Session 2009/2010

Second Report

Committee For The Environment
Inquiry into Climate Change
Volume Three

TOGETHER WITH THE MINUTES OF PROCEEDINGS, MINUTES OF EVIDENCE AND WRITTEN SUBMISSIONS RELATING TO THE REPORT

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Membership and Powers

The Committee for the Environment is a Statutory Departmental Committee established in accordance with paragraphs 8 and 9 of the Belfast Agreement, section 29 of the Northern Ireland Act 1998 and under Standing Order 46.

The Committee has power to:

- Consider and advise on Departmental budgets and annual plans in the context of the overall budget allocation;
- Consider relevant secondary legislation and take the Committee stage of primary legislation;
- Call for persons and papers;
- Initiate inquires and make reports; and
- Consider and advise on any matters brought to the Committee by the Minister of the Environment

The Committee has 11 members including a Chairperson and Deputy Chairperson and a quorum of 5.

The membership of the Committee since 9 May 2007 has been as follows:

Mrs Dolores Kelly (Chairperson) 6
Mr Cathal Boylan (Deputy Chairperson)

Mr David Ford Mr Adrian McQuillan 7
Mr Ian McCrea Mr Alastair Ross 1
Mr Peter Weir Mr Daithi McKay
Mr John Dallat 5 Mr Danny Kinahan 3,4
Mr Roy Beggs 2

1 From January 21 2008, Mr Alastair Ross replaced Mr Alex Maskey on the Committee for the Environment.

2 With effect from 15 September 2008 Mr Roy Beggs replaced Mr Sam Gardiner.

3 With effect from 29 September 2008 Mr David McClarty replaced Mr Billy Armstrong

4 With effect from 22 June 2009 Mr Danny Kinahan replaced Mr David McClarty

5 With effect from 29 June 2009 Mr John Dallat replaced Mr Tommy Gallagher

6 With effect from 3 July 2009 Mrs Dolores Kelly replaced Mr Patsy McGlone

7 With effect from 17 September 2009 Mr Adrian McQuillan replaced Mr Trevor Clarke

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NIIRTA

NORTHERN IRELAND INDEPENDENT RETAIL TRADE ASSOCIATION

Mr Patsy McGlone MLA
Chairman
Environment Committee
Northern Ireland Assembly
Parliament Buildings
Stormont
BT4 3XX

5 May 2009

Dear Patsy

Re: Climate Change Enquiry

I hope you are well.

I am writing to you in connection with the Climate Change Enquiry. We were somewhat disappointed that we are not being called to give oral evidence following our written submission. As you are no doubt aware our members take their commitment to tackling climate change very seriously and as an organisation we are very keen to play our role in promoting responsible attitudes to protecting our environment.

In addition, a number of our members have led the way in making changes to their shops to play their role in tackling climate change. As you are aware Paul Stewart, NIIRTA's President and Managing Director of J C Stewart's in your own constituency is the first independent supermarket owner in Northern Ireland to install a new eco-friendly state of the art wood pellet boiler which will reduce his company's carbon footprint considerably. We also have other examples and case studies which we feel would make a significant contribution to your Committee Enquiry.

I very much look forward to hearing from you.

Yours sincerely

Glyn Roberts
Chief Executive.

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Web: www.niirta.com Email: admin@niirta.com
Company Registration No. NI 040031

Submission from Carbon Trust

Summary Table of Issues Presented to the Committee in Writing during its Public Consultation Phase

On 23 November 20008 the Environment Committee agreed to conduct an inquiry into climate change. The Committee's current position on climate change was established at its meeting on 7 September 2007 when it considered a number of questions relating to the UK Climate Change Bill (now the Climate Change Act).

On 11 December 2008 the Committee agreed the aim and terms of reference for the inquiry:

Aim:

To understand the implications of climate change for Northern Ireland and to make recommendations on government policies, in line with the Committee's earlier response on the UK Climate Change Bill, to mitigate the impacts of climate change, examine economic implications and identify suitable adaptation initiatives.

Terms of Reference:

1. To identify initial commitments for Northern Ireland that will ensure it plays a fair and proportionate role as part of the UK in meeting climate change targets.

2. To consider the necessary actions and a route map for each significant sector in Northern Ireland (energy, transport, agriculture and land use, business, domestic, public sector etc)

3. To identify the costs associated with meeting these obligations and compare them with the costs that will be incurred if they are not achieved.

4. To identify a formal cost effective mechanism for assessing the potential impact of new policies on climate change / CO2 emissions. (Akin to Regulatory Impact Assessments/Rural Proofing)

5. To make recommendations for appropriate targets/actions that could be included in the new Northern Ireland Sustainable Development Implementation Plan.

6. To make recommendations on a public service agreement for the DOE Climate Change Unit's commitments in the second Programme for Government that will ensure Northern Ireland will meet its climate change obligations.

7. To consider what secondary legislation raising powers within the UK Climate Change Act would contribute to Northern Ireland's commitment to the UK Climate Change Bill.

8. To express views on if and how the Assembly might conduct more effective scrutiny of climate change responsibilities across all relevant departments.

To produce a report on the findings and recommendations of the inquiry by September 2009.

The tables below summarise points raised in written submissions to the inquiry where they contribute clearly to the terms of reference.

The tables are presented in three columns. The left hand column outlines the terms of reference, the central column included submissions received in writing in response to the public advertisement of the inquiry.

Some comments have relevance to more than one clause in which case they are duplicated in the tables. The specialist adviser has highlighted the key points in the submission for easy reference and in the right hand column has made notes where appropriate regarding the relevance, validity and provenance of the submission, provided additional relevant facts, identified gaps and suggested additional research needs emanating from the information.

Note: MtCO2e = Million tonnes of carbon dioxide equivalent

Carbon Trust

ToR 1: To identify initial commitments for Northern Ireland that will ensure it plays a fair and proportionate role as part of the UK in meeting climate change targets.	The so-called “20/20/20" package agreed by European Union leaders for the EU27 in January 2008 set a number of ambitious commitments to fight climate change and promote renewable energy, namely: 20% cut in greenhouse gas emissions by 2020, compared with 1990 levels 20% contribution from renewable energy sources (by consumption) by 2020 20% cut in energy consumption through improved energy efficiency by 2020 This sets the context for the UK agreed target of a 15% contribution from renewable energy by 2020 and although this target is not presently disaggregated by country, we believe that NI’s contribution to the UK (and EU) target should be at least of this magnitude i.e. at least 15% of NI’s total energy consumption (electricity, thermal and transport energy) should come from indigenous renewable energy sources by 2020. Indeed, in light of other considerations such as concerns about security of supply, we believe consideration should be given to setting a higher target as part of a comprehensive, holistic package of measures designed to achieve rapid, deep cuts in NI’s carbon emissions. Exploitation of the technical resource available from wind energy and an aggressive policy towards improving standards of energy management (conservation and efficiency) will be the key tenants of such a package. In December 2008, the Committee on Climate Change (CCC) proposed carbon budgets to put the UK on a trajectory to reduce emissions by 80% (from a 1990 baseline) by 2050, and their proposals included an interim target of 34% reduction by 2020, rising to 42% if a global successor deal to Kyoto is reached. An 80% reduction is estimated to be achievable at a cost of between 1-2% of UK GDP in 2050. But cost is not the only barrier to success. Achieving these targeted reductions challenges businesses’ and the public sector’s current capabilities and resources as well as demanding a shift in technologies and business models. The sustainable development strategy for Northern Ireland and the Executive’s Programme for Government includes a number of very challenging energy and climate change related targets including: Reducing NI’s CO2	EU ‘20/20/20’ target – by 2020 cut GHG by 20%, cut energy consumption through efficiency by 20% and supply 20% from renewables. At least 15% of NI energy (thermal, electric, transport) from renewables by 2020; given NI’s resources should be higher Improve standards of energy management and exploiting renewables key. CCC targets of 34/42% Sustainable Development Strategy: CO2 by 30% by 2025 Carbon footprint by 25% by 2025 40% of electricity from indigenous renewables by 2025 Requires investment of millions and demand management programme Need NI Dept Energy and Climate Change, including aspects of DETI, OFMDFM, DoE, DARD, etc. Adopt (minimum) SMART targets from UK Climate Change Act Develop evidence based delivery plan to meet targets as cost effectively as possible Deliver sector specific action oriented campaigns Public sector demonstrate leadership, decarbonise estate Building regulations, Investment Strategy, Planning all support move to low carbon infrastructure

	emissions by 30% below 1990 levels by 2025; Reducing NI carbon footprint by at least 25% by 2025; and 40% of electricity consumed beyond 2025 to be from indigenous renewable sources	Avoid 'exporting wealth' through non-local low carbon energy or carbon credits. Use measure of 'carbon intensity of NI Economy'
	Attainment of these targets in NI will require a multi billion pound investment in both generation capacity and demand-side management projects over the next 10-plus years. Investment at this scale will require careful planning and management to ensure NI's move to a low carbon economy is achieved at maximum cost advantage to businesses and citizens. We believe that NI's contribution to UK/European carbon reduction targets can be best managed and delivered through the establishment of a NI Department of Energy and Climate Change, allowing such a Department to take ownership of the various targets and policies presently set by DETI, OFMDFM, DoE, DARD and others. The following actions will help NI deliver on challenging carbon reduction targets in an optimal manner: Adopt – as a minimum – the SMART targets set by the Climate Change Act and ensure that the processes and procedures for carbon budgeting and accounting envisaged by the Act, are applied at a NI level. Development and delivery of an evidence based implementation plan to ensure carbon reduction targets are met in the more cost advantageous manner i.e. prioritising measures with the lowest carbon abatement cost. Delivery of focussed, targeted, carbon reduction awareness campaigns aimed at the various sectors of the economy explaining the need to reduce emissions and highlighting the associated opportunities e.g. reduced energy bills, new business opportunities. NI Public Sector organisations to demonstrate leadership through an accelerated programme of decarbonising their estates which will not only bring about substantial resource efficiency gains but will help build capacity and capability within local businesses regarding the delivery of low carbon solutions. Ensure NI's Building Regulations, Investment Strategy and Planning processes drive a rapid move to low carbon buildings, infrastructure and solutions. Avoid 'exporting wealth' through the purchase of non-indigenous low carbon energy and/or carbon credits. It is	

	worth noting that although absolute reductions in carbon emissions is critical, in order to 'correct' for any 'structural' changes in NI's energy usage, we would encourage the inclusion of robust carbon intensity metrics within a suite of key performance indicators e.g. a measure of the carbon intensity of NI economy expressed in terms of millions of tonnes of carbon per £'000 million GDP.	
ToR2: To consider the necessary actions and a route map for each significant sector in Northern Ireland (energy, transport, agriculture and land use, business, domestic, public sector etc)	In 2003, the Carbon Trust and Invest NI commenced a project to develop an action plan that would set Northern Ireland on the path to a low carbon economy. The 'NI Vision Study' examined the prospects for reducing CO2 emissions in five key sectors of the economy. Although the study was concluded in March 2005 many of the key findings remain valid today and we attached a copy of the study report to this submission for the Committee's reference and information. The study concluded that it was possible to realise a 60% reduction in carbon emissions by 2050 (the then target in the UK Energy White Paper), provided early action was taken to: Optimise energy use by implementing all possible energy efficiency and reduction measures; Decarbonise energy/fuel supplies by investing in renewable energy resources; and Decouple economic growth and social activity from the consumption of high-carbon fuels by developing low carbon technologies, products and services. The project also published an initial action plan to help initiate this change: Immediate actions Encourage improvements in energy efficiency in all sectors of the economy by developing additional support mechanisms for smaller organisations and by setting up a capital fund to support major investment in new buildings and industrial plant. Improve building energy efficiency via improved standards, efficiency labelling and compliance monitoring by, for example, requiring all buildings over 1,000 square metres to display a building energy performance certificate that complies with the EU Energy Performance of Buildings Directive. Also support moves towards zero emission buildings. Change public procurement procedures to promote the highest energy efficiency standards and to demonstrate public sector leadership in reducing carbon emissions. This should include only procuring space in buildings within the top quartile of energy performance, a Government	See shaded left

	commitment announced in its 2004 Energy Efficiency Action Plan. Improve the quality of data collected on energy use, and make it more readily available to consumers to facilitate better targeting of support for energy efficiency measures and to enable progress to be monitored and publicised. Developing options for the future Support the exploitation of local renewable resources such as wind and bioenergy by increasing renewable obligations on energy suppliers. Modify the regulatory scheme to encourage the uptake of good quality CHP and discourage the use of inefficient local generators during peak periods. Encourage investment in the fledgling low carbon technology sector and take the lead on developing new technologies where Northern Ireland could obtain commercial advantage. Cross-cutting actions	
	Develop planning procedures that have the minimisation of energy demand and transport use as prime criteria and explore the options for a transport efficiency programme. Plan and execute sustainability marketing campaigns to capture the hearts and minds of the population and seek to build up the skills base in application of low carbon technologies. Keep a watching brief on international developments in low carbon technologies and position Northern Ireland to become an early adopter of emerging technologies, such as low/zero emission vehicles. The project also considered the actions necessary for key sectors of the economy and these are summarised in the following annexes to the report: Annex A Scenarios for a low carbon economy Annex B Prospects for bio-energy in Northern Ireland to 2050 Annex C Prospects for the commercial, public and agriculture sectors Annex D Prospects for the domestic sector to 2050 Annex E Prospects for power supply in Northern Ireland to 2050 Annex F Prospects for the industrial sector to 2050 Annex G Prospects for energy savings in transport to 2050	
ToR3: To identify the costs associated with meeting these obligations and compare them with the costs that will be incurred if they are not achieved.	A substantial and credible body of work exists into the economics of climate change. The conclusion of such studies encourage early action to reduce greenhouse gas emissions and suggests that the cost of taking action to avoid the worst economic impacts of climate change can be limited to around 1% of global GDP per annum against 5-20% cost of inaction. The 'NI Vision Study' estimated the	Financial estimates provided Stern and NI Vision estimates of jobs and benefits NI could save £500 million per annum with cost effective energy management techniques Businesses

	cost of reducing NI's carbon emissions by 60% by 2050, which based on the carbon-abatement costs used in national studies, totalled £775 million or around 4% of Northern Ireland's GDP in 2004. This equated to £75 per tonne of CO2, which is at the upper end of the cost range outlined in the 2004 Energy White Paper. However, some wider economic scenarios suggest the cost could be £1.25bn-£2.5bn. It should be noted that the move to a low carbon economy will deliver significant cost savings brought about by energy efficiency improvements and deployment of cost effective renewable energy technologies. Data from the Government's Performance and Innovation Unit report of February 2002 suggests that (based on an annual energy spend of £2bn) at least £500 million per annum could be saved in NI through the deployment of existing, cost effective energy management and energy efficiency technologies and techniques. Indeed, energy surveys conducted by the Carbon Trust in businesses within Northern Ireland has identified over £100 million of annual energy savings (£50 million pa of which have been implemented, reducing carbon emissions by over 465,000 tonnes of CO2 pa) and within the domestic sector where the relative and absolute savings are highest, the Energy Saving Trust has indicated that by improving standards of energy efficiency in the home, the average householder in Northern Ireland could save £340 a year which amounts to over £223 million per annum. Furthermore, the move to a low carbon economy will generate significant wealth creation and economic development opportunities. The low carbon energy sector has been identified as an important growth focus by a number of UK and global regional development agencies and one which we believe offers a solid foundation for a forward looking, wealth creating, economic strategy for a region like NI.	so far saved £50 million pa Householders could save £233million pa
	Northern Ireland already has considerable capability and capacity in a number of key industry sectors which, if strategically managed, could transfer to the low carbon sector. Our natural resources (wind, land, marine) and strategically important infrastructure (e.g. deep-port and cranage facilities), aligned with the internationally recognised talent in low carbon research that	

	resides in both our local Universities, provides the building blocks to enable Northern Ireland to become a significant player in the fast growing clean energy sector - both as a creator of products and services and as an exploiter of the available technologies. This opportunity should be explicitly recognised by the NI Assembly and Executive and help shape the outworking of energy and climate change policy. There is precedent of some small nations that have implemented a strategic energy technology development focus and who have developed profitable niche markets for global products. For example, Denmark in wind turbine technology, Austria in biomass boiler technology and (to a lesser extent) New Zealand in small-scale combined heat and power systems. Although NI is much smaller than these comparators, there is potential for significant economic benefits through innovative product development and through effective networking and partnering to serve existing low carbon supply chains. If NI fails to develop, deploy and exploit clean energy technologies we face the prospect of importing such technologies whilst exporting wealth from NI. In an attempt to quantify the opportunities for NI businesses in relation to the renewable energy sector, an initial study by the Carbon Trust determined that although around 2 million jobs could be created across Europe by 2020, NI businesses will need to work hard to realise these opportunities: NI businesses need to be creative in thinking about the opportunities that the low-carbon economy will present to develop new products and markets. Manufacturers must also not neglect the service opportunities associated with the low-carbon economy, given the contribution that services can make to their profitability. They will also need to act quickly to link into the supply chains being formed to produce the new low-carbon products and establish an early toehold in emerging global markets. The risks and expense involved in developing new low-carbon products means that NI manufacturers will also increasingly need to look at identifying potential collaborative partners. Alongside the government, industry must also make the commitment to invest in the R&D and skills required to deliver the low-carbon economy.	

Firms also need to look beyond their current relationships and approaches to markets. For example, the key role that manufacturing will play in the low carbon economy gives it the chance to improve its profile and image. Clearly the exact number of jobs created in the NI economy depends on many factors. It would depend on the success of companies exploiting supply chain opportunities and exporting products and services to the UK and EU. The initial estimates for potential job creation in NI set out in the table below is based on the premise that NI companies could capture a small share of the total EU and UK market through export of goods and services, and a significantly larger share of the home market. The table provides a range based on NI capturing 0.1% - 1% of total jobs generated in the EU market; 1% - 2% in the UK; and 5% - 10% of jobs generated through renewable energy in Northern Ireland. NB: these estimates are best considered as a discussion point and in actuality would vary depending on the NI's success in capturing potential opportunities.

High case		*Low case*	
Share of Jobs in Renewables	***Potential Employment***	***Share of Jobs in Renewables***	***Potential Employment***
1% of total jobs generated in EU	20,200	0.1% of total jobs generated in EU	2,020
2% of total jobs generated in UK	11,260	1% of total jobs generated in UK	5,630
10% of total jobs generated in NI	1,614	5% of total jobs generated in NI	807
Potential number of jobs in NI	33,074		8,459
Average GVA per employee NI	£29,853		£29,853
Total GVA pa	£988m		£253m

This provides an indication as to the number of jobs that could potentially be generated in NI based on the assumed percentage share of the total market in each region. This percentage share could vary and is subject to the aggressiveness of NI companies in participating and benefitting from renewables supply chain opportunities. If NI companies position themselves well to benefit from the opportunities arising through the renewables supply chain in the coming years the number of jobs created in NI could potentially be around 33,000; this represents an addition to the economy of c£1billion per annum in terms of GVA. To put this into perspective: The EU Commission estimate that continued investment in renewable energy systems could generate an additional 2,023,000 people in full time employment in the EU by 2020,

	accounting for jobs lost in the traditional energy sector;	
	Total energy infrastructure investment in the EU before 2030 is estimated at more than $2 trillion; A detailed study by the Carbon Trust has estimated that UK revenues from offshore wind could hit £8bn per year by 2020 and create up to 70,000 jobs in the UK; In 2006, the global wind industry employed 235,000 people according to WWEA; Germany reports 12,500 people employed in the solar hot water industry and 30,000 people employed in the solar PV industry; and The Obama-Biden comprehensive New Energy for America plan aims to help create five million new jobs by strategically investing $150 billion ovover the next ten years to catalyze private efforts to build a clean energy future.	
ToR4: To identify a formal cost effective mechanism for assessing the potential impact of new policies on climate change / CO2 emissions. (Akin to Regulatory Impact Assessments/Rural Proofing)	We strongly support the introduction of a formal 'climate change' / 'GHG emissions' / 'low carbon economy' proofing requirement for all NI originated policies. This approach should be extended to inform all major projects in NI which would entail, for example, subjecting significant public and private sector infrastructure investments to such a proofing test. Such a systematic process would help avoid lock-in to high carbon projects and systems and help 'future-proof' strategic investments. The cross-Departmental nature of this requirements points again to the need for a NI Department of Energy and Climate Change, or similarly mandated Department.	Climate change or GHG emissions or low carbon economy proofing of all policies and projects This 'future proofs' all investment Need coordination, so DECC needed to deliver
ToR5: To make recommendations for appropriate targets/actions that could be included in the new Northern Ireland Sustainable Development Implementation Plan.	The science of climate change presently indicates that the UK and other 'developed' economies need to reduce their GHG emissions by 80% by 2050 as a commensurate and proportionate response to enhanced climate change (this being legislated for by the Climate Change Act which commits the UK to an 80% reduction relative to 1990 base year). Although, this UK-wide target has not been disaggregated by country, we believe that it should be adopted by NI and that the process and procedures for carbon budgeting and accounting envisaged by the Act, should be applied at a NI level. This will help ensure that NI truly plays its part in moving to a low carbon economy. All NI-specific GHG targets should be kept under review in light of emerging research regarding enhanced climate change and scale of cuts required in GHG emissions. We also believe there is merit in revisiting a number of	Adopt UK targets Review SD targets to ensure 'SMART'

	climate/energy related targets within the sustainable development strategy for NI to ensure that they are SMART and will deliver on the policy objectives in the most cost-efficient manner.	
ToR6: To make recommendations on a public service agreement for the DOE Climate Change Unit's commitments in the second Programme for Government that will ensure Northern Ireland will meet its climate change obligations.	We feel that this would best be achieved through the Northern Ireland Executive and Assembly creating a dedicated NI Department of Energy and Climate Change. The cross-cutting nature of climate change and the move to a low carbon economy is so profound that continued separation of responsibilities across multiple Departments risks inefficient and sub-optimal policy and delivery. Such a new Department should be adequately resourced and empowered to ensure that NI's move to a low carbon economy is achieved in the most rapid and cost-advantageous manner possible and in such a way as to maximise the wealth creation opportunities for NI plc through the creation, development and commercial exploitation of low carbon intellectual property and technologies.	DECC is best option
ToR7: secondary legislation	x	
ToR8: effective scrutiny	x	

Correspondence/Submission from Irish Academy of Engineering Standing Committee on Climate Change

From: Paddy Purcell [mailto:paddypurcell@ireland.com]
Sent: 07 May 2009 16:12
To: McGarel, Alex
Cc: TSmyth; PLangford; PCallery; michael phillips; johnduffy7@eircom.net; alan cooper; Don Moore; mhayden2@gmail.com
Subject: Adaptation for Climate Change

Alex McGarel,
Environment Committee,
Northern Ireland Assembly

7th May 2009

Re: Irish Academy of Engineering --- Climate Change Input to Environment Committee

Dear Alex,

I am Chairman of the Irish Academy of Engineering Standing Committee on Climate Change and am writing, following discussion with a number of senior people from the public sector,

engineering consultancy and the research community in Northern Ireland who attended a recent climate change workshop in Dublin, to seek the opportunity for the Academy to input to the current deliberations on climate change by the Environment Committee of the Northern Ireland Assembly.

The Irish Academy of Engineering comprises approximately one hundred and twenty invited senior members of the engineering profession, and is an all-island body with membership from Northern Ireland and the Republic of Ireland. Its aim is to concern itself with medium to long term matters (say 10 to 100 years) related to the engineering field, rather than current issues. We seek to provide authoritive, unbiased evidence based advice to Government and government agencies in Northern Ireland and in the Republic of Ireland on important issues, usually in the form of reports.

The Academy's Standing Committee on Climate Change is currently in the process of completing a report on "Critical Infrastructure - Adaptation for Climate Change". The Committee held a one day workshop on 28th April 2009 in Dublin Castle to obtain essential input from owners of critical infrastructure, policy makers, climate change researchers and engineers. This was attended by seventy invited senior people from Northern Ireland and the Republic of Ireland and four keynote papers were circulated in advance. The keynote speakers made presentations on the morning of the workshop followed by open forum discussion. Most of the day was given over to detailed discussion in six workshop breakout groups focused on three areas of critical infrastructure viz. Energy; Water Services and Flood Protection. Each of these three areas was addressed by two of the breakout groups, who considered a number of pre-set questions (see attached) and any other matters they considered important. Each group provided feedback to a pleanary session in the late afternoon with their considered view of the key issues to be addressed and the required actions. The workshop concluded with an open forum discussion. We were pleased that John Gormley, Minister for Environment, Heritage and Local Government took time to address the workshop.

The Academy's Standing Committee has commenced drafting it's report, based in the main on the output from the workshop and the associated keynote papers and presentations. I attach for the information of the Assembly's Environment Committee a copy of the four papers presented at the workshop. We believe that our final report, to be published later in the Summer, will be of significant interest and benefit to the Environment Committee and seek your advice on how best we can communicate it to the Committee. My personal contact details are paddypurcell@ireland.com tel: 353 1 2802201; mobile: 353 86 8044613

Yours Sincerely,

Paddy Purcell,
Chairman, Standing Committee on Climate Change,
Irish Academy of Engineering.

Research Paper: Meeting the Challenge of Adaptation

CLIMATE CHANGE: MEETING THE CHALLENGE OF ADAPTATION

Conor Murphy & Rowan Fealy

Irish Climate Analysis and Research Units
Dept. of Geography, National University of Ireland Maynooth

ACRONYMS

C4I: Community Climate Change Consortium For Ireland
CCCma: Canadian Centre for Climate Modelling and Analysis
CMRC: Coastal and Marine Resources Centre
CSIRO: Commonwealth Scientific and Research Organisation
ECHAM: European Centre Hamburg Model
GCM: Global Climate Model
HadCM: Hadley Centre Coupled Model
ICARUS: Irish Climate Analysis and Research UnitS
IPCC: Intergovernmental Panel on Climate Change
RCM: Regional Climate Model
SNIFFER: Scotland and Northern Ireland Forum For Environmental Research
SRES: Special Report on Emissions Scenarios
UKCIP: United Kingdom Climate Impacts Programme

SUMMARY OF LIKELY CHANGES IN KEY PARAMETERS

Work on climate change in Ireland to date has been successful in refining the likely impacts of climate change over the course of the coming century. However, significant uncertainty and challenges remain and it is essential that researchers in this critical area work closely with end-users of data to ensure best possible information is used for decision making and designing for the future. While acknowledging the uncertainty that remains the following is a summary of likely changes in key parameters.

- Temperatures are likely to increase everywhere relative to the present with greatest increases suggested for the summer and autumn of up to 3.4°C by the end of the century.
- With increases in average temperatures a change in extreme events is to be expected with an increase in the intensity and duration of heatwaves and a decrease in frost occurrence likely.
- Precipitation remains an uncertain variable with differences in the extent and spatial distribution of changes between different modelling approaches. A robust signal of increased seasonality is evident with wetter winters and drier summers likely. No clear direction of change is evident for spring and autumn.
- As changes in average climate progress, changes in extremes can be expected with the magnitudes likely to increase and the occurrence of extreme events for all climate

variables (with the exception of minimum temperatures) likely become more frequent.

- Increases of 8-11% in 60m height average wind speeds are likely in winter by mid-century, with decreases of 14-16% in summer, but assessment of this variable to date has been subject to high levels of uncertainty.
- In relation to stream flow, robust increases in winter and spring flows in the order of 20% in winter are likely by mid to late century. Reductions in summer and autumn months of over 40% are likely in many catchments. Catchments show different signatures of change depending on characteristics determining runoff response.
- Flood events are likely to become more frequent with the current 50 year event likely to be associated with a ~10 year return period by mid to late century. While uncertainty remains low flow events are also likely to become more frequent.
- IPCC scenarios suggest a likely sea level rise of between 0.28 to 0.43m by the end of the century relative to 1980-1999. However, recent thinking suggests that this may be too conservative with increase of over 1m suggested. Localised rises will depend on characteristics such as isostatic rebound and topography.
- The likelihood of increased storminess, higher sea levels and wind speeds will result in a subsequent enhancement of wave heights and storm surges, when combined with riverine flooding will pose serious flood risks in many of our coastal cities and for key infrastructure.

Even if greenhouse gas emissions were capped at 2000 levels some degree of climate change can be expected due to the inertia in the climate system. In light of these findings there is a requirement to urgently review the security of critical infrastructure; to prioritise adaptation measures for existing infrastructure as well as incorporate provisions for adaptation in all new infrastructure. Failure to do so would place unacceptable risk on the wellbeing of society.

PURPOSE OF THIS PAPER

The purpose of this paper is to provide information to the engineering community on where we currently stand in our knowledge of the impacts of climate change in Ireland. It seeks to identify what we know and where the key uncertainties lie in relation to climate variables and impacts that are critical to designing robust engineering strategies for the future. Rather than trawl the substantial literature in the limited time available it provides some of the important findings from the key reports produced for Ireland in recent years, particularly Sweeney et al., 2008, McGrath et al., 2008 and Hulme at al., 2002. The thrust behind these reports has been to inform policy development in adapting to climate change. It is hoped that these findings will serve as a starting point for dialogue between the climate change research community and the engineering community about where we need to go from here in order to refine and provide the best information as possible for a profession with a substantial degree of responsibility in ensuring successful adaptation to climate change for this and future generations in Ireland.

1. Introduction

The need to adapt to the impacts of climate change in Ireland has become increasingly recognised in recent years. For many engineering projects, plans and programmes a medium to long term view of climate change impacts is essential so that appropriate designs, resilience and robustness to future changes in climate can be achieved. Climate change impact assessment in Ireland has been on the research agenda for over eighteen years now with the first comprehensive approach dating back to the McWilliams report in 1991 which set prescribed climate scenarios for impact modellers to use. The second main assessment; Climate Change, Impacts and Scenarios for Ireland (Sweeney et al., 2003) occurred in 2003 using downscaled global climate data as input to models in several key sectors. While this report marked a significant advance in understanding the impacts of climate change and provided strong signals regarding spatial variations in impacts throughout Ireland it is limited in that key uncertainties are omitted, with results being based on output from only one Global Climate Model.

Progress since then has been significant in developing capacity to produce climate change scenarios and impact assessments in an increasingly sophisticated manner. Over this time capacity in Regional Climate Modelling has been developed at a number of centres nationwide, while increasingly sophisticated approaches to manipulating output from climate models has enabled multiple runs of numerous models to be employed in attempts to capture and quantify the cascade of uncertainty that exists in assessing climate change impacts, thereby providing endusers with more appropriate information for adapting to climate change. Key reports publishing results from this period of significant growth include Climate Change; Refining the Impacts for Ireland (Sweeney et al., 2008), Ireland in a Warmer World: Scientific Predictions of the Irish Climate in the Twenty-First Century (McGrath et al., 2008), Implications of the EU climate protection target for Ireland (McElwain, and Sweeney, 2006) and Climate Change: Regional Climate Model Predictions for Ireland (McGrath et al., 2005). In Northern Ireland additional information has been derived through the continually evolving generations of UKCIP reports (most recently, Hulme et al. 2002) which have informed key policy documents such as the SNIFFER Report of 2002 and 'Preparing for Climate Change in Northern Ireland' (Arkell et al., 2007). In addition, the international standing of research on climate change in Ireland has been reflected in the number of papers published in leading academic journals and the increasingly important contributions that Irish researchers are making to the international agenda, particularly in informing different generations of the reports from the Intergovernmental Panel on Climate Change (IPCC).

2. Sources of Uncertainty

Producing future climate scenarios and future impacts is by no means an exact science. Despite advances in modelling chaotic behaviour and natural variability in the climate system, it is clear that climate models will never be able to provide a singular prediction of future climate (Jones, 2000). Giorgi (2005) highlights three major sources of uncertainty in GCM simulations: model configuration uncertainty, uncertainty due to internal model variability and uncertainty due to the stochastic nature of natural forcing.

Of these, uncertainty in model configuration is by far the most significant. Wilby and Harris (2006) highlight the fact that over reliance on a single GCM in impact assessment could lead to inappropriate planning or adaptation responses. Indeed to do so would be to suppress a key source of uncertainty in climate impacts modelling (Hulme and Carter, 1999).

Additionally, projections intended to represent plausible transient climate change due to anthropogenic forcing must rely heavily on future projections of population growth, economic activity and technological change which are inherently uncertain. (Webster *et al.* 2002). An overview of the SRES emissions scenarios used in climate modeling is given at the end of the paper.

Despite the high degree of sophistication of GCMs, their output is generally too coarse to be useful for regional or local scale impacts analysis as important processes which occur at sub grid scale are not at present resolved by these models (Wilby *et al.*, 1999). Due to computational limitations, the grid box output from GCMs is generally in the order of 100s kms. While this is adequate to capture large scale variability, many important process in the climate system occur at much smaller spatial scales and thus are too fine to be resolved in the modelling process. Therefore regionalisation or downscaling of GCM outputs is required for meaningful impact assessment with uncertainty associated with the approaches taken. In terms of approach uncertainty two categories of downscaling have come to the fore, namely, dynamic approaches, in which the physical dynamics of the system are solved explicitly, and empirical or statistical downscaling. Both approaches are subject to benefits and limitations in terms of computational costs and assumptions made, with neither emerging as entirely preferable over the other.

Finally, uncertainty exists in the models used to conduct impact assessments. From a hydrological perspective conceptual rainfall-runoff models have been most widely used for impact assessment. Such models are subject to limitations in parameter stability, parameter identifiability and equifinality, each of which gives rise to uncertainty in model output. Wilby and Harris (2006) and Murphy et al. (2008) show that uncertainty in future flow changes due to equifinality is comparable in magnitude to the uncertainty in emissions scenario

In dealing with these uncertainties it is important to note that the key reports on which this paper is based use different climate models, emissions scenarios, downscaling techniques, impact models, time period of simulation in the future and control periods from which future changes are derived. Therefore they provide a good indication of the ranges of uncertainty associated with climate change in Ireland, but also challenges as to how we provide information to users of the data. Table 1 characterises the range of approaches taken by these reports in producing future climate scenarios.

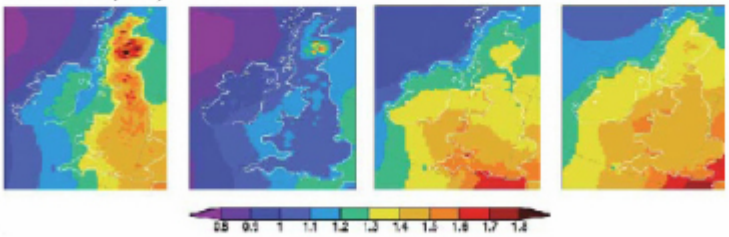
Scenarios	GCMs	Emissions Scenarios	Downscaling Approach	Control and future time periods
C4I	ECHAM4 ECHAM5 HadCM3L HadCM3H	A2 SRES A1B SRES B1 SRES B2 SRES	Regional Climate Modelling & Statistical Downscaling	1961-2000 2021-2060
UKCIP02	HadCM3 HadAM3H	Constructed 4 scenarios from low to high representing the SRES Range	Regional Climate Modelling Pattern Scaling	1961-1990 thirty year time period centred around the 2020s, 2050s, 2080s
ICARUS	HadCM3 CCCma CSIRO (Mark2)	A2 B2	Statistical Downscaling	1961-1990 thirty year time period centred around the 2020s, 2050s, 2080s

Table 1: Approaches used in the key reports used in compiling paper

3. TEMPERATURE PROJECTIONS

Future projections in temperature are attributed with higher confidence levels than many other variables projected by GCMs. However, while there is a good degree of consistency between the different projections made for Ireland, uncertainties exist depending on the GCMs, emission scenarios, downscaling methods, and baselines used. From the simulation results derived for Ireland from the C4I project (McGrath et al., 2008) (Figure 1) temperature projections for mid-century show warming everywhere relative to the present, the warming being accentuated in summer and autumn (1.2 to 1.4 °C warmer). The warming shows a spatial gradient, with the greatest temperature increases projected for the south and east. For the latter part of the century warming of up to 3.4°C is expected with greatest increases again evident for the east and south east.

Figure 1 Seasonal warming: mean of 8 ensemble simulations showing the temperature change (°C) between periods 2021-2000 and 1961-2000 for winter, spring, summer and autumn (from left to right). The warming is greatest in the summer/autumn (1.2-1.4°C) (Caption and Figure after McGrath et al., 2008).



Based on the multi-model ensemble simulations (based on 3 GCMs and 2 emissions scenarios) derived by Fealy and Sweeney (2008), results for seasonal changes in temperature and precipitation are presented for three 30-year time slices centered on the 2020s, 2050s and 2080s. Regional climate model projections for Ireland suggest that,

over the present century, this warming rate is likely to increase to between 0.2-0.3°C/decade. As a consequence, an increase of between 0.7-1.0°C is likely to occur in all seasons by the 2020s (Fealy and Sweeney, 2008). This increase is projected to be more or less uniform across Ireland (Figure 2). By the 2050s, mean seasonal Irish temperatures are projected to increase by between 1.4 to 1.8°C, with the greatest warming in the autumn months. This increase is likely to be associated with a greater warming of the interior of the island resulting in an enhanced 'continental effect'. Coastal areas are likely to be slightly cooler than inland areas in summer due to the presence of sea breezes during the summer months. This continental effect becomes further enhanced by the 2080s, with temperature increases of between 2.0°C to 2.7°C. On a seasonal basis summer and autumn show likely temperature increases of between 2.5-3.0°C, very much in line with C4I projections, although direct comparison is not fully justified.

In comparison with the UKCIP02 scenarios for Northern Ireland annual mean temperatures are likely to increase by between 0.5-2.0°C by mid century and by 1.0-3.5°C by the end of the century. On a seasonal basis the UKCIP02 scenarios also show warming in all seasons with the greatest increases in summer and autumn of between 1.0-3 .5°C and 1.5 to 4.0°C respectively. In line with current trends winter and spring are also likely to become reliably warmer. Figure 3 shows temperature changes for Northern Ireland for the low and high emissions scenarios used in UKCIP02.

Such changes in temperature also have implications for future water temperatures and energy requirements. In relation to the latter McGrath et al. (2008) highlight a clear trend of decreasing heating energy demand, while a weak demand for air conditioning may develop in the southeast of the island during summer months.

4. TEMPERATURE EXTREMES

Little work has been completed on the impact of climate change on future extreme events. Of the work that has been completed, the frequency, intensity and duration of temperature extremes, which can have a negative effect on human societies and ecosystems, are projected to change. The prolonged heat wave that occurred in Europe in 2003, one of the hottest on record, resulted in an excess of 35,000 deaths, while in Ireland during the summer months of 2006, above average mean temperatures, which were over 1°C higher than the 'normal' 1961-1990 period (nearly 2°C higher than 'normal' in the midland stations of Clones and Kilkenny), combined with below average precipitation, resulted in significant soil moisture deficits through out much of the southern part of Ireland with resultant impacts on agriculture (Met Eireann, 2006).

While such extreme events are consistent with the natural variability of the climate system, evidence from the observational records suggests there is a tendency towards an increase in frequency of occurrence and intensity of extreme events. A significant increase was found to have occurred in both maximum and minimum temperatures over the 1961-2005 period (McElwain & Sweeney, 2007). This increase in minimum temperatures has resulted in a shortening of the frost season and a significant decrease in the annual number of frost days (by more than half at a number of stations) (McElwain & Sweeney, 2007). While the number of consecutive cold days has been decreasing over

the same period at a number of stations in Ireland, the duration of heat waves has also been increasing.

Fealy and Sweeney (2008), in an analysis of likely future changes in extremes based on the A2 (Medium-high) scenario, found that significant changes are likely to occur in the four key indices of extreme events, namely:

- hot-day threshold (T_{max} 90th percentile),
- cold-night threshold (T_{mn} 90th percentile),
- number of frost days ($T_{min} < 0^{o}C$)
- longest heat wave (Heat wave duration).

Trends were found to be significant (0.01 significance level) at all synoptic stations analysed for all the temperature indices employed in their analysis. An increase in the intensity of extreme temperatures (the hot day threshold) is indicated for all stations, rising by a rate of more than $0.2^{o}C$/decade, particularly for inland stations. An increase in the duration of heat waves is also projected by between 3-4 days per decade, while a decrease in the number of frost days per decade, especially at inland stations, is also likely due to the cold night threshold rising by $0.2\text{-}0.3^{o}C$/decade. These projected changes are consistent with the observational records, indicating that a good degree of confidence can be placed in these findings.

Figure 2 Changes in temperature by Fealy and Sweeney (2008). Results based on a mean ensemble of output from three GCMs forced with two emissions scenarios.

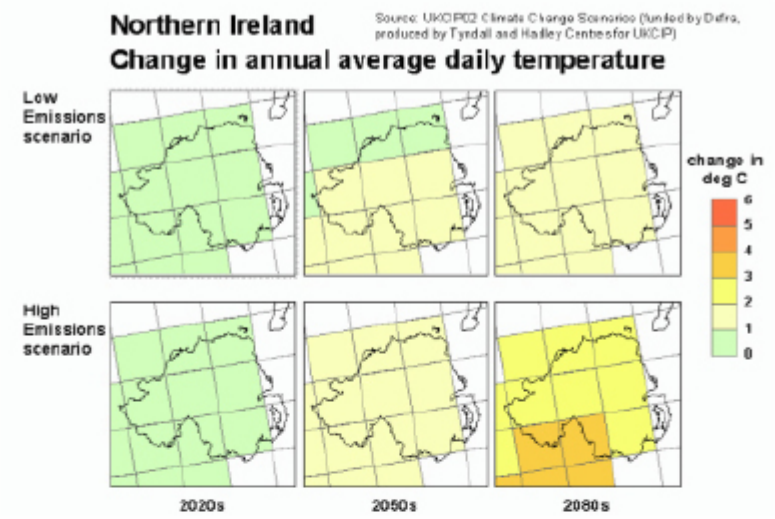


Figure 3 Percent change in annual average daily temperature for Northern Ireland for the UKCIP02 Low and High Emissions Scenarios (Arkell et al., 2007).

5. PRECIPITATION PROJECTIONS

Changes in precipitation over the course of the present century are likely to have a greater impact on Ireland than changes in mean temperature, due to the potential of increased flooding during the winter months and reductions in stream flow during the summer months. Projected changes in precipitation suggest that an increased seasonality with wetter winters and drier summers and a change in the spatial distribution are likely for all future time periods. Dealing firstly with the ICARUS scenarios produced by Fealy and Sweeney (2008) mean ensemble changes by the 2020s suggest that winter precipitation is likely to increase by approximately 3%. A similar magnitude decrease in national precipitation is projected to occur during the summer months, although a large regional decrease, of the order of 10-16%, is projected to occur along the south and east coast.

Greater seasonality of precipitation becomes evident during the 2050s, with an increase in the order of 12% projected to occur during the winter months. A similar reduction is projected to occur during the summer months. Regional decreases of between 20-28% are projected for locations along the south and east coasts (Figure 4).

These seasonal and spatial changes are further enhanced by the 2080s. An increase in winter precipitation of 15% is projected to occur nationally, with above average increases projected for the midlands. Nationally, summer reductions of 19% are likely, with decreases of between 30-40% along the east and south coasts.

Increases in winter precipitation are projected to occur for all time periods, while reductions are consistently projected to occur for all other seasons. If realised, these changes in the seasonal and spatial distribution of precipitation are likely to result in an increased likelihood of flooding, particularly in the midlands and west of Ireland, while water availability and quality are likely to be adversely affected during the late summer and autumn months in all regions, but particularly along the south and east coasts.

While not directly comparable due to the difference in simulated time periods, spatial differences in projected precipitation are apparent between both the C4I (McGrath *et al.*, 2008) and Fealy and Sweeney (2008) simulations for the middle of the century. The C4I simulations (McGrath *et al.*, 2008) project a greater decrease in summer precipitation along the west coast of Ireland, with reductions in the order of 6 to 9%, while the Fealy and Sweeney (2008) projections suggest the greatest decrease in summer precipitation will be experienced along the east and south coast.

UKCIP02 scenarios for Northern Ireland also suggest an increased seasonality with increases in winter rainfall of up to 10% for the 2020s, up to 15% for the 2050s and up to 25% for the 2080s, depending on emission scenario. It is worth keeping in mind that the upper limit of the UKCIP02 scenarios is a high emission scenario, equivalent A2 SRES scenario, again highlighting the importance of uncertainties and methodologies employed.

While there are differences in the extent and spatial distributions of changes in winter and summer, there is agreement in the overall direction of change. This however cannot be said for the shoulder seasons of spring and autumn with no clear and robust changes forthcoming. Both ICARUS and C4I scenarios suggest decreases in spring precipitation for mid-century while the UKCIP02 scenarios suggest an increase of up to 10%. In autumn both the ICARUS and UKCIP02 scenarios suggest decreases while the C4I scenarios suggest increases. These differences largely reflect uncertainties in the different models and approaches employed and the greater uncertainty associated with modelling precipitation, as compared to temperature, and stress the importance of employing multiple model simulations in order to develop robust adaptation strategies for the future.

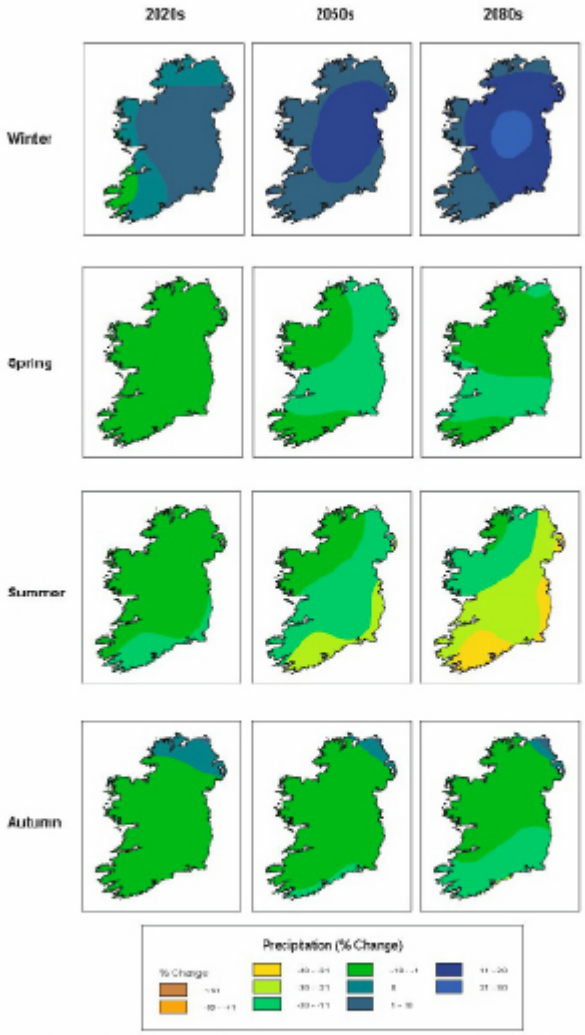
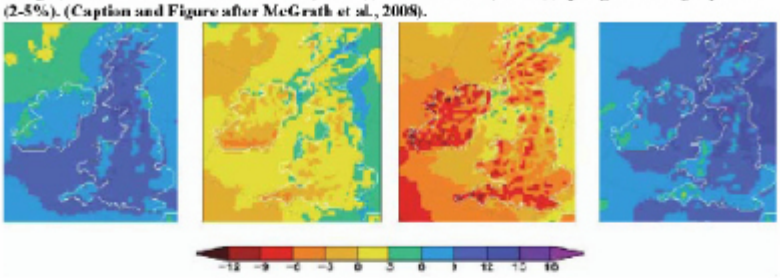


Figure 4 Percent changes in precipitation by Fealy and Sweeney (2008). Results based on a mean ensemble of output from three GCMs forced with two emissions scenarios.

Figure 5Seasonal changes in precipitation: mean of 8 ensemble simulations showing the percentage change between periods 2021-2060 and 1961-2000 for winter, spring, summer and autumn (from left to right). Autumn and winter are wetter (5-10%), summer drier (5-10%); spring is also slightly drier (2-5%). (Caption and Figure after McGrath et al., 2008).



6. Extremes of Precipitation

Due to the difficulties and uncertainties involved in modeling precipitation, confidence in estimates of changes in extreme events is very low. As global temperatures increase, the hydrological cycle will likely become more intense and will result in more extreme precipitation events. Changes in intensity or duration are likely to result in an increase in flood frequency and magnitude, while water shortages or drought conditions are likely due to reductions in precipitation. Analysis of extreme precipitation events by Fealy and Sweeney (2008) suggests a significant and increasing trend in the highest 5-day rainfall totals at eight synoptic weather stations analysed. These stations are located in the midlands and along the east coast. An increase in the longest number of consecutive dry days was found to be significant at all stations, with the greatest increases for stations in the east and midlands. These changes suggest that Irish precipitation, typically characterised as low intensity long duration, is likely to become more intense resulting in increased surface runoff.

McGrath et al. (2008) in modeling the sensitivity of the climate system to Atlantic sea surface temperatures suggest that there will be an increase in the frequency of very intense cyclones with associated increases in extremes of precipitation, translating into an increased risk of storm damage and flooding. However, there remains considerable uncertainty in these projections and further research is required (McGrath et al., 2008).

In the UK, Hulme et al. (2002) suggest that extreme winter precipitation will become more frequent. By the 2080s, winter daily precipitation intensities that are experienced once every two years on average may become up to 20 per cent heavier. Very dry summers - like 1995 – may occur in half the years by the 2080s, while very wet winters like 1994/95 may occur on average almost once a decade for the Medium-High Emissions scenario.

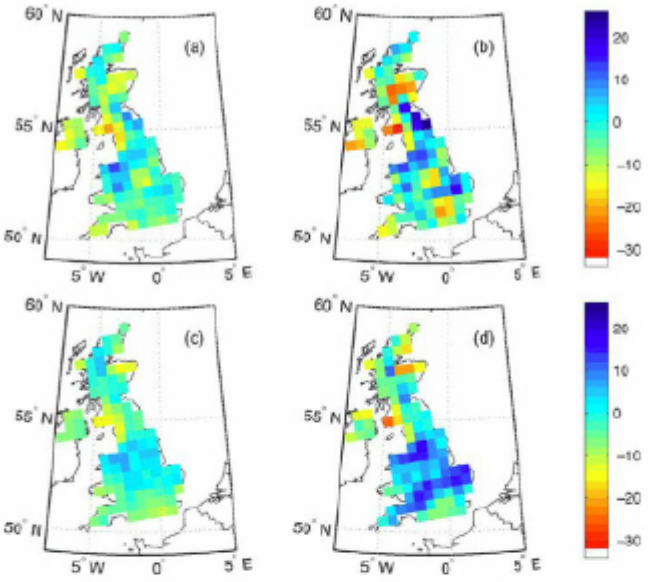


Figure 6 Percentage change in 1-day rainfall event magnitudes between control and future simulations for (a) HadRM3H, 10-year return period, (b) HadRM3H, 50-year return period, and for 10-day rainfall event magnitudes, (c) HadRM3H, 10-year return period and (d) HadRM3H, 50- year return period. (Ekstrom et al. 2005).

More recently Ekstrom et al (2005) used a regional climate model (HadRM3H) to estimate the impact of climate change on design storm depths to examine climate change impacts on various structures. Their work showed that the HadRM3H model may be used with some confidence to estimate extreme rainfall distributions, showing good predictive skill in estimating statistical properties of extreme rainfall during the baseline period, 1961–1990. The authors used HadRM3H (following the IPCC SRES scenario A2 for 2070–2100) to assess possible changes in extreme rainfall across the UK. Results indicate that for short duration events (1–2 days), event magnitude at a given return period will increase by 10% across the UK. For longer duration events (5–10 days), event magnitudes at given return periods show large increases in Scotland (up to ~30%), with greater relative change at higher return periods (25–50 years). The results presented for Northern Ireland show decreases in the order of 10% for 1-day rainfall totals with a 10-year return period and greater reductions ranging up to 20% for the 50-year return period. Reductions in the order of 5-10% are also evident for corresponding recurrence intervals of 10-day rainfall magnitudes. Data for the Republic was not available.

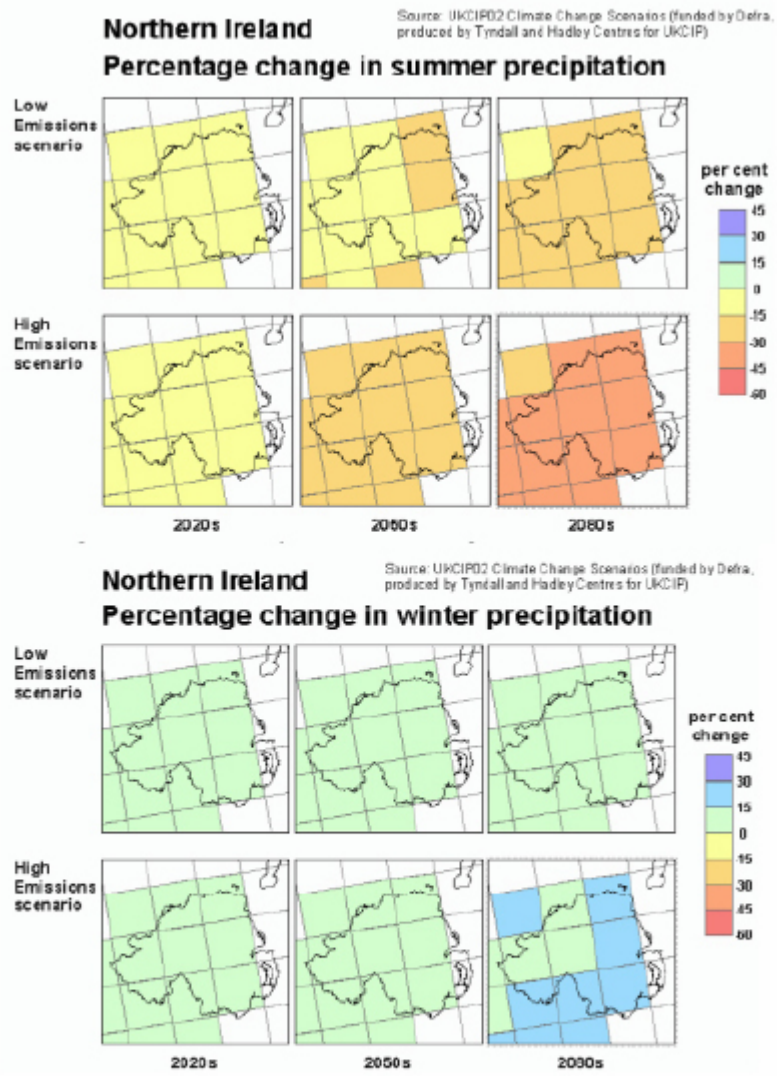


Figure 7 Percent changes in summer and winter precipitation for Northern Ireland. Results based on the UKCIP02 Low and High emissions scenarios. (Arkell et al., 2007)

7. WIND SPEED

An understanding of changes in windspeeds is important from an energy perspective as well as in terms of assessing the future integrity of physical structures. In a preliminary study, McGrath et al. (2008) have studied the impacts of climate change on wind speeds from a wind energy perspective. Using a regional climate modelling approach a small ensemble of wind predictions were produced at 60m level for Ireland. The idea of the modelling experiment was to quantify changes in future wind speeds and to evaluate the ability of dynamical downscaling to describe near surface winds at the local level. The results of these simulations for Ireland for the period 2021-2060 in comparison to current are shown in Figure 8. On a seasonal basis increases of between 8-11% (ECHAM5 A1B simulation) are shown for winter. In contrast summer decreases of as much as 14-16% are suggested for the ECHAM5 B2 simulation, with the modelling exercise indicating a decrease in the likelihood of useful windspeeds during summer months.

In terms of the above results, McGrath et al highlight that the results should be treated with caution in light of the uncertainty in emission scenarios, the reliability of AOGCM simulations and the coarse grid (~13km horizontal resolution) used for downscaling. In order to increase confidence in projections for future wind speeds the quantification of uncertainty will require an ensemble approach and higher resolution downscaling, with significant computational costs. Nonetheless basic uncertainty in the raw data for modelling windspeeds will remain problematic.

In modelling future daily mean windspeed Hume et al. (2002) find the largest changes in wind speed in the winter and summer seasons with spring and autumn speeds changing little from today. From the simulations produced for Ireland for the 2080s changes in windspeed are within natural variability for the low emissions scenario in winter for the majority of the island, in contrast the high emissions scenario suggest little change for Northern Ireland, while increases in the order of 7% are likely for parts of the midlands. During the summer in the 2080s average wind speed in Northern Ireland decreases quite substantially with greatest reductions of up to -11% for the east coast. In the South the UKCIP02 simulations show similar scale changes continuing along the east coast with greater reductions for the south east of greater than 11%. Reductions in the midlands and west as suggested by UKCIP02 range between -3% and -5% for the 2080s under the same high emissions scenario. In line with McGrath et al, Hulme et al also note the large uncertainties involved in modeling future wind speeds. The consistency between different models and the coarse physical representation within HadRM3 are not sufficient to be able to attach any level of confidence to wind speed and highlight that more caution should be taken when using these results than when using those for temperature and precipitation.

In getting a handle on extremes Hulme et al. suggest the use of empirical relationships to obtain statistics at a shorter time-scale than the daily- averages. They suggest that the maximum hourly-average wind speed is about 30 per cent higher than the daily-average wind speed, while the maximum gust, which may occur only for a few seconds, is typically about twice the daily-average wind speed. The authors highlight that there is no evidence to suggest that these empirical relationships will change greatly in the future.

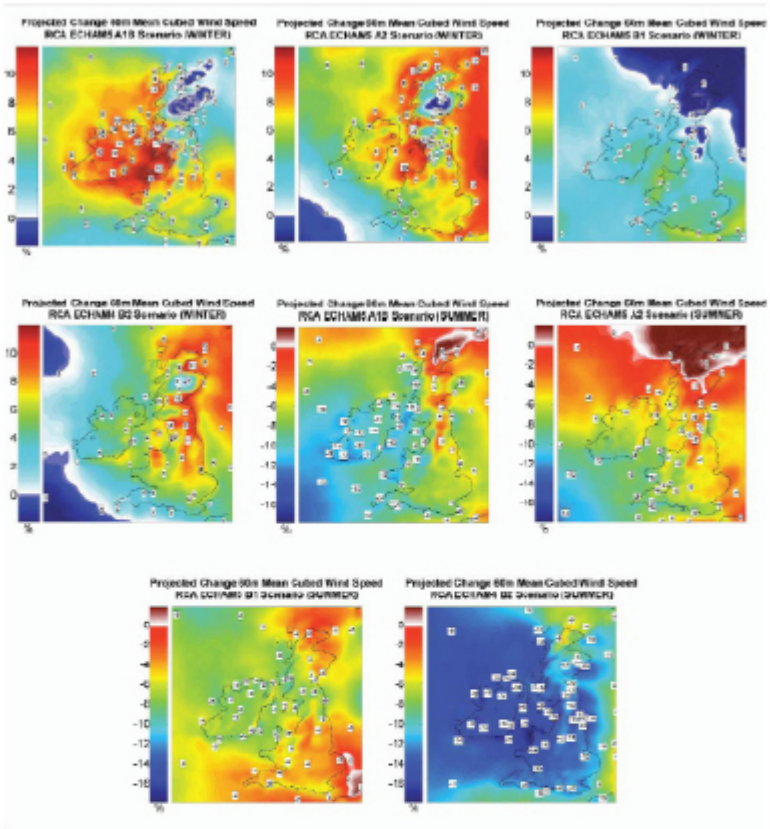


Figure 8 Projected change in wind power by season (2021-2060 relative to 1961-2000): % change in the mean annual cubed wind speed at 60 m level for 4 climate simulations. (McGrath et al., 2008)

8. River Flow

Using conceptual rainfall-runoff models to simulate river flow for a number of catchments in Ireland, Murphy and Charlton (2008) and Steele-Dunne et al. (2008) have identified a number of consistent signals for changes in hydrological regimes most prominently driven by changes in precipitation patterns, while uncertainty remains in others (Murphy and Charlton, in press, Steele-Dunne et al., 2008).

Based on the climate scenarios outlined, both Murphy and Charlton and Steele-Dunne et al. reveal that robust increases in winter and spring streamflow are apparent. All of the catchments assessed in both of these studies show substantial increases in winter and spring flows and decreases in summer and autumn. In winter, increases of up to 20% in the amount of water flowing in rivers are expected in the majority of catchments by mid-to-late century, with greatest increases occurring in January and February. Such increases would have major implications for flooding.

Reductions in summer months reach over 40% in surface water dominated catchments using ensemble averages, with uncertainty bounds reaching as much as -70% in the Boyne by the end of the century. Murphy and Charlton (2008) highlight that reductions during summer will not be as substantial in groundwater dominated catchments due to the sustaining nature of larger baseflows. While there is good agreement between both studies in terms of winter and summer simulations there are substantial disparities between both approaches in relation to autumn changes. Murphy and Charlton suggest that large reductions continue well into autumn months, while Steele-Dunne et al. suggest less severe reductions. This disparity is likely due to the difference in rainfall scenarios used (as highlighted above there are particular uncertainties regarding the direction of rainfall changes in autumn) as well as in the structures and processes represented by the rainfall-runoff models employed. Further work is required and ongoing in relation to the latter.

What is consistent between the two sets of results is that greatest uncertainty in modeling future flow regimes is associated with the lower flow seasons of summer and autumn. The most notable reductions in surface water are simulated for the Ryewater and Boyne. These catchments are the most heavily populated in the country and comprise a substantial proportion of the Greater Dublin Area (GDA). Significant reductions in the Boyne are suggested by the 2020s in early summer and autumn with reductions becoming more pronounced as the century progresses. By the end of the century reductions of up to 70% are simulated in August. Such reductions in surface water availability would have substantial implications for the entire water environment – from water supply to quality issues to loss of habitat.

In terms of water resources it is important to recognize that climate change is only one pressure, with other main drivers of demand including population growth and development. Therefore the impacts and vulnerabilities due to climate change are themselves closely linked to non-climatic factors. Furthermore, characteristics of the water resource system dictate vulnerability to climate change. In some circumstances, a large physical effect can have a very small impact, for example, where there is currently plenty of excess slack in the management system. In other cases a very small effect can have a significant impact, where the management system is already under extreme pressure (Arnell, 1998; Arnell and Delaney, 2006).

As mentioned above, higher winter flow is associated with implications for river flooding, with a reduction in return periods for floods of a particular magnitude. Almost all the catchments studied confirm a decrease in return periods. In the case of the River Barrow for example the once-in-a-fifty year flood has fallen to an 18-year event by mid century, and for the Blackwater to just over an 11-year event by mid century. These

changes are consistent with Steele-Dunne et al., who for the Blackwater by mid-century suggest that the current 40 year return period is likely to be associated with a 9 year recurrence interval. These changes raise concerns regarding the integrity of flood defenses, the capacity of urban storm drainage systems, the need for greater caution concerning planning and development of vulnerable areas as well as insurance implications for commercial and private properties. In a situation where more frequent winter flooding is likely, concerns regarding the maintenance of water quality also arise. It must be pointed out that confidence in relation to extreme flood events is lessened due to the assumptions regarding stationarity in a changing climate and the noise introduced by calculating return periods for low frequency events on relatively short datasets.

In assessing specific flow percentiles Murphy and Charlton (2008) found that substantial increases are likely for Q5 (the flow exceeded 5% of the time) with some catchments showing increases of between 20-30% relative to the baseline by mid to late century. Q95 (the flow exceeded 95% of the time) shows significant reductions for some catchments with reductions of between 20-50% by mid to late century. It should be noted that there is a large difference in magnitude of changes between catchments. Changes in the variability of flow regimes are also likely as a result of climate change. By the 2050s increases in variability are simulated for the majority of catchments. By the end of the century further increases in the variability of daily streamflow are likely. The catchments showing the least change in variability are the groundwater-dominated catchments

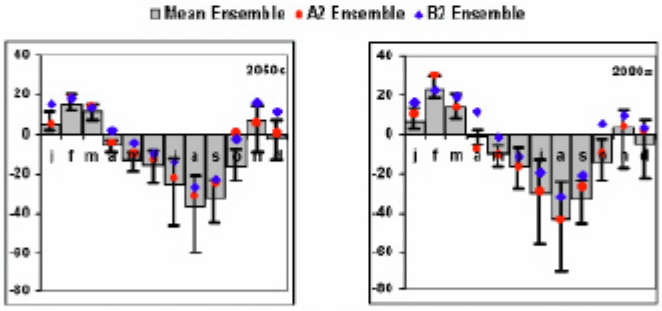


Figure 9 Percent change in monthly streamflow for the Boyne by the 2050s and 2080s. The grey columns represent changes of the Fealy and Sweeney (2008) mean ensemble used to force the rainfall runoff model. Error bars represent uncertainty in rainfall runoff model projections. Simulations have been conducted for 8 other catchments throughout Ireland. (Murphy and Charlton, 2008)

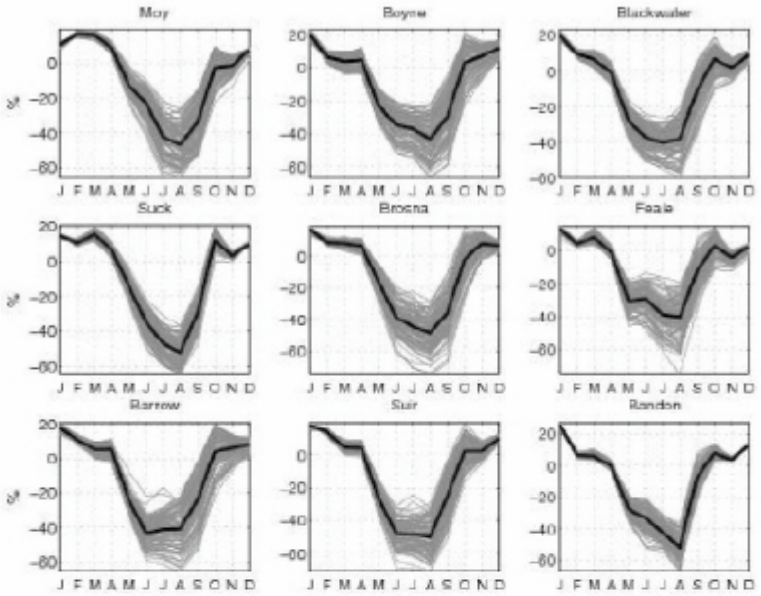


Figure 10 Change in monthly mean daily flow due to climate change under the SRES A1B scenario. Grey bars show uncertainty in rainfall-runoff model, with the mean shown as a black dashed line. (Steele-Dunne *et al*, 2008)

9. Sea level Rise

Relative sea level, or the height of the sea relative to the land, ultimately determines the location of the shoreline and any fluctuations in relative sea level will affect the coastal morphology. Globally, sea level has been rising over the 20th century at a rate of 1-2 mm yr^{-1}, resulting in a total rise of 0.17 m. Over the period 1961-2003, sea level rose at an average rate of 1.8 mm yr^{-1}. However, an increase in this rate, to 3.1 mm yr^{-1}, was observed over the 1993-2003 period. Evidence from observations indicate that warming of the oceans has occurred to depths of at least 3000 m. This warming has resulted in the thermal expansion of the oceans. Over the 1993-2003 period, the contribution from thermal expansion to sea level rise is estimated to have been 0.42 mm yr^{-1}. Figures 11 and 12 illustrate the increase in sea surface temperatures for the Northern hemisphere and Port Erin, Irish Sea.

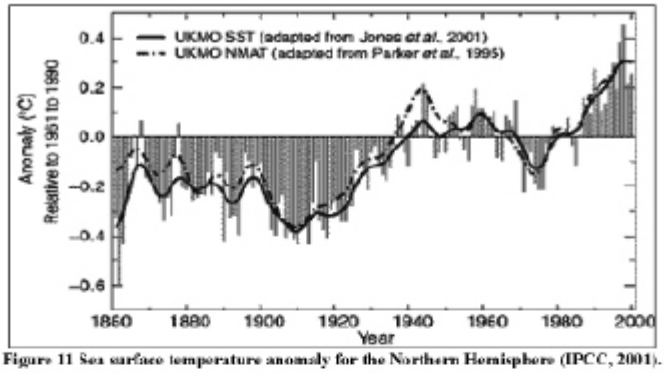


Figure 11 Sea surface temperature anomaly for the Northern Hemisphere (IPCC, 2001).

Continuing thermal expansion, melting of terrestrial glaciers and snow cover and contributions from the large ice sheets of Greenland and Antarctica are likely to result in a sea level rise of between 0.28 to 0.43 m by the end of the present century, relative to 1980-1999 (IPCC, 2007). However, these ranges may significantly underestimate the future increase in globally averaged sea level, as they do not include important uncertainties in the carbon-cycle feedback. Hansen (2007) argues that sea level rise is likely to be much greater, in the order of metres over the century timescale, due to the non-linear response of ice sheets to climate forcing. In order to prevent such a scenario occurring, global temperatures would need to be stabilised at less than 1°C above the year 2000 levels (Hansen, 2007).

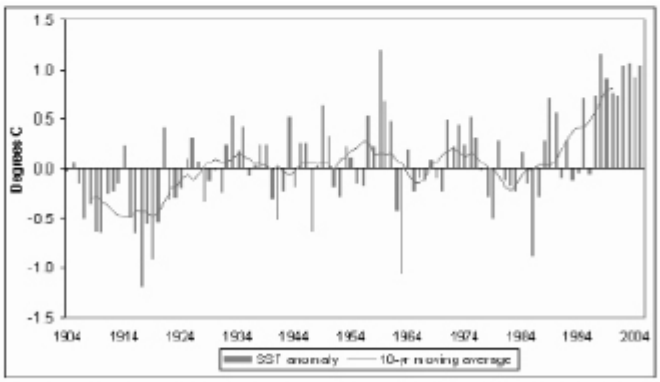


Figure12 Annual average anomalies (1904-2005) of Irish Sea sea surface temperatures from Port Erin, Isle of Man, relative to the 1961-1990 period (Data reproduced with kind permission of the Port Erin Marine Laboratory, Isle of Man).

Sea temperature and sea level in Irish waters have been rising slowly in recent decades with satellite and in situ coastal observations showing a general warming trend of 0.3-0.4°C per decade since the 1980s (McGrath et al. 2008). McGrath et al also highlight a more rapid rate of warming of 0.6-0.7°C has been suggested for the Irish Sea. These trends are consistent with what has been observed globally. Rising sea levels in recent decades are linked to warming of the oceans and the resulting thermal expansion of seawater and the influx of freshwater from melting land ice. McGrath et al (2008) highlight that from satellite observations sea levels are rising on average 3.5cm per decade around Ireland, well in excess of ongoing isostatic adjustment.

Rates of highest rebound are associated with locations where the greatest mass of ice was located, approximately north of a line from north Wexford to south Donegal (Edwards and O'Sullivan, 2007), while south of this line rebound rates are slight or negative. As a consequence of isostatic rebound, mean sea level at Malin Head appears to be decreasing, while at Dublin it appears relatively stable.

Regional projections of sea level rise for the present century are subject to a high degree of uncertainty as warming of the surface layers of the oceans is not likely to be uniformly distributed across the ocean surface. Regional changes in atmospheric pressure and ocean circulation will also affect the distribution of sea level rise (Hulme *et al.*, 2002). Due to the uncertainties in regional projections of sea level rise, global projections are employed to assess the likely impacts of sea level rise on the Irish coast. However, caution must be exercised in interpreting the results as these estimates may under or over estimate regional sea level rise by up to ±50% (Hulme *et al.*, 2002).

Global projections, from a range of global climate models, suggest that globally averaged sea level will rise by between 0.28 and 0.43 m (IPCC, 2007), indicating an annual rate of increase of between 2.8 to 4.3 mm yr^{-1}, assuming a linear increase, over the course of the present century (1980-1999 to 2080-2099). If a wider range of emissions scenarios is included, a range of between 0.18 to 0.59 m is considered more likely. A higher rate of sea level rise cannot be excluded, but due to a limited understanding of key processes, such as the potential for increased flow rates of ice from Greenland and Antarctica, our ability to quantify an upper value is limited (IPCC, 2007).

Combining these sea level projections with isostatic rebound rates for Ireland (After Edwards and O'Sullivan, 2006), projected rates of relative sea level vary substantially around the Irish coast. Locations in the extreme southwest, from the Dingle Peninsula to Cape Clear are likely to experience the largest increases in relative sea level, at a rate of between 3.3 to 4.8 mm yr^{-1}, while on the north east coast, from Malin Head to north of Dundalk, a rate of between 2.2 to 3.7 mm yr^{-1} is likely.

Based on previous estimates of sea level rise (IPCC, 2001), Fealy (2003) calculated the potential area of land likely to be inundated due to a sea level rise of 0.48 m, and found that over 380 km^2 of the land area of Ireland had a greater than 10% risk of inundation due to sea level rise over the present century (Figure 13). While this figure represents a lowering of previous estimates of land area vulnerable to inundation, vulnerable locations

represent areas with significant land values, such as Dublin, Cork and Wexford and the Shannon Estuary.

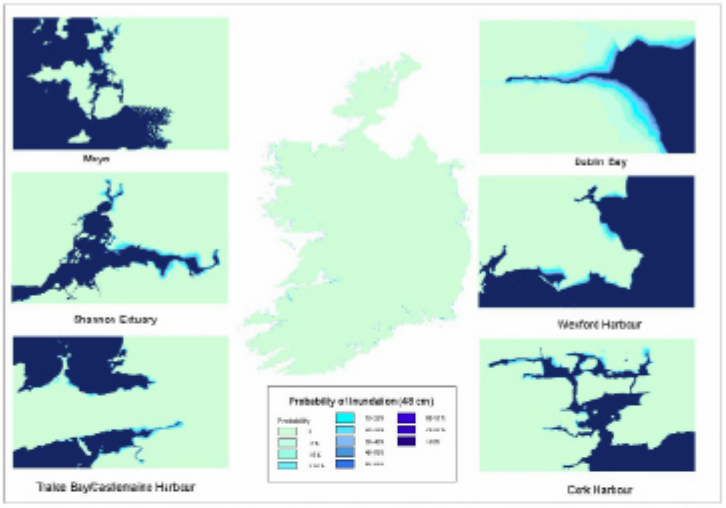


Figure 13 Probability of inundation associated with a sea level rise of 0.48 m (Source: Fealy, 2003)

The projected increase in relative sea level is also likely to result in an increase in wave energy being transmitted to the shoreline (Hulme *et al.*, 2002). In addition to an increased vulnerability of inundation due to a rise in relative sea level, coastal locations are also likely to be impacted due to changes in erosion and deposition rates.

In terms of wave heights, preliminary results from McGrath et al. (2008) show that there is some evidence of significant increases in Atlantic wave heights for the period 2031-2060, with extreme wave heights showing an increase of up to 10%, except in parts of the south and west. However, the authors highlight that these results are based on the data from only one GCM and one future greenhouse gas emission scenario and should therefore be treated with caution. Also, the resolution of the data (0.25°) is too coarse for a detailed analysis around the Irish coastline. In spite of these limitations, the basic data do provide a qualitative description of the possible impacts of climate change on wave heights around Irish coastal waters. Current work to refine these findings is ongoing between the Coastal and Marine Resources Centre (CMRC) in UCC and Met Eireann.

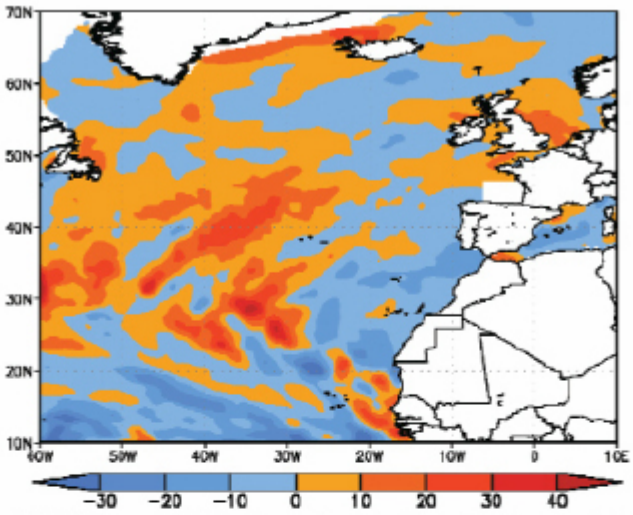


Figure 14 Relative changes (%) in the 10-year return value of annual maximum significant wave height between the future (2031-2060) and past (1961-1990) control run.

10. Storm Surges

An increase in relative sea level over the present century will mean that low-lying coastal areas will be increasingly susceptible to permanent inundation with subsequent changes in erosion and deposition. While temporary changes in extreme water levels, resulting from storm surge events particularly if coupled with high astronomical tides, are likely to present a much greater potential for damage through overtopping of coastal defences with resultant flooding. Additionally, storm surge events can have a significant and lasting impact on the coastal morphology as a temporary increase in water levels and wave energy will impact on the processes of erosion, transportation and deposition, through the reworking of material which may be in equilibrium with the existing coastal energy regime.

Due to projected increases in tropical sea surface temperatures, climate models indicate that it is very likely that tropical cyclones (typhoons and hurricanes) will become more intense, with higher wind speeds and more intense precipitation, while extra tropical storm tracks are projected to move polewards (IPCC, 2007). While Ireland is not directly affected by hurricane activity, due to insufficient temperatures of the sea surface off the coast required for hurricane formation, the remnants of Atlantic hurricanes can become rejuvenated as they cross the Atlantic from west to east and pass over the warmer sea surface temperatures associated with the Gulf Stream. Due to the model projected changes in storm intensity and associated increases in wind speeds, a significant enhancement of wave heights is likely as these low pressure systems pass over the Atlantic. For countries along the eastern Atlantic seaboard, such as Ireland, an increase in

surge elevation is likely to lead to increased vulnerability from flooding and storm damage. An increase in relative sea level is likely to further exacerbate increased surge levels associated with more intense extra tropical storm activity.

In an analysis of extreme water levels and sea level rise, Fealy (2003) assessed the probability of inundation associated with an increase in sea level of 0.48 m and an extreme water level of 2.6 m, which represents a 1-in-100 year event on the east coast and 1-in12 year event on the west coast (Figure 15) (Carter, 1991). The return period associated with an extreme water level of 2.6 m is likely to decrease as a consequence of sea level rise, for example, the current 1-in-100 year event is likely to become a 1-in-10 year (or less) event. An extreme water level of 2.6 m combined with an increase in sea level of 0.48 m, is likely to place approximately 680 km^2 of land at risk of inundation (>10% probability) (Fealy, 2003).

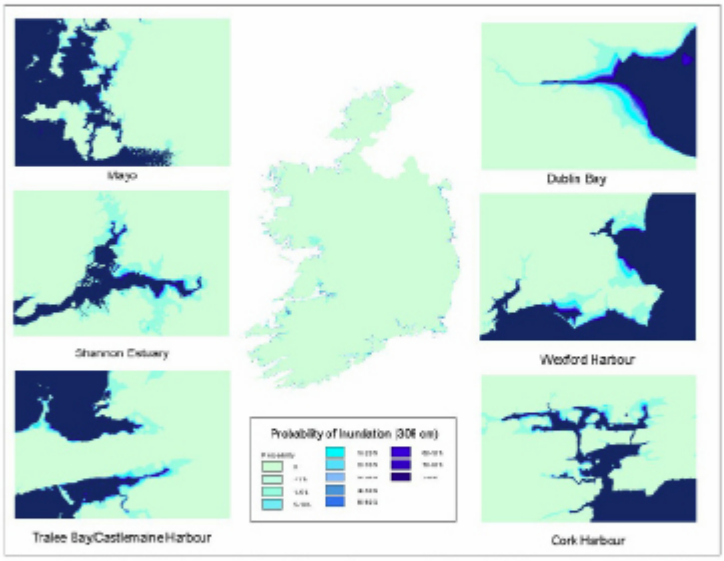


Figure 15 Probability of inundation with an extreme water level of 2.6 m and sea level rise of 0.48m (Source: Fealy, 2003)

11. Key Questions for Discussion

The likely changes in future climate and its impacts identified above raise serious questions of how we should adapt to meet these challenges in the areas of water services, flood alleviation and energy. While they are serious the impacts identified are not exhaustive. Few sectors are charged with as much responsibility as engineering for ensuring effective adaptation to climate change and in this light some points are highlighted that may spark further discussion during the workshop.

- Do we need an industry standard set of climate scenarios that incorporates as many sources of uncertainty as possible?
- What are the key data constraints in moving state of the art forward?
- How can climate researchers provide information to meet the needs of the engineering profession?
- Do we need to move towards a probabilistic approach akin to UKCIP09?
- Are we close to the point where we can attribute likelihoods to key impacts?
- What are the key gaps in knowledge that remain?
- What are the critical pieces of infrastructure that must be protected at all costs and are we in a position to produce risk assessments for these?
- Can we produce simulations for key design standards used in the engineering profession?

SRES Emissions Scenarios

The **A1** emissions scenario describes a future world of very rapid economic growth, global population that peaks in mid-century and declines thereafter, and the rapid introduction of new and more efficient technologies. Major underlying themes are convergence among regions, capacity building, and increased cultural and social interactions, with a substantial reduction in regional differences in per capita income. The A1 scenario family develops into three groups that describe alternative directions of technological change in the energy system. The three A1 groups are distinguished by their technological emphasis: fossil intensive (A1FI), non-fossil energy sources (A1T), or a balance across all sources (A1B) (where balanced is defined as not relying too heavily on one particular energy source, on the assumption that similar improvement rates apply to all energy supply and end-use technologies).

The **A2** emissions scenario describes a very heterogeneous world. The underlying theme is self-reliance and preservation of local identities. Fertility patterns across regions converge very slowly, which results in continuously increasing global population. Economic development is primarily regionally oriented and per capita economic growth and technological change are more fragmented and slower than in other storylines.

The **B1** emissions scenario describes a convergent world with the same global population that peaks in mid-century and declines thereafter, as in the A1 storyline, but with rapid changes in economic structures towards a service and information economy, with reductions in material intensity, and the introduction of clean and resource-efficient technologies. The emphasis is on global solutions to economic, social, and environmental sustainability, including improved equity, but without additional climate initiatives.

The **B2** emissions scenario describes a world in which the emphasis is on local solutions to economic, social, and environmental sustainability. It is a world with a continuously increasing global population at a rate lower than in A2, intermediate levels of economic development, and less rapid and more diverse technological change than in the B1 and A1 storylines. While the scenario is also oriented towards environmental protection and social equity, it focuses on local and regional levels.

In 1992, the Intergovernmental Panel on Climate Change (IPCC) published the first emissions scenarios, which were the precursor to the present SRES (Special Report on Emissions Scenarios) emissions scenarios employed in both the Third (IPCC, 2001) and Fourth Assessment Reports (IPCC, 2007). These scenarios assume varying levels of future demographic, technological, environmental, societal and economic developments that result in different future emissions scenarios for the main greenhouse gases and aerosols. While over 40 emissions scenarios were developed, four central 'families' or sets of equally probable scenarios, namely A1, A2, B1 and B2 which span approximately 80% of the range of future emissions contained in the SRES. Modelling the future climate for a given emissions scenario will always result in a range of future scenarios being simulated due to uncertainties inherent in the climate and modelling system (Hulme and Carter, 1999).

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The Irish Academy of Engineering

Critical Infrastructure Adaptation for Climate Change

Energy Infrastructure

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Workshop Dublin Castle: 28th April 2009

Summary

Every day, we hear of new initiatives in the energy sector to mitigate climate impacts. While major changes are underway in energy infrastructure, little attention has been given to climate adaptation.

Ireland's location in the Atlantic Ocean off Northern Europe has implications for energy supply – we are heavily dependent on import of fossil fuels over long distances, but we have a favourable setting for renewable generation from wind and ocean. The Northern Atlantic is linked to the arctic, where observed rates of change are shown to be faster than the rest of the world. Future energy infrastructure development must therefore address two distinct issues:

- facilitate the exploitation of renewable energy resources
- withstand any environmental impact of climate change

The lead time from planning to operation can be 10 to 30 years in the energy sector. Although this lead time has been reduced significantly in recent years, due primarily to technological advance, projections for energy supply and demand must look forward 20 to 40 years ahead. Plans are heavily dependent on socio-economic factors and on climate change. Latter examples of major impact are flooding of gas network marshalling stations and electricity substations or the destruction due to high winds of electricity lines.

Hence there is a wide range of adaptation issues to be addressed in the energy sector.

These include:

- Socio-economic models and methodologies for integrating adaptation in future demand
- Preparation of wind and wave resource atlases for future scenarios
- Need for climate parameters that will impact on efficiency and capacity factors of energy conversion and storage systems
- Need for adaptation in Codes and Standards for design of power plants, electricity and gas network substations, oil storage and dam safety based on predictions of extreme rainfall, wind, wave and surge - standards that are higher than in most design situations;
- Analysis of the so-called "Water-Energy Nexus", the complex linkage between energy for water/wastewater and water for energy, with changes in rainfall, evaporation, river flows, sea level and surge
- Coastal protection measures at reserve oil storage, pipelines, power generating stations, network substations and seabed cables;
- Bioenergy Action Plan measures accounting for seasonal changes in crop temperature and water cycle.

Measures to address adaptation must be comprehensive and integrated with other sectors, taking account of multiple factors through national and international policies

Introduction

Energy is a vital service for domestic, business, farming and industrial activity. An associated quality infrastructure is essential for Ireland to attract and retain high-tech industrial investment and for the country to have competitive energy supplies and balanced regional development.

Energy asset management and infrastructure planning has to be resilient as it responds to changes in climate and other factors. The long lead-in timescales for major energy infrastructure means that this response must be factored into energy policy, in a manner that accounts for adaptation strategies so that actions are consistent and adaptable.

The objective is to integrate the results of recent climate research in Ireland into the risk reduction strategies of energy planning, operation and maintenance. Existing energy systems in Ireland need to be checked for resilience and flexibility. Priority in energy planning must be given to win-win situations, that is, measures that are robust and flexible enough to cope with changing climate conditions. Irreversible actions are to be avoided.

This paper reviews the issues that arise for the energy sector. It presents a simple 'climate check' taking account of significant uncertainty involved in climate change assessment, uncertainty that arises at many levels, from:

- complex climate models at a global level,
- downscaling to the regional level
- local hydrodynamic modelling for water environment
- social and political inputs and assumptions made over the forecast period.

Notwithstanding this uncertainty, the efficiency and effectiveness of investment decisions can benefit from this climate-check. Measures can be said to be 'climate checked' rather than 'climate-proofed', because of the level of uncertainty involved.

Particular monitoring and research programmes for energy resources and procedures will be required to improve the level of certainty, taking account of additional climate research results as they become available.

Energy Infrastructure – Existing & Planned

Gas Networks

The Bord Gáis Eireann natural gas network consists of 2,169km of high-pressure steel transmission pipelines and over 9,765km of distribution pipelines. The gas network is supplied through three seabed pipelines from Scotland, two to Ireland and one to Northern Ireland. In recent years, the transmission system has been extended to Mayo and North-South and many additional towns are being connected throughout the country.

National Oils Reserve Agency

The National Oils Reserve Agency is the state body responsible for the holding of national strategic oil stocks at a level determined annually by the Minister for Communications, Energy and Natural Resources. Operational stocks in Ireland are held at major ports, at the Whitegate

refinery and by large oil consumer companies. Ireland's IEA Stockholding Requirement for 2008 amounted to 2 million tonnes of Crude Oil Equivalent.

Electricity Networks

The ESB electricity network consists of 150,000km of low and medium voltage networks (mainly overhead lines) and 12,000km of high voltage circuits of which 5,800km relates to the transmission grid and is operated by Eirgrid. In Northern Ireland NIE has 2,100km of transmission network and 42,000km of distribution network. By 2025, the electricity transmission grid will carry 60% more power to cities and towns across Ireland. Eirgrid's strategy "GRID25" is an essential initiative to facilitate reliable, secure and affordable electricity supplies throughout Ireland. Without it, within the next five to ten years key parts of the grid will have reached capacity with likely overloading increasing risk to supply security. The total expenditure on network capital infrastructure during the period 2001 - '10 incl. is €6.5 billion, which is the largest undertaken by any electricity distribution company in Europe.

The demand level forecasts in 2025 are based on the Economic and Social Research Institute's long-term forecast of moderate growth in economic activity. The projections allow for reductions through energy efficiency and savings and for impacts of climate mitigation such as an increase in the share of electricity in the transport market, through electric vehicles.

Electricity generation in 2020 is projected to maintain present generation from coal, peat and hydro, to phase out oil, to maintain natural gas at about 50% and to increase substantially the amount coming from renewables. Renewable energy will contribute a total of 40% comprising primarily wind power, biomass and a small contribution from ocean energy. Accommodation of wind generation is a significant driver of transmission expansion. Energy storage as a complement to renewable variability is also being evaluated.

General

Contingency plans are in place to mitigate energy supply disruptions in line with Ireland's EU and IEA obligations.

A comprehensive White Paper was published in 2007 [4], setting out the Government's Energy Policy Framework to 2020. While climate adaptation is not specifically mentioned, it addresses issues that are relevant under the headings Strategic Goals for Security of Supply and Sustainability of Energy Supply. These are listed below.

Actions to Ensure Security of Energy Supply

- Ensuring that electricity supply consistently meets demand
- Ensuring the physical security and reliability of gas supplies to Ireland
- Enhancing the diversity of fuels used for power generation
- Delivering electricity and gas to homes and businesses over efficient, reliable and secure networks
- Creating a stable attractive environment for hydrocarbon exploration and production
- Being prepared for energy supply disruptions.

Actions to Promote the Sustainability of Energy Supply and Use

- Addressing climate change by reducing energy related greenhouse gas emissions
- Accelerating the growth of renewable energy sources
- Promoting the sustainable use of energy in transport
- Delivering an integrated approach to the sustainable development and use of bioenergy resources
- Maximising Energy Efficiency and energy savings across the economy
- Accelerating Energy Research Development and Innovation Programmes in support of sustainable energy goals.

The “All-Island Grid Study" [9] was published in January 2008. For a range of electricity generation portfolios, it provides a review of theoretical and practicable renewable energy resources and analyses the grid strengthening measures required to support each portfolio. Up to 42% renewables was considered.

In Northern Ireland, Department of Enterprise, Trade and Investment has recently published a Pre - Consultation Scoping Paper, “Northern Ireland Strategic Energy Framework 2009"[5].

The present level of new build and upgrading of energy infrastructure represents a major shift in scale from today’s levels and presents significant challenges to all involved in its delivery. Future infrastructural development will take place in an environment different to todays due to climate change and their delivery must take such changes into account.

Parameters Affected by Climate Change

Summary predictions are presented below for key parameters [6], [7], together with their links to energy infrastructure.

Air Temperatures – linked to higher summer and reduced demand, prolonged growing season for bio energy, drying of peat lands

Temperatures are likely to increase everywhere relative to the present with greatest increases suggested for the summer and autumn of up to 1.2 – 1.4 oC (relative to 200) by 2060 and to 3.4oC by the end of the century. With increases in average temperatures a change in extreme events is to be expected with an increase in the intensity and duration of heatwaves and a decrease in frost occurrence likely.

Sea temperatures – linked to thermal power plant cooling water systems

Sea temperature generally mirrors temperature trends over land. However, over the Irish Sea the satellite measurements suggest a more rapid warming rate (0.6-0.7°C per decade).

Precipitation – linked to hydro, bio energy and energy for water pumping

Precipitation remains an uncertain variable with differences in the extent and spatial distribution of changes between different modeling approaches. A robust signal of increased seasonality is evident with wetter winters and drier summers likely. No clear direction of change is evident for spring and autumn.

Wind speeds – linked to wind power

Increases of 8-11% at 60m height average wind speeds are likely in winter by around mid-century [7], with decreases of between 14-16% in summer but assessment of this variable to date has been subject to high levels of uncertainty [7]. McGrath notes that the Irish observational records indicate that average annual wind speeds decreased in the 1990s, with this trend continuing in the early years of the 21st century.

Sea level rise and storms – linked to seabed cables, coastal power plants and substations on reclaimed land, ocean energy, ports with oil reserves

IPCC scenarios suggest a likely sea level rise of between 0.28 to 0.43m by the end of the century relative to 1980-1999. However, recent thinking suggests that this may be too conservative with increase of over 1m suggested.

The likelihood of increased storminess, higher sea levels and wind speeds will result in a subsequent enhancement of wave heights and storm surges, when combined with riverine flooding will pose serious flood risks in many of our coastal cities.

River flows and flooding – linked to hydro, dam safety, cooling water, water supply

In relation to stream flow robust increases in winter and spring flows in the order of 20% in winter are likely by mid to late century. Reductions in summer and autumn months of over 40% are likely in many catchments. Catchments show different signatures of change depending on characteristics determining runoff response.

Flood events are likely to become more frequent with the current 50 year event likely to be associated with a ~10 year return period by mid to late century. While uncertainty remains low flow events are also likely to become more frequent.

Sunshine/cloudiness – linked to solar thermal and photovoltaics

No significant trends. However, these elements are particularly difficult to model.

Relative humidity – linked to thermal power generation efficiency

No significant trends.

Landuse – biological processes, peat extraction

Changes in species composition are predicted for many habitats, arising from a combination of temperature increase, changes in nutrient cycles and productivity, and soil moisture. Climate change induced drying of heaths and peat lands are likely to increase fire risk. Drying also

increases the possibility of wind erosion, particularly on degraded sites, while extreme rainfall events also increase erosion risk and suspended solids loadings to downstream watercourses.

Vulnerabilities

Vulnerabilities are reviewed below in four categories.

Table 4.1 Relative Severity of Climate Change on Energy Infrastructure

Infrastructure	Relative Severity of Climate Change Adaptation
Efficiency and Capacity Factors of Power Generation	Very High
Water – Energy Nexus	High
Coastal	Medium
Networks, Storage	Medium

Efficiency and Capacity Factors of Power Generation

Significant vulnerabilities relate to power generation.

For fossil-fuelled power plants, optimisation of efficiency of energy transformation from primary energy to electricity is critical to the design and operation, not only from the point of view of economics but also in reducing the amount of carbon and other emissions. The higher the efficiencies of Ireland's power plants, the fewer plants are needed and total emissions are lower. Rising ambient temperatures reduce efficiency of the necessary air or water cooling systems within the power plants.

In addition, a plant using cooling water from rivers or from the coast has an overall plant efficiency approximately 2-3% higher than air-cooled systems. Water cooling is dependent on mixing in river flows or tidal currents and is subject to environmental constraints such as fisheries movement. A number of power plants on the Danube River shut down during a heat wave across Central Europe in 2003, when river temperatures increased beyond acceptable limits.

The efficiency of intermittent renewable power plants such as wind, run-of-river hydro and wave, will change as changes occur in the average wind speed, river flow and wave height. Increased wind speed can on the one hand lead to greater electricity production from wind turbines, but on the other hand, in storm situations wind turbines must be shut down to avoid storm damage and distribution lines suffer.

Another criterion is power plant capacity factor. This is the annual average output in MWhrs as a percentage of the output if the plant was running continuously. Increased downtime due to extreme weather conditions and to additional maintenance can affect both the efficiency and the capacity factor. For intermittent renewable plants, called non-despatchable plants, there are knock-on inefficiencies in start/stop of other supporting plants.

Energy - Water Nexus

Hydropower will become less efficient as winter flows are increased and summer flows are reduced. Standards for dam safety during extreme floods will need to be reviewed and operating procedures modified. The predicted 40% reduction in low flows will probably mean that other uses will take priority rather than hydropower for large parts of the year, such as public water supply and downstream environmental flows. Cooling water may be subject to constraints as mentioned above. Reduced low flows will also constrain the possible locations of new thermal plants, close to larger rivers where sufficient assimilative capacity is available for effluents.

In the future, substantial energy may be required for increased pumping of water supplies and wastewater systems for populations and industry, due to reduced local low flows. Irrigation pumping may be required. This is practised at present in the low-rainfall vegetable growing region of north Dublin and its widespread use in the future has been mentioned [6]. A higher standard of wastewater and/or sludge treatment may be required which may be energy intensive.

Coastal Infrastructure

Large energy infrastructures are located on the coast, close to jetties for import of oil and coal, and close to cooling water and to centres of population. Oil reserve storage is also on the coast. Most are on reclaimed land. Extensive wave and tidal plants are planned, under test at present off the coast and they are dependent on marine support services from local ports. Seabed cables and pipelines are located on the east coast, across the Shannon Estuary and planned for Co Mayo.

This infrastructure is vulnerable to sea-level rise and especially to storm surge and wave height. One parameter is worth noting in particular - the modelling results indicate an increase in the frequency of storm surge events and a significant increase in the height of extreme surge, with most of the extreme surges occurring in wintertime. There is also some evidence of significant increases in wave height extremes. (The 0.9m height that occurred during the 2002 storms may increase to 1.5m).

Networks and Storage

Higher average temperatures are expected to reduce the need for heating in winter and perhaps increase the need for cooling in summer.

In common with other critical infrastructure, the energy sector has facilities located throughout the country that are vulnerable to flooding and extreme wind loads. These include wind farms, substations, overhead lines, gas stations, oil terminals, offshore drilling rigs, etc. Codes and standards may need to be reviewed, similar to the Pitt Review report and the Energy Networks Association report in the UK, which followed the severe Gloucestershire flood in 2007. This recommended that the 1000-year risk should be considered.

In the longer term, infrastructure reinforcement measures may be required and in extreme scenarios, relocation to more secure locations may be appropriate. Health and safety response policies will be required to deal with catastrophes.

Adaptation Measures

The approach to adaptation in engineering infrastructure could be commenced by:

- Applying a probabilistic approach that provides the basis for a risk assessment due to climate change, with potential constraints on future energy options
- Examining approaches to integrating the impacts of climate change in design
- looking for opportunities to monitor key parameters at existing infrastructure to improve our understanding of climate change trends and impacts.

Plants and networks can be adapted to a certain extent to altered climatic conditions. While the existing energy infrastructure is not expected to be affected by the climate changes expected in the next 20–30 years temperature and sea level rise will need to be addressed. Towards the end of the century the effects will become more pronounced.

Energy infrastructure planning has a lead time of 10 to 30 years. Changes in the next 20 to 40 years are more readily identified than longer-term changes that depend on many social and political assumptions. Changeover and adaptation of plant capacities to address them should be implemented as required.

Predictions indicate that measures are required related to:

- Demand – seasonal changes, irrigation pumping, etc
- Supply – changes to renewable resources, to efficiency and capacity factors of conventional fuel conversion, and to risks at networks and storage facilities
- Local physical setting requiring modifications common to all infrastructure (coast, floodplains).

Measures can be categorised as win-win, no-regrets, regrets, and adaptation actions.

Win-Win Solutions are robust measures in the context of climate change. For example, increasing measures for energy storage provide security of supply and also contribute to climate adaptation.

Table 5.1 Win-Win Solutions

Measure	Contribution to adaptation to climate change
Energy Storage –CAES1, hydro, electric cars	Protection against disruption and extremes
Network Renewal/Smart Networks	Facilitates renewables, energy efficiency
Increased water Impoundment	Pumping supplied at base load rather than at marginal high-emission supply

No-Regret Solutions are measures that are robust and flexible enough to be viable under different climatic scenarios and thus will not be affected later by climate change.

Table 5.2 No-Regret Solutions

Measure	Benefit of measure under changing climate
Demand Management	Climate change neutral

Regret Solutions are measures that bear a high risk of being counter-productive regarding adaptation to climate change, because the adaptive capacity of other sectors is reduced in relation to effectiveness, increases costs, etc.

Table 5.3 Regret Solutions

Measure	Potential problems under changing climate
Siting critical infrastructure in floodplains	Increased flood protection

Many initiatives in the 2007 Energy Policy White Paper [4] are 'win-win' solutions, such as storage for security of supply. This type of analysis highlights the advantages of an integrated approach to energy management within spatial planning and an adaptation strategy. It strengthens future engineering and science policy, linked on climate change by identifying research needs, communicating them to the research community and making best use of available research results.

Interaction with Other Sectors

Management action to address one climate pressure may increase the risk of not achieving objectives for another pressure. Climate change may increase this risk further, highlighting the need for integrated thinking.

Research

Research in adaptation covers a very wide field of problem areas.

The greater part of research efforts up until now have been directed at understanding and describing the impacts of the changing climatic conditions. There has been only limited focus on solutions to the specific challenges connected with future climate change.

Specific research for the energy sector will involve:

- Socio-economic models and methodologies for integrating adaptation in future demand
- Preparation of wind and wave atlases for future scenarios
- Need for identification of climate parameters that will impact efficiency and capacity factors of energy conversion and storage
- Need for adaptation in Codes and Standards for design of structures, power plants, electricity and gas network substations, oil storage and dam safety based on predictions of extreme rainfall, wind, wave and surge - standards that are higher than in most design situations;
- Analysis of the so-called "Water-Energy Nexus", the complex linkage between energy for water/wastewater and water for energy, with changes in rainfall, evaporation, river flows, sea level and surge
- Coastal protection measures at reserve oil storage, pipelines, power generating stations, network substations and seabed cables;
- Bio energy Action Plan measures accounting for seasonal changes in temperature and water cycle.

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(Footnotes)

1 Compressed Air Energy Storage

The Irish Academy of Engineering: Flood Protection Infrastructure

The Irish Academy of Engineering

Flood Protection Infrastructure

Tony Smyth, Office Of Public Works

Workshop on:
Critical Infrastructure - Adaptation for Climate Change
Dublin Castle 28th April 2009

Introduction

Definition of critical infrastructure in flood defence context

Typically **Critical infrastructure** is a term used by governments to describe assets that are essential for the functioning of a society and economy. Most commonly associated with the term are facilities for electricity generation and transmission, telecommunications, transportation, water supply and public health services.

For the purposes of this paper, I am taking the definition to extend to those assets that provide protection to these facilities from flood damage. They are referred to as flood defence assets, i.e. infrastructure that provides protection from flooding to homes, businesses, infrastructure and the environment and includes embankments and walls, which have been constructed by a public authority or by a private concern. It includes river or coastal defences, natural or constructed, whether or not they are subject to a maintenance programme.

A brief outline of the critical infrastructure – existing & planned.

Do we know the defence assets?

In many cases we do know that flood defence structures exists because they have been constructed by a public authority in relatively recent times for the specific purpose of providing flood protection. Such defence assets include:

Flood defence schemes

The OPW has a significant programme of flood defence schemes as part of our wider flood risk management responsibilities. Such schemes are designed to provide the internationally accepted standard of protection and are climate checked by examining two scenarios of Climate Change.

They include also those assets constructed by the OPW as part of the Arterial Drainage Programme under 1945 Act, or as part of a coastal protection scheme. They include flood relief and drainage works constructed under statutes that pre-date the 1945/'96 Acts.

All of these schemes and assets are, in general, subject to a statutory duty of maintenance.

Old Land Commission Embankments:

In some cases, however, defence assets were constructed in the distant past and while they provide a level of flood protection, they may not always be identified as such. The design standard of protection is probably not known and the structural condition may be uncertain. It may not be the subject of regular inspection and maintenance regime. While in some cases old trust funds exist to provide for the maintenance, in reality they are now inadequate to fund a proper maintenance programme.

Urban drainage network.

The urban drainage network particularly in the older areas of cities & towns may have been designed & constructed during the Victorian era. That they are still serviceable is a tribute to their original designers/constructors and to the inspection and maintenance regimes in place in the Local Authorities.

Design and planning parameters affected by climate change and current assumptions for change.

Design of flood defences and flood relief schemes is based on historic record or on methods derived from such records and make the assumption that the period of record is statistically stationary. We normally define the level of flood defence for rivers as the 1% event and for coastal flooding as the 0.5% event, subject to the proposed scheme being cost beneficial and environmentally sustainable.

However, climate science is saying that for the future the rainfall, and hence river flows, and sea levels are likely to increase significantly. For example the recently completed Kilkenny flood relief scheme was designed to provide protection against the 1% flood. We don't know however, what level of protection the scheme will provide in say 50 years time, and hence what works need to be planned and financed to maintain the design standard, and indeed whether it is economically viable to maintain this standard.

Similarly, for coastal defences, the prediction is that sea level will rise and that surges will become more frequent. This would expose coastal defences to a greater risk of erosion, to more frequent storm events, increasing the risk of damage or collapse, and increasing the need for maintenance.

Allowances for Future Scenarios

At present the allowances that the OPW makes, in terms of numerical values for future changes in relevant phenomena or characteristics, which should typically be used for each of these scenarios, are set out in Table 1 below.

	Mid-Range Future Scenario	High-End Future Scenario
Extreme Rainfall Depths	+ 20%	+ 30%
Flood Flows	+ 20%	+ 30%
Mean Sea Level Rise	+ 500 mm	+ 1000 mm
Land Movement	- 0.5 mm / year[1]	- 0.5 mm / year[1]

Note 1: Applicable to the southern part of the country only (Dublin – Galway and south of this)

Table 1: Allowances for Future Scenarios

It is important to note that:

- The allowances are based on current knowledge and science, and will be frequently reviewed and may be updated, as further research is undertaken

– The allowances are national, and some regionalisation or provision for the nature of the relevant catchment may be suitable where adequate knowledge or analysis would support this (although this would need to be robustly justified where the allowances are less than the assumed national allowances)

Similarly, the Greater Dublin Strategic Drainage Study sets out these values to be applied to drainage design.

Climate Change Category	Characteristics
River flows	20% increase in flows for all return periods up to 100 years
Sea level	400+mm rise (see Climate Change policy document for sea levels as a function of return period)
Rainfall	10% increase in depth (factor all intensities by1.1) Modify time series rainfall in accordance with the GDSDS climate change policy document

Table 2 Climate Change Factors to be Applied to Drainage Design

We can, therefore, have a reasonable degree of confidence that the standards for newly designed flood defences and drainage infrastructure do take the anticipated impacts of climate change into consideration. These allowances will be need to be kept under review and amended as the climate science identifies emerging scenarios and is in a position to provide further evidence on the impacts on river flows and sea levels.

Vulnerabilities of this critical infrastructure to climate change.

Two aspects of vulnerability need to be considered:

i. Failure of the asset itself through damage during flood event, inadequate maintenance programme or the design capacity being exceeded.
ii. Consequential damage to other infrastructure or assets protected by the flood defences.

The first of these has to do with the intrinsic condition and performance of the flood defence asset. The second with the infrastructure it protects from the flood event.

What is at risk? – Identify the assets

As a first step it is important to identify those significant flood defence assets that provide flood protection. These are the embankments, walls that provide protection from the flood event. As stated above these are not always known or identified and in such circumstances may be vulnerable to being removed as part of a development or other works at their location.

Vulnerabilities due to climate change-

Conor has set out in his paper the climate change impacts related to flooding. For convenience and ease of reference I've summarised them here:

- Stream flow is expected to increase in winter and spring. It is expected that an increase in the order of 20% in winter are likely by mid to late century. Reductions in summer and autumn months of over 40% are likely in many catchments. There are, however differences between catchments.

- Flood events are likely to become more frequent with the current 50 year event likely to be associated with a ~10 year return period by mid to late century. While uncertainty remains low flow events are also likely to become more frequent.

- IPCC scenarios suggest a likely sea level rise of between 0.28 and 0.43m by the end of the century, relative to 1980-1999. However, recent thinking suggests that this may be too conservative.

- The likelihood of increased storminess, higher sea levels and wind speeds will result in a subsequent enhancement of wave heights and storm surges, when combined with riverine flooding will pose serious flood risks in many of our coastal cities and for key infrastructure

Flood defence assets – designs become inadequate

Rivers,

The implications therefore are that many flood defences will not continue to provide the level of protection that was anticipated when they were built. The flood design event will be exceeded more frequently than was assumed at the design stage.

Coastal

The expected rise in sea level will impact on the coastal flood risk due to the higher water levels and to the greater and more frequent surges. It will impact also on the rate of erosion of vulnerable coastline, as it will expose areas of natural shoreline, which are not at present subject to frequent storm action

What is being done in this sector, here and internationally, to adapt to climate change.

Specifically in the area of flood risk management:

The OPW has commenced the Catchment Flood Risk Assessment and Management (CFRAM) programme. It's useful to set out here a very brief description of the CFRAM programme, as it is anticipated that the programme will address most of the shortcomings and vulnerabilities identified above.

Catchment Flood Risk Management

Underlying the policy is a fundamental shift in the way we deal with flood risk and is reflected in our Catchment Flood Risk Assessment and Management (CRFAM) Programme. The objective of the programme is to develop and implement an integrated, pro-active and catchment-based approach in line with international best practice to ensure effective management of existing and potential future flood risks

Under the Programme, it is intended to carry out Catchment Flood Risk Assessment and Management Studies Plan (CFRAMS) for each river Catchment. The output from these studies will be a Flood Risk Management Plan (CFRMP) that defines existing and foreseeable flood hazards and risks within a catchment and the methods, mechanisms, policies and proposals for managing the hazards and risks.

The CFRMP includes examination of 'most likely future scenario' and a high-end future scenario, in terms of risk, and management options for dealing with the risk identified. It is important to note that climate change is considered at every stage of the CFRAM process.

We have begun this process with pilot studies on the River Lee, the River Dodder, the River Suir, and the Fingal-East Meath area. There is an informative website for the Lee project for anyone seeking further information. (www.leecframs.ie)

The OPW intends to roll out a national programme of CFRAMS to cover all river catchments and coastal areas. The completion date, subject to continued funding by Government for the Flood Risk Management Programme, will meet the dates set out in the EU Floods Directive for the preparation of flood hazard and risk maps, and flood risk management plans.

OPW database as part of CFRAMS process

As part of the CFRAMS programme underway, the OPW plans to identify systematically the major flood defence assets and record them in a Flood Asset Database. In this way it is planned to record on a database, their position, and to inform the owners or other authorities of their importance for flood protection. The data gathered during the survey has been incorporated into our flood risk assessment. And will be used to develop a programme of flood defence asset management and maintenance.

Flood extent maps – example from Lee

Another output from each CFRAM will be a set of flood extent maps, showing the areas at risk from flood inundation for three levels of probability, 10%, 1%, and 0.1%. I've included a sample, which is in draft at present, at the end of the paper for illustration. (See figure 1)

Flood Risk Management Plan

The CFRAM process described briefly above, will develop for each catchment, a set of predictive flood maps which will include an allowance for the impacts of climate change in the delineation of the flood extent maps.

The Flood Risk Management Plan will consider various future pressures including climate change when identifying the measures and actions to manage floods in the catchment

Design specification

The design specification for flood relief schemes (fluvial and coastal) and for urban drainage schemes as seen above will make allowances for the impacts of climate change.

Planning & Development Guidelines

During 2008, the OPW, and the DoEHLG published draft guidelines "The Planning System and Flood Risk Management". Taken together with emerging information on flood extents, these guidelines will lead to improved development decision-making by Planning Authorities and by developers.

EU floods directive

The purpose of the directive is "*to establish a framework for the assessment and management of flood risks, aiming at the reduction of the adverse consequences for human health, the environment, cultural heritage and economic activity associated with floods in the Community*".

The principal requirements of the Directive are that Member States shall:

- Undertake a preliminary flood risk assessment (PFRA) to determine areas of existing or potential future 'significant' risk, and for those areas;
- Prepare flood hazard and risk maps; and
- Prepare flood risk management plans.

In Ireland, these latter two requirements of the Directive will be delivered through the Catchment Flood Risk Assessment and Management (CFRAM) Studies.

Northern Ireland

The approach in Northern Ireland is similar to that adapted here, and indeed is somewhat further advanced. I know from our regular meetings and from information on their website that the Rivers Agency has already developed Asset Management Plans for their flood defences. They have produced a Strategic Flood Map, which illustrates the areas

throughout Northern Ireland that have flooded from rivers and the sea in the past and those which are estimated to be prone to flooding now and in the future.

The map developed in co-operation with the Department of Environment to meet the requirements of its Planning Policy Statement 15 (PPS 15) - Planning and Flood Risk.

What climate change / research information is required and in what form

Uncertainty

The biggest challenge is the uncertainty associated with the climate change scenarios being developed by climate scientists. If we knew with confidence what was going to happen, it would be far easier to make the economic and other decisions related to investment in flood protection and risk management works, development planning, etc. The uncertainty requires policies to be implemented that are based on emerging scientific data and general assumptions about its impacts. The research efforts need to be concentrated on reducing these sources of uncertainty, to enable more cost effective flood risk management solutions to be devised that are 'climate change proofed'.

The OPW has been aware of the gaps in our knowledge & information in relation to the effects that climate change scenarios will have on the flood risk management programme. To address these short -comings we have identified the following areas that require research programmes.

- Rainfall and Climate Analysis
- Catchment Response Analysis
- Sea Level and Storm Surge Analysis.

Conclusions

There is uncertainty about the level of impacts climate change will have on river and coastal flooding. In the light of the costs of providing protection to our towns and cities, it is most important that this research is directed to reducing these uncertainties to allow engineers to design, construct and maintain the most cost effective defences.

Disclaimer

This paper was prepared by Tony Smyth, for presentation at an Irish Academy of Engineering workshop on "Critical Infrastructure – Adapting for Climate Change", to stimulate discussion on the potential issues relating to flooding. The views expressed are those of the author.

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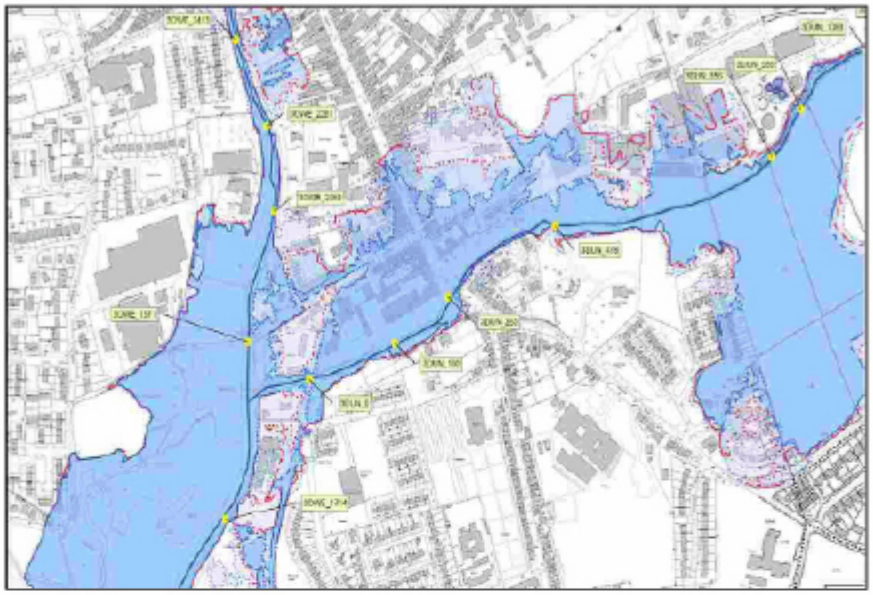

Figure 1: Sample Flood Extent Map from River Lee CFRAMS. For 10%, 1% and 0.1% predicted flood

Workshop on “Critical Infrastructure – Adaptation for Climate Change"

Questions for Breakout Sessions

1. What are the critical pieces of infrastructure that must be protected at all costs and are we in a position to produce risk assessments for these and to prioritise required actions?

2. What climate change information do engineering professionals need from researchers or other sources to enable policy makers, planners, designers and those implementing infrastructure projects and adapting existing infrastructure, adequately address the challenges of climate change?

3. How can we ensure that Irish climate change research is as relevant as possible and cost effective?

4. What actions, in priority order, need to be taken and by whom in the short term to enable those involved in planning, designing and implementing critical infrastructure to adequately address the potential medium/long term impacts of climate change? (Highlight say the three most urgent actions).

5. Does climate change present opportunities for Ireland and what adaptation measures are required to maximise these.

6. Any other recommendations?

The Irish Academy of Engineering

Critical Infrastructure - Water Supply

Michael Phillips, Dublin City Engineer

Workshop on:
Critical Infrastructure - Adaptation for Climate Change

Dublin Castle 28th April 2009

Critical Infrastructure - Adaptation for Climate Change

Climate Change and Water

Water is the key to the survival of all human, animal and plant life on this planet. It has the ability to mix with some substances, to corrode others, to operate as a vapour, liquid or solid, and at the same time has extraordinary self-cleaning properties, yet we in Ireland usually take water for granted. That situation will alter, however, as climate change takes effect, and we come to recognise water for the liquid gold it is. As a result, the conservation, use, demand and treatment of water have to be given the most careful consideration in order to ensure a sustainable environment.

The impact of climate change on water resources will become critical for people's lives and economies. Even if CO2 emissions were stabilised today, the temperature increases and consequent impact on water availability would continue for some decades. The latest assessment report of the intergovernmental Panel on Climate Change (1) projects that global average temperatures in 2010 will be 1.8oC higher than the 1980-2000 average. Meanwhile, the world's population is expected to increase from the current 6.5 billion to 8 billion in 2020, and hit 13 billion by 2100. While the rate of increase of greenhouse gas emissions depends on global population, and on economic, technological and social trends, the link to population is clearest: the more people there are, the higher emissions are likely to be. The rate of climate change will be determined largely by the USA and the emerging economies of China and India, and what

happens in Ireland will have little net effect. Nevertheless, these global trends will affect us and it is prudent that we should plan for the expected changes.

As outlined in the other summary papers here, global climate models are used to forecast the expected climate change and, to predict for Ireland, these models have to be downscaled. The predicted outcome for Ireland for the present century is a temperature rise in excess of 2o, coupled with 11% more rainfall in winter, but 25-40% less rainfall in summer and early autumn. While IPCC scenarios suggest sea levels to rise between 0.28 - 0.43m over the next century (relative to1980 – 1999), recent thinking suggests this may be too conservative with the potential for a one meter rise possible, along with an increase in the frequency and severity of coastal storms (2,3). In addition more frequent and severe droughts, flooding and weather events are to be expected.

The impact of changing farming patterns, possible changes in the hydrological cycle or failure of the North Atlantic Drift ('gulfstream current'), whether due to natural phenomena or human interference, and the arrival of alien flora or fauna, imported accidentally or otherwise into the country, pose additional threats. Thus Climate Change will, directly and indirectly, impact on every aspect of our daily life, and we will have to adapt over time to these changes. For this long-term adaptation to be sustainable, we need long-term planning of our water resources and to have systems in place to recognise when, where and by how much the change is occurring.

Water Supply Availability

Ireland is fortunate that it is well endowed with water resources, having one of the highest rates of water availability in Europe. Unfortunately, the places where water availability is greatest and where water is most needed tend to be at opposite ends of the country (4)

Most of the eastern half of the country has 750 to1,000 mm of rainfall a year, compared with 1,000 to1,300 mm in the west, and over 2,000 mm per year in many mountainous districts. When evaporative and plant transpiration losses are taken into account, annual effective rainfall is approximately 350 to 550mm in the east, 620 to 820mm in the west, and more than 1,500mm in mountainous areas.

The rain profile and the abundance of surface sources has resulted in over 70% of the population being able to draw its water supply from freshwater lakes, reservoirs and rivers (surface water abstraction). About 30% of water supply sources that abstract more than 10m3/day are derived from groundwater, and many private and agricultural users also depend on groundwater sources (4). This is considerably less than in other countries (e.g. North America 51%, European average75%). Groundwater in Ireland is generally of good quality, requires less treatment, and is cheaper to develop and distribute than surface abstraction. The proportion of water supplied from groundwater is likely to grow as development increases.

The part of the effective rainfall that percolates into the ground to reach the water table is called groundwater recharge. This varies depending on the effective rainfall available, and the geological conditions. Recent research in Ireland indicates that less than 5% of annual effective rainfall becomes groundwater recharge where subsoils comprise thick clay, but can be over 80% where gravels occur. In many areas, particularly the uplands, the bedrock that transmits the groundwater (the aquifer) cannot accept significant quantities of recharging waters due to its poorly transmissive nature. Climate Change will also affect the intensity of the precipitation and this could be critical to the balancing of what is required for groundwater recharge and what runs off into the nearest watercourse

Pollution of groundwater in Ireland tends to be microbiological rather than chemical.

The oceans cover some 70% of the planet; yet deriving potable water from seawater on a commercial basis is relatively recent. As an island, Ireland is ideally located to use such a source and availability and quality are not an issue. Membrane technology and the process of reverse osmosis (RO) have dramatically changed the market, and the price of desalination has significantly reduced in recent years. The main difficulty with membrane technology is the energy required to operate it, and disposal of the brine residue

Adapting to the Future

The most current census gives a population of 5.9 million for the Island of Ireland (5). .It is forecast that there will be 7.8 million people in Ireland by 2026 (6), with the east of the country being the more densely populated. The increase in population together with societies' increasing dependency on essential services ("always-on" availability) highlights the need to minimise any disruption. This can be achieved through emergency preparedness, contingency planning and investment in critical infrastructure.

For the foreseeable future, water will continue to be abstracted from surface and groundwater sources, with salt or brackish water providing an additional supply in some circumstances. The protection of surface water sources and the increasing demands present challenges. In particular the growth of 'water thirsty' crops, and crops grown as biomass or as a biofuel, may increase irrigation needs.

While groundwater currently provides only 30% of Ireland's water supplies, it is important to note that 70% of Ireland is underlain by 'poorly productive' bedrock aquifers – bedrock which is limited in its ability to accept recharge and transmit groundwater laterally. It is critical therefore, that we continue to research the recharge acceptance, storage, capacity, movement and quality of groundwater resources.

Demand is often highest when water is most scarce, so with changing rainfall patterns we may have to investigate the possibility of storing water in times of plenty to meet future demand. Aquifer storage and recovery (ASR) is a technology that may help in some areas to bridge the gap between supply and demand (7)

To date the supply of water in Ireland has been fairly resilient but this cannot be taken for granted. The impact of climate change on weather events, as experienced with floods in recent years, has demonstrated the fragility of the existing infrastructure. Maintaining a specified level of resilience into the future will be complicated by the tendency of the hazard, vulnerabilities and consequences to change over time.

The 2007 floods in the UK had a dramatic effect on electricity power substations, water and wastewater treatment works, and road and rail network. People in recent years have become accustomed to a reliable supply of water and energy and were left feeling exposed and unprepared for the situation when they ceased to function. In total in the UK there were five water and 322 wastewater treatment works affected by the floods. The loss of the Mythe water treatment works deprived 350,000 people of water for up to 17 days. However, it was the "near misses" at various power sub stations, which would have cut off over one million people, that brought home the vulnerabilities of the infrastructural assets (8).

This highlights that there is a need for a more systematic approach into the vulnerability of critical infrastructure and a coordinated approach to improving its resilience. Resilience is considered as the ability of a system or organisation to withstand or recover from adversity, i.e. it is possible to achieve the core activities in the face of adversity through a combination of measures (8).

Demand

The perception of the availability of water is based on the demands for it at a particular time. These demands may originate from a global or national perspective. One such demand is the fact that Ireland, because of its size, must economically be export-orientated in order to ensure economic growth. With a possible population of 8 million by 2026 on the island of Ireland, this means that the demand on available water resources will have to include sufficient flexibility to cater for the uncertainty that global trade introduces to the situation.

In general terms, the population distribution would indicate that approximately 5 million would be along the eastern seaboard and 3 million along the western seaboard (9). At present the population for the Dublin Region is 1.2 million and the daily production of water is 550 Mega litres per day. Assuming adequate sources are available this would mean that facilities would have to double to meet the demand. It is for such a scenario that the design of critical infrastructure would have to cater. Consequently, the loss of an essential service, such as water supply, has the potential to cause greater disruption, economic and social, than might have occurred in the past.

Internationally, Ireland will also be viewed as 'water rich' compared with 'water poor' developing countries. This could result in increasing inward migration of people and encourage the growth here of 'water hungry' crops, such as wheat, the world production of which is decreasing due to water shortages elsewhere. The production of one kilogram of wheat requires 1000 litres of water (10).

Providing water for Ireland's future population and economic growth will present many challenges. It is not known if there will be adequate water to meet demand, and hence it is critical that we reduce demand in the future. This can be achieved through pricing policies, conservation, harvesting and alternative or even multiple re-uses of non-potable water.

Source

Going forward the resilience of the existing systems need to be proven, as without a water supply the rules of behaviour of society become untenable. Increasing pressure on water sources due to population growth, increase in demand and pollution threats means that a clearly defined approach to protecting future needs is essential. Strategies focused on managing and conserving water, land and biological resources to maintain and restore healthy, effectively functioning and climate change-resilient ecosystems are one way to deal with the impact.

The most critical part of the water supply system is the source. This can be affected in two ways, namely, the quantity and the quality. The changing weather patterns will have a major impact in the medium to long term. On a macro scale more precipitation will occur in the west than in the east of the Country and the more intense storms may have a detrimental effect on storage and soakage due to the speed of run off. The other threat to the availability of water will be the abstraction of it – the volume, location, by whom and for what purpose. Increasing use of irrigation systems in agriculture, if it should occur, will present problems so prioritisation will become an issue.

The quality of Irish Rivers is reported on by the Environmental Protection Agency (EPA). The Water Quality Report 2004 – 2006 (11) states that while pollution in the Eastern half of the country has been substantially reduced it has remained the same in comparison with the previous period. Increases in pollution have occurred in the North Western, Shannon and Neagh Bann River Basin Districts. This report may give cause for concern with the increase in pollution in some locations but the work by the EPA has highlighted that the general deterioration of river

quality in Ireland has been arrested and that the sources of pollution are being identified. In the period from 1998 to 2006, the source of pollution for 50% of the rivers was as a result of municipal wastewater discharges. The remaining sources were ascribed mainly to agriculture, forestry and industry.

The implementation of the EU Water Framework Directive, the Flood Directive and the creation of River Basin Management Plans have resulted in an integrated approach to managing the quality of the river catchments (12). This approach will greatly assist in defining acceptable limits and reducing threats to the catchments. In ensuring that the quality of drinking water sources is preserved the competing needs of the towns, in relation to abstraction and wastewater discharges and the agricultural sector in relation to disperse pollution and irrigation will have to be finely balanced. Increasing pressure on future sources from all activities of society heightens the risk of pollution incidents. As a result bankside storage i.e. reservoirs alongside the river will become essential in order to ensure clean raw water while the incident passes the inlet pipe.

The issues going forward are therefore:

- Where will the significant water resources be located?
- How can the resources be quantified and protected for future use in the most sustainable manner?
- How can we develop an effective education programme on demand and re-use for such a long timescale when the majority of people operate on short to medium term plans and have entrenched views on issues such as the re-use of treated effluent? How can the current institutions be utilised or modified to prepare a strategy to reduce uncertainty, and integrate the outcome into medium-term strategies for the future?

Infrastructure

The majority of water supply systems in Ireland are, with the exception of the very large urban areas, small and discrete. The treatment of water to current standards throughout the country has only commenced since joining the EU in 1973. Prior to this time while a supply system existed for many towns there was a very basic treatment available and no treatment where group water schemes existed. As a result infrastructure in the form of integrated treatment works, large pipelines, storage reservoirs are only located close to the large urban areas. There is no interconnection between these networks e.g. Dublin is not connected to Waterford or Cork to Limerick.

The infrastructure for a water supply system generally consists of a treatment works, large water carrying (arterial) mains to convey the water to the town or city, storage reservoirs on the perimeter of the urban area and then distribution mains to deliver to the houses. Pumping stations may or may not be required depending on the contours of the supply area.

In an ideal situation every location in a town or city should be capable of being supplied from more than one source The Dublin region, at present, does not have the interconnecting pipework to ensure continuous supply when watermain bursts occur. Moreover, in the Dublin Region production and demand are, and have been for many years, finely balanced. While storage reservoirs that can provide from 24 hours to potentially three days storage do exist in the Dublin area it has been necessary to carry out a strategic storage study in order to cater for increased demand in recent years. It has identified the need for additional storage capacity in the region.

Connections are provided to towns on route from the raw water reservoir/treatment works to the large urban area e.g. Bray is connected to the Dublin City supply as it is located on the route from Roundwood Treatment Works to the City.

Ireland is a small country in infrastructural terms, when you consider that gas pipelines originating in Siberia transfer gas throughout Europe. Thus a decision on the necessity of transporting water around the country in order to ensure continuity of supply is not technically difficult but it would be costly and is it sustainable? In recent years in order to conserve water a programme of leakage reduction through the rehabilitation of water mains has been implemented. In the Dublin area an investment of €10 million will replace approximately 10 kilometres of pipeline however it is estimated that 800 kilometres of watermains are over 80 years old. This gives an indication of the scale of investment that is required when infrastructure needs are considered on a national basis. The availability of finance for investing in critical infrastructure is recognised as an issue in other countries as well (13).

The factor that all treatment works and pipelines have in common is an energy requirement. While some of the plants have generating units (e.g. hydro) the majority have a single source of energy from the national grid. Levels of back up from standby generators would only exist on plants close to the large urban areas. While Dublin City is fortunate, in so far, that 80% of its water is transported by gravity from the treatment works in Kildare and Wicklow the majority of other areas require pumps at source and sometimes in-line to ensure adequate pressures and flows. Thus the availability of adequate energy sources is probably the most critical element after source protection in ensuring the delivery of potable water. In smaller areas the availability of mobile generators may be more feasible. These issues would be included in current risk registers for all plants

In modern times the treatment of water has become quite sophisticated and the resources needed to man it require detailed training. While the large urban areas, due to their scale, can afford to have adequate resources to enable a treatment works to continue operating if subjected to damage from a disaster the availability of personnel in less densely populated areas may present difficulties if it is necessary to maintain a supply. It is essential therefore that such risks are mitigated against and that those personnel have the best available skillsets to manage the situation.

The following are some of the other factors that will impact on the infrastructure:

- Pipe systems will be more prone to cracking due to greater soil movement from wetting and drying cycles
- Assets on flood plains will be at increased risk from flooding, storm damage, coastal erosion and rises in sea level.
- Existing sewerage was not designed to cater for the expected more intense rainfall which is likely to exceed the capacity of parts of the network and cause local flooding.
- Dams will be more prone to siltation resulting from increased soil erosion or overtopping due to storms.
- Bankside storage required to ensure continuity of raw water supply

International Situation

The EU Commission has also published a green paper on Critical Infrastructure Protection, (14,15,16,17) which outlines the options on what would enhance prevention, preparedness and response to the Union's critical infrastructure protection. It states that the effective protection of critical infrastructure requires communication, coordination, and cooperation nationally and at EU

level among all interested parties – the owners and operators of infrastructure, regulators, professional bodies and industry associations in cooperation with all levels of government and the public.

The destruction or disruption of infrastructure providing key services could entail the loss of lives, the loss of property, a collapse of public confidence and morale in the EU. Any such disruptions or manipulations of critical infrastructure should to the extent possible, be brief, infrequent, manageable, geographically isolated and minimally detrimental to the welfare of the Member States, their citizens and the European Union (18).

The EU has also produced a white paper in 2009 –"Adapting to climate change: Towards a European framework for action"(12,19) The EU's objective is to improve resilience to deal with the impact of climate change. It also adopts a phased approach. The intention is that Phase 1 (2009 – 2012) will lay the groundwork for preparing a comprehensive adaptation strategy to be implemented during phase 2 in 2013.

One of the proposals in the paper is to establish a "Clearing House Mechanism" as an IT tool and database. This database would capture the considerable amount of information and research, which already exists, but is not shared across Member States. Such a database could be crucial in developing critical infrastructure strategies and improving its resilience.

The EU recognises that due to the variability and severity of climate impact most adaptation measures will be taken at national, regional and local level. However these measures can be supported and strengthened by an integrated and coordinated approach at EU level (18). For this reason the EU seeks to reduce the impact of disasters within the EU by:

- The development of knowledge based disaster prevention policies at all levels of government
- Linking relevant actors and policies throughout the disaster management cycle
- Improving the effectiveness of existing policy instruments with regard to disaster prevention.

The UK published a National Security Strategy in 2008, which covers not only security threats but also transnational crime, pandemics and flooding. The strategy includes the compilation of a national-level risk register setting out its assessment of the likelihood and potential impact of the range of different risks that may affect the UK. It is the intention that prompt action and improved prevention will be achieved through partnership between the public and private sectors (8).

Water UK, the association of water companies in the UK, commissioned its own report on the floods of 2007 in order to ensure that climate change and extreme events are taken into consideration in their flood risk management and in the protection of critical water infrastructure (20).

The United States launched a National Infrastructure Protection Plan (NIPP) in 2006 This provides for a coordinated approach to critical infrastructure protection, setting out national priorities, goals and requirements for effective distribution of funding and resources to ensure continuity in the event of an attack or disaster (8).

In addition the various water associations have implemented amongst the utilities the concept of "Utilities Helping Utilities". This proposal encourages utilities and local/state governments to establish intrastate mutual aid and assistance networks. The concept is about creating an opportunity to enhance water and wastewater utility resilience in response to disasters during

the response and the recovery phases. An agreement is designed to provide a mechanism whereby water/wastewater utilities that have sustained damages from natural or man-made events could obtain emergency assistance in the form of personnel, equipment, materials and other associated services as necessary, from other water/wastewater utilities (21).

The Netherlands has also taken a systematic and coordinated approach to tackling potential disruption to critical infrastructure. They have established a project, Protection of Vital Infrastructure, which aims to develop an integrated package of measures to protect infrastructure in both the private and public sectors from security threats, accidents, and extreme natural phenomena (8).

Conclusion

This highlights the fact that the identification and role of critical infrastructure is given serious consideration in most developed economies today. In the current environment of uncertainty, how can we assess decisions across a 20,30, or even 40-year time horizon? At present when we make a decision in relation to infrastructure in Ireland, it may take up to 10 years to implement. How can we create more certainty? Is this a situation of creating scenarios, which would illustrate the potential political and societal situation in 50 years and then test our decisions against those scenarios? (22). The challenge is not only to develop a better understanding of the known hazards but also the changing and newly emerging vulnerabilities and consequences of loss as well as their interrelationships (8). Whatever decision is arrived at in relation to the role of critical infrastructure and drinking water it might behove us to remember

An ounce of prevention is worth a pound of cure.

- Benjamin Franklin.

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Research Paper – ‘Climate Change Policy Framework in NI’

Jeff Mochan, Research Officer
14 May 2009

The purpose of this note, prepared for the Committee for the Environment, is to identify the current policy frameworks in the NI Executive and its Departments to mitigate and adapt to the impacts of climate change.

Sustainable Development Strategy

The NI Sustainable Development Strategy[1] was published by the SoS in May 2006. It was intended to represent 'our first steps in establishing the focus for tackling the challenges ahead toward our long term objective of securing a better future for the present generation and protecting the future for generations to come'.

The strategy dealt with 6 main themes/policy areas as outlined below:

Sustainable consumption and production

Vision: NI as a one planet economy.

Strategic objectives:

- To become more resource efficient.
- To make the NI public sector a UK regional leader in sustainable procurement.
- To minimise the unsustainable impacts of consumption.

Natural resource protection and environmental enhancement

Vision: NI has a diverse, healthy and resilient natural environment.

Strategic objectives:

- To conserve our landscape and manage it in a more sustainable way.
- To protect and enhance the freshwater and marine environment.
- To improve our air quality.
- To conserve, protect, enhance and sustainably re-use our historic environment.
- To protect and enhance biodiversity.

Sustainable communities

Vision: NI is built around a network of sustainable communities encompassing urban and rural areas, where existing settlements and any new developments are designed to be more sustainable.

Strategic objectives:

- To increase the economic well-being of the people of NI.
- To create an attractive, high quality environment where people feel safe and which provides the conditions for health and social well-being.
- To promote the development of community engagement, civic leadership and responsible citizenship.

Climate change and energy

Vision: NI adapts to the impacts of climate change and operates as a highly energy efficient society using a sustainable energy system.

Strategic objectives:

- To reduce greenhouse gas emissions, principally by promoting energy efficiency and the use of renewables.
- To establish NI as a world class exemplar in the development and use of renewable energy.
- To plan and prepare for climate change impacts in NI.

Learning and communication for sustainable development

Vision: An informed society, committed to the co-ordinated pursuit of sustainability.

Strategic objectives:

- To provide access for all citizens to gain sustainable development skills and knowledge.
- To bring about the behavioural changes necessary to progress towards a sustainable society.

Governance and sustainable development

Vision: Good governance enjoys a strong relationship with its social partners and supports a thriving, innovative and sustainable business community.

Strategic objectives:

- To mainstream sustainable development across Government.
- To strengthen the network of accountability for governance for sustainable development.

Programme for Government

The Programme for Government (PfG)[2] was published by OFMDFM, on behalf of the Executive, in May 2007. It was intended to set out 'our plans and priorities for 2008-2011 as well as some of our longer term aspirations and intentions'.

In its foreword and introduction, the PfG states that:

- We will work together to address the key challenges we face and build a shared and better, and more sustainable future for all our people.
- We aim to build a prosperous, fair and inclusive society, supported by a vibrant and dynamic economy and a rich and sustainable environmental heritage.

In its strategic priorities, the PfG states that:

- Our over-arching aim is to build a peaceful, fair and prosperous society in NI, with respect for the rule of law and where everyone can enjoy a better quality of life now and in years to come.
- We must also do this in ways that protect and enhance the physical and natural environment and use resources as efficiently and sustainably as possible.

- It is also imperative that economic growth and wealth creation are taken forward in a manner which is fair and sustainable if we are to meet the needs of today, as well as those of future generations.

Sustainability is 1 of 2 cross-cutting themes in the PfG, which states that:

…..building a sustainable future will be a key requirement for our economic, social and environmental policies and programmes. We will ensure that the principles of sustainability…..underpin our approach to all our activities. As an Executive, we will demonstrate our commitment to sustainability through the decisions and actions that we take and will work in partnership with others outside government to promote a wider understanding and knowledge of the issue.

The PfG priorities provide a framework to address the key social, economic and environmental challenges we face. The following priorities are relevant to climate change:

- Priority: Growing a dynamic, innovative economy. The PfG states that this will require investment in our infrastructure, driving forward social transformation and environmental improvement.
- Priority: Protect and enhance our environment and natural resources. The PfG states that:
- There are recognised links between a healthy environment, a thriving economy and a high quality of life.
- Action is needed to protect and enhance our environment for future generations.
- It is clear that climate change is one of the most serious problems facing the world. While we recognise that it requires action internationally, we are determined to play our part in addressing this challenge by reducing our impact on climate change.
- At a local level, therefore, action is needed to protect our built heritage, our landscape and marine environment and to reduce our impact on climate change.
- This Executive recognises the importance of Sustainable Development, encompassing economic, social and environmental considerations.
- Priority: Invest to build our infrastructure. The PfG states that:
- Considerable investment is needed in our infrastructure. Over recent decades, such investment has not been given the required priority and we now have major deficiencies in key areas.
- This limits our capacity for further fair economic and social development and undermines our ability to safeguard our environment and comply with key EU Directives.

The Public Service Agreements in the PfG are the detailed directions and guidance given to Departments to achieve their desired outcomes. Not all PSAs have obvious implications for climate change, but many have at least indirect influence.

Note that it might be worth considering how PSAs can also bring unintended negative outcomes, and if they represent the best way to achieve intended positive outcomes. Thus, when scrutinising the PSAs, consideration could be given to sectoral contributions to greenhouse gas emissions and the direction/guidance outlined above in the Sustainable Development Strategy and PfG. For example:

- In productivity growth (PSA 1), promoting a competitive and outward looking economy brings obvious financial and social benefits in employment, but if NI exports goods to

global markets while importing similar goods for local consumption then this might involve an unnecessary carbon cost to the economy. If, however, it involved research, development, manufacturing and export of 'green technologies', it could represent a 'win-win' situation.

- In tourism (PSA 5), enhancing NI's tourism infrastructure also brings obvious financial and social benefits in employment, but if NI achieves that through more high-carbon infrastructure (such as more/bigger airports) then this might involve an unnecessary carbon cost to the economy, social costs to the population and degradation of the very qualities which attracted tourists in the first place. If, however, it involved development of 'green tourism', it could represent a 'win-win' situation.
- In making peoples' lives better (PSA 7), reducing levels of fuel poverty by implementing energy efficiency measures directly benefits those living in fuel poverty while also reducing the climate change implications of energy inefficient housing.
- In improving the transport infrastructure (PSA 13), improving the strategic road network brings obvious benefits for business and social mobility, at least in the short term, but if it does so by encouraging more cars onto the roads it might just exacerbate problems of carbon emissions, pollution and congestion while diverting possible funds from lower-carbon alternatives. If, however, those roads were improved while increasing priority for public transport or car-sharing, for example, it could represent a 'win-win' situation.

The PSAs with relevance to climate change are outlined below:

PSA 1: Productivity growth

- Objective 1: Promote a competitive and outward looking economy. (DETI)
- Objective 3: Ensure a modern sustainable economic infrastructure to support business. (DETI)
- Objective 7: Improve the Strategic Road Network by the advancement/ completion of a range of major works schemes. (DRD)

PSA 3: Increasing employment

- Objective 4: Promote business growth. (DETI)

PSA 4: Supporting rural businesses

- Objective 1: Support the development of rural businesses. (DARD)
- Objective 3: Support environmentally sustainable land management. (DARD/DoE)

PSA 5: Tourism

- Objective 1: Enhance NI's tourism infrastructure. (DETI/DCAL)
- Objective 2: Promote the growth of the tourism sector. (DETI)

PSA 7: Making peoples' lives better

- Objective 4: Reduce levels of fuel poverty. (DSD)

PSA 11: Driving investment and sustainable development

- Objective 2: Regenerate former military sites to promote economic growth and for the benefit of local communities. (OFMDFM/DSD)
- Objective 3: Coordinate delivery of the Sustainable Development Strategy. (OFMDFM)
- Objective 4: Support the wider Public Sector in taking account of sustainable development principles when procuring works, supplies and services. (OFMDFM/DFP)

PSA 12: Housing, urban regeneration and community development

- Objective 1: Provide access to decent, affordable and energy efficient housing. (DSD)
- Objective 2: Regenerate disadvantaged urban areas. (DSD/DE/DHSSPS/ DEL/DETI/OFMDFM)
- Objective 3: Promote viable and vital towns and city centres, helping to create shared spaces that are accessible to all and where people can live, work and socialise. (DSD/DCAL)
- Objective 5: Promote strong, integrated sustainable communities where people want to live, work and socialise. (DSD)

PSA 13: Improving the transport infrastructure

- Objective 1: Improve the Strategic Road Network by the advancement/ completion of a range of major works schemes. (DRD)
- Objective 2: Maintain the road infrastructure to keep it safe, effective and reliable through resurfacing, surface dressing and the timely repair of road defects. (DRD)
- Objective 3: Promote increase in usage of public transport. (DRD)

PSA 14: Promoting safer roads

- Objective 2: Contribute to safer roads, using a range of initiatives, including road safety engineering, traffic calming and further enhancement of the pedestrian and cycling network. (DRD)

PSA 15: Water and sewerage infrastructure

- Objective 3: Acceptable levels of compliance with EU requirements and other relevant standards and targets by 2010. (DRD)

PSA 17: Rural infrastructure

- Objective 1: Improve rural infrastructure. (DARD)

PSA 22: Protecting our environment and reducing our carbon footprint

- Objective 1: Take forward strategic action to improve air quality and reduce our carbon footprint. (DoE/DETI/DSD)
- Objective 2: Promote energy efficiency and the use of renewable energy. (DETI)
- Objective 3: Improve the quality and ecological status of the water environment. (DoE/DCAL/DARD)
- Objective 4: Take forward action to improve air quality. (DoE/DHSSPS/DETI)
- Objective 5: Promote waste management and reduce the annual tonnage of controlled waste illegally disposed. (DoE)
- Objective 7: Conserve NI's bio-diversity. (DoE)
- Objective 8: Deliver a modern effective planning system which meets the needs of the whole community and the economy while protecting the environment. (DoE)

PSA 23: Managing the risk of flooding from rivers and seas

- Objective 1: Deliver sustainable flood risk management policies to meet society's social, environmental and economic needs. (DARD)
- Objective 2: Implement the requirements of the European Directive for the assessment and management of flood risks. (DARD)
- Objective 3: Reduce the number of properties at risk of flooding from rivers and the sea. (DARD)
- Objective 4: Maintain flood defence and drainage infrastructure in a satisfactory condition. (DARD)

DEPARTMENTAL PRIORITIES

Most, if not all, Departments have some policies on climate change. It can be argued, however, that these policies will have little positive influence on climate change unless they are reflected in the core activities of the Department.

The top-level direction statements of the Executive Departments are outlined below:

OFMDFM[3]

Purpose: to set a central overarching vision for government

Strategic objectives:

- Supporting Ministers and the institutions of government.
- Building a PfG and modernising government programme.
- Promoting better community relations, a culture of equality and rights.
- Targeting social need and promoting social inclusion.

DARD[4]

Vision: a thriving and sustainable rural community and environment in NI.

Strategic goals:

- To improve performance in the market place.
- To strengthen the social and economic infrastructure of rural areas.
- To enhance animal, fish and plant health and welfare.
- To develop a more sustainable environment.

DCAL[5]

Vision: a confident, creative, informed and vibrant community.

Goals:

- Enable as many people as possible to experience and appreciate the excellence of our cultural assets.
- Promote creativity and innovation and lifelong learning.
- Encourage respect for and celebration of diversity.
- Ensure the sustainable management of our cultural infrastructure.
- Develop and deliver quality cultural products and services.
- Reform and modernise our service delivery.

DE[6]

Vision: to educate and develop the young people of NI to the highest possible standards, providing equality of access to all.

Strategic aims:

- Valuing education.
- Fulfilling potential.
- Promoting equality and inclusion.
- Resourcing education.

DEL[7]

Aim: to promote learning and skills, to prepare people for work and to support the economy.

Objectives:

- To promote economic, social and personal development through high quality learning, research and skills training.
- To help people into employment and promote good employment practices.

DETI[8]

Goal: to grow a dynamic, innovative economy.

Priorities:

- Productivity Growth - improve manufacturing/private services productivity.
- Increasing Employment - raising employment levels.
- Tourism - develop the tourism sector.

DOE[9]

Aim: to improve the quality of life for everyone in NI through promotion of sustainable development principles in all the activities of government and wider society, reduction of road traffic casualties and promotion of efficient and effective local government.

Objectives:

- To protect, conserve and enhance the natural environment and built heritage.
- To improve the quality of life of the people of NI by planning and managing development in ways which are sustainable and which contribute to creating a better environment.
- To reduce road casualties.
- To support a system of Local Government which meets the needs of residents and ratepayers.

DFP[10]

Vision: Leading reform, delivering value and promoting sustainability

Departmental Objectives:

- To prioritise the use of resources available to NI, ensure that these are used efficiently and secure the reform and modernisation of public services.
- To deliver efficient and cost effective services to the public in the Department's areas of executive responsibility.

DHSSPS[11]

Mission: to improve the health and social well-being of the people of NI.

Main responsibilities:

- Health and social care, which includes policy and legislation for hospitals, family practitioner services and community health and personal social services.
- Public health, which covers policy, legislation and administrative action to promote and protect the health and well-being of the population.
- Public safety, which covers policy and legislation for fire and rescue services.

DRD[12]

Vision: a region with modern, safe and sustainable roads, transport and water services which meet the public need.

Key objectives:

- Supporting the economy by maintaining and developing safe and sustainable transportation networks; promoting airport and harbour services.
- Addressing regional imbalance in infrastructure; and shaping the long-term future of the region.
- Contributing to community health and well-being and protection of the environment by maintaining and developing the policy and regulatory environment for sustainable, high quality water and sewerage services.

DSD[13]

Mission: together, tackling disadvantage, building communities.

Strategic priorities:

- To invest in housing and address the housing crisis.
- To build communities, tackle disadvantage and encourage social responsibility.
- To create vibrant cities, towns and urban areas.

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The Irish Academy of Engineering

Flood Protection Infrastructure

Tony Smyth, Office Of Public Works

Workshop on:
Critical Infrastructure - Adaptation for Climate Change
Dublin Castle 28th April 2009

Transform Scotland Trust:
'Towards a Healthier Economy'

Introduction

Definition of critical infrastructure in flood defence context

Typically **Critical infrastructure** is a term used by governments to describe assets that are essential for the functioning of a society and economy. Most commonly associated with the term are facilities for electricity generation and transmission, telecommunications, transportation, water supply and public health services.

For the purposes of this paper, I am taking the definition to extend to those assets that provide protection to these facilities from flood damage. They are referred to as flood defence assets, i.e. infrastructure that provides protection from flooding to homes, businesses, infrastructure and the environment and includes embankments and walls, which have been constructed by a public authority or by a private concern. It includes river or coastal defences, natural or constructed, whether or not they are subject to a maintenance programme.

A brief outline of the critical infrastructure – existing & planned.

Do we know the defence assets?

In many cases we do know that flood defence structures exists because they have been constructed by a public authority in relatively recent times for the specific purpose of providing flood protection. Such defence assets include:

Flood defence schemes

The OPW has a significant programme of flood defence schemes as part of our wider flood risk management responsibilities. Such schemes are designed to provide the internationally accepted standard of protection and are climate checked by examining two scenarios of Climate Change.

They include also those assets constructed by the OPW as part of the Arterial Drainage Programme under 1945 Act, or as part of a coastal protection scheme. They include flood relief and drainage works constructed under statutes that pre-date the 1945/'96 Acts.

