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Martin McTaggart

Renewable Energy Initiatives within the Public Sector

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The purpose of this paper is to provide an overview of initiatives taken within the public sector to implement forms of renewable energy, with a particular emphasis on measures taken by local authorities. This paper begins with an outline of the performance of renewable energy strategies within Nottingham City Council. Then this paper will provide an analysis of energy consumption within Northern Ireland's public sector estate. Subsequently, by using reports from the Department of Finance and Personnel (DFP), this paper will offer a brief summary of best-practice case studies of energy efficiency projects within public sector buildings, along with two renewable energy case studies. Finally, this paper will provide some international case studies of renewable energy initiatives within the public sector.

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Key Points

- On 25 June 2009, the European Union Directive (2009/28/EC) on the promotion of the use of energy from renewable sources took effect, with an objective to increase renewable energy share of total energy consumption to 20 per cent by the year 2020.
- The United Kingdom's national target, as set by the Directive, is to increase its share of energy consumption from renewable sources from 1.5 per cent in 2005 to 15 per cent by 2020.
- The recast of the EU's Energy Performance of Buildings Directive (EPBD) (2010/31/EU) was established to transform the building sector towards ambitious energy efficiency standards and increase renewable energy use.
- Between 2003 and 2007 Nottingham reduced domestic gas consumption by 16 per cent, which was the greatest fall of all Local Authorities within the East Midlands and of all the core cities, putting Nottingham in the top 8% of local authorities in the UK for domestic energy efficiency.
- The annual energy bill for Northern Ireland's public sector estate in 2011/12 reported a cost of £181 million representing an increase by 129.1 per cent from the 1999/2000.
- Department of Finance and Personnel estimates suggest that in 2010/11 buildings alone account for 80 per cent of energy used in Northern Ireland's public sector.
- The Public Sector Energy Campaign (PSEC) is a key component of the Department of Finance and Personnel's (DFP) efforts to conform to the Energy Efficiency (Northern Ireland) Order 1999, which requires the Department to take appropriate action for promoting Energy Efficiency within public bodies.
- In Germany, by 2020 the share of electricity supply contributed by renewable energy sources is targeted to be at least 35 per cent.
- By 2020, Malmö, Sweden, is expected to be climate neutral and have all municipal operations run on 100 per cent renewable energy, with goals for its public sector to serve as a role model and positive example to others.[1]
- By 2025, Copenhagen, Denmark, aims to be the first capital city in the world to become carbon neutral.

[1] International Renewable Energy Agency, City in Focus Malmö, Sweden, 1 Available at: http://www.malmo.se/download/18.31ab534713cd4aa9213d20b/1383649547546/ICLEI_Case+study+on+Malm%C3%B6+renewabke+energy+2012_7_Malmo.pdf

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Introduction

One key principle of increasing Renewable Energy (RE) uptake within the public sector is to save money by reducing expenditure on energy consumption. With rising energy prices, a tighter public purse, and a need to demonstrate leadership in carbon reduction, it is becoming ever more essential for public sector buildings to become "lean, clean energy users."[2] To this end, rapid growth of energy production from renewable sources and increased Energy Efficiency (EE), in particular of buildings which cause a large portion of total energy needs, is said to have a dampening effect on energy prices, reduces energy import dependency, and cuts emissions of climate-damaging carbon dioxide (CO_2).[3]

1 Renewable Energy and the European Union

In terms of RE, on 25 June 2009, the European Union (EU) Directive (2009/28/EC) on the promotion of the use of energy from renewable sources took effect. The goal of this directive is to set out a common framework for the proportion of RE, including "wind, solar, aerothermal, geothermal, hydrothermal, ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases."[4]

In particular, these provisions included an EU overall target to increase the RE share of total energy consumption from the 2005 level of 8.5 per cent to 20 per cent by the year 2020.[5] The directive included mandatory national targets for the overall share of energy from RE sources. The United Kingdom's target, as set by the 2009 Directive, is to increase its share of energy consumption from renewable sources from 1.5 per cent in 2005 to 15 per cent by 2020.[6]

The building sector has been identified as one of the key sectors in achieving overall EU energy 2020 targets. Beyond national targets, the EU aims to reduce greenhouse gas emissions in the building sector by between 88 and 91 per cent from 1990 levels by 2050.[7]

The recast of the EU's Energy Performance of Buildings Directive (EPBD) (2010/31/EU) was established to reach these targets and to transform the building sector towards ambitious EE standards and increase RE use. Article 9 of the EPBD

[2] Nottingham City Council, Energy Strategy 2010-2020, 27

[3] German Federal Ministry for the Environment, Climate Energy, Available: http://www.bmub.bund.de/en/topics/climate-energy/; Wengenmayr, R. Bührke, T. 2013., Renewable energy: sustainable concepts for the energy change, v

[4] EU Directive 2009/28/EC Available at: http://www.energy-community.org/pls/portal/docs/360177.PDF

[5] EU Renewable Energy Policy, Available at: http://www.euractiv.com/energy/eu-renewable-energy-policy/article-117536 ; EuroStat Data In Focus 'Renewable energy statistics 2005' Available at: http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-QA-07-019/EN/KS-QA-07-019-EN.PDF

[6] National Renewable Energy Action Plan for the United Kingdom, Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47871/25-nat-ren-energy-action-plan.pdf

[7] EU Low Carbon Road Map; Available at:http://www.cbss.org/wp-content/uploads/2012/12/EU-Low-Carbon-Road-Map-2050.pdf

obliges Member States to ensure that after 31 December 2018 all new buildings occupied and owned by public authorities are 'nearly zero-energy buildings' (NZEB), and all new buildings are to be nearly 'zero-energy' by 31 December 2020.[8] Equally, Member States shall:

> *"Draw up national plans for increasing the number of NZEB and following the leading example of the public sector, develop policies and take measures such as the setting of targets in order to stimulate the transformation of buildings that are refurbished into nearly zero-energy buildings."*[9]

The UK Department for Communities and Local Government's (DCLG) impact assessment noted that:

> *"In stating that that the energy required 'should' be covered to a very significant extent from renewables, the Commission are not imposing an obligation on Member States to ensure this happens. In this context, the word 'should' is an aspirational or permissive term which means that where possible and subject to economic and other considerations, developers are encouraged to use renewables as the main source of energy supply in new buildings. It does not mean that the main source of energy must come from renewables."*[10]

The UK national plan 'Increasing the Number of Nearly Zero-Energy Buildings' covers all four jurisdictions: England, Wales, Northern Ireland and Scotland. The plan submitted to the European Commission confirms the UK's legally binding commitment to greenhouse gas emission reduction targets of at least 34 per cent by 2020 and 80 per cent by 2050.[11]

In Northern Ireland, the governing legislation is the Building (Amendment) Regulations (Northern Ireland) 2014 and The Energy Performance of Buildings (Certificates and Inspections) (Amendment) Regulations (Northern Ireland) 2014. From this, the requirement to obtain and display a Display Energy Certificate (DEC) came into effect on 30 December 2008, which is to allow the public to see the energy efficiency of a building. DECs are required for buildings with a total useful floor area of more than 500m^2 occupied by a public authority or an institution providing a public service.[12]

[8] NZEB is defined in Article 2 of the recast EPBD as "a building that has a very high energy performance… The nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby".

