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Anaerobic Digestion in Northern Ireland

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This briefing paper provides an overview of anaerobic digestion (AD) in Northern Ireland (NI). The paper explores what AD is, the extent and usage of AD in NI, the regulation of AD in NI, funding support available for AD in NI, and opposition to AD development in NI. It also provides information on environmental considerations and AD's potential role in NI's future energy strategy.

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Frequently used abbreviations

AD – Anaerobic Digestion

CHP – Combined Heat and Power

DAERA – Department for Agriculture, Environment and Rural Affairs

DARD – Department for Agriculture and Rural Development (now DAERA)

DfE – Department for the Economy

DETI – Department of Enterprise, Trade and Investment (now DfE)

kW – kilowatt (1000 kW = 1 MW)

kWth – Kilowatt-thermal per hour (unit of heat-supply capacity)

MW – megawatt (1 MW = 1000 kW)

MWh – megawatts energy per hour

NIAO – Northern Ireland Audit Office

NIEA – Northern Ireland Environment Agency

NIRO – Northern Ireland Renewable Obligations

NIRHI – Northern Ireland Renewable Heat Incentive

NNFCC - National Non-Food Crops Centre

RO – Renewable Obligations (England and Wales)

ROS – Renewable Obligations (Scotland)

ROCs – Renewable Obligations Certificate

WML – Waste Management Licence

1 What is anaerobic digestion?

Anaerobic Digestion (AD) is a natural process, whereby a biomass feedstock (i.e. silage, slurry, manure, food waste and energy crops) is broken down (digested) in the absence of oxygen (anaerobic). The digestion of the biomass produces methane (~65%), carbon dioxide (~35%). This biogas can then be collected and combusted to generate electricity and/or heat (combined heat and power; CHP). Figure 1 shows a simplified AD schematic with attached generating station.

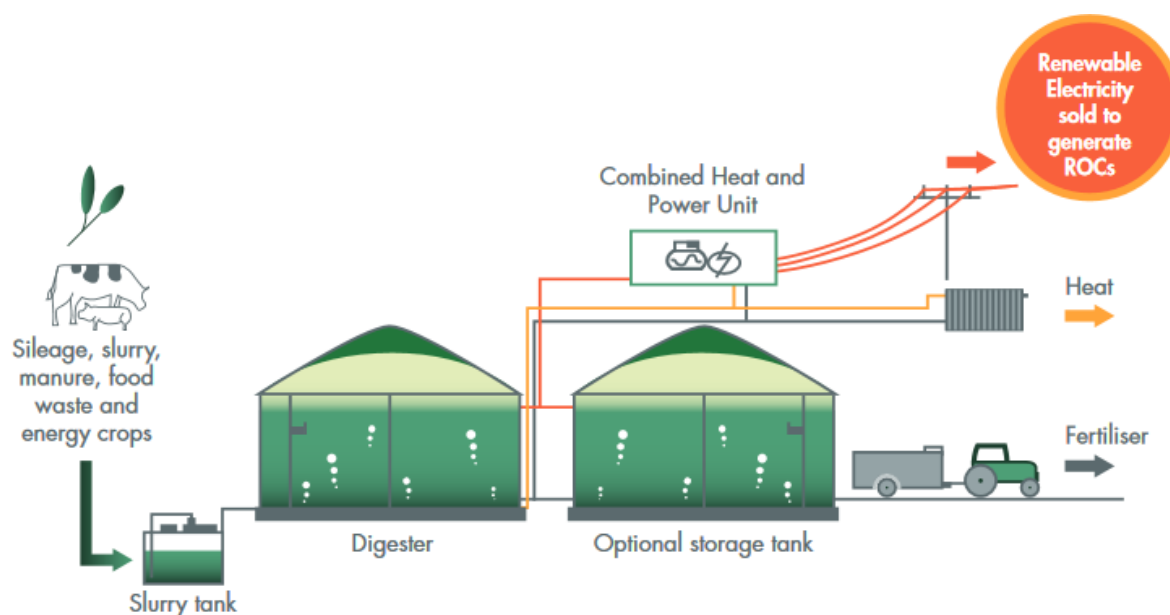


Figure 1. Simplified anaerobic digestion plant schematic. Source: NIAO report (2020)¹

2 Anaerobic digestion extent in Northern Ireland

The initial uptake of AD technology in NI was slow in comparison to GB, despite similar government financial incentives². However, the combination of the closure and subsequent reduction of the GB financial support schemes, but sustained support from the NI schemes (see section 5), and the high availability of feedstocks (see section 3), made NI the most attractive region in the UK for AD investment³. As such, NI has three and half times as many AD based generating stations (per square kilometre) as GB⁴.