All of these schemes and assets are, in general, subject to a statutory duty of maintenance.

Old Land Commission Embankments:

In some cases, however, defence assets were constructed in the distant past and while they provide a level of flood protection, they may not always be identified as such. The design standard of protection is probably not known and the structural condition may be uncertain. It may not be the subject of regular inspection and maintenance regime. While in some cases old trust funds exist to provide for the maintenance, in reality they are now inadequate to fund a proper maintenance programme.

Urban drainage network.

The urban drainage network particularly in the older areas of cities & towns may have been designed & constructed during the Victorian era. That they are still serviceable is a tribute to their original designers/constructors and to the inspection and maintenance regimes in place in the Local Authorities.

Design and planning parameters affected by climate change and current assumptions for change.

Design of flood defences and flood relief schemes is based on historic record or on methods derived from such records and make the assumption that the period of record is statistically stationary. We normally define the level of flood defence for rivers as the 1% event and for coastal flooding as the 0.5% event, subject to the proposed scheme being cost beneficial and environmentally sustainable.

However, climate science is saying that for the future the rainfall, and hence river flows, and sea levels are likely to increase significantly. For example the recently completed Kilkenny flood relief scheme was designed to provide protection against the 1% flood. We don't know however, what level of protection the scheme will provide in say 50 years time, and hence what works need to be planned and financed to maintain the design standard, and indeed whether it is economically viable to maintain this standard.

Similarly, for coastal defences, the prediction is that sea level will rise and that surges will become more frequent. This would expose coastal defences to a greater risk of erosion, to more frequent storm events, increasing the risk of damage or collapse, and increasing the need for maintenance.

Allowances for Future Scenarios

At present the allowances that the OPW makes, in terms of numerical values for future changes in relevant phenomena or characteristics, which should typically be used for each of these scenarios, are set out in Table 1 below.

	Mid-Range Future Scenario	High-End Future Scenario
Extreme Rainfall Depths	+ 20%	+ 30%
Flood Flows	+ 20%	+ 30%
Mean Sea Level Rise	+ 500 mm	+ 1000 mm
Land Movement	- 0.5 mm / year[1]	- 0.5 mm / year[1]

Note 1: Applicable to the southern part of the country only (Dublin – Galway and south of this)

Table 1: Allowances for Future Scenarios

It is important to note that:

- The allowances are based on current knowledge and science, and will be frequently reviewed and may be updated, as further research is undertaken

– The allowances are national, and some regionalisation or provision for the nature of the relevant catchment may be suitable where adequate knowledge or analysis would support this (although this would need to be robustly justified where the allowances are less than the assumed national allowances)

Similarly, the Greater Dublin Strategic Drainage Study sets out these values to be applied to drainage design.

Climate Change Category	Characteristics
River flows	20% increase in flows for all return periods up to 100 years
Sea level	400+mm rise (see Climate Change policy document for sea levels as a function of return period)
Rainfall	10% increase in depth (factor all intensities by1.1) Modify time series rainfall in accordance with the GDSDS climate change policy document

Table 2 Climate Change Factors to be Applied to Drainage Design

We can, therefore, have a reasonable degree of confidence that the standards for newly designed flood defences and drainage infrastructure do take the anticipated impacts of climate change into consideration. These allowances will be need to be kept under review and amended as the climate science identifies emerging scenarios and is in a position to provide further evidence on the impacts on river flows and sea levels.

Vulnerabilities of this critical infrastructure to climate change.

Two aspects of vulnerability need to be considered:

i. Failure of the asset itself through damage during flood event, inadequate maintenance programme or the design capacity being exceeded.
ii. Consequential damage to other infrastructure or assets protected by the flood defences.

The first of these has to do with the intrinsic condition and performance of the flood defence asset. The second with the infrastructure it protects from the flood event.

What is at risk? – Identify the assets

As a first step it is important to identify those significant flood defence assets that provide flood protection. These are the embankments, walls that provide protection from the flood event. As stated above these are not always known or identified and in such circumstances may be vulnerable to being removed as part of a development or other works at their location.

Vulnerabilities due to climate change-

Conor has set out in his paper the climate change impacts related to flooding. For convenience and ease of reference I've summarised them here:

- Stream flow is expected to increase in winter and spring. It is expected that an increase in the order of 20% in winter are likely by mid to late century. Reductions in summer and autumn months of over 40% are likely in many catchments. There are, however differences between catchments.

- Flood events are likely to become more frequent with the current 50 year event likely to be associated with a ~10 year return period by mid to late century. While uncertainty remains low flow events are also likely to become more frequent.

- IPCC scenarios suggest a likely sea level rise of between 0.28 and 0.43m by the end of the century, relative to 1980-1999. However, recent thinking suggests that this may be too conservative.

- The likelihood of increased storminess, higher sea levels and wind speeds will result in a subsequent enhancement of wave heights and storm surges, when combined with riverine flooding will pose serious flood risks in many of our coastal cities and for key infrastructure

Flood defence assets – designs become inadequate

Rivers,

The implications therefore are that many flood defences will not continue to provide the level of protection that was anticipated when they were built. The flood design event will be exceeded more frequently than was assumed at the design stage.

Coastal

The expected rise in sea level will impact on the coastal flood risk due to the higher water levels and to the greater and more frequent surges. It will impact also on the rate of erosion of vulnerable coastline, as it will expose areas of natural shoreline, which are not at present subject to frequent storm action

What is being done in this sector, here and internationally, to adapt to climate change.

Specifically in the area of flood risk management:

The OPW has commenced the Catchment Flood Risk Assessment and Management (CFRAM) programme. It's useful to set out here a very brief description of the CFRAM programme, as it is anticipated that the programme will address most of the shortcomings and vulnerabilities identified above.

Catchment Flood Risk Management

Underlying the policy is a fundamental shift in the way we deal with flood risk and is reflected in our Catchment Flood Risk Assessment and Management (CRFAM) Programme. The objective of the programme is to develop and implement an integrated, pro-active and catchment-based approach in line with international best practice to ensure effective management of existing and potential future flood risks

Under the Programme, it is intended to carry out Catchment Flood Risk Assessment and Management Studies Plan (CFRAMS) for each river Catchment. The output from these studies will be a Flood Risk Management Plan (CFRMP) that defines existing and foreseeable flood hazards and risks within a catchment and the methods, mechanisms, policies and proposals for managing the hazards and risks.

The CFRMP includes examination of 'most likely future scenario' and a high-end future scenario, in terms of risk, and management options for dealing with the risk identified. It is important to note that climate change is considered at every stage of the CFRAM process.

We have begun this process with pilot studies on the River Lee, the River Dodder, the River Suir, and the Fingal-East Meath area. There is an informative website for the Lee project for anyone seeking further information. (www.leecframs.ie)

The OPW intends to roll out a national programme of CFRAMS to cover all river catchments and coastal areas. The completion date, subject to continued funding by Government for the Flood Risk Management Programme, will meet the dates set out in the EU Floods Directive for the preparation of flood hazard and risk maps, and flood risk management plans.

OPW database as part of CFRAMS process

As part of the CFRAMS programme underway, the OPW plans to identify systematically the major flood defence assets and record them in a Flood Asset Database. In this way it is planned to record on a database, their position, and to inform the owners or other authorities of their importance for flood protection. The data gathered during the survey has been incorporated into our flood risk assessment. And will be used to develop a programme of flood defence asset management and maintenance.

Flood extent maps – example from Lee

Another output from each CFRAM will be a set of flood extent maps, showing the areas at risk from flood inundation for three levels of probability, 10%, 1%, and 0.1%. I've included a sample, which is in draft at present, at the end of the paper for illustration. (See figure 1)

Flood Risk Management Plan

The CFRAM process described briefly above, will develop for each catchment, a set of predictive flood maps which will include an allowance for the impacts of climate change in the delineation of the flood extent maps.

The Flood Risk Management Plan will consider various future pressures including climate change when identifying the measures and actions to manage floods in the catchment

Design specification

The design specification for flood relief schemes (fluvial and coastal) and for urban drainage schemes as seen above will make allowances for the impacts of climate change.

Planning & Development Guidelines

During 2008, the OPW, and the DoEHLG published draft guidelines "The Planning System and Flood Risk Management". Taken together with emerging information on flood extents, these guidelines will lead to improved development decision-making by Planning Authorities and by developers.

EU floods directive

The purpose of the directive is "*to establish a framework for the assessment and management of flood risks, aiming at the reduction of the adverse consequences for human health, the environment, cultural heritage and economic activity associated with floods in the Community*".

The principal requirements of the Directive are that Member States shall:

- Undertake a preliminary flood risk assessment (PFRA) to determine areas of existing or potential future 'significant' risk, and for those areas;
- Prepare flood hazard and risk maps; and
- Prepare flood risk management plans.

In Ireland, these latter two requirements of the Directive will be delivered through the Catchment Flood Risk Assessment and Management (CFRAM) Studies.

Northern Ireland

The approach in Northern Ireland is similar to that adapted here, and indeed is somewhat further advanced. I know from our regular meetings and from information on their website that the Rivers Agency has already developed Asset Management Plans for their flood defences. They have produced a Strategic Flood Map, which illustrates the areas

throughout Northern Ireland that have flooded from rivers and the sea in the past and those which are estimated to be prone to flooding now and in the future.

The map developed in co-operation with the Department of Environment to meet the requirements of its Planning Policy Statement 15 (PPS 15) - Planning and Flood Risk.

What climate change / research information is required and in what form

Uncertainty

The biggest challenge is the uncertainty associated with the climate change scenarios being developed by climate scientists. If we knew with confidence what was going to happen, it would be far easier to make the economic and other decisions related to investment in flood protection and risk management works, development planning, etc. The uncertainty requires policies to be implemented that are based on emerging scientific data and general assumptions about its impacts. The research efforts need to be concentrated on reducing these sources of uncertainty, to enable more cost effective flood risk management solutions to be devised that are 'climate change proofed'.

The OPW has been aware of the gaps in our knowledge & information in relation to the effects that climate change scenarios will have on the flood risk management programme. To address these short -comings we have identified the following areas that require research programmes.

- Rainfall and Climate Analysis
- Catchment Response Analysis
- Sea Level and Storm Surge Analysis.

Conclusions

There is uncertainty about the level of impacts climate change will have on river and coastal flooding. In the light of the costs of providing protection to our towns and cities, it is most important that this research is directed to reducing these uncertainties to allow engineers to design, construct and maintain the most cost effective defences.

Disclaimer

This paper was prepared by Tony Smyth, for presentation at an Irish Academy of Engineering workshop on "Critical Infrastructure – Adapting for Climate Change", to stimulate discussion on the potential issues relating to flooding. The views expressed are those of the author.

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means that an overall Scottish cycle target of 13 percent likely represents a benefit to the economy of almost £2 billion, while an overall target of 27 percent would probably benefit the Scottish economy by more than £4 billion.

It should be noted that we did not find a general-purpose tool that can calculate the economic benefits of increased walking in the same way as for cycling. We also did not find data that allow for the calculation of other economic benefits from increased cycling and walking, such as benefits due to reduced congestion. These other benefits tend to be calculated on a project-specific basis.

According to Scottish Government statistics (2007A), car-based trips account for up to 69 percent of all commuting[7]. This provides plenty of room for switching to walking or cycling and so in answering *Question 3-2*, we considered reducing car commuting by 20 percent and 40 percent through a switch to walking and cycling. It is possible to calculate the economic benefits of these reductions in car commuting by using figures from Sustrans (2006) and the DfT (2008). These identify the financial benefit that results from switching a commute to walking or cycling, due to the increased productivity and reduced absenteeism that results from the commuter's improved health. By combining these figures with the Scottish population of 15-64 year olds (GRO Scotland, 2008C) and the Scottish average gross income of £432 per week (Scottish Government, 2007B), we can determine the potential benefit to the whole Scottish economy, as shown in *Table 2* (details of the calculations can be found in *Appendix A*, page 23).

Table 2. Economic benefit of switching commutes from cars to walking or cycling. Two scenarios are provided: Switching 20 percent and switching 40 percent of car commutes to walking or cycling. The monetised benefits come from Sustrans (2006) and the Department for Transport (2008), and the number of trips, gross average income, and population of 15–64 year olds in Scotland come from the Scottish Government (2007A; 2007B) and the GRO Scotland (2008C). Full details of the calculations are in *Appendix A* on page 23

Reduce car commutes by	New walking or cycling trips	Sustrans (2006) economic benefits	DfT (2008) annual economic benefits
20%	79,976,270	£663,803,038	£2,763,979,877
40%	159,952,539	£1,327,606,075	£5,527,959,755

The results in *Table 2* show that the Scottish economy stands to benefit by £0.6–£2.7 billion through a 20 percent switch and £1.3–£5.5 billion through a 40 percent switch from car commuting to walking or cycling. The DfT states that these are annual economic benefits, and it should be noted that the Sustrans data was only compiled for commutes undertaken on traffic-free paths. Finally, the difference between the DfT and Sustrans figures shows that more work needs to be done to improve the accuracy of the benefit factors. However, the results still provide a good indication of the scale of economic benefit that can be realised.

7. The statistic relates to commutes undertaken by car, van, or lorry, but it is reasonable to assume that the bulk of these commuter journeys are car-based.

4. LOCAL PUBLIC TRANSPORT

4.1. Overview of findings related to public transport and the economy

In the Scotecon report, *Transport and the Scottish Economy: Key Issues*, McQuaid and Greig (2002) cite research showing that investment in public transport made towns and cities more attractive business locations. However, the level of economic activity or job creation that can be attributed to public transport investment is not specified. On the other hand, Laconte (1999) puts numbers on public transport's job creation benefits in the UITP report *Investing in Urban Transport*. He finds that when judged by passenger kilometre, public transport generates twice as many jobs as the car. And when judged by barrel of oil, public transport's job creation benefits are four times that of the car. A more recent report by UITP (2003) puts the job creation advantage of public transport at two- to three-times that of private transport. The same report finds that every US$10 million (£5 million[8]) invested in public transport capital projects creates more than 300 new jobs and a US$30 million (£15 million) gain in business.

4.2. Local public transport questions we set out to answer

Question 4-1: *What would be the cost due to extra congestion if local public transport were removed?*

Question 4-2: *What would be the financial benefit from congestion relief of switching X% of journeys from private transport?*

4.3. Answering the local public transport questions

The cost of congestion to the UK economy is estimated to be anywhere between £7–£19 billion a year (British Chambers of Commerce, 2007B; Eddington, 2006; Green Party, 2004). Significantly reducing congestion could therefore be of great benefit to the economy. However, we did not find figures showing what percentage of car journeys would have to be switched to public transport to achieve this goal (*Question 4-2*). Similarly, this lack of a link between units of public transport usage and units of congestion makes it impossible to answer *Question 4-1*.

To answer such questions, work needs to be done to determine how increasing public transport use in Scotland would impact on congestion. This will depend on the how many new public transport journeys are due to people switching from cars, how many are additional journeys, and whether when some people leave their cars behind, others are encouraged to make additional car journeys. Even if a link between public transport use and congestion can be established, further work needs to be done to relate units of decrease in congestion to economic impact.

8. United States dollars have been converted to pound sterling using the HM Revenue & Customs average exchange rate for 2007 (HMRC, 2008C).

5. LONG DISTANCE PUBLIC TRANSPORT

5.1. Overview of findings related to long distance public transport and the economy

The Transport Research Institute (TRI) at Napier University conducted a study comparing the relative costs between train and car for long-distance travel (Kirby et al., 2006). This research determined the average monetised value (to employers) of time spent working on the train for three routes: Manchester–London, Birmingham–London, and Manchester–Birmingham. The figures are based on extensive data and conservative assumptions, however they are specific to the three routes and it is not immediately possible to generalise them to a national level. With further work, the data and methods employed by the Napier study could be combined with other data (e.g. number of business trips annually) to produce national figures.

There are also various claims about the positive benefits of specific rail schemes:

- A UK high-speed rail network will generate £16–£44 billion in GDP productivity benefits over 60 years, and £6.3–£32 billion in net benefits (Atkins, 2008)
- High-speed rail from London to Birmingham could produce £2.24 billion in productivity benefits (Rail Management, 2008A)
- Eddie Stobart's three year rail freight contract with Tesco is estimated to bring £3 million of environmental benefits (BCC, 2007A)
- Reopening the Thornton to Leven railway line would have major benefits to Leven's economy (BBC, 2008)

However, the above claims should be viewed with caution in light of Eddington's (2006) finding that claimed macro-economic benefits of large transport schemes are risky and prone to inaccuracies (see *Section 1.2* for details). In any case, there is no way to generalise the above economic benefits as they are based on analysis of specific projects. The research that comes closest to demonstrating general economic impacts of long distance public transport is the UITP (2003) report already cited in *Section 4.1*. Their findings stated that every US$10 million (£5 million[9]) invested in public transport capital projects creates more than 300 new jobs and a US$30 million (£15 million) gain in business.

5.2. Long distance public transport questions we set out to answer

Question 5-1: *What is the benefit to the Scottish economy due to work completed on trains?*

Question 5-2: *What would be the financial benefit from extra productivity if X% of car or air journeys were switched to the train?*

5.3. Answering the long distance public transport questions

More work needs to be done to answer either of the above questions. The best starting point for further work is the research by the TRI at Napier University (Kirby et al., 2006). If the number of business journeys undertaken by rail in Scotland can be determined, this can be combined with the methods and data sources in the TRI research to calculate an answer to *Question 5-1*. Once this has been established, it is possible to approach *Question 5-2*. The methods employed by the TRI involve calculating the financial benefit due to productivity on an average rail journey, and so this could be used with figures on the number of car- or air-based business trips in Scotland to answer the question.

9. United States dollars have been converted to pound sterling using the HM Revenue & Customs average exchange rate for 2007 (HMRC, 2008C).

6. PRIVATE MOTOR TRANSPORT

6.1. Overview of findings related to private motor transport and the economy

6.1.1. General issues

Road schemes are often promoted because of the monetary benefit it is claimed they will bring to the economy. However, SACTRA (1999) found that 85–90 percent of these monetised benefits are due to time savings. Against this, motorised traffic in urban areas has an impact on non-motorised traffic in the form of time loss for pedestrians and space loss for bicycles. Maibach et al. (2007) found that passenger cars cost the economy 0.26! ct (0.18p[10]) per vehicle kilometre due to these impacts. And Eddington (2006) found that car owners do not pay the true costs of travelling on the roads at peak times and that positive impacts of transport projects are overstated when environmental impacts are not taken into account. The Green Party of England and Wales (2004) places road transport's 'hidden' economic burden on the UK economy at £11–£17 billion per year.

6.1.2. Health and noise impacts

On top of these general economic costs, work has been done to determine the economic impact of road transport due to specific issues. The Green Party of England and Wales estimates that annual UK health costs due to road transport are £11.1 billion and annual noise impacts impose an annual cost of £2.6 billion. Maibach et al. (2007) calculate unit costs based on European averages, putting the costs due to car-generated air pollution at 0.05! ct–0.93! ct (0.03p–0.64p) and costs due to car noise at 0.07! ct–0.84! ct (0.05p–0.58p), both per passenger kilometre. Road accidents also represent a cost to the economy, of £2.5 billion or £2.9 billion per year, depending on the source (Eddington, 2006; Green Party of England and Wales, 2004). The unit cost of passenger car accidents in the UK is placed at 3.43! ct (2.35p) per passenger kilometre by Maibach et al. (2007). Combining all these sources – pollution, noise, and accidents due to passenger cars – the European Commission (2001) finds that the average European unit cost is approximately 5.50! ct (3.77p) per passenger kilometre.

6.1.3. Congestion

In *Section 4.3* some of the findings related to congestion's cost to the economy were discussed. These findings put congestion's impact on the economy at £7–£8 billion per year, £17.5 billion per year, and £19.1 billion per year according to Eddington (2006), the British Chambers of Commerce (2007B), and the Green Party of England and Wales (2004), respectively. Eddington (2006) further estimates that by 2025, congestion across the UK will cost businesses £10 billion per year and result in £12 billion worth of wasted time to households. In unit costs, the European Commission (2001) calculated that congestion due to passenger cars costs the UK economy 0.80! ct (0.55p) per passenger kilometre.

6.1.4. Road user charging

The former UK transport minister, Ruth Kelly, claimed that a road user charging scheme in Manchester will deliver far greater economic growth and quality of life benefits than only investing in public transport. Across the UK, Eddington (2006) puts the figure on road user charging's potential benefits at £28 billion per year, with £15 billion of that being direct GDP benefits. In urban areas, Eddington calculates that for every £1 spent on a road user charging scheme, £3·80–£4·40 additional GDP will be generated.

6.2. Private motor transport questions we set out to answer

Question 6-1: *What is the economic cost, due to health and congestion impacts, of additional car drivers on Scottish roads?*

Question 6-2: *How much is lost to the Scottish economy due to the purchase of new (imported) cars?*

10. Euros have been converted to pound sterling using the HM Revenue & Customs average exchange rate for 2007 (HMRC, 2008A).

6.3. Answering the private motor transport questions

The Scottish Government's (2007C) transport statistics show that in 2005/2006, the average distance travelled by a car, van, or lorry driver was 3,595 miles (5,786 kilometres), while the average distance travelled by a passenger in a car, van, or lorry was 2,080 miles (3,347 kilometres). We can therefore calculate the average economic burden of car drivers and passengers due to health and congestion impacts, as shown in *Table 3*.

Table 3. Worst-case average annual cost to the economy of each car driver and passenger, due to health and congestion impacts. Calculations are made using two different sources for health impacts: Maibach et al. (2007) and the European Commission (2001). Travel statistics come from the Scottish Government (2007C). Euros have been converted to pound sterling using the HM Revenue & Customs average exchange rate for 2007 (HMRC, 2008A).

Impact	Cost	
	Maibach et al.	European Commission
Car Drivers		
Air pollution, noise, & accidents	5,786km ! 0·0356£/km† = £205·9816	5,786km ! 0·0377£/km† = £218·1322
Congestion‡	5,786km ! 0·0055£/km = £31·8230	5,786km ! 0·0055£/km = £31·8230
Total	**£238**	**£250**
Car Passengers		
Air pollution, noise, & accidents†	3,347km ! 0·0356£/km† = £119·1532	3,347km ! 0·0377£/km† = £126·1819
Congestion‡	3,347km ! 0·0055£/km = £18·4085	3,347km ! 0·0055£/km = £18·4085
Total	**£138**	**£145**

sources: †Maibach et al., 2007; ‡European Commission, 2001; Scottish Government, 2007C; HMRC, 2008A

Since Maibach et al. (2007) provide a range for costs due to air pollution and noise, it is also possible to calculate the 'best-case' average cost to the economy. In this case, the unit cost due to air pollution, noise, and accidents is £0·0243 per passenger kilometre. Following the same process as in *Table 3*, this provides a cost per driver of £172·4228 and a cost per passenger of £99·7406. *Table 4* provides a summary of the results based on these different data, rounded to the nearest pound.

Table 4. Summary of average Scottish car drivers' and passengers' average annual cost to the economy due to health and congestion impacts.

Source	Car driver economic cost	Car passenger economic cost
Maibach et al. (2007) worst-case	£238	£138
Maibach et al. (2007) best-case	£172	£100
European Commission (2001)	£250	£145

The above figures could be used to answer *Question 6-1* if we assume that each additional driver or passenger on Scottish roads is average. This could be used to calculate an indicative figure of the economic burden due to health and congestion of a scheme that will generate extra car-based journeys.

The sources that were used for this research did not provide any answers to *Question 6-2*. This question would be an interesting avenue of further research, as there is no mass market car manufacturing in Scotland and so all new cars are imported. Work on this topic could look at the opportunity cost by considering what people might otherwise spend their money on if they didn't have the need or desire to purchase an imported car. It is possible that spending on cars displaces money that would otherwise be put into the Scottish economy.

7. AIR TRANSPORT

7.1. Overview of findings related to air transport and the economy

7.1.1. General issues, tax breaks, and unpaid external costs

One of the general dangers of assigning benefits to air travel expansion is discussed by Eddington (2006). He states that, "where the environmental impact of transport growth is not factored into decision-making, the positive impact of a transport project is likely to be overstated, since the negative long-term impact of transport emissions is not balanced against the short-term benefits." Because the negative environmental impacts of air transport can be significant over the long term, it is vital that these impacts are considered alongside any positive ones. When considering aviation's impacts from climate change alone, Whitelegg et al. (2003) calculate the cost to the UK economy at £2 billion per year. Maibach et al. (2007) and the European Commission (2001) also calculated aviation's economic cost due to climate change and found this to be ! 530 (£362[11]) per passenger per flight and ! 32 (£22) per 1,000 passenger kilometres, respectively. And when WWF used the UK government's own models for determining the benefits of a third runway at Heathrow, but with more realistic assumptions in line with UK Treasury guidance and the Stern Review (2007), they found that the project will be a cost to the UK economy of £5 billion (WWF, 2008).

More generally, through tax breaks, aviation receives an effective subsidy of £9.2 billion per year[12], and generates annual external costs of £3.7 billion (Sewill, 2003; Whitelegg et al., 2003). This is the equivalent of every person in the UK paying £220 each year to the aviation industry (excluding oil companies and aircraft manufacturing). And as the Royal Commission on Environmental Pollution notes, if restrictions were placed on air transport, the displaced resources would find other uses which would likely provide a similar market value but with much less environmental damage (RCEP, 2007). Considering Eddington's warning on the need to include environmental impacts in decisions, this indicates that displacing resources from air travel is likely to have a net positive economic impact.

7.1.2. Health and noise impacts

Whitelegg et al. (2003) estimate that the UK aviation sector is responsible for health costs due to air pollution of more than £1.3 billion per year and costs to the economy due to noise pollution of £313 million per year. More generally, they cite a European Environment Agency finding that puts that the combined environmental and health costs due to aviation at ! 44 (£30) per 1,000 passenger kilometres. Maibach et al. (2007) also calculate unit costs for a European average and they find that per flight, the average European air passenger costs the economy ! 117 (£80) due to air pollution, ! 118 (£81) due to accident costs, and ! 228 (£156) due to noise pollution. The European Commission (2001) puts the economic cost due to the first three sources – air pollution, noise, and accidents – at ! 5 (£3) per 1,000 passenger kilometres.

7.1.3. Consumer spending deficit

Air links to other countries represent the potential for incoming people to spend money in Scotland, and therefore contribute to the economy, and also for Scots travelling abroad to spend money outside of Scotland that they might otherwise have spent at home. How much is spent by foreigners coming in versus Scots going abroad determines whether air links represent a net economic boost or an economic drain in the context of consumer spending. Transport Times (2008) states that regional airport expansion is driven by an increase in second homes in Europe and Eastern European workers travelling home on their time off. This kind of demand takes money out of the local economy.

Whitelegg et al. (2003) found that in 2001 UK residents spent £18.7 billion abroad, whilst visitors to the UK only spent £7.6 billion – a deficit of £11.1 billion. According to Friends of the Earth England, Wales, and Northern Ireland (FoE EWNI), by 2004 this deficit had grown to £15 billion as foreigners only spent £11 billion whilst British travelling abroad spent £26 billion (FoE EWNI, 2005). They also found that when considering the purchasing of air tickets and air freight, the UK has recorded a deficit since the mid-1980s,

11. Euros have been converted to pound sterling using the HM Revenue & Customs average exchange rate for 2007 (HMRC, 2008A).
12. This 'effective subsidy' to the aviation industry comes from money lost to the Exchequer due to a lack of fuel tax and VAT on tickets, and duty free goods sold at airports and onboard flights.

as more British residents purchase services from foreign airlines than foreigners purchase services from British airlines. This deficit was £3.2 billion in 2003 and £3.3 billion in 2004.

When looking at Scotland specifically, in 2004 the ratio of Scots' spending abroad versus visitors spending in Scotland was 2.5:1. Only £866 million was spend by visitors compared to the £2.157 billion spent by travelling Scots, representing a deficit of £1.291 billion (FoE EWNI, 2005). The deficit alone is more than was spent by incoming visitors. With current airport expansion plans, Scotland's deficit will likely rise to £2.6 billion per year assuming passenger growth is equal for incoming and outgoing travel. However, that assumption might not be realistic as from 1995–2005, outward tourism grew at twice the rate of inward tourism to Scotland, so the annual deficit by 2020 could be much larger (FoE EWNI, 2005).

7.2. Air transport questions we set out to answer

Question 7-1: *What is the financial cost of climate change impacts due to Scottish residents flying?*

Question 7-2: *What is the net financial impact to the Scottish economy due to incoming and outgoing air-based tourism spending?*

7.3. Answering the air transport questions

We could not find reliable figures for the number of passenger kilometres due to flights originating and terminating at Scottish airports, so it is not possible to make calculations for Scotland's economy using the European Commission's (2001) figures. However, Maibach et al. (2007) provide figures for each passenger. The Scottish Government (2007C) statistics show that in 2006, Scottish residents made 4,562,000 trips outside the UK by air. This represents 9,124,000 total passenger flights between Scotland and destinations outside the UK, but does not include flights within the UK. It is not therefore possible to properly answer *Question 7-1*. However, *Table 5* shows the impact international Scottish-based air travellers are having on the economy.

Table 5. Average annual cost to the economy due to Scottish residents flying outside of the UK. The economic impacts are calculated using economic impact data from Maibach et al., (2007) and Scottish travel data from the Scottish Government (2007C). Euros have been converted to pound sterling using the HM Revenue & Customs average exchange rate for 2007 (HMRC, 2008A).

Cause of economic impact	Economic cost due to Scottish residents flying abroad
Air pollution	£80·12 ! 9,124,000 = £731,014,880
Accident costs	£80·80 ! 9,124,000 = £737,219,200
Noise pollution	£156·12 ! 9,124,000 = £1,424,438,880
Climate change	£362·92 ! 9,124,000 = £4,835,720,000
Total	**£7,728,392,960**

As can be seen, even when internal UK flights are discounted, Scottish travellers are already costing the economy £7.7 billion each year due to health and climate change impacts. If internal UK flights could be included this number would be significantly higher. This is not to suggest that Scotland should aim to eliminate all flights, but these economic costs will increase with air passenger numbers. It is important for the government to shape policy to eliminate unnecessary flying and therefore minimise the cost incurred to the Scottish economy.

Section 7.1 provided an answer to *Question 7-2* for previous years, showing that in 2004, air-based tourism resulted in a real cost to the Scottish economy of £1.291 billion due to more money being spent by Scottish residents abroad than was spend by incoming visitors. This economic cost is predicted to rise to £2.6 billion by 2020, but there are no current figures for more recent years. As this is a key figure that can inform tourism and transport policy, the Scottish Government should maintain regular statistics on the net spending impact due to air-based tourism. This would make it easier to discover the true costs of subsidising flights in Scotland. More work is also necessary on determining the impact that air industry subsidies and tax breaks have on displacing resources that could be spent on more sustainable and economically beneficial activities.

8. CONCLUSIONS

8.1. Summary of the purpose of this research

Findings discussed in *Section 1.2* found that projected economic impacts of big transport projects are often based on the assumed benefits of time savings. The section also looked at sources that found these benefits are often just estimates, many simply statements of hope, and that there is little actual evidence of GDP benefits or transformational aspects from completed projects (Eddington, 2006; McQuaid and Greig, 2002). It is therefore important for us to gain a better understanding of the actual economic impacts of transport projects, especially the impacts that result from factors other than time savings. Overall, we found a mixed picture. There are several holes in our understanding but also evidence in some areas that produces interesting figures. What follows is a summary of both areas where we were able to answer the questions we had posed, and also areas where more work is needed.

8.2. Answers to our questions

Smarter choices

- Smarter choices initiatives have a benefit to cost ratio of 10.

Active travel

- Switching short journeys in Scotland from car to bicycle to reach a cycling mode-share of 20 percent on short distances (or 13 percent of all distances) would result in an economic benefit of at least £1 billion per year due to reduced mortality and more likely £2 billion per year when improved health is included.
- Switching short journeys in Scotland from car to bicycle to reach a cycling mode-share of 40 percent on short distances (27 percent of all distances) would result in an economic benefit of at least £2 billion per year due to reduced mortality and more likely £4 billion per year when improved health is included.
- Switching 20 percent of car commutes in Scotland to walking or cycling would result in economic benefits of up to £2.7 billion per year.
- Switching 40 percent of car commutes in Scotland to walking or cycling would result in economic benefits of up to £5.5 billion per year.

Motorised transport

- Each driver in Scotland costs the economy £172–£250 per year due to health and congestion impacts.
- Each car passenger in Scotland costs the economy £100–£145 per year due to health and congestion impacts.

Air transport

- In 2004, Scottish residents abroad spent £1.3 billion more than visitors spent in Scotland. With current air transport growth, this deficit will likely rise to more than £2.6 billion per year by 2020.
- Scottish residents flying to destinations outside the UK cost the economy £7.7 billion per year due to health and climate change costs. This does not include Scottish residents flying to destinations within the UK.

8.3. Areas where more work is needed

Smarter choices

- Calculating the overall economic impact of smarter choices initiatives (for instance, including health effects) and how this compares to investing in enhanced road capacity and shorter trip times by private cars.

Active travel

- Calculating the economic impacts due to improved general health when walking and cycling rates increase.

Local public transport

- Determining the relationship between increased public transport use and congestion. Furthermore, it is necessary to understand what effect a unit of decrease in congestion would have on the economy.

Long distance public transport

- Information should be compiled on how many business trips are undertaken by rail in Scotland. This could be combined with the monetised benefit calculation methods from Kirby et al. (2006) to understand their economic benefit.

Motorised transport

- Scotland has no mass-market car production facilities, and so all new cars are imported. However, there is a lack of information on what the resulting loss to the economy is and the displacement effects. This work should determine what people would otherwise spend money on if they did not have the need or desire to purchase a car.

Air transport

- It is vital to understand what the net financial impact is to the Scottish economy of incoming and outgoing air-based tourism. The Scottish Government should publish annual statistics on these figures as a guide to policy-making.
- A robust understanding should be developed of the impact that flight subsidies and tax breaks have. They displacing resources which would otherwise be spent on more economically beneficial and sustainable activities.

8.4. Concluding Remarks

Further research into the issues highlighted in *Section 8.3* will enhance our understanding of the relationship between transport choices and their economic impacts. A better understanding is important for sound decision-making. However, with the existing information we can already see that there are some real, significant, economic benefits to be realised by moving people from their cars and onto bicycles or their feet. Revisions to the appraisal system and following the recommendations in *Chapter 9* will help to improve the basis for decision-making and fill some of the gaps in our knowledge.

At the same time, every single car driver and passenger is costing the economy hundreds of pounds a year in health and congestion costs, so there is benefit from reducing car use even before replacing it with a more active mode. And as well as air transport's well-understood environmental problems, it is placing an economic burden on Scotland's economy. This is felt both through health costs and through the net outflow of over a billion pounds a year due to tourism.

9. RECOMMENDATIONS

Section 8.3 summarises where further work is needed. Transform Scotland believes that carrying out this work would be of benefit to our understanding of the true economic impacts of transport decisions. In addition, based on our findings, we have six recommendations:

(1) Scottish Transport Appraisal Guidance (STAG) should include the direct economic benefits resulting from improved health due to increased cycling and walking. This could make use of the *HEAT for Cycling* tool, but must also incorporate walking and benefits resulting from improved health. Evidence on increased productivity and reduced absenteeism should also be included.

(2) STAG should substantially reduce the emphasis given to time savings. The benefits attributed to these time savings are often unproven, and there are very real economic benefits associated with the other aspects of transport projects discussed in this report.

(3) The productivity benefits resulting from working when travelling by train or bus should be incorporated in STAG. These benefits can outweigh any benefits estimated to arise from time savings.

(4) The health and congestion costs of additional car drivers and passengers should be fully considered in transport project appraisal.

(5) Research should be conducted on the displacement effect of car purchases. It is important to understand what people would spend their money on if they didn't have the desire or need to buy a car, and how these alternative purchases would affect the Scottish economy.

(6) The Scottish Government should publish annual statistics quantifying the net effect on the Scottish economy of air-based tourism. It is vital to know how much to visitors spend in Scotland compared with the amount Scots spend when they fly abroad.

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APPENDIX A
DETAILS OF SELECTED CALCULATIONS

Details of the *HEAT for Cycling* calculations behind *Table 1* (p. 9)

The first input necessary for the *HEAT for Cycling* tool is 'number of trips per day.' As we are investigating the benefits of switching 19 percent and 39 percent of all journeys under five miles from car to cycling, we used the average annual trips under five miles per person in Scotland (Scottish Government, 2007A) and Scotland's population of 15–64 year olds (GRO Scotland, 2008C).

Table 6. Calculations for number of journeys to input into the *HEAT for Cycling* tool. The resulting inputs are shown in the last two rows of the table.

Item	Datum	Source
Scotland's population of 15–64 year olds (2007)	3,447,253	*Mid-2007 Population Estimates Scotland* (GRO Scotland, 2008C)
Trips under 5 miles per person per year (2004/2005)	675.00	*Travel by Scottish residents* (Scottish Government, 2008A)
19% of trips under 5 miles per person per year	128.25	0.19 × 675.00
39% of trips under 5 miles per person per year	263.25	0.39 × 675.00
Total trips under 5 miles taken by 15–64 year olds per year	2,326,895,775	675.00 × 3,447,253
19% of 15–64 yos' annual trips under 5 mi.	442,110,197	128.25 × 3,447,253
39% of 15–64 yos' annual trips under 5 mi.	907,489,352	263.25 × 3,447,253
19% of 15–64 year olds' *daily* trips under 5 miles	**1,211,261**	442,110,197 ÷ 365
39% of 15–64 year olds' *daily* trips under 5 miles	**2,486,272**	907,489,352 ÷ 365

The next input that is needed is the mean trip length in kilometres. The Scottish Government (2007A) provides figures for the number of trips: under one mile; from one to under two miles; and from two to under five miles. So as not to overstate the mean trip length, the median distance for each range was used to calculate the overall figure, as shown in *Table 7*.

Table 7. Mean trip length for all trips under five miles, per person per year, in 2004/2005. Data for the number of trips in each distance range come from the Scottish Government (2007A).

Distance range	Nº trips in range	Median dist. in range	Total dist. of trips
under 1 mile	226	! 0.5 miles	= 113.0 miles
1 to under 2 miles	197	! 1.5 miles	= 295.5 miles
2 to under 5 miles	252	! 3.5 miles	= 882.0 miles
all under 5 miles	675	–	1,290.5 miles
all under 5 miles		1290.5 ÷ 675 = 1.911851852 miles **= 3.076827307 kilometres**	

The third input we needed was the mean proportion of the working age population who die each year. To find this, we used data from the GRO Scotland (2008B; 2008C).

Table 8. Death rate for the working age population in Scotland in 2007. The working age population is taken to be men and women aged 15–64 years old. The number of deaths are taken from GRO Scotland, 2008B and the total population is taken from GRO Scotland, 2008C.

Deaths of 15–64 year olds	Scotland's population of 15–64 year olds	Mean proportion of 15–64 year olds that die each year
11,153	÷ 3,447,253	= 0.00323533

Finally, we used the *HEAT for Cycling* tool (WHO, 2007) to calculate the economic savings due to reduced mortality of switching 19 percent (*Table 9*) and 39 percent (*Table 10*) of trips under five miles in Scotland from car to bicycle.

Table 9. *HEAT for Cycling* tool inputs and result showing the economic savings of switching 19 percent of short journeys in Scotland from car to bicycle. The final result (shown with a grey background) was calculated using the *HEAT for Cycling* tool (WHO, 2007).

Item	Datum	Comment
Number of trips per day	1,211,261	see *Table 6*
Mean trip length (km)	3.076827307	see *Table 7*
Mean number of days cycled per year	365	trip figures are based on average annual individual trip data
Proportion of trips that are one part of a return journey (or 'round trip')	0	
Proportion undertaken by people who would not otherwise cycle	1	benefit of all these trips switching from car to bicycle
Mean proportion of working age population who die each year	0.00323533	see *Table 8*
Value of life (in pound sterling)	£1,215,000	from DfT, 2008
Maximum annual benefit	**£990,227,000**	

Table 10. *HEAT for Cycling* tool inputs and result showing the economic savings of switching 39 percent of short journeys in Scotland from car to bicycle. The final result (shown with a grey background) was calculated using the *HEAT for Cycling* tool (WHO, 2007).

Item	Datum	Comment
Number of trips per day	2,486,272	see *Table 6*
Mean trip length (km)	3.076827307	see *Table 7*
Mean number of days cycled per year	365	trip figures are based on average annual individual trip data
Proportion of trips that are one part of a return journey (or 'round trip')	0	
Proportion undertaken by people who would not otherwise cycle	1	benefit of all these trips switching from car to bicycle
Mean proportion of working age population who die each year	0.00323533	see *Table 8*
Value of life (in pound sterling)	£1,215,000	from DfT, 2008
Maximum annual benefit	**£2,032,571,000**	

Details of commuting switch from car to walking or cycling calculations behind *Table 2* (p. 10)

To calculate the economic benefit of switching 20 percent or 40 percent of car-based commutes to walking or cycling required some basic data first: number of trips involved and the median gross weekly income in Scotland. *Table 11* shows where these data came from and the calculations that were made.

Table 11. Data and calculations needed to determine the benefits of switching commuters from car to walking or cycling.

Item	Datum	Source
Scotland's population of 15–64 year olds (2007)	3,447,253	*Mid-2007 Population Estimates Scotland* (GRO Scotland, 2008C)
Car, van, or lorry driver commutes per person per year (2004/2005)	93	*Travel by Scottish residents* (Scottish Government, 2008A)
Car, van, or lorry passenger commutes per person per year (2004/2005)	23	*Travel by Scottish residents* (Scottish Government, 2008A)
Total car-, van-, or lorry-based commutes per person per year (2004/2005)	116	93 + 23
Total car commutes by 15–64 year olds	399,881,348	116 × 3,447,253
20% of car commutes by 15–64 year olds	**79,976,270**	0.2 × 399,881,348
40% of car commutes by 15–64 year olds	**159,952,539**	0.4 × 399,881,348
Median Scottish gross weekly income (2006)	£432.00	*Scottish Economic Statistics 2007* (Scottish Government, 2007B)
Median Scottish gross daily income (2006)	**£86.40**	£432.00 ÷ 5

Using the results (shaded grey) from *Table 11*, it is possible to calculate the total economic benefit of switching 20 percent (*Table 12*) and 40 percent (*Table 13*) of car commuters to walking or cycling, the results of which were used in *Table 2* (*Section 3.2*, p. 8).

Table 12. Calculation of the economic benefit of switching 20 percent of car-based commuters to walking or cycling.

Sustrans (2006) economic benefits		DfT (2008) economic benefits	
79,976,270	see *Table 11*	79,976,270	see *Table 11*
! £8.30	Sustrans (2006) benefit	! 0.4 ! £86.40	DfT (2008) benefit see *Table 11*
= £663,803,038		**= £2,763,979,877**	

Table 13. Calculation of the economic benefit of switching 40 percent of car-based commuters to walking or cycling.

Sustrans (2006) economic benefits		DfT (2008) economic benefits	
159,952,539	see *Table 11*	159,952,539	see *Table 11*
! £8.30	Sustrans (2006) benefit	! 0.4 ! £86.40	DfT (2008) benefit see *Table 11*
= £1,327,606,075		**= £5,527,959,755**	

DARD, DFP, DCAL, DSD and Dept of Education Responses re What extent PSA Contribute to NI's Emission Reduction Target

Environmental Policy Branch

Department of
Agriculture and
Rural Development
www.dardni.gov.uk

Alex McGarel
Clerk, Environment Committee
Room 245
Parliament Buildings
Stormont
Belfast
BT4 3XX

Room 651
Dundonald House
Belfast BT4 3SB
Telephone: 028 9052 4773
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27 May 2009

Dear Alex,

Departmental contribution to climate change targets

You wrote on 8 May 2009 to the Clerks of the Assembly Committees requesting an indication from Departments of how and to what extent our Public Service Agreements contribute to Northern Ireland's emission reduction target to reduce greenhouse gas (or GHG) emissions by 25 per cent below 1990 levels by 2025.

DARD's key PSA is PSA 4, supporting rural businesses, which aims to help agri-food businesses and rural SMEs develop and grow and contribute to a more sustainable environment.

The following DARD actions under PSA 4 targets (in italics) contribute to lower GHG emissions:

> *By 2013 invest £45m in improving the competitiveness of the agricultural sector, including £10m to support the modernisation of farms.*

A manure efficiency technology scheme (METS), delivered as an element of the NIRDP's Farm Modernisation Programme, will support

efficient slurry distribution and so contribute to reduced emissions of the GHG nitrous oxide.

> *By 2013 increase to 50 per cent the area of agricultural land in Northern Ireland covered by environmental enhancement agreements.*

DARD's agri-environment programme limits fertiliser use and livestock numbers on participant farms, as well as limiting the cultivation of environmentally valuable habitats. An increase in participant numbers and area covered by the programme will contribute both to reduced GHG emissions and to the potential for carbon sequestration.

> *The conversion of an additional 1,650 ha of agricultural land and non-agricultural land to forest and woodland to be achieved by March 2011.*

Forest Service's strategy for Sustainability and Growth aims to double woodland cover (conventional woodland and short rotation coppice) and promote the sustainable management of existing forests, contributing both to carbon sequestration and to the availability of renewable energy sources.

> *Ensure that farm nutrient balances are maintained at levels below 145kg per ha for nitrogen and reduced to 10kg per ha for phosphorus by 2011.*

The Nitrates Directive Action Programme (NDAP) limits emissions of nitrous oxide and ammonia.

Research undertaken by the Agri-Food and Biosciences Institute and others will help determine the extent to which these measures, as they are rolled out, will contribute to to Northern Ireland's emission reduction target.

I am copying this to the Clerk of the Agriculture and Rural Development Committee.

INVESTOR IN PEOPLE

If you have a hearing difficulty you can contact the Department via the textphone on 028 9052 4420

An Roinn Talmhaíochta agus Forbartha Tuaithe
Mánnystrie o Fairms an Kintra Fordórin

Yours sincerely,

Peter Scott

INVESTOR IN PEOPLE

If you have a hearing difficulty you can contact the Department via the textphone on 028 9052 4420

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Mr Shane McAteer
Clerk
Committee for Finance and Personnel

Room 419
Parliament Buildings
Stormont

29 May 2009

Departmental Contribution to Climate Change Targets

Dear Shane

Alex McGarel, Clerk to the Environment Committee wrote to you on 8 May 2009 seeking information on how and to what extent each of the Public Service Agreements (PSAs) for which the Department is responsible contributes to Northern Ireland's emission reduction target outlined in PSA 22.

I should be grateful if the Finance & Personnel Committee would consider the draft response attached at Annex A for issue to the Environment Committee Chairperson.

Yours sincerely,

NORMAN IRWIN

Annex A

Department of Finance and Personnel response to the Environment Committee request as to how and to what extent each of the PSAs for which it has responsibility contributes to Northern Ireland's emission reduction target.

1. The Department of Finance and Personnel (DFP) has responsibility for the delivery of objectives within three of the Public Service Agreements (PSAs) outlined in the Programme for Government agreed in January 2008. In achieving the objectives under these PSAs, DFP policies and actions will make a contribution to the reduction in greenhouse gas emissions target for which the DOE has responsibility under PSA 22.

2. The following paragraphs summarise the actions DFP is taking which may also help to reduce greenhouse gas emissions in Northern Ireland under each PSA. Whilst these are listed under the PSA to which they most closely relate, these actions may apply to more than one of the PSAs and in many cases will also apply to other Departments.

PSA 11 – Driving investment and sustainable development

3. Whilst OFMdFM has responsibility for the Sustainable Development Strategy for Northern Ireland and the subsequent Implementation Plan, DFP takes the lead on many of the targets and actions therein relating in particular, to the Government Estate, energy efficiency and shared

services. The Department published its first Sustainable Development Action Plan (SDAP) in January 2007 to deliver these targets followed up by a 3 year plan covering 2008-11.

4. The Department has a key role in promoting energy efficiency across the entire public sector in Northern Ireland. This includes monitoring and reporting on progress towards targets for the public sector estate on energy efficiency and carbon reduction. These targets are to:

- Reduce absolute carbon from fuel and electricity used in buildings by 12.5% by 2010/11, relative to 1999/00;
- Increase the energy efficiency of the buildings measured in kilowatt hours (kWh) of fuel and electricity used per square metre of building floor area by 15% by 2010/11, relative to 1999/00; and
- Reduce electricity consumption by 1% annually from 2007 to 2012.

The figures currently available for 2006/07 show a reduction in absolute carbon emissions of 2.5% since 1999/00. Whilst this may fall short of the target at this stage, it is important to note that this reduction has been achieved despite an increase of 8% in the area of the estate on which data was reported over the same period.

Energy efficiency in the buildings on the estate has improved by 9% since 1999/00 and appears to be on schedule to achieve the target of a 12.5% improvement by 2010/11.

Regarding the third target, a baseline for 2006/07 has now been established and the Department is currently collating the data to report on the 2007/08 year.

5. The NI Departments have also committed to achieving a carbon neutral office estate by 2015. DFP is currently assessing the best way to achieve this target in buildings for which it is responsible.

6. The Department also provides financial assistance for energy efficiency and renewable energy projects in the public sector estate from the Central Energy Efficiency Fund. Currently, £2 million is available annually to provide grants which may cover up to 100% of project costs. Since 1990 approximately 2,500 projects have received funding and it is estimated these projects have saved approximately 700,000 tonnes of carbon dioxide.

7. In addition to targets on energy efficiency the SDAP also seeks to reduce emissions through the development of a “green" Information and Communication Technology (ICT) Strategy, by reducing the consumption of water on the estate, the cancellation of all bottled water contracts and through minimising expenditure on air and road travel.

8. The SDAP also includes a number of targets and actions which also relate to sustainable procurement activities which are covered in more detail under PSA 21.

PSA 20 – Improving public services

9. DFP is taking the lead on delivering a number of reform programmes aiming to deliver a modern, high quality and efficient public service by improving NICS capacity and providing NICS staff with the necessary tools and technology. Many of the programmes are now implemented or in the advanced stages of implementation but it will be some years yet before the benefits realisation process has been completed and their impact on greenhouse gas emissions assessed.

IT Assist

10. IT Assist are working on a programme to introduce the virtualisation of servers, which affects all departments across the NICS. The delivery of the resilient data centres has provided the environment needed to consolidate servers from across the NICS. Essentially this will reduce the number of servers and associated requirement for air conditioning. Indications at the moment are that this will have a significant effect on reducing energy requirements and hence carbon emissions. We are currently in the process of metering the electricity consumption of server rooms with a view to establishing baselines and sound metrics upon which to report progress towards the target.

Delivery and Innovation Division (DID) in DFP is also working with the Central Procurement Directorate to agree the next contract for the supply of ICT equipment for the NICS, which is due for renewal in October 2009. Environmental credentials will feature in the assessment of products being considered.

DID would welcome support from the Environment Committee to the approach to reducing carbon emissions and the need to establish baseline measurements of power consumption of ICT.

Printer technology

11. DFP has also focused attention on the reduction of paper consumption by the Department and is seeking to achieve a 30% reduction by 2011 on a 2006/07 baseline. A Printer Technology Strategy is currently being developed which will undoubtedly focus on the continued reduction in the number of individual desktop printers across the NICS which will contribute in turn, to a reduction in paper consumed.

Records NI

12. Improved exploitation of the Records NI capability will be a focus for work over the 12-24 months with an expectation that this will reduce the amount of paper used across the NICS. Reducing the volume of paper ordered by the NI Departments should lead to fewer deliveries and a saving in transport emissions.

Workplace 2010

13. The Workplace 2010 programme has now been terminated. DFP Properties Division is in the process of drafting a new strategy (Workplace NI) which will consider the overall objectives of Workplace 2010 i.e. to reduce the overall footprint of the NICS office estate; to provide accommodation that will enable the Civil Service to transform the way it delivers public services; to provide accommodation that is fit for purpose in which staff are proud to work; and to safeguard funding for priority front line services.

PSA 21 – Enabling Efficient Government

14. The Sustainable Procurement Action Plan for Northern Ireland (NI SPAP) presents a number of overarching actions which will assist in the delivery of the Programme for Government commitment to support the wider Public Sector in taking account of sustainable development principles when procuring works, supplies and services. The NI SPAP is being taken forward by each Centre of Procurement Expertise (CoPE) in relation to their respective portfolios. The NI SPAP has two relevant targets, to -

- “Make the Government Estate carbon neutral by 2015", and

- "Increase the use of the OGC/DEFRA schedule of environmentally friendly products ("Quick Wins") during 2008-2009 to 100% usage of the schedule by March 2009"

15. In addition the Central Procurement Directorate (CPD) of DFP and all of the CoPEs are tasked with implementing the EC Directive on Energy End Use Efficiency and Energy Services, which requires Member States to achieve energy savings of at least 9% by 2016. Under this Directive the approach adopted in GB and recommended by DETI is the use of Voluntary Agreements (VA's) between CPD and CoPE's. VA's aim to meet the requirements of the Directive through a voluntary mechanism which must be assessed, supervised and followed up to ensure that they have in practice an effect equivalent to the legislation. For NI Departments this is set within the Framework of the SPAP - Quick Wins, that all Government Departments are mandated to use. Quick Wins set the standards for a range of products including energy-using equipment and vehicles.

16. CPD also liaises with the Centre of Expertise in Sustainable Procurement (part of the Office of Government Commerce in Whitehall) on sustainability issues in relation to EU on Greening Public Procurement.

17. Although the PSA 22 target is essentially an operational target it needs to be considered in conjunction with other similar targets for Sustainable Operations on the Government Estate. As there is a limit to what can be achieved operationally with existing infrastructure it is necessary to consider how the structure, fabric and services of buildings can be designed and procured to reduce the emissions baseline and increase the potential for achievement of further emissions reductions through operational management.

As carbon dioxide is one of the most significant greenhouse gases, CPD has adopted a Low Carbon Design policy for construction procurement. CPD's construction procurement practitioners are proactive in advising clients in the early stages of a project on the scope for incorporating low carbon design features, including low and zero carbon technologies (LZCT) e.g. biomass, solar heating panels, photovoltaic cells, heat pumps and wind turbines. CPD subsequently includes requirements in project briefs and technical specifications when initial appraisals have indicated that Low carbon Design is both economically and technically feasible.

CPD complies with the requirements of the Government Construction Clients Group (GCCG) Sustainability Action Plan (SAP). Specifically the GCCG SAP sets targets for the achievement of the BRE Environmental Assessment Method (BREEAM) standard of "Excellent" for new build projects and "very good" for refurbishment projects. The building's carbon footprint required to meet the BREEAM standards exceed the minimum standards of the current (2006) Building Regulations. The low carbon design policy encourages design and procurement to exceed the minimum requirements of the Building Regulations, constrained by the caveat of minimising whole life costs.

CPD's low carbon design policy also requires that the use of air conditioning must be fully justified and, if unavoidable, must be of the low energy type. This has led to a reduction in carbon emissions and the use of refrigerants that have significant global warming potentials. The reduction of nitrous oxides from heating systems is also addressed through for example the specification and procurement of energy efficient low nitrous oxide burners.

FROM THE MINISTER

Department of
Culture, Arts
and Leisure
www.dcalni.gov.uk
An Roinn
Cultúir, Ealaíon
agus Fóillíochta
Mánnystrie o
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Our ref: **COR 204/2009**
CAL ref: **C152/09**

Date: **2 June 2009**

Mr McGlone
Chairperson
Committee for the Environment
Environment Committee Office
Room 245
Parliament Buildings
Belfast
BT4 3XX

Dear Mr McGlone

DCAL CONTRIBUTION TO CLIMATE CHANGE

Your minute of the 10 May 2009, addressed to Mr McElduff refers.

DCAL targets under PSA 9, including those PSAs which my Department also provides part input to, which are essentially designed to increase access to and participation in culture, arts and sports activities, do not directly contribute to Northern Ireland's emission reduction target.

However, my Department supports actions, consistent with wider Government policy, principally the Northern Ireland Sustainable Development Action Plan, which endeavour to ensure that Northern Ireland makes its full contribution to UK targets to reduce greenhouse gas emissions. Indeed my Department and its Arms Length Bodies have taken positive steps in terms of energy efficiency measures.

For example, at the end of April 2009, DCAL HQ with approximately 190 staff, relocated from Interpoint to Causeway Exchange into an open-plan office environment. This has strengthened the Department's commitment to waste management. In addition, the Department has moved to minimise its dependency on car travel with 68% reduction in the number of car parking spaces available. Alongside this, DCAL has developed a Staff Travel Plan

aimed at encouraging staff to avail of more sustainable modes of transport when travelling to work.

DCAL and its Arms Length Bodies have a significant capital programme for which it makes extensive use of DFP's Central Procurement Directorate (CPD). As carbon dioxide is one of the most significant green house gases CPD has adopted a Low Carbon Design policy for construction procurement. Furthermore, CPD complies with the requirements of the Government Construction Clients Group (GCCG) Sustainability Action Plan (SAP). Specifically the GCCG SAP sets targets for the achievement of the BRE Environmental Assessment Method (BREEAM) standard of "Excellent" for new build projects and "very good" for refurbishment projects.

Finally, DCAL takes the lead on the policy on Architecture and the Built Environment (A+BE) for Northern Ireland published in June 2006, one of the underlying principles of which is sustainable development. The policy is supported by a Ministerial Advisory Group and a number of Expert Advisors whose role includes carrying out design review of significant capital projects. Encouraging sustainable development is an integral part of these reviews.

I trust that you will find this information useful.

A copy of this reply goes to Mr McElduff.

GREGORY CAMPBELL MP MLA
Minister of Culture, Arts and Leisure

Department for Social Development
www.dsdni.gov.uk

Clerk to the Committee
Environment Committee Office
Room 245
Parliament Buildings
Belfast

BT4 3XX

2 June 2009

Dear Alex,

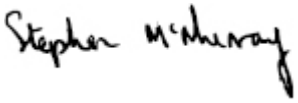
Inquiry into Climate Change

The Chair of the Environment Committee wrote to the Social Development Committee on the 10 May to request details of how, and to what extent, the Public Service Agreements for which the Department for Social Development has responsibility contributes to Northern Ireland's emission reduction target.

The attached table summarises how the work of this Department contributes to the Northern Ireland emissions reduction target.

I hope this response is helpful to you.

Yours sincerely



STEPHEN McMURRAY

cc Peter McCallion
John Ball
Billy Crawford

Annex 1

Summary of how the Department contributes to the NI emissions reduction target

Public Service Agreement	How this contributes to the emissions reduction target
No. 7 "Drive a Programme across Government to reduce poverty and address inequality and disadvantage."	The Department's primary tool in tackling fuel poverty is the Warm Homes Scheme. The purpose of the Scheme is to improve domestic energy efficiency and, therefore reduce energy consumption in eligible households in the owner-occupied and private rented sector. The key objective of the Scheme is "to achieve an energy efficiency gain of at least 15% in 10,000 fuel poor households this year" (subject to available funding).
No. 12 "Promote decent, energy efficient, affordable housing and regenerate disadvantaged areas and towns and city centres, and support community development to create environments which enhance quality of life and contribute to well-being"	The Department is required to provide access to 'decent, affordable and energy efficient housing'. All new social housing must now conform to a minimum of level three in the code for sustainable housing. In effect this housing is 25% more energy efficient than ever before. All new build grant aided projects have to achieve an excellent rating on the Building Research Establishment Environmental Assessment Method (BREEAM) or equivalent accreditation system, and refurbishment projects have to achieve a good rating. In addition, part of the rationale for promoting

Public Service Agreement	How this contributes to the emissions reduction target
	town and city centres regeneration is that it is more easily accessible by forms of transport other than private car and that fully integrated high quality Public Realm projects are developed which are more environmentally sustainable. In addition: Along the frontages of arterial and secondary arterial routes in Belfast, almost 800 trees were planted in 2008/09. In the North West, 31 trees were planted in 2008/09 and elsewhere across Northern Ireland, tree planting takes place as part of environmental improvement or public realm schemes in town centres or Neighbourhood Renewal areas. The Department is part-funding the Connswater Community Greenway project in East Belfast. This will help deliver a high-quality linear park from the Castlereagh Hills to Inner East Belfast, re-establishing a wildlife corridor and making a significant contribution to enhancing the natural environment. The draft masterplan for the Crumlin Road Gaol and Girdwood Barracks site, includes a commitment to sustainable development on the site. This is expected to involve measures aimed at reducing carbon emissions and energy requirements, saving water and providing a well-planted landscape to ensure that the scheme is environmentally sound
No. 22 " Improve the quality of our natural and built environment and heritage and reduce our carbon footprint"	The Department lists in its corporate plan that a 'reduction in greenhouse gas emissions is a by-product of work to reduce fuel poverty' (see Public Service Agreement 7 above). The Department also takes account of this Public Service Agreement with regard to its estate. In 2004 the Minister for Finance and Personnel endorsed three targets to apply to all public bodies: 1. To increase the energy efficiency of the buildings on their estates measured in terms of kilowatt-hours (kWh) of fuel and electricity used per square metre of building floor area by 15% by 2010/11, relative to a base year of 1999/2000. 2. To reduce absolute carbon, from fuel and electricity used in buildings on their estates by 12.5% by 2010/11, relative to a base year of 1999/2000. 3. To source at least 10% of their electricity from renewable sources by 31 March 2008. The Department has either achieved or is on track to achieve these targets. In addition the Department is currently finalising a new Sustainable Operations Action Plan which will further improve the energy efficiency of the Department's Estate.

Northern Ireland
Assembly

Committee for Education
Room 241
Parliament Buildings

Tel: +44 (0)28 9052 1655
Fax: +44 (0)28 9052 1371

To: Alex McGarel
Clerk to the Committee for the Environment

From: John Simmons
Clerk to the Committee for Education

Date: 3 June 2009

Subject: Departmental Contribution to Climate Change Targets

Ref: 363/09/I/03

Please see attached correspondence of 29 May 2009 from the Department of Education regarding Departmental Contribution to Climate Change Targets. This was provided in response to a request for information from the Committee for the Environment.

The Committee for Education noted this letter at its meeting on 3 June 2009.

Regards

John Simmons
Committee Clerk

(5)

Department of
Education
www.deni.gov.uk
an Roinn
Oideachais
agus Leanúnaigh
Lear

Rathgael House
43 Balloo Road
Bangor
BT19 7PR

John Simmons
Clerk to the Committee
Committee for Education
Room 241
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Stormont
BELFAST
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EDUCATION
COMMITTEE
RECEIVED
29 MAY 2009
363/09/E/03

Tel No: (028) 9127 9693
Fax No: (028) 9127 9100

Email: john.leonard@deni.gov.uk

Your Ref: 363/09/M/02

29 May 2009

Dear John

Departmental Contribution to Climate Change Targets

You wrote on 13 May 2009 following a request from the Committee for the Environment for an indication on how and to what extent each of the Public Service Agreements (PSA) for which the Department of Education (DE) has responsibility contribute to Northern Ireland's emission reduction target.

As part of its lead responsibility for PSA 16 – Investing in the Health and Education Estates – DE procurement contracts incorporate the principles of sustainable development, and the Department aligns with CPD advice on sustainable procurement. All DE major works in schools must, in accordance with the Government Construction Client's Group (GCCG) include measures to achieve a Building Research Establishment Environment Assessment Method (BREEAM) rating of "excellent" for new schemes or "very good" for refurbishment schemes.

While not having a lead responsibility for PSA 22 itself, the education estate has reduced its CO2 emissions from 67 kg/square metre in 1999/2000 to 34 kg/square metre in 2007/08. This is mainly attributable to the Education and Library Boards switching from "brown electricity", which is produced from fossil fuels, to Eco Energy which is electricity produced from renewable sources such as wind or solar power.

[redacted]

The implementation of the revised curriculum is an important indicator under PSA 19 Raising Standards in our Schools, and will help educate, inform and involve more of our young people in dealing with issues such as climate change, both now and in the future.

From Year 1 onwards, the statutory revised curriculum includes Education for Sustainable Development (ESD). Through ESD, pupils explore environmental issues and climate change and the need to manage human impact on the environment. At primary level pupils have the opportunity to appreciate the environment, their role in maintaining and improving it, and understand how their actions can affect the environment.

As they move into post-primary, pupils have the opportunity to come to understand the interdependence of society, the economy and the environment; to develop respect for the needs of both present and future generations; to act towards promoting an improved environment; and to learn about exercising environmental responsibility through, for example, conservation of resources, waste management and the promotion of local biodiversity.

Yours sincerely

JOHN LEONARD
Departmental Assembly Liaison Officer

[redacted]

‘Third Sector Declaration on Climate Change’

every action counts

We therefore commit to [*Give organisation here*] from this date.....to

- Publicly affirm the importance of urgent action to deliver behaviour change at all levels to combat climate change.
- Adopt public plans and appropriate strategies to reduce our carbon dioxide emissions (especially in energy use, transport, recycling, buying and in setting a low community and to support climate change initiatives that facilitate societal and environmental justice. We will make these plans public with a year. In addition we will ensure that they are monitored and that our progress is evaluated in a way that is de ady understood and easily accessible.
- Act as a leader in communicating and enabling our members, service users and clients to adapt to the impact of climate change, to reduce their carbon dioxide emissions, take other relevant initiatives and to raise public awareness about to action. We recognise the wide range of measures, skills, knowledge and expertise, that may be required to make the changes in their lives and their communities.
- Support national legal targets for greenhouse gas emissions and advocate for measures from green tax schemes to be used in programmes that reduce carbon emissions as well as support environmental and social justice.
- Work with central and local government and others to advocate for, and support policies and initiatives for, environmental and social justice that will assist the UK to reach or exceed the national target to reduce carbon dioxide emissions by 80% by 2050.
- Ensure that by acting with our partners, groups, members or communities and the tribal sector as a whole, we inform, inspire and encourage action as part of a wider movement that can make a real difference on climate change.

Signed by _____

Director/Founder/Trustee/Project Leader

To learn more and to publically show your commitment visit:
www.everyactioncounts.org.uk/declaration

Declaration Version 1.0, June 2007

NILGA response re evidence from Royal Commission on Environmental Pollution (RCEP)

ROYAL COMMISSION ON ENVIRONMENTAL POLLUTION

- - - - - -

held at

55 Whitehall,
London, SW1

on

Friday, 3rd April, 2009

- - - - - -

STUDY ON ADAPTATION TO CLIMATE CHANGE
IN THE UNITED KINGDOM

- - - - - -

Interview with

MR. MARTIN WHEATLEY
(Programme Director,
Local Government Association)

MR. TIM PEPPIN
(Director of Regeneration and Sustainable Development)

and

MS. KAREN SMYTH
(Head of Policy)

- - - - - -

COMMISSION MEMBERS

SIR JOHN LAWTON (In the Chair)

DR. IAN GRAHAM-BRICE
PROFESSOR PETER S. LISS
PROFESSOR JUDITH PETTS
PROFESSOR MIKE DEPLEDGE
PROFESSOR MICHAEL ROBERTS
PROFESSOR GORDON S.MACKERRON
MR. PETER MATTHEWS

- - - - - -

In attendance: MR. TOM EDDY (Secretary to the Commission)
MS. RACHAEL YOKOO LAURENCE
MS. PHILINE ZU-ERMGASSEN
MS. DEBBIE PUTT
MS. YOLANDA RIZZI
MS. LAURA PLEASANTS

MS. MADELEINE CUSACK
MR. JON FREEMAN

MR. RUSSELL REEFER (Policy Officer)

- - - - - -

(Transcript of the Shorthand Notes of Marten Walsh Cherer Ltd., 12-14 New Fetter Lane, London, EC4A 1AG.
Telephone No: 020-7936 6000. Fax No: 020-7427 0093.
email: info@martenwalshcherer.com. www.martenwalshcherer.com)

- - - - - -

THE CHAIRMAN: Thank you very much for coming. I do not know how often you get together, we are very grateful to you. This is an evidence session so we keep a written record. We make sure that you see it before we use it in any way. You can get to comment on it and so on.

You have the questions, but we may not ask all the questions if we are out of time. We realise that you may not necessarily be able to answer them or you may find it difficult to answer them. We understand that. There may be one or two follow-up questions also.

I am going to kick off. Regarding adaptation at local levels, what do you learn from one another in the exchange of good practice or bad practice? Are there issues that you can address in Wales, for example, that you may wish to address in Scotland? What is your take on that exchange of information and best practice and so on?

MR. WHEATLEY: Can I, first of all, thank you and the Commission for inviting us to give evidence. We very much appreciate the opportunity to do that. I would like to say generally that adaptation is moving strongly up the agenda for Councils. The LGAs' Climate Change Commission highlighted the need to look

at adaptation and recognised that even by comparison with mitigation, which has not always received the attention it might deserve in all quarters, adaptation was still struggling. The Councils pushed it up the agenda and we have been doing so subsequently. Fifty-six authorities have chosen an adaptation indicator as part of their Local Area Agreement.

I think that you are absolutely right that it is incumbent upon the three or four national associations to work with each other on this. We are indeed beginning to do so through attending each other's meetings. Tim may say a bit more about an initiative in Wales in a moment where we are doing some sharing. I think it is a good question to pose to us and something that we should think about more systematically. Although the issues are very local and we know that the adaptation threats that face a particular community differ very much from place to place, they are not particular respecters of national boundaries within the United Kingdom. If we think, for example, of categories of authorities, coastal authorities or whatever, those things go to promote learning in the four countries.

MR. PEPPIN: Yes, we realise that we can learn from each other from this and we want to work as closely as possible together. There are perfect examples where we can share experiences.

Within Wales, we have launched a programme called "Changing Climate, Changing Places". We are working with four

local authorities as pilots to look at adaptation. We are working with the Environment Agency, the Countryside Council for Wales and the UKCIP. The process we are going through there is that those authorities are looking at historical things that happen in their areas. This is the local climate impact programme that UKCIP do where they look and see what has happened in the past, events such as high winds and floods, and then they go to the authorities and say, "How did you respond? What did you do when that happened?" They literally get a feel for how much work was involved in dealing with weather events.

They will be using trend data to look ahead to say, "If those events are going to happen more frequently in the future and this was the implication of what happened in the past, how much more resource is going to be needed in the future?" With the business assessment model, they will look and see, at a service-by-service level, what are the implications of those weather events.

That work is at a relatively early stage at the moment, but we have been discussing it with the LGAs and it will go over to CCP meetings in the near future so that we can start to learn from that so that we do not have reinvent the wheel.

THE CHAIRMAN: Do you have anything to add for Northern Ireland?

MS. SMYTH: From our perspective, we tend to find that we benefit from the work that the LGAs do. As we are such a small

organisation in itself, we do tend to learn from other places quite well. We have a number of distinct problems in Northern Ireland.

THE CHAIRMAN: Including a Secretary of State or Minister who does not believe in climate change!

MS. SMYTH: Thank you for saying that.

THE CHAIRMAN: That is fine. We understand that.

MS. SMYTH: I am not saying more about that. Aside from that, the local governments in Northern Ireland are undergoing our first reform for 37 years so council minds are not focused on environmental issues. They are trying to move together to go forward on a huge platform of change, which is causing an issue at the moment. Also, we have the distinct issue of having a border with another EU Member State, as a guardian state, and climate change does not recognise borders. What we tried to do is take forward climate change work on a cross-border basis and at a strategic level with the 26 councils which are currently in the North and also the six councils in the South. Unfortunately, we were unsuccessful in getting that funding and also because of the issue already mentioned, there is precious little support from the government.

I would say that it is highly unlikely that anything substantial will come forward from Northern Ireland in the near future although there have been a number of very

successful pilot projects for councils in the last couple of years that we would like to go forward.

THE CHAIRMAN: There is an interesting follow-up to that. You may not yet have the information. Martin said that there are 56 LGAs who signed up to Local Area Agreement 198. There is a lot that has happened therefore. You have a different situation in Northern Ireland. What is your take on the spread of competencies across the local authorities? There are some that are clearly extremely good and there must be others which bad and are lagging behind. What is the spread of competencies if you can judge it at all? It is quite a difficult thing to do systematically?

MR. WHEATLEY: I think the first thing to say is not to assume that because a council does not have this target in its LAA, it is not a pressing issue. There are nearly 200 national indicators and councils choose 35, but they get monitored on all of them in a comprehensive area assessment. We will look at performance against all of those indicators. Councils should feel under challenge on climate adaptation even if they have not chosen it as one of their targets, not least also because another feature of comprehensive area assessment is that it will take a look at the sustainable use of resources. One can very easily see, therefore, how councils could be probed and challenged on the extent to which they make resource-allocation decisions with a view to sustainability.

THE CHAIRMAN: I was not aware that if a council had not signed up to LAA 198, for example, the comprehensive area assessment would nevertheless look right across the piece. I think that is really important. Thank you.

MR. PEPPIN: We have a slightly different set-up in the Welsh context, by the Welsh Assembly Government has recently published its latest sustainable development scheme. In the WAG, we are working very closely with them and they are funding us to run a sustainable development framework for all authorities. The message from the Assembly is that they want sustainable development to be the central organising principle of the public sector in Wales. What we are trying to do is to make sure that there is a consistency across authorities in the way that they are dealing with it. That is the purpose of our framework.

What we are trying to do is to make sure that those authorities which are ahead of the game are sharing what they are doing with the other ones which are perhaps struggling so that we bring everyone up to the same sort of point. We have just run two events, one in North Wales and one in South Wales, on climate change and change management. One of the things that has come out of that is that we are going to be looking to develop a timeline where we will say, "Where do we need to be by 2030? Let us work back from there and say what are some of the key milestones that we are going to have to

hit. If we can identify those milestones then we can start to put together some coordinated work across authorities where all authorities can work towards those targets. We know that we need a certain number of staff to be trained by a certain date in order to achieve what we need to do. If we can have that programme then at least that will give us quite a strong handle on which authorities are on the pace and which ones are not.

MS. SMYTH: What we find is that with a number of authorities who are frequently (unclear) so their minds are concentrated more on the issues of securing climate change adaptation than other authorities who do not have that shape yet. What we say is that we have a very different system in Northern Ireland where councils largely raise their own revenue and do have access to certain revenue like Scotland and Wales, but with a different organised system. We do have a corresponding system at the moment. These are issues that are dealt with within the RPA.

We are still in a system where we have a local government order who says how we spend the money, but unless we have actually got legislation to deal with issues, we cannot really do it. We are very good at finding loopholes, but the councils find it very difficult to do. We have in the past been able to help in this situation. We have got a draft definition drafted for Northern Ireland that came under the work of the Northern Ireland Climate Change Impact

Partnership, but councils are not signing up to that without some form of financial support from government.

THE CHAIRMAN: Peter?

MR. MATTHEWS: For Karen's benefit, I am Chairman of the Northern Ireland Utility Regulator. I have a lot to do with water, gas and electricity. I would like to elaborate a little bit on what John has been asking you. There is a difference between competence and commitment. You are an organisation to which local authorities belong and the relationship between you and local authorities is very much a voluntary one. You may very well commit to practices and to approaches which seem very reasonable, but authorities may well decide to do things differently. They may be to do with climate change, but they may do things differently and therefore there is a tendency towards a less organised approach by virtue of the diversity of commitment in councils, councils from this side and councils from that side. How do you cope with talking to us nationally, but ensuring that these commitments are done globally, particularly in England and Wales? Could you just exemplify that by telling us about how you think the protocols are working between the Environment Agency and the LGAs?

THE CHAIRMAN: Who wants to go first?

MR. WHEATLEY: First of all, on that last point, we do not have any formal protocols between the Environment Agency and the LGA. We talk to them a lot and we have a good working

relationship, but I am not aware of any formal signed things in this area.

MR. MATTHEWS: I do not want to embarrass you, but there is a formal arrangement between the LGA and the Environment Agency and there is a series of protocols which address particular areas of relationship which define the way things will be approached in terms of the local authority and its Environment Agency relationship.

THE CHAIRMAN: If you are uncertain, why do you not write to us. There is a lot that goes on and an individual cannot necessarily know it all.

MR. WHEATLEY: Yes. On the issue of consistency, I can answer that at a number of levels. At a certain level, clearly, representing a sector where each council has its own independent democratic legitimacy, we would defend the right of councils to tune the priority they give to different issues according to their own assessment of what is more or less important. Going beyond that, when it comes to means more than ends, it is certainly not our job, as a representative association, to enforce a particular approach to tackling climate risk or any other aspect of councils' responsibilities.

I think it is very important about something which is very much an issue of risk management and risk assessment that part of what councils have to do here is manage climate risk

as one of a set of major risks that they have to look at corporately. They have different approaches about how they do that. I would be cautious about whether it is right or appropriate for us to tell people what to do minutely. That said, we do our best, as an association and also as part of the wider LGA group, including the Improvement and Development Agency, to encourage people to think about what they do and do it effectively.

In the course of the last year, we have published one document on councils' statutory powers which, amongst other things, is busting the misconception that some like to have that they do not have the powers to do things. They clearly have a lot of relevant powers. Also, in cooperation with the Environment Agency, we published a document on good approaches to climate adaptation.

Beyond that, the Improvement and Development Agency is launching around now a leadership academy for councils on all aspects of climate change, including adaptation. We are trying to push awareness of the issue and awareness of what other councils are doing, but we would say that it is not our role either to say to people ultimately, "You must take an interest in this issue." It is certainly not our job to tell professionally-run organisations exactly how they ought to be going about their business.

THE CHAIRMAN: I think that is perfectly fair, thank you. Tim?

MR. WHEATLEY: It is a similar response from the Welsh perspective. I suppose we are slightly lucky in that with only 22 authorities, it is easier to get a dialogue going and to get some element of consistency. It is relatively easy to get all 22 together to discuss issues.

I think the issue of publications is important. It is where an association can get a message out to authorities and trigger a response across the whole of Wales. We will commission some work in the future which looks at a whole range of issues including climate change. That gets disseminated to all local authorities and we are encouraging them to use that in their work on the next round of community strategies. We would like to see them having a much more community-centred risk approach: "What are some of the trends? What are some of the future trends that are going on? What impact will that have on communities? What are the major risks?"

Things like climate change pose major risks and we would like to see the next generation of community strategies being much clearer about how they are going to deal with those issues. The Community Strategies document is prepared as a partnership document. The Environment Agency will be part of that at local level as well as working with us at a national level looking at some of these publications and more strategic issues.

THE CHAIRMAN: Karen, we have already heard that you have been to the Vale(?) Does it make your initiative to work together more difficult?

MS. SMYTH: It is a setback, but at least what we have been able to do is put forward what we think will be a way forward in raising awareness and focusing people's awareness on climate change. I think that, to some extent, we are very lucky in that because we are a smaller area and people do communicate quite well. Certainly, we specifically have in Northern Ireland a partner-sharing system, at at local government association level as well as at Assembly level.

The way we take issues forward is very much on an agreed basis. It is all on an agreed basis. We do not really take anything from it until everyone has pretty much gone into it.

From the way we work together, we have a very strong officer group system that we rely on to take issues forward within the councils as well. We work quite closely with them in developing a consistent approach. I would definitely echo the key thing that we should be supporting rather than enforcing. It is the only way forward. It is also sharing best practice whenever you see best practice occurring.

THE CHAIRMAN: Thank you very much. Ian?

PROF. GRAHAM-BRYCE: I have a couple of questions which are really dealing with priorities. I think, in a sense, you have gone a long way to answering those in the earlier responses you have

given to the Chairman and to Peter Matthews.

I would like to ask you this in a slightly different way or go further with the issue in a slightly different way. You indicated -- and it is certainly our impression from the evidence that we have -- that there is a spectrum of concern and involvement with the issue of adaptation among different local authorities. What do you think determines the priority that a local authority gives to adaptation? Why are some much more ahead in the sense we are talking about than others?

MR. WHEATLEY: Of course it ought to be based on a relative assessment of risk. If every local authority was approaching this as we would all want, it might still be the case that, for very genuine reasons and varying levels of risk, it was attracting different levels of priority. However, I would not pretend for a minute that everyone is yet at a level at which they are consistently judging the risk correctly.

We are at a stage of this issue coming up the agenda. We have a number of councils who are exemplary in this regard and a number for whom the issue is still a developing issue. What everyone else wants to do at national level, including yourselves, who are concerned about this issue, is to continue to draw it to people's attention.

The other thing that clearly determines what people actually do as opposed to what they aspire to do is resourcing. Councils face a lot of pressure on capital

spending, their own capital spending and then trying to persuade central government to marshall a lot of local capital spending which comes from national programmes. We are actually doing a piece of work at the moment to theme into the forthcoming spending review which is looking across the spectrum of councils' capital investment means. It is highlighting that climate risk is one of the factors that needs to drive an assessment of what capital spending is required in physical infrastructure. I do not just mean roads, but buildings that people live in, work in and so forth. We are going to try and exemplify the cost of that.

That is part of a bigger problem. There tends to be a skew in national funding towards doing new things as opposed to adapting or refurbishing or renewing existing things. I think for councils adapting the physical infrastructure, that is part of bigger picture about maintenance and renewal of the capital stock. First of all, it tends to be of a lower priority in national funding to put money into renewing or refurbishing things that are there already than new things. Then the element that is about adapting to climate risk has to compete with other things including just the sheer demand for basic maintenance. You have probably seen in the press recently about the level of potholes for authorities when authorities are struggling to find capital resources to deal with that very basic requirement. Going on to find capital

resources for a fundamental re-modelling is more of a challenge.

Certainly, in our spending review submission, we will be making very strongly the case to government that looking after the existing stock is very important and adapting to climate risk is a very important part of that. It is illustrating the massive future costs of failing to invest now.

PROF. GRAHAM-BRYCE: I am sure the others will want to comment. If I understand you correctly, the first part of your answer was suggesting that strengthening a risk assessment approach would actually get at this issue.

MR. WHEATLEY: That is absolutely right. The practical way that we have to get people to address this is almost to detach it from the wider climate change debate which is often dominated by mitigation. Mitigation is hugely important. It is vital that councils get a grip on that as well. In fact, in terms of the way in which we are managing our own group across the LGA group, we have one theme about carbon reduction. We have put adaptation in a theme which is about managing environmental risks so it goes with other things like pollution risk and so on. People see it in that context and not part of some sort of environmental crusade. Even those people who are fairly climate-sceptic can buy the need to make sure that the roads do not melt when we have a very hot summer. They may believe that climate change is not occurring

or, if it is occurring it is not the result of manmade activity, but if you confront someone with what happens to their local economy and the cost to their road maintenance budget of road-melting, it becomes a debate that anyone can have.

MR. PEPPIN: I certainly agree with having a risk basis for it. One has to underpin the authorities' approach by putting it in a wider context with all the other factors they are dealing with.

Regarding the difference between authorities, you do get good authorities and you get less good authorities. Some of them are under good leadership and good-quality members, but there are always some authorities, on whatever issue, who will always be better than others.

Equally, in some authorities, you will get some individuals who have some real interest a particular area and because of their ability and talent, they have actually helped to raise it up the agenda. Sometimes you get both happening in an authority. You get a good authority with some excellent individuals and they tend to be the ones who are flying on this.

There is a mixture, but what we are trying to encourage is that local authorities do not just have a knee-jerk response, "Oh, this is terrible, we must be seen to be doing something." It is a rational look across the board, looking

at what the science is saying. What are some of the key factors for that particular area? Each of the authorities have their own particular issues which are going to be a greater risk. If it is a coastal area it is going to be very different to, say, the Brecon Beacons National Park with the biodiversity issues that they are particularly interested in. It is about having a rational look and trying to prioritise in accordance with all the other pressures which tend to be more immediate. That is another important issue. When you put them on the political cycle as well, it is sometimes harder to get authorities to galvanise for things which are further down the road.

MS. SMYTH: I think that certainly in our experience we have, from the outside, what looks like a scatter-gun approach to the issue. It is very much dependent upon what pots in one area will go for specific pots of work and there is no strategic approach to that.

We are getting bits and pieces of European funding to do different bits and pieces of work at council level and within communities, but looking at it more generally, it is chosen because of individual personal interest, council experiences and the desire of different communities. It is really those that can do, those who want to do, those who need to do and other than that, some councils have better methodology with regards to strategic planning. Aside from that, we have a

local government (unclear) group which consists of executives and officers from all the district councils which again are looking at specific emergency adaptation measures, but the more general adaptation measures is something that is lacking at the moment.

THE CHAIRMAN: Mike? As we are always going this way, we will mix it up a bit in terms of who goes first.

PROF. DEPLEDGE: This follows on from the discussions that we have been having about resource limitations and risk assessment. You will be aware that in our adaptation report, we have three exemplar areas to look at: biodiversity; sea level rise and the coastal zone; and fresh water, floods and drought and so on. My question is do you anticipate an uneven distribution in climate change impacts with respect to those three exemplars? Do you have any kind of planning in terms of resource indications and risk assessment proposals?

THE CHAIRMAN: Do your members have them?

PROF. DEPLEDGE: Members, yes.

THE CHAIRMAN: It is a nasty one. Go for it.

MS. SMYTH: It is a nasty one. Certainly from the Northern Ireland perspective, the short answer is that I am not exactly sure at the moment what the situation is going to be. From experience, we are already subject to statutory duties regarding sustainable development and soon there will be a statutory duty about biodiversity. There is no (unclear) in

those treaties, implementation of the sustainable development strategy, for example. There is all this work still in there that we know we have to do. We do not know how we are supposed to do it and we have no resources to take it forward and no government leadership on how we should do it.

Certainly, we have a mapping exercise recently which has been completed with regard to fresh water in flood risk areas which has been something that has hit us in quite a public way and it is the thing that the public are most aware of. Once you get that public awareness then you can actually get stuff done. There is a little understanding at the moment of where the cracks will occur and how those will relate to the socioeconomic profile of the communities that have been substantially affected. Obviously, Northern Ireland has a huge coastline, but I do not think any work has been done to the best of my knowledge. I could be wrong about that, but certainly it is not something I am aware of.

THE CHAIRMAN: Is that failure of central government?

MS. SMYTH: Yes.

THE CHAIRMAN: That is very interesting. Tim?

MR. PEPPIN: To a large extent, it is the geography and characteristics of each local authority area so you will get some who fasten in on and focus on the risk to their coast. I think that part of the problem is the enormity of what we are trying to deal with. There are so many elements to climate

change anyway and we have lots of specialist officers working in certain areas. Part of the challenge is standing back and encouraging officers to look at the big picture and say, "In the overall scheme, how do all these different strands work that need to be pulled together?"

There is a danger that with all the local elements of work that go on, the prioritisation does not always happen because a particular work area will be driven by those involved in it. Part of what we are trying to achieve is getting the different teams working in different areas to say, "How does all this fit together against our assessment of risk? What are other authorities doing? Are they working collaboratively? If there are coastal areas that have particular issues, can they work across areas with some of the issues?" We are looking at sharing work on biodiversity and ecology and in North Wales there are discussions going on there.

I think there are ways that we can collaborate on some of this but, at the end of the day, the key thing is that each authority will be looking at their own particular set of characteristics and trying to draw up an action plan which makes sense in their own terms. What we are trying to achieve is a bit of added value by saying, "Do not just do that on your own. Work collaboratively and then you may be able to share some of that work that has been done."

PROF. DEPLEDGE: Do you think you have been successful in doing that? Do you think you are making progress?

MR. PEPPIN: It is early days but every now and then we get a ray of light coming through.

THE CHAIRMAN: That is great. Martin?

MR. WHEATLEY: I think we know that impacts are going to vary enormously on a very local basis. That includes within a particular authority area often. We know that there are some macro differences. I am sure you are all aware that there is a macro difference in climate risk terms between the north and west of the United Kingdom and south and east in terms of predicted changes of rainfall which are going to feed into water stress, flooding and issues of that kind.

What will help councils take a step forward is that UKCIP have for a long time been promising very local forecasting information. It is being eagerly awaited by councils as to putting together information which either is not available at the moment or is not pulled together in a way that enables people to see what is going on. I understand that is to be published in a rather strange season which we call "the government spring" of this year. I hope it will be very soon so that we can plan forward.

The final point I would make is that there are two kinds of impact. There is the direct physical impact and then there is the secondary impact that that has on people and economic

activity and so on. Floods in a particular location may not have a particular impact if nobody lives there and it is not a site of conservation interest or anything like that. A lesser degree of flooding in an area that is more built up or is very important scientifically will have a major impact. Councils have to take it in two steps when the information comes to them.

THE CHAIRMAN: Before I ask Peter to come in, Karen, you said something and I want to be sure we have got it right. We talked about the coastal zone and you have a huge length of coastline in Northern Ireland. Were you implying that with adaptation needs in terms of sea level rise and so on, there is not any kind of systematic planning in the coastal zone to do that?

MS. SMYTH: As far as I know there is none that has been done on the coastline. Certainly there has been work done by the Rivers Agency on a cross-border basis as well, which is important because we share floodgates and what-have-you. As I say, that is to the best of my knowledge. I will check for you.

THE CHAIRMAN: If you can check and come back to us because it is a really quite interesting and important comment. Peter?

PROF. LISS: You touched on my question in your reply to the last question when Martin was speaking about UKCIP, now called UKCP/09. If you are trying to plan for climate change, you

presumably have to have some idea of what that change might be otherwise you are planning in a vacuum. Where do you get your information from? Linked to that, what roles do your associations play on behalf of local authorities or do they all get their own information and interpret it in their own way? Do you help them in the sense of getting information more centrally, saying, "We will save you the job and we will do it on behalf of all the authorities under our particular association"? That is the first part of the question.

THE CHAIRMAN: Tim?

MR. PEPPIN: We have taken on the role of trying to do this as an association for authorities so that we can highlight the information that is available to all 22 and the National Parks. From working with UKCIP, that is why we came up with this idea of the "Changing Climate, Changing Places" programme, working with four authorities to test it out to see how well it works. We will then disseminate that and show how it has worked in those four authorities to the others so that they can then start to do the same.

It is relying on the UKCIP data. The other partners are the Environment Agency and the Countryside Council for Wales. They both have their own research capacity. They have now allocated time to the project. As those authorities start to look in detail at the issues that are arising, the ANCCW will then supply their own trend data to help those authorities

work out what the scale of this issue is, what needs to be done and what sort of measures they should be taking.

I think we can learn quite a lot from the four pilots. We can demonstrate how the data has been used there and then encourage the other authorities to follow on. The other authorities are really watching to see what is going to happen with these pilots at the moment so they do not all run off doing their own thing.

PROF. LISS: How reliable do you think the data is?

MR. PEPPIN: It is difficult to say, to be honest. It has to be better than nothing in the end. I think that the authorities recognise that if they are going to do some serious planning on this, they need to start somewhere and the UKCIP and the ANCCW is the best place to start.

THE CHAIRMAN: Karen?

MS. SMYTH: At the moment, the best way of describing what we are doing is acting like a postbox for the information that we have and disseminating that amongst our councils. We are also receiving information from members and officers in our councils and sharing that with the rest of the sector.

As there is so little happening in Northern Ireland on this issue, it is not that people are seeking a technical degree of information. What we are doing is hopefully linking with UKCIP and the likes of Gerry Metcalfe within the Northern Ireland Climate Change Impacts programme, which is a body

comprised of local government, private sector, public sector and all the key agencies in local government departments. Also, we are linked into the Scotland and Northern Ireland Forum for Environmental Research. We can call on them to do the work for us and we have done. They are actually a private sector organisation. The structures are beginning to arrive and the mechanisms are beginning to arrive, but the actual body has not been organised yet.

THE CHAIRMAN: Martin?

MR. WHEATLEY: I do not see any realistic alternative to councils relying on UKCIP data and forecasts. As an association, we do not have the resources or expertise to duplicate that and it would be very silly to do so if we did.

As I said in my previous answer, the slightly tricky bit is not the raw climate impact forecast, but thinking through what it actually means for the community. In a positive light, a council that really knows what it is doing ought to be able to make a very good job of that locally because it is aware of the population and the pattern of infrastructure and services. Working with other local agencies and the local business community and residents means that it ought to be possible to develop a pretty good and informed view about what the actual experience risk is likely to be as opposed to the raw physical risk.

I think certainly we will want to be working nationally

with Defra and UKCIP as this data comes out to encourage people, in much the same way as Tim was saying for Wales, to look at what some councils have already been doing even ahead of publication of UKCIP data and saying, "If they can do it, you can do it." Without imposing a particular methodology on people, it can at least show them what other people have been doing and encourage them to regard this as important data and something we need to get to grips with.

PROF. LISS: Tim, you mentioned something which I had thought about and that is about wind, windiness and gustiness of the wind. We have been down to the Met Office and they showed us various things that they are supplying to UKCIP. They are generally about temperature, rainfall and the obvious climate things that we know about. If they change they make a big impact. You mentioned wind. Is wind and gustiness something which actually you think is important? You can see why it might be. If it goes down presumably it is less of a problem; if it goes up, presumably that does constitute a potential problem. Are you going to get that out of UKCIP or UKCP/09?

MR. PEPPIN: It is one of the things that they are looking at when they are looking back over the last five years at weather incidents, when there have been incidents of high wind. That will be one of the issues in the report, implications where there was damage to structures or whether they had to close facilities, bridges or whatever. Looking forward to

projections of future wind events would be one of the ones that they will want to look at. If there has been a major significant issue within a particular local authority area, we would want to look at the trends to say, "That has already happened in the past and there is going to be more of that. What do we need to do to adapt to try and cope with something like this?"

PROF. LISS: So you have told UKCIP or the Met Office, or whoever you have communicated with, that actually windiness and gustiness is a parameter for the future which you would be interested in having. Their models will potentially give that. Whether it is reliable or not is another matter. You can probably get some data out of that. Is that on their parameter list, as it were, of things that they can feed to you through UKCIP?

MR. PEPPIN: I would have thought so. I cannot say for definite, but I would have thought that that would have been one of the things that we would raise.

PROF. LISS: Maybe we could get that finalised.

THE CHAIRMAN: One of the things the Commissioners are struggling with is that when you go to the Met Office and talk to UKCIP themselves, they worry about the reliability of the predictions. Even though they are state-of-the-art, they are really worrying about the predictions.

As a Commission, we are caught on the horns of a dilemma

because, on the one hand, we do not want people to be too reliant on UKCIP because we know that it has warts. On the other hand, we do not want to be discouraging. If you say to people, "Do not worry, these predictions are just hopeless so do not use them", you are throwing the baby out with the bathwater if you are not careful because people have to use some sort of information.

What is the balance to be struck between healthy scepticism of these predictions on the one hand and the people's day jobs, having to make decisions, on the other? We are struggling with that. The South-East of England might get dryer, but it might get wetter.

PROF. LISS: You get these pressures from your individual local authorities as well. They will say, "How reliable is this stuff?"

THE CHAIRMAN: It is a real challenge. One wants to be sceptical but not discouraging. I am not sure that is easy to do.

MR. PEPPIN: I take your point. I think it will be interesting to see what these four pilots come up with and if they have some solid evidence or whether the evidence is inconclusive.

PROF. GRAHAM-BRYCE: The concern is also that some of the evidence has demonstrated what we might call "a touching faith" in the precision of these predictions. Perhaps we should be arguing that of course they are very helpful and they are essential, but in a sense you need to adapt for a degree of uncertainty

and not for a precise outcome. Is that an issue that you have seen, recognise and feel you might contribute towards resolving?

MR. PEPPIN: I think we certainly recognise an issue here. I think there is a big issue of public confidence in the work that is being done. If we come out with a statement and say, "The summers are going to get hotter and dryer" and then we have a summer like last year then people start to think, "Oh, they do not know what they are talking about." Building public confidence is important because if the community is not supporting what we are trying to do then the members quickly latch onto that and the basis for us to do the action is undermined then. For example, there was a heatwave action plan that was going to come out from the Assembly last year. They delayed it because the weather was so appalling.

THE CHAIRMAN: That is helpful. Mike, did you want to follow up with something?

PROF. ROBERTS: Yes, it is this issue about doing pilots at the moment to improve the way that adaptation fits into the risk assessment processes at council level. With the Climate Change Committee being set up, there will be an Adaptation Sub-Committee. You could see the opportunity for a much more integrated networking between central government and local authorities if the mechanisms are put in place to work effectively.

I am wondering from your perspective what change or what difference you want to see. There are 26,000 bodies which are going to have to do national risk assessments and develop action plans over the next five or six years. That is going to be a huge task. How would you like to see that national focus on the committees? How do you want that cascaded down? How can you use that to increase awareness at local authority level?

MR. PEPPIN: Our representation on the Climate Change Commission is a council leader who is working very closely with us at officer level. The officer who is the lead support in that council is also the person who is leading on "Climate Change, Changing Places". What we are doing is ensuring that the Commission is kept fully informed of our work in the pilots so that lessons that we are learning will be fed into the Adaptation Sub-Group of the Commission. You met with them recently, did you not, in Cardiff?

THE CHAIRMAN: Mike was not on the Commission. Some of this did.

MR. PEPPIN: We would look to use the results coming out of the pilot work to help inform the management position on how we are going to respond. I mentioned the timeline idea. We would certainly want to try and feed in some of the learning from that to say, "If these are some of the issues that we are going to have to deal with, what is a realistic timescale that needs to be at a certain point so that we can start to then

progress what needs to be done at a national level?"

THE CHAIRMAN: Martin?

MR. WHEATLEY: I think the key thinking for us is to make sure that the very welcome extra degree of national attention with things like the Adaptation Sub-Committee and indeed Defra's very welcome strengthening over the last year of their capacity on this issue is applied in the right way. The right way is not about developing standard operating procedures for every council and exactly what they are supposed to be doing. It is about providing councils with information (as already discussed with UKCIP) and data and so on and encouraging effective local working together.

I really think that national organisations need to be managing their assessment of climate risk at a local level. If you are something like the Highways Agency trying to produce a national forecast of climate risk on the highways network, it is almost meaningless because different sections of network are very different from place to place. The government needs to be making sure that local assessments of climate risk by agencies working across with local authorities is the primary method of doing things rather than a whole load of national assessments that you then try to stick together. That is not going to work on an issue like this.

The other thing that the new apparatus at national level can help with is picking up the common issues that emerge from

that local work. For example, there is what I was talking about earlier about the need for investment in the existing capital stock. To the extent that common themes emerge about certain kinds of infrastructure everywhere or in a large number of places and resourcing needs, we would hope that the Sub-Committee and the Defra team are playing a helpful role in talking to other bits of government about that.

MS. SMYTH: Can I say something off the record?

THE CHAIRMAN: Please.

(Discussion off the record)

THE CHAIRMAN: You do not have to be away, do you, by spot on half-past ten? Can we run over a little? It is really valuable and helpful and with three of you it takes a bit longer. Judith?

PROF. PETTS: I would like to move to land use planning. Obviously, I realise that you may not be planning experts or have that particular role. My question is in two parts. First, do we have the appropriate scale for land use planning? Obviously, in England, in the last week, we have managed to reorganise again local authorities' scales so that is an issue, but we have national planning framework, regional spatial strategies and local development plans. Do you feel that this scale of planning that is undertaken is at the right level?

The more detailed question and perhaps the more specific

question relates to the powers of both development planning and development control. Do you feel that the right powers exist to be able to deal with climate change adaptation?

THE CHAIRMAN: Shall we get Karen to kick off?

MS. SMYTH: In Northern Ireland, the local government has no planning powers at all. That is changing as in 2011 we will. At the moment, we have a consultative role in development and area planning and we are involved in emergency planning. We will be changing radically with councils being responsible directly for developmental and community planning in 2011.

What we are doing at the moment is actually working with the planning service to design a new system. There will be a consultation on that in the next couple of months. We have been working on it over the last couple of years to take that forward as a transfer function and we are very excited that we are getting planning powers at last.

THE CHAIRMAN: Who has the planning powers? Is it at Stormont?

MS. SMYTH: It is an agency that we deal with.

THE CHAIRMAN: It is at Stormont?

MS. SMYTH: Yes. It is under the Environment Minister. In saying that, the regional development strategy in Northern Ireland, "Shaping our Future", which is currently under revision, has paragraphs in it about global climate change and how it is going to impact on Northern Ireland. It outlines a number of aims. It is considering indications of climate change to make

good use of non-renewable resources, to restrain emissions of greenhouse gases and a strategy for Northern Ireland. Certainly, that has followed through in the programme for government. It is a target in the programme for government for Northern Ireland to reduce greenhouse gases.

But, for example, our waste management strategy does not mention climate change. I have already referred to the fact that the sustainable development structure has not been taken forward. There is a huge gap between words and action in Northern Ireland. There are delays arising for a number of different reasons, some of them politically and some of them viability.

We are very optimistic about what local councils will be able to do post 2011, but you have to be aware that that is going to be another delay. At the moment, the planning service is in a bit of a downward spiral because the way they are funded is largely dependent upon the number of planning applications they get. Obviously, with the economic downturn, they are not getting the same funds and they are laying planning officers off so it is a bit of a mess. It is in a state of flux in Northern Ireland and that is the best position I can give you at the moment.

THE CHAIRMAN: Martin?

MR. WHEATLEY: To start with the issue of scale, I actually think that this is an issue where the level at which the land use

planning implications should be thought through should very definitely be the local planning authority. Beyond national level principles like, "You ought to think of climate risk as part of your local development framework", a lot of the conversation this morning has been about local variability. The LGA is pretty sceptical about the value of planning at regional level generally, but this area is more uncontestable than others. The government office regions are unlikely to be relevant to anything very much. They have lumped together areas which have very different types and scales of climate risk.

That is not to imply that we think that in all cases individual local planning authorities are the natural unit for thinking about the implications of climate risk. Clearly, for example, if two or more authorities share the same river catchment and there are issues about increased risk of flooding and loss of water resources in that catchment, they ought to be working together. To the extent that we are able, as a representative association, we will be encouraging planning authorities to work together on climate risk aspects as we do on other aspects of planning where it makes sense to do things cross-boundary.

Moving on to the point about powers, one of the very welcome aspects of current planning legislation is that it is commendably accommodating to planning authorities doing things

jointly and producing joint local strategies and joint local documents. That would certainly be one model that councils could follow if there was a particular shared type of climate risk that it made sense to tackle across planning authority boundaries.

The 2004 Planning Compulsory Purchase Act has put on planning authorities a statutory duty to exercise their functions with the objective of contributing to the achievement of sustainable development. We already have a good basis in national planning legislation for making that part of local planning. Last year's Planning Act puts a new duty on authorities to incorporate mitigation and adaptation into their local development frameworks.

Also, through that Act, we have a new approach to developing contributions towards the infrastructure levy which, subject to the state of the property market, ought to be another way in which councils can use the planning system to contribute to climate adaptation.

THE CHAIRMAN: Thank you. Tim?

MR. PEPPIN: From Wales, in terms of spatial scale, we have Planning Policy Wales, in a series of technical advice notes, to give a Wales-wide perspective. We then have a spatial plan which breaks Wales down into six areas and local development plans being produced by each of the individual authorities.

In terms of scale, it should work, in theory, regarding

spatial plans.

There are a few issues there. One is timing where a number of authorities are quite advanced now with local development plans. There is guidance coming out now so in terms of the order of things, it will be embedded into that guidance further upstream.

The other thing is quality. On some of the work on the spatial plan, there are concerns about the fact that, in many ways, a lot of the work in the spatial plan is seen as a "business as usual" model. A lot of authorities have raised questions about that because they feel that it has not taken on board the climate change risks to the spatial regions. The quality of the information in the spatial plans, which are a material consideration, has raised concerns. They have had the Commission for Sustainable Development(?) to do work on the low farming regions so we are hoping there will be some more thought given to some of these issues on that, but against timing.

As Karen mentioned, there is the economic recession. That is still having a major impact. We are seeing lots of calls and pressures at various economic summits to streamline the plans whereas a lot of changes in the planning system have been brought in deliberately to try and make sure that some of these issues are taken into account as part of the process. You have different tensions there. On the one hand, you have

to streamline it and, on the other hand, you have to put checks and balances in the system that are quite beneficial.

THE CHAIRMAN: I want to bring it to a close now. We have not covered absolutely everything. Was there something that you thought you were going to say to us, but we have not asked you so you have not said it?

MS. SMYTH: I intend to send through some of the recent work we have done. There has recently been a Northern Ireland Assembly inquiry on climate change as well so I will give you the response on that. Also, there is the NICCIP response to that as well. Also, there is the coastal zone issues that we talked about.

THE CHAIRMAN: Thank you.

MR. PEPPIN: I will send through the work that we have done on the future.

THE CHAIRMAN: Yes, that would be helpful.

MR. PEPPIN: I also have a question. Where does this go? What are the next steps on the work of this particular Committee?

THE CHAIRMAN: We produce a report. We are focusing very much on the institutional arrangements for adaptation to climate change, one of the reasons we asked you to come. Underpinning that and trying to understand the broad implications of what is going to happen with water, biodiversity, coastal flooding and so on is to say, "As a society, do we have the processes in place which will allow us to make the right kind of

decisions in a timely manner?" The report is going to be that and then maybe recommendations about where we think there are gaps in the structures, organisations and processes that we will use.

MR. PEPPIN: Where do the recommendations go to?

THE CHAIRMAN: To central government.

MR. PEPPIN: Will they go through the devolved adminstrations?

THE CHAIRMAN: Yes, and increasingly from the Royal Commission reports, which we very much welcome, we are beginning to get devolved administrations making responses to the recommendations independently of the Westminster government. We very much welcome that.

MR. WHEATLEY: Thank you very much for inviting us to come and see you. I found the discussion very helpful. It is more a summation of points I made before. It is vitally important that the national policy and institutional framework enables effective action and planning action at local level rather than seeking to tell people what to do. As discussed on this issue, that is an even more important principle than it is elsewhere.

The other thing that may be a bit neglected is the need for capability and professional expertise. I think this is a point that goes wider than climate adaptation. It is delivering environmental policy. Some of this stuff requires expertise in risk management, expertise in engineering, a

whole range of professional disciplines. It is not just local government but all of the organisations which need to get to grips with these issues are often struggling to find people through age, structures, professions and so on. I would be very interested if the Commission has anything to say on that front.

THE CHAIRMAN: That is a helpful comment because it is a thing that we keep banging up against -- this lack of professional expertise. There is a real issue in this. Thank you very much. That was very interesting and very helpful. If you do think of something else that you want to say to us, please drop us a line and if we think of something, if you do not mind, we will write to you. We found that very helpful so thank you.

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Questions for the Oral Evidence Session – LGA, COSLA, NILGA, WGLA

1. In the context of adaptation at local levels, what can you learn from one another? Are there issues that you can address in Wales, for example, that you may wish to address in Scotland?

It is vital that the four devolved administrations of the UK work together to share good practice and learning. NILGA works closely with the local government bodies in the other administrations

on a number of key issues and is beginning to share experiences and learning with regard to climate change. On the recommendation of UKCIP, we have been in contact with the WLGA to learn about their CCCP project, which is viewed as a methodology with great potential for councils on adaptation.

NILGA has developed a declaration on climate change similar to the Nottingham declaration and has benefitted from advice posted online on that website, and by the WLGA, LGA and COSLA. Although NI targets are set in the NI Programme for Government, given the present level of activity in the region, it is hard to say if these will be met, and it is likely that we will face an incredibly steep and fast learning curve when action becomes a requirement. It will therefore be immensely valuable to us to monitor and learn from action taking place in other jurisdictions.

In addition, local government in Northern Ireland is in the midst of a period of reform, the first for 37 years. At present the planning function is performed by an agency of central government. This is due to be transferred in 2011 to local government, along with a power of wellbeing and responsibility for community planning. Work on climate change adaptation and sustainable development has taken somewhat of a back seat in the interim, as priority is being given to developing the future shape, structure and functions of local government in Northern Ireland.

There are isolated examples of good practice in local government that we are happy to share, but the current lack of support and leadership from the NI administration on climate change is having a negative impact on councils taking this work further forward.

NILGA also benefits from the relationship that the NI administration has with the Scottish Executive through the provision of the Scotland and Northern Ireland Forum for Environmental Research (SNIFFER), who produced a recent report: “Review of Climate Change Mitigation Tools for Local Authorities" highlighting a number of ways in which policy makers and local authorities could strengthen the development of tools to address climate change.

2. If you had the resources, what would you do regarding your approach to locally driven adaptation?

Within the last year, NILGA has attempted to lever in funding from Europe to enable local government to resource and staff work on carbon reduction and climate change adaptation, but this bid was unsuccessful, and it is therefore highly unlikely that any strategic cohesive work will be carried out in the short to medium term by NI local government. We now have, however, a blueprint for a strategic project at local government level that is fully costed and which we feel would provide a significant step-change in local government work on climate change.

Some pilot projects such as the Eco-challenge project and STEM project have been extremely successful and we are currently seeking resources to roll these out on a regional basis.

We are also interested in the potential of initiating a CCCP type project in a NI council, but given the Review of Public Administration timetable and associated priorities this is unlikely to happen in the short term. It is also the case that NI local government is suffering from ‘pilotitis’ to a certain extent, with many councils already concentrating their efforts on running pilot schemes in advance of the RPA, on a vast array of issues.

3. How are your requirements for adaptation prioritised in relation to other demands?

Climate change adaptation does not feature at all highly on the NI Assembly agenda and although a number of councils, groups of councils and local government officer groups are

working well on these issues, without strategic leadership, commitment and resources form central government, there is only a limited amount that local government can do in Northern Ireland. NI councils govern 4% of the public sector budget at present, which will increase to 10% after the RPA.

It is also important for the RCEP to note that the Assembly government is struggling to implement the NI Sustainable Development Strategy and the Ni Waste Strategy, both of which will fundamentally impact on climate change adaptation in the region. There is no NI climate change strategy.

We are attempting to show leadership to our communities on the issue, but the public are being exposed to extremely mixed messages on climate change from a number of sources.

NILGA is working within the NI Climate Change Impacts Partnership, with representatives of government, the private sector and the voluntary/community sector to explore ways of prioritising adaptation. This group has extremely limited resources.

NILGA and the NICCIP have both recently responded to calls for evidence to a NI Assembly Inquiry on Climate Change and I will be furnishing the RCEP with the terms of reference of this inquiry and copies of our responses.

4. Do you anticipate uneven distribution of climate change impacts with respect to the three report exemplars (Biodiversity – nature conservation and protected areas; Sea-level rise and the coastal zone, including estuaries; Freshwater – flood and drought)?

Local authorities in NI are already subject to a statutory duty regarding sustainable development and will soon be subject to a statutory duty regarding biodiversity in their areas. There is currently no satisfactory guidance for either of these duties.

A mapping exercise has recently taken place with regard to freshwater flood risk areas, on a cross-border basis, and considerable resources have been directed at ensuring recent flooding events in Belfast do not recur.

At present there is little understanding of where impacts will occur and how these will relate to the socio-economic profile of the communities potentially affected.

It is likely that this work will develop more readily when councils are responsible for both area and community planning as well as having a greater involvement in emergency management

Public awareness is extremely low, and access to information is limited.

5. Local Democracy, Economic Development and Construction Bill – how will the introduction of this Bill affects adaptation efforts?

This bill will not apply in NI save for repealing some un-commenced aspects of the PPERA

6. How and where do you get your climate change information to inform the Local Authorities (IPCC< UKCIP, LGA Climate Change Commission, other)? How do local authorities interpret this information and ensure it is understood by decision makers?

This process is currently still in development. NILGA obtains information from the Department of Environment and Defra, mainly via the NICCIP, who are closely connected to UKCIP. We also conducted a substantial amount of researching the run up to the submission of our bid for EU We were involved in discussions with the LGA climate change commission in the early stages of their work, but it is fair to say that the LGA has moved much further and faster than NILGA on this issue. NILGA also works closely with LACORS, who are a point of information and advice for local government on regulatory services issues.

NILGA in turn, keeps relevant officers, groups of officers and members informed and up to date with key developments, through the work of our Health and Environment Working Group. A number of councils are also taking forward cross-border and other adaptation projects, and are keeping NILGA informed of their progress.

NILGA has recently reinvigorated a local government awards scheme which featured a number of awards for environmental schemes. Information on schemes related to climate change is also disseminated via our website, regular meetings, and monthly newsletter.

7. How are the local authorities and associations able to influence national decisions on adaptation?

NILGA, through its lobbying activity and relationship with the various NI government departments is continually trying to reinforce the need for adequate planning for and adaptation to climate change. We are trying to ensure that awareness of climate change is built in to all relevant government policy, but at present, it is only visible in high level government strategy that has not been implemented.

NILGA therefore views its role in NICCIP as vital, given the cross-sectoral nature of this group. It is likely that local government will have greater influence regarding adaptation post 2011, given the functions that are to be transferred to and new roles created for local government in Northern Ireland.

8. Do you think the local government associations could do more towards adaptation? What would you like to be able to do?

Given adequate resources NILGA could lead the sector in a strategic project to develop a cohesive and consistent approach to climate change adaptation and mitigation across all its member councils. NILGA has scoped such a project and it is our view that a strategic approach to this work is necessary.

There is a clear role for NILGA to build adaptation and SD principles into the work of the new councils, and NILGA would value the extra capacity necessary to begin to take this work forward within the statutory transition committees that are being formed towards the end of 2009. However, with the lack of government leadership currently being experienced on climate change, this is unlikely to take place.

9. How does the present economic growth model fit with the need to adapt to climate change?

It is the NILGA view that there are clear challenges and also economic opportunities presented by the need to develop more sustainably and to adapt to climate change. It is clear that current practices are unsustainable, and we are extremely supportive of the research and development work taking place in Northern Irish Universities on sustainable technologies and practice.

Northern Ireland has serious socio-economic problems, with many of our households already experiencing some degree of fuel poverty. It will be critical for local government to develop its civic leadership role quickly in the area of climate change mitigation and adaptation to ensure that current problems are not exacerbated.

It will be difficult to develop public confidence in this work without appropriate political leadership.

Planning:

10. How can the planning powers available to you be used to develop adaptation?

At present local government in NI has no planning powers, save a consultative role in development and area planning and a coordinating role in emergency planning. Post 2011, the planning role of local government will change radically, with councils being responsible for area plans, development control and community planning. The provision of the enabling power of well being will also be critical to councils in developing adaptation measures.

11. To what extent does the National Planning Framework help or hinder adaptation?

The Regional Development Strategy for NI 'Shaping Our Future' is currently under revision. Published in 2001, its current incarnation notes that "Global climate change has been identified as an issue which must be taken into account in planning the future development of the region.

An objective of the Strategy is to contribute to reducing the impact of global warming, both locally and globally, and to emphasise the importance of cutting environmental costs generally, by reducing the consumption of natural resources and energy from non-renewable sources, and increasing the amount of waste material which is recycled rather than dumped."

The document goes on to outline a number of aims under a heading of "Wise Use of the Environment", including

- To consider the implications of climate change
- To make prudent use of no-renewable resources
- To help restrain emission of greenhouse gases
- To promote the waste management strategy for NI

However, when these aims are followed up, targets and useful action does not always appear as a result. For example the Waste Strategy for NI "Towards Resource Management" doesn't mention climate change and is still seriously behind on implementation targets. The sustainable development strategy, although giving targets for greenhouse gas reduction, has not been implemented. There is a huge gap between words and action in much of this work, largely stemming from the prioritisation of Northern Ireland's unique political situation within the UK.

I will be also submitting some work that NILGA has already done for an NI Assembly inquiry into climate change.

KS

Further Evidence from Hans Schreuder

From: Hans IP [hans@ips-pix.biz]
Sent: 03 June 2009 19:35
To: McCann, Sean
Cc: Long, William
Subject: Re: Environment Committee Meeting 21 May

Mr McCann and Mr Long,

Following on from my oral evidence, there is so much brand new scientific information that has been published since then that it is imperative that I bring this to your attention.

Please allow me to send you the latest reports from around the world, showing beyond a shadow of a doubt that there is absolutely no scientific basis for the much hyped man-made global warming nor man-made climate change.

It is critical that you and your Climate Change Committee read these latest reports, as it will clearly indicate that all the evidence that I have already brought to your attention is now being confirmed independently by scientists world-wide.

As I mentioned during my oral evidence, the team of scientists that I work with are at the very cutting edge of proper climate science, not the pseudo-science as practised by all who so loudly proclaim that man is causing global warming and climate change.

Other teams of scientists are now independently coming out with the exact same conclusions that I have spoken about.

Kind regards,

Hans Schreuder

----- Original Message -----

From: McCann, Sean
To: hans@ips-pix.biz
Cc: Long, William
Sent: Tuesday, May 26, 2009 9:46 AM
Subject: Environment Committee Meeting 21 May

Mr Schreuder

Please find attached a thank you letter following your oral evidence session to the NI Assembly Environment Committee Climate Change Inquiry on 21 May.

Thanks

Sean McCann
Environment Committee Staff

From: Hans IP [hans@ips-pix.biz]
Sent: 23 May 2009 11:23

To: Long, William
Subject: Fw: Due Diligence and Facts on the IPCC

Dear Mr Long,

Thank you again for your intervention to get me to present oral evidence to the Northern Ireland Climate Change Committee and I hope it will make the Committee think more than twice about the entire issue of man-made climate change.

Below is a combination of several emails from one of my Australian cyber contacts, Malcolm Roberts, highlighting the true nature of the UN IPCC.

Please be so kind and make other members of your Committee aware of this.

Over the next few weeks, I will also gather information about the sources of official global temperature measurements, to clearly indicate that there has been no global warming for at least 7 years and, depending on the parameters used, no warming since the peak of 1998.

Please feel free to ask me for any further information on any aspect of climate change and mankind's non-existent influence upon it.

Kind regards,

Hans

----- Original Message -----

From: Malcolm Roberts
To: Malcolm Roberts
Sent: Thursday, May 21, 2009 1:22 AM
Subject: Due Diligence and Facts on the IPCC

Due Diligence and Facts on the IPCC - No. 1 in a Series

What scientific foundation?

Presenting something as it is not, to secure unfair gain, is fraud.

Kevin Rudd has repeatedly stated the government's position on global warming is reliant on reports from the UN's Intergovernmental Panel on Climate Change, IPCC. Lets consider the IPCC's actions.

According to Lord Monckton's 2007 public speech at Cambridge University, the IPCC's 1995 Scientific Report draft included the following three statements:

1. "None of the (scientific) studies cited above has shown clear evidence that we can attribute the observed (climate) changes to the specific cause of increases in greenhouse gases". Source, IPCC, 1995.

2. "No study to date has positively attributed all or part (of observed climate change) to anthropogenic causes". Source, IPCC, 1995.

3. “Any claims of positive detection of significant climate change are likely to remain controversial until uncertainties in the total natural variability of the climate system are reduced." Source, IPCC, 1995.

Yet, in the IPCC’s 1995 summary Report for Policymakers widely distributed through the media and governments, all three of the above statements by IPCC scientists were removed and replaced with: “The balance of evidence suggests a discernible human influence on global climate". Source, IPCC 1995 rewrite.

Due Diligence and Facts on the IPCC - No. 2 in a Series

The IPCC can’t even count its own members

The IPCC has repeatedly falsely implied 2,500 scientists support the IPCC’s claim that human activity caused global warming. Using data from the IPCC McLean (2007) shows only 62 reviewers reviewed Chapter 9 which claims human causation of global warming. Of these only 5 reviewers endorsed the claim (McLean, 2007, page 15). Five! And there is doubt they were even objective scientists.

McLean (2009) provides hard numerical data and in reference to the IPCC’s notion that a significant human influence on global climate is supported by 2,500/4,000 scientists, McLean states: “There’s no question whatsoever. It’s utterly wrong"

Some IPCC reviewers were not scientists at all. They were lobbyists and activists.

It seems the IPCC can’t even count its own members and does not even know what is a scientist.

Does the IPCC lack the numerical competency to even accurately count the number of scientists involved in preparing IPCC reports. Or is the IPCC deliberately misleading?

The IPCC stands naked, exposed.

IPCC scientists oppose the IPCC - No. 3 in a Series

The rapidly growing spontaneous world-wide people’s movement debunking climate alarm is informally led by scientists on the IPCC.

IPCC scientists are publicly stating their concern at the distortion of science in the IPCC’s clearly politically motivated reports. (References provided below.)

Scientists are concerned about the IPCC’s destruction of science, the scientific process and peer review.

Scientists are expressing strong opposition despite some being penalised financially and in their careers and despite unfounded smears on their reputation.

They are courageously speaking out to ensure valuable public resources and attention stop being diverted to a non-problem because there is no evidence human activity caused Earth’s latest period of global warming that ended in 1998. They see the urgent need to protect science’s credibility from the IPCC’s false inferences and unscientific processes.

There is strong evidence human activity did not cause that latest period of global warming.

The infamous hockey stick graph is crooked - No. 4 in a Series

Initially, the IPCC embraced the now infamous Hockey Stick graph fabricated by Mann, Bradley and Hughes (MBH) in 1998 and extended in 1999. The IPCC embraced the graph's use even though the graph bypassed standard scientific peer review processes. That graph has since been scientifically proven to contain many falsities. It omitted known warmer periods 400 years ago and even in the 1930's. MBH's graph is scientifically discredited world-wide as completely unscientific and in gross error.

Once McIntyre and McKitrick had exposed the MBH falsity the IPCC quietly dropped use of the graph. Yet the damage had already been done because MBH's graph had been extremely influential in discussions of 20th century global warming. The IPCC helped spread the damage - using a falsity.

From what I've seen, if the IPCC was a company it would be up for fraud.

Have you done your own due diligence for Australia?

Malcolm Roberts

BE (Hons), MBA (Chicago)

Fellow AICD, MAIM, MAusIMM, MAME (USA), MIMM (UK), Fellow ASQ (USA, Aust)

180 Haven Road
Pullenvale QLD 4069
Phone:
Home 07 3374 3374
Mobile 04 1964 2379
E-mail: catalyst@eis.net.au

Please note: Apart from the name of my suburb and state, my contact details are not for publication and are provided only for your own personal use to reply.

References:

Monckton, Lord C, 2007. "Apocalypse? No!" DVD of speech presented to Cambridge University Union. Available free from http://video.google.com/videoplay?docid=5206383248165214524 or from http://scienceandpublicpolicy.org/apocalypseno-dvd.html [both Accessed: March, 2009]

McLean, J, 2007. An Analysis of the Review of the IPCC 4AR WG I Report. Science & Public Policy Institute http://mclean.ch/climate/docs/IPCC_review_updated_analysis.pdf [Accessed: February, 2009]

McLean, J, 2009. The IPCC Can't Count its "Expert Scientists" - Author and Reviewer Numbers are Wrong, International Climate and Environmental Change Assessment Project

http://mclean.ch/climate/docs/IPCC_numbers.pdf [Accessed: February, 2009]

Don't accept my writing. Read McLean and discover for yourself the IPCC's unfounded alarm and falsities. The 2007 report is equivalent to around just ten pages of text. The 2009 Update is less than five. Both these highly objective reports were made using IPCC data provided by the IPCC. It seems the IPCC can't even count its own members and does not even know what is a scientist.

McLean advises that both papers required only some critical analysis and the ability to count. His computing background was useful to speed up the work.

What McLean says cannot be sensibly refuted because the data is available to everyone and where necessary McLean describes his data processing method.

The IPCC falls by its own actions, its own data.

Singer, NIPCC, 2008. Report entitled "Nature, Not Human Activity Rules the Climate". http://sepp.org/publications/NIPCC_final.pdf Produced by a group of internationally eminent scientists, including scientists on the IPCC panel. Prepared by the Nongovernmental International Panel on Climate Change (NIPCC) 2008 as a Science and Environmental Policy Project and published by The Heartland Institute, page 24. Edited by S F Singer, internationally renowned Professor emeritus of Ecology and Environment, respected climate scientist, physicist, first director of USA's National Weather Satellite Service and former vice-chairman for five years of the US National Advisory Committee on Oceans and Atmospheres, member of IPCC panel of advisory scientists. References to 168 sources.

Michaels, P J, PhD, Editor, 2005. Shattered Consensus - The True State of Global Warming. (Rowman & Littlefield: Plymouth, UK). Containing chapters by internationally eminent climate scientists on specific topics in climate science. Includes 3 IPCC scientists (one Lead Author) and a consultant to the IPCC. References 729 sources.

Singer, S F and Avery, D T, 2007. Unstoppable Global Warming - Every 1,500 Years. (Rowman & Littlefield, Plymouth, UK). Comprehensive, reader friendly book on all aspects of climate alarm. References 534 sources.

Michaels, PJ and Balling, R C, 2009. Climate of Extremes - Global Warming Science They Don't Want You to Know. (Cato institute, Washington, USA). Michaels is a member of the IPCC and Balling a consultant to the IPCC. Their four page preface alone is worth the book's price. The whole book very valuable. References to 278 sources and reading.

Jump on the internet and look for yourself. Start with Michaels, Singer, Christie among many prominent climate scientists on the IPCC who strongly refute IPCC reports and/or the IPCC's politicisation of science and its unscientific methods.

eg,

Everett, J, 2009. Global Climate Change Facts: The Truth, The Consensus, and the Skeptics. Available from: http://www.climatechangefacts.info/index.htm [Accessed May, 2009] Award winning scientist with comprehensive data including data from the USA's National Oceanic and Atmospheric Administration

There is now a range of scientific papers available by various scientists detailing the fabrication of the Mann, Bradley, Hughes hockey stick graph. Two highly reputable sources include the two Canadian statisticians who exposed the fabrication:

McKitrick, R author of chapter 2, in Michaels, P J, PhD, Editor, 2005. Shattered Consensus - The True State of Global Warming. (Rowman & Littlefield: Plymouth, UK). Pages 20-49

McIntyre, S, 2009. http://www.climateaudit.org/pdf/mcintyre.mckitrick.2003.pdf and in general http://www.climateaudit.org/ [Both accessed: May, 2009]

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end

IHT Response re Information on 'Translink New Fleet'

From: Geoffrey Perrin [Geoffrey.Perrin@scottwilson.com]
Sent: 28 May 2009 09:34
To: Long, William
Subject: DoE Assembly committee hearings on Climate Change.

Dear Mr. Long,

Further to your recent email please find below the information in relation to the Member's question.

IHT did not have an answer to the question so we asked Translink for their assistance.

Attached is the detail of their reply.

I trust this is satisfactory,

With kind regards,

Geoffrey Perrin.

From: Geoffrey Perrin [mailto:perrin.geoffrey@googlemail.com]
Sent: 26 May 2009 21:26
To: Geoffrey Perrin
Subject: Fwd: IHT

---------- Forwarded message ----------

From: Philip O'Neill <philip.o'neill@translink.co.uk>

Date: Tue, May 26, 2009 at 4:24 PM

Subject: RE: IHT

To: Bert Bailie <Bert.Bailie@rpsgroup.com>

Cc: bailiehjh@aol.com, perrin.geoffrey@googlemail.com

Bert,

Basically, the Member was correct. The experience of the industry generally and indeed our own in recent times clearly shows that engine upgrades from Euro II to Euro V (and soon to be Euro VI) have reduced harmful emissions and resulted in cleaner engines. In other words, there is less carbon dioxide, nitrous oxide and particulates However, there is a cost in terms of fuel consumption. Modern buses with air conditioning, double glazing, safety factors, higher seating capacity etc. are significantly heavier (gross weight); this has also increased fuel consumption.

Typically, a new vehicle, e.g. Volvo B10BLE (low-floor urban vehicle), will achieve 5.7 mpg, whereas older type vehicles, e.g. N-type/Q-type Tiger will reach 7.9 mpg (28% difference).

However, we continue to work with manufacturers and technical staff to develop ways to mitigate these unintended consequences.

We are also looking at new hybrid vehicles and have been trialling various levels of (fuel) additives, e.g. bio diesel, for some time.

Finally, it may be of interest to note that there are two elements in fuel cost calculations, consumption and price. The price of fuel, as everyone is aware, has been very volatile in recent years and clearly the long-term real trend for net price in the industry is decisively upwards. In addition, the freezing of fuel duty rebate in relation to fuel consumption and the weighted analysis of fleet type, i.e. towards increasing double-deckers, has inevitably resulted in higher fuel consumption figures, particularly in urban areas such as Londonderry and Belfast. It is reasonable to assume that on the basis of future bus purchases, fuel consumption will continue to deteriorate as older and more fuel-efficient vehicles will have been phased out.

I hope the foregoing is helpful.

Regards,

Philip

From: Bert Bailie [mailto:Bert.Bailie@rpsgroup.com]
Sent: 21 May 2009 16:13
To: Philip O'Neill
Cc: bailiehjh@aol.com; perrin.geoffrey@googlemail.com; Geoffrey Perrin
Subject: IHT

Hi Philip

Hope all is going well with you. I'm hoping you can help IHT with this query.

Last week the IHT attended the DoE Assembly committee hearing on Climate Change. During questioning we were asked about the fuel consumption of new low carbon emission buses purchased by Translink. We obviously did not have information from which to answer the query and we were asked to see if we could provide further advice – The Clerk of Committee has followed up with the following:-

The Committee for the Environment wishes to thank you for attending the meeting on 14 May 2009 and presenting your very useful oral evidence.

Members were particularly interested in the discussion on the ‘translink new fleet’ and have requested further details on the fleet.

(Members queried the fact that low carbon emission vehicles were being used that possibly would use more fuel)

Basically one member seemed to have the idea that recently purchased buses with more environmentally friendly engines producing lower carbon emissions actually used more fuel.

Can you provide IHT with any information that we can use to answer this query. As you will appreciate we would like to respond to this query as soon as possible and you assistance would be greatly appreciated.

Geoffrey Perrin (90705111) or myself can discuss – I will not be in the office again until Monday but you may get me on 07817210272 – if responding by email can you send to both my email addresses as I am only working part-time.

Many thanks

Bert

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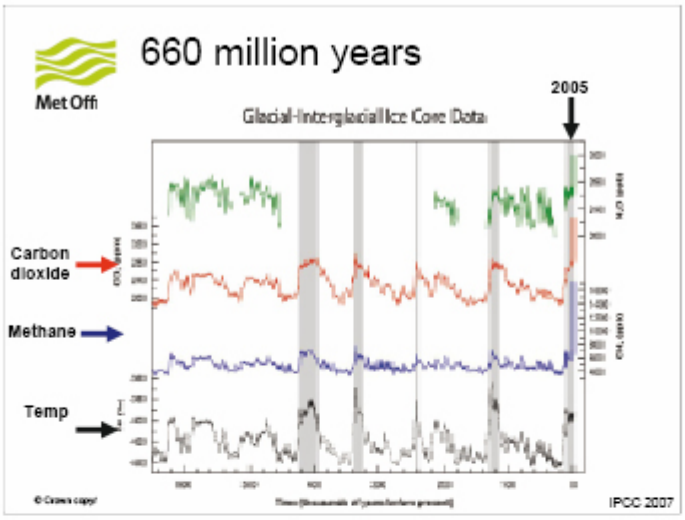
tel : (028) 9066 7914
web : www.rpsgroup.com/nireland

Met Office Presentation on Global Temperatures over past 20 years



How the planet was over the last 660,000 years, data from the IPCC rpt 2007

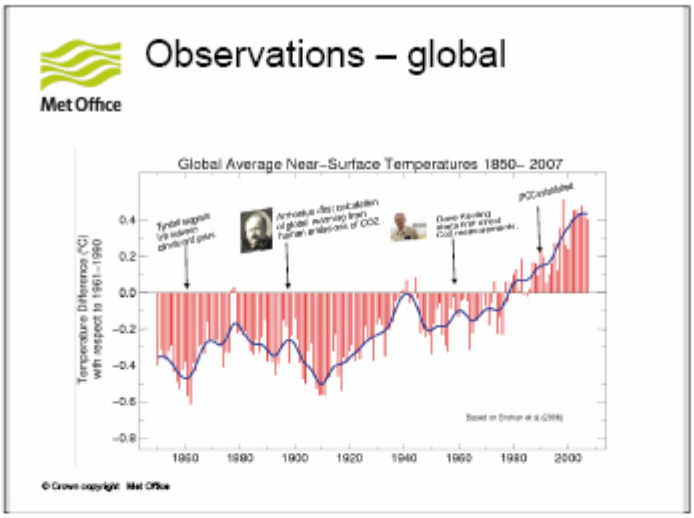
Previous warm periods globally shaded vertically in grey

Three main GHGs represented, Carbon Dioxide, Methane & Nitrous Oxide

Temperature line at the bottom

Concentrations of GHGs now higher than they have ever been in this period.

It takes time for the atmosphere to react and you certainly wouldn't expect to see a reaction in this time scale



Coming closer to the present, this graph shows how temperatures – especially in the last 20-30 years, have continued to rise. 2007 tied with 1998 for Earth's second warmest year in a century.

Key Message

•There is no single measure of global temperature, but the mix of observations shows a warming trend.

•The rate of warming is increasing in modern times.

Back ground

The timeline shows that climate science has a history and has gone from "lone scientist" to "mass cooperation of scientists worldwide" (e.g. IPCC). Interesting dates include

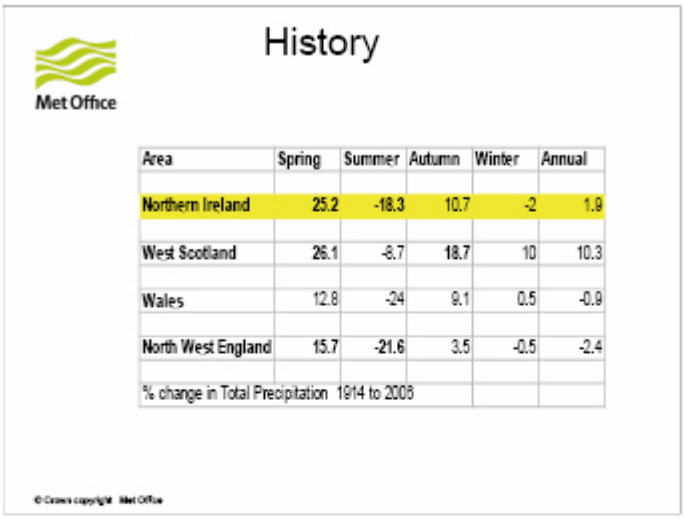
1859 – Tyndall (UK physicist) explained atmospheric heat in terms of the capacities of various gases to absorb or transmit radiant heat.

1896 - Svante Arrhenius, (Swedish physical chemist,) studied how changes in the amount of CO2 may affect climate. **He devised an "energy budget" model, getting temperatures by adding up how much solar energy was received, absorbed, and reflected.**

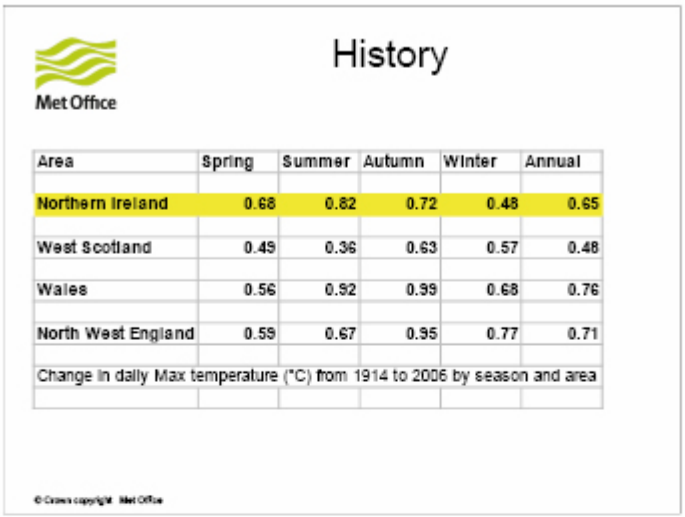
He also introduced the concept of **"feedback."**

1957 – Keeling (American chemist) long-term CO_2 measurements began in 1957 with the first flask collection at the South Pole. Hawaiian measurements started in March 1958. That air had 316 parts per million of CO_2 - by March 2007 the comparable value was 384 parts per million. As data curves lengthened, patterns emerged. Seasonal changes and hemispheric differences traced the breathing of the biosphere.

1988 – IPCC The IPCC was formed in 1988 by the United Nations Environmental Programme and World Meteorological Organization to gain a better understanding of global climate change.

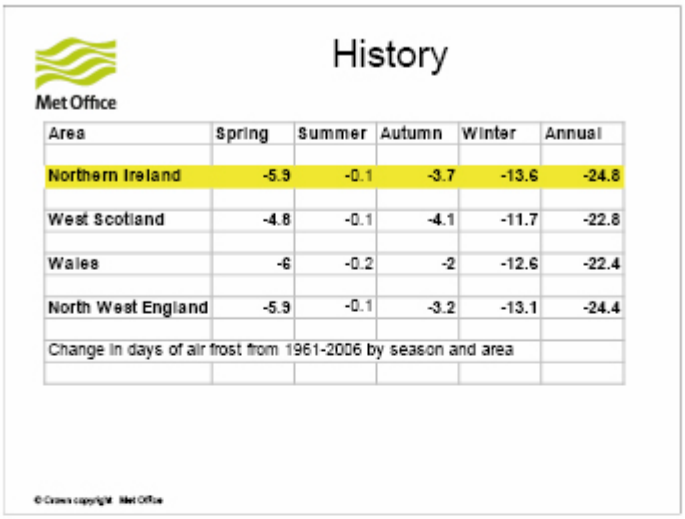


Seasons are
March April May
June July August
September October November
December January Feb



Changes in maximum day time temperatures through the last century and into this one in Northern Ireland.

It is likely that these will be updated by UKCP09 in the next few moths but are likely to show further increases



The reduction in frost days gives a measure of the changes in night time temperatures.

The Sceptics View

Met Office

- Planetary Geometry
  Too slow
- Solar heating variations
  Too small
- Aerosols
  Cools climate
- Enhanced Greenhouse Effect
  Only possible explanation

© Crown copyright Met Office

To summarise then, the nay sayers

- **Earth is tilted and wobbles as it orbits the sun. This affects how much solar energy we receive– crudely put, tipped towards the Sun we receive more, tipped away, we receive less.** (Tilt currently about 23.44°)
- During cooler periods, snow-melt is reduced and glaciers slowly form – especially over the Northern hemisphere, which contains most of the land – which may cause the earth to gradually cycle in and out of ice ages.
- However, these orbital wobbles (known as Milankovitch cycles) operate on a timescale of around 100,000 years– **not on the same timescale as global warming** so we need to look elsewhere.

Key Messages

- Sunspots indicate a more active phase - the Sun emits more light and heat, roughly every eleven years.
- Solar irradiance before 1978 is estimated from proxy data (sunspots, etc) and is less reliable than that measured since then by satellites.
- Over the last 50 years the irradiance has been fairly stable in contrast to increasing global temperatures.
- In fact, since 1970 the sun has actually been cooling off slightly.
- **Key Messages**

Aerosols, are small solids or liquid particles - of varying composition, size and shape - suspended in air.

Key Messages:

- Aerosols have a **direct effect** (scattering and absorption of shortwave and thermal radiation), leading to cooling.
- Aerosols cooling effect on the atmosphere, is thought to have mitigated some of the expected global warming .
- They also have an **'indirect effect' by** interaction through the modification of cloud properties (e.g. Acting as condensation nuclei.
- **Natural aerosols include:** dust storms, sea salt, volcanoes, etc
- **Manmade aerosols include:** surface / strip mining, fossil fuel and biomass burning.
- Solar variations and aerosol actions do affect climate, but not significantly enough to explain recent temperature records.

6

RSPB Response re Changes in Temperatures in the Seas and Bird Diseases as a Result of Climate Change

From: McCann, Sean
Sent: 27 May 2009 12:37
To: Long, William
Subject: FW: Further information from RSPB to the Climate Change Inquiry

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From: Delaney, Colum [mailto:Colum.Delaney@rspb.org.uk]
Sent: 27 May 2009 12:24
To: McCann, Sean
Subject: Further information from RSPB to the Climate Change Inquiry

Hi Sean,

As a follow up to the RSPB's submission to the Climate Change Inquiry on the 21st May, please see below some additional information, as per your request. I hope that this proves useful to the Committee. Let me know if you require anything else, or further info.

1. Defra's website has a useful review about insect distribution and agriculture. The document is at http://www.defra.gov.uk/farm/environment/climate-change/pdf/climate-ag.pdf (see pages 38-43).

2. For some further information about the impacts of Climate Change on ecosystem linkages in the marine environment (including some fisheries information), please see the recent Marine Climate Change Impacts Partnership (MCCIP) publication . You can download the report here: http://www.mccip.org.uk/elr/

Thanks,

Colum

Colum Delaney
RSPB NI Policy Advocacy Officer
0771101 9809
028 90 690853

Colum

At the meeting on 21 May the RSPB discussed the changes in temperatures in the seas around NI and bird diseases as a result of climate change.

I would be grateful if you could forward any further information you may have on this.

Thanks

Sean

MCCIP: Marine Climate Change Impacts

2009

MCCIP Marine Climate Change Impacts Partnership

Marine climate change impacts

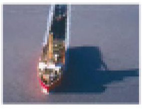
Exploring ecosystem linkages

Understanding the links between climate change impacts on the oceans is a critical priority for our future wellbeing. By taking a new 'bigger picture' approach, we can start to show how the interconnected nature of the marine ecosystem magnifies the many discrete impacts of climate change, documented in the MCCIP Annual Report Cards.

To support this new approach, we asked five groups of leading scientific experts on issues such as ocean acidification, Arctic sea-ice loss, seabirds and food webs, non-native species, and coastal economies to give us their views.

CO_2 and ocean acidification

In the last 200 years, ocean acidity has increased by 30% and at a rate much faster than anytime in the last 65 million years. This has serious implications for marine ecosystems and climate regulation.



Arctic sea ice

In the last decade there has been a 35% decrease in summer sea ice extent and a 15% reduction in winter sea ice, leading to changes in habitats and ecosystems.

A view from above

Climate change has already caused changes in plankton, fish distribution and species composition in the seas around the UK. Declines in some seabird populations such as black-legged kittiwakes, terns and skuas may continue as a result.

Non-native species

Most introductions of non-native species have arrived via human intervention, intentional or otherwise. The likelihood that they will establish and flourish in the UK marine environment could be greater due to climate change.

Coastal economies and people

Many of our coastal communities will face both challenges (e.g. increased flood and erosion risks, declining traditional fisheries) and opportunities (e.g. new tourism patterns, new fisheries) through climate change.

PHOTOS from top: Natural History Museum, iStockphoto.com/westphalia, Lorne Gill/SNH, Paul Newland/MarLIN, Davey Benson.

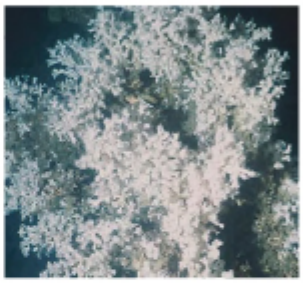
www.mccip.org.uk/elr

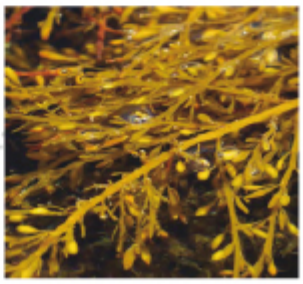
Introduction

The ecosystem linkages report card builds on the science of our Annual Report Cards to show how broader marine climate change impacts come together.

This report uses five topics, ranging from global to local scale issues, to demonstrate the linked relationships that you need to consider when planning for marine climate change.

By demonstrating these interactions in the marine environment, we can begin to understand why there is a need to take an 'ecosystem approach' to address the impacts of climate change at the coast and in our seas.





Topic Index	Page
CO_2 and ocean acidification: running into the buffers?	4 – 5
Arctic sea ice	6 – 7
A view from above: changing seas, seabirds and food sources	8 – 9
Non-native species	10 – 11
Coastal economies and people	12 – 13

The information provided in the five topic spreads is just a brief summary drawn from detailed peer-reviewed documents. To access these full documents go to www.mccip.org.uk/elr

How does this ecosystem linkages report card link to MCCIP Annual Report Cards and how is it different?

Previous MCCIP report cards have explored a wide range of topics, highlighting key impacts for individual components of the marine environment (e.g. seabirds). This report brings together these individual components, looking at how changes in one part of the marine ecosystem impact upon others (e.g. how seabirds interact with *all* levels of the marine food web).

PHOTOS from top: Lorna GILSON, Murray Roberts/SAMS, Lorna GILSON, Lorna GILSON.

How much do we know?

Each of the topic spreads include confidence assessments to give you a better understanding of how much we know. 'Connecting' arrows or boxes are colour coded according to whether our confidence is high, medium or low.

High Confidence

Medium Confidence

Low Confidence

How are the topics linked?

The acidification of our seas has been identified relatively recently as a major global issue, affecting the world's seas and oceans, with the Arctic being particularly vulnerable. It is tempting to assume that changes occurring in the Arctic as a result of climate change are not relevant to the UK but they have local scale impacts at a UK level. This happens through various mechanisms such as the general effect of rising sea levels due to melting ice, changes to north-east Atlantic food webs, and opening of Arctic sea routes, which all have implications for non-native species and coastal economies in the UK.

Within the broader framework of climatically driven change, significant effects are being observed in the ecology of the UK marine environment. Major changes to plankton communities are having knock-on effects to fish and birds. Species new to the UK are finding a more hospitable climate in which to establish and spread. All of this has major implications for our economy involving issues such as coastal defence, aquaculture, fishing and tourism. The links between the topics are shown in more detail through the rest of the report.

Other human pressures

Whilst the focus of this report is on climate change impacts, it is important to acknowledge the role of other pressures on the marine ecosystem. These pressures can combine with climate change to magnify impacts. These include:

Coastal infrastructure; Fishing; Leisure activities; Oil, gas and mineral extraction; Pollution; Renewables; Shipping.

Where particularly relevant, these other pressures are highlighted in this report.

The UK Government has set out a vision for 'clean, healthy, safe, productive and biologically diverse seas'. As climate change and ocean acidification take hold, understanding the impacts is a key element of knowing what to do to maintain a healthy marine environment. Understanding these impacts and what their knock-on effects may be will influence how we use and value our coasts and seas both now and in the future.

PHOTOS from top: RSPB, Sea Life Surveys/Specialist Stock.

CO_2 and ocean acidification: running into the buffers?

The oceans are an enormous store of carbon, substantially greater than on land or in the atmosphere, and play a key role in the global carbon cycle, especially in helping regulate the amount of CO_2 in the atmosphere.

The oceans are important because they have taken up 27-34% of the CO_2 produced by humankind through the burning of fossil fuels, cement manufacturing and land use changes since the industrial revolution.

Whilst this has somewhat limited the historical rise of CO_2 in the atmosphere, thereby reducing the extent of greenhouse warming and climate change caused by human activities, this has come at the price of a dramatic change to ocean chemistry. In particular, and of great concern, is the measurable change in ocean pH and carbonate and bicarbonate ion concentration – 'ocean acidification'. Our understanding of the impact of CO_2 on the carbonate chemistry is such that we know with very high certainty that ocean acidification will continue.

To access the full peer-reviewed document go to www.mccip.org.uk/elr/acidification

Key linkages...

Acidification

Atmospheric CO_2 dissolves in the ocean to form a weak acid.

Atmospheric CO_2 increases.

Ocean acidity increases.

Reduced buffering capacity of the ocean to take up CO_2 will increase the fraction of CO_2 retained in the atmosphere.

Ecosystem impacts

Ocean acidification is a serious threat to many marine organisms which may have implications for food webs and ecosystems, but these are difficult to predict as little is understood of their ability to adapt.

Impacts of increased acidity will be evident through:

Increased physiological stress (e.g. growth, respiration and reproduction).

Reduced growth and survival of early life stages.

Reduced ability to make shells and skeletons (calcification) by marine organisms.

Potential changes to other biogeochemical processes (e.g. nitrification, C:N ratios).

Changes in nutrient chemistry and speciation.

Impacts up the food web.

Ocean acidification is intimately linked to the ocean's climate regulation role through its uptake of CO_2.

PHOTOS from top: Natural History Museum, Donna Roberts

LESSONS FROM THE DEEP PAST

Ocean acidification events in the Earth's past may help us interpret the future of our oceans in a world of increasing CO_2 emissions.

As a result of an ocean acidification event 55.5 million years ago –

- The mass extinction of many benthic shell forming organisms may have occurred.
- Many pelagic shell forming organisms survived.
- Recovery took hundreds of thousands of years.

Today...

- Until 200 years ago atmospheric CO_2 had been constant for 650,000 years and possibly for 20 million years.
- In the last 200 years ocean acidity has increased by 30%, a rate much faster than anytime in the last 65 million years. Substantial extinctions of benthic and planktonic organisms could result.

Climate regulation

The oceans are an enormous store of carbon, substantially greater than on land or in the atmosphere and hence play a key role in the global carbon cycle, especially in helping regulate the amount of CO_2 in the atmosphere.

The continued uptake of CO_2 will lead to a slow down in the ocean's ability to absorb CO_2 therefore leaving more CO_2 in the atmosphere.

Other climate change feedbacks are possible but the direction and level are highly uncertain (e.g. cloud cover induced by dimethylsulphide (DMS) produced by plankton, changes to atmospheric CO_2 induced by changes to calcification and/or the biological pump).

Confidence rating

applies to the links between boxes shown by coloured arrows AND to the impacts described in each coloured box

High Confidence

Medium Confidence

Low Confidence

Links to Arctic sea ice...