[9] Concentrated Action Energy Performance of Buildings, Implementing the EPBD, pp47

[10] Department for Communities and Local Government Impact Assessment of Recast of the Energy Performance of Buildings Regulations Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/39379/Impact_Assessment.pdf

[11] Concentrated Action Energy Performance of Buildings, Implementing the EPBD, pp357

[12] DFP, Display Energy Certificate, Available at: http://www.dfpni.gov.uk/index/buildings-energy-efficiency-buildings/energy-performance-of-buildings/content_-_energy_performance_of_buildings-decs2.htm

Article 5 (4) of the EPBD requires the European Commission to publish a report on the progress of Member States in reaching cost-optimal levels of minimum energy performance requirements for buildings.

In this respect, the European Commission is currently carrying out a study in the area of the progress of Member States in meeting minimum energy performance requirements, which is expected in early 2015 and could lead to an uptake of the guidelines on a comparative methodology framework for calculating cost-optimal levels of minimum energy performances requirements for buildings and building elements.[13]

2 Nottingham City Council

Over the past forty years Nottingham City Council has demonstrated a persistent drive to meet national targets for low carbon transition and renewable energy. In 1975 the Nottingham District Heating Scheme was established as the largest and longest heat network in the UK.[14] This helped boost Nottingham's place as a leading energy efficient city within the UK and a strong competitor with other leading European low energy cities.

Between 2003 and 2007 Nottingham managed to reduce domestic gas consumption by 16 per cent, which was the largest fall within a local authority within the East Midlands.[15] This put Nottingham in the top 8% of local authorities in the UK for domestic energy efficiency.

In 2006 Nottingham City Council generated almost 3 per cent of its own non-transport energy consumption from renewables and waste, largely due to the 'Energy from Waste' plan incinerator at Eastcroft.[16] Moreover, Nottingham City Council generated 11.45 per cent of its own heat and power from CHP and renewables, which is set against a Sustainable Communities Strategy 20 per cent target for Local Authorities.[17] The UK's second most energy self-sufficient city, Coventry, by contrast generated only 0.74% of its own non-transport energy from renewables and waste in 2006.[18]

Nottingham City hosts 38.3MWe of installed gas Combined Heat and Power (CHP) capacity across 4 large and 6 small sites. This represents 51 per cent of the installed CHP capacity in the East Midlands.[19] In 2006 Nottingham City's gas CHP plants generated an estimated 191 GWh of power and 372 GWH of heat, amounting to 11.45 per cent of total energy consumption generated and 14.3 per cent of total electricity consumption generated within the City.[20]

[13] EU Issue Tracker, Energy Performance Requirements for Buildings: Commission Report Jan 2014
[14] Nottingham City Council, Energy Strategy 2010-2020, 10
[15] Nottingham City Council, Energy Strategy 2010-2020, 5
[16] Nottingham City Council, Energy Strategy 2010-2020, 5
[17] Nottingham City Council, Energy Strategy 2010-2020, 5
[18] Nottingham City Council, Energy Strategy 2010-2020, 9
[19] Nottingham City Council, Energy Strategy 2010-2020, 10
[20] Nottingham City Council, Energy Strategy 2010-2020, 10

In an effort to sustain this success and establish Nottingham as a 'future-proof' city, in April 2010 Nottingham City Council published its 'Energy Strategy 2010-2020' with an overarching programme relating to sustainable energy supply and use, towards the goal of:

> *"Cutting emissions, maintaining energy security, maximising economic opportunities and protecting the most vulnerable".*[21]

The intention behind this is to insulate the city against high energy prices by securing low carbon energy supply and services for the business, public and domestic sector.[22]

While acknowledging the challenge ahead for meeting national and local targets, the Energy Strategy 2010-2020 prioritises the delivery of:

- A 26% reduction of carbon dioxide emissions against 2005 levels;
- 20% of the City's own energy generated within the Greater Nottingham area is to be used from renewable or low/zero carbon sources by the target date of 2020.[23]
- Reduction in energy consumption within public sector infrastructure.
- Reduction of energy use in domestic properties and the eradication of fuel poverty by 2016.
- A cut in energy demand to provide a 26 per cent reduction in carbon emissions to 1,329k tones CO2 per annum by 2020.[24]

As mentioned above, a key priority of Nottingham City Council's Energy Strategy is the reduction of public sector local authority, domestic, industrial and commercial energy consumption. Wider targets have been set to reduce the carbon emissions from the entire Government's estate by 30 per cent by 2020.[25]

As will be discussed further in Section 4.1.5 below, many public services fall under the UK Government's mandatory Carbon Reduction Commitment Energy Efficiency Scheme (CRCEES). Nottingham City Council is a full participant in the CRCEES and ranked 138th out of 2,097 in the 2011/2012 CRC Performance League Table.[26] Of all participating City Councils, Manchester City Council ranked the highest of all local authorities at fourth, and by contrast Belfast City Council ranked 1,725th.[27]

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[21] Nottingham City Council, Energy Strategy 2010-2020, 5
[22] Nottingham City Council, Energy Strategy 2010-2020, 23
[23] Nottingham City Council, Energy Strategy 2010-2020, 5
[24] Nottingham City Council, Energy Strategy 2010-2020, 7
[S] Sustainable Operations in the Government Estate (SOGI) targets. Available at: http://sd.defra.gov.uk/progress/soge/
[26] CRC Environment Agency, CRC Performance League Table. Available at: http://crc.environment-agency.gov.uk/pplt/web/plt/public/2011-12/CRCPerformanceLeagueTable20112012
[27] NB.Information published in the Performance League Table (PLT) is based on information provided by participants. As a result no guarantee can be given that this information is accurate, complete or up to date. The PLT may be amended further to auditing, successful relevant appeals and verification requests.

Table 1 shows Nottingham City Council's Energy Strategy targets to reduce electricity consumption and gas consumption from the City Council's own estate as part of the City Council's internal Local Authority Carbon Management Plan (LACM). From Table 1 it can be seen that Nottingham City Council projects to have decreased electricity consumption by 37.5 per cent from the 2006 level of 45.48GWh to 28.40GWh in 2021. Nottingham City Council also intends to decrease gas consumption by 38.5 per cent from the 2006 level of 112.03GWh to 68.88GWh in 2021.

Table 1: Nottingham City Council's Electricity and Gas Consumption for 2006 and future targets

Year	Electricity Consumption (GWh)	Gas Consumption (GWh)
2006	45.48	112.03
2011	39.38	100.96
2016	31.56	76.54
2021	28.40	68.88

Source: Nottingham City Council (2010)

In March 2014, Nottingham City Council announced its plan to build the UK's largest solar canopy in order to develop its renewable energy and reduce carbon emissions to save money on energy consumption and raise an income from electricity Feed In Tariffs (FIT) and exporting energy to the national grid. The Council has already provided solar panels on 3,254 out of the 3,580 homes in Nottingham that have registered solar panels and built ten out of the 39 commercial solar panel arrays registered within the city. Plans have been approved for solar power canopies to be built at two of Nottingham's Park and Ride sites with an expected completion date of April 2015.