[The Official Information Portal on Anaerobic Digestion](#)⁵ provides a [biogas map](#) showing all operational anaerobic digestion plants in the UK (excluding water treatment facilities). This biogas map (figure 2) indicates that there are 76 operational

¹ NIAO report (2020), [Generating electricity from renewable energy](#) (p. 56)

² *ibid* (p. 11)

³ *ibid* (p. 11)

⁴ *ibid* (p. 6)

⁵ The official information portal on anaerobic digestion was developed and is maintained by the National Non-Food Crops Centre (NNFCC). This information site was supported by the UK Government and industry.

AD facilities in NI (as of June 2019), of which, 64 predominately use agricultural feedstock (farm-fed), and the remaining 12 ADs utilise municipal, commercial and industrial waste as feedstock (waste-fed).

OFGEM also provides an online [Renewables and CHP register](#) which includes publicly available data on [accredited stations](#) from RO schemes (including NIRO). AD generating stations are classified under the 'fuelled' category⁶ in the OFGEM Renewables and CHP register. In NI, the Renewables and CHP register includes 139 fuelled accredited stations (figure 3). Of those 139 stations, 132 are currently active with the remaining seven still in preliminary status.

As other technologies are included in the 'fuelled' category, care should be taken when using the OFGEM Renewables and CHP register data.

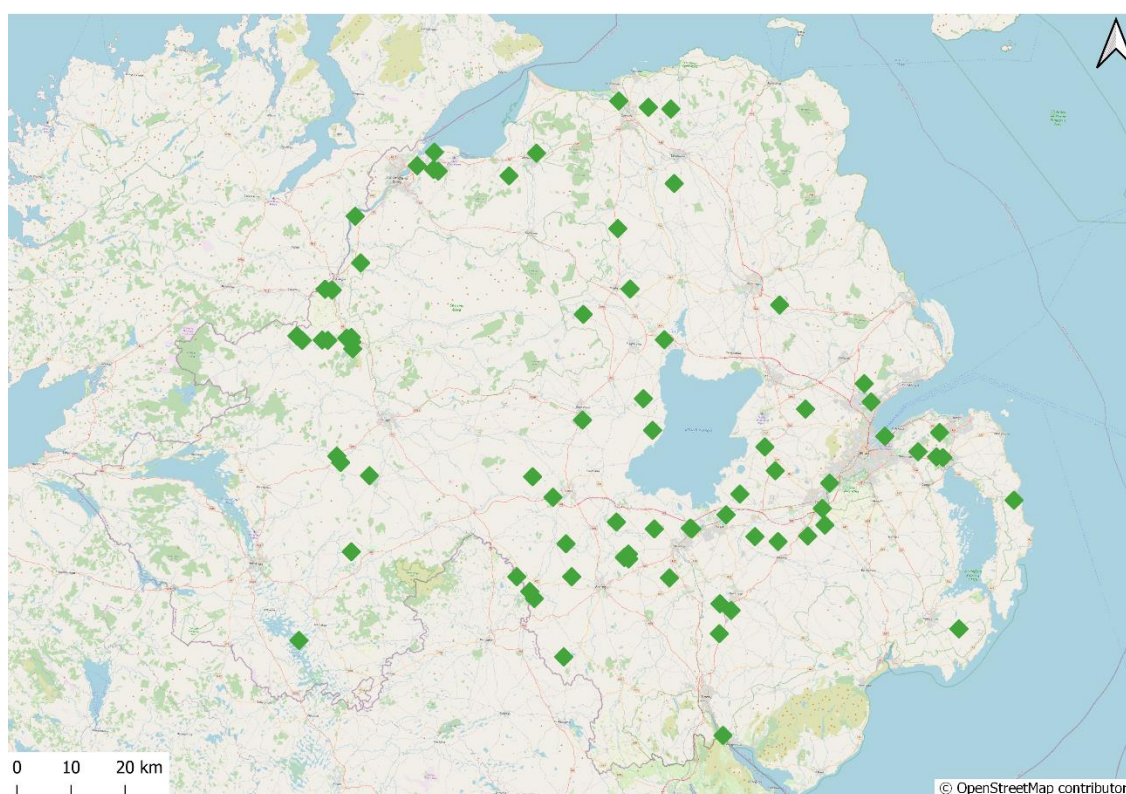


Figure 2. Location of NNFCC biogas facilities in Northern Ireland⁷.