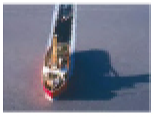
- Winter time sea ice acts as a lid preventing CO_2 returning to the atmosphere.
- Sea ice produces brines which sink and take CO_2 with them.

Why it matters

Increasing ocean acidification has the potential to harm marine ecosystems and alter the oceans' ability to take up excess CO_2 from the atmosphere leading to a direct impact on future climate change.

Socio-economic impacts of ocean acidification are difficult to predict. However, the goods and services provided by the marine environment to the UK are important; for example, multi-million pound fisheries, fish meal and aquaculture industries employ tens of thousands of people and if impacted by ocean acidification this could have a direct economic effect. Globally, coral reefs have been valued at $30 billion and provide food, tourism and shore protection. Any threat to them will be important for the economies of some of the UK's overseas territories.

Arctic sea ice



Sea ice is formed at the surface of the Arctic Ocean during winter. Most of it melts during the summer, but some can persist to become multi-year ice. The Arctic atmosphere has warmed by about twice the global average in the last 30 years, resulting in record reductions in Arctic sea ice extent and thickness, especially in summer.

Arctic sea-ice reductions have significant impacts locally, regionally and globally through effects on climate, wildlife and humans, and indirectly on sea level. The high albedo of ice means that much of the incoming solar radiation to the Arctic region is reflected back to space without being able to warm the atmosphere, land or sea. When the coverage of sea ice reduces, more radiation is absorbed, adding to warming and loss of sea ice. Sea ice also helps to regulate the exchange of heat, gases and moisture between the ocean and atmosphere, and impacts on ocean stratification, salinity, and the global atmospheric and ocean circulation.

The Arctic will continue to warm throughout the 21st century. Arctic seas could be free of sea ice in summer within a few decades.

To access the full peer-reviewed document go to www.mccip.org.uk/elr/arctic

Key linkages...

Climate changes

Current status

Regional Arctic climate change affects the global climate system.

Sea ice reductions alter the climate system through changes in the heat fluxes to the atmosphere, ocean circulation, and albedo.

What could happen

More open ocean due to sea-ice loss is likely to lead to increased rate of CO_2 uptake and ocean acidification.

The Arctic is expected to continue to warm for the remainder of the 21st century.

Increasing precipitation and melting will lead to fresher Arctic seawater.

The Arctic is expected to be ice free in summer within the next few decades.

In addition – land ice will continue to melt increasing sea-level rise – coastal communities affected further.

Human impacts and natural resources

Current status

A warming Arctic contributes to sea-level rise.

Traditional lifestyles of indigenous peoples are impacted.

What could happen

25% of known oil and gas reserves are in the Arctic and reduced sea ice will make access to these easier.

Extension of present fishing grounds polewards. Further regime shifts in sub-Arctic ecosystems affects fisheries.

Shorter trade routes between the Atlantic and the Far East. There will be increased opportunities for ship-based tourism.

Additional shipping increases the chances of pollution and introduction of non-native species through ballast water.

PHOTO strip: iStockphoto.com/[illegible]

Ecosystem changes

Current status

Sea-ice loss leads to habitat and ecosystem changes – more sunlight, earlier in the spring changes primary production.

Regime shifts in Arctic ecosystems are affecting fisheries.

What could happen

The Arctic will be particularly susceptible to ocean acidification, with impacts on physiology and calcification of marine organisms.

Top predators such as seals, whales, walrus and polar bears could be lost due to their reliance on sea ice for their feeding and/or breeding.

The summer feeding grounds of UK over-wintering bird populations may be disrupted.

Loss of sea ice may allow the northward migration of non-native species into the Arctic leading to impacts on the Arctic ecosystem.

Confidence rating

applies to the links between boxes shown by coloured arrows AND to the impacts described in each coloured box

High Confidence

Medium Confidence

Low Confidence

Relevance to UK

- Ease of access to oil and gas reserves.
- Shorter shipping routes to and from the Far East.
- Important changes to the climate system.
- Major changes to North Atlantic ecosystems.

A view from above: changing seas, seabirds and food sources

Seabirds sit at the top of the marine food web and hence are sensitive to human activities and changes in environmental and biological conditions which affect the whole ecosystem. There is growing evidence that the scale of marine climate change impacts around the UK is becoming sufficiently pronounced to have a noticeable effect on seabird populations.

Climate change has already caused changes in plankton and fish distribution and species compositions and, compounded by fishing, is probably involved in a marked decline in the productivity of sandeel stocks around the UK. Sandeels are the key food source of most seabirds, and the decline in sandeel availability has led to a decrease in numbers and breeding success of several species of seabirds.

In the short term (less than 5 years), the recent succession of poor breeding years caused by reduced sandeel availability are likely to propagate through the population leading to a decline in adult breeding numbers. Beyond this, changes will depend on the balance between breeding success, maturation rate and adult survival, which are difficult to predict. Much will depend on future patterns of sandeel production or whether an alternative prey species emerges which is available to seabirds.

To access the full peer-reviewed document go to www.mccip.org.uk/elr/view

Key linkages...

Primary production

Nutrient availability is affected by various climate change factors. This has direct effects on phytoplankton species and their abundance and timing of blooms. Phytoplankton are the basis of the marine food-web.

Fish

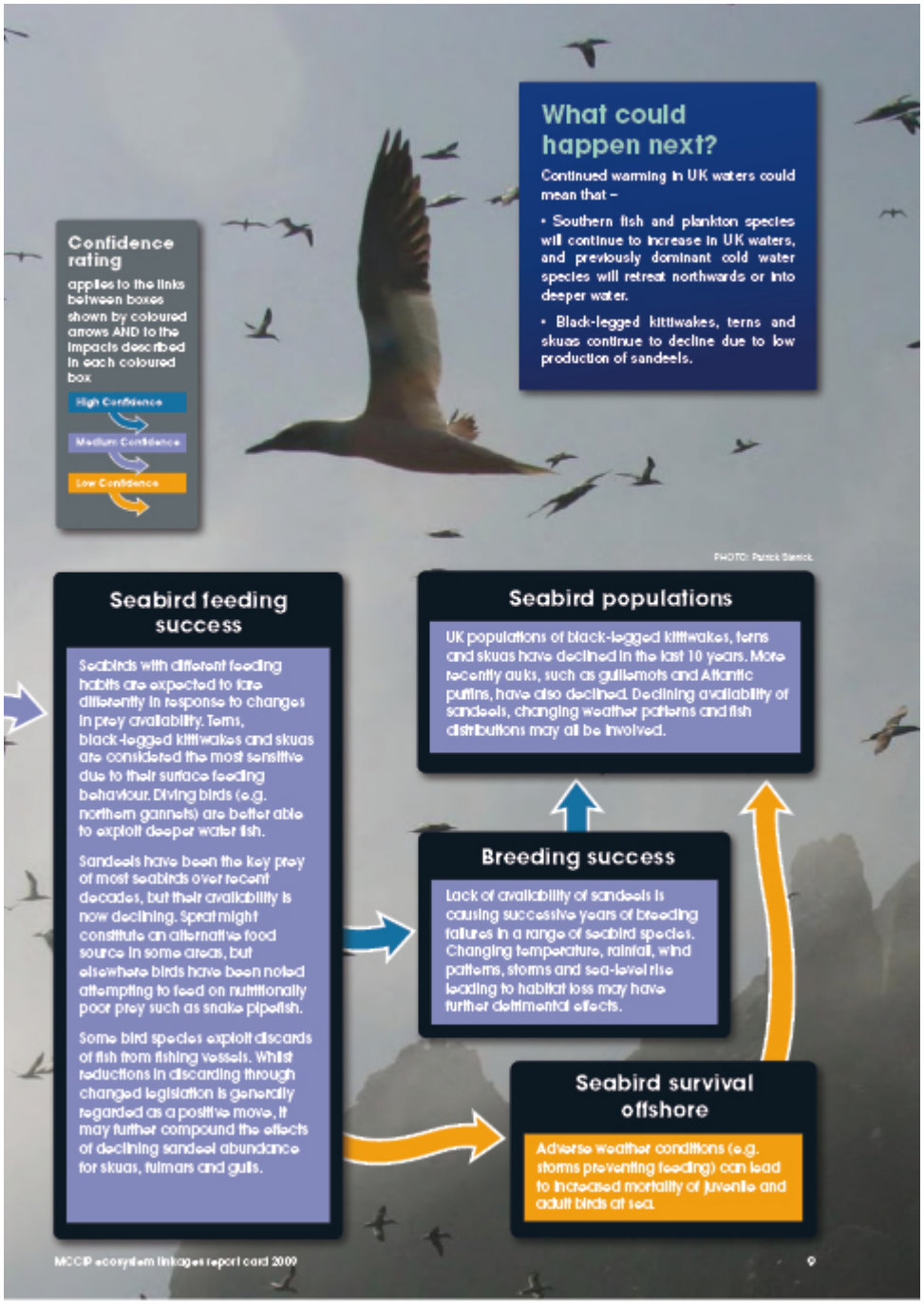
The effects of climate change on fish are difficult to distinguish from the impacts of fishing. However, shifts in species distribution into deeper water and more northerly locations in the NE Atlantic, and an increase in the incidence of southern species in UK waters, are clearly related to warming. Some species also show temperature related changes in recruitment and growth.

Sandeels, a key prey species for other fish and seabirds, have declined in abundance in UK waters since about 2000, to the point where fisheries have been closed. In the southern North Sea, sandeel recruitment is negatively affected by sea temperature. Overall, it seems that the decline in sandeels is probably a consequence of the combination of fishing and climate change.

Zooplankton

Warming-related northward shifts in the distribution ranges of zooplankton in the NE Atlantic are bringing smaller, warm water species into UK waters with different seasonal patterns of production and overall abundance. A key cold water species *Calanus finmarchicus* has reduced in abundance by 70% in the last 40 years, whilst the related warm water species *Calanus helgolandicus* has increased in abundance. These two species reproduce at different times of year and the change has an impact on energy flow through the food web. Recent experimental evidence shows that acidification can also be expected to have a detrimental effect on the reproduction of some key plankton species.

PHOTO at top: Lorne GIBSON.


What could happen next?
Continued warming in UK waters could mean that –
• Southern fish and plankton species will continue to increase in UK waters, and previously dominant cold water species will retreat northwards or into deeper water.
• Black-legged kittiwakes, terns and skuas continue to decline due to low production of sandeels.
Confidence rating
applies to the links between boxes shown by coloured arrows AND to the impacts described in each coloured box
High Confidence
Medium Confidence
Low Confidence
PHOTO: Patrick Barrick
Seabird feeding success
Seabirds with different feeding habits are expected to fare differently in response to changes in prey availability. Terns, black-legged kittiwakes and skuas are considered the most sensitive due to their surface feeding behaviour. Diving birds (e.g. northern gannets) are better able to exploit deeper water fish.
Sandeels have been the key prey of most seabirds over recent decades, but their availability is now declining. Sprat might constitute an alternative food source in some areas, but elsewhere birds have been noted attempting to feed on nutritionally poor prey such as snake pipefish.
Some bird species exploit discards of fish from fishing vessels. Whilst reductions in discarding through changed legislation is generally regarded as a positive move, it may further compound the effects of declining sandeel abundance for skuas, fulmars and gulls.
Seabird populations
UK populations of black-legged kittiwakes, terns and skuas have declined in the last 10 years. More recently auks, such as guillemots and Atlantic puffins, have also declined. Declining availability of sandeels, changing weather patterns and fish distributions may all be involved.
Breeding success
Lack of availability of sandeels is causing successive years of breeding failures in a range of seabird species. Changing temperature, rainfall, wind patterns, storms and sea-level rise leading to habitat loss may have further detrimental effects.
Seabird survival offshore
Adverse weather conditions (e.g. storms preventing feeding) can lead to increased mortality of juvenile and adult birds at sea.
MCCIP ecosystem linkages report card 2009
9

Non-native species

New species of fauna, flora or unicellular organisms that are not indigenous and become established in the waters around the UK are termed marine non-natives.

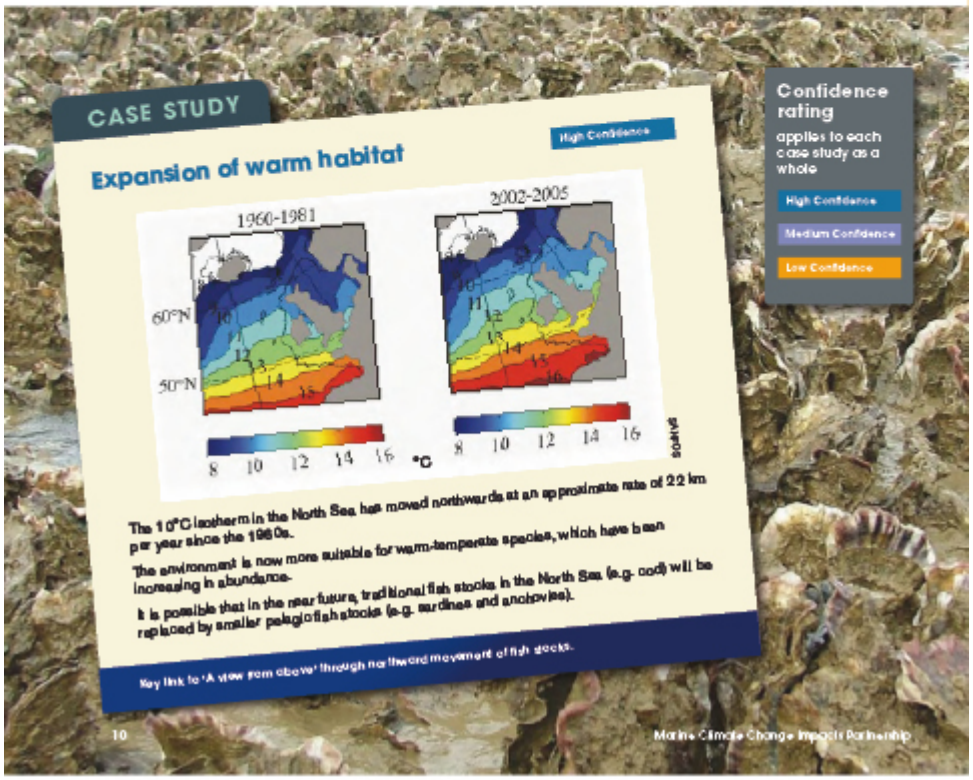
Some of these species can be considered to be invasive if they spread rapidly and cause economic or environmental harm, or harm to human health. Most introductions have arrived via human intervention, intentional or otherwise (e.g. aquaculture, ballast water).

More recently due to climate change some species have expanded their ranges to become established in new regions and some already introduced species have been able to take advantage of warmer conditions to become more abundant.

There is little evidence to suggest that marine non-natives in the UK have caused extinctions of native organisms. Localised impacts have included sporadic poisoning or smothering of farmed organisms in aquaculture, clogging of nets, or fouling of structures – all events of considerable concern for the aquaculture industry.

To access the full peer-reviewed document go to www.mccip.org.uk/elr/non-natives

PHOTOS from top: Paul Newland/MarLIN, Joss Wiggins.



Regional case studies for Ireland, Scotland, Wales and England are detailed in the full review document.

©R De Oliveira/Photolibrary.

CASE STUDY

Man-made introductions

Low Confidence

The invasive Chinese mitten crab introduced by man from Asia (found in 1935 in the Thames) lives in both estuaries and rivers in the UK and is becoming a major pest and predator on native species including young fish.

Colonisation by Chinese mitten crabs has greatly increased in the UK in recent years due to warmer temperatures.

In the case of the Chinese mitten crab, climate change did not lead to its introduction but has been implicated in its more recent rapid spread.

Key link to 'coastal economies and people' as sea defences can act as stepping stones for non-natives moving in response to climate change.

CASE STUDY

Trans-arctic migration

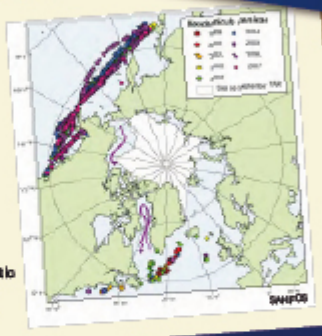
Medium Confidence

The Pacific diatom *Neodenticula seminae* arrived in the North Atlantic in 1999, after becoming locally extinct 800,000 years ago.

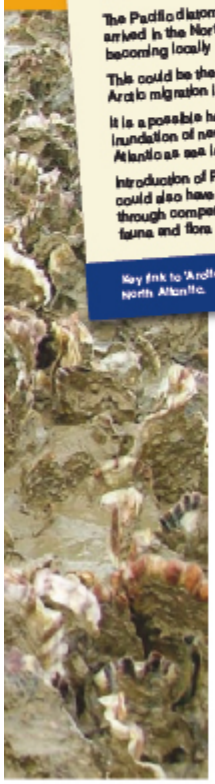
This could be the first evidence of a trans-Arctic migration in modern times.

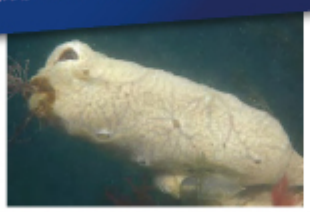
It is a possible herbinger of a potential inundation of new organisms to the North Atlantic as sea ice cover decreases.

Introduction of Pacific species to the N. Atlantic could also have an impact in the longer term through competition and hybridisation of the fauna and flora native to the UK.



Key link to 'Arctic sea ice' as reduced sea ice cover enables Pacific species to move into the North Atlantic.





Consequences and likely future changes

It is possible that in the near future traditional fish stocks in the North Sea (e.g. cod) will be replaced by smaller pelagic fish stocks (e.g. sardines and anchovies).

In the case of the Chinese mitten crab, climate change did not lead to the introduction but has been implicated in its more recent rapid spread.

Introduction of Pacific species to the N. Atlantic could also have an impact in the longer term through competition and hybridisation of the fauna and flora native to the British Isles.

Non-natives can have an economic impact on fisheries and aquaculture (e.g. the recent jellyfish bloom off Ireland, and new Harmful Algal Blooms, see the full online review for more details).

PHOTOS: Rohan Holt/CCW, Lorna Gill/SNH (bowl image).

Coastal economies and people

The shape of any coast changes over time in response to changes in energy (waves, tides and currents), material (sediment type and supply), existing coastal morphology and sea level.

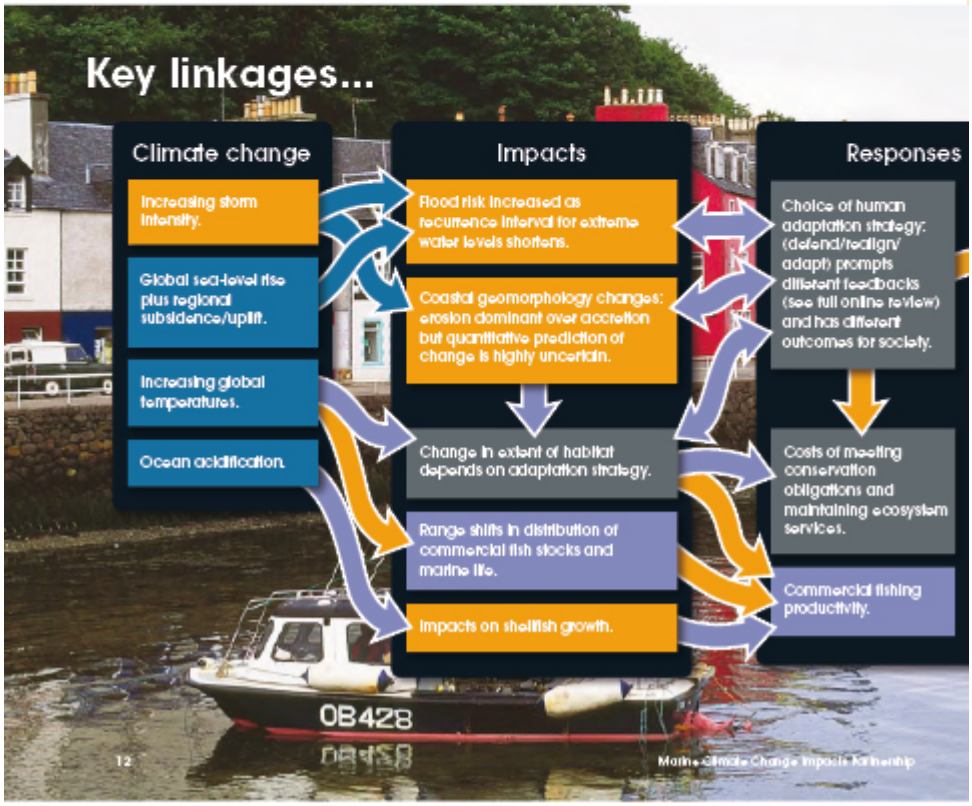
The potential implications of climate change, such as coastal flooding, coastal erosion and habitat change affect a diverse range of human economic activities including recreation and tourism, ports and shipping, transport and commerce.

For coastal economies and people, relative sea-level rise with increased rates and extent of coastal erosion and higher frequency of flooding are likely to be the main direct impacts.

How we respond to these challenges will directly influence environmental and socio-economic outcomes.

To access the full peer-reviewed document go to www.mccip.org.uk/elr/coasts

PHOTOS from top: Daisy Benson, Lorne Gill/SNH.



CASE STUDY

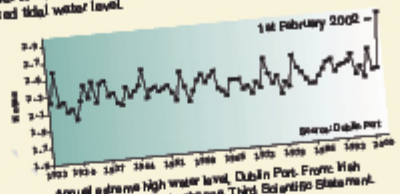
Storm surges in the Irish Sea

In February 2002, a low pressure system in the southern Irish Sea coincided with the spring tide, leading to an extreme water level (i.e. the highest water level in any given year) of 2.9 m above Mean Sea Level. This is the highest level in Dublin Port since records began in 1923. In Belfast the tide reached 1 m above the predicted tidal water level.

The storm surge led to–

- Widespread flooding in Dublin and Belfast.
- Marked coastal erosion between Cork and Belfast.
- £4 million of damage on the Isle of Man and damage on the north-east English coast and the western Scottish coast.
- Ferry services across the Irish Sea were suspended.

A 0.5 m rise in sea level would mean the extreme water level of February 2002 could become an annual event. Many UK and Irish ports are on estuaries and may experience increased frequency of storm surges which would affect their operations.



Annual extreme high water level, Dublin Port. From: Irish Committee on Climate change, Third Scientific Statement. Royal Irish Academy. ©John Sweeney

Weather chart for storm surge on Feb 1st 2002. © Crown copyright 2002, the Met Office.

and Implications

Coastal defence costs.

Landscape quality.

Property loss – annual flood losses in the UK could reach £27 billion by 2080.

The annual average erosion damage is set to increase by 3–9 times by the 2080s.

Tourism and recreation.

Public safety.

Infrastructure loss.

Social and cultural impacts on coastal communities.

Confidence rating

applies to the links between boxes shown by coloured arrows AND, where appropriate, to the impacts described in each coloured box

- High Confidence
- Medium Confidence
- Low Confidence

Links to other topics...

CO_2 and ocean acidification

- Potential impacts on shellfish aquaculture productivity.
- Ocean acidification will be an added stressor on those fisheries that are already under pressure.

Arctic sea ice

- Ecotourism opportunities increase to the Arctic.
- Opportunities for ports and shipping through shorter trade routes.

A view from above

- Impacts on ecotourism opportunities around the UK due to changes in food-web linkages.
- Possible impacts from changes to traditional inshore fisheries.

Non-natives

- Increased growth of existing non-native species will affect aquaculture structures.
- An increase in harmful algal bloom events could affect fish farms and fisheries.
- Non-native species can extend their range by using sea defences as stepping stones.

Five key issues for decision makers to consider

1. Changes are happening now and will continue to happen. The UK Climate Projections will provide important insights into future change.
2. Ocean acidification is a critical emerging issue and the UK's Ocean Acidification Programme, along with other international research initiatives will become important sources of knowledge over the next five years.
3. The interconnected nature of marine ecosystems magnifies the many discrete impacts of climate change and this needs to be considered when making management decisions.
4. Global changes in marine ecosystems as a result of climate change will have impacts for the UK at national, regional and local levels.
5. The evidence base provided by long term data sets and specific research programmes are extremely important in understanding the impacts of climate change.

From science to policy: demonstrating excellence in the UK

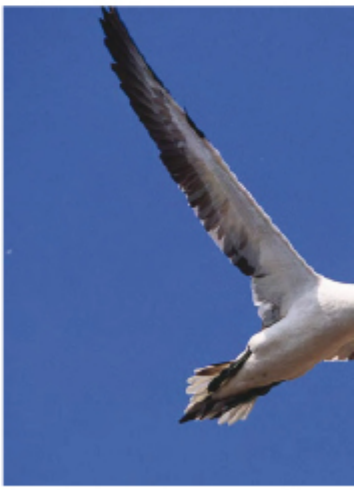
In 2005, the UK Government and devolved administrations undertook a review on progress in meeting their vision for 'clean, healthy, safe, productive and biologically diverse seas' and towards making a real difference within a generation. One of the major conclusions from that work was that it was difficult to form a clear overview on the impacts of climate change on the marine environment. From this conclusion was born the Marine Climate Change Impacts Partnership (MCCIP) and the development of annual report cards.

The ecosystem linkages report card draws on the existing strengths of MCCIP in bringing together leading science and policy approaches in the UK into a unified, easy to access document on what is changing, how confident we are and why it matters. This new 'big picture approach' illustrates the world-leading role the UK is taking to best understand and communicate what is happening to our seas as a result of climate change and ocean acidification. It also illustrates the leading nature and excellence of marine science in the UK and showcases key work underway throughout the country.

It shows that although marine science is distributed across many institutions and research centres, by bringing it together we form a compelling view on marine climate change, and illustrate the quality and diversity of science that is needed to support decision making in this area. It is noticeable how a broad base of research is needed to understand both the current impacts and what may happen in the future, alongside the increasing importance of long-term datasets and earth observing systems.

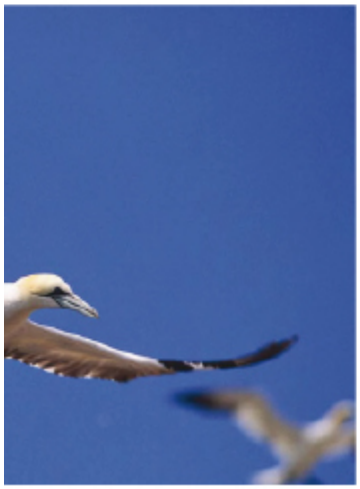
Our seas also have a role to play in developing mitigation strategies and marine renewable energy is being proposed as a clean alternative to traditional energy sources and the oceans capacity for carbon storage is being investigated.

PHOTOS: Gavin Parsons, Lorne GIBSON.



Marine Climate Change Impacts Partnership

PHOTO: Paul Kay



MCCIP ecosystem linkages report card 2009

UK marine climate change: looking ahead

Marine bills

The UK Marine and Coastal Access Bill and the forthcoming Scottish Marine Bill and Northern Ireland Marine Bill do not contain provisions to directly tackle the effects of climate change on the marine environment. However, the proposals are intended to be sufficiently flexible to take account of changes to the marine environment whether this arises through climate change, technological development or for any other reason.

The marine policy statement and marine plans, will help to ensure the UK makes appropriate use of marine resources in the fight against climate change

Climate change legislation

The Climate Change Act requires a programme of policies and proposals which contribute to the achievement of sustainable development and set out how the UK Government will respond to the risks facing the UK as a result of climate change. It also places a duty on Welsh Ministers to lay before the National Assembly for Wales a report on the objectives, action taken and future priorities of the Welsh Ministers in relation to greenhouse gas emissions and the impact of climate change in Wales.

A Climate Change (Scotland) Bill also proposes a duty for Scottish Ministers to provide a programme of policies and proposals to address the consequences of climate change.

Developing marine climate change adaptation strategies in the UK

Our MCCIP adaptation survey and workshop demonstrated a clear need to develop integrated marine adaptation strategies bringing together nature conservation with public and private sector interests at national, regional and local scales to build adaptive capacity.

UK's Ocean Acidification Programme

The Natural Environment Research Council and the Department for Environment, Food & Rural Affairs are developing a collaborative five year research programme of approximately £12m to consider ocean acidification. The drivers and rationale for the programme are detailed in the NERC Earth System Science Theme Action Plan. The research programme will focus on the north-east Atlantic (including European shelf and slope), Antarctic and Arctic Oceans.

UK Climate Projections

The new update to UKCIP's climate projections will include a separate marine and coastal projections report for the first time. MCCIP will have an important role to play in communicating its findings.

Identifying research priorities

MCCIP is looking to develop a list of marine climate change impacts research gaps. The list will consider what we need to know and what this information is needed for.

MCCIP Annual Report Cards

MCCIP will continue to provide up-to-date information on marine climate change impacts with the next report card being prepared for 2010.

EU Marine Strategy Framework Directive

The Marine Strategy Framework Directive aims to achieve good environmental status in Europe's waters by 2020. As we develop our understanding of what good environmental status means and the measures we are going to need to put in place to achieve it, it is vital that this is influenced by our growing understanding of the impacts of climate change on the marine environment.

Online report card with full review documents

The ecosystem linkages report card is explored in much more detail in our online version where supporting evidence for each of the topics is available.

www.mccip.org.uk/elr

MCCIP Marine Climate Change Impacts Partnership

What is MCCIP?

MCCIP is a partnership between scientists, government, its agencies and NGOs. The principal aim is to develop a long-term multidisciplinary approach to understanding and communicating the implications of climate change in our seas.

Partner organisations

Agri-food and Biosciences Institute, British Energy, Cefas, Countryside Council for Wales, The Crown Estate, Defra, Department of Energy and Climate Change, Department of the Environment Northern Ireland, Environment Agency, Fisheries Research Services, Joint Nature Conservation Committee, Marine Environmental Change Network, Marine Institute Galway, Natural England, NERC 'RAPID-WATCH' programme, RSPB, Sir Alister Hardy Foundation for Ocean Science, Scottish Environment Protection Agency, Scottish Government, Scottish Natural Heritage, States of Guernsey, States of Jersey, UK Climate Impacts Programme, Welsh Assembly Government, WWF.

For more information on how to become a member of MCCIP, contact the MCCIP Secretariat at office@mccip.org.uk

MCCIP Annual Report Card

The 2007/2008 MCCIP Annual Report Card looked at 28 individual topics in detail. Please go to www.mccip.org.uk/arc to access both the summary document and the full peer reviewed reports from leading marine climate scientists.

The next MCCIP Annual Report Card is due to be published in 2010.

Further details and contacts

Further details on the work of MCCIP can be found on our website www.mccip.org.uk

If you have any further enquiries please contact us at office@mccip.org.uk

Please cite this document as: MCCIP (2009). Marine Climate Change Ecosystem Linkages Report Card 2009. (Eds. Baxter JM, Buckley PJ and Frost MT), Summary Report, MCCIP, Lowestoft, 16pp.

Your feedback

To help us understand if we are meeting your needs we need your views. Our short online questionnaire provides you with the opportunity to help shape future report cards and other MCCIP products. Go to www.mccip.org.uk/elr/survey

List of contributors

Topic leaders

CO_2 and ocean acidification: running into the buffers?
Turley C, Plymouth Marine Laboratory.

Arctic sea ice
Rodger A, British Antarctic Survey.

A view from above: changing seas, seabirds and food sources
Heath M, Fisheries Research Services.

Non-natives
Reid PC and Edwards M, Sir Alister Hardy Foundation for Ocean Science.

Coastal economies and people
Cooper JAG, University of Ulster.

Other contributing scientists

Cook EJ, The Scottish Association for Marine Science.

Findlay HS and Mangi S, Plymouth Marine Laboratory.

Furness R, University of Glasgow.

McCollin T, Fisheries Research Services.

McQuatters-Gollop A, Sir Alister Hardy Foundation for Ocean Science.

Minchin D, Marine Organism Investigations.

Pinnegar J, Cefas.

Ridgwell A and Schmidt DN, University of Bristol.

Wanless S, Centre for Ecology and Hydrology.

Quality assurance

The MCCIP report card working group commissioned the contributing scientists and identified appropriate specialists to peer-review the quality of the science.

The working group would like to thank all of the experts who kindly peer-reviewed the science behind the report card.

Extract from Bjorn Blomborg in Wall Street Journal

From: Zsuzsa Horvath (PA for Bjorn Lomborg) [pa@lomborg.com]
Sent: 22 May 2009 22:42
To: Zsuzsa Horvath (PA for Bjorn Lomborg)
Subject: Lomborg in Wall Street Journal: The Climate-Industrial Complex

Please find below a copy of the newest op-ed by Bjorn Lomborg's that has just been published in the Wall Street Journal. Thank you for your continued interest, but if you do not wish to receive Dr. Lomborg´s op-eds in the future, please let me know.

http://online.wsj.com/article/SB124286145192740987.html

The Climate-Industrial Complex
Some businesses see nothing but profits in the green movement.

By BJORN LOMBORG

Some business leaders are cozying up with politicians and scientists to demand swift, drastic action on global warming. This is a new twist on a very old practice: companies using public policy to line their own pockets.

The tight relationship between the groups echoes the relationship among weapons makers, researchers and the U.S. military during the Cold War. President Dwight Eisenhower famously warned about the might of the "military-industrial complex," cautioning that "the potential for the disastrous rise of misplaced power exists and will persist." He worried that "there is a recurring temptation to feel that some spectacular and costly action could become the miraculous solution to all current difficulties."

This is certainly true of climate change. We are told that very expensive carbon regulations are the only way to respond to global warming, despite ample evidence that this approach does not pass a basic cost-benefit test. We must ask whether a "climate-industrial complex" is emerging, pressing taxpayers to fork over money to please those who stand to gain.

This phenomenon will be on display at the World Business Summit on Climate Change in Copenhagen this weekend. The organizers -- the Copenhagen Climate Council -- hope to push political leaders into more drastic promises when they negotiate the Kyoto Protocol's replacement in December.

The opening keynote address is to be delivered by Al Gore, who actually represents all three groups: He is a politician, a campaigner and the chair of a green private-equity firm invested in products that a climate-scared world would buy.

Naturally, many CEOs are genuinely concerned about global warming. But many of the most vocal stand to profit from carbon regulations. The term used by economists for their behavior is "rent-seeking."

The world's largest wind-turbine manufacturer, Copenhagen Climate Council member Vestas, urges governments to invest heavily in the wind market. It sponsors CNN's "Climate in Peril" segment, increasing support for policies that would increase Vestas's earnings. A fellow council member, Mr. Gore's green investment firm Generation Investment Management, warns of a significant risk to the U.S. economy unless a price is quickly placed on carbon.

Even companies that are not heavily engaged in green business stand to gain. European energy companies made tens of billions of euros in the first years of the European Trading System when they received free carbon emission allocations.

American electricity utility Duke Energy, a member of the Copenhagen Climate Council, has long promoted a U.S. cap-and-trade scheme. Yet the company bitterly opposed the Warner-Lieberman bill in the U.S. Senate that would have created such a scheme because it did not

include European-style handouts to coal companies. The Waxman-Markey bill in the House of Representatives promises to bring back the free lunch.

U.S. companies and interest groups involved with climate change hired 2,430 lobbyists just last year, up 300% from five years ago. Fifty of the biggest U.S. electric utilities -- including Duke -- spent $51 million on lobbyists in just six months.

The massive transfer of wealth that many businesses seek is not necessarily good for the rest of the economy. Spain has been proclaimed a global example in providing financial aid to renewable energy companies to create green jobs. But research shows that each new job cost Spain 571,138 euros, with subsidies of more than one million euros required to create each new job in the uncompetitive wind industry. Moreover, the programs resulted in the destruction of nearly 110,000 jobs elsewhere in the economy, or 2.2 jobs for every job created.

The cozy corporate-climate relationship was pioneered by Enron, which bought up renewable energy companies and credit-trading outfits while boasting of its relationship with green interest groups. When the Kyoto Protocol was signed, an internal memo was sent within Enron that stated, “If implemented, [the Kyoto Protocol] will do more to promote Enron’s business than almost any other regulatory business."

The World Business Summit will hear from “science and public policy leaders" seemingly selected for their scary views of global warming. They include James Lovelock, who believes that much of Europe will be Saharan and London will be underwater within 30 years; Sir Crispin Tickell, who believes that the United Kingdom’s population needs to be cut by two-thirds so the country can cope with global warming; and Timothy Flannery, who warns of sea level rises as high as “an eight-story building."

Free speech is important. But these visions of catastrophe are a long way outside of mainstream scientific opinion, and they go much further than the careful findings of the United Nations panel of climate change scientists. When it comes to sea-level rise, for example, the United Nations expects a rise of between seven and 23 inches by 2100 -- considerably less than a one-story building.

There would be an outcry -- and rightfully so -- if big oil organized a climate change conference and invited only climate-change deniers.

The partnership among self-interested businesses, grandstanding politicians and alarmist campaigners truly is an unholy alliance. The climate-industrial complex does not promote discussion on how to overcome this challenge in a way that will be best for everybody. We should not be surprised or impressed that those who stand to make a profit are among the loudest calling for politicians to act. Spending a fortune on global carbon regulations will benefit a few, but dearly cost everybody else.

Mr. Lomborg is director of the Copenhagen Consensus, a think tank, and author of “Cool It: The Skeptical Environmentalist’s Guide to Global Warming" (Knopf, 2007).

Best wishes
Zsuzsa Horvath
Personal assistant
Phone: +36-1-321-6595

Sustainable Development Commission Stock Take Report July 2006 – 'Delivering improvements in existing housing

http://www.sd-commission.org.uk/publications.php?id=400

Submission from arc21

Our Ref: RB/9th March 09
Your Ref:
E-Mail: ricky.burnett@arc21.org.uk

9th March 2009

Northern Ireland Assembly
Environment Committee Office
Room 245
Parliament Buildings
Stormont
BT4 3XX
FAO Alex McGarel

Dear Mr McGarel,

Northern Ireland Assembly Environment Committee Inquiry into Climate Change

I refer to your recent letter in respect of the above.

Climate change is viewed as a key issue not just within local government but also within the waste sector. The way forward for waste management in Northern Ireland is set out in the Northern Ireland Waste Management Strategy produced in 2006, entitled "Towards Resource Management ". The title is laudable but it was produced with little discernable reference to the issue of Climate Change. Using our resources more efficiently which correlates to reducing waste arisings will also reduce environmental impacts. Almost all environmental impacts are linked to the goods and services that the economy provides and these impacts can occur across the life cycle of a product.

The NI Waste Strategy could show more linkage with other strategic policy initiatives such as sustainable development. Consequently, there could be merit in producing a revamped National Waste Strategy which emphasises the need to combat climate change and demonstrates a more holistic and integrated approach to tackling the environmental and economic impacts of wastefulness in the use of material resources and energy. The English Waste Strategy was delayed until 2007 to take account of other strategic policy issues such as climate change. It quotes the Stern Review and suggests that methane emissions from landfill accounts for 3% of all UK greenhouse gas emissions with at that time, UK recycling estimated to save more than 18m tonnes of carbon dioxide per year.

It is worth noting that the other devolved administrations in Scotland and Wales are both in the process of considering their own National Waste Strategies with a view to producing a new

Strategy that more appropriately reflects current thinking and we are given to understand that climate change is at the foremost in their thinking.

The waste sector is currently subject to a number of targets as a tool to drive forward the changes necessary. These targets have originated through legislation in Europe and are almost exclusively weight based. Examples of these include landfill diversion of municipal waste, recycling targets including packaging waste, waste electronics, end of life vehicles and batteries. It would be important that any targets emerging from this inquiry that impact on the waste sector are compatible with existing waste targets.

It is important to recognise that any strategy arising from this inquiry must be underpinned by a series of measures including the application of adequate resources to ensure suitable delivery. Experience in regards to the Sustainable Development and indeed the National Waste Strategy do not bode well in this regard. It is important that administrative and mechanical/procedural arrangements are put in place to facilitate a more holistic approach to implementation and delivery.

Finally it is important that decisions are based on evidence and therefore it is vital that adequate and appropriate research in undertaken to produce such evidence. This is as equally true in the waste sector as it is for other sectors such as energy and transport. We would encourage that a robust programme of research be developed to ensure that timely information is produced from which appropriate guidance may be formulated.

I trust this is of interest.

Yours sincerely,

R. Burnett
Policy Director

DETI, DHSS&PS and OFMDFM Responses re What Extent PSAs Contribute to NI's Emission Reduction Target

From the Office of the Minister

Department of
Enterprise, Trade and Investment
www.detini.gov.uk

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Our Ref: DETI SUB 310/09

Mr Patsy McGlone
Chair, Environment Committee,
Room 245,
Parliament Buildings
BELFAST
BT4 3XX

31st May 2009

Dear Patsy

I refer to your letter of 10 May 2009 to the Chair of the ETI Committee, requesting details of how, and to what extent, each of the Public Service Agreements (PSAs) for which DETI has responsibility contributes to Northern Ireland's emission reduction target, specifically to reduce greenhouse gas emissions by 25% below 1990 levels by 2025, as defined in PSA 22. Please see details attached overleaf.

Your Committee may also wish to note that I hope to put a new Strategic Energy Framework (SEF) out to consultation this Summer. It will propose ambitious goals and targets for renewable energy for the next ten and more years and will seek to point industry and business towards planning for a sustainable, low carbon energy future that will increase security of energy supplies for domestic and business use and also contribute to European Union climate change targets.

In addition to my Department's work on developing the new SEF, there are already a number of DETI activities aimed at improving energy competitiveness and security of supply and enhancing sustainability. I attach a list of these activities which may be of interest to your Committee (see attached Annex).

Sincerely,

ARLENE FOSTER MLA

cc: Mark Durkan, Chair, Committee for Enterprise, Trade and Investment

DETI's contribution to Northern Ireland's emission reduction target:

PSA 22 – Protecting our Environment

DSO – Promote energy efficiency and the use of renewable energy

PSA target	2008/09 Operating Plan target	2008/09 outturn	Comments on progress at 31 March 2009	2009/10 Operating Plan target
Secure 12% of electricity consumption in Northern Ireland from indigenous renewable sources by 2012	By 31 March 2009, ensure 7% of electricity consumption is from indigenous renewable sources. (Baseline 2008: 5.5%)	7%	2008/09 Operating Plan target met. Number of operating large scale (>1 MW) wind farms in NI is 21, with total capacity 280 MW. This equates to just over 200 turbines. Total renewable capacity to meet the 12% target is around 361 MW; 332MW wind and 29 MW non-wind. Based on existing operational wind farms and those in development and accepted on to the Grid by NIE, it is expected that the 2012 targets will be met.	By 31 March 2009, ensure 8.5% of electricity consumption is from indigenous renewable sources

FROM THE MINISTER FOR HEALTH,
SOCIAL SERVICES AND PUBLIC SAFETY
Michael McGimpsey MLA

Department of
Health, Social Services and Public Safety
www.dhsspsni.gov.uk

Sláinte, Seirbhísí Sóisialta agus Sábháilteachta Poiblí

Poustie, Resydènter Heisin an Fowk Siccar

Mr Patsy McGlone MLA
Committee for the Environment
Room 245
Parliament Buildings
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Tel: 028 90 520642
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Our Ref: COR/643/2009

12th June 2009

Dear Patsy,

Thank you for your letter of 10 May seeking evidence in relation to the Committee's Inquiry into Climate Change.

Please find outlined in the attached Memorandum a brief synopsis of how and to what extent each of the Public Service Agreements (PSA) for which the Department of Health, Social Services and Public Safety has responsibility contributes to Northern Ireland's emission reduction target as defined in PSA 22 – reduce greenhouse gas emissions by 25% below 1990 levels by 2025.

I hope you find this information helpful.

Regards,

Michael.

Michael McGimpsey MLA
Minister for Health, Social Services and Public Safety

MEMORANDUM

Committee for the Environment: Inquiry into Climate Change

Introduction

1. The following Memorandum is provided by the Department of Health, Social Services and Public Safety (DHSSPS) in response to Patsy McGlone's communication of 10 May 2009 seeking written evidence on the Committee's Inquiry into Climate Change.

2. A brief synopsis of how and to what extent each of the Public Service Agreements (PSA) for which the DHSSPS has responsibility, contributes to Northern Ireland's emission reduction target as defined in PSA 22 – reduce greenhouse gas emissions by 25% below 1990 levels by 2025.

Brief outline of the PSAs that the DHSSPS has sole or part responsibility

3. Of the total of 23 PSAs, the DHSSPS has either sole or part responsibility for delivery of ten PSAs and subsidiary Objectives. A brief synopsis of how and to what extent each of the PSAs contributes to PSA 22 is given in the following table:

PSA	Description	How the target contributes to emissions reduction	What extent the target contributes to emissions reduction
6 (2/3/&4)	Children & family	No direct or indirect contributions	N/a
7 (1,/2 & 3)	Making peoples lives better	No direct or indirect contributions	N/a
8 (1/2/3/4/&5)	Promoting health and addressing health inequalities	No direct or indirect contributions	N/a
10 (1)	Helping our children and young people to achieve through education	No direct or indirect contributions	N/a
12 (2)	Housing, Urban regeneration and community development	Replacing old and thermally inefficient premises with new highly insulated buildings	Providing joined up working to implement regeneration projects
16 (1/2 &3)	Investing in the health and education estates	Replacing old and thermally inefficient premises with new highly insulated buildings	Providing joined up working to implement regeneration projects

18 (1/2 & 3)	Deliver high quality health and social services	No direct or indirect contributions	N/a
20 (1/4 & 5)	Improving public services	Objective 1 includes implementation of Workplace 2010 and the upgrading of energy performance of DHSSPS office accommodation	Limited to DHSSPS accommodation on the Stormont Estate
21 (5)	Enabling efficient government	Health Estates Investment Group (HEIG) within the DHSSPS is a centre of Procurement expertise and as such has developed design briefs for Sustainable Design	All projects about the HSC Trust's delegation limit are required to apply the HEIG Sustainable development Design Brief
22 (4)	Protecting our environment	Indirect contribution through the monitor air quality indicators provided by DOE as part of the Investing For Health Strategy	Northern Ireland wide coverage

DHSSPS Policy Interventions that support PSA 22

4. The primary policy intervention within the Department of Health, Social Services and Public Safety which has an impact on reducing emissions is Health Technical Memorandum 07 – 02 *EnCO_2de - making energy work in healthcare* (2006).

5. EnCO_2de was issued to Health and Social Care organisations under cover of Professional Estates Letter (PEL) 06 08 on 31 May 2006. This PEL mandates the use of EnCO_2de by all HSC organisations.

6. The range of energy efficient options identified in EnCO_2de are: solar, wind, bio-fuels and ground linking. Of the bio- fuels, Biomass requires the following issues to be considered:

   - For most larger acute sites, resilience of heat supply is required, resulting in dual-fuel boilers being installed. The simplest way to provide dual-fuel is via an interchangeable or dual –fuel burner, the combination of fuels normally being natural gas and light fuel oil. However, there is potential to consider using alternative fuels such as biomass, particularly in areas where natural gas is not available.

   - Biomass includes: wood residues, forestry residues; recovered wood waste; straw; short-rotation crops (such as coppiced hazel); poultry litter and livestock slurry.

   - Continuity of supply is an issue, but many organisations are finding several potential suppliers in their area.

Use of renewable technologies in operation or planned that support PSA 22

7. The Northern (formally United Hospitals) Health and Social Care (HSC) Trust has installed a 660W kW Westas V47 wind turbine at the Antrim Area Hospital. This installation provides nearly 1.9 million units (kWh) of electricity per year, which equates to an annual energy saving electricity saving of more than £90,000. The turbine has an average saving of 1539 tonnes of carbon dioxide, 20.4 tonnes of sulphur dioxide and 5.1 tones of nitrous oxide per year.

8. The new Downe hospital under construction in Downpatrick is has a Biomass boiler system installed.

9. The new Hospital in the South West to the north of Enniskillen is planned to include a Biomass boiler system installed.

Investment in Energy Efficiency and CO_2 reducing measures to support PSA 22

10. Mid Ulster Hospital – conversion to low energy lighting.

11. Mater Hospital – Insulation valve covers on heating valves in boiler house.

12. Royal Victoria Hospital – Replacement of inefficient calorifiers with plate heat exchangers.

13. Altnagelvin Hospital – Installation of a 725KWE gas CHP (Combined Heat and Power) unit supplying two thirds of the electrical demand and the base heating load.

Contribution to Government target to reduce CO_2 Emissions by 30 % below 1990 levels by 2025

14. Latest available figures for 2006/07 show that the DHSSPS estate, excluding the Departmental occupied office buildings, has achieved a reduction of over 29% in carbon emissions (CO_2) against 1990 levels.

Further Policy Initiatives

15. The Climate Change Act has set a target of cut carbon emissions by at least 80% by 2050 with a minimum reduction of 26% by 2020 across the UK. In addition, the Committee on Climate Change (CCC) may recommend a higher target of 34% reductions by 2020 to ensure that climate change is contained.

16. The Northern Ireland Executive and the Assembly have signed up to the provisions of the Climate Change Act being extended to Northern Ireland and this includes the targets as set out by the CCC. The Northern Ireland Executive is currently working to reduce greenhouse gas emissions in Northern Ireland by 25% on 1990 levels by 2025 however the UK targets are more demanding should Northern Ireland have to make an equal contribution for the UK as a whole. The area of carbon reduction commitments (CRC) may also have significant impact on HSC funding.

17. Carbon management will therefore become an increasingly important issue for the Department and HSC & Public Safety organisations. We are therefore taking

the opportunity for 2009/2010 to refocus on a carbon reduction approach to sustainability, environmental issues and energy performance.

18. We are therefore proposing to commission a HSC & Public Safety Carbon Footprint to allow the development of a HSC & Public Safety Carbon Strategy. The Strategy will be underpinned by:

- The development of guidance and targets for Sustainable Operations on the HSC and Public Safety estates
- The development of biodiversity guidance for the HSC & Public Safety Estate
- To develop by March 2010 assessment guidance for DHSSPS policy makers to ensure that the principals of Sustainable Development are considered as part of the policy development process.

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From: Cathie White
Clerk to the Committee for the Office of the First Minister and deputy First Minister

Date: 16 June 2009

To: Alex McGarel
Clerk to the Committee for the Environment

Subject: Response to PFG PSA Commitments to Climate Change

At its meeting on 10 June 2009, the Committee for the Office of the First Minister and deputy First Minister agreed to forward the response from the Office of the First Minister and deputy First Minister to your letter of 10 May 2009.

Cathie White
Committee Clerk

Cathie White
Clerk
Committee for OFMDFM
Room 416
Parliament Buildings
BELFAST

BT4 3XX 02 June 2009

Dear Cathie

Re: Letter from Committee of the Environment in relation to PFG PSA Commitments and climate change

Thank you for your letter of 15 May regarding the above. Several of the actions and targets contained within those PSA's for which this Department has a lead responsibility contribute, or have the potential to contribute, towards Northern Ireland's emissions reduction targets. Specifically;

PSA 11: Driving Investment and Sustainable Development

- The Investment Strategy (ISNI) contains a commitment to build sustainability into each infrastructure project as comprehensively as possible – with a view to avoiding the creation of an 'energy intensive' society.
- Target 35 of the first Sustainable Development Implementation Plan was concerned with reducing Northern Ireland's greenhouse gas emissions and brought together commitments and targets from across government that would contribute to achieving this – it is our intention to build on this as we develop the new Sustainable Development Implementation Plan.

- Development of a Sustainable Consumption Action Plan for Northern Ireland - sustainable consumption is about ensuring efficient use of natural resources, including fossil fuels, and limiting our impact on the environment to that which can be sustained in the long-term, including reducing carbon emissions – we are continuing our work in this area.
- Within the new Sustainable Development Implementation Plan, we will progress delivery, where appropriate, of the key targets associated with strategic sustainable
- consumption and production objectives - these key targets are concerned with resource efficiency, sustainable procurement and consumption patterns. Taken together, the range of measures associated with these targets has the potential to effect a substantial reduction in Northern Ireland's greenhouse gas emissions.
- The Statutory Duty in relation to sustainable development requires relevant public authorities to act, in the exercise of their functions, in the manner they consider best calculated to promote the achievement of sustainable development in Northern Ireland.

PSA 21: Enabling Efficient Government

- Strategic procurement, managed through a centre for procurement expertise and carried out in line with sustainable development principles has the potential to deliver reductions in the greenhouse gas emissions associated with the functions of the Department, while contributing to the most economically advantageous outcomes.

The actions and objectives outlined above, will continue to form an important part of the ongoing sustainable development policy process. As we develop our new Sustainable Development Implementation Plan, we look forward to consulting with a wide range of stakeholders, to help refine these further, as part of the Executive's broader efforts to achieve our emissions reduction targets.

I hope that you find this information useful.

Yours sincerely

Signed Gail McKibbin

GAIL MCKIBBIN
Departmental Assembly Liaison Officer

DRD Response to Committee for Information on PSAs

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Your reference:
Our reference:

2 June 2009

Dear Roisin

DEPARTMENTAL CONTRIBUTION TO CLIMATE CHANGE TARGETS

Thank you for your letter of 15 May, following Alex McGarel's memo of 8 May to all Committee Clerks seeking information as to how and to what extent each of the Public Service Agreements (PSA) for which each Department has responsibility contributes to Northern Ireland's emission reduction target.

DRD has lead responsibility for two of the 23 PSAs set out in the Programme for Government as follows:

- PSA 13: Improving the Transport Infrastructure; and
- PSA 15: Water and Sewerage Infrastructure.

Annex A details our assessment of the extent to which these PSAs contribute to Northern Ireland's emission reduction target. More generally, in line with the cross cutting themes set out in the Programme for Government and DRD's commitment to ensuring that the principles of sustainability underpin all our activities, both PSAs aim to provide for the delivery of sustainable infrastructure that meets economic, social and environmental needs.

Yours sincerely,

ALAN DOHERTY
Assembly Liaison Officer

ANNEX A

1. As part of its inquiry into climate change, the Committee for the Environment has requested that each department indicates on how and to what extent each of the Public Service Agreements (PSA) for which it has responsibility, contribute to Northern Ireland's emission reduction target.

2. DRD has lead responsibility for two of the 23 PSAs set out in the Programme for Government as follows:

   - PSA 13: Improving the Transport Infrastructure; and
   - PSA 15: Water and Sewerage Infrastructure

3. An assessment of the extent to which these PSAs contribute to Northern Ireland's emission reduction target is set out below. More generally, in line with the cross-cutting themes set out in the Programme for Government and DRD's commitment to ensuring that the principles of sustainability underpin all our activities, both PSAs aim to provide for the delivery of sustainable infrastructure that meets economic, social and environmental needs.

PSA 13: Improving the Transport Infrastructure

4. The objective of PSA 13 is to *maintain and develop the public road and rail network and improve public transport provision to deliver a modern, efficient and* ***sustainable transportation system*** *that facilitates economic growth and social progress across the region.*

5. In pursuit of that objective, PSA 13 sets out a range of targets with regard to investment in roads infrastructure and public transport which are of direct relevance to the climate change target.

6. The investment in the road network set out under PSA 13 addresses both the enhancement of the Strategic Road Network and the maintenance of the existing road infrastructure. Although significant, the programme of investment in our roads is essential to ensure the safety and reliability of the network while addressing a

legacy of under-investment in order to meet social and economic needs across the region.

7. Not withstanding the need for increased investment in our roads infrastructure, the department recognises the real need to reduce greenhouse gas emissions across the transport sector to meet the challenge of climate change. As part of the solution, alongside investment to reduce journey times, the PSA sets out a significant level of investment in public transport, including the Belfast Rapid Transit Project. The planned investment in buses, trains and facilities aims to promote increased utilisation of public transport and reduced dependency on the private car, thereby contributing to the climate change target. To facilitate progress in this area, the department will also continue to promote behavioural change and more sustainable modes of travel. In addition, Roads Service will aim to ensure that sustainability and the minimization of environmental impacts are central to the delivery of all roads infrastructure projects.

8. While DoE is the lead department for PSA 22 and the PfG emissions target, DRD is fully committed to ensuring that it contributes as far as possible to facilitating a reduction in greenhouse gas emissions. It is clear that realisation of the Executive's climate change target will require action on transport emissions. In the context of facilitating economic growth and social progress in line with the wider Programme for Government priorities, this is likely to prove highly challenging. The department is therefore, in the process of establishing a new Sustainable Transport Policy Division to assist in the development of sustainable transport arrangements. The immediate priority for the Division will be to establish the baseline greenhouse gas emissions from transport and the scale of the challenge if emissions are to be reduced. The Division will also aim to contribute to the identification and consideration of options on the way forward. The outcome of that work will inform the review of the Regional Transportation Strategy now underway.

PSA 15: Water and Sewerage Infrastructure

9. The objective of the PSA is to *contribute to the health and well being of the community and the protection of the environment by developing and maintaining a*

policy and regulatory environment which provide modern, high quality water and sewerage services.

10. The delivery of the PSA and the realisation of higher standards is likely to have a positive environmental impact more generally. However, the water industry is very energy demanding and the establishment of higher standards has the potential to increase energy consumption levels. In light of that, NI Water are measuring and managing their energy use and greenhouse gas emissions through environmental management systems. NI Water has set targets to reduce energy consumption levels and to source 8% of green energy by 2008. That target has been exceeded and NI Water is now looking at the options available to produce more energy in house through use of hydro and wind turbines. It is also conducting pilot studies on the viability of using bio-fuels in fleet operations.

DETI ACTIVITIES RELATING TO IMPROVING ENERGY COMPETIVENESS AND SECURITY OF SUPPLY AND ENHANCING SUSTAINABILITY

Energy Efficiency

- DETI has recently provided funding to extend the Department of Energy and Climate Change (DECC) work on low carbon solutions for households and communities to Northern Ireland. This is a programme of research to determine how Government can deliver policy measures that will encourage uptake by householders and communities. The emerging findings from this work (called The Big Energy Shift) will be launched shortly.

Demand Side Management

- DETI is engaged with its counterpart DCENR on a demand side management study that is examining the effect of aggressively managing electricity demand in the context of the work to develop the two grid networks. Managing demand as an energy efficiency measure could make a significant contribution to addressing climate change.

Smart Metering

- DETI recently launched a consultation on more effective billing and metering and smart metering. This will allow DETI to develop a policy position in relation to smart metering over the next ten years. The consultation closed on 19th May.

Awareness Raising of Sustainable Energy

- DETI continues to provide funding for Action Renewables to provide free technical advice to householders and communities on renewable energy technologies and offer a signposting service to the Low Carbon Building Programme, which offers grant support until 2011 to domestic households in Northern Ireland for the installation of renewable energy technologies.

Co-ordination / Cross Departmental Working

- DETI recently established a Sustainable Energy Inter-departmental Working Group, chaired by the Minister, which will ensure that sustainable energy issues are dealt with strategically across NI departments. A key challenge for this group will be to develop actions and structures that will effectively deliver an improved Northern Ireland solution to key sustainable energy issues.

Large Scale Renewables

- NI proposals to develop Offshore Wind and Marine Renewables in NI waters is currently the subject of a Strategic Environmental Assessment;
- A NI cross-departmental bioenergy action plan is planned to issue for consultation this summer.

Renewable Heat

- Work is due to start this year on a Renewable Heat strategy, target and support system. Energy used for heat accounts for around 50% of carbon emissions in the UK.

Micro generation

- From July 2006-March 2008, DETI provided £10.8million of funding for the Reconnect programme to allow householders to install micro-renewable technologies. This resulted in displacement of 54.4 MW of fossil fuel generated electricity and heat (54.2 MW heat and 2 MW electricity displaced) which resulted in a CO_2 saving of 21,074 tonnes per annum.

Gas

- DETI is undertaking a study into the possible expansion of the gas industry to West and North-West of NI. Natural gas is the least polluting fossil fuel, and there are clear environmental benefits in replacing oil as the primary energy source.

Electricity

- Reinforcement and upgrading of the electricity transmission and distribution networks to support the generation of electricity from renewable sources, primarily wind. This will make a significant impact on Northern Ireland's ability to meet future renewable targets and the EU 2020 climate change targets.

Response from Stop Climate Chaos NI

Further Information to the Environment Committee Inquiry into Climate Change

The Stop Climate Chaos Northern Ireland (SCC NI) coalition would like to supply the Committee with the following information as supplementary to the presentation made on 28 May.

1. Northern Ireland's Emissions

During questions from members, the Coalition quoted two figures (22.46 and 16.3 million tonnes) as the most recent emissions totals for Northern Ireland. We were asked to clarify why two figures were quoted.

Both the figures quoted are official and accurate, however they do relate to different aspects of Northern Ireland's emissions. The first figure (22.46 million tonnes) relates to total greenhouse gas emissions (this includes carbon dioxide, methane, nitrous oxide, etc expressed in tonnes of carbon dioxide equivalent), while the second figure (16.3 million tonnes) is for carbon dioxide emissions only (both figures were calculated by AEA Technology, for DEFRA and the Devolved Administrations – see pages 24 and 25 of DOENI's Environmental Statistics Report). As is standard practice, the 'carbon footprint' figure quoted in our original submission (12.83 tonnes per capita) was calculated by dividing the total greenhouse gas emissions (22.46 million tonnes) by total population (estimated at 1.75 million).

While both figures are of interest (the Northern Ireland Sustainable Development Strategy set separate targets for reductions of greenhouse gases emissions and for reductions of carbon dioxide emissions), the Coalition believes that the total greenhouse gas figure is the most important. The Coalition is calling on the Northern Ireland Assembly to set a legally binding target to reduce total greenhouse gas emissions in Northern Ireland by 80% by 2050, with an interim target to reduce greenhouse gas emissions by at least 34% by 2020. These targets are adopted by the UK Climate Change Act but do not specifically apply to Northern Ireland.

2. Measures Identified by the Committee on Climate Change for Northern Ireland

The Committee on Climate Change's first report, released in December 2008, includes an analysis of what opportunities exist for making emission reductions in Northern Ireland. It states Northern Ireland could contribute emissions reductions of over 2MtCO2e (Million tonnes of carbon dioxide equivalent) in 2020:

- Emissions from buildings and industry could be reduced by up to 1 MTCO2 in 2020 by using energy more efficiently;
- More efficient vehicles and new transport fuels could deliver reductions of up to 1 MTCO2 in 2020;
- Emissions from agriculture, land use and forestry and waste management sectors could be reduced by up to 0.5 MtCO2e in 2020.

Members of the Environment Committee correctly identified that 2MtCO2e reductions represents less than 10% of Northern Ireland's emissions; a figure which is pitifully short of the 34% reduction target set for the UK as a whole for 2020 and also the Programme for Government target of 25% reductions by 2025. The Environment Committee then asked the Coalition to identify the measures that should be introduced to achieve additional reductions in emissions. The Coalition believes that first and foremost Northern Ireland should request the Committee on Climate Change to conduct further analysis of how Northern Ireland should best achieve a 34% reduction by 2020.

It should be noted that the Committee on Climate Change acknowledged in their report the limitations of the methodology used to estimate Northern Ireland's contribution. For example, when considering the reductions that could be achieved by direct and indirect abatement in buildings it is noted that the methodology 'does not account for national differences in key aspects related to fuel use and energy efficiency of existing buildings which will impact on emissions reduction potential'. It is also noted that 'further work would be required before these [estimates] could form part of national emissions reduction strategies or national carbon budgets'.

The Committee on Climate Change's statutory duties include:

To provide advice on the sectors of the economy in which there are particular opportunities for contributions to be made towards meeting the budgets through reductions in emissions.

The Committee must, at the request of a national authority other than the Secretary of State, provide advice, analysis, information or other assistance to the authority in connection with any target, budget or similar requirement relating to emissions of greenhouse gas that has been adopted by the authority or to which the authority is otherwise subject.

(Climate Change Act Sections 34 (1d) and 38 (3)).

In effect this means that if the Assembly set a target the Committee on Climate Change can offer advice on how best to achieve it. The Coalition strongly recommends this course of action.

3. The Role of the OFMDFM Committee in Climate Change Targets

The Coalition believes that specific responsibilities to deliver the targets set in a Northern Ireland Climate Act and in the associated carbon budgets should be identified in public service agreements for each department. It would follow that each Committee would then have a role in scrutinising their department's performance.

The Coalition is also aware that climate change and energy related policies are controlled and scrutinized by many Departments and Committees. For example, OFMDFM is responsible for sustainable development, DFP for building regulations, DRD for transport policy and DARD for bioenergy policy. It may therefore be advantageous for Northern Ireland to adopt a governance model similar to the Department of Energy and Climate Change (DECC) in England and Wales, to ensure greater cohesion and facilitate better integration across the UK. The Committee associated with such a department would play a critical role in overseeing Northern Ireland's performance against climate change legislation.

Response from CNCC

Response to questions from Environment Committee further to CNCC's oral evidence 28th May

The Committee requested information on the amount of energy saved per wind turbine as opposed to the more conventional power stations, including the amount of carbon used in the production and installation of turbines and the payback time for turbines.

The amount of energy and/or emissions, especially Carbon Dioxide (CO2) saved per wind turbine depends on what it is the wind power displaces. For example, if you displaced 1 MW of electricity produced from burning coal with 1 MW of electricity produced from wind power that would, on

average, result in savings in terms of CO2 emissions of approximately 99%. This figure is based on an average (971g) of the BERR figures of 955 to 987 grammes of CO2/kWh for UK coal as compared to an average of 10.5 gCO2/kWh (range 9 to12gCO2/kWh) for onshore wind power. If the electricity produced from wind power displaced that produced from gas, the savings would be less, because gas has lower CO2 emissions than coal, as demonstrated by the fact that most of the emissions reduction achieved in NI in recent years was primarily due to gas replacing coal and oil as an energy source in our power stations.

However, there are a range of figures even for one fuel source because there are so many variables, for example, different plants vary according to

- their level of efficiency for the same fuel source
- the intrinsic variation in the quality/purity of the fuel sources e.g. the carbon content of coal
- the efficiency of the plant itself e.g. those with additional features such as filters or scrubbers such as flue gas desulphurisation units will tend to have lower efficiencies, as will older plants.

Taking the first point above in relation to the variability of plants using the same fuel source, Combined Cycle Gas Turbine (CCGT) plants, for example, are much more efficient than, the older, Open Cycle Gas Turbine (OCGT) plants. For example, at Ballylumford, the thermal efficiency of the CCGT is approximately 54% efficiency whereas, the older, OCGT operated at approximately 33% efficiency, see http://www.premier-power.co.uk/power-generation/ccgt-plant/ for more. Similarly, according to Coolkeeragh's own figures, the CCGT there operates at 55% efficiency as opposed to the 28% efficiency of the previous plant, see http://www.coolkeeraghesb.co.uk/press_news/press_releases/latest_article.htm

However, a gas powered Combined Heat and Power (CHP) plant, where the heat generated is also used, would have an even higher efficiency, of approximately 80% or more. CHP plants are much more efficient than 'conventional' plants, whatever the fuel. One CHP plant, Avedor, in Denmark operates at 95% efficiency. A CHP plant powered by renewable energy e.g. biomass would have yet lower emissions, because of the nature of the fuel (renewable rather than fossil).

If you look at other gases like sulphur oxides and/or nitrous oxides or a range of gases together, the picture becomes even more complicated. In short, the emissions vary from station to station, even with the same fuel source, so unless you have detailed information on the figures for one particular station, you will have to base your calculations on an average of emission savings or a range of savings. Further to that, I have given, in Table 1, a number of sources for the life cycle analysis (LCA) of emissions from various energy sources. The LCA figures include things like emissions arising from the construction of the power plant and so should give a better representation of the full impact of a particular power station.

According to the Irish Wind Energy Association, the energy payback time for a wind turbine is 3 to 5 months, see http://www.iwea.com/index.cfm/page/environmentalimpacts?#q62. This ties in with the figures from other bodies like the Danish Wind Energy Association who say 3 to 6 months. Furthermore, according to the British Wind Energy Association, "this compares favourably with coal or nuclear power stations, which deliver only a third of the total energy used in construction and fuel supply" see http://www.bwea.com/edu/calcs.html . According to "Can Nuclear Energy Reduce CO2 Emissions?", published in Australian Science July 2005, based upon the use of high grade uranium ores, nuclear power stations must operate for 7-10 years before generating their energy inputs, compared to 3-6 months for wind power. For low grade ores the energy inputs are so large that a nuclear power station emits more CO2 than an equivalent gas fired power station, see www.sustainabilitycentre.com.au/Nukes&CO2.pdf

According to most sources, lignite is far and away the dirtiest fuel evaluated, with emissions approaching 1400gCO2/kWh, (e.g. according to IPCC) which would make lignite between 2 and 3 times as polluting (in terms of CO2) as gas and roughly 140 times as polluting as wind power.

Table 1 Life Cycle Analysis (LCA) of different energy sources

	Lignite	Coal	Oil	Gas	Nuclear	PV	Wind	Hydro	Biomass	Source
	1100-1700g	950-1250	500-1200	470-780	2.8-24	43-73	8-30 onshore and 9-19 offshore	1-34	35-99	IAEA Weisser paper
	1075-1350	190 - 1050	600-750	400-450	Up to 75	Up to 100	Up to 25			IPCC
		955-987	818	446		154-178	9-12	5-32		BERR
		955-987	818	430		98-167	7-9	3.6-11.6	17-27	Internat. Energy Agency
Energy payback time, months					94-120	36-48	3-5 onshore 6-8 offshore			

Sources

IAEA Weisser A guide to life-cycle greenhouse gas (GHG) emissions from electric supply technologies www.iaea.org/OurWork/ST/NE/Pess/assets/GHG_manuscript_pre-print_versionDanielWeisser.pdf

IPCC AR4 Working Group 3 report Mitigation of Climate change Chapter 4 Energy Supply

http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-chapter4.pdf .

Approximate figures based upon graph, page 283.

BERR – DTI New and Renewable Energy Prospects for the 21st Century Supporting Analysis P213 http://energytech.at/(en)/allgemein/results/id550.html

IEA – Benign Energy? The Environmental Implications of Renewables www.iea.org/textbase/nppdf/free/1990/benign1998.pdf

Nuclear

As regards nuclear power, taking a life cycle analysis it is clearly not zero carbon, as the UK Government admitted, in the Energy White Paper consultation of 2007 (p188, para 42). As regards the life cycle emissions on nuclear, in a paper in Nature “Nuclear Energy assessing the emissions" see http://www.nature.com/climate/2008/0810/full/climate.2008.99.html, an evaluation of over LCA 100 analyses of nuclear which had a range of 1.4 to 288g CO2eq/kWhe led the author to conclude that a mean value of 66g CO2eq/kWhe was reasonable.

The OKO Institute of Applied Ecology report “Comparing Greenhouse Gas Emissions and Abatement Costs of Nuclear and Alternative Energy Options from a Life-Cycle perspective" attributes nuclear power plants in Germany with 34 g/CO2 per kWh. Other studies have come up

with higher figures of between 30 to 60 g/CO2 per kWh. Some sources have much higher estimates e.g. of up to 73 to 230g CO2 per kWh. The OKO report also says on page 6

“The net CO2 emissions of electricity from small scale gas-fired power cogeneration plants are lower than CO2 emissions of electricity produced in nuclear power plants."

It is worth pointing out the government’s own advisors, the Sustainable Development Commission have argued against the use of nuclear. The SDC report “Is nuclear the answer?" (2006) said on page 22

“OUR ADVICE TO THE GOVERNMENT IS THAT THERE IS NO JUSTIFICATION FOR BRINGING FORWARD PLANS FOR A NEW NUCLEAR POWER PROGRAMME AT THIS TIME, AND THAT ANY SUCH PROPOSAL WOULD BE INCOMPATIBLE WITH ITS OWN SUSTAINABLE DEVELOPMENT STRATEGY"

M Campbell June 2008

Carbon in the Vegetation and Soils of Northern Ireland

CARBON IN THE VEGETATION AND SOILS OF NORTHERN IRELAND

M.M. Cruickshank, R.W. Tomlinson, P.M. Devine and R. Milne

ABSTRACT

The amount of carbon stored in vegetation and soils (including peat) in Northern Ireland has been estimated and the distributions mapped on a 1km × 1km grid as part of a national inventory. This was funded by Government to help meet some of its commitments under the UN Framework Convention on Climate Change. Knowing the sizes of the carbon stores (reservoirs) and the factors influencing them will help in developing policies to protect and enhance them as a contribution to the amelioration of global warming. To calculate these carbon stores, the area and carbon density of each vegetation and soil type were required. Similar data sources and methods were used to those in complementary inventories in Great Britain, but modifications were required in Northern Ireland, including the use of CORINE land cover (classification and maps) and the development of a soil carbon database. The total amount of carbon stored is estimated to be 4.4Mt in vegetation (5.1Mt, allowing for forests underestimated by CORINE) and 386Mt in soils. Forests account for 55% of the carbon in vegetation, and peat for 42% of that in soils—a product of their relatively high carbon densities.

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INTRODUCTION

Under the UN Framework Convention on Climate Change, the United Kingdom (UK) government is committed to adopting policies and taking measures to protect and enhance reservoirs of greenhouse gases. The project reported in this paper was part of a UK inventory of carbon stored in vegetation and soils and of the fluxes of carbon between them and the atmosphere. Inventories were started in Great Britain (GB) in the early 1990s and were extended to Northern Ireland (NI) in 1994. For the NI data to be an acceptable part of the national inventory, it was essential to use a methodology comparable with that used in GB, but changes were necessitated by different data sources, vegetation and soil types. Basic requirements were to know the extent of, and obtain a carbon density for, each vegetation and soil type. The NI carbon stores for 1990 were calculated by summing the products of the total area and carbon density for each vegetation/soil type. Carbon distributions were mapped on a 1km × 1km grid. The work was contracted by the Department of Environment (UK) through the Natural Environment Research Council.

MATERIALS AND METHODS

VEGETATION CARBON

Vegetation cover was taken from the CORINE (Co-ordination of Information on the Environment) land-cover map of Ireland (O'Sullivan 1994), which was based on the methodology and classification of the European Union (European Union 1992). The study in GB also had used a satellite-based land-cover map, but one developed from the 1990 Countryside Survey (Barr *et al.* 1993). Although that used a different classification, links to CORINE classes have been recognised (Wyatt *et al.* 1994). The CORINE database provided the area of each land-cover class in NI, for which a carbon density was then estimated.

CORINE land cover

The CORINE map was based on visual interpretation of LANDSAT TM images of May 1990 and is held as a database in ARC/INFO (GIS). Land cover is shown in polygons at level 3 of the CORINE classification, although in Ireland peat bogs and pastures were subdivided to level 4 (Table 1). Carbon in lakes and rivers was omitted in the GB carbon inventory and that approach was continued in NI (that is, class 5 was not used, nor was class 4.2.3, intertidal flats). Following the CORINE methodology, the minimum polygon size mapped was 25ha, so that polygons of 'pure' classes contain patches of other cover types. For example, a polygon of arable land (2.1.1) can include scattered fields of pasture (2.3.1), provided that their total extent does not exceed the percent-

age defining the mixed arable–pasture class (2.4.2). Other 'pure' classes include more than one cover type—suburban areas (1.1.2) with trees, grass and built surfaces are an example. These presented similar problems to classes that are mixed by definition, such as 2.4.1, 2.4.2 and 2.4.3. In general the lack of mixed semi-natural vegetation classes in CORINE means that those classes may be even less pure than the agriculture classes. All these aspects of definitions were considered in devising carbon densities for CORINE classes.

Carbon densities for cover types

To obtain carbon densities for all the CORINE classes, several complementary solutions were required. Work on carbon sequestration by forests (Cannell *et al.* 1996) had revealed a different species and age structure in NI from that in GB, so carbon densities for forests were calculated using

Table 1—CORINE classification: land-cover classes (Ireland) used for the carbon inventory.

Level 1	*Level 2*	*Level 3*
1. Artificial surfaces	1.1 Urban fabric	1.1.1 Continuous urban fabric
		1.1.2 Discontinuous urban fabric
	1.2 Industrial, commercial and transport units	1.2.1 Industrial or commercial units
		1.2.2 Road and rail networks and associated land
		1.2.3 Sea ports
		1.2.4 Airport
	1.3 Mines, dumps and construction sites	1.3.1 Mineral extraction site
		1.3.2 Dump
	1.4 Artificial non-agricultural vegetated areas	1.4.1 Green urban areas
		1.4.2 Sport and leisure facilities
2. Agricultural areas	2.1 Arable land	2.1.1 Non irrigated arable land
	2.3 Pastures	2.3.1 Pastures[a]
	2.4 Heterogeneous agricultural areas	2.4.1 Annual crops associated with permanent crops
		2.4.2 Complex cultivation patterns
		2.4.3 Land principally occupied by agriculture, with significant areas of natural vegetation
3. Forest and semi-natural areas	3.1 Forests	3.1.1 Broad-leaved forest
		3.1.2 Coniferous forest
		3.1.3 Mixed forest
	3.2 Scrub and/or herbaceous vegetation associations	3.2.1 Natural grassland
		3.2.2 Moors and heathlands
		3.2.4 Transitional woodland-scrub
	3.3 Open spaces with little or no vegetation	3.3.1 Beaches, dunes, sand
		3.3.2 Bare rocks
		3.3.3 Sparsely vegetated areas
		3.3.4 Burnt areas
4. Wetlands	4.1 Inland wetlands	4.1.1 Inland marshes
		4.1.2 Peat bogs[b]
	4.2 Coastal wetlands	4.2.1 Salt marshes
		4.2.3 Intertidal flats

[a] Level 4: polygons of pasture (2.3.1) were subdivided, on image evidence, into 2.3.1.1 where > 75% was good pasture, 2.3.1.2 where > 75% was poor pasture and 2.3.1.3 was a mix of good and poor pasture.
[b] Level 4: peat bogs (4.1.2) were subdivided, on image evidence, into 4.1.2.1 not exploited and 4.1.2.2 exploited (no vegetation cover, owing to surface peat stripping).

local volume and area data. Similarly, carbon densities for agricultural crops can be calculated from yield data published annually by the Department of Agriculture for Northern Ireland (DANI). Therefore carbon densities for some 'pure' CORINE classes were specific to NI, and for mixed classes involving these a weighted average carbon density could be based on evidence of the proportions of the component 'pure' types. For the remaining CORINE classes, links with GB classes allowed the carbon density used there to be applied.

Carbon densities for forests were calculated from volume and area data and factors for converting volume into carbon, which vary by species and age (Milne and Brown 1997). Calculations were based on conifers in the state sector (because most are found there) and broadleaves in the private sector (for the same reason). Data on conifers were supplied by the Forest Service (DANI) for the areas in the 1993 forest estate of six major species or species groups divided into 10-year age bands. The first step was to calculate an age-weighted average carbon density for each species or group and thence the average for all conifer forests weighted by the relative areas of the species; this produced a value of 34t C ha^{-1} (Table 2a). Details of the method used have been outlined by Milne and Brown (1997).

The carbon density for broadleaves was derived similarly to that for conifers, except that more sources of data had to be combined. A private woodland inventory between 1975 and 1979 provided volume and area tables for major species in age groups as the starting point (Graham 1981) and was complemented by additional evidence of the changing extent of broadleaves up to 1993. Firstly, the total area of grant-aided private planting in each year since 1979 was obtained from Annual Reports of the Forest Service and it was assumed that little had been planted without grants. Secondly, the Forest Service estimated the likely percentage of broadleaves, but volume data were not available. Thirdly, evidence was found of the rate of forest loss on farms in recent years (Guyer and Edwards 1988). In the calculation, allowance was made also for continued carbon sequestration by the trees planted before 1979.

These various sources were combined to calculate an average carbon density for broadleaved forest in 1993 of 62.3t C ha^{-1}. For broadleaves (Table 2b), only the equivalent of the last row for conifers (Table 2a) is given; species and trees >50 years were combined. The calculation for broadleaves was more complex, as several data sources had to be used, but also more generalised, owing to limitations in the data. (1) The Private Woodland Inventory took place over 5 years and included volume and area data for species planted in (a) 5-year age bands back to 1930, (b) between 1900 and 1929 and (c) before 1900. (2) In the Inventory the minimum area for survey was 5ha. (3) Volume (m^3) and area (ha) were generalised in the published Inventory Report, as were factors for converting volume into carbon (Milne and Brown

Table 2a—Estimated carbon densities of coniferous forests in Northern Ireland in 1993 (t ha^{-1}).

Age (years)	*1–13*	*14–23*	*24–33*	*34–43*	*44–53*	*54–63*	*64–73*	*>73*	*Net*
Species									
All pines	8.7	17.4	26.1	34.3	47.9	63.9	69.6	83.6	26
All larches	10.9	19.1	40	54.2	55.8	59.7	73.4	57.7	38
Douglas fir	23.4	40.9	70.1	79.9	137.8	146	195.4	—	87.1
Norway spruce	8.1	14.1	43	62.2	73.4	81.1	107.8	76.7	48.7
Sitka spruce	7.6	13.3	43.3	61.9	84.6	91.6	97.2	49.6	31.8
Other conifers	12	21	53.8	67.6	92.8	102.9	111.6	52.4	59.9
All conifers	8.1	14.2	42.6	56.7	75.7	83.2	106.6	62.4	34

For each species/group the average (net) carbon density is weighted by the area in each age class. Similarly, the overall average (34) is weighted by the area in each group.

Table 2b—Estimated carbon densities of broadleaved forests in Northern Ireland in 1993 (t ha^{-1}).

Age (years)	*1–10*	*11–20*	*21–30*	*31–40*	*41–50*	*>50*	*Net*
All species	1.6	12.5	28.5	39.2	46.5	113.2	62.3

Owing to limitations in the data, all species and all trees >50 years were grouped together.

1997). (4) Further generalisation was apparent in data for woodland losses and post-Inventory planting. It was decided, because of these factors, to base the calculation of average carbon density for broadleaves on all species together and to combine the two oldest age classes in the Inventory, that is, all trees over 50 years were grouped together.

The carbon density for mixed forests, in the absence of evidence on the proportion of conifers and broadleaves, was taken as the mean carbon density for forests of these two types (48.2t C ha^{-1}). Trees in hedgerows (mainly broadleaves) were excluded, as in the GB carbon research. With a generally smaller field size in NI, a larger proportion of trees was thereby omitted, but a sample estimate of carbon in hedgerows in NI suggested that this omission would not significantly affect the overall carbon total.

Carbon densities for the main arable crops and orchards were based on yield and area data published annually by DANI using the method applied by Adger and Subak (1996) to GB. Mean yields and areas for 1989–93 were used rather than for 1990 alone because that year was noted to have been slightly exceptional. The area-weighted average carbon density for arable crops was calculated to be 1.8t C ha^{-1} (Table 3). The carbon density for orchards (13.5t C ha^{-1}) was applied to discontinuous orchards in CORINE class 2.4.1 (see below).

The agricultural statistics provide only some of the data needed to calculate a carbon density for improved grass (mainly in CORINE class 2.3.1, pasture), which accounts for about 78% of the agricultural area. Yields are published for hay and silage, but such grassland is also grazed for part of the year, and yields are not published for the much larger proportion of grassland that is only grazed. Additional data were supplied by the Agricultural Institute of Northern Ireland: length of the growing season, duration of grazing, standing crop estimates at different times of the year, and conversions to dry matter and to percentage carbon. With these data, average carbon densities were calculated for silage, hay and grazed-only grassland. These were applied to the published areas of the three grassland types to derive a weighted average carbon density for all improved grassland of 0.89t C ha^{-1}, which was rounded to 1t C ha^{-1}.

Some CORINE classes in NI, without local evidence of carbon density, were linked to equivalent classes in GB, and the carbon density used there was applied. This approach was followed for all classes with little or no vegetation cover; a carbon density of 0t C ha^{-1} was used for built-over urban classes, some semi-natural classes with sparse or no vegetation and exploited peat bogs. In GB a carbon density of 1.5t C ha^{-1} had been used for unimproved grass by Milne (1994), who recognised that it would be likely to contain more carbon than improved grass. This density was applied to upland grassland and sand dunes (CORINE classes 3.2.1 and 3.3.1). As heaths and moors (3.2.2) and peat bogs, fens and salt marshes (4.1.1, 4.1.2.1 and 4.2.1) may include small shrubs as well as non-woody species, the higher carbon density of 2.0t C ha^{-1} used in GB was also applied in NI. These generalised carbon densities could be improved if local evidence becomes available.

CORINE classes that include two or more cover types with different carbon densities required evidence of the proportions of the component types. For example, the varying proportions of built-over surfaces, grass and trees in suburban areas (1.1.2) were estimated by analysis of aerial photographs (1:3000) and topographic maps (1:2500) for sample areas in Belfast. In this, the largest urban area, the sources were readily available and the samples could include a representative variety of the suburban area. The surface cover (built-over, grass, trees) was recorded for intersections on a 1cm × 1cm grid and the percentage of all intersections that fell on each of these surfaces was calculated. The percentages were combined with carbon densities already found for the three component types to calculate a weighted carbon density for class 1.1.2 of 3.5t C ha^{-1}. A carbon density for public parks and golf courses (1.4.2), a large area of which occurs in the Lagan Valley close to Belfast (Fig. 1), was derived similarly, supported by evidence from tree surveys (Tomlinson 1988). The weighted carbon density of 12t C ha^{-1} calculated for this class in the Lagan Valley was applied to all such areas in NI. Airports (1.2.4) comprise built surfaces (0t C ha^{-1}) and grass (1t C ha^{-1}). Examination of the satellite images indicated that each of these surface types accounted for about half of the area, so a carbon density of 0.5t C ha^{-1} was applied.

Weighted averages were also required for mixed agricultural classes. CORINE class 2.4.2 was used in Ireland for a mix of arable and grass, with grass between 25% and 75% of the area (O'Sullivan 1994). It was assumed that on average there was 50% of each, so the mean carbon density between these cover types was applied (1.4t C ha^{-1}). The same solution was used for class 3.2.4, which involves a mix of trees with grass. The trees were given the calculated carbon density (36t C ha^{-1}) for sycamore/ash/birch (based on the Private Woodland Inventory, used for broadleaved forests) and the grass was given a carbon density of 1t C ha^{-1}, leading to an average for the class of 18.5t C ha^{-1}. Two other mixed classes required evidence of the proportions of cover types with already estimated carbon densities. Class 2.4.1 was used for orchards scattered amongst grass fields in one large area of County Armagh. The percentage extent of orchards was found from topographic

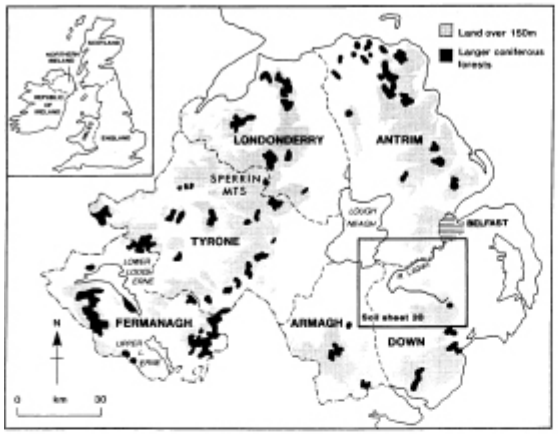

Fig. 1—Location map.

maps of 1975 and then reduced for 1990 on evidence from published agriculture statistics of the decline in orchards. This allowed the calculated carbon densities for orchards (13.5t C ha^{-1}) and grass (1t C ha^{-1}) to be combined in an area-weighted value (3t C ha^{-1}). The extensive class 2.4.3, 'agriculture but with significant areas of natural vegetation', presented a greater problem because both the component vegetation types and their proportions varied widely. A stratified sample from across NI of twelve grid squares (10km × 10km) containing large and small polygons of 2.4.3 was examined on the satellite images and the component cover types noted. The most common mixtures were pasture with natural grassland and natural grassland with bog and pasture, which led to the choice of a carbon density of 2t C ha^{-1} to reflect the dominant cover-type mix.

The carbon densities for all the CORINE classes are listed with the carbon results in Table 5.

SOIL CARBON

The basic requirements, as for vegetation, were the extent of each soil type and its carbon density. The methodology used in GB was again modified to take account of differences in available data sources, soil types and cover. In GB a 1km × 1km database of dominant soil types had been available, but while a Soil Survey by DANI was well advanced and maps were being published, no NI database was available at the date of the carbon inventory. It was therefore necessary to identify dominant soils in 1km × 1km grid squares from the 1:50,000 soil maps to initiate a database for NI.

Property data for major soil types, from which carbon densities could be calculated, were supplied by the Soil Survey, which also assisted in estimating carbon densities for minority soil types on a 'nearest relation' basis. However, the carbon content of a given soil type depends partly on the vegetation or other cover. The carbon densities for soils under grass could be calculated from property data because the Soil Survey did most of its soil analysis under this cover type; for soils under other cover types the scale of cover-related differences in England and Wales was applied. This required the dominant cover type to be interpreted for the dominant soil in each grid square from the CORINE images. Particular care was required in estimating the carbon density of peat and peaty soils. To assist in comparing the results with those from GB, the soil types in NI were placed in the

Table 3—Estimated carbon densities for arable crops (wheat, barley, oats and potatoes) and apples (cooking) 1989–93.

Crop	*Yield (t ha^{-1})*	*Residue/ product*	*Final biomass*	*Growth function*	*Days per year*	*Mean biomass (t ha^{-1})*	*% Dry matter*	*% Carbon*	*Carbon (t ha^{-1})*	*Area (ha)*
Wheat	6.55	1.3	15.1	0.6	270	6.7	83	48.5	2.7	6,140
Barley	4.28	1.2	9.4	0.6	270	4.2	83	45.7	1.6	37,960
Oats	4.45	1.3	10.2	0.6	270	4.5	83	46	1.7	2,520
Potatoes	30.78	0.4	43.1	0.6	160	11.3	45	42.3	2.2	10,200
Area-weighted mean carbon densities for arable crops = 1.8t ha^{-1}										
Apples	20.8	1.2	46.1	0.75	355	33.6	80	50	13.5	1,900
Carbon density for apple crop = 13.5t ha^{-1}										

Carbon density relates to the standing carbon stock. Yield per ha and area from Department of Agriculture (NI) annual statistics. All other factors as in Adger and Subak (1996).

groups of the Avery Classification used in England and Wales (Avery 1980). From these several sources and steps a soil carbon database for NI was developed that included seven variables: profile type, parent material, dominant cover type, peat depth, carbon density, Avery Soil Group and the grid reference of the south-west corner of the grid square.

Dominant soil types

The dominant soil type of each 1km × 1km grid square was read from the 1:50,000 soil maps as the profile–parent material combination (for example, brown earth on basalt till) and entered in a SIR (Scientific Information and Retrieval) database. When the soils of eastern Northern Ireland had been recorded it was realised that the diversity of both geology and topography produced intricate distributions of soils within some grid squares, which could lead to errors in identifying the dominant type. Therefore the dominant soils recorded for one soil map were checked against a computer extraction of soil types for grid squares supplied by the Soil Survey. Sheet 20, covering 1200km^2, was used, being the only sheet for which such data were available when required in the carbon study. The dominant soil had been incorrectly identified in less than 3% of grid squares and this occurred where two or more soils were nearly co-dominant. Subsequently, for the west systematic checks were made of relative areas in such squares by dividing the 1km × 1km squares into 100 cells. Soil Surveys conventionally do not map in urban and disturbed areas, but soil maps of these were available in NI through the HOST project (Higgins 1997).

Carbon densities from soil properties

Soil carbon density is calculated from three properties: bulk density, organic carbon content and depth. Except for peat, bulk density (g ml^{-1}) was field dry bulk density, and carbon content was percentage carbon by loss on ignition. These data were supplied by the DANI Soil Survey, together with depths for both the topsoil and subsoil where relevant (rankers have only topsoils). Carbon densities for soil types without property data, typically those in small areas, were estimated in discussion with the Soil Survey.

Cover-related differences in soil carbon

The carbon density of a given soil type varies in relation to cover, which was defined in broad groups: arable, permanent grass, semi-natural, trees, urban and other (Howard *et al.* 1995). In GB these groups were produced by combining the 58 land-cover types used in the ITE land classification (Barr *et al.* 1993) and they were available to the carbon study as dominant cover for the 1km × 1km squares, for which the dominant soil series was also available. Although links are recognised between the ITE and CORINE cover classes, the latter could not all be placed into the required broad groups because (as noted above) some CORINE classes are mixed and some 'pure classes' include more than one cover type. Also, intricate soil distributions in NI mean that many 1km × 1km grid squares contain several soil types, and it should not be assumed that the dominant soil in a grid square always coincides with the dominant vegetation group of that square. Therefore, the CORINE images at 1:100,000 were consulted alongside 1:50,000 soil maps to interpret the dominant cover for the part of the grid square with the dominant soil. Two cover groups were divided. Tree cover on peat or peaty soils was distinguished as forest, because that would be required for later work on fluxes (Cruickshank *et al.* 1996). (Trees colonising cut-over bogs were classed as 'trees'). Urban areas were divided into built-over urban and suburban. A soil carbon density of 0t C ha^{-1} was applied to built-over urban areas, whereas for suburban areas evidence of the proportions of cover types referred to above was generalised and half the carbon density for the same soil type under grass was applied.

In GB, soil carbon densities were available under different cover types, but in NI almost all soil property sampling was under grass. Therefore, the carbon density of soil under grass could be calculated from NI data. For soil under other cover types the carbon density under grass was amended using the ratio found in England and Wales between carbon density under grass and that under the other cover type. To obtain these ratios, mean carbon densities were calculated separately for all the soils under arable, grass and semi-natural vegetation (soils in urban and disturbed areas and peat were excluded). Arable soils in England and Wales had 84% of the carbon density of those under grass, whereas soils under semi-natural vegetation had 133% of the carbon density under grass. These ratios were applied to soils recorded under arable or semi-natural cover in NI. In GB, soils under tree cover were combined with those under semi-natural vegetation because few carbon densities were available under tree cover. This approach was continued in NI.

Peat and peaty soils

The extent of peatland in NI has been mapped previously (Hammond 1979; Cruickshank and Tomlinson 1990), but for the carbon inventory peat was recorded only in those grid squares where it was shown as dominant on the soil maps. Peat was recorded by the Soil Survey where the organic layer exceeded 0.5m; and where the organic layer was 0.5m or less, peaty soils were mapped. The soil maps do not distinguish peat depth, which was required at half-metre intervals for carbon density

(Table 4). The next deepest half-metre interval above 0.5m would be 1m, so that was taken as the minimum peat depth. Mean peat depth for each grid square was derived from evidence in post-graduate theses and surveys of peatland and peat extraction. Double (1954) provided many depth soundings for most of the thirty large peat areas he surveyed, from which a mean depth was calculated for the grid squares in which those bogs occurred. Theses involving pollen analysis and vegetation history yielded depths at point locations, which were used to extrapolate depths for adjacent grid squares (Goddard, A. 1971; Goddard, I.C. 1971; Francis 1987; and Hanna 1993). Elsewhere, the Northern Ireland Peatland Survey maps (Cruickshank and Tomlinson 1990) and a peat extraction survey (Cruickshank *et al.* 1995), together with field knowledge acquired during those surveys, were used to estimate peat depth to the nearest 0.5m.

Carbon densities for peat of different depths in GB were estimated by Milne and Brown (1997) using evidence of peat bulk density and carbon content from a Forest Authority peat survey in Scotland. That evidence was used by Milne and Brown to amend previous estimates of carbon density (kt km^{-2}) for different depths of blanket and basin peat by Howard *et al.* (1995).

In the absence of sufficient NI data for peat bulk density and percentage carbon, the estimates of blanket peat carbon densities related to depth as used by Milne and Browne (1997) in GB were applied to NI (Table 4). Additional depths were extrapolated from the rate of increase in carbon with depth observed in the GB figures. Estimating carbon densities for basin peat was more difficult. Milne and Brown (1997) do not give values to depths greater than 3m, whereas many basin bogs in Northern Ireland are much deeper (for this study all lowland raised bogs were included with basin bogs). To extend carbon values to greater depths, it was assumed that the rate of increase in carbon with depth was the same as for blanket peat

Table 4—Carbon densities for peat related to depth.

Total peat depth (m)	*Carbon density with S, F, T, N (t ha^{-1})*	*Carbon density with A, P (t ha^{-1})*
Blanket peat		
1.0	530	580 for all depths
1.5	830	
2.0	1130	
2.5	1470	
3.0	*1860*	
3.5	2250	
4.0	2630	
4.5	*3030*	
5.0	*3450*	
5.5	*3933*	
Basin peat		
1.0	357	286
1.5	607	500
2.0	857	714
2.5	1179	*2.5 967*
3.0	1500	*3.0 1200*
3.5	*1815*	
4.0	*2124*	
4.5	*2442*	
5.0	*2784*	
5.5	*3174*	
6.0	*3618*	
6.5	*4125*	
7.0	*4702*	
7.5	*5360*	

Carbon density at different depths as used by Milne and Brown (1997), with density at additional depths extrapolated for Northern Ireland in italics. Cover types: S, semi-natural; F, forest; T, trees; N, none; A, arable; P, pasture.

(Table 4). The soil maps do not differentiate between blanket and lowland peat, but that division was available from the Northern Ireland Peatland Survey maps. Cover was found from the satellite images as outlined earlier.

Carbon densities calculated for peaty soil types in NI from Soil Survey data presented problems, which were solved in discussion with the Soil Survey. Peaty soils have a well-defined surface organic layer, but less than 0.5m deep, and include humic rankers, podzols and peaty podzols, surface- and ground-water humic gleys and organic alluvium. The required property data were limited because the Soil Survey concentrated on agricultural land, and bulk density is difficult to determine in peaty soils. The carbon densities calculated for these soils under grass were high, and many of the records were under semi-natural vegetation, trees or forest. An increase of 133% over that for grass cover (as used for other mineral soils) would have yielded carbon densities higher than for 1m of peat in some cases; alternative extrapolations of carbon density were required. The image evidence for the cover of podzols and peaty podzols suggested that where there was grass it was usually of poor quality and almost semi-natural. Therefore, for these soils the carbon density under grass was used also under semi-natural (and tree) cover. Conversely, when semi-natural cover on ground- and surface-water humic gleys was examined on the satellite image it was often indistinguishable from the cover on adjacent peat but significantly different from grass on these soils. Therefore, 133% of the carbon density under grass was used, which yielded a value intermediate between that under grass for these soils and 1m of peat under semi-natural cover. Organic alluvium is known by the Soil Survey to be diverse, sometimes the residue from former peat cutting in valley floors, and the grass cover is often wet and rushy, approaching semi-natural. The listed carbon density for 1m of lowland peat under grass is only 286t C ha^{-1} (Table 4), which is lower than the carbon density calculated for many peaty soils under grass. From field knowledge and discussion with the Soil Survey it was decided to apply the carbon density for 1m of lowland peat under semi-natural vegetation to all organic alluvium, regardless of cover.

CARBON STORAGE MAPS

In GB the distribution of carbon stores had been mapped on a 1km × 1km grid so similar maps of NI were required. For vegetation carbon, the CORINE database (in ARC/INFO) was intersected with a 1km × 1km coverage of the Irish National Grid, and the area (ha) of each CORINE class was calculated for every square using ARC/INFO commands. These areas were multiplied by the relevant carbon densities to yield the total carbon store (t) for the grid square, which could then be divided by 100 to obtain a mean density (t C ha^{-1}) for each grid square. The densities obtained for the dominant soil types in 1km × 1km grid squares were downloaded into an ARC/INFO coverage to produce the soil carbon map. The carbon densities for grid squares on both maps were grouped into the same class ranges as used in GB.

RESULTS

VEGETATION AND SOIL CARBON STORES

Vegetation

The vegetation carbon store in NI is estimated to be 4.4Mt, which can be subdivided by CORINE classes (Table 5). The concentration of carbon in certain classes is explained by their carbon density rather than areal extent. Notably, 55% is in the three forest classes, which occupy only 5% of the land area, whereas the extensive improved grass (2.3.1, pasture) accounts for only 17% of the carbon store but 56% of the area. A comparison of Table 5 with the results for GB (Milne and Brown 1997) showed some contrasts in carbon storage by broad cover types. In NI over three times as much carbon is stored in agricultural vegetation (36% compared with 10% in GB), but forests account for less carbon (52%) than in GB (80%). However, semi-natural vegetation in NI stores a similar proportion of the carbon (11%) to that of GB (10%).

The importance of forests as carbon stores is clear, even though they were underestimated by the CORINE figures. The total area for the three main forest classes of CORINE is 63,348ha, and they contain 2.4Mt carbon (Table 5). However, Forest Service planting data (state sector), combined with data on the extent of private sector forests from various sources (as above), indicated a total area of 78,238ha for 1993. The CORINE underestimate may be explained partly by a difference in date, as the satellite images were scanned three years earlier in May 1990. However, there are two further explanations: firstly, young trees (less than *c.* 10 years old) were not sufficiently well grown to affect reflectance and were not apparent in image interpretation and, secondly, small patches of forests, which are common in the private sector, were missed because the minimum polygon size mapped was 25ha. The omitted forests would have been recorded in lower carbon density CORINE classes. The planting statistics show 14,890 more hectares of forests than CORINE, and while the age and species composition of these forests is unknown an estimate can be made of the possible additional carbon store. If it is assumed that they included

both conifers and broadleaves, of all ages, then the average carbon density for mixed forest (48.2t C ha^{-1}) could be multiplied by the missing area to estimate the carbon stored in those forests. The additional carbon could be about 0.7Mt, which would raise the estimate for total carbon stored in vegetation to 5.1Mt.

Soils

As for vegetation, the total carbon store can be estimated and subdivded by soil types (Table 6). The total amount, at 386Mt C, is between 76 and 88 times as much as in vegetation (depending on whether allowance is made for the forests missed by CORINE). That is a major difference, but a similarity exists in that for both soils and vegetation a large proportion of the carbon is held in a few types. Peat (classes 10.1 and 10.2 in Table 6) is only 15% by area but contains 42% of the carbon store. (This extent of peat exceeds the CORINE area for peat bogs (Table 5) because peat under forest and agricultural cover is in other CORINE classes.) Peaty soils account for a further 10%, again out of proportion to their extent (not all peaty soil types are evident in Table 6 because some are within larger groups such as podzols). The high proportion of carbon in these groups is explained by the relatively high carbon density of peat and of groups that include peaty soils (last column of Table 6). Another connection between vegetation and soils is that about 63% of forests are on peat or peaty soils. Even if only the carbon density of the thinnest peat is taken (530t C ha^{-1} for blanket and 357t C ha^{-1} for lowland), the peat contains many

Table 5—Vegetation carbon storage by CORINE classes.

CORINE class	*Area (1km × 1km)*	*Area (%)*	*Carbon (kt)*	*Carbon (%)*	*Carbon density (t ha^{-1})*
1.1.1	53	0	0	0	0
1.1.2	307	2	107	2	3.5
1.2.1	35	0	0	0	0
1.2.2	6	0	0	0	0
1.2.3	4	0	0	0	0
1.2.4	12	0	1	0	0.5
1.3.1	25	0	0	0	0
1.3.2	1	0	0	0	0
1.4.1	9	0	1	0	1
1.4.2	41	0	50	1	12
2.1.1	322	2	58	1	1.8
2.3.1	7,625	56	763	17	1
2.4.1	64	0	19	0	3
2.4.2	1,430	11	200	5	1.4
2.4.3	624	5	125	3	2
3.1.1	85	1	529	12	62.3
3.1.2	522	4	1,774	40	34
3.1.3	27	0	129	3	48.2
3.2.1	531	4	80	2	1.5
3.2.2	325	2	65	2	2
3.2.4	129	1	239	5	18.5
3.3.1	12	0	2	0	1.5
3.3.2	0	0	0	0	0
3.3.3	2	0	0	0	0
3.3.4	0	0	0	0	0
4.1.1	18	0	4	0	2
4.1.2.1	1,291	9	258	6	2
4.1.2.2	34	0	0	0	0
4.2.1	1	0	0	0	2
Total	13,535	100	4,404	100	

times more carbon than the (conifer) forest growing on it (34t C ha^{-1}).

CARBON STORAGE MAPS

The maps of vegetation and soil carbon stores show similarities in distribution and show also that the lower carbon density classes are the most extensive (Figs 2 and 3). The carbon densities for grid squares extend to much higher values than are apparent on the maps; for example, the maximum value for soil carbon is >5000t C ha^{-1} in the deepest lowland bogs. The top class for vegetation (Fig. 2) is accounted for by the larger forests and shows a western and northern distribution, for example in the Sperrin Mountains and Co. Fermanagh (Fig. 1). The lowest class dominates over much of the lowland, which corresponds with the 80% of NI in 'improved' land. Areas in the intermediate classes commonly contain some tree cover in small forests, and the belt around Belfast is explained by trees in parks and suburban large gardens. Similarly, the discontinuous orchards south of Lough Neagh raise the carbon density, and extensive blanket bogs in most of the uplands appear in the same class.

The highest soil carbon densities are for areas of deep peat and include some of the extensive upland blanket bogs (for example in north Antrim) and more patchy lowland bogs (Fig. 3). Thinner peat and peaty soils in the intermediate classes are mainly in the uplands. Elsewhere, carbon densities for mineral soils are generally low and follow a similar distribution to the lower classes on the vegetation map.

DISCUSSION

FIRST ESTIMATES OF VEGETATION AND SOIL CARBON STORAGE IN NORTHERN IRELAND

Inventories of carbon stored in vegetation and soils were achieved in the time-scale required, but these first estimates could be improved, notably if the carbon densities for some vegetation and soil types were based on more local empirical evidence.

Carbon densities for cover types

Trees have the highest carbon densities among vegetation and it was assumed, without local evidence, that the same forest carbon conversion factors would apply as did in GB. This potential error should be investigated further.

Table 6—Carbon storage by major soil groups and cover types. A = arable, P = improved grass, S = semi-natural, Su = suburban, N = no cover (urban and peat extraction). Forest (F) is used only on peat and peaty soils; on other soil types it is included under trees (T).

Avery Soil Code	*Area of soil groups, subdivided by land cover (km²)*							*Total*	*Carbon storage in soil groups, subdivided by land cover*							*Total*	
	A	*P*	*S*	*T*	*F*	*N*	*Su*	*km² (%)*	*A*	*P*	*S*	*T*	*F*	*Su*	*N*	*kt (%)*	*t ha⁻¹*
1.2 Raw alluvial soils	74	390	26	9		24	11	534 (4)	1,193	7,453	671	228		105		9,651 (3)	181
1.3 Raw skeletal soils		1	29					30									0
3.1 Rankers	21	469	581	42	29	4	12	1,158 (8)	245	6,591	15,051	788	785	76		23,527 (6)	203
3.2 Sank-ranken	2	17	38	1		3		61									0
4.1 Calcareous pelosols		4						4		78						78	195
5.1 Brown calcareous soils	1	3						4	10	46						57	142
5.4 Brown earths	135	1,292	31	20		8	51	1,537 (11)	1,945	21,989	702	452		423		25,512 (7)	166
5.5 Brown sands	55	356	3	4		8	67	493 (4)	960	7,401	83	111		697		9,252 (2)	188
5.6 Brown alluvial soils	1	4						5	13	61						74.1	148
6.1 Brown podzolic soils	2	379	23	6		1	7	418 (3)	35	5,981	473	135		45		6,669 (2)	160
6.3 Podzols		108	84	8	2			202 (1)		3,336	3,144	266	80			6,825 (2)	338
7.1 Stagnogley soils	260	6,022	253	166		29	172	6,902 (49)	3,309	101,686	5,813	3,697		1,494		115,999 (30)	168
7.2 Stagnohumic gley soils		122	324		127			573 (4)		3,725	13,918		5,461			23,103 (6)	403
8.2 Sandy gley soils	12	2	1				3	18	144	29	19			22		213	118
8.4 Argillic gley soils		7				1		8		134						134	168
8.5 Humic-alluvial gley soils	1	7			1			9	25	210			40			275	306
8.7 Humic gley soils		3	1	1				5		120	46	46				211	421
10.1 Raw peat soils	1	15	1,193		297	4		1,510 (11)	29	820	95,346		24,591		366	121,152 (31)	802
10.2 Earthy peat soils	3	182	277	40	40	7	5	554 (4)	93	6,194	28,615	3,305	3,987	89	698	42,982 (11)	776
Total	568	9,383	2,864	297	496	89	328	14,025	8,002	165,854	163,881	9,028	34,944	2,951	1,064	385,723	

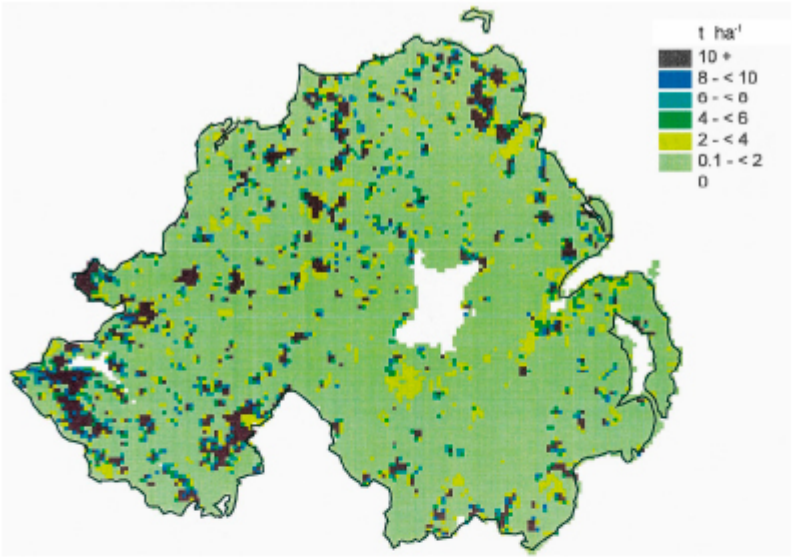

Fig. 2—Distribution of carbon stored in vegetation, based on average carbon density for 1km × 1km grid squares.

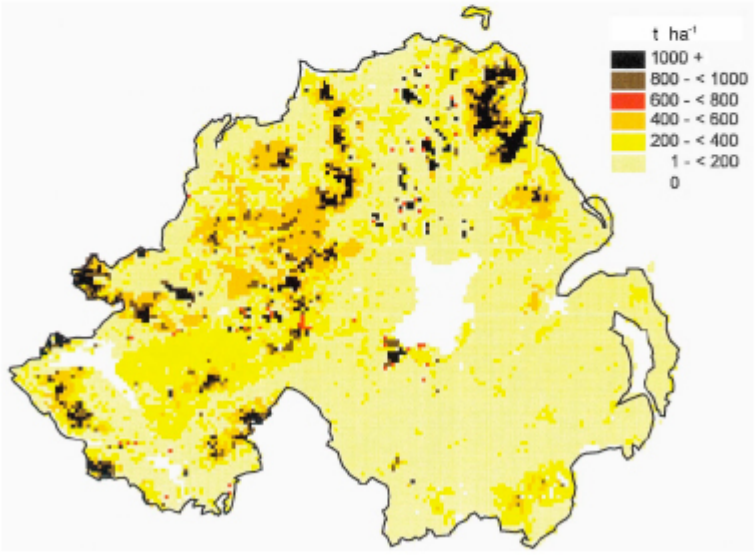

Fig. 3—Distribution of carbon stored in soils, based on average carbon density for 1km × 1km grid squares.

Whenever possible, carbon densities for vegetation types were based on local evidence, but for some cover types the densities used in GB were applied, that is, for the extensive peatlands, upland grass and heath. Carbon densities based on local field experiments are desirable.

Bulk density of peat and peaty soils

Peat and peaty soils account for over half the carbon stored in soils, but this study had to rely on bulk densities from GB for peat and estimates of bulk density for peaty soils. Small errors in both of these could significantly affect the total soil carbon store. Experience from the Northern Ireland Peatland Survey (Cruickshank and Tomlinson 1990) and an investigation of peat extraction (Cruickshank *et al.* 1995) indicated a considerable extent of draining and cutting of peat, a point made more generally about Irish peatland by Immirzi *et al.* (1992). These activities could have implications for bulk density and carbon at different depths. Therefore two experiments, one on a raised bog, the other on blanket bog, were carried out; in both cases the samples were taken approximately 0.5m from behind a vertical face left by peat cutting. Samples were taken at 0.5m intervals through the whole depth (blanket peat 1m deep and raised bog 3m deep). Although the results provided insufficient data on which to modify the peat carbon densities used in GB, the samples had slightly higher average bulk densities than were recorded there, which could be explained by drying due to peat cutting. The difference between raised/basin and blanket peat samples was less than in GB. Further work on peat bulk density and carbon content is required. The work of Galvin (1976) provides valuable data on bulk density of Irish peat, but carbon content is not included. More accurate information is required about variation in peat depth at the 1km × 1km grid square scale.

Cover-related contrasts in soil carbon density

Although cover differences were considered in calculating soil carbon storage, this was not based on local evidence. Soil under semi-natural vegetation in England and Wales generally contained about 33% more carbon than that under grass, and this ratio was also applied under trees, owing to the lack of alternative data. Evidence from paired sampling of the same soil type under different cover types is needed, not only to improve the soil inventory, but also because it is crucial to understanding the effects of changes in land cover on soil carbon storage. In the Republic of Ireland Little and Bolger (1995) reported contrasts in percentage organic carbon and bulk density between brown earths at three sites: with larch and ash, both approximately 40 years old, and grassland. Under the trees percentage organic carbon was higher in all horizons. Bulk density was higher under grass, being attributed to compaction by machinery and livestock. However, additional information about the thickness/depth of horizons than is in the report would be needed to calculate carbon density differences between the three sites.

APPLICATIONS OF THE INVENTORIES

Contrasts, similarities and connections between vegetation and soil carbon stores are clear. More carbon is stored in soils, which stresses their importance, but, while only a small amount of carbon is stored in vegetation, that is the pathway through which soil stores are increased or reduced. For example, it follows from the cover-related differences in soil carbon that if the vegetation is changed from grass to broadleaved forest more carbon will be sequestered from the atmosphere, because trees act as a carbon sink as they mature. In addition more carbon will be sequestered by the soils under the trees. Conversely, if forest is cleared and converted to grass, or grass is replaced by arable crops, the soil carbon store will be reduced because the conversion is to cover types with less soil carbon. This implies less carbon sequestration and possible emission to the atmosphere. Therefore, the inventories of carbon in vegetation and soils for the target year of 1990 are being followed by estimates of annual changes in carbon storage, some of which are related to cover change (Cruickshank *et al.* 1997).

CARBON STORAGE IN IRELAND

The methodology used in NI, even with modifications, was comparable with that used in GB. Similar modifications could allow carbon inventories to be extended to other countries with CORINE land cover, yield and area data for forests and agricultural crops, soil maps and property data. For example, the Republic of Ireland has many of these sources, and where gaps exist default methods (Intergovernmental Panel on Climate Change 1995) are available to achieve inventories of carbon stores. The objective of the IPCC is to encourage all countries to adopt land-use policies to protect and enhance sinks of carbon and other greenhouse gases in order to ameliorate global warming.

ACKNOWLEDGEMENTS

This research was funded under the UK Department of the Environment's Climate Change Programme (Contract no. EPG 1/1/3). The Department of Agriculture (NI) provided unpublished data and advice on: yields of hay,

silage and grazed grass; forest area and volume; and soil properties. In particular we thank Raymond Steen (Hillsborough Agricultural Research Institute), Pat Hunter-Blair and David Kirkpatrick (Forest Service), and James Cruickshank, Alex Higgins and Crawford Jordan (Agricultural and Environmental Science Division, which includes the Soil Survey of Northern Ireland). Without their assistance this project would have been impossible.

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Research Paper – Cross cutting scrutiny of climate change structures in Wales and the Republic of Ireland

Jeff Mochan, Research Officer
12 June 2009

The purpose of this note, prepared for the Committee for the Environment, is to outline the cross-cutting nature of the scrutiny roles of:

- The Sustainability Committee of the Welsh Assembly.
- The Joint Committee on the Environment, Heritage and Local Government and the Joint Committee on Climate Change and Energy Security in the Republic of Ireland Houses of the Oireachtas.

Wales

The Welsh Assembly Sustainability Committee[1] considers and reports on the relevant duties placed on the Assembly, the First Minister, Welsh Ministers or the Commission which relate to climate change, among other issues. Its reach, therefore, is not limited to the Department for Environment, Sustainability and Housing[2], which has responsibility for cross-cutting measures of mitigation and adaptation of climate change. As its remit includes the relevant duties placed on the Assembly, the First Minister, Welsh Ministers or the Commission which relate to climate change, its scrutiny cuts across all Ministers and Departments relevant to climate change.

Republic of Ireland

The Joint Committee on the Environment, Heritage and Local Government[3] scrutinises the work of the Department for Environment, Heritage and Local Government, which has responsibility for addressing climate change. Its reach is limited, therefore, to the Department for Environment, Heritage and Local Government[4], and its scrutiny only applies to that Department. It does not, therefore, cut across all Ministers and Departments relevant to climate change.

The Joint Committee on Climate Change and Energy Security[5] considers medium and long-term climate change targets, and key measures to meet them, among other things. Its reach is not limited to any one Minister or Department, and its scrutiny cuts across all Ministers and Departments relevant to climate change.

[1] http://www.assemblywales.org/bus-home/bus-committees/bus-committees-third1/bus-committees-third-sc-home.htm

[2] http://wales.gov.uk/about/departments/desh/?lang=en

[3] http://www.oireachtas.ie/viewdoc.asp?fn=/documents/Committees30thDail/J-EnvHerLocGov/Homepage.htm

[4] http://www.environ.ie/en/AboutUs/

[5] http://www.oireachtas.ie/viewdoc.asp?fn=/documents/Committees30thDail/J-Climate_Change/Orders_of_Reference/document1.htm

Carbon Trust Support to the Public Sector in other Devolved Administrations

Carbon Trust support to the Public Sector

Services direct from the Carbon Trust

Website & Customer Centre
Our website acts as the key entry point for many new customers and allows public sector bodies to access a whole range of sector specific self-assessment tools, guides and directories. Alternatively public sector bodies may contact the Carbon Trust for free advice on any aspect of energy saving.

Publications
The Carbon Trust publishes fact sheets, case studies and in-depth guides tailored to public sector organisations enabling them to profit from the largest library of independent advice on energy efficiency in the UK. Orders can be placed through the Carbon Trust or our website.

Staff awareness material
To help promote energy savings actions among public sector employees our range of posters, stickers and awareness campaign packs offer important tips and ideas to get them involved.

Training Workshops
Interactive training workshops are available nationwide, covering a range of topics such as energy management, footprinting and biomass.

Carbon Surveys
Carbon surveys are delivered by independent, accredited consultant to help identify key energy savings opportunities within public sector bodies. These can range from simple low or no-cost measures to investments that typically pay for themselves in 1-2 years.

Bespoke Support
Tailored support to customers offered on a 50/50 funded basis. Bespoke support includes delivery of technical and behavioural change expertise around a variety of barriers to the implementation of carbon reduction projects as identified by pubic sector customers.

Public Sector Carbon Management
This is a five-step programme for larger public sector bodies, providing a strategic view of how carbon impacts the organisation by identifying the risks and opportunities associated with climate change. To date we have delivered tailored carbon management support to over 440 public sector bodies including councils, universities, government departments and NHS organisations.

Design Advice
This specialist service includes a detailed printed guide and face-to-face consultancy to help identify the carbon savings in new and renovation building projects, offering free or subsidised consultancy advice throughout the project stages. Additionally, Strategic Design Advice, offered at the concept stage, supports the wider context impact of a building and will take into account shared services or the integration of renewables.

Public Sector Network
To help accelerate the sector based identification of carbon reduction projects and to speed up project implementation this dedicated web-based online community offers a useful forum for public sector bodies to discuss carbon saving technologies, debate solutions for behavioural change, and react to incoming policy and legislation.

Low Carbon Building Accelerator
The Carbon Trust Low-Carbon Building Accelerator demonstrates how major refurbishments of non-residential buildings can be completed in a low-carbon and cost effective manner. Hampshire County Council has been an exemplar participant in this programme.

Energy Technology List
The Energy Technology List, managed by the Carbon Trust, offers a comprehensive guide to public sector customers assisting them in procurement decisions. Covering 14 technology equipment categories organisations can search over 14,000 energy efficient technology products. Visit the website at www.eca.gov.uk/etl.

Other services available from and supported by the Carbon Trust Group

Salix Finance
Salix Finance is an independent, publicly funded company, set up in 2004, to accelerate public sector investment in energy efficiency technologies through invest to save schemes. Salix has public funding from the Carbon Trust and is working across the public sector with councils, NHS Foundation Trusts, Higher and Further Education institutions and Central Government.

Partnerships for Renewables
Partnerships for Renewables (PfR) has been established by the Carbon Trust to work in partnership with public sector bodies to develop, construct and operate renewable energy projects on public sector land. PfR finances all the costs of project development and resultant capital expenditure, thereby providing a low-risk opportunity to access the economic and environmental benefits associated with renewable energy.

Carbon Trust Standard
The Carbon Trust Standard Company was set up by the Carbon Trust in June 2008 to provide independent validation of organisations' achievements in carbon reduction. It works with leading organisations to certify their performance in measuring, managing and reducing their greenhouse gas emissions. To date 35 public sector bodies have achieved the standard including BERR, DEFRA, HM Treasury, London Fire Brigade and OGC.

The Carbon Reduction Label
The Carbon Reduction Label has been developed by the Carbon Trust to help organisations and consumers understand the carbon footprints of the products and services they use. Due to the pressure on the public sector to show leadership in procurement there is now strong interest from public bodies in labelled products and services as well as how they can build their own influence over their supplier. We foresee this area to have significant growth potential.

Public Sector Support within the Devolved Administrations

All of the services described above are available in England. The extent to which these services are offered across the Devolved Administrations (DAs) of Wales, Scotland and Northern Ireland varies, predominantly due to our funding relationships. This has consequently had a significant impact on the relative uptake of our services and profile of our brand within the public sector across the DAs.

Public Sector Service	England	Scotland	Wales	Northern Ireland
Website, Customer Centre & Publications	✓	✓	✓	✓
Training workshops	✓	✓	✓	*
Carbon Surveys	✓	✓	✓	*
Bespoke Support	✓	✓	✓	*
Carbon Management	✓	✓	✓	*
Design Advice	✓	✓	✓	*
Public Sector Network	✓	✓	✓	✓
Energy Technology List	✓	✓	✓	✓
Salix Finance (Existing match funded scheme)	✓	✓	✓	✓ UK funded
Salix Finance Loans (09/10 fully funded scheme)	✓			See below
Partnership for Renewables	✓	✓	✓	✓ UK funded
Carbon Trust Standard	✓	✓	✓	✓
Carbon Label Co	✓	✓	✓	✓

* Only available to the public sector where fully funded by customer

Northern Ireland
Funding from Invest NI prevents us from offering the full range of our services to Public Sector bodies in Northern Ireland. Carbon Trust wrote the to the DETI Minister Arlene Foster in April seeking support to work with her Ministerial colleagues to consider funding the Carbon Trust's re-engagement with the NI Public Sector.

Salix Finance Loans (09/10 fully funded scheme) In the most recent budget, the UK Government announced: *'£65 million of new funding for loans to install energy efficiency measures in public buildings, delivered through Carbon Trust Salix Scheme ...'*. We understand that HMT has allocated funds on the Barnett formula and is offering a proportion of these funds (c.£1.8m) to the Northern Ireland Assembly. We wrote to Invest NI (our local funder) in May indicating that we would welcome the opportunity of extending our programme to efficiency deliver this benefit in Northern Ireland.

Scotland
To date 47 Scottish bodies have taken part in the Carbon Management Programme with a further 12 taking part during this financial year. By March 2010 59 organisations will have taken part including 32 local authorities, 8 NHS Boards, 8 universities plus SEPA, Scottish Government, Scottish Prison Service and Scottish Courts Service. Of the 23 organisations that had developed a carbon management plan by March 2008 so far they have reduced their emissions base by over 100,000 tCO2 and reduced their energy bills by over £6m. Building on this success we are trailing in Scotland a less intensive version of Carbon Management for smaller pubic bodies and we anticipate 30 organisations will have completed this activity by March 2010.

Wales
We have a working relationship with all 22 local authorities as well as the fire, ambulance and police services within Wales. Through our excellent working relationship with the Consortium of Local Authorities in Wales (CLAW) we have been able to adopt and roll out key strategies. Our schools and leisure centre controls initiative have been extremely successful saving over 26,000 tonnes of annual emissions. 10 Welsh local authorities have committed to working in partnership with the Carbon Trust to reduce their carbon footprint by 20-70%. Within the Higher Education sector Cardiff, Swansea, Aberystwyth, Bangor and Newport universities plus UWIC have been involved within our Carbon Management Programme. Due to the restructuring of the health sector within Wales during 2008-9, we have reorganised and redeveloped our approach but we continue to build on the success of our Carbon Management Programme. The first organisation to be awarded the Carbon Trust Standard in Wales was the North Wales NHS Trust.

England
Our extensive engagement with public sector carbon management customers in England has seen us work in partnership with:

- 220 Local Authorities (over half of all English councils)
- 73 universities (over half of all English universities)
- 73 NHS Trusts (about 1/10th of English NHS trusts)

In addition, we are a leading partner in The Low Carbon Cities Programme which delivers support to the cities of Bristol, Leeds and Manchester to promote area-wide carbon reductions and to inform the development of a public sector-led area-wide carbon reduction programme.

As of today (12 June 2009) we are launching the English Surveys for Schools campaign and will be writing out to 5,000 secondary school head teachers offering our new tailored school surveys.

Reports published following Sustainability Committee's Inquiry into Carbon Reduction in Wales

From: Hawkins, Virginia (Assembly - Committee Service)
[mailto:Virginia.Hawkins@Wales.gsi.gov.uk]
Sent: 11 June 2009 09:14
To: McGarel, Alex

Cc: Singleton, Meriel (Assembly - Commitee Service)
Subject: Inquiry into climate change

Dear Alex

Attached are Word versions of the carbon reduction reports that we have published so far – we still have a report into carbon reduction by land use to publish (in July) and our final report giving strategic recommendations in October.

Also attached are the letters written to individual ministers and copied to the Minister for Environment, Sustainability and Housing following the committee's scrutiny session no mainstreaming sustainability within their portfolios. The letters are not in the public domain yet as they will form the annex of our report. We would appreciate it if you did not publish them until we have published out report which should be by the end of June.

I have had a quick look at the Climate Change Act and the reporting requirements for Welsh Ministers are different to those for Northern Irish Ministers. The Northern Ireland Ministers do have to be consulted, however, by the Secretary of State on the setting of carbon budgets and the reporting of progress towards meeting them. There is, however, a requirement for the 'appropriate department' in Northern Ireland to publish an adaptation programme. Interestingly, I note that the reference in the Climate Change Committee's carbon budget documentation is to the Scottish and Welsh Governments and the Northern Ireland Department of the Environment which might perhaps indicate that they are not dealing with Northern Ireland at Ministerial level.

Finally, here is a link to our Minister's statement about setting up the Climate Change Commission for Wales and a link to their website.

http://new.wales.gov.uk/about/cabinet/cabinetstatements/2007/ccomm/?lang=en

http://new.wales.gov.uk/topics/environmentcountryside/climate_change/tacklingchange/strategy/commission/?lang=en

I hope some of this is useful – please let me know if you would like any more information or if you would like a formal, more focussed response form the committee.

Best wishes

Dr Virginia Hawkins
Clerc Phwyllgor
Committee Clerk
Gwasanaethau'r Pwyllgorau
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www.cynulliadcymru.org
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Cynulliad Cenedlaethol Cymru
National Assembly for Wales

Residential Carbon Reduction in Wales

1st report of the Sustainability Committee's Inquiry into Carbon Reduction in Wales

March 2008

Contents

Committee Membership

Name	Constituency
Mick Bates (Chair)	Montgomeryshire
Lorraine Barrett	Cardiff South and Penarth
Alun Davies	Mid and West Wales

Lesley Griffiths	Wrexham
Alun Ffred Jones	Arfon
Leanne Wood	South Wales Central
Darren Millar	Clwyd West
Karen Sinclair	Clwyd South
Brynle Williams	North Wales

Chair's Introduction

"There is no place like home. But our homes are responsible for 27 per cent of the UK's carbon emissions. If the UK is to play its part in avoiding catastrophic climate change then we must drastically reduce them…….. The investment and the political courage required are substantial. But the results promise to be spectacular: fuel poverty wiped out, energy security enhanced and true leadership in the transition to a dynamic low-carbon economy. There is not a moment to lose".

Tony Juniper Executive Director Friends of the Earth England, Wales &

Northern Ireland in: HOME TRUTHS: A low-carbon strategy to reduce UK housing emissions by 80% by 2050, Brenda Boardman University of Oxford's Environmental Change Institute 2007.

Global warming is an issue that concerns all of us and, as we experience first hand its effects, impacts on all our lives. One of the biggest contributions to global warming is the emission of carbon dioxide (CO2) into the atmosphere. CO2 emissions come from a variety of sources but everything we do, from making a cup of tea to building an office block, has an impact on the amount of CO2 that is released into the atmosphere.

As soon as the Committee was first established, we were unanimous in our view that our first priority should be to examine how Wales is contributing to the urgently needed task of reducing carbon emissions and contributing to national and international targets.

In this, the first report into carbon reduction in Wales, we look at how CO2 emissions can be reduced in housing and residential developments. We received evidence from a wide range of people and organisations who outlined the main challenges in reducing CO2 emissions. We were also given many examples of good practice and it is around these concrete actions that we have built our recommendations.

It is important for every organisation and individual to play their part in reducing the amount of carbon dioxide we emit in Wales. Not only will it help to secure a pleasant, healthy standard of living for our own children but will help to ensure a future for generations across the world.

I would like to thank all those who have given us written and oral evidence for sharing their knowledge and expertise with us and for their openness and frankness in expressing their views to us.

This report will form part of our final report which will be published in the summer of 2008. We have also published an introductory document which is designed to be read as an introduction to any of the topic reports that we produce on carbon reduction in Wales and contains our terms of reference and the policy background to carbon reduction. The introduction document can be found on our website at:

http://www.assemblywales.org/bus-home/bus-committees/bus-committees-third-assem/bus-committees-third-sc-home/inquiries/inquiries_-_carbon_reduction_household.htm

We welcome your thoughts and comments on this report, which can be sent to us at: Sustainability.comm@Wales.gsi.gov.uk or write to us at:

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We would like to publish some of your ideas and views on our website so that other people can read them.

You can also find out more about how to contribute to our written consultations on future topics on our website at:

http://www.assemblywales.org/bus-home/bus-committees/bus-committees-third-assem/bus-committees-third-sc-home.htm

Chapter 1 – Introduction

Carbon reduction from the residential sector

1.1 The residential sector is thought to account for about 10 per cent of the carbon dioxide emissions in Wales (plenary speech on climate change by the First Minister, 13 February 2007). Around two-thirds of the housing stock that will be standing in 2050 is likely to have been built before 2005 (Review of sustainability of existing buildings, Department for Communities and Local Government, November 2006); the average existing home requires four times the energy to heat as one built to the latest building regulations (Energy efficiency action plan, Department for the Environment, Food and Rural Affairs (DEFRA), 2007). In 2004, approximately 84 per cent of domestic energy was used on space and water heating (61 per cent for space heating and 23 per cent for hot water) (Domestic energy consumption by end use, 1970 to 2005 Department for Business, Enterprise and Regulatory Reform).

1.2 All new buildings funded or built on land disposed of by the Welsh Assembly Government must now meet the BREEAM Ecohomes Excellent environmental standard (UK energy efficiency action plan, DEFRA, 2007).

1.3 In 2004, residential customers in Wales consumed 5,600GWh of electricity (Digest of United Kingdom energy statistics, Department for Trade and Industry (DTI), 2006). Of the total residential electricity consumption, the proportions used by different types of usage are as follows: miscellaneous appliances 21 per cent, cold appliances (e.g. fridges and freezers) 18 per cent, internal lighting 16 per cent, consumer electronics 16 per cent (of which two-fifths is from televisions), cooking 15 per cent (more than one-quarter of which is from kettles), and wet appliances (e.g. washing machines, washer/dryers and dishwashers) 14 per cent (Digest of United Kingdom energy statistics DTI, 2006). The standby facility is responsible for an estimated 6 per cent of domestic electricity consumption (Energy consumption in the United Kingdom, DTI and Office for National Statistics, July 2002). By 2020, home computers and consumer electronics are projected to account for 45 per cent of electricity used in the home (The ampere strikes back: How consumer electronics are taking over the world, Energy Saving Trust, June 2007)

1.4 Energy consumption for lighting has increased by 63 per cent between 1970 and 2000, and by 11 per cent between 1990 and 2000, mainly due to the shift from rooms being lit by single ceiling bulbs towards multi-source lighting (DTI and National Statistics, Energy consumption in the United Kingdom, July 2002). The UK Government is currently looking to implement a ban on the sale of incandescent bulbs by 2011.

1.5 The main means of reducing the carbon dioxide burden from dwellings currently being used are the following: Welsh Assembly Government

- Reducing demand for space heating in existing buildings, through grants or other financial incentives and awareness-raising about improving insulation.
- Increasing the use of renewable energy in new-build dwellings (minimum level determined by both Welsh national and local planning guidance).
- Changing the energy source for space and water heating to more carbon-efficient sources (encouraging the penetration of the gas network throughout Wales – determined by negotiation with private companies; improving the supply infrastructure and consumption of biomass heating – determined by the Welsh Assembly Government through grants, and through negotiation with the private sector).

UK Government

- Reducing demand for space heating in new buildings, by requiring better standards of insulation through Building Regulations (DCLG, Building Regulations).
- Changing the energy source for space and water heating to more carbon-efficient sources (encouraging the uptake of renewable space and water heating sources – assisted via the UK Government through grants or other financial incentives Low Carbon Buildings Programme, Department for Business, Enterprise and Regulatory Reform).
- Legislating to ban energy-inefficient appliances (such as filament light bulbs – currently determined by the Government, Italy is planning mandatory energy efficiency standards for appliances (Italian Ministry for the Environment, Land and Sea, Fourth National Communication under the UN Framework Convention on Climate Change, p.100, November 2007).

Europe

- Reducing the energy demand of appliances (reducing stand-by energy use (European Commission, Eco-design consultation forum discusses concrete action to reduce 'standby' electricity consumption), and legislating for improved minimum standards for energy-efficiency)
- Requiring energy labels on buildings (European Parliament and European Council, Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings), cars (European Parliament and European Council, Directive 1999/94/EC of the European Parliament and of the Council of 13 December 1999 relating to the availability of consumer information on fuel economy and CO2 emissions in respect of the marketing of new passenger cars) and appliances (European Council, Council Directive 92/75/EEC of 22 September 1992 on the indication by labelling and standard product information of the consumption of energy and other resources by household appliances).

1.6 The former Environment, Planning & Countryside Minister announced an aspiration in Plenary on 13 February 2007 that all new buildings would be carbon neutral by 2011 and stated that the

Welsh Assembly Government would be opening negotiations with the UK Government with a view to seeking devolution of building regulations (Welsh Assembly Government, Carwyn Jones AM, Minister for Environment, Planning & Countryside, Sustainable Buildings, Cabinet Oral Statement, 13 February 2007).

1.7 The Welsh Assembly Government launched a consultation on the draft Planning Policy Statement: Planning and Climate Change, in December 2006 (Welsh Assembly Government, Planning Policy Statement, Planning for Climate Change, Consultation draft, December 2006). One of the aims of the statement is to provide leadership to local authorities, which will start to influence how they consider stepping up the standards of development by the private sector beyond those in current building regulations.

Chapter 2 – Key issues and recommendations

“We will aim to achieve annual carbon reduction-equivalent emissions reductions of 3 per cent per year by 2011 in areas of devolved competence. We will set out specific sectoral targets in relation to residential, public and transport areas.“

One Wales - A progressive agenda for the government of Wales – Labour and Plaid Cymru Groups in the National Assembly – June 2007.

2.1 We are very pleased to see this commitment to carbon reduction in the One Wales document and fully support the coalition government in their efforts to achieve it.

2.2 We have received evidence from many of our witnesses, however, doubting whether the target can be achieved using the methods currently being used by the Welsh Assembly Government and expressing concern over the lack of clarity about how the target will be achieved.

2.3 In this chapter, we outline six ‘headline’ recommendations and illustrate the impact we think they could make on achieving the 3 per cent target in Wales.

2.4 The residential sector is an area in which the Welsh Assembly Government has many powers to influence carbon reduction and we therefore consider that this sector has the potential to make a large contribution to the 3 per cent target.

“It is our strong belief that the majority of actions needed to deliver significant carbon emissions reductions in the household sector can be undertaken within the existing powers of the National Assembly for Wales".
Energy Saving Trust written evidence SC(3) CR-R3

2.5 We have attempted, for each of the headline recommendations, to indicate the potential amount of household carbon saved in relation to the 2005 figures. We hope that this will give clear guidance to the Welsh Assembly Government on the areas where they can make the most impact in carbon reduction in Wales. The calculations and assumptions used in the carbon reduction figures are at Annex D.

2.6 All our evidence emphasised the importance of leadership in driving through changes and supporting those delivering them. There were calls from several witnesses for the Welsh Assembly Government to show a strong lead in and commitment to reducing CO2 emissions and support those, especially local authorities, tasked with achieving the reductions.

2.7 The evidence for these headline recommendations is discussed in more depth in later chapters. We wish, however, to highlight these six recommendations at the start of report.

Planning

2.8 We heard a great deal of evidence from all our witnesses about the effectiveness of radical planning policies in gaining reductions in CO2 emissions.

Based on the evidence of the effectiveness of the 'Merton' rule (see Chapter 3) in achieving CO2 reductions, we therefore recommend:

Headline Recommendation 1: The Committee recommends that, through a Ministerial Interim Planning Policy Statement (MIPPS), the Welsh Assembly Government require developments of over 5 dwellings and all commercial developments to produce at least 10 per cent of their energy requirements through on site renewable energy or local decentralised sources.

We consider that the implementation of recommendation HL1 would lead to a far greater reduction in CO2 emissions than the 10 per cent as builders and developers would attempt to reduce the amount of energy needed to be generated on site by making the buildings more energy efficient.

We estimate that the implementation of Headline Recommendation 1 could result in annual carbon savings of around 1,400 tonnes per year.

Headline Recommendation 2: The Committee recommends that, through a Ministerial Interim Planning Policy Statement (MIPPS), the Welsh Assembly Government require developments of less than 5 dwellings to reduce their predicted CO2 emissions by at least 25 per cent based on current building regulations through improvements to the energy performance of buildings, and/or the efficient supply of heat, cooling and power.

We estimate that the implementation of Headline Recommendation 2 could result in annual carbon savings of around 150 tonnes per year.

New buildings

2.9 Many of the witnesses expressed concern about the Welsh Assembly Government's aspiration for all new build to be carbon zero by 2011.

Based on the concerns about the lack definition or guidance on carbon zero buildings in Wales (see chapter 4), the Committee recommends:

Headline Recommendation 3: The Committee recommends that Building Regulations are devolved to the Welsh Assembly Government as a matter of urgency.

We estimate that the implementation of Headline Recommendation 3 could result in annual carbon savings of around 15,800 tonnes per year from 2011 onwards.

Headline Recommendation 4: The Committee recommends that the Welsh Assembly Government adopts the Code for Sustainable Homes with immediate effect. We also recommend that, when Building Regulations are devolved, those which would enable the highest level of the Code for Sustainable Homes to be enforced should be revised first.

We estimate that the implementation of Headline Recommendation 4 could result in annual carbon savings of around 4,000 tonnes per year in 2009 and 2010 (after which, the zero carbon requirement applies).

Existing buildings

2.10 It was accepted by all our witnesses that Wales has a particular problem with hard to heat homes and that many of these are in the private sector.

2.11 There was also evidence that the uptake of the installation of microgeneration schemes within existing buildings in Wales was low and would not meet the Welsh Assembly Government's targets (see Chapters 5 and 6)

Based on the concerns expressed about the energy efficiency of many homes and the costliness of the installation of microgeneration equipment, we recommend the following:

Headline Recommendation 5: The Committee recommends that the Welsh Assembly Government should fund a programme of retrofitting of all existing hard to heat homes so that they meet one of the agreed levels in the Code for Sustainable Homes.

We estimate that the implementation of Headline Recommendation 5 could result in annual carbon savings of around 98,000 tonnes per year from 2008 - 2017.

Headline Recommendation 6: The Committee recommends that the Welsh Assembly Government actively promotes the Low Carbon Building programme in Wales and provides additional grants for microgeneration schemes in existing housing.

We estimate that the implementation of Headline Recommendation 6 could result in annual carbon savings of around 2,400 tonnes per year from 2009 – 2012 and 10,070 tonnes per year from 2013 - 2020.

The total estimated CO2 reduction as a result of implementing all of the above recommendations would be between 98,000 and 125,000 tonnes per year between 2008 and 2020, a cumulative total of 1,245,790 tonnes.

The estimated percentage saving of all household emissions over 2005 figures is 16.8% by 2020, an average of 1.3% per year.

Chapter 3 – The role of the planning system in carbon reduction

Areas of devolved competence

"planning officers might become heroes"
Evidence from the Centre for Alternative Technology (Sustainability Committee meeting 11 October 2007)

3.1 The planning system is devolved to the Welsh Assembly Government within the framework of England and Wales planning legislation.

3.2 The overwhelming evidence we received emphasised the fact that, although the Welsh Assembly Government already has many of the powers needed to achieve substantial carbon

reduction in residential buildings, these powers are not being fully utilised. There were areas where the Welsh Assembly Government was considered to have made progress, for example, the issue of the Draft Climate Change MIPPS. It was generally acknowledged, however, this does not go far enough. The majority of our recommendations, therefore, call for the Welsh Assembly Government to show a strong lead to planners, local authorities, the building industry and consumers to realise the potential for residential sector carbon savings in Wales.

3.3 We received evidence from many witnesses about the effectiveness of new, radical approaches to planning in addressing the issues surrounding residential carbon reduction. Two examples of good practice were the London Borough of Merton and Woking Borough Council (Sustainability Committee 18 October 2007 SC(3)-06-06 Papers 3 and 4). The Centre for Alternative Technology considered that planning officers could play a key role in championing new proposals for carbon reduction.

3.4 We also heard that radical planning policies are not achievable without clear and strong political leadership to support their implementation. Merton and Woking Councils strongly emphasised that their policies would not have been as effective without clear leadership and support from organisations such as the London Assembly. The vast majority of those who gave evidence (including several Welsh local authorities) called for a stronger direction and more support from the Welsh Assembly Government for more radical planning policies to achieve CO2 savings in the built environment.

3.5 The use of the 'Merton rule' which requires that all new developments use on site renewable energy to cut CO2 emissions by at least 10 per cent advocated by many of those who gave evidence. Wrexham County Council identified the new Local Development Plan framework as an ideal vehicle for such policies and the establishment of minimum standards across Wales (Wrexham County Borough Council, written evidence SC(3) CR-R19).

3.6 Much of the evidence we received pointed to an apparent lack of leadership from the Welsh Assembly Government. We consider that, in the realm of planning, where the Welsh Assembly Government has substantial devolved powers, these are not being used to their full potential to achieve meaningful reductions in residential CO2 emissions.

3.7 We consider that local authorities in Wales have the potential to be as innovative in their planning policies as local authorities such as Merton and Woking have been in England and we would strongly encourage them to be so. They need, however, the mechanisms, guidance and support from the Welsh Assembly Government to develop and implement those policies.

3.8 The evidence and discussion above led us to our first two headline recommendations (see Chapter 2) and to the recommendation 7 below which we consider will not only help to achieve CO2 reductions but will also give a lead to local authorities in Wales to seek other innovative planning policies to address the problem.

Recommendation 7: The Committee recommends that the Welsh Assembly Government revises Planning Policy Wales and the associated guidance to strengthen the requirements for local authorities to include policies aimed specifically at carbon reduction in their Local Development Plans.

3.9 Much of the evidence pointed towards a lack of commitment to carbon reduction outcomes in the planning process. It was suggested that planning permission for new build and renovation should be more focussed on carbon reduction outcomes which should be embedded in Local Development Plans. The Wales ECO Centre went as far as to suggest that permission should only

be granted if the application meets certain low carbon targets (Wales ECO Centre written evidence SC(3) CR-R14).

3.10 Concern was expressed by some witnesses that the application process for low carbon technologies associated with new build was often complicated and difficult to understand. The Wales Home Energy Conservation Association (HECA) Forum recommended that stronger guidance be given by the Welsh Assembly Government to encourage local authorities to accept applications which include microgeneration (Wales HECA Forum written response SC(3) CR-R16).

3.11 We believe that for any schemes or policies to be truly successful, their aims, objectives and methods of implementation should be clear, easily understood and easily accessible.

Recommendation 8: The Committee recommends that the Welsh Assembly Government reviews the application process for the installation and use of low carbon technologies in residential buildings with a view to simplifying and accelerating the process.

3.12 Another obstacle to the granting of planning permission for carbon reduction outcomes which was identified by our witnesses was a lack of awareness by planners of the benefits of and potential for low carbon development and microgeneration. It was felt that the existing guidance and information provided to planners, both in their initial training and through their ongoing professional development, does not place sufficient emphasis on low carbon outcomes.

3.13 We consider that it is crucial that those practitioners at the 'sharp end' understand the best ways of developing and implementing planning policies for carbon reduction, and their benefits. They should have access to the most up to date information, techniques and expertise.

Recommendation 9: The Committee recommends that the Welsh Assembly Government works with the Royal Town Planning Institute to develop and promote training, advice and guidance for planners in the areas of low carbon design and the use of microgeneration energy sources.

3.14 We consider that the planning system in Wales should take the lead in enabling low carbon development and technologies. From the evidence we have received so far, it can have the opposite effect.

3.15 We will return to planning as the final topic of our inquiry. Even at this early stage of our inquiry, it has become very apparent that planning and the planning system plays a large part in moving towards a low carbon society in Wales and it is a theme which will be highlighted at each stage of our report.

Chapter 4 – New buildings and carbon reduction

4.1 The way in which new buildings are designed and constructed is regulated through UK Building Regulations. Currently, building regulations are not devolved to the Welsh Assembly Government and so apply across England and Wales. The Welsh Assembly Government has asked for Building Regulations to be devolved to it so that it can meet its target of all new buildings being zero carbon by 2011 (the target in England is for 2016).

4.2 Concerns were expressed by the Wales Environment Link and the Home Builders Federation amongst others about the lack of a definition of zero carbon building in Wales (Wales Environment Link written evidence SC(3) CR-R15, Home Builders Federation written evidence SC(3) CR-R8). In England, the Code for Sustainable Homes sets out both a definition and the required minimum standards for a building to be accepted as zero carbon. The code is used extensively throughout the building industry in England. Many of the witnesses called for it to be adopted in Wales as soon as possible.

4.3 We are concerned that the 2011 target does not have a clear definition of what is required to meet it. A standard definition across England and Wales would appear to help those businesses who operate in both countries. The adoption of the Code for Sustainable Homes in Wales, as it appears to be widely accepted as a good, well thought out standard, would avoid unnecessary 'reinvention of the wheel' in Wales.

4.4 The evidence and discussion above led us to our third and fourth headline recommendations (see Chapter 2). We consider that the adoption of the Code for Sustainable Homes in Wales will help the Welsh Assembly Government to show a strong lead in achieving their 2011 target of zero carbon new build (subject to the devolution of building regulations).

4.5 The National Federation of Builders highlighted the lack of knowledge across the building industry of building techniques, materials and technologies for achieving low or zero carbon buildings (evidence to the Sustainability Committee 25 October 2007). Both Merton Council and Sustainable Housing Europe (SHE) emphasised the need for training and up to date, accessible information to be available for all sectors of the building trade (evidence to the Sustainability Committee 18 October 2007). The issue is particularly concerning in the 'grey economy' as a number of smaller builders operate here and are not accessible to national organisations.

4.6 There was also discussion about the importance of the role of consumers in understanding and requesting the use of low carbon technologies and techniques in any building work they are commissioning. The need to change consumer behaviour was recognised by many of the witnesses and is discussed further in Chapter 5.

4.7 We are concerned about this lack of knowledge and information within the building trade whilst we acknowledge the difficulties facing the industry in reaching all its practitioners. We believe that builders and developers are well placed to promote the use of low carbon building techniques and new technologies to their customers, whatever the size of their operation. We believe that, with economies of scale, the costs associated with new, low carbon building materials and techniques will reduce to be comparable with those of existing materials and technologies.

Recommendation 10: The Committee recommends that the Welsh Assembly Government works with the Construction Industry Training Board (CITB) and the Sector Skills Council for Construction to develop and promote training, advice and support for the construction industry in the area of low carbon building.

4.8 The benefits of the installation and operation of microgeneration systems was illustrated by Merton and Woking Councils. It was widely acknowledged that, whilst microgeneration can play an important role in reducing CO2 emissions from residential buildings, there is a lack of information about and training in their installation and operation.