It is estimated that one of the Park and Ride sites, 'the Queen's Drive', alone will generate £121,000 a year for the Council, with £25,000 worth of electricity being exported to the national grid, £63,000 earned in FIT and £33,000 in energy savings.[28] In addition the second Park and Ride site at 'Colwick Racecourse' is estimated to provide an additional £95,000 annual income.[29]

At the Queen's Drive site there will be 4,000 solar panels installed with 3,000 to be mounted at the Colwick site, together expanding to 10,500 square metres. Nottingham City Council estimate that the Queen's Drive solar energy canopy alone will increase the amount of solar power produced on the City Council's own property by 400 per

[28] Nottingham City Council, Nottingham to Develop the UK's Largest Solar Canopy, Available at: http://m.nottinghamcity.gov.uk/article/27161/Nottingham-to-develop-UKs-largest-urban-solar-canopy

[29] Nottingham City Council, Nottingham to Develop the UK's Largest Solar Canopy, Available at: http://m.nottinghamcity.gov.uk/article/27161/Nottingham-to-develop-UKs-largest-urban-solar-canopy

cent, generating more than 1.0GWh of renewable energy and saving over 600 tonnes of carbon each year.[30]

Currently Nottingham boasts one of the largest electric bus fleets across Europe, with plans to increase the total number of electric buses to 50 by September 2015.[31] Up to 50 per cent of electric bus fuel requirements are to be provided through the solar array at the Queen's Drive Park and Ride site through electric charging points.[32]

Overall, according to Councillor Alan Clark, the City Council Portfolio Holder for Energy and Sustainability:

> *"Harvesting power from our urban energy farms means that we can gather a large amount of sustainable energy for the city. This not only boosts our reputation as being the UK's most sustainable and innovative energy city, it will provide locally sourced energy for local people."*[33]

3 Energy Consumption within Northern Ireland's Public Sector

This section will offer an overview of energy consumption within Northern Ireland's public sector estate.

Northern Ireland's public sector estate covers a wide range of building types including, for instance, office buildings, schools, hospitals, leisure centres, prisons and work depots.[34]

Since the 1999/2000 base year until 2010/2012, the size of the occupied floor area in the public sector estate had increased by 6.8 per cent to 8.17km^2.[35] A number of possible reasons are cited as explaining this increase, including enhanced data reporting and the inclusion for the first time of the Department of Justice.[36] In 2011/12 estate decreased to 8.1km^2, this was attributed to rationalisation.[37]

Although estimates suggest that the public sector accounts for just between 5 and 6 per cent of energy consumed in Northern Ireland, Table 2, on the following page, shows that the annual energy bill in 2011/12 reported a cost of £181 million representing an increase by 129.1% per cent from the base year.[38]

[30] Nottingham City Council, Nottingham to Develop the UK's Largest Solar Canopy, Available at: http://m.nottinghamcity.gov.uk/article/27161/Nottingham-to-develop-UKs-largest-urban-solar-canopy
[31] Jane Urquhart, Nottingham Councillor for planning and transportation, quoted in BBC News, Available at: http://www.bbc.co.uk/news/uk-england-nottinghamshire-26152557
[32] Nottingham City Council, Nottingham to Develop the UK's Largest Solar Canopy, Available at: http://m.nottinghamcity.gov.uk/article/27161/Nottingham-to-develop-UKs-largest-urban-solar-canopy
[33] Nottingham City Council, Nottingham to Develop the UK's Largest Solar Canopy, Available at: http://m.nottinghamcity.gov.uk/article/27161/Nottingham-to-develop-UKs-largest-urban-solar-canopy
[34] Department of Finance and Personnel, Public Sector Energy Campaign 2011-2012
[35] Department of Finance and Personnel, Public Sector Energy Campaign 2011-2012
[36] Department of Finance and Personnel, Public Sector Energy Campaign 2011-2012
[37] Department of Finance and Personnel, Public Sector Energy Campaign 2011-2012
[38] Department of Finance and Personnel, Public Sector Energy Campaign 2011-2012

Table 2: Northern Ireland Public Sector Total Energy Consumption and Costs (Buildings and Non-Buildings) 1999/00 – 2011/12

Year	Total Energy Consumed	% Change since 1999/00 Base Year	Total Cost	% Change Since 1999/00 Base Year
1999/00	2,308 GWh	-	£79m	-
2009/10	2,529 GWh	+9.6 %	£180m	+127.8%
2010/11	2,503 GWh	+8.5 %	£182m	+130.4%
2011/12	2,425 GWh	+5.1 %	£181m	+129.1%

Source: DFP, Public Sector Energy Campaign 2011-2012

Estimates suggest that buildings alone account for 80 per cent of energy used in Northern Ireland's public sector.[39] Table 3 shows that since the base year, the amount of energy used in public sector buildings has increased by 0.4 per cent.[40]

Despite improved EE and improved absolute carbon emissions between 2009/10 and 2011/12, the total energy cost in buildings increased by £7 million over the same period.[41] The cost of energy within buildings and non-buildings has, however, remained relatively constant over the same period at approximately £180m.[42]

Table 3: Northern Ireland Public Sector Total Energy Consumption and Costs (Buildings Only) 1999/00 – 2011/12

Year	Total Energy Consumed	% Change since 1999/00 Base Year	Total Cost (To Nearest £m)	% Change Since 1999/00 Base Year
1999/00	2,002 GWh	-	£61m	-
2009/10	2,113 GWh	+5.5%	£132m	+114.8%
2010/11	2,073 GWh	+3.5%	£136m	+119.4%
2011/12	2,7011 GWh	+0.4%	£139m	+127.9%

Source: DFP, Public Sector Energy Campaign 2010-2011

Table 4, on the following page, shows that although there was a notable increase in total energy consumption between the base year and 2011/12, there was also a marked decrease over a shorter period of time between 2009/10 and 2011/12.[43] It is notable that oil consumption has decreased in each year, while the uptake of biomass

[39] Department of Finance and Personnel, Public Sector Energy Campaign 2010-2011, 8
[40] Department of Finance and Personnel, Public Sector Energy Campaign 2011-2012
[41] Department of Finance and Personnel, Public Sector Energy Campaign 2010-2011,13
[42] Department of Finance and Personnel, Public Sector Energy Campaign 2011-2012
[43] Department of Finance and Personnel, Public Sector Energy Campaign 2011-2012

and renewables has increased over the same period. However, the combined contribution of renewables and biomass represents less than 1.5 per cent of total energy used according to the latest figures.

Table 4: Total Energy Consumption by Fuel Type (MWH) (Including Buildings Use and Non-Building Use)

Fuel Type	1999/00	2009/10	2010/11	2011/12
Electricity	782,374	1,013,708	1,025,092	1,015,697
Oil	906,190	511,567	466,563	399,170
HFO	202,871	70,386	45,931	45,931
Gas	331,254	816,489	840,043	848,512
LPG	26,639	26,939	18,858	12,721
Coal	59,101	72,304	72,963	72,962
Biomass	0	10,405	10,487	11,089
Renewables	0	7,335	22,771	18,499
Totals	2,308,428	2,529,133	2,502,708	2,424,581

Source: DFP, Public Sector Energy Campaign 2010-2011

In terms of Departmental and public body energy expenditure, Table 5 on the following page shows that the highest total cost in 2011/12 was borne by the Department of Health Social Services and Public Safety, with £45,720,701 including the Northern Ireland Fire and Rescue Service and Health estates, which represents a decrease from 2009/10 of £514,610. The Department or Public Body with the second highest energy expenditure in 2010/11 was the Department of Education with £34,722,707 spent on schools, which is a decrease of £854,347 from 2009/10.