⁶ Fuelled stations are those which generate electricity from eligible biomass, bioliquid, energy crops and waste. Technologies included under fuelled category; AD, sewage gas, landfill gas, energy from waste with CHP, advanced conversion technologies and dedicated biomass with CHP.

⁷ Data extracted from NNFCC's 'Biogas map' <https://www.biogas-info.co.uk/resources/biogas-map/> [last accessed 31/03/2021]



Figure 3. Location of OFGEM accredited fuelled stations within Northern Ireland⁸.

⁸ Data extracted from OFGEM's 'Renewable and CHP register'
<https://www.renewablesandchp.ofgem.gov.uk/Public/ReportManager.aspx?ReportVisibility=1&ReportCategory=0> [last accessed 31/03/2021]

3 Anaerobic digestion usage in Northern Ireland

NI has the highest stocking density (i.e. animals per hectare) within the UK for three of the mainly farmed animal species (i.e. cattle, pigs and poultry). NI has comparable cattle stocking densities with the Republic of Ireland (RoI), but has a higher stocking density for pigs and sheep than RoI (Table 1). This high stocking density means that NI has a wealth of animal waste feedstock in comparison to the rest of the UK, which has aided NI to become the UK's hotspot for AD.

Table 1. Key comparable features relating to livestock within jurisdictions across the UK and RoI

	England	Scotland	Wales	NI	RoI
Total livestock numbers	Cattle ⁹ – 5,146,000 Sheep ¹⁰ – 15,390,000 Pigs ¹¹ – 3,776,000 Poultry ¹² – 138,850,000	Cattle ¹³ – 1,730,000 Sheep ¹⁴ – 6,670,000 Pigs ¹⁵ – 319,300 Poultry ¹⁶ – 14,900,000	Cattle ¹⁷ – 1,137,399 Sheep ¹⁸ – 10,037,474 Pigs ¹⁹ – 24,503 Poultry ²⁰ – 7,515,804	Cattle ²¹ – 1,611,776 Sheep ²² – 1,986,932 Pigs ²³ – 674,428 Poultry ²⁴ – 24,780,381	Cattle ²⁵ – 7,208,600 Sheep ²⁶ – 5,145,800 Pigs – 1,616,000 Poultry – no data
Total farmed area in hectares	9,160,000 ²⁷	5,660,000 ²⁸	1,594,887 ²⁹	1,023,163 ³⁰	4,524,400 ³¹
Approximate crude livestock stocking densities per hectare (livestock numbers ÷ by total farmed area)	Cattle – 0.56 Sheep – 1.6 Pigs – 0.41 Poultry – 15.15	Cattle – 0.30 Sheep – 1.17 Pigs – 0.05 Poultry – 2.63	Cattle – 0.71 Sheep – 6.29 Pigs – 0.01 Poultry – 4.7	Cattle – 1.57 Sheep – 1.94 Pigs – 0.65 Poultry – 24.21	Cattle – 1.59 Sheep – 1.13 Pigs – 0.35 Poultry – no data

⁹ DEFRA (2020) [Livestock numbers in England and the UK](#)

¹⁰ *ibid*

¹¹ *ibid*

¹² *ibid*

¹³ Scottish Government (2019) [Scottish Agricultural Census: June 2019](#) (p. 8)

¹⁴ *ibid* (p. 10)

¹⁵ *ibid* (p. 12)

¹⁶ *ibid* (p. 11)

¹⁷ Welsh Government (2019) [Total Livestock in Wales](#)

¹⁸ *ibid*

¹⁹ *ibid*

²⁰ *ibid*

²¹ DAERA (2019) [Agricultural Census in Northern Ireland, Results for June 2019](#) (p. 13)

²² *ibid* (p. 14)

²³ *ibid* (p. 15)

²⁴ *ibid*

²⁵ Central Statistics Office Ireland (2020) [Crops and Livestock Survey June Final Results](#)

²⁶ *ibid*

²⁷ DEFRA (2020) [Defra Statistics: Agricultural Facts, England Regional Profiles](#)

²⁸ Scottish Government (2019) [Scottish Agricultural Census: June 2019](#) (p. 2)

²⁹ Welsh Government (2019) [Type of Agricultural Land](#)

³⁰ DAERA (2019) [Agricultural Census in Northern Ireland, Results for June 2019](#) (p. 3)

³¹ Central Statistics Office Ireland (2019) [Area Farmed in June by Type of Land Use, Region and Year, PxStat database](#)

The vast majority of AD facilities in NI are farm-based, utilising waste products. Data extracted from the NNFCC [biogas map](#) (figure 4) shows the predominance of animal by-products (63 AD facilities) and energy crops and silage (57 AD facilities) for feedstocks. Most AD facilities use a combination of feedstocks, and out of the 76 AD facilities listed in the NNFCC [biogas map](#), 57 use a mix of animal by-products and energy crops and silage to feed their ADs.