4.9 We also received evidence indicating that the costs associated with the installation of microgeneration technology could be offset and more people encouraged to install them if there

were attractive and realistic feed-in tariffs to the National Grid. These would enable people who had installed microgeneration equipment to sell any surplus energy generated to the National Grid, so reducing reliance on fossil fuel powered energy generation.

4.10 We consider that the use of on site microgeneration can make a substantial contribution to carbon reduction and that every effort should be made to encourage individuals and organisations to consider it as a way of reducing their emissions.

Recommendation 11: The Committee recommends that the Welsh Assembly Government works with the Construction Industry Training Board (CITB) and the Sector Skills Council for Construction to develop and promote training, advice and support for the construction industry in the installation and the use of microgeneration energy sources.

Recommendation 12: The Committee recommends that the Welsh Assembly Government explore mechanisms for creating a market for surplus energy generated by individual microgeneration plants such as the creation of local energy supply companies with agreed feed-in tariffs

4.11 Concern was expressed by the Welsh Local Government Association (WLGA) that developers can often see building zero carbon homes as a competitive disadvantage. They estimated the additional building costs of low carbon homes was 7-10 per cent (Sustainability Committee 25 October 2007). Merton and Woking Councils however, gave examples of developers going beyond the minimum requirements for carbon reduction whilst providing affordable housing.

4.12 Housing standards imposed on the social housing sector are more stringent than those imposed upon the private sector (e.g. new public sector housing now has to adhere to the EcoHomes excellent standard). Concerns were expressed by the WLGA and the Wales and West Housing Association that this could deter developers from entering the social housing market.

Recommendation 13: The Welsh Assembly Government should engage with developers as soon as possible to identify the benefits to them of pioneering zero carbon house building techniques in Wales.

Recommendation 14: The Committee recommends that the Welsh Assembly Government should identify good practice in the social housing sector and set up a knowledge exchange with private sector developers and builders.

Recommendation 15: Where land in the ownership of the Welsh Assembly Government is to be released for residential development, it should be done so at a discounted rate for the construction of zero carbon housing.

Recommendation 16: Where land in the ownership of the Welsh local authorities is to be released for residential development, the Welsh Assembly Government should encourage and support local authorities to do so at a discounted rate for the construction of zero carbon housing.

Chapter 5 – Carbon reduction in existing buildings.

"To tackle the issue of residential emissions in Wales is to tackle the particular issues that old housing stock poses."

Countryside Council for Wales, written evidence SC(3) CR-R4

5.1 Wales has the largest percentage of housing stock built before 1919 in the UK, at around 36 per cent. This stock is often difficult to insulate and heat. In addition, a comparatively large proportion of Welsh homes are not connected to the mains gas network, meaning that they rely on electricity or bottled oil or gas to heat them. These two factors mean that Wales has a bigger challenge than other parts of the UK in making its housing stock energy efficient.

5.2 We received views from all our witnesses about the issue of hard to heat homes. There were a range of suggested solutions. The Centre for Alternative Technology suggested a rolling programme of demolition and replacing them with new, energy efficient buildings (Evidence to the Sustainability Committee 11 October 2007). The Countryside Council for Wales and several other witnesses highlighted the German programme for retrofitting all pre1978 housing stock to meet modern energy efficiency standards (funded by the German Government). The German Government also requires all existing housing stock to be remodelled to incorporate renewable energy based heating systems from 2010 with the aid of government funding.

5.3 Wales also has a high proportion of owner occupied housing stock. This was considered to be an advantage by the Countryside Council for Wales whilst several witnesses considered that this was a disadvantage as local authority funding was often directed to social housing. The Wales Audit Office report on the Home Energy Conservation Act (HECA) said that:

"For some councils the 'quick wins' of improvements in the energy efficiency of their own housing stock, have already been achieved and more effort needed to be focussed on efficiencies in private housing stock".
Delivering the Home Energy Conservation Act in Wales, Wales Audit Office, September 2007.

5.4 We are concerned at the apparent lack of ability of local authorities in Wales to tackle the problem of carbon emissions from hard to heat homes and call for leadership from the Welsh Assembly Government on how to address the problem.

5.5 The evidence and discussion above led us to our fifth headline recommendation (see Chapter 2). We believe that, if the Welsh Assembly Government is serious about addressing CO2 reduction and meeting its 3 per cent target in Wales, then it needs to address the issue of the high level of hard to heat existing housing stock.

5.6 The Low Cost Buildings Programme (LCBP) was identified by many witnesses as an example of how government funding could potentially encourage owners of existing homes to decrease their CO2 emissions. The scheme provides funding for microgeneration technologies to be fitted to existing dwellings.

5.7 The Wales HECA Forum, however, highlighted the small uptake of the programme in Wales, with only 585 applications being received in two and a half years. This was contrasted starkly with the Welsh Assembly Government's targets for microgeneration of 30,000 units by 2012 Microgeneration Action Plan Welsh Assembly Government March 2007). The programme was considered to be poorly advertised and, as its name and terms and conditions for application had changed, difficult for potential consumers to access and understand.

"Indeed, confusion is a feature of many initiatives - notably the Low Carbon Buildings Programme. Many builders interviewed did not know about it, and various changes to the project mean that people are generally unaware of exactly what is available".
National Federation of Builders, Wales SC(3)-07-07(p1): 25 October 2007

5.8 Despite programmes such as LCBP, several witnesses identified the costs associated with the initial installation of microgeneration equipment as being perceived as off putting to many consumers. The HECA Forum advocated top up grants from the Welsh Assembly Government and local authorities to encourage uptake.

5.9 We too are concerned at the apparent lack of commitment to microgeneration in Wales despite the aspirations of the Action Plan. We look forward to discussing the results of the Action Plan implementation group's report on the first 12 months of the plan when it is delivered in March of this year with the Minister.

5.10 The evidence and discussion above led us to our sixth headline recommendation (see Chapter 2). We believe that the Welsh Assembly Government's microgeneration targets will not be met without increased funding and the provision of accurate, up to date and easily accessible information about the schemes available.

5.11 During the course of our inquiry, the Wales Audit Office published a report into the implementation of the HECA in Wales. The report pointed to a lack of commitment to implementing the terms of the HECA by many local authorities in Wales. The WLGA, HECA Forum and Wales Environment link all pointed to evidence in the report indicating that the vast majority of local authorities did not meet their targets for energy conservation and only 4 local authorities have full time HECA officers. Friends of the Earth considered that, as funding for the HECA work was not dependant on targets being achieved, there were no incentives for local authorities to meet them (evidence to the Sustainability Committee 11 October 2007).

5.12 Concerns were also expressed at the lack of baseline data against which to measure energy efficiency savings and the different ways in which each local authority measured its efficiency savings, making comparisons between authorities difficult to make.

5.13 During her evidence to the Committee, the Minister for Environment, Sustainability and Housing stated her wish to repeal the HECA for Wales, mirroring current thinking in England (SC(3)-02-08 (p2): 24 January 2008). The requirements placed on local authorities by the Act would be replaced by outcomes based performance indicators aimed at reducing CO2 emissions.

5.14 From the evidence we have received, we consider that the HECA has not realised its potential to achieve significant CO2 reductions in the residential sector. We welcome the Minister's aspirations for outcomes based performance indicators.

5.15 We are concerned, however, that there does not appear to be an agreed baseline for local authorities against which to measure their performance.

Recommendation 17: The Committee therefore recommends that the Welsh Assembly Government consults with Welsh local authorities on the most effective way of measuring CO2 emissions from residential properties in their area to establish a true baseline against which each local authority can measure improvement.

5.16 We are also concerned that many of the issues raised by the Wales Audit Office in their report need to be addressed by local authorities in order to meet any performance indicators that are established.

Recommendation 18: The Committee therefore recommends that the performance indicators should contain targets with milestones for improvement, a clear indication of what is being measured (e.g. CO2 reduction, average energy efficiency of housing stock, number of homes given advice/grants, reduction in the percentage of hard to heat homes). The targets should also reflect the current state of the housing stock within the local authorities' areas and should be tailored accordingly.

Recommendation 19: The Committee also recommends that the Welsh Assembly Government issues guidance to local authorities on methods of achieving their targets e.g. full time dedicated staff to implement household carbon reduction policies, how reductions can be made in private properties, sharing of good practice.

Chapter 6 – Behavioural Change

"According to DEFRA's 'Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2004', the residential sector in Wales was responsible for 11 percent of total CO2 emissions and that this sector saw the fastest growing increase in emissions between 1990 and 2004 (+16 per cent).

Although there is evidence that the growth in energy demand in the domestic sector in the UK has begun to level off in recent years, the significant improvement in energy efficiency in UK households since the 1970s has not been translated into comparable reductions in overall energy use and CO2 emissions."
Friends of the Earth Cymru, SC(3)-05-07 (p1): 11 October 2007.

"The reduction of carbon dioxide is a behavioural change as well as a technical change. In fact, it is probably half and half".
Environment Agency Wales, Sustainability Committee 4 October 2007.

6.1 Changing people's behaviour to achieve reductions in CO2 emissions is becoming a recurring theme of this inquiry and one where we can all, as individuals, make a difference.

6.2 Although the Welsh Assembly Government has limited powers over the production and supply of energy, it does have much wider powers to influence the usage of and demand for energy in households in Wales. The Welsh Assembly Government is able to influence behavioural change through incentives, education, advice and awareness raising.

6.3 As can be seen in the figures quoted by Friends of the Earth Cymru above, in spite of measures aimed at reducing consumption, household consumer energy demand continues to grow because of increasing household temperatures and proliferation of consumer electronics.

6.4 Many of our witnesses indicated that the reason for this was that many consumers fail to understand the benefit of or need for individual energy reduction/energy efficiency actions and investment. The WLGA and Pembrokeshire Coast National Park Authority both highlighted the need for urgent action to educate consumers (Pembrokeshire Coast National Park, written evidence SC(3) CR-R11).

6.5 Several witnesses referred to various recent surveys which have indicated that, although householders agree with the need to combat global warming and reduce CO2 emissions, they are not making changes in their own behaviour which would contribute.

Recommendation 20: The Committee recommends that the Welsh Assembly Government produces a sustained and widespread marketing and education campaign aimed at encouraging and informing people about the benefits of reducing their energy consumption.

6.6 Many witnesses pointed to the fact that information and advice for consumers is patchy, fragmented and often hard to find. The Energy Saving Trust highlighted their Sustainable Energy Network funded by Welsh Assembly Government which aims to provide consistent, understandable advice which is easily accessible across Wales.

6.7 The Wales Consumer Council advocated a system of One Stop Shops for energy saving advice and help. They and many other witnesses also emphasised the role played by community organisations such as the Women's Institute in leading behavioural change at a local level (Wales Consumer Council, written evidence SC(3) CR-R17).

6.8 We welcome the funding of the Sustainable Energy Network by the Welsh Assembly Government and consider that it has great potential to realise savings in domestic energy consumption. We consider, however, that there is still a need for a more integrated approach to delivering advice on carbon reduction.

Recommendation 21: The Committee therefore recommends that, the Welsh Assembly Government should continue to fund the Sustainable Energy Network. The Network should be expanded and enhanced however to encompass all those organisations providing advice (including the Carbon Trust) into a truly One Stop Shop for all carbon reduction help and advice with additional funding from the Welsh Assembly Government.

6.9 We fully support the work of community groups in Wales. We consider that they have a large and influential role to play in influencing behaviour change on an individual and community level.

Recommendation 22: The Committee recommends that the Welsh Assembly Government makes additional funds available for community based carbon reduction projects.

6.10 The Wales Consumer Council and the Energy Retail Association (Sustainability Committee 18 October 2007) were amongst those who highlighted the need for more information to be given to consumers about their energy consumption. Studies have shown that consumers are more likely to change their behaviour if they have information about their energy consumption on a real time basis that they can access within their own home. Both organisations advocated the use of Smart Meters which show energy consumption within the home in real time in providing consumers with more information.

6.11 We agree with the view that more information should be made available to consumers and welcome the Welsh Assembly Government's current trials of Smart Meters and other display devices in a selection of households in Wales.

Recommendation 23: The Committee recommends that the Welsh Assembly Government, subject to the outcomes of current trials, supports the UK Government in their efforts to encourage the utility companies to fund the installation of Smart Meters or their equivalent in all households across Wales.

If the utility companies do not fund the installation of Smart Meters or their equivalent, the Committee recommends that the Welsh Assembly Government fund their installation for all households.

Chapter 7 – Targets

"So, targets are important as they are the other side of the indicators. The key question that needs to be asked is, 'What will we do if we do not meet the targets?' Will we adjust the policies? Do we actually have to invest some money into other ways of achieving those targets?"

Environment Agency Wales, Sustainability Committee 4 October 2007.

7.1 The Welsh Assembly Government has set a series of targets for improving energy efficiency and reducing carbon emissions.

- Aspiration to carbon neutral newbuild target by 2011;
- 3 per cent annual reduction target for carbon emissions by 2011 in areas of devolved competence;
- A commitment to 'contribute fully to meeting UK-wide targets' (20 per cent below 1990 levels by 2010);
- 30,000 microheating and electricity units installed by 2012, 300,000 such units installed by 2020;
- Individual targets for local authorities to improve domestic energy efficiency of between 3 and 16 per cent by 2006/07 through policy agreements
- 4 TWh of renewable energy in Wales by 2010

7.2 Various witnesses we heard doubted whether there are sufficiently robust mechanisms in place to enable the Welsh Assembly Government to meet these targets. The majority of them now have deadlines of between 2 and 3 years for their implementation but there was much concern expressed about the lack of guidance from the Welsh Assembly Government on how they are proposing to achieve them.

7.3 There was unanimous agreement that the newbuild aspiration could not be realised without the devolution of building regulations to the Welsh Assembly Government which has still not been achieved. As discussed in Chapter 4, there was also concern expressed about the lack of definition of zero carbon in Wales. The Home Builder's Federation highlighted the extent of information and strategic planning already available in England leading up to their target of zero carbon newbuild by 2016 (Code for Sustainable Homes, Building a Greener Future policy document, Draft Strategy for Sustainable Construction).

7.4 When questioned about the ability of the Welsh Assembly Government to fulfil its aspiration for zero carbon newbuild and whether there would be additional funding available for resources to revise and maintain devolved regulations, the Deputy Minister for Housing said:

"It is an aspiration that we are pursuing. It is out in the public domain and everyone is aware of it. The important thing is that there is clarity that this is an aspiration that we are pursuing with the revenue that we have available."
Sustainability Committee, 15 November 2007.

7.5 Although welcomed by all the witnesses, the 3 per cent annual reduction target was criticised for being 'aspirational' and showing a lack of commitment and for being unclear as to the definition of areas of devolved responsibility.

7.6 It is unclear how the targets set by the Welsh Assembly Government fit with the UK Government's current targets and how they will fit with the target of 60 per cent proposed in the current Climate Change Bill. Many of our witnesses sought to address this issue and a number of different answers were forthcoming.

7.7 The microgeneration and local authority target have already been discussed elsewhere in this report and the 4 TWh of renewable energy in Wales by 2010 will be discussed as part of the energy production part of this inquiry.

7.8 We too welcome the setting of targets by the Welsh Assembly Government and their commitment to contribute fully to the UK targets. We share the concerns of many of our witnesses, however, about the lack of strategic direction and leadership in making explicit how those targets are to be achieved. We look forward to the outcome of the Renewable Energy Route Map consultation and the first evaluation of the implementation of the Microgeneration Action Plan to show the way forward in achieving these targets.

Recommendation 24: The Committee recommends that the Welsh Assembly Government produce detailed action plans outlining how they intend each of the targets they have set to be met.

Recommendation 25: The Committee recommends that the Welsh Assembly Government reports progress on achieving the targets every six months to the Assembly in plenary and to the Sustainability Committee or its equivalent.

Recommendation 26: The Committee recommends that, in addition to recommendation 16, the Welsh Assembly Government reports to the Committee every six months on its progress in implementing the recommendations from this report that it has accepted.

Annex A: Summary of recommendations

Headline recommendations:

Headline Recommendation 1: The Committee recommends that, through a Ministerial Interim Planning Policy Statement (MIPPS), the Welsh Assembly Government require developments of over 5 dwellings and all commercial developments to produce at least 10 per cent of their energy requirements though on site renewable energy or local decentralised sources.

Headline Recommendation 2: The Committee recommends that, through a Ministerial Interim Planning Policy Statement (MIPPS), the Welsh Assembly Government require developments of less than 5 dwellings to reduce their predicted CO2 emissions by at least 25 per cent based on current building regulations through improvements to the energy performance of buildings, and/or the efficient supply of heat, cooling and power.

Headline Recommendation 3: The Committee recommends that Building Regulations are devolved to the Welsh Assembly Government as a matter of urgency.

Headline Recommendation 4: The Committee recommends that the Welsh Assembly Government adopts the Code for Sustainable Homes with immediate effect. We also recommend that, when Building Regulations are devolved, those which would enable the highest level of the Code for Sustainable Homes to be enforced should be revised first.

Headline Recommendation 5: The Committee recommends that the Welsh Assembly Government should fund a programme of retrofitting of all existing hard to heat homes so that they meet one of the agreed levels in the Code for Sustainable Homes.

Headline Recommendation 6: The Committee recommends that the Welsh Assembly Government actively promotes the Low Carbon Building programme in Wales and provides additional grants for microgeneration schemes in existing housing.

Other recommendations

Recommendation 7: The Committee recommends that the Welsh Assembly Government revises Planning Policy Wales and the associated guidance to strengthen the requirements for local

authorities to include policies aimed specifically at carbon reduction in their Local Development Plans.

Recommendation 8: The Committee recommends that the Welsh Assembly Government reviews the application process for the installation and use of low carbon technologies in residential buildings with a view to simplifying and accelerating the process.

Recommendation 9: The Committee recommends that the Welsh Assembly Government works with the Royal Town Planning Institute to develop and promote training, advice and guidance for planners in the areas of low carbon design and the use of microgeneration energy sources.

Recommendation 10: The Committee recommends that the Welsh Assembly Government works with the Construction Industry Training Board (CITB) and the Sector Skills Council for Construction to develop and promote training, advice and support for the construction industry in the area of low carbon building.

Recommendation 11: The Committee recommends that the Welsh Assembly Government works with the Construction Industry Training Board (CITB) and the Sector Skills Council for Construction to develop and promote training, advice and support for the construction industry in the installation and the use of microgeneration energy sources.

Recommendation 12: The Committee recommends that the Welsh Assembly Government explore mechanisms for creating a market for surplus energy generated by individual microgeneration plants such as the creation of local energy supply companies with agreed feed-in tariffs.

Recommendation 13: The Welsh Assembly Government should engage with developers as soon as possible to identify the benefits to them of pioneering zero carbon house building techniques in Wales.

Recommendation 14: The Committee recommends that the Welsh Assembly Government should identify good practice in the social housing sector and set up a knowledge exchange with private sector developers and builders.

Recommendation 15: Where land in the ownership of the Welsh Assembly Government is to be released for residential development,

it should be done so at a discounted rate for the construction of zero carbon housing.

Recommendation 16: Where land in the ownership of the Welsh Local Authorities is to be released for residential development, the Welsh Assembly Government should encourage and support local authorities to do so at a discounted rate for the construction of zero carbon housing.

Recommendation 17: The Committee therefore recommends that the Welsh Assembly Government consults with Welsh local authorities on the most effective way of measuring CO2 emissions from residential properties in their area to establish a true baseline against which each local authority can measure improvement.

Recommendation 18: The Committee therefore recommends that the performance indicators should contain targets with milestones for improvement, a clear indication of what is being measured (e.g. CO2 reduction, average energy efficiency of housing stock, number of homes given advice/grants, reduction in the percentage of hard to heat homes). The targets should also reflect the current state of the housing stock within the local authorities' areas and should be tailored accordingly.

Recommendation 19: The Committee also recommends that the Welsh Assembly Government issues guidance to local authorities on methods of achieving their targets e.g. full time dedicated staff to implement household carbon reduction policies, how reductions can be made in private properties, sharing of good practice.

Recommendation 20: The Committee recommends that the Welsh Assembly Government produces a sustained and widespread marketing campaign aimed at encouraging and informing people about the benefits of reducing their energy consumption.

Recommendation 21: The Committee therefore recommends that, the Welsh Assembly Government should continue to fund the Sustainable Energy Network. The network should be expanded and enhanced however to encompass all those organisations providing advice (including the Carbon Trust) into a truly One Stop Shop for all carbon reduction help and advice with additional funding from the Welsh Assembly Government.

Recommendation 22: The Committee recommends that the Welsh Assembly Government makes additional funds available for community based carbon reduction projects.

Recommendation 23: The Committee recommends that the Welsh Assembly Government, subject to the outcomes of current trials, supports the UK Government in their efforts to encourage the utility companies to fund the installation of Smart Meters or their equivalent in all households across Wales.

Recommendation 24: The Committee recommends that the Welsh Assembly Government produce detailed action plans outlining how they intend each of the targets they have set to be met.

Recommendation 25: The Committee recommends that the Welsh Assembly Government reports progress on achieving the targets every six months to the Assembly in plenary and to the Sustainability Committee or its equivalent.

Recommendation 26: The Committee recommends that, in addition to recommendation 16, the Welsh Assembly Government reports to the Committee every six months on its progress in implementing the recommendations from this report that it has accepted.

Annex B: List of respondents to the call for written evidence

http://www.assemblywales.org/bus-home/bus-committees/bus-committees-third-assem/bus-committees-third-sc-home/inquiries/inquiries_-_carbon_reduction_household/carbon_reduction-household.htm

Brecon Beacons National Park

Cardiff Council

Centre for Alternative Technology

Countryside Council for Wales

Energy Saving Trust Local Support Team (South East Wales)

Energy Saving Trust Wales

Friends of the Earth Cymru

Home Builders Federation

Neath Port Talbot Council

Pembrokeshire Coast National Park Authority

Swansea Housing Association (1) and Swansea Housing Association (2)

Wales and West Housing Association Ltd

Wales Environment Link

Wales Home Energy Conservation Association

Welsh Association of National Park Authorities (WANPA)

Welsh Consumer Council

Welsh Local Government Association

West Wales ECO Centre

Wrexham County Borough Council

WWF Cymru

Annex C – List of witnesses providing oral evidence.

Thursday 4 October 2007 SC(3)-04-07 : Transcript

Environment Agency Wales

SC(3)-04-07 : Paper 1 : Environment Agency Wales

Carbon Trust

SC(3)-04-07 : Paper 2 : Carbon Trust

Energy Saving Trust

SC(3)-04-07 : Paper 3 : Energy Saving Trust

Sustainable Development Commission

SC(3)-04-07 : Paper 4 : Sustainable Development Commission (pdf 112KB)

Thursday 11 October 2007 SC(3)-05-07 : Transcript

Friends of the Earth Cymru

SC(3)-05-07 : Paper 1 : Friends of the Earth Cymru

Wales Environment Link

SC(3)-05-07 : Paper 2 : Wales Environment Link

Centre for Alternative Technology

SC(3)-05-07 : Paper 3 : Centre for Alternative Technology

Coal MTAN Petition

SC(3)-05-07 : Paper 4 : Petition PO61(GR): Coal MTAN

Coal MTAN Petition Annex

SC(3)-05-07 : Paper 4 : Petition PO61(GR): Coal MTAN (pdf 308KB)

Thursday 18 October 2007 SC(3)-06-07 : Transcript

Energy Retail Association

SC(3)-06-07 : Paper 1 : Energy Retail Association Evidence

SC(3)-06-07 : Paper 1 : Energy Retail Association Presentation (pdf 449KB)

Sustainable Housing in Europe (SHE)

SC(3)-12-07 : Paper 2 : Sustainable Housing in Europe (SHE) Project (pdf 1.71MB)

SC(3)-12-07 : Paper 2 : Sustainable Housing in Europe (SHE) Annex (pdf 1.58MB)

SC(3)-12-07 : Paper 2 : Sustainable Housing in Europe (SHE) Synopsis (pdf 2.77MB)

London Borough of Merton

SC(3)-06-07 : Paper 3 : Report by London Borough of Merton (pdf 1.33MB)

SC(3)-06-07 : Paper 3 : Presentation by London Borough of Merton (pdf 449MB)

Woking Borough Council

SC(3)-06-07 : Paper 4 : Woking Borough Council Paper

SC(3)-06-07 : Paper 4 : Presentation by Woking Borough Council (pdf 133MB)

Thursday 25 October 2007 SC(3)-07-08 : Transcript

National Federation of Builders Cymru

SC(3)-07-07 : Paper 1 : National Federation of Builders Cymru

Welsh Local Government Association

SC(3)-07-07 : Paper 2 : Welsh Local Government Association Evidence (pdf 255KB)

SC(3)-07-07 : Paper 2 : Welsh Local Government Association Appendix 2 (pdf 2.29MB)

Community Housing Cymru

SC(3)-07-07 : Paper 3 : Community Housing Cymru

energywatch Wales

SC(3)-07-07 : Paper 4 : energywatch Wales (pdf 173KB)

Thursday 15 November SC(3)-09-07 : Transcript (PDF, 178kb)

Deputy Minister for Housing

SC(3)-09-07 : Paper 4 : Paper from the Deputy Minister for Housing

Thursday 24 January SC(3)-02-08 : Transcript (PDF, 292kb)

Minister for the Environment, Sustainability and Planning

SC(3)-02-08 : Paper 2 : Home Energy Conservation Act, UK Planning Bill, UK Climate Change Bill

Annex D: Carbon reduction calculations

Headline Recommendation 1: The Committee recommends that, through a Ministerial Interim Planning Policy Statement (MIPPS), the Welsh Assembly Government require developments of over 5 dwellings and all commercial developments to produce at least 10% of their energy requirements though on site renewable energy or local decentralised sources.

Assumptions:

- Only carbon savings from residential new build are calculated
- All new build attains a 10 per cent reduction in energy use in order to reduce the cost of providing 10 per cent of on-site energy generation
- Approximately 8,315 new residential dwellings are built per annum in Wales (average annual new build 1999-2003), of which 8,000 are assumed to be in developments of 5 dwellings and greater with immediate effect. We also recommend that, when Building Regulations are devolved, those which would enable the highest level of the Code for Sustainable Homes to be enforced should be revised first.

Assumptions:

- Code Level 3 is attained by 2009/10, and Code Level 5 by 2011/12 (assuming that Building Regulations are not devolved and the 2011 zero carbon target is not achieved)
- Approximately 8,315 new residential dwellings are built per annum in Wales (average annual new build 1999-2003)
- New build to current Building Regulations averages 1.9 tonnes of CO2 per annum (based on average energy performance of new build)

Energy efficiency gains will be 0.48 tonnes per dwelling in 2009/10, and 1.9 tonnes per dwelling in 2010/11.

Annual savings from 2009/10 = 0.48*8,315 = 4,000; from 2011/12 = 1.9*8,315 = 11,800

Total savings = 4,000 tonnes in 2009/10, and a further 11,800 tonnes per annum from 2011/12 (these savings are not additional to those achieved from Headline Recommendation 3)

Headline Recommendation 5: The Committee recommends that the Welsh Assembly Government should fund a programme of retrofitting of all existing hard to heat homes so that they meet one of the agreed levels in the Code for Sustainable Homes.

Assumptions:

- 'Hard to heat' homes are those with solid walls that are not on the gas network[1]. Because information on hard to heat homes is unavailable, the proxy used here is those in fuel poverty: approximately 245,000 homes in 2006 were fuel poor[2]
- Average gas consumption in Wales was 20,442kWh in 2003[3]; average electricity consumption was 4,278kWh
- Fuel poor homes use the Wales average amount of fuel
- New build to current Building Regulations averages 1.9 tonnes of CO2 per annum (based on average energy performance of new build), of which approximately 50 per cent are from gas and 50 per cent from electricity (5,000kWh gas; 2,209kWh electricity)
- Retrofits meet Level 1 of the Code for Sustainable Homes (4,500kWh gas; 1988kWh electricity)
- 10 per cent of fuel poor homes are retrofitted each year from 2008/09 to 2017/18 to meet the Welsh Assembly Government's target of eliminating fuel poverty by 2018[4]
- Carbon emissions from gas are 0.19kg CO2 per kWh; from electricity are 0.43kg CO2 per kWh

Carbon reductions for gas are 15,942*0.19 = 3 tonnes per dwelling

Carbon reductions for electricity are 2,290*0.43 = 1 tonne per dwelling

Annual carbon savings for each of the ten years 2008 to 2017 are 4*24,500 = 98,000 tonnes

Total savings = 98,000 tonnes per year from 2008 to 2017

Headline Recommendation 6: The Committee recommends that the Welsh Assembly Government actively promotes the Low Carbon Building programme in Wales and provides additional grants for microgeneration schemes in existing housing.

Assumptions:

- The microgeneration targets of 20,000 heating and 10,000 electricity units by 2012 and 100,000 heating and 200,000 electricity units by 2020[5] are achieved in equal steps from 2009/10

- Microgeneration heating units generate 1,500kWh per year, of which 1,000kWh replaces fossil fuel (gas) generation
- Microgeneration electricity units generate 800kWh per year, all of which replaces fossil fuel (electricity) generation
- Carbon emissions from gas are 0.19kg CO2 per kWh; from electricity are 0.43kg CO2 per kWh

Annual carbon savings from 2009/10 to 2011/12:

Microgeneration heat = 6,666 * 1,000 * 0.19 = 1,266 tonnes

Microgeneration electricity = 3,333 * 800 * 0.43 = 1,147 tonnes

Total savings = 2,400 tonnes per year from 2009 to 2012

Annual carbon savings from 2012/13 to 2019/20:

Microgeneration heat = 10,000 * 1,000 * 0.19 = 1,900 tonnes

Microgeneration electricity = 23,750 * 800 * 0.43 = 8,170 tonnes

Total savings = 10,070 tonnes per year from 2013 to 2020

The Table below indicates the total carbon savings achieved by each of the Headline Recommendations from 2008 to 2020. Carbon emissions reductions are those over household emissions in 2005 in all cases (7,451kt)[6]. The emissions reductions are regarded as being cumulative over the 2005 household emissions. It is assumed that the goal of zero carbon for new build is achieved by 2011.

Because the total excludes those measures that are mutually exclusive, the following sums are allowed:

- Recommendation 1: 1,400 tonnes (the reduction results from Recommendation 4, which assumes that new build houses achieve Level 3 of the Code for Sustainable Homes by 2009)
- Recommendation 2: 150 tonnes from 2009 to 2010 (after which the zero carbon requirement applies)
- Recommendation 3: 15,800 tonnes from 2011 onwards
- Recommendation 4: 4,000 tonnes from 2009 to 2010 (after which the zero carbon requirement applies)
- Recommendation 5: 98,000 tonnes from 2008 to 2017
- Recommendation 6: 2,400 tonnes from 2009 to 2012, and 10,070 tonnes from 2013 to 2020

Recommendation	Year													
2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total	
1 - 10% on-site (>5 dwellings)		1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	16,800
2 - 25% reduction (<5 dwellings)		150	150	150	150	150	150	150	150	150	150	150	150	1800
3/4 - Building Regs (zero carbon)/ - Code for Sustainable Homes		4,000	4,000	15,800	15,800	15,800	15,800	15,800	15,800	15,800	15,800	15,800	15,800	158,000
5 - Retrofit hard to heat homes	98,000	98,000	98,000	98,000	98,000	98,000	98,000	98,000	98,000	98,000	0	0	0	980,000
6 - Support microgeneration		2,400	2,400	2,400	2,400	10,070	10,070	10,070	10,070	10,070	10,070	10,070	10,070	80,170
Total	98,000	105,950	105,950	117750	117750	125420	125420	125420	125420	125420	27420	27420	27420	
Cumulative Saving (over 2005 figures)	98,000	203,950	309,900	427,650	545,400	670,820	796,240	921,660	1047,080	1,172,500	1,199,920	1227,340	1,254,790	
% saving	1.3	2.7	4.2	5.7	7.3	9.0	10.7	12.4	14.0	15.7	16.1	16.5	16.8	

[1] National Assembly for Wales, http://www.assemblywales.org/5184cb73296aceee2208323a52de7b20.pdf

[2] Welsh Assembly Government, Fuel poverty in Wales, 2004: Modelled headline fuel poverty statistics for 2005 and 2006, http://new.wales.gov.uk/dsjlg/research/fuelpoverty2004/modelled.pdf?lang=en

[3] DTI, Welsh homes burn more gas but use less leccy, 28 July 2005, http://www.gnn.gov.uk/Content/Detail.asp?ReleaseID=165260&NewsAreaID=2

[4] Welsh Assembly Government, Fuel poverty in Wales, 2004: Fuel poverty analysis, http://new.wales.gov.uk/dsjlg/research/fuelpoverty2004/analysise.pdf?lang=en

[5] Welsh Assembly Government, Microgeneration action plan launched, 20 March 2007, http://wales.gov.uk/news/archivepress/enterprisepress/2007/1422044/?lang=en

[6] DEFRA, Local and regional CO2 emissions estimates for 2005, http://www.defra.gov.uk/environment/statistics/globatmos/download/regionalrpt/local-regionalco2emissions2005.xls

Cynulliad Cenedlaethol Cymru
National Assembly for Wales

Carbon Reduction by Transport in Wales

2nd Report of the Sustainability Committee's Inquiry into Carbon Reduction in Wales

March 2008

Contents

Committee Membership

Name Constituency

Mick Bates (Chair) Montgomeryshire

Lorraine Barrett Cardiff South and Penarth

Alun Davies Mid and West Wales

Lesley Griffiths Wrexham

Alun Ffred Jones Arfon

Leanne Wood South Wales Central

Darren Millar Clwyd West

Karen Sinclair Clwyd South

Brynle Williams North Wales

Chair's introduction

People in Wales, throughout the UK, and beyond, are beginning to realise how important it is to tackle climate change and the role that they as individuals can play in helping to achieve this. Governments across the western world are also demonstrating their commitment to reducing carbon emissions from all sectors, by introducing "green" policies. Indeed, the UK Government is in many respects leading the way in introducing the first piece of legislation in the world to lay legally binding targets for reducing greenhouse gas emissions.

The Welsh Assembly Government has also given a commitment within the One Wales document to reduce carbon emissions in those areas over which it has powers.

Against this background, the Committee agreed as our first priority to examine how Wales is performing in reducing its carbon emissions within the context of our national and international targets. We agreed to split the inquiry into a series of sub-topics, such as transport, planning and land-use, to focus our evidence sessions.

In this, the second report into carbon reduction in Wales, we look at transport emissions. We received written evidence from a wide range of organisations and took oral evidence from organisations representing transport providers, passenger transport, sustainable and integrated transport, and local authority officers. We also received evidence on examples of good practice and from an academic perspective. (See pages 26 and 27 for organisations involved)

We are confident that the evidence we have gathered from this broad variety of perspectives has provided us with robust information on which to base our recommendations. Although our recommendations are primarily aimed at the Welsh Assembly Government, we hope that you, as individuals, can use them as food for thought in your own efforts to reduce carbon emissions, whether it be opting for more sustainable modes of transport or by eco-driving.

This report will form part of our final report, to be published towards the end of 2008. As always, we welcome your thoughts and comments on this report, which we would like to publish on our website for others to read. Comments can be sent to us at Sustainability.comm@Wales.gsi.gov.uk or:

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National Assembly for Wales
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Further information about how to contribute to our written consultations on future topics can be found on our website at:

http://www.assemblywales.org/bus-home/bus-committees/bus-committees-third-assem/bus-committees-third-sc-home.htm

Chapter 1 – Introduction

1.1 The Department for Transport suggests that transport contributes to around 15 per cent of global CO2 emissions and 23 per cent (by source) of UK domestic emissions. Road transport accounts for around 93 per cent of all CO2 emissions from domestic transport. (Towards a Sustainable Transport System: Supporting Economic Growth in a Low Carbon World, October 2007)

1.2 According to DEFRA's Key Facts About: Global Atmosphere (October 2004), transport is the most rapidly growing source of emissions and is the only sector in which emissions have been rising consistently since 1990. The House of Commons Environmental Audit Committee in its report, Reducing Carbon Emissions from Transport (July 2006), concluded that, unless action is taken, emissions in the sector are projected to continue rising.

1.3 The Stern Review argued that transport is one of the more expensive sectors from which to cut emissions, because the low carbon technologies tend to be expensive and the welfare costs of reducing demand for travel are high. Transport will be among the last sectors to bring its emissions down below current levels. (Stern Review Report on the Economics of Climate Change, October 2006)

1.4 According to the Eddington Review of transport's role in sustaining the UK's productivity and competitiveness (December 2006), transport pricing should better reflect the carbon impacts of travel. The House of Commons Environmental Audit Committee has suggested that higher carbon modes of transport, such as air and motoring, have become relatively cheaper than lower carbon modes, such as bus and rail. (Reducing Carbon Emissions from Transport, August 2006)

1.5 The Commission for Integrated Transport in Transport and Climate Change: Advice to Government (2007) provides options to cut transport emissions, which involve addressing one or more of the following:

- Reducing the demand for movement (including raising public awareness, using the planning system to reduce the need for travel, traffic demand management schemes such as road-pricing, and encouraging the use of ICT facilities such as video-conferencing);
- Changing the choice of transport mode (including substituting road transport with other modes such as rail freight, improving the railway system and bus transport, promoting behavioural change through smarter choices, encouraging the use of demand responsive transport, walking and cycling);
- The technical efficiency of vehicles (including increasing the tax on some fuels, varying Vehicle Excise Duty to reflect fuel efficiency, reducing emissions from new cars) – largely determined by the UK Government and the EU;
- The carbon content of the fuels used to power them (including increasing the proportion of fuel from renewable and non-fossil sources) – determined by the EU; and

- The efficiency of vehicle use (including reducing national speed limits and encouraging road safety measures and eco-driving) – mostly determined by the UK Government.

1.6 Of the five options listed above, the Welsh Assembly Government has most responsibility and scope for influence over the first two, i.e. the demand for movement and the choice of transport mode.

Road transport

1.7 Regional and local transport consumption statistics show that road transport accounts for approximately 16 per cent of the total carbon dioxide emissions in Wales. Passenger cars are estimated to account for more than 60 per cent of the carbon emitted by transport activities. (Department for Business, Enterprise and Regulatory Reform, 2002) The Department for Transport's National Travel Survey 2005 shows that the average distance travelled by car increased by around three per cent between 1995-1997 and 2005. Total road traffic was forecast to grow by 17 per cent between 2000 and 2010. (Department for Environment, Transport and the Regions, Transport Ten Year Plan 2000: Background Analysis, July 2000)

Air travel

1.8 In the aforementioned report, the Environmental Audit Committee suggest that air transport is undergoing the most rapid increase of any transport sector and that, by 2050, aviation will account for at least one quarter of the UK economy's "entire capacity to emit carbon". It is widely recognised that the climate impacts associated with air transport are more severe than those associated with emissions at ground level. (Growth scenarios for EU and UK aviation: contradictions with climate policy, Tyndall Centre for Climate Change Research, January 2006)

1.9 Department for Transport figures show that passenger growth at Cardiff International Airport in the ten years to 2002 was 9.8 per cent per annum, greater than the UK regional average. (The Future of Air Transport: Key Facts – Wales, December 2003)

1.10 It is widely accepted that demand management is currently the only realistic means of limiting the carbon dioxide emissions from air transport, principally through price signals – determined by the UK Government. Evidence from Brons M et al 2002, published in the Journal of Air Transport Management 8, indicates that price affects the demand for flying, in particular for non-business trips. (Price elasticities of demand for passenger air travel: a meta-analysis, 2002)

Wales Transport Strategy

1.11 The Welsh Assembly Government is required, under the Transport (Wales) Act 2006, to promote safe, integrated, sustainable, efficient and economic transport. The Act also places a requirement on the Welsh Assembly Government to publish a Wales Transport Strategy.

1.12 Connecting Wales, a draft Wales Transport Strategy, was published in July 2006, containing the theme "to minimise the need to travel" and suggests land-use planning, use of technology, managing demand and raising awareness, as possible methods to achieve this. Connecting Wales also includes a theme of achieving greater use of sustainable and healthy modes of travel, highlighting a reduction in single-occupancy car use and "smarter choices" as possible ways in which to do so.

1.13 The final Wales Transport Strategy is due to be published in Spring 2008, to be followed by a National Transport Plan. Each of the four regional transport consortia is also preparing a Regional Transport Plan and these are due to be completed in 2009.

Chapter 2 – Key issues and recommendations

"We will aim to achieve annual carbon reduction-equivalent emissions reductions of 3% per year by 2011 in areas of devolved competence. We will set out specific sectoral targets in relation to residential, public and transport areas. "

One Wales - A progressive agenda for the government of Wales – Labour and Plaid Cymru Groups in the National Assembly, June 2007

2.1 The Committee welcomes the coalition government's commitment to carbon reduction contained within the One Wales document and fully supports it in its efforts to achieve this.

2.2 On the basis of evidence gathered from a wide range of organisations during this inquiry, the Committee is concerned that the Welsh Assembly Government's commitment is not sufficiently reflected within its current transport policies to enable the 3 per cent target to be achieved.

2.3 Whilst the transport sector is an area in which the Welsh Assembly Government does not have wide ranging powers to influence carbon reduction, the Committee believes that a significant impact on the 3% target can be made through changing the focus of its transport policies, changing behaviours, and improving public transport.

2.4 In this chapter, the Committee outlines four 'headline' recommendations that it believes will be key to achieving significant reductions in carbon emissions by transport. For each of the headline recommendations, the Committee has attempted to provide the potential savings in carbon dioxide emissions from transport that could be achieved if they were to be adopted by the Welsh Assembly Government. The calculations and assumptions used to arrive at the potential savings are provided at Annex D.

2.5 Other recommendations follow in later chapters of this report.

Government policy

2.6 The majority of witnesses claimed that carbon reduction must be a high priority on the transport agenda. According to the Commission for Integrated Transport, carbon reduction is currently a secondary consideration (Sustainability Committee, 22 November 2007). The evidence gathered by the Committee also suggested that the Welsh Assembly Government must take a much stronger lead in tackling carbon emissions by transport in Wales. Cardiff City Council and the South East Wales Transport Alliance (SEWTA) claimed that the Wales Transport Strategy was full of well-meaning statements to reduce carbon emissions, but was very short on details to turn this into reality. (Cardiff City Council written evidence SC(3) CR-T3; SEWTA written evidence SC(3)-T11)

2.7 There was also concern among respondents that the delay in publication of the Wales Transport Strategy and the National Transport Plan was having a knock-on effect on the Regional Transport Plans.

2.8 The Committee received conflicting evidence from some witnesses and the Deputy First Minister and Minister for Economy and Transport as to the exact proportion of transport funding

currently being allocated to sustainable transport. The Association of Transport Co-ordinating Officers (ATCO) and the Welsh Local Government Association (WLGA) suggested that less than one third of transport funding was being spent on sustainable transport, as compared to 70 per cent in Scotland (ATCO, Sustainability Committee 29 November 2007, WLGA, written evidence SC(3) CR-T16). The Deputy First Minister and Minister for Economy and Transport stated in his oral evidence to the Committee that "the current proportion is 50:50 between public transport and roads" and that this split is likely to continue for the next 3 years. (Sustainability Committee, 24 January 2008).

2.9 The Committee is concerned that insufficient emphasis is being placed on carbon reduction within the Welsh Assembly Government's transport policies, and in particular that too much investment is targeted at road-building and too little at sustainable transport, walking and cycling. The Committee is also concerned about the apparent lack of urgency in completing the Wales Transport Strategy and the National Transport Plan.

Headline Recommendation 1: The Committee recommends that the Welsh Assembly Government takes a much stronger lead by placing carbon reduction at the heart of the Wales Transport Strategy and by increasing funding for sustainable transport from around 50 per cent to around 70 per cent of the transport budget, in line with Scotland.

The Committee estimates that implementation of Headline Recommendation 1 could, from 2009 onwards, achieve a potential annual saving of carbon dioxide emissions of between 36,000 and 72,000 tonnes.

2.10 The Committee heard evidence from Friends of the Earth (FoE) and the Association of Transport Co-ordinating Officers that Regional Transport Plans must include commitments to real action on cutting carbon emissions (FoE, written evidence SC(3) CR-T7). Other respondents to the inquiry suggested that, at present, draft Regional Transport Plans concentrate too heavily on economic development with insufficient reference to sustainability.

2.11 Concerns were also expressed that a reduction in funding for the four Regional Transport Consortia had contributed to the delay in production of the Regional Transport Plans and could compromise their ability to deliver the plans. The County Surveyors' Society Wales (CSS Wales) specifically expressed concerns about the current arrangements for local authority funding of public transport initiatives and claimed that there were better ways of funding transport in the future through the Regional Transport Consortia (CSS Wales, Sustainability Committee, 29 November 2007).

2.12 The Committee is disappointed that there would appear to be too much emphasis on economic development within the draft Regional Transport Plans at the expense of carbon reduction priorities and is concerned that the funding allocated to the Regional Transport Consortia might not be sufficient to ensure their effective implementation.

Headline Recommendation 2: The Committee recommends that the Welsh Assembly Government ensures that the National Transport Plan and Regional Transport Plans include specific and measurable objectives to cut carbon emissions and that sufficient funding is provided to the Regional Transport Consortia to be able to deliver these objectives.

The Committee estimates that implementation of Headline Recommendation 2 could, from 2009 onwards, achieve a potential annual saving of carbon dioxide emissions of 231,000 tonnes.

2.13 The Committee heard evidence from the County Surveyors' Society Wales that carbon reduction was too far down the list of priorities in the Welsh Tranport Appraisal Guidance (WelTAG), the Welsh Assembly Government's transport investment appraisal technique. It was, however, reassured that the technique provided an initial safeguard that could be developed further.

2.14 SEWTA suggested that if investment in transport was to reduce carbon emissions, then carbon reduction must be moved up the list of priorities, as it is currently stalled on the starting grid (SEWTA, written evidence, SC(3) CR-T11). Sustrans argued that the WelTAG favoured large expensive schemes in excess of £5 million that very often increase carbon emissions (Sustainability Committee 22 November 2007 SC(3)-10-07 Paper 4).

2.15 Whilst the Committee recognises that the WelTAG provides an important mechanism by which the carbon impact of potential projects can be assessed, it is deeply concerned as to the priority to which carbon reduction is given within WelTAG.

Headline Recommendation 3: The Committee therefore recommends that the Welsh Assembly Government reviews the use of WelTAG as a matter of urgency to ensure that carbon reduction is the main objective when assessing projects.

The Committee believes that implementation of Headline Recommendation 3 will contribute towards achieving the savings that could be delivered through Headline Recommendation 2.

Changing Behaviours

2.16 The majority of witnesses suggested that the marketing of "smarter choices" is one of the keys to changing behaviour. Sustrans claimed that more information on existing alternatives to the private car can lead to reductions in car use of up to 12 per cent. The Association of Transport Co-ordinating Officers suggested that for 40 per cent of journeys, a good "smart" alternative already exists and that all that is required is smart marketing tailored to suit the needs of individuals.

2.17 The Committee is concerned at the Minister's admission that there are currently only five travel co-ordinators in Wales charged with providing tailored information to individuals on existing alternatives to the private car. The Committee notes Sustrans' proposal that for £15 million, which it claimed is less than the cost of building half a mile of motorway; its TravelSmart behavioural change programme could be rolled-out across large towns and cities in Wales and could achieve a 1 per cent reduction of 81,000 tonnes in carbon dioxide emissions per annum from all transport.

Headline Recommendation 4: The Committee recommends that the Welsh Assembly Government conducts a pilot scheme in Wales based on the Sustrans' TravelSmart programme to assess its impact, before considering its roll-out across Wales.

The Committee estimates that implementation of Headline Recommendation 4 could achieve a potential annual saving of carbon dioxide emissions of 81,000 tonnes.

Chapter 3: Government policy

“Policies need to become more inspirational and solutions-based."
Friends of the Earth, written evidence, SC(3) CR-T7

“We cannot build our way out of traffic and transportation problems."
County Surveyors’ Society Wales, Sustainability Committee, 29 November 2007

3.1 Most respondents claimed that there was a conflict in the Welsh Assembly Government’s transport and carbon reduction policies, where sustainability competes with economic development. Wales Environment Link (WEL) highlighted, in particular, increased funding for the road network and subsidies for national and domestic air links as contradictory to policies on reducing carbon emissions (WEL, written evidence, SC(3) CR-T15). Friends of the Earth went one step further in suggesting that current transport policies were encouraging a significant increase in carbon emissions.

3.2 The Committee questions the consistency of Welsh Assembly Government policy in setting targets for the reduction of carbon emissions from transport, whilst continuing to subsidise domestic air travel.

3.3 Witnesses suggested that local authorities must lead by example in providing administration centres and public buildings at locations where sustainable modes of transport can provide mobility and accessibility for workers and visitors. The Commission for Integrated Transport argued that public sector organisations should be given targets in relation to the procurement of efficient cars and Sustrans suggested that they should be given sectoral targets.

3.4 The Association of Transport Co-ordinating Officers believed that local authorities and public bodies should adopt effective travel plans immediately and other respondents went a step further in suggesting that local authorities should be charged with requiring organisations in their area to develop green travel plans.

3.5 The Committee believes that local authorities and public bodies have a responsibility to be exemplars in the development and introduction of ground-breaking policies to support their staff in taking sustainable travel and working options.

Recommendation 5: The Committee recommends that local authorities and public bodies lead by example by providing administration centres and public buildings at locations where there are sustainable modes of transport for workers and visitors.

Recommendation 6: The Committee recommends that the Welsh Assembly Government gives public sector organisations targets in relation to the procurement of efficient motor vehicles and adoption of green travel plans.

3.6 The Wales Transport Research Centre argued that development planning projects, both public and private, must be considered in terms of multi-modal transport implications for passenger and freight. (Wales Transport Research Centre, Sustainability Committee, 22 November 2007). It further suggested that out-of-town commercial, retail and sporting land use must be discouraged, where there was a lack of existing public transport. Better integration of land-use and transport planning was required at a regional and local level.

3.7 The Committee supports the view that better integration of land-use and transport planning is required at a regional and local level to reduce the need to travel and to encourage use of public transport wherever possible.

Recommendation 7: The Committee recommends that the Welsh Assembly Government should urgently revise its statutory planning guidance for local authorities to ensure that proposals for development are not permitted where adequate public transport cannot be provided.

3.8 The South West Wales Integrated Transport Consortium (SWWITCH) suggested that the Welsh Assembly Government must look “beyond the transport box" in terms of carbon reduction to include those who plan for other public services, such as health, social services, housing and education. (SWWITCH, written evidence, SC(3) CR-T12). The decisions made on the location of services and facilities in these portfolios had an enormous potential impact on the demand for transport. Sustrans agreed that more joined-up thinking across government departments in general was needed, and highlighted in particular that walking and cycling directly saved the NHS, and other spending on preventable deaths and illnesses attributed to physical inactivity.

Recommendation 8: The Committee broadly supports this view and recommends that there is more joined-up thinking across departmental portfolios within the Welsh Assembly Government and local authorities to ensure that decisions on the location of services and facilities take into consideration transport implications.

Chapter 4: Changing behaviours

“Environmental concerns alone are not enough of an incentive to change behaviour." Netherlands eco-driving project, background paper to Sustainability Committee, 6 December 2007

4.1 The majority of witnesses argued that the promotion of wider travel choices could encourage people to change their behaviour. Sustrans claimed that most car journeys in Wales were local: 60 per cent of car trips were less than five miles and around 25 per cent were less than 2 miles.

4.2 Cardiff City Council suggested that changing behaviours would require improvements to the content, provision, accessibility and promotion of travel information; provision of transport improvements to encourage car-sharing and use of public transport, cycling and walking, promotion of travel planning and sustainable freight travel, reduction in the cost of public transport, and the provision of new roads and improvements to existing roads, where these can provide public transport and congestion benefits.

4.3 The Commission for Integrated Transport, the Energy Saving Trust and Friends of the Earth each claimed that the introduction of an eco-driving scheme could lead to fuel savings of between 5 and 10 per cent (Energy Saving Trust, written evidence, SC(3) CR-T6).

4.4 In the Netherlands, an eco-driving project achieved reductions in fuel use of up to 20 per cent over the last eight years. Evidence from the Netherlands and other countries across Europe showed that, in order to maximise results, marketing and promotion must focus on individual benefits, such as cost reductions, safety and comfort, rather than on environmental aspects.

4.5 The Energy Saving Trust highlighted its role in co-ordinating an eco-driving campaign for the Scottish Government, which had led to a doubling of awareness of eco-driving from 15 per cent to 34 per cent, within its target audience of over 850,000 commuters into Edinburgh and Glasgow.

4.6 The Committee notes the successes of eco-driving schemes in the Netherlands and other countries across Europe and welcomes the UK Government's commitment to include elements of eco-driving as part of the driving test from this year.

Recommendation 9: The Committee recommends that the Welsh Assembly Government introduces a wide marketing and promotion campaign on the benefits of eco-driving, paying particular attention to cost and safety benefits, rather than environmental aspects.

Recommendation 10: The Committee further recommends that the Welsh Assembly Government introduces a pilot scheme in one local authority area where all public sector employees, for whom driving is part of their job, must undertake an eco-driving course.

4.7 According to SWWITCH, the Sustainable Travel Towns initiative must be a fundamental element of the Wales Transport Strategy, rather than a token gesture. Many witnesses questioned the Welsh Assembly Government's commitment to the project and stressed that, rather than introducing pilot schemes in Wales which had already proved successful in England, there was a need to roll-out the projects across Wales, including in some rural areas.

4.8 According to Sustrans and the Association of Transport Co-ordinating Officers (ATCO), the details and proposed level of funding for the Sustainable Travel Town projects were also required urgently, as there were concerns that the funding would be spread too thinly or would not be "new" money.

4.9 The Committee welcomes the Welsh Assembly Government's announcement of the creation of four Sustainable Travel Towns in Wales, but believes that there is no need for any more pilot projects, as the success of the initiative has already been widely proved in England.

Recommendation 11: The Committee recommends that the Welsh Assembly Government demonstrates its commitment to the Sustainable Travel Towns project by announcing details and levels of funding as a matter of urgency and by rolling-out the project across Wales, including in some rural areas, without any further pilots.

4.10 The Committee heard evidence from the Wales Transport Research Centre and Wales Environment Link that new technology provided a process by which to reduce the need to travel and should thereby assist in changing behaviour. Examples provided included internet shopping, home deliveries, video-conferencing, and home-working, which in itself was particularly effective in reducing traffic congestion at peak times.

4.11 The Committee believes that opportunities provided through new technology, such as home-working and video-conferencing, should be encouraged more widely and suggests that the Welsh Assembly Government, local authorities and other public bodies have a role in promoting such opportunities.

Recommendation 12: The Committee therefore recommends that the Welsh Assembly Government, local authorities and other public bodies lead the way in encouraging and incentivising home-working amongst their employees and the use of video-conferencing wherever possible.

Chapter 5: Improving public transport

“The challenge can only be met by investment in developing and promoting real and attractive alternatives to car use."
Cardiff City Council, written evidence, SC(3) CR-T3

5.1 The Committee heard evidence that changing perceptions of public transport, particularly buses and local trains, was essential in achieving a modal shift from private car use. The Confederation of Passenger Transport Cymru (CPT Cymru) argued that poor perceptions of comfort, punctuality, convenience, safety, and service were currently deterring potential passengers (CPT Cymru, Sustainability Committee, 6 December 2007). According to Sustrans, people also perceived door-to-door journey times by car compared to public transport to be twice as quick as they actually were.

5.2 SEWTA suggested that promoting and publicising public transport in order to change perceptions required significantly increased funding and innovative thinking, for example, offering a free trial to travel on public transport. The Wales Transport Research Centre argued that advertising had a significant effect in lifestyle decisions and highlighted that current annual spend by the UK car industry is £500 million; public transport advertising was nearer £60 million.

5.3 The Committee agrees that perceptions of public transport must be challenged in innovative ways if a modal shift from private cars to sustainable public transport is to be achieved.

Recommendation 13: The Committee recommends that the Welsh Assembly Government provides support and guidance to local authorities on providing incentives to promote and publicise public transport, for example offering a free trial to travel on public transport.

5.4 The majority of witnesses argued that direct government funding to encourage major improvements in public transport product quality would have a greater impact on modal shift than most other means. The Chartered Institute for Logistics Transport (CILT) suggested that it would be more popular than some of the “sticks", such as road-pricing, which would follow more naturally later, if required (written evidence, SC(3) CR-T4).

5.5 The Committee firmly believes that a real modal shift from private car use to public transport can only be achieved with increased government investment in public transport infrastructure and vehicles, to ensure that individuals experience a comfortable, reliable, punctual, cost-effective and safe journey by public transport, wherever possible.

Recommendation 14: The Committee recommends that the Welsh Assembly Government reviews its planned expenditure on public transport provision and provides direct funding at an early stage to

encourage major improvements in the quality of public transport, before other options such as road-pricing can be considered.

5.6 The Confederation of Passenger Transport Cymru argued that the use of statutory Quality Bus Partnerships could drive quality upwards to make bus travel an effective alternative. It further argued that the Welsh Assembly Government could, through local authorities, encourage the use of statutory Quality Bus Partnerships with those bus companies that used environmentally friendly vehicles and that had achieved environmental standards, such as Green Dragon.

5.7 The Committee notes that the Deputy First Minister and Minister for Economy and Transport, in his statement on Welsh provisions in the Local Transport Bill (4 December 2007), suggested that the Bill would make Quality Contract Schemes “a realistic option".

Recommendation 15: The Committee recommends that once the Local Transport Bill becomes law, the Welsh Assembly Government issues guidance to local authorities to ensure that they use Quality Bus Partnerships and Quality Contract Schemes, to encourage bus operators to give priority to reducing the carbon emissions of their vehicles.

5.8 A number of witnesses suggested that action should be focused on severe localised peak congestion at interchanges along key routes and within urban centres for optimum results in reducing carbon emissions. Both SEWTA and Friends of the Earth argued that it would be easier to cut carbon emissions in south-east Wales, where alternative provision for many journeys only need to be enhanced, than in mid-Wales where other options are more difficult.

5.9 The Association of Transport Co-ordinating Officers and the Wales Transport Research Centre suggested that demand-responsive intelligent transport solutions could enhance low usage public transport in rural areas, especially at off-peak times. Such provision could include higher frequency limited stop buses, community transport operations, car-sharing and taxi-bus schemes.

5.10 The Committee believes that action must be taken throughout Wales in order to efficiently tackle carbon emissions by transport. The Committee agrees that low usage public transport should be supplemented in rural areas, particularly during off-peak times, with demand-responsive intelligent transport solutions.

Recommendation 16: The Committee therefore recommends that the Welsh Assembly Government provides the necessary funding and guidance to local authorities to introduce pilot schemes across rural Wales, such as community buses, car-sharing and taxi-bus schemes.

5.11 Rail capacity must be increased to meet the anticipated growth and demand, according to Network Rail and the Association of Train Operating Companies (Network Rail, written evidence, SC(3) CR-T9). They believe that, whilst there is a continuing need for improvements to infrastructure, such as new and extended platforms, significant increases in rail rolling stock were also required.

5.12 Network Rail further argued that increased investment in railway infrastructure could contribute to the modal shift required from private cars to public transport. Passenger Focus suggested that investment was needed in areas such as additional services and newer rolling stock that more directly influence passengers' choice of transport mode (Passenger Focus, written evidence, SC(3) CR-T10).

5.13 It was suggested by the Association of Train Operating Companies (ATOC) that there was no prospect of reducing carbon emissions if the low-carbon energy needed to power trains in 20 to 30 years is not there (ATOC, Sustainability Committee, 6 December 2007). This is an issue to which the Committee would like to return at a later stage in the inquiry.

5.14 The Committee agrees that increased investment in infrastructure and rolling stock is needed to meet the anticipated growth in passenger numbers and to encourage the transfer of freight from road to rail. However, the Committee suggests that this needs to be managed carefully to avoid the potential for conflict between the increased use of the railways for passengers and for freight.

Recommendation 17: The Committee therefore recommends that the Welsh Assembly Government provides significant investment in new and extended platforms, in rolling stock, and in ensuring that the infrastructure can also support the expected growth in passenger numbers and the increasing transfer of freight from road to rail.

5.15 Network Rail was keen to see closer collaborations between the rail industry and Welsh Transport authorities over the development of transport policies to reduce carbon emissions. In particular, Network Rail suggested that the Route Utilisation Strategy, which informs the development and delivery of timetables, infrastructure maintenance and renewals for the network, must be developed through a partnership of the rail industry and Welsh transport authorities.

5.16 The Committee believes that the uptake of rail transport can only be increased by improved timetabling of passenger journeys and reduced journey times, wherever possible.

Recommendation 18: The Committee recommends that the Welsh Assembly Government works closely with Network Rail and the train operating companies to enhance timetabling for rail passengers and to reduce journey times to allow more flexibility and encourage uptake.

5.17 A number of witnesses suggested that enhanced bus and rail co-ordination, including introducing and marketing integrated ticketing to improve connections, particularly in towns and villages, could make public transport a more viable option.

5.18 The Association of Transport Co-ordinating Officers (ATCO) suggested that there was a lack of awareness of existing products that needed to be addressed. The Confederation of Passenger Transport Cymru in particular argued that integrated ticketing initiatives, such as the PlusBus scheme, already existed, but that they had not been marketed. However, ATCO argued that the PlusBus scheme had been promoted extensively over the past eight years, but the numbers using the scheme were still quite small.

5.19 The Committee believes that integrated ticketing across bus and rail journeys, if timetabling and connection times are co-ordinated effectively, can play an important role in encouraging both commuters and tourists to switch to public transport.

Recommendation 19: The Committee recommends that the Welsh Assembly Government works closely with local authorities and transport providers to promote integrated ticketing for existing travel options across bus and rail journeys, whilst ensuring co-ordination of timetables and minimising connection waiting times.

5.20 The Confederation of Passenger Transport Cymru suggested that political will and leadership from local authorities was required to enable the implementation of necessary measures, such as bus lanes and park and ride facilities.

5.21 The Wales Transport Research Centre argued that there was a need for investment in more long-distance commuter bus lanes and safe and convenient park-and-ride schemes. The Confederation of Passenger Transport Cymru claimed that improving reliability and making bus transport an effective alternative required investment in bus lanes, bus priority at junctions, and park-and-ride facilities.

5.22 The Committee believes that the Welsh Assembly Government has a role in influencing local authorities to implement and promote bus lanes and park-and-ride facilities where they would make a significant impact on tackling carbon emissions in urban areas.

Recommendation 20: The Committee recommends that the Welsh Assembly Government encourages local authorities to show leadership in the implementation and promotion of bus lanes and safe and convenient park and ride facilities.

5.23 The Institute of Advanced Motorists and the Energy Saving Trust suggested that Green Fleet Reviews should be introduced in Wales (Institute of Advanced Motorists, written evidence, SC(3) CR-T8; Energy Saving Trust, written evidence, SC(3) CR-T6). Green Fleet Reviews are currently being funded by the Department for Transport in England and the Scottish Government in Scotland and provide organisations with tailored fleet management advice to help lower running costs, to reduce environmental impact and to enhance corporate social responsibility.

5.22 The Committee notes the work of the Green Fleet Reviews in England and Scotland in providing organisations with tailored advice in relation to reducing their environmental impact and running costs.

Recommendation 21: The Committee recommends that the Welsh Assembly Government considers introducing Green Fleet Reviews in Wales.

Chapter 6: Road-pricing

“Preparing people through promoting behavioural change will make them more receptive to initiatives for sustainable transport and road-pricing in the longer term".

Cardiff City Council, written evidence, SC(3) CR-T3

6.1 The Committee heard evidence to suggest that UK-wide road-pricing with local implementation was required. SEWTA argued that road-pricing could make a substantial difference, whether it was operated nationally or just within cities and on the motorways. Road-pricing would not necessarily be applicable to the whole of Wales.

Recommendation 22: The Committee recommends that any future non-local road-pricing scheme should be integrated across the United Kingdom, but with regional and local flexibility as to how it is applied.

6.2 According to the Association of Transport Co-ordinating Officers, road-pricing should only be supported if it funded passenger transport improvements. SEWTA suggested that road-pricing was a source of funds which should be returned to users of the transport system by way of capital investment in public transport and in the highway system, improved highway maintenance, increased support of public transport services, support for travel plans and soft measures. The Local Transport Bill would make it a requirement for all of these funds to be reinvested in support of local transport policies.

6.3 The Committee agrees that adequate public transport alternatives must be available before the introduction of any local road-pricing schemes can be considered.

Recommendation 23: The Committee therefore recommends that the Welsh Assembly Government does not approve any local road-pricing schemes unless it can be demonstrated that adequate alternative public transport provision is available.

6.4 Road-pricing must be connected to the environmental credentials of vehicles and be introduced within the context of a more effective public transport system, stressed the Commission for Integrated Transport. SEWTA also suggested that relating the level of charges to the carbon emissions profile of the vehicle and to the number of passengers, could give clear signals to consumers to switch to more efficient cars or other more sustainable modes of transport. Others suggested that road-pricing must be set at variable rates based on sections of the road, areas and times of day.

6.5 The Committee notes that the Deputy First Minister and Minister for Economy and Transport is currently considering road-pricing on future large infrastructure projects, where there are congestion issues (Statement on Welsh provisions in the Local Transport Bill, 4 December 2007). The Committee stresses that, if significant improvements to congestion and environmental impacts are to be achieved from any such future road-pricing schemes, they must relate to the environmental performance of vehicles and numbers of passengers.

Recommendation 24: The Committee recommends that any future road-pricing schemes relate to the environmental credentials of vehicles and number of passengers and that adequate support is provided to public transport in order to anticipate increased demand.

Chapter 7: Adequacy of current powers

“A lack of powers must not become an excuse for Wales not to reduce CO2 emissions".

7.1 The Committee was interested to hear from respondents and witnesses as to whether they believed the Welsh Assembly Government needed any further powers in order to effectively address the problem of carbon dioxide emissions from vehicles.

7.2 An overwhelming majority of respondents and witnesses argued that the Welsh Assembly Government already had the powers it needed to have a considerable impact on tackling carbon emissions by transport, but that they needed to be used more effectively. The Confederation of Passenger Transport Cymru argued that the Welsh Assembly Government and local government lacked the resources and political will to introduce and enforce key measures, although the necessary powers were available to them.

7.3 Wales Environment Link argued that joint working with the UK Government in non-devolved areas in relation to carbon reduction by transport should urgently be sought and reported on by the Welsh Assembly Government.

7.4 The Association of Transport Co-ordinating Officers suggested that increased funding for and improvements in the marketing of sustainable transport alternatives were key ways in which the Welsh Assembly Government and local authorities could achieve results within their existing powers. It did, however, recognise the difficulty for local authorities to increase spending in this area against a background of spending pressures.

7.5 The Chartered Institute of Logistics and Transport (UK) Wales Region recognised that there was a constraint as to the amount of action that the Welsh Assembly Government could take, due to the fact that it did not have control over all transport policy decisions.

7.6 On the basis of the evidence gathered, the Committee firmly believes that the Welsh Assembly Government can, within its current powers, make a significant contribution to tackling carbon emissions by transport and that the recommendations contained within this report provide an effective action plan to achieve this.

7.7 The Committee further believes that the Welsh Assembly Government can have influence in those areas of transport policy that are not devolved, through close discussions with the UK Government and its departments to drive forward change.

Recommendation 25: The Committee recommends that the Welsh Assembly Government works closely with the UK Government to explore taking forward action in the non-devolved areas of transport, such as the technical efficiency of vehicles, carbon content of fuels and reduced speed limits.

7.8 According to the Association of Transport Co-ordinating Officers (ATCO), the Local Transport Bill would give Welsh Ministers and local authorities more control over the provision of bus services through the use of quality partnerships and quality contracts. However, ATCO suggested that the Welsh Assembly Government needed more powers to integrate and co-ordinate bus services. Wales Transport Research Centre argued that the full franchising of local bus services was necessary to deliver fully integrated transport, but the Local Transport Bill does not go this far.

7.9 According to Sustrans, a duty should be placed on the Welsh Assembly Government to develop and maintain a network of traffic free shared-use paths across Wales. It further claimed

that a current lack of funding for maintenance was proving to be a disincentive for local authorities to build paths for walking and cycling. Sustrans proposed the introduction of a Walking and Cycling Paths Legislative Competence Order to address this anomaly.

7.10 The Committee believes that Sustrans' proposal for the introduction of a Walking and Cycling Paths Legislative Competence Order has merits and suggests that the proposal should be considered in more detail by the Welsh Assembly Government.

Recommendation 26: The Committee recommends that the Welsh Assembly Government considers fully the proposal by Sustrans to introduce a Walking and Cycling Paths Legislative Competence Order, with a view to placing a duty on the Welsh Assembly Government to develop and maintain a network of traffic-free shared-use paths across Wales.

7.11 The Committee believes that the recommendations contained within this report provide an effective action plan for the Welsh Assembly Government to make a significant impact on reducing carbon emissions by transport. The Committee intends to monitor the impact of implementation of the recommendations and would therefore wish to receive regular updates from the Welsh Assembly Government on progress.

Recommendation 27: The Committee recommends that the Welsh Assembly Government reports to the Committee every six months on its progress in implementing the recommendations from this report that it accepts.

Annex A: Summary of recommendations

Headline recommendations:

Headline Recommendation 1: The Committee recommends that the Welsh Assembly Government takes a much stronger lead by placing carbon reduction at the heart of the Wales Transport Strategy and by increasing funding for sustainable transport from around 50 per cent to around 70 per cent of the transport budget, in line with Scotland.

Headline Recommendation 2: The Committee recommends that the Welsh Assembly Government ensures that the National Transport Plan and Regional Transport Plans include specific and measurable objectives to cut carbon emissions and that sufficient funding is provided to the Regional Transport Consortia to be able to deliver these objectives.

Headline Recommendation 3: The Committee recommends that the Welsh Assembly Government reviews the use of WelTAG as a matter

of urgency to ensure that carbon reduction is the main objective when assessing projects.

Headline Recommendation 4: The Committee recommends that the Welsh Assembly Government conducts a pilot scheme in Wales based on the Sustrans' TravelSmart programme to assess its impact, before considering its roll-out across Wales.

Other recommendations:

Recommendation 5: The Committee recommends that local authorities and public bodies lead by example by providing administration centres and public buildings at locations where there are sustainable modes of transport for workers and visitors.

Recommendation 6: The Committee recommends that the Welsh Assembly Government gives public sector organisations targets in relation to the procurement of efficient motor vehicles and adoption of green travel plans.

Recommendation 7: The Committee recommends that the Welsh Assembly Government should urgently revise its statutory planning guidance for local authorities to ensure that proposals for development are not permitted where adequate public transport cannot be provided.

Recommendation 8: The Committee broadly supports this view and recommends that there is more joined-up thinking across departmental portfolios within the Welsh Assembly Government and local authorities to ensure that decisions on the location of services and facilities take into consideration transport implications.

Recommendation 9: The Committee recommends that the Welsh Assembly Government introduces a wide marketing and promotion campaign on the benefits of eco-driving, paying particular attention to cost and safety benefits, rather than environmental aspects.

Recommendation 10: The Committee further recommends that the Welsh Assembly Government introduces a pilot scheme in one local authority area where all public sector employees, for whom driving is part of their job, must undertake an eco-driving course.

Recommendation 11: The Committee recommends that the Welsh Assembly Government demonstrates its commitment to the Sustainable Travel Towns project by announcing details and levels of

funding as a matter of urgency and by rolling-out the project across Wales, including in some rural areas, without further pilots.

Recommendation 12: The Committee recommends that the Welsh Assembly Government, local authorities and other public bodies lead the way in encouraging and incentivising home-working amongst their employees and the use of video-conferencing wherever possible.

Recommendation 13: The Committee recommends that the Welsh Assembly Government provides support and guidance to local authorities on providing incentives to promote and publicise public transport, for example offering a free trial to travel on public transport.

Recommendation 14: The Committee recommends that the Welsh Assembly Government reviews its planned expenditure on public transport provision and provides direct funding at an early stage to encourage major improvements in the quality of public transport, before other options such as road pricing can be considered.

Recommendation 15: The Committee recommends that once the Local Transport Bill becomes law, the Welsh Assembly Government issues guidance to local authorities to ensure that they use Quality Bus Partnerships and Quality Contract Schemes, to encourage bus operators to give priority to reducing the carbon emissions of their vehicles.

Recommendation 16: The Committee recommends that the Welsh Assembly Government provides the necessary funding and guidance to local authorities to introduce pilot schemes across rural Wales, such as community buses, car-sharing and taxi-bus schemes.

Recommendation 17: The Committee recommends that the Welsh Assembly Government provides significant investment in new and extended platforms, in rolling stock and in ensuring that the infrastructure can also support the expected growth in passenger numbers and the increasing transfer of freight from road to rail.

Recommendation 18: The Committee recommends that the Welsh Assembly Government works closely with Network Rail and the train operating companies to enhance timetabling for rail passengers and reduce journey times to allow more flexibility and encourage uptake.

Recommendation 19: The Committee recommends that the Welsh Assembly Government works closely with local authorities and transport providers to promote integrated ticketing for existing travel options across bus and rail journeys, whilst ensuring co-ordination of timetables and minimising connection waiting times.

Recommendation 20: The Committee recommends that the Welsh Assembly Government encourages local authorities to show leadership in the implementation and promotion of bus lanes and safe and convenient park and ride facilities.

Recommendation 21: The Committee recommends that the Welsh Assembly Government considers introducing Green Fleet Reviews in Wales.

Recommendation 22: The Committee recommends that any future non-local road-pricing scheme should be integrated across the United Kingdom, but with regional and local flexibility as to how it is applied.

Recommendation 23: The Committee recommends that the Welsh Assembly Government does not approve any local road-pricing schemes unless it can be demonstrated that adequate alternative public transport provision is available.

Recommendation 24: The Committee recommends that any future road-pricing schemes relate to the environmental credentials of vehicles and number of passengers and that adequate support is provided to public transport in order to anticipate increased demand.

Recommendation 25: The Committee recommends that the Welsh Assembly Government works closely with the UK Government to explore taking forward action in the non-devolved areas of transport, such as the technical efficiency of vehicles, carbon content of fuels and reduced speed limits.

Recommendation 26: The Committee recommends that the Welsh Assembly Government considers fully the proposal by Sustrans to introduce a Walking and Cycling Paths Legislative Competence Order, with a view to placing a duty on the Welsh Assembly Government to develop and maintain a network of traffic-free shared-use paths across Wales.

Recommendation 27: The Committee recommends that the Welsh Assembly Government reports to the Committee every six months on

its progress in implementing those recommendations from this report that it has accepted.

Annex B: List of respondents to written call for evidence

Arriva Trains Wales

Beehive Housing Co-operative

Cardiff City Council

Chartered Institute of Logistics and Transport (UK) Wales Region

Countryside Council for Wales

Energy Saving Trust

Friends of the Earth Cymru

Institute of Advanced Motorists Motoring Trust

Network Rail

Passenger Focus

South East Wales Transport Alliance (Sewta)

South West Wales Integrated Transport Consortium (SWWITCH)

Sundance Renewables (Sustainable Energy Co-operative) Ltd

Sustrans Cymru

Wales Environment Link

Welsh Local Government Association (WLGA)

Annex C: List of witnesses providing oral evidence

Thursday 22 November 2007 SC(3)-10-07 : Transcript

Commission for Integrated Transport

SC(3)-10-07 : Paper 1 : Commission for Integrated Transport Submission (pdf 82 KB)

Wales Transport Research Centre

SC(3)-10-07 : Paper 2 : Transport Impacts - Issues and Steps to Deliver:- Briefing Note by Professor Cole, Wales Transport Research Centre

Sustrans

SC(3)-10-07 : Paper 4 : Sustrans Submission (pdf 161 KB)

Thursday 29 November 2007 SC(3)-11-07 : Transcript

County Surveyors' Society Wales

SC(3)-11-07 : Paper 1 : County Surveyors Society Wales - Links to Regional Transport Plans

Association of Transport Co-ordinating Officers Wales

SC(3)-11-07 : Paper 2 : Association of Transport Co-ordinating Officers' Submission

Thursday 6 December 2007 SC(3)-12-07 : Transcript

Association of Train Operating Companies

SC(3)-12-07 : Paper 1 : Association of Train Operating Companies (ATOC) Submission

Confederation of Passenger Transport Wales

SC(3)-12-07 : Paper 2 : Confederation of Passenger Transport Wales Submission

Background paper to the Committee: Eco-driving in the Netherlands

Briefing paper for the Committee on Eco-driving in the Netherlands

Thursday 24 January 2008 SC(3)-02-08 : Transcript

Deputy First Minister and Minister for Economy and Transport, Ieuan Wyn Jones AM

SC(3)-02-08 : Paper 1 : Paper from the Deputy First Minister on Carbon Reduction by Transport (pdf 48KB)

Annex D: CO2 Calculations: transport

Headline recommendation 1: The Committee recommends that the Welsh Assembly Government takes a much stronger lead by placing carbon reduction at the heart of the Wales Transport Strategy and by increasing funding for sustainable transport from around 50 per cent to around 70 per cent of the transport budget, in line with Scotland.

Assumptions:

- The Welsh Assembly Government's transport budget for 2009-2010 and 2010-2011 is adjusted so that an additional 20% of the total transport budget is allocated to promoting smarter choices, public transport, walking and cycling etc.
- Average emissions from car journeys are about 0.2 kgs per kilometre (2.9 tonnes per annum for 14,500 kilometres)
- This additional expenditure could reduce the volume of cars on the roads in Wales by between 180 and 370 million vehicle kilometres per annum (0.8 to 1.7 per cent of 2006 vehicle kilometres by cars in Wales). (Average annual increase over the last five years is 370 million vehicle kilometres, equal to about 1.7 per cent of 2006 vehicle kilometres by cars in Wales)

The Assembly Government's draft budget for 2009-2010 for transport is £867 million (£563 million revenue and £304 million capital). Reallocation of 20% of this budget would therefore mean an additional expenditure of £173 million per annum on sustainable transport.

The number of car journeys per person in Wales has been rising over recent years as has the total of vehicle kilometres by cars. In the short-term this additional expenditure may slow down further increases in emissions from car journeys that would otherwise have occurred. The savings at the top end of the range would only be achieved if the additional expenditure resulted in no further growth in vehicle kilometres by cars.

Annual Savings from 2009 onwards = 36,000 to 72,000 tonnes

Headline recommendation 2: The Committee recommends that the Welsh Assembly Government ensures that the National Transport Plan and Regional Transport Plans include specific and measurable objectives to cut carbon emissions and that sufficient funding is provided to the Regional Transport Consortia to be able to deliver these objectives.

Assumptions:

- National and Regional Transport Plans all set out policies and programmes capable of achieving the target of reducing carbon emissions from transport in Wales by 3% per annum from 2009 onwards
- Current carbon dioxide emissions from road transport in Wales are estimated as 7.2 million tonnes per annum (Source: DEFRA, consumption figures for 2005)
- Carbon dioxide emissions from other transport modes in Wales (excluding international aviation and shipping) are estimated as 0.5 million tonnes (Source: Department for Transport, based on share of GB emissions from road and other transport).

Annual Savings from 2009 onwards = 231,000 tonnes. Savings from recommendation 1 would contribute to this.

Headline recommendation 3: The Committee therefore recommends that the Welsh Assembly Government reviews the use of WelTAG as a matter of urgency to ensure that carbon reduction is the main objective when assessing projects.

This recommendation will contribute towards achieving the savings that should be delivered through recommendation 2.

Headline recommendation 4: The Committee recommends that the Welsh Assembly Government conducts a pilot scheme in Wales based on the Sustrans' TravelSmart programme to assess its impact, before considering its roll-out across Wales.

Assumptions:

- The programme in Wales achieves a similar impact to recent large-scale TravelSmart projects in England that have resulted in annual savings in car travel ranging from 740 to 1,400 km per household. Based on the lower figure in this range, and the average CO2 emissions per km of new cars sold in 2005, Sustrans' Research and Monitoring Unit has estimated that a TravelSmart programme targeting all urban households in England could achieve annual carbon savings of up to 2.2 million tonnes of carbon dioxide.
- TravelSmart programme is delivered to 0.5 million households in Wales living in the largest towns and cities.

Annual Savings = 81,000 tonnes. This could be funded by the additional resources for sustainable transport in recommendation 1.

Cynulliad Cenedlaethol Cymru
National Assembly for Wales

Carbon Reduction by Industry and Public Bodies in Wales

3rd report of the Sustainability Committee's Inquiry into Carbon Reduction in Wales

April 2009

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Chair's Introduction

This is our third report into carbon reduction in Wales and much has changed since we published our first report earlier in the year.

The urgency of the need for action on climate change is now widely recognised and the recommendation of the UK Climate Change Committee that we need to be moving towards an 80% cut in our carbon emissions has made our inquiry and recommendations even more valid.

We also face a worrying time financially with the prospect of further months of recession ahead of us.

It is timely, therefore, that we should be focussing on the measures that industry and public bodies can take to reduce their carbon emissions in this report. At a time of financial hardship, sustainability issues are often sidelined as economic considerations take centre stage. I hope in this report that we are able to highlight the benefits to industry and public bodies of adopting a low carbon approach to the way in which they do business. We believe that, by becoming a leader in the move towards a low carbon economy, not only can Wales gain a competitive edge and boost business and employment, but that existing businesses and organisations can benefit financially both in the long and short term.

We cannot ignore the need to tackle climate change by reducing our carbon emissions at every level which is why our recommendations in this report cover all sectors of business and all public bodies in Wales.

I would like to thank all those who have given us written and oral evidence for sharing their knowledge and expertise with us and for their openness and frankness in expressing their views to us.

This report will form part of our final report which will be published in the spring of 2009. We have also published an introductory document which is designed to be read as an introduction to any of the topic reports that we produce on carbon reduction in Wales and contains our terms of reference and the policy background to carbon reduction. The introduction document can be found on our website at:

http://www.assemblywales.org/bus-home/bus-committees/bus-committees-third-assem/bus-committees-third-sc-home/inquiries/inquiries_-_carbon_reduction_household.htm

We welcome your thoughts and comments on this report, which can be sent to us at: Sustainability.comm@Wales.gsi.gov.uk or write to us at:

National Assembly for Wales

Assembly Parliamentary Service

Assembly Offices

Cardiff Bay

CF99 1NA

We would like to publish some of your ideas and views on our website so that other people can read them.

You can also find out more about how to contribute to our written consultations on future topics on our website at:

http://www.assemblywales.org/bus-home/bus-committees/bus-committees-third-assem/bus-committees-third-sc-home.htm

Chapter 1 - Introduction

The contribution of industry to carbon emissions has shown a consistently decreasing trend across the UK, with a reduction of 15 million tonnes of CO2 in the 15 years since 1990, while the commercial and public sector contribution has decreased by 5 million tonnes over the same period[1] (see Table 1). These figures are not available on a Wales-only basis.

Table 1 UK industrial and public sector carbon dioxide emissions (million tonnes of carbon dioxide)

	1990	1995	2000	2005
Non-energy industry	114	107	109	99
Commercial and public sector	51	52	48	46
Total	165	159	157	145

The public sector in the UK is responsible for 8 % of carbon dioxide emissions[2]. 25 % of the public sector's total carbon footprint is accounted for by activities in buildings[3]; 56 % of the energy consumed by commercial and public buildings is used for heating, and 15 % for lighting[4].

All new buildings funded or built on land disposed of by the Welsh Assembly Government must now meet the Ecohomes Excellent environmental standard[5].

In July 2007, the European Commission unveiled its mid-term review of industrial policy in response to globalisation and climate change[6], which notes that the basic principles of a sustainable industrial policy will be followed up by an Action Plan in early 2008. A policy document due to have been released in autumn 2007 "will address policies to support energy intensive industries reducing their environmental impact whilst staying competitive"[7].

The biggest driver for reducing the carbon emissions from industry and public bodies is cost, because energy use (the biggest source of emissions) is expensive. However, public opinion and social corporate responsibility are of increasing influence, and many organisations, particularly businesses, are using environmental strategies to derive competitive advantage.

There are limited opportunities for devolved legislation in the industrial sector. Currently, the Welsh Assembly Government has responsibility for policy under the following areas:

- Economic regeneration and development, including social development of communities, reclamation of derelict land and improvement of the environment.
- Promotion of business and competitiveness.

The National Assembly for Wales may seek legislative powers under these matters. However, even following a successful referendum under the Government of Wales Act 2006, there is an extensive list of exceptions for which legislative competence could not be gained. These exceptions are listed in Annex A.

Devolved responsibilities are wider for public bodies. In particular, the Welsh Assembly Government has policy responsibility for the powers, duties and financing of local authorities, and for the organisation and funding of the National Health Service.

The Situation in Wales

One of the factors influencing Wales' high per capita emissions is the presence of energy-intensive industry. Port Talbot Steelworks, for example, accounts for approximately 16 % of all carbon emissions in Wales[8]. Improving the carbon efficiency of the biggest emitters has a large impact on Wales' emissions. The largest carbon dioxide emitters in Wales are captured under the EU Emissions Trading Scheme (EUETS), and have carbon reduction targets appertaining to that scheme. A total of 61 installations in Wales are members of the EUETS, representing about 56 % of total emissions from Wales, however, only 39 Scheme members emitted carbon dioxide in 2006. Emissions in 2006 were 3 million tonnes in excess of the allowance[9], although the scheme is estimated to have saved 1.3 million tonnes of carbon dioxide per year for each of the three years of the current scheme. The details of the 39 EUETS emitters are shown in Table 2.[10]

Table 2 Welsh emitters captured under the EUETS, with their emissions in 2005 and 2006

Installation Name	Installation Type10	CO2 Emissions (tonnes)	
2005	2006		
Aberthaw Power Station	Electricity generation	5,264,973	7,340,340
Port Talbot Steelworks	Industry	6,132,851	6,589,194
Connahs Quay Power Station	Electricity generation	3,434,321	3,158,476
Chevron Limited - Pembroke	Industry	2,320,641	2,251,765
Total Milford Haven Refinery	Industry	1,038,345	1,234,371
Baglan Bay Power Station	Electricity generation	1,104,318	1,142,501
Uskmouth Power Plant	Electricity generation	993,930	866,925
Deeside Power Station	Electricity generation	978,825	640,379
Padeswood Works	Industry	300,016	623,006
Shotton Combined Heat and Power Station	Industry	542,497	485,252
Barry Power Station	Electricity generation	321,303	237,008
Kronospan Ltd	Industry	82,971	104,287
Celsa Manufacturing (UK) Limited	Industry	56,197	63,051
Point of Ayr Terminal	Industry	57,581	54,992
UPM-Kymmene (UK) Ltd	Industry	51,947	46,010

Installation Name	Installation Type10	CO2 Emissions (tonnes)	
2005	2006		
Airbus UK Ltd	Industry	34,189	35,154
Corus Packaging Plus UK	Industry	39,745	35,111
Pont-y-Felin Insulation	Industry	33,189	31,539
Solutia UK Limited - Newport	Industry	26,765	28,377
Warwick International Ltd - Mostyn	Industry	26,440	23,241
Corus UK Ltd	Industry	22,049	21,625
Alphasteel Limited	Industry	20,978	20,889
Novera Energy Mines Gas Generation Plant	Industry	18,828	15,160
Bridgend Boiler House (Ford)	Industry	12,620	12,040
University Hospital of Wales	Public	9,664	9,548
Visteon Swansea - Boiler House	Industry	8,014	8,074
RF Brookes - Rogerstone Park	Industry	7,319	7,912
District Energy Ltd	Industry	5,697	6,183
Solutia Generating Plant - District Energy Ltd	Industry	5,666	5,597
Corus Colors	Industry	7,189	5,459
Morriston Hospital	Public	5,641	5,386
RAF St Athan	Public	7,542	5,367
Dennis Ruabon Tiles Ltd	Industry	3,320	3,002
Bro Morgannwg NHS Trust - PoW Hospital	Public	2,945	2,889
South Cornelly Power Station	Electricity generation	2,262	2,790
Celsa Manufacturing (UK) Ltd - New Melt Shop11	Industry		2,775
Dynevor Arms LNG Storage Facility	Industry	2,552	2,512
Magnox Electric Ltd - Wylfa	Electricity generation	909	640
Cardiff IDC	Industry	57	264
Total		22,984,297	25,129,091

The total carbon dioxide emissions by sector for Welsh installations captured by the EUETS are:[11]

Electricity generation – 13,389,059 tonnes

Industry – 11,716,842 tonnes

Public – 23,190 tonnes

For the EUETS establishments, more than half of the industrial output of carbon dioxide is accounted for by Port Talbot Steelworks, and more than half of the output of carbon dioxide from electricity generation is accounted for by Aberthaw power station. Together, these two installations account for approximately 33 % of Welsh emissions.

It is worth noting that although most public bodies fall below the EUETS limits, local authorities and health trusts are large emitters relative to domestic consumers: the public sector in the UK is responsible for 8 % of carbon dioxide emissions[12].

The Carbon Reduction Commitment (CRC) is a scheme proposed in the 2007 Energy White Paper[13]. It is intended to deliver carbon savings of 1.2MtC[14] per year by 2020 from large commercial and public sector organisations (such as supermarkets, hotel chains, and government departments), focusing on organisations for which energy efficiency benefits would outweigh administrative costs. The UK Government launched a 15-week consultation on its

proposals in June 2007. The response to the consultation, and the analysis of responses, is due in early 2008[15]. The main features of the CRC are:

- A reliance on self-certification of emissions, backed up by third-party verification
- Allowances issued via auction, following an introductory phase of fixed price allowances
- Auction revenue will be recycled to participants by means of an annual payment proportional to the average annual emissions since the scheme's inception, with a bonus/penalty according to the organisation's position in a CRC league table.

Improving Carbon Efficiency

One of the most important precepts in reducing carbon emissions is that reduction of energy demand is the first step in the carbon efficiency hierarchy. This is because the energy losses that happen as a result of the production, generation and transmission of energy mean that for every unit of energy not used by the consumer, as much as two to three units of energy are saved at the production stage[16]. Despite its crucial role in reducing carbon emissions, reducing energy demand tends to receive less attention than some of the alternatives:

"You can easily imagine people wanting to show off their micro-wind turbines to their friends and neighbours... but it's a lot harder to conceive of anyone wanting to show off their cavity wall or loft insulation"[17].

Many of the demand reduction means for industry and public bodies are the same as those in other sectors, and are either related to physical modifications (draught-proofing, insulation, energy-efficient light bulbs etc), or behavioural change (switching appliances off when not in use, wearing slightly warmer clothing instead of using more fossil fuel heating etc).

The main currently used means of reducing the carbon emissions from industry and public bodies are the following:

- Improving the environmental efficiency of working – through the promotion of tele- and video-conferencing and more flexible working patterns, and by encouraging home-working.
- Encouraging the implementation of Environmental Management Systems – such systems are usually based on continuous environmental improvement, and can lead to substantial carbon and cost savings. Green Dragon is a Wales-based scheme that is supported by the Welsh Assembly Government, Environment Agency Wales, and Welsh local authorities. A total of 769 organisations in Wales are currently certified[18]. The Welsh Assembly Government has a role in encouraging the uptake of energy efficiency and carbon reduction schemes.
- Changing the energy source for space and water heating to more carbon-efficient sources. This can be achieved by:
- Changing to the use of combined heat and power, which local authorities such as Woking have taken great strides to develop. Under the Climate Change Act 2008, Welsh Ministers are required to produce a climate change measures report, which local authorities will have a duty to 'have regard to'. Such a report may be a means of encouraging the development of combined heat and power by Welsh local authorities.
- Improving the penetration of the gas network throughout Wales. Gas is a more carbon-efficient way to heat space and water than solid fuel or electricity. Since the gas network is maintained by private companies, a business case may need to be established for further extension of the network.

- Improving the supply infrastructure and increasing consumption of biomass for heating. The Welsh Assembly Government has a role through marketing and grant aid for biomass, and one of the means it currently uses to achieve this is through Woodfuel Wales (www.woodfuelwales.org.uk).
- Increasing the use of renewable energy in new developments. The minimum level (currently nil throughout Wales) is determined by:
- The UK Government under Building Regulations for new build and refurbishment. Negotiations are under way to devolve Building Regulations to Wales.
- Welsh Ministers under planning policy.
- Local authorities through local development plans. Local authorities can stipulate a minimum level of renewable energy to be provided in all new developments (subject to certain conditions), as the London Borough of Merton has done.

The UK Government also operates the Low Carbon Buildings Programme that arranges grants for the installation of renewable energy. The streams for businesses and SMEs have now closed. The stream for the public sector is still available for funding of up to £1 million per organisation[19].

- The public sector (in particular the Welsh Assembly Government and local authorities) has a role in stimulating the market for environmentally beneficial products through its procurement activities.

Chapter 2 – Key issues and recommendations

"We will aim to achieve annual carbon reduction-equivalent emissions reductions of 3 % per year by 2011 in areas of devolved competence. We will set out specific sectoral targets in relation to residential, public and transport areas."
One Wales - A progressive agenda for the government of Wales – Labour and Plaid Cymru Groups in the National Assembly – June 2007.

2.1 We are very pleased to see this commitment to carbon reduction in the One Wales document and fully support the coalition government in their efforts to achieve it.

2.2 We are concerned, however, about the ability of the private sector to deliver a meaningful contribution to the target and about the role that the public sector will be expected to play in helping the targets to be achieved.

2.3 In this chapter, we outline eight 'headline' recommendations and illustrate the impact we think they could make on achieving the 3 % target in Wales. Unlike previous reports, we have not assigned an actual carbon saving figure to each of the recommendations because we consider that, without these recommendations, there is serious doubt about whether the 3 % savings could realistically be achieved. Our headline recommendations are, therefore, of a fundamental and strategic nature.

The industry and the private sector

2.4 Carbon emissions from the private sector is an area that the Welsh Assembly Government does not have a great deal of direct influence over. The largest producers of CO2 emissions in Wales are covered by stringent air quality and EU regulated emissions targets, whilst some smaller businesses will fall under the proposed Carbon Reduction Commitment. There are,

however, businesses of various sizes, which could lower their carbon emissions but do not fall under any regulation.

2.5 We were concerned to hear from the Deputy First Minister and Minister for the Economy and Transport that, although the Welsh Assembly Government was planning to set carbon emissions targets for the private sector as part of the One Wales targets, there will be no regulations put in place to achieve those targets.

2.6 We consider that the current approach of voluntary action and 'encouragement' by the Welsh Assembly Government has not worked. Carbon reductions achieved by industry in Wales have been largely driven by the wish of private companies, often with their head offices outside Wales, to reduce their carbon emissions and comply with EU or UK legislation. We consider that it will be virtually impossible for industry within Wales to reduce its carbon emissions to a sufficient level without some form of regulatory mechanism being in place. We therefore recommend:

Headline Recommendation 1: The Welsh Assembly Government sets targets for carbon reduction in the industrial and business sector in Wales as part of its implementation of the One Wales carbon reduction commitment. Following a five year period of voluntary action by the industrial and business sector in Wales to meet the targets imposed on them, the Welsh Assembly Government implements regulations that require the targets to be met.

We estimate that, if the current downward trend is followed until 2011 and a 3 % target is achieved by voluntary agreement and then regulation, a carbon saving, (over and above the current downward trend) of 2,650,000 tonnes is achievable; 80 % of the reduction accruing in the business sector and 20 % in the industrial sector[20].

2.7 We received evidence from many contributors that Wales has a great potential to be a leader in the development and manufacture of carbon reduction technology.

2.8 We welcome the Minister's intention to launch a Strategy for Green Jobs in November 2008. We consider, however, that the strategy needs to be based on an evaluation of the potential for green jobs in Wales. We therefore recommend:

Headline Recommendation 2: The Welsh Assembly Government should carry out an assessment of the employment opportunities that could be created in Wales through reducing carbon emissions, which should include an evaluation of the skills needed within the workforce. The assessment and evaluation should inform the Welsh Assembly Government's Green Jobs Strategy.

2.9 We are concerned that the Welsh Assembly Government's strategic framework for economic development – Wales a Vibrant Economy (WAVE) – fails to take into account any climate change or sustainability issues and focuses almost entirely on a 'business as usual' model for the Welsh economy. We therefore recommend:

Headline Recommendation 3: The Welsh Assembly Government to revise/replace current economic strategies to give carbon reduction

a high profile and be explicit about how it can act as one of the key principles to sustainable economic growth.

2.10 The up front costs of implementing carbon reduction measures can be high, especially for those companies who have no requirement to reduce their carbon emissions through compulsory trading schemes. We received calls from many of our witnesses for some form of incentivisation for small and medium sized enterprises (SMEs) in particular to introduce carbon reduction schemes. We therefore recommend:

Headline Recommendation 4: The Welsh Assembly Government to introduce a sliding scale rebate on Business Rates to businesses not covered by any carbon trading scheme who achieve agreed levels of carbon reduction or agreed levels of accreditation in schemes such as The Green Dragon Environmental Standard.

We estimate that, if 20% of businesses exceed the 3% target by 1%, 15% exceed it by 2% and 10% exceed it by 3%, the annual savings, over and above those achieved by HR1 could be approximately 52,000 tonnes.

The public sector

2.11 The public sector in Wales is an area in which the Welsh Assembly Government is able to exert a great deal of influence and therefore one in which it will be able to ensure that carbon reduction targets are met.

2.12 We were surprised that evidence from several public bodies considered that they would be able to achieve more than the proposed 3% year on year reduction in their carbon emissions.

2.13 We consider that a higher target for public bodies would offset those sectors where the achievement of the 3% target would prove more challenging and show strong leadership to both the private and public sector on carbon reduction. We therefore recommend:

Headline Recommendation 5: The Welsh Assembly Government sets targets for carbon reduction across the whole of the Public Sector in Wales as part of its implementation of the One Wales carbon reduction commitment. The Welsh Assembly Government should consider setting those targets in excess of 3% for the public sector in Wales.

We have found it difficult to estimate accurately the potential savings from the public sector due to the fluctuating pattern in emissions over the past 5 years (for more detail see the calculations at Annex D). Based on a saving of 4% and 5% on the 2007-2008 figures, we estimate that annual savings of 256,000 tonnes and 307,000 tonnes respectively could be achieved[21].

Headline Recommendation 6 : The Welsh Assembly Government should work closely with the WLGA and other public sector bodies to produce guidelines for local authorities and public bodies on the baselining, collection and reporting of carbon reduction information to ensure a consistent and understandable approach.

2.14 The issues associated with the start up costs of many carbon reduction schemes were again highlighted in much of the evidence. Public bodies are currently having to rely heavily on their existing capital budgets to fund any carbon reduction measures. There was general acceptance that the savings achieved by the schemes would offset much of the initial cost but that these savings could be realised over an extended period after the initial installation costs had been incurred.

2.15 We believe that, in order for public bodies to fulfil their leadership role on carbon reduction and achieve a higher level of reduction than other sectors, some form of financial assistance is required to offset initial set up costs for carbon reduction schemes. We therefore recommend:

Headline Recommendation 7: The Welsh Assembly Government should consider making money available to appropriate public bodies to 'kick start' capital programmes for achieving carbon reduction. The Welsh Assembly Government should agree a programme of offsetting the capital funding through subsequent savings in energy bills (having regard to substantial changes in fuel prices) at the time of providing the funding.

We estimate that, if the same level of take up of the scheme was achieved as that of a similar scheme in Scotland, the annual savings, over and above those achieved by HR5 could be around 2,600 tonnes..

2.16 An emerging theme throughout our inquiry into carbon reduction in Wales has been that of the need for a coherent and consistent approach to carbon reduction across all departments of central and local government.

2.17 We received evidence that this is not happening in many local authorities and that often the development of policies and programmes does not take carbon reduction issues into account. We therefore recommend:

Headline Recommendation 8: The Welsh Assembly Government reviews and amends where necessary all the targets set for public bodies in Wales to ensure that they are consistent with carbon reduction targets.

Chapter 3 - Carbon reduction by industry

3.1 Wales has the 12th highest carbon emissions per capita in the world. Much of the carbon produced by industry in Wales comes from the power generation industry which will be discussed in our next report.

3.2 There are, however, many large industrial emitters (see Table 1 for details). Whilst the largest industrial emitters are covered by the European Union Emissions Trading Scheme (EUETS) which regulates the amount of carbon they can emit, there are many other businesses in Wales who are not covered by the scheme and it is these that we will concentrate on in this section of the report.

3.3 We were concerned that at our meeting on 18 June this year, the Deputy First Minister and Minister for Economy and Transport seemed unsure about whether or not industry (except heavy

industry) and business would be included under the areas considered to have devolved competence in Wales. We welcome the confirmation from the Minister for Environment, Sustainability and Housing on 1 July that business (excluding industries covered by the EU Emissions Trading Scheme) will be included in as a sector in the One Wales carbon reduction commitment.

3.4 We are very concerned, however, that the Green Jobs Strategy consultation which was published in November 2008 contained no reference to the 3% target reduction in the main body of the text and that the only reference to it in one of the annexes stated that:

“The targets set by Government, particularly the Welsh Assembly Government’s 3% year on year target for carbon reduction, will have an indirect impact on business through our procurement processes – acting as a stimulus to business to improve their own energy efficiency, to realise the competitiveness benefits that will result, and to seize the new “Green Jobs" opportunities. Assisting companies to deliver Green Jobs, as well as incorporating the concept of Green Jobs into our own organisation will contribute to the wider vision we have for Wales." [22]

3.5 We strongly urge the Welsh Assembly Government to reconsider this reference to an indirect impact on businesses and to implement our first headline recommendation.

Business competitiveness in Wales

3.6 The CBI emphasised that economic competitiveness must underpin climate change policy and expressed concern that, if companies in Wales were to be asked to go further in cutting their carbon emissions than companies based in other domestic or international areas, their ability to compete with them would be compromised.

3.7 This was not identified as an issue, however, by some of our other contributors. UPM Kymene considered the work they had undertaken to reduce their carbon emissions had considerable benefits to their business in terms of cost reduction and readiness for compliance with targets and regulations which would also apply to their competitors in the future.

3.8 The Carbon Trust and the Royal Society of Chartered Surveyors (RICS) also supported this view, seeing the challenge of carbon reduction as an opportunity rather than a threat to business competitiveness.

3.9 We agree that the importance of the ability of businesses in Wales to compete in both domestic and international markets cannot be overstated. In the current economic climate, the competitiveness of Welsh business is even more important.

3.10 We disagree, however, that businesses in Wales would be disadvantaged by the setting of targets which do not currently apply in other countries.

3.11 Our headline recommendation 1 calls for the setting of targets and for regulations to ensure those targets are met. We consider that businesses in Wales, with the appropriate support (see headline recommendation 4) will be able to make a valuable contribution to carbon reduction. Equally importantly, we believe that they could have a considerable competitive advantage by being ‘ahead of the game’ when, inevitably, more stringent targets and regulations are introduced at UK, European and International levels.

3.12 Many organisations giving evidence to this inquiry and to other sections of our carbon reduction inquiry have emphasised the potential for Wales to be a leader in the field of carbon reduction technology. The demand for the research and development of new and existing

technologies, some of which already exist in Wales, will increase in the near future. Witnesses considered that Wales must be in a position to capitalise on the potential employment opportunities offered by this increase. In addition to our headline recommendation 3, we also recommend:

Recommendation 1: The Welsh Assembly Government should ensure that there is sufficient support, including financial incentives and advice available to enable the low carbon technologies developed by bodies such as the Low Carbon Research Institute in Wales to be manufactured in and marketed from Wales.

Recommendation 2: The Welsh Assembly Government should set targets for the percentage of low carbon technologies developed by bodies such as the Low Carbon Research Institute in Wales that go on to be manufactured in Wales and should use incentive schemes to enable those targets to be reached.

Recommendation 3: The Welsh Assembly Government should work in partnership with the Higher and Further education sectors, the sector skills councils, professional development bodies and schools and colleges to ensure that appropriate training and skills are available to meet the needs of companies developing in the low carbon technology market as part of its Green Jobs Strategy.

3.13 Our only concern about the potential effect of increased targets for carbon reduction on the competitiveness of Welsh business is that of the penalisation of early adopters.

3.14 Both the CBI and UPM Shotton expressed concern that those companies who had already made large savings in their carbon emissions would be required to make even more (and more costly) savings whilst getting no recognition for the work they have already undertaken. We therefore recommend:

Recommendation 4: That any Welsh Assembly Government targets for carbon reduction in industry should not penalise early adopters either by setting unrealistic targets that they cannot achieve because of the savings they have already made or by offering incentives for carbon reduction which they will not be able to access.

Consumer demand

3.15 There were conflicting views expressed in the evidence on the role of consumers in driving carbon reduction in the commercial sector.

Trading schemes

3.16 There appeared to be a general acceptance of the statutory trading schemes such at the European Union Emissions Trading Scheme (EUETS) and the proposed Carbon Reduction Commitment.

3.17 The Environment Agency, however, criticised the EUETS as it only applies at a member state level and therefore only means a requirement for a 1% reduction by large industries in Wales. They recommended that the third phase of the EUETS needs to include benchmarking by type of industry and measurement against that benchmark to encourage all industry to reduce its emissions.

3.18 They suggested that the most effective way to achieve the reductions in carbon necessary through the EUETS was to tie targets for individual countries and sectors into the targets set by the EU, namely a 28% – 32% reduction in carbon emissions by 2020.

3.19 We agree that greater emissions reduction targets should be imposed on those companies covered by the EUETS in Wales. We therefore recommend:

Recommendation 5: The Welsh Assembly Government should urge the UK Government to support the proposed amendments to Phase 3 of the EUETS to link state and sectoral targets to overall EU emissions targets.

3.20 The Climate Change Act 2008, introduces a Carbon Reduction Commitment (CRC). This is due to come into force in 2010 and will require many large companies in Wales to cap their carbon emissions to an agreed annual limit. Those exceeding the limit will have financial penalties imposed on them.

3.21 We have, as yet, been unable to get evidence of how many companies will potentially be affected by the CRC in Wales.

3.22 The Climate Change Act 2008 also introduces the powers for Welsh Ministers to introduce a carbon trading scheme in Wales. We consider that this would be very beneficial in helping to meet the Welsh Assembly Government's carbon reduction targets. We therefore recommend:

Recommendation 6: The Welsh Assembly Government should commission research in order to produce an evidence base for the establishment of an emission trading scheme in Wales by the end of 2009 through the powers given to it in Section 47 of the Climate Change Act 2008 with a view to using the scheme to contribute towards achieving national, UK and EU targets.

Recommendation 7: The Welsh Assembly Government should use the powers given to it in Schedule 4 of the Climate Change Act 2008 to require all businesses that are not covered by any national trading scheme to produce a carbon appraisal to establish a baseline for their trading agreement. The carbon appraisals should be carried out by the Carbon Trust.

Knowledge and information

3.23 A theme that has recurred throughout our inquiry into Carbon Reduction in Wales is that of the need for clear, concise, consistent and accessible information available from a single source. This section of the inquiry has been no different in the evidence we have received.

3.24 Marks and Spencer and PennPharm emphasised the need for businesses to know and understand their carbon footprint before they could start to reduce their emissions.

3.25 PennPharm pointed to the work that they had done with small and medium enterprises (SMEs), highlighting that the fact that many of them are not aware of carbon reduction issues and therefore do not know that they need information and help.

“However, I sometimes feel that I am filling in gaps that do not exist, or gaps that people are not aware exist, in terms of education and on guidance on where to start. My experience is that some businesses do not know what they do not know and there is no route-map to take them from A to B and C to D"

3.26 There was also criticism of the role of the Energy Saving and Carbon Trusts in providing advice to larger companies. UPM Shotton considered that they work “on the margins of carbon reduction" and only offer small scale solutions. They said that they got most of their help and advice on carbon reduction directly from the UK government or the EU.

3.27 The Centre for Business Relationships, Accountability, Sustainability and Society (BRASS) at Cardiff University identified environmental legislation as being a barrier to carbon reduction. They regarded it as very complicated and sometimes over burdensome and considered that companies often have trouble in keeping up to date with it.

3.28 We are very concerned that, yet again we have received strong evidence that the existing structures for providing help and advice on carbon reduction are inadequate. Whilst we acknowledge the work of the Energy Saving and Carbon Trusts in this area, we feel that they are limited by their remit and funding and are not taking a pro-active role in encouraging carbon emission reduction. We therefore, once again recommend:

Recommendation 8: The Welsh Assembly Government should establish a One Stop Shop for information and advice on carbon reduction. The one stop shop should take a pro active role in raising awareness of carbon reduction issues and giving help and advice to all business sectors.

3.29 We also received evidence from several organisations about the lack of clarity of the roles of the EU, UK Government and Welsh Assembly Government in setting targets and administering schemes. This was particularly emphasised by UPM Shotton whose parent company was not based in the UK.

3.30 We consider that, if Wales is to achieve national and international carbon reduction targets, the roles of each layer of government in setting and ensuring the achievement of those targets should be made explicit. We therefore recommend:

Recommendation 9: There should be clear and accurate information made available to business through the Carbon Trust (until the establishment of the body recommended in recommendation 8) on the differing roles undertaken and funding opportunities provided by the Welsh Assembly Government, UK Government and the EU

3.31 There was an agreement amongst all witnesses that there needs to be a sharing of good practice amongst organisations and companies in Wales. Several of them pointed to the Welsh Assembly Government as having a key role in facilitating this.

3.32 There was also concern expressed about the lack of clear, standardised benchmarking and information and reporting required by various statutory and voluntary schemes. The CBI Confederation of British Industry (CBI) highlighted the problems encountered by many organisations in knowing how to compare the data and which standards are the correct ones to be measuring and comparing. They also highlighted the problems of data capture. Many of the schemes require the same data to be captured and reported in different ways, increasing costs and often resulting in incorrect data being submitted.

3.33 We are concerned about the lack of standardisation in the requirements for the benchmarking and reporting of data. This is an issue that will also be raised later in this report when we comment on public bodies in Wales. We therefore recommend:

Recommendation 10: The Welsh Assembly Government should work with the UK Government and other agencies to ensure that any Wales and UK wide requirements for measuring, benchmarking and reporting systems for carbon reduction should require data recording and reporting to be undertaken in the same way.

Leadership and support

3.34 Another recurring theme of our inquiries has been the call for the Welsh Assembly Government to show strong leadership in carbon reduction.

3.35 Many witnesses called for the Welsh Assembly Government to provide a lead by indicating where it wants business to go in terms of carbon reduction. There was particular concern expressed about the One Wales commitment. Several witnesses stressed that they were unsure of what it meant for the business sector in Wales and called for clarification as soon as possible.

3.36 The CBI emphasised the need for business to have a clear vision of what the Welsh Assembly Government wanted it to do so that it could plan for the future. Most companies have business plans for many years into the future and any changes to those plans need to be identified as soon as possible. Uncertainty in the business sector affected investment and growth and could, ultimately, affect competitiveness.

3.37 In common with witnesses in other parts of our carbon reduction inquiry, several contributors identified the planning system as a barrier to companies achieving carbon reduction. They cited the length of time taken to reach planning decisions and the bureaucracy and red tape involved in making a planning application as major challenges.

3.38 BRASS considered that the Welsh Assembly Government should review the planning system to seek to make best use of it to achieve its carbon reduction policies.

3.39 We will be revisiting the planning system and its impact on carbon reduction policies in the light of evidence we have received throughout the carbon reduction inquiry in a later part of the inquiry.

3.40 We agree that businesses need firm guidance from the Welsh Assembly Government to help them plan their future investment and business strategies. In addition to Headline Recommendation 3 we therefore recommend:

Recommendation 11: The Welsh Assembly Government to review other policies which impact on economic development and carbon reduction (e.g. planning policies) with a view to aligning them to the revised economic polices.

Behavioural change

3.41 All the evidence we received acknowledged the need for behavioural change from staff, customers and suppliers.

3.42 We received evidence of good practice from British Telecom. They have introduced innovative policies towards the ways in which their staff work, 'agile working' e.g. encouraging home and remote working, flexible hours and hot desking. These policies have resulted not only in increased retention of staff but also an estimated £500 million saving in estate costs (including heat and power). An independent assessment estimated that home working staff alone cut carbon emissions by 3,600 tonnes a year.

3.43 BT has also influenced the carbon emissions of their suppliers by requiring them to reduce their emissions to retain their business and have actively engaged with their customers to identify reduced carbon solutions to their needs.

3.44 BRASS believed that, in order for companies to create behavioural change amongst their customers and employees, they must be convinced of the urgency, relevance and importance of the issue. They must also be able to see benefits to their business from tackling their carbon emissions.

3.45 Marks and Spencer and UPM Shotton both highlighted good practice in engaging employees. Marks and Spencer have climate change champions within each store and UPM Shotton use an employee suggestion scheme (with rewards) for employees to suggest ways in which the company could further reduce its carbon emissions.

3.46 The examples of good practice we have received show how far companies are able to go in influencing behavioural change. We believe, however, that for the majority of companies in Wales, they will not be able to achieve such changes without clear, consistent, accessible and relevant help and advice. We therefore think that recommendation 8 is essential to help companies to achieve behaviour change.

3.47 We also believe that companies can greatly influence the behaviour of their suppliers through the procurement process. We therefore recommend:

Recommendation 12: The Welsh Assembly Government should ensure that good practice in procurement is shared through the Value Wales initiative and should encourage small, medium and large scale businesses to interact and share ideas.

Chapter 4 – Carbon reduction by public bodies

4.1 The public sector forms the largest employer and owner of property in Wales. As such, and with its day to day contacts with individuals and organisations across the country, it has the potential to take a leading role in achieving carbon reduction targets in Wales.

4.2 We were disappointed at the lack of response to the consultation exercise from local authorities and other public bodies. Four local authorities and four other public bodies (two NHS Trusts, one police force and the National Public Health Service for Wales) submitted evidence to the written consultation. We found it very hard, on this evidence, to identify not only the issues encountered by public bodies, but also examples of good practice.

Leadership

4.3 As with the private companies we took evidence from in this inquiry, there were calls from the public sector for more leadership from the Welsh Assembly Government on carbon reduction issues and more 'joining up' of policies being made in Wales.

4.4 Whilst there was a general recognition of the potential for public bodies to be seen as leaders in carbon reduction, several public bodies called for more guidance and help from the Welsh Assembly Government on how to achieve the carbon reduction targets they have been and will be set.

4.5 The Local Government Information Unit (LGIU) also emphasised the leadership role of local authorities. They can not only act as exemplars but also bring together different organisations to develop and share good practice. They stated, however, that, with the exception of Cardiff Council and a few isolated local examples, local authorities in Wales are not demonstrating the necessary leadership to tackle carbon emissions effectively.

4.6 There was also concern expressed about the way in which Welsh Assembly Government policies could be seen to be contradictory.

4.7 The Welsh Health Estates considered that there is a tension between Welsh Assembly Government health policy demand and carbon reduction. They see a constant battle to reduce carbon whilst coping with increased demand due to reductions in waiting times, out of hours and weekend working, increased diagnostic tests and more high tech equipment. They consider that the new model of decentralising health services will undoubtedly result in increased carbon emissions.

4.8 The LGIU and Cardiff Council identified the lack of co-ordination within local authorities on carbon reduction issues.

4.9 The LGIU considered that the local authority economic development function is not reflecting the need to address carbon reduction. They called for leadership from the Welsh Assembly Government in identifying how carbon reduction can be mainstreamed into economic development policy at a local level.

4.10 The importance of engagement with the carbon reduction agenda at a high level within public bodies was also emphasised.

4.11 Cardiff Council considered that their success in carbon reduction can be attributed to the fact that the Chief Executive and Members have signed up to the carbon reduction strategy and form a sustainable development panel. Various scrutiny committees are also scrutinising the council's performance on carbon reduction.

4.12 The LGIU identified that there are enthusiastic individuals in local authorities across Wales who are promoting the carbon reduction agenda but leaders and chief executives of many Welsh local authorities aren't recognising it as an agenda they need to address. They also called for stronger leadership from the WLGA on the carbon reduction agenda. They consider that the WLGA isn't engaging with the carbon reduction agenda at a high enough level.

4.13 The Tyndall Centre for Climate Change Research suggested that the public sector could take the lead by reducing their carbon emissions by 100%. Whilst we think that this would be too large a burden to impose on public bodies currently, it is something we would like to see them aspire to in the not too distant future.

4.14 We recognise the potential for public bodies in Wales to play a leading role in carbon reduction and this has been emphasised by our headline recommendation 5. We are concerned, however, at the apparent lack of leadership currently being displayed by many of them, by the WLGA and by the Welsh Assembly Government. We therefore recommend:

Recommendation 13: The Welsh Assembly Government work together with the WLGA to ensure that local authorities in Wales fulfil their role as key leaders in carbon reduction.

Recommendation 14: The Welsh Assembly Government should issue guidance to local authorities on the ways in which the targets in the Energy Efficiency Performance Indicator could be achieved.

Recommendation 15: The Welsh Assembly Government should consider rolling out the support currently given to all local authorities to develop energy strategies.

Knowledge and information

4.15 Several witnesses identified a lack of knowledge about carbon reduction issues and techniques and a lack of information about the level and source of carbon emissions within their own organisations as major barriers.

4.16 The City and County of Swansea considered that they do not have sufficient local and internal expertise, experience and knowledge and lacked the resources to find quality solutions to their carbon emissions.

4.17 Cardiff City Council expressed concern about the lack of benchmarking of carbon emission being carried out by local authorities in Wales. An exercise conducted by them had identified their main source of carbon emissions as being from schools whereas they had assumed it was from their vehicle fleet. They emphasised the need for benchmarking so that public bodies could target their carbon reduction strategy more accurately.

4.18 Several witnesses highlighted the difficulty in obtaining information about their carbon emissions as the information had not been kept historically. Rhondda Cynon Taff (RCT) emphasised the importance of having reliable, accurate and auditable data, common reporting mechanisms and a greater role for the Wales Audit Office in benchmarking and assessing carbon emissions.

4.19 We consider that information about and benchmarking of carbon emissions is essential for public bodies to be able to tackle their carbon emissions in a strategic and targeted manner and consider that our headline recommendation 6 is vitally important in helping to achieve this.

Resources

4.20 One of the issues that has been common to all the sections of our inquiry into carbon reduction in Wales has been that of the availability of resources to tackle carbon reduction.

4.21 All those who submitted evidence for this part of the inquiry highlighted the costs involved with implementing carbon reduction measures.

4.22 The Consortium of Local Authorities (CLAW) and Cardiff Council emphasised the cost savings that could be achieved by carbon reduction measures in the long term. CLAW estimated that it will cost an estimated £0.5 million to achieve savings of around £2.5 million through carbon reduction over 5 years.

4.23 They highlighted the problems associated with the initial outlay of capital funding for energy efficiency measures. Any work done on using renewables or other energy efficiency measures must be funded from the capital already available to local authorities and may be difficult to find. The payback time of renewable technologies could mean that public bodies are not seeing a return on their investment for several years in the future and may mean that they are not able to justify the initial outlay.

4.24 Several witnesses highlighted the need to emphasise cost savings as well as carbon reduction as a driver for emissions reduction projects. Cardiff Council considered that carbon reduction measures make sound financial sense for public bodies.

4.25 Much of the evidence called for funding for public bodies to offset the initial capital outlay for carbon reduction measures. Rhondda Cynon Taff County Borough Council went as far as to recommend that carbon emission reduction should be a key part of the criteria for allocating or awarding funding to public bodies.

4.26 We recognise all the competing demands made on capital funding for public bodies and acknowledge the difficulties in allocating funding to areas that may not be perceived as being ‘front line’.

4.27 We consider, however, that realistic attempts to meet carbon reduction targets in Wales can only be made by ‘pump priming’ some of the initial capital costs for public bodies in Wales. The long term savings, both in terms of carbon emissions and in financial terms, make the short term injection of funding essential. We believe that headline recommendation 7 should be implemented to achieve the dual aims of carbon reduction and savings in energy costs.

Targets

4.28 Much of the activity of the public sector in Wales is subject to the requirement to achieve targets set both internally and externally by the Welsh Assembly Government. To date, carbon reduction targets have mainly taken the form of performance indicators for all or parts of the organisation. The CRC referred to in the previous chapter will affect some, if not all, of the local authorities in Wales and will require them to meet carbon targets across the whole of their estate.

4.29 All of our evidence acknowledged the continuing need for targets in the public sector and called for them to be clear and consistent with each other.

4.30 Several public bodies called for Welsh Assembly Government to set a greater carbon reduction target for public bodies than for other sectors in Wales. The National Public Health Service for Wales estimated that, to achieve an 80-90% reduction in carbon emissions by 2030, the NHS in England and Wales will need to reduce energy consumption by between 6% and 8% per year. RCT recommended that a more stringent annual carbon reduction target of 10% by 2011 should be set. They do not believe that the 3% target will be enough. When questioned, many of the witnesses said that they would consistently be able to achieve carbon reductions of above the 3% proposed by the Welsh Assembly Government.

4.31 We welcome this initiative from the public sector and urge the Welsh Assembly Government to seize the opportunity to implement our headline recommendation 5 and consider requiring a higher percentage reduction in emissions from public bodies in Wales than from other sectors.

4.32 The Welsh Health Estates were concerned about the carbon reduction targets that they had been set as they didn't reflect an increase in demand. Targets for things other than carbon reduction such as reduced waiting times are leading to carbon emissions remaining stable even though energy efficiency measures have been taken to reduce them. They advocated energy labelling for each building so that their energy efficiency can be measured and monitored.

4.33 CLAW also identified a missed opportunity for targets for local authorities to encourage mainstreaming of carbon reduction in the fact that the new energy performance indicator for energy usage is not included in the Core Asset Suite of indicators.

4.34 We are concerned about the lack of 'joined up' target setting both by and for public bodies. We believe that it is vital to encourage as much ownership of the carbon reduction agenda by all areas of public bodies as possible. To this end, we urge the Welsh Assembly Government to implement our headline recommendation 8 to ensure consistency in target setting for public bodies. We also recommend:

Recommendation 16 : That the new performance indicator for energy usage be included in the Core Asset Management Suite of indicators to ensure the connections are made between managing the local government estate and reducing carbon emissions.

4.35 Concern was also expressed about the readiness of public bodies in Wales for the introduction of the CRC. The LGIU gave evidence that, of the 22 local authorities in Wales, only one, Cardiff Council, has joined the carbon trading scheme set up for local authorities to shadow the CRC. This was also reflected in the written evidence, as few of the local authorities who responded were aware of if they would be covered by the CRC or, if they were, how it would affect them.

4.36 We are concerned about the lack of apparent preparedness for the scheme which is due to come into force in 2009. As yet, we have not been able to access figures for the number of public bodies in Wales who will be covered by the scheme but wish to emphasise the need for all public bodies to be ready for it. We therefore recommend:

Recommendation 17: That the Welsh Assembly Government identifies at an early stage those local authorities and public bodies who will come under the Carbon Reduction Commitment and works

with those organisations to ensure that they have sufficient expertise and resources to meet the requirements of the scheme.

Annex A: Summary of recommendations

Headline Recommendation 1: The Welsh Assembly Government sets targets for carbon reduction in the industrial and business sector in Wales as part of its implementation of the One Wales carbon reduction commitment. Following a five year period of voluntary action by the industrial and business sector in Wales to meet the targets imposed on them, the Welsh Assembly Government implements regulations that require the targets to be met.

Headline Recommendation 2: The Welsh Assembly Government should carry out an assessment of the employment opportunities that could be created in Wales through reducing carbon emissions, which should include an evaluation of the skills needed within the workforce. The assessment and evaluation should inform the Welsh Assembly Government's Green Jobs Strategy.

Headline Recommendation 3: The Welsh Assembly Government to revise/replace current economic strategies to give carbon reduction a high profile and be explicit about how it can act as one of the key principles to sustainable economic growth.

Headline Recommendation 4: The Welsh Assembly Government to introduce a sliding scale rebate on Business Rates to businesses not covered by any carbon trading scheme who achieve agreed levels of carbon reduction or agreed levels of accreditation in schemes such as The Green Dragon Environmental Standard.

Headline Recommendation 5: The Welsh Assembly Government sets targets for carbon reduction across the whole of the Public Sector in Wales as part of its implementation of the One Wales carbon reduction commitment. The Welsh Assembly Government should consider setting those targets in excess of 3% for the public sector in Wales.

Headline Recommendation 6 : The Welsh Assembly Government should work closely with the WLGA and other public sector bodies to produce guidelines for local authorities and public bodies on the baselining, collection and reporting of carbon reduction information to ensure a consistent and understandable approach.

Headline Recommendation 7: The Welsh Assembly Government should consider making money available to appropriate public bodies to 'kick start' capital programmes for achieving carbon reduction. The Welsh Assembly Government should agree a programme of offsetting the capital funding through subsequent savings in energy bills (having regard to substantial changes in fuel prices) at the time of providing the funding.

Headline Recommendation 8: The Welsh Assembly Government reviews and amends where necessary all the targets set for public bodies in Wales to ensure that they are consistent with carbon reduction targets.

Recommendation 1: The Welsh Assembly Government should ensure that there is sufficient support, including financial incentives and advice available to enable the low carbon technologies developed by bodies such as the Low Carbon Research Institute in Wales to be manufactured in and marketed from Wales.

Recommendation 2: The Welsh Assembly Government should set targets for the percentage of low carbon technologies developed by bodies such as the Low Carbon Research Institute in Wales that go on to be manufactured in Wales and should use incentive schemes to enable those targets to be reached.

Recommendation 3: The Welsh Assembly Government should work in partnership with the Higher and Further education sectors, the sector skills councils, professional development bodies and schools and colleges to ensure that appropriate training and skills are available to meet the needs of companies developing in the low carbon technology market as part of its Green Jobs Strategy.

Recommendation 4: That any Welsh Assembly Government targets for carbon reduction in industry should not penalise early adopters either by setting unrealistic targets that they cannot achieve because of the savings they have already made or by offering incentives for carbon reduction which they will not be able to access.

Recommendation 5: The Welsh Assembly Government should urge the UK Government to support the proposed amendments to Phase 3 of the EUETS to link state and sectoral targets to overall EU emissions targets.

Recommendation 6: The Welsh Assembly Government should commission research in order to produce an evidence base for the

establishment of an emission trading scheme in Wales by the end of 2009 through the powers given to it in Section 47 of the Climate Change Act 2008 with a view to using the scheme to contribute towards achieving national, UK and EU targets.

Recommendation 7: The Welsh Assembly Government should use the powers given to it in Schedule 4 of the Climate Change Act 2008 to require all businesses that are not covered by any national trading scheme to produce a carbon appraisal to establish a baseline for their trading agreement. The carbon appraisals should be carried out by the Carbon Trust.

Recommendation 8: The Welsh Assembly Government should establish a One Stop Shop for information and advice on carbon reduction. The one stop shop should take a pro active role in raising awareness of carbon reduction issues and giving help and advice to all business sectors.

Recommendation 9: There should be clear and accurate information made available to business through the Carbon Trust (until the establishment of the body recommended in recommendation 8) on the differing roles undertaken and funding opportunities provided by the Welsh Assembly Government, UK Government and the EU

Recommendation 10: The Welsh Assembly Government should work with the UK Government and other agencies to ensure that any Wales and UK wide requirements for measuring, benchmarking and reporting systems for carbon reduction should require data recording and reporting to be undertaken in the same way.

Recommendation 11: The Welsh Assembly Government to review other policies which impact on economic development and carbon reduction (e.g. planning policies) with a view to aligning them to the revised economic polices.

Recommendation 12: The Welsh Assembly Government should ensure that good practice in procurement is shared through the Value Wales initiative and should encourage small, medium and large scale businesses to interact and share ideas.

Recommendation 13: The Welsh Assembly Government work together with the WLGA to ensure that local authorities in Wales fulfil their role as key leaders in carbon reduction.

Recommendation 14: The Welsh Assembly Government should issue guidance to local authorities on the ways in which the targets in the Energy Efficiency Performance Indicator could be achieved.

Recommendation 15: The Welsh Assembly Government should consider rolling out the support currently given to all local authorities to develop energy strategies.

Recommendation 16 : That the new performance indicator for energy usage be included in the Core Asset Management Suite of indicators to ensure the connections are made between managing the local government estate and reducing carbon emissions.

Recommendation 17: That the Welsh Assembly Government identifies at an early stage those local authorities and public bodies who will come under the Carbon Reduction Commitment and works with those organisations to ensure that they have sufficient expertise and resources to meet the requirements of the scheme.

Annex B: List of respondents to the call for written evidence

http://www.assemblywales.org/bus-home/bus-committees/bus-committees-third1/bus-committees-third-sc-home/inquiries_sd/inquiries_-_carbon_reduction/carbon_industry.htm

Barry and Vale Friends of the Earth

Bro Morgannwg NHS Trust

Carbon Trust in Wales

Cardiff Council

Camarthenshire NHS Trust

City and Council of Swansea

Energy Saving Trust Wales

Flintshire County

Local Government Information Unit (LGiU)

National Public Health Service for Wales

North Wales Police (PDF49KB)

Rhondda Cynon Taf County Borough Council

Royal Institution of Chartered Surveyors Wales (RICS Wales)

UPM Kymmene (UK) Ltd

Wales Environment Link

Waste Network of SE Wales Friends of the Earth Groups

Welsh Local Government Association

Annex C – List of witnesses providing oral evidence

Thursday 7 February 2007 – SC(3)-03-08 : Transcript

Tyndall Centre

SC(3)-03-08 : Paper 1 : Tyndall Centre

Centre for Business Relationships, Accountability, Sustainability and Society, Cardiff University

SC(3)-03-08 : Paper 2 : Centre for Business Relationships, Accountability, Sustainability and Society, Cardiff University

Environment Agency Wales

SC(3)-03-08 : Paper 3 : Environment Agency Wales

The Carbon Trust in Wales

SC(3)-03-08 : Paper 4 : The Carbon Trust in Wales

Thursday 21 February 2007 – SC(3)-04-08 : Transcript

Confederation of British Industry Wales

SC(3)-04-08 Paper 1 : Confederation of British Industry Wales

British Telecom

SC(3)-04-08 Paper 2 : British Telecom

Marks and Spencer

SC(3)-04-08 Paper 3 : Marks and Spencer

UPM Shotton

SC(3)-04-08 Paper 4 : UPM Shotton

SC(3)-04-08 Paper 4 : Additional Paper from UPM Kymmene (UK) Ltd - A Report of Carbon Reduction at UPM Shotton Paper Mill, Flintshire

PennPharm

SC(3)-04-08 : Paper 5 : Paper on Carbon Reduction by Industry from Penn Pharmaceutical Services Ltd

SC(3)-04-08 : Paper 5 : Penn Pharmaceuticals 3-Year Health, Safety and Environment Plan Proposed Timescale (pdf 11.5 KB)

SC(3)-04-08 : Paper 5 : Penn Pharmaceuticals Key Data on Human Resources, Health, Safety and Environment (pdf 41.6 KB)

Thursday 28 February 2008 – SC(3)-05-08 : Transcript

Consortium of Local Authorities Wales

SC(3)-05-08 : Paper 1 : Submission by Consortium of Local Authorities in Wales on Carbon Reduction by Industry and Public Bodies

Welsh Assembly Government

SC(3)-05-08 : Paper 2 : Submission from the Welsh Assembly Government on NHS Estates on Carbon Reduction in Wales

Countryside Council for Wales

SC(3)-05-08 : Paper 3 : Countryside Council for Wales Submission on Carbon Reduction by Industry and Public Bodies

Thursday 8 May 2008 – SC(3)-09-08 : Transcript

Local Government Information Unit

SC(3)-09-08 : Paper 1 : Consultation Response from Local Government Information Unit (LGiU) on Carbon Reduction in Wales

Cardiff Council

SC(3)-09-08 : Paper 2 : Consultation Response from Cardiff Council on Carbon Reduction in Wales

Wednesday 18 June 2008– SC(3)-13-08 : Transcript

Deputy First Minister and Minister for Economy and Transport

SC(3)-13-08 : Paper 2 : Paper from the Welsh Assembly Government on Carbon Reduction by Industry

Wednesday 16 July 2008 - SC(3)-17-08 : Transcript

Minister for Social Justice and Local Government

Annex D: Carbon reduction calculations

This paper describes the potential carbon emissions reductions achievable through some of the headline recommendations of the Public Sector and Industry section of the Inquiry into Carbon Emissions in Wales.

Headline Recommendation 1: The Welsh Assembly Government sets targets for carbon reduction in the industrial and business sector in Wales as part of its implementation of the One Wales carbon reduction commitment. Following a five year period of voluntary action by the industrial and business sector in Wales to meet the targets imposed on them, the Welsh Assembly Government implements regulations that require the targets to be met.

Assumptions:

- Voluntary action continues the overall trend in Wales between 1990 and 2006 (a 1.3% annual reduction for the sector defined as 'business', and 0.2% reduction for 'industrial processes').
- Following the five years of voluntary reductions (starting in 2006-07 and ending in 2011-12), subsequent reductions are fixed at 3 % annually.

Emissions reductions will be in the order of 680,000 tonnes over the five years to 2011, with 97 % of the reduction arising from the 'business' sector, and 3 % from 'industrial processes'. Emissions reductions over the subsequent eight years would be 2.65 million tonnes, with 80 % of the reductions accrued by 'business', and 20 % by 'industrial processes'.

Total savings = 3,330,000 tonnes between 2006 and 2019

Headline Recommendation 4: The Welsh Assembly Government to introduce a sliding scale rebate on Business Rates to businesses not covered by any carbon trading scheme who achieve agreed levels of carbon reduction or agreed levels of accreditation in schemes such as The Green Dragon Environmental Standard.

Assumptions:

- 'Agreed levels of carbon reduction' are in addition to those outlined in Headline Recommendation 1.
- The scheme applies to the sector classified as 'business', and starts in 2012-13 to coincide with the proposed regulations outlined in Headline Recommendation 1.
- 20 % of the total businesses (as measured by emissions) exceed the 3 % goal by 1 %, 15 % exceed it by 2 %, and 10 % exceed it by 3 %.

Emissions reductions will be 475,000 tonnes over the period for those exceeding the target by 1 %, 432,000 tonnes for those exceeding the target by 2 %, and 336,000 tonnes for those exceeding the target by 3 %.

Total savings (over and above those from Headline Recommendation 1)

= 417,000 tonnes between 2012 and 2019

Headline Recommendation 5: The Welsh Assembly Government sets targets for carbon reduction across the whole of the Public Sector in Wales as part of its implementation of the One Wales carbon reduction commitment. The Welsh Assembly Government should consider setting those targets in excess of 3% for the public sector in Wales.

Summary

Public sector emissions (as defined below) are shown in Table 1 for the financial years 2003-04 to 2007-08. Transport, electricity and gas emissions are counted from the majority of major public sector emitters in Wales.

Table 1 Total emissions of carbon dioxide from the public sector

	2003-04	2004-05	2005-06	2006-07	2007-08
Total emissions of carbon dioxide (tonnes)	752,318	855,687	872,536	734,555	764,133

Public sector carbon emissions have followed an inconsistent pattern over the past five years.

Detail

For the purpose of this paper, public sector carbon emissions are defined as those arising from transport and energy in the Welsh NHS Trusts, police forces, local authorities, and Welsh Assembly Government.

Only those public sector bodies that have information for the last five years have been included. This comprises:

- 8 of the 9 Welsh NHS Trusts
- All 4 Welsh police forces
- 17 of the 22 Welsh local authorities (transport costs), and 16 (electricity and gas)
- The Welsh Assembly Government

Table 2 shows the total amount paid by these public sector organisations for transport fuel during each of the past five financial years, the resulting amount of fuel purchased, and the carbon dioxide emissions associated with that.[23][24]

Table 2 Carbon dioxide emissions from public sector transport fuel

	Cost of fuel (£'000)				
2003-04	2004-05	2005-06	2006-07	2007-08	
Welsh NHS	3,488	3,675	4,320	4,559	4,979
Police	3,305	3,730	4,185	4,430	4,610
Local authorities	12,790	14,191	16,565	16,952	18,680
Welsh Assembly Government	184	259	278	358	292
Total	19,767	21,855	25,348	26,299	28,561
Average price of diesel23 (p/l)	77.9	81.9	90.9	95.2	96.9
Average price of diesel (less VAT)24	66.3	69.7	77.4	81.0	82.5
Millions of litres of fuel used	29.814	31.356	32.749	32.468	34.619
Conversion factor (kgCO2/l)	2.68				
Tonnes of carbon dioxide emitted	79,903	84,034	87,768	87,014	92,780

Table 3 shows the total amount paid by these public sector organisations for electricity and gas during each of the past five financial years, the resulting amount of fuel purchased, and the carbon dioxide emissions associated with that. Because only the total cost is known, the assumed split between electricity and gas is 65:35[25].

Table 3 Carbon dioxide emissions from public sector electricity and gas use

	Cost of fuel (£'000)				
2003-04	2004-05	2005-06	2006-07	2007-08	
Welsh NHS	15,741	20,908	31,217	30,499	28,537
Police	1,814	1,983	2,913	4,012	3,753
Local authorities	29,535	31,106	39,235	46,511	44,314
Welsh Assembly Government	754	908	1,056	1,492	1,835
Total	47,844	54,905	74,421	82,514	78,439
Average price of electricity26 (p/kWh)	3.6227	3.62	4.53	6.18	6.24
Average price of gas (p/kWh)	1.0528	1.05	1.52	2.00	1.63
Millions of kWh (electricity)	859.1	985.9	1,067.9	867.9	817.1
Millions of kWh (gas)	1,594.8	1,830.2	1,713.6	1,444.0	1,684.3
Conversion factor (kgCO2/kWh) (electricity)	0.43				
Conversion factor (kgCO2/kWh) (gas)	0.19				
Tonnes of carbon dioxide emitted (electricity)	369,403	423,921	459,176	373,182	351,341
Tonnes of carbon dioxide emitted (gas)	303,012	347,732	325,592	274,359	320,012
Total tonnes of carbon dioxide emitted	672,415	771,653	784,768	647,541	671,353

Assumptions:

- A target of either 4 % or 5 % annual reductions is applied and achieved overall (allowing scope for some authorities to perform better or worse than the target).[26][27][28]
- The target applies to the sector classified as 'public'.
- The target applies for the period 2010-11 to 2019-20.

Total savings = 2.6 million tonnes between 2010 and 2019 for the 4 % target

3.1 million tonnes between 2010 and 2019 for the 5 % target

Headline Recommendation 7: The Welsh Assembly Government should consider making money available to appropriate public bodies to 'kick start' capital programmes for achieving carbon reduction. The Welsh Assembly Government should agree a programme of offsetting the capital funding through subsequent savings in energy bills (having regard to substantial changes in fuel prices) at the time of providing the funding.

The carbon savings calculated below relate to a revolving loan scheme for Small and Medium Enterprises.

Assumptions:

- Carbon savings are equal to those achieved by Loan Action Scotland (see http://www.scotland.gov.uk/Resource/Doc/173994/0048525.pdf for further details). This is based on an assumption that the same number of applicants succeed in securing loans for energy efficiency measures in Wales as have been successful in Scotland (a function of marketing and loan availability, rather than number of businesses and turnover).

Total savings = 2,650 tonnes per year, or 26,500 tonnes over 10 years

(Footnotes)

1 Type assessed by MRS

2 Joined Scheme in 2006 as a 'New Entrant'

3 DBERR, Table 4.1.2: Average annual retail prices of petroleum products and a crude oil price index [accessed 19 February 2009], values for calendar years only.

4 HMRC has advised me that public bodies are able to claim VAT back for journeys undertaken for 'business needs'

5 DBERR, Table 3.4.1: Prices of fuels purchased by non-domestic consumers in the United Kingdom (including the Climate Change Levy) [accessed 19 February 2009]. The prices quoted are those for 'large consumers' (defined as an annual consumption of 20,000-70,000kWh of electricity and 27,778-277,777kWh of gas).

6 No information is available for 2003, so the 2004 value has been used.

7 No information is available for 2003, so the 2004 value has been used.

[1] DEFRA, UK emissions of greenhouse gases, http://www.defra.gov.uk/environment/statistics/globatmos/gagccukem.htm#gatb3

[2] DEFRA, UK energy efficiency action plan 2007, http://ec.europa.eu/energy/demand/legislation/doc/neeap/uk_en.pdf

[3] ibid

[4] Pout C et al, 2002. Carbon dioxide emissions from non-domestic buildings: 2000 and beyond. BRE: Watford, England.

[5] DEFRA, UK energy efficiency action plan 2007, http://ec.europa.eu/energy/demand/legislation/doc/neeap/uk_en.pdf

[6] European Commission, Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions: Mid-term review of industrial policy – a contribution to the EU's growth and jobs strategy, http://ec.europa.eu/enterprise/enterprise_policy/industry/doc/mtr_in_pol_en.pdf

[7] European Commission, EU renews industrial policy for strong manufacturing base in response to globalisation and climate change, http://europa.eu/rapid/pressReleasesAction.do?reference=IP/07/1007&format=HTML&aged=0&language=EN&guiLanguage=en

[8] Calculated from EUETS submissions

[9] Environment Agency Wales, Response to an information request.

[10] Type assessed by MRS

[11] Joined Scheme in 2006 as a 'New Entrant'

[12] DEFRA, UK energy efficiency action plan 2007, http://ec.europa.eu/energy/demand/legislation/doc/neeap/uk_en.pdf

[13] DTI, Meeting the energy challenge: A White Paper on energy, May 2007, http://www.dti.gov.uk/files/file39387.pdf

[14] MtC = Megatonnes of carbon equivalent = 1,000,000 tonnes of carbon equivalent. 1 tonne of carbon equivalent equates to 3.66 tonnes of carbon dioxide

[15] DEFRA, Action in the UK: Carbon Reduction Commitment, http://www.defra.gov.uk/Environment/climatechange/uk/business/crc/index.htm

[16] Kevin Anderson, Research Director: Tyndall Centre for Climate Change Research, Drinking in the last chance saloon: The challenge of climate change and 'sustainable' energy, http://www.naseg.co.uk/presentations/Nov2007/TCCCRKA_Nov_2007.ppt

[17] Professor Paul Ekins, Head of Environment Group, Policy Studies Institute, A hundred thousand points of light: The local energy revolution. In: Green Futures Special Supplement in association with the Ashden Awards for Sustainable Energy and Defra. http://www.ashdentrust.org.uk/PDFs/green_futures.pdf

[18] As of 27 November 2008

[19] DBERR, Low carbon buildings programme Phase 2, http://www.lowcarbonbuildingsphase2.org.uk/

[20] Many of the large carbon emitting industrial processes will be covered by the EUETS and CCR so are not included in the Welsh Government's sphere of devolved competence.

[21] Public Bodies emit very little direct carbon. These calculations are based on their energy consumption and refer to savings that would accrue from the reduced energy generation

needed. The figures also include transport emissions from public bodies' fleets. These figures are also included in the carbon reduction figures in the transport report.

[22] Green Jobs for Wales - A Consultation – Welsh Assembly Government, November 2008

[23] DBERR, Table 4.1.2: Average annual retail prices of petroleum products and a crude oil price index [accessed 19 February 2009], values for calendar years only.

[24] HMRC has advised me that public bodies are able to claim VAT back for journeys undertaken for 'business needs'

[25] Based on the split for several public bodies for which details are available

[26] DBERR, Table 3.4.1: Prices of fuels purchased by non-domestic consumers in the United Kingdom (including the Climate Change Levy) [accessed 19 February 2009]. The prices quoted are those for 'large consumers' (defined as an annual consumption of 20,000-70,000kWh of electricity and 27,778-277,777kWh of gas).

[27] No information is available for 2003, so the 2004 value has been used.

[28] No information is available for 2003, so the 2004 value has been used.

Mainstreaming Sustainability in Governmental Portfolios

Dear Andrew

Please pass on my thanks to your officials who attended the Sustainability Committee last week.

I am writing, on behalf of the Committee to each of the Ministers who attended or sent officials to the meeting last week to pass on the committee's thoughts on the sessions and request some further information.

We welcome the evidence given about the work of Value Wales in developing its sustainable procurement policies and were especially impressed with the examples given of the reduction in paper usage and carbon savings.

The committee also welcome the engagement of the Wales Spatial Plan with the sustainability agenda and look forward to receiving further information about how the Wales Spatial Plan is contributing to the carbon reduction agenda.

The Committee were concerned, however, about the role of sustainability in the finance and public services parts of your portfolio.

Whilst we accept that the finance part of your portfolio may not appear to have many direct links with environmental sustainability, the Minister for Environment, Sustainability and Housing stressed to us that the cabinet had warmly welcomed the principle that sustainable development should be the single key organising principle of the Welsh Assembly Government and the importance ensuring that every single action that the Government takes contributes to the sustainability agenda and responds to the climate change agenda. We believe that this means that explicit links should be made between sustainability and climate change and the way in which your portfolio operates.

In terms of the finance, whilst we welcome the funding of sustainability initiatives through the Strategic Capital Investment Fund, there does not appear to be a direct link between the need to achieve the Assembly's sustainability objectives and the decision making process during the budget rounds. We think that you have a key role to play in ensuring that the Welsh Assembly Government's sustainability agenda is adequately funded across all portfolios. With the assistance of the Minister for Environment, Sustainability and Housing, we consider that some form of sustainability assessment tool could be developed which questions the sustainability outcomes of the funding bid for by each department.

During our evidence gathering for the Industry and Public Bodies section of our carbon reduction report, several public bodies in Wales called for more leadership from the Welsh Assembly Government in terms of carbon reduction and sustainability issues. We believe that you, as the Minister with overall responsibility for the relationship between public bodies in Wales are in an ideal position to provide that leadership through your management of the Local Service Boards process. Whilst we applaud the work being done by Carmarthenshire and Gwynedd, we would like to see your portfolio taking a more active role in ensuring that sustainability is high on the agenda of the Local Service Boards.

The Minister for Environment, Sustainability and Housing has identified public services as one of the sectors which will have specific carbon reduction targets under the One Wales agreement. It would appear that your portfolio gives the ideal opportunity to co-ordinate and monitor emissions and energy usage from public services in Wales as part of their contribution to the public sector targets.

I would be grateful if you could send the committee information on how you will be benchmarking greenhouse gas emissions in the run up to 2011 and monitoring the reduction in those emissions post 2001 within your portfolio. I would also like information on how you will be linking policies within your portfolio to the new Sustainable Development Scheme.

Mainstreaming Sustainability in Governmental Portfolios

Dear Brian

Thank you for attending the Sustainability Committee last week.

I am writing, on behalf of the Committee to each of the Ministers who attended or sent officials to the meeting last week to pass on the committee's thoughts on the sessions and request some further information.

The Committee was struck by the lack of engagement with the sustainability agenda within your portfolio and concerned about how the local government and social justice portfolio will be able to contribute to the One Wales target of a 3% reduction in greenhouse gas emissions.

Whilst we accept that the responsibility for specific areas of local government such as education and local authority controlled housing rest with other Ministers, we believe that your portfolio should play a leadership and co-ordination role in terms of setting the over arching framework within which local authorities in Wales should be carrying out their duties. This, we believe, includes giving clear leadership and direction on the Welsh Assembly Government's expectations and requirements in terms of sustainability.

The Minister for Environment, Sustainability and Housing has identified public services as one of the sectors which will have specific carbon reduction targets under the One Wales agreement. It would appear that your portfolio gives the ideal opportunity for emissions and energy usage

from local government in Wales to be benchmarked and monitored as part of their contribution to the public sector targets.

During our evidence gathering for the Industry and Public Bodies section of our carbon reduction report, several local authorities in Wales called for more leadership from the Welsh Assembly Government in terms of carbon reduction and sustainability issues. We believe that you, as the Minister with overall responsibility for the relationship between the Welsh Assembly Government and local government in Wales, are in an ideal position to provide that leadership.

Whilst we accept that the social justice part of your portfolio may not appear to have many direct links with environmental sustainability, the Minister for Environment, Sustainability and Hosing stressed to us that the cabinet had warmly welcomed the principle that sustainable development should be the single key organising principle of the Welsh Assembly Government and the importance ensuring that every single action that the Government takes contributes to the sustainability agenda and responds to the climate change agenda. We believe that this means that explicit links should be made between sustainability and climate change and the policies within your portfolio.

I would be grateful if you could send the committee information on how you will be benchmarking greenhouse gas emissions in the run up to 2011 and monitoring the reduction in those emissions post 2001 within your portfolio. I would also like information on how you will be linking policies within your portfolio to the new Sustainable Development Scheme.

Mainstreaming Sustainability in Governmental Portfolios

Dear Elin,

Thank you for attending the Sustainability Committee on 2 April. Please pass on my thanks to your officials who also attended.

I am writing, on behalf of the Committee to each of the Ministers who attended or sent officials to the meeting last week to pass on the committee's thoughts on the sessions and request some further information.

The Committee welcomed the recognition within your department of the range of emissions from agriculture and farming, which includes methane and nitrous oxide and reduction by 10 per cent emissions since 1990. The Committee were also encouraged to hear that a further 10 percent reduction will be achievable with the continuation of current methods and would encourage the investigation of more innovative methods to move beyond this estimated reduction.