Table 5: Total Costs by Department/Public Body (£) (Including Non-Building Use)

	(£) 2009/10	(£) 2010/11	(£) 2011/12
Councils	14,813,049	15,235,221	18,273,932
DARD	1,218,235	1,506,337	1,474,015
DE – Schools	35,577,054	37,193,409	34,722,707
DE Core	301,479	233,419	293,004
DEL – FE/HE	13,071,175	13,644,237	15,308,309
DEL Core	335,981	184,194	218,784
DETI	315,269	268,144	290,883
DFP	1,115,043	1,094,040	1,237,116
DHSSPS – NIFRS & Health Estates	46,235,311	45,720,747	45,720,701
DHSSPS Core	271,360	270,783	316,797
DOE	1,085,682	1,259,742	1,142,103
DOJ**	-	2,974,310	3,344,827
DRD	1,456,122	1,313,779	1,255,933
DRD Street Lights	9,117,777	11,183,187	11,357,863
DSD	2,044,065	2,319,759	2,442,024
Major NDPBs	4,398,760	4,829,363	5,474,824
NI Assembly	294,721	341,483	260,140
NI Prison Service **	3,101,705	-	-
NIO**	274,751	263,888	263,887
OFMDFM	51,010	70,377	56,679
PSNI	6,861,950	7,715,971	7,533,454
Water Process	37,644,010	34,772,979	30,277,727
Total	179,584,495	182,395,367	181,265,728

Source: DFP, Public Sector Energy Campaign 2010-2011

4 The Public Sector Energy Campaign

The Public Sector Energy Campaign (PSEC) is a key component of the Department of Finance and Personnel's (DFP) efforts to conform to the Energy Efficiency (Northern Ireland) Order 1999, which requires the Department to take appropriate action for promoting EE within public bodies.

This campaign is set within the context of the Northern Ireland Executive's Sustainable Development Strategy 'Everyone's Involved'.[44] This plan contained a target to reduce greenhouse gas emissions by at least 25 per cent on 1990 levels by 2025.[45]

The primary objective of the PSEC is to:

> *"Improve energy efficiency and reduce carbon emissions across the public sector in Northern Ireland through the analysis and publication of energy consumption and expenditure data."*[46]

According to the Minister for Finance and Personnel, Simon Hamilton, the PSEC has two main strands. Firstly, it collates, analyses and presents data on the energy use and performance of buildings occupied by the Northern Ireland Departments, and the Northern Ireland Office, including their associated bodies, agencies, boards, executives and trusts; encompassing both health and education estates as well as district councils and relevant Non-Departmental Public Bodies (NDPBs).[47]

The second PSEC strand was the Central Energy Efficiency Fund (CEEF) which was established in 1993 to provide financial assistance for energy and carbon dioxide saving measures, which could not be financed through Departmental budgets.[48] While this fund initially offered support for Northern Ireland Departments it was later extended to the wider public sector estate. During its lifetime the CEEF supported 2,598 projects.[49]

4.1 DFP's Good Practice Case Studies

This section outlines a selection of good practice case studies on a range of energy efficiency projects funded by the CEEF. The projects, which received 100 per cent funding from the CEEF, included the:

- Installation of decentralised natural gas condensing boilers at Lagan Valley Hospital.
- Swimming pool energy conservation projects at Methodist College Belfast.

[44] Northern Ireland Executive (2010), 'Everyone's Involved: Sustainable Development Strategy, Available: http://www.ofmdfmni.gov.uk/sustainable-development-strategy-lowres__2_.pdf
[45] Department of Finance and Personnel, Public Sector Energy Campaign 2010-2011, 3
[46] http://www.dfpni.gov.uk/index/buildings-energy-efficiency-buildings/public-sector-energy-campaign.htm
[47] http://www.niassembly.gov.uk/Assembly-Business/Official-Report/Reports-13-14/10-March-2014/#AQO%205730/11-15
[48] http://www.dfpni.gov.uk/index/buildings-energy-efficiency-buildings/public-sector-energy-campaign.htm
[49] http://www.niassembly.gov.uk/Assembly-Business/Official-Report/Reports-13-14/10-March-2014/#AQO%205730/11-15

- Automatic lighting controls at the University of Ulster, Jordanstown Campus.
- Building Management System (BMS) linked heating controls and gas conversion at the University of Ulster, Belfast Campus.
- Conversion of major boiler houses to natural has at Queen's University Belfast.
- Combined Heat and Power (CHP) installation at Queen's University Belfast Physical Education Centre.
- Installation of swimming pool covers at Queen's University Belfast Physical Education Centre.
- CHP installation at Hydebank Young Offenders Centre.
- Heat recovery at Cascades Leisure Centre, Craigavon.
- Installation of Liquefied Petroleum Gas (LPG) heating in mobile classrooms for the Southern Education Library Board.
- Replacement of mechanical steam traps with GEM traps at Antrim Area Hospital.
- CHP installation at Ards Leisure Centre.

What follows is an overview of four examples of successful public sector energy efficiency case studies. It should be noted that these initiatives involve the implementation of EE rather than RE. Nonetheless, these case studies offer a valuable insight into the process of implementing energy and carbon dioxide saving measures.

4.1.1 Case Study: Conversion of Major Boiler Houses to Natural Gas at Queen's University Belfast

In April 1999 five main boiler houses on the Queen's University Belfast were converted from heavy fuel oil (HFO) or gas oil to natural gas. Three primary drivers for converting to natural gas include:

- The lower cost of natural gas compared to other fuels;
- The lower environmental impact of natural gas incorporating improved controllability, a reduction in sulphur dioxide and reduced maintenance costs; and
- Increased efficiency benefits compared to HFO systems from the elimination of HFO storage tank heating, higher combustion efficiency and the ability to install condensing boiler systems.[50]

[50] Department of Finance and Personnel , Good Practice Case Studies, Case Study 5, Available at: http://www.dfpni.gov.uk/good_practice_case_study_no.5.pdf

As a result of converting five boiler houses this project extended to 22 buildings at Queen's University Belfast, consisting of science and engineering buildings, one student accommodation building and one sports centre. As a result of this project, gas oil is now considered an alternative fuel by the University, which allows the University to choose the most cost effective fuel.[51]

While it was not possible to quantify the immediate benefits of this project, the forecasted benefits included a potential annual cost savings of over £45,000, along with potential carbon dioxide savings of over 2,300 tonnes per annum over an estimated payback period of about two years. This project received 100 per cent funding from the CEEF with the cost of alterations to the initial specification to allow the installation of dual fuel Ecoflame burners were borne by Queen's University.[52]

4.1.2 Case Study: CHP Installation at Queen's University Belfast Physical Education Centre

In April 2002 a gas fired Combined Heat and Power (CHP) unit was installed in the boiler plant room in order to provide the base load heat requirement for the University's Physical Education Centre (PEC). CHP is said to achieve energy efficiencies of 60 to 80 per cent or more and cost savings compared to conventional forms of electricity generation and heat only boilers.[53] In this project the operating strategy of the heating system for the two PEC swimming pools was altered in order to permit the unit to operate without a heat rejection radiator, which reduced the capital cost by approximately 10 per cent.[54]

This project received 100 per cent funding from the CEEF and became operational six months ahead of schedule. The benefits resulting from the CHP installation include annual cost savings of over £34,200 and carbon dioxide savings of over 188 tonnes per annum over a payback period of approximately 4.4 years.[55]

4.1.3 Case Study: Heat Recovery at Cascades Leisure Centre, Craigavon

In April 1999 an extract air heat recovery system was installed in the Cascades Leisure Centre in Craigavon. This system comprised inverter control of the supply and extract fans, variable diffusers for supply air, air-to-air plate heat exchangers, variable recirculation dampers, and modulating control of heater batteries. The logic behind

[51] Department of Finance and Personnel , Good Practice Case Studies, Case Study 5, Available at: http://www.dfpni.gov.uk/good_practice_case_study_no.5.pdf

[52] Department of Finance and Personnel , Good Practice Case Studies, Case Study 5, Available at: http://www.dfpni.gov.uk/good_practice_case_study_no.5.pdf