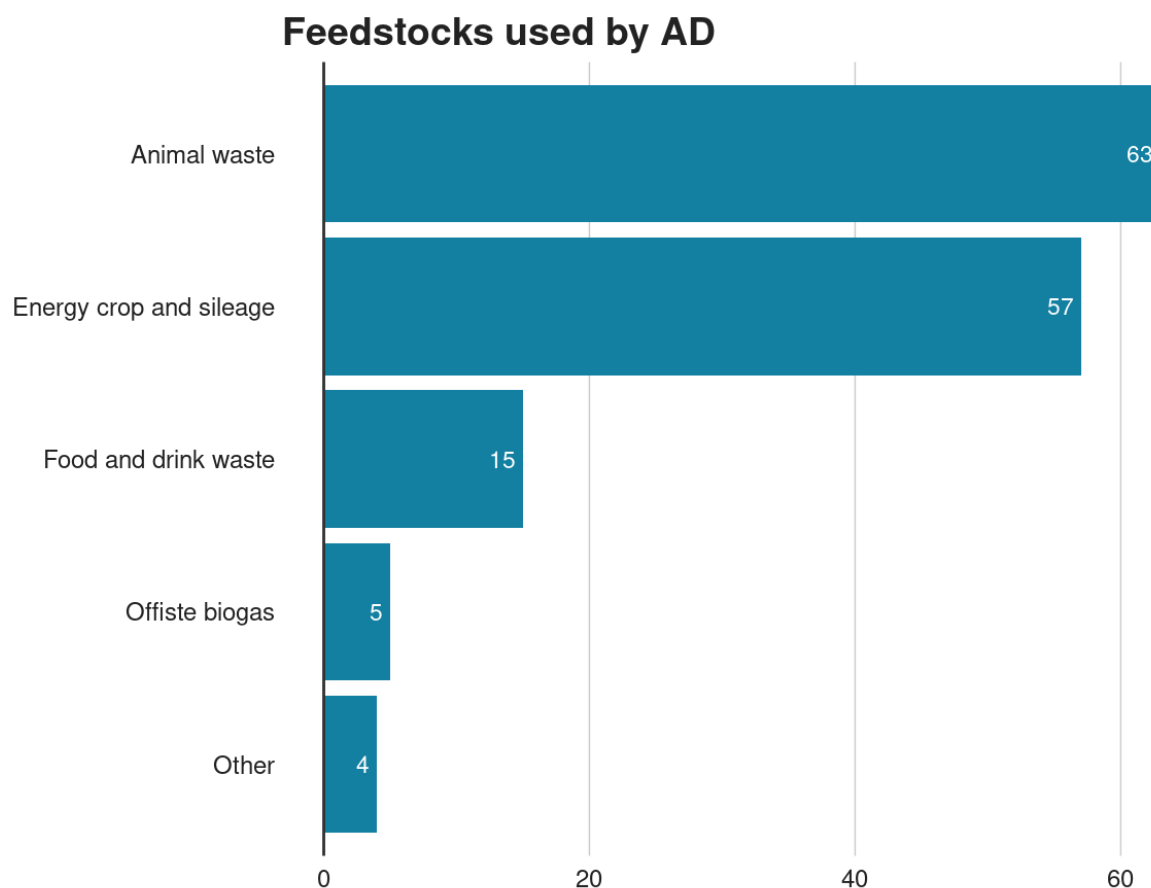


Figure 4. AD feedstock usage in NI. Animal slurries and litter (includes cattle, pig, poultry and unspecified), Energy crop and silage (includes energy crops, maize and grass silage), Food and drink waste (includes municipal, commercial and industrial), Offsite biogas (includes containerised offsite biogas), Other (includes dairy waste, effluent and animal processing waste). Note that 1 AD facility's feedstock was unknown and has such not been included. Data extracted from [NNFCC biogas map](#).

The biogas produced at these AD facilities is generally used to generate heat and electricity (CHP), which is both used onsite and increasingly, surplus electricity is sold to export suppliers.

The produced biogas can also be upgraded to be injected into the natural gas grid (biomethane), however this is not currently being done in NI (see section 8). The digestate produced during AD can be used as fertiliser on local farmland, as it currently has no market value.