The Committee understands the difficulties associated with gathering data on Carbon emissions and that some time-lag is unavoidable, however the committee were concerned that the data is retrospective to three years as the need for up to date information is crucial to the tackling of Carbon emissions and the Committee would encourage you to consider ways of improving the process to ensure the data is more recent. The Committee would also like to see greater clarity brought to the method for estimating and defining the 3 per cent target within your department.

We would also suggest that you consider the relevance of the Green Job Strategy as part of the review of axis 3 and how you may incorporate this into any new scheme. The Committee sees this as an opportunity to make a significant impact on the rural economy and the Government's commitment to promoting green jobs.

I would be grateful if you could send the committee information on how you will be benchmarking greenhouse gas emissions in the run up to 2011 and monitoring the reduction in those emissions post 2001 within your portfolio. I would also like information on how you will be linking policies within your portfolio to the new Sustainable Development Scheme. Finally, it would be useful if you could provide further information on the percentage of policies from your department that had received a fair or good rating with regards to “a sustainable environment" when assessed through the Policy Gateway Integration Tool.

Mainstreaming Sustainability in Governmental Portfolios

Dear Ieuan

Please pass on my thanks to your officials who attended the Sustainability Committee on 2 April.

I am writing, on behalf of the Committee to each of the Ministers who attended or sent officials to the meeting last week to pass on the committee’s thoughts on the sessions and request some further information.

It was unfortunate that you were unable to attend the scrutiny session on 2 April 2009. Due to the importance of your portfolio in achieving Carbon Reduction, the Committee would like to invite you to attend a meeting early in the summer term to further explore the issues.

The Committee were encouraged by the evidence received which suggested that Sustainability was being mainstreamed into all aspects of your portfolio. In particular the Committee welcomed the work being undertaken to make Cardiff and the surrounding region into a sustainable travel town and we look forward to seeing this rolled out to other parts of Wales.

The Committee were also interested to hear about the Sustainable Development Implementation tool, which is used at the early stages of projects and look forward to receiving a copy of this tool.

The Committee, however, expressed concern that a lot of the evidence we heard was about aspirations and there was little evidence of achievements to date. Whilst we welcome the shift in funding for transport away from roads, towards other modes of transport, and understand that this is a slow process, the Committee are keen to see that the correct decisions are being made and that adequate resources are in place to guarantee delivery. For example, consideration is being given to a relief road to Cardiff airport but improving the rail link is 25 out of 25 in the list of priorities for rail improvements across Wales. The Committee believes that there needs to be strategic joined up thinking between the projects in order to achieve real Carbon reduction.

The Committee welcomes the work being undertaken within your department and with the Department for Environment, Sustainability and Housing to look at developing a Sustainability assessment tool, however the Committee were concerned about the lack of methods in place to measure the impacts of your policies on Carbon reduction, as this should be a vital part in ensuring your policies are effective.

I would be grateful if you could send the committee information on how you will be benchmarking greenhouse gas emissions in the run up to 2011 and monitoring the reduction in those emissions post 2001 within your portfolio. I would also like information on how you will be linking policies within your portfolio to the new Sustainable Development Scheme. Finally, it would be useful if you could provide further information on the percentage of policies from your department that had received a fair or good rating with regards to “a sustainable environment" when assessed through the Policy Gateway Integration Tool.

Mainstreaming Sustainability in Governmental Portfolios

Dear Jane,

Thank you for attending the Sustainability Committee on 2 April. Please pass on my thanks to John Griffiths and your officials who also attended.

I am writing, on behalf of the Committee to each of the Ministers who attended or sent officials to the Sustainability Committee to pass on the committee's thoughts on the sessions and request some further information.

The Committee were encouraged by the evidence received on the inclusion of Sustainable Development as a key guiding principle for the curriculum. This inclusion is particularly important as it ensure that sustainability is mainstreamed for the future generations. The Committee also welcomes the work being undertaken with the Deputy First Minister to ensure the necessary skills are in place for the delivery of the Green Jobs Strategy.

The Committee were however concerned that there was little evidence presented to suggest that there are adequate measures in place to evaluate the outcomes of your policies and projects to deliver the Sustainability targets. Whilst the Committee understands that there is a need to gather baseline data with regards to the Carbon emissions from your portfolio, the Committee would like to see clear measures in place to evaluate what you are doing.

The Committee were also concerned about the lack of clarity within the cabinet regarding where ministerial responsibility lies for the different sources of carbon emissions. For example, it is unclear whether the emissions from schools in Wales will be within your responsibility as Minister for Education, Children, Lifelong Learning and Skills, or Brian Gibbons as Minister for Social Justice and Local Government. The Committee think that it is important for all cabinet members to be clear where their responsibilities lie for carbon emissions as the first step to reducing them. I have written to Jane Davidson separately on this matter.

I would be grateful if you could send the committee information on how you will be benchmarking greenhouse gas emissions in the run up to 2011 and monitoring the reduction in those emissions post 2001 within your portfolio. I would also like information on how you will be linking policies within your portfolio to the new Sustainable Development Scheme. Finally, it would be useful if you could provide further information on the percentage of policies from your department that had received a fair or good rating with regards to "a sustainable environment" when assessed through the Policy Gateway Integration Tool.

Mainstreaming Sustainability in Governmental Portfolios

Dear Alun Ffred,

Thank you for attending the Sustainability Committee on 2 April. Please pass on my thanks to your officials who also attended.

I am writing, on behalf of the Committee to each of the Ministers who attended or sent officials to the meeting to pass on the committee's thoughts on the sessions and request some further information.

The Committee were pleased to hear evidence outlining the mainstreaming of Sustainability through your portfolio in particular the steps made towards monitoring of the environmental

impacts of tourisms CO2 emissions. We would encourage this work to continue by breaking the data down further to establish where the emissions are originating from.

A theme which was present throughout the sessions was a need to clarify responsibilities between ministerial portfolios, and the Committee would suggest that you clarify where the responsibility for reducing travel emissions to and from the sites within your responsibility lies. We would also encourage your department to continue to work closely with other departments to ensure that the necessary improvements for public transport are made to improve access to Wales' tourist and heritage sites and developing the links to points of entry into Wales and major towns and cities.

The Committee were interested in the evidence you provided over the use of the Policy Gateway Integration Tool within your department to successfully inform policies and we look forward to receiving further information on the policies which have gone through this process. The Committee were also pleased to hear about the inputs from your department into policies which were concerned with Sustainable Development such as the Climate Change Action Plan.

The Committee noted the work being undertaking at various CADW properties to improve their sustainability credentials such as the ground source heat pump in Raglan castle and are looking forward to seeing the results of your review into the CADW estate. The Committee sees these as important in making Wales truly sustainable, and we hope that this will be a major feature in the tourism strategy

I would be grateful if you could send the committee information on how you will be benchmarking greenhouse gas emissions in the run up to 2011 and monitoring the reduction in those emissions post 2011 within your portfolio. I would also like information on how you will be linking policies within your portfolio to the new Sustainable Development Scheme. Finally, it would be useful if you could provide further information on the percentage of policies from your department that had received a fair or good rating with regards to "a sustainable environment" when assessed through the Policy Gateway Integration Tool.

Mainstreaming Sustainability within Health and Social Services Portfolio

Dear Edwina,

Please pass on my thanks to your officials who attended the Sustainability Committee last week.

I am writing, on behalf of the Committee to each of the Ministers who attended or sent officials to the meeting last week to pass on the committee's thoughts on the sessions and request some further information.

The Committee welcomed the clear and well explained evidence presented by your officials about the actions being taken within your portfolio to integrate sustainability such as the development of the toolkit and the progress towards achieving the energy efficiency baseline. In particular, we were encouraged to hear about the innovative ways of using technology to address the problem through developments like telemedicine. The Committee would suggest that the Welsh Assembly Government consider using the Health and Social Services department as an example of good practice for the mainstreaming of sustainability.

The Committee would like some further information on the all Wales guidance for the commissioning of contracts within Local Authorities and the development of travel plans within

the NHS. The Committee would also like further information the incorporation of sustainability within the design of major new developments within the Health estates.

I would be grateful if you could send the committee information on how you will be benchmarking greenhouse gas emissions in the run up to 2011 and monitoring the reduction in those emissions post 2001 within your portfolio. I would also like information on how you will be linking policies within your portfolio to the new Sustainable Development Scheme.

Changing Climate: Changing Places

- providing practical support to local authorities in how to address the challenges and opportunities of climate change

1. Aim of the Project

Climate Change is a global problem and has been identified as a key priority for governments at all levels. The evidence base for impacts relating to climate change is rapidly evolving and the Stern Review (DEFRA 2006) and Intergovernmental Panel on Climate Change reports (2007) clearly demonstrate the need to act now to reduce greenhouse gas emissions and adapt to climate change. In Wales, Welsh Assembly Government have highlighted this challenge in the Environment Strategy, the draft Climate Change Adaptation Plan “Responding to a Changing Climate" and the ‘One Wales’ partnership document.

In response to the climate change agenda, all 22 unitary authorities in Wales plus fire and rescue and National Park Authorities signed the Welsh Commitment to Address Climate Change which was launched in April 2006. This document commits their authority to take action to address the impacts of climate change through adaptation and mitigation activity. Changing Climate, Changing Places will help support that commitment with practical advice.

This project is being developed to improve the resilience of local communities in Wales to the impacts of climate change. It will improve the capacity of local authorities in Wales to address this issue.

Strategic planning and service delivery will be enhanced by developing detailed local climate impact profiles and identifying appropriate policy and adaptation responses. The project will answer the basic questions:

- What does climate change mean for our community?
- What risks and opportunities does climate change represent to services and particular localities?
- How can we adapt now and in the future?

The project will take a holistic approach to climate change. Whilst the primary focus will be on adaptation the project will also include consideration of mitigation issues.

It is a collaborative initiative involving, Environment Agency Wales, Countryside Council for Wales, UK Climate Impacts Programme and Welsh Local Government Association and joint working between local authorities.

2. Climate Change Impacts

Over the past 10 years the Hadley and Tyndall Research Centres, through the UK Climate Impacts Programme (UKCIP), have developed models to predict how global warming will affect the climate in the UK. Although there are differences in the detail, these models tend to produce broadly similar conclusions about what is going to happen in the first half of this century regardless of whether our emissions are ' business as usual' or if we act cut them. The extent to which these changes occur will depend on how we are able to control emissions. Either way, we are committed to changes.

For Wales, the main impacts by 2080 will be:

- A longer growing season
- Milder wetter winters
- Drier hotter summers
- Increases in extremes of heat, and decreases in extremes of cold.
- Warmer seas and sea level rise of up to 100cm.
- More extreme events (droughts, heat waves, flooding)
- More frequent and more violent storms/gales

These predictions suggest major environmental risks for Wales, which include:

- Increased flood risk to our rivers and coasts
- Land erosion
- Inadequate drainage and sewerage systems
- Drier soils and subsidence
- Significant habitat and species changes
- Water quality issues in rivers and lakes
- Greater incidence of drought and problems with water supply;
- Lower air quality
- Acidification in our seas

Economic and social impacts will also be significant, for example:

- Higher incidence of mortality from storm events, heat waves, skin cancer
- Reduced energy demand in winter, but increased demand in summer
- An increased prevalence of insect and water borne disease
- Vulnerability of transport, waste and energy infrastructure
- Increases in demand for depleted water supplies
- Increased costs for irrigation and the crops it supports
- Increased costs for insurance and decreased property values
- Increased risk of forest and heathland fires
- Changed agricultural practices for food and biomass crops
- A changed Welsh landscape
- Growth in tourism due to warmer weather;
- Renewable energy generation infrastructure (wind, tidal and solar)

These predictions are based on 2002 data, and provide broad parameters for us to start planning for the future. UK Climate Impacts Programme will be updating their scenarios in December 2008, providing a much more accurate prediction of the consequences of climate change at a local level. This data will allow us to assess the probability of these changes happening and the scale of impacts on 25km grid squares. The UKCIP 08 data and weather generator model will provide detailed information on the probability and risk of environmental thresholds being exceed in the future related to temperature, rainfall, high tide levels and other parameters.

3. Project Proposal

Changing Climate: Changing Places will bring together expertise from Environment Agency Wales, Countryside Council for Wales, WLGA, UK Climate Impacts Programme, and others to support a number of pilot authorities in Wales, to pilot strategic and practical approaches to climate change adaptation and, to a lesser extent, mitigation. These organisations, together with the local authorities, hold a wealth of scientific, technical and policy expertise which can be used to provide an evidence base to address this agenda.

The pilots will be used as 'demonstration schemes and test beds' to encourage action across all authorities. Models, tools and techniques will then be developed which can be disseminated amongst all Welsh unitary authorities, in order for them to effectively plan for climate change adaptation. Policy staff from the local authorities, ASPBs, UKCIP will work together to:

- develop more integrated strategic planning for adaptation and mitigation at a local level including for individual service areas
- achieve a greater understanding of likely impacts, level of risk and appropriate responses from the UKCIP 08 scenarios
- share data and information to inform decision-making
- use specialist local and scientific knowledge to inform policy and practice
- 'climate proof' strategy and practice for key issues like flood risk and water resource management, spatial planning and consider how service areas like education and social services will need to respond to the changing climate and the new challenges this will bring
- ensure communities become aware of the adaptation agenda and their role in mitigation
- identify knowledge gaps and research needs to inform future climate change adaptation
- extend strategic planning horizons to 2100 to consider adaptation challenges and backcast for effective objective and target setting
- develop understanding among decision makers, policy officers and members of climate change adaptation and its impacts on strategy and service delivery.

It is proposed that the project runs for 3 years from January 2008 – January 2011 and will involve recruiting a small number of authorities as partners. Balanced geographic coverage is essential covering north and south Wales, valleys and coastal authorities. Each authority will provide a focus on a major area for adaptation.

It is recognized that some Welsh local authorities are already developing Climate Change Action Plans, many of these focus primarily on mitigation rather than adaptation. Existing action plans are not a prerequisite for choosing the pilot authorities. It is essential that a commitment to work on adaptation already exists among lead members and officers in the authority – to gain maximum access and benefit through officer time, and maximize the effectiveness of project delivery. Some bids for Local Service Boards have also identified climate change as a priority.

4. Outcomes and Outputs

There will be a number of tangible outputs from this collaborative work, which will be disseminated as the project progresses:

Outcome	Output
Building organisational capacity to use UKCIP08 data	training
Improve understanding of the likelihood of risks posed by climate change	risk register
Application of UKCIP08 data to local scenarios informing modeling and policy development (e.g flood risk management, water resource management)	models
Mapping of risk to infrastructure and communities	maps
Increasing understanding of the relationship between land use and soil carbon retention and adaptation (e.g. tree planting and flooding)	maps
Increased understanding of ecological connectivity	maps
Development of a local climate impacts profile using historical evidence for awareness raising	information pack
information for sustainability appraisal and strategic environmental assessment	data
Analysis of likely impacts of climate change at local level and recommended adaptation responses for key service areas. The service areas will be identified in partnership with the pilot authorities but will include: transport, social services, emergency planning and planning.	detailed report and incorporation of adaptation measures in service delivery
Production of generic and service specific guidance to Welsh local authorities on how to build climate change adaptation into heir work planning and action	guidance
Action to reduce greenhouse gas emissions from local authority activities and assessment of feasibility to commit to specific reduction targets including 'carbon neutral authorities'	guidance

5. Resource Requirements

This project presents an opportunity to share resources, primarily staff time, in order to work better together. UKCIP, WLGA, EAW and CCW have all indicated that they would be willing to commit this time, and expertise to the project.

As far as possible it is intended that existing resources are used to deliver this project, as this work compliments the business objectives of the core partner organisations.

The Strategic Framework for Climate Change recently developed by WAG could potentially fund aspects of this project around the Climate Change Adaptation theme.

In addition to staff time, the following resources will be offered to the project by the core partners.

Environment Agency Wales

- support for plenary events, workshops and training

- interpretation of results of climate change science programme on water resources, flood risk; water framework directive, monitoring, freshwater, maritime and land management.
- coastal LIDAR modelling on flood risk and extreme flood events
- local fluvial, water, sewer modelling
- rainfall data, river flow from RADAR model with Met Office
- air quality - ozone NOx and particulates data
- local water consumption and leakage data
- fisheries management approaches
- BAP species data for wetland habitats
- water quality and bathing water monitoring data
- catchment sensitive farming - soils and contamination
- waste infrastructure resilience to increased flood risk
- catchment and river basin management approaches

UKCIP

- upto three plenary events per year to which all authorities will be invited in order to learn from the progress of the project partners and introduce some of the UKCIP tools
- 2/3 topic presentations each year. eg on impacts and adaptation for particular service areas or might include an introduction to some of its tools and related short training events.
- electronic enquiry desk on adaptation issues and parallel phone calls from the 4 or 5 participating authorities
- UKCIP tools directly accessible from the UKCIP website. UKCIP will train the authorities using existing project management frameworks
- at least one event in Wales that addresses issues relating to the next set of climate scenarios information (UKCIP08)

CCW

- staff time input in terms of advice, policy development, modelling etc.
- access to natural environment datasets held by CCW such as the Phase 1 database and interpretation
- input to risk assessment from a natural environment perspective
- financial input to necessary risk analysis within pilot authorities
- WLGA
- project management and co-ordination
- financial support for research work/consultancy support

6. Requirements of Unitary Authority Partners

The following will be required of local authority partners:

- political and senior management team commitment to pursue and complete the project
- senior lead officer to lead a project group within the authority - to enable reporting to Cabinet/Executive Committee and Corporate Management team level
- a lead officer to co-ordinate staff within the authority to input into the project, co-ordinate data and co-author reports and guidance with core partners
- staff time from relevant departments and directorates
- access and staff support on data sets to inform the local climate impacts profile
- facilities and catering for event management within the authority
- budget for production of project report for the authority for internal (and external) audiences

7. Management and Reporting

It is proposed that a Management Board is set up to progress the Project with representatives from WLGA, EAW, UKCIP and CCW and participating authorities to meet three times a year to monitor progress. In addition, a steering group of climate change lead officers from the partner organisations will meet on a quarterly basis (or as appropriate) to progress the work.

Progress on the project will also be reported via the Wales Climate Change Adaptation Group and Steering Group and the Environment Strategy Reference Group.

Dr. Alan Netherwood
Environment Agency Wales

Dr. Clive Walmsley
Countryside Council for Wales

Gerry Metcalf
UK Climate Impacts Programme

Dr. Kevin Bishop
Welsh Local Government Association

Sustainability Committee's Energy Report

Contents

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Chair's Introduction

We are lucky in that we have one of the largest renewable energy resources of any country in Europe: we are blessed with a large amount of wind, marine, wave and hydro resources, as well as huge amounts of biomass potential.

David Hood, Consultant and Engineer, Centre for Alternative Technology

If we go for our indigenous renewable resource for Wales with real vigour and commitment, it will be there every year, in perpetuity. I can see that as being the best investment for Wales. For jobs and manufacturing, if we can get that working back down the supply chain for research and academia, we could be talking about a massive Welsh renewable programme on the scale of an Apollo programme.

Paul Allen, Development Director, Centre for Alternative Technology

Energy is at the heart of everything we do. We cannot live our lives without it whether it be for lighting, heating and cooking in our homes, powering the machines and gadgets we use in our work or producing heat and power for making the products we use every day like steel or paper.

Yet traditional ways of producing energy by using fuel such as coal, gas and oil, gives us the biggest single source of carbon emissions. These emissions are now widely acknowledged as making a large contribution to climate change which will inevitably impact on the lives of everyone on the planet.

So what do we do about the fact that something we need to live our lives is contributing to such devastating effects on the environment in which we live? Some people say that we must radically change the way we live and that our current lifestyle is totally unsustainable. Many of the people who have given us evidence for our inquiry, however, have argued that, with small changes in our lifestyles, such as making our homes more energy efficient, using energy saving devices in the work place, cleaning up our industrial processes and using renewable ways of generating our energy, we will need to produce far less fossil fuel based energy than we do at the moment.

I believe that these changes, coupled with the use of new technologies for fossil fuel energy generation and the rapid expansion of the renewable energy sector will mean that a low carbon energy sector does not mean us living in cold, dark houses or having to give up our technologically advanced ways of working. Instead, it should lead us, as policy makers, employers and individuals to be aware of the choices we have when producing and using energy and the ability to make those choices based on what is best not only for our immediate needs but also for the long term future.

I would like to thank all those who have given us written and oral evidence for sharing their knowledge and expertise with us and for their openness and frankness in expressing their views to us.

This report will form part of our final report which will be published in the spring of 2009. We have also published an introductory document which is designed to be read as an introduction to any of the topic reports that we produce on carbon reduction in Wales and contains our terms of reference and the policy background to carbon reduction. The introduction document can be found on our website at:

http://www.assemblywales.org/bus-home/bus-committees/bus-committees-third-assem/bus-committees-third-sc-home/inquiries/inquiries_-_carbon_reduction_household.htm

We welcome your thoughts and comments on this report, which can be sent to us at: Sustainability.comm@Wales.gsi.gov.uk or write to us at:

National Assembly for Wales
Assembly Parliamentary Service
Assembly Offices
Cardiff Bay
CF99 1NA

We would like to publish some of your ideas and views on our website so that other people can read them.

You can also find out more about how to contribute to our written consultations on future topics on our website at:
http://www.assemblywales.org/bus-home/bus-committees/bus-committees-third-assem/bus-committees-third-sc-home.htm

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According to a report prepared for DEFRA, the Welsh Assembly Government, the Scottish Executive and the Northern Ireland Department of the Environment by AEA Technology in 2007[9]:

> There is now only one nuclear power station in Wales whilst there has been a growth of Combined Cycle Gas Turbines stations (CCGTs) partly to replace the generating capacity from Trawsfynydd Nuclear Station, which closed in 1991. The increase in generation capacity in Wales comes from the opening of a 500 MW CCGT at Deeside in 1994, a 1,420 MW CCGT at Connahs Quay in 1996, a 250 MW CCGT at Barry in 1998, and a 575 MW CCGT at Baglan Bay in 2002. The remaining fossil fuel generation is from two conventional coal stations. One power station (oil-fired) at Pembroke has closed. The coal-fired station at Uskmouth closed and subsequently reopened as Fifoots after being upgraded and fitted with Flue Gas Desulphurisation. Aberthaw is the other conventional coal station.

Table 2: Percentage shares of electricity generation in Wales as at end 2006[10]

Generation method	Percentage share
Gas	40.3
Coal	25.8
Nuclear	20.1
Pumped Storage	7.6
Renewables	4.0
Other	2.2

Source: DBERR

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Renewable electricity

Wales had an installed renewable electricity capacity of 543 megawatts (MW) of electricity generation in 2006[11]. Most renewable sources are intermittent and, therefore, do not operate at their installed capacity - most operate at a percentage, which in the case of onshore wind is about 20 to 40 per cent of the installed capacity[12]. By comparison, in 2006, nuclear power stations operated at a load factor of 69 per cent, combined cycle gas turbine stations at 54 per cent, and coal-fired stations at 66 per cent[13].

The actual contribution of renewable resources to Wales's electricity production is 4 per cent (see Table 2). The 4 per cent figure accounted for 1,409 GWh, of which 275 GWH were hydropower, 867 GWh were wind and

[9] AEA Technology, *Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2006*, August 2007, p14 http://www.airquality.co.uk/archive/reports/cat07/0709180907_DA_GHGI_report_2005.pdf
[10] DBERR, *Energy trends*, December 2007, p. 20, http://www.berr.gov.uk/files/file43304.pdf
[11] DBERR, *Energy trends September 2007*, p16 http://www.berr.gov.uk/files/file41460.pdf
[12] Sustainable Development Commission. *Wind power in the UK: A guide to the key issues surrounding onshore wind power in the UK.* (May 2005) pp.17-18 http://www.sd-commission.org.uk/publications/downloads/Wind_Energy-NovRev2005.pdf
[13] DBERR, *Digest of United Kingdom Energy Statistics 2007*, p. 136, http://stats.berr.gov.uk/energystats/dukes07.pdf

wave power, 182 GWh were landfill gas and 84GWh were other biofuels[14] (see also Fig.1).

The majority of renewable electricity capacity installed in Wales is wind, followed by hydro (Fig 1). Solar photovoltaic accounts for a very small amount of generation but has grown rapidly since 2004. Based on the assumed capacity factors above, and assuming that no more renewables came online since the data were collected, the total output for renewables in 2007 was 1.787 TWh.

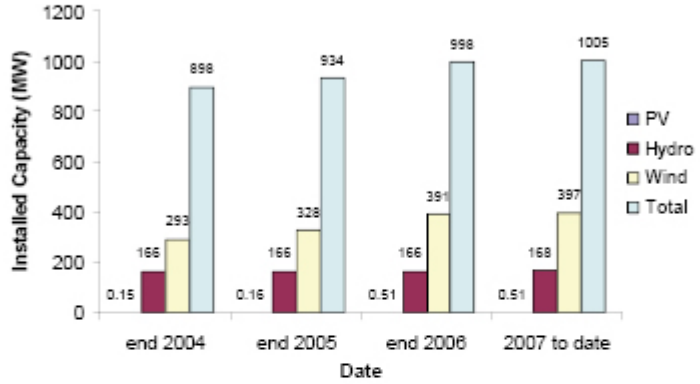

Figure 1: Growth in installed capacity electricity generation in Wales since the end of 2004.
Sources: Scottish Power Manweb and Western Power Distribution. (PV = Solar Photovoltaic)

Renewable heat

Due to the lack of a distribution network and the localised and generally small scale nature of heat generation, there are no Wales-specific data concerning the total consumption of renewable heat. The Renewable Energy Route Map for Wales highlights some of the larger biomass installations over 25 MW_{th}[15] but there are a number of smaller generation devices, such as solar thermal for individual homes for which data are not available.

4. Government Policies

[14] DBERR, *Energy trends*, December 2007, p. 20,http://www.berr.gov.uk/files/file43304.pdf
[15] Welsh Assembly Government, *Renewable Energy Route Map for Wales*. February 2008. p.11. Some of the sites are at the construction stage and are not yet operational.

Welsh Assembly Government

The Welsh Assembly Government target for renewable energy is as follows[16]:

> The Assembly Government has a target of 4TWh of electricity per annum to be produced by renewable energy by 2010 and 7TWh by 2020. In order to meet these targets the Assembly Government has concluded that 800MW of additional installed (nameplate) capacity is required from onshore wind sources and a further 200MW of installed capacity is required from off shore wind and other renewable technologies.

Figure 2 shows progress in meeting this target. This demonstrates that whilst the output from renewables is increasing, it is not currently at the rate necessary to reach the 2010 Welsh Assembly Government target.

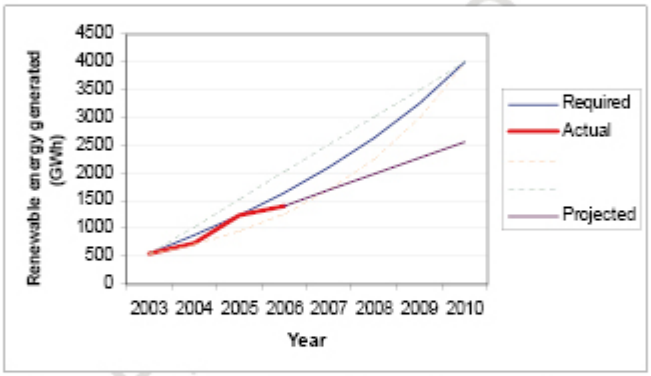

Figure 2: Progress in meeting the 4TWh target for renewable energy generation. The projection assumes that capacity will be added at the average rate from 2003-2006.
Source: DBERR

Other targets are highlighted below:

- The Welsh Assembly Government has set out a commitment to sustainable energy production which will include the drawing up of an Energy Strategy that will cover 'diversified renewable energy generation and biomass'[17].

[16] Ibid.

[17] Welsh Assembly Government *One Wales: A Progressive Agenda for the Government of Wales*, 27 June 2007.

- The *Environment Strategy for Wales* includes a commitment to 'renewable and low carbon energy generation'[18].
- An aim to encourage 800 MW of new on-shore wind electricity development by 2010[19].
- The *Renewable Energy Route Map* sets out the Welsh Assembly Government's intention to increase renewable energy, and estimates that up to 33 TWh of electricity could be generated in Wales by 2025 with a saving of more than 14 million tonnes of CO_2[20].
- Support for renewables through the planning system through Technical Advice Note 8 which includes the designation of areas for onshore wind development and advice to local authorities to adopt policies to encourage the use of renewable energy[21].
- The *Microgeneration Action Plan for Wales* contains the following targets[22]:
    - To install 20,000 microgeneration heating units by 2012, with of the order of 100,000 by 2020,
    - To install 10,000 micro-electricity units by 2012, rising to numbers in the order of 200,000 by 2020, and
    - To have in place 50 combined heat and power and/or district heating systems by 2020.
- The *Bioenergy Action Plan for Wales* proposes:
    - 5 terawatt-hours of electricity and 2.5 terawatt-hours of usable heat energy from renewable biomass by 2020

UK Government

The majority of UK Government's policies are contained in the Energy White Paper[23] and supporting documents:

- Ten per cent of the UK electricity demand to be supplied through renewables by 2010.
- A strengthening of the Renewables Obligation up to 20 per cent. Additionally the RO scheme will be banded so that a mixture of renewable technologies are supported, not merely the least expensive[24].
- Planning reforms to reduce obstacles to renewables[25].

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[18] Welsh Assembly Government, *Environment Strategy for Wales*, May 2006. Link to Strategy
[19] Welsh Assembly Government, *Energy Wales: Route Map to a Clean, Low-Carbon and More Competitive Energy Future for Wales*, June 2005.
http://new.wales.gov.uk/docrepos/40382/403823114l/4038211241 2/energyroutemape.pdf?lang=en
[20] Welsh Assembly Government, *Renewable Energy Route Map for Wales*, February 2008.
[21] Welsh Assembly Government, *Planning Policy Wales Technical Advice Note 8: Planning for Renewable Energy*, July 2005.
[22] Welsh Assembly Government, *Microgeneration Action Plan for Wales*, March 2007.
http://new.wales.gov.uk/docrepos/40382/403823114l/4038211241 3/plane.pdf?lang=en
[23] The Stationery Office, *Energy White Paper: Our Energy Challenge – Creating a Low Carbon Economy*, (February 2003).
[24] The Stationery Office, *The Energy Bill*, January 2008.
http://www.publications.parliament.uk/pa/cm200708/cmbills/053/2008053.pdf
[25] *The Planning Bill*, Bill 71 2007-08

- The continuation of the Low Carbon Buildings Programme with an extra £50 million announced in 2006 to provide grants to householders and organisations to install microgeneration technologies[26].
- Removal of current barriers to the connection of microgeneration installations to the National Grid (working with Ofgem and National Grid UK).
- Increased public sector involvement with the private sector to increase research and development of low carbon technologies[27]
- Combined Heat and Power (CHP) installations are to be exempted from the climate change levy and reformed planning guidance will increase the consideration given to CHP in new planning applications[28].
- The establishment of the Energies Technologies Institute to be 50:50 funded between the public and private sector with £600 million[29]. Full operation was announced on 17 December 2007[30].

In addition, the UK Government's White Paper on Nuclear Power states[31]:

> "The Government believes new nuclear power stations should have a role to play in this country's future energy mix alongside other lowcarbon sources; that it would be in the public interest to allow energy companies the option of investing in new nuclear power stations; and that the Government should take active steps to facilitate this".

Europe

- A binding target of a 20 per cent share of renewable energies of overall EU consumption by 2020[32].
- To cut greenhouse gases by at least 20 per cent by 2020 and by 30 per cent in the context of a comprehensive international agreement[33].
- Increased support for renewable technology development through the Directive on Electricity Production from Renewable Energy Sources[34].

5. Devolved responsibilities

[26] HM Government, *Climate Change the UK Programme*, March 2006 http://www.defra.gov.uk/environment/climatechange/uk/ukccp/pdf/ukccp06-all.pdf
[27] The Stationary Office, *Meeting the Energy Challenge – A White Paper on Energy*, May 2007. pp. 216-234. http://www.berr.gov.uk/files/file39387.pdf
[28] *Ibid.* p. 13.
[29] Department of Trade and Industry, *Energy Technologies Institute Prospectus*, September 2006. http://www.energytechnologies.co.uk/assets/files/ETI_Prospectus.pdf.
[30] Energies Technologies Institute website http://www.energytechnologies.co.uk/
[31] Department for Business, Enterprise and Regulatory Reform *Meeting the Energy Challenge: A white paper on nuclear power* January 2008 http://www.berr.gov.uk/files/file43006.pdf
[32] European Commission, *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: 20 20 by 2020: Europe's climate change opportunity*, 23 January 2008, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0030:FIN:EN:PDF
[33] *Ibid* p. 5.
[34] European Commission, *Directive 2001/77/EC of The European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market*, (September 2001) http://eur-lex.europa.eu/pri/en/oj/dat/2001/l_283/l_28320011027en00330040.pdf

Legislative Competence

Energy does not appear as a separate field in Schedule 5 of the *Government of Wales Act 2006*. The following are all UK Government reserved matters:

- oil and gas (apart from pollution);
- the generation (>50MW), transmission and supply of electricity (apart from pollution);
- energy conservation (apart from the encouragement of energy efficiency otherwise than by prohibition or regulation).

Electricity Consents

Planning application consents for all applications under 50MW rests with local authorities in Wales. At present, responsibility for consenting to power stations with a generating capacity of greater than 50 MW in Wales and England rests with the Secretary of State for Business, Enterprise and Regulatory Reform under the provisions of Section 36 of the *Electricity Act 1989*. The Welsh Assembly Government is a formal consultee in the consents process but has no statutory role in the final decision.

The *UK Planning Bill*[35] proposed a reform of planning for nationally significant infrastructure projects, including energy projects above 50 MW and major gas infrastructure projects in Wales and England. An independent Infrastructure Planning Commission will make decisions on nationally significant infrastructure projects.

The threshold for consents for installations offshore differs, in that the Welsh Assembly Government can only consent to developments under 1 MW. Some changes have also been proposed under the *Draft Marine and Coastal Access Bill*[36], including the creation of a Marine Management Organisation which would have a lead role in consenting applications in Welsh offshore waters between 1 – 100 MW. Table 3 outlines the current and proposed consents powers.

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[35] UK Planning Bill http://services.parliament.uk/bills/2007-08/planning.html
[36] Draft Marine Bill http://www.defra.gov.uk/marine/legislation/index.htm

Table 3: Proposed Consent Bodies for Electricity Installations

Installation size	Current consent body	Proposed consent body
Nationally Significant Infrastructure	Secretary of State for Business, Enterprise and Regulatory Reform	Infrastructure Planning Commission
> 50 MW onshore	Secretary of State for Business, Enterprise and Regulatory Reform	Infrastructure Planning Commission
< 50 MW onshore	Local Authorities	Local Authorities
> 100 MW offshore	Secretary of State for Business, Enterprise and Regulatory Reform	Infrastructure Planning Commission
1 - 100 MW offshore	Secretary of State for Business, Enterprise and Regulatory Reform & Welsh Assembly Government	Marine Management Organisation & Welsh Assembly Government
< 1 MW offshore	Welsh Assembly Government	Welsh Assembly Government

Infrastructure Planning Commission: Established by the Planning Act 2008
Marine Management Organisation: proposed by the Draft Marine and Coastal Access Bill
For offshore installations, the Welsh Assembly Government's role is in providing licences under the *Food and Environmental Protection Act 1985* and the *Coast Protection Act 1949*

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The Minister for Environment, Sustainabilty and Housing has indicated on several occasions that it is the position of the Welsh Assembly Government that responsibility for determining applications for generating stations greater than 50MW onshore and up to100MW offshore[37] should come to Wales.

[37] Sustainability Committee, 4 June 2008, p20 http://www.assemblywales.org/bus-home/bus-committees/bus-committees-third1/bus-committees-third-sc-home/bus-committees-third-sc-agendas/sc20080604qv.pdf?langoption=3&ttl=SC%283%29-12-08%20%3A%20Transcript%20%28PDF%2C%20187kb%29

Chapter 2 – Key issues and recommendations

> "We will aim to achieve annual carbon reduction-equivalent emissions reductions of 3 per cent per year by 2011 in areas of devolved competence. We will set out specific sectoral targets in relation to residential, public and transport areas."

One Wales - A progressive agenda for the government of Wales – Labour and Plaid Cymru Groups in the National Assembly – June 2007.

2.1 We are very pleased to see this commitment to carbon reduction in the One Wales document and fully support the coalition government in their efforts to achieve it.

2.2 In this chapter, we outline six 'headline' recommendations and illustrate the impact we think they could make on achieving the 3 per cent target in Wales.

2.3 As outlined in the introduction to this report, the energy production sector is an area in which the Welsh Assembly Government has limited powers to influence carbon reduction. All decisions on energy installations above 50MW (1MW in the sea) are made currently by the UK Government and will soon be made by the Independent Planning Commission (IPC).

2.4 This has lead not only to Wales being a net exporter of energy but also the highest carbon emitter of any of the countries in the UK.

2.5 Concern was expressed by many of our witnesses about the potential energy gap caused by the delay between the decommissioning of old fossil fuel and nuclear power stations and the commissioning of new energy production facilities.

2.6 There were also concerns expressed about the security of our energy supply as we rely heavily on imported oil and gas for energy production.

2.7 Whilst carbon reduction from large scale energy generation is not within the remit of the Welsh Assembly Government, it has, quite rightly, concentrated its efforts on the renewable energy sector. We consider that renewable energy can play an important role not only in reducing carbon emissions but also in helping to partially address the problems of the energy gap and security of supply.

2.8 Much of our evidence, whilst acknowledging the work already done by the Welsh Assembly Government on renewable energy, expressed disappointment that the Welsh Assembly Government has not done more to realise the full potential of renewable energy in Wales.

Strategic Action

2.9 Much of the evidence we received pointed to a lack of high level strategic direction from the Welsh Assembly Government. Whilst we welcome the

imminent production of the Renewable Energy Routemap (RERM) for Wales, we believe that this does not go far enough in providing a picture of the energy mix that the Welsh Assembly Government wishes to have in Wales (both fossil fuels and renewables) and the preferred locations for them. We therefore recommend:

Headline Recommendation 1: Whilst we acknowledge the lack of powers of the Welsh Assembly Government over fossil fuel energy production in Wales, we recommend that the Welsh Assembly Government, as part of its energy strategy, produce a strategic framework for all energy production in Wales, indicating spatially and in terms of output the preferred energy mix for Wales.

2.10 We received evidence during the inquiry about the importance of the adequacy of existing infrastructure during the construction and connection phase of new energy production facilities.

2.11 Road access for large plant and machinery to sites where new power plant was to be installed had proved difficult for new sites, especially those in more rural areas and had led to long delays in installation work and local disruption.

2.12 Connectivity to the existing electricity and gas supply grids was cited as a particular issue in mid Wales and with links form north to south Wales where there are historically poor grid connections.

2.13 The main infrastructure issues have so far been encountered mainly by developers installing renewable energy projects. The Committee is concerned, however, that new sites for fossil fuel power stations and possible carbon capture and storage technologies could also suffer from a lack of existing infrastructure. We therefore recommend:

Headline recommendation 2: The Welsh Assembly Government undertake a thorough review of the adequacy of the transport infrastructure and grid connection for the construction of both fossil fuel and renewable energy plants in the areas identified in the strategic framework recommended in HL1.

Headline recommendation 3: The Welsh Assembly Government to continue to encourage grid and distribution companies to work co-operatively with developers to develop an integrated approach to connection for large scale renewables.

Renewable energy

2.14 The Welsh Assembly Government has estimated that if the aspirations in the RERM are achieved, up to 4 million tonnes of carbon per year could be saved.

2.15 We are concerned about the fact, referred to in much of the evidence, that there is confusion between the renewable energy targets e.g. those in TAN 8, targets for micorgeneration and the carbon reduction targets and how the two sets of targets relate to each other.

2.16 We are also concerned by the lack of progress towards meeting the current targets for renewable energy.

2.17 We consider that whilst the aspirations in the RERM have the potential to make a substantial impact on Wales' carbon emissions, they will remain as aspirations if more action is not taken by the Welsh Assembly Government to ensure that they become a reality. We therefore recommend:

Headline Recommendation 4: The Welsh Assembly Government simplifies the number and nature of targets set for carbon reduction and ensures that there is consistency and explicit linkages between targets for renewable energy and carbon reduction.

Headline Recommendation 5: The Welsh Assembly Government focuses on the achievement of the targets it has set by:

- **Providing sufficient incentives for the research, development and manufacture of renewable energy technologies in Wales;**
- **Issuing guidance and advice on ways to achieve the targets; and**
- **disseminating widely examples of good practice of organisations and individuals achieving its targets.**

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Microgeneration

2.18 Many of those who gave us evidence on microgeneration expressed frustration at the lack of take up of the available technologies, especially by householders and small businesses.

2.19 Dulais Ltd described the market for micorgeneration as:

> "A tap waiting to be turned on. It just needs the right conditions"

2.20 Most of those who submitted evidence identified costs and the perceived length of payback times as a barrier to the installation of microgeneration.

2.21 Witnesses also emphasised that there is huge potential for new businesses to be created in Wales manufacturing, supplying and installing microgeneration technology if the potential market for it can be stimulated. We therefore recommend:

Headline Recommendation 6: The Welsh Assembly Government to explore the potential for local authorities in Wales to issue loans for the installation of domestic microgeneration technology e.g. the Kirklees scheme, or repayment based on feed in tariff revenue.

Chapter 3 – The energy mix

3.1 Although the Welsh Assembly Government does not have any powers over large scale fossil fuel energy generation, we consider that, as a net exporter of energy produced by fossil fuels, we needed to explore the contribution of fossil fuels as well as renewable energy to the overall energy mix in Wales.

Fossil Fuels

3.2 There was general agreement amongst those submitting evidence that, in the short term, fossil fuels (i.e. coal, oil and gas) as well as nuclear will remain the main source of energy generation in Britain.

3.3 Several challenges were identified in moving towards a low carbon economy and low carbon energy production:

- Current fossil fuel power generation is responsible for approximately one third of Wales' carbon emissions and current technologies for producing 'greener' energy processes (e.g. carbon capture and storage, clean coal technology) are not particularly suited to retrofitting to existing power production plant;

- As the majority of our fossil fuel is imported, there is a growing concern about the security of the supply of raw materials from areas of the world which could be politically volatile;

- Fossil fuel resources are not infinite and long term replacements for them will have to be developed;

- It was widely acknowledged that there will be a gap in energy production in Britain between the nuclear resource and old fossil fuel powers stations being decommissioned (a process which is already underway) and new large scale power generation coming on stream;

- Transmission losses from carrying power over a long distance can result in up to 5% of power being lost between where it is generated and where it is used.

3.4 Several witnesses expressed concern about the lack of strategic thinking in the UK's energy policies.

3.5 The World Wide Fund for Nature highlighted the conflicts between the proposals for the construction of new coal fired power stations across the UK which did not take advantage of the potential new technologies for de carbonising the energy production process such as carbon capture and storage (CCS) and the setting of more stringent carbon reduction targets. They said:

> "Coal is the major source of the problems to date in terms of the carbon that has already accumulated in the atmosphere, and if you look at the business as usual projection, the rush back to coal globally and in industrialised countries is the main problem we face."

3.6 The Carbon Capture and Storage Association were concerned that the emphasis by the UK Government on post combustion technologies which could be retrofitted to existing power stations and could be sold to countries such as China was holding up policy and regulation for CCS in the new power stations that are being planned. In their opinion, this could result in new stations being built without CCS capabilities.

3.7 Although we did not take any evidence directly on the use of nuclear power to produce energy in the UK, several witnesses pointed to the potential gap between the existing installation at Wylfa being decommissioned and the possible construction of a new nuclear plant there. Concern was expressed by many witnesses about the reliance on nuclear power as a clean energy source and the time lag between the decommissioning of current plants and the building of new ones.

Renewable energy

3.8 We received a great deal of evidence about the potential of renewable energy to address many of the issues raised by fossil fuel energy production such as security of supply and transmission losses as well as carbon reduction.

3.9 The opportunities and barriers for individual technologies are discussed in more details in the next chapter. We would, however, like to make a few general comments here about the potential role of renewable energy technologies in the energy mix for Wales.

3.10 There was general agreement amongst all those submitting evidence that Wales has a great potential for generating renewable energy due to its geographical location.

3.11 There were concerns expressed, however, at the emphasis in the Renewable Energy Route Map and previous Welsh Government policy on wind power and marine renewables. The Wales Energy Research Group (WERG) were critical of the government' approach saying:

> "The initial consultation through the energy route-map suggests that half of that renewable energy should be met from a marine source, whether it is the tidal barrage, or a mix of all the other marine entities. The utility companies always require a balanced portfolio of renewable energies, and they will be critical in this whole decision-making. I think that the decision will be taken out of our hands."

3.12 Much of the evidence stressed the need to have as many renewable technologies contributing to the energy mix as possible.

3.13 Concern was expressed about the reliance on energy from the proposed development of a scheme in the Severn Estuary to help to meet the EU's target of 20% of energy being generated from renewable sources by 2020.

3.14 The projected development time for a scheme in the Severn Estuary means that it may not be producing energy until 2022 at the earliest.

3.15 We were concerned at the evidence from the Royal Society for the Protection of Birds (RSPB) that the UK Government has agreed with the EU that the output from a scheme in the Severn Estuary can be counted towards the 2020 target even if it does not start to produce energy until after the target date. We feel that, given the urgency of the need to address our carbon reductions and slow down the pace of climate change, other renewable energy schemes need to be found to meet the 2020 targets. We therefore recommend:

Recommendation 1: The Welsh Assembly Government indicate the renewable energy mix that will be required in Wales to meet the 2020 targets which does not include a scheme in the Severn Estuary and lobbies the UK Government to do the same.

Strategic approach

3.13 We are concerned abut the apparent lack of strategic direction for the UK's energy policy and the potential for conflict between energy and carbon reduction policies. Although we have no remit to make recommendations to the UK Government on their energy policy, we think that it is important that we get our own house in order in Wales and demonstrate a cohesive and integrated approach to energy production and climate change.

3.14 We believe that the Welsh Government should produce a co-ordinated strategy for energy in Wales, outlining the energy mix that it would want to have. We therefore recommend Headline Recommendation 1.

3.15 We also believe that there is a potential for CCS to play an important role in decarbonising energy production. We agree with the evidence that we were given that a more strategic approach needs to be taken to the research and development of CCS technology and that, if proven, it should be used on all new coal power stations.

3.16 We are concerned, however, that the current emphasis on sites for secure storage is focussed mainly on areas of spent oil and gas deposits in the North Sea. The Carbon Capture and Storage Association told us that there were possible sites for storage off the Welsh coast but these sites have not been investigated as yet.

3.17 We welcome the positive views that the Minister gave us on carbon capture and storage. We therefore recommend:

Recommendation 2: The Welsh Assembly Government to lobby the UK government with its views on the use of Carbon Capture and Storage technology to ensure that any new fossil fuel power stations built in

Wales are CCS ready and that any new fossil fuel power stations built are close to areas where satisfactory carbon storage can take place.

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Chapter 4 – Renewable energy

> "If you look at a renewable energy map of Europe, you will see that Wales is the Saudi Arabia of green electricity—we are most well endowed with it."

Paul Allen, Development Director, Centre for Alternative Technology

4.1 One of the clearest messages that we were given by those submitting evidence to us is that Wales has vast potential to be a leader in the development and use of renewable energy technologies.

4.2 We were very pleased to hear from the Minister that Wales is considered as a leader in sustainability and applaud the work that has been done so far by the Welsh government to address the issues around climate change and encourage the development and implementation of renewable energy in Wales. We look forward to the publication of the Renewable Energy Route Map and the Wales Energy Strategy and consider that both of these will be key documents in moving towards a low carbon future.

4.3 We consider that it is now time to put the strategies and plans into action – we in Wales must now 'walk the walk' as well as 'talking the talk'.

4.4 We heard evidence that plans for renewable energy have to be implemented quickly if EU, UK and Welsh targets are to be reached and the inevitable rise in global temperatures is to be slowed to a level at which we are able to adapt to its effects.

4.5 We acknowledge that difficult decisions will have to be made and that the economic downturn could make financial decisions about renewable energy even harder.

4.6 The Environmental Audit Committee said in their recent report on the green economy and the economic recession:

> "The fiscal stimulus measures intended to pull the economy out of recession represent an invaluable opportunity decisively to transform the UK into a low carbon economy. A programme of investments in low carbon industries would help build a modern and sustainable economy, securing Britain's competitiveness and future prosperity in the new global economy that will emerge from this crisis.[38]"

We agree wholeheartedly with the views of the Environmental Audit Committee and firmly believe that the development of a market for renewable energy and the associated research and technology in Wales will provide a valuable too to combat the effects of the current economic downturn.

4.7 Whilst many witnesses shared our welcome for the Renewable Energy Route Map and the proposed Energy Strategy, there was a general consensus in much of the evidence we received that Wales is not realising its full potential for renewable energy. Many witnesses expressed concern and frustration at the missed opportunities for and barriers to the development of a

[38] Environmental Audit Committee, *Pre-Budget Report 2008: Green fiscal policy in a recession*, March 2009

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renewable technology market with associated research, development and technology supply sector in Wales.

4.8 Many reasons were given for the lack of progress, but a few key themes emerged form the evidence which we will discuss in the rest of this chapter.

Targets

4.9 In addition to EU, UK and Welsh carbon reduction targets, there are also EU, UK and Welsh targets for renewable energy.

4.10 Several of those who submitted evidence said that there is a great deal of confusion caused by the number of targets for carbon reduction and renewable energy and the relationship between them.

4.11 There appears to be little explicit linkage made between the way in which targets for renewable energy are contributing to carbon reduction targets or to how targets set at the Welsh level are contributing to UK targets and those set at the UK level are contributing to EU targets.

4.12 We believe that any targets set by the Welsh Assembly Government for renewable energy should show an explicit link to how they are contributing to other targets at Wales, UK and EU levels. We consider that the publication of the new renewable Energy Route Map and Energy Strategy will be an excellent opportunity for the Welsh Assembly Government to simplify its targets and put them into context. We therefore recommend Headline Recommendation 4.

4.13 The Welsh targets for renewable energy are:

- TAN 8
  - 4TWh of electricity per annum to be produced by renewable energy by 2010 and 7TWh by 2020;
  - encourage 800 MW of new on-shore wind electricity development by 2010;
- Microgeneration Action Plan
  - To install 20,000 microgeneration heating units by 2012, with of the order of 100,000 by 2020;
  - To install 10,000 micro-electricity units by 2012, rising to numbers in the order of 200,000 by 2020;
  - To have in place 50 combined heat and power and/or district heating systems by 2020;
- Bioenergy Action Plan for Wales
  - 5 terawatt-hours of electricity and 2.5 terawatt-hours of usable heat energy from renewable biomass by 2020;
- Renewable Energy Route Map
  - Up to 33TWh per year of electricity from renewable sources by 2030. Half from marine, a third from wind and the rest mainly from sustainable biomass. Up to 3TWHt of renewable heat.

4.14 Figures published by the Department for Business Enterprise and Regulatory Reform for 2007 showed that the of electricity generated from renewable sources in Wales fell from 1,404 TWh in 2006 to 1,370 TWh in 2007.

4.15 Several of our witnesses expressed concern about whether the targets that have been set by the Welsh Assembly Government are actually achievable. Dulas told us their concerns about the microgeneration targets:

> "I take a sharp intake of breath every time I hear those targets, as do the people responsible for setting them, I am sure. They are ambitious and fantastic targets, but a little sprinkling of reality might be needed. There are about 5,000 photovoltaic installations across the UK at the moment, and the Government has been stimulating that market for at least seven years. It has been a slow start, but 10,000 units by 2012 in Wales alone would require radical change, and I do not see any radical policy changes or radical grant initiatives on the horizon."

The Wales Environment Trust said:

> "We need a radical deployment; things need to start happening on the ground now. What seems to happen every time is that we get a new set of targets or a new strategy is written and, by the time that process has been undertaken, you are 50 per cent of the way down the road towards the time for meeting your target."

4.16 We too are concerned abut the lack of progress towards meeting the renewable energy targets set by the Welsh government. If the targets set thus far have not been achieved or do not look as if they are likely to be achieved, ate those even more stretching targets that are now being set also likely to suffer the same fate?

4.17 We believe that the Welsh Assembly Government should focus on the achievement of the targets that they have set and therefore recommend Headline Recommendation 5.

Community engagement

4.18 The majority of renewable energy installations will be located in or close to a community in Wales. One of the strengths of renewable energy is that it is able to generate and supply power and heat to local communities.

4.19 Whilst there is the potential for renewable energy installations to disrupt some aspects of the life of some people in a community, there are also potentially great benefits for communities to having renewable energy close by.

4.20 During the eighteen months that we have been collecting evidence for our inquiry into carbon reduction in Wales, the issue of the effect of renewable energy installations on communities has been the one which has generated the largest amount of correspondence to the committee. All of the correspondence has been about the concerns of local communities about either biomass or wind generation.

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4.21 From the evidence we have received, it appears that, communities where renewable energy schemes may be sited can feel excluded from the decision making process about the scheme and that it can be perceived as something that is being imposed on them rather than something in which they can play a part.

4.22 Many large and medium scale renewable energy schemes do offer benefits to the local communities in terms of financial payments or other benefits. A report for the Welsh Assembly Government[39] estimated that, in 2007, around £650,000 per year was paid to communities in Wales by developers as a result of wind farm developments. The report's authors also estimate that if the government's target of an additional 800MW of onshore wind power is reached, the benefits could rise to around £2 million a year.

4.23 The same report also suggested that more of the monies paid to communities by developers could be targeted at carbon reduction schemes within the communities and that opportunities for using the money to gain match funding for larger projects were not always used.

4.24 We heard from several witnesses how important community engagement in a new scheme is, from its inception and throughout to its operating life, to the success of the scheme.

4.25 Whilst we applaud the local community benefit schemes that are already in existence, we would urge that they are extended beyond wind farm schemes to include biomass plants and other forms of renewable energy development.

4.26 We believe that communities can benefit greatly from a relationship with the developers of renewable energy schemes but that engagement must come at an early stage in the project and that further environmental benefits to the communities involved should come out of the benefit agreement. We therefore recommend:

Recommendation 3: The Welsh Assembly Government to issue guidance to communities and developers on the use of monies gained from community benefit agreements on carbon reduction and/or sustainable projects (e.g. community heating schemes, home insulation, development of community energy action plans) and of match funding available from the Welsh Assembly Government and EU funding streams.

Recommendation 4: The Welsh Assembly Government establish and publicise a database of existing community benefit schemes which can be used by communities wishing to enter into such schemes to identify good practice.

[39] Richard Cowell, Gillian Bristow & Max Munday of Cardiff University, with Peter Strachan of Aberdeen Business School. *Wind Farm Development in Wales: Assessing the Community Benefits, 2008* http://new.wales.gov.uk/firstminister/research/economic/capacitybuilding/windfarm/windfarms.pdf?lang=en

4.27 We also believe, for the evidence we were given, that there can be great benefits for communities in establishing their own community energy schemes.

4.28 The Hermon Community Microgeneration Project estimate that they will receive £80,000 pounds annual profit from selling electricity to be taken into the national grid from 2 wind turbines that will be built by the community. The profit will be used to fund community development schemes.

4.29 Several witnesses advocated the community approach taken by Hermon and suggested that communities should be encouraged to produce their own community energy strategies which would enable them not only to identify energy savings within the community but also opportunities for energy generation and distribution. We therefore recommend:

Recommendation 5: The Welsh Assembly Government to issue guidance on and provide funding for the development of community energy action plans.

Planning

4.30 A theme which has run throughout our inquiry into carbon reduction in Wales is that of the ability of the planning system to enable carbon reduction measures to be implemented.

4.31 Many of those giving evidence to this section of the inquiry echoed the views of the majority of witnesses in other parts of the inquiry that the planning system can act as a barrier to the development and installation of renewable energy technologies.

4.32 We heard that large, medium and small scale installations can all encounter problems with the planning system ranging from delays because of the length of time taken to make decisions on planning applications, through the restrictions that can be placed on schemes to the expense and complication of the system for individual and small companies.

4.33 We welcome the intention of the Welsh Assembly Government to give permitted development rights to domestic scale solar and photovoltaic technologies and urge them to extend the same rights to wind and ground source heat pumps.

4.34 We will be dealing further with all aspects of the planning system and carbon reduction in our final report but wish to make the following recommendations about renewable energy and the planning system:

Recommendation 6: The current TAN8 should be urgently revised to include all forms of renewable energy including marine renewables.

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Recommendation 7: The Welsh Assembly Government should issue guidance to local authorities on the use of policies for carbon reduction in Local Development Plans.

Grid connection

4.35 The issue of grid connection and the extent of the energy distribution gird in Wales is one which we have explored on a number of occasions. The lack of a north/south link and the scarcity of the gas grid on mid Wales have been discussed during the course of our fuel poverty inquiry but issues over the grid have also been brought to our attention during this inquiry.

4.36 Much of the evidence we received about grid connection pointed to the length of time taken to connect to the grid. Welsh Power told us:

> National Grid are unwilling to make any speculative investment in the system, which means that new build takes significant time. We note that wind generation in mid-Wales is probably going to find connection difficult for this reason as well. The transmission connection queue now makes connections of new plants in Wales difficult before 2017.

4.37 The Hermon Community Microgeneration Project highlighted the advantages of connecting to existing grid connections available locally. They considered that establishing the existence of local connections was key to the success of schemes such as theirs.

4.38 We heard examples of good practice in mid Wales where a Welsh Assembly Government initiative has encouraged grid and distribution companies to work co-operatively with all potential developers of renewable energy schemes in the area to establish the distribution network needs of the area in the medium to long term. We therefore recommend:

Recommendation 8: The Welsh Assembly Government to continue to encourage grid and distribution companies to work co-operatively with developers to develop an integrated approach to connection for large scale renewables.

4.39 Another barrier to grid connection, especially for small energy producers, is the cost of connection. Fre-energy told us that they had an estimate of £26,000 to connect a small anaerobic digester to the grid.

4.40 We were also concerned that several witnesses told us that they were having to pay a fee to be put on the waiting list for gird connection.

4.41 We were very pleased to hear from Scottish Power that charges for being added to the waiting list for grid connection have been dropped and recognise that grid connection charges are a commercial matter. We would, however, urge the UK Government and OFGEM who regulates the market, to consider the level of charges for grid connection, especially for small generators.

Large scale renewables

4.42 The abundance of natural sources for generating renewable energy in Wales that the Centre for Alternative technology referred to means that Wales should be an ideal place for investment in the development and installation of large scale renewable energy projects.

4.43 From the evidence we were given, it is clear that, although schemes such as the proposed Severn Tidal Power Project and the Gwynt Y Mor wind farm in North Wales represent large scale schemes, other technologies such as tidal schemes and large scale anaerobic digestion are not being developed to their full potential in Wales.

4.44 There appear to be several reasons for this, some within the remit of the Welsh Assembly Government and others which will need policy changes at the UK level.

4.45 The Sustainable Development Commission warned that:

"The position in which we find ourselves is that we have too many people looking for too many alternatives, and they all believe that their idea is always the right idea while someone else's idea is always the wrong idea. We get to the point at which different technologies are actively competing against each other and rubbishing each other's version of their capacity to deliver on that target. We simply need to get back to the starting point of recognising that we may not know all the answers at this stage, but we have to take on all those options."

4.46 We believe that this competition and the reliance on 'proven technology' for investment have hampered the progress of renewable energy technology in Wales. We welcome the Minister's statement that funding is being given to assess the potential of alternative schemes for the Severn Tidal Power project and urge that the Welsh Assembly Government provides more incentives to attract the research and development of large scale renewable technologies that will have direct applications in Wales.

4.47 It was suggested by several witnesses that the system of Renewable Obligations Certificates (ROCs) does not provide enough incentive for energy companies to invest in large scale renewable generation, especially tidal schemes, and that the absence of any similar scheme for heat does not encourage the development and installation of large scale combined heat and power schemes (CHPs).

4.48 We were also concerned to hear that, under the proposed new Scottish scheme, Renewables Obligation Scotland (ROS), wave energy schemes would qualify for five ROCS and tidal energy schemes would qualify for three ROCs (in England and Wales both types of scheme qualify for two ROCs).

4.49 We welcome the inclusion of provisions for a Renewable Heat Incentives scheme in the Energy Act 2008. We believe that, for large scale renewable energy to become a viable alternative to fossil fuel generation in Wales, there should be as much incentivisation as possible for renewable energy. We therefore recommend:

Recommendation 9: The Welsh Assembly Government to lobby the UK Government to:

- **Implement the Renewable Heat Incentives Scheme as soon as possible;**
- **Ensure that any renewable obligations scheme in Scotland does not operate at the expense of investment in schemes in England and Wales.**

4.50 We strongly believe that large scale wind power, in conjunction with other renewable energy technologies has the potential to provide a good source of renewable energy for Wales. We have made recommendations for wind power throughout this report so will concentrate, in this section of the chapter, on other large scale renewables.

4.51 We were interested to receive evidence from Prenergy about the large biomass plant which is being built in Port Talbot and on the potential domestic market for biomass from the Forestry Commission.

4.52 We consider that energy from biomass has a great potential in Wales, but were concerned about some aspect of the evidence we received.

4.53 Whilst Prenergy's evidence claimed that the plant would contribute 70% of the 2010 renewable generation target for the whole of Wales, it is also expected to emit an estimated 743,000 tonnes of carbon per year. Whilst the energy source is from renewable forestry, the forests are in the northern USA and so will create carbon emissions in transportation and the carbon emitted from the plant will be included in Wales' overall carbon emissions.

4.54 We were also concerned that the heat from the plant would not be used as there are no plans to include infrastructure to pipe heat from the plant for use in the local area.

4.55 The Biomass Energy Centre told us that:

> "Biomass is a low energy density, ubiquitous fuel. It is therefore not well suited to long distance transport and it is appropriate to make use of it whenever possible, close to the point of production. This tends to militate against large scale operations."

Whilst the Forestry Commission emphasised the fact that currently, the domestic production of wood biomasss was limited and mostly accounted for by current demand. They advocated that the market for biomass should be stimulated by encouraging land owners to manage their woodlands and therefore produce a greater crop.

4.56 We are concerned about the development of inappropriate large scale biomass plants in Wales, especially where there is no facility for the plant to become a combined heat and power plant (CHP). We support, however, the development of small and medium scale biomass for CHP in Wales and the stimulation of the supply of biomass from woodland and form other sources for the domestic market. We therefore recommend:

Recommendation 10: The Welsh Assembly Government lobby the UK Government to ensure that any large scale biomass schemes approved in Wales are appropriate in terms of being CHP schemes and in terms of not contributing to carbon emissions through transport and other emissions.

Recommendation 11: That it is made a prerequisite for any small and medium scale biomass schemes be CHP schemes.

Recommendation 12: That the revised Wood Energy Business Scheme (WEBS) supports CHP.

4.57 We believe that there is a great potential for the development of tidal stream and wave energy generation technology around the coast of Wales.

4.58 The Countryside Council for Wales called for the Welsh Assembly Government to show leadership in encouraging the development of wave and tidal technologies. They said:

> "From a wave and tidal perspective, the tidal stream and tidal range, the sector is much more in its infancy. We recognise that there are various challenges associated with the development of these technologies. The developers of these technologies are looking for clarity and certainty, and we and the Government can play a role in helping them to understand the issues associated with their technologies to help them to bring them forward in a strategic way.....Scotland has also undertaken a marine renewable energy strategic environmental assessment, which has enabled the Crown Estate to undergo a licensing round for wave and tidal devices. That is a crucial point—there is now a framework in place for these developers, with these technologies, to go to Scotland."

4.59 Evidence from Swanturbines estimated that and investment of around £500 million was needed from government in the UK to develop and establish between five and ten types of tidal and wave energy generation technologies which would be viable not only for use around the UK but could also form a valuable export market around the world.

4.60 We also heard evidence from Cardiff University School of Engineering about the potential for wave and tidal schemes to provide important flooding controls for coastal areas, so performing a dual function.

Microgeneration

4.61 The current targets for the installation of microgeneration equipment in Wales discussed earlier in this chapter seem highly unlikely to be met. The main reasons for this, mentioned in Chapter 2 are the high installation costs of the equipment and the comparatively long pay back time. The Micropower Council also identified planning restrictions and a lack of accessible information for those wanting to install microgeneration equipment as further barriers.

4.62 The Severn Wye Energy Agency estimated that it would cost around £25,000 per house to reduce the carbon emissions from an old, hard to heat home in Wales by 60%. She considered that this level of capital outlay was beyond the ability of many householders.

4.63 Several witnesses spoke to us about the Low Carbon Buildings Programme which was designed to provide grants to home owners, community groups and public bodies to part fund the installation of microgeneration equipment.

4.64 Whilst welcoming the programme, the majority of those giving evidence criticised its administration and the way in which the funding was allocated.

4.65 The Buildings research Establishment, who administer the programme told us that they had been given no budget to advertise the scheme and that those applying for the scheme were put in touch with local advisors who did not always have expertise in all renewable technologies and so may not be recommending the most appropriate technology.

4.66 We were pleased to hear that the scheme has been extended for householders until 2010 and that, £33.6 million has been committed and £8.8 million paid of the £48 million allocated to the scheme. Of that, £1.8 Million has been committed in Wales and £0.5 million paid.

4.67 We heard form the Energy Savings Trust in Northern Ireland that top up grants of up to 15% are available for Low Carbon Buildings Scheme and that this has resulted in increased uptake of the scheme.

4.68 We believe that schemes such as the Low Carbon Buildings Scheme are a vital tool to achieving microgeneration and renewable energy targets. We therefore recommend Headline Recommendation 6 and:

Recommendation 13: The Welsh Assembly Government takes a lead in promoting the Low Carbon Buildings Programme in Wales and lobbies the UK Government to renew the Low Carbon Buildings Programme after 2010 in addition to the proposed system of feed in tariffs for renewable energy generation.

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Annex A – List of Recommendations

Headline Recommendations:

Headline Recommendation 1: Whilst we acknowledge the lack of powers of the Welsh Assembly Government over fossil fuel energy production in Wales, we recommend that the Welsh Assembly Government, as part of its energy strategy, produce a strategic framework for all energy production in Wales, indicating spatially and in terms of output the preferred energy mix for Wales.

Headline recommendation 2: The Welsh Assembly Government undertake a thorough review of the adequacy of the transport infrastructure and grid connection for the construction of both fossil fuel and renewable energy plants in the areas identified in the strategic framework recommended in HL1.

Headline recommendation 3: The Welsh Assembly Government to continue to encourage grid and distribution companies to work co-operatively with developers to develop an integrated approach to connection for large scale renewables.

Headline Recommendation 4: The Welsh Assembly Government simplifies the number and nature of targets set for carbon reduction and ensures that there is consistency and explicit linkages between targets for renewable energy and carbon reduction.

Headline Recommendation 5: The Welsh Assembly Government focuses on the achievement of the targets it has set by:

- **Providing sufficient incentives for the research, development and manufacture of renewable energy technologies in Wales;**
- **Issuing guidance and advice on ways to achieve the targets; and**
- **disseminating widely examples of good practice of organisations and individuals achieving its targets.**

Headline Recommendation 6: The Welsh Assembly Government to explore the potential for local authorities in Wales to issue loans for the installation of domestic microgeneration technology e.g. the Kirklees scheme, or repayment based on feed in tariff revenue.

Other Recommendations:

Recommendation 1: The Welsh Assembly Government indicate the renewable energy mix that will be required in Wales to meet the 2020 targets which does not include a scheme in the Severn Estuary and lobbies the UK Government to do the same.

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Recommendation 2: The Welsh Assembly Government to lobby the UK government with its views on the use of Carbon Capture and Storage technology to ensure that any new fossil fuel power stations built in Wales are CCS ready and that any new fossil fuel power stations built are close to areas where satisfactory carbon storage can take place.

Recommendation 3: The Welsh Assembly Government to issue guidance to communities and developers on the use of monies gained from community benefit agreements on carbon reduction and/or sustainable projects (e.g. community heating schemes, home insulation, development of community energy action plans) and of match funding available from the Welsh Assembly Government and EU funding streams.

Recommendation 4: The Welsh Assembly Government establish and publicise a database of existing community benefit schemes which can be used by communities wishing to enter into such schemes to identify good practice.

Recommendation 5: The Welsh Assembly Government to issue guidance on and provide funding for the development of community energy action plans.

Recommendation 6: The current TAN8 should be urgently revised to include all forms of renewable energy including marine renewables.

Recommendation 7: The Welsh Assembly Government should issue guidance to local authorities on the use of policies for carbon reduction in Local Development Plans.

Recommendation 8: The Welsh Assembly Government to continue to encourage grid and distribution companies to work co-operatively with developers to develop an integrated approach to connection for large scale renewables.

Recommendation 9: The Welsh Assembly Government to lobby the UK Government to:

- Implement the Renewable Heat Incentives Scheme as soon as possible;
- Ensure that any renewable obligations scheme in Scotland does not operate at the expense of investment in schemes in England and Wales.

Recommendation 10: The Welsh Assembly Government lobby the UK Government to ensure that any large scale biomass schemes approved in Wales are appropriate in terms of being CHP schemes and in terms of not contributing to carbon emissions through transport and other emissions.

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Recommendation 11: That it is made a prerequisite for any small and medium scale biomass schemes be CHP schemes.

Recommendation 12: That the revised Wood Energy Business Scheme (WEBS) supports CHP.

Recommendation 13: The Welsh Assembly Government takes a lead in promoting the Low Carbon Buildings Programme in Wales and lobbies the UK Government to renew the Low Carbon Buildings Programme after 2010 in addition to the proposed system of feed in tariffs for renewable energy generation.

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Annex B: List of Respondents to the call for written evidence

http://www.assemblywales.org/bus-home/bus-committees/bus-committees-third1/bus-committees-third-sc-home/inquiries_sd/inquiries_-_carbon_reduction/carbon_energy.htm

British Telecom
Countryside Council for Wales
EDF Energy
Energy Saving Trust
Friends of the Earth
Gardner, Ian (PDF 130 KB)
Graveson Energy Management (GEM).
RWE n-power
Wales Environment Link
Welsh Power Group Ltd
WWF Cymru

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Annex C – List of witnesses providing oral evidence.

Wednesday 25 June 2008 SC(3)-14-08 : Transcript

Welsh Energy Research Centre
SC(3)-14-08 : Paper 1 : Submission by the Welsh Energy Research Centre on Energy Production
Paper to note
SC(3)-14-08 : Paper 3 : Paper to note : Committee's Visit to Germany and Austria
Freiburg Energy Department
SC(3)-14-08 : Paper 3 Annex A Part 1 : Presentation from Freiburg Energy Department (fact-finding visit) (pdf 7.5KB)
SC(3)-14-08 : Paper 3 Annex A Part 2 : Presentation from Freiburg Energy Department (fact-finding visit) (pdf 4.8KB)
Energiesparverband
SC(3)-14-08 : Paper 3 Annex B : Presentation from Energiesparverband (fact-finding visit) (pdf 4 MB)

Wednesday 9 July 2008 SC(3)-15-08 : Transcript

RWE n-power
SC(3)-15-08 : Paper 1 : Submission from RWE n-power to Inquiry into Energy Production
Association of Electricity Producers
SC(3)-15-08 : Paper 2 : Submission from the Association of Electricity Producers to Inquiry into Energy Production
Welsh Power Group Limited
SC(3)-15-08 : Paper 3 : Submission from Welsh Power Group Limited to Inquiry into Energy Production
SC(3)-15-08 : Paper 3 Annex A : Welsh Power Group Ltd Response to Energy Routemap (pdf 3.00 MB)
WWF
SC(3)-15-08 : Paper 4 : Paper and Background Material from WWF on Carbon Capture and Storage
SC(3)-15-08 : Paper 4 Annex A : WWF Report on Evading Capture (pdf 1.8MB)
SC(3)-15-08 : Paper 4 Annex B : WWF Assembly Brief on UK Energy Bill
Paper to note
SC(3)-15-08 : Paper 6 : Paper to Note - Committee's Visit to Germany and Austria
SC(3)-15-08 : Paper 6 Annexes : Presentations from Austria and Germany (fact-finding visit)

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Wednesday 16 July 2008 SC(3)-17-08 : Transcript

Paper to note
SC(3)-16-08 : Paper 6 : Paper to Note - Committee's Visit to Germany and Austria
Friends of the Earth
SC(3)-16-08 : Paper 7 : Paper from Friends of the Earth on Energy Production

Thursday 25 September 2008 SC(3)-18-08 : Transcript

Micropower Council
SC(3)-18-08 : Paper 3 : Evidence on Energy Production from Micropower Council
Renewable Energy Association
SC(3)-18-08 : Paper 4 : Evidence Session on Energy Production from the Renewable Energy Association (pdf 557 KB)
WWF
SC(3)-18-08 : Paper 7 : WWF Further Evidence on Carbon Capture and Storage (follow-up to evidence session 9 July)
SC(3)-18-08 : Paper 7 : WWF Further Evidence on Carbon Capture and Storage Annex 1 : Canary in the Cage Briefing (pdf 125 KB)
SC(3)-18-08 : Paper 7 : WWF Further Evidence on Carbon Capture and Storage Annex 2 : Pöyry Energy Consulting report to WWF and Greenpeace UK, on implications of UK meeting its 2020 renewable energy target (pdf 733 KB)

Thursday 9 October 2008 SC(3)-19-08 : Transcript

Severn Wye Energy Agency
SC(3)-19-08 : Paper 1 : Evidence from Severn Wye Energy Agency (SWEA) on Energy Production
Hermon Community Micro-generation Project
SC(3)-19-08 : Paper 4 : Evidence from Hermon Community Micro-generation Project on Energy Production

Thursday 16 October 2008 SC(3)-20-08 : Transcript

Biomass Energy Centre
SC(3)-20-08 : Paper 4 : Biomass and Electrical Power Generation - Comments from the Biomass Energy Centre

Thursday 13 November 2008 SC(3)-22-08 : Transcript

Sustainable Development Commission

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SC(3)-22-08 : Paper 1 : Evidence Energy Production Sustainable Development Commission submission
Countryside Council Wales
SC(3)-22-08 : Paper 2 : Evidence from CCW on Large Scale Renewables
School of Engineering Cardiff University
SC(3)-22-08 : Paper 3 : Evidence from the Hydro-Environmental Research Centre, Cardiff University
RSPB
SC(3)-22-08 : Paper 4 : Evidence from RSPB
Environment Agency
SC(3)-22-08 : Paper 5 : Evidence from Environment Agency Wales
Swansea University
SC(3)-22-08 : Paper 6 : Evidence from Swansea University

Thursday 20 November 2008 SC(3)-23-08 : Transcript

Conservation of Upland Montgomeryshire
SC(3)-23-08 : Paper 2 : Annex 1 - Conservation of Upland Montgomeryshire Energy Statement
SC(3)-23-08 : Paper 2 : Inquiry into Carbon Reduction in Wales: Evidence from the Conservation of Upland Montgomeryshire (pdf, 76.5Kb)
ARUP
SC(3)-23-08 : Paper 3 : Annex - Planning for Renewable Energy in Wales (pdf, 5Mb)

Thursday 27 November 2008 SC(3)-24-08 : Transcript

Minister for Environment, Sustainability and Housing
SC(3)-24-08 : Paper 1 : Paper on Energy Production in Wales from the Minister for Environment, Sustainability and Housing

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Response re the Activities of the Transport, Infrastructure and Climate Change Committee in the Scottish Parliament

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15 June 2009

Dear Patsy

Thank you for your letter of 4 June 2009 regarding your inquiry into climate change and your request for information on the activities of the Transport, Infrastructure and Climate Change Committee here in the Scottish Parliament on this matter.

As you are aware, this Committee is the lead committee for consideration of the Scottish Government's Climate Change (Scotland) Bill which will debated at Stage 3 in the Scottish Parliament before the end of June. The Committee reported to the Scottish Parliament at Stage 1 on the Bill and its report covered a number of issues you raise in your letter. The Committee also received amendments to the Bill at Stage 2 on target setting, monitoring and reporting. I attach a link to the Bill page which contains links to all the relevant material during the Committee's consideration of the Bill, including the Committee's Stage 1 report on the general principles of the Bill.

http://www.scottish.parliament.uk/s3/bills/17-ClimateChange/index.htm

The Parliament's information service, SPICe, have produced a briefing paper which summarises the key changes to the Bill following the Stage 2 amendment process. I attach a link for information.

http://www.scottish.parliament.uk/business/research/briefings-09/SB09-43.pdf

You letter asks questions regarding the structures which are in place for the development and delivery of climate change policy. You will note that in its Stage 1 report, Committee stated in paragraphs 228, 229—

"The Committee calls on the Scottish Government to ensure that its statutory 'report on proposals and policies' provides a comprehensive overview of the potential contribution of all sectors in society to achieving emissions reductions. It should provide clear statements of policy intent and the direction for policy development which will lead to the reductions required to meet the challenging targets set by this Bill. It should also outline those initiatives currently underway to tackle climate change, including the Government's public engagement implementation plan.

The Committee also considers it to be essential that the strategy overview document that will inform this process is produced as quickly as possible to allow sufficient time for the content of this significant and potentially detailed report to be developed, prior to its publication in 2010. The Committee requests that the Scottish Government provides a clear timescale for the production of the strategy overview discussion document, and an indication as to its contents, before Stage 2." It is expected that the Scottish Government's climate change strategy document will be published shortly.

Throughout its work on climate change, the Committee has had regular meetings and informal briefing sessions with Officials from the Scottish Government to aid members' understanding of the issues involved in this area.

In addition to consideration of the Climate Change (Scotland) Bill, the Committee's scrutiny of the Scottish Government's Draft Budget 09-10 focussed on the climate change element of its remit. The report encompassed the general impact of the Draft Budget on climate change and the development of the Scottish Government's carbon assessment tool.

In its report, the Committee expressed concern that the Draft Budget did not contain sufficient proposals to contribute to the climate change agenda. It also felt that the Scottish Government's climate change reduction targets were set too far into the future and its current proposed strategy for reducing annual emissions lacked urgency. The Committee therefore recommended that a system of carbon accountability be established in time for the draft budget 2010-11 and the Spending Review 2010, and that revisions be made to the 2009-10 budget to facilitate this.

The Committee considered that future budgets, and the next Spending Review, should reflect updated legislation on emissions targets. The Committee suggested that the next budget refocus its priorities on policies specifically designed to reduce greenhouse gas emissions and to contribute to addressing climate change, advising that subsequent budgets be presented with the fullest possible details of how expenditure across all portfolios will contribute to the reduction of emissions.

It is expected that the Committee will return to this issue following summer recess when it scrutinises the Scottish government's Draft Budget 2010-11 and looks at developments in this area.

I hope that this information is helpful and if you have any further questions once you have reviewed this material, please do not hesitate to get in touch.

Yours sincerely,

Patrick Harvie MSP
Convener
Transport, Infrastructure and Climate Change Committee

Climate Change Inquiry
Key Issues Paper

Key Issues:

1. Legislation and Policy

- Policy Development

Most respondents suggested Northern Ireland's current policies on climate change are inadequate for the obligations it has signed up to under the Sustainable Development Strategy, UK Climate Change Act and European legislation

The business sector called for policies to balance certainty with flexibility to ensure business can meet the challenges.

The small business sector would welcome incentivised action but is opposed to taxes and excessive legislation.

Most respondents urged government to look for and take advantage of win-win opportunities for reducing carbon emissions. This is particularly applicable for energy efficiency measures.

Many respondents called on government to recognise the opportunities of a green economy and strive to become a world leader in this area.

- Legislation

Nearly all respondents called for more legislation to underpin the UK Climate Change Act and enable Northern Ireland to contribute its fair share to obligations made to the UK Climate Change Act.

There was concern about the limited scope of the powers of the UK Climate Change Act in Northern Ireland and most respondents would like to see new primary legislation introduced. There was some concern however that this would delay action.

Farmers and small businesses stressed the need for legislation and regulation to be applied proportionately so that it does not disadvantage some sectors more than others.

- Climate / carbon impact assessments

Most respondents want a mechanism introduced that will assess the impact of all new legislation, strategies and programmes on carbon emissions / climate change. Processes being developed in GB and RoI could help to inform this process.

The business sector suggested Northern Ireland should consider a 'shadow cost of carbon' approach to accounting.

- Coordination of legislation

Several respondents noted the need for coordination of legislation across the UK and with the Republic of Ireland.

2. Targets and Budgets

- Northern Ireland Targets

Almost all respondents felt Northern Ireland has a duty to contribute its fair share to UK carbon emission reduction targets.

Many respondents expressed concern that the Northern Ireland Sustainable Development Strategy carbon emission reduction target is insufficient to ensure Northern Ireland contributes its fair share.

The majority of respondents called for Northern Ireland to introduce legally binding carbon emission reduction targets. Many called for the same target that has been agreed to in the UK Act, i.e. 80% reduction on 1990 CO2 levels by 2050, and also for parity on a legally binding 2020 target.

Most also wanted legally short term targets but were divided as to whether these should be rolling five year carbon budgets or annual carbon reductions.

- Sector Specific Targets

Most respondents from sectoral perspectives accepted they would have to take action to contribute to carbon reduction emission targets but they want leadership and long-term commitment from government and accurate data underpinning any obligations placed on their sector.

Several respondents were concerned about the setting of sectoral targets at UK level and were keen to ensure that a Northern Ireland perspective was taken into account.

Concern was also expressed about the need for sufficient information to establish accurate base line data.

- Role of the Committee on Climate Change

Several respondents suggested the Committee on Climate Change should be formally asked, as provided for in its mandate, to assist in the setting of national and sectoral indicators and targets for Northern Ireland.

One respondent suggested that the role of the Committee on Climate Change should be established via secondary legislation.

- Role of the Met Office

The Met Office noted that it is the authority on climate data and could be used to provide guidance to the Assembly on details of practice and policy.

- Reporting Mechanisms

Some respondents offered suggestions on who should report and how. Most of these involved the Climate Change Committee reporting to the Northern Ireland Assembly as well as the Executive.

3. Structures and Accountability

- Government structures

Many respondents suggested a government structure modelled on England's Department of Energy and Climate Change would be a more effective way to address climate change in Northern Ireland.

One respondent suggested a skilled dedicated body should undertake detailed assessment of progress against targets in a role similar to the Environmental Audit Committee in England. The Northern Ireland Audit Office was suggested for the role.

- Role of Government

Many respondents, particularly from the business sector, called for government to show leadership on addressing climate change.

Respondents from the business sector urged government to maintain economic stability while moving to a low carbon economy.

Business and industry were concerned that government would inform them of their roles and responsibilities rather than engaging with them early in the process in a constructive way.

Some respondents suggested public service agreements should define how departments will contribute to milestones based on EU, UK and NI targets and how they might link to their sustainable development obligations.

Some respondents stressed the moral imperative for Northern Ireland to address climate change.

- Role of DOE Climate Change Unit

Several respondents saw a coordination role for DOE's Climate Change Unit.

One respondent suggested all existing and anticipated legislation over the next 10 years should be analysed for conflicts with climate change tarets and implementation

- Delivery mechanisms including delivery of carbon commitments

Most business respondents recognised the need for sectoral targets but called for these to be SMART with 'road maps' established for their delivery. They urged for recognition that some sectors have greater opportunities for delivery than others and that timescales may differ.

The business sector recognised the importance of the Carbon Reduction Commitment scheme noting it would affect all government departments and most councils as well as major businesses.

- Public procurement

Many respondents suggested that the public sector procurement budget offers significant opportunities for delivering on reduction targets through setting requirements and leading investment.

- Role of the Planning System

Some respondents suggested planning played a major role in mitigating and adapting to climate change. PPS 18 (renewables) in particular was mentioned on several occasions but so were other PPSs.

Several respondents raised concerns about the progress and detail of PPS 18.

- Role and responsibilities of local government

Several respondents recognised that local government would have a significant role to play in the future as more delivery responsibilities are devolved to the new district councils.

Some respondents suggested that central government should impose a statutory obligation on local authorities to contribute to emissions reduction targets.

- Investment and innovation

Several respondents stressed the need for investment and innovation when addressing climate change.

4. Costs

- Cost of delivering climate change obligations

Many respondents referred to the Stern report in their response but there was very little on the specific costs anticipated by industry and businesses in Northern Ireland for addressing climate change. [Need for research?]

Several business respondents urged government to act sooner rather than later so they can factor climate change requirements into their long term strategies now rather than trying to catch up over a short period.

Some respondents suggested the Committee on Climate Change should be requested to provide a breakdown on costs of actions and inaction for Northern Ireland akin to their work in the UK as a whole.

Several respondents noted the need to consider the long term impacts of both mitigation and adaptation measures when building any infrastructure now to avoid costly errors.

5. Sectoral Targets and Action

- Energy
- Consumption

Several respondents noted the importance of the price of energy in influencing consumption and some suggested this could be used as a driver for change.

- Efficiency – domestic and business

Several respondents called for more promotion of mechanisms to retrofit homes for greater energy efficiency.

One respondent suggested Energy Performance Certificates should become mandatory for house sales and rentals from 2015 and should also be introduced for commercial buildings. The respondent also urged the expansion of the rate rebate programme to energy efficiency households.

[Note - the Committee is seeking clarification on the discrepancy between building regulations for social and private housing.]

- Renewable

One respondent suggested that UK legislation on feed-in tariffs for electricity and heat tariffs should be transposed to Northern Ireland to promote renewable technology.

Most respondents recognised the importance of renewable energy sources as a means of reducing carbon emissions and a range of recommendations were made.

- Transport

Most respondents recognised the contribution of transport to carbon emissions in Northern Ireland and a range of recommendations were made.

- Waste

Several respondents suggested all waste should be viewed as a potential resource and urged government to maximise its energy and resource yield.

- Food

One respondent noted links between high carbon lifestyles and increasing incidence of obesity and that tackling one would help address the other adding to the imperative for action.

- Land use
- Forestry / Agriculture

Several respondents noted the need to consider competing uses for land uses – between food and energy.

The agriculture sector was particularly concerned that emission reduction targets would be established for Northern Ireland based on data derived from UK figures. The need for dedicated research was stressed.

The agriculture sector stressed the need to ensure that attempts to adapt to climate change did not undermine long term objectives.

The agriculture sector raised concerns about the impact of the current carbon labelling scheme on food (BS2050) as it fails to recognise primary land destruction or lifetime carbon emissions and makes no concession for agricultural practices and technologies banned in Europe, e.g. GMOs / hormone usage.

6. Other

- Leaning from other jurisdictions

Some respondents suggested research should be undertaken as to how other jurisdictions across the world are dealing with incorporating climate change adaptation and mitigation into their structures and policies to learn from best practice and devise an appropriate system for Northern Ireland.

- Cross-cutting approaches

Several respondents suggested Northern Ireland should work with the Republic of Ireland to coordinate emissions goals, assessment tools and practical joint activities.

- Adaptation

Many respondents recognised a risk of short term adaptation activities compromising long term objectives.

- Climate change and the Sustainable Development Strategy

Some respondents suggested the Sustainable Development Implementation Plan should be the vehicle for delivery of key climate change targets. Also, that the SD Plan should provide a short term route map for action.

Several respondents referred to and supported the SD target for the Northern Ireland Government Estate to be carbon neutral by 2015.

Further information from CTS Projects Ltd

CTS PROJECTS LIMITED

Sean McCann
Clerk to Environment Committee
Environment Committee Office
Room 245
Parliament Buildings
Stormont
BT4 3XX

11th June 2009

Dear Sean

NORTHERN IRELAND ASSEMBLY ENVIRONMENT COMMITTEE INQUIRY INTO CLIMATE CHANGE – Further Information

Thank you for the opportunity to give oral evidence to the Committee. As per your letter dated 26th may 2009 I have pleasure in enclosing some supplementary evidence as requested.

I enclose the Swedish Model for building towards an Oil Free Society. I also have enclosed a graph showing CO2 levels over 350,000 years and the affect of sea-level and temperatures, these can be linked back to Ice Ages and other climatic events. I have also enclosed the new Swedish Government incentive programme to get construction workers back to work by improving energy efficiency that in turn targets one of the biggest contributors to CO2; domestic houses.

I trust this is to your satisfaction. I remain at your disposal.

Yours sincerely

Mr Connaire McGreevy
Director

Enc

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FSB

Rozell Renewables

Swedish Energy Efficiency Incentives

The Swedish Government will introduce the following tax credit allowances from 1st July 2009 in order to stimulate the Green Economy, Reduce CO2 and help construction workers.

By extending the system of tax credits to cover repairs, maintenance, and extension, the government wants to increase the demand for labour and green technologies including manufacturing. This can also reduce the illegal employment in the construction sector.

The new domestic tax deduction (HUS-deduction) will include both domestic such as laundry, cleaning and childcare, as well as repair and renovation work such as painting and wall papering.

The public consultation on the memorandum expired February 6, 2009. The government then submitted a bill to parliament at the end of March 2009. The rules proposed to enter into force in June 2009 but should apply also repair and conversion work carried out and paid as of December 8, 2008.

The Government's proposals for tax reductions targeted at the person who has the actual maintenance responsibility for their housing i.e. the owner or Housing Associations.

The total amount to be credited may be up to 100 000 SEK (£8,300 approx) during a fiscal year or 50% of the labour costs involved in the Energy Improvements.

The government has previously proposed that a new system of tax credit for domestic work to be introduced July 1, 2009. The system, known as invoice model, includes the buyer of the service may be a direct tax credit on purchase. The memo proposed that this system will apply to all services covered by the HUS-deduction (scheme above).

Contact

Ingrid Björnsson
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Background to the Swedish renewable energy success:

General Incentives, combined with a responsible legislation that conserve nature values

Sweden has a tradition of using general incentives and steering mechanisms to achieve environmental progress at low cost. Over the years a common understanding and support for this "Swedish model" has been achieved among the Swedish political parties and interested organizations.

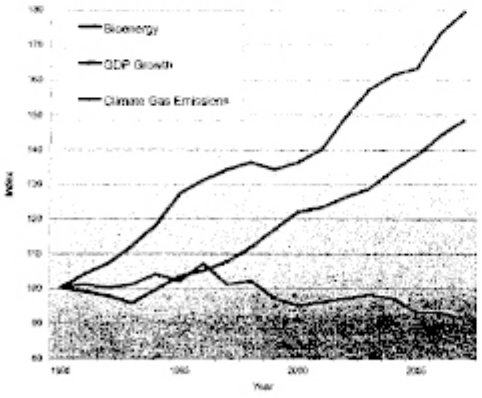
The common view is to use the Polluter Pays Principle, PPP, were the government decides a fee or a tax for companies and households to pay for unwanted emissions. The polluter has to pay for the costs he actually creates somewhere else in the society, such as health costs, acidification costs or climate change costs.

The most successful Swedish programmes are:

- **Sulphur taxes**
- **Nitrogen Oxid fees - NOX-fees**
- **Carbon dioxide taxes – CO_2**

The Sulphur and Nitrogen fees reduced the emissions to very low levels in less than a decade ten to twenty years ago. The Carbon dioxide tax was introduced in 1990 and the development showed in picture 1. has taken place since then. The use of bioenergy has increased by 80 per cent since 1990 and GHG emissions have been reduced by 9 % together with an economic growth of more than 45 % during the period.

1. Economic Growth and Carbon Reduction

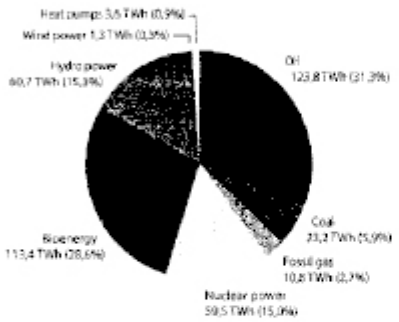


SVEBIO
www.svebio.se

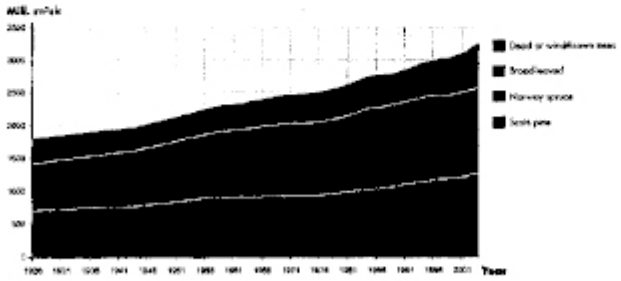
Renewables stood for 43 % of the total energy use in Sweden in 2007, counted according to the EU method to calculate share of renewables. According to the traditional Swedish way of calculating final energy use after distribution losses bioenergy accounts for 28 % of energy used.

The vast growth of bioenergy production has taken place together with a continuous growth of the Swedish forest industry. There has been no major competition between the different uses for bioenergy, pulp or timber. In fact 54 per cent of the bioenergy use takes place within the forest industry, making it a strongly developed environmentally healthy industry. In addition the Swedish forest is capable of delivering other values, such as a sound nature for people to visit and spend spare time for recreation as well as habitat for wild life and many rare species. The development of the total volume of forest in Sweden is showed in picture 3. A forest policy is needed to achieve both forest production, bioenergy, and nature values. This year the Swedish forest legislation which demands replanting after harvest celebrates its 100 year anniversary.

2. Share of final energy use 2007

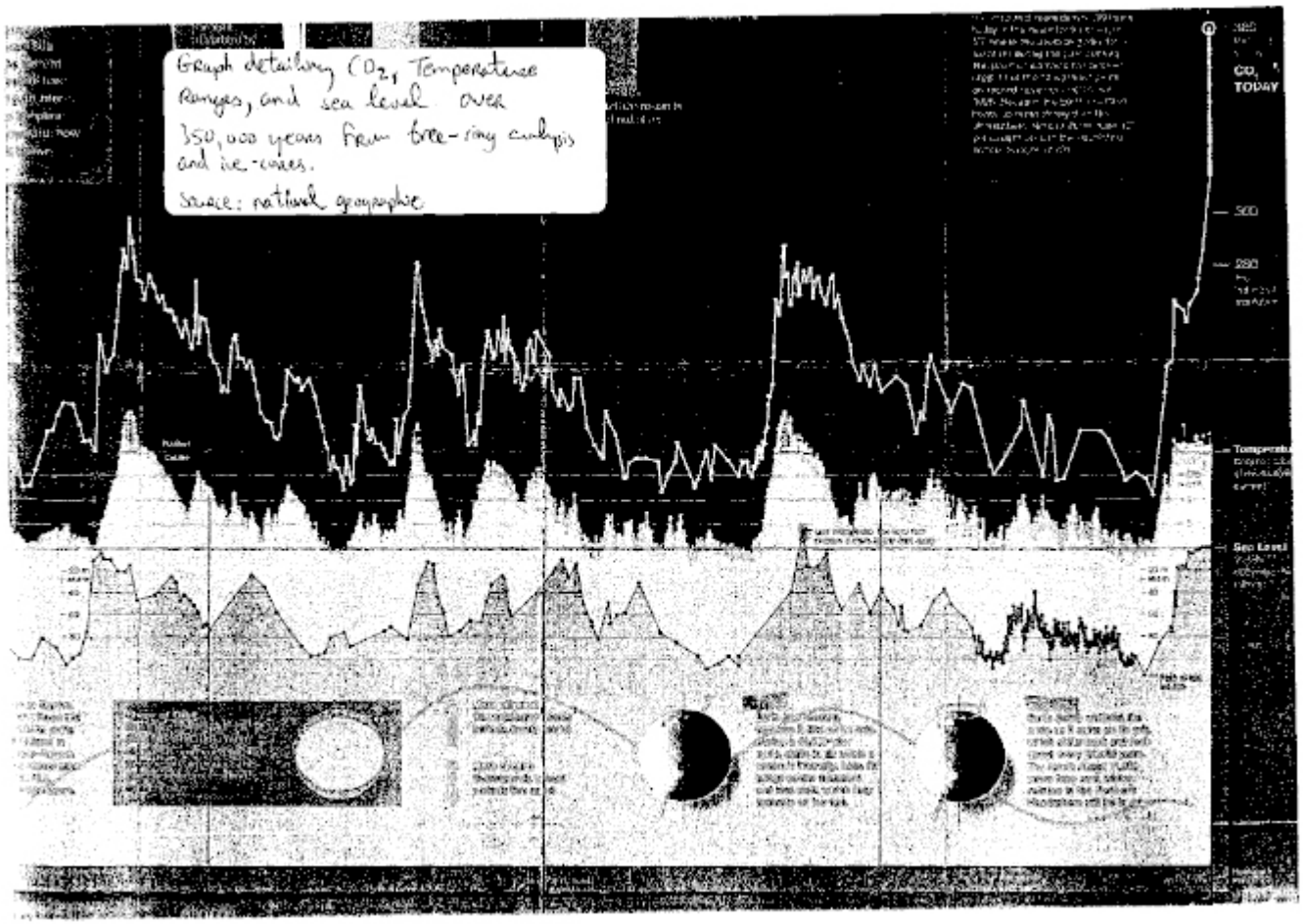


3. Trend for total standing volume since 1920



Gustav Melin
President Svebio,
Swedish Bioenergy Association

SVEBIO
www.svebio.se


Graph detailing CO_2, Temperature Ranges, and sea level over 350,000 years from tree-ring cutlips and ice-cores.
Source: national geographic
CO₂ TODAY
500
280
Sea Level

Making Sweden an

OIL-FREE

Society

Commission on Oil Independence
21 June 2006

Foreword

In December 2005, the Government appointed a commission to draw up a comprehensive programme to reduce Sweden's dependence on oil. There were several reasons for this. The price of oil affects Sweden's growth and employment. Oil still plays a major role for peace and security throughout the world. There is a great potential for Swedish raw materials as alternatives to oil. But, above all, the extensive burning of fossil fuels threatens the living conditions of future generations. Climate change is a fact which we politicians must face. Broad and long-term political efforts are needed.

Interest in the Commission's work is and has been enormous. Many people took part in the hearings which were the start of the Commission's work. In contacts with me or other members of the Commission, very many more took part by presenting proposals, criticising, and analysing problems and solutions.

Since the objective of ridding ourselves of our dependence on oil by the year 2020 is bold, and the issue embraces the whole of society, it was essential that the Commission should have a broad base. Experts from industry, agriculture and forestry, science – and special experts on energy efficiency and district heating – met for the discussions we had. In this way, the Commission was forced to examine conflicts of goals and different aspects of practically all the issues.

The result is a consensus report. No member of the Commission gained a full hearing for his/her standpoints and views. But all were prepared to look for compromises, weigh up the pros and cons and accept not fully achieving their own ideal position on each individual issue.

This openness meant that we were able to agree on the best common denominator in the task we faced: to mark out a path to strengthen Sweden's competitiveness and take a substantial step towards reducing emissions of greenhouse gases. This greatly pleases me.

On only one point were we not able to agree. The question as to whether protection is needed for domestic and EU-produced ethanol divided the group. On the one hand, Christian Azar stated that Sweden should be proactive for the abolition of the European tariff protection of its own production of ethanol. This is a respectable position. On the other hand, most of the members of the Commission supported the view that protection and stimulation of our own ethanol production is needed during the initial phase.

Apart form this, the Commission is in total agreement on the contents of the report.

I hope this spirit can continue to characterise discussions about our dependence on oil. The next stage will now follow. The changes required will not be realised solely by political decisions, nor by market forces in industry alone, nor by individual farmers and forest farmers who see future opportunities for profit. Not until all the positive forces in society aim for the same goals can Sweden achieve independence from oil. In this work, I hope the Commission's report will be an important contribution.

Stockholm, 28 June 2006

Göran Persson

Contents

A vision for Sweden

The nations of the world seem increasingly like neighbourhoods in a shrinking global village. Modern information technology gives us amazing new opportunities for cross-border exchanges of knowledge and hence for insight into one another's distinctive cultural characters and living conditions. And the globalised economy has bound us together in a web of mutual dependency.

Today the human race has better chances than ever before of solving the enormous challenges we face. When we look out over the globe, we can rejoice in several promising trends. Even so, here and there global developments continue to be unsustainable. The major "survival issues", among others energy and climate problems, call for far greater commitment and strong political and industrial leadership, at both national and international levels.

Declining access to conventional oil, in combination with our joint responsibility to stop global warming, will be a test of the world community's readiness to switch to energy systems that are more sustainable in the long term. Basically, it is a question of the will to show solidarity with present and future generations.

Sweden accepts this challenge!

In this document, we propose a number of far-reaching, concrete measures that can end our dependence on oil by the year 2020 and tangibly reduce our use of oil products. Our ambitious objectives are as follows:

- Through more efficient use of fuel and new fuels, consumption of oil in road transport shall be reduced by 40-50 per cent.
- In principle no oil shall be used for heating residential and commercial buildings
- Industry shall reduce its consumption of oil by 25-40 per cent

The fleet of private cars must become more efficient from an energy point of view. The need for physical travel can be reduced by a well built-out IT infrastructure and IT solutions, *inter alia* enabling distance work and travel-free meetings. The Government should contribute to large-scale production of new, domestic biofuels from forests and fields. Public transport should be given the resources to become faster, more convenient and good value.

All this means that we can not only reduce emissions of greenhouse gases. We can also secure our supply of energy, strengthen our economy and promote the development of sound growth driven by technology and environment, with new business opportunities for Swedish industry. In short: the phase-out of oil can further strengthen our position as one of the world's leading nations in sustainable development.

However, our ambitions are not really new. They have a long previous history. And they will obviously need to be followed up and intensified in the decades following 2020.

In the last thirty years Sweden has, for example, reduced its use of oil for heating residential and commercial buildings by seventy per cent. This has been achieved by replacing oil with

biofuel-fired district heating plants, direct electricity and electrically driven heat pumps and, not least, by better insulation of buildings.

We will now continue to reduce our consumption of oil at the same time as we also utilise biofuels in order to replace as far as possible direct electricity for heating buildings.

Since the mid-1970s we have also succeeded in reducing average energy consumption per square metre of living space through new technology facilitating a more efficient use of energy. However, during the same period total living space increased by almost fifty per cent. The saving was eaten up by increased consumption, the so-called rebound effect.

We will now move on, with the lessons we have learnt. As an overall strategy, the Commission proposes extensive efforts to improve the efficiency of society's total energy consumption. It is also essential that the rebound effect be counteracted through the design of the tax system, education, energy counselling and a national campaign to save energy.

2020 is the primary time horizon for the objectives presented in this document. But naturally, efforts to make more efficient use of energy and the phasing out of both oil and other fossil energy carriers will need to continue for decades after that. This is connected above all with climate policy and the already existing objectives and requirements to reduce by 2050 emissions of greenhouse gases by 60-80 percent compared with today's level of emissions.

We are technology optimists and want Sweden to be at the forefront in the gradual use of new, resource-efficient, renewable technology – hybrid vehicles, solar cells, wave energy, fuel cell vehicles, new biofuels, and energy-saving IT solutions and also technology we cannot know anything about yet or can just divine. We prepare for this type of development in our proposals by massive support to research, development and commercialisation of new technology.

We would also like to underscore the need for partly new values and a way of life based to a greater extent on solidarity, at both national and individual levels. The role of homes and schools is therefore important, and we need to support the bearers of ideas, the popular movements, in their ambition to encourage new thinking and a deeper understanding of our world. Democracy can and must therefore be intensified and politics renewed. In this work, information paths such as, for example, the Internet must also be used in order, *inter alia*, to reach the younger generations with knowledge and information.

Sweden is to be sure a small neighbourhood in the global village. But we have great and growing opportunities to contribute to positive change, now and for tomorrow!

The Commission on Oil Independence

The Commission on Oil Independence was set up by the Government in December 2005 and was requested to present concrete proposals for reducing Sweden's dependence on oil by 2020 and, in this connection, also significantly reduce our actual consumption of oil.

For over fifty years oil has been one of the most indispensable physical lubricants in modern welfare societies. It is fuel for most forms of transport and raw material for many everyday products such as, for example, plastics, synthetic rubber, paints, varnishes, medicines and

cleaning products. It is also used in certain industrial processes and to a lessening extent for heating.

The current global oil debate therefore arouses both interest and concern. Will the world's reserves of conventional oil in the long term decrease or even come to an end? Must we count on a less secure supply of oil from the Middle East and other politically troubled areas? If so, how will this affect the cost of heating and transport? How vulnerable are we? At the same time, like other countries Sweden has promised to reduce its climate impact.

Composition of the Commission

The Prime Minister, Göran Persson, was chairman of the Commission which comprised the following eight members from the research world, industry and social life: Professor Christian Azar, Chalmers University of Technology, Lars Andersson, government investigator into bioenergy, Lotta Bängens, Chairman of Sweden's Energy Advisers, Birgitta Johansson-Hedberg, CEO, Lantmännen, Leif Johansson, CEO, AB Volvo, Göran Johansson, former chairman of the Swedish Metalworkers Union, Christer Segersäcen, Chairman of the Federation of Swedish Forest Owners, Lisa Sennerby-Forsse, Secretary-General, Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning
The Commission's Staff comprised Stefan Edman, biologist, writer, former Political Adviser to the Prime Minister and Anders Nylander, architect and expert on energy.

Working methods
The Commission worked openly and together with experts in order to spread current knowledge to the media and those interested in the general public. Four public hearings broadcast on television were arranged on different themes and attracted considerable interest in Sweden and around the world.

13 December 2005: Will oil run out – and, if so, when?
20 January 2006: Sweden's green gold – what potential do forestry and agriculture offer for bioenergy now and in the future?
17 February: How can we reduce our dependence on petrol and other fossil fuels in the transport sector?
22 March: How can we reduce our dependence on oil and other fossil fuels for heating and power production?
Material in preparation for and after the hearings was presented on the Government website During the spring, the Staff held many meetings with the actors concerned, the media and other interested parties.

Will oil run out – and, if so, when?

In the earth's interior there are very extensive coal-based energy resources, from methane hydrates deep in the oceans and in northerly permafrost areas to unexploited deposits of oil sands and shale oils. The superficial deposits of coal, oil and gas that man makes use of today are the tip of the planet's enormous energy pyramid.

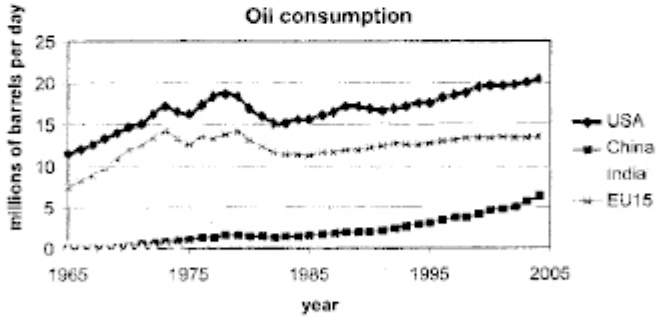
Thus, oil will never run out, neither in a theoretical nor a practical sense. However, how large the amounts that will actually be available for human use in the future is an entirely different matter and more difficult to judge. The answer to a large extent depends on the one hand on the technology that can be used for its extraction and, on the other, on the prevailing

economic and environmental conditions. In general, it may be said that the deeper and more difficult to access the oil deposits lie, the more expensive it will be to extract them and the greater the impact will be on the environment.

The international petroleum industry considers that the amount of conventional oil at the beginning of the industrial revolution was 6 000 – 8 000 billion barrels (1 barrel = 159 litres; the world's current daily consumption is 84 million barrels). With existing technology, it should be possible to extract half of this, 3 000 – 4 000 billion barrels, of these about a thousand billion barrels have already been produced. To this may perhaps be added some thousand billion barrels of non-conventional oil. At the present level of consumption – and deducting what has already been consumed – according to the oil industry's estimate there would be sufficient oil for at least a hundred years.

Assessments of when the global oil peak will occur vary among different actors. The OECD's expert body, the International Energy Agency, considers the peak will come somewhere between 2020 and 2030, while BP, British Petroleum, believes it will occur in the period 2015-2020.

The expert group Aspo, the Association for the Study of Peak Oil and Gas, makes a considerably more pessimistic assessment of the supply of unexploited oil reserves and expects a peak before 2010. According to Aspo, extraction of the conventional oil reserves will decline dramatically in the coming decades.



Oil consumption in some major countries. Source: BP World Energy Statistics

The Commission bases its work mainly on the assessment of future world oil carried out by the energy committee of the Royal Swedish Academy of Sciences (KVA), which may be briefly summarised under the following points:

- New oil deposits that are discovered nowadays in the course of a year, approximately 10 billion barrels, are equivalent to only a third of the world community's current annual consumption, some 30 billion barrels. Demand is increasing by about 2 per cent a year while most oil-producing countries show decreasing production
- Known reserves amount to 900-1200 billion barrels; a total of 1300 billion barrels may possibly remain to be discovered
- The Middle East is a key region with over 60 per cent of the world's oil reserves. Here and in some of the other major oil-producing countries developments are characterised by political unrest
- Oil prices will continue to be high due to increasing use of oil in western industrial countries as well as in China and India and other rapidly growing economies

How dependent on oil is Sweden today?

Sweden's dependency on oil has varied over time. Use of fuel oil for heating, for example, has decreased dramatically from top levels in the 1970s while use of petrol has stood still for the last ten, fifteen years (see figure below).

OBS! THAT THE DIAGRAM STILL ARE IN SWEDISH TEXT AND THAT YOU FIND THE ENGLISH TRANSLATION UNDERNEATH THE DIAGRAM (WILL BE UPDATED).

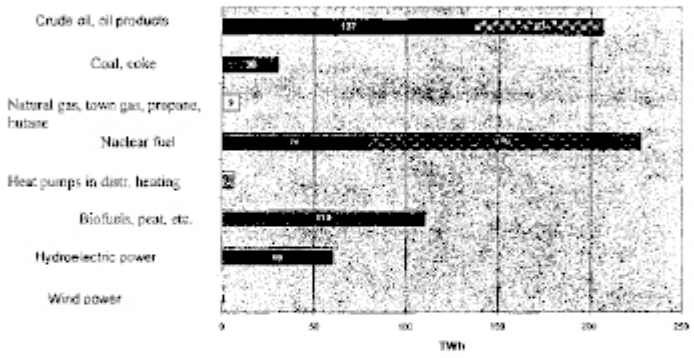
Supplies of oil products
Sweden 1946–2004

Diagram text:

Supplies of oil products in Sweden, long-term series
Petrol Diesel Aviation fuel, etc. Fuel oil 1 Fuel oil 2-6, heavy oil
Source: Swedish Petroleum Institute and Statistics Sweden

We have chosen to illustrate Sweden's dependency on oil in 2004 with the aid of the two diagrams below. The first diagram refers to the total *supply* of energy which amounted to approximately 647 TWh. Crude oil and oil products accounted for 32 per cent and biofuels, peat, etc. for 17 per cent:

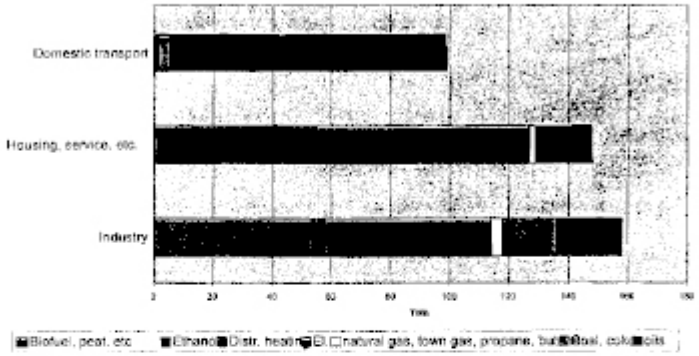
Total energy supplied in Sweden 2004



The patterned parts refer to heat losses in the form of cooling water regarding nuclear energy, and for oil, foreign shipping, non-energy purposes and refinery losses. Source: Swedish Energy Agency

The second diagram measures so-called end-*use* energy, which is the energy bought for the residential or commercial building or put in the car tank. There are losses here too which, however, are not discussed until later in the text. In end-use, oil products account for about 33 per cent. Bioenergy for direct use and district heating plants, which mainly use biofuel, together account for about 28 per cent, and the share of electricity is 32 per cent.

End-use energy distributed among sectors in Sweden 2004



Source: Swedish Energy Agency

Use of oil in 2004, in percentage terms and absolute terms for each sector:

Sector	Oil use		Areas of use, oil
Transport sector	97 per cent	95 TWh	Motor operation
Agriculture, forestry, Fisheries	70 per cent	7 TWh	Tractors, drying, contractors' equipment, fish processing
Building sector	67 per cent	2 TWh	Contractors' equipment, heating, drying
Residential and commercial buildings	11 per cent	10 TWh	Private heating (i.e. not district heating plants) and hot water
Industry	11 per cent	18 TWh	Heating and process energy
Production of district heating	8 per cent	4 TWh	Peak load, etc.
Service sector	6 per cent	3 TWh	Heating and motor operation, etc.
Production of electricity	1 per cent	3 TWh	Power in industry and district heating plants

The Commission's points of departure

The Commission sees five strong reasons for phasing out Sweden's dependency on oil, improving the efficiency of energy use and in the long term replacing fossil energy sources with renewable energy:

1. We will reduce Sweden's climate impact
2. We will secure Sweden's supply of energy in the long term
3. We can become a leading nation in the development of new technology for sustainable use of energy and more efficient use of energy
4. We will strengthen our international economic competitiveness
5. We will use and develop the energy resources from forests and fields, "Sweden's green gold"

Use of oil and climate impact are two sides of the same coin. They can only be fundamentally changed by regional and international cooperation. In this respect, the EU is Sweden's most important arena. Since we became members over ten years ago, our target-oriented climate policy has been of considerable importance for the development of the Union's common strategies. Sweden will continue to lead efforts to reduce emissions of greenhouse gases. Furthermore, we now want to develop models, control instruments and concrete measures to reduce dependence on oil, and in the long term on coal and natural gas also.

These measures must not obstruct preconditions for sustainable economic growth, including cross-border trade and communications. At the same time, we claim it is reasonable that each nation utilise its own, perhaps unique, preconditions for managing the switch to renewable energy. Several of our proposals for replacing oil are therefore based on Sweden's possibilities of producing biofuels and biopower on forest and agricultural land.

We wish to stress that "use of oil" is not the same as "dependence on oil". Our measures certainly aim to reduce as far as possible actual consumption of oil by the year 2020. We also want to reduce the one-sided dependence on oil in areas where total independence from oil will take much longer to achieve, for example in the transport sector.

All in all, these ambitions will give Sweden considerable opportunities to drive and stimulate a new resource-efficient technical and business development, above all for bioenergy but also to a high degree regarding vehicle, building and industrial technology. This can contribute to further strengthening Sweden's already prominent role on the global market and generate small and large enterprises, employment, export income and a vigorous regional development. As a nation we will utilise our enormous forest holdings, good arable land and our rich supply of fresh water. But we will also make use of the fact that Sweden is strong in the IT area with good competence, extensive infrastructure and a high degree of IT maturity.

How well we succeed will depend to some extent on price trends on the oil market. In our view, the current high oil prices are primarily not due to the start of physical oil scarcity but to a combination of increased demand and disruptions in the form of political unrest and problems in connection with the actual extraction of oil.

However, in the longer term, the situation will probably be different. We have been influenced by the experts who predict that supplies of conventional oil will decline. The reasons for this are the continued substantial and growing oil consumption of the rich countries, including the EU and USA, in combination with greatly increased energy needs in megastates such as China and India. It is also a fact that fewer and fewer new major sources of oil are being discovered. Furthermore, security of supply may be jeopardised by increased political unrest in the Middle East and elsewhere.

An uncertain factor in the analysis is coal, which can already be used for relatively cheap production of petrol and diesel. If this is done on a large scale, the world will move towards a more rapid and extensive climate impact, even though it will be possible to a certain extent to trap and store carbon dioxide. Increased use of coal must therefore be counteracted, both by national policies and in the international climate negotiations.

The Commission was requested to find the best strategies for reducing dependence on oil and actual use of oil in Sweden by the year 2020. The proposals will deliver us from a costly and insecure dependence on oil and thereby unnecessarily large emissions of climate gases and, at the same time, strengthen the international economic competitiveness of this country and our companies.

Our analyses and proposals

The Commission proposes the following national objectives for more efficient use of energy and reduced dependence on oil by the year 2020:

- Swedish society as a whole should be able to make 20 per cent more efficient use of energy by 2020 and thereby at the same time create intensified, cost-effective prosperity that is sustainable in the long term
- By 2020 in principle no oil should be used for heating residential and commercial buildings
- Road transport, including transport in the agricultural, forestry, fisheries and building sectors, should reduce use of petrol and diesel by 40-50 per cent by 2020
- Industry should reduce its use of oil by 25-40 per cent by 2020

Realisation of these extremely ambitious objectives presupposes, among other things, that very powerful investments are made, not least in the three sectors transport, industry and heating. As a result of the increasingly high price levels for oil and oil products, market-economic incentives will also steer us away from consumption of oil. With increased access to alternative technical solutions, for example in the form of vehicles that can also be powered by renewable fuels, actual dependence on oil will end.

Our proposals for measures imply a considerable challenge to the whole of society. They demand above all a large measure of trusting collaboration between politics, industry and research. We wish to point out that our Commission is in itself an expression of precisely this kind of broad consensus. When all is said and done, support and commitment is needed from each and everyone of us, as citizens and consumers in everyday life.

In separate sections below, we present our proposals in the three areas – heating of residential and commercial buildings, transport and industry. Annex 1 briefly presents some of the extensive factual material that has guided us.

The Commission's proposals are based on the following five overall strategies:

1. Radically more effective use of energy by the whole of society

For decades the industrial countries, including Sweden, have built their welfare and modernisation on an abundant supply of electricity and fuel at low prices. This precondition,

which has primarily been regarded as a law of nature, is scarcely likely to remain in a world with a growing demand for energy, incipient oil scarcity and requirements to reduce emissions of carbon dioxide. The cost of energy, including oil, will gradually rise to presumably permanently high levels.

For our common future, it is essential that nations and companies can meet this new situation by making more efficient use of energy, through new technology, utilisation of IT, better planning and creative commitment on the part of citizens and employees.

A more effective use of energy means that the same product value and prosperity gain can be produced at lower cost and with lower energy consumption, which is positive for the finances of companies, households and the public sector.

This means not just reduced emission of carbon dioxide but also better long-term management of renewable energy sources so that they can cover more needs than would otherwise have been the case. Environmental stress, *inter alia* climate impact, will hence also be reduced.

Last but not least, making more efficient use of energy will give impetus to an expanding growth and business sector powered by environmental technology, with products and services for both the domestic market and growing global demand.

It is our firm conviction that the phasing out of Sweden's dependence on oil can only be successful if it is based on vigorous and continual efforts to improve the efficiency of society's total use of energy. Central responsibility for ensuring that this takes place is, however, at present divided among several different public authorities.

The Commission proposes therefore that a "council" or "energy conservation centre" be created. Its task will be to be proactive for a more offensive development with sector objectives, a duty to report to the Swedish Riksdag and Government on developments as well as follow-up and continually raised targets.

The Commission proposes an energy efficiency objective for Sweden that means Swedish society as a whole should improve energy efficiency by 20 per cent by 2020. This implies an average annual 1.5 per cent increase in energy efficiency.

2. Historic investment in forest fuels and energy crops

Sweden and Finland are the EU countries with the largest acreage of woodland per inhabitant, of considerable importance for their economies, jobs and prosperity. Forests do not just produce timber and pulpwood but also substantial quantities of fuel raw material for heating, electricity and propellants.

Our arable land is also of high quality and can yield, in addition to foods, large amounts of energy crops. As a result of the reform of the Common Agricultural Policy, it no longer steers towards food production. This in combination with the introduction of an energy crop premium and other control instruments promoting renewable energy means that more and more acreages will in future be used for the production of energy.

Thus, this country has at its disposal considerable potential for bioenergy (see annex 1)

The Commission proposes that in the next few decades Sweden make major investments in the production of bioenergy from raw materials from forest and field which can greatly help to replace fossil fuels in industry and for heating, electricity and transport purposes. In this way, by fuel replacement we could in principle totally eliminate oil in the heating of residential and commercial buildings by 2020. During the same period, we could also, in combination with energy-saving technology, reduce the total amount of petrol and diesel in the transport sector by 40-50 per cent.

The Commission proposes the following long-term strategies, and assumes that they be implemented so that the objectives for nature conservation, outdoor life and recreation are not jeopardised:
(see page 21 and annex 2, Bioenergy and nature conservation):

1. Forest growth be increased in the long term by 15-20 per cent through more efficient management in the form of clearing, thinning out, refined plant material, ditch clearing and fertilisation as well as through more intensive cultivation of spruce and broad-leaf trees on a few per cent of the acreage.

2. Energy crops and energy broad-leaf trees be cultivated on arable land and disused, non-afforested farmland on a scale of 300 000 – 500 000 hectares.

3. The Government invest funds to stimulate education, plant support, procurement of technology as well as production facilities for the manufacture of fuels (see page 21-22).

3. Electricity for a sustainable supply of energy

Electricity is an efficient and valuable energy carrier. Use of electricity has increased in Sweden over several decades and is, per capita, remarkably high compared with other industrial countries in the developed world. It is uncertain how consumption of electricity will develop in Sweden in the future when historically low Swedish electricity prices are levelled out to the European level.

Very little electricity is produced in Sweden using oil or other fossil fuels. However, the common European electricity market, to which we nowadays belong, is largely supplied by fossil condensing power with a very low degree of efficiency and fuelled by coal. If, by improving efficiency, we reduce our consumption of electricity in Sweden we will be able to reduce emissions of carbon dioxide. The Commission wishes to stress that *inter alia* industry's need of electricity for specific purposes in industrial processes must be accommodated in a secure way.

The Commission proposes that the Government and industry cooperate to achieve the following:

1. More efficient use of electricity in industry. It is assessed that non-energy-intensive industry can in many cases improve electricity efficiency by 40 per cent and residential and commercial buildings by 20 per cent.
2. Increased production of domestic renewable electricity. There are plans to extend wind power by about 10 TWh by 2015. According to Svensk Fjärrvärme AB, the potential for

district-heating-based electricity is about 25 TWh, based on the data for district heating plants that may apply around 2010; with gasification technology it will further increase. In watercourses already harnessed, more electricity can be produced. Support will be given to research and plants for solar cells, wave power and hydrogen gas for fuel cells, the new sources of power that will be of considerable importance in the future (see page 28). The major power companies, not least state-owned Vattenfall, should take additional responsibility for the development of research and demonstration projects, in order to increase investments in commercial, renewable electricity production.

3. Reduced consumption of electricity for heating buildings. This should be achieved by more efficient climate shells and installations, increased use of IT-based systems for more efficient use of energy and by switching above all to biofuel-fired district heating, environmentally approved wood boilers, pellet burners and pellet stoves.

4. The role of energy gases

Energy gases should play an essential role in our ambitions to reduce Sweden's dependency on oil.

The Commission is dubious about a large-scale extension of the natural gas network and, hence, about the Russian natural gas planned to be distributed to Germany in a pipeline on the bottom of the Baltic Sea. Interested parties want to link this fossil gas to our country and, *inter alia* build a gas network to supply the Lake Mälare valley and Bergslagen. There are also plans for a pipeline southwards through Östergötland and Småland in the future.

We are aware that natural gas can replace a certain proportion of coal and oil in industrial processes and thereby contribute to reduced emissions of carbon dioxide from individual plants. And we can also see the positive synergy effects of renewable biogas for vehicle propulsion that may arise in the context of the gas pipeline.

To us the overriding problem is, however – along with the danger of reduced security of energy supply – that a large-scale supply of natural gas could replace and thus risks crowding out domestic biofuels used in many heating and district-heating power plants. In this way, the historically unique investment in bioenergy which we propose in this programme would be obstructed. The large-scale introduction of natural gas will thereby probably also lead to a total increase rather than a reduction in emissions of greenhouse gases in Sweden.

Danish natural gas, about 10 TWh, has long been available in Sweden. It is distributed along the west coast, from Skåne through Halland to Göteborg, and on to Stenungsund. Gas has replaced oil for heating and in industrial processes, among others the petrochemical industry in Stenungsund. The gas pipeline has also functioned as infrastructure for the vehicle gas established in south and west Sweden. A link to Norwegian natural gas is now also planned, via Preemraff's plant in Lysekil, which is thereby expected to strengthen its chances of producing Europe's cleanest fossil diesel fuel from residue oil.

The Commission proposes that the Government does not actively commit itself to increased use of natural gas in Sweden in the future. The gas pipeline along the west coast should on the other hand be used as rationally as possible. Industries with a special need of gas to replace coal and oil in processes should to some extent be supplied with LNG transported by rail, road or boat, that is to say natural gas in liquid form. The advantage of a solution of this type

is that it does not commit us to a fixed natural gas infrastructure that is not sustainable in the long term. On the other hand, the Government should support local and regional infrastructures for biogas from rotting and gasifying of biomass, for use in both vehicles and industrial processes.

5. Control instruments at EU level

The EU emission trading system for carbon dioxide entered into force in 2005. Its formulation affects in several ways the conditions for reducing oil and fossil fuels in Sweden, *inter alia* in energy-intensive industry. It is therefore politically difficult to introduce additional control measures that impair the competitiveness of Swedish companies in relation to other companies in the EU. In order to speed up developments towards higher efficiency and other fuels, it is important that the ceiling for the number of emission rights is gradually lowered.

The trading system also concerns the district heating sector. Swedish district heating is a climate policy success story. In the past thirty years we have succeeded in moving from almost a hundred per cent oil in district heating to a predominance of biofuels in combination with small amounts of fossil energy carriers. This was made possible thanks to different types of control instruments such as carbon dioxide tax and now also trade in emission rights.

The remaining oil in district-heating systems is almost exclusively used for what is known as peak production on cold winter days, hence in furnaces that are used for a very short period. The Commission estimates that this oil will also be phased out by 2020, with the present price relations and control measures.

Should the EU emission trading system be weakened, there is the risk of a return to fossil fuels. Should this, contrary to expectation, occur, supplementary national rules will be needed.

If the EU has much more stringent requirements on its industry than other countries, the competitiveness of our companies may be jeopardised. It is therefore essential that a global climate policy system be developed within the framework of the climate agreement that is to supersede the Kyoto Protocol in 2012. Should commitments by the poorer countries be delayed, this should not be taken as a pretext for deteriorated climate policy in, for example, western countries.

The Commission proposes that Sweden contribute to a gradual tightening of the EU emission trading system. A reasonable objective is that distribution of emission rights decreases in the next ten to fifteen years so that total emissions in the trading sector will be 25 per cent lower in 2020 compared with 1990. This would give considerable impetus to reducing emissions of carbon dioxide and thereby consumption of oil.

It is also essential that Sweden more actively pursues the auctioning issue in order to create a better functioning market and lower economic cost for achieving the climate goals. We should also develop well balanced strategies to protect the fiercely competitive electricity and fuel-intensive industry from competition from regions that do not have a climate policy. This may increase opportunities to pursue a more ambitious climate policy in Europe during the period when the rest of the world lags behind.

Objectives for residential and commercial buildings

Remove heating oil by 2020!

The Commission proposes a radical bid to make the use of energy in residential and commercial buildings more efficient, more economical and ecologically sustainable. This means that by 2020 oil should be phased out and the use of direct electricity for heating minimised. New houses must use the best technology to combine energy efficiency with attractive housing. The existing housing stock must be modernised on the basis of the same objective. By means of intelligent control of lighting, heating and ventilation, major energy savings can be achieved in buildings. IT has great potential for creating positive changes in the future.

Since the mid-1970s, Sweden has reduced its use of oil for heating by 70 per cent. There are good chances of reducing our remaining use of oil, about 10 TWh, to in principle no use of oil at all by 2020. Switching to other types of energy is economically interesting, partly due to high market oil prices, but also as a result of an active energy policy that has introduced both oil replacement grants and carbon dioxide charges on fossil fuels.

The Commission wishes to underscore the importance of replacing oil with biofuels, preferably in combination with heat from solar panels. In population centres with district heating, the alternative should be connection to the district-heating network. Biofuel-fired district heating plants are at present available in many more than a hundred municipalities. Domestic fuel assets – wood, chips, pellets – are so extensive (see annex) that they can replace the remaining oil in the heating sector without further ado. The strength of the district heating network is that in extremely resource-efficient systems it can make use of locally available energy resources that would otherwise be lost or be difficult to make direct use of in buildings – waste heat from industries, energy from waste, geothermal energy or different types of less refined or "difficult" biofuels.

We are also of the view that both existing and new heating plants should be supplemented by what is termed power plant technology so that in addition to heat they can also produce electricity. Technology for small-scale heating power production, known as micro-district heating plants, is interesting but needs to be further developed. The green electricity certificates and amended tax rules mean that this will probably take place without additional special control measures. Today, about 6.6 TWh electricity is produced in district heating plants. According to the district heating industry, with gasification technology, the potential for 2020 is 25-27 TWh, estimated on the district heating data that it is considered will apply in 2010.

Measures to improve efficiency must be applied in the entire chain from extraction, processing and conversion of energy, and not just regarding end use. Today, about half of all primary energy resources are lost before they reach the end consumer. All efforts to improve efficiency must aim to reduce the strain on limited energy resources and the environment.

The Commission proposes the following measures that should constitute the frame for national efforts to achieve more efficient use of energy in residential and commercial buildings:

1. **Enhanced efficiency in connection with the construction of new buildings**

- *Low energy housing with little or no external heat supply*

The Government and the building industry should jointly formulate incentives that stimulate construction of a high proportion of new low energy houses. By 2020 the share in new housing could be at least 75 per cent. This concept which has spread rapidly on the continent, is based on reliable technology with a tight climate shell, advanced heat exchange, intelligent control systems for use of electricity, clever windows, etc. These houses are slightly more expensive in the construction phase but economically advantageous to run since energy consumption per square metre of living space is halved compared with the best conventional technology.

- *Tightened building regulations*
  Building regulations relating to energy conservation should be tightened. Notification of planned and new tightened regulations should be given early so that the market has time to adjust to the new requirements. Parties to the building process should put effort into verifying that the set requirements have been met or exceeded. Weighting factors should be introduced for different types of energy when a building's energy consumption is estimated so that the gross supply of energy is made visible just as much as the carbon dioxide load. Installation of broadband should be encouraged in order to enable distance work.

- *Energy-related deductions on real estate tax*
  At present all new buildings are entitled to a real estate tax deduction for the first five years. We propose that the size of the deduction be linked to the building's energy performance, related to the weighting factors (see above), and that a similar arrangement also be considered in connection with investments to enhance energy efficiency in existing buildings.

2. Improving energy efficiency in connection with reconstruction
Requirements should be introduced for improvement of energy efficiency in the respective sub-systems, including tightened requirements for follow-up and observance of the framework of regulations.

3. Improving efficiency in existing residential and commercial buildings

- *"The million programme" and other older properties*
  Special efforts are needed to achieve energy efficiency improvements in connection with the extensive renovation and modernisation that will need to be carried out in the years ahead in the large housing stock built in the decades after the Second World War. These include, among others, the apartment blocks in what is known as the million programme which started in 1965. Measures can best focus on bringing the housing companies to carry out in-depth planning for good overall solutions, investments in systems to improve energy efficiency, joint procurement of technology, in combination with demonstration projects in, for example, the areas ventilation and building envelope, that is to say additional insulation and windows. It should be possible to give grants or tax relief to property owners who participate in a Programme for Improving Energy Efficiency (see below).

- *Buildings with direct electric heating*
  Reduction of direct electric heating of buildings should be accelerated. This must be effected by more efficient climate shells and installations and by switching over to heating methods that do not use electricity. A good alternative may, for example, be to provide a well insulated house heated by direct electricity with biofuel heating. Increased

efforts should be made to reduce the cost of changing to waterborne systems, for example by joint local/regional procurement of technology for cost-effective, waterborne systems.

- *Property owners and managers*
  Start a Progamme for Improving Energy Efficiency (PIEE) for property owners. The participants carry out measures in accordance with the Energy Declaration and in exchange receive financial stimulants, for example a temporary tax reduction or, alternatively, a tax reduction for certain environmentally sound installations (ROT). Investments are also made in training for caretakers and management personnel, possibly in the form of training cheques for participants in the PIEE.

- *Spread knowledge about improving energy efficiency*
  A special effort to spread knowledge about energy efficiency improvement, methods, good examples and basic knowledge should be made for all social groups. The prime target groups are schools and preschools, consumers and tenants as well as all the actors in the building sector from purchasers and planners to entrepreneurs and craftsmen. Experience can be gained from the activities and the information campaign carried out by the Delegation for Energy Supply in the South of Sweden during the period 1998-2003.

- *State leads the way*
  State-built, state-owned and state-administered buildings must reduce their energy consumption, *inter alia* on the basis of the measures proposed in the Energy Declaration. Good examples and models should be set by, for example, ministries and authorities. A similar aim should apply for other public premises, among others schools and hospitals.

  The state must also set a good example and promote growth and development of the market for the best products/applications, through public procurement and support to research and development in the area. Procurement should only be from the best performer quartile in energy efficiency.

Objectives for the road transport sector: *Reduce use of oil by 40-50 per cent by 2020!*

The Commission proposes measures that can reduce use of fossil petrol and diesel in road traffic by 40-50 per cent by the year 2020. This objective also comprises the machines and transport used in the sectors agriculture and forestry, fisheries and building activities.

In combination with more efficient transport, increased production of renewable fuels, and by changing over to a fleet of vehicles that are not dependent on just fossil fuels, it will be possible to end the road traffic sector's dependence on oil.

A decisive precondition to attain such an ambitious goal is that the fleet of private cars – which today are about twenty per cent "thirstier" than the EU average – use their fuel considerably more efficiently. Freight logistics must also be rendered more efficient with the aid of ITS (intelligent transport systems), by higher loading rate vehicles and more optimal interaction between car, train and boat. What is known as the economic driving method and improved observance of speed limits contribute to reduced consumption of oil, as, of course, does increased travel by public transport.

In addition to all these measures to improve efficiency, large amounts of petrol and diesel must be replaced by biofuels from forest and energy crops. We propose (page 12) a historically unique bid to produce most of these fuels from Swedish agriculture and forestry. In this way, the Commission wants to contribute to greater security of energy supply and create the preconditions for environmentally driven growth, jobs and faith in the future in Swedish rural areas.

How well we succeed in reaching this objective partly depends on how high the price of oil rises and what the alternatives will cost. At the same time, we are of the view that the climate issue in itself justifies implementation of these changes.

The Commission proposes seven interacting measures:

1. Encourage a more energy efficient fleet of private cars!

The Commission considers that by 2020 Sweden's fleet of private cars should be on average 25–50 per cent more energy efficient than they are today. There are several possibilities for achieving this:

- A higher proportion of modern diesel vehicles. Diesel technology is 25–30 per cent more energy efficient than the petrol motor, and should gradually be provided with renewable diesel fuels (see section 3, p21). However, diesel cars at present emit more nitric oxides than petrol cars. This must be remedied. Negotiations in the EU on new exhaust requirements for private cars will lead to improvements.

- An investment in hybrid vehicles, which can use fuel or electricity can speed up the development towards oil independence. Hybrid technology, which for buses and lorries is most suitable for traffic in built-up areas, can reduce fuel consumption by up to 35 per cent. Fossil diesel can be phased out more rapidly, and tomorrow's biodiesels from forests and energy crops will last longer. With hybrid vehicles that can also be charged via the electricity network, known as plug-in-hybrid technology, probably half or more of a private car's fuel needs can be replaced with electric power. A breakthrough in the near future for hybrid vehicles of this type will tangibly improve our chances of phasing out the use of oil in the transport sector in the long term. For the system as a whole to be sustainable, electricity should be produced from renewable energy sources.

- A rejuvenation of the fleet of private cars and also a development towards reduced weight could play a major role to bring down energy consumption. One of the reasons why recently sold Swedish cars emit about 20 per cent more carbon dioxide per km than the EU average is the low proportion of diesel cars in Sweden. Other factors are also important. The average for new petrol cars sold in Sweden (194 g carbon dioxide/km) is above the average for other north European countries (Finland 181; Denmark 178; Germany 179; Holland 176; UK 175; Belgium 165). We also note that Sweden's somewhat heavier fleet of cars are among the safest in Europe.

The Commission calls for considerably more effective legislation regarding the three main components that steer towards fuel-efficient vehicles: carbon dioxide based vehicle tax, preferential taxation of company cars where fuel-efficient alternatives are encouraged and energy and carbon dioxide tax on fuel.

We are also of the opinion that fuel efficiency should be included as an essential requirement in connection with environmental classification of cars. To be classified as an environmental car, it is reasonable that the car's energy efficiency is better than that of the corresponding conventional alternative. Energy consumption should be defined in a way that takes into account the conditions of all size groups. This is in order to secure development of technology for all types of vehicle. A requirement of this nature is needed to make it clear to consumers and producers that there will hardly be a sufficient supply of biomass if the majority of all the world's cars are to be powered by biofuels at today's consumption levels.

In connection with choosing a vehicle, consumers should also be made aware that petrol and diesel prices are expected to rise, on the one hand due to oil price development on the world market and, on the other, through tax rates for managing environmental problems. For this purpose, Sweden should try introducing a consumer-adapted energy labelling system for cars of the type nowadays applied in the Netherlands and the UK.

We also consider that more efficient use of the fleet of vehicles should be encouraged by improved traffic planning and route optimisation, *inter alia* with the aid of ITS (intelligent transport system), GPS and a bonus system for car sharing (which could reduce fuel consumption by 10-20 per cent). Since 1 March 2006, an economic driving method, known as ecodriving, has been a compulsory part of driving school training and should also comprise heavy traffic, tractors, contractors' equipment, etc. A follow-up should be carried out with so-called spareoach programmes.

Public procurers of vehicles should be able to assist in the development of technology by buying at an early stage demonstration vehicles with special qualities if necessary at higher prices than commanded by the simplest standard vehicle that can manage to meet the transport requirement in question. Authorities should procure vehicles with new technology to the extent judged necessary to speed up the phase-out of fossil fuels and introduction of efficient vehicles.

2. Improve the efficiency of goods traffic and reduce its share on the roads!

The Commission would like to point to the decisive role for industry and economic growth that fast transport with delivery security plays in a country like ours with substantial distances to one another and long distances to the markets on the continent.

The Government must therefore make sure that the transport sector's dependence on oil is ended and that this is effected in a way that does not damage Swedish companies and the Swedish economy. A method that promotes both the economy and oil reduction is to continuously increase lorries' loading rates and to upgrade both logistics and engine technology so that oil consumption in goods traffic can be reduced. At the same time there should be a gradual changeover from fossil fuels to biofuels.

The Commission also proposes positive control measures that put a premium on goods transport in energy-efficient combinations of road, rail and sea.

We want the Government together with municipalities and other local actors to contribute to building and improving the efficiency of transshipment terminals and equipping ports. In connection with large flows of goods, a higher share of sea transport is often an interesting alternative with on average six times lower oil consumption per tonkilometre. Municipalities

with rail connections have a special responsibility to utilise the synergy potential between goods transport on road and rail.

The Commission considers that it should be considerably easier in connection with public procurement to demand energy-efficient and environmentally adapted goods transport. The state sector should lead the way by procuring transport within the best performance quartile on the market and by creating good logistics for its own goods transport. A similar policy should apply for municipalities and county councils.

The state sector should also support the development and use of ITS (intelligent transport system) in order to help the transport industry to improve logistics and transport efficiency.

3. Increase the share of fuels from agriculture and forestry

The Commission proposes that, to replace petrol and diesel, Sweden should produce 12-14 TWh biofuel annually from forest and arable land by 2020. This country has excellent soil and climate conditions to achieve this. At the same time, new impetus will be created and a broad platform for development of technology and business in the green industries.

The EU has tariff protection for imports of ethanol which diminishes opportunities for, for example, Brazilian ethanol derived from cane sugar to compete on the European market. The tariff, which is part of EU agricultural policy, is motivated today by the need to protect the EU market during the build-up of its own, domestic biofuels. The negotiations now in progress in the World Trade Organisation, WTO, will probably move in the direction of a dismantling of this protection and a liberalisation of the global market. Biofuels will thereby be a commodity like all other commodities, which is, of course, desirable and in line with free trade principles.

In the present situation, imports of Brazilian ethanol would be economically advantageous for Sweden. However, with increased demand on the world market, we can expect higher prices and an "upward price adjustment" in relation to our own domestic production. The Commission's view on ethanol is that as a first generation of biofuels, it has increased interest on the market for alternatives to fossil fuels in a meritorious way. To accommodate the market's rapidly growing needs, continued development of acreage- and energy-efficient fuels, the second generation of biofuels, is required.

The Commission would also like to underscore that it is the conditions on a cross-border market that ultimately determine how the production and flow of raw material and end-use biofuel respectively will appear in reality. In certain situations we will perhaps import forest raw materials for production of fuel which we subsequently export, *inter alia* to other nations' fleets of cars. The price of forest for energy in relation to other areas of use will play a part, as also differences in the cost of fuel production in the different countries.

The Commission proposes the following measures:

- The Government contribute to the initiation of a number of pilot and demoplants that produce "second generation biofuels" such as DME, FTD, methanol and biogas – produced by gasification of the bio-based raw material – forest-based ethanol as well as biogas from bio-based raw materials that are most efficient from the point of view of

acreage, cost and energy efficiency. These biofuels present considerable differences in efficiency between different raw material alternatives, production process and fuel. The Government's contribution should focus on the alternatives that appear to have the best long-term preconditions for high energy-efficiency and financial strength.

Support should also be given to the development of high efficiency bio-refineries that can produce both gaseous and liquid fuels as well as electricity and heat from a mix of the most expedient raw materials from forest and field. Likewise, the Government should engage in the construction of the partly new infrastructure that will be needed for fuel distribution and possibly also for linking up major regional heat networks in order to make use of the entire energy content of the bio-based raw material.

- The Government should promote biofuel by means of economic control instruments such as tax relief and fuel certificates. Sweden should also continue to be proactive in the EU to bring about rules that enable a higher admixture of ethanol and RME (rape methyl ester) in petrol and diesel respectively. The Government's involvement should be based on a uniform definition of an environmental car that also includes energy efficiency (see above).

- The Government should supplement EU grants for cultivation of energy crops with funds from the national Regional Development Programme.

- The effects of investment in bioenergy on land use, the landscape and nature conservation should be analysed in a study based, *inter alia*, on region-based impact assessments. The Commission would like to stress how important it is that energy production in fields and forests takes place as far as possible in harmony with food production and existing forestry, as well as societies' other general objectives, including biodiversity, nature conservation and outdoor life in forest and cultivated countryside (see annex 2, Bioenergy and nature conservation).

4. Make public transport cheaper and more attractive!

The Commission has been influenced by the Swedish Public Transport Association's assessment that travel by public transport could grow by about thirty per cent during the period 2006-2020, chiefly in population centres. If this is the case, it will be a considerable contribution to the transport sector's oil reduction.

With rising oil and petrol prices this development will accelerate. In order to be sustainable in the long term, however, it needs to be supported and encouraged by investments that promote comfort, speed, availability, and hence make travel by public transport an alternative worth its price.

The Commission proposes the following measures:

- The Government should support pilot and development projects with public transport in a number of municipalities, focusing among other things on comfort, speed and biofuels.

- The Government should encourage use of public transport to and from workplaces. A possible method currently being investigated is that employers be able to offer their employees free public transport without social charges and benefits tax.

- A uniform, convenient pay system for all public transport should be introduced.

5. Strengthen the role of the train!

The current share of journeys longer than 100 kilometres by long-distance trains is about 14 per cent. Continued high oil prices may contribute to more people choosing rail travel which, in its turn, will lead to reduced oil consumption. However, to systematically increase travel by long-distance train at the expense of travel by air and private car, vigorous measures are required.

The Commission proposes the following measures:

- The Government should make a strong investment in the railways for new fast train connections between major cities.
- The Government should build away the bottleneck in the centre of Stockholm.
- The Government should guarantee in the long term a low VAT rate on train journeys.

6. Air travel

The Commission judges that high oil prices will in the long term impair profitability. Fast trains should be capable of winning over air passengers, thereby increasing their share of medium-distance travel. Trains have a competitive advantage by being able to offer more space and service. However, time and price are decisive competitive factors for the future of the railways.

Society should promote alternatives to air travel where possible. It may be a question of encouraging the use of IT in the form of tele-, video- and webconferencing at companies and authorities and/or encouraging travel policies that put a premium on rail travel. It is also a matter of improving rail services between population centres at medium distances so that the train may become the chief alternative for private journeys on these routes.

Air travel urgently needs to be included in the EU's trade in carbon dioxide emissions but presupposes tightened goals for the Union's trading system. Together with other countries, Sweden should support research and development of more efficient aircraft engines and new fuels of the hydrogen gas and bio-based aviation kerosene type.

7. Distance work

It is an indisputable fact that IT offers completely new opportunities to reduce environmental stress from passenger transport. But it is not yet used to a sufficiently large extent to produce noticeable effects. Where possible, mobility should be replaced by accessibility. The technology already exists, it is relatively easy to count in the environmental and financial gains and there are also possibilities of utilising innovative control instruments.

The Commission considers that the public sector should lead the way in this area in order to speed up the development and use of alternative methods for passenger transport which will

then impact on the private sector also, both regarding use and development. One condition is accessibility to flexible modes of work. If employers enable more distance work to take place than is the case today, the daily commute to work can be reduced. Another area that may involve major reductions in transport is the use of virtual meetings that offer an alternative to costly, environmentally stressful and time-consuming official journeys.

Objectives for industry:
Reduce consumption of oil by 25-40 per cent by 2020!

The Commission proposes that measures be taken so that by 2020 Swedish industry can improve efficiency and reduce its consumption of oil for heating and processing purposes by 25-40 per cent.

Industry's total oil consumption today is about 20 TWh. Roughly half is used for heating and half for various production processes.

It should be possible to replace at least half of the share of heating oil – thus, 25 per cent of industry's total oil consumption – with biofuels and/or district heating. The heating networks provide an opportunity to locally link up industries with heat needs and excess heat respectively, and also efficient system solutions with, for example, district-heating plants. A control measure working in this direction is the EU carbon dioxide trading system (however, all of industry does not participate in this). The Commission proposes (see pages 15-16) that Sweden should contribute to gradually tightening this system. In certain industrial processes where replacing oil with solid biofuels is problematic, electricity is a possibility. However, imported coal combustion power represents about three times higher emissions of carbon dioxide than if oil had been used and therefore is not an attractive alternative. Furthermore, it tends to be more expensive. But in the long term the share of electricity from renewable sources of energy will increase. Irrespective of how electricity is produced, considerable energy efficiency improvements should be made (see our proposals below).

For other industrial processes, oil needs to be replaced by energy gases. Initially these could be (fossil) natural gas with a gradually increased admixture of renewable gases, for example upgraded biogas and synthesis gas produced from biomass. The Commission previously (see page 14) gave its views on the use of natural gas in the Swedish energy system. It should, however, to some extent be possible to provide industries with a special need of gas as a replacement for coal and oil in processes, with LNG transported by rail, road or sea, that is to say natural gas in liquid form. The advantage of this type of solution is that it does not commit us to a fixed gas infrastructure that is not sustainable in the long term.

We propose the following measures:

- Control measures may need to be strengthened so that oil used for heat and steam in industry is replaced by biofuels or connection to district heating.

- Supplement the "Programme for Improving Energy Efficiency" so that it also comprises oil. Small and medium-sized companies should be given supplementary support through energy offices or energy consultants.

- Develop cooperation between basic industry and the Institutes of Technology. This could be done, *inter alia*, by doctoral candidates in the field of "technology for improving energy efficiency".

- Encourage measures to improve electricity efficiency.
  Non-energy-intensive industry is judged in many cases to have a potential for improving the efficiency of electricity by about 40 per cent. There are several successful examples of management and employees together reducing their company's dependence on energy and oil; one of the projects was called "Stop unnecessary use". Additional incentives are needed for a detailed review of energy consumption and possibilities of improving energy efficiency in companies.

R&D and commercialisation of new knowledge – to make Sweden an oil-free, energy-efficient society

The Commission would like to point out how decisively important continued development of knowledge is for the improvement of efficiency and the phase-out of oil. We want to see new strong investment in applied research and different demonstration projects and also further government involvement, together with industry, to commercialise technology and service systems that can speed up the changeover to more sustainable energy in the future.

There are, of course, many areas and projects that deserve our interest and support. In the following section, pertaining to the sectors we have discussed in this report, we present a selection of examples of what we consider should be given high priority in the short and medium term.

Residential and commercial buildings

Sweden has built up considerable knowledge, often in international cooperation, regarding energy technology and energy systems relating to buildings. It is now a matter of implementing this knowledge and bringing about collaboration between different areas and actors. The previous focus on buildings and technical systems needs to be supplemented by research into user participation and other so-called soft issues.

Building system issues

Continued research is needed into interaction between the regional system and the buildings, and interaction between the different subsystems in a building, and how technology can be better adapted to the users. Knowledge about measurement and feedback can strengthen the behaviour of residents as regards reducing their consumption of energy.

Order, own, administer

Use of energy in a building depends on how the various roles have been played, from placement of the order to the administrative phase. It is about incentives and control systems, contract terms and administrative organisation.