[53] Department of Finance and Personnel , Good Practice Case Studies, Case Study 6, Available at: http://www.dfpni.gov.uk/good_practice_case_study_no.6.pdf

[54] Department of Finance and Personnel , Good Practice Case Studies, Case Study 6, Available at: http://www.dfpni.gov.uk/good_practice_case_study_no.6.pdf

[55] Department of Finance and Personnel , Good Practice Case Studies, Case Study 6, Available at: http://www.dfpni.gov.uk/good_practice_case_study_no.6.pdf

installing a heat recovery system at a leisure centre is to the prospect of saving up to 30 per cent of the energy required or approximately 10 per cent of the total energy bill.[56]

This project received 100 per cent funding from the CEEF and yielded an annual cost savings benefit of £40,570 (or 44 per cent) and carbon dioxide savings of over 538 tonnes per annum over a payback period of approximately 5.1 years.[57] However, immediately after the installation difficulties were encountered regarding excess humidity caused by low air temperature set points. While this issue was resolved due to fine tuning of the control strategy, daily maintenance is required.[58]

4.1.4 Case Study: Installation of LPG heating in Mobile Classrooms for the Southern Education Library Board

While many schools use temporary buildings or mobile classrooms, either as full-time class rooms or for specialised activities, such classrooms are generally poor energy performers and can potentially sustain high energy costs if used on a long term basis.[59]

In March 2002 the South Education and Library Board replaced direct electric convector heaters with individual Liquefied Petroleum Gas (LPG) fired boilers and low pressure hot water (LPHW) heating systems within 96 temporary classrooms across 10 schools. The reasoning behind this project was to address the high running costs of electric heaters, as electricity is one of the most expensive forms of energy.[60]

This project received 100 per cent funding from the CEEF and was considered very successful, including annual cost savings of £45,900 (or 71 per cent) and carbon dioxide savings of over 326 tonnes per annum over a payback period of approximately 3.6 years.[61]

4.1.5 Summary

As of the end of March 2011 the CEEF was withdrawn. The DFP Minister cited two reasons for this withdrawal. Firstly, public bodies were investing via their departmental budgets and using the benefits that accrue over time or via 'invest-to-save' opportunities. Secondly, other initiatives exist which provide similar incentives to

[56] Department of Finance and Personnel , Good Practice Case Studies, Case Study 9, Available at: http://www.dfpni.gov.uk/good_practice_case_study_no.9.pdf
[57] Department of Finance and Personnel , Good Practice Case Studies, Case Study 9, Available at: http://www.dfpni.gov.uk/good_practice_case_study_no.9.pdf
[58] Department of Finance and Personnel , Good Practice Case Studies, Case Study 9, Available at: http://www.dfpni.gov.uk/good_practice_case_study_no.9.pdf
[59] Department of Finance and Personnel , Good Practice Case Studies, Case Study 10, Available at: http://www.dfpni.gov.uk/good_practice_case_study_no.10.pdf
[60] Department of Finance and Personnel , Good Practice Case Studies, Case Study 10, Available at: http://www.dfpni.gov.uk/good_practice_case_study_no.10.pdf
[61] Department of Finance and Personnel , Good Practice Case Studies, Case Study 10, Available at: http://www.dfpni.gov.uk/good_practice_case_study_no.10.pdf

promote energy efficiency, in particular Carbon Reduction Commitment Energy Efficiency Scheme (CRCEES).[62]

The CRCEES (formerly known as the Carbon Reduction Commitment) is the UK's mandatory climate change and energy saving scheme. It is central to the UK's strategy for improving energy efficiency and reducing carbon dioxide emissions, as set out in the Climate Change Act 2008. It was designed in order to raise awareness in large organisations and encourage changes in behaviour and infrastructure, covering large public and private sector organisations.[63]

The DFP Minister also noted that regulation 5 of the Energy Efficiency (Eligible Buildings) Regulations 2013 – coming into force in January 2014 – requires public sector bodies to have an energy efficiency plan in place. As a result, instead of having a fund which Departments or public sector bodies can draw from, this duty is mainstreamed upon Departments to have energy efficiency plans and to invest their resources in initiatives that will release energy efficiency benefits.[64]

5 Renewable Energy Initiatives within Northern Ireland's Public Sector

This section will outline two case studies of renewable energy initiatives take to date within Northern Ireland's public sector.

5.1 Cookstown Leisure Centre Willow Biomass Energy Project

This project was one of the first taken by a District Council in Northern Ireland to examine the possibility of switching from a traditional oil boiler to heating a large public building with willow biomass fuel.[65] In December 2007 Cookstown District Council worked with many partners to complete the installation of the 500kW boiler and the planting of Short Rotation Coppice (SRC) willow to use as a fuel.[66]

The biomass boiler currently provides the base load of heat into Cookstown Leisure Centre and uses about 2,000kg of willow chips daily, which are grown locally be a consortium of famers, Northern Bio-Energy Ltd.[67] It provides heat to the main pool, the

[62] http://www.niassembly.gov.uk/Assembly-Business/Official-Report/Reports-13-14/10-March-2014/#AQO%205730/11-15
[63] For more information see: https://www.gov.uk/government/policies/reducing-demand-for-energy-from-industry-businesses-and-the-public-sector--2/supporting-pages/crc-energy-efficiency-scheme
[64] http://www.niassembly.gov.uk/Assembly-Business/Official-Report/Reports-13-14/10-March-2014/#AQO%205730/11-15
[65] RASLES, Cookstown Leisure Centre – Willow Biomass Energy Project, Available at: http://www.raslres.eu/2010/03/cookstown-leisure-centre-willow-biomass-energy-project/
[66] [66] Dr. Geoff Sellers, Report on the Biomass for Energy Study Tour to Northern Ireland. Available at: http://www.agronomy.uhi.ac.uk/Final%20report.pdf
[67] Friends of the Earth, Energy from biomass: Straw Man or Future Fuel? Available at: file:///C:/Users/mctaggartm/Downloads/energy_biomass.pdf

learner pool, air handling units within the pool and the main sports hall, radiators and domestic hot water.[68]

Monitoring of the boiler demonstrated that, over a two year period, over 250,000 litres of oil had been saved, which is the equivalent of a reduction in carbon dioxide emissions of 670 tonnes and financial savings of £32,000 (including the cost of willow).[69]

5.2 Camphill Community, Clanabogan, Omagh Renewables Project

The Omagh Environment and Energy Consortium (OEEC) was established 2002 in an association of representatives from the Ulster Farmers Union, the Northern Ireland Agricultural Producers' Association, the Camphill Communities, Omagh District Council, the Department of Agriculture and Rural Development and the Omagh College of Further Education.[70]

In September 2004, The OEEC decided to develop a land based renewable energy project on the Camphill site. The OEEC raised almost £200,000 funded by Omagh Local Strategy Partnership to launch this project.[71] Mr Bruce Robinson, then Permanent Secretary at the Department of Enterprise Trade and Investment stated that:

> *"The Camphill Community at Clanabogan with its Environmental projects is a flagship venture for Northern Ireland".*[72]

This facility offers a range of key renewable energy technologies developed and installed on side, including:

- **A 20 kW wind turbine for electricity generation**, which is grid connected and supplies electricity for residential facilities and workshops on site. The output of the turbine is in the region of 50,000 units of electricity per year.
- **A biomass fuelled district heating system,** which primarily uses wood chip from the Camphill site however it can also burn wood pellets and grain, supplied locally. The boiler provides heat for roughly two thirds of the site. The annual running costs for the boiler are between £4,000 and £5,000, however the equivalent costs of fossil fuels is estimated to have been between £18,000 and £25,000 per year, thereby saving approximately £15,000 annually. This project