4 AD regulations in NI

Planning permission in NI is predominately the preserve of local councils under the [Planning Act \(Northern Ireland\) 2011](#) and [Planning Policy Statement 18: Renewable Energy](#). AD plants may also be required to undertake an Environmental Impact Assessment if they are over specified thresholds and criteria under the [Planning \(Environmental Impact Assessment\) Regulations \(Northern Ireland\) 2017](#) (schedules 2.3 and/or 2.11).

Under the [Waste and Contaminated Land \(Northern Ireland\) Order 1997](#) and the [Waste Management Licensing Regulations \(Northern Ireland\) 2003](#), any activity which involves the treatment, keeping or disposal of waste must be authorised by NIEA, meaning AD plants processing waste as part of its feedstock are required to obtain a Waste Management Licence (WML) from NIEA. A WML will only be granted if planning permission has been granted³². During NIEA's 2019 review of AD plants, it was found that out of 68 operational facilities, 28 were either in the process of acquiring a WML or had not applied for one, and two plants were undergoing enforcement proceedings³³.

The [Nutrient Action Programme Regulations \(Northern Ireland\) 2019](#) sets requirements for AD digestates, including a fertilisation plan, spreading method (Low Emission Slurry Spreading Equipment), storage, record keeping, and compliance monitoring, to ensure the protection of waters against pollution caused by agricultural practices. Additionally, the [Conservation \(Natural Habitats etc.\) Regulations \(Northern Ireland\) 1995](#) and the [Control of Pollution \(Silage, Slurry and Agricultural Fuel Oil\) Regulations \(Northern Ireland\) 2003](#) set minimum standards for the storage of farm slurry, including the design, construction and operation of said systems.

If an AD plant with an associated generating station wishes to export excess electricity, an application for a Grid connection should be made via Northern Ireland Electricity (NIE) under the [Electricity Safety, Quality and Continuity Regulations \(Northern Ireland\) 2012](#). For microgeneration, AD facilities are required to obtain a purchase contract with an export supplier³⁴.

Additional regulatory controls:

- Animal and Plant Health Agency (APHA) Approval/validation³⁵: all UK AD plants or compost sites must get approval from APHA in order to operate. To get validation, digestate samples must be sent in to be tested to ensure the process is removing bacteria such as Salmonella and either E.coli or Enterococcaceae;

³² DAERA, [Waste management licensing](#) [last accessed 25/03/2021]

³³ NIAO report (2020), [Generating electricity from renewable energy](#) (p. 51)

³⁴ NIE (2020), Microgeneration (G98/NI), <https://www.nienetworks.co.uk/connections/generation-connections/micro-scale#panel1tab1>

³⁵ DEFRA (2020), [Using animal by-products at compost and biogas sites](#)

- The [British Standards Institution Publicly Available Specification 110](#) (BSI PAS 110): This provides specifications on anaerobic digestate quality for health and safety purposes;
- The [Anaerobic Digestate Quality Protocol](#) (ADQP): This applies to England, Wales and NI. It clarifies what material can be used for digestate production and identifies the markets for digestate use e.g. agriculture. It requires that that digestate meets PAS 110;
- [Animal By-Product](#) (ABP) Regulations: These categorise ABPs according to their level of risk - Category one (high risk) to Category three (low risk). Digestate cannot be made from Category one. Most Category two ABP must be pressure-rendered before they can be used for AD processes. However, some, such as manure, can be used without prior treatment. All Category three ABP must have a sanitisation or pasteurisation step in the AD process;
- [Biofertiliser Certification Scheme](#) (BCS): This is an independent, non-compulsory, quality assurance scheme for digestate. It clarifies what inputs can be used in digestate, the safe processing of inputs and minimum quality standards in line with PAS110 and ADQP.

5 AD grants available in Northern Ireland

Financial support for ADs in NI is currently limited. Previously financial support has come from Government schemes, commercial loans and equity investments, and privately sourced investments and loans. Below are examples of AD grants in NI.

5.1 [Northern Ireland Non-Domestic Renewable Heat Incentive \(NIRHI\)](#)

The NIRHI scheme was introduced in 2012 by the then Department of Enterprise, Trade and Investment (DETI). The Department for the Economy (DfE) now controls this scheme (OFGEM administer the scheme on DfE's behalf). The scheme offers a tariff for biogas (AD) boiler or CHP heating systems. Only installations that are <200 kWth, and not accredited under the NIRO scheme are eligible³⁶.

The NIRHI scheme was subject to a [public inquiry](#) (2017-2020) after concerns were raised over the potential costs of delivery for the scheme's lifecycle (20 years). The [New Decade New Approach](#) deal recommended the scheme to be closed and replaced by a scheme that "effectively cuts carbon emissions".