Industry

We see ahead of us several areas where research and development in cooperation between universities/colleges and industry can have a positive impact on the phase-out of oil. Here are some examples:

Improving energy efficiency
The Government should support research into applied industrial energy efficiency. With higher oil prices, the need for research support is more necessary than previously in order to contribute to enhanced competitiveness for Swedish industry. Research must show how Swedish industry can improve its energy efficiency and reduce its dependence on oil and electricity through a system view and by converting both industrial processes and support processes to, *inter alia*, district heating and biofuels.

Systems research
Technical conditions, economic factors and other conditions in the surrounding world affect the energy system. Research into systems analyses can improve methods for realising sustainable overall solution. Other research areas of a systems nature concern, for example, biofuels and waste and special niches such as district cooling and district-heating-powered absorption cooling.

Transport

The Green Car
The Green Car, phase 2, is an R&D programme to reduce total exhaust emissions from motoring. The focus is on engines, alternative fuels and electric and hybrid systems. This programme should be supplemented by substantial investment in applied vehicle research, the production of prototypes and demosystems in order to develop hybrid technology as well as improve the technology for use of alternative fuels in vehicles.

Investment in technical development for "greener" aircraft
One of the major challenges regarding future energy supply concerns air transport. A vision for the year 2020 of future air traffic that has been established by the European organ ACARE means that fuel consumption and emissions of carbon dioxide should decrease by 50 per cent. The Swedish aviation industry holds a strong position in several of the areas that require further technological development to achieve this target. A development programme for a "Green Aircraft" could put Sweden in a strong position internationally and complement other efforts well. The programme should focus on technical development and what are termed demonstrators, chiefly regarding engine components and aircraft structures and systems.

Technology and plants for biofuels
Research and demonstration of biofuels from "well to wheel", focusing on the development of efficient technical and distribution systems as well as economy and infrastructures, needs to receive strong government support and involvement.

The Government should strongly support demo- and full-scale plants for synthesis gas production of methanol, DME, FT diesel from solid biomass and black liquor. Continued support should be given to the development of ethanol from forest raw material. We also propose that the Government invest in the development of a complete infrastructure both for these fuels and for biogas/biomethane in some suitable areas, possibly the Lake Mälare valley, Skåne and on the West Coast.

Biorefinery is the term for a facility that produces electricity, heat and gaseous and liquid fuels, and in some cases chemical raw materials too, as efficiently as possible. The Government should support research into the development and implementation of several biorefineries of this nature, for example connected to local or regional district heating networks.

Plant biology research
Rapid developments in the biosciences will in future contribute to both increased growth and plant material with "designed" properties for different purposes. Among other things, the potential of biomass as an energy raw material may thereby increase.

Today, basic molecular technology research primarily contributes to increasing our understanding of how properties can be regulated, controlled, inherited and find expression in different environments. In the future, new knowledge in this field will gradually increase the efficiency of plant improvement programmes. An example is the promising work in progress at the Umeå Plant Science Centre (UPSC), one of northern Europe's foremost environments for plant biology research.

Fuel production in agriculture and forestry

The contribution of agriculture
R&D is needed in several areas to increase knowledge about agriculture's potential as a producer of energy raw material; here are some examples:

- Cultivation techniques for different crops in different soils, *inter alia* for hemp and other "new" energy crops.
- Continued plant breeding and bio-technical research into energy broad-leaf trees and agricultural crops in order to obtain the desired properties
- Logistics and technology for handling and transport of waste products and different types of plant material
- Economy, control instruments, job opportunities, rural development issues
- Effects of energy crop cultivation on surrounding environments, biodiversity, soil and water, as well as the role of the countryside for recreation and outdoor life

The contribution of forestry
R&D is needed in several areas to increase knowledge about forestry's potential as a producer of energy raw material; here are some examples:

- Increased production of forest raw material by sustainable management methods in conventional forestry
- The preconditions for intensive cultivation of forest that is sustainable in the long term
- Best use of different parts of the forest raw material; development of environmental technology for biofuels , improved logistics and management, transport of takeoff
- Nutritional balance and acidification risk in connection with extraction of logging residue
- Continued genetic refinement of plant material with an opportunity to implement new techniques

Development of the public transport system

The Government should support R&D and local pilot projects for transportation efficiency in town planning and public transport and R&D concerning advanced car-sharing schemes and telematics for private cars (see page 21)

Tomorrow's energy technology

- **Solar cells**

Solar cells are already available but at the same time they are an example of tomorrow's technology for producing clean, renewable electricity. Intensive research work is in progress to, *inter alia*, create cells with improved efficiency and economy. Through the Ångström laboratory in Uppsala, Sweden is a leading nation in solar cell research. We have northern Europe's largest production of solar cell modules, in the form of two companies in Gällivare, and an important plant in Arvika. It is essential to link up research and production in pilot projects, among other things, in order to develop new thin film technology.

- **Wave power**

Research into ways of utilising the energy of ocean waves can be developed into promising technology for renewable electricity production. Practical experiments are ongoing at present at a test facility on the West Coast.

- **Hydrogen gas**

Hydrogen gas is an energy carrier that, above all in fuel cell vehicles, has great potential to reduce dependence on oil in the transport sector in the long term. The major vehicle actors (Toyota, Ford, Daimler, Chrysler, GM/Opel and Honda) nowadays estimate that the fuel cell car may be commercialised some time during the period 2012-2020.

Sweden currently invests SEK 30 million annually in fuel cell research and about SEK 10 million in hydrogen gas research. It is essential that the Government and industry assist in developing demonstration projects around fuel cell buses with the appurtenant infrastructure in Stockholm, Göteborg and Malmö. In this connection, SamVäte i Väst, which is aiming for the introduction of hydrogen gas in Western Götaland, may be an interesting partner.

Annex 1

Factual background

The Commission bases its standpoints on extensive factual background material, on the one hand from sectors where we ourselves are active and, on the other, from the Commission's hearings and through material placed at our disposal from various trade organisations and interest groups. The figures in brackets refer to the respective pages in the proposals section.

Sweden's bioenergy potential (p. 12)

Sweden has excellent climate and soil conditions for producing considerable amounts of bioenergy for heating, transport and certain industrial purposes.

The biofuel market has strongly expanded from 40 TWh in the 1970s to 110 TWh today. In recent years, annual growth was 4-5 TWh. Growth was previously strongest in the distance heating sector but is now considerable in other sectors too. An example that may be mentioned is use of pellets, which in 2005 was 7 TWh with a growth of 19 per cent in total and 33 per cent in sales to private houses.

To try to estimate both the use of biofuels and the potential for bioenergy production that may be available on Swedish agricultural and forestry land in the long term and in the management of waste flows, etc. is a difficult task. Assessments vary depending on the criteria set. And basic Swedish statistics need to be greatly improved.

The Commission had access to basic data from the Swedish Energy Agency, the Swedish Board of Agriculture, the National Board of Forestry, the Federation of Swedish Farmers, the Swedish Bioenergy Association (SVEBIO), the Swedish University of Agricultural Sciences (SLU), the Swedish Forest Industries Federation, etc. The tables below are an attempt to sum up on the one hand the acreages that can be used for biofuel production and the waste product flows and, on the other, an assessment of how great a supply and use respectively may be outlined for the future, compared with the present. Roughly estimated, production in fifty years time could very well be twice as large as today.

Biofuels, supply and use* (TWh)

*including import/export opportunities within the respective sector

	2005	2020	2050
Gross supply			
Firewood, logging residues, stumps	20	40	52
Industrial by-products for sale	16	22	35
Industrial by-products for internal use	19	20	35
Spent liquor, etc.	44	45	45
Waste, pine tar pitch, peat, demolition wood, etc.	8	15	31
Fuels from energy crops (incl. waste products and energy wood)	1	10	32
Miscellaneous, etc.		2	8
	108	154	228
Gross use excl. conversion losses			
Housing	11	16	20
Distance heating	20	26	36
Electricity production	18	22	34
Forestry industry, internal incl. spent liquor, etc.	57	59	65
Transport (gas, liquid, electricity for plug-in-hybrid, etc)	2	26	63
Miscellaneous, etc.	1	5	10
	108	154	228

Source: The Commission's summary

Naturally, the market will have a decisive impact on developments regarding which products will be available and how and to what extent they will be used in the various sectors.

Regarding an assessment of which land could be used for which production, the table below shows a possible development. It is too early to say anything about which of the biofuel products will be produced on the different lands. But it may be seen that the land and opportunities are available.

	2005		2020		2050	
Acreages for biofuel	ha	TWh	ha	TWh	ha	TWh
Agricultural land in total -	5 215 600		3 215 600		3 215 600	
comprising agricultural land for energy crops	80 000	0.5	160 000	2	400 000	11
fallow acreage	320 000	0.0	320 000	4	320 000	10
waste products, straw, fertiliser, etc.		0.5		4		11
previous agricultural land	400 000	0	400 00	2	400 000	12
Forest land in total	23 000 000		23 000 000		23 000 000	
Production		94		94		94
comprising increased productivity in existing forest land				23		30
intensive afforestation	0	0	200 000	2	1 150 000	27
other biofuels, waste, peat, etc.		13*		23		33
Total biofuel acreage ha/energy TWh	26 615 600	108	26 615 600	154	26 615 600	228

* including imports assessed to be 7-9 TWh in 2005

Source: The Commission's summary

Buildings are almost always unique systems as regards technology and use. All energy efficiency measures and oil conversion must therefore regard every individual building as a system and analyse how that system will function with a larger energy supply system. Oil consumption in this sector is very unevenly distributed across Sweden.

In connection with the oil crises in the 1970s, many and rapid improvements were carried through regarding energy consumption in Swedish single-family homes and apartment blocks. But since the 1980s the rate of improvement has waned. The figures below also show that houses with optimised performance are much better (50-80 per cent) than newly built houses in the present situation.

Consumption of energy in single-family houses 1970-2002

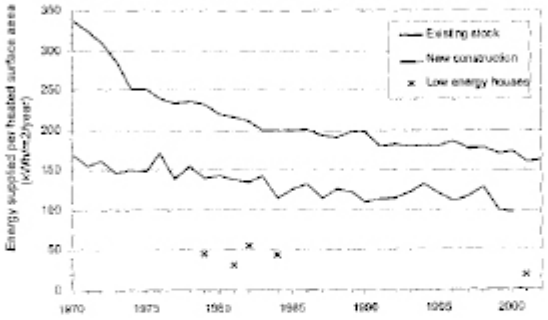


Figure 1 Energy consumption (energy supplied) for heating and warm water per heated surface area in single-family houses between 1970 and 2002. The curve for the existing stock represents all heated surface area during the current year and the curve for new houses shows energy consumption at the time of completion. Examples of values measured from newly built low-energy houses illustrate the gap to the best technology available (BAT). All data are corrected for normal year.
Source: Jonas Nässén and John Holmberg, Department of Physical Resource Theory, Chalmers University of Technology

Consumption of energy in apartment blocks 1970-2002

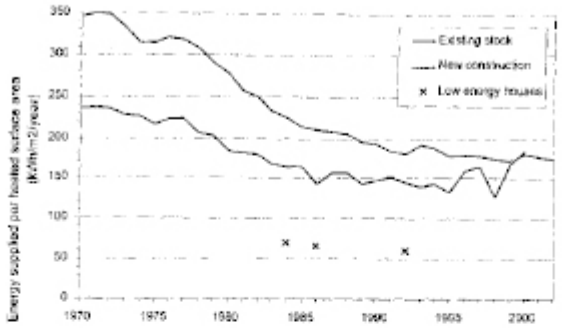


Figure 2. Energy consumption (energy supplied) for heating and hot water per heated surface area in apartment blocks between 1970 and 2002. The curve for the existing stock represents all heated surface area during the present year and the curve for new buildings shows energy consumption at the time of completion. Examples of measured values from newly built low-energy houses illustrate the gap to the best available technology (BAT). All data are corrected for normal year.
Source: Jonas Nilsson and John Holmberg, Department for Physical Resource Theory, Chalmers University of Technology

Transport (p 18-24)

The transport sector as a whole is approximately 94 per cent dependent on oil-based fuels. 3 per cent is electricity for most of the trackbound traffic. Aviation is fuelled exclusively by paraffin oil and shipping by bunker oils.

Petrol and diesel make up more than 97 per cent of road traffic fuel, about 8 billion litres of petrol and diesel. 2.7 per cent are biofuels: 250 million litres of ethanol for low admixture and 32 million litres for E85 and bus fuel, a further 19 million normal m3 natural gas (fossil gas), 10 million normal m3 biogas and 11 thousand m3 RME (rape ethyl esters).

The total number of vehicles in Sweden is at present made up of 4.2 million private cars, about 70 000 lorries and 8 000 local buses. Fuel consumption for private cars is at present on average 20 per cent higher than in the 15 EU member states. This is due to the fact that cars in Sweden are older and on average slightly heavier, and there is a low proportion of diesel vehicles (which are 25-30 per cent more energy efficient than the corresponding petrol vehicle).

In the last ten years, transport of passengers increased by 14 per cent and goods transport by 26 per cent.

From base year 1990, the road sector's emissions of carbon dioxide have so far increased by 9 per cent, almost exclusively from heavy lorries. To achieve the Government's intermediate goal, a stabilisation of CO_2 emissions at the 1990 level by 2010, these must in continuation

decrease by 1.4 per cent per year. However, the prognosis points more to an *increase* in emissions by an average 2 per cent per year.

More energy-efficient vehicles

The effects of hybrid technology are greatest for refuse lorries and urban buses producing 20-25 per cent fuel saving and for wheel loaders 20-40 per cent fuel saving. There is less potential for long-distance lorries, 5-8 per cent, as their energy efficiency is already relatively high today. In 2020, all new buses and 50 per cent of new lorries are expected to be provided with hybrid technology. This means in total 17 000 heavy hybrid vehicles with a reduction of over 600 million litres of diesel.

Motor-vehicle taxes differentiated by carbon dioxide emissions will be introduced for private cars as from 1 October 2006. Light lorries may be included in the system when information on the carbon dioxide emissions of these vehicles is available in the road traffic register, based on the EU Directive recently issued by the European Commission. There are also plans to draw up a common EU method for measuring and reporting fuel consumption for heavy vehicles, with the aim of introducing control measures differentiated by carbon dioxide emission for these vehicles too.

Biofuels from soil and forest

The first generation of biofuels is produced in relatively simple processes and comprises ethanol, biogas and rape methyl esters:

- 0.3 TWh ethanol is produced annually from corn by the Agroetanol company in Norrköping, owned by Lantmännen and the Federation of Swedish Farmers. By 2008 capacity will have quadrupled compared with today's level.
- 0.1 TWh RME, rape methyl ester, is produced annually in Sweden. Two new factories will start production in 2006 in Karlshamn and Stenungsund. The preconditions for producing RME in Sweden are limited because of the climate and due to opportunities to sell the rape fodder meal.
- 0.2 TWh biogas as vehicle fuel is produced annually from sludge, food waste and household waste. It is estimated that by 2020 production will be 3-5 TWh. Many different by-products and crops are suitable for biogas production. The rotted residue can be returned to the field. In some quarters, regional biogas networks are planned that will connect producers of organic residual products (farms, sewage plants, food industries) with rotting facilities and filling stations.

In the years ahead, it will also be possible to produce biogas as a second generation fuel by gasification of biomass (wood), see below.

The second generation of biofuels is usually produced by more advanced technology. A process of this type, which *inter alia* is under development at facilities in Örnsköldsvik, is hydrolysis of wood cellulose for sugar, followed by fermentation of the sugar into ethanol. Another process involves gasification of biomass (wood) and black liquor into gas mixtures which, in their turn, can be synthesised into DME (dimethyl ester) methanol, methane and FTD (Fischer-Tropsch diesel).

To optimally economise with the acreages of forest and arable land that could be used for energy purposes, which are after all limited, a considerable share of tomorrow's biofuels should be made up of synthesis-gas-based products. Research facilities for gasification processes are available in Piteå and Värnamo. Demo plants are planned and subsequently several commercial full-scale plants will probably be built.

Gasification technology has the potential to produce excellent total efficiency.

Gasification	**Ethanol combinations**
70% biogas	21% ethanol
20% distance heating	16% electricity
10% loss	35% distance heating
	28% loss

OBS! THAT THE DIAGRAM STILL ARE IN SWEDISH TEXT AND THAT YOU FIND THE ENGLISH TRANSLATION UNDERNEATH THE DIAGRAM (WILL BE UPDATED).

Förgasning

70% biogas
20% fjärrvärme
10% förluster

Etanolkombinat

21% etanol
16% el
35% fjärrvärme
28% förluster

Source: BAFF, Göteborg energy
Diagram text:
BIOREFINERY AND ENERGY COMBINATIONS
(ethanol, electricity and district heating production)
300 000 ton TS/1400 GWh
90 000 ton TS/approx. 540 GWh
50 000 ton TS/250 GWh
Steam, Water, By-products
62 500m ^{3}/350 GWh ethanol
for approx. 80 000 cars
(51/100km, 18 kWh/100km)
Energy efficiency 70-75% 585 GWh distance heating for 260 GWh electricity

CO_2 **efficiency 90-100%** for	about 40 000 normal private houses	sufficient
households	(15 000 kWh per house)	53 000
kWh/household)		(5 000

For production of fuels, agricultural crops require more input energy than forest-based raw materials. According to what is termed the well-to-wheel analysis – which specifies the number of possible transport miles per hectare cultivated energy crop – DME from broad-leaf plantations is most efficient. Ethanol/biogas from sugar-beet also has relatively good values while ethanol/biogas from corn and biogas from field crops produce half as much transport service. Rape for production of RME for admixture to diesel fuel has lower efficiency. What makes it economically viable to produce corn ethanol and RME from oil plants is not just the energy part, which like other biofuels receives tax relief, but also the by-products that are generated at the same time for, among other things, fodder. This explains why substantial investments are made in this area.

However, the technical systems will in all probability gradually improve, and also different combinations of crops and technology may increase efficiency.

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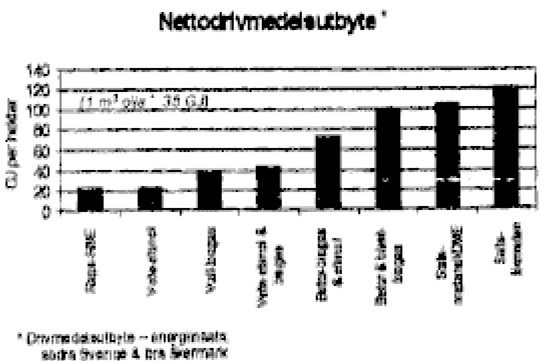


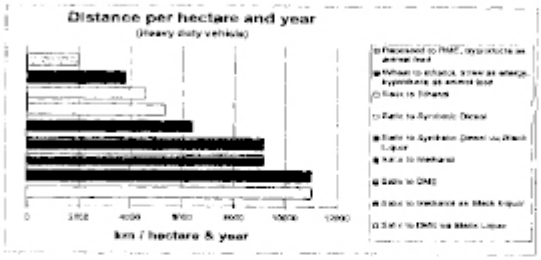
Diagram text:
GJ per hectare
Rapeseed RME
Wheat-ethanol
Straw-biogas
Wheat-ethanol & biogas
Beet-biogas & ethanol

Net fuel exchange*

Beet & tops biogas
Salix-Methanol/DME
Salix-biomethane
* Fuel output – energy input;
south Sweden & good agricultural soil

The diagram shows how much net energy (J or KWh) that can be extracted per hectare through different production systems (after deduction of the energy used for cultivation and processing).
Source: Pål Börjesson, LTH 2006-07-03

Distance per hectare for a heavy vehicle with diesel engine efficiency



The diagram shows how many kilometres a heavy vehicle can run per hectare and year on fuels produced by different production systems (after deduction of the energy used for processing).
Source: AB Volvo

Full-scale fuel cell vehicles and admixture

Biofuels can be used on the one hand for admixture with fossil fuels (RME and FTD in diesel, ethanol in petrol) or as full-scale fuel (ethanol in E85 vehicles, RME, DME and FTD in diesel vehicles). Biogas can be used in engines for fossil gas/biogas.

DME and FTD can only be used in diesel engines. DME gives extremely low emissions of particles and nitric oxides and is also better than FTD regarding utilisation of raw material. Since it is gaseous it is best suited for vehicles that can be tanked up at depots, that is to say delivery cars, buses and refuse lorries. Vehicles of this type will be manufactured both in Sweden and other countries in the coming decade. With the normal rate of exchange of vehicles and assuming good accessibility and competitive fuel prices, the Swedish Public Transport Association estimates that all local buses in the country could be fuelled by DME in 2020.

FTD is less efficient and slightly more expensive to produce than DME, but, on the other hand, is a liquid diesel fuel that can be made available at ordinary filling stations.

Public transport

Travel by public transport will probably increase in pace with the anticipated increase in petrol prices. This applies in particular if the benefits tax on free public transport is removed, and if public transport succeeds in offering greater comfort, timetables with more frequent service and simpler ways of paying.

The Swedish Public Transport Association believes there will be a 30 per cent increase by 2020, primarily in metropolitan areas, equally distributed among bus and rail traffic. In this connection, consumption of oil-based fuels may decrease by almost half a billion litres, provided that 70 per cent of the additional passengers are motorists and that all buses in county and local traffic are fuelled by biogas or biodiesel (DME, FTD) by 2020.

Several interesting local pilot projects are ongoing around the country, relating to transport efficient town planning and more efficient public transport, for example the ComFort project in Jönköping and the travel experience project in Mölndal.

Electrically powered train journeys contribute to reduced dependence on oil when they replace road and air transport. At present trains account for 14 per cent of passenger journeys over 100 kilometres.

Air transport

Aviation is an important part of the transport sector:

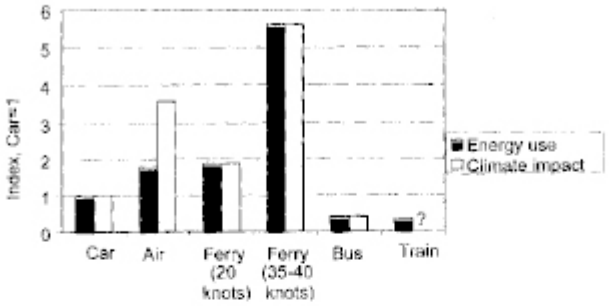
- The average Swede flies about 300 miles per year which is equivalent to a return journey Stockholm-London. This is six times more than the global average. Over 10 per cent are domestic journeys
- The Swedes' air travel consumes about 15 TWh fuel (2006)
- Air travel increased between 1990 and 2001 by more than 5 per cent a year (measured as passenger-km)

Aircraft mainly use aviation kerosene, in private aviation what is termed aviation petrol. Even with considerably more fuel-efficient aircraft, in a few decades air travel may be responsible for greater climate impact than motoring.

It may be possible in the long term for liquid hydrogen and bio-based aviation kerosene to replace oil-based fuels. However, these fuels do not solve the problem of emissions of nitric oxides and steam which are responsible for half of aviation's climate impact. Access to primary energy may also be problematic; to produce the volume of hydrogen (or biokerosene) for Swedish air transport assessed for 2050 would require the equivalent of the whole of today's Swedish nuclear power.

Aviation is at present free from carbon dioxide tax, energy tax and VAT (except 6 per cent on domestic flights). This means that a litre of aviation fuel costs about SEK 4 compared with a litre of petrol which costs SEK 11-12 (in the case of USD 60/barrel for raw oil). If climate impact from Swedes' air travel were valued according to the current Swedish carbon dioxide tax of SEK 0.92 per kg, the sum would be about SEK 7 billion a year, which is equivalent to an extra cost of SEK 600 for a return flight Stockholm-London.

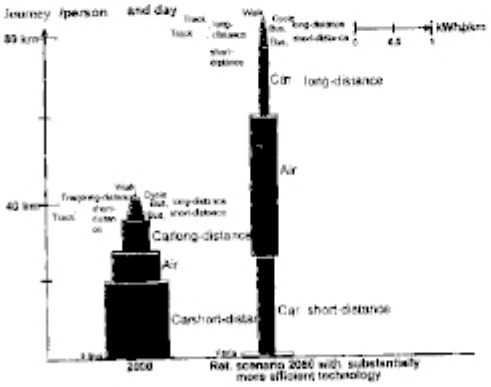
Energy consumption and climate impact respectively for different forms of transport



The diagram shows energy consumption per passenger kilometre for different forms of transport. The question-mark on the column for trains indicates that the climate impact of rail travel depends on whether trains are powered by electricity or diesel.
Sources: Åkerman, Jonas & Höjer, Mattias, How much transport can the climate stand? – Sweden on a sustainable path in 2050, Energy Policy (in press). Sausen, Robert et al., Aviation radiative forcing in 2000: An update on IPCC (1999), Meteorologische Zeitschrift, Vol. 14, No. 4, 555-561, August 2005.

Length of journey and energy consumption, air transport compared with other types of transport

(height of column equal to length of journey, width of column equal to energy/person-km)



The diagram shows travel per person and day in 2000, followed by a scenario for the situation in 2050, with today's development but with substantially improved energy efficiency.

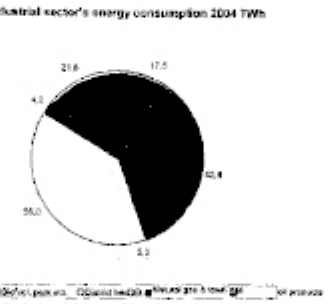
Source: Åkerman, Jonas & Höjer, Mattias, How much transport can the climate stand? – Sweden on a sustainable path in 2050, Energy Policy 34 (2006) 1944-1957.

Sea transport

8 per cent of the volume of goods in Sweden is conveyed by ship, despite the fact that sea transport of goods is more energy efficient than any other alternative. The challenge, however, is to make ships' bunker oils cleaner and more environment-friendly. In May 2006, new tightened international requirements entered into force regarding sulphur and nitric oxides. In total, 22 TWh bunker oil was used in 2004, most of which, over 20 TWh consisted of heavy fuel oils. Diesel fuel oil and light fuel oils amounted to just under 2 TWh.

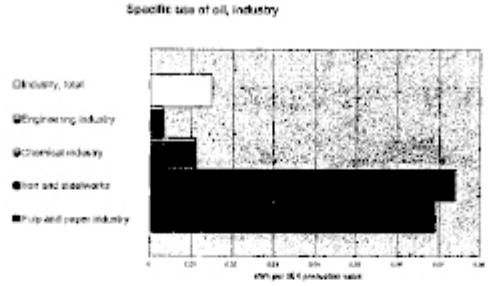
Industry (p. 24)

In 2004, Swedish industry used a total of 157.4 TWh, 21.8 TWh (14%) of this was oil in end energy usage. Energy will remain one of the most important production factors in the iron, steel, paper and pulp industries; access to energy is a key precondition for other industries too.



End use of energy in the industrial sector 2004, in total 157.4 TWh
Source: Swedish Energy Agency

Oil has different importance for different industries. If you measure oil use per production value, the sensitivity to oil energy costs of basic industry becomes evident.



Industry's specific use of oil, kWh per SEK production value at 1991 prices
Source: Swedish Energy Agency

Pulp and paper industry
A dramatic change in use of oil in the pulp and paper industry took place from the 1970s and twenty years on. Today, just under 25 per cent oil is used in the process compared with thirty years ago. What are termed mass furnaces for lime-burning require high energy intensity. At present oil cannot be replaced by solid biofuel, some form of energy gas, natural gas and in the long term biogas is required; experiments are also being made with bark powder.

Petrochemical industry
In the petrochemical industry fossil oil is used as a raw material, for example for pharmaceuticals, waterborne paints and mobile telephone cases. It will continue to be the most important raw material, however chemical products based on vegetable and animal oils are already available. In the future, ethanol may also become an important raw material for plastics and other chemico-technical products. For this industry, access to natural gas is essential, both as raw material and energy supply.

The refining industry
For a long time ahead, diesel and petrol will remain essential products in the transport area. International consultant studies show that the Scandinavian refineries are among the most energy efficient in the world. There are further possibilities here of improving efficiency with natural gas as raw material for hydrogen gas.

Steel industry
This industry is well ahead in the use of the best process technology. New processes can give major savings as far as use of raw materials and energy is concerned. Developments are at present at the trial or demonstration stage and it will therefore take a decade before they are of importance. The majority of energy-saving efforts are made in connection with new investment or radical reconstruction.

From the energy viewpoint, ore-based (integrated) works predominate. This is because coke for reducing agents and alloyers is included in the energy balance.

It is characteristic of the steel industry that most of the energy-intensive processes occur at high temperature. The energy is mainly used in processes where the operating temperature exceeds 1 000 °C. The steelworks therefore need access to high-quality energy carriers such as coal and oil products, gas (liquefied petroleum gas or natural gas) and electric power. Low-grade biofuels cannot be used for energy reasons and also because burning of oil or gas takes place in the same "space" as material that is to be heated.

Other manufacturing industries
Some oil is used in other industries too. Here, distance heating and biofuels can play a major role. Through improved efficiency and saving, a company can normally reduce its use of energy by 30-60 per cent.

Annex 2

Bioenergy and nature conservation

The Commission wishes to underscore how important it is that energy production on arable land and in forests take place in as much harmony as possible with society's other general goals for, *inter alia*, biological diversity, nature conservation and outdoor life in forest and countryside.

We have therefore requested Urban Emanuelsson, PhD, Director of the "Centre for Biological Diversity" at Sweden's University of Agricultural Sciences and Uppsala University, to describe a strategy for this purpose.

Text: Urban Emanuelsson

Sweden is a relatively sparsely populated country with vast forest acreages and many farms which, in spite of EU grants and environmental compensation, find themselves on the brink of unprofitability. At the same time, there is considerable awareness here of the negative environmental impact of continued use of fossil fuels. It is therefore completely logical to invest in a substantial increase in Swedish biofuel production.

To begin with, it should also be mentioned that, since the early 1990s, Sweden has been strongly committed on the international arena to preserving biological diversity both in this country and at the international level. This work has received positive international attention. Without making too detailed a presentation of what biological diversity is, in this context it may be said that it concerns variation both at the gene, species, biotope/landscape level and regarding ecological processes. Today, for example, it is apparent that there is considerable awareness of the importance of the species for upholding several vital functions of human society.

A few decades ago, production of biofuels already came to be considered a potential danger to nature conservation, a threat to biological diversity. An increase in this type of production may indeed be a major nature conservation problem if this production is laid in the traditional way "on top of" the existing production of food, timber and pulpwood. But this is exactly what must not happen; the fight against two major environmental problems, that is to say the threat to biological diversity and the threat from greenhouse gas impact should not need to compete for resources and priority. There is a great danger that totally different researchers, politicians and administrators will be engaged in one or the other issue. We therefore need to launch a strategy based on the following four main lines:

1. Firstly, use of land can be roughly planned so that areas that are particularly suitable for biofuel production are given major opportunities to pursue **efficient production** of this type. In an equivalent way, the landscape can be roughly planned so that areas with **valuable biodiversity are not utilised for biofuel production** if it damages biodiversity. A number of control instruments should be produced to enable a strategy of this kind.

2. Secondly, there must be a continued adaptation of food and wood production so that a further step can be taken towards these "normal" industries **becoming better in relation to the preservation and sustainable utilisation of biological diversity.** This continued adaptation may mean a certain decrease in production but, at the same time, this decrease may be easier to bear if there is the possibility of higher biofuel production on other acreages. This part of the strategy is presumably a fairly "cheap" way for the forest and agricultural industries to leave more space in the landscape for biofuel production.

3. A third sub-strategy would mean starting from **existing biofuel cultivation systems and subsequently develop these in a target-oriented way** so that they become of considerable value for biological diversity. It may, for example, be a question of modifying cultivation systems for quick-growing broad-leaf trees.

4. The fourth and last sub-strategy primarily concerns **creating new cultivation systems or modifying systems** so that they produce both fuel and a more desirable biodiversity compared with that which existed before modification took place. This may, for example, be of importance regarding areas of wetlands type.

These four sub-strategies demand extensive development work but also research. In this context, the major challenge is to ensure that this work does not just fall within an existing part of the world of authorities or research. The researchers and authorities that have been engaged up to now in biofuel production have had an aim and direction very similar to that of traditional production researchers in agriculture and forestry. Thus, biodiversity has usually been discussed only superficially by these people. The equivalent applies to traditional nature conservation research. Biofuel systems have only been studied by a few individual nature conservation researchers. What is needed is therefore not just the development of intensive cooperation; **development and research work is also needed that is expressly engaged in "discovering" systems that produce both substantial biodiversity and energy.** This is a challenge researchers and authorities have not previously faced.

Designing **concrete land use systems and management systems** is a challenge to researchers. Designing **systems of control instruments** is largely a challenge to authorities, but in cooperation with user organisations and researchers. This is very complicated work. One difficulty lies in our sectorised legislation in which systems of control instruments, for example regarding forest land and arable land respectively, vary greatly. Moreover, control instruments often focus on a specific purpose, something which is already a major disadvantage today, for example when it comes to coordinating leakage control, stimulating biodiversity, cultural environment and recreation. If, in addition, control instruments are to be produced in the future that aim for increased biofuel production without a reduction of biodiversity, a great deal of creativity is required regarding coordination of the various systems of control instruments. Today's environmental work in Sweden is governed overall by 16 environmental objectives. The system has proved successful and gives environmental work a clear focus. To question these 16 environmental objectives may therefore not be a particularly constructive strategy. On the other hand, conflict situations arise between different environmental objectives, above all between those comprised of climate impact or biodiversity. Thus, it is of great importance for continued credible environmental work that considerable efforts be made to develop the control instrument side and the actual land use side.

In concrete terms, it is above all in the forest and agricultural landscape that a coordination of biofuel and biodiversity efforts needs to be achieved. Today, there is a discussion in forestry about intensive forest cultivation on certain areas of the landscape. This discussion concurs with the biofuel discussion. So far, both non-profit nature conservation associations and the Swedish Environmental Protection Agency have in principle opposed a development of this type. The reason being that areas of intensive cultivation would mean a deviation from the principle of giving reasonable consideration to nature conservation everywhere in the forest. So why applaud the fact that some forest areas risk becoming even more depleted of biological diversity than they are today. If, on the other hand, a system had been available to **"exchange" increased production on certain areas for higher levels regarding biological diversity on other areas**, the system could presumably be tried out with an ambition for maintained and even increased biological diversity in the total landscape at the same time as total production could be increased. A concrete problem that strongly counteracts the realisation of such a system is that it is often not the same owner who manages the presumptive areas for intensive cultivation and the areas that are interesting for biodiversity. There is reason to investigate more closely through concrete scenario work the possibility of exchanging increased production in really trivial forests for increased protection and consideration in other forests.

Another complex problem that should be studied concerns south and central Swedish forests stemming from a pasture and agricultural landscape. Forests of this nature often contain actual or potential nature conservation values. The simplest nature protection solution here has mainly been **"free development"**. This solution is questioned today in many contexts by both nature conservation researchers and culture-historical researchers. Lost biological diversity and diminished culture-historical value may in many cases, but absolutely not in all cases, be the consequence of "free development". A certain timber takeoff may presumably in some cases result in forests being better able to maintain their biodiversity, culture-historical value and recreational value. Some research into this is already ongoing today, however, the nature conservation side and the production side should be better coordinated. It should also be mentioned in this context that very trivial forests that have long been exposed to "tough" forestry **may be restored** to some extent with directed efforts. Research of this nature is in progress and could be combined with studies of the changeover to energy-focused forestry.

In the agricultural landscape the issues are rather different compared with forest land. In some cases, it is so much clearer here that energy production with the right aim can produce several other positive environmental effects. For example, different experiments have been ongoing for about twenty years, albeit on a small scale, to **combine nutrient salt reduction with energy production and an increase in the landscape's biodiversity.** It is a question of wetlands, existing or newly established, where hay-cutting regimes can produce shore meadow environments which are valuable for several threatened wetlands organisms, not least wading birds and ducks. The art is to find the right sort of grass or sedge vegetation that can be used for both a reduction of nutritive substances and for biofuel production and also be positive for biological diversity. In these contexts it is perfectly clear that the system of control instruments has not yet managed to encourage the right combinations of energy, reduction and biodiversity functions.

Also in farms with a more conventional focus carrying on beef production based on natural pastures, **pasture production** could have a concertina effect. In years with weak pasture and grazing production, the "energy pasture" could be included in meat production while, in productive years, this pasture could be used for biofuel production.

Various alternatives and combinations of agricultural crops and wetlands crops involve problems when it comes to **harvest, storage and extraction of energy.** Tree crops have therefore a short-term advantage. However, in their utilisation, products from agricultural land and wetlands have an inherent flexibility that may be of great value for nature and culture conservation. Harvest, storage and conversion methods are therefore of major interest outside the narrow biofuel sector.

A concrete problem that concerns management of arable land for biofuel production is where fast-growing trees such as **Salix and Populus should be placed in an agricultural landscape.** More in-depth studies are needed into both environmental optimisation and possibilities of finding adequate control instruments for their location in the landscape.

Cultural values and recreational values are very important landscape values, often combined in some way with nature conservation values. It is essential that these values are also clearly included in any investigation work and scientific studies that need to be carried out in order that biofuel production and biological diversity can be combined in the landscape.

The international connection should also be mentioned in this context. A special effort in Sweden, on the one hand regarding biofuel production and, on the other, concerning the interplay between other environmental aspects may lead to considerable future exports of services. There is probably every reason to initiate as soon as possible international research cooperation with countries with warmer climates.

Plan but protect private initiative!
This is probably a main issue as regards responsible management of biofuel production in this country in relation to biodiversity values but also to cultural and recreational values. Thus, systems for physical planning are needed and relatively strong control instruments linked to these. But, at the same time, private initiative must be protected and encouraged. This is not an easy equation to solve. Ecological forest landscape planning may be seen as one of several sources of inspiration, as also several successful municipalities where town-country planning has worked well. Kristianstad with its Vattenrike may be mentioned and Örebro with its extensive restoration project. A number of rural development projects may also be seen as sources of inspiration, for example Bråbygden in the county of Kalmar.

Separate statement of opinion to the Commission on Oil Independence

Christian Azar, Chalmers University of Technology

I share the Commission's conclusions and objectives in most areas. However, I would like to express some dissentient views. I refer on the one hand to the issue of international trade in ethanol and, on the other, to views on corn-based ethanol and RME.

Tariff-free imports of ethanol from tropical countries

A considerable share of the biofuels used in Sweden today is supplied through imports. In the light of this, it is important to review the trade situation. However, the Commission has chosen not to side with tariff-free imports of ethanol from countries outside the EU. I am of the view that the Commission should have clearly supported free trade for ethanol and biofuels in general. This issue is important for several reasons:

1. It is important in principle. Sweden has traditionally advocated free trade. We participate in the WTO negotiations where we demand that the developing countries open their markets. There is broad agreement that our prosperity is partly based on free trade, and this should be so in this case too, particularly since it is the developing countries that have a great deal to gain from the issue. We cannot expect Brazil to buy our lorries without tariffs and at the same time insist on tariffs on fuel which they can produce at lower cost.

2. Production costs for Brazilian ethanol based on sugar-cane are considerably lower than for corn ethanol (which probably applies to production in other tropical countries too).

3. Sugar-cane ethanol in tropical countries has a much better area efficiency than corn ethanol or RME in Sweden/EU. It may be a question of three to six times higher net yield from biofuels per hectare.

4. Sugar-cane ethanol in tropical countries has considerably better energy efficiency than corn ethanol or RME. This means that the indirect CO_2 emissions linked to production will be lower if we choose to open up for free trade. When opportunities for Swedish imports of ethanol from countries outside the EU became considerably limited, it led to extensive imports of ethanol from Europe instead, whose CO_2 emissions are half as great or even equally as great as if petrol had been used. (The exact figures vary a great deal depending on system limits, which energy system there is in the background and how by-products are counted. It should be noted in this context that the ethanol factory in Norrköping has considerably lower CO_2 emissions than wine ethanol and corn ethanol in the US since the energy for production of ethanol in Norrköping comes from bioenergy.)

Thus, it is not just a question of fundamental principles of trade policy but also the fact that regarding ethanol free trade can make it easier, cheaper and more environmentally friendly to achieve the Commission's ambition for reduced CO_2 emissions and oil independence than if we develop support systems that lead to investments in corn-based ethanol and RME.

From this perspective, there is also reason to feel some hesitance about the Commission's objective for *domestic production* of biofuels of 12-14 TWh/year. Given that the first generation of domestic fuels can scarcely reach this goal (half of Sweden's acreage of arable

land would be required), of which the Commission is aware, and that it is still unclear how efficient (regarding both costs and technology) the second generation of fuel will be, there is no reason to bind ourselves to this objective. It would have been better to have an objective of 12-14 TW/year use of biofuels in Sweden. If it subsequently proves more efficient for Sweden to import ethanol from the tropics and export pellets to the continent for heating and power production, there is no reason to counteract this.

Lastly, it should be noted that sugar-cane ethanol will also require large acreages, if not just Sweden but most of the world were to aim for biofuels. For example, if the entire European fleet of private cars were to be run on ethanol today, it would require roughly ten times more land than the whole of Brazil's sugar-cane production uses today (half of which is used for ethanol production). Thus, in the long term there may be considerable problems with environmental protection and nature conservation. The problem does not just concern sugar-cane ethanol but also the fact that demand for bioenergy at the global level may be expected to be many times greater than potential supply in the next fifty to a hundred years.

Measures may already need to be introduced to protect nature and poor farmers in the third world, although a tariff at the present time is not the right instrument. It is the overall demand for land for food, timber and bioenergy that is the decisive driving force and a tariff on ethanol imports is not a good solution to this much larger complex of problems, especially bearing in mind that sugar-cane ethanol is energy-efficient use of land. A detailed analysis is required of the control instruments that could be used but it might be a question of certification systems, national frameworks of rules for protection of sensitive ecosystems and for protection of poor farmers in the South, and in a much longer perspective possibly energy tax on bioenergy.

Views on corn ethanol and RME

The other matter on which the Commission and I have somewhat different opinions concerns biofuels from traditional agricultural crops in Sweden (above all corn ethanol and RME based on rape-oil). I am of the view that the Commission should have made it explicitly clear that corn ethanol – or RME plants – are not an attractive strategy from the climate and oil replacement point of view. These fuels have neither sufficiently good energy and area efficiency nor sufficiently low production costs to be able to compete with other biofuels in the long term.

I have no objection to building a few plants in the initial phase – these plants could be regarded as part of a strategy to start a market, etc. – but a continued expansion of such plants as we are now seeing is not a sustainable path forward. Furthermore, the build-up of an industry of this type would strengthen the forces lobbying for continued high subsidies and tariffs on ethanol from tropical countries.

There is also the risk of a backlash affecting all biofuels, particularly if we continue to import and *subsidise* biofuels from the *EU* with CO_2 emissions that are half as high or even almost equally as high as emissions from petrol.

Biofuel policy is complicated and there are risks of impasses. These must be explicitly discussed. The Commission would like to see higher admixture of RME. A possible alternative strategy would be to reduce the admixture of RME and increase imports of ethanol from the tropics to the corresponding extent. This would lead to the same reduction in the use of oil, reduced CO_2 emissions and resources left to develop the second generation of fuels.

Sweden's strategy for production of domestic biofuels should mainly focus on these second generation fuels, that is to say ethanol from cellulose or biofuels produced through gasification, for example DME or methanol, and it is then a question of support to demonstration and prototype facilities and measures to enable market introduction. Thus, in these respects I share the Commission's assessment.

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Assembly Research Paper on the Climate Change Bill in the Scottish Parliament

Climate Change Bill in Scottish Parliament
Jeff Mochan, Research Officer
22 June 2009

The purpose of this note, prepared for the Committee for the Environment, is to outline the main provisions in the Climate Change (Scotland) Bill to date. This note covers:

- The Bill as introduced in December 2008.
- The Bill as amended to date, after Stage 2 consideration.
- Likely amendments already expected at Stage 3 consideration.

Bill as Introduced[1]

The aim of the Bill is to establish a framework to drive greater efforts at reducing Kyoto Protocol greenhouse gas emissions in Scotland by creating mandatory climate change targets to reduce Scotland's greenhouse gas emissions.

The main policy areas covered in the Bill, as introduced, are outlined below.

Part 1 – Emissions Reduction Targets. The Bill:

- Creates the statutory framework for greenhouse gas emissions reductions in Scotland, setting reduction targets of 50% for 2030 and 80% for 2050.
- Requires Ministers to set annual targets, in secondary legislation, for Scottish emissions from 2010 to 2050.

Part 2 – Advisory Functions. The Bill contains provisions to allow Ministers to establish a Scottish Committee on Climate Change, or designate an existing body to exercise advisory functions.

Part 3 – Reporting Duties. The Bill places duties on Ministers to report regularly to the Scottish Parliament on Scotland's emissions and on progress made towards the emissions reduction targets.

Part 4 – Duties of Public Bodies. The Bill contains powers to allow Ministers, by order, to:

- Impose climate change duties on public bodies.
- Issue guidance to those bodies relating to their climate change duties.
- Require those bodies to report upon discharge of those duties.

Part 5 – Other Provisions.

- Chapter 1 – Adaptation. The Bill requires Ministers to lay climate change adaptation programmes before the Scottish Parliament.
- Chapter 2 – Forestry. The Bill will allow modification by secondary legislation of the functions of the Forestry Commissioners to enable the Forestry Commission in Scotland to play a greater role in tackling climate change.
- Chapter 3 – Energy Efficiency, Energy Performance of Existing Non-Domestic Buildings and Renewable Heat. The Bill:
- Requires Ministers to produce an action plan setting out their current and proposed measures to promote the energy efficiency of buildings in Scotland, as well as measures to encourage behavioural change towards energy efficiency.
- Contains measures for assessing the energy performance of existing non-domestic buildings in order to raise awareness of the contribution that those buildings can make to

mitigating climate change through reducing energy demand and, thereby, emissions of greenhouse gases.

- Places a duty on Ministers to take such steps as they consider appropriate to promote the use of heat from renewable sources.
- Chapter 4 – Waste Reduction and Recycling. The Bill will enable Ministers to make regulations on waste reduction and recycling by different methods.

Bill As Amended To Date[2]

The main changes to the Bill, following Stage 2 consideration, are outlined below. Note that the Stage 3 debate in the Scottish Parliament is scheduled for 24 June 2009.

- Part 1 – Emissions Reduction Targets

Interim target:

- The interim target has been set for 2020, at a level of 34% lower than the baseline.
- Ministers are enabled to modify the target to a higher figure.

Setting annual targets:

- Annual targets set for each year in the period 2011-2019 must be set at a consistent rate of reduction to allow the interim target to be met.
- Target-setting criteria include the likely impact on jobs/employment opportunities, those living in poorer/deprived or island communities, and environmental considerations (in particular, biodiversity).
- Annual targets can be modified. In addition:
- Where this is done, Ministers must lay a report before the Parliament explaining why that modification has been made and make a statement to the Parliament on that report.
- Where a different modification is made to that recommended by the relevant body, Ministers must lay a report before the Parliament explaining their reasons and make a statement to the Parliament on that report.
- Where the date to set an annual target has been missed, Ministers are allowed to set a date as soon as practicably possible.

Advice before setting annual targets:

- Ministers are required, before setting annual targets, to publish advice received from the relevant body.
- The relevant body must express a view as to whether the annual targets are appropriate and to explain that view by reference to the target-setting criteria.

Net Scottish emissions account and carbon units and carbon accounting:

- The ‘domestic effort target’ has been introduced to ensure that the reduction in climate contribution is through predominately domestic sources rather than through international credits.

- The net amount of carbon units that may be credited to the account must not exceed the 'allowable amount' which is defined.
- Ministers cannot credit carbon units to the net Scottish emissions account in the period 2010-2012, and the amount of units that can be credited to the account for the period 2103-2017 is subject to a limit of to up to 20%.
- Ministers can modify the use of carbon units and take advice before setting or modifying such limits; the Advisory Body is required to express a view on the extent to which the annual targets should be met by the use of carbon units.

Scottish share of emissions from international aviation and international shipping:

- An Order, by which Ministers may make provision regarding greenhouse gas emissions from international aviation and international shipping attributable to Scotland, must be laid before the Parliament no later than 1 June 2010.

Part 2 – Advisory Functions

Functions of advisory body:

- The functions of the Advisory Body include providing advice, analysis, information and other assistance to Ministers in respect of Ministers' functions under the interim target.

Advice on annual targets:

- The provision for the Advisory Body to express a view on the contribution of 'sectors of the Scottish economy' towards meeting the annual targets has been replaced by a more specific requirement for it to express a view on how the energy efficiency, energy generation, land use and transport sectors can contribute to greenhouse gas emissions reduction.
- The Advisory Body is required to express a view as to 'what' annual targets are appropriate, rather than 'whether' annual targets are appropriate.

Part 3 – Reporting Duties

Reports on annual targets:

- The report on annual targets not only states the amount of the net Scottish emissions account for the target year, but also:
- The proportion of the reduction in the net Scottish emissions account which is accounted for by reductions in net Scottish emissions.
- The amount of the net Scottish emissions account for each preceding target year and the cumulative amount of the net Scottish emissions account for the target year and all preceding target years.
- The average greenhouse gas emissions per megawatt hour of electricity generated in Scotland in the target year.
- The average greenhouse gas emissions per megawatt hour,and the estimated lifetime cumulative emissions, of any new electricity generation capacity greater than 50 megawatts approved in Scotland in the target year.

- If any adjustment is required to the annual target because the method of measuring or calculating net Scottish emissions changes, Ministers must state, in their report to the Parliament, why the adjustment is required, the adjustment required, and the adjusted amount.

Reports on emissions attributable to Scottish consumption of goods and services:

- Ministers are required to lay before the Parliament an annual report on the emission of greenhouse gases (whether in Scotland or elsewhere) which are produced by or otherwise associated with the consumption and use of goods and services in Scotland during that year.

Reports on interim and 2050 targets:

- Ministers are required to lay a report, no later than 31 December 2015, before the Parliament on the progress being made towards meeting the interim target, stating whether the progress being made is consistent with a reduction over time to meet both the interim and the 2050 targets.
- Reports on the interim and 2050 targets must state the cumulative amount of the net Scottish emissions account.

Provision of further information to the Scottish Parliament:

- Parliamentary scrutiny of the various reports required under the Bill has been increased:
- Ministers must send 'immediately', to parliamentary committee Conveners, copies of the reports on annual, interim and 2050 targets, proposals and policies for meeting annual targets, and proposals and policies to compensate for excess emissions.
- Ministers must have regard to any resolution or report of a parliamentary committee on these reports.
- Ministers must attend the appropriate parliamentary committees, if invited to do so, to give evidence on the report.

Part 4 – Duties of Public Bodies

Duties of public bodies relating to climate change:

- Public bodies are required, in exercising their functions, to act: in the best way calculated to contribute to the delivery of the emissions reduction targets; in the best way calculated to help to deliver any adaptation programmes; and in a way that it considers is the most sustainable.

Guidance to relevant public bodies:

- Ministers now 'must' give guidance to relevant public bodies, and those bodies 'must' have regard to such guidance.

Reporting on climate change duties:

- Any public body found to be failing to comply with its climate change duties must prepare a report on the action it is taking to comply with those duties in the future.

Part 5 – Other Provisions

Chapter 1 – Adaptation:

- The adaptation programme laid before the Parliament must include arrangements for involving employers, trade unions and other stakeholders in meeting adaptation objectives, and mechanisms for ensuring public engagement.
- Ministers must report on progress towards implementation of programmes for adaptation, progress towards implementation of programmes for adaptation, and on programmes for adaptation, in order to strengthen the Government's approach to adaptation, increase scrutiny, accountability and provide for an annual report on its adaptation programme.
- Ministers are required to lay a land use strategy, including objectives for sustainable land use, before the Parliament no later than 31 March 2011.

Chapter 2 – Forestry:

- The biodiversity duty, under the Nature Conservation (Scotland) Act 2004, is applied to any such body, trust etc formed by the Forestry Commissioners.

Chapter 3 – Energy Efficiency, Energy Performance of Existing Non-Domestic Buildings and Renewable Heat:

- The plan for promoting energy efficiency must now include improving the energy efficiency of living accommodation and must set annual energy efficiency targets.
- The definition of 'energy efficiency' has been extended to include 'surplus heat from electricity generation or other industrial processes for district heating or other purposes'.
- Ministers are required to prepare and publish a plan for the promotion of the use of heat from renewable sources, including targets for the percentage of heat to be produced from renewable sources and a date set by which such targets should be met. Ministers must make a statement to the Parliament on the plan.
- Ministers are required to provide (or revise existing) guidance on the conditions to which consent will be granted for the construction of new, or the extension of existing, energy generating stations of a capacity greater than 50 megawatts.
- Ministers 'must' provide for the assessment of the energy performance of non-domestic buildings, and the emission of greenhouse gases produced by or otherwise associated with such buildings, or with activities carried out in such buildings.
- Owners of non-domestic buildings must comply with such assessments, and powers available to Ministers, to ensure compliance, are strengthened.
- Council tax can be reduced for energy efficient improvements to dwellings.
- The definition of 'maintenance', in terms of a tenement management scheme, in the Tenements (Scotland) Act 2004 includes installation of insulation.
- Ministers are required to amend the relevant legislation so that air source heat pumps, wind turbine micro-generation equipment within the curtilage of domestic properties, and

micro-generation equipment within the curtilage of non-domestic buildings is considered permitted development (will not need planning permission).

- Ministers are required to ensure that the energy performance of any newly constructed building that becomes part of the civil estate in Scotland falls within the top quartile of energy performance.
- The Bill requires Ministers are required to lay a report before the Parliament for each financial year (beginning 2010-2011) assessing progress made towards improving the efficiency and contribution to sustainability of civil estate buildings.

Chapter 4 – Waste Reduction and Recycling:

- Regulations on waste reduction and recycling are laid before the Parliament will be subject to a 60-day scrutiny period.
- The Order on the provision of information on waste must be laid no later than 1 year from the date of the Bill receiving Royal Assent.

Note, also, that after considerable debate at Stage 1, the Government announced that it would remove from the Bill the provision that would enable the Forestry Commissioners to delegate their functions, thus allowing it to lease out part of the forest estate. The Bill has been so amended.

Part 6 – General and Miscellaneous

- Ministers and the Advisory Body are required to take into account the way in which they exercise their functions (as conferred on them by the Bill) contributes to the achievement of sustainable development.

Additional Amendments Likely Before Stage 3[3]

At Stage 2, Ministers agreed to discuss, consider or act on the following amendments, at/before Stage 3, as outlined below.

Part 1

Ministers agreed to discuss amendments:

- That take account of the impact of greenhouse gas emissions that occur outside Scotland, but for purposes of providing goods or services in Scotland.
- On emissions reduction proposals in Scotland that do not adversely affect other countries.

Part 2

Ministers agreed to bring back amendments to:

- Require the Advisory Body's functions to provide advice on the interim target as well as advice on the effectiveness of Ministers' proposals and policies for achieving the interim and 2050 targets.
- Require the Government to define and quantify how various sectors are expected to contribute to overall emissions reduction.

Part 4

Ministers agreed to bring back amendments to require reports by public bodies on compliance with their climate change duties to contain information about the way in which procurement policies and wider workplace policies contribute to these duties.

Part 5

Ministers agreed to:

- Discuss an amendment to insert a public engagement strategy into the Bill.
- Bring forward an amendment to require Ministers to report on measures they intend to take to reduce emissions from non-domestic buildings, and when they intend to make provisions for powers to ensure compliance.

Agreement appeared to be reached on the principle of creating climate change burdens for a public body or Ministers to reduce greenhouse gas emissions.

[1] http://www.scottish.parliament.uk/s3/bills/17-ClimateChange/b17s3-introd-en.pdf

[2] http://www.scottish.parliament.uk/business/research/briefings-09/SB09-43.pdf

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Assembly Research Paper – The Carbon Trust in NI and the Public Sector

The Carbon Trust in NI and the Public Sector
Jeff Mochan, Research Officer
25 June 2009

The purpose of this note, prepared for the Committee for the Environment, is to:

- Outline reasons why the Carbon Trust in NI does not currently work with the public sector.
- Identify any barriers which might prevent it doing so in the future.

In 2008, Invest NI commissioned consultants to evaluate the Carbon Trust and other energy programmes/services. The final report of that evaluation included the following observations and recommendations.[1]

The Carbon Trust is funded mainly by Government to deliver programmes and services on its behalf. Funding is sourced from Central Government in GB, but a Government Agency (Invest NI) in NI. Annual business plans are developed by the Carbon Trust on a local basis, and agreed with each local funder.

The Carbon Trust (in the UK) developed the following key objectives, based upon the remit set for the Carbon Trust and the themes set out in the Climate Change Programme that it would be expected to cover:

- To ensure that UK business and the public sector contribute fully to meeting ongoing targets for greenhouse gas emissions.
- To improve the competitiveness of UK business through resource efficiency.
- To support the development of a UK industry sector that capitalises on the innovation and commercial value of low-carbon technologies nationally and internationally.

The Carbon Trust in NI was established in May 2002; it was mainly funded through Climate Change Levy receipts, but, since inception, Invest NI has supplemented this funding.

A key activity of the Carbon Trust in NI was a NI Energy Scoping Study, which established a robust analysis of final energy usage and carbon emissions in the industrial, commercial and public sectors. Subsequent activities have focussed on helping businesses reduce their energy usage, costs and carbon emissions, and serving as a catalyst for moving NI towards a low carbon economy.

The main aim of the Carbon Trust in NI was set to ensure that the work programme, to introduce low carbon technologies and practices into NI businesses as agreed with the Carbon Trust, is delivered efficiently and effectively for the benefit of NI businesses.

Over time, the aims of the Carbon Trust in NI were developed to include identifying and improving the energy efficiency of Northern Ireland industry, commerce and the public sector.

Invest NI is responsible for working in partnership with the Carbon Trust in NI to help promote/support energy saving projects within the business community and public sector, and so contribute to reducing carbon emissions, mitigating climate change. The Carbon Trust is the key programme in NI aimed at promoting and supporting energy efficiency in the industrial and commercial sectors.

2 strategies present opportunities for the Carbon Trust in NI, which is currently largely dependent on Invest NI for financial support:

- The DETI draft NI Strategic Energy Framework (launched in 2008).
- The forthcoming Sustainable Development Strategy for NI (currently being developed).

Current support allows the Carbon Trust in NI to deliver a range of activities and initiatives, but these are constrained, to a certain extent, in that they must be consistent with Invest NI objectives. By securing funding from other sources, the Carbon Trust in NI would be less constrained and less dependent on a single funding source.

Future support could be expanded; the report recommended that the Carbon Trust in NI should be encouraged to present opportunities to other parts of Government that deliver on the Sustainable Development Strategy for NI. This should include sourcing further funding to support the delivery of other areas of work which fall outside the remit of the support provided by Invest NI.

The conclusion reached by reading the report outlined above is that it appears that there is no reason why the Carbon Trust in NI cannot work more with the private sector, if it chooses to

seek additional funding options; indeed the Invest NI evaluation report recommends that the Carbon Trust in NI does so.

[1] http://www.investni.com/evaluation_of_ct_energy_programmes_final_exec_sum.doc

Notes of Meetings of Committee Visit to London

Meeting, Friday 19 June 2009 with Climate Change Mitigation and Land Use Unit London

Attendance:
Committee for the Environment

Mr Cathal Boylan Deputy Chairperson

Mr Roy Beggs

Mr Tommy Gallagher

Mr Alastair Ross

Mr Peter Weir

Alex McGarel Clerk

Sean McCann Assistant Clerk

Sue Christie Specialist Adviser

Climate Change Mitigation and Land Use Unit

Jonathan Mogford

The Climate Change Mitigation and Land Use Unit is a unit within DEFRA.

The Department of Energy and Climate Change (DECC) co-ordinates work in Whitehall on climate change. DEFRA'a role in this is twofold:

1. It is the lead in adapting to climate change

2. It deals with climate change mitigation in areas such as agriculture, waste and industrial gases.

The government focus is on the application of the duty of the Climate Change Act to get organizations to set out their approach to tackling climate change.

The main areas of the discussion with members were the co-ordination of the work into climate change, targets for individual departments, the possibility of fines for departments not meeting targets, the possibility of allowances being made for particular circumstances within regions, a

communications strategy, work with local government, the effectiveness of current structures, how government departments are adapting, emissions trading schemes and DEFRA's role in the preparation for the Copenhagen summit.

Jonathan stated that there is a lot of work ongoing on tackling climate change but that is particularly focused on England. Scotland are currently setting their own targets and DECC are leading discussions on UK level targets but the focus at the moment is on Whitehall departments. There is also work ongoing in relation to allowances for particular circumstances in regions.

There is a real need to improve the evidence base in relation to agriculture which is a big agenda to think about in terms of lower carbon.

A copy of the presentation by the Unit is attached.

Meeting, Friday 19 June 2009 with DECC

Attendance:
Committee for the Environment

Mr Cathal Boylan Deputy Chairperson

Mr Roy Beggs

Mr Alastair Ross

Mr Peter Weir

Alex McGarel Clerk

Sean McCann Assistant Clerk

Sue Christie Specialist Adviser

DECC

Mr James Hughes

Mr Phil Davis

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DECC'S three overall objectives are:

- To ensure energy is secure, affordable and efficient;
- To bring about the transition to a low-carbon Britain;
- To achieve an international agreement on climate change at Copenhagen in December 2009.

Mr Hughes stated that there is a lot of ongoing work with the devolved administrations which form part of the project boards. An energy and climate change strategy will be published mid July 2009.

Scotland is working on its own targets and Wales has just produced their own climate change strategy. The Northern Ireland targets are currently lagging behind the rest of the UK. DECC are willing to work with Northern Ireland officials and are keen to encourage NI officials to communicate with DEFRA.

The current focus of work is on areas such as decarbonising the electricity supply, changes in diets for cattle, accountability, the flow of information and work with the devolved administrations.

The main areas of discussion with members were DECC's role in the Copenhagen summit, cross departmental work on climate change, buy in from government departments and engagement with NI departments such as DETI and DOE.

Meeting, Friday 19 June 2009 with Rural Climate Change Forum London

Attendance:
Committee for the Environment

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Mr Roy Beggs

Mr Tommy Gallagher

Mr Alastair Ross

Mr Peter Weir

Alex McGarel Clerk

Sean McCann Assistant Clerk

Sue Christie Specialist Adviser

Rural Climate Change Forum London

Mr John Gilliland

Mr Zitouni Ould-Dada

Mr Jeremy Eppel

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managers, acts as a catalyst and coordinator of work on climate change in the rural sector, advises Defra on rural climate change policies, helps ensure that policies are sufficiently ambitious and will lead to real results, and advises on research priorities to build a stronger evidence base on reducing greenhouse gas emissions from agriculture and managing the impacts of a changing climate.

The work of the Forum is central to Defra's Agriculture and Climate Change Project, under the Farming for the Future Programme. The Forum was formed in March 2005 and its current term ends in October 2008. John Gilliland is the Forum's Chair.

The Forum has 3 key roles:

1. To look at the evidence base of climate change research and make recommendations to government as to how gaps can be filled.

2. To communicate this information.

3. To advise on policy.

Mr Gilliland stated that carbon dioxide is not the biggest issue within agriculture, methane and nitrous oxide are more potent and need to be addressed.

Food security in Europe will be at threat by 2080 and agriculture will be a particular focus at the Copenhagen summit. There is a need to coral the evidence basin in Northern Ireland and DARD has a role to play in tackling climate change. At the moment there is a lack of information out there and even the agricultural media do not have a great understanding of the issues.

The main areas of discussion with members were roles and responsibilities, information and communication, current structures and the key issues for Northern Ireland

A copy of the presentation by the Forum is attached.

Meeting, Thursday 18 June 2009 with Environmental Audit Committee London

Attendance:
Committee for the Environment

Mr Cathal Boylan Deputy Chairperson

Mr Roy Beggs

Mr Tommy Gallagher

Mr Alastair Ross

Mr Peter Weir

Alex McGarel Clerk

Sean McCann Assistant Clerk

Sue Christie Specialist Adviser

Environmental Audit Committee

Mr Gordon Clarke Clerk

Richard Douglas Specialist Adviser

The Environmental Audit Committee (EAC) was established by the Labour Government when it came into power in 1997 in accordance with its manifesto.

The Committee is allowed to interpret its terms of reference itself and so has latitude to focus on the issues it feels are the most important of the day.

To date EAC has focused on monitoring the operations of government such as the sustainability of the government estate targets. These have been independently scrutinised by the Sustainable Development Commission.

To date monitoring has been good but to date this has not translated into a resultant change of government behaviour.

The priority of the EAC for the life of this Parliament is climate change. It has looked at biofuels, personal carbon trading and emissions from shipping and is currently looking at forestry, emissions trading, carbon budgets and green jobs. As a rule it would have 4 -5 inquiries as a top priority with a longer list ongoing.

The EAC is made up of 16 members. This is larger than most select committees and carries a risk of being unwieldy however there tends to be an active core of 6-7 well informed members with a high level of interest. The set up of the EAC makes provision for the Minister of the Environment to be a member but in practice this does not take place.

EAC has been set up along the same principles of the Public Accounts Committee but without the level of support from the National Audit Office. Consequently it works more like a regular select committee and its inquiries tend to have been more policy focused.

In theory the EAC has a staff of 7 but in practice the main team comprises 2 clerks and 2 specialists with admin support as required. The specialists are appointed to bring the Committee up to speed on issues quickly and ensure it is meeting the right people during its inquiries. Staff impartiality is seen as important and the work of the Committee is member-led.

The relationship the committee has with the devolved regions is often not straightforward; devolution settlements were not symmetrical across the regions. To date the EAC has only tended to cover DAs where issues are reserved.

The Government responds to EAC reports within 2 months but the EAC are not always happy with the quality of response.

The EAC made the following observations in response to Members' questions:

All attention to date tends to have been on mitigation. More work needs to be done on adaptation to climate change.

Devolution makes some processes tricky. Where the terms of reference of an inquiry are for a reserved issue, such as fiscal policy, their UK-wide action is straightforward, for other inquiries, such as the ongoing one on green jobs, activity in the devolved regions is less clear cut.

The creation of DECC has created more leverage but Treasury is still a big stumbling block and the silo mentality of Departmental structure has not yet been overcome. There is need for the top leaders of Departments to understand the importance of climate change within their remits. There are still a lot of links to be made.

Regulation gives confidence to businesses and encourages them to adopt green models into the future even when market signals make this difficult.

EAC hoping to do more post legislative scrutiny in future, e.g. 3-5 years after an Act has been introduced.

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A copy of the presentation by the Forum is attached.

Environment Committee Visit to Climate Change Unit Power Point Presentation

"Climate Change" & the Agriculture, Forestry & Land Management Sector (AFLM).

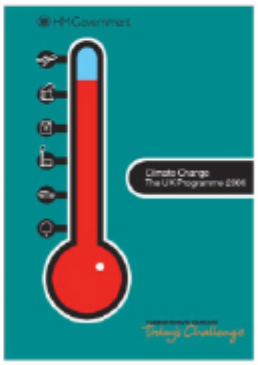
Dr John Gilliland OBE

Chairman, Rural Climate Change Forum, London

June 2009

Rural Climate Change Forum

- **Established** in 2005 – England Only
- **High level Forum** for dialogue on GHG mitigation & Climate Change adaptation
- **Advises** on **Research**, **Policy** and **Communications** to Government, Rural Stakeholders & Internationally
- **Membership** - Leaders from the breath of Rural Stakeholder Organisations
- Helps **steer** the delivery of **UK Climate Change Programme** & **Committee on Climate Change's** first report to Government (Dec 2008).



The Climate Change Message
"UK Agriculture is a Net Emitter of GHGs"

- 7% of UK GHG emissions (21% of NI's)
- 1% of UK carbon dioxide emissions
- 40% of UK methane emissions
- 60% of UK nitrous oxide emissions

NB – Methane is 23 times more potent than CO2
- Nitrous Oxide is 296 times more potent

Atmospheric concentrations of these three gases were stable for thousands of years before growing rapidly following the Industrial Revolution from 1750 onwards

Office of Climate Change

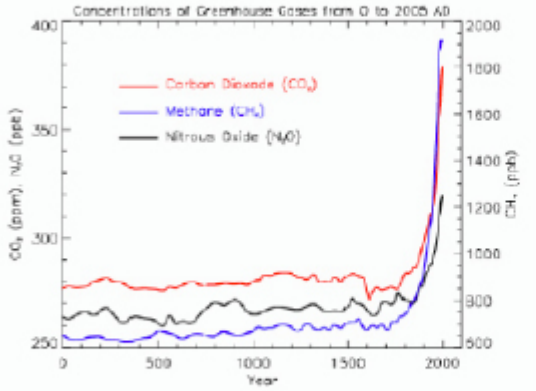


Figure shows changes in the atmospheric concentrations of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) over the past 2000 years.

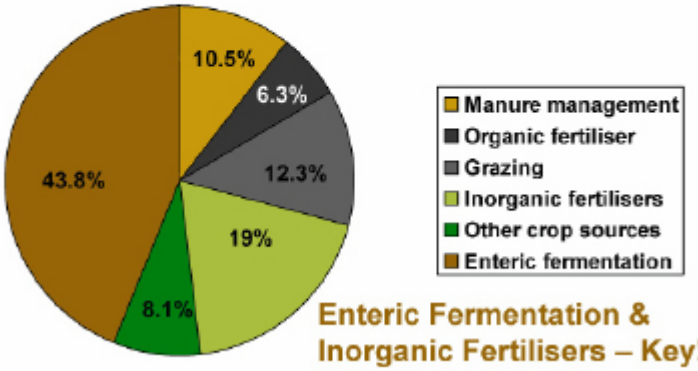
(Measurements are determined from ice cores and atmospheric samples.)

The growth in concentration of carbon dioxide, methane and nitrous oxide after 1750 is consistent with the expansion of human activities resulting from the Industrial Revolution

Figure taken from the IPCC Fourth Assessment Report (AR4).

Where do the UK Agricultural GHG Emissions come from?

2005 – Carbon equivalent

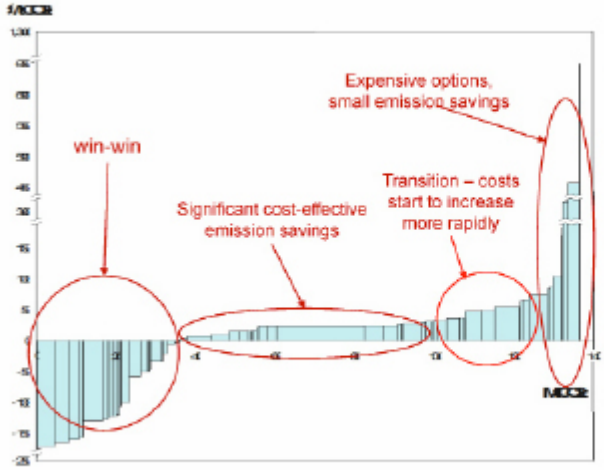


Enteric Fermentation & Inorganic Fertilisers – Key!!

Potential for GHG Abatement from AFLM Sector in UK

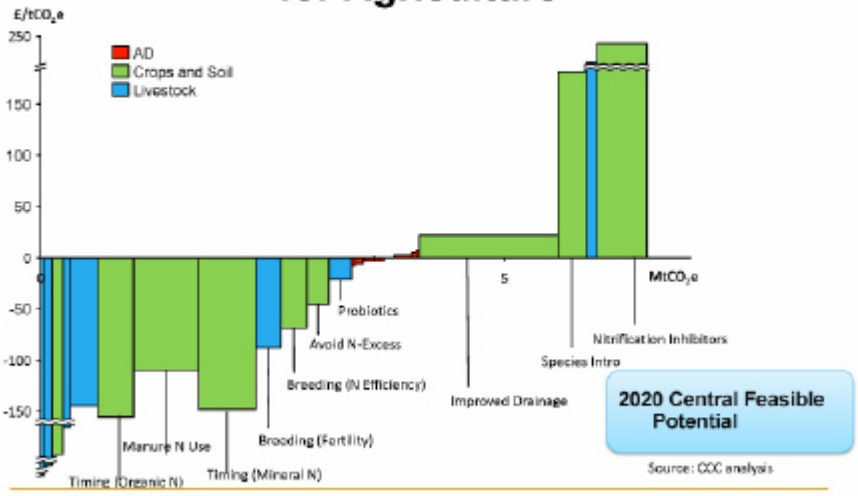
- **Realistic Abatement potential** of 10% to 15% by 2022 (IGER/ADAS 2007)
- **Committee on Climate Change 1st Report** (Dec 2008) suggested a **technical GHG Reduction Potential** of **13MtCO2e** per year by 2020 and a **Realistic Potential 6 MtCO2e per year**, depending on the balance of policy instruments pursued.
- **Potential** calculated through the construction of a **Marginal Abatement Cost Curve** (MAC) for Agriculture (SAC 2008)

Marginal abatement cost curves



- Options ranked in decreasing order of cost-effectiveness from L to R
- Width of each bar: abatement potential
- Height of each bar: cost-effectiveness

Marginal Abatement Cost Curve (MAC) for Agriculture



Source: CCC analysis

"Identification of Knowledge Gaps" Research Priorities

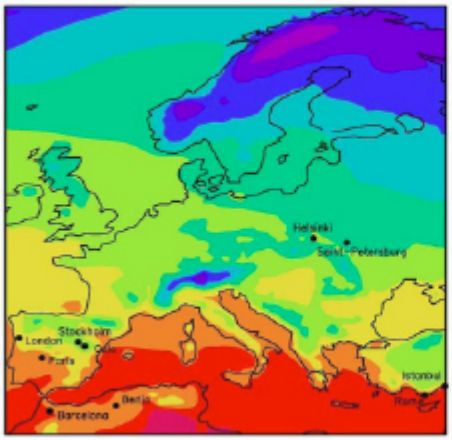
- **Timing** of mineral Nitrogen applications
- Use of **Nitrification Inhibitors/Slow Release** fertilisers
- **Carbon storage**, Forestry, Soils & Soil Emissions
  (No till/min till; Organic Soils)
- Manipulation of **Animal Diets** for methane mitigation
- The Role & Acceleration of **New Technology**
- Improvement in the **National GHG inventory**
- **Perverse Outcomes** due to interconnectivity of Sector

The Reasons for Farmers & Land Managers to Engage?

- **Sustainability** of the European & Global **Food Chains**
- New **Legislation** & **Policies**
- New **Market Place** Developments
- More **Extreame Weather** Events (Droughts, Floods)
- More **Pests & Diseases** (Blue Tongue, Brown Rot, etc.)
- Creating new **Knowledge** & **Jobs** in the "Green Economy"

Sustainability of the European Food Chain?

The climate map of Europe in 2080: high emissions scenario, based on temperature and aridity (but not rainfall)



The amount our climate could change is significant

Our natural environment is not adapted to the Climate of Southern Europe

This would mean significant changes to how we use land, and manage our water supply.

The affect on the more Southerly Countries will also effect us: trade and relations

International Centre for Research on the Environment and Development (France)
University of Bremen

The Challenges – Food Sustainability &/or Climate Change??!!

- By 2050 – **80% reduction in GHG Emissions**
- By 2050 – **World Population** increase from 6 **to 9bn**
- By 2050 – **Global temperature increase of between 2 to 4C**
- **1C increase in Global temp. reduces Global grain yield potential by 10%** as aridity moves out from the Equator
- **Fischer Boel** – "When it comes to food production & climate change, we are caught between the devil & the deep blue sea….. But we're not forced to accept either starvation or ecological disaster. We must find away to both feed ourselves & start to bring climate change under control." **11/05/09**

New Policies, The UK "Climate Change Act"

- The **first** in the **World & "Cross Party"** supported.
- **Compulsory Targets** to reduce GHG emissions by **80%** by 2050, against the 1990 baseline.
- Royal Ascent **Nov 08**, first report delivered on 1st of **Dec 08**, including targets for 1st three of the five year **Carbon Reduction Budgets**
- **Committee on Climate Change** set up to oversee & advise Government (Chair – Lord Adair Turner)
- Includes **all GHGs** (methane & nitrous oxide) & **all Sectors** of the Economy
- **2009 Budget** agreed GHG Emission Reduction Targets of **34% by 2022**, at end of 3rd Carbon Budget

UK Climate Change Programme included a commitment to……

Examine the scope and feasibility of a market-based mechanism to facilitate the trading of greenhouse gas (GHG) reductions from agriculture, forestry and other land management sectors

Is Emissions Trading for this sector possible?

Globally – Currently Chicago Carbon Exchange
New Zealand by 2013, England ????

First Analysis of Economic/Market Mechanism (NERA 2007)

- **Characteristics of Agriculture Sector make emissions trading difficult and expensive:**
  - Lots of (small) units, costly to administer
  - Many diffuse sources of emissions
  - Emissions vary depending on boundaries
- **But a project-based scheme could be possible?**
- **Looking one step back from producers could be possible?** (Feed, Fertiliser or First Processors)

The Consequence of Dietary change on Climate Change

The **food** we eat has a **large impact** on Climate Change

e.g. A Human **Carnivore** produces **1.5 tonnes** of CO_2e/year more than a **Vegan**

while a **4x4 SUV** produces **1 tonne** of CO_2e/year more than a **Toyota Prius Hybrid**

University of Chicago

But, be wary of the Perverse Outcomes!!!

- **UK Ruminant Livestock** production is **grass based**
- **Permanent grass** is an excellent **"Carbon Sink,"** and very good for **biodiversity**
- Uncontrolled **ploughing** of permanent grass will lead to **excessive GHG emissions** & **reduction in biodiversity**
- **Forced destocking** of livestock without behavioural **change in consumption** will lead to **exporting GHG emissions** from UK food consumption

New Market Place Developments!

Food Chain, Carbon Accounting – PAS 2050 Standard

- Facilitated by UK Government & British Standards
- Supported by Food Industry (Ass. British Agric.; British Sugar; Cadbury; Co-op; Innocent; Muller; Pepsico; Sainsbury; Tesco; M&S; MacDonalds)
- Indirect Landuse Change Consequences & On farm offsets?

Public Opinion – Tesco Survey

- 97% would actively seek low carbon products if same cost
- 35% would seek them even if more expensive

Walkers Crisps – Carbon Footprint Label

"A 35gram bag has 75grams of CO2"

Measuring Carbon Foot Print of a Dairy Product

Table 3.2 – Contribution to Swedish dairy chain emissions

%	91%	1%	4%	2%	2%	Not included in %
$kgCO_2eq$	11,873	102	523	250	255	643*
	Farm	In transport	Packaging	Processing (incl. waste)	Distribution	Consumer

Source: Milk and the environment (Swedish Dairy Association). Converted from liquid milk at 7.25% milk solids.

Product Life Cycle Analysis becoming the norm!

Projected Job Creation in UK Renewables by 2020, if 20% EU Target is to be met!

	Jobs	Jobs	Jobs	Jobs per MW
	EU27	UK	NI	
Offshore wind	154,180	251,280	1,400	10
Onshore wind	144,550	209,400	8,360	6
Tide & wave	19,270	41,880	2,790	10
Solar thermal	280,000	5,600	640	23
PV	245,000			34
Hydro	28,000	8,360	560	20
Geothermal	10,000			10
Bio-waste	264,000	13,960	830	20
Solid Biomass	264,000	19,540	1,230	22
Bio-gas	614,000	13,960	340	8
Total RES jobs	2,023,000	564,000	16,150	

Source: Renewable Energy Supply Chain in Northern Ireland, June 2008

Current Farmer Attitudes to Climate Change

- **Defra's 2008 Livestock Market Roadshow**

  Farmers cynical about climate change, keen not to recognise that it was happening, yet took 1400 leaflets on anaerobic digestion & nutrient management.

- **Farming Futures Attitudinal Survey, Sept 08**

  60% farmers - Climate Change is having **impact now**
  63% think **impact over next 10 years**

  36% taking action now to **adapt to the impacts**
  Main barrier - farmers don't believe they can do much

Explain "Best Practice"

A "Low Carbon Agriculture," Education & Extension Service??

- **Do not exceed** annual crop Nitrogen Requirement – (Role for Soil Analysis & Precision Farming)
- **Make full allowance** of Manure Nitrogen applied annually.
- **Timing & conditions** at Nitrogen application is essential.
- **Feed livestock efficiently** for yield & GHG reduction.
- **Use Genetics** to improve livestock efficiency & GHG reduction

Explain "Best Practice"

- **Use Anaerobic Digestion** to its full potential
- **Efficient management** of Woodlands & Grassland to maintain & improve **Carbon Sink**
- **Expand Bioenergy** Crops to displace fossil fuel emissions
- **Use of Energy Efficiency** & wider **Renewable Technologies**

Climate Change, Communication to the AFLM Sector is essential!

Act on CO2 Campaign

- Launched in 2007, 2009 – 2011 Campaign to target ***Climate Friendly Farming*** (still under construction)
- Target audiences: farmers, land managers, advisers, agents
- Message: Explain impact of N2O & CH4 emissions & what farmers can & will have to do to reduce them
- Activities to include :

  Articles in Media & Defra's Farming Link magazine
  Messages at Defra's key Public events (Royal Show)
  Signposting to information already available
  (e.g. Farming Futures) from Government websites

Climate Change Communication to the AFLM Sector is Essential!

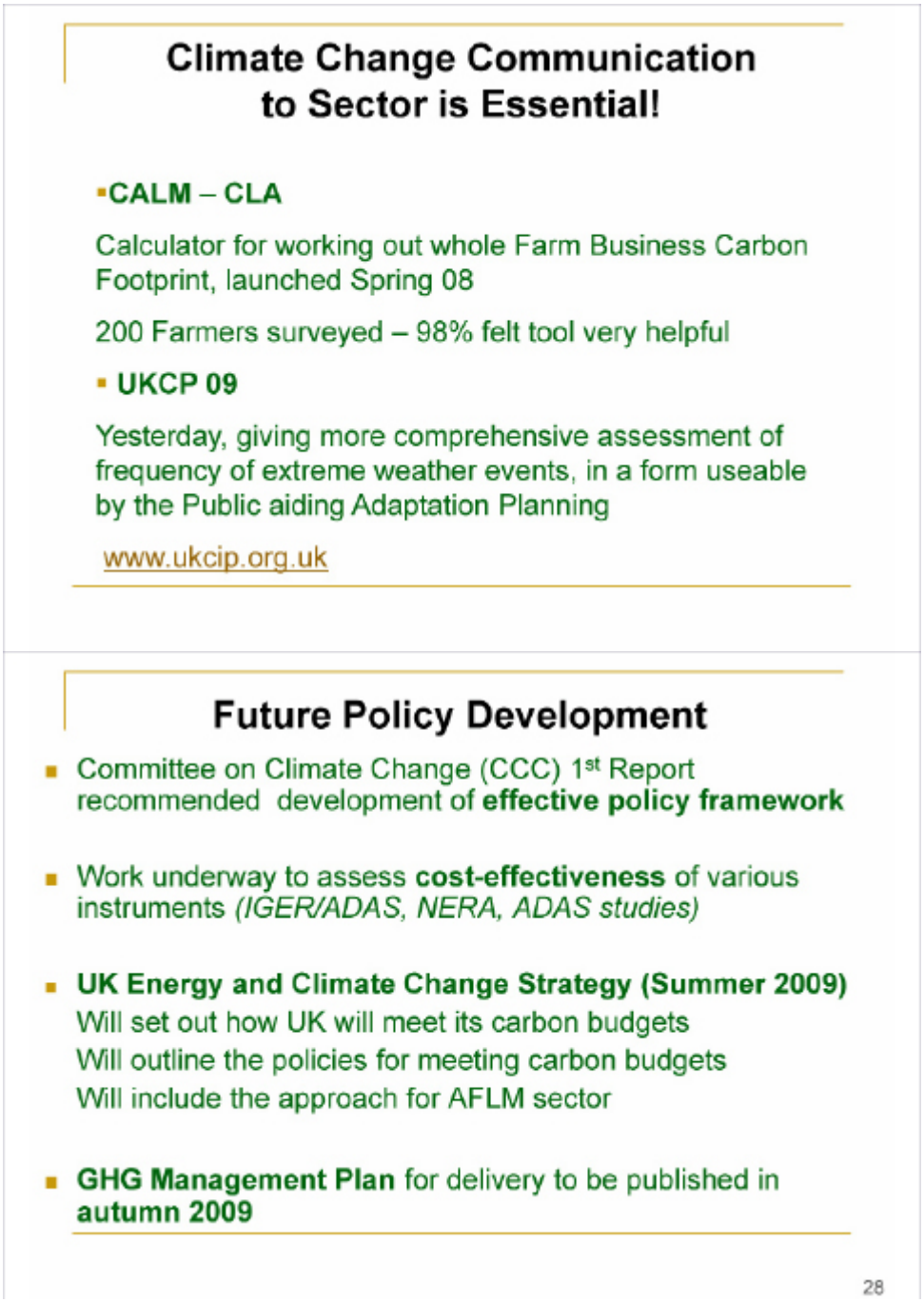
- **Farming Futures Project**

NFU, CLA, Applied Research Forum & facilitated by Forum For the Future using case studies & best practice

www.farmingfutures.org.uk

- **Climate Change Task Force**

NFU, CLA + Agricultural Industries Confederation,
Report published Dec 07 & disseminated to Sector



Environment Committees Visit to Climate Change Unit - Questions

During its visit to the Department's Climate Change Unit on the 25 June the Environment Committee was given a presentation by Brendan Forde covering the operational extent and functional role of the Climate Change Unit. Following the presentation, the Chairperson indicated that he wished to raise some questions on behalf of the Committee. However, he acknowledged that some of the questions had already been answered in the presentation and where this is the case it has been reflected below.

To consider:

Q.1 (a) How long has the Climate Change Unit been in existence (b) What is their budget (c) How many staff have they in place (d)What are their roles?

A.1.(a) The Climate Change Unit has been in existence since 2003.

A. 1.(b),(c)&(d) As per B. Forde's presentation on 25 June 2009.

Q.2. If the work DOE has done/is doing is likely to be enough for Northern Ireland to meet its obligations under the Sustainable Development Plan (25% reduction below 1990 levels in greenhouse gas emissions by 2025)?

A.2. Overall responsibility for the Sustainable Development Implementation Plan lies with OFMDFM. As per B Forde's explanation on 25 June, there is no road map to describe how Northern Ireland will achieve the target to reduce greenhouse gas emissions by 25% below 1990 levels by 2025.

Q.3. If DOE thinks the above Sustainable Development target is sufficient to ensure Northern Ireland contributes its fair share to the UK emissions reduction target?

A.3. There has been no determination made in Northern Ireland as to what is a 'fair share' of UK emissions. The UK emissions reduction target has not been allocated for each constituent country.

Q.4.(a) If DOE will introduce legally binding carbon/greenhouse gas emission reduction targets for Northern Ireland? (b) If not, how will Northern Ireland's contribution to the target be measured?

A.4.(a) The introduction of legally binding carbon/greenhouse gas emission reduction targets for Northern Ireland would be the collective responsibility of the Northern Ireland Executive.

A.4.(b) Northern Ireland's contribution to the overall UK greenhouse gas emissions is published in the annual Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland (latest edition – 1990 to 2006 available on the National Atmospheric Emissions Inventory website: http://www.naei.org.uk/reports.php?list=GHG).

Q.5. Has DOE approached the Committee on Climate Change to discuss targets/ monitoring/reporting/action plans from a Northern Ireland perspective?

A.5. DOE engages regularly with the Committee on Climate Change on a wide range of climate change issues including the above.

Q.6.Which other government departments has the Climate Change Unit worked with to date and on what particular climate change issues?

A.6. As per B. Forde's presentation on 25 June 2009.

Q.7. Does DOE have sufficient data to enable them to measure progress against targets?

A.7.Yes. As per B Forde's explanation on 25 June.

Q.8.What is DOE doing in cross-sectoral work to ensure other departments are able to contribute to their sectoral targets when established by the Committee on Climate Change in September?

A.8. DOE keeps other departments briefed on a regular basis on the work of the Committee on Climate Change. Functional responsibility for policy development remains with the relevant departments.

Q.9. Has any work been done by DOE on assessing the impacts of other government policies and strategies on climate change adaptation and mitigation?

A.9. DOE does not have the functional responsibility for this task nor does the Climate Change Unit have the resources to carry out impacts studies on other government policies.

Q.10. Is any work being done by DOE on integrated communications tying climate change issues to connected areas such as waste, energy, health and transport, with specific target audiences such as the public, business and other departments?

A.10. DOE does not have the functional responsibility for this task nor does the Climate Change Unit have the resources to carry out a full communications strategy.

Q.11. What consideration has DOE given to delivering/encouraging/supporting cross departmental working to deliver a better overall programme addressing multiple issues and identifying early, cheap actions?

A.11. The Programme for Government's target to reduce emissions is the collective responsibility of individual departments within their functional accountability. The Sustainable Development Implementation Plan describes cross-departmental actions on climate change. Overall responsibility for the Sustainable Development Implementation Plan lies with OFMDFM.

Q.12. Is DOE working with other jurisdictions and if so what conditions are taken into account to ensure Northern Ireland needs are taken into account?

A.12. As per B Forde's presentation on 25 June.

Sustainable Development Commission’s “Green New Deal" Papers

Green New Deal for Northern Ireland

Package 1: Housing

1. **Summary**

1.1. This paper sets out a costed and deliverable programme of housing measures to reduce waste in our use of energy, and particularly fossil fuels. This programme will maintain and create jobs; will reduce our current energy insecurity and safeguard our economic future; can be delivered using skills and companies already present in Northern Ireland; will reduce our CO2 emissions and assist in delivering carbon and renewables targets; will deploy mature, stable technologies that householders can trust; and can be afforded.

1.2. The Green New Deal housing programme:

- Can begin in 2009;
- Will sustain or produce 10,000 to 15,000 direct and indirect jobs – and skilled staff to fill these vacancies are already available in the Northern Ireland economy;
- Will save a net £700 million (NPV) over the lifetime of the measures, based on lifetime savings of around £3 billion (based on current energy costs) and a total financing requirement of £2.3 billion;
- Will be financed two-thirds by beneficiary households, with one-third from a Green New Deal finance package. This package might be purely government funding, of around £75 million per year. Work continues to assess scope for leveraging public money through bank borrowing. If this is possible, incremental public spend (over and above funding already available for some of this work from existing sources) might be small.

1.3. The maximum Northern Ireland Assembly contribution is therefore assessed as £75 million per annum. This means a maximum cost of £7,500 per job supported. In terms of a Recovery Plan for Northern Ireland, such an annual contribution is modest. This is particularly good value for money when set against the benefits to the wider economy and the environment, including meeting a range of existing departmental targets.

2. **The Green New Deal**

2.1. This paper is an Annex to [reference the Vision paper] which sets out at greater length the case for the Green New Deal in Northern Ireland. The key points of that wider paper are:

2.1.1. Northern Ireland is 99% dependent on imported fossil fuels. This is an economic time-bomb, rendering us particularly vulnerable to rising prices for fuel and carbon. So we need to invest to use energy more efficiently, and to de-couple from fossil fuels;

2.1.2. We have a large construction sector, which is suffering badly in the recession. We have spare skills available, today that could be usefully deployed;

2.1.3. Public expenditure will not be adequate to the scale of this task. Programme spend must be used to prime the pump for private investment.

2.2. There is a strong case to give housing measures (and specifically, energy efficiency) a high priority as part of a Green New Deal. Recent work by Lord Stern and Alex Bowen[1] assessed various possible stimulus interventions against two criteria: economic benefit (scored out of 12) and climate benefit (scored out of 6). The top measures, scoring 12 for economics and 5 for climate, were: residential energy efficiency; public building energy efficiency; and boiler replacements[2].

2.3. A note on sources. This paper has been produced by a group including the leading NI authorities on energy efficiency[3]. The key data source is the NI Housing Conditions Survey (NIHCS), one of the most robust surveys of its kind in the UK and Europe.

3. Current position

3.1. Overall, Northern Ireland's housing is at a similar efficiency level to the rest of the UK. However, our carbon footprint is the highest in

40 per cent house

The 40% house project demonstrated how it is possible to reduce the energy consumption in a range of residences by 60% through energy efficiency measures, technological improvements and demand management. The scenario focused on improving the building fabric of existing homes and recommends a long-term strategy for refurbishing the entire building stock.

Key elements of the 40% house scenario include:

- Raise the energy performance of existing housing stock to what is currently best practice
- The worst homes are replaced
- Lighting and appliances energy consumption are reduced to 44%
- Low and zero technologies are installed

Case studies included an 18th Century cottage; Victorian semi-detached houses; a 1920s semi-detached home; a 1930s mid-terrace; and a 1980s development home. (See www.40percent.org.uk for more information.)

[1] *An outline of the case for a green stimulus*, Nicholas Stern and Alex Bowen; February 2009

[2] The other priority measure is lighting and appliance replacement, but this is not included in the Green New Deal because of the limited labour input and benefits to the NI economy.

[3] Principally from the NI Housing Executive, Energy Savings Trust and the Utility Regulator, but the project has also benefited from input from Bryson House, NIE Energy Supply, Friends of the Earth, NI Federation of Housing Associations and the Construction Employers' Federation.

the UK, and energy costs are higher in part because of dependence on expensive heating oil (which is the main fuel for 70% of homes) and because of inefficient boilers. The current situation is described in Table 1 below.

Table 1

Current situation	
Measure	**Number of Properties**
Insulation	
Cavity wall insulation	75,000 homes have none
Solid wall insulation	75,000 homes have none
Loft insulation	500,000 homes have only up to 150mm 30,000 have none
Double glazing	130,000 have partial 98,000 have none
Heating type	
Oil	500,000
Coal	30,000
Electric	35,000
Dual/other	40,000
Gas	115,000
Wood pellet	2,000

Source: NIHCS 2006

Notes

3.2. There is considerable scope for improving energy efficiency through loft and cavity wall insulation. Few homes have the recommended depth of loft insulation (270mm).

3.3. Of the 500,000 homes using oil, around 400,000 have older, inefficient boilers. There is scope to replace these boilers with more efficient A or B rated oil-fired boilers, or convert to gas or bio-mass where appropriate.

Calderdale and Kirklees

The Calderdale and Kirklees Energy Savers (CAKES) scheme was launched in September 2000. By providing advice, registered installers, fixed discount prices, preferential credit facilities and cash backs this scheme offered householders in Calderdale and Kirklees financially viable, easily accessible and energy efficient heating and insulation measures. 1455 households were involved in the scheme and 2080 energy efficient measures were installed by 2003, saving home-owners £272,946. Estimated lifetime CO_2 savings are 34,304 tonnes.

The scheme concentrated on:

- Cavity wall and loft insulation
- Draft proofing
- Installing condensing boilers
- Heating controls

Alongside the fuel bill and CO_2 savings, CAKES has helped to develop an approved discount local installer network.

Building on the success of CAKES, Kirklees launched the Warm Zone project in 2007 to both tackle fuel poverty and contribute to further reductions in greenhouse gas emissions. Savings made from energy and water efficiency measures are reinvested in efficiency measures in other buildings thereby giving a continuous funding stream. In the first 18 months the scheme created 84 full-time jobs.

Sources: ManagEnergy Newsletter, Directorate-General Energy and Transport, European Commission, April 2009; and Kirklees Council.

4. Proposed programme of work

4.1. Table 2 below lists the recommended measures and technologies. We would stress again that none of these measures is technologically "cutting-edge" or experimental. These are stable, mature technical approaches that can be accurately costed and whose benefits are well known.

4.2. The side-bars in this document (on the 40% house and CAKES) describe previous projects that have successfully achieved similar consumer and economic benefits.

4.3. This paper is a pragmatic proposal – it focuses on immediately deliverable measures that will boost employment as well as cutting waste. The programme described is not a full response to the challenge of UK and EU targets, nor is it large enough for Northern Ireland to deliver its full share of savings to meet the Climate Change Committee's carbon budgets. Moreover, it does not deal with all possible energy efficiency and renewable measures. The programme will need to be kept under review as technologies "cross the bar" to being mature and stable, and as the scale of the challenge we face in the housing sector is confirmed.

Table 2

Recommendations				
Measure	**Proposed no. units**	**Future heat mix**	**Cost per unit**	**Total**
Insulation				
Cavity wall	75,000		£500	£40m
Solid wall (internal)	75,000		£6000	£450m
Loft (270mm)	500,000		£300	£150m
Heating conversion				
Oil – A & B rated boilers	150,000	250,000 A or B rated	£1,000	£150m
Gas	250,000	350,000	£2,500	£630m
Wood pellet	55,000	57,000	£5,000	£280m
Other	-	50,000	-	-
Renewables				
Solar water panels	200,000		£3,000	£600m
Total:				**£2,300m**

Notes

4.4. Solid wall insulation has been limited to internal measures to avoid potential planning and aesthetic difficulties often associated with external insulation.

4.5. For heating conversions it has been assumed around 50,000 home owners will be non-movers.

4.6. There is considerable scope for increasing the number of homes on gas. An ambitious target of a further 250,000 households using gas by 2020 has been adopted. This will require leadership from the Northern Ireland Assembly and Executive, and also from gas providers, if it is to be realised.

4.7. Efficient oil-fired boilers will be coming to the end of their useful lives during the course of the refurbishment programme. A rolling conversion of these boilers has been factored in. Building Regulations specify A or B rated boilers but in reality this is often ignored for retrofits in the private sector and it was felt that, in practice, enforcement was ineffective. An incentivisation scheme for replacing inefficient oil boilers would be very beneficial.

4.8. There is potential for increasing the number of homes with double-glazing but there are some difficulties with this measure. Not every home can cost effectively install double-glazing and there can be planning considerations, particularly with listed buildings and in conservation areas. In addition, the energy saving is at the lower end of the scale so the sub group felt it should not be a measure to take forward with the same emphasis that other insulation demands, hence it is not included in financial terms. However, it may be possible to consider a package which takes older homes with solid walls and

sash windows together.

4.9. The sub-group noted that extension of requirements for Energy Performance Certificates (EPCs) has scope to build consumer support for energy efficiency, as well as creating jobs. However, EPCs have not been included in the programme as a direct consumer benefit cannot be assessed.

4.10. Two technologies have been excluded at this stage, but should be kept under review:

4.10.1. Solar PV is considered not cost-effective at this time. However, introduction of a micro-renewables feed-in tariff is likely in GB and is under consideration in Northern Ireland. If such a tariff were to be introduced, consideration should be given to implementing solar PV in the programme (potentially, if some householders (of the 200,000 south facing roofs) wanted to use available funding for PV as opposed to Solar Thermal, they could be afforded that choice);

4.10.2. Heat pumps are currently undergoing trials by the Energy Savings Trust. Early indications are promising; if these are fulfilled, consideration should be given to including these in the programme.

5. Impacts

5.1. The impacts of the work programme set out above would be of three main kinds: jobs, consumer financial savings and carbon savings. The programme would also contribute to meeting a wide range of NI Assembly departmental objectives (Table 4 refers).

Jobs

5.2. Our overall view on employment impacts is that the programme could directly create at least 5,000 jobs, which might support a further 5,000 to 10,000 jobs indirectly. In total, 10,000 to 15,000 jobs.

5.3. We have found no direct assessment of employment effects in NI, but have triangulated to our view from the following:

5.3.1. The government of the Republic of Ireland plans to create 4000 jobs in fitting insulation to 50,000 homes through the investment of €100 million in one year[4]. Pro rata, an investment of €2.5 billion (£2.3 billion) over ten years would mean a programme 2.5 times larger, so 10,000 jobs;

5.3.2. Based on assumptions: that the overall cost of a medium-skilled employee is £40,000 all in; and that half of the total cost of a measure represents that labour cost, on average; we might calculate that £80,000 of spend supports one job for one year. So a programme delivering £2.3 billion over ten years - £230 million per year - might generate 2,875 jobs;

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[4], *National Insulation Programme for Economic Recovery*, Department of Communications, Energy and natural Resources 2009

5.3.3. The Sustainable Development Commission calculates that a UK-wide stimulus of £30 billion per year could create at least 800,000 jobs. Pro rata, spending £2.3 billion over 10 years (£230 million/year) would support around 6,000 jobs;

5.3.4. According to the Renewable Energy Association (Stimulus Proposal 2009) job creation figures can be multiplied 2 to 3 times to account for employment up the supply chain.

Carbon and Financial savings

5.4. Expected carbon and financial savings are set out in Table 3.

Table 3

Carbon and Financial Savings					
Measure	**Proposed No of Units**	**Total Annual Carbon Savings (tonnes C)**	**Total Lifetime Carbon Savings (tonnes C)**	**Total Lifetime Customer Savings (£ million)**	**Assumed lifetime of installed measure**
Insulation (including comfort)					
Cavity Wall Insulation	75,000	14,600	585,000	£242	40
Solid Wall Insulation (Internal)	75,000	47,200	1,417,000	£674	30
Loft Insulation (0-270mm)	30,000	9,600	382,000	£158	40
Loft Insulation (top-up)	470,000	34,200	1,369,000	£567	40
Heating Conversion					
Old Oil to A-rated Oil Condensing Boiler	150,000	25,800	309,000	£211	12
Old Oil to A-rated Gas Condensing Boiler	250,000	102,000	1,219,000	£855	12
Fuel-switching to Biomass heating (Wood pellet)	55,000	57,599	1,151,979	£445	20
Renewables					
Solar Water Heating	200,000	18,973	474,326	£241	25
TOTAL		**294,522**	**6,426,805**	**£3,014**	

Source: Energy Savings Trust 2009

Notes

5.5. Savings are based on Northern Ireland fuel and property splits from the NIHCS 2006, financial savings are based on Jan 2009 energy prices and carbon savings assume the same carbon factors as the Northern Ireland Sustainable Energy Programme (NISEP, previously the Energy Efficiency Levy or EEL).

5.6. Energy savings are based on data modeled for Buildings Research Establishment (BRE) for the GB Carbon Emission Reduction Target (CERT) programme. All insulation savings include a reduction for comfort taking.

5.7. Top-up loft is assumed to be a weighted average of top-ups from 50mm and 100mm of existing loft insulation.

5.8. An 'old' oil boiler is assumed to be 80% efficient on average (current UK stock average), while any new gas/oil boilers are assumed to be A-rated (replacement efficiency calculated as the sales weighted average of new oil condensing boilers from Oftec).

5.9. A 12-year lifetime for the installation of a gas condensing boiler in the calculations above, as this is the estimated lifetime of the boiler itself. However, it has also been assumed that this measure actually will involve extending the gas pipelines to a number of these houses, therefore enabling them to continue to use the cleaner natural gas even after their new gas boiler expires. So there would be a case for attaching a longer lifetime to this measure (NISEP/CERT use 20 years) and increasing the total lifetime savings.

Departmental targets

5.10. Table 4 sets out the wide range of departmental targets that would be furthered by implementation of the proposed programme.

Table 4

Departmental Targets Addressed by the Proposal	
Department	**Targets**
DARD	Rural poverty Biomass production
DEL	Employment Training and accreditation
DETI	Energy Strategy Job Creation Training and accreditation
DFP	Energy performance Reinforcing Building Regulations CMS Accreditation Register
DHSSPS	Health and wellbeing (includes objectives on Fuel Poverty)
DOE	Air quality

	Climate Change
DSD	Housing Fuel Poverty
OFMDFM	Sustainable Development Strategy Anti - Poverty Strategy

Summary of impacts

5.11. In short, we consider the programme would:

5.11.1. Produce substantial financial benefits (£700 million NPV) from reducing energy waste and avoiding imported and expensive fossil fuels;

5.11.2. Maintain or create at least 10,000-15,000 direct and indirect jobs;

5.11.3. Require an investment of around £2.3 billion over 10 years.

6. Implementation and financing

6.1. The sub group felt from experience that grant funding of around one third of costs is usually sufficient to unlock householder contributions for the remainder. Thus the sum requiring to be financed is one third of the total £2.3 billion i.e., around £750 million. (The actual contribution required from a householder would be less, if the household is economically vulnerable, but the average contribution will be around one-third.)

6.2. If the New Deal is to be wholly funded from public expenditure, then around £75 million a year over ten years might be required. However, a number of existing programmes provide some funding for energy efficiency measures (e.g., Warm Homes, Northern Ireland Housing Executive programmes, Northern Ireland Sustainable Energy Programme) and so incremental spending requirement might be somewhat less.

6.3. The Green New Deal Finance Sub-Group is in discussions with banks, whether existing or additional public funding could be leveraged through borrowing. Although this would increase the total long-term cost of measures, it might enable more to be deployed earlier and so bring forward the benefits. Given the additional benefits arising from maintaining employment through the recession, this merits consideration.

6.4. If bank lending is an important part of the Green New Deal funding package, this will affect implementation and governance. Given public sector borrowing rules, government is unlikely to be able to borrow itself without seeing an off-setting reduction elsewhere in its overall capital programmed. Lending would therefore be better arranged through an intermediary that could contract with government (as funding provider), with banks (as lender) and also with a range of delivery partners. (A PFI deal - where the public sector pays private contractors to achieve outcomes, and the contractor raises the capital itself – could be an alternative).

6.5. The identity and governance of this "intermediary" would be for further discussion. It must balance the need for general acceptability (which might rule out a profit-making body) with the need for a business-like and efficient approach. Housing Associations may be able to offer useful experience, given their substantial experience of "stretching" public money through private borrowing.


A
SUSTAINABLE
NEW
DEAL
A stimulus package for economic, social and ecological recovery
Sustainable
Development Commission

Foreword

There are always defining moments in the history of any dominant model of progress. It's hard to imagine how 2009 will not be seen, in retrospect, to be one of those moments. The combination of the severest economic recession since the 1930s, increasingly stark warnings from the scientific community about the risk of accelerating climate change, worsening environmental problems and resource shortages and the grave threat of widespread social disruption, leaves no room at all for business-as-usual mindsets or responses.

On a rather more modest scale, 2009 is also a defining moment for the current government. With little more than a year to run in its current term, it faces unprecedented challenges to its own credentials. But it is also presented with a unique opportunity to create lasting change and effect a vital transition to a sustainable low carbon economy.

It's against that backdrop that the Sustainable Development Commission has been developing its advice to Treasury and to Number 10 regarding the Budget on April 22nd. The 2008 Pre-Budget Report indicated some significant shifts in the direction of what we have called a 'Sustainable New Deal', but at nothing like the scale that is now required given such dire threats both to the global economy and to the global environment.

In short, this is a moment that demands unprecedented leadership, robust policy, and decisive action. This report sets out the framework for such a response, at a scale commensurate with the challenge, and provides a clear agenda for action. The economic crisis of 2009 has the potential to seed the economic opportunities of tomorrow. But it demands courage and vision today. That is our challenge to Government.

Tim Jackson, Economics Commissioner and
Jonathon Porritt, Chairman

Executive summary

On April 22nd, in the 2009 Budget, the UK Government has an unprecedented opportunity to bring forward a green recovery package that will transform the shape of the UK economy. This will make good, for the first time, on the extraordinary ambition levels to which this Government has committed itself over the last few years. Ministerial speeches at the Low Carbon Industrial Summit on March 9th could not have been clearer on that score.

"This transition to low-carbon is an environmental and economic imperative. It is also inevitable. There is no high-carbon future. Low-carbon is not a sector of an economy – it is an economy."

Lord Mandelson, BERR

"The science says we need to cut greenhouse gas emissions by 80% to avoid the most catastrophic and irreversible effects of climate change. We'll have 20% of current emissions, with an economy that we want to be three times bigger. It's not just a change, it's a transformation."

Ed Miliband, DECC

"We can now build a new green economy. Rise to one of the greatest peace time challenges of all, that will not only help our country prosper, but will build a better, more secure and more sustainable world."

Prime Minister **Gordon Brown**

The Sustainable Development Commission has been advising Government on both the scale and the scope of a proposed recovery package, and these are our principal conclusions and recommendations:

1 The Government should be prepared to commit up to £30 billion a year for the next three years on its green recovery package. This would represent around 50% of a total recovery package amounting to 4% of the UK's annual GDP.

2 We need to do this now to narrow the gap between ourselves and other OECD competitors. The total current commitment on green measures here in the UK amounts to 0.1% of annual GDP spread over three years. South Korea's green recovery package is 30 times larger, at 3% of GDP over the same time frame.

3 Without a commitment on this scale, there is every likelihood that the Government's low-carbon, sustainable measures will be totally overwhelmed by 'mainstream' (i.e. high-carbon and unsustainable) measures. Together with commitments made in the 2007 Comprehensive Spending Review, an investment strategy of the kind proposed would put the Government on track to achieving the extremely ambitious targets in the Climate Change Act.

4 The priority areas making up that package comprise:
- Upgrading existing housing stock
- Scaling up renewable energy supply
- Redesigning the national grid
- Promoting sustainable mobility
- Low-carbon investments in the public sector
- Skills for a low-carbon, sustainable economy.

5 Work in all these areas can start immediately, but over the next few years there will still need to be a major investment (by Government and employers) in skills for a sustainable, low-carbon economy. As both the TUC and employers have pointed out, it is foolish to go on willing the ends without willing the means.

6 More work will be needed on this, but provisional calculations suggest that a green recovery package of up to £30 billion a year for three years could create at least 800,000 jobs. More than 50% of the investments incurred under a programme of this kind would generate significant financial returns within a couple of years.

We are obviously aware of the fact that a 'Sustainable New Deal' of this scale and scope has significant implications for the Public Sector Borrowing Requirement. We have therefore argued that although there is now no alternative other than to fund such a package primarily through deficit funding in the first instance, it is crucial that the Government sets in place as speedily as possible a combination of alternative funding mechanisms including green taxation, green bonds and other 'invest to save' mechanisms.

In conclusion, the overall thrust of this document is clear: it is crucial for the UK to commit to a substantial recovery package for the UK economy, for the reasons spelled out many times by Government Ministers; at least 50% of that package needs to be focused on low-carbon and sustainable investments; this is the **only** way both to accelerate the journey out of the current recession, which will be painful enough anyway, and to avoid pitching us straight back into wholly unsustainable, consumption-driven, high-carbon growth. There is indeed no 'high-carbon future'.

And the Budget on April 22nd provides the obvious opportunity to stake out that critical strategic territory.

"Underlying all these measures is a common principle: the need to lay down now the infrastructure and the hardware to support a low carbon recovery and the green economy of the future."

Gordon Brown, Davos, 30th January 2009

1 Context

We are living through very difficult times. Global economic turbulence and the prospect of deep recession present an enormous challenge to government, to businesses and to households. But times of crisis are also times of opportunity, as the Prime Minister's Davos speech (cited above) affirms.[1] An unprecedented opportunity now exists to transform our economy and our society for the better.

A strong international consensus is emerging in support of a very simple idea.[2] Economic recovery demands investment. Targetting that investment carefully towards energy security, low-carbon infrastructures and ecological protection offers multiple benefits. These benefits include:

- freeing up resources for household spending and productive investment by reducing energy and material costs
- reducing our reliance on imports and our exposure to the fragile geo-politics of energy supply
- providing a much-needed boost to employment in the expanding 'environmental industries' sector [3]
- making progress towards the demanding carbon reduction targets established by the UK Climate Change Act
- protecting valuable ecological assets and improving the quality of our living environment for generations to come.

This paper sets out the SDC's position on the scope and scale of a green stimulus – an economic recovery package aimed at investment in the technologies and infrastructures needed for the transition to a sustainable, low-carbon society. The paper is framed around five key questions.

- How much has been committed to green recovery so far?
- What are the appropriate targets for green stimulus investment?
- How much should be spent on a green recovery package?
- Can this level of spending be justified in the UK?
- What are the likely returns in terms of jobs and other benefits?

The report summarises existing commitments to green recovery across the world and compares these to the green stimulus commitments in the UK. So far, it is clear that the UK lags some considerable way behind other countries in committing funds to green economic recovery.

The paper finds support for a strong emerging consensus on an appropriate target for such investments. As the Prime Minister has remarked, 'the contours of a resilient low-carbon recovery are becoming clear'. This 'green sweet spot' for investment includes retrofitting buildings (domestic and non-domestic) for energy efficiency, additional support for renewable energy technologies, encouraging sustainable mobility, modernising the electricity grid, and investing in eco-system protection and maintenance.

When it comes to the appropriate level of investment, the paper finds support for the view that up to 4% of annual GDP should be committed immediately to economic recovery. Estimates of the appropriate green content of this vary. Lord Stern has suggested a minimum of 20%. Green contributions across the world range from nothing at all to 80% of overall recovery packages. We present arguments here that at least 50% of

1 Remarks of Gordon Brown to the World Economic Forum in Davos, Friday January 30th 2009. Online at: www.number10.gov.uk/Page18201.

2 Initiatives include the American Recovery and Reinvestment Act (ARRA) 2009, UNEP's call for a global 'green new deal, the UK Green New Deal Groups 2008 report, work by the Deutsche Bank, the Aldersgate Group, HSBC Global Research, the Grantham Institute, the Center for American Progress, and elements of 'green stimulus' in economic recovery packages in countries as varied as China, South Korea, Australia and Denmark, including the UK's 2008 Pre-Budget Report and its forthcoming 'green industrial strategy'.

3 Globally, environmental industries are worth $4 trillion dollars already and are likely to expand by at least 50% in the next decade.

recovery packages should be devoted to green investments. **For the UK, this level of spending is equivalent to £30 billion per annum.**

There would be little point in this level of commitment if appropriate targets for funding could not be identified. There are some issues in the short-term in relation to implementation (and the appropriate skills training to achieve this). But the report finds clear evidence that across five target investment areas, a green recovery 'pot' could quite quickly become over-subscribed from legitimate calls for investment to meet key policy targets.

Returns from a green recovery package come in the form of direct financial returns (from energy savings), indirect returns to the economy from reduced emissions, greater energy security and improved quality of life, and social returns in terms of jobs.

In spite of these returns, there is clearly an issue for government in terms of raising this level of recovery funding. The report addresses four possible mechanisms for long-term funding of a green recovery. These include deficit spending, forms of environmental taxation, issuing green bonds, and models of energy service provision with a degree of public interest. In the short-term, the most likely route is through deficit spending. However, this option is clearly less favourable in the long-term and serious efforts should now be taken to explore the potential for the other three options.

In the UK, numerous calls for a green stimulus have already been made. Back in mid-2008, the UK-based Green New Deal Group published a landmark report calling for a concerted policy response to what they called the 'triple crunch' – the credit crisis, energy security and climate change.[4] The report stimulated much of the more recent thinking around a global Green New Deal.

Early in 2009, the Environmental Industries Commission, a trade association for the environmental technology and services sector, set out a series of proposals for a Green Growth Jobs Strategy which would support the environmental industry in the UK. These included a £10 billion 'Green Jobs Investment Fund' to create and protect some 200,000 jobs.[5]

More recently, a report from the Grantham Research Institute in conjunction with the ESRC Centre for Climate Change Economics and Policy, co-authored by Lord Stern, emphasised the case for greening economic recovery packages. 'A 'green' fiscal stimulus can provide an effective boost to the economy, increasing labour demand in a timely fashion,' the authors argued, 'while at the same time building the foundations for sound, sustainable and strong growth in the future.' The report also presents an informal 'ranking' of different policy options.[6]

Proposals for a green fiscal stimulus package have also come from the Local Government Association, and are currently being worked on by a range of environment NGOs, and by the Trades Union Congress. Green Alliance is developing a major new programme of work in this area, and WWF is working on proposals for the One Planet Economy.

The consensus emerging around the idea of greening economic recovery is a clear positive benefit to emerge from the global financial crisis. The Sustainable Development Commission therefore applauds the Gordon Brown's Davos commitment to a global 'green stimulus' and supports his intention to develop a 'low carbon recovery package' for the UK. As the Prime Minister himself remarked in a newspaper interview earlier this year, 'rather than [the recession] pushing the environment into a lower order of priority, the environment is a part of the solution.'[7]

4 A Green New Deal – published on behalf of the Green New Deal Group by nef (the new economics foundation), July 2008
5 EIC 2009. EIC's Growth Jobs Strategy: investing for the future. Policy Recommendations for promoting Britains environmental industries. London: Environmental Industries Commission.
6 Bowen et al 2009. An outline of the case for a 'green' stimulus. Alex Bowen, Sam Fankhauser, Nicholas Stern, & Dimitri Zenghelis,
7 'Tough lap for the marathon man' The Observer, 4th January 2009. Online at: www.guardian.co.uk/politics/2009/jan/04/gordon-brown-interview.

However, as the March 2009 report from the Environmental Audit Committee (EAC) on the Government's 2008 Pre-Budget Report demonstrates, there is currently a huge gap between levels of political exhortation and the reality of the Pre-Budget Report. The EAC is deeply concerned about the very modest scale of commitments in the PBR, the reluctance of Treasury to publish any assessment of the **overall** impacts on the environment of its fiscal stimulus package (in other words, showing the balance between the sustainable elements and the customary unsustainable elements), and its continuing failure to think again about green taxation. It concludes: 'Meeting our climate change and renewable energy targets will require a step-change in environmental investments. The Budget in 2009 should contain a much bigger and more coherent package of green fiscal stimulus.'

In that context, this report also addresses briefly the critical question of what happens beyond short-term recovery. Most analyses assume that the ultimate aim is to re-stimulate the kind of consumption-driven growth that has dominated the last few decades. As we have argued elsewhere, this goal is in the long-term entirely unsustainable without significant changes in both macro-economic structure and the social dynamics of consumerism. Our major new report on this *Prosperity Without Growth?* was published at the end of March.

In spite of this, it is clear that a green economic recovery of the form envisaged here is an essential first step in the transition to a more sustainable economy. There is now a unique window of opportunity to take decisive action in pursuit of agreed policy goals, and at the same time to put the UK economy on the path to sustainable economic recovery.

The purpose of this document is therefore to set out some of the parameters for an economic recovery package that puts sustainability at the heart of the UK economy. A key element is to address the financial scope of a green recovery package and an appropriate set of targets for it. In pursuit of that aim, we first present a brief comparative summary of proposed recovery packages across the world.

2 Green recovery – international commitments

How much has been committed so far?

Enormous sums of money have already been committed by governments in response to the economic crisis. By the end of last year, an estimated $7 trillion had been spent globally in underwriting toxic assets, recapitalising banks and attempting to restore confidence in the financial sector and stimulate lending. The cost of these financial rescue packages was driven largely by the size of the 'toxic asset' base and the perceived capitalisation needs of the banks.

Direct recovery packages have also been sought (and sometimes offered) in other sectors. For instance, the car industry has received direct support from government in both the UK and the US. The US government committed over $23 billion to bail out the ailing giants GM and Chrysler at the end of last year.[8] In the UK, the Government has promised to underwrite loans to the car industry totalling £2.3 billion.

Beyond financial rescue for specific sectors, broader economic stimulus packages have now been established in countries right across the world, including North and South America, Europe and the Asia Pacific countries. Their aim is to 'kickstart' the economy through a mixture of tax cuts, social spending and public investment. The total value of existing recovery packages is currently in the order of $3 trillion.

In principle, the potential exists for each of these different recovery measures to contain a 'green stimulus' component. Direct support for the financial sector, for instance, could be allied with conditions or investment vehicles to ensure that lending is preferentially targeted at sustainable investments.[9] Sectoral bailouts like those afforded to the car industry, could be made conditional on shifting towards greener manufacturing and low-carbon vehicles.[10]

Most obviously, the broader economic stimulus packages offer a clear potential both for green investment and for tax reforms to promote sustainability. Evidence suggests that this possibility is already being exploited by numerous countries across the world. As a recent HSBC Global Research report remarks, the 'colour of stimulus' is going green. Out of a total commitment of almost $2.8 trillion committed to economic recovery plans to date, $436 billion (15.6% of the total) can be characterised as green stimulus, according to the HSBC analysis.[11]

As Table 1 illustrates, the extent of green stimulus varies considerably across countries. Some plans still have no green component at all while others (notably China, the EU package and South Korea) incorporate green investment plans that represent a very substantial proportion of the recovery funding.

8 See eg, The Guardian, 30th December 2008. Online at: hwww.guardian.co.uk/business/2008/dec/30/general-motors-gmac.
9 This could include the establishment of 'green bonds' to promote sustainable investment, as proposed by Climate Change Capital and others.
10 Both the US and the UK car industry support packages have elements of this. £1 billion of the UK package is for investment in the development of green vehicles. See for example: http://news.bbc.co.uk/1/hi/uk_politics/7853149.stm.
11 HSBC 2009. *A Climate for Recovery. The colour of stimulus goes green.* HSBC Global Research.

Table 1: Green elements of economic stimulus plans[12]

Country/Region	Fund $b	Period	Green Fund $b	% Green
Asia Pacific				
Australia	26.7	2009–12	2.5	9.3%
China	586.1	2009–10	221.3	37.8%
India	13.7	2009		0%
Japan	485.9	2009–	12.4	2.6%
South Korea	38.1	2009–12	30.7	80.5%
Thailand	3.3	2009		0%
Subtotal Asia Pacific	**1,153.8**		**266.9**	**23.1%**
Europe				
EU	38.8	2009–10	22.8	58.7%
Germany	104.8	2009–10	13.8	13.2%
France	33.7	2009–10	7.1	21.2%
Italy	103.5	2009–	1.3	1.3%
Spain	14.2	2009	0.8	5.8%
UK	30.4	2009–12	2.1	6.9%
Other EU States	308.7	2009	6.2	2.0%
Subtotal Europe	**634.2**		**54.2**	**16.7%**
Americas				
Canada	31.8	2009–13	2.6	8.3%
Chile	4.0	2009		0%
US EESA	185.0	10 years	18.2	9.8%
US ARRA	787.0	10 years	94.1	12.0%
Subtotal Americas	**1.007.8**		**114.9**	**11.4%**
TOTAL	**2,796**		**436**	**15.6%**

The 'greenest' recovery package is South Korea where over 80% of the stimulus is targeted towards environmental goals. The funding is allocated to four main areas:

- conservation (low carbon vehicles, clean energy and recycling)
- quality of life (green neighbourhoods and housing)
- environmental protection (including flood defence) and
- infrastructure (IT and green transport networks)

Employment benefits are estimated to include the creation of 960,000 new jobs over the next four years. Interestingly, the government seems to view its Green New Deal as a way of placing South Korea at the forefront of 21st Century economies. Launching the package on the 6th January, South Korea's Prime Minister Han Seung-soo said: 'We are in an unprecedented global economic crisis. We must respond to the situation in an urgent manner... The Green New Deal will provide these. The 21st century global environment is here and we will find new growth engines for this era.'[13]

12 Source: *A Climate for Recovery – the colour of stimulus goes green.* (HSBC, February 2009)
13 Online at: http://english.mosf.go.kr/issues/policyissues/economic_view.php?sect=laws_policies&pmode=&cat=&sn=6280&page=1&SK=ALL&SW=4.

The largest overall commitment to a green stimulus comes from the Obama administration's American Recovery and Reinvestment Act 2009, which committed $787 billion in stimulus spending. Around $94 billion (12%) of this total can be characterised as green stimulus according to HSBC Global Research. This includes $26 billion for low carbon power (mainly renewables), $27.5 billion for energy efficiency in buildings, $4 billion for low carbon vehicles, around $10 billion for rail and $11 billion to upgrade the electricity grid. The aim is 'to create and save three to four million jobs, jumpstart our economy, and begin the process of transforming it for the 21st century'.[14]

To date, the UK lags behind these examples. A £20 billion ($28 billion) recovery plan was included in the 2008 Pre-Budget Report. A green stimulus component of £535 million (less than 3% of the total) was included in the package. This comprised £300 million for accelerated replacement of new railway carriages; £200 million (1% of the total package) for energy efficiency (mostly brought forward investment) in people's homes, and £25 million for flood defence and water infrastructure.[15]

The HSBC analysis counted an additional element of green stimulus through the car industry bailout which guaranteed £1 billion in loans for investment in low carbon vehicles, but no evidence is as yet available to justify such a conclusion. Even including this sum, the UK's green recovery plans amount at most to only $2 billion, or 7% of the stimulus spending so far (Table 1), near the bottom of the league of countries who have so far committed to the idea of a green recovery.

In summary, there is a wide and increasing level of support for the concept of a substantial green stimulus within economic recovery plans and considerable scope to expand the level of UK ambition in this regard. This would be entirely consistent with the Gordon Brown's own remarks to the World Economic Forum.

Commenting on the World Bank's $100 billion stimulus package for the developing world, the Prime Minister commented: 'I would hope and expect that up to $10 billion of this will got on a low carbon stimulus'. But this level of funding has yet to emerge in the UK Government's own recovery plans.

14 The American Recovery and Reinvestment Act of 2009 – Discussion Draft. Online at: http://appropriations.house.gov/pdf/RecoveryReport01-15-09.pdf.

15 *Facing Global Challenges: supporting people through difficult times.* Pre-Budget Report 2008. London: HM Treasury.

3 Targets for green stimulus spending

What should the money be spent on?

A striking consensus is also emerging on the appropriate targets for a green stimulus package. A key element in all the suggestions so far has been a focus on the transition to a low carbon economy. As the Prime Minister suggests in his Davos speech 'the contours of a resilient low-carbon recovery are becoming clear', not just from the proposals from a wide variety of observers but from plans being made on the ground in numerous countries.

Back in mid 2008, the UK Green New Deal group argued that stimulus spending should be focused on the twin challenges of climate change and energy security. Proposals included a vision for a low-carbon energy system that will make 'every building a power station' as well as 'creating and training a "carbon army" of workers to provide the human resources for a vast environmental reconstruction programme'.[16]

There is clearly a strong case for a stimulus focused on energy and carbon. Re-capitalising the world's energy systems for a low carbon world will be a major investment challenge over the next fifty years. The International Energy Agency's *World Energy Outlook* estimated that energy investment needs between 2010 and 2030 will be in excess of $35 trillion.[17] Bringing forward some of this investment and targeting it specifically at renewable energy, low-carbon technologies and energy efficiency could pay massive dividends later.[18]

UNEP's global Green New Deal has widened the remit of spending to include reinvesting in natural infrastructure: sustainable agriculture and ecosystem protection. Ecosystems already provide tens of trillions of dollars worth of services to the world economy.[19] So protecting and enhancing ecosystems is vital to economic productivity in the future, UNEP points out. They also call for substantial investments in clean technologies, sustainable agriculture and sustainable cities.

In a report published at the end of last year, the Deutsche Bank identified a 'green sweet spot' for stimulus spending, consisting of investment in energy efficient buildings, the electricity grid, renewable energy and public transportation. 'One of the reasons that the "green sweet spot" is an attractive focus for an economic stimulus is the labor-intensity of many of its sectors,' the authors claim.[20] We return to this claim in Section 6.

The Grantham Institute report makes a useful contribution by suggesting a range of criteria against which targets for green recovery should be assessed. These include:

- timeliness – the extent to which significant spending could be carried out within a year or so
- the potential for long-term social returns
- the existence of positive 'lock-in effects' in establishing low-carbon capital stock
- the likely extent of job creation and domestic fiscal 'multiplier' effects[21] and
- the use of under-utilised resources.

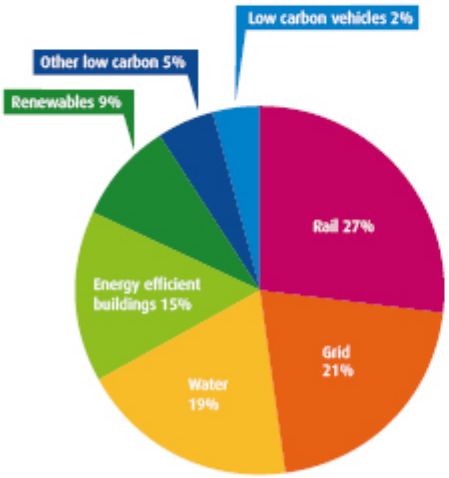
16 GND 2008, p3.
17 World Energy Outlook 2008 (www.iea.org/Textbase/npsum/WEO2008SUM.pdf). Reference scenario (business as usual) investment is $26 trillion. Achieving a 550 ppm stabilisation would cost $4.1 trillion more that this, and achieving a 450 ppm stabilisation would be add another $5.1 trillion to this cost.
18 Nicholas Stern's (2007) review on the economics of climate change, famously argued that for as little as 1% of GDP we could save ourselves costs as high as 25% of GDP later on.
19 In a paper published in 1997, ecological economists Robert Costanza and his colleagues estimated that the value of global ecosystem services amounted to around $33 trillion per year. At the time, the global GDP was only $18 trillion per year (Costanza et al 1997).
20 DB 2009, p4.
21 This refers to the potential for the stimulus to lead to private investment and household consumption demand over and above the original government spending.

As the HSBC report makes clear, not all of these factors are easy to assess. In particular, there are still significant unknowns in relation to the potential for job creation and possible multiplier effects. Indeed there is an urgent need for government to develop the capability to assess these effects properly.

In the meantime, however, there are already 'good enough' answers to many of the questions – including, as we show in a later section, strong indications about the potential for job creation. Using the criteria in a qualitative way, the Grantham Institute report produces a useful evaluation of selected spending proposals. Numerous proposals rank highly against these criteria.

In particular, there are high-ranking options within each of the four 'sweet spot' areas: energy efficiency in buildings, renewable energy, the electricity grid and public transportation. Furthermore, the report identifies several other areas where proposals rank well against the criteria, including: boiler replacement, industrial CHP and ecosystem enhancement (afforestation eg).

Figure 1: Targets for existing green recovery funds



When it comes to existing commitments, there is no hard and fast rule across the national recovery plans. Some countries have opted for more investment in transportation, others for more in building energy efficiency. A few have opted for expenditure in Carbon Capture and Storage.

The balance of investments across the existing portfolio of commitments (amounting to $436 billion) is shown in Figure 1. The highest level of commitment so far has been in the rail network (27%), followed by upgrading of the electricity grid (21%), water and ecosystem protection (19%) and improving energy efficiency in buildings (15%). Other low carbon technologies (including renewables, CCS and low carbon vehicles) account for the remaining 18% of stimulus commitments (Figure 1).

In the UK case, out of a total of roughly £1.5 billion, two thirds of the commitment is allocated to loans for the development of low-carbon vehicles, while the rest is divided between domestic sector energy efficiency, investment in high speed rail, and a small amount for flood defence and water management.

Again, it seems clear from this analysis that there is the potential for a much more systematic allocation of financing to a variety of other green investment targets. We explore this potential further in Section 5.

In Section 5, we explore the potential for investments in six priority areas of green spending in the UK. For now, it is sufficient just to note that the emerging consensus suggests that there is a unique opportunity to invest now in the technologies and infrastructures that will be needed to address energy security, prevent climate change, and protect ecosystems.

4 Financial scope of a green stimulus

How much should be spent on a green recovery package?

In December last year, the IMF called for a fiscal stimulus level greater than 2% of world GDP.[22] The total stimulus commitment of $2.8 trillion identified in the HSBC report amounts to a little over 5% of global GDP ($55 trillion). But spread over the three years or so of the commitment programmes this implies a stimulus commitment at a level of approximately 1.5% of GDP.[23]

The Grantham Institute study argues that a case can be made for much larger levels of fiscal stimulus, perhaps as high as 4% of the GDP. This case is supported by Paul Krugman, winner of the 2008 Nobel Prize in economics, who has argued for a stimulus package for the US worth 4% of the GDP.[24] Globally, this would be equivalent to annual spending of around $2.5 trillion.

The equivalent commitment for the UK would be in the region of £60 billion – approximately three times the total size of the November PBR stimulus, and up to nine times the size of the implied annual commitment. There is a clear argument then that the UK – like many other governments – has not yet committed sufficiently to economic recovery, and has certainly not committed to the right kind of sustainable, low-carbon recovery, as argued by the Environmental Audit Committee

The **degree** to which such a stimulus should be 'green' is also in dispute. Across the world, approximately 16% of existing commitments (and less than 0.25% of global GDP) are targeted towards green investments (Table 1). But this proportion is heavily influenced by strong green commitments in China (38%), South Korea (81%) and at EU level (59%). Green elements in the US ARRA amount to 12% of its total package (having been watered down during the Bill's passage through Congress). The UK commitment is lower again at only 7% (including the car loan guarantees which many believe are far from 'green', let alone genuinely sustainable), representing only 0.1% of GDP spread over three years.

In defence of the limited size of its own 'green stimulus' to date, the UK Government has argued that the PBR should be seen in the context of an estimated £50 billion investment in the low carbon sector over the period 2008-2011, already established through the 2007 Comprehensive Spending Review (CSR07).[25] This much larger figure includes:

- £5.8 billion in private sector investment in renewables through the Renewables Obligation
- £10 billion in energy efficiency investment through programmes like the Carbon Emissions Reduction Targets, Community Energy Savings Programme, Warm Front, Decent Homes, the Landlord Energy Savings Allowance and Smart Metering
- £7.6 billion investment in the electricity transmission and distribution network; and
- £23 billion on public transport and low carbon vehicles (including Crossrail, and Transport for London).

22 See eg: www.imf.org/external/pubs/ft/survey/so/2008/INT122908A.htm.

23 Some commitments are over shorter periods of one to two years but others – including the large US commitments – are over a considerably longer timeframe.

24 *Finding a way out of the Economic Crisis*, 14th November 2008. BBC reporter Nick Robinson's newslog and interview with Paul Krugman is online at: www.bbc.co.uk/blogs/nickrobinson/2008/11/finding_a_way_out_of_the_economic_crisis.html. The ARRA package approved by Congress amounted to 5.5% of US GDP, although spreading its spending over up to a decade.

25 See Angela Eagle's written reply to Colin Challen's Parliamentary Question. Online at: www.theyworkforyou.com/wrans/?id=2009-01-21b.240318.h.

Clearly, the CSR07 commitment to low carbon investment is to be welcomed. It is a vital first step towards meeting the demanding carbon reduction targets established in the UK Climate Change Act.[26] Taken over three years, this £50 billion figure represents a commitment at the level of around 1% of the UK GDP.[27]

But it would clearly be questionable to position this existing commitment as part of an economic stimulus. In the first place, it is a commitment that predates the financial crisis and therefore sits in the baseline – rather than as an additional stimulus. Perhaps more worryingly, there must inevitably be questions about the potential to achieve the predicted £50 billion out-turn – particularly in the current economic situation – when this depends largely on the ability of government policy to stimulate private sector investment.

Perhaps the strongest argument for an expanded green stimulus is that a £50 billion commitment over three years is still insufficient to achieve the UK's demanding carbon targets. The original Stern recommendation assumed an atmospheric stabilisation target of 550 ppm. More recent IPCC evidence suggests the need for a 450 ppm stabilisation target, with more stringent reductions in carbon emissions.

Stern himself is on record as saying that to achieve a 500 ppm stabilisation target the appropriate level of investment should be at least 2% of GDP. Accountancy firm PriceWaterhouse Coopers (PwC) has suggested that meeting the 450 ppm target could require 3% of GDP to be spent on carbon mitigation.

At the higher end of these estimates, the UK should be committing something in the region of £45 billion each year to low-carbon investment alone. This would mean an additional £30 billion each year over and above the CSR commitment. In terms of a stimulus commitment at the level of £60 billion per year (4% of GDP), this suggests that at least 50% of the package should be dedicated to green spending.

This is clearly higher than the average commitment so far. It's also somewhat higher than calls for green recovery made elsewhere. The Grantham Institute has made the strongest case for a significant green component, suggesting 'that a green stimulus of the order of 20% of the total [of 4% of global GDP] would be appropriate (higher in countries with lots of unexploited opportunities for low-cost decarbonisation)'.

In our view, there are a number of arguments in support of a much more extensive greening of recovery packages. In the first place, as we've seen, this higher level of investment is required anyway to have a chance of meeting climate change targets and taking precautionary measures against imminent threats to energy security.

Equally importantly, there is a strong argument that generic recovery spending – with no green focus – will jeopardise sustainability. Investing in road building, for example, may be a decent-ish way of protecting jobs and boosting economic activity. But this will never lead to green growth. On the contrary, it is quite possible (through the phenomenon of 'infrastructure lock-in') for current investments in high-carbon infrastructures to make it all but impossible to achieve environmental

26 In pursuit of an 80% reduction in carbon emissions by 2050, the UK Climate Change Committee's 1st report has now set out a series of interim targets, the most immediate of which is to achieve a 34-42% reduction in carbon emissions over 1990 levels by 2020.

27 GDP at current prices in 2007 was just under £1.4 trillion. Over a three year period with 5% per annum nominal growth (3% real and 2% inflation) total GDP would have amounted to £4.6 trillion.

targets later. For instance, US NGOs have pointed out that President Obama's stimulus package includes $27 billion to be spent on new roads – an investment that dwarfs the much smaller sums of money set aside for low-carbon electric and hydrogen vehicles.

Likewise, bringing forward investments in school and hospital building programmes – as envisaged in the PBR – will stimulate jobs and contribute to the nation's health and productivity. But if these spending programmes are not explicitly tailored to achieve low-carbon outcomes, they represent a vast missed opportunity in carbon reduction, and could lock us into high-carbon public infrastructure for another 20 or 30 years at least. It is extraordinary that both of the Government's big capital programs (in health and education) are still not achieving the kind of low-carbon, sustainability standards that should now be absolutely mainstream in all new public sector investments.

Perhaps most strikingly of all, a fiscal stimulus dedicated towards a generic increase in highstreet spending – such as the VAT reduction in the PBR – could have entirely perverse consequences. Even if it is successful in boosting consumption – evidence suggests that households are just as likely either to save the additional income or spend it on non-domestic goods and services – there is no way of targeting this spending towards low-carbon outcomes. It would have made a great deal more sense (as the Sustainable Development Commission has been arguing for years) to have reduced VAT on all low-carbon goods and services associated with refurbishing and renovating our existing housing stock.

There will always be some call on government to spend during a recession in pursuit of broader social goals – employment in key sectors, social security for the most vulnerable and so on. On the whole, however, there are very strong arguments to suggest that green investment and green jobs should be seen not as a marginal addition to the conventional packages, but as the single biggest element in economic recovery.

As we shall see in Section 6, both social and economic returns on these investments are at least as good as those on more conventional stimulus spending. But equally importantly, green investment is absolutely essential to achieve sustainability targets.

Neither the green stimulus in PBR 08, nor indeed the much larger CSR 07 commitment, is sufficient to ensure economic recovery and build a low carbon economy. Circumstances have changed. The emerging consensus is that there is a need for a much stronger economic stimulus even than that before witnessed during the last months of 2008. And this must certainly entail increased investment over pre-crisis spending plans. Given this need, there remains a very strong case to target at least 50% of the additional spending through a 'green stimulus' element.

In short, the SDC believes that there is justification for bringing forward immediately a £30 billion green stimulus programme over and above the expected out-turn from the CSR07 commitments.

5 Priority areas

Can we justify this level of spending in the UK?

There is no point in committing up to 2% of the UK's GDP to green recovery, if there is no identifiable and appropriate target for this level of spending. Taking as a starting point the Deutsche Bank's 'green sweet spot' and the Grantham Institute qualitative analysis of green recovery targets, we identify here six key areas which taken together would justify spending consistent with a green recovery programme of up to £30 billion over and above the expected out-turn of CSR 07.

These six are by no means exhaustive, but they demonstrate in more detail how the principles described in the first part of this report might be translated into practice.

Separately from this initiative, we have also commented on Defra's own 'Green Jobs Proposal', which it has presented to Treasury. This provides an excellent summary of the wide range of opportunities available to government for short-term, job-generating investments in conservation, biodiversity, land-based industries and the local environment. A total of around £100 million would make a substantial impact in these areas, and would in the process provide a closer analogy with the original 'New Deal' initiated by President Roosevelt in the aftermath of the Great Depression in the US. The 'Civilian Conservation Corps' created at that time ended up employing millions of people involved in local conservation projects.

There are also a number of persuasive proposals from Non-Governmental Organisations (including the Soil Association and the National Trust) for government to think again about new ways of stimulating local food production systems. The potential here is enormous, and there are already signals of accelerated demand for allotments and other local food schemes. These could be significantly boosted by relatively modest, cost-effective interventions, co-ordinated through existing regional mechanisms.

In conjunction with bodies like the Environment Agency, British Waterways, the Homes and Communities Agency and the National Parks, Defra has also identified a number of substantial opportunities to help restore tow paths and waterways, clean up contaminated land, enhance flood protection and accelerate investments in sustainable waste management – including projects already in the pipeline for generating renewable energy from food waste. These are exactly the kind of strategic interventions that Treasury should be working hard to bring forward with Defra.

As that terrain is already well covered, we have focused on the six areas below. Costing these proposals **precisely** is beyond the scope of this document. However, we do offer some ballpark estimates – in at least some of these cases – for the levels of funding that might be needed to achieve policy targets. These all suggest that finding appropriate targets for this level of investment is not an issue.

Taken as a whole, our proposals would:

- Make a fundamental contribution to the development of a the low-carbon economy envisaged in recent speeches by the Prime Minister, Ed Miliband and Peter Mandelson
- Accelerate cuts in greenhouse gas emissions
- Create new jobs quickly, and in places that matter, including some of the UK's most deprived communities
- Reduce inequality, particularly by tackling the root causes of fuel poverty and poor access to transport
- Lay the foundations for UK businesses to capture a significant share of the global market in green technologies.

5.1 Accelerate the upgrading of existing housing stock

Whilst the challenge is huge, so too is the opportunity for cost-effective action. In the Stern and Bowen report mentioned earlier in this document, residential energy efficiency scores as the most effective type of programme in terms of return on investment, alongside public building energy efficiency, boiler replacement programmes, and lighting and appliance replacement.

No climate change strategy can succeed without having at its foundations a comprehensive upgrading of existing housing stock. Space heating in domestic buildings accounts for close to 20% of UK carbon emissions, and of the 25 million households in the UK, 96% of these fall some way short of the best energy performance standards. Even as the energy standards for new buildings and individual appliances improve, efficiency gains are being outstripped by the rising energy demand from ever more household equipment. Fuel poverty is on the increase again simply because not enough action has been taken to insulate our homes, which puts poor households under strain from the underlying trend of increases in fossil fuel prices. This can only get worse in the future.

The SDC has been focused on the issue of energy efficiency of the existing housing stock since 2006. Our ground-breaking report, 'Stock Take' (http://www.sd-commission.org.uk/publications.php?id=400), contained a detailed analysis of the technical potential for retrofitting. A key finding of 'Stock Take' was that whilst the technologies are already all available, a completely different approach is required to get further than the low hanging fruit of cavity walls, low-energy light bulbs and loft insulation. This needs to be driven by clear targets, financial incentives, skills training, and area-based approaches to maximise savings.

In our opinion, achieving the twin aims of eliminating fuel poverty and hitting the UK 2050 carbon reduction target means bringing the entire housing stock up to an energy efficiency standard equivalent to BRE's SAP 81 rating, which would cut current energy use in homes by 80%.

The economic, technical and logistical demands of this task are huge. Even at a rate of one million households a year, it would take 24 years to retrofit the UK housing stock to the required standard. Average costs for retrofitting households to SAP 81 are believed to be in the region of £11,000 per dwelling, although costs will of course vary depending on the type of property. Measures required range from the more obvious insulation and double glazing through to more expensive and disruptive interventions – such as cladding of solid walls, solar water heating, and fuel switching for properties off the gas grid (from oil to biomass or ground source heat pumps). There is enormous potential to drive down the costs of all of these technologies through the kind of 'economies of scale' achieved in Germany.

In addition to space heating, there will also be a need to tackle electricity demand for appliances through product standards, behaviour change, technical measures (such as smart metering and dynamic demand) and, where appropriate, the installation of microgeneration. Each type of technology has its own issues, and the potential for economies of scale to drive down costs will vary.

The policy landscape around existing homes is complex, but not yet in any way sufficient to reach the SAP 81 target proposed above.

- Current policies for funding energy efficiency and fuel poverty programmes are through obligations on the energy suppliers (the Carbon Emissions Reduction Target or CERT) and direct from Government (Warm Front, the Decent Homes programme, and the oversubscribed Low Carbon Buildings Programme).
- A new £350m Community Energy Savings Programme (CESP), due to be launched in September, still relies on a voluntary approach by coalitions of energy suppliers, Local Authorities and communities. Although very promising, this is unlikely to reach more than 90,000 homes in around 50 communities.

- The SDC has also developed proposals for the energy efficiency policy landscape post 2012 – for the Supplier Obligation which will replace CERT – which has the potential to drive the energy supply side with as much urgency as the energy demand side. This is under active consideration by DECC.

- Consultations on a Heat and Energy Saving Strategy (HES), were launched on February 12th, styled by Ed Miliband 'the great British refurb'. Ministers are seeking views on the challenge of giving 400,000 households a year 'whole house energy makeovers' by 2015, based on estimates of an average of £6,000 per household. (Achieving SAP81, including a component for skills, is likely to require in the region of £11,000.)

We believe the Government needs to go a great deal further than this. Taking training and installation costs together, the SDC estimates that there is scope for an ambitious £11 billion per year domestic retrofit programme, which would reach an average of one million households a year over and above those reached by existing and currently envisaged policy measures.

Such a programme should begin by building on the CESP proposals – systematically targeting the most deprived wards in order to tackle local concentrations of fuel poverty, and create economies of scale by focusing on particular localities. Some of the most cost effective measures, such as biomass-fuelled district heating or CHP, will require investment into infrastructure at a community level. (The SDC is itself beginning a project on Community Infrastructure Re-investment in order to assess the potential for bringing private sector capital into this equation).

The radical acceleration of action on existing homes would achieve rapid carbon savings, create jobs, drive down the costs of technologies, further improve living conditions for the most deprived communities, save households money, and reduce our dependency on imported fossil fuels. There is no more compelling case for a green stimulus.

5.2 Scaling up renewable energy supply

The UK has a clear and extremely ambitious target for renewable energy by 2020: to generate 15% of *total energy supply* from renewable sources by 2020. This implies at least 30% of all **electricity generation** from renewables by that date,[28] compared with around 4% at the moment.

Despite some signs that international firms are responding to the longer-term policy framework by showing increased interest in the UK, the recession has created a perverse effect in undermining the economics of large-scale renewables, as a result of the increased cost of and access to capital, the falling price of fossil fuels (notably oil), and the collapse in the price of CO_2 allowances on the carbon market (from €30 in mid-2008 to €8 per tonne in February 2009).

Aside from the demand side measures such as CERT and CESP referenced above (which are not specifically targeted at renewables), the main support mechanism here in the UK is the Renewables Obligation. This requires licensed suppliers to source an increasing percentage of their electricity (7.9% for 2007/8, rising to 15.4% by 2015/16) from renewable sources, or face a buy-out price. The Renewable Energy Association estimates the RO to have provided about £875million of support to the renewables industry for the 2007/2008 obligation period. Intended to bring forward the most cost-effective technologies, the RO has been criticised for failing to support renewable technologies which are further from market readiness. New proposals seek to overcome this through the revised 'banding' of ROCs –

Growth potential from wind energy

The wind industry is now established as one of the highest-growth industries in Europe – expanding at an average rate of 12% over the last 5 years. By 2007, the cumulative installed capacity was 57 GW (gigawatts), with significant job creation – 145,000 people were employed in the European Union (EU) wind energy sector at the end of 2007.

Germany, Spain and Denmark have secured the majority of the benefits from that growth and now account for more than 70% of the EU's installed capacity. Moreover, due to significant exporting from Germany and Denmark, these three countries account for more than 90% of the EU's wind-sector employees.

EU Member State	Installed wind capacity, end 2007	Wind employment, end 2007
Germany	22.3GW	80,000
Denmark	3.1GW	21,600
Spain	14.7	31,500
UK	2.2	5,000

Bain's analysis points to four factors that were common to these countries and critical to the rapid growth of their wind industries:

- Support schemes to reduce commercial uncertainty (e.g. feed-in tariff).
- Rapid building of new infrastructure (e.g. the grid) to accommodate the wind industry.
- A swift process for gaining planning consent.
- Support for wind energy in local communities – with opportunities for participation in ownership of wind farms or through tax revenues paid to local authorities for tangible benefits to the community.

The offshore market is still emerging, and the UK is strongly positioned to capture a significant share of installations due to its excellent offshore wind conditions.

Source: Employment opportunities and challenges in the context of rapid industry growth, Bain and Company, 2008.

28 *Building a low carbon economy*, page 193. Assumes the UK's burden share of the EU's 20% target is 15% of energy from renewables by 2020.

e.g. landfill gas will get one quarter ROC per MWh, wave/tidal will attract two ROCs, and so on.

Additional measures for offshore renewable energy include the Offshore Wind Capital Grants Scheme (£97m for 10 projects), and the Marine Deployment Fund (set up in 2004 with a budget of £50m, but which has had no take up). There is also a Bioenergy Capital Grant scheme for biomass heat and CHP plant, including Anaerobic Digestion (AD) for which the 2008/09 round is worth £4m. Other measures include the Bio-energy Infrastructure Scheme to support supply chains for harvesting, processing and storing biomass (worth around £6m), and the Environmental Transformation Fund which offers £10m in grants for commercial scale AD. Ministers recently announced a £500,000 fund for accelerated research into tidal reef and tidal fence technologies for the Severn estuary. Under growing pressure to lift the UK from its humiliating position close to the bottom of the EU renewables league table, the Government has recently committed to feed-in tariffs for renewable heat, renewable power and renewable gas under the Energy Act 2008. The feed-in tariff system – which offers a simple fixed payment for every unit of renewable energy generated – has been used successfully in a number of EU member states and elsewhere.