[68] Dr. Geoff Sellers, Report on the Biomass for Energy Study Tour to Northern Ireland. Available at: http://www.agronomy.uhi.ac.uk/Final%20report.pdf
[69] Friends of the Earth, Energy from biomass: Straw Man or Future Fuel? Available at: file:///C:/Users/mctaggartm/Downloads/energy_biomass.pdf
[70] Action Renewables, Renewable Energy at Camphill Community, Omagh
[71] http://www.camphillclanabogan.com/index.php?Environment-Sustainable-Energy-Project-58
[72] http://www.camphillclanabogan.com/index.php?Environment-Biomass-District-Heating-130

received grant assistance through the Department of Economic Development (DED) 'Energy Demonstration Scheme'.[73]

- **Solar collector panels**, which were mounted to provide approximately 50 per cent of the annual hot water needs.
- **A 2kW photovoltaic array for electricity generation,** which is grid connected and replaces electricity from the grid.[74]

5.2.1 Lessons Learnt

Strong representation and input from the collaboration of local business, employers and policy makers were seen as key to providing a platform of expertise on which to build this collaborative project.[75]

6 International Examples of Public Sector Renewable Energy

This section aims to outline number international good practice renewable energy initiatives, with a focus on the public sector.

6.1 Germany

In Germany the expansion of RE sources has made solid progress in recent years, and further advances were made in 2012, with a share of 12.7 per cent of total final energy consumption and 23.5 per cent of total electricity consumption. As a result, renewable energy sources have become an important and reliable pillar of the '*Energiewende*'[76] transformation of energy supply in Germany.[77]

By 2020 the share of electricity supply contributed by renewable energy sources is targeted to be at least 35 per cent. The primary foundation for this is the revision of the Renewable Energy Sources Act (EEG) in 01 January 2012, which is designed to ensure a continuing steady rise in the generation of electricity from renewable energy sources.

In June 2011, the German government confirmed an extensive reorientation of its energy policy and to undertake a phase out of nuclear energy to move into the age of renewable energy.[78] Key objectives in this development include:

[73] http://www.camphillclanabogan.com/index.php?Environment-Biomass-District-Heating-130
[74] Action Renewables, Renewable Energy at Camphill Community, Omagh
[75] http://www.camphillclanabogan.com/index.php?Environment-Sustainable-Energy-Project-58
[76] Energiewende = German for Energy Transition by Germany to a sustainable economy by means of renewable energy, energy efficiency and sustainable development.
[77] Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), National and International Development Renewable Energy Sources in Figures, Available at: http://www.erneuerbare-energien.de/en/unser-service/mediathek/downloads/detailview/artikel/renewable-energy-sources-in-figures-1/
[78] Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), National and International Development Renewable Energy Sources in Figures, Available at: http://www.erneuerbare-energien.de/en/unser-service/mediathek/downloads/detailview/artikel/renewable-energy-sources-in-figures-1/

- Cease usage of nuclear power by the end of 2022.
- Dynamic expansion of renewable energy sources.
- Rapid expansion and modernisation of electricity grids.
- Improvements in energy efficiency with the aid of modern technologies, especially in the fields of buildings, mobility and electricity consumption.

RE use has increased quickly in Germany in the past years. In the year 2011, 20 per cent of the power from German grids came from renewable energy sources, which is nearly seven times as much as in 1990.[79] This achievement has been accredited to successful development of wind energy, with an overall energy input of 46.5 terawatt-hours (TWh) in 2011 and contributions from bioenergy sources, which produced around 37TWh in electricity power during 2011 and photovoltaic power generation, contributing 3 per cent of overall power production at 19TWh.[80]

In 2012 renewable energy sources achieved:[81]

- 12.7 per cent of total final energy consumption – electricity, heat and motor fuels (2011: 11.6 [per cent).
- 23.5 per cent of gross electricity consumption (2011: 20.4 per cent).
- 10.2 per cent of final heat energy consumption (2011: 9.9 per cent).
- 5.7 per cent of motor fuel consumption (2011: 5.5 per cent).
- Greenhouse gas emissions avoided came to 145 million tonnes CO2 equivalent (2011: 128 million tonnes), including 82 million tonnes saved by electricity remunerated under the EEG
- Investments triggered totalled €19.5 billion (2011: €23.2 billion).
- 377,800 people employed in the renewable energies sector (2011: 381,600).

6.1.1 Upper Palatinate Region, Germany

In the Upper Palatinate Region of Bavaria a number of RE initiatives have emerged across different district authorities. One recent example includes the district government of Regensburg, which aims to fulfil the NZEB requirement of the EU Directive 2010/31/EC, by constructing a new low carbon secondary school building in

[79] Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), Renewable Energies Driving Germany's Energiewende, October 2012 , 12-13; Available at: http://www.bmub.bund.de/fileadmin/Daten_BMU/Pools/Broschueren/Motor_der_Energiewende_eng_bf.pdf

[80] Wengenmayr, R. Bührke, T. 2013., Renewable energy: sustainable concepts for the energy change, 6

[81] Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), National and International Development Renewable Energy Sources in Figures, Available at: http://www.erneuerbare-energien.de/en/unser-service/mediathek/downloads/detailview/artikel/renewable-energy-sources-in-figures-1/

Lappersdorf.[82]This project combines the integration of an innovative heating and cooling system (using geothermal energy and heat pumps) in combination with modern architecture for buildings planned to achieve carbon neutrality, including photovoltaic (PV) installation for electricity supply and floor heating with single-room temperature control.

The total cost of the construction of the building was estimated to be between €15 – 16 million and was financially supported by the Bavarian State Government. The primary energy savings and RE production included:[83]

• Geothermal heat generation ca. 10.3 toe/year.

• Heat recovery / air conditioning: ca. 12.9 toe/year.

• Electricity generation from PV ca. 10.7 toe/year.

6.1.2 Lessons Learnt

According to a 'Regions 202020' report, key factors for achieving this project involved:

> *"The early integration of energetical planning into architectural planning and design process" and the "early participation of political and administrative stakeholders".*[84]

Additionally, this project demonstrated that the technology for NZEB is already on the market and market" therefore "this type of building project should be replicable anywhere in Europe".[85]

6.2 Malmö, Sweden

Often initiatives taken at local authority level can play a significant role in supporting the achievement of national targets. To this end, local governments can develop and set targets, whether through comprehensive city strategies, sector-specific targets or integration of municipal campaigns. Yet, Malmö - a municipality of 280,000 inhabitants located in Southern Sweden - represents a case in which a city has set targets which are significantly higher than the European Union's target for Sweden (49 per cent by 2020) and national set targets (50 per cent by 2020). By 2020, Malmö is expected to be

[82] Regions 202020, Energy-efficient secondary school Lappersdorf, Available at: http://regions202020.eu/cms/assets/Uploads/Resources/130123-ENNEREG-Good-Practice-ZREU-Buildings-Energy-efficient-school-Lappersdorf.pdf

[83] Regions 202020, Energy-efficient secondary school Lappersdorf, Available at: http://regions202020.eu/cms/assets/Uploads/Resources/130123-ENNEREG-Good-Practice-ZREU-Buildings-Energy-efficient-school-Lappersdorf.pdf

[84] Regions 202020, Energy-efficient secondary school Lappersdorf, Available at: http://regions202020.eu/cms/assets/Uploads/Resources/130123-ENNEREG-Good-Practice-ZREU-Buildings-Energy-efficient-school-Lappersdorf.pdf

[85] Regions 202020, Energy-efficient secondary school Lappersdorf, Available at: http://regions202020.eu/cms/assets/Uploads/Resources/130123-ENNEREG-Good-Practice-ZREU-Buildings-Energy-efficient-school-Lappersdorf.pdf

climate neutral and have all municipal operations run on 100 per cent renewable energy, with goals for its public sector to serve as a role model and positive example to others.[86]

In order to reach this target, over the last few decades Malmö has drawn from the benefit of committed local politicians, private investment in renewable energy, strong co-operation with regional stakeholders and a deep knowledge of locally available renewable energy sources.[87]

Malmö's 'Environmental Building Programme' is a dialogue-based process designed to exceed national targets of energy performance of new buildings and public owned development areas.