Those funded under the NIRHI scheme are eligible for support for 20 years from the start of their accreditation. The scheme closed for new applications on 29th February 2016.

³⁶ DfE (2019), [Non-Domestic Northern Ireland Renewable Heat Incentive – Guidance Volume 1: Eligibility and Application Process](#) (p. 27-28)

5.2 [Northern Ireland Renewables Obligation \(NIRO\)](#)

The NIRO scheme was introduced in 2005 and was the main support for renewable electricity projects in NI, and operated in tandem with the Renewable Obligation schemes in GB ([ROS](#) in Scotland and the [RO](#) in England & Wales). Renewables Obligation Certificates (ROCs) are issued as evidence of compliance and can be traded across the UK, which can then be sold to electricity suppliers (e.g. [Power NI Power Purchase Agreement](#)). The number of ROCs issued is determined by the technology generating the station, its size and when it was first accredited³⁷ (e.g. AD <500 kW eligible for up to 4 ROCs per unit energy produced)³⁸. Also, suppliers may pay a 'buy-out' fee to Ofgem for each MWh of electricity that is not covered by ROCs or enter into an agreement with an electricity supplier to export excess electricity to the grid³⁹.

It is important to note that the AD facility does not form part of the accreditation process (though it may be subject to requirements under planning and environmental regulations). Instead it is the generating station (CHP) that is accredited under the NIRO scheme.

The NI Audit Office (NIAO) recently conducted an inquiry into the NIRO scheme after concerns were raised by various players. [Part four of the NIAO report](#) examined the financial support for the uptake of AD. Until 2011, small-scale wind received higher NIRO support than AD generators. After 2011 DETI increased the financial support (amount of ROCs) for small-scale AD (≤5 MW), mirroring GB (although GB did this through the introduction of the [Feed-In-Tariff](#) (FiT) scheme). GB began to reduce the financial support offered through the FiT scheme in 2013 whilst NIRO support was maintained at 2011 levels⁴⁰.

Generators will receive ROCs for 20 years from their accreditation date or until 31st March 2037, whichever is earlier⁴¹. The scheme closed to new applications on 31st March 2017.

5.3 Sustainable Utilisation of Poultry Litter (SUPL)

In 2012, DETI and the then Department of Agriculture and Rural Development (DARD) launched a Small Business Research Initiative competition to address the sustainable use of poultry litter⁴². Poultry litter is rich in agricultural nutrients, nitrogen and phosphorus and has typically been spread on agricultural land. However, concerns

³⁷ DfE, [The Northern Ireland Renewables Obligation \(NIRO\)](#) [last accessed 25/03/2021]

³⁸ DfE, [ROC/MWh banding levels from 1st July 2015](#) [last accessed 25/03/2021]

³⁹ DfE, [The Northern Ireland Renewables Obligation \(NIRO\)](#) [last accessed 25/03/2021]

⁴⁰ NIAO report (2020), [Generating electricity from renewable energy](#) (p. 41)

⁴¹ DfE, [Northern Ireland Renewables Obligation](#) [last accessed 25/03/2021]

⁴² DfE (2016), [Hamilton and McIlveen announce world leading £23 million Anaerobic Digestion plant near Ballymena](#)

were raised surrounding agricultural runoff polluting ground and surface waters, ammonia emissions and increased cases of botulism in cattle⁴³.

Two companies received support through the scheme; Ballybofey AD, County Donegal (£9.3m commercial loan) and Tully Centralised AD plant, Ballymena (£8.5m commercial loan and £1.3 equity investment)⁴⁴. The SUPL scheme is now closed.

5.4 Other support

Financial support for AD facilities in NI has also come from the UK Green Investment Group Recycling and Waste LP (RAW) fund, Invest NI and private equity and capital management funds:

- 3 MW Ballymena AD plant (Stream BioEnergy), County Antrim - £8.7m RAW fund, £8.7m Invest NI, £4.4m Foresight AD EIS Fund, £1.5m Xergi⁴⁶ (additional funding £7.4m loan from Invest NI via SUPL scheme)⁴⁷;
- 0.5 MW Gorthill AD plant, County Londonderry - £1.8m RAW fund, SQN Capital Management £1.8m⁴⁸;
- Glenmore AD plant, County Donegal - £14m loan SQN Asset Finance (additional funding £9.3m loan from Invest NI via SUPL scheme)⁴⁹.

6 Opposition to AD in Northern Ireland

Opposition to AD in NI has tended to be focused on larger AD facilities that are in close proximity to residential areas. Examples of opposition to AD in NI are provided below.