Given the range of grant programmes and market based incentives, both current and planned, what level of additional investment might be required? A recent Ernst & Young study (commissioned by Centrica) concludes that in the next 15 years an additional £234 billion of new investment will be needed to meet UK energy goals – including security of supply, climate change targets and renewables targets. This implies an average investment of around £16 billion per annum between now and 2025. This is considerably higher than anything achieved through the Renewables Obligation and grant support schemes to date.

Analysis by the Renewable Energy Association has identified an immediate need of £625 million in spending in support of renewable energy, including: retrofitting buildings with decentralised energy; supporting bulk energy transport infrastructures; and building up crucial skills, training and awareness. At the same time, a growing number of business leaders (including Lord Browne, former Chief Executive of BP) have expressed growing concerns about the failure of government to provide the right leadership here, and have called for much more decisive measures (particularly on large scale renewables) to enable us to meet our 2020 targets.

In our opinion, Ministers should be aiming to make available a sum of at least £2 billion a year for the next three years – over and above the expected outturn from private investment through the Renewables Obligation – to ensure that we have at least a reasonable prospect of meeting our targets. The returns to the nation in terms of carbon savings, improved energy security, and meeting the UK renewable energy targets will be invaluable.

In advocating this approach, we recognise that this is not ideal. Ideally, we would move away entirely from straight government subsidy for renewables towards an electricity and heat market which values carbon and innovation properly. This was the case that we made in *Lost in Transmission*.[29] But at the moment, we are in an awkward transition phase. Grant funding is coming to an end, and capital is very hard to come by. The distant promise of feed-in tariffs and a better deal for renewables is not enough to raise capital for projects.

Ours is therefore a two-pronged approach:

- Continued reform of the regulatory structures for energy, and of grid regulation in particular, to allow renewables and distributed energy to compete
- At the same time, financial support in the form of grants or loans for renewable energy and distributed energy, seen explicitly as a transitional measure to allow the markets to develop.

29 www.sd-commission.org.uk/publications/downloads/SDC_ofgem_report%20(2).pdf

5.3 Redesigning the National Grid

Although the grid has been enhanced over the years, it was designed essentially to connect large point-source producers to largely passive users. The role of Ofgem, as the UK regulator of Gas and Electricity Markets, has been primarily to create a stable energy market and to keep prices down per unit of energy down for consumers.

In our report, *Lost in Transmission*, the SDC set out proposals for putting the need to decarbonise the electricity system at the heart of the regulatory framework. This is a critical success factor for achievement of the Government's emissions targets.

Lost in Transmission identified a series of areas for transformation. These include the creation of a regulated market for heat (most of which is currently lost), stronger incentives for the connection of renewables, putting a higher price of carbon into the cost/benefit models used by Ofgem, better enabling of local, distributed and embedded generation, and the stimulation of low-carbon innovation and investment by energy companies. The role of price control reviews in setting the levels of investment in generation, transmission and distribution are fundamental. Although we are very pleased that the Government accepted the majority of our recommendations, its refusal to amend Ofgem's primary purpose, to take proper account of today's low-carbon imperatives, remains deeply disappointing.

The Sustainable Development Commission is very supportive of the body of new proposals emerging to ensure that the National Grid is truly 'fit for purpose' in terms of the critical role it has in securing a low-carbon future for the UK. 'Grid 2.0' has the following attributes:

- It would enable distributed generation, with consumers becoming energy producers in their own right, feeding into the grid through micro-renewables, at household, workplace and community level.
- It would allow for the rapid connection of large-scale renewables such as wind, tidal and wave, particularly through strengthening the grid offshore and in Scotland, thereby allowing access from these to sources of demand in the south and east.
- It would enable intelligent management of energy demand by both consumers and suppliers, by accelerating the roll-out of smart meters and other appropriate technology. (However, the current target is to achieve this in households by 2020, which is a patently inadequate target).
- It would provide market-based incentives for both investment in low-carbon innovation, and for the inclusion within the energy mix of remote and intermittent types of renewable generation.

Market arrangements

Grid 2.0 can only be achieved by a combination of adjusting the way the market works and is regulated, and through direct public investment. Since there is a very complex set of issues surrounding gas and electricity markets, all we can do at this stage is put forward some principles for consideration. More in-depth feasibility work exists, for example, with the National Grid itself.

The primary market mechanism is Ofgem's Price Control Reviews – which would need to be used to place a much stronger requirement upon operators to invest in transforming the Grid. Since any such measures will be passed through to consumers in higher prices per unit of energy (or heat), it is vital that changes are balanced by the sort of retrofitting programme proposed in 5.1 above, so that any increases in the unit price for energy are offset by improvements in energy efficiency.

Many renewable schemes do not currently go ahead for financial or planning reasons. This means that grid connections constructed before projects are finalised may be wasted; on the other hand, waiting until finalisation may build in long delays. Our proposal is for Government to take more of this risk itself, investing in the connection of renewables through some sort of

'revolving fund', which is replenished as new energy production comes onstream. This fits with the logic of additional public expenditure at a time of recession, recouped through additional income in later years. In our Ofgem report, we called this 'connect then manage'.

Detailed work has already been undertaken on one aspect of Grid 2.0: the strengthening of the capacity of the National Grid to allow the connection of renewables.

The Transmission Access Report considered the changes that are required to facilitate the timely connection of new generation. It was conducted because network access is seen as a barrier to entry for new generators, particularly renewable generators. In June 2008, the TAR Final Report made a number of recommendations on how to improve transmission access. At the same time, Government published its Renewable Energy Strategy consultation. In both documents, Ofgem and Government asked the transmission companies to initiate work to identify the transmission reinforcements needed to support the 2020 targets. Ofgem and Government also invited the Energy Networks Strategy Group (ENSG) to provide critical industry-wide input to this work.

The total cost of the proposed reinforcements identified in the ENSG report is £4.7bn which would allow the resulting network to accommodate a further 45 GW of generation, of which 34 GW would be a combination of onshore and offshore wind generation. The development of the potential reinforcements are phased to achieve a 2020 delivery date, with the initial phase being delivered in 2015 based on the prospective growth of renewables in each region.

The ENSG study covers only one aspect of Grid 2.0. We have not been able to identify cost estimates for the other key components of Grid 2.0 – such as local distribution systems which allow for the active management of levels of two-way energy flows which would enable micro-generation at scale and over large areas. In the US, where Grid 2.0 is a key part of the current fiscal stimulus package, the cost per household in the U.S. has been estimated at the equivalent of £6,000. US estimates are for 10% savings both in the cost of energy and in carbon emissions from electricity supply, due to the increased efficiency of the redesigned grid. Greater savings in emissions should of course gradually result from increased take-up by renewable energy providers. These figures imply annual savings of around $40 billion, with a payback period of 25 years. Any conversion from U.S. to UK costs per household is problematic – for example, such a calculation would need to take into account the higher density of housing and the greater age of the housing network here in the UK. But to give a very rough indication, if the UK spent five times less than U.S. per household, the total cost would still be around £30 bn. Higher household density in the UK, reducing the total cost of the project, also has the effect of greatly reducing the payback period, probably to around 10 years.

To help make this happen, without further delays of the kind that will make it totally impossible to achieve our 2020 targets, we believe the Government should be prepared to commit up to £5 billion a year on grid improvements of one kind or another, over and above the £7.6 billion expected to be delivered through CSR 07.

5.4 Promoting sustainable mobility

Transport emissions account for over a quarter of UK carbon, and are rising faster than any other sector. The sector is heavily reliant on imported fuels with a significant cost to the UK trade deficit. Of the 5.3 million tonnes of petroleum products used for energy in the UK, 78% are consumed by the transport sector (BERR 2008). BERR projections for UK oil and gas production and demand indicate that by 2013 we could be importing 80 million tonnes of oil equivalent. At $100 a barrel, this would cost the economy $57 billion.

In addition, people's heavy reliance on the car, even for short journeys is contributing to:

- **congestion** – which the Eddington Review estimated will cost £22 billion by 2025 if left unchecked
- **road accidents** – with about 3000 killed and 28,000 seriously injured every year on UK roads
- **increasing levels of obesity** – By 2050, Foresight modelling indicates that 60% of adult men, 50% of adult women and about 25% of all children under 16 could be obese[30]
- and **lower levels of environmental quality** across the UK.

Urgent action is needed on all these counts, in particular:

1) to massively increase levels of walking and cycling for shorter journeys
2) to encourage behaviour change to more efficient use of motorised transport (car sharing and public transport)
3) to ramp up investments to improve the capacity and efficiency of the rail network
4) to introduce decisive, hard-hitting measures to create a shift to lower carbon vehicles.

Smarter Choices

The 'Smarter Choices' approach involves a range of strategies that are designed to provide communities with the information they need to make more sustainable travel choices. The DfT is already committed to engaging with local authorities, yet a significant number (20%) do not even consider Smarter Choices in their Local Transport Planning.

Through its Sustainable Travel Towns project, the DfT has been working with Darlington, Peterborough and Worcester to introduce a range of sustainable travel measures on a town-wide basis. All three towns have run travel marketing and personalised journey planning pilots. Ten Smarter Choices measures have been identified in the Department for Transport publication, *Making Smarter Choices Work*:

- Workplace travel plans;
- School travel plans;
- Personalised travel planning
- Public transport information and marketing
- Travel awareness campaigns
- Car clubs
- Car sharing schemes
- Teleworking
- Teleconferencing
- Home shopping.

As a critical element in its 'green recovery' plans, the Government should now commit to a national roll-out programme for 'Smarter Choices'. This would help people to both avoid the need to travel, and to find cheaper, more efficient, and lower-carbon ways of making essential journeys in the face of the credit and climate crunches. 'Smarter Choices' need to be 'locked-in' through further measures; including financial measures for instance, (reduced bus fares), redesigning road space (bus priority lanes, widening pavements and re-designing junctions), and regulatory measures (re-allocating car parking space for bicycle and car clubs). The costs of reconfiguring infrastructure in

30 www.foresight.gov.uk/Obesity/20.pdf

this way depend on the scale of the measures, particularly new walking and cycling routes and expenditure on bus services.

In comparison to many European countries, the UK has lagged far behind in the creation of high quality and attractive routes for cycling and walking. Since 1950, there has been a fivefold reduction in cycling, and fear of the danger imposed by motorised traffic is cited as the primary reason people don't cycle as much as they'd otherwise like to. Investment levels in cycling in the UK have historically been in the region of £1 per person per year, whereas areas of the Netherlands, even after 30-40 years of development, are still investing at between €3 and €27 per person per year. As a result, of journeys under 5 miles in the Netherlands, 34% are made by bicycle and 27% are walked. A recent report for Cycling England estimated a benefit of just over £300 per additional cyclist per year,[31] and this is **excluding** the potential savings due to reduced obesity, mental health benefits, and social benefits.

At the higher end of the range of spending in the Netherlands – which is exactly where the UK needs to be to catch up – the investment spending in walkability and cyclability needs to be in the region of £1 billion each year. Overall, however, such policies are considerably cheaper and more cost-effective than new road-building. Based on data from the three existing 'Smarter Choices' schemes, the scaled-up cost of a national programme would be in the region of £400 million a year. DfT's own evaluation of these schemes shows (when congestion and carbon reductions are fully monetised), a cost/benefit ratio of 1:10, implying savings of £4 billion a year. Using DfT's own figures, the NGO Sustrans estimates savings from such a scheme of nearly a million tonnes of CO_2 a year.

The report, *A Low Carbon Transport Policy for the UK*, written by Keith Buchan of the Metropolitan Transport Research Unit, includes a wide-ranging policy package to tackle CO_2 emissions from transport and reduce them by 26% by 2020. http://www.bettertransport.org.uk/media/press_releases/november_2008/cutting_emissions. Amongst six areas of policy, it includes proposals to reduce journey lengths and transfer short car journeys to walking and cycling. It suggests a substantial 'Smarter Choices' fund to help change travel behaviour, including specific initiatives on school travel (walking, cycling, school safety zones and school buses), shopping (home delivery, local collection and local sourcing) and leisure (entrance/public transport tickets for sporting/music events, support for local parks), as well as more 'car clubs' and better information and marketing of travel choices.

Taking all this into account, we believe the Department for Transport should commit to an integrated programme of Sustainable Mobility measures of at least £1.5 billion a year for the next three years. We see no reason why the lion's share of this should not come via redirection of current commitments on road building.

31 *Valuing the Benefits of Cycling – A report to Cycling England*, May 2007 www.sustrans.org.uk/webfiles/AT/Useful%20reading/Valuing%20the%20benefits%20of%20cycling%20.pdf

Government fleet/new car procurement

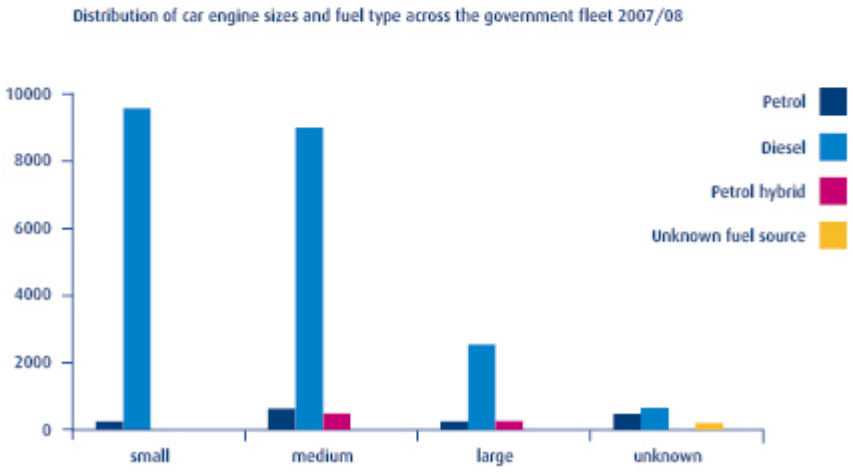
Over and above investments of this kind in 'Smarter Choices', the Government must set an example in the way it procures new vehicles. The Government's fleet consists mainly of small/medium diesel vehicles (see figure below). Despite a target for new vehicle procurement of 130gCO_2/km, there is a lack of clear commitment to procure ultra-low carbon vehicles, as well as a lack of guidance to induce behaviour change to ensure the most sustainable travel options are taken.

The Low Carbon Vehicle Procurement Programme (LCVPP) represents a commitment by government to be a leader in the procurement of lower carbon vehicles. The SDC has welcomed this. However, as the programme focuses on vans in the first phase (£20m), the government must broaden the commitment to include **all** sizes and types of ultra-low carbon vehicles, including electric vehicles (EVs) powered by renewable energy sources.

The SDC recommends an announcement of a significantly larger fund in the future to replace government fleet vehicles (after proper consideration of all relevant life cycle factors), with ultra-low carbon vehicles which would help government meet its carbon reduction commitments, as well as stimulate innovation in the industry. To achieve real results in this area, the Government should consider an investment of £500m, in addition to the £30m already earmarked for a subsequent phase of LCVPP.[32]

We believe this would represent far better value for money for tax payers than the current 'scrappage schemes' under consideration, which would serve, in effect, to create a market that simply isn't there at the moment. This would stimulate unprecedented innovation amongst vehicle manufacturers to compete in that market place.

Figure 2: Existing Government car fleet by engine type and size



32 SDiG 08 data collected from departments indicates a government fleet size of 23,556 vehicles. As a proxy for ultra-low carbon vehicles, we have used the 2009 Ford Fiesta ECOnetic, which the government's Act on CO_2 website lists as the most fuel efficient new car (www.direct.gov.uk/actonCO2) at 98 gCO_2/km. If 100% replacement is assumed, and using the current price of the Fiesta ECOnetic of £12K as a per unit estimate, the cost of such a programme would be £283m.

Rail

As regards rail transport, fares are already 50% higher in the UK than they are in Europe. And yet the Government is planning to reduce its investment in the railways by £2 billion a year, whilst expecting passengers to contribute an additional £9 billion a year. This makes no sense at all, in that it will further preference car use over rail at a time when we need to be doing exactly the opposite.

Though it is beyond the scope of this report to present a detailed analysis, the Sustainable Development Commission believes that the Government must now unequivocally demonstrate its commitment to the future of rail. Whilst we strongly support its recent interest in High Speed Rail and in the further electrification of the existing network, we would like to see this brought forward more urgently and at a much higher ambition level. With subsidies maintained at the current level, this indicates the need for a commitment of around £5 billion a year. This is over and above the £23 billion out-turn expected from the CSR 07, which is dominated by the funding for Crossrail.

5.5 Low carbon investments in the public sector

The SDC has an on-going programme of work to encourage Government to lead by example with respect to its own sustainable operations and procurement. Every year, we produce a report on performance by Whitehall departments against its own targets. On CO_2, for instance, government offices were responsible for 2,642,623 tonnes of CO_2 in 2007/08[33]. There is a commitment to cut these emissions by 30% by 2020 (compared with 1999–2000 levels). SDiG 08 reports a reduction of 6.3% in carbon emissions from offices since the baseline year; an improvement of 2.3% from 2006/7. This is clearly woefully inadequate given the additional target the Government has for achieving carbon neutrality on the central government estate by 2012.

Media interest in the poor energy performance of government buildings is very high. An unpublished auditing study will show that some 8,849 public sector buildings emit **5.6m tonnes** of CO_2 per year, with one in six buildings receiving the lowest possible energy efficiency rating.[34] Pan-government figures continue to show poor performance against the BREEAM buildings standards commitment, with only 42% of total projects (new build and major refurbishments) achieving the required standard.[35]

This sends out all the wrong signals both to the private sector and to individuals. From next year, all Government departments, along with the wider public sector (school, hospitals, prisons and local authorities) will be required to participate in the Carbon Reduction Commitment (CRC). This scheme will also encompass large swathes of the private sector. Poor understanding of its implications for the public sector is compounded by the fact that the baseline for the CRC will already have taken into account the improvements in carbon emissions made in recent years, and will therefore prove a much more challenging starting point. Poor performance by public sector organisations will result in the leakage of taxpayers' money to the private sector.

Many of the measures required to address this chronic under-performance have short payback times, which makes this whole area of Government performance a prime target for 'invest to save interventions'. The Commission is working closely with DECC, and with the Centre of Expertise for Sustainable Procurement (CESP), on how this 'Big Energy Shift' across Government and the Public Sector can be dramatically accelerated. Increased levels of funding are a necessary but not sufficient condition. It is notable, for instance, that the principal financing mechanism in this area – the SALIX fund – remains undersubscribed, as is the public sector element of the Low Carbon Buildings Programme.

The reality is that hard pressed School Heads or NHS Trust Chief Executives are required to give priority to the delivery of the front-line services for which they are accountable, and there is growing evidence that many would actively welcome a more prescriptive 'command and control' approach, which would give them the benefits of lower fuel costs and lower-carbon buildings through directed help and support. Otherwise, the kind of targets outlined in the NHS's excellent new 'Carbon Reduction Strategy for England' will remain exactly that – just another batch of non-mandated aspirations, which means that vast sums of taxpayers' money will continue to be wasted simply as a consequence of not getting on top of the NHS's enormous energy bills.

Dramatically improved energy efficiency initiatives must be the top priority for government. However, a programme of support (advice and finance) for self-generated renewable energy is also needed. This should include regional/collaborative schemes to allow departments to work together and share costs as well as opportunities. The SDC is undertaking research to identify which self-generation technologies would work best on the government estate.

33 Sustainable Development Commission, *Sustainable Development in Government* (SDiG) 2008 Assessment, December 2008
34 The Guardian, 23 December 08, accessed at www.guardian.co.uk/environment/2008/dec/23/carbon-emissions-uk
35 Sustainable Development Commission, *Sustainable Development in Government* (SDiG) 2008 Assessment, December 2008

Early findings highlight wind energy, photovoltaic and biomass as the most appropriate technologies. The study will identify in rough terms the size of the investment required, the potential energy production, and the associated carbon savings.

Initial findings suggest a level of investment of at least £3bn a year. We see no reason why these investments (in both efficiency and self-generation) should not be made via an extension of the existing SALIX fund.

Crucially, this proposal offers the means of achieving the existing target of carbon neutrality in energy use on the central government estate by 2012. Hitting this target is important not just for its own sake, but because there is a substantial reputational risk to Government in missing it. There is also a substantial financial penalty for failure: if carbon reductions are not made on the central government estate, the Carbon Reduction Commitment will require offsets to be bought from elsewhere at an estimated cost (at their current very low price) of £40 million per year.

5.6 Employment and skills

This proposal supports the other five priority areas, but is no less important. There is plenty of evidence to suggest that even if the demand-side strategies outlined above, were put in place, much more effort will also be required on the supply side. Defra's Green Jobs Strategy, for instance, outlines in stark terms the skills shortages, manifest in unfilled vacancies in key sectors such as the construction industry.

It is critical that as many as possible of the substantive proposals in this document translate into jobs in short order – otherwise they will not work as a stimulus package and may not be deliverable anyway. Although this will be partly a matter of taking up existing slack, it will almost certainly require reskilling and upskilling. This means the skills sector will have to design the courses and qualifications needed and start to provide the training on the scale needed within a very tight timetable. The SDC is already in dialogue with DIUS, whose responsibility it is, working through a range of delivery partners, to help make this happen.

For each of our proposals this means:

- working with the relevant government departments and private companies to identify the skills and resources needed
- working with the Sector Skills Councils and other skills and qualification specifiers (including leading-edge employers, trade and professional bodies etc) on the range of the skills required
- on the basis of the above, ensuring that training providers (whether FE colleges, private sector training companies, or employers themselves) are able to supply the training needed, and, where appropriate, redeploying government finance to enable them to respond quickly
- ensuring that companies are aware of the opportunities this kind of 'Sustainable New Deal' could create for them, so that they create demand for skilled employees (whether this means training the existing workforce or employing new employees). In part, this means making use both of DIUS's 'Train for Gain' brokers (advisors to business on the subsidised training they could receive) and of BERR's 'Business Link' advisers
- providing additional financial support to the extent that there is demand for skilled labour but shortage of funds means this does not translate into demand for courses.

This requires a whole series of enabling interventions by government rather than central planning. DIUS cannot and should not be issuing edicts about how many courses in what are conducted where – but it should be ensuring that information flows quickly to the right people, and that central government funding flows appropriately. At the very least, the Government should be significantly ramping up its investment in business support to help SMEs meet new expectations around resource efficiency and low-carbon.

More quantitative work has been done on specific sectors. For example, the TUC estimates that jobs in the energy sector as a whole will need to grow from 16,000 to 133,000 to manufacture, construct and operate the new technologies.[36] In the period to 2020, on- and offshore wind farms are likely to generate over 80% of the 38.5 GW of installed renewable electricity capacity, and up to 36,000 direct new UK jobs could be created in the wind energy sector.[37]

For retrofitting housing stock, the current levels of investment in skills seems to be insufficient to meet even the existing level of demand, let alone

36 *Supply Chain Constraints on the Deployment of Renewable Electricity Technologies* Douglas Westwood, 2008.
37 *Employment opportunities and challenges in the context of rapid industry growth*, Bain and Company, 2008.

that which would be required for the accelerated programme we propose.[38] Investment in retrofitting skills is estimated (within the £11,000/property) at an average of £500 per dwelling. Without this, costs will be higher, because the skills gap is already pushing up the price of domestic retrofitting. Much of the coordination on skills training occurs at local level. For example, the London Energy Partnership found that six Sector Skills Councils have responsibility for skills and training in energy efficiency and renewable energy.[39] Co-ordination and decision-making on skills provision is needed both at national and local levels.

Summary

What's clear from this illustrative exercise is that there is more than sufficient scope for a green stimulus investment in the order of £30 billion per year. In addition to these priority areas, it is also worth remarking here that there are enormous additional opportunities in addressing energy efficiency in the non-domestic building stock, improving process efficiency – in particular through small-scale co-generation technologies – in industry, implementing distributed heat and power networks, and investing in ecosystem protection and maintenance.

In summary, the SDC is proposing a Sustainable New Deal for the UK which sets in place annual investments of around £30 billion per year. Taken together with the anticipated outturn of £50 billion from CSR07, this would put the UK on track to achieve its climate change commitments, reduce the cost of energy to the national purse, improve health (for example through lower fuel poverty and less obesity) and deliver improved environmental quality for generations to come.

In the final section of this report, we explore some of these social returns in more detail.

38 ProEnviro, *Skills for a Low Carbon and Resource Efficient Economy*, 2008
39 LDA/London Energy Partnership, Skills for a low-carbon London: summary report and recommendations, March 2007

6 Social returns to a green stimulus package

What are the likely returns in terms of jobs and other benefits?

The social returns to a green stimulus package of the kind outlined in the previous section are to be found in a number of areas:

- Reduced reliance on scarce and imported energy resources
- Reduced carbon emissions
- Economic savings from lower fuel bills, reduced congestion, fewer road traffic accidents and reduced pollution
- Improved quality of life through healthier lifestyles, lower levels of obesity and better neighbourhoods
- Protection and creation of a significant number of jobs.

We have already indicated the extent of some of these returns in the previous sections. Estimates from the US suggest that green energy initiatives have the potential to save the US economy almost half a billion dollars each year for every $1 billion invested, as well as saving over half a million tonnes of greenhouse gases and providing 30,000 jobs. It's been estimated that a large-scale programme to expand energy conservation and renewable energy in the EU could create up to two million new full-time jobs. The South Korean Green New Deal estimates that it will create almost one million new jobs.[40]

Numerous other recent reports (including those associated with national recovery plans) have pointed to the employment potential from a green stimulus. As Deutsche Bank has argued, 'one of the reasons that the "green sweet spot" is an attractive focus for an economic stimulus is the labor-intensity of many of its sectors.'[41]

A report by University of Massachusetts' Political Economy Research Institute (PERI) supports that view. It identifies six priority areas for investment: retrofitting buildings, mass transit/freight rail, smart grid, wind power, solar power and next generation biofuels. The authors calculate that spending $100 billion on these interventions over a two year period would create two million new jobs. By contrast, the same money directed at household spending would generate only 1.7 million jobs. And if directed at the oil industry, fewer than 600,000 jobs.[42]

As the HSBC analysis makes clear, there are still considerable question marks over the precise potential for job creation from a green stimulus – as there are for job creation from any recovery package. Estimates differ from country to country, from sector to sector, and from context to context. Ideally, we would need a robust, sectorally-disaggregated model of employment to assess the precise impacts in the UK. Treasury has been talking for years about potential jobs from investments in 'a green industrial revolution', but has as yet failed to do any comprehensive analysis of what this means in practice.

In the absence of such an exercise, Table 2 convenes a number of the estimates for job creation (or protection) from studies and spending plans around the world. It shows the nature of the spend, the estimated job creation potential, the overall scale of investment and the investment cost per job. The final column shows the (pro rata) employment benefit from a fiscal package worth £30 billion.

40 See for example: *A green global recovery? Assessing US economic stimulus and the prospects for international coordination.* Policy briefing PB09-3. Peterson Institute for International Economics/WRI, February 2009; *Green Jobs: towards decent work in a*

Table 2: Estimated job impacts of stimulus spending

Programme	Jobs created or saved	Investment billion £	Investment cost per job £k/job	Job creation potential from £30b
Renewables and energy efficiency (PERI/CAP study)	2,000,000	69.0	34	870,000
Renewables, grid, energy efficiency, public transport (ARRA)	2,500,000	77.4	31	968,000
Energy efficiency (Apollo Institute, US)	21,500	1.0	32	935,000
Renewables, energy efficiency, public transport, water and waste (South Korea)	950,000	21.4	23	1,333,000
Renewables, energy efficiency, public transport, ecosystems (UNEP)	30,000	0.7	23	1,305,000
Infrastructure fund to build low carbon homes (EIC)	160,000	6.0	38	800,000
Retrofit energy efficiency in low income homes (EIC)	145,000	1.5	10	2,900,000
Retrofit energy efficiency in schools and hospitals (EIC)	21,500	1.0	47	645,000

Although there are some outliers, there is a reasonable consensus from these estimates that a stimulus package of up to £30 billion a year could create at least 800,000 new jobs.

It's important to note in addition that there are clear, additional economic returns from a green stimulus. Some – but not all – of these returns accrue directly to government, and can therefore properly be accounted for in a fiscal account of any stimulus package. Such returns include direct fuel cost savings to government, as well as indirect savings in public expenditure resulting from reduced health costs, less congestion and lower levels of pollution. Internalising some of these costs – for instance through a carbon price – will inevitably increase the visibility of these direct returns to the government purse.

Some of the returns accrue to businesses and households rather than directly to government. In conditions of recession, this is clearly in the national interest in so far as it boosts household income and reduces the pressure on firms to axe jobs. But it also raises the question of how such spending is to be paid for.

Four broad options present themselves: deficit spending; raising money through environmental taxation or the auctioning of carbon permits; issuing green bonds; or increasing the public ownership of energy-related assets.

1 In the very short-term, the most obvious option is conventional deficit spending – increasing the Public Sector Borrowing Requirement. But it is far from ideal. Increased deficit spending at this point is likely to push the public sector net debt to levels approaching 70% of the GDP within a year or so, from which the UK could take decades to recover.[43] Besides this, there are clear signs of 'saturation' in conventional debt markets, with a real prospect of failure in the government's ability to raise increasing levels of debt.[44]

For this reason, there is now a strong case for serious consideration of the other options. If households are – as would be expected – benefitting from reduced energy-related costs as a result of green recovery investments, then what is required is an appropriate mechanism for balancing investment costs against these economic returns. Each of the three additional options identified above achieves this aim.

2 Environmental taxation is perhaps the 'bluntest' instrument for recovering investment costs, but one in which there are strong grounds for serious consideration. There is clearly an urgent need to open up a public debate about the long-term sustainability of the UK tax base in the context of rising public sector debt. The role that a shift towards environmental taxes might play in this should be a part of that discussion. In fact, the UK Government has a long-standing commitment to the principle of environmental taxation which it has completely failed to capitalise on so far, and irrespective of its use as a funding mechanism here, there is a strong case to improve the Government's record in this regard.

3 A further option would be to fund specific elements of a sustainable new deal through 'green bonds' – bond issues which are targeted directly at low-carbon investments of the kind identified in Section 5. This idea has a strong rationale under current conditions for a variety of reasons. In the first place, it is clear that many of these investments offer considerable returns, at a point in time when the returns on conventional savings (particularly household savings) are disappearing.

The absence of suitable savings vehicles is particularly frustrating when the propensity of UK households to save is finally emerging from the doldrums. The savings ratio in the UK collapsed dramatically over the last decade and fell below zero in the first half of 2008 to reach a 40 year low. But it is now recovering – as it tends to do in times of economic slowdown. Keynes's 'paradox of thrift' is frustrating for government policies aimed at encouraging people to spend. But instead of going against the grain of people's natural financial prudence at such times, there is a good case for providing robust and credible vehicles to save in a form which could provide the basis for stimulus funding. Green bonds offer people a clearly differentiated way of bringing consumer choice to bear on investment markets at time when bond markets are saturating.

This opportunity is important for another reason. The evidence from consumer research suggests that people are desperate for guidance on ways not just to change their lifestyles to be 'greener', but also to shift their investment decisions.[45] By targeting such bonds at domestic savers, green bonds could also reduce the UK's high exposure to 'external' debt.[46] In summary, green bonds provide a differentiated savings product when the propensity to save is high; and in doing so they inject investment funds directly into green recovery.

4 Finally, innovative service structures, which share the rewards from low carbon investment between households and investors, have a clear rationale here. This 'energy services model' is usually assumed to proceed through private sector energy service companies, and there is no reason to preclude that possibility here. But there are some strong arguments to suggest that government itself could take some stake in the ownership of energy-related assets – particularly when public funds are flowing through them to stimulate investment. The argument here is not dissimilar to the one used to justify public ownership in the banks. There is a legitimate public claim on the return from public investment wherever those funds are directed. The energy sector case for equity funding from the public sector is at least as strong as the financial sector case where the model is now widely accepted.

One thing is clear: achieving long-term social goals in the energy sector already requires innovative thinking and creative approaches to asset ownership and investment architecture. The case for a green recovery package simply pulls these issues to the fore. Before consigning the nation to additional years of national debt, it is clearly crucial to explore the full range of funding options in much greater depth.

43 For more discussion on this issue see *Prosperity without Growth? The Transition to a Sustainable Economy*. (Sustainable Development Commission, 2009).

44 On 25th March 2009, a 'gilt' auction failed in the UK for only the 4th time since 1986. Though not in itself an indication of a collapse, this failure was a worrying indication of increasing difficulty (and cost) in funding UK public debt.

45 *I will if you will – Report of the UK Sustainable Consumption Roundtable* (Sustainable Development Commission/National Consumer Council, 2006)

46 The external debt refers to debts held overseas. The UK's external debt is the second highest in absolute terms after only the USA and is equivalent to around four and a half times the UK GDP (SDC 2009, Chapter 2).

7 The road to a sustainable economy

The arguments set out in this document suggest that there is a very strong case for expanding the green stimulus set out in the November PBR as part of a wider package of measures to rescue the UK economy from the current recession, whilst at the same time furthering sustainable development.

Consideration of the different timescales involved here is essential for any evaluation of these proposals. The sustainable development agenda is necessarily long-term, and some of the programmes SDC has suggested would require consistent funding over a long period, particularly in the case of a comprehensive retrofit of the existing housing stock. Assuming an economic recovery in 2010, any such long-term programmes would need to be continued after the end of the period during which a fiscal stimulus is required.

In fact, from a sustainable development perspective, the notion of 'economic recovery' is itself a problematic one, because recent patterns of virtually worldwide economic growth, if resumed in a year or two, will have a devastating impact on eco-systems, and on the capacity of the planet to provide the foodstuffs, metals, and other natural and environmental resources on which the world economy depends.

The relentless pursuit of this kind of business-as-usual economic growth would bring us, in the medium to long term, back into recession, principally through the mechanisms of increased commodity prices and climate-induced shocks. Short-term proposals for a Budget for sustainability, as set out in this document, and others like it from other organisations, should therefore be seen in this longer-term context. This context has been addressed head-on in the SDC report *Prosperity without Growth?*.

In spite of this, as we have demonstrated, there are very strong arguments in support of an immediate green stimulus package which could comprise at least 50% of an economic recovery package representing some 4% of GDP. A green stimulus offers jobs and economic recovery in the short term, energy security and technological innovation in the medium term, and a sustainable future for our children in the long term.

CIEH Paper 1

Chartered Institute of Environmental Health

NI Environment Committee
Inquiry on Climate Change

Supplementary Paper 1

August 2009

The Chartered Institute of Environmental Health

As a professional body, we set standards and accredit courses and qualifications for the education of our professional members and other environmental health practitioners.

As a knowledge centre, we provide information, evidence and policy advice to local and national government, environmental and public health practitioners, industry and other stakeholders. We publish books and magazines, run educational events and commission research.

As an awarding body, we provide qualifications, events, and trainer and candidate support materials on topics relevant to health, wellbeing and safety to develop workplace skills and best practice in volunteers, employees, business managers and business owners.

As a campaigning organisation, we work to push environmental health further up the public agenda and to promote improvements in environmental and public health policy.

We are a registered charity with over 10,500 members across England, Wales and Northern Ireland.

Any enquiries about this response should be directed in the first instance to:

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1.0 Background and context

1.1 The Environment Committee is currently completing an inquiry on climate change and the issues relating to Northern Ireland. We gave evidence to this inquiry in May 2009. During the evidence session members of the committee requested further information on several points that we raised. This supplementary paper seeks to provide further information relating to the specific request for further detail regarding the costs associated with upgrading existing housing stock in Northern Ireland.

2.0 Detail

2.1 The government has made a pledge that carbon emissions from existing homes be cut by 80% by 2050. The housing sector represents 27% of total emissions in the UK, and increases in population and falling household size mean this sector is set to increase. It is estimated that some 80% of homes that will be standing in 2050 have already been built. Therefore, existing housing stock will need to play a key role in achieving climate change targets.[1]

2.2 In their submission to the NI Assembly Environment Committee Inquiry into Climate Change the Energy Saving Trust (EST) recommended that a series of targets must be set in Northern Ireland for the reduction of greenhouse gases. EST referred to The Committee on Climate Change's analysis[2] and highlighted the fact that one key feature of the sectors covered, particularly the residential sector, seemed to be the scope for significant energy-efficiency improvements. Significant energy savings are possible in housing because they can be made at low cost, nil cost and at even negative cost, as up-front investment would be quickly recouped and deliver a good return.

2.3 However, it was noted that while the Climate Change's analysis looked at the reduction of emissions in the UK as a whole it did not break down the potential for Northern Ireland and the EST were not aware of any NI-specific work on this. The energy efficiency and microgeneration technologies in NI are different from those in the UK as a whole. One reason for this is the number of households that are on gas. In GB, 95% of households are on gas, but only 122,000 homes are here.

2.4 There does not appear to be any specific analysis that has been undertaken to look specifically at the costs of NI meeting delivering a 'fair and proportionate' share of the UK's climate change targets, and this is understandable because NI's appropriate share has yet to be determined.

2.5 In terms of the costs of delivering improvements to the energy performance of existing buildings it worthwhile noting the Synthesis of Climate Change Policy Appraisals, (DEFRA, January 2007)[3] which showed that it is more cost-effective to deliver carbon savings in the household sector than in any other and the findings of the CCC's analysis[4] highlight that 'One key feature of the sectors covered, in particular of the residential sector, is that there appears to be scope for significant energy efficiency improvement at a cost to the economy and to individuals which is low, nil, or indeed negative (i.e. where upfront investment would be quickly repaid and give a good return).' Despite the fact that this report originated from DEFRA this point is just as relevant and applicable in NI as in England and Wales.

2.6 The EST offered some figures to the NI Assembly Environmental Committee when evidence was given on 14 May 2009:

"There are 75,000 homes that need cavity wall insulation; 75,000 homes that have solid wall insulation; 500,000 homes that need their lofts topped up to the right level of insulation; and 150,000 oil boilers that need to be upgraded. By 2020, we need 250,000 gas conversions, 55,000 wood-pellet boilers, and 200,000 solar and water panels, if we are to get to where we want to be. We need 50,000 ground or air heat pumps. The cost of those measures amounts to £2·6 billion over the next 10 years or so, but they will result in savings of £3·7 billion and 7·3 million tons of carbon."

2.7 Notwithstanding the excellent work of the EST, there still exists considerable scope for improving the efforts made in assisting private home owners and landlords to improve energy efficiency within existing housing. Particularly in this time of economic recession when often modest investment could yield significant savings.

2.8 Not enough use is being made of existing opportunities where public sector services in NI have a “ready made" interface with homeowners and occupiers. These settings and services, which include community health services (e.g. district nurses, health visitors, occupational therapists, social workers etc) as well as environmental health services, often present ideal opportunities to provide simple information on energy saving which at its most basic involves no cost to the homeowner.

2.9 Serious consideration should be given to utilising these opportunities much more effectively and to that end the development of an integrated information pack which sets out the benefits; the steps that individuals can take; and provides a comprehensive list of where further assistance and information can be obtained (including financial assistance with improvements). CIEH would be very happy to assist in the development of this idea and, assuming funds were available for its production, the development of such a pack. We have strong links with the Chartered Institute of Housing who should also be involved in this, along with other potential partners.

2.10 CIEH argued that the remit for home energy efficiency, currently with the Northern Ireland Housing Executive, would have been much better positioned within the new local authorities post RPA, simply because they have much better opportunities in terms of interfaces with the general public, coupled with their active involvement in health partnerships. This remains our position.

[1] Sustainable Development Framework Existing Housing Stock – Climate Proofing February 2009

[2] http://www.theccc.org.uk

[3] http://www.defra.gov.uk/environment/climatechange/uk/ukccp/pdf/synthesisccpolicyappraisals.pdf

[4] http://www.theccc.org.uk/reports/

CIEH Paper 2 - Obesity

Chartered Institute of Environmental Health

NI Environment Committee Inquiry on Climate Change

Supplementary Paper 2

August 2009

The Chartered Institute of Environmental Health

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1.0 Background and context

1.1 The Environment Committee is currently completing an inquiry on climate change and the issues relating to Northern Ireland. We gave evidence to this inquiry in May 2009. During the evidence session members of the committee requested further information on several points that we raised. This supplementary paper seeks to provide further information relating to the specific request for further detail regarding the links between obesity and climate change.

2.0 Detail

2.1 Given the rapidly increasing global concern over the growing percentage of populations, particularly in developed nations and including the United Kingdom and Ireland, a wealth of evidence exists suggesting causal factors (many of which could be readily deduced in any case) which predispose individuals to obesity. People who are obese consume a high percentage of foods high in fat, salt and sugar; eat a high proportion of processed foods; and tend to take little or no physical exercise and in particular either drive or take public transport in preference to walking or cycling.

2.2 All three of these lifestyle issues and choices are inherently carbon intensive either in terms of CO2 emissions from the activities themselves (High fat foods; sugar and salt; processed foods and transport are all sources of significant CO2 emissions) or in the case of meat and dairy the methane (CH3) emissions produced by the animals themselves. Clearly the greater the demand

for meat and dairy products, the more intensive these industries become and the greater the carbon footprint as a result.

2.3 Apart from the types of food eaten, there is also evidence that suggests that people who are obese eat more food in general than those with a normal body mass index.

2.4 Research carried out by Department of Epidemiology and Population Health at the London School of Hygiene and Tropical Medicine[1] compared two theoretical populations: one with a 'normal' mix of body types, and the other an 'overweight' population where 40% of people were obese and the findings show that as the population distribution of body mass index (BMI) increases so does greenhouse gas emissions. Compared with a normal population distribution of BMI, a population with 40% obese requires 19% more food energy for its total energy expenditure. Greenhouse gas emissions from food production and car travel due to increases in obesity in a population of 1 billion are estimated to be between 0.4 giga tonnes (GT) and 1.0 GT of carbon dioxide equivalents per year.

2.5 This research shows that the maintenance of a healthy BMI has important environmental benefits in terms of lower greenhouse gas emissions. The authors argue that obesity should be recognised as an environmental problem because of its contribution to climate change from additional food and transport GHG emissions.

2.6 An earlier report by the Institute for European Environmental Policy (IEEP) in 2007[2] also linked climate change and obesity. The report found that by returning to the walking patterns of 30 years ago, when car ownership was less common (i.e. by walking just 1 hour more during the week), people could help save up to 11 MtCO2 (15.4% of total emissions from passenger cars) and reduce the chances of becoming obese (i.e. avoiding an average weight gain of 2lb 11oz each year, which over 20-30 years could lead to an obese body weight).

2.7 In other words this study suggests that reverting to the walking patterns we had before owning a car, when physical activity included more regular walking to work, to the shops and to escort children to school, could be an important part of national programmes to fight climate change and obesity. The costs of such programmes are likely to be dwarfed by those that would be incurred by the National Health Service and society at large through inactivity, ill-health and premature death as a consequence of obesity (estimated at £8.2 billion per year).

2.8 Globesity: A Planet Out of Control?[3] is a book by four public-health researchers who show how climate change and obesity draw from a shared web of roots. Both problems worsen as car culture spreads, desk jobs replace manual jobs, and carbon-intensive foods (including meat) become available to more and more eaters

2.9 The Department of Health in England has recognised the importance of providing sustainable food in hospitals and how this has a positive impact, not only on health and well-being, but also on the environment. In their report 'Sustainable food: a guide for hospitals[4]' the DH and the NHS highlight the importance of sustainable food, defining it as food that should be produced, processed and traded in ways that contribute to thriving local economies and sustainable livelihoods whilst avoiding damaging natural resources and avoid contribute to climate change. Sustainable food should also be safe, healthy and nutritious for consumers and it should "respect biophysical and environmental limits in its production and processing, while reducing energy consumption and improving the wider environment."

2.10 It has been suggested that production, distribution and consumption of food in the UK account for 22% of total greenhouse gas emissions[5] and the NHS accounts for 25% of all public sector carbon emissions and 3.2% of total carbon emissions in England[6]. It is therefore recognised that the sheer volume of NHS food services provides a significant opportunity for the

NHS to alter its approach to the sourcing of ingredients and the production of food, leading to improvements in the health of patients and staff, while reducing environmental impacts.

2.11 The Scottish National Food and Drink Policy Leadership Group recently compiled extensive research on health and food sustainability and noted that the biggest contributors to the ecological footprint within Scotland are the food industry, the housing sector and mobility (including air travel). Whilst there is debate about the exact contribution of food, there is some agreement that the food supply chain accounts for around 20% of the Scottish footprint (Garnett, 2008[7], SEI, 2008[8]) Within the food supply chain, there are several key areas that can be identified as major contributors namely; Intensive livestock production (methane production); food processing (water, energy costs); food packaging; food conveyance (at all stages from production to processers to retailers to consumers); and food waste

2.12 In their study report on A Framework for Pro-environmental Behaviours DEFRA (2008)[9] focused on three main areas of action related to the food chain notably waste and recycling, eating food locally in season and adopting diets with lower environmental impacts. Whilst reductions in each of these arenas are desirable from an environmental sustainability perspective, there may be unintended consequences (both positive and negative) in terms of economic and socio-cultural perspectives (and indeed dietary implications) which require careful modelling to be able to assess potential intervention effects. For example, reduction in the consumption of sugary drinks which are presented in a range of packaging, transported from far distant sites of production, which are often stored and served from chilled (energy using) cabinets and vending machines could make a significant contribution to the reduction in dental caries and obesity with minimal impact on the socio-cultural sustainability of Scotland.

Summary

Typical dietary behaviours of people who are obese or, alternatively, the type of diets that predispose individuals to obesity are also carbon intensive, more so than a healthier diet.

Correspondingly, changes in dietary behaviour that would hypothetically reduce an individuals risk of obesity and improve overall physical health would also have a positive environmental impact.

Likewise, other behavioural patterns such as more physical exercise through for example walking and cycling as an alternative means of transport to the car, which are proven to benefit overall health and wellbeing, as well as reduce obesity risk, are also less carbon intensive.

There are very clear opportunities for government departments and agencies, most notably in the health and environmental sectors, to develop joint campaigns and programmes around these issues. Much greater effort needs to be channelled into doing so.

[1] Edwards P and Roberts I. Population adiposity and climate change. IJE 2009;

[2] Davis, A et al (2007) Unfit for purpose: how car use fuels climate change and obesity Institute for European Environmental Policy: London

[3] Delpeuch, F et al Globesity: A Planet Out of Control? (2009)

[4] Department of Health, April 2009

[5] DEFRA, Securing the Future, 2005

[6] NHS Sustainable Development Unit, Saving Carbon, Improving Health, 2009

[7] Garnett T (2008) Cooking up a storm Food Climate Research Network. University of Surrey http://www.fcrn.org.uk/frcnPubs/publications/PDFs/CuaS_web.pdf

[8] SEI (2008) http://www.resource-accounting.org.uk/downloads

[9] DEFRA (2008) A framework for pro-environmental behaviours London: DEFRA.

“Smarter Travel" Policy from Department of Transport

smartertravel

A Sustainable Transport Future

A New Transport Policy for Ireland 2009-2020

Executive Summary

Transport and travel trends in Ireland are unsustainable, as outlined in Chapter 1 of this Policy. Even with the much needed investment in *Transport 21*, if we continue with present policies, congestion will get worse, transport emissions will continue to grow, economic competitiveness will suffer and quality of life will decline.

Chapter 2

Chapter 2 summarises the results of a public consultation process by the Government on how to respond to the above trends. There was very significant engagement from both the public and organisations with over 480 submissions received. There was broad agreement with the Government's vision to have a sustainable transport system by 2020, including a recognition that fiscal measures will have to be introduced to discourage people from using the car unnecessarily.

Chapter 3

In Chapter 3 the Government reaffirms its vision for sustainability in transport and sets out five key goals: (i) to reduce overall travel demand, (ii) to maximise the efficiency of the transport network, (iii) to reduce reliance on fossil fuels, (iv) to reduce transport emissions and (v) to improve accessibility to transport. To achieve these goals and to ensure that we have sustainable travel and transport by 2020, the Government sets the following key targets:

- Future population and employment growth will predominantly take place in sustainable compact forms, which reduce the need to travel for employment and services
- 500,000 more people will take alternative means to commute to work to the extent that the total share of car commuting will drop from 65% to 45%
- Alternatives such as walking, cycling and public transport will be supported and provided to the extent that these will rise to 55% of total commuter journeys to work
- The total kilometres travelled by the car fleet in 2020 will not increase significantly from current levels
- A reduction will be achieved on the 2005 figure for greenhouse gas emissions from the transport sector

Chapter 4

Chapter 4 outlines the actions to reduce travel demand. Pivotal is the need to improve the alignment of spatial and transport planning to stop urban sprawl and urban-generated one-off housing in peri-urban areas. Actions are also set out to align employment and transport policies, with a particular focus on encouraging e-working. The Chapter also outlines commitment by Government to support mobility management programmes, which encourage people to switch to more sustainable modes of travel. It signals also the need to develop solutions to make the movement of goods more efficient. The Chapter also indicates the Government's intention to introduce carefully targeted fiscal measures to discourage unnecessary use of the car.

Chapter 5

To ensure that a reduction in travel demand and reliance on the car can be achieved, there must be appropriate, reliable and user-friendly alternatives in place. Chapter 5 sets out the Government's ambition to provide such alternatives. Apart from the very significant investment in Transport 21, which will provide public transport for around 140,000 additional commuting passengers, there is a need to realise provision for a further 90,000 commuting passengers. The main commitment is to transform both rural and urban bus services to meet this challenge. More dramatically, around 200,000 people will switch to cycling and walking and the Chapter sets out the Government's commitment to radical measures to support these modes so that citizens can take these healthy options in safety.

Chapter 6

Chapter 6 focuses on the actions that can be taken to improve the efficiency of motorised transport to reduce emissions and reliance on fossil fuels. There is a commitment to making all publicly funded transport fleets more sustainable. The Government commits to an ongoing programme to encourage and demand more efficient driving through training and adoption of more environmentally appropriate speed limits and through the use of technology to tackle road traffic congestion. At international level, Ireland will support schemes to reduce emissions in the aviation and maritime sectors and we will meet our obligation to achieve a target of having 10% of all transport fuels from renewable sources by 2020.

Chapter 7

Chapter 7 outlines the steps needed to ensure integrated delivery of the Policy. The issues cut right across all areas of Government and co-ordination arrangements are proposed to ensure that policies are aligned. The Department of Transport will drive delivery of individual actions. Existing transport agencies have an important role to play in delivering the targets in the Policy. Their roles will be reviewed in the light of the Government's new strategy. Local authorities will be required to prepare transport plans in keeping with this strategy and ensure that local development plans are aligned to them. The potential for all-island initiatives are outlined and the chapter also sets out support schemes for sustainable travel projects, including the concept of sustainable demonstration towns.

ICTU "Round Table" Presentation

Chapter 8

The final chapter, Chapter 8, highlights the funding needed to implement the Policy by 2020, which is estimated to total some €4.8 billion over the lifetime of the Policy. The funding of the Plan will be a matter for decisions by the Government in the light of prevailing economic and Budgetary parameters. In the first instance, however, the Department of Transport will use the opportunity of the forthcoming review of *Transport 21* to examine its existing substantial investment programme to ensure that it fully complements the broader objectives of the Policy. *Transport 21* provides for total investment of €34 billion up to 2015 and there are clearly opportunities to make important steps toward achieving the aims set out in this Policy within this timeframe. The mechanisms for reporting progress on delivery are also set out.

Key Actions

Achieving sustainable transport will require a suite of actions that will have complementary impacts in terms of travel demand and emissions. Although the Policy contains 49 actions, they can be grouped into essentially four overarching ones:

- Actions to reduce distance travelled by private car and encourage smarter travel, including focusing population growth in areas of employment and to encourage people to live in close proximity to places of employment and the use of pricing mechanisms or fiscal measures to encourage behavioural change.

- Actions aimed at ensuring that alternatives to the car are more widely available, mainly through a radically improved public transport service and through investment in cycling and walking.
- Actions aimed at improving the fuel efficiency of motorised transport through improved fleet structure, energy efficient driving and alternative technologies, and
- Actions aimed at strengthening institutional arrangements to deliver the targets.

It is important to underline that the targets and actions are relevant to both urban and rural living. The Government is committed to rural regeneration and throughout the Plan there are individual actions, such as improved bus services in rural areas, which reinforce this ambition.

Business (and Job) Opportunities in the Environmental Goods and Services Sector

ICTU Round Table

24th June 2009

Dr. Peter Brennan, Managing Director

EPS Consulting

www.epsconsult.ie

Opening Remarks

- Regulatory framework largely agreed; good news as investors respond to clear policy signals
- Peak oil, sustainable development and global warming are the key drivers
- Ireland is playing catch-up
- Areas of Ireland's competitive advantage known but awaiting full commercial exploitation
- Very significant investments in EGS at global level
- Who is in charge? 21 agencies/Departments in this space
- Critical that all perceived barriers to investment be removed
- Significant jobs potential if quick, well-resourced and ambitious projects are supported by Exchequer with private investment
- Rapid expansion of the EGS sector should be the Government's over-arching priority; Green Jobs are a fact not a myth

Defining the Sector

- The EGS sector encompasses a very wide range of activities and definitions of the sector can, and do, differ.
- The US Department of Commerce defines it as those environmental technologies that "*advance sustainable development by reducing risk, enhancing cost-effectiveness, improving process efficiency, and creating products and processes that are environmentally beneficial or benign*".
- The European Commission has adopted the OECD/Eurostat definition which states that: "*The environmental goods and services industry consists of activities which produce goods and services to measure, prevent, limit, minimise or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco systems. This includes cleaner technologies, products and services that reduce environmental risk and minimise pollution and resource use.*"

The Irish EGS Sector

- Air Pollution Control
- Cleaner Technologies and Processes
- Environmental Consultancy
- Environmental Monitoring
- Energy Efficiency
- Energy Management and Auditing
- Marine Pollution Control
- Noise and Vibration Control
- Remediation and Reclamation of Land
- Renewable Energy
- Waste Management and Recycling
- Water Supply and Wastewater Treatment

The Green Economy

- Global market estimated at €3 trillion
- Non-energy element valued at $650 billion i.e. four times size of global software industry
- UK market forecast to be worth £152 billion by 2020
- US to invest $140 billion as part of economic stimulus package
- EU has approved €105 billion in co-financing for green economy projects; with €48 billion ear-marked for climate change projects
- High Level Action Group on the Green Economy set up (May 2009)
- Key growth sectors in Ireland were identified in August 2008 and include:
  - Water and waste water treatment
  - Renewable energy
  - Energy efficiency

Venture Capital Activity

- The year 2008 - the coming of age of the "Greentech" or "Cleantech" sector
- Global VC investments was €6.3 billion; up from €4.7 billion in 2007
- The UK was the main source of cleantech investment in Europe, with 40% of all European venture capital backed cleantech companies based in the UK
- It is estimated that almost half of the UK cleantech deals completed in 2006 received public sector support
- With the exception of the water sector, the vast majority of the investment is in renewable energy (solar, wind and biofuels)
- In the US, investment in solar energy has overtaken investment in biofuels
- To date, with notable exceptions (including ESB's Novus Modus, BoI, AIB, KBC, Dolmen Green Effects Fund, Green Investments), little investment in EGS sector by VC community in Ireland
- 75% of VC investments are under £2m (UK, 2009)

IS IRELAND GETTING ITS SHARE OF THIS INVESTMENT AND IF NOT WHY NOT?

Drivers in Renewable Energy/Energy Efficiency

- Climate change
- Energy Security
- Oil depletion
- Aging power infrastructure (developed world)
- Energy as development bottleneck (rapidly-industrialising countries)
- Energy poverty (slowly developing countries)
- Deregulation: innovation, funds, entrepreneurship
- Breakthroughs in materials science
- Low-cost communication technologies

- LEADING TO: Fundamental re-engineering of the world's energy industry around low carbon solutions and architecture

Drivers – Environmental Consultants' Survey

Where Will The Jobs Come From? Big Ideas!

- Electric Vehicles
- Retrofitting
- Energy efficiency
- Smart transport
- Wind
- Other Renewables
- Forestry
- Water
- Green Tourism

Electric Vehicles

- Potentially the single biggest carbon project for the island of Ireland
- Simon Coveney's report makes the case
- Key Messages:
  - Current level of ambition far too low
  - By 2030 all cars should be EVs (350,000 by 2020)
  - Technology developing fast
  - Ireland the ideal laboratory
  - 8m/tonnes+ reduction in carbon per annum
- Jobs potential arises in relation to:
  - R&D for roll-out at EU level
  - Manufacturing of EVs (EVs cost a fraction of combustion vehicles)
  - Battery/re-charging infrastructure (including domestic)
  - Grid connections

WHAT IS THE JOB POTENTIAL OF THIS INITIATIVE?

Retrofitting

- Some 1m of 1.5m Irish homes pre-date 1990 (275,000 houses vacant at time of 2006 census)
- Households spend some €2.2 billion on energy (average of €1,600 (2005)) and emit 11.9Mt of carbon pa; around 8 tonnes per house – twice that of an average cow!
- 35% of heat loss through walls and 25% through roof; not technology intensive
- SEI's HESS has budget (2009) of just €49m i.e. a grant of €3,500 for 14,000 homes. Is this enough?
- If average cost of typical household retrofit was €7,500 then an investment of €13.5 billion needed
- In addition, public buildings and commercial offices also need to improve their energy efficiency in line with the NEEAP
- Retrofitting is labour intensive, is capable of using Irish materials, will return 40% of spend to the Exchequer: so why then is level of activity so low?

COULD RETROFITTING 2M HOMES/BUILDINGS OVER FIVE YEARS GENERATE 20,000 JOBS?

Energy Efficiency

- Most cost efficient way to reduce dependence on fossil fuels (and consequently to reduce GHG emissions)
- NEEAP (2009-2020) sets out Government's plans but detailed implementation budget not announced
- Could 2 million smart meters be installed at same time as water meters? (only 2,223 smart meters installed to date (March 2009))
- Expanding scope of ACA Scheme would leverage more investment
- Potential jobs content of NEEAP (assuming full implementation) should be assessed
- Also look to export potential: McKinseys has estimated (2009) that global energy efficiency investment opportunities could be worth €131 billion

AS MOST ENERGY EFFICIENT EQUIPMENT IS IMPORTED IS THERE SCOPE FOR MORE INDIGENOUS MANUFACTURE?

Smart(er) Transport

- *smartertravel*>>> sets ambition but specific measures not costed (within overall budget envelope of €4.5bn over 11 years)
- What is CIE's carbon footprint and what is being done to invest in public transport to reduce GHG emissions?
- Electrify the Belfast to Cork line and all Dublin and Cork commuter lines using surplus wind energy
- Replace all petrol/diesel vehicles with EVs
- Reform legislation to incentive private investors; more buses – more jobs
- Promote e-working – quality of life issues a significant issue for commuters
- Start planning now for Transport 22 and factor in potential carbon/energy savings into capital appraisal guidelines

Wind

- 1,077 Mw connected to the national grid (June 2009) i.e. supply for 700,000 homes; wind accounted for some 40% of all generation in recent months
- 2020 target requires another 6,480 Mw
- Micro-generation (4,500 units) will also contribute
- €16bn + of potential investments in the pipeline awaiting CER approval
- Deloitte's estimate (June 2009) jobs could rise from 1,500 to over 10,000 by 2020.
- Turbines account for 75% of total cost
- Spirit of Ireland's wind storage project a major innovation
- **BUT**>>>>
  - Offshore only viable at $200/barrel; hence need for REFIT
  - Turbine manufacturing opportunity not identified as a priority (Galway's C&F Group the pathfinder)
  - Skills shortages a real problem
  - Offshore planning legislation (Foreshore Acts) should be replaced by more modern legislation

Other Renewables

- **Biomass:** Bioenergy Action Plan (2007); BioSpark's €40m investment in Claremorris; GEGA a major player
- **Biofuels**: must be sustainable; in past year algal biofuel projects got $1 billion in VC investments; bio-refinery and bio-energy competence centres set up
- **Ocean**: AEA Technologies forecast of global market is €200 billion; Bacon/ESRI study (2005) estimate 1,900 Irish jobs could be created by 2020; SEI a lead player
- **Tidal**: Ireland's OpenHydro leading the way
- **Solar**: Genersys Ireland believes solar could cater for 30% of household's heating needs; but 10-year payback
- **Geothermal:** GAI examining regulatory framework; also 10-year + payback

HOW MANY IRISH COMPANIES WILL BECOME WORLD LEADERS?

Forestry

- Some 40% of total GHG emissions come from land use (12.2 million cattle primarily)
- Forests act as a carbon sink hence NCCS target of 5Mt of offsets by 2020 (from 2Mt currently)
- Not achievable unless massive increase in annual level of planting; has fallen to just 6,000 hectares – 20,000 hectares is (1996) target
- Has Coilte a conflict of interest?
- Has anyone realised that carbon sequestered in forests has a value? (5Mt @ €35/tonne equals €175m per annum)?
- Remove the barriers preventing investment

AS FORESTRY CAN CREATE RURAL JOBS WHO IS DRIVING THE INVESTMENT OPPORTUNITIES?

Water

- Water is a finite commodity; global warming will put a price on this scarce resource
- World Economic Forum Water Project highlights scale of problem
- EU WFD the driver
- Need one National Authority not 32
- Significant additional jobs will be created only when domestic water is metered
- NDP (to 2013) spend of €4.7 billion scattered among local authorities; no economies of scale and unit cost of procurement too high as a result
- Very limited R&D activity
- Investment Programme for Greater Dublin Region (to 2035) the largest job creation project

Green Tourism

- Consumers are now far more aware of the impact of flying and travelling in terms of carbon emissions and are prepared to pay more
- Some companies turning this into a business opportunity
- Bord Failte published Eco-Tourism Handbook (March 2009)
- Airlines should introduce carbon offset products to attract tourists to Ireland
- NCC could offer offsets to attract convention visitors
- UK's ICARUS Project helps companies implement a Carbon Reduction Programme
- US car rental companies are offering carbon offsetting
- Inchydoney Island Hotel and Spa has largest (80 sq metres) array of solar panels in Ireland
- Carbon offsets could be invested in Irish projects such as forests

COULD IRELAND BECOME A TRULY 'GREEN' TOURISM DESTINATION?

One Company's Contribution

The ESB announced the creation of 3,700 'green economy jobs' as follows:

Smart networking	750
Smart metering	750
EVs	600
Wind energy	300
Property construction	550
New technologies	350
Home insulation	250
Other	150

R&D

2020 Vision: Ireland will be at the forefront of energy research supporting the development of energy efficiency and renewable technologies (NEEAP)

- About €35 trillion will be needed to develop and deploy new clean technologies between now and 2050 (IEA)
- Not at all clear how much being spent annually on EGS R&D in Ireland
- SEI, including Ocean Energy Development; €7m (2009)
- Charles Parsons Energy Research Awards; €20m over seven years
- EI's R&D Fund and Competence Centres
- Irish Energy Research Council has identified priority areas (May 2008)
- SFI's remit now includes sustainable energy and energy-efficient technologies with a €90m budget (six years to 2013)
- 7FP has strong EGS focus

IS THIS LEVEL OF EGS R&D ENOUGH TO ACHIEVE 2020 VISION?

Where Will We Get The Money?

- Carbon tax could easily raise €1bn a year
- ETS auctioning revenue available from 2013 and could be worth €630 per annum by 2020 (assuming 18Mt of allowances sold at €35/tonne)
- Hypothecate monies into a Green Fund(s)?
- Go one step further: set up Anglo Irish as a bank with a dedicated mandate to provide project finance and working capital for Green Economy jobs, and to trade carbon offsets to support Ireland's aim to become a Green Economy
- Many claims on this windfall so how best to use this green revenue?
- Publication of MACC will inform decision-taking
- **What are your views on this split?**
  - 25% for fuel poverty
  - 30% for retrofitting
  - 15% for REFIT
  - 15% for NEEAP
  - 15% for other green economy incentives

What Works In Europe

- The WRAP Capital Grant Scheme (UK)
- The Carbon Trust Enhanced Capital Allowance Scheme (UK)
- Fideme Investment Fund (F)
- Programme for Cleaner Technology (DK)
- Green Financing Measure (N)
- Energy Investment Tax Relief Scheme (N)
- SenterNovem Carbon Reduction Plan (N)
- kfW Bank Programme for investment in renewable energy (D)

(Source: EPS Consulting, August 2008)

WHAT TYPES OF INCENTIVE SCHEMES COULD WORK IN IRELAND?

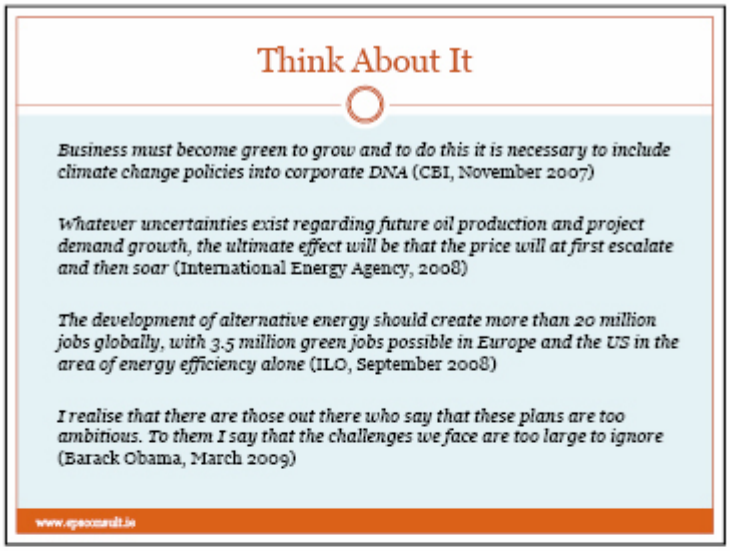
What Others Are Doing

- US to invest $6.6 billion in green economy R&D
- Siemens have already manufactured 6,400 wind turbines
- Denmark's wind turbine industry now consists of 200 companies and has a 35% share of global markets
- BP to invest €500m in Energy BioScience Institute (UC Berkeley)
- Austria has a Master Plan for Environmental Technologies and funds sector and sub-sector EGS networks
- UK's Commission on Environmental Markets and Economic Performance has already set national strategy (November 2007); Carbon Reduction Commitment (which will save business £1 billion by 2020) and Low Carbon Industrial Strategy launched

IN CONTRAST, IRELAND HAS JUST SET UP A HIGH LEVEL ACTION GROUP ON THE GREEN ECONOMY; WE ARE WAY BEHIND OUR COMPETITORS

Sources

- EPS Consulting report on EGS sector: www.epsconsult.ie/news/greeneconomy
- NEEAP: http://www.dcenr.gov.ie/NR/rdonlyres/FC3D76AF-7FF1-483F-81CD-52DCB0C73097/0/NEEAP_full_launch_report.pdf
- Smarter Travel: http://www.transport.ie/upload/general/11284-0.pdf
- Simon Coveney's EV report: http://www.oireachtas.ie/documents/committees30thdail/j-climate_change/reports_2008/20090428.pdf

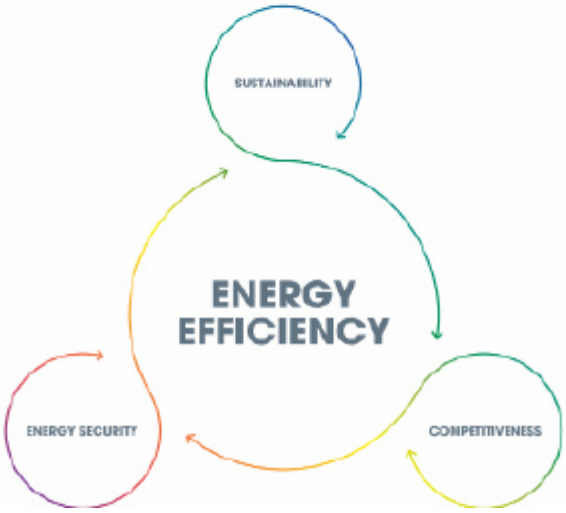


“Energy Efficiency Action Plan" from the Department of Communications, Energy and Natural Resources

Department of Communications, Energy and Natural Resources
Roinn Cumarsáide, Fuinnimh agus Acmhainní Nádúrtha

Maximising Ireland's Energy Efficiency

The National Energy Efficiency Action Plan 2009 – 2020



Executive Summary

Fossil fuels accounted for 96% of all energy use in Ireland in 2007. Our reliance on these fuels means that Ireland, like the rest of the world, is faced with a dilemma. Our current trend of increasing energy use derived from fossil fuels is not sustainable, and with the threat of increasing oil prices as supply dwindles, action needs to be taken now to shift to a sustainable energy future. We have reached a point where we need to make major changes in our lifestyles, our business and the public sector. By reducing our dependence on imported energy, we protect ourselves against international energy price rises whilst reinforcing national competitiveness.

Improving Ireland's energy efficiency is an essential component of our sustainable energy policy. Energy efficiency is internationally recognised as the most cost-effective means of reducing dependence on fossil fuels. The Government's energy policy framework for the period 2007 - 2020 incorporates this goal at its heart and is designed to steer Ireland towards a new and sustainable energy future; one that helps increase security of supply, makes energy more affordable, improves national competitiveness and reduces our GHG emissions.

The International Energy Agency (IEA) recognises the importance of energy efficiency (see Figure 1 below), stating that while technological progress is needed to achieve some emissions reductions, efficiency gains and deployment of existing low-carbon energy accounts for most of the savings.[1] The IEA propose a climate policy scenario, the 450 Policy Scenario, which targets a stabilisation of GHG emissions at 450ppm CO_2-eq and consists of a broad suite of policy measures designed to steer the world away from the harmful effects of dependence on fossil fuels. It is noticeable that the most significant savings can be realised from energy efficiency.

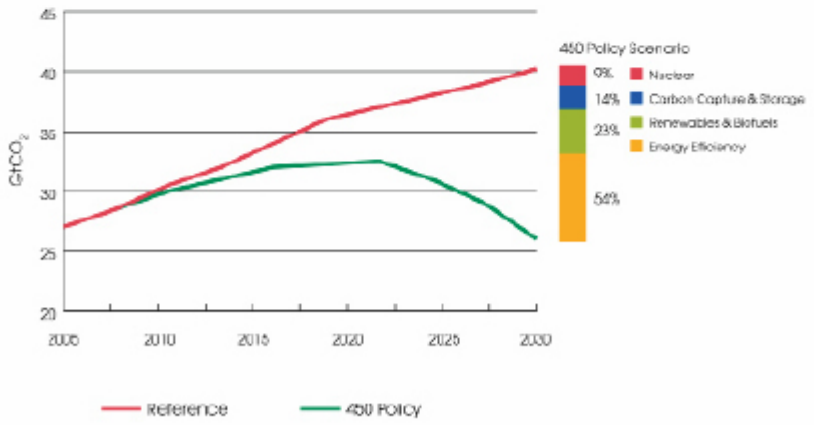


Figure 1: Reductions in Energy-Related CO_2 Emissions in the Climate-Policy Scenario[2]

1 IEA (2008) *World Energy Outlook 2008*.

2 Source: IEA (2008).

Extent of the Challenge

Ireland's demand for energy has grown by 86% over the period 1990 – 2007, with usage increasing in every sector of the economy. Last year, approximately €6 billion was spent on imported energy, and demand is projected to grow by about 24% over the period 2007 – 2020[3] unless action is taken now to reduce demand and usage. This is illustrated in Figure 2 below, which shows historical trends in energy demand and future projections.

The Government has committed to achieving by 2020 a 20% reduction[4] in energy demand across the whole of the economy through energy efficiency measures. A national target of 20% equates to a total of 31,925 Gigawatt hours (GWh) saved in 2020. Recognising that Government must lead by example, we are challenging the public sector to achieve a 33% reduction in public sector energy usage over the same period.

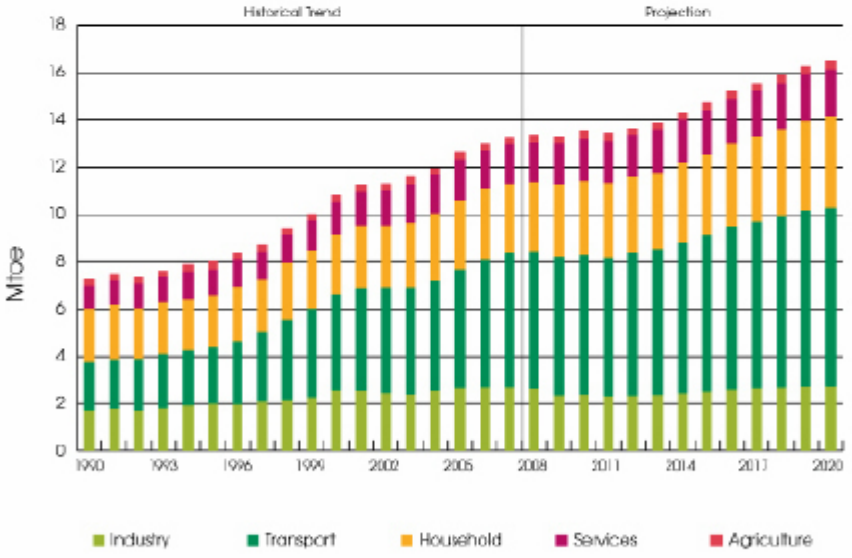


Figure 2: Total Final Demand for Energy by Sector 1990 – 2020 (Final Energy Consumption)[5]

3 Based on revised baseline projections produced for SEI by ESRI using the HERMES macroeconomic model. Further detail available in SEI (CFSSJ) (2008) *'Energy in Ireland 1990 - 2006'*.

4 As compared to average energy use over the period 2001 - 2005.

5 Source: Sustainable Energy Ireland.

Reducing energy demand and consumption also works towards achieving Ireland's climate change objectives. The National Climate Change Strategy 2007 – 2012 outlines how the various measures, taken across all sectors of the economy, will act to reduce Ireland's GHG emissions in the Kyoto period 2008 to 2012. It also identifies how the effect of the measures being pursued will position us for the post-Kyoto period, and which further measures are being researched and developed to enable us to meet our 2020 commitment. Figure 3 below demonstrates the GHG emissions contribution from each sector of the economy.

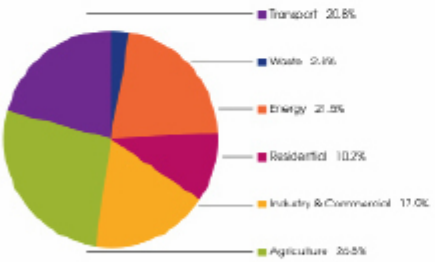


Figure 3: Ireland's Greenhouse Gas emissions[6]

A Roadmap to Energy Savings

The purpose of this Action Plan is to identify policies and measures that have the potential to contribute towards our national 20% target. The Action Plan builds upon the Energy Efficiency Action Plan that was submitted to the European Commission in September 2007, required as part of Ireland's obligations under the Energy Services Directive (ESD), which requires Member States to deliver energy savings of 9% by 2016.

Our existing and committed actions at this time (which are outlined more fully in the following chapters) are projected to deliver 23,730GWh of energy savings in 2020, which is equivalent to a 15% saving on the baseline period or reference energy consumption.[7] We will also reduce our CO_2 emissions by approximately 5.7 million tonnes. The savings identified in Table 1 overleaf[8] represent approximately €1.6 billion in avoided energy costs for the economy in the year 2020.[9]

6 Source: Environmental Protection Agency.

7 Estimates of the impact of future actions are based on available economic forecasts and informed by relevant national and international studies and experience. Actual impact figures may vary considerably and will therefore be adjusted in the next and subsequent National Energy Efficiency Action Plans, the first of which is due no later than 2011.

8 Estimates have been adjusted to account for current economic conditions where appropriate.

9 Based on average 2008 energy prices.

	GWh PEE[10]	$ktCO_2$
Business and public sectors		
SEI Public Sector Building Demonstration Programme – support for new and retrofit public sector building initiatives	140	40
Building Regulations 2005 – improved efficiency of non-residential buildings	360	133
Building Regulations 2010 – 30% improvement on energy performance of non-residential buildings relative to 2005 building regulations	1,330	322
SEI Large Industry Programmes (Energy Agreements 15393 and Large Industry Energy Network)	4,070	887
SEI small business supports – Energy MAP and training for small businesses	565	141
Existing ESB demand side management initiatives	435	96
Renewable Heat Deployment Programme (ReHeat)	410	92
Accelerated Capital Allowances for Energy-Efficient Equipment	800	143
Sector Total	8,340	1,864
Residential sector		
Building Regulations 2002 – improved energy performance of residential buildings	1,015	266
Building Regulations 2008 – 40% improvement on energy performance of residential buildings relative to 2002 building regulations	2,490	615
Building Regulations 2010 – 60% improvement of residential buildings relative to 2002 building regulations	1,100	272
Low Carbon Homes 2013 – 70% improvement of residential buildings relative to 2002 building regulations	395	98
House of Tomorrow Programme – developer support for buildings exceeding existing building regulations	30	7
Warmer Homes Scheme	170	42
Home Energy Saving scheme – improving current residential building stock in Ireland	600	157
Smart meter installation – estimated efficiency gains among domestic users	690	120
Greener Homes Scheme	265	64
Ecodesign for Energy-Using Appliances (Lighting)	1,200	210
Efficient Boiler standard	2,400	585
Sector Total	10,355	2,436
Transport sector[11]		
Improved fuel economy of private car fleet	1,530	412
Efficient driving measures	655	176
Electric Vehicle Deployment	965	360

10 The conversion to primary energy equivalent takes into account the conversion losses in electricity.

11 Savings estimates relating to transport measures are based on analysis undertaken by Department of Transport (DoT). Results have been calibrated to reflect latest methodologies developed at EU level for the purpose of estimating savings against EU Energy Services Directive (ESD) targets. A full range of potential savings from transport is included in the Government's Smarter Travel Policy, which includes additional measures not referenced here.

Mobility management – travel plans	1,090	294
VRT / Motor tax changes	200	54
E-working	150	40
More sustainable public transport fleets	90	24
Sector Total	4,670	1,350
Energy supply sector		
Transmission and distribution efficiencies improvement – reaching loss target of 7.5%	310	72
Winter Peak Demand Reduction Scheme	55	10
Sector Total	365	82
Total Projected Savings	23,730	5,722
National 20% Savings Target	31,925	
Additional Savings to be Captured	8,195	

Table 1: Projected Energy Savings 2020

While it is hugely positive that we are in a position to demonstrate actions and measures that are projected to achieve three-quarters of the national target, this is only the first step for Ireland. We will have to identify further savings of 8,195GWh, through a combination of new measures and over-achievement of existing actions. We anticipate that the list of measures will evolve as new actions are developed and ongoing programme experience informs our calculations of energy savings. Likewise, some of the actions contained within this Action Plan have no savings yet associated with them. As we develop these actions, we will ensure that an appropriate level of energy and CO_2 saving is represented in the calculation of the national target.

The Action Plan contains 90 actions, measures and programmes which will each play their part in securing a more sustainable energy future for Ireland. Of the 90 actions five stand out as having key importance for the delivery of the national target:

1 **We have launched a multi-annual National Insulation Programme for Economic Recovery to assist homeowners and vulnerable members of society to substantially reduce their energy bills.**

2 **We will continue to support business to become more competitive through tax allowances for energy-efficient technologies, energy management tools and support programmes.**

3 **We will develop proposals for the introduction of an Energy Demand Reduction Target, which could make a significant contribution to our 2020 target.**

4 **We will drive the public sector towards purchasing only green goods and services as part of the target to reduce energy usage in the public sector by 33%.**

5 **We are developing an electric vehicle deployment strategy which will result in a minimum of 10% of our passenger car and light commercial vehicle fleet being electrically powered by 2020.**

The total Government purchasing budget is over €10 billion per annum, giving significant leverage to those in the public sector to 'move the market' towards the competitive provision of sustainable products and services. To exploit this leverage, while also maximising energy efficiency and associated savings in its own estate, the public sector must take the lead through (*inter alia*) the procurement of energy-

efficient accommodation, products and services. We are therefore committed to publishing Green Public Procurement Guidelines that will aim to achieve a level of green public procurement equal to that realised by best performers in the European Union.

From January 2009 all homes offered for sale, rent or lease are required to have a Building Energy Rating (BER). This rating will classify the energy efficiency of the house and provide homeowners with the information required in order to improve the thermal efficiency of their dwelling. Combined with the allocation of €69 million for the Home Energy Saving scheme in 2009, the demand for BERs should serve to stimulate the market for green goods and services.

In the business and public sectors, significant savings are expected from improving the energy performance requirements of new non-residential buildings, improving existing buildings and encouraging more businesses and public bodies to actively address their energy use and to use the most energy-efficient plant, machinery and equipment.

For the energy supply sector, we believe that introducing an Energy Demand Reduction Target for energy suppliers or distributors holds great promise, and are working towards bringing forward proposals for such a scheme to Government in 2009. In the advance, a national consultation exercise will be undertaken.

Significant potential energy savings exist through the development of energy efficiency lighting. Modern energy-efficient bulbs and luminaires provide an immediate opportunity for significant efficiency gains. The Government has committed to the use of fluorescent lighting wherever practicable and to the replacement of incandescent light bulbs in public buildings with modern Compact Fluorescent Lamps (CFLs). As part of the Carbon Budget 2008, Government announced its intention to bring forward legislation to remove inefficient lighting products such as incandescent bulbs from the Irish market. During the course of the consultation period, the European Commission published its proposals for an EU-wide phasing out of incandescent light bulbs, to begin in September 2009. Rather than having to introduce primary legislation, the elimination of inefficient incandescent light bulbs will now take place under the 2005 EU Ecodesign of Energy-Using Products Directive.

Transport 21, and the more recently published Smarter Travel – A Sustainable Transport Future, identify a number of actions and measures that will make a substantial contribution towards achieving our 20% target; amongst the most important is Government's intent to ensure that 10% of our passenger car and light commercial vehicle fleet will be electrically powered by 2020. We will also provide Sustainable Energy Ireland (SEI) with funding to further research and identify demonstration projects over the lifetime of this plan.

This Action Plan will be closely monitored on an ongoing basis by an Interdepartmental Implementation Group that will report to Government at regular intervals on progress being made towards our 20% target. As new measures and savings are identified, this Action Plan will be periodically revised accordingly. We will publish updated Action Plans in 2011 and 2014, in accordance with European Commission requirements.

Key Action Plan Measures

The following are the principal measures contained within this Action Plan, and represent the key targets for Government to achieve to meet our 2020 commitments.

Public Sector

4 We will establish in 2009 a high level Working Group, involving key Departments and Agencies,

to draw up an Action Plan for achievement of the 33% energy savings target for the public sector.

5 We will investigate the feasibility of a public sector obligation scheme to facilitate the achievement of the 33% target.

6 We will require all public sector bodies to produce annual reports setting out their energy efficiency actions and progress towards the 33% target.

7 We will introduce energy efficiency programmes for Government Departments, State Agencies, Local Authorities, the Health Service and all other areas of the public sector.

9 We will investigate the feasibility of applying a minimum standard beyond building regulations for new buildings (including significant renovations) intended for use by public sector bodies.

12 We will introduce in 2009 Guidelines for Green Public Procurement in the Public Sector.

Business

15 We are providing tax incentives to encourage companies to buy the most energy-efficient equipment.

17 We are supporting the networking and exchange of best energy efficiency practice by the largest industrial energy users.

18 We are supporting businesses in maximising their energy efficiency through adoption of IS393, the Irish Standard for Energy Management.

19 We are assisting smaller businesses with limited resources to improve their energy management through the Energy MAP initiative.

23 We will review Non-Domestic Building Regulations in 2010.

29 We will demonstrate the significant potential available through ICT efficiencies, working closely with the industry, utilising technological solutions such as virtualisation, co-location, efficient IT hardware, optimised cooling technologies and energy management controls.

30 We will plan for the development of energy-efficient cloud computing and co-location of data centres.

Residential

32 We are providing grants and other incentives to householders to upgrade the energy-efficiency of older homes through the Home Energy Saving scheme.

33 We will encourage more energy-efficient behaviour by householders through the introduction of smart meters.

34 We are upgrading the energy performance of homes occupied by those on low incomes through the Warmer Homes Scheme.

40 We have made new Building Regulations delivering a 40% improvement in new housing energy efficiency standards.

42 We have rolled out a Building Energy Rating system to new houses from 2007 and have extended this to existing houses from 2009.

46 We will investigate the feasibility of applying a minimum standard for dwellings occupied by those in receipt of rent supplement.

Transport

47 We will develop an electric vehicle deployment strategy that will result in a minimum of 10% of our passenger car and light commercial fleet being electrically powered by 2020.

48 We have re-structured the VRT and motor tax systems to incentivise the purchase of more energy efficient vehicles.

49 We are enhancing the labelling system for cars to provide more information on CO_2 emissions and on fuel economy.

52 We are encouraging use of public transport through tax incentives under the TaxSaver Commuter Ticket Scheme.

53 We are providing transport-specific advice to fleet managers on energy management.

59 We will introduce mobility management initiatives including support for workplace travel plans, school travel plans and personalised travel planning.

62 We will implement the National Cycle Policy Framework and publish a National Walking Policy to encourage modal shift.

Energy Supply

65 We are promoting competition and choice and continuing to developing the All-Island Energy Market Framework across a range of energy priorities, building upon the establishment in 2007 of the Single Electricity Market, leading to a more efficient supply sector.

67 We will work towards the introduction of an Energy Demand Reduction Target for energy suppliers.

68 We will prioritise energy efficiency in our investment decisions for new generation plant under the NDP 2007 - 2013.

69 We will complete a comprehensive cost-benefit review in 2009 of the potential for distributed generation.

70 We will reduce distribution losses to 7.5% by 2010.

72 We will significantly expand our demand side management initiatives.

74 We will implement a wide-ranging programme to fully investigate the opportunities and long-term policy options for the micro-generation of electricity via small-scale technologies.

Research & Development

79 We are targeting a world-class research capacity in sustainable energy and energy-efficient technologies through Science Foundation Ireland.

80 We have provided substantial funds for research, development and demonstration in energy efficiency, renewable energy sources, end-use technologies and related capacity building through Sustainable Energy Ireland.

82 We are providing funding to early-stage researchers in priority areas of energy research through the Charles Parsons Energy Research Awards.

83 We are demonstrating and promoting, through Sustainable Energy Zones, the range of technologies, techniques, policies and behaviours that will help to deliver a sustainable energy future for Ireland.

83 We are developing a Greenhouse Gas Abatement Cost Curve for Ireland.

Cross-Sectoral

84 We are raising awareness of energy efficiency and providing advice on how to be more energy efficient through Power of One – our National Energy Efficiency Awareness Campaign, and other initiatives such as Green Schools.

85 We are raising awareness of the significant contribution of inefficient use of energy to climate change through our Climate Change Awareness Campaign – CHANGE.

86 We are implementing many fiscal measures to protect and enhance the environment and are examining others, including the introduction of a carbon tax.

89 We will develop and publish a model contract template and Guidelines for Energy Service Companies (ESCOs).

90 We will continue to publish *Energy Efficiency in Ireland* reports, which monitor progress on energy efficiency.

Response from Department of the Environment, Heritage and Local Government to Committee Query on Climate Changes Structures

July 2009

Mr. Patsy McGlone MLA
Chairperson
Committee for the Environment

Environment Committee Office
Room 245
Parliament Buildings
Belfast
BT4 3XX

Dear Mr. McGlone,

I refer to your recent letter to me regarding the inquiry being carried out into climate change by the Northern Ireland Assembly Environment Committee.

At the time, you also wrote to the International Climate Change Unit in this Department. My reply to you incorporates the response from this section.

A range of structures are in place in the Republic, all aimed at ensuring that a 'whole-of government' approach is taken in relation to policies and measures relating to climate change.

Our response is broken down as follows.

- Political structures:
- National structures - Mitigation
- National structures - Adaptation
- The role of the Environmental Protection Agency
- International structures

Yours sincerely

Pat Macken
Climate Change Policy: National

1. Political Structures

Since the publication of the National Climate Change Strategy 2007 - 2012, work has continued across Government Departments on the development of measures to reduce national greenhouse gas emissions. Progress in implementing such measures, and the coordination of work across Government with respect to the climate change agenda is overseen by the Cabinet Committee on Climate Change and Energy Security.

The Taoiseach, Mr. Brian Cowen T.D., chairs this Cabinet Committee and membership also includes the Tánaiste and Minister for Enterprise, Trade and Employment, the Minister for the Environment, Heritage and Local Government, the Minister for Communications, Energy and Natural Resources, the Minister for Agriculture, Fisheries and Food, the Minister for Finance, the Minister for Foreign Affairs, the Minister for Health and Children, the Minister for Transport, the Attorney General and the Minister of State with responsibility for energy and the environment.

The Cabinet Committee was established to provide oversight for the development and implementation of effective policies and measures which meet the energy, environmental and climate change priorities set out in the Programme for Government.

A Senior Officials' Group on Climate Change and Energy Security, chaired by the Department of the Taoiseach has also been established to support the work of the Cabinet Committee. There are also a number of subgroups which report to the Senior Officials Group including a Technical Analysis Steering Group. (These two Groups are discussed further under National structures – Mitigation).

I note that you have also written to the Clerk of the Joint Committee on Climate Change and Energy Security and to the Clerk of the Select Committee on the Environment, Heritage and Local Government. Their respective replies will deal with the Committee work in more detail.

As a brief overview, the Joint Committee on Climate Change and Energy Security was created by Dáil order on 14 November 2007 to consider the following issues:

- medium and long term climate change targets and the key measures needed to meet those targets;
- the role of the Agriculture sector in providing bio-fuel and biomass crops and consequential implications;
- the levels of power supply which can be generated from renewables or other new power supplies;
- the projected energy demand from transport and the implications for energy security and emissions targets;
- such other matters as may be referred to it from time to time by both Houses of the Oireachtas

The Joint Committee on Climate Change and Energy Security is also important in developing cross-party consensus both on targets and on the measures required to achieve them.

Membership details are available from the following web address:

http://www.oireachtas.ie/viewdoc.asp?fn=/documents/Committees30thDail/J-Climate_Change/Membership/document1.htm

The Select Committee on the Environment, Heritage and Local Government also has role in this area, considering Bills, Estimates for Public Services, International agreements, Annual Output Statements, and Value for Money and Policy Reviews produced by or within the aegis of the Department of the Environment, Heritage and Local Government

Membership details are available from the following web address:

http://www.oireachtas.ie/viewdoc.asp?fn=/documents/Committees30thDail/S-EnvHerLocGov/membership/document1.htm

2. National structures - Mitigation

As mentioned previously, the Cabinet Committee on Climate Change and Energy Security is supported by a Senior Officials Group.

The Senior Officials Group supports the work of the Cabinet Committee on Climate Change and Energy Security and helps to ensure appropriate synergies with the relevant cross-departmental teams.

The Senior Officials Group is tasked with addressing the challenges posed to Ireland in achieving its greenhouse gas emission targets and informing and implementing policy in this regard. Departmental membership mirrors that of the Cabinet Committee, and the Group is chaired by the Department of the Taoiseach.

At the request of the Cabinet Committee, an informal Expert Advisory Panel has been established to give an independent expert perspective on the potential for, and cost of, greenhouse gases reductions in the non-ETS sector. The Panel has met on three occasions to date and it is anticipated it will make a report to the Cabinet Committee before the end of the year.

The Technical Advisory Steering Group was established to provide analysis to Government on the implications for Ireland of the European Commission's proposed greenhouse gas targets for 2020. The Department of the Environment, Heritage and Local Government chairs the group, which meets quarterly and reports to the Senior Officials Group.

The Steering Group includes representatives from the Departments of Environment, Heritage and Local Government, Communications, Energy and Natural Resources, Transport, Enterprise, Trade and Employment, Agriculture, Fisheries and Food, Finance and the Taoiseach.

It also includes representatives from COFORD (the National Council for Forest Research and Development), Teagasc (the agriculture and food development authority in Ireland) , the Economic and Social Research Institute (ESRI), Forfas (Ireland's national policy advisory body for enterprise and science), the Environmental Protection Agency, Central Statistics Office (CSO), Sustainable Energy Ireland (SEI) and the Marine Institute.

Subgroups to these Groups have been established on an ad-hoc basis to consider specific issues and to report to the two main Groups. The Technical Analysis Steering Group will oversee progress across these areas and may also identify further issues for attention. At present these include:

- an Energy Modelling Group
- a Group working on the Development of a National Transport Model
- a Sub-Group to develop guidelines and change experiences on quantifying policies and measures
- a Working Group to feed into and discuss agriculture modelling
- a Preferred Policy Measures Group to reduce greenhouse gas emissions for Ireland

3. National structures - Adaptation

In its National Climate Change Strategy for the period 2007-2012, the Irish Government made a commitment to publish a National Adaptation Strategy in 2009. The planned adaptation strategy will provide a framework for integration of adaptation issues into decision-making at national and local level.

The EPA is currently finalising a report on the impacts of climate change which will input into the development of the adaptation strategy. Subsequent steps will be informed by the findings of this report. The strategy must be informed by the best available scientific research in order to

enable the various sectors to plan ahead and develop policies and strategies to enable Ireland cope with the likely impacts of climate change.

A steering group has been established which will facilitate the Department in consulting with stakeholders. Attached at Appendix 1 is a list of members of this steering group. It is hoped that a representative from Northern Ireland will also participate on this group.

The European Commission, in its white paper Adapting to climate change: Towards a European framework for action, proposed the establishment of the Impacts and Adaptation Steering Group (IASG) which would be composed of experts and representatives from the EU Member States who are involved in the process of preparing national adaptation programmes and measures. Technical groups would feed into this steering group. The Department will be represented on these groups when they are established.

4. The role of the Environmental Protection Agency

The Environmental Protection Agency (EPA) has responsibilities for a wide range of licensing, enforcement, monitoring and assessment activities associated with environmental protection.

The Climate Change Programme in the EPA encompasses responsibilities for Emissions Trading, Kyoto Project Mechanisms, National Inventories, Emissions Projections, Scientific Advice, and Climate Change Research. It is structured into 8 functional areas as follows:

1. Emissions Trading – National Competent Authority;

2. Emissions Trading – National Allocation Authority;

3. National Emissions Trading Registry;

4. Kyoto Project Mechanisms;

5. Reporting and Review of National Inventories (for Greenhouse gases and for Acid Gases)

6. National Emissions Projections (for Greenhouse Gases and for Acid Gases);

7. Air and Climate Science (including Acid Gases and Earth Observations);

8. Climate Change Research

5. International structures

In relation to contacts with our European partners and at the international level, on-going discussion, cooperation and liaison takes place through the following channels and structures:

- EU: Working Party on International Environmental Issues (Climate change) – this group of officials, representing each Member State of the Union and the European Commission meet on a monthly basis. The group discuss and agree on European Union positions going into the international negotiations taking account of the over-arching policy agreed by Heads of State and Government at the European Council.
- EU: Expert Groups – these informal groups of national experts meet under a mandate from the Working Party to discuss and provide advice on the technical, detailed elements of the positions being developed. There is, for example, an expert group on land use,

land use change and forestry (LULUCF) looking at new and improved accounting rules for the sector and another on the flexible mechanisms under the Kyoto Protocol, looking at the workings of the mechanisms and how they might be made more efficient. The expert group on reporting looks at inventory information, how it is managed, reported and reviewed and future requirements in this area. All expert group work is passed to the Working Party for final approval.

- International level: the policy context for the climate change negotiations at international level is the objective of limiting greenhouse gas emissions so as to prevent dangerous climate change as set out in Article 2 of the United Nations Framework Convention on Climate Change.
- The Parties to the Convention have been meeting frequently over the past 18 months, following the Bali Roadmap (December 2007), which agreed a programme of work designed to ensure that a successor to the Kyoto Protocol would be agreed at the meeting of the Conference of the Parties in Copenhagen in December 2009.
- During the international negotiations, the EU holds coordination meetings on the spot on a daily basis, with the Presidency speaking on behalf of the EU in the plenary sessions, while there are nominated “lead negotiators" appointed to speak in the Ad Hoc Working Groups. Many bilateral meetings with third countries take place during the international meetings, usually with the EU Troika who regularly report back to the Working Party on the discussions held.

Appendix 1

Membership of National Adaptation Strategy Steering Committee

Organisation	
D/ Environment, Heritage and Local Government	Water Quality Section
	Water Policy
	Water Inspectorate
	National Parks & Wildlife
	Spatial Planning
	Planning
D/Transport	
D/Agriculture, Food and Forestry	
D/ Communications, Energy & Natural Resources	
Environment Protection Agency	
Teagasc (The agriculture and food development authority in Ireland)	
Fáilte Ireland	
Office of Public Works	
Met Eireann	
Geological Survey of Ireland (GSI)	
COFORD (The National Council for Forest Research and Development)	
Marine Institute	

Department Reply to Request for Response from Officials and a Hansard Recording in

Relation to the Environment Committee Visit to Climate Change Unit

Central Management Branch
10-18 Clarence Court
BELFAST
BT2 8GB

Telephone: 028 90 5 40855
Facsimile: 028 90 5 41169
Email: una.downey@doeni.gov.uk

Date: 6 July 2009

Mrs Alex McGarel
Clerk to the Environment Committee
Northern Ireland Assembly
Parliament Buildings
Stormont
Belfast
BT4 3XX

Dear Alex

Further to the request for further information following the Committee's visit to the Climate Change Unit (CCU) on 25 June 2009, please see attached:

i. response prepared by CCU officials.

ii. copy of presentation

The Hansard record will also be relevant.

I trust this information is of assistance, should you require anything further please contact me directly.

Yours sincerely,

Úna Downey

DALO

Presentation for Environment Committee Visit to Climate Change Unit on 25 June 2009

ENVIRONMENT COMMITTEE

VISIT TO CLIMATE

CHANGE UNIT, CALVERT HOUSE

25 June 2009

DOE

Committee's Terms of Reference

"To make recommendations on a public service agreement for the DOE Climate Change Unit's commitments in the Second Programme for Government that will ensure Northern Ireland will meet its climate change obligations."

DOE

CC Resources

Defra/DECC
- Approx 317 staff
- Programme - approx £1 billion

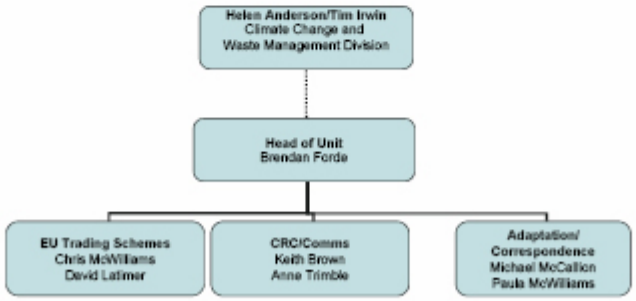
Scottish Executive
- Approx 25 staff
- Programme - approx £1 million

Welsh Assembly Government
- Approx 15 staff
- Programme- approx £2m

Republic of Ireland
- Approx 11staff
- Programme - approx €1 million

DOE

PEPG Climate Change Unit



DOE

CCU Work Areas

- Ministerial Business Support
  - Correspondence
  - Briefing
  - Inquiries, etc.
  - Assembly Questions
- Ministerial Policy Support

Policy Support

- UK Climate Change Act including arrangements/work with Committee on Climate Change
- Carbon Reduction Commitment (CRC)
- EU mitigation policy including Energy and Climate Change Package, progress towards Copenhagen, Charging Regulations, transposition of Aviation Directive and Phase 3 EU ETS
- Communication on climate change

Policy Support (cont)

- Adaptation policy – EU white paper, UK Projections
- Requirements under CC Act - adaptation including risk assessment and NI adaptation programme
- GHG inventory and projections
- Others
  - PSA monitoring
  - Support for NICCIP
  - Carbon policies e.g. carbon neutral
  - Policy assistance to others – Defra, DETI, etc.

DOE

How CCU Feeds into Decision Making in NI

- Within Department main advisor on climate change policy to Minister with exception of NIEA, waste and planning policy where we would provide input
- Role with Executive under Ministerial Code since climate change is cross-cutting e.g. Committee on Climate Change report, CRC policy, etc.

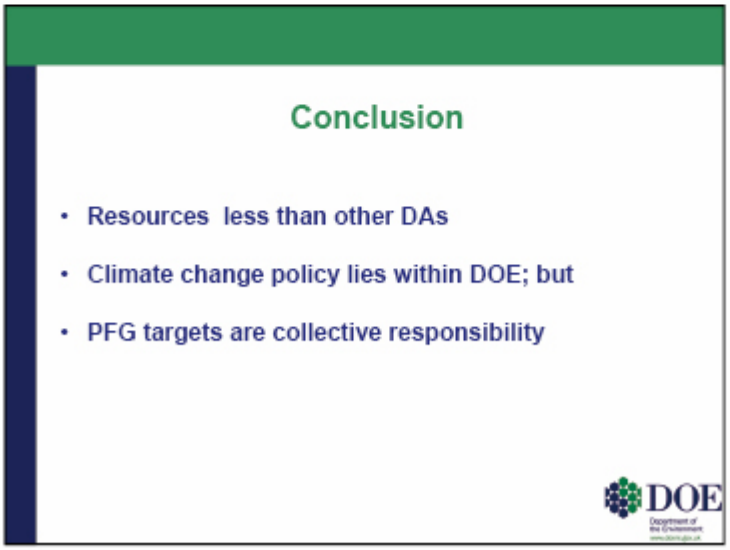
DOE

How CCU Feeds into Decision Making in NI (cont)

- Outside Department - make 'part input' on climate change related issues through officials and/or Minister e.g. DETI's Strategic Energy Framework, Bioenergy Strategy, DRD's Regional Development Strategy Review, etc.
- However, don't drive other Departments. Policy is that climate change is collective responsibility

Liaison with other DAs, UK Government

- Daily contact by e-mail/telephone
- Around specific policies - formalised arrangements with multiple meetings, memorandums of understanding, project groups, etc.



Greenhouse Gas Emissions Report
July 2009

Reducing Greenhouse Gas Emissions from Road Transport

Paper One: Baseline Report 1990-2006

DRAFT

Department for Regional Development
Transportation Policy Division
July 2009

CONTENTS

DRAFT

EXECUTIVE SUMMARY

i. This is the first in a series of papers which have been commissioned to inform the development of sustainable transport arrangements through the Review of the Regional Transportation Strategy. The paper sets out the 1990 baseline and 2006 position on greenhouse emissions from transport in the North and highlights a number of key trends impacting on transport emissions.

ii. Drawing on the findings of this paper, further studies will be undertaken to identify and cost options to reduce greenhouse gas emissions from road transport. These papers will take account of the legislative and policy context, anticipated technological developments. Key research findings and the experience and plans of other administrations.

iii. Through the Programme for Government (PfG) the Executive have set out their commitment to ***reduce greenhouse gas emissions by 25% below 1990 levels by 2025***.

iv. By 2006, greenhouse gas emissions here had reduced by 6% on the 1990 baseline. Conversely, however, emissions from road transport increased by 53% during this period adversely impacting on the cumulative progress realised in other areas. Had the level of emissions from road transport been maintained at or near to 1990 levels, this would have contributed to a 13% reduction in greenhouse gas emissions rather than the 6% realised.

v. While the private car remains the largest contributor to road transport emissions, 70% of the increase in greenhouse gas emissions from road transport from 1990-2006 can be attributed to the freight sector. These trends reflect the significant growth in vehicle ownership and traffic since 1990 and would appear to have been driven by the unprecedented expansion of the local population and economy over that period.

vi. In the absence of significant technological developments, behavioural change or policy initiatives, emissions from road transport are likely to continue to rise. Moreover, that increase has the potential to be at a rate in excess of the cumulative reductions achieved in other areas. As such, it is highly unlikely that the Executive's PfG target can be achieved without action to reduce greenhouse gas emissions from road transport.

vii. The scale of the challenge is considerable, but it is unlikely to decrease in the absence of a concerted policy response, focused on all areas of transport including freight.

viii. Any response, however, cannot be taken forward in isolation from government's wider policy agenda. The Executive's top priority is to grow the economy, with a focus on high value activities and more balanced regional development. Alongside initiatives to address poverty and exclusion, this has the potential to require higher levels of mobility in relation to people, goods and services. The challenge will be to effectively manage and appropriately respond to that demand while delivering real reductions in emissions from transport. It is also imperative, that policies across government do not unnecessarily increase the demand for transport or promote unsustainable outcomes.

DRAFT

1. BACKGROUND

Context

1.1 Climate Change is one of the most significant challenges facing the world today. If unaddressed, it has the potential for far reaching economic and societal impacts both locally and internationally.[1]

1.2 Ultimately, addressing climate change requires action internationally, however, the Executive are determined to play their part and reduce our impact on climate change.

1.3 In line with this, the Programme for Government (PfG) sets out a target to ***reduce greenhouse gas emissions by 25% below 1990 levels by 2025***. The PfG target reflected UK wide targets at that time, requiring a 50% reduction in greenhouse gas emissions by 2050. Subsequently, the Climate Change Act 2008, enacted by Parliament in November 2008, sets a UK wide target for a reduction in greenhouse gas emission of at least 80% by 2050, and reductions in CO_2 emissions of at least 26% by 2020, against a 1990 baseline.

1.4 By 2006 road transport had emerged as one of the largest sources of CO_2 emissions in the North accounting for 29% of total carbon emissions (16331 kt). It is, therefore, unlikely that targeted reductions in greenhouse gas emissions can be achieved without action to reduce emissions from road transport.

1.5 In addition to the commitment to reduce greenhouse gas emissions, however, the Executive have also set out how growing the economy, with a focus on high value activities and more balanced regional development, is their top priority. Transport is both an enabler and a

[1] *Stern Review on the Economics of Climate Change* (October 2006) discusses the effect of climate change and global warming on the world economy. Available at http://www.hm-treasury.gov.uk/sternreview_index.htm

consequence of economic growth[2] with higher levels of economic growth historically associated with increased demand for transport.

1.6 Realisation of the Executive's economic goals, therefore, is likely to require increased mobility of people, goods and services. Delivering reductions in greenhouse gas emissions from road transport while ensuring the provision of transport arrangements that meet economic and social needs presents a significant challenge.

1.7 Reconciling these potentially competing priorities is a key objective of the review of the Regional Transportation Strategy (RTS) now underway.

1.8 To inform the review of the RTS, and contribute to the development of sustainable transport arrangements, this paper aims to clarify the nature of the challenge, by

- setting out the 1990 baseline and the most up-to-date figures available (2006) for greenhouse gas emissions;
- identifying key trends in transport emissions;
- highlighting key trends impacting on transport demand; and
- projecting the levels of greenhouse gas emissions from road transport to 2020-2025 based on the continuation of existing trends and identifying a trajectory for achieving the targets.

1.9 Further papers will be produced identifying and costing options to reduce transport emissions.

Greenhouse Gas Emissions Data

1.10 The data on greenhouse gas emissions set out in this report are taken from the Northern Ireland Greenhouse Gas Inventory. Calculated

[2] *The Eddington Transport Study* (December 2006) sets out an analysis and discussion of the link between transport and economic productivity. Available at http://www.dft.gov.uk/about/strategy/transportstrategy/eddingtonstudy/

annually by AEA Technology on behalf of the Department of the Environment (DoE), the estimates are consistent with the United Nations Framework Convention on Climate Change (FCCC) reporting guidelines and the UK Greenhouse Gas Inventory. The results are published in a combined inventory report setting out estimates for England and the Devolved Administrations.[3]

1.11 The Inventory estimates emissions of the six direct greenhouse gases: Carbon Dioxide (**CO_2**); Methane (**CH_4**); Nitrous Oxide (**N_2O**); Hydrofluorocarbons (**HFCs**); Perfluorocarbons (**PFCs**); and Sulphur Hexafluoride (**SF_6**). These are weighted to reflect the relative global warming potential (GWP) of each gas, using the effect of CO_2 over a 100 year period as a reference. This results in the following weighting:

Greenhouse Gas	GWP Weighting
1 Carbon Dioxide	1
2 Methane	21
3 Nitrous Oxide	310
4 Sulphur Hexafluoride	23,900
5 Perfluorocarbons	Varies according to individual gas
6 Hydrofluorocarbons	Varies according to individual gas

1.12 These are set out in relation to 9 main producers / sinks of greenhouse gas emissions as follows:

i Agriculture,
ii Business
iii Energy Supply
iv Industrial Process
v Land Use Change
vi Public
vii Residential
viii Transport
ix Waste Management

[3] *Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland 1990-2006* (September 2008). Estimated and published by AEA Technology on behalf of DEFRA, The Scottish Executive, The Welsh Assembly Government and DoE. Available at http://www.naei.org.uk/report_link.php?report_id=527

1.13 Within each of these sectors, more detailed breakdowns are available. For example, within Transport it is possible to look at road, rail, air and marine emissions, and even within each of these it is possible to break these down further still, i.e. within road transport it is possible to look at the emissions produced by various types of road transport.

1.14 There is some inherent uncertainty in the estimates, however, the reporting methodology fully conforms to FCCC reporting guidelines and as such the estimates set out in the inventory are the most robust available at a UK and devolved administration level. Not withstanding that, the methodologies and data sources used to compile the inventory are reviewed annually and revisions are made as appropriate. Revisions are also applied historically, i.e. the 1990 baseline figure may change from inventory to inventory based on these improvements.

1.15 The Inventory and local climate change targets are based on operational components. In transport this relates to the emissions associated with operating the vehicle or running the engine. Although a number of studies have indicated that the majority of emissions from transport are associated with the operation of vehicles[4], there has been some debate internationally regarding the merits of a wider focus on the carbon footprint of transport. This would require consideration of emissions associated with the construction and maintenance of travel infrastructures - i.e. street lighting, vehicle production and road construction – in addition to the operation of the vehicle.

1.16 While recognising the potential merits of such an approach, it would be difficult to provide for a robust assessment of past and future trends at NI level given the nature of both local and international reporting and monitoring frameworks. However, in assessing options on the way

[4] The AEA report, *Carbon Footprinting of Policies, Programmes and Projects* investigated the life cycle elements for public transport and concluded that for buses and trains 72% and 92% of emissions respectively were associated with running the vehicle. Research by Toyota on their vehicles found that 72% of life cycle emissions were produced from driving.

forward, where practical and in line with the availability of robust data, future papers will aim to consider wider life cycle emissions.

1.17 In the interim, it is noted that some aspects of these wider life-cycle elements of transport will be included elsewhere in the Inventory (i.e. energy, industriel processes) and that all capital projects, including the construction of roads, are subject to sustainability requirements.

2. GREENHOUSE GAS EMMISSIONS BASELINE 1990 - 2006

1990 Baseline

2.1 The Northern Ireland Greenhouse Gas Inventory (September 08) estimates that in 1990 total greenhouse gas emissions in the North were 23,651 ktCO_2 equivalent. Road transport (3,258 kt CO_2 e) is estimated to have accounted for approximately 14% of total greenhouse gas emissions in 1990 (Chart 1) and 19% (3,210 kt) of all carbon emissions (Chart 2).

Chart 1: 1990 Total Weighted Greenhouse Gas Emissions by Main Producers/Sinks (kt CO_2 equivalent)[5]

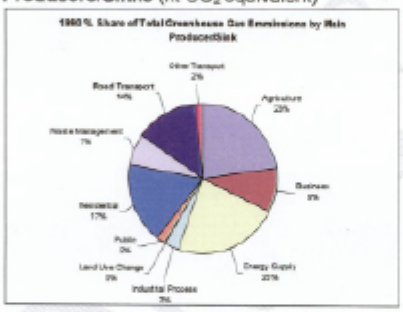
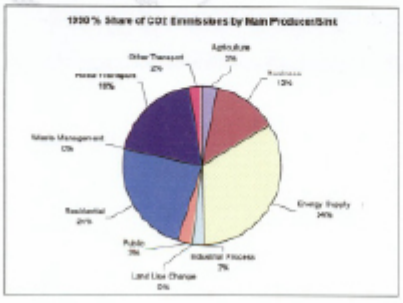


Chart 2: 1990 CO_2 Emissions by Main Producers/Sinks



[5] For ease of reference the data on the transport sink has been broken down into 'road transport' and 'other transport'.

Reduction Target and Road Transport Emissions

2.2 Achievement of the PfG target will require a reduction in greenhouse gas emissions to a maximum of 17,888 ktCO_2 equivalent by 2025. Delivery of the target set out in the Climate Change Act would require a reduction in carbon emissions across all sectors to a maximum of 12,434 kt by 2020.

Table 1: 1990 Baseline and Targets for Total Emissions

	1990 Baseline	Target Maximum Emissions	Required Reduction
PfG: reducing greenhouse gas emissions by 25% below 1990 levels by 2025	23,851 kt	17,888 kt	5963 ktCO_2 e
Climate Change Act 2008: reductions in CO^2 emissions of at least 26% by 2020, against a 1990 baseline	16,578 kt	12,268 kt	4310 ktCO_2

2.3 Where all sectors to contribute equally to the PfG target on greenhouse gas emissions, i.e. each sector reduced its GHG emissions by 25% on 1990 levels, this would require a reduction in road transport emissions from 3,258 ktCO_2 e to 2,443 ktCO_2 e by 2025.

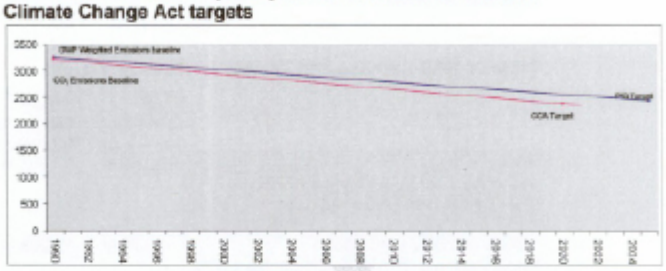
2.4 The Climate Change Act sets a target to deliver a reduction of at least 26% in carbon emissions by 2020. CO_2 accounted for some 99% of all greenhouse gas emissions from road transport in 1990. Realisation of the Climate Change Act target would, therefore require a reduction in CO_2 road transport emissions from 3,210 kt to 2,375 kt by 2020.

Table 2: 1990 Baseline and Indicative Targets for Road Transport Emissions

	1990 Baseline	Target Maximum Emissions	Required Reduction
PfG: reducing greenhouse gas emissions by 25% below 1990 levels by 2025	3,258 kt	2,443 kt	815 ktCO_2 e
Climate Change Act 2008: reductions in CO^2 emissions of at least 26% by 2020, against a 1990 baseline	3,210 kt	2,375 kt	835 ktCO_2

2.5 While the CO_2 reduction target set out in the Climate Change Act requires a higher level of reduction within a more condensed timeframe, the scale of the challenge, based on a linear year-on-year reduction from 1990, is broadly similar in both cases.

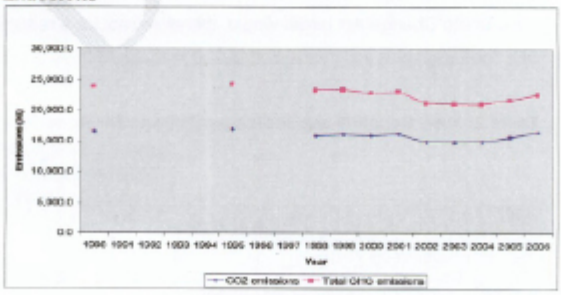
Chart 3: 1990 – 2025 trajectory for achievement of PfG and Climate Change Act targets



2006 Emissions

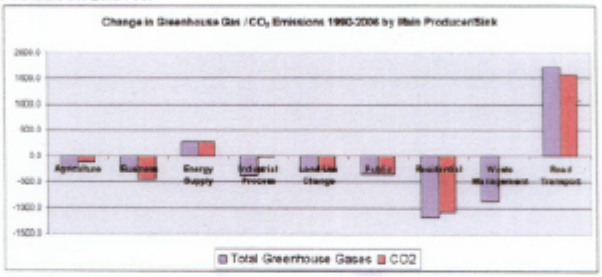
2.6 The North's total greenhouse gas emissions in 2006 were 22,461 kt CO_2 equivalent, a reduction of some 6% (1,390 kt CO_2 e) on the 1990 baseline. While the reduction in CO_2 emissions was lower, at 1.5% (247 Kt) on 1990 levels, as illustrated in chart 4, the overall trends are broadly similar.

Chart 4: Annual Greenhouse Gas (kt CO_2 equivalent) and CO_2 Emissions



2.7 Despite the apparent progress, however, the level of reduction experienced was significantly lower than that at UK level[6], while increases in both overall greenhouse gas and CO_2 emissions were experienced in two key areas, energy supply and transport (chart 5).

Chart 5: Change in Greenhouse Gas / CO_2 Emissions by Main Producer/Sink NI



2.8 Although the increase in energy supply was relatively marginal, approximately 5%, total greenhouse gas emissions from road transport increased by 53% (1,716 kt CO_2 e), with carbon emissions from road transport increasing by 50% (1,590 kt) during the same period. As a consequence, by 2006 road transport accounted for 22% of all greenhouse gas emissions and 29% of CO_2 emissions, compared to 14% and 19% respectively in 1990.[7]

2.9 As illustrated in table 2 below, the increased emissions from road transport were significantly greater than the overall reductions achieved. Had the level of emissions from road transport been maintained at or near to 1990 levels, this would have contributed to a reduction of 13% in total greenhouse gas emissions and a reduction of 11% on carbon emissions, as apposed to the 6% and 1.5% reductions realised.

[6] At UK level, a reduction of 18% on the 1990 was recorded in GHG emissions by 2006, while CO_2 emissions reduced by 8% at UK level during the same period.

[7] Transport emissions at UK level also increased during the period 1990-2006. The rate of increase however at 6% for GHGs and 8% for CO_2 was significantly lower.

Table 3: Change in Emissions 1990-2006

	Total Greenhouse Gas Emissions	CO_2 Emissions
Total Change 1990-2006	-1390	-247
Change in Road Transport	+1716	+1590

2.10 The significant increase in road transport emissions since 1990 similarly impacts on the level of challenge presented if road transport is to fully contribute to the targeted reductions set out in the PfG and the Climate Change Act (table 4).

Table 4: Impact of 2006 Position on Targets

	1990 Baseline	Target Emissions	2006 Position	Required Reduction
PfG: reducing greenhouse gas emissions by 25% below 1990 levels by 2025	3,258 kt	2,443 kt	4974 kt	2531 kt
Climate Change Act 2008: reductions in CO^2 emissions of at least 26% by 2020, against a 1990 baseline	3,210 kt	2,375 kt	4800 kt	2425 kt

2.11 In that context, to fully contribute to the PfG target, a 51% reduction is required on 2006 greenhouse gas emissions from road transport by 2025. Similarly, realisation of the target set out in the Climate Change Act will require a 51% reduction in CO_2 emissions by 2020, with both targets to be achieved within significantly constrained timeframes.

2.12 Achievement of the PfG target in this context would require an average reduction in annual emissions from road transport of 133 Kt CO_2 e each year from 2006-2025. Between 1990-2006, however, the total reductions achieved in emissions across all sectors here, excluding transport, averaged 194 kt CO_2 e per annum (reducing to 87 kt CO_2 e if transport emissions are factored in). The scale of the challenge is,

therefore, considerable, particularly in light of the current upward trends in transport emissions.

DRAFT

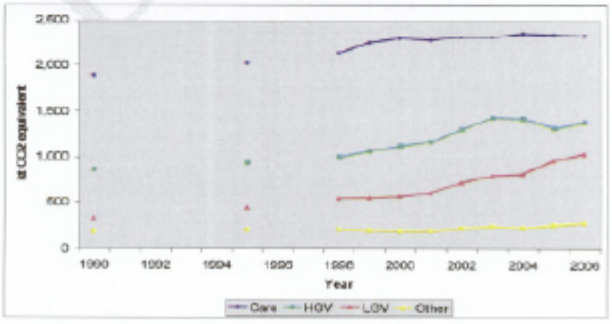
3. KEY TRENDS IN TRANSPORT EMISSIONS

3.1 It is perhaps unsurprising, that in relation to modes of transport or vehicle type, the car is the largest contributor to road transport emissions (see table 5 & chart 6). In 2006, cars produced 2,315 $ktCO_2$ equivalent, which equates to 46% of all road transport emissions in that year. In 1990, cars produced fewer emissions (1,883 $ktCO_2e$), but this equated to a higher percentage of the total road transport emissions (56%). Since 1990, emissions from cars have increased by 23%. While this is a significant rate of increase, it remains well below the overall rate of increase in emissions from road transport.

Table 5: Road Transport Emissions by Vehicle Type 1990-2006 ($KTCO_2e$)

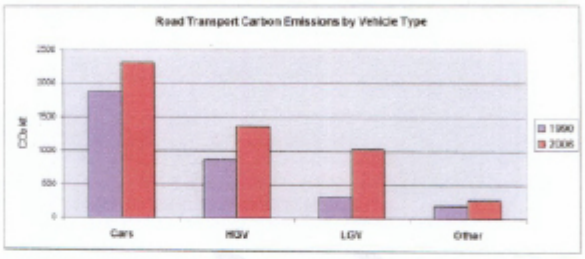
	Cars	HGV	LGV	Other
1990	1883	885	323	187
1995	2021	939	435	211
1998	2122	999	536	214
1999	2233	1060	539	200
2000	2284	1114	557	191
2001	2263	1158	597	195
2002	2299	1295	715	228
2003	2301	1416	792	248
2004	2342	1406	809	232
2005	2325	1305	953	280
2006	2315	1309	1024	281

Chart 6: Carbon Emissions by Vehicle Type 1990-2006



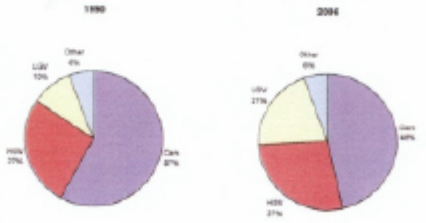
3.2 The most significant increase in road transport emissions in recent years has been in relation to the movement of freight (LGV and HGV) accounting for 70% (1205 CO_2 kt) of the total increase in carbon emissions from road transport (1731 CO_2 kt) during this period, as illustrated in chart 6 below.

Chart 7: Carbon Emissions by Vehicle Type 1990 and 2006



3.3 Within the freight sector, there has been a particularly significant rise in emissions from light goods vehicles (LGV), an increase of some 217% on 1990 levels, accounting for 40% of the total increase in carbon emissions from road transport. The increase in emissions from heavy goods vehicles (HGV) at 58% was less marked. As a consequence, by 2006, LGV accounted for 21% of total carbon emissions from road transport, up from 11% in 1990 (chart 8).

Chart 8: Carbon Emissions share by Vehicle Type 1990/2006



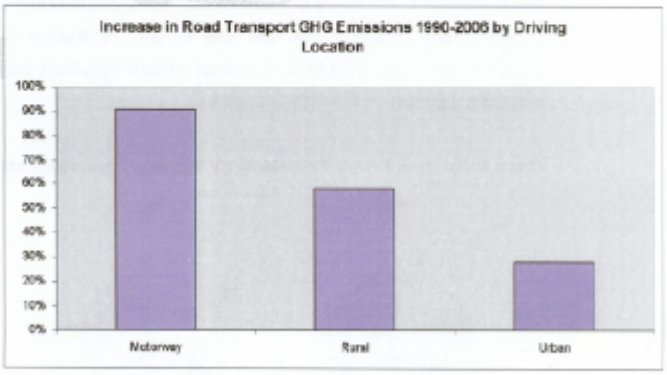
3.4 The Greenhouse Gas Inventory estimates also provide a breakdown of emissions between motorway, urban and rural driving. By 2006, rural driving had emerged as the largest source of emissions accounting for 40% (2,019 $ktCO_2e$) of greenhouse gas emissions from road transport. By comparison, urban driving accounted for total emissions equivalent to 1,643 $ktCO_2$ and motorway driving 1,317 $ktCO_2e$.

Table 6: Road Transport GHG Emissions 1990 & 2006 by Mode of Transport and Driving Location

		Cars	HGV	LGV	Other	Total
1990	Motorway	293	318	61	17	689
	Rural	736	302	136	43	1279
	Urban	852	185	126	120	1283
2006	Motorway	468	590	237	24	1317
	Rural	956	583	436	64	2019
	Urban	892	217	351	184	1644

3.5 Since 1990, emissions from rural driving have increased by 58%, urban driving 28% and motorway driving 91% (chart 9).

Chart 9: Increase in Road Transport GHG Emissions 1990-2006 by Driving Location



3.6 Not withstanding the differential rates of increase, however, the proportion of greenhouse gas emissions from road transport attributable to rural driving remains broadly comparable to the 1990 position, as illustrated in chart 10 below. There has, however, been a significant reduction in the proportion of emissions attributable to urban driving and a parallel, though not necessarily related, increase in emissions from motorway driving.

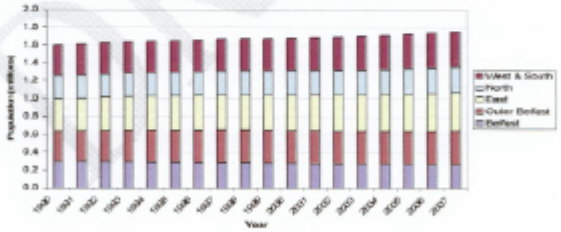
Chart 10: Road Transport GHG Emissions 1990 & 2006 by Driving Location

4. Trends Impacting on the Demand for Transport and Emission Levels

4.1 Transport is recognised as a derived demand, it is not undertaken for its own sake, but rather is an intermediate function which provides for the movement of goods and people from one location to another. As such the demand for transport, in relation to goods, services and people, will be impacted upon by a number of factors, including population and settlement trends, economic growth and levels of prosperity.

4.2 Against the backdrop of an emergence from a period of conflict and division, the North has undergone significant transformation since 1990, experiencing economic and demographic growth unprecedented in recent years. By 2006, the local population had increased by 10% on 1990 levels, though there was little change in the distribution of the population as illustrated below.

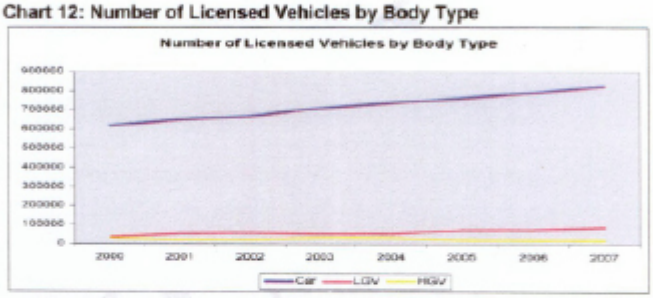
Chart 11: Northern Ireland Population by NUTS III classification, 1990-2007



4.3 During the same period, the local economy experienced levels of growth above the UK average, as a consequence of which it emerged as one of the fastest growing regions. Crucially, unlike previous periods of growth in the local economy, this was led by the private sector with particularly strong growth in the service sector.

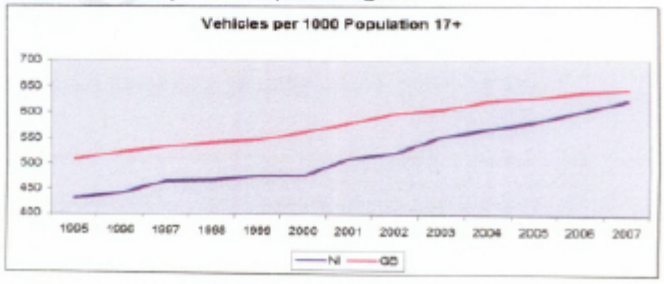
4.4 The increase in population and the expansion of the local economy were mirrored by a significant increase in the number of licensed vehicles, almost doubling from 543,000 in 1990 to 1,008,000 in 2007. As illustrated in Chart 12, from 2000 to 2007 the number of private cars licensed increased by 33%. While private cars continue to make up the vast majority of licensed vehicles (85.2%) the number of LGVs licensed during the same period increased by 119%, broadly reflecting trends in emissions.

Chart 12: Number of Licensed Vehicles by Body Type



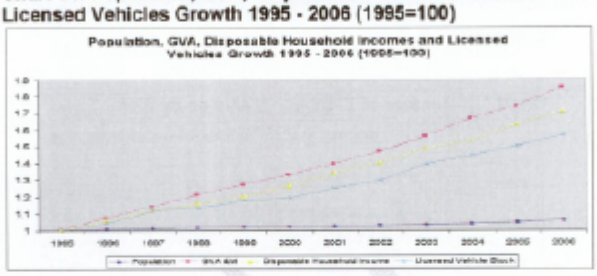
4.5 Not withstanding the trends set out above, the level of car ownership in the North remains below that for GB. While that differential has narrowed over recent years, there is, therefore, continued potential for significant growth in vehicle ownership levels.

Chart 13: Vehicles per 1000 Population aged 17+



4.6 As illustrated in chart 14 below, the trend in vehicle registrations would appear to be particularly closely related to increased productivity and prosperity. This is in line with the findings of the Stern Review[8] which concluded that income was a key driver behind growth in transport emissions.

Chart 14: Population, GVA, Disposable Household Incomes and Licensed Vehicles Growth 1995 - 2006 (1995=100)



4.7 Reflecting that position, there has been a significant increase in traffic from 17, 210 VKT (million vehicle kilometres) in 2001 to 20,002 VKT in 2007. During this same period, the total length of road across the North increased by less than 2% to 25,120km. Given the imbalance in vehicle and road growth it may not be unexpected that traffic speeds decreased by 12% from 2001 to 2007, with a 7% decrease on the 5 strategic corridors. However, such a conclusion would fail to take account of the extensive nature of the local road network and measures to enhance the effective operation of the network. Moreover, there is also clear evidence that the provision of extra road capacity in conditions of actual or expected congestion has consistently lead to greater volumes of traffic and cannot be provided in line with rates of traffic growth[9].

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[8] *Stern Review on the Economics of Climate Change* (October 2006)

[9] SACTRA (The Standing Advisory Committee on Trunk Road Assessment), *Trunk Roads and the Generation of Traffic* December 1994 from
Phil Goodwin *The Economic Factors that will Affect Future Transport Modes: Conjectures on the dynamic functional transformation of intelligent infrastructure* Intelligent Transport Systems, December 2006

4.8 Increased journey times have a significant economic and environmental impact, reducing productivity as workers and goods spend more time travelling, and increasing the costs and environmental impacts of travel as more fuel is consumed. The Eddington Transport Study[10] estimated that congestion costs the UK £7-8 billion of GDP per annum rising to £22 billion by 2025 if left unchecked. Similarly, studies have suggested that road congestion costs approximately 1% of EU GDP per year[11].

4.9 Addressing congestion is, therefore, of critical importance from both an economic and environmental perspective. Moreover, evidence would suggest that this is an issue which cannot be resolved through investment in roads in isolation from measures to restrict demand or promote alternative or more sustainable transport choices.

4.10 While recognising the overall growth in traffic, data from the Northern Ireland Travel Survey would indicate that individual behaviours and travel patterns have remained relatively stable over the period 1999-2007 as illustrated below in table 7, with continuing high levels of dependence on the private car (chart 15).Similarly the reasons why people travel have changed little, with leisure, shopping and travel to work remaining the main purpose for travel.

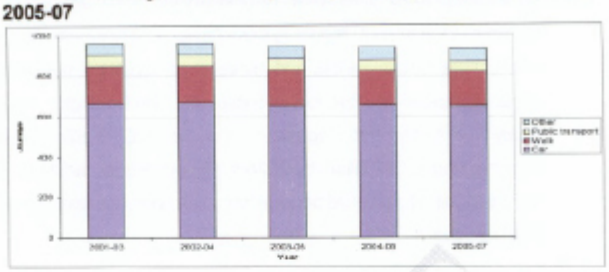
Table 7: Average Travel Behaviours: 1999-2001 & 2005-2007

	Miles per year	Number of journeys per day	Average journey length (miles)	Time taken (hours)	Proportion travelled by car (% of distance travelled)
1999-2001	5,985	2.7	6.1	304	82%
2005-2007	5,999	2.5	6.5	306	81%

[10] Sir Rod Eddington: *The Eddington Transport Study: Transport's role in sustaining the UK's productivity and competitiveness*, HM Treasury, December 2006

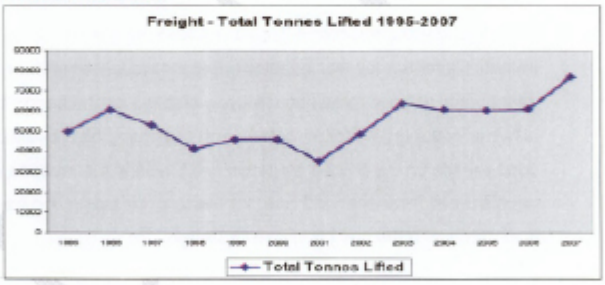
[11] Chris Nash, with contributions from partners: UNITE (UNIfication of accounts and marginal costs for Transport Efficiency) Final Report for publication, Funded by 5th Framework RTD Programme.

Chart 15: Average number of journeys made per person, 2001-03 - 2005-07



4.11 Since 2003, all freight within the North has been transported by road. The demographic and economic growth experienced in recent years is mirrored in the significant increase in freight (chart 16).

Chart 16: Total Tonnes lifted Within NI by Goods Vehicles Over 3.5 Tonnes: 1995-2007



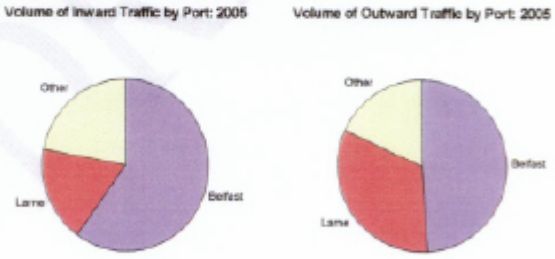
4.12 The recent Freight Transport study published by Intertrade Ireland[12] provides an in-depth overview of the key trends and anticipated developments in relation to freight on the island of Ireland. That report indicates that the high growth in freight tonnes lifted is strongly related to the transport of construction materials. Indeed, by 2006 construction materials accounted for almost half of all tonnes lifted.

[12] Intertrade Ireland, *Freight Transport Report for the Island of Ireland*, March 2008

4.13 This would appear to have important implications as the construction sector is one of the most intensive users of freight services in all developed countries. However, in general most of the inputs to construction are only moved over short distances. Conversely, while higher value goods may involve less tonnage, they tend to have longer average lengths of haul. This has important future implications, given the Executive's goal to restructure the local economy with a focus on growth in high value sectors and exports.

4.14 Moreover, given the open nature of the local economy, our peripheral location and small internal market, a move towards high value economic activities, will require the maintaince of efficient and effective external transport links. With the exception of a very small tonnage of air freight, all international freight movements to and from the island of Ireland are by sea. In relation to NI ports, the significant majority of inward and outward movement is through the ports of Belfast and Larne (chart 17).

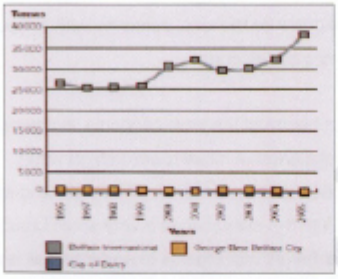
Chart 17: Volume of Traffic by Port: 2005



4.15 Air freight has long been concentrated in Belfast International Airport as illustrated below. As such, the key external links are largely concentrated in or in close proximity to the Belfast Metropolitan Area (BMA). If the export potential of locally based businesses is to be

enhanced, therefore, it is of critical importance, that the transport infrastructure at the regional and BMA level, facilitates the effective and efficient movement of goods to and from the ports of Belfast and Larne and the Belfast International Airport.

Chart 18: Cargo Handled at Northern Ireland Airports 1996-2005[13]



[13] Intertrade Ireland, *Freight Transport Report for the Island of Ireland*, March 2008, p43

5. PROJECTED EMISSIONS TO 2025

5.1 A study commissioned by the ***Scotland and Northern Ireland Forum for Environmental Research*** (SNIFFER), on behalf of DOE, in July 2007, set out to monitor and project the North's greenhouse gas and carbon dioxide emissions. The modelling tool subsequently developed looked at projected emissions from electricity generation, industry, domestic combustion, commercial & public, road transport, aviation, agriculture (cattle & soils), waste, Land use, Land use change & Forestry (LULUCF) and other sources.

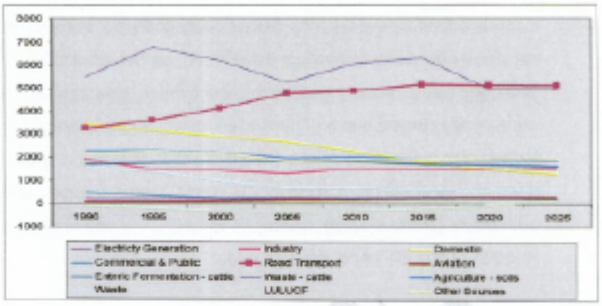
5.2 The report concluded that by 2025, using current policy impacts and sector forecasts, greenhouse gas emissions here would have decreased by 13% on 1990 levels, and that CO_2 emissions would have decreased by 9% on 1990 levels (table 8).

Table 8: Summary of Greenhouse Gas Emissions & Projections, 1990-2025 ($ktCO_2e$)

Gas	Sector Name	1990	1995	2000	2005	2010	2015	2020	2025
CO_2	Electricity Generation	5480	5650	5243	5267	6112	5360	4973	4973
CO_2	Industry	1827	1491	1457	1325	1509	1483	1464	1464
CO_2	Domestic	3480	3183	2966	2737	2299	1955	1514	1339
CO_2	Commercial & Public	548	384	280	259	270	279	287	294
CO_2	Road Transport	3271	3618	4149	4620	4913	5189	5157	5125
CO_2	Aviation	114	122	158	222	239	261	277	295
CH_4	Enteric Fermentation - cattle	1713	1804	1826	1872	1838	1724	1691	1634
CH_4	Waste - cattle	246	253	262	277	270	257	255	246
N_2O	Agriculture - soils	2367	2330	2219	2002	2043	1954	1918	1878
CH_4	Waste	1588	1410	989	701	576	640	606	585
CO_2	LULUCF	-30	-142	-270	-286	-248	-170	-15	155
	Other Sources	2210	2270	2201	1863	1816	1941	1965	1985
	Total	**22805**	**23584**	**22452**	**21097**	**21840**	**21754**	**20095**	**19975**
	% change		**3%**	**-2%**	**-8%**	**-4%**	**-5%**	**-12%**	**-13%**

5.3 The projections also indicate, however, that emissions from road transport will continue to rise through to 2025, increasing by 57% (1,854 $ktCO_2$) on 1990 levels. As a consequence, by 2025, road transport is projected to account for 26% of all greenhouse gas emissions to become the single largest source of GHG emissions.

Chart 19: Summary of Greenhouse Gas Emissions & Projections, 1990-2025 ($ktCO_2e$)



5.4 That projected increase of 1,854 $ktCO_2$ on the 1990 baseline for road transport emissions is equivalent to 64% of the total projected reductions (2,890 $ktCO_2e$) across all sectors. As such, where emissions from road transport by 2025 to be maintained at the 1990 baseline, total emissions would be projected to decrease by 21%.

5.5 Transport emissions and the level of demand for transport will be impacted upon by a number of factors, including wider socio-economic trends, political initiatives and developments in the policy environment at the local, national, European and international level. This is not a static environment and projections must be treated with a certain degree of caution. While acknowledging this, it is clear that given past trends and taking account of the current policy environment, emissions from road transport are likely to continue to increase in the absence of significant technological developments, behavioural change or policy initiatives.

6. CONCLUSION

6.1 The PfG, in line with the Sustainable Development Strategy, has set an ambitious target for a reduction in local emissions of greenhouse gases. The scale of the challenge, particularly given progress to date should not be under estimated. While progress has been made across a number of sectors, emissions from transport have increased significantly since 1990, adversely impacting on the cumulative progress realised in other areas.

6.2 Given the nature of transport and the costs associated with a move towards more sustainable arrangements, the Stern Review recognised that deep cuts in emissions from the transport sector are likely to be more difficult in the shorter term, but the report also concluded that such cuts will ultimately be needed. While, it may be possible to pursue more ambitious reductions in other sectors to address potential shortfalls in transport, the fact remains that further increases in road transport emissions will significantly undermine the potential to successfully realise the Executive's targets and commitments in this area. Transport must, therefore, play its part. Indeed the outworking of the Climate Change Act, the Renewable Energy Directive and related legislation are likely to require action to reduce emissions from road transport.

6.3 As set out in section 2 of this paper, to fully contribute to realisation of the PfG target, a 51% reduction is required on 2006 greenhouse gas emissions from road transport by 2025. Similarly, realisation of the target set out in the Climate Change Act will require a 51% reduction in CO_2 emissions by 2020. This would require from 2006 an average year on year reduction in CO_2 emissions from road transport in the range of 133 – 173 Kt CO_2. The scale of the challenge is considerable, but it is unlikely to decrease in magnitude in the absence of a concerted policy response. Moreover, it will require a focus on all areas of transport including freight.

6.4 That response, however, cannot be taken forward in isolation from government's wider policy agenda. The move towards a high value economy, more balanced growth at the sub-regional level and promoting inclusion in line with the Executive's economic and social priorities may require increased levels of mobility of people, goods and services. The challenge is to effectively manage and appropriately respond to demand while delivering real reductions in emissions from transport. It is also imperative, that policies across government do not unnecessarily increase the demand for transport, promote unsustainable outcomes or mitigate efforts to reduce emissions in this area.

DRAFT

Letter from DFP Minister in relation to Carbon Trust Funding

From the Office of the Minister

Department of Finance and Personnel

Craigantlet Buildings
Stoney Road
Belfast BT4 3SX
Telephone 028 9052 9140
Email: Private.Office@dfpni.gov.uk

Dolores Kelly MLA
Chair
Environmental Committee
Room 245, Parliament Buildings
Belfast
BT4 3 XX

Our Ref: COR /782/09

23 September 2009

Dear Dolores

FUNDING THE CARBON TRUST

Thank you for your letter of 30 July 2009 in which you seek details of the funding options available to the Carbon Trust to assist the public sector to meet its carbon reduction commitments.

As you are aware, the Carbon Trust funded through Invest NI, provides support for the private sector free of charge. Northern Ireland Departments can also avail of the services provided by the Carbon Trust provided they are willing to pay for these services.

Indeed my Department has availed of the Carbon Trust's advice on a number of occasions, for example on the consideration of CHP and the installation of a biomass boiler on the Stormont estate.

In addition to the Carbon Trust, there are other alternatives that Departments can consider to address the issue of improving energy efficiency. For example Properties Division within my Department provides a comparable range of services relating to improving energy efficiency to a number of public sector clients on a similar basis as the Carbon Trust. The Division also administers a long-established Central Energy Efficiency Fund, which currently makes available £2 million annually to fund projects which aim to deliver energy savings and/or carbon reductions. Northern Ireland is currently the only region of the UK which awards full grant funding for energy efficiency measures for public sector buildings on an annual basis.

Yours sincerely

SAMMY WILSON MP MLA

[redacted]

Research Paper:
Climate Change Obligations

Northern Ireland Assembly

Climate Change Obligations
Briefing Paper

October 2nd, 2009

1. UK Carbon Reduction Targets

The Climate Change Act 2008 extends throughout the UK. The NI Assembly granted legislative consent to the extensions of its provisions on 10 December 2007 and it became law on the 26 November 2008. There are a number of provisions of the Act but in relation to greenhouse gas emissions and carbon budgeting there are two key pieces of information. These are:

- a legally binding target of at least an 80% cut in greenhouse gas emissions by 2050 with an interim target of 34% by 2020; and
- a carbon budgeting system to cap emissions over five year periods. The first three carbon budgets will run from 2008 -12, 2013 - 17 and 2018 - 22 and the first had to be set by 1 June 2009.

In May 2009, following the UK Government's stated intention in its April Budget, Parliament approved the first three carbon budgets. The figures are presented in table 1

Table 1 Carbon levels for the first three carbon budgets[1]

	Budget 1 (2008-12)	Budget 2 (2013–17)	Budget 3 (2018–22)
Carbon budgets (MtCO2e)1	3018	2782	2544
Percentage reduction below 1990 levels	22	28	34

The UK Climate Change Committee in following the EU framework has produced two sets of budgets for the UK. The Intended budget will apply following a global deal on climate change and will require an emissions reduction of 42% in 2020 relative to 1990 (31% relative to 2005). This translates to required emissions reductions of 175 MtCO2e in 2020. The Interim budgets require an emissions reduction of 34% in 2020 relative to 1990 (21% relative to 2005). This translates to required reductions of 110 MtCO2e in 2020.

2. Northern Ireland response

The UK government consulted with the devolved administrations on these proposals and the then Minister for the Environment responded[2] noting the targets while also indicating the potential negative effects these could have on employment, actions to address fuel poverty, and NI Executive finances among others. However, there have been no specific targets set, as yet, for NI in relation to carbon budgeting.

2.1 NI Programme for Government Targets

The NI Programme for Government did establish targets for reduction in greenhouse gas emissions. This was set at a 25% reduction below 1990 levels by 2025. It also set a target of reducing CO2 emissions by 30% from 1990 levels by 2025. The end-of-year delivery report[3] 1 April 2008 – 31 March 2009 on the PfG has stated that the 25% target for greenhouse gas emissions is a 'major challenge going forward'. At that time the report stated that the reduction in greenhouse gas emissions for NI stood at 6% (of 1990 figures). The report in consideration of the Review Area, Greenhouse Gas Emissions and Sustainable Development identified a number of areas of concern. These are highlighted in table 2 below

Table 2 Chief areas of concern in the Review Area: Greenhouse Gas Emissions and Sustainable Development

Reference	Indicator	RAG STATUS
Priority Three: Key Goal 1	Reduce greenhouse gas emissions by 25% below 1990 levels by 2025 and Improve Energy Efficiency in homes	
PSA 22: Indicator 2	Through the Sustainable Development Implementation Plan 2008 - 2011, progress delivery, where appropriate, of the Key Targets associated with strategic Climate Change and Energy objectives	
PSA 22: Indicator 6	Achieve the health based objectives for 7 key air pollutants in the Air Quality Strategy by the relevant dates	
PSA 11: Indicator 7	Develop and take forward delivery of the Sustainable Development Implementation Plan 2008 - 2011	
PSA 11: Indicator 9	Development of a Sustainable Consumption Action Plan for Northern Ireland by 2008	
PSA 11: Indicator 16	Through the Sustainable Development Implementation Plan 2008-2011, progress delivery, where appropriate, of the Key Targets associated with strategic Sustainable Consumption and Production objectives	

This report is critical of departments stating that “from the Departmental returns it is not clear how the delivery of the targeted reductions are intended to be achieved". It is also states that

“Furthermore there was little evidence of any plans/actions from the Lead Department with an apparent reliance on mainly UK-wide initiatives. Overall the RAG[4] Assessment for this Key Goal was RED with little evidence to provide assurance that current actions are placing NI on the sort of trajectory that would plausibly see achievement of a challenging target – even one that is 16 years away".

It is also critical of the lack of co-ordination between departments to achieve these and other targets.

A recent report[5] by AEA Technology has stated that greenhouse gas emissions have fallen in Northern Ireland by 13% since 1990 while CO2 emissions have decreased by 9% since that time. Table 3 outlines the figures for the UK administrations

Table 3 Net C02 and Greenhouse Gas Emissions for the UK regions[6]

	England	Wales	Scotland	N Ireland
CO2 (Mt CO2 e)	-8.7	-9.5	-14.7	-8.7
Total (Net Emissions6) (Mt CO2 e)	-19.6	-14.7	-19.9	-12.6

This raises an issue for clarification i.e. in March of this year the end-of-year delivery report on the PfG stated that

“The target is a 25% GHG reduction below 1990 levels by 2025 and at 2006 we stood at a 6% reduction.."

As noted in table 2 this is now estimated at 12.6%. It is difficult to see how a further 7% reduction in GHGs could be achieved in only 3 years since 2006.

2.2 Carbon Reduction Commitment

Although there is no identifiable high level carbon budget target specific to Northern Ireland a UK-wide scheme – the Carbon Reduction Commitment (CRC) – will apply to around 100 organisations in NI. CRC is scheduled to come into effect in April 2010. This is a 'cap and trade' scheme which is designed to create a shift in awareness, behaviour and infrastructure. To quote the department's website[7]:

"The CRC will target emissions from energy use from large non-energy intensive organisations in both the public and the private sector whose annual mandatory half hourly metered electricity use is above 6,000MWh – focusing on those emissions outside the Climate Change Agreements (CCAs) and outside the direct emissions covered by the EU Emissions Trading Scheme (EU ETS). In addition, firms with more than 25% of their energy use emissions in Climate Change Agreements would be completely exempt".

2.3 Low Carbon Transition Plan

The Department of Energy and Climate Change has produced a low carbon transition plan detailing how the UK and its regions will meet the 34 percent cut in emissions on 1990 levels by 2020[8].