In 2009, the 'Environmental Programme for the City of Malmö 2009-2020 was adopted, stating a variety of environmental goals including:[88]

- **More efficient energy consumption.** By 2020, in Malmö energy consumption will be decreased by at least 20 per cent per person compared 2001-2005 levels. By 2030, this is to drop a further 20 per cent.
- **Increased renewable energy.** Solar wind, water and biogas will be phased in and fossil fuels phased out, as the proportion of renewable energy is to reach 100 per cent by 2020.
- **Reduction of emissions.** Greenhouse gas emissions will be decreased by at least 40 per cent from the baseline level in 1990.
- **Transition in transport.** Incorporating the significant development of rail traffic and other electricity (green electricity) driven public transport, as well as an extended network of cycle lanes.

Over the past twenty years, Malmö has undertaken a series of RE projects including:

- The re-development of the inner city's disused brown fields and industrial spaces with energy efficient buildings,
- The transformation of the Western Harbour (Västra Hamnen), which now operates on 100 per cent local renewable energy in which buildings receive energy from solar, wind and a heat pump that extracts heat from an aquifer, facilitating seasonal storage of heat and cold water in a limestone strata

[86] International Renewable Energy Agency, City in Focus Malmö, Sweden, 1 Available at: http://www.malmo.se/download/18.31ab534713cd4aa9213d20b/1383649547546/ICLEI_Case+study+on+Malm%C3%B6+renewabke+energy+2012_7_Malmo.pdf

[87] International Renewable Energy Agency, City in Focus Malmö, Sweden, 1 Available at: http://www.malmo.se/download/18.31ab534713cd4aa9213d20b/1383649547546/ICLEI_Case+study+on+Malm%C3%B6+renewabke+energy+2012_7_Malmo.pdf

[88] International Renewable Energy Agency, City in Focus Malmö, Sweden, 1 Available at: http://www.malmo.se/download/18.31ab534713cd4aa9213d20b/1383649547546/ICLEI_Case+study+on+Malm%C3%B6+renewabke+energy+2012_7_Malmo.pdf

underground. The Western Harbour is an ongoing project and the area will not be fully developed until at least 2030.

- Augustenborg, an industrial area which now has 450m^2 solar thermal panels connected to its central heating system. In terms of eco-building, in Augustenborg a new school was constructed with natural materials, adopting high-level of natural lighting, ground source heat pumps, solar thermal panels and composting toilets. The Augustenborg project has been described as "astonishing; energy consumption has decrease, basement flooding has been preventing and perhaps most important of all, the inhabitants are once again proud of living in the Augustenborg area.[89]
- Solar panels have been installed in school buildings and in 2007 at Sege Park, Malmö launched the largest photovoltaic plant in Sweden, withal a total area of 1,250m^2 and a maximum effect of 166Kw.[90]

6.2.1 Lessons Learnt

According to the International Renewable Energy Agency (IRENA) a number of lessons can be learnt from the Malmö experience. In particular the IRENA noted the significance of engagement of local politicians in providing strong leadership from within the municipality by taking action and setting targets which exceeded national levels.[91] Likewise, the involvement of local and regional stakeholders in renewable energy targets and cited as necessary for encouraging ownership of the action plan and linking in regional government and other municipalities to strengthen approaches to ensure a consistent and interconnect strategy.[92] Equally it was deemed vital that local energy utility providers be brought on board to identify and support targets.[93]

6.3 Denmark

6.3.1 The Triangle Region, Denmark

The Triangle Region is organised as an association of six Danish municipalities, including Billund, Fredericia, Kolding, Middelfart, Vejen and Vejle. The Triangle region has initiated a coordinated approach to RE initiatives to reduce energy consumption.

[89] Climate Action, Malmö – From Industrial Waste Land to Sustainable City, Available at: http://www.climateactionprogramme.org/climate-leader-papers/ilmar_reepalu_mayor_city_of_malmoe_sweden/

[90] Solar Region, Solar City Malmö - Solar Region Skåne, Available at: www.solarregion.se/files/solarcitymalmoeng080410light.pd

[91] International Renewable Energy Agency, City in Focus Malmö, Sweden, 6 Available at: http://www.malmo.se/download/18.31ab534713cd4aa9213d20b/1383649547546/ICLEI_Case+study+on+Malm%C3%B6+renewabke+energy+2012_7_Malmo.pdf

[92] International Renewable Energy Agency, City in Focus Malmö, Sweden, 6 Available at: http://www.malmo.se/download/18.31ab534713cd4aa9213d20b/1383649547546/ICLEI_Case+study+on+Malm%C3%B6+renewabke+energy+2012_7_Malmo.pdf

[93] International Renewable Energy Agency, City in Focus Malmö, Sweden, 6 Available at: http://www.malmo.se/download/18.31ab534713cd4aa9213d20b/1383649547546/ICLEI_Case+study+on+Malm%C3%B6+renewabke+energy+2012_7_Malmo.pdf

The municipality of Middelfart used the Energy Supply Company (ESCO) model to make energy savings in approximately 100 public buildings. Public sector energy efficiency measures are often financed either from within existing budgets or by seeking additional finance. Other arrangements such as performance contracting and public-private partnership can be pursued as financing measures. The ESCO model is a concept where, through a third party, renovation and modernization tasks are achieved without financial risk for the municipality.[94] This project required an investment, which was estimated to be €6 million with primary energy savings having shown more than 24 per cent.[95]

The Triangle Region also launched an ESCP project on 33 sports centres within the region with a focus on energy renovation and integration of renewables from photovoltaic installation. The expected cost of the project was approximately €5 million with anticipated energy savings of between 5 and 25 per cent.[96]

6.3.2 Copenhagen

By 2025, Copenhagen aims to be the first capital city in the world to become carbon neutral. In order to reach this goal, the city council adopted a comprehensive carbon reduction plan, 'the CPH Climate Plan 2025', which seeks to develop extensive retrofitting of buildings, reorganisation of the energy supply and change in transport habits.[97]

The CPH Climate Plan 2025 is focused on reducing building emissions, which are responsible for 75 per cent of the city's $C0_2$ emissions.[98] In response to the reality that many of Copenhagen's buildings were built within the 1960s and 1970s and do not conform to energy efficiency standards, the CPH targets both new and existing public and private buildings.