Doogary residents in 2019 opposed a 500 kW centralised AD plant over concerns that additional slow moving traffic would adversely affect safety on the A5, the potential environmental, odour and noise impacts and potential explosion risk⁵⁰. However, the proposed AD plant was supported by local farmers, the Foyle Food Group and the Ulster Farmers' Union⁵¹. Subsequent to the written objections by residents, Fermanagh and Omagh District Council planning officials made a recommendation to refuse planning permission for the development⁵².

Planning permission for a pig farm with an associated 500 kW AD facility in Newtownabbey was granted in 2016⁵³. The AD facility (CHP) would use the produced

⁴³ NIAO report (2020), [Generating electricity from renewable energy](#) (p. 58)

⁴⁴ AQW 12692/17-22, Mr Stewart Dickson to the Minister for the Economy

⁴⁵ DfE (2016), [Hamilton and McIlveen announce world leading £23 million Anaerobic Digestion plant near Ballymena](#)

⁴⁶ UK Green Investment Bank (2016), [Northern Irish anaerobic digestion plants secure £10.5 investment](#)

⁴⁷ NIAO report (2020), [Generating electricity from renewable energy](#) (p. 58)

⁴⁸ UK Green Investment Bank (2016), [Northern Irish anaerobic digestion plants secure £10.5 investment](#)

⁴⁹ AQW 11550/17-22, Mr Stewart Dickson to the Minister for the Economy

⁵⁰ Ulster Herald (2019), [Doogary residents object to anaerobic digestion plant](#)

⁵¹ *ibid*

⁵² *ibid*

⁵³ Independent.ie (2017) [Construction begins on controversial farm which will house 15,000 pigs](#)

pig slurry to provide base power for the farm, including heating for the pig houses. Local opposition from the community, and further afield⁵⁴, centred on excessive odour and noise, and animal welfare concerns⁵⁵. More than 2000 people wrote official objection letters to the council, and 184,000 people signed an online petition against the development⁵⁶.

In 2021, Belfast City Council approved Energia Group's £40m centralised AD plant, despite objections from Belfast Harbour which owns a film studio close to the proposed site and have planning permission for a £45m extension, and Giant's Park Development Ltd, which intends to deliver a £170m leisure development near the site⁵⁷. Belfast City Council rebuked Giant Park's object as they have yet to submit planning permission and no pre-planning consultation has taken place. The Council report also included noise and air quality assessments finding that the AD plant would not harm the film studio⁵⁸.

Additionally, public confidence in renewable energy schemes has been significantly reduced due to the NIRHI public inquiry and subsequent NIAO NIRO inquiry⁵⁹.

7 AD environmental considerations

In 2010, the NI Executive established a target to achieve 40% of all electricity consumption to be generated from renewable sources by 2020⁶⁰, and in 2019 the target was exceeded⁶¹. For the most recent 12 month period (January 2020-December 2020) 49.2% of total electricity was generated from renewable sources, of which 5.4% comes from biogas and 0.6% from CHP and hydro technologies⁶².

However, there are concerns regarding the environmental impact of AD plants in NI, especially surrounding ammonia production. Ammonia emissions from the storage of silage and other waste stock on AD facilities is increased if large amounts of material such as silage, pig and poultry litter are stored on site or where digestate is spread⁶³. The deposition of ammonia, which is a source of nitrogen, can cause damage to valuable ecosystems through nitrogen enrichment or eutrophication, as well as acidification of waterways causing damage to aquatic biodiversity⁶⁴.

⁵⁴ Celebrities including Brian May, Martin Shaw and Jenny Seagrove publicly opposed the pig farm development; i.e. Belfast Telegraph (2015) [Queen's Brian May blasts plans for huge pig farm in Northern Ireland](#)

⁵⁵ Independent.ie (2017) [Construction begins on controversial farm which will house 15,000 pigs](#)

⁵⁶ Belfast Telegraph (2015) [Queen's Brian May blasts plans for huge pig farm in Northern Ireland](#)

⁵⁷ Belfast Telegraph (2021), [£40m bioenergy plant site should get green light despite protests](#)

⁵⁸ Belfast Telegraph (2021), [£40m bioenergy plant site should get green light despite protests](#)

⁵⁹ NIAO report (2020), [Generating electricity from renewable energy](#) (p. 3)

⁶⁰ DETI (2010), [A strategic framework for Northern Ireland](#) (p. 3)

⁶¹ NIAO (2020), [Generating electricity from renewable energy](#) (p. 2)

⁶² DfE (2021), Issue 18 – [Electricity consumption and renewable generation in Northern Ireland January 2020 to December 2020](#) (p. 5)

⁶³ DAERA (2018), [Standing advice for development of land that may affect Natural Heritage Interests](#) (p. 3)

⁶⁴ *ibid*

NI produced 12% of the UK's ammonia emissions in 2020, despite only having 3% of the UK population and 6% of the UK's land area⁶⁵. 96% of NI's ammonia emissions come from the agriculture sector (75% cattle, 14% poultry, and 8% pig)⁶⁶. As such, much of NI's designated sites and priority habitats in Northern Ireland have reached or exceeded their critical level of ammonia⁶⁷ (i.e. 98% of Special Areas of Conservation exceeding ammonia levels⁶⁸).