Summary of actions in Northern Ireland in respect of low carbon transition[9]

- The key target in relation to Northern Ireland is the reduction in emissions of 25% on 1990 levels.
- An Inter-departmental Working Group on Sustainable Energy was established in 2008 to ensure a more co-ordinated approach to the promotion of sustainable energy including energy efficiency and renewable energy. This is chaired by the DETI Minister.
- Electricity consumption from renewable energy sources has doubled since the introduction of the Northern Ireland Renewables Obligation in 2005. The target is to achieve 12% of total electricity consumption by 2012 (mainly from onshore wind); currently it is 7%. DETI has proposed in its consultation document Draft Strategic Energy Framework for Northern Ireland 2009 that the new target for electricity from renewable sources be increased to 40% by 2020. However, this would require significant upgrading of the grid which would be at a significant cost, possibly £1billion over 10 or 12 years[10].
- DETI has published the Cross-Departmental Bioenergy Action Plan for consultation – closes 30th October.
- Northern Ireland Energy Efficiency Action Plan is currently being developed and should be completed before the end of 2009.
- Northern Ireland must contribute to the UK energy savings target under the Energy End Use and Energy Services Directive. The UK target is 1% per annum – 9% by 2016. DETI has a target of reducing energy consumption by 1% per annum from 2007 until 2012. Because the UK target supersedes the NI one DETI intends to extend the monitoring of the target of reducing electricity consumption from 2007 by 1% annually until 2012 to all fuels.

- Initiatives to incentivise businesses are overseen by DETI.
- 51% reduction is required on 2006 greenhouse gas emissions from road transport by 2025. The Minister for Regional Development recently announced a review of its Regional Transportation Strategy. A key objective of this review will be to ensure more sustainable transport arrangements.
- DARD – support for willow coppicing; increase land afforested from 6 to 12% by 2056 which will improve opportunities for carbon sequestration
- The Northern Ireland Public Sector Energy Campaign aims to promote the efficient use of energy by Northern Ireland Public Bodies. Overall targets for this campaign are listed below.

Targets[11]

- To increase the energy efficiency of the buildings on their estates measured in terms of kiloWatt-hours (kWh) of fuel and electricity used per square metre of building floor area by 15% by 2010/11, relative to a base year of 1999/2000;
- To reduce absolute carbon, from fuel and electricity used in buildings on their estates by 12.5% by 2010/11, relative to a base year of 1999/2000; and
- To reduce electricity consumption across the estate by 1% annually from 2007 to 2012 against the base year of 2006/07

3. Scotland

The Climate Change (Scotland) Act 2009 has also set a target of an 80% reduction of greenhouse gases based on 1990 levels by 2050. It also establishes an interim target for 2020 of at least 42% reductions in emissions, with the power for this to be varied based on expert advice from the UK Committee on Climate Change. Scotland has therefore adopted the target from the Intended budget estimates established by the Climate Change Committee, prior to any agreement being reached at a global level. This compares with the NI target of 25% by 2025. Annual targets must also be set in secondary legislation and from 2020 onwards annual targets must deliver at least 3% per annum reductions. The long term framework will also include emissions from international aviation and international shipping.

As well as setting targets this Act also requires a carbon assessment[12] of the budget including a description of the direct and indirect impact of the spending plans. This high level analysis will help the Scottish government to place the carbon impact of its use of goods and services in the context of the national and global economy and help raise awareness of the contributions different sectors make in respect of carbon impact[13].

Key Points of this Assessment[14]

- The carbon assessment of the Budget provides a first attempt to understand the carbon impact of the goods and services purchased through Government spending.
- It is estimated that total emissions resulting from the 2010-11 Draft Budget will be 11.5 Mt CO2-equivalent. For comparison, this would be around 14 per cent of the estimated carbon footprint for Scotland as a whole, based on a 2004 estimate.
- Over time, reductions in the emissions intensity of the economy as a whole will drive down the estimated carbon impact of future budgets.

- This assessment indicates that the amount of carbon for each pound of expenditure across the different areas of Government spending does not vary greatly.
- Emissions that may result from the use of public goods and services, whether beneficial in terms of reducing emissions (e.g. spending on energy efficiency or afforestation) or negative in terms of increasing emissions (e.g. road use) are not captured.
- It is anticipated that methods for assessing the carbon impact of the Budget will continue to be developed alongside other assessment methods to improve understanding of the emission impacts of both Government expenditure and policies.

The annual reports referred to (for the period 2010 to 2050) must set out the emissions of greenhouse gases, whether in Scotland or elsewhere, which are produced by or otherwise associated with the consumption and use of goods and services in Scotland during that year. The Climate Change (Scotland) Act is the only legislation which requires that this kind of reporting by carried out on a statutory basis. This step ensures that production-based and consumption-based emissions are considered together[15].

4. Wales

The Welsh Assembly is currently developing a Climate Change Strategy that aims to bring together the High Level Policy Statement and the Programme of Action which will be published at the end of 2009. However in the 'One Wales' document it states that

"We will aim to achieve annual carbon reduction-equivalent emissions reductions of 3% per year by 2011 in areas of devolved competence. We will set out specific sectoral targets in relation to residential, public and transport areas. We will work with the heavy industry/power generation industries to reduce emissions in those sectors"[16].

Jane Davidson has stated that the Programme of Action represents plans to commit £300m by all Ministers of the Welsh Assembly across all departments to contribute towards tackling climate change[17].

5. Republic of Ireland

The Climate Change Policy Unit at the Department of the Environment, Heritage and Local Government, has advised on the current status of the proposed Climate Change legislation and the National Climate Change Adaptation Framework. This is outlined below:

- In July 2009[18] the Government approved the Minister John Gormley's proposal to proceed to draft Heads of a Climate Change Bill.
- The proposed legislation will provide an overarching framework which will complement and support the existing arrangements under the Cabinet Committee on Climate Change and Energy Security.
- The proposed Climate Change Bill will enshrine principles and policies towards underpinning the national effort in combating climate change as a core priority in the pursuit of a sustainable, low carbon economy and the integration of principles outlined in the National Climate Change Strategy 2007 – 2012[19] for all relevant development activity.
- The Department, in this initial phase, is consulting with other Government Departments and their associated agencies with a view to scoping the legislation and further elaborating policies and principles to reflect the priorities of the various sectors.

- The legislation will also include enabling provisions and the consultation phase is focusing on identifying areas where provisions allowing for the development of secondary legislation might be required.
- The legislation will also cover climate change adaptation. In this context, the Department is also developing a National Climate Change Adaptation Framework in tandem with the draft Climate Change Bill.
- The Minister has publicly indicated his intention to publish the climate change legislative proposals and adaptation strategy by the end of 2009.

6. Obligations emanating from Europe

6.1 Targets

The EU is committed to reducing its overall greenhouse gas emissions by 20% below 1990 levels by 2020. In December 2008 the EU Parliament and Council reached agreement on a package to help the EU transform into a low carbon economy. The EU Climate and Energy package incorporates a number of different policies and targets. For example, the following targets have been set for 2020:

- cutting greenhouse gases by at least 20% of 1990 levels (30% if other developed countries commit to comparable cuts)
- increasing use of renewables (wind, solar, biomass, etc) to 20% of total energy production (currently ± 8.5%)
- cutting energy consumption by 20% of projected 2020 levels - by improving energy production

6.2 Cutting Emissions

Power plants and energy–intensive industries will have to cut emissions to 21% by 2020 compared to levels in 2005. This will be enabled by revision and implementation of the EU's emission trading scheme which will grant fewer emissions allowances. How emissions trading works can be found in Appendix 2.

6.3 Increasing the use of renewables and cutting energy consumption

In relation to renewable energy the key document is the DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THECOUNCIL on the promotion of the use of energy from renewable sources amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC is the key document[20]. The aim of this legislative act is to achieve by 2020 a 20% share of energy from renewable sources in the EU's final consumption of energy

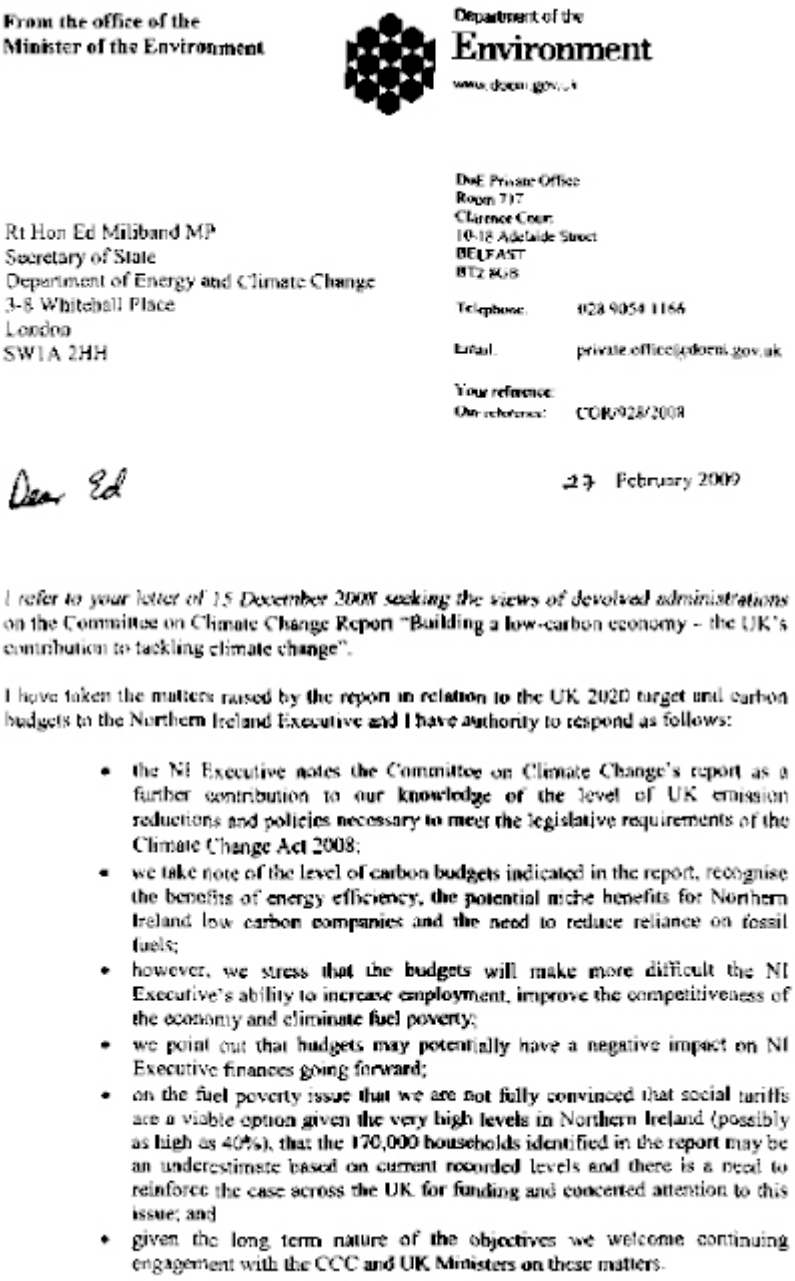
For the UK the share of energy from renewable sources in gross final consumption of energy at 2005 levels is 1.3%. The UK's 2020 target for share of energy from renewable sources in gross final consumption of energy is 15%.

The directive also states that each country should reach a 10% renewables share in its transport sector, and establish criteria for the sustainable use of biofuels. Each country is expected to adopt a national renewable energy action plan setting out its national targets for the share of

energy from renewable sources consumed in transport, electricity, heating and cooling in 2020 and will notify it to the Commission by June 2010[21].

7. References

Appendix 1



From the office of the
Minister of the Environment

Department of the
Environment
www.doeni.gov.uk

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Your reference:
Our reference: COR/928/2008

Rt Hon Ed Miliband MP
Secretary of State
Department of Energy and Climate Change
3-8 Whitehall Place
London
SW1A 2HH

Dear Ed

27 February 2009

I refer to your letter of 15 December 2008 seeking the views of devolved administrations on the Committee on Climate Change Report "Building a low-carbon economy – the UK's contribution to tackling climate change".

I have taken the matters raised by the report in relation to the UK 2020 target and carbon budgets to the Northern Ireland Executive and I have authority to respond as follows:

- the NI Executive notes the Committee on Climate Change's report as a further contribution to our knowledge of the level of UK emission reductions and policies necessary to meet the legislative requirements of the Climate Change Act 2008;
- we take note of the level of carbon budgets indicated in the report, recognise the benefits of energy efficiency, the potential niche benefits for Northern Ireland low carbon companies and the need to reduce reliance on fossil fuels;
- however, we stress that the budgets will make more difficult the NI Executive's ability to increase employment, improve the competitiveness of the economy and eliminate fuel poverty;
- we point out that budgets may potentially have a negative impact on NI Executive finances going forward;
- on the fuel poverty issue that we are not fully convinced that social tariffs are a viable option given the very high levels in Northern Ireland (possibly as high as 40%), that the 170,000 households identified in the report may be an underestimate based on current recorded levels and there is a need to reinforce the case across the UK for funding and concerted attention to this issue; and
- given the long term nature of the objectives we welcome continuing engagement with the CCC and UK Ministers on these matters.

Appendix 2

How does emissions trading work?

Let's say that companies A and B both emit 100,000 tonnes of CO2 per year. The government gives each of them 95,000 emission allowances. One allowance represents the right to emit 1 tonne of CO2. So, neither company is fully covered for its emissions. At the end of each year, the companies have to surrender a number of allowances corresponding to their emissions during the year, whatever the emissions of the individual company are. If they fail to do so, they face a fine of € 40 per missing allowance during the 2005-2007 trading period, and € 100 during the second 2008-2012 trading period. Companies A and B do not want to pay the fine and both have to cover 5,000 tonnes of CO2. They have two ways of doing this.

They can either reduce their emissions by 5,000 tonnes, or purchase 5,000 allowances in the market. In order to decide which option to pursue, they will compare the costs of reducing their emissions by 5,000 tonnes with the market price for allowances.

For the sake of the example, let's say that the allowance market price is € 10 per tonne of CO2. Company A's reduction costs are € 5 (i.e. lower than the market price). Company A will reduce its emissions, because it is cheaper than buying allowances. Company A may even reduce its emissions by more than 5,000 tonnes, say 10,000 tonnes. For Company B, the situation may be the opposite: its reduction costs are € 15 (i.e. higher than the market price) so it will prefer to buy allowances instead of reducing emissions.

Company A spends € 50,000 on reducing 10,000 tonnes at a cost of € 5 per tonne and receives € 50,000 from selling 5,000 tonnes at a price of € 10. So Company A fully offsets its emission reduction costs by selling allowances, whereas without the Emissions Trading Scheme it would have had a net cost of €25,000 to bear. Company B spends € 50,000 on buying 5,000 tonnes at a price of € 10. In the absence of the flexibility provided by the Emissions Trading Scheme, company B would have had to spend €75,000.

Since only a company that has low reduction costs and therefore has chosen to reduce its emissions, like Company A, is able to sell, the allowances that Company B buys represent a reduction of emissions, even if Company B did not itself reduce emissions.

This is important to remember. This ensures that the cheapest reductions are made first. Since the scheme is EU-wide, companies will seek out the cheapest reductions in the whole of the EU and ensure that they are made first. It is this flexibility in the system which makes emissions trading the most cost-effective manner of achieving a given environmental target. The overall cost to industry would have been higher if Company B had been forced to reduce emissions at its own plant at a higher cost.

[1] Million tonnes of CO2 equivalent per year

[2] This letter is in Appendix 1

[3] Building a Better Future: End of Year Delivery Report: 1 April 2008 – 31 March 2009. The Northern Ireland Executive's Programme for Government 2008-2011

[4] This refers to RED, AMBER, GREEN designations to highlight the degree of concern

[5] Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2007. Report to the Department for Energy and Climate Change, The Scottish Government, The Welsh Assembly Government and The Northern Ireland Department of Environment. AEAT, 2009.

[6] Total Greenhouse Gas Emissions: six greenhouse gases are reported on: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFC), perfluorocarbons (PFC), and sulphur hexafluoride (SF6)

[7] http://www.doeni.gov.uk/index/protect_the_environment/climate_change/crc.htm

[8] http://www.decc.gov.uk/en/content/cms/publications/lc_trans_plan/lc_trans_plan.aspx

[9] Ibid

[10] All-Island Grid Study. Workstream 1, Renewable Energy Resource Assessment. January 2008. Department of Communications, Energy and Natural Resources/Department of Enterprise, Trade and Investment

[11] http://www.dfpni.gov.uk/index/public-sector-energy-campaign.htm

[12] http://www.scotland.gov.uk/Publications/2009/09/17102339/0

[13] http://www.scotland.gov.uk/Publications/2009/09/17102339/2

[14] Ibid

[15] http://www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/climatechangeact/reporting

[16] One Wales. A progressive agenda for the government of Wales. An agreement between the Labour and Plaid Cymru Groups in the National Assembly. June 27th, 2007

[17] http://www.theccc.org.uk/news/features/332-jane-davidson-on-climate-change-in-wales

[18] http://www.irishtimes.com/newspaper/ireland/2009/0728/1224251492566.html

[19] http://www.environ.ie/en/PublicationsDocuments/FileDownLoad,1861,en.pdf

[20] http://register.consilium.europa.eu/pdf/en/08/st03/st03736.en08.pdf

[21]Press Release, Council of the European Union. Council adopts climate-energy legislative package. Brussels, 6 April 2009,8434/09 (Presse 77)

Research Paper: Climage Change: Republic of Ireland, Wales and the North-South Ministerial Council

Research and Library Services

Climate Change: Republic of Ireland, Wales and the North-South Ministerial Council

Briefing Paper

November 6th, 2009

1. Republic of Ireland – National Climate Change Strategy 2007-2012[1]

1.1 Principles

The RoI Strategy is based on the following principles:

- The need to take a long term view taking into consideration the likely future commitments and the economic imperative for early action
- The promotion of sustainable development including through integration of climate change considerations into al policy areas
- The protection of economic development and competitiveness
- Maximisation of economic efficiency at a macro level and within sectors
- Equitable approach to all sectors, having regard to the relative cost of mitigation between sectors

1.2 Policy Options

The Strategy adopts an integrated approach using a range of policy options such as:

- Economic instruments such as taxation and emissions trading
- Regulation and other incentives directed towards behavioural change
- An approach to establish common and co-ordinated policies and measures implemented at EU and international level
- Participation in international emissions trading

2. Sector-specific approaches

2.1 Energy Supply

- Reduction on reliance of fossil fuels by expanding the use of renewable energies such as wind, solar, wave, and biomass.
- 15% of electricity from renewable energy by 2010 and 33% by 2020.
- Promotion of energy efficiency and reduction in CO2 output by participation in the EU Emissions Trading Scheme.

2.2 Public Transport

- Sustainable Transport Action Plan – see Appendix 1.
- Modal shift to public transport.
- Introduction of biofuels obligation with 10% target of fuel used in transport to be from biofuel source by 2020.
- Vehicle Registration Tax (VRT) and Road Tax changed to reward the purchase of more fuel-efficient vehicles.

2.3 Residential

- Building Regulations revised to aim for 40% improvement on current thermal performance standards
- Grants to support homeowners to switch to renewable energy heating under Greener Homes Scheme
- Changes to planning to allow micro-renewable technologies for homeowners (e.g. solar panels, wind turbines etc)
- Energy efficiency campaigns to encourage behavioural change
- Smart meters to be supplied to all electricity customers
- Energy efficiency measure to be funded in social housing programmes
- Building Energy Rating (BER) certification required for all domestic and non-domestic buildings sold from January 1 2009

2.4 Industry, Commercial and Services

- Building Energy Rating (BER) certification required for all domestic and non-domestic buildings sold from January 1 2009
- Energy Efficient Action Plan to deliver a significant reduction in energy demand by 2020 – target of 33% by 2020
- Promotion of energy efficiency across businesses through Irish Standard for Energy Management (IS 393) but in particular support its implementation in Small and Medium Enterprises (SMEs)
- €26m commercial bioheat support scheme - grants provided to companies and small businesses to install wood chip and wood pellet boilers in large buildings and commercial premises
- €11m Combined Heat and Power (CHP) programme – provides grants for the installation of CHP units (up to 1Mw) for use in hotels, leisure centres, small hospitals etc. Target of deployment of 800Mw by 2020.

2.5 Agriculture, Land Use and Forestry

Two key approaches:

- Reform of Common Agriculture Policy (CAP) resulting in full decoupling of payments from production. This is projected to reduce emissions by 2.4million tonnes CO2 equivalent per annum in the period 2008-2012.
- Increase in land afforested from 10% to 17% to sequester 2.08Mt Equivalent CO2 per annum.

2.6 Waste

- Waste accounted for 2.5% of Greenhouse Gas Emissions.
- National Strategy on Biodegradable Waste (2006) – requires 80% of biodegradable municipal waste to be diverted from landfill by 2016
- Market Development Programme for Waste Resources 2007-2011 was published by the Market Development Group to promote more recycling in Ireland of materials recovered in this country.
- Raising awareness e.g. Race against Waste Campaign
- Working towards fitting landfill gas recovery and flaring/use at all existing sites under EPA licensing control.

2.7 Public Sector

- Target of a 33% reduction in greenhouse gas emissions by the public sector by 2020.
- Only CFL light bulbs only purchased for use in public buildings since 2007.
- Conversion of heating systems in large public buildings to biomass burners.
- Energy efficient design of new buildings.
- Energy Awareness.
- Public Procurement – consideration of incorporating environmental criteria into public procurement contracts (worth approximately €10 billion/annum). A national action plan for green public procurement is being discussed at government level.

3.0 Wales

Jane Davidson, the Welsh Assembly Minister for Environment, Sustainability and Housing intends to allocate £300 million towards tackling climate change. This will be used across all departments to achieve a high-level goal of greenhouse gas emissions reductions of 3% per year by the year 2011. The actions that will be funded to achieve this goal have not been finalised but will be contained in the Welsh Climate Change Strategy due to be published before the end of 2009. The consultation document on the Programme for Action can be accessed here. The proposed initiatives are outlined below:

3.1 Reducing emissions from the transport sector

Sustainable Travel Towns

Investment in infrastructure, e.g. park and ride sites, bus priority corridors.

Strategic Park and Ride

These will be established along the main traffic routes in Wales to help reduce congestion and make public transport more accessible for commuters.

Inter-modal Freight consolidation centre

This would move freight between different types of transport and therefore reduce unnecessary road journeys.

3.2 Reducing emissions from the business sector

- Skills for a low carbon economy

Development of skills to equip people to work in low carbon business in the long term and to ensure that economic and social benefits are maximised from a low carbon economy.

- Low carbon and resilient business

To ensure that business advice also includes advice on climate change

- Enhanced support for SMEs

Focus on enhancing support for SMEs to take action to tackle climate change.

- More effective use and regulation of waste heat and energy efficiency

Promotion of the use of waste heat and improved energy efficiency through awareness raising and regulation where necessary.

3.3 Reducing emissions from the residential sector

- Developing and area-based approach to domestic energy efficiency

This focuses on improving the energy efficiency of all homes in an area.

- Supporting Community Scale Energy Generation

To develop a programme that will support community scale energy projects and to encourage the development of low carbon energy schemes (50Mw).

3.4 Reducing emissions from agriculture and land use

- Agriculture and land management

Additional support to promote sustainable land management approaches including a new land management scheme. Capital grant for woodland cover.

- Dairy and red meat road maps – increasing efficiency across the entire food chain

Aim is to identify where carbon can be cut from the food chain for the meat and dairy sectors.

3.5 Reducing emissions from the waste sector

- Promoting Anaerobic Digestion

Investment to support the development and commercialisation of anaerobic digestion.

3.6 Reducing emissions from the Public sector

- Reducing the carbon footprint of the Assembly Government estate

Reduction of the carbon footprint of the Welsh Assembly Government estate by implementing the Carbon Management Plan.

- Reducing the carbon footprint of education services

An assessment of the carbon impact will be integrated into decision-making on school reorganisation.

- Delivering schools to higher building standards

Adoption of standards as a condition of new and refurbished school buildings.

3.7 Adapting to climate change in Wales

- Framework for adapting to the impacts of climate change in Wales

A framework will help incorporate impacts of climate change into decisions and improves the ability of Wales to respond to the challenges and opportunities to meet obligations under the Climate Change Act.

3.8 Helping society to adapt to climate change in Wales

- Building up evidence on social justice, equality and adapting to the effects of climate change

The Government will focus on increasing its understanding of the social justice and equality consequences of climate change risk.

- Helping the Public Sector to address the impacts of climate change

Focus on building the Public Sector's ability to adapt to the effects of climate change.

- Communications and Engagement

Build awareness of climate change and equip organisations with the ability to help local communities be prepared for climate change and its effects.

3.9 Helping the economy adapt to climate change

- Supporting an economy to cope with climate change and its effects.

Building more evidence to understand how climate change will affect Wales' economy.

- Equipping decision makers

Equip and inform decision makers to take decisions that take account of climate change risks.

3.10 Understanding Impacts on the natural Environment

- Working with partners to enhance our understanding of the impact of climate change on the Wales' natural environment, support projects to monitor changes and use the latest projections.

4. Climate Change discussion between Fianna Fáil and the Green Party

4.1 Background

Fianna Fáil and the Green Party have worked together over the past two years during a period of record global economic downturn. The paper 'Proposed Renewed Programme for Government' is their agreed paper produced as a review of the 'Programme for Government', which was negotiated prior to the current economic situation. The goals set out in the document provide the political basis of Government action on national renewal and economic recovery.

Realising the environmental challenges we face today, one of the purposes of the measures discussed in the paper is to move towards a low carbon economy by utilising the country's natural energy, forestry and food resource :

"There will be great rewards for the country that understands and responds quickly to the environmental challenges of this new century. Moving to a low-carbon economy, we will take advantage of our own natural resources in energy, forestry and food".

Both Parties believe that Ireland has the chance to be a forerunner in the global battle against climate change, and states that carbon emission targets will be legally binding. They stress their understanding of the link between economic sustainability and environmental sustainability, with proposals to invest in public transport, new broadband infrastructure and more energy efficient buildings as it makes both economic and environmental sense .

This paper will look at the Renewed Programme for Governance in relation to negotiations regarding climate change under section 5, Our Environment. While this is the main topic of discussion in this paper, the other areas covered by the Renewed Programme include: The Economy and Public Finances, Enterprise and Jobs, A more caring and Just Society, Building for the future: Our Infrastructure, A Learning Nation, Enhancing Our Democracy and Public Services, A vibrant Ireland, and Ireland's International Role.

4.2 Proposed Renewed Programme for Government .

4.2.1 Our Environment: Climate Change

The paper proposes:

1. The introduction of a Climate Change Bill to give a legislative foundation to the annual carbon budget. The Bill will include:

- A target of 3% annual average reduction in GHG emissions
- Annual carbon budget put on a statutory basis
- Government Departments to take responsibility for changes in emissions associated with their policies so that they are consistent with the overall 3% annual reduction target.

- Estimates of carbon impact of expenditure programmes announced in the annual budget to be included in the carbon budget.
- Adaptation and mitigation obligations on emanations of the State.
- Monitoring and reporting obligations on the private sector.

2. The addition of a 'Climate Change Impact' assessment to considerations which must be included for all Cabinet decision-making.

3. The development of a National Climate Change Adaptation Strategy to ensure that the necessary procedures needed to adapt to the challenges faced with climate change are implemented at every level of society.

4.3 Economy and Public Finances: Taxation for Sustainable Development

The paper proposes the introduction of Carbon Tax in Budget 2010. The principles underlying the carbon levy to be introduced in 2010 will be:

- those most at risk of fuel poverty will be protected,
- the improvement of the fuel efficiency of our current housing stock,
- the reduction of the relative tax burden on labour.

Any revenues generated through the application of the tax will be accounted for in identified areas of spending in the Carbon Budget.

4.4 Enterprise and Jobs: The Green Economy

One of the fundamental areas of economic policy will be to implement a Green New Deal to move away from fossil-fuel based energy production by investment in renewable energy and to increase energy efficiency for the reduction of demand, waste and costs. To ensure that green criteria are at the centre of all state procurement, both parties suggest the introduction of new public procurement procedures and guidelines. The revision of the Capital Investment Programme will be carried out to ensure the inclusion of new budget realities, the need to deliver a Smart Economy and to meet mandatory climate change emissions reduction targets.

4.5 Enterprise and Jobs: Forestry

One of the aims will be to review state forestry policy to take account of the importance of its role in tackling climate change. Following the review, the current range of programmes and supports will be enhanced to assist the accomplishment of 17% forestry cover by 2030, therefore contributing to meeting climate change commitments. Another idea is the combined work of the Government with the Irish forestry sector, including Coillte, for the development of a scheme where some of the finance set aside to buy carbon credits abroad will be used for forestry investment in Ireland.

5. North South Ministerial Council

5.1 Background

The North South Ministerial Council (NSMC) was established under the Belfast/Good Friday Agreement in 1998. Comprising Ministers of the Northern Ireland Executive and the Irish Government, its purpose is to:

“develop consultation, co-operation and action within the island of Ireland - including through implementation on an all-island and cross-border basis - on matters of mutual interest and within the competence of the Administrations, North and South."

There are six Areas of Co-operation in which common policies and approaches are agreed in the NSMC and then implemented separately in each jurisdiction. The six Areas include:

1. Agriculture: Common Agricultural Policy issues, Animal and Plant Health Policy and Research and Rural Development.

2. Education: Education for children with special needs, educational under-achievement, teacher qualifications and school, youth and teacher exchanges.

3. Environment: Environmental protection, pollution, water quality management and waste management in a cross-border context

4. Health: Accident and emergency planning, co-operation on high technology equipment, cancer research and health promotion.

5. Tourism, including Tourism Ireland: The promotion of the island of Ireland overseas as a tourist destination through the publicly owned limited liability company Tourism Ireland Limited.

6. Transport: Co-operation on strategic transport planning including road and rail infrastructure and public transport services and road and rail safety.

5.2 The Role of the NSMC in Climate Change

Although one of the Co-operation Areas under the auspices of the NSMC is Environment, according to a statement made by the Department of Environment (DoE) NI, at a meeting of the Assembly Environment Committee 25th June 2009 , climate change is not a mandated area in the NSMC. The only time it may come up is when climate change cross-cuts one of the other topics under discussion. For instance, a Workshop held in Newry, June 2009 to Examine the Impacts of Climate Change on the Implementation of the Water Framework Directive, meant that the discussion of climate change was a requirement of the NSMC.

Climate Change is instead dealt with by the British-Irish Council (BIC) as it is one of their Priority Areas of Work under Environment . The most recent publication from the BIC was a discussion paper called “Adapting to Climate Change in the British-Irish Council Region" (2006). This was submitted to the 2nd European Climate Change Programme to inform of the development of the EU’s Green Paper on Adaptation, and the working towards a White Paper .

For more information on the BIC, visit their website at: http://www.british-irishcouncil.ie

References

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2 Ibid

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5 Committee for Environment Official Report Climate Change Inquiry 25th June 2009 http://archive.niassembly.gov.uk/environment/2007mandate/minutes_of_evidence/2008/090625_climatechange.htm

6 Committee for Environment Official Report Climate Change Inquiry 25th June 2009 http://archive.niassembly.gov.uk/environment/2007mandate/minutes_of_evidence/2008/090625_climatechange.htm

7 http://www1.british-irishcouncil.org/work/environment.asp

8 Adapting to Climate Change in the British Irish Council Region http://www3.british-irishcouncil.org/work/climate_change_paper.pdf

Appendix 1

Republic of Ireland

Transport

Smarter Travel – a Sustainable Transport Future

The key document in respect of sustainable travel proposals is Smarter Travel – a Sustainable Transport Future details proposals to achieve a sustainable travel and transport system by 2020.

Five key goals form the basis of the policy. These are:

- Improve quality of life and accessibility to transport for all and, in particular, for people with reduced mobility and those who may experience isolation due to lack of transport
- Improve economic competitiveness through maximising the efficiency of the transport system and alleviating congestion and infrastructural bottlenecks
- Minimise the negative impacts of transport on the local and global environment through reducing localised air pollutants and greenhouse gas emissions
- Reduce overall travel demand and commuting distances travelled by the private car
- Improve security of energy supply by reducing dependency on imported fossil fuels

There are 49 actions in the document detailed over 5 chapters beginning at chapter 4. The following gives a flavour of the actions to be taken but it is recommended that the document be consulted for greater detail.

2.3 Chapter 4 – Actions to encourage smarter travel

- Aligning Spatial Planning with Transport

Enhance existing legislative provisions to deliver deeper integration of spatial and transport planning. Government investment in new public facilities will be linked, as far as is practicable, to

the need to give priority to walking, cycling and public transport as the primary means of accessing these facilities.

Better integration of land use planning and transport policies in the relevant planning guidelines as part of their ongoing review. The document indicates that future policy guidelines will include require significant housing developments in cities and towns to have good public transport connections and safe routes for walking and cycling so that these connections and local amenities can be accessed. Other requirements are for development of land in urban rail networks to be high density and appropriate for public transport and the requirements that developments above a certain scale have viable travel plans in place. It should be noted that there is no definition of 'good' public transport connections in the document or indeed what is meant by 'significant' housing developments or how a 'certain scale' is defined.

Promotion of Land Use and Transportation Strategies (LUTS) to support better co-ordination and integration of development planning between local authorities across Gateways and Hubs .

Local authorities will be required to prepare plans to retrofit areas with the aim of establishing sustainable neighbourhoods so that walking and cycling are the best options for local trips e.g. to shops and schools.

- Aligning Employment Policy with Transport Planning

All organisations in the public sector will have to set targets for e-working where appropriate.

Government will carry out research to determine if e-working centres can be established so that people in rural areas and in satellite towns can work in locations closer to home.

- Mobility Management

As part of the Green Schools Travel Programme every school and college will have to develop a school travel plan to encourage students to take alternatives to the car. As part of this programme local authorities will have to provide safe walking and cycling routes to and from school and other educational institutions.

The Government has supported a pilot scheme for the development of Workplace Travel Plans and will work towards a requirement for organisations with over 100 employees to develop and implement a workplace travel plan.

- Personalised Travel Plan to encourage alternatives to the car.

A levy in the region of €200 has been placed on employee parking in key urban areas to dissuade the use of the private car for commuting purposes.

- Movement of Goods

95% of freight is moved by road and over 30% of greenhouse gases originate from the freight sector. The emphasis here therefore is on how to reduce emissions e.g. using more fuel-efficient vehicles. The realistic role of rail freight is also being considered. Logistics are also being considered to ensure more efficient transfer of goods.

- Fiscal Measures

This involves the introduction of fiscal measures as disincentives to using the car.

2.4 Chapter 5 – Actions to deliver alternative ways of travelling

- Public Transport

Redesign of bus services including bus networks and implementation of bus priority and traffic management measures.

Implement real time passenger information on bus services in Dublin then role out to other cities and rural areas.

Integrated ticketing to be made more widely available.

Increase Public Service Obligation (PSO) services over and above those provided by Dublin Bus and Bus Éireann

Development of an Intelligent Transport Systems and Services Action Plan as basis to improve efficiency and effectiveness of bus fleet management and service punctuality.

Urban bus service in significant urban areas will have:

- A bus route within 800m of a house
- A schedule which commences at 6am and finishes at 1am, 7 days/week depending on demand
- A frequency of at least 10 minutes at peak hours and 20 minutes at non-peak hours
- A pre-pay cashless transaction, to minimise delays at stops
- A defined level of comfort and cleanliness on vehicles

For other areas the Government will:

- Offer a 7day/week transport service for those in rural communities and smaller urban areas.
- Review criteria for provision of school transport.
- Provide Park and Ride facilities near to urban centres.
- Expansion of the Rural Transport Programme
- Examine the expansion of school and other publicly funded buses to provide other local transport services.
- Cycling and Walking

Government will publish and implement a National Cycle Policy Framework.

Government will publish National Walking Policy.

Release of state-owned land, where possible, for cycling and walking routes.

- Car Clubs and Car Sharing

Establish car-sharing website (work with NI to make this applicable to the whole island).

Support public and private car club schemes and legislate to make car club on-road parking available

- Other Motorised Transport

Consider giving traffic priority to mopeds and segways.

- Integration measures

Greater use of smart card ticketing for public transport services e.g. Irish Rail to introduce smart cards latter half of 2009.

Integrated ticketing will roll out so that it is national in scope. Possible development of an all-island travel ticket to complement work of Tourism Ireland.

Park and ride expanded to include taxis and bikes.

Creation of a National Travel Information Portal offering an on-line integrated journey planner.

- Successor to Transport 21 Programme

This will be developed and will address issues such as environmental and social impacts in the cost benefit analysis.

2.5 Chapter 6 – Actions to improve the efficiency of motorised transport

- Aviation

Work within Europe to promote efficiency of air travel.

Public Service Obligation (PSO) for regional air services due for renewal in 2011 and will be considered in the context of expanding bus and rail services so that the most sustainable modes of transport are given priority support.

- Maritime

Work at international level to reduce emissions from shipping.

Review of the 2005 Ports Policy Statement to ensure that the efficiency in the movement of goods is maximised.

- Roads

Enforcement of speed limits.

Improve information for road users, prioritise road space for public transport, reduce fuel consumption and emissions etc

Deployment of 'Incident Management Technologies' on key road arteries to ensure better movement of traffic.

- Renewable Energy in Transport and Fuel Economy

Commitment that 10% of energy used in transport is sourced from renewable resources.

Incentives to encourage switch to electric vehicles with the aim of receiving market penetration by 2020.

Promote the use of alternative technologies in public sector fleets. Every public sector organisation and public transport provider will have to prepare a plan for the replacement of their fleet with the most sustainable vehicle and fuel type.

Motor tax scheme revised to encourage purchase of cars with lower CO2 emissions.

Sustainable Energy Ireland (SEI) – a research facility – has had its remit extended to include sustainable energy and energy efficient technologies in the transport sector.

- Driver Behaviour

National driving test will include a module on efficient driving which could reduce emissions by 10%.

2.6 Chapter 7 – Actions to ensure efficient delivery of the plan

- Overarching Legislation

A Sustainable Travel and Transport Bill will be introduced.

- Co-ordination at Government level

The inter-departmental working group that assisted in the development of this policy will be retained to advise on progress of it implementation and on alternatives approaches if targets are not being met.

National Sustainable Travel Office will be established to oversee the delivery of many of the initiatives in the policy.

- Other arrangements at National level

The role of the Dublin Transportation Authority will include a range of responsibilities and functions from other transport organisations including the department of transport. This will encompass functions relating to a National Transport Regulator.

- Delivery at Regional and local level

Local Authorities will be empowered to prepare transport plans to complement their development plans. These will include establishing sustainable transport plans for their area and incorporating targets for shifts to sustainable transport modes in the next statutory review of the Regional Planning Guidelines. The Minister of Transport will also be given powers in relation to these plans.

- All-Island arrangements

Work with NI to develop sustainable transport initiatives in both jurisdictions.

- Demonstration Sustainable Travel Towns and Areas

Government will establish and support a national competition to deliver outstanding examples of sustainable travel towns and rural areas. A national partnership between government departments would support this initiative. Funding will be routed through local authorities which will co-ordinate proposals.

- Other related action

Embed best practice in the principles of sustainable travel in all relevant local authorities and state agencies.

Engage with third level institutions to ensure sustainable travel is a core component in relevant course leading to qualifications in areas such as civil engineering, regional and urban planning and public administration.

Department of Transport to develop branding to support concept of smarter travel.

Fund established to support innovative travel projects.

National Travel, Transport and Mobility Household Survey will be established to support the goals and targets of this policy

- Progress over the short, medium and long term

Biennial report required from the inter-departmental working group on the progress towards implementing the report with the first to be submitted to Government in 2010.

Appendix 2

Climate Change and Water Framework Directive Workshop

The workshop offered a chance for climate change scientists and river basin planners to interact and consider the impacts of climate change on the delivery of Water Framework Directive and River Basin Plans.

The objectives of the workshop were:

- To identify what is needed for achievement in the first River Basin Plans (end 2009) in relation to climate change adaptation
- To identify actions needed to adapt to our changing climate for the 2nd river basin plan (end of 2015)
- To provide an opportunity for climate change and WFD scientists to get together to discuss the issues and identify any actions.

In general the workshop focused on how to deal with the possible pressures on the water environment, created by the effects of climate change and the actions that will be required to deal with such impacts. The three areas of interest were:

1. biodiversity and non native species and protected areas

2. abstraction and flow regulation and morphology

3. diffuse & point source pollution.

Some of the key recommendations made by the 3 workshop groups (made up of a mixture of NI and ROI Waste Framework Directive and Climate Change staff), are as follows:

- During the River Basin Planning (RBP) Cycle 1, data will need to be collected and collated to ensure that the knowledge base is available for implementing climate change scenarios in RBP Cycle 2.
- Existing water quality and hydrological models will need to be re-visited and verified to ensure they are fit for purpose for re- running with data from the new probabilistic climate change scenarios.
- Abstraction licensing regimes should incorporate mechanisms to take the likely effects of climate change (higher winter flows and lower summer flows) into account. In NI the planned review of licenses in 2009 should take into account the new climate change scenarios. In ROI, the forthcoming licensing regime needs to include mechanisms to deal with climate change
- New policies and measures should be designed to include metering, water efficiency etc to ensure more sustainable use of water to manage water demand. A suggestion was to start with pilot studies to show the effectiveness of these measures to get buy in from the public.
- An holistic catchment approach will be required to ensure that agriculture and land use planning, flooding and the Water Framework Directive (WFD) all take an integrated approach in dealing with impacts of climate change. This may require the establishment of a high level policy group to take joint ownership of issues and to ensure joined up working between policy makers in each department. There may be a role for the Scotland and Northern Ireland Forum for Environmental Research (SNIFFER) in facilitating initial conversations in this area.
- Forthcoming regulations and guidance documents need to be climate proofed. This will include abstraction, consenting and land use policy and guidance.

[1]Information taken from Ireland, National Climate Change Strategy 2007-2012. Department of Environment, Heritage and Local Government.

Research Paper: Likely Impacts of Climate Change in NI

The purpose of this note, prepared for the Committee for the Environment, is to identify the likely impacts of climate change in NI on key groups and sectors.

The Government's UK Climate Impacts Programme[1], in its latest report, states that trends related to temperature are statistically significant, but very few other trends outlined are equally reliable, because of high natural variability and short observational datasets. This does not, however, necessarily contradict expectations from model projections of climate change.

Studies show that unambiguous trends at UK level are unlikely to emerge in some variables for several decades to come. This could mean that the impacts identified by the SNIFFER project in

2007[2], apart from those related to temperature, are likely to be indicative only, rather than sufficiently reliable to predict exact outcomes for NI over the next 10, 20 or 50 years.

SNIFFER identified the following impacts, as threats to or opportunities for NI, from climate change:

Cross-Sector Impacts

- Increasing flood risk, with implications for the built environment and economic infrastructure.
- Significant reduction in summer rainfall, with implications for the natural environment.
- Warmer summers with more extreme hot days, both positive and negative with implications for different geographical settings.
- Impacts on biodiversity, with implications for fisheries, tourism and recreation.

Conservation, Biodiversity and Habitats

Threats:

- Warmer winters change distribution and composition of habitats.
- Warmer temperatures increase invasive non-native species and threaten ecosystems.
- Flooding and erosion threaten inter-tidal habitats, salt marshes and mudflats.
- Loss of coastal grazing marsh.
- Tidal flooding threatens estuarine and river ecology.
- Warmer seas affect phytoplankton, and, so, sand eels and seabirds.

Opportunities (such as the expansion of a species or wetter winters for some habitats) tend to be accompanied by equivalent threats (such as the loss of another species and drier summers respectively).

Fisheries

Threats:

- Flooding threatens fish egg survival and juvenile salmon.
- Lower flows and water quality, and increased temperatures, kill fish.
- Melting polar ice cools the Atlantic and threatens salmon habitats.
- Disturbed fish breeding seasons affects angling.

Opportunity of warmer waters benefiting aquaculture through higher growth rates and new species.

Note that, in 2007[3]:

- Total recorded landings of fish into NI were 17008 tonnes, with an estimated value of £19m (8216 tonnes wet fish worth £4.8m and 8792 tonnes shell fish worth £14.2m).

- 1489 people were employed in the NI fishing industry (catching, processing, marketing and others).

Agriculture

Threats:

- Wetter weather threatens field drainage.
- Crop yields and animal health.

Opportunities:

- Potential for new crops.
- Less cold weather problems including frost damage and the need to house animals indoors.

Note that agriculture accounted for 24% of NI total greenhouse gas emissions in 2005[4]. In 2007[5]:

- The total agricultural labour force was 48974 people.
- Agriculture contributed 1.3% of NI GVA, against 0.7% of UK GVA.
- Farms were categorised as: very small (76% in NI, 78% in UK); small (13% in NI, 10% in UK; medium (5% in NI and UK); or large/very large (5% in NI, 8% in UK).

Forestry

Threats:

- Hotter drier summers increase water uptake by woodlands and restrict planting in limited water areas.
- Increased risk of forest fires.
- Changing risk of insect pest and disease outbreaks.
- Extended summer droughts bring widespread tree mortality.

Opportunities:

- Higher potential productivity.
- Altered site suitability of tree species.
- Increased commercial planting.

Note that, in 2007, 8.5% of the total farmed area in NI was in forestry, against 16.2% in the UK[6].

Water

Threats:

- Lower flows.
- Increased temperatures affect water quality.
- Storms may cause sewer overflows.
- Increased rainfall causes soil erosion and leaching.
- Reduction in sewer base flow levels may result in blockages.
- Drier, hotter summers increases demand for water.
- Lower summer run-off leads to reduced flushing of estuaries and lakes.
- Higher evaporation and lower inflows leads to reduction in open-water storage.
- Increased pests and changed life-cycles of aquatic and land-based organisms.
- Summer storms after dry periods lead to high pollutant levels.

Opportunities:

- Wet winters provide opportunity for increased water storage.
- Business benefits from increased demand for water-efficient products.

Note that, in 2006[7]:

- NIW provided 619m litres of drinking water to c795k households and businesses through more than 26500 km of water mains.
- Compliance with mean zonal NI drinking water standards rose from 98.65% in 2004 to 99.34% in 2006.
- NIW collected 133 million cubic meters of wastewater through c14.5k of sewers from 660k businesses and households connected to the sewerage system.
- Compliance with NI Water Order Consents rose from 63% of people served by compliant works in 2004 to 77% in 2006.

Coastal and Flood Risk Management

Threats:

- Increase in flooding.
- Increase in winter fluvial flooding.
- Increase in coastal flooding and erosion.

No opportunity was identified.

Note that the Rivers Agency estimates that[8]:

- In an event with a 100 to 1 chance of occurrence in any year, some 60k properties are at risk from flooding, c14k of which are in Greater Belfast.
- While coastal erosion is perceived to be a minor issue, climate change is likely to make this more significant.

Buildings, Construction and Planning

Threats:

- Increase in winter flooding.
- Increase in summer temperatures and drought.
- Rising sea levels.

No opportunity was identified.

Note that residential buildings accounted for 14% of NI total greenhouse gas emissions in 2005[9].

Business

Threats:

- Wetter winters damage stock and premises, supply chains, reputations and credibility.
- Exposure of outdoor workers to hotter summer temperatures.
- Changed demand for seasonal goods and services.

Opportunities:

- Boosted sales of summer goods.
- Business growth in outdoor activities and al fresco retail.
- Increased demand for cooling products.

Note that, in 2007[10]:

- Relative to the UK, NI had a larger share of employees in the public sector, construction, manufacturing and agriculture.
- NI was still more of a small firm economy than the UK, with only 19% of employment in NI by large firms (250+ employees) compared to 41% in the UK.

Insurance

Threats:

- Wetter winters and rising sea levels mean increased inland and potentially coastal flooding.
- Hotter, drier summers mean increased subsidence.

Opportunity of possible reduction in certain claims.

Transport

Threats:

- Wetter winters and inland flooding.

- Drier summers with drier soils and vegetation.
- Hotter summers with more extreme temperatures.

Opportunity of increased demand for walking and cycling.

Note that transport accounted for 25% of NI total greenhouse gas emissions in 2005[11].

Tourism

Threats:

- Wetter winters affect outdoor tourism.
- Coastal changes cause flooding and degrade beaches.
- Dry summers cause water shortages and affect the natural environment.

Opportunities:

- Drier, hotter summers increase demand for domestic tourism.
- Warmer winters allow year-round tourism.
- Hotter weather allows more outdoor and water-based activities.

Note that, in 2003[12]:

- Total income generated by tourism was worth £783m (3.5% of NI GVA).
- External visitors' contribution to the NI economy was the lowest in the UK or RoI.
- More than 36k jobs were supported by resident and non-resident tourism

Energy

Threats:

- Heightened risk of subsidence and heave leave structures vulnerable to damage or collapse.
- Greater demand for air conditioning.

Opportunity of reduction in winter heating demands and fuel poverty.

Note that energy supply accounted for 14% of NI total greenhouse gas emissions in 2005[13].

Health

Threats:

- Flooding impacts on physical and mental health.
- Hotter summers and 'heatwaves'.
- Hotter summers and milder winters mean increased bacterial growth and pest activity.

- Longer summers increase exposure to UV-rays.

Opportunities:

- Reduction in cold-weather mortality and morbidity.
- Improved public health from more physical recreation potential.

Sport and Recreation

Threats:

- Wetter winters and storms mean adverse conditions for outdoor sport and recreation.
- Dry weather affects local habitats and species vital for nature-based recreation.
- Damage to sports facilities through flooding and drought.

Opportunities:

- Drier, hotter summers allow more outdoor sport and recreation.
- More water-based recreation and sports.
- Warmer winter weather allows more year-round outdoor sport and recreation.

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Northern Ireland Green New Deal Group

The Green New Deal for Northern Ireland is a joined up approach to the 'triple crunch' of recession, rising energy prices and climate changei.

The proposal is a simple one: investing in an ambitious programme to cut consumption of fossil fuels can create thousands of new jobs; help secure our energy supply; and build a competitive low-carbon economy.

Around 10% of Northern Ireland's income is spent on importing fossil fuels on which we are 99% dependent for our energy. Facing a future of rising energy prices we risk serious economic and social failure unless we act swiftly to reduce that dependence.

The Green New Deal vision is to:

- Refurbish tens of thousands of existing homes each year with full insulation and renewable energy, including the 137,000 homes that fail to meet the Decent Homes Standard and thus making significant inroads into fuel poverty.
- Transform the energy performance of public and commercial buildings through energy efficiency measures and making 'every building a power station'.
- 'Decarbonise', regionalise and localise the supplies of both electricity and heat through large-scale renewables, micro-generation and using fossil fuels more efficiently.
- Employ a 'carbon army' of high- and lower-skilled workers to implement this vast systematic reconstruction programme creating around 24,000 new jobs.
- Transform our transport system to be fit for purpose in the coming era of high oil and carbon prices by providing a real public transport choice for everyone.
- Create thousands of 'green collar' jobs in the £3,000 billion world market for Low Carbon Environmental Goods and Services.
- Develop a wide-ranging package of financial innovations and incentives to assemble and leverage the very large sums needed to implement such a programme, based on collaboration and partnership between the public sector, the private sector, other stakeholders and the public.

The Green New Deal Group is a cross-sectoral initiative led by CBI, ICTU, NICVA, UFU and Friends of the Earth. A full list of members and advisors is at the end of this document.

Introduction

In common with the rest of the world Northern Ireland is in the grip of a serious recession. Job losses are mounting and many businesses are suffering. There is a squeeze on the public finances as revenue falls and the outcome of the Government's fiscal stimulus and quantitative easing is unknown. At first sight it may appear that the Northern Ireland Executive is constrained

in what it can do to arrest rising unemployment, much less restore employment to previous levels. Yet while macro-economic policy is reserved to Westminster, key policy levers—industrial and energy policy, education and training, the environment and social policy—are in devolved hands.

If unemployment is the most immediate threat that Northern Ireland faces, it is not the only one. Last year the price of oil rose to nearly $150 a barrel. At the time of writing it was $70 but the consensus in the energy industry is that the future is one of volatile and inexorably rising prices as we emerge from recession and global oil production reaches its historical peak. 99% of Northern Ireland's energy comes from imported fossil fuels, leaving us highly vulnerable to the price and politics of oil with serious implications for security of supply

A third threat comes from climate change and our need to cut emissions in line with global agreements while building a low carbon economy in order to remain internationally competitive. The price of carbon is currently low but will inevitably rise as policy bites: a significant challenge for a region with particularly high carbon emissions.

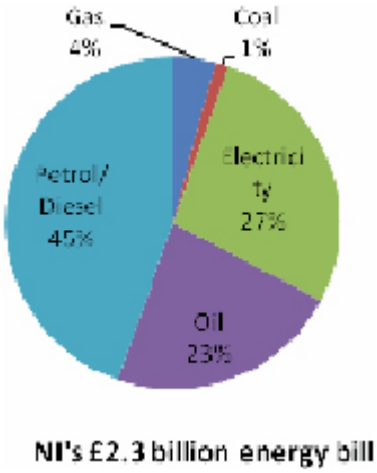
But from threats come opportunities. The Green New Deal Group proposes a transformational policy programme aimed at tackling growing unemployment and declining demand inspired by Franklin D Roosevelt's New Deal of the 1930s. This programme involves policies and novel funding mechanisms to substantially reduce the use of fossil fuels. This in turn will help us tackle climate change and cope with rising and volatile energy prices caused by peak oil.ii

Approaches similar to this are being taken by many Governments around the world: from South Korea and China to Australia and the USA. Centred on moving power and transport infrastructures away from their dependence on fossil fuels, it has become known as the Green New Dealiii.

The proposals in this paper show that by focussing on reducing Northern Ireland's vast imported energy bill we can create in the region of 24,000 (see appendix A) high and low skilled jobs in the short term; substantially reduce our dependence on imported energy; make significant inroads into tackling fuel poverty; comply with international agreements to cut CO2 emissions; and lay the foundations of an internationally competitive low-carbon economy, thus securing employment and business success for the long term.

Northern Ireland's Fuel Bill

Northern Ireland energy users in the domestic, commercial, industrial, transport and public sectors spend a total of £2.3 billioniv a year on energy, 99% of which is derived from imported fossil fuels. This constitutes between 9% and 11% of GVA5 and represents a very significant leakage from the Northern Ireland economy.



NI's £2.3 billion energy bill

vi

As primary energy and carbon prices rise these figures can only get worse. Economic modelling shows that a sustained oil price of $150 per barrel would reduce energy demand but the proportion of GVA spent on imported fossil fuels would increase to between 11% and 14%vii. We would be paying significantly more money for a great deal less energy.

An oil price of $250 per barrel is regarded by some experts as entirely plausible but is beyond the range of most economic models. It is clear however, that the trend would be an ever higher proportion of GVA being spent on ever decreasing amounts of energy.

Carbon prices are currently very low but there is a growing international commitment to cutting emissions through increasing the cost of carbon. It has been estimated that in order not to exceed the 450ppm CO2 threshold that the price of carbon will need to rise to $100 a tonne by 2010.viii Climate science is telling us that global temperature rises above 2 degrees C are now inevitable. The expected costs of climate change are rising fast, and so should our willingness to spend money so as to mitigate global warming and avoid those costs.

These scenarios are clearly economically worrying but also socially disastrous, pushing many more households into fuel poverty unless their dependence on fossil fuel is reduced.

The challenge is to construct a glide path to an attainable lower level of consumption quantifying the value of the saving in fossil fuel expenditure and carbon together with the cost of the measures required. Short, medium and long term targets should be identified and achieved through a series of five-year programmes based on a range of oil and carbon price scenarios.

Such an approach can progressively eliminate the extraordinary amounts of waste in the system: wasted energy; wasted money; and wasted human potential.

Housing

There are some 705,000 dwellings in Northern Ireland. Despite improvements over the past decade, over 90% of houses still fall some way short of the best energy performance standards. Domestic space and water heating is responsible for over 40% of energy consumed in Northern Ireland along with associated emissions.

We envisage a systematic programme to retrofit the entire housing stock[1] to the best energy performance standards over as quick a period as is feasible and ultimately reducing energy use in homes by 80%ix.

This is a huge challenge but it is important to focus on what can be done immediately. The Green New Deal Group proposes an initial £230 million per annum programme, including £75 million assembled from government and other sources, creating 10,000 to 15,000 direct and indirect jobs. Around 1.3 million measures are foreseen over 10 years cutting out (during the measures' lifetime) around £3 billion in wasted fuel costs, and saving over 6 million tonnes of carbon. The measures range from basic insulation and double glazing to solid wall insulation, solar water heating and fuel switching. (see separate 'Housing Package' paper).

If the 137,000 houses that fail to meet the Decent Homes standard were targeted at an early stage, progress on tackling fuel poverty could be significantly accelerated.

A Community: Following a popular anti-nuclear protest in the early 70s the city of Freiburg found itself with an energy problem. The solution was found in renewables, energy efficiency and innovative design. Working closely with residents, the University and business the city has transformed itself into a model of sustainability. A typical house uses about 30% less energy than the national average while innovative passive homes manage to reduce energy costs by 90%. Over 12,000m2 of solar panels have been installed along with 500km of cycle lanes and an extensive tram network. The renewables and environmental services sector employs around 10,000 people, about 25% higher than the German average.

Public and commercial buildings[2]

Northern Ireland's public sector organisations (including local authorities, healthcare trusts and universities) account for over 5% of NI's total energy use and around 700,000 tonnes of carbon dioxide annually. Total annual expenditure on energy from imported fossil fuels is around £130 million.x

With an EU Directive requiring that the public sector leads by example in improving energy efficiency, we estimate that 20% of its energy use could be saved by an investment of £120-180 million on basic measures with a payback of 4-6 years giving recurring cost savings of £30 million per annum.xi

Beyond this, there is considerable scope for self generated renewable energy. Early findings from a study by the Sustainable Development Commission suggest that wind, photovoltaics and biomass are the most appropriate technologies.xii

Buildings in the commercial sector account for a similar scale of energy use and potential for energy efficiency and renewable technologiesxii

A Country: Concentrating on energy efficiency and technological solutions to energy security Japanese industry has managed to keep its overall energy consumption unchanged since the early 1970s despite increases in output. Japanese companies are leading the field in technologies such as PV, fuel cells and hybrid cars. Well known names like Sharp, Kyocera, Mitsubishi and Sanyo, produce about half the world's photovoltaic solar panels, a market worth $10 billion a year. Renewables and energy saving devices are common place in Japanese homes. Japan has a well developed public transport system with the highest per capita rail patronage, with 8.8b passengers per annum, and nearly 24,000km of track.

Scaling up Renewable Energy Supply

Just 6% of our electricity supply and 1% of our total energy comes from indigenous renewable sources. By 2020 at least 15% of total UK energy must be renewable in order to meet EU targets; this implies that for Northern Ireland we will need to generate up to the grid limit for wind of 42%.xiv

Renewable heat is underdeveloped here but the economic conditions are good and we already have both agricultural expertise and a supply of marginal agricultural land as the raw materials to enable delivery. There is no obvious reason why we should not meet or exceed 14% of our heat needs from this source by 2020 in line with the rest of the UK.xv A Renewable Heat Incentive together with a proper legal and regulatory framework would help expand this market

Very considerable investment is therefore needed in renewable energy at a time when the industry is suffering from difficulties with access to capital; falling oil prices; and the collapse of the price of carbon. A credible and ambitious target of 40% of electricity from indigenous renewable sources by 2020 would be an important signal for private sector investment.

Overcoming these difficulties could deliver an 11% reduction in CO2 emissions and the creation of between 8,000 and 33,000 jobs depending on how successful we are at capturing the supply chain opportunities in the global market.xvi

Vital to achieving these outcomes are a fully supportive planning system and an electricity grid designed to allow contributions from distributed generation.

Sustainable mobility

Transport is responsible for at least 45% of expenditure on imported fossil fuels, equivalent to at least 4% of GVA, and for 28% of total energy use. Transport emissions are rising faster than any other sector and the sector is perilously dependent on imported petroleum products.

Real challenges lie ahead in ensuring that our transport system is a sustainable one and central to this will be the availability of a real public transport choice for most people.

Increasing fuel costs are likely to be a key driver for achieving a modal shift towards low carbon options. The challenge is to avoid the pain of such price rises by planning for that shift to take place in advanc.

A Company: In 2007 Marks and Spencer launched the Plan A initiative. The plan covers “100 commitments over 5 years to address the key social and environmental challenges facing M&S today and in the future". The aims of Plan A are that by 2012 the company will: be carbon neutral; send no waste to landfill; extend sustainable sourcing; help improve the lives of people in its supply chain; and help customers and employees live a healthier lifestyle. The company has stuck to Plan A despite the recent downturn in profits. M&S purchases about 2.6TWh of renewable energy, enough for all its shops and offices in England and Wales.

Sustainable industries

A recent report from the Department of Business, Enterprise and Regulatory Reformxvii estimated the global market value of Low Carbon Environmental Goods and Services to be over £3,000 billion with the UK sector worth £106 billion. This is somewhere between the healthcare and construction sectors in size.

In Northern Ireland the BERR report estimated the market value of the sector at £3.3 billion with 1,620 companies employing 30,600 people.

This sector of the economy is expected to grow by an average of 5% per annum despite the recession with much of the growth generated by renewable energy activities. Thus policies and investment to scale up renewable energy supply (see above) will help underpin the development of businesses able to take advantage of new opportunities in the low carbon technology market.

Employment and skills

Retrofitting the entire building stock with energy efficiency measures; scaling up renewable electricity to 40% of the total; and installing renewable heat networks will require a 'carbon army' of high and lower skilled workers.

The Sustainable Development Commission estimates that 800,000 new jobs could be created and sustained in the UK by a green stimulus package of £30 billion a year. In Northern Ireland terms this could mean 24,000 jobs (albeit we recognise there will be a modest reduction in jobs in traditional coal and oil distribution businesses). See appendix A for further detail.

The recession is biting hard and there is an urgent need to implement the measures described in this paper with a minimum of delay. That means moving swiftly to ensure that the necessary upskilling and reskilling takes place and this in turn means close collaboration between the relevant public bodies and the private sector together with the necessary investment. A clear signal from Government that it shares the kind of vision set out in this paper would help both students and colleges to make important decisions about the future.

Sources of funding

The total cost of a full green recovery package for Northern Ireland is likely to be in the region of £900 million per annum or 3% of GVA[xviii]. This is clearly a very large amount of money that is not obviously available from within the Northern Ireland block. Nevertheless, given the economic, social and environmental benefits that will flow from such spending, a significant contribution from public funds is warranted, and will have the ability to leverage significant additional investment.

Funding from within currently planned public expenditure could include:

- The Barnett consequential of the recent UK economic stimulus package;
- Maximising the potential of the Investment Strategy for Northern Ireland for new energy investments and associated training;
- Reallocating expenditure saved by tackling the inefficiencies arising from sectarian segregation and associated service duplication;
- Focusing existing economic support programmes on the Green New Deal.
- Much of the required investment is capable of showing an economic return at today's prices and will therefore be attractive to the private sector but a clear policy and financial framework is needed to enable those investments to be accelerated. It is likely that the most effective means of securing this investment will be innovative mechanisms that combine public and private sources of funding. Possibilities include:
- Bond finance: capital is raised through the bond markets for investment in energy saving measures and a revenue stream is created through a 'pay as you save' scheme whereby the cost of the measures is recovered through energy bills.

- A surcharge on the regional rate serving as a revenue stream for a bond issue via a non-government body – such a cast iron revenue stream would secure the lowest interest rates.
- A more substantial restructuring of the rating system to incentivise investment in low carbon technologies and energy efficiency, while penalising those properties that continue to waste energy.
- Housing equity unlock: a charge on a property serves as security for the capital investment in energy saving measures and is paid for through a 'pay as you save' scheme.
- European Investment Bank loans made available through the local banks; a mutualised body; and/or other agencies.
- Salix Finance: the use of an enhanced Carbon Trust Salix fund to finance investment in the public sector.

Local authority bonds: local councils could issue bonds securitised against the rates base to carry out energy efficiency measures on their own buildings

Northern Ireland Green Energy Bond issued by government if Treasury rules were relaxed, or by local banks or a mutual institution to attract savings from individuals and pension funds

While one of the ways out of recession is to persuade people to spend more, not surprisingly people's instinct is to save rather than spend. Worse, they are saving in a banking system that is reluctant to lend thus locking up a valuable resource. But the economy needs investment at least as much as consumption so the trick is to make 'savers into saviours' and offer trustworthy savings opportunities that will invest people's savings in the Green New Deal, offering them a better return than current very low interest rates and an opportunity to invest in their own community.

Conclusion

Northern Ireland needs a 'big idea' to cope with recession and to plan for a sustainable future. The Green New Deal is that big idea.

Our unusually high dependence on imported fossil fuels makes this particularly compelling as does our relatively high levels of carbon dioxide emissions.

It builds on our traditional strengths in manufacturing, construction and agriculture and offers the prospect of a sustainable future for those industries, as well as providing Northern Ireland with a distinctive competitive advantage as it achieves low carbon status.

It is also a project on which it should be easy to achieve political consensus and popular support, building a sense of common purpose in dealing with some of the biggest challenges facing Northern Ireland.

The Green New Deal Group will produce a series of papers setting out a package of measures for housing; public buildings; commercial buildings; renewable energy; sustainable industries; employment and skills; and finance mechanisms.

A series of working groups have been formed to take this work forward.

The role of Government in achieving the benefits of the Green New Deal is clearly critical: offering strong leadership; providing funding which can leverage substantial investment; developing the necessary policy framework; and working in partnership with a range of stakeholders.

The prize is a considerable one: a way out of recession; significant job opportunities; escape from almost total dependence on imported fossil fuels; significant reductions in fuel poverty; cuts in our carbon emissions in line with international obligations; and the foundations of a competitive low carbon economy of the future.

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10 June 2009

Members of the Green New Deal Group

Bryson Charitable Group
Chamber of Commerce
CBI
Energy Savings Trust
Friends of the Earth
Institute of Directors
ICTU
NICVA
NI Environment Link
NI Federation of Housing Associations
NI Manufacturing
Sustainable Development Commission
Translink
Ulster Farmers Union

With advice and help provided by the following

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Appendix A: Estimated jobs impact of stimulus spending

The table below is reproduced from the Sustainable Development Commission's A Sustainable New Deal. It shows the job creation possibilities from a UK green stimulus package based on a number of international studies. The commission concludes "Although there are some outliers, there is a reasonable consensus from these estimates that a [UK] stimulus package of up to £30 billion a year could create at least 800,000 jobs."

The final column has been added to the table and shows what this would mean for Northern Ireland on a pro rata basis.

Programme	Jobs created or saved	Investment billion £	Investment cost per job £k/job	Job creation potential from £30b	NI Job creation potential £900m
Renewables and energy efficiency (PERI/CAP study)	2,000,000	69.0	34	870,000	26,000
Renewables, grid, energy efficiency, public transport (ARRA)	2,500,000	77.4	31	968,000	29,000
Energy efficiency (Apollo Institute, US)	21,500	1.0	32	935,000	28,000
Renewables, energy efficiency, public transport, water and waste (South Korea)	950,000	21.4	23	1,333,000	40,000
Renewables, energy efficiency, public transport, ecosystems (UNEP)	30,000	0.7	23	1,305,000	40,000
Infrastructure fund to build low carbon homes (EIC)	160,000	6.0	38	800,000	24,000
Retrofit energy efficiency in low income homes (EIC)	145,000	1.5	10	2,900,000	88,000
Retrofit energy efficiency in schools and hospitals (EIC)	21,500	1.0	47	645,000	20,000

Endnotes

i A Green New Deal, New Economics Forum, London, July 2008

ii The International Energy Agency's 2008 World Energy Outlook has acknowledged that conventional oil production will 'level off' by 2030, and the recently established UK Industry Task Force on Peak Oil's first report, The Oil Crunch, http://peakoiltaskforce.net/ also acknowledges peak oil as a major economic and political concern in terms of energy security for the UK.

iii See for example, HSBC's Global Research report A Climate for Recovery, Feb. 2009, http://globaldashboard.org/wp-content/uploads/2009/HSBC_Green_New_Deal.pdf; the UNEP's Green Jobs: Towards Sustainable Work in a Low Carbon World, Oct 2008,

http://www.unep.org/publications/search/title_search.asp?search=Green+Jobs&image.x=6&image.y=9

iv From DETI and DBERR data.

v Ibid

vi From data in Northern Ireland Vision Study, Carbon Trust, 2005

vii Modelling by University of Ulster

viii An elaborate proposal for global climate policy architecture: specific formulas and emissions targets for all countries in all decades by Prof Jeffrey Frankel of the Harvard Project on International Climate Agreements.

ix A Sustainable New Deal, Sustainable Development Commission, London, April 2009

x Northern Ireland Vision Study, Carbon Trust, 2005

xi Carbon Trust

xii A Sustainable New Deal, Sustainable Development Commission, London, April 2009

xiii Northern Ireland Vision Study, Carbon Trust, 2005

xiv Northern Ireland Strategic Energy Framework 2009: pre-consultation scoping paper, DETI, November 2008

xv Ibid

xvi Northern Ireland Renewable Energy Supply Chain , Carbon Trust, June 2008

xvii Low Carbon and Environmental Goods and Services: an industry analysis, Innovas Solutions Ltd, commissioned by BERR, March 2009

xviii £900 million is pro-rata to the SDC's recommended £30 billion package for the UK in A Sustainable New Deal, Sustainable Development Commission, London, April 2009

[1] This paper does not address the important issue of energy efficiency and renewables for 'new build' properties. We intend to do so in future work.

[2] As note 1.

Climate Change in Scotland Response 1

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Patsy McGlone
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29 June 2009

Dear Patsy

Thank you for your letter of 4 June requesting information about climate change in Scotland as part of the Northern Ireland Assembly Environment Committee inquiry into climate change. I am pleased to respond on behalf of the Scottish Government. To best reflect the information you have requested, I will address three key points in this letter, namely: the approach in Scotland to adaptation and mitigation; the effectiveness of government structures; and, liaison with the UK Government, and the other devolved administrations.

Approach to adaptation and mitigation

As a small nation of five million people, Scotland is determined to act as a model of best practice in tackling climate change to influence the international community to agree an ambitious new climate change treaty at Copenhagen in December 2009. The Climate Change (Scotland) Bill sets bold targets for emissions reductions, and Scotland's Climate Change Delivery Plan, published on 17 June, sets out the high level measures needed to achieve these reductions by 2020 and beyond.

The Delivery Plan, available at www.scotland.gov.uk/climatechangedeliveryplan, identifies the key sectors for abatement, and four major transformational measures needed to deliver the targets:

- a massive increase in clean, green energy;
- wholesale adoption of electric vehicles powered by green energy;
- major improvements in energy efficiency and reduction in demand for energy; and
- significant increases in forest cover to absorb more carbon.

Delivering the ambitious targets will be key to unlocking Scotland's vast potential in renewable energy.

The world-leading Climate Change (Scotland) Bill was passed unanimously by the Scottish Parliament on 24 June. The Bill includes:

- all internationally recognised greenhouse gases;
- emissions from international aviation and shipping;
- a system of annual targets for cuts in emissions;
- an interim target for 2020 of 42% reductions, with a power to vary the interim target based on expert advice from the UK Committee on Climate Change; and

- a legally binding commitment on all future Scottish governments to deliver at least 80% cuts in emissions by 2050.

Scottish Ministers are committed to delivering the highest achievable emissions reductions based on expert advice. The Scottish Government has also made a commitment to assess the carbon impact of its spending from 2010-11. While the carbon impact of government spending has been measured in some countries, the Scottish Government is potentially leading the world in integrating carbon assessment into key budget decision-making.

Within Government, new, stronger governance will deliver the ambitious targets. Carbon will be treated in the same way as money and there is a new Climate Change Delivery Board at Director level supported by a new Operational Group, organised along sector lines – power, heat, transport, waste, agriculture and land use, and forestry – and covering cross-cutting themes – carbon management, funding, resources, economic growth, planning, adaptation, public sector, national conversation and stakeholder engagement.

The Climate Change (Scotland) Bill also establishes a requirement for Government and public bodies to start preparing for the consequences of the unavoidable changes in Scotland's climate. Records show that Scotland's climate is already changing and, due to the level of greenhouse gases already in the atmosphere, will certainly continue to change for several decades to come. This will have wide reaching consequences for the way we live and work in Scotland. Revised climate projections released by the Met Office on 18 June suggest an increase in heavy rainfall events, an increase in summer temperatures in Scotland by more than 3ºC by the 2080s, and a reduction in snowfall by 60 per cent or more in mountainous areas, stopping completely in other regions. The Scottish Government recently included climate change as a risk on its Strategic Risk Register, as a step towards actively managing the negative impacts of climate change. Because many adaptation decisions are taken at a local level by individual organisations, Government will need to work with all sectors to prepare for this change. To provide strategic direction for this, work is currently ongoing to develop Scotland's Adaptation Framework to build our resilience to the impacts of climate change. The Adaptation Framework is currently going through a consultation period, which closes on 20 July.

Government structures

The Scottish Government has one overarching Purpose – to focus the Government and public services on creating a more successful country, with opportunities for all of Scotland to flourish, through increasing sustainable economic growth. This is supported by five strategic objectives that drive the work of government – to create a Wealthier and Fairer, Greener, Smarter, Safer and Stronger, and Healthier Scotland. These objectives inform the National Performance Framework, where progress on fifteen National Outcomes is measured by forty-five National Indicators. Specific targets in the framework on sustainability call for emissions to be reduced over the period 2005 to 2011, and reduced by 80% by 2050.

When the present administration came to power following the May 2007 elections to the Scottish Parliament, the new Scottish Ministers took steps to reorganise the structure of the Scottish Government. The previous departmental system was replaced by a larger number of smaller, more flexible directorates which work across all five Strategic Objectives. This cross-cutting system reduces the potential for 'silo' approaches, allows greater communication between officials, and enhances the strategic decision-making ability of the organisation.

Further, Scottish Ministers also included climate change at the centre of government in the Finance and Sustainable Growth portfolio (alongside energy and transport) recognising that it is not just an environmental issue: it impacts on all walks of life, and all branches of government.

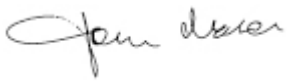
Liaison with UK Government and Devolved Administrations

There are a number of levels of communication between the Scottish Government, UK Government and other Devolved Administrations. As a starting point, you will know that the UK Climate Change Act is based on a partnership approach between the UK Government and Devolved Administrations. There are a number of areas where the Act requires consultation with the Devolved Administrations including setting or amending the overall targets and carbon budgets under the Bill. Prior to the UK Government's carbon budgets announcement on 22 April, for example, Ministers in the Devolved Administrations each wrote to the the UK Government Secretary of State for Energy and Climate Change to give their views on the level of UK carbon budgets between 2008-22 and associated issues.

Of course, liaison does not only happen at those points where there is a statutory requirement for that. Again, taking the UK Climate Change Act as a starting point, the associated Concordat sets out the underlying principles for co-operation in its implementation as well as arrangements to make that work in practice. This is supported by a Framework Document which governs the relationship between the Committee on Climate Change and its sponsor departments and administrations. Officials in the Scottish Government have very positive working relationships with their counterparts in the UK Government and other Devolved Administrations, both on the basis of regular meetings of working groups and more ad-hoc contact. For example, climate change has been one of the issues on the agenda of the British Irish Council environment sectoral group. Climate change ministers from Scotland and Northern Ireland (as well as other member administrations) met in Jersey in April this year.

I hope this is useful to you. The Scottish Government believes climate change to be a serious threat, and the cost of action to address the issue now will be much less than cost of inaction. Scottish Ministers see the shift to a low carbon economy as a major opportunity for Scotland, particularly for economic recovery. I look forward to reading your Committee's report in September.

Yours sincerely



JOHN MASON

Climate Change in Scotland Response 2

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15 June 2009

Transport, Infrastructure and Climate Change Committee

Dear Patsy

Thank you for your letter of 4 June 2009 regarding your inquiry into climate change and your request for information on the activities of the Transport, Infrastructure and Climate Change Committee here in the Scottish Parliament on this matter.

As you are aware, this Committee is the lead committee for consideration of the Scottish Government's Climate Change (Scotland) Bill which will debated at Stage 3 in the Scottish Parliament before the end of June. The Committee reported to the Scottish Parliament at Stage 1 on the Bill and its report covered a number of issues you raise in your letter. The Committee also received amendments to the Bill at Stage 2 on target setting, monitoring and reporting. I attach a link to the Bill page which contains links to all the relevant material during the Committee's consideration of the Bill, including the Committee's Stage 1 report on the general principles of the Bill.

http://www.scottish.parliament.uk/s3/bills/17-ClimateChange/index.htm

The Parliament's information service, SPICe, have produced a briefing paper which summarises the key changes to the Bill following the Stage 2 amendment process. I attach a link for information.

http://www.scottish.parliament.uk/business/research/briefings-09/SB09-43.pdf

You letter asks questions regarding the structures which are in place for the development and delivery of climate change policy. You will note that in its Stage 1 report, Committee stated in paragraphs 228, 229—

"The Committee calls on the Scottish Government to ensure that its statutory 'report on proposals and policies' provides a comprehensive overview of the potential contribution of all sectors in society to achieving emissions reductions. It should provide clear statements of policy intent and the direction for policy development which will lead to the reductions required to meet the challenging targets set by this Bill. It should also outline those initiatives currently underway to tackle climate change, including the Government's public engagement implementation plan.

The Committee also considers it to be essential that the strategy overview document that will inform this process is produced as quickly as possible to allow sufficient time for the content of this significant and potentially detailed report to be developed, prior to its publication in 2010. The Committee requests that the Scottish Government provides a clear timescale for the production of the strategy overview discussion document, and an indication as to its contents, before Stage 2." It is expected that the Scottish Government's climate change strategy document will be published shortly.

Throughout its work on climate change, the Committee has had regular meetings and informal briefing sessions with Officials from the Scottish Government to aid members' understanding of the issues involved in this area.

In addition to consideration of the Climate Change (Scotland) Bill, the Committee's scrutiny of the Scottish Government's Draft Budget 09-10 focussed on the climate change element of its remit. The report encompassed the general impact of the Draft Budget on climate change and the development of the Scottish Government's carbon assessment tool.

In its report, the Committee expressed concern that the Draft Budget did not contain sufficient proposals to contribute to the climate change agenda. It also felt that the Scottish Government's

climate change reduction targets were set too far into the future and its current proposed strategy for reducing annual emissions lacked urgency. The Committee therefore recommended that a system of carbon accountability be established in time for the draft budget 2010-11 and the Spending Review 2010, and that revisions be made to the 2009-10 budget to facilitate this.

The Committee considered that future budgets, and the next Spending Review, should reflect updated legislation on emissions targets. The Committee suggested that the next budget refocus its priorities on policies specifically designed to reduce greenhouse gas emissions and to contribute to addressing climate change, advising that subsequent budgets be presented with the fullest possible details of how expenditure across all portfolios will contribute to the reduction of emissions.

It is expected that the Committee will return to this issue following summer recess when it scrutinises the Scottish government's Draft Budget 2010-11 and looks at developments in this area.

I hope that this information is helpful and if you have any further questions once you have reviewed this material, please do not hesitate to get in touch.

Yours sincerely,

Patrick Harvie MSP
Convener
Transport, Infrastructure and Climate Change Committee

Response from Climate Change and Water Industry and Environmental Quality Directorates in Relation to Climate Change in Scotland

Climate Change and Water Industry and Environmental Quality Directorates
John Mason, Director

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Patsy McGlone
Chairperson
Committee for the Environment
Northern Ireland Assembly
Environment Committee Office
Room 245
Parliament Buildings

Belfast
BT4 3XX

29 June 2009

Dear Patsy

Thank you for your letter of 4 June requesting information about climate change in Scotland as part of the Northern Ireland Assembly Environment Committee inquiry into climate change. I am pleased to respond on behalf of the Scottish Government. To best reflect the information you have requested, I will address three key points in this letter, namely: the approach in Scotland to adaptation and mitigation; the effectiveness of government structures; and, liaison with the UK Government, and the other devolved administrations.

Approach to adaptation and mitigation

As a small nation of five million people, Scotland is determined to act as a model of best practice in tackling climate change to influence the international community to agree an ambitious new climate change treaty at Copenhagen in December 2009. The Climate Change (Scotland) Bill sets bold targets for emissions reductions, and Scotland's Climate Change Delivery Plan, published on 17 June, sets out the high level measures needed to achieve these reductions by 2020 and beyond.

The Delivery Plan, available at www.scotland.gov.uk/climatechangedeliveryplan, identifies the key sectors for abatement, and four major transformational measures needed to deliver the targets:

- a massive increase in clean, green energy;
- wholesale adoption of electric vehicles powered by green energy;
- major improvements in energy efficiency and reduction in demand for energy; and
- significant increases in forest cover to absorb more carbon.

Delivering the ambitious targets will be key to unlocking Scotland's vast potential in renewable energy.

The world-leading Climate Change (Scotland) Bill was passed unanimously by the Scottish Parliament on 24 June. The Bill includes:

- all internationally recognised greenhouse gases;
- emissions from international aviation and shipping;
- a system of annual targets for cuts in emissions;
- an interim target for 2020 of 42% reductions, with a power to vary the interim target based on expert advice from the UK Committee on Climate Change; and
- a legally binding commitment on all future Scottish governments to deliver at least 80% cuts in emissions by 2050.

Scottish Ministers are committed to delivering the highest achievable emissions reductions based on expert advice. The Scottish Government has also made a commitment to assess the carbon impact of its spending from 2010-11. While the carbon impact of government spending has been measured in some countries, the Scottish Government is potentially leading the world in integrating carbon assessment into key budget decision-making.

Within Government, new, stronger governance will deliver the ambitious targets. Carbon will be treated in the same way as money and there is a new Climate Change Delivery Board at Director level supported by a new Operational Group, organised along sector lines – power, heat, transport, waste, agriculture and land use, and forestry – and covering cross-cutting themes –

carbon management, funding, resources, economic growth, planning, adaptation, public sector, national conversation and stakeholder engagement.

The Climate Change (Scotland) Bill also establishes a requirement for Government and public bodies to start preparing for the consequences of the unavoidable changes in Scotland's climate. Records show that Scotland's climate is already changing and, due to the level of greenhouse gases already in the atmosphere, will certainly continue to change for several decades to come. This will have wide reaching consequences for the way we live and work in Scotland. Revised climate projections released by the Met Office on 18 June suggest an increase in heavy rainfall events, an increase in summer temperatures in Scotland by more than 3ºC by the 2080s, and a reduction in snowfall by 60 per cent or more in mountainous areas, stopping completely in other regions. The Scottish Government recently included climate change as a risk on its Strategic Risk Register, as a step towards actively managing the negative impacts of climate change. Because many adaptation decisions are taken at a local level by individual organisations, Government will need to work with all sectors to prepare for this change. To provide strategic direction for this, work is currently ongoing to develop Scotland's Adaptation Framework to build our resilience to the impacts of climate change. The Adaptation Framework is currently going through a consultation period, which closes on 20 July.

Government structures

The Scottish Government has one overarching Purpose – to focus the Government and public services on creating a more successful country, with opportunities for all of Scotland to flourish, through increasing sustainable economic growth. This is supported by five strategic objectives that drive the work of government – to create a Wealthier and Fairer, Greener, Smarter, Safer and Stronger, and Healthier Scotland. These objectives inform the National Performance Framework, where progress on fifteen National Outcomes is measured by forty-five National Indicators. Specific targets in the framework on sustainability call for emissions to be reduced over the period 2005 to 2011, and reduced by 80% by 2050.

When the present administration came to power following the May 2007 elections to the Scottish Parliament, the new Scottish Ministers took steps to reorganise the structure of the Scottish Government. The previous departmental system was replaced by a larger number of smaller, more flexible directorates which work across all five Strategic Objectives. This cross-cutting system reduces the potential for 'silo' approaches, allows greater communication between officials, and enhances the strategic decision-making ability of the organisation.

Further, Scottish Ministers also included climate change at the centre of government in the Finance and Sustainable Growth portfolio (alongside energy and transport) recognising that it is not just an environmental issue: it impacts on all walks of life, and all branches of government.

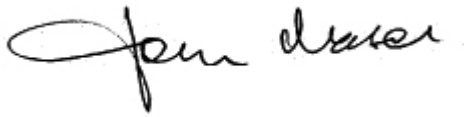
Liaison with UK Government and Devolved Administrations

There are a number of levels of communication between the Scottish Government, UK Government and other Devolved Administrations. As a starting point, you will know that the UK Climate Change Act is based on a partnership approach between the UK Government and Devolved Administrations. There are a number of areas where the Act requires consultation with the Devolved Administrations including setting or amending the overall targets and carbon budgets under the Bill. Prior to the UK Government's carbon budgets announcement on 22 April, for example, Ministers in the Devolved Administrations each wrote to the the UK Government Secretary of State for Energy and Climate Change to give their views on the level of UK carbon budgets between 2008-22 and associated issues.

Of course, liaison does not only happen at those points where there is a statutory requirement for that. Again, taking the UK Climate Change Act as a starting point, the associated Concordat sets out the underlying principles for co-operation in its implementation as well as arrangements to make that work in practice. This is supported by a Framework Document which governs the relationship between the Committee on Climate Change and its sponsor departments and administrations. Officials in the Scottish Government have very positive working relationships with their counterparts in the UK Government and other Devolved Administrations, both on the basis of regular meetings of working groups and more ad-hoc contact. For example, climate change has been one of the issues on the agenda of the British Irish Council environment sectoral group. Climate change ministers from Scotland and Northern Ireland (as well as other member administrations) met in Jersey in April this year.

I hope this is useful to you. The Scottish Government believes climate change to be a serious threat, and the cost of action to address the issue now will be much less than cost of inaction. Scottish Ministers see the shift to a low carbon economy as a major opportunity for Scotland, particularly for economic recovery. I look forward to reading your Committee's report in September.

Yours sincerely



John Mason

3.3.2 Breakdown of UK Emissions Data: England, Scotland, Wales, Northern Ireland and Unallocated

All land-based emissions are allocated directly to the appropriate inventory of the constituent countries: England, Scotland, Wales or Northern Ireland.

Emission estimates from national navigation (i.e. coastal shipping, including local ferries, fishing fleets, local port movements by support vessels) and domestic aviation (flights between UK airports) are allocated to the individual countries also. For coastal shipping, the UK emission estimates are split between England, Scotland, Wales and Northern Ireland according to port movement data from the DfT Maritime Statistics. For domestic aviation, the emissions for each flight are allocated to England, Scotland, Wales or Northern Ireland according to the airport of flight origin.

The emission estimates from international shipping and aviation are excluded from the national total in the UK GHG inventory and also from the DA emissions totals.. These are reported as "memo items" alongside the UK GHG inventory data in the annual submissions to the UNFCCC. In autumn 2008, for the first time an estimate was made of the approximate share of these "memo item" emissions across England, Scotland, Wales and Northern Ireland.

Emissions from the oil and gas exploration & production offshore industry sector are not allocated to the individual country inventories of England, Scotland, Wales and Northern Ireland. Instead, these are reported within a separate "unallocated" category. The emissions from the onshore elements of this industry sector (mainly from gas and oil terminals) are allocated to the appropriate country inventory.

The most recent GHG Inventory report for the Devolved Administrations shows that the UK distribution of net greenhouse gas emissions (i.e. the sum of emissions and removals) in 2006, expressed in terms of global warming potentials (GWP), is:

- England 77.1%
- Scotland 9.1%
- Wales 7.8%
- Northern Ireland 3.4%
- Unallocated 2.6%

Meeting with Joint Committee on Climate Change and Energy Security

Meeting, Tuesday 30 June 2009 with Joint Committee on Climate Change and Energy Security

Attendance:

Joint Committee on Climate Change and Energy Security

Sean Barrett Chair Joint Committee on Climate Change and Energy Security
Mr Michael McKenna Clerk to Joint Committee on Climate Change and Energy Security
Dr Peter Brennan Consultant to Joint Committee on Climate Change and Energy Security
David Taylor Energy Advisor to Joint Committee on Climate Change and Energy Security

Committee for the Environment

Mr Patsy McGlone Chairperson
Mr Cathal Boylan Deputy Chairperson
Alex McGarel Clerk
Sean McCann Assistant Clerk

The Joint Committee on Climate Change and Energy Security was formed in September 2007 consisting of thirteen members of Dáil Éireann, and 4 members of the Senate to consider:

- medium and long term climate change targets and the key measures needed to meet those targets;
- the role of the Agriculture sector in providing bio-fuel and biomass crops and consequential implications;
- the levels of power supply which can be generated from renewables or other new power supplies;
- the projected energy demand from transport and the implications for energy security and emissions targets;
- such other matters as may be referred to it from time to time by both Houses of the Oireachtas

The Joint Committee is due to report by December 2009 and has published 2 reports to date - Scrutiny Report on three proposals relating to the implementation of the EU Climate – Energy legislative package and Drive for Zero, a report on electric vehicles.

A taskforce has been set up to investigate the use of electric vehicles and the Committee feels that the government target should be far more ambitious and that all cars on the island of Ireland past 2020 should be electric vehicles. The Minister has supported the report on electric vehicles and framework conditions are being set in place but more investment is needed.

The Cabinet Sub Committee on Climate Change and Energy Security are driving the discussions on climate change, the Department of the Environment is the lead department, the Minister is responsible for carbon budgets and there is a National Climate Change Strategy to the year 2012 which includes all targets. A post 2013 strategy is to be published after the Copenhagen summit in December 2009.

The Republic of Ireland currently does not have a Climate Change Act although a raporteur from the joint committee has been appointed to make recommendations on an act.

The Joint Committee has sponsored a draft Bill (December 2008) on Offshore Renewable Energy Development but members feel that they are not getting adequate feedback from departments, particularly energy, environment and agriculture. The Committee feels there is a need for Ireland to speed up procedures for dealing with developers in offshore renewables as there is 16bn Euro of development being held up. The Bill is trying to put offshore energy into the framework of existing legislation.

Wind energy in the Republic of Ireland is not commercially viable at the moment as wind penetration is still very low. The Electricity Supply Board is becoming a renewables company and aim to be carbon neutral by 2030. The big issue for wind energy is grid access and the Committee feels there are enormous opportunities for green jobs.

There is not currently any marine legislation in the Republic of Ireland, something the Committee feels needs to happen.

Eir Grid has produced a report on moving grids offshore and has committed resources to strengthening their network. A government white paper on energy has been published but this will take 5-10 years to roll out.

The Commission on Taxation has a wide mandate and will almost certainly introduce a carbon tax which could raise around 10-15bn Euro by 2020 which could be invested in areas such as the Home Energy Savings Scheme. Other plans at the moment are the National Energy Efficiency Action Plan and the Smarter Travel Plan. Sustainable Energy Ireland and the Electricity Supply Board have conducted a joint study on cost effective measures which will be published soon.

DSD Reply on Social Housing Standards

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Gasworks Business Park

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e-mail: john.ball@dsdni.gov.uk

Tel: (028) 9082 9041

Mr Alex McGarel
Clerk of the Committee for the Environment
Committee for Environment
Room 247
Parliament Buildings
BELFAST
BT4 3XX

14 September 2009

Thank you for your letter dated 29 May regarding social housing standards. The Committee has asked the Department for information on any difference in the social housing standards set in relation to grants for private housing and grants for Housing Executive tenants.

The Department does not provide grants for Housing Executive tenants. The Housing Executive manages a Heating Replacement Scheme which improves the energy efficiency of their stock and forms part of their planned improvement programme.

The Warm Homes Scheme provides grants to owner occupiers or households in the private rented sector to improve the energy efficiency of their homes. The Warm Homes Scheme has two elements: Warm Homes and Warm Homes Plus. Warm Homes is open to eligible householders and provides insulation measures up to a maximum grant of £850. Warm Homes Plus will assist households where additional measures, such as heating or complex insulation, are required. Warm Homes Plus focuses on homes with no central heating system, a solid fuel system, Economy 7 or bottled gas system. The maximum grant available is £4,300.

I trust this information is helpful.

John Ball
Department for Social Development

cc Clerk of the Social Development Committee

AFBI Visit Presentation

AFBI has approximately 700 staff, and occupies 7 specialised sites across Northern Ireland.

Newforge Lane, Belfast.
Stormont.
Omagh.
Crossnacreevy.
Loughgall.
Hillsborough.
Bushmills

OVERALL STRUCTURE

Chief Executive – Dr George McIlroy

Three Research Divisions:

- **Veterinary Science**
- **Applied Plant Science**
- **Agriculture, Food and Environmental Sciences**

Agriculture, Food & Environmental Sciences

Dr Sydney Holl
Deputy Chief Executive

Food Microbiology

Food Microbiology

Consumer Confidence & Food Safety
Quality & Consumer Choice
Novel Processes & Products

Fisheries and Aquatic Ecosystems

Agriculture

Sustainable Livestock Systems
Sustainable Forage & Crop Systems
Renewable Energy

Agri Environment

Nutrient Management
Land use & Environmental Monitoring
Climate Change

Agriculture Branch - Research Themes

- Increasing production efficiency and competitiveness through improved use of primary inputs
- Improving quality and safety of animal and crop products whilst enhancing animal welfare
- Enhancing agriculture's contribution to the environment (including renewable energy)



Integration of focus areas

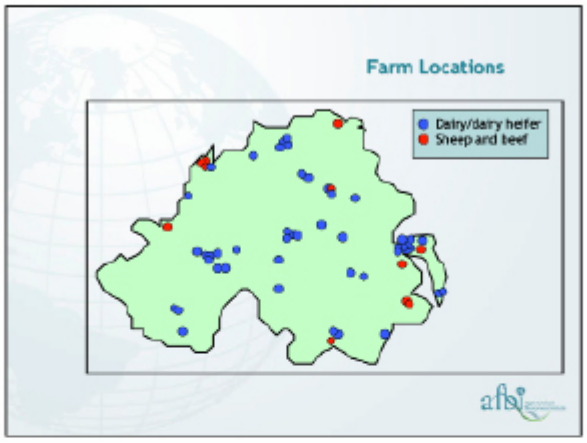
Experimental Resources

AFBI Hillsborough Farm (310 ha)

- Beef — 100 Suckler cows (50 Limousin x Friesian, 50 Stabilizer Breed)
  400 growing + finishing cattle
- Pigs — 150 Sow Unit with pigs from birth to bacon
- Sheep — 450 Breeding Ewes and lambs to finish
- Dairy — 320 Dairy cows and 150 replacements
  200 Holstein Friesian, 20 Norwegian,
  60 Norwegian x Friesian, 40 Jersey x Friesian

On farm research studies also a major feature of research programmes in the last 10 years

On farm research studies involve 48 farms (dairy, beef, pig and sheep farms)


Farm Locations
Dairy/dairy heifer
Sheep and beef

The AFBI Environment and Renewable Energy Centre, Hillsborough

Developed through the Secretary of State's Environment and Renewable Energy Fund

Anaerobic Digester at AFBI Hillsborough

1 Data on emissions of greenhouse gases from grassland and from ruminant animals from experiments carried out over many years under a range of conditions.

2 Research programme into mitigation strategies to reduce greenhouse gas emissions from agricultural soils and from ruminant livestock.

3 Inventory of soil carbon in Northern Ireland soils.

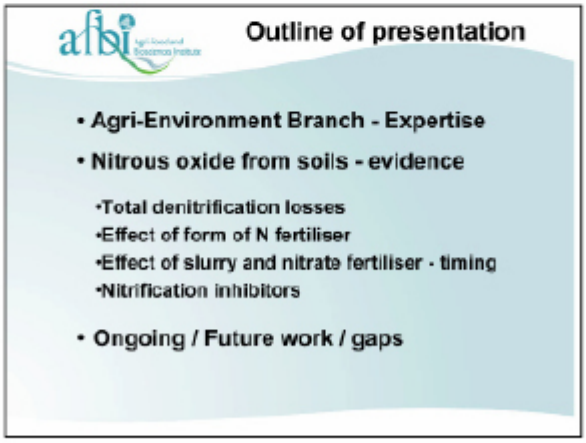
4 Research into the opportunities to replace energy from fossil fuels with energy from locally sourced biomass sources.

5 Long term monitoring of terrestrial and fresh water ecosystems.

6 Research programme into the lifecycle carbon analysis of sources of biomass renewable energy and anaerobic digestion, and into the carbon footprint analyses of agricultural products

AFBI

7. Work on projections of changes in greenhouse gas emissions, arising from the production of the major agricultural commodities in the four UK countries, in response to changes in agricultural and trade policies.



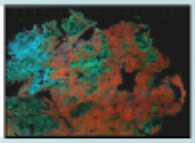
AFBI Visit Presentation from Catherine Watson

Agri-Environment Branch

Expertise

- Eutrophication
- Soil fertility
- Nutrient management
- Nitrogen transformations
- Phosphorus sources
- Environmental change
- Stable isotopes (^{15}N)
- GIS and GPS
- Multivariate statistics



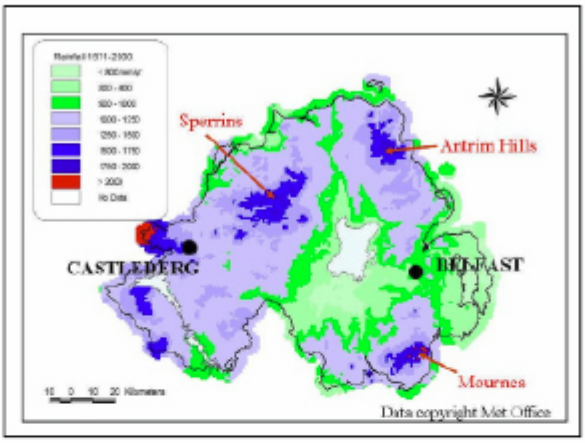


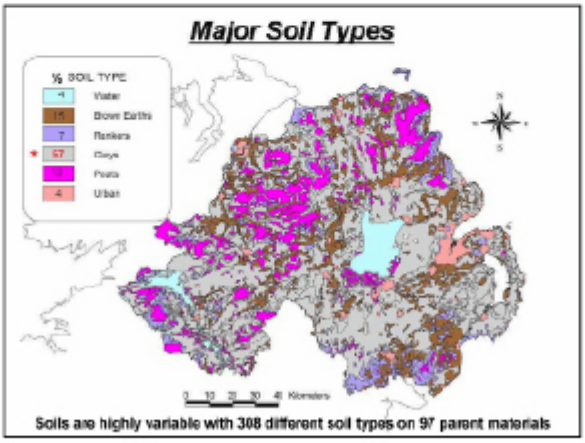
Agri-Environment Branch

Our research addresses land and nutrient management issues to make appropriate and efficient use of resources, while protecting the environment. The integrated research effort covers the impact of nutrients used by agriculture on air, soil and water quality

Major work programmes

- Nitrogen
- Phosphorus
- Soil Quality
- Nutrient Management


Sperrins
Antrim Hills
CASTLEDERG
BELFAST
Mournes
Data copyright Met Office


Major Soil Types
Water
Brown Earths
Rankers
Peats
Urban
Soils are highly variable with 308 different soil types on 97 parent materials

Measuring nitrous oxide production from soils

1) Stetic chambers

2) Stable isotopes (15N)

Stable isotopes allow both N_2O & N_2 to be measured using a mass spectrometer

Nitrous oxide from soils -evidence

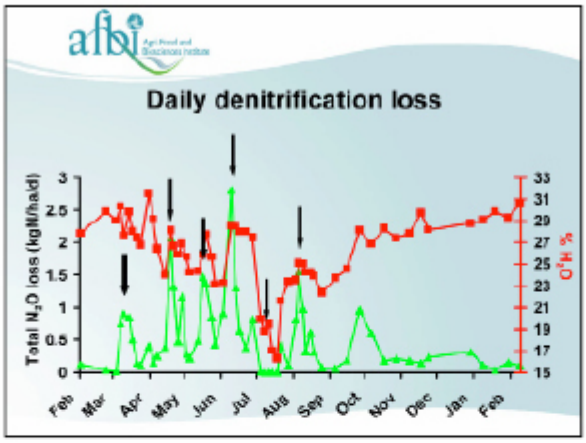
Measured at Hillsborough since 1989

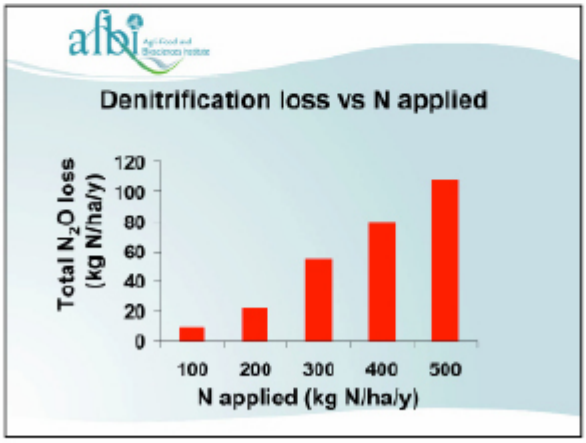
Good understanding of many factors influencing losses:

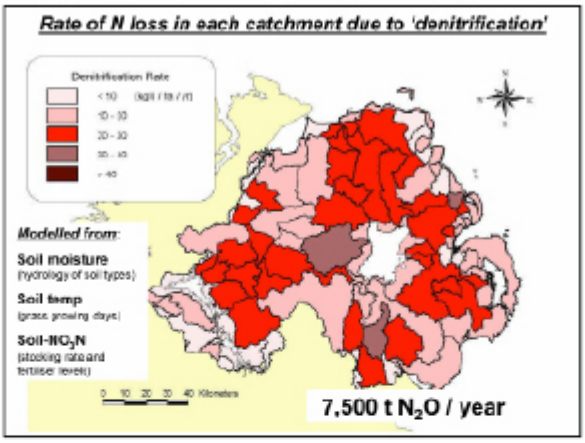
- Soil factors: NO_3 concentration, moisture, temperature
- Management factors: fertiliser type, rate and timing of applications, slurry applications

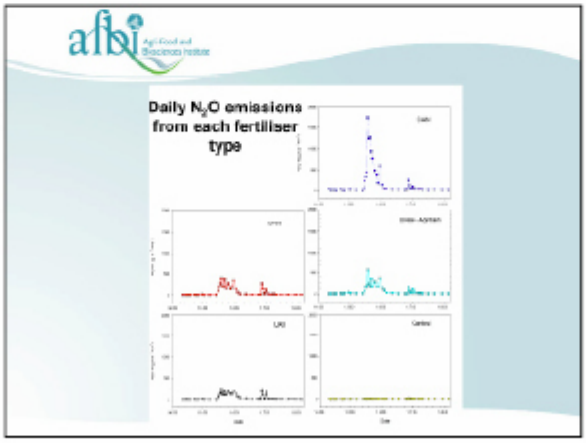
NI denitrification model developed

Model + GIS used to predict losses across NI

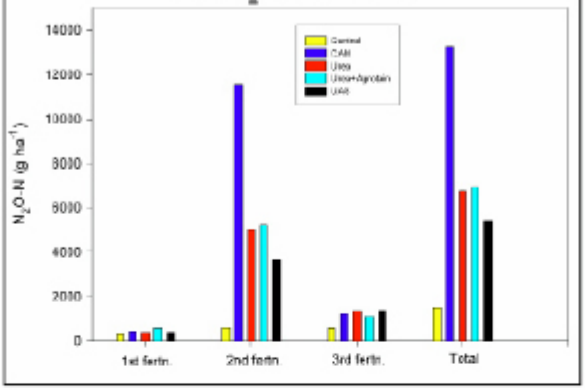

Daily denitrification loss
Total N_2O loss (kgN/ha/d)
$\delta^{15}N$ ‰
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb


Denitrification loss vs N applied
Total N_2O loss (kg N/ha/y)
N applied (kg N/ha/y)


Rate of N loss in each catchment due to 'denitrification'
Denitrification Rate
< 10 (kgN / ha / yr)
10 - 20
20 - 30
30 - 40
> 40
Modelled from:
Soil moisture
(hydrology of soil types)
Soil temp
(grass growing days)
Soil-NO_3N
(stocking rate and fertiliser levels)
0 10 20 30 40 Kilometers
7,500 t N_2O / year


afbi
Daily N_2O emissions from each fertiliser type

Total N_2O emissions



afbi Agri-Food and Biosciences Institute

N_2O emission factors for each fertiliser-N, and seasonal weighted mean EFs.
IPCC default emission factor = 1.25 ± 1.0 %.

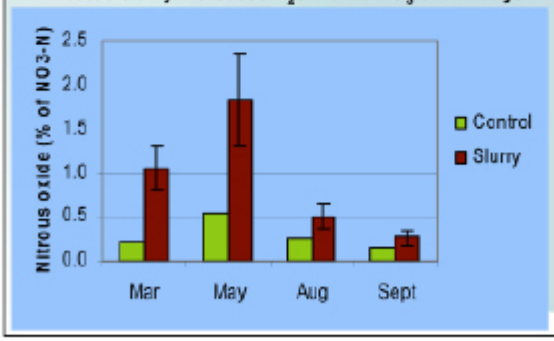
Site/Crop	N material	Net N_2O emission factor (%)[a]			
		N2 (Spring)	N3 (Early summer)	N4 (Mid-summer)	Seasonal weighted mean
Hillsborough (grass)	CAN	0.13	10.99	0.01	3.93 ± 1.17[b]
	Urea	0.06	4.47	0.02	1.74 ± 0.47[a]
	Urea+Ag	0.25	4.63	0.01	1.80 ± 0.48[a]
	UAS	0.07	3.06	0.06	1.20 ± 0.42[a]

[a]Net emission after subtraction of control value, as % of N applied.
Values with different letters are statistically different (p<0.05).

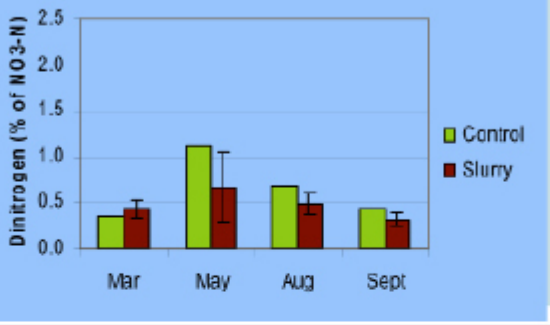
How much nitrate fertiliser is lost as N_2O and N_2 when slurry is applied at the same time?

- Soil - acid brown earth, 46% sand, 31% silt, 21% clay, 12% OM
- Cattle slurry - 22 m^3/ha, 60 kg NH_4-N/ha
- Control - ammonium bicarbonate, 60 kg NH_4-N/ha
- Potassium nitrate - 60 kg NO_3-N/ha, 52 atom % ^{15}N
- March, May, August, September
- Fluxes of N_2O and N_2 measured for 4 days

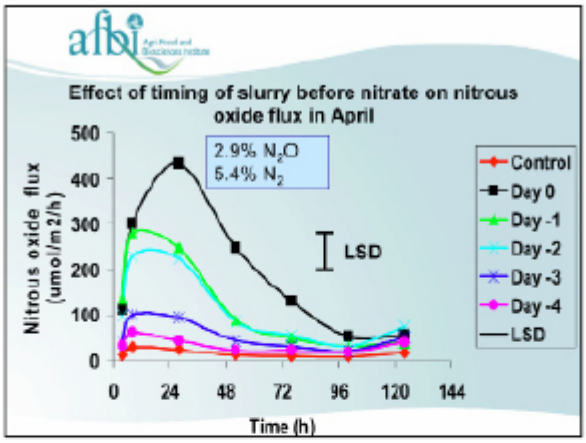
Cattle slurry increases N_2O from KNO_3 over 4 days



Cattle slurry decreases N_2 from KNO_3 over 4 days



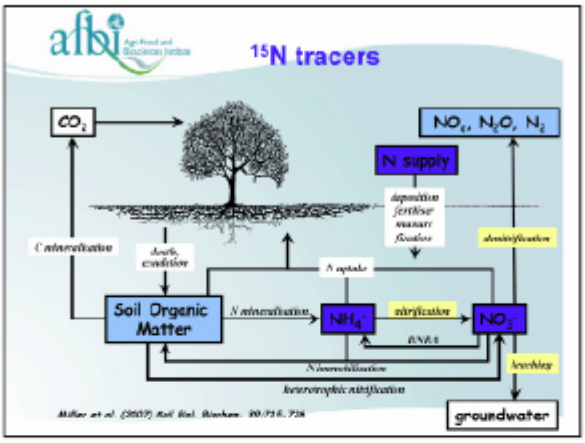
Can the loss of nitrate fertiliser as N_2O and N_2 be lowered by applying the slurry before the fertiliser?

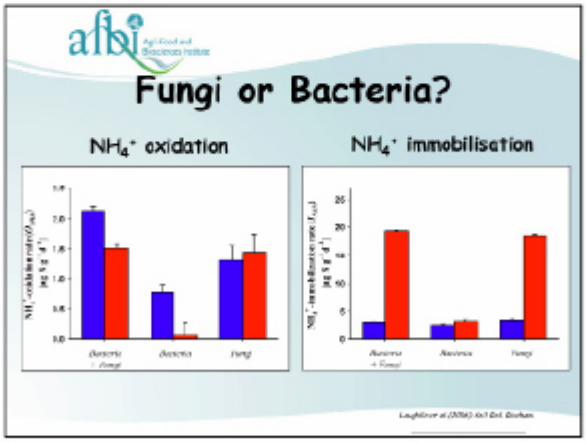


Importance of Nitrification

Nitrification changes non-mobile NH_4^+ into a free reactive species NO_3^-, which if produced in excess to plant needs is either leached into ground and surface waters or denitrified to produce N_2O and N_2.

Inhibiting nitrification can potentially reduce leaching and denitrification N gas losses.


15N tracers
CO2
NO3, N2O, N2
N supply
deposition
fertiliser
manure
fixation
denitrification
C mineralisation
Soil Organic Matter
N mineralisation
NH4+
nitrification
NO3-
leaching
groundwater


Fungi or Bacteria?
NH4+ oxidation
NH4+ immobilisation

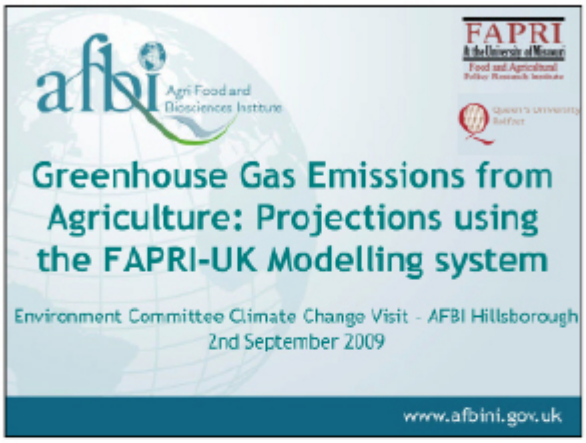
Mode of action of nitrification inhibitors

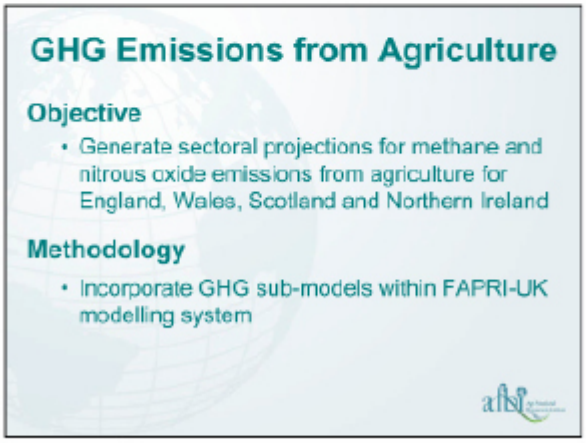
Inhibits ammonia mono-oxygenase

HAO = hydroxylamine oxidoreductase

Nitrous oxide from soils - evidence gaps

- Timing of slurry and fertiliser applications after silage harvest
- Slurry spreading techniques
- Effect of anaerobic digestion of slurry on emissions.
- Effect of pH on proportions of N_2 and N_2O produced by denitrifiers (lime?)
- Role of nitrification inhibitors
- Role of different soil microbes (e.g. fungi, bacteria) on GHG emissions
- Measurement of N_2O emissions on a whole farm basis (laser diode technology)





AFBI Visit Greenhouse Gas Emissions from Agriculture Presentation

GHG Emissions from Agriculture

Overview of FAPRI-UK Project

- Four sets of models that simulate the main agricultural sectors in England, Wales, Scotland and Northern Ireland
- These models comprise the UK component of the EU model operated by FAPRI-Missouri
- The EU model is linked to the FAPRI Global modelling system

GHG Emissions from Agriculture

UK models solve simultaneously with EU models to determine price and production levels

GHG Emissions from Agriculture

- The UK modelling system contains sub-models that cover the major commodities produced in the UK:
  - wheat, barley & rapeseed
  - cattle, pigs, sheep & poultry
  - milk
- The model captures financial and physical linkages among sectors e.g. beef & dairy sectors

GHG Emissions from Agriculture

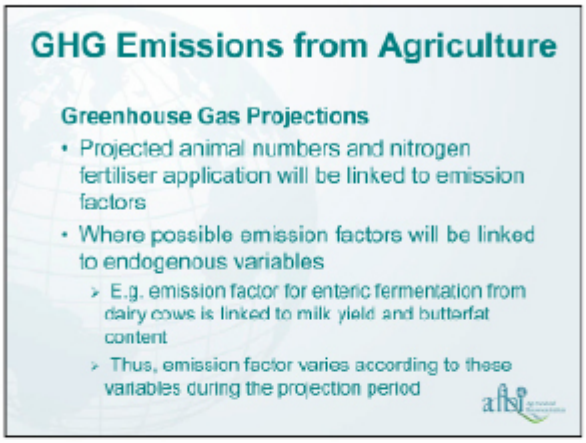
Approach to Policy Analysis

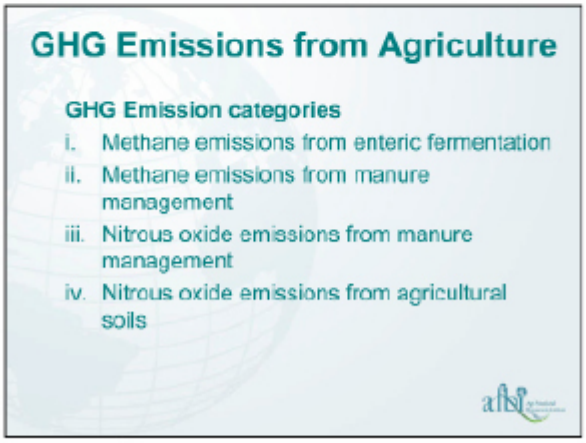
Models generate 10-year:

- Baseline projections – assuming current policies remain in place
- Policy scenario projections – sets of policy assumptions pertaining over 10 years

Comparison made between each Scenario and Baseline projections

Note: Results are projections *not* forecasts





4

AFBI Visit Research Paper

AFBI Research relevant to greenhouse gas emissions from agriculture and land use

July 2009

AFBI's research and development programme contributes to greenhouse gas emission research in a number of ways:

AFBI -

1. holds data on emissions of greenhouse gasses from grassland and from ruminant animals from experiments carried out over many years under a range of conditions.

2. has a research programme into mitigation strategies to reduce greenhouse gas emissions from agricultural soils and from ruminant livestock.

3. has prepared an inventory of soil carbon in Northern Ireland soils.

4. is conducting research into the opportunities to replace energy from fossil fuels with energy from locally sourced biomass sources.

5. has a research programme into the lifecycle carbon analysis of sources of biomass renewable energy and anaerobic digestion, and into the carbon footprint analyses of agricultural products

6. conducts long term monitoring of terrestrial and fresh water ecosystems.

7. is able to model the effects of changes in the economics of farming and land use systems on the structure of land use and make projections of the resulting changes in greenhouse gas emissions

1. Holds a data on scientifically measured emissions of greenhouse gasses from grassland and from ruminant animals under a range of conditions.

Over the last 20 years AFBI has been carrying out ruminant metabolism studies in state of the art indirect open circuit respiration calorimeters, which enable direct measurement of methane production. A number of papers have been published which include methane emission figures from various classes and breeds (eg Holstein, Norwegian, Jersey cross) of ruminant livestock, and from winter and spring calving dairy cows. Results from other studies are held by AFBI.

A combination of dentirifcation studies by AFBI and modelling of denitrification in grassland across Northern Ireland have enabled AFBI to produce maps of Northern Ireland showing estimate rates of nitrous oxide emissions.

2. Has a research programme into mitigation strategies to reduce greenhouse gas emissions from agricultural soils and from ruminant livestock.

(a) Methane

Methane is a major greenhouse gas and contributes about 18 per cent towards the global warming effect. Within the UK, ruminant livestock are the primary source of methane production, accounting for approximately 20% of total methane production. AFBI is well equipped to develop methane mitigation strategies for ruminant livestock with state of the art indirect open circuit respiration calorimeters, which enable direct measurement of methane production. In December 2007 AFBI, in association with UCD and Teagasc, Grange were successful in obtaining Department of Agriculture and Food Stimulus Funding to evaluate effects of dietary changes on methane production from ruminants.

Research has now been extended into the methane emissions from grazing animals under a range of regimes and these studies are being linked to associated nitrous oxide emissions so that lifecycle carbon footprint data can be collated.

(b) Denitrification and nitrous oxide

Nitrous oxide is a greenhouse gas which absorbs 270 times more heat per molecule than carbon dioxide. The major source of nitrous oxide emissions in the UK is from agricultural activities. Climatic and agricultural conditions conspire to ensure Northern Ireland soils have some of the highest rates of denitrification in the UK. Microbes in the wet and carbon-rich soils of Northern Ireland reduce nitrate in the soils through the process of denitrification to produce two principal gaseous products, nitrogen and nitrous oxide, in the ratio of approximately 3:1. These gases are lost to the atmosphere. The nitrogen produced is not a problem environmentally but the nitrous oxide, being a greenhouse gas, may contribute to global warming. AFBI research has shown that denitrification rates increase linearly with increasing rate of CAN applied. Loss rates as high as 3 kg N/ha/d have been measured at Hillsborough (CENIT site). Modelling of denitrification losses using the AFBI GIS predicts that around 7,500 tonnes of nitrous oxide are emitted annually from Northern Irish soils (Jordan & Smith, 2005). This corresponds to around 5% of the current annual UK emissions of nitrous oxide. Northern Ireland accounts for 6% of the land area of the UK. Current work by AFBI involves the use of inhibitors and stable isotopes to study the nitrogen cycle and how to manage it to minimise nitrous oxide losses from fertilisers (both chemical and organic). In addition, AFBI in association with Teagasc and University College Dublin, have recently received Stimulus funding for a joint project to investigate opportunities to maximise the efficiency of slurry-N and urea-N utilisation by grassland, using nitrification and urease inhibitors as a strategy for environmental protection. The impact of these inhibitors on greenhouse gas emissions (N2O, CH4, CO2), ammonia emissions and nitrate leaching are being quantified under contrasting soil and environmental conditions in Ireland to enable emission factors to be verified.

(c) Ammonia emissions

Ammonia emissions from manures during storage and after spreading on the land account for a significant proportion of UK emissions. AFBI research includes examination of trailing-shoe spreading technology which can significantly lower ammonia losses to the atmosphere.

3. Inventory of Soil Carbon

Until recently, there was no reliable inventory of soil carbon for the UK as required by the Kyoto Protocol. Under the Kyoto Protocol, the UK is required to make estimates of net carbon emissions to the atmosphere. One potential source is the soil. An important driver of soil carbon losses and gains is changes in land use. AFBI Science has delivered the Northern Ireland soil and land use input to a recent standardised UK soil carbon database compatible with Geographic Information Systems (GIS) and numerical modelling requirements, using agreed protocols (Bradley et al, 2005). This has provided a baseline from which the effect of land use change and management options on soil carbon turnover can be modelled by other researchers.

AFBI have estimated that the soil carbon storage to 1 metre depth across Northern Ireland amounts to 296 million tonnes of carbon, about 6.5% of the UK total (in line with the ratio of the area of the Province to that of the UK). As expected, the highest density of soil carbon is in the peat overlying high ground. Current work involves measuring peat depth and changes in the bulk density of peat with depth to update our estimate of the total carbon stocks for Northern Ireland.

4. Opportunities to replace energy from fossil fuels with energy from renewable sources

AFBI considers that the future for renewable energy from agriculture and forestry in Northern Ireland lies with small-scale, rural, embedded systems which are sustainable and will generate income for farmers and foresters and benefit the wider rural community. Building on many years of research which has pioneered short rotation coppice willow AFBI was recent developed the Environment and Renewable Energy Centre (EREC) at AFBI Hillsborough which combines a significant research programme around a range of renewable energy technologies delivering heat and electricity to the AFBI Hillsborough site.

The Environment and Renewable Energy Fund allocated £3.6m to AFBI to set up the EREC at AFBI Hillsborough and to develop a research programme into key renewable energy technologies relating to agriculture. The renewable energy research programme is being developed in consultation with DARD.

The EREC incorporates a biomass heating system and a wood-chip drying store being installed at the AFBI Hillsborough site, and this will facilitate a research programme into the production, storage and utilisation of biomass crops including SRC willows, other biomass crops and forestry residues.

An Anaerobic Digester is also part of the EREC scheme and the biogas is being used to generate electricity and heat in the EREC. Aspects of solar technologies are also being evaluated.

EREC staff at Hillsborough are working with other groups in AFBI including those in Applied Plant Science and in Agriculture and Food Economics, and are also developing both local and international collaborative research links into agriculturally relevant aspects of renewable energy.

The EREC will give AFBI a unique capability to provide research data on renewable energy from production to utilisation across a range of land-based enterprises, and to develop ways of building renewable energy projects into farming systems to achieve maximum carbon emission reductions, in ways that are both economically viable and sustainable.

(a) Biomass and Energy Crops

AFBI has pioneered research into short – rotation coppicing of willows and has over 30 years of experience at its Loughgall Centre into all aspects of growing, harvesting and utilising the crop. AFBI expertise has been recognised through high-level participation in a number of key EU-networked projects over the past 10 years. At a technology transfer level we are closely involved with Rural Generation Ltd in developing heat and power systems from willow coppice while incorporating novel bio-remediation technology in association with a local sewage works. AFBI was also involved in a recent EU supported innovative project whereby a consortium of local farmers are growing willow for biomass used to heat a local Leisure Centre run by Cookstown District Council. This project was co-ordinated by AFBI scientists, involved growers, suppliers and users of wood chip, and also resulted in a ‘Best Practice’ guide for the management of SRC willows.

Through the EREC AFBI has initiated biomass research projects into

i) The bioremediation of farm dirty water through SRC willows

ii) Techniques for the improved establishment and early growth of miscanthus

iii) The recovery of forest brash and its use as a biomass fuel

iv) The storage and drying of woody biomass fuels

v) The identification of alternative biomass crops & forestry species

(b) Anaerobic digestion

Anaerobic digestion of agricultural manures and other organic materials has significant potential to produce renewable energy as biogas and to aid in the management of plant nutrients from these materials. AFBI has installed a 600 cubic metre mesophilic on-farm anaerobic digester with the research objectives of:

- Determining physical and financial base-line performance
- Researching performance improvers such as co-digestion
- Modelling feasibility of on-farm anaerobic digestion for NI
- Determining contribution of anaerobic digestion to greenhouse gas mitigation
- Providing information for policy and industry

The digester as been operational for about one year and is producing research data on the yield and quality of biogass from the digestion of cow manure. The biogas is being used for the generation of electricity and heat through the EREC.

5. Long term monitoring of terrestrial and fresh water ecosystems

(a) Effect of elevated CO2 on nitrogen dynamics in temperate grassland soils

Climate change due to increasing atmospheric CO2 concentrations will have an impact on biogeochemical cycles in terrestrial ecosystems. Since carbon (C) cycling is closely linked to nitrogen (N) cycling, elevated atmospheric CO2 concentrations may influence both the internal cycling of nitrogen (N) as well as the processes that regulate the total ecosystem nitrogen balance. Because N is a limiting nutrient in most ecosystems, changes in the N availability or N cycling will be controlled by the long-term response of ecosystems to atmospheric CO2. Studying the effect of elevated CO2 on microbial N transformations and plant N uptake in soil is technically difficult and extremely expensive. Long-term studies (>5years) are required as the system needs to be in equilibrium before any meaningful data can be obtained. The University of Giessen in Germany set up a unique field experiment approx. 9 years ago (called Free Air CO2 Environment (FACE) experiment) maintaining elevated atmospheric CO2 concentrations above a grassland sward. The FACE facility is funded by the Hessian Agency for the Environment and Geology in Germany and the system has now reached equilibrium. Researchers in AFBI have been collaborating with Professor Christoph Muller at the University of Giessen and more recently at UCD for a number of years. The collaboration is based on AFBI's expertise in the use of stable isotopes (15N and 13C) to investigate N and C dynamics in soil and Professor Muller's expertise in the analysis of data using simulation models.

At present AFBI has a unique opportunity to use the FACE experiment to undertake collaborative research with the University of Giessen on the effect of elevated CO2 levels on soil N dynamics. This collaboration utilises the expertise in both organisations. The information obtained from the FACE experiment could be applied to grassland systems in Northern Ireland to predict more accurately the response of grassland to environmental change and improve our understanding of

how changing climate and atmospheric composition interact to influence agricultural sustainability. The research may also help in developing future strategies to make N cycling more efficient leading to enhanced plant growth and minimising losses to the environment.

(b) Environmental Change Network (ECN) UK

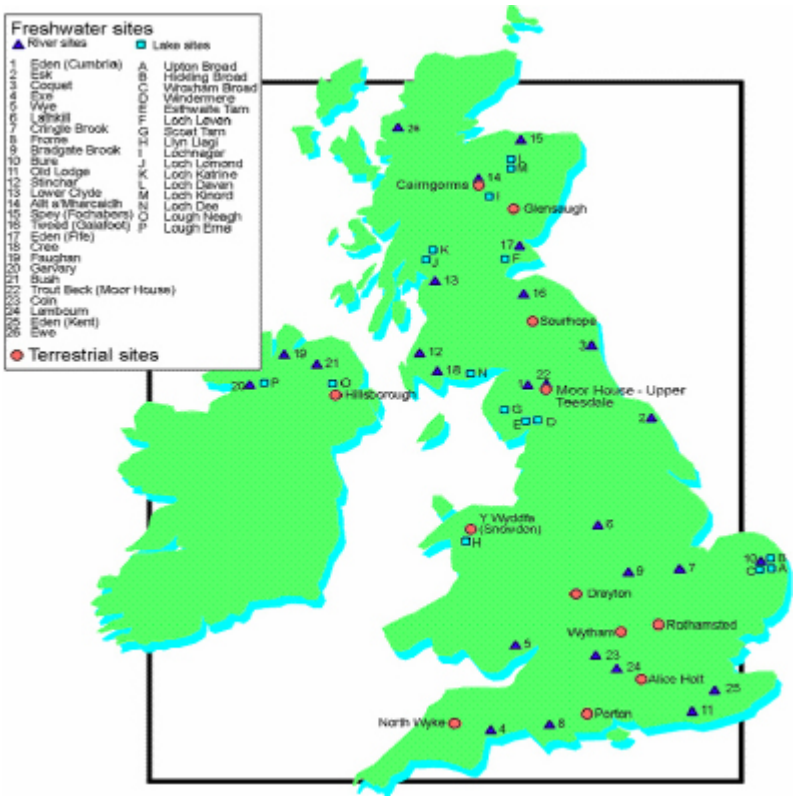
Since 1994, AFBI Science has been operating one of twelve terrestrial sites within ECN UK, at AFBI's Hillsborough site, Co. Down (Figure 3) and 3 freshwater sites (Lough Neagh, L Erne and River Bush). ECN is a long-term ecosystem monitoring and research network, designed for the detection, interpretation and prediction of long-term environmental change in order to help mitigate and adapt to climate change.

The chief objectives of the ECN are:

- to obtain uniform and comparable long-term datasets for key environmental components at selected sites by using standardised protocols
- to integrate these datasets in such a way as to identify changes and improve our understanding of the causes of such changes. (Sykes & Lane 1996, Sykes et al 1999).

In addition to monitoring components of the physical and chemical environment, such as meteorology and atmospheric chemistry, ECN also monitors changes in selected biota. Changes in these biological populations can then be considered against changes in the physical environment. Detecting this pattern of biotic responses to changes in key, driving variables relies on the use of complex analytical and statistical tools to tease out real effects of environmental change from natural population fluctuations.

Figure 3: The UK Environmental Change Network



The 'Climate Change Indicator' pages available online (see www.ecn.ac.uk) generate graphs direct from the ECN database to show recent change. Work is also progressing to identify climate-induced changes in biota. Ground predators (Coleoptera: Carabidae) are pitfall-trapped across the Network and the results used, with climate data, to test for climate-induced change. The data have been independently subjected to a novel species range classification and to correspondence analysis. Both analyses have indicated significant responses over time (1993 – 2000). Temporal changes in the balance of northern and southern elements within ground beetle communities show a significant increase in the presence/activity of southern species at the expense of northern (cold-adapted) species. The community structure in upland sites had also changed along a climatic (temperature) gradient, with certain flightless species (Carabus) declining significantly (Figure 4).

Figure 4: Carabus glabratus, a large, flightless ground beetle affected by climate change

Monitoring at the River Bush ECN site indicates that survival rates of North Atlantic salmon, an economically important species, have declined markedly since 1996, possibly due in part to climate change.

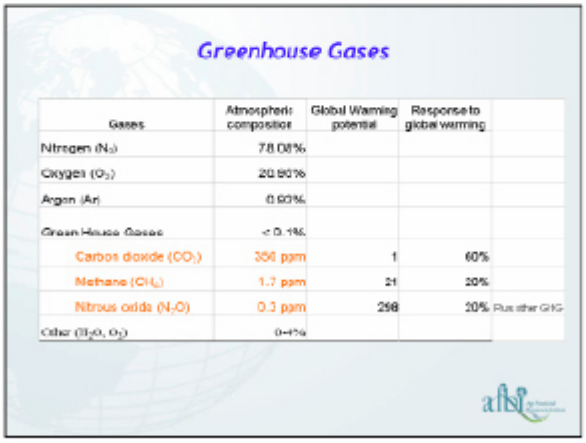
6. Lifecycle analysis of 'Carbon Footprints' and greenhouse gas emissions

AFBI is bringing together its scientists from across a range of disciplines to develop lifecycle analyses figures for important agricultural products from Northern Ireland, and for the range of biomass resources from agriculture which are starting to be utilized. IPCC procedures are being followed into which data sourced locally data are being incorporated in order to identify the most appropriate figures to be used in the Northern Ireland context, and to support local agriculture

as it seeks to meet the increasing demand for information on the carbon footprint of its products.

7. Modelling the effects of changes in the economics of farming and land use systems on the structure of land use and make projections of the resulting changes in greenhouse gas emissions

The Economics Branch within AFBI is one of the leading UK groups working on the FAPRE model of the impacts of economic changes on the structure of agricultural and rural land use. This group are currently evaluating how the modeling of greenhouse gas emissions can be linked to their existing economic models with a view to providing the ability to provide the essential link between economic changes and the resulting changes in the pattern of emissions of greenhouse gases.



AFBI Visit Research Presentation

Greenhouse Gases from Agricultural Industry

- Contributions from Agriculture
  - In UK: 7% of total GHG emission
  - In NI: > 23% of total GHG emission
    - 9% from agricultural soil (nitrous oxide & methane)
    - 9% from cattle (methane – enteric fermentation)

- Government targets for GHG reduction (based on 1990 level)
  - In UK: 80% reduction by 2050
  - In NI: 30% reduction for CO_2 by 2025
    25% reduction for all GHG by 2025

Northern Ireland Livestock Methane Budget

Budget for methane emissions from domestic livestock in Northern Ireland *

Livestock	Population	Enteric fermentation		Manure Management		Total Methane output
		Emission factor	Methane output	Emission factor	Methane output	
		(kg/year)	(t/year)	(kg/year)	(t/year)	(t/year)
Dairy cattle	352400	100	35,240	14.00	4,934	40,174
Non dairy cattle	1,330,000	48	63,840	6.00	7,980	71,820
Sheep	2,200,000	8	18,100	0.19	430	18,530
Goats	2000	5	10	0.12	0	10
Horses	9700	18	175	1.40	14	189
Pigs	415,200	2	623	3.00	1,246	1,868
Poultry	18,652,100	0	0	0.08	1,453	1,453
Total			118,001		16,057	134,057

* The emission factors were IPCC Tier 1 default values (IPCC, 1996)

Greenhouse Gases Measurements
- AFBI Facilities

- Two indirect open-circuit respiration calorimeter chambers installed at AFBI Hillsborough in 1992. Currently there are only 4 large animal chambers in the UK and Ireland

Calorimeter Chambers
- Principle of Measurement

- Animals are housed in the chamber
  - Measurement of amount of air flow into the chamber
  - Measurement of concentrations of oxygen, carbon dioxide and methane in air into and out of chambers
  - Calculation of total amounts (litre/day) of oxygen inhaled and carbon dioxide and methane expired by animals

- These measurements are used for two objectives:
  - Determining methane and CO_2 emissions (l/d) of cattle and sheep for greenhouse gases research
  - Calculating heat production and methane energy output (MJ/d) to examine the efficiency of energy use for production

Mobile Methane Measurement for grazing cattle

SF_6 Trace Gas Technique - Procedures

- A brass permeation tube, containing SF_6 (sulphur hexafluoride) gas of known release rate, is placed into the rumen of animals before measurements
- Expired gas samples are collected from animals using pre-evacuated collars
- Methane and SF_6 gas concentrations in the collar are assessed using Gas Chromatography

- Methane emission:

  CH_4 (l/min) = QSF_6 * $[CH_4]/[SF_6]$

  Where: QSF_6 = known release rate from permeation tube

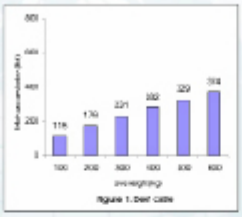
  $[CH_4]$ and $[SF_6]$ = concentrations of these gases in the collars

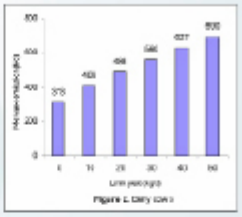
AFBI Hillsborough Research on

Mitigation of Enteric Methane

- From 1992, over 800 dairy cows, 130 beef cattle and 50 sheep have been used in calorimeter measurements to examine effects on methane emission from
  - Animal factors
    - Cattle breed (e.g., dairy cow: Holstein vs. Jersey vs. Norwegian)
    - Genetic merit of cows (high vs. medium vs. low yielding)
    - Stage of lactation (early vs. mid vs. late)
    - Parity (first vs. second or over)
  - Dietary factors
    - Concentrate proportion (high vs. medium vs. low)
    - Grass type (fresh grass vs. grass silage vs. dry grass)
    - Forage type (grass silage vs. maize silage vs. whole crop wheat silage)
    - Diet quality (high vs. low protein level; high vs. low ME content)
    - Dietary additives (oil, fumaric acid, yeasts, etc.)
- All results have been published in a range of refereed scientific journals, scientific conferences and farming press

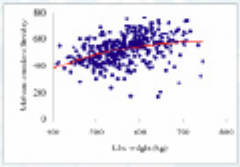
Methane emission from cattle

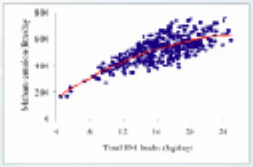


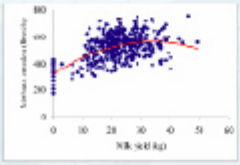


- For example, a cow with milk yield of 35 litres/day can produce 590 litres/day of methane, its global warming potential is equivalent to amount of CO_2 generated by an average UK family car over a distance of 55 miles.

Predicting methane emission from dairy cattle







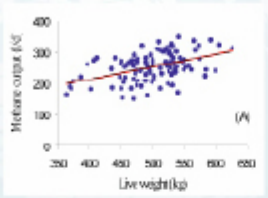
$CH4-E = DEI (0.094 + 0.028 ADFc) - 2.453 (FL-1)$

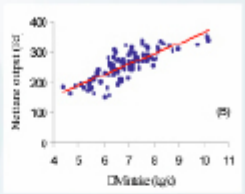
$CH4-E = DEI (0.096 + 0.035 FPI - 2.298 (FL-1)$

$CH_4 (l/d) = [38.30 + 4.890 FP] DMI - 0.719 DMI^2 - 20$

$CH_4 (l/d) = 0.591 LW + 5.426 MY + 65$

Predicting methane emission from beef cattle



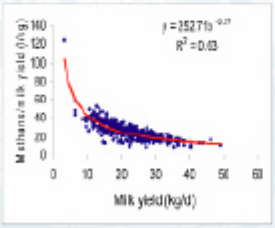


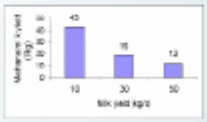
CH_4 (L/d) = 36.1 DMI + 8.1

CH_4 (L/d) = [32.4 − 305.8 ME/GE + 199.1 DE/GE + 4.35 ME] DMI − 14.9

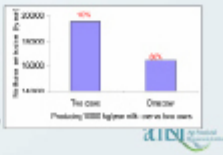
Mitigation Strategies

- Reducing methane emission with increasing milk production





- Increasing milk yield reduces methane emission per kg milk



- To produce 10,000 kg/year milk, using one high yielding cow, rather than two low yielding cows, could reduce methane emission by 20% (assuming no change in fertility, diet, etc.)

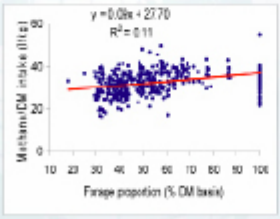
Mitigation Strategies

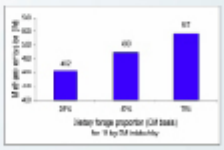
- Reducing methane emission with increasing milk production

	Low output system	High output system
Live weight (kg)	550	650
Milk yield (kg/year)	5500	8000
Methane output (litre/year)	166,446	205,014
Methane output (litre/day)	461	562
Methane/milk yield (litre/kg)	30.6	25.6	
	100%	84%

Mitigation Strategies

- Decreasing dietary forage proportion reduces methane emission

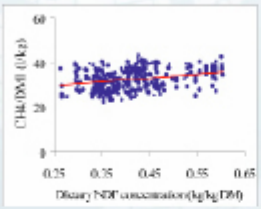




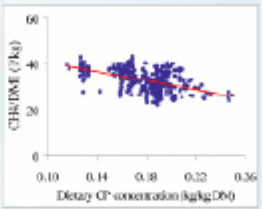
Dietary forage proportion	25%	50%	75%
Methane emission	100%	100%	112%

Other Mitigation Strategies

- Reducing neutral detergent fibre content in diet

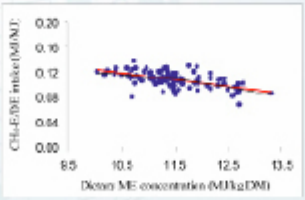


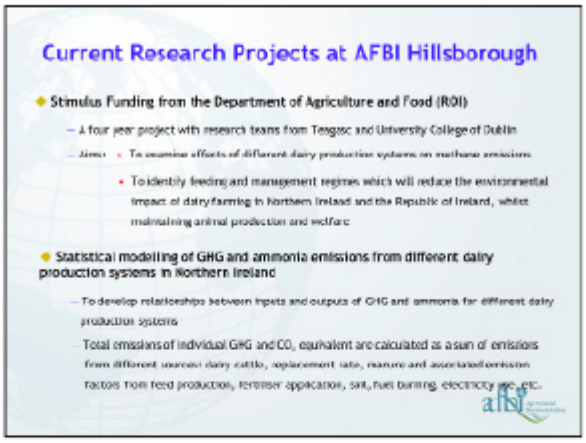
- Increasing crude protein content in diet



Other Mitigation Strategies

- Increasing metabolicable energy content in diet reduces methane emission





9

Draft Flood and Water Management Bill Executive Summary

Executive Summary

i. This consultation paper seeks comments on a draft Flood and Water Management Bill and on other matters where we wish to seek views before drafting legislation. It sets out the main reasons why the UK and the Welsh Assembly Governments believe we need to change the law and how we propose to change it.

ii. The draft Bill aims to give effect to the UK Government's response to Sir Michael Pitt's Review 'Learning Lessons from the 2007 Floods' (June, 2008) published in December 2008 and 'Future Water' the UK Government's Water Strategy for England published in February 2008. The draft Bill also aims to give effect to the flood and water aspects of the Welsh Assembly Government's 'Environment Strategy' its 'New Approaches Programme' including addressing issues identified by Sir Michael Pitt's Review and the Welsh Assembly Government's 'Strategic Policy Position Statement on Water'.

iii. The draft Bill will create a more comprehensive and risk based regime for managing the risk of flood and coastal erosion, which for the first time embraces all sources of flooding. It will also enable better management of water resources and quality. The Bill will help us to manage and respond to severe weather events such as flood and drought which are set to become more frequent as a result of climate change.

iv. The draft Bill also ensures that those managing the risk of flood or coastal erosion will take account of other concerns such as sustainability, biodiversity and the whole water cycle.

v. In addition to consulting on the issues covered by the provisions in the draft Bill, which are contained in Sections 2 and 4 of this document, we are also consulting in Sections 3 and 5 on the detail of how to implement a number of other policies to be included in the resulting legislation to be introduced into Parliament.

vi. These include consulting on whether a case exists for wider reforms to the way in which flood and coastal risk activity is funded; reforms to Internal Drainage Boards; and the means for resolving neighbourhood disputes over flooding issues.

vii. Matters of interest to the Welsh Assembly Government are set out in Annex A, which details their policy position and invites comments on a number of policy proposals for Wales.

viii. In addition to the issues mentioned above, the UK Government and Welsh Assembly Government will each assess the recommendations of Martin Cave's Review of competition and innovation in water markets and Anna Walker's Review of charging and metering for household water and sewerage services. Where they believe it necessary to legislate to implement any changes as a result of these reviews they each intend to do so as part of this Bill. Defra will issue a consultation before the Summer Recess on the retail competition package. The UK Government and the Welsh Assembly Government will be consulting separately on the time limiting of abstraction licenses.

ix. The draft Bill has several aims but they can be grouped under the three themes of security, service and sustainability. The draft Bill will provide:

- greater **security** for people and their property from the risk of flooding and coastal erosion by creating clearer structures and responsibilities for managing that risk, building on the Government's response to Sir Michael Pitt's Review. It will improve leadership on flood risk, and enable better planning for and prediction and warning of floods. It will introduce a targeted approach to reservoir safety based on risk. It will deliver greater security of water supply in the event of water company failure, and improve the protection of essential supplies during drought;
- better **service** for people through new ways of delivering major infrastructure projects, better protection of essential water supplies during drought and improving complaints and enforcement procedures; and
- greater **sustainability** by helping people and their communities adapt to the increasing likelihood of severe weather events due to climate change, encouraging sustainable drainage systems in new developments, protecting communities and the environment better from the risk of flooding, and protecting water resources and improving water quality.

x. Publishing this draft Bill enables pre-legislative parliamentary scrutiny and public consultation. A full debate on the draft Bill and the other issues raised for consultation will help ensure the legislation is appropriate and can deliver the intended benefits as outlined in the summary Impact Assessment (see Part 4 of this document) which accompanies the draft Bill. The introduction of legislation to Parliament will depend on the availability of parliamentary time.

xi. Further information on how to respond to this consultation paper is provided in Section 6 of Part 1, which is followed at Annex B by a complete list of the questions asked. The closing date for responses is 24 July 2009. We cannot guarantee that responses made after this date will be taken into account.

xii. This document has four parts:

- **Part 1: The consultation paper –** this sets out the policy background and rationale for the proposals, summarises the provisions in the draft Bill and explains how they will be implemented;
- **Part 2: The draft Bill –** the proposed legislative provisions;
- **Part 3: The Explanatory Notes –** to help the reader in understand what the draft Bill does and how;
- **Part 4: The summary Impact Assessment –** a summary analysis of the costs and benefits of the proposals contained in the draft Bill and consultation paper. This brings together the results of a series of more detailed impact assessments for separate parts of the policy covered by this document which are available on the Defra website[1].

1 http://www.defra.gov.uk/environ/fcd/floodsandwaterbill.htm

Appendix 5

List of Witnesses

List of Witnesses who gave Oral Evidence to the Committee

Mr Mike Thompson Ms Katherine White	Committee on Climate Change

Mr James Dillon Mr Jim Kitchen	Sustainable Development Commission Northern Ireland
Mr Alex Hill Professor John Mitchell	Met Office
Ms Frances McCandless	Northern Ireland Council for Voluntary Action
Mr Keith Brown Mr Brendan Forde Mr Stephen Peover	Department of the Environment
Mr Mark Ennis Mr Nigel Smyth	Confederation of British Industry
Ms Lynsey Orr Mr Noel Williams	Energy Saving Trust
Mr Charles Anglin	British Wind Energy Association
Mr Gary Connolly Mr Michael Walsh	Irish Wind Energy Association
Mr Michael Doran Mr Liam Dornan Mr Tom McClelland Ms Nuala O'Neill	Royal Institution of Chartered Surveyors
Mr Herbert Bailie Mr Geoffrey Perrin Mr Philip Robinson	Institution of Highways and Transportation
Mr Gavin Rafferty Mr Brian Sore Mr David Worthington	Royal Town Planning Institute
Mr Sam Knox Mr Gary McFarlane Dr Brian Hanna	Chartered Institute of Environmental Health
Ms Karen Smyth Ms Eileen Campbell	Northern Ireland Local Government Association
Mr John Best Mr James Brown Mr Graham Furey Ms Aileen Lawson	Ulster Farmers' Union
Ms Patricia Mackey Ms Emer Murnaghan Mr Raymond Smyth	Northern Ireland Climate Change Partnership
Mr Colum Delaney Mr James Robinson	Royal Society for the Protection of Birds
Mr Glynn Roberts Mr Paul Stewart	Northern Ireland Independent Retail Trade Association
Mr John Hardy Mr Connaire McGreevy	CTS Projects
Mr Hans Schreuder	ILoveMyCarbonDioxide.com
Mr Neil Alldred Mr Declan Allison Mr Malachy Campbell Mr Seamus Óg Gallagher Ms Eithne McNulty	Climate Change Coalition Northern Ireland

Mr Peter Archdale	
Mr Malachy Campbell	Council for Nature Conservation and the Countryside
Mr Patrick Casement	
Mr Geoff Smyth	Carbon Trust Northern Ireland
Ms Bairbre de Brún	MEP Sinn Féin

Appendix 6

List of Abbreviations

List of Abbreviations

1. AFBI – AgriFood Biosciences Institute

2. ASSI – Areas of Special Scientific Interest

3. BWEA – British Wind Energy Association/Irish Wind Association

4. CBI – Confederation of British Industry

5. CCC – Committee on Climate Change

6. CCCNI – Climate Change Coalition Northern Ireland

7. CIEH – Charted Institute of Environmental Health

8. CNCC – Council for Nature Conservation and the Countryside

9. CVNI – Conservation Volunteers Northern Ireland

10. DARD – Department of Agricultural and Rural Development

11. DCAL – Department of Culture, Arts and Leisure

12. DECC – Department of Energy and Climate Change

13. DEFRA – Department for Environment, Food and Rural Affairs

14. DEL – Department for Employment and Learning

15. DETI – Department of Enterprise, Trade and Investment

16. DFP – Department of Finance and Personnel

17. DHSSPS – Department of Health, Social Services and Public Safety

18. DOE – Department of the Environment

19. DRD – Department of Regional Development

20. DSD – Department for Social Development

21. EAC – Environmental Audit Committee

22. ECCC – Energy and Climate Change Committee

23. EFRA – Environment, Food and Rural Affairs Committee

24. EPC – Energy Performance Certificate

25. EST – Energy Saving Trust

26. ETI – Enterprise, Trade and Investment Committee

27. FSB – Federation of Small Business

28. FOE – Friends of the Earth

29. GHG – Greenhouse gas

30. ICTU - Irish Congress of Trade Unions

31. IHT – Institute of Highways and Transportation

32. IOD – Institute of Directors

33. NIAO – Northern Ireland Audit Office

34. NICI – Northern Ireland Cycling Initiative

35. NICIP – Northern Ireland Climate Change Impacts Partnership

36. NICVA – Northern Ireland Council for Voluntary Action

37. NIE – Northern Ireland Electricity

38. NIEL – Northern Ireland Environment Link

39. NIRRTA – Northern Ireland Independent Retailers Association

40. NILGA – Northern Ireland Local Government Association

41. NT – National Trust

42. PAS – Publicly Audited Standard

43. PFG – Programme for Government

44. PPS – Planning Policy Statement

45. PSA – Public Service Agreement

46. QUB – Queen's University Belfast

47. RCCF – Rural Climate Change Forum

48. RICS – Royal Institute of Chartered Surveyors

49. RPA – Review of Public Administration

50. RSPB – Royal Society for the Protection of Birds

51. RTPI – Royal Town Planning Institute

52. SDC – Sustainable Development Commission

53. SDS – Sustainable Development Strategy

54. SMART – Specific, measurable, achievable, realistic and timebound

55. SMEs – Small and Medium Sized Enterprises

56. SNI – Sustainable Northern Ireland

57. UFU – Ulster Farmers Union

58. VAT – Value Added Tax

59. WWF – World Wide Fund for Nature