The City of Copenhagen has already commenced a number of initiatives to reduce energy consumption within existing building mass as well as new build. The CPH set a target to reduce energy consumption within city administration buildings by 40 per cent compared to 2010, which will be in part achieved by the installation of 60,000 m^2 solar cell panels on existing and new municipal buildings.[99] In addition, all city administration vehicles are to be run on electricity, hydrogen or biofuels. Thus energy conservation is a requirement for municipal buildings (representing about five per cent of total floor

[94] Regions 202020, Good Practice ESCO http://regions202020.eu/cms/assets/Uploads/Resources/111116GoodpracticeESCO.pdf
[95] Regions 202020, Good Practice ESCO http://regions202020.eu/cms/assets/Uploads/Resources/111116GoodpracticeESCO.pdf
[96] Regions 202020, Good Practice ESCO http://regions202020.eu/cms/assets/Uploads/Resources/111116GoodpracticeESCO.pdf
[97] City of Copenhagen, CPH 2025, Climate Plan, Available at: http://kk.sites.itera.dk/apps/kk_pub2/pdf/983_jkP0ekKMyD.pdf
[98] City Climate Leadership Awards, Copenhagen: CPH Climate Plan 2025, Available at: http://cityclimateleadershipawards.com/copenhagen-cph-climate-plan-2025/
[99] City of Copenhagen, CPH 2025, Climate Plan, Available at: http://kk.sites.itera.dk/apps/kk_pub2/pdf/983_jkP0ekKMyD.pdf

space in the city). Copenhagen intends to achieve 10 per cent of its total CO2 reduction (50,000 tonnes) by 2015, through construction and renovation projects.[100]

Copenhagen City Council has also initiated a wind turbine project object to be met with the installation of more than 100 new wind turbines by 2025 both inside and outside municipal borders – land based and offshore. This project is to increase renewable energy production towards the goal of carbon neutral district heating.

6.3.3 Anticipated Economic Consequences

The CPH 2025 Climate Plan is expected to provide an overall positive economic result leading to economic benefits for Copenhagen. This plan is estimated to require an investment in the region of DKK 2.7bn by 2025 from the City of Copenhagen. According to the CPH plan, the investment required for making Copenhagen will lead to energy savings which will improve the City Administration economy for decades into the future due to rising prices in conventional energy sources.[101] Furthermore given that this conversion will take place gradually, this means that existing facilities will not be replaced before it is necessary.[102]

6.4 Vancouver, Canada

Reportedly, by collaborating with energy utility providers, government, business innovators and non-profit sectors, today Vancouver has the smallest per capita footprint of any city in Northern America.[103]

According to the 'Vancouver Economic Development Commission', buildings in Vancouver are responsible for a significant proportion of the city's overall environment, in contributing:

- 28 per cent of greenhouse gas emissions.
- 30 per cent of energy consumption.
- 12 per cent of potable water consumption.
- 30 to 40 per cent of landfill waste.[104]

British Columbia municipalities are adopting green building as a strategy to help them meet greenhouse gas emission targets. British Columbia's Climate Action Secretariat addresses the energy efficiency of buildings, requiring new standards to be implemented by 2010 and that all new publicly-funded buildings be legally required to

[100] City of Copenhagen, CPH 2025, Climate Plan, Available at: http://kk.sites.itera.dk/apps/kk_pub2/pdf/983_jkP0ekKMyD.pdf
[101] City of Copenhagen, CPH 2025, Climate Plan, Available at: http://kk.sites.itera.dk/apps/kk_pub2/pdf/983_jkP0ekKMyD.pdf
[102] City of Copenhagen, CPH 2025, Climate Plan, Available at: http://kk.sites.itera.dk/apps/kk_pub2/pdf/983_jkP0ekKMyD.pdf
[103] City of Vancouver, 'Greenest City: 2020 Action Plan'
[104] Vancouver Economic Development Commission, 2009, Greenest Buildings in Vancouver

have net-zero greenhouse gas emissions by 2016; and that all new houses and buildings within the province have net-zero greenhouse gas emissions by 2020.[105]

The Vancouver municipal government has demonstrated environmental leadership across a number of initiatives to encourage green building and sustainability urban planning in the city. For instance, Vancouver's Corporate and Community Climate Action Plan targets go beyond the established global Greenhouse Gas reduction targets established by the 1997 Kyoto Protocol.[106]

Despite experiencing a growth of population of over 27 per cent, Vancouver is set to bring its community-based greenhouse gas emissions down to 5 per cent below 1990 levels. Vancouver's electricity is generated within British Columbia, 93 per cent of which is from renewable sources and the city is developing neighbourhood-scale renewable energy projects. The city of Vancouver has also implemented the greenest building code in North America[107]

Building on this success, in April 2011 the 'Greenest City 2020 Action' (GCAP) is an initiative which was launched by Vancouver City Council to address Vancouver's environmental challenges through a number of measurable targets to make it the Greenest City in the world by 2020.[108]

Part of the GCAP involves an objective to reduce community-based greenhouse gas emissions by 33 per cent from 2007 levels.[109] One of the key priories for 2011-2014 for this objective includes the action of working with partners in the city to build new neighbourhood-scale renewable energy systems.

The Neighbourhood Energy Utility (NEU) provides one such instance of this, in providing heat and hot water to all buildings within the Southeast False Creek community, including the former Olympic Village.[110] The NEU has reduced greenhouse gas emissions by 55 per cent over conventional energy sources.[111] In 2010, the housing development in Southeast False Creek became the first multi-unit residential building in Canada to generate as much energy as it uses.[112]

Another priority for the GCAP is to transfer large-scale steam systems to renewable energy, particularly within large industrial operations and universities, which burn natural gas in centralized steam systems. The GCAP wishes to convert systems to

[105] Vancouver Economic Development Commission, 2009, Greenest Buildings in Vancouver
[106] Vancouver Economic Development Commission, 2009, Greenest Buildings in Vancouver
[107] City of Vancouver, 'Greenest City: 2020 Action Plan'
[108] City of Vancouver, 'Greenest City: 2020 Action Plan'
[109] City of Vancouver, 'Greenest City: 2020 Action Plan'

[110] After the 2010 Vancouver Winter Olympics, the Olympic accommodation became residential housing. The development aligns with the City's goals, addressing environmental, economic, and social issues. The Olympic Village is a mixed-use community, with approximately 1,100 residential units, area parks, and a growing number of retail and service outlets.
[111] City of Vancouver, 'Greenest City: 2020 Action Plan'
[112] City of Vancouver, 'Greenest City: 2020 Action Plan'

alternative renewable fuels like biomass to heat water, in order to increase energy efficiency and reduce greenhouse gas emissions.[113]

6.4.1 Conditions for Success

According to the GCAP, the accomplishment of the objective to make Vancouver the Greenest City in the world by 2020 is reliant upon a number of key overlapping factors including:

- **Consistent action from provincial and federal governments** to not only decrease carbon content of vehicle fuels and electricity but also to enable Canadian cities to build a low-carbon future by municipalities providing new regulatory authority.[114] To this end, the city will be able to develop policy which consistently raises requirements and reduces uncertainty for developers.[115]
- **Financing tools and incentives to green existing buildings** to attend to concerns of affordability and fairness while increasing the pace of change towards green developments and retrofits.
- **Capacity Building** by bringing together different groups to build partnerships and ensure there are enough skilled workers to meet the requirements of a rapidly growing green building sector.
- **Education and outreach programs to engage building occupants** to inform their choices regarding electricity and water consumption and waste produced and ensure effective operation of green building technologies.[116]

[113] City of Vancouver, 'Greenest City: 2020 Action Plan'
[114] City of Vancouver, 'Greenest City: 2020 Action Plan'
[115] City of Vancouver, 'Greenest City: 2020 Action Plan'
[116] City of Vancouver, 'Greenest City: 2020 Action Plan'