Consideration may also need to be made in regards to animal waste exports to RoI post-EU exit. Thousands of tonnes of animal waste are shipped to RoI each year⁶⁹, and under Annex 2 of [The Northern Ireland Protocol](#), it provides for the continuation of EU regulation for the shipping of animal waste⁷⁰. Under a 'no-deal' outcome, concerns were raised over what NI would be able to do with this excess waste⁷¹. Therefore if the Northern Ireland Protocol ceases to operate, NI will need plans in place to deal with these waste products.

8 NI's future energy strategy and AD

A consultation on the future policy options for the Energy Strategy for Northern Ireland was launched on 31st March 2021⁷². The future Energy Strategy proposes to deliver net zero carbon and affordable energy⁷³.

The consultation paper highlights that NI is a "region of excellence in onshore wind and bioenergy with a range of innovative companies across anaerobic digestion, biomass, energy from waste and associated feedstock supply"⁷⁴. The paper discusses the potential role of AD in supplying biomethane through injection into the gas grid in the future energy strategy, and indicates that biomethane injection should be the initial focus for decarbonising gas emissions⁷⁵. There are several European countries (e.g. Germany, France, Italy and Denmark) which are utilising AD supplied biomethane in their national gas grids⁷⁶. The UK Government plans to introduce a Green Gas Support Scheme (GB only) in autumn 2021 (running until 2025) for AD produced biomethane injected into the gas grid⁷⁷.

The consultation proposes to undertake a review of the costs and benefits of biogas and biomethane. This would identify the potential scale of local biogas production,

⁶⁵ NIAO General report (2020), [Generating electricity from renewable energy](#) (p. 52)

⁶⁶ *ibid*

⁶⁷ DAERA (2018), [Standing advice for development of land that may affect Natural Heritage Interests](#) (p. 6)

⁶⁸ Irish News (2019), [North facing 'monumental disaster' due to ammonia pollution](#)

⁶⁹ Belfast Telegraph (2019) [Animal waste export 'could be threatened' under no-deal Brexit](#)

⁷⁰ [Regulation \(EC\) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste](#)

⁷¹ Belfast Telegraph (2019) [Animal waste export 'could be threatened' under no-deal Brexit](#)

⁷² DfE (2021), [Dodds announces consultation on a new Northern Ireland Energy Strategy](#)

⁷³ DfE (2021), [Energy Strategy for Northern Ireland: Consultation on Policy Options](#) (p. 3)

⁷⁴ *ibid* (p. 54)

⁷⁵ *ibid* (p. 103-104)

⁷⁶ Institut français des relations internationales (2019) [Biogas and biomethane in Europe: Lessons from Denmark, Germany and Italy](#)

⁷⁷ BEIS (2021) [Future Support for Low Carbon Heat and The Green Gas Levy: Government response to consultations](#) (p10-47)

commercial viability, potential additional support and wider environmental and sustainability measures needed⁷⁸.

A barrier to these plans is that almost 70% of homes in NI use oil for heating, along with significant oil usage by businesses and the public sector⁷⁹, as many properties in NI are not currently connected to the gas grid (currently ~230,000 properties connected in Greater Belfast⁸⁰). The NI Utility Regulator estimates that 65% of properties will have access to the gas grid by 2023, but the remaining unconnected properties will be disproportionately located in rural locations or communities of less than 200⁸¹.

⁷⁸ DfE (2021), [Energy Strategy for Northern Ireland: Consultation on Policy Options](#) (p. 104)

⁷⁹ Northern Ireland Executive, Gas; <https://www.northernireland.gov.uk/topics/energy/gas> [last accessed 31/03/2021]

⁸⁰ Utility Regulator NI (2020) [Retail Market Monitoring, Quarterly Transparency Report: Quarter 3: July to September 2020](#)

⁸¹ Utility Regulator NI (2020) [Gas Distribution Networks GD23 Price Control: Our approach to GD23](#) (p. 11)