Reducing emissions in Northern Ireland

Committee on Climate Change
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Acknowledgements

The Committee would like to thank:

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Contents

The Committee

The Rt. Hon John Gummer, Lord Deben, Chairman
Lord Deben was the UK's longest-serving Secretary of State for the Environment (1993 to 1997). He has held several other high-level ministerial posts, including Secretary of State for Agriculture, Fisheries and Food (1989 to 1993). He has consistently championed the strong links between environmental concerns and business interests. Lord Deben also runs Sancroft, a corporate responsibility consultancy working with blue-chip companies around the world on environmental, social and ethical issues. He is Chairman of Valpak Limited and the Personal Investment Management and Financial Advice Association.

Baroness Brown of Cambridge FRS
Baroness Brown of Cambridge DBE FREng FRS (Julia King) is an engineer, with a career spanning senior engineering and leadership roles in industry and academia. She currently serves as Chair of the CCC's Adaptation Committee; non-executive director of the Offshore Renewable Energy Catapult; and Chair of the Carbon Trust. She was non-executive director of the Green Investment Bank, and led the King Review on decarbonising transport (2008). She is currently supporting the UK offshore wind sector as Sector Champion for the development of the Sector Deal as part of the Government's Industrial Strategy. She is a Fellow of the Royal Academy of Engineering and of the Royal Society, and was awarded DBE for services to higher education and technology. She is a crossbench Peer and a member of the House of Lords European Union Select Committee.

Professor Nick Chater
Nick Chater is Professor of Behavioural Science at Warwick Business School. He has particular interests in the cognitive and social foundations of rationality, and applying behavioural insights to public policy and business. Nick is Co-founder and Director of Decision Technology Ltd, a research consultancy. He has previously held the posts of Professor of Psychology at both Warwick University and University College London (UCL), and Associate Editor for the journals Cognitive Science, Psychological Review, Psychological Science and Management Science.

Professor Piers Forster

Professor Forster is Director of the Priestley International Centre for Climate and Professor of Physical Climate Change at the University of Leeds. He has played a significant role authoring Intergovernmental Panel on Climate Change (IPCC) reports, and is a coordinating lead author for the IPCC's sixth assessment report. Professor Forster established the forest protection and research charity, the United Bank of Carbon, and has a number of roles advising industry, including membership of the Rolls Royce Environment Advisory Board.

Dr Rebecca Heaton

Rebecca Heaton is Head of Sustainability and Policy at Drax Group. She is responsible for the sustainability of the global forest supply chains used to produce biomass for its power station, and for research and policy work. She has extensive experience working for a number of energy businesses on a range of topics, including biofuels, land-use and forestry, and climate change adaptation. She previously led the work of the Energy Research Partnership (ERP) Bioenergy Review 2011 and was a member of the Editorial Board of Global Change Biology – Bioenergy.

Paul Johnson

Paul Johnson is Director of the Institute for Fiscal Studies and a visiting professor at University College London (UCL). He is widely published on the economics of public policy, and co-wrote the 'Mirrlees review' of tax system design. He was previously Chief Economist at the Department for Education (2000 to 2004) and Head of Economics of Financial Regulation at the Financial Services Authority (1999 to 2000).

Professor Corinne Le Quéré FRS

Corinne Le Quéré is Professor of Climate Change Science and Policy at the University of East Anglia (UEA), specialising in the interactions between climate change and the carbon cycle. She is lead author of several assessment reports for the UN's Intergovernmental Panel on Climate Change (IPCC), Director of the annual update of the global carbon budget by the Global Carbon Project (GCP), and Chair of the French Haut Conseil pour le climat.

Executive Summary

In July 2018, the Permanent Secretary of the Department for Agriculture, Environment & Rural Affairs (DAERA) in Northern Ireland requested the Committee's advice on how Northern Ireland could reduce greenhouse gas emissions between now and 2030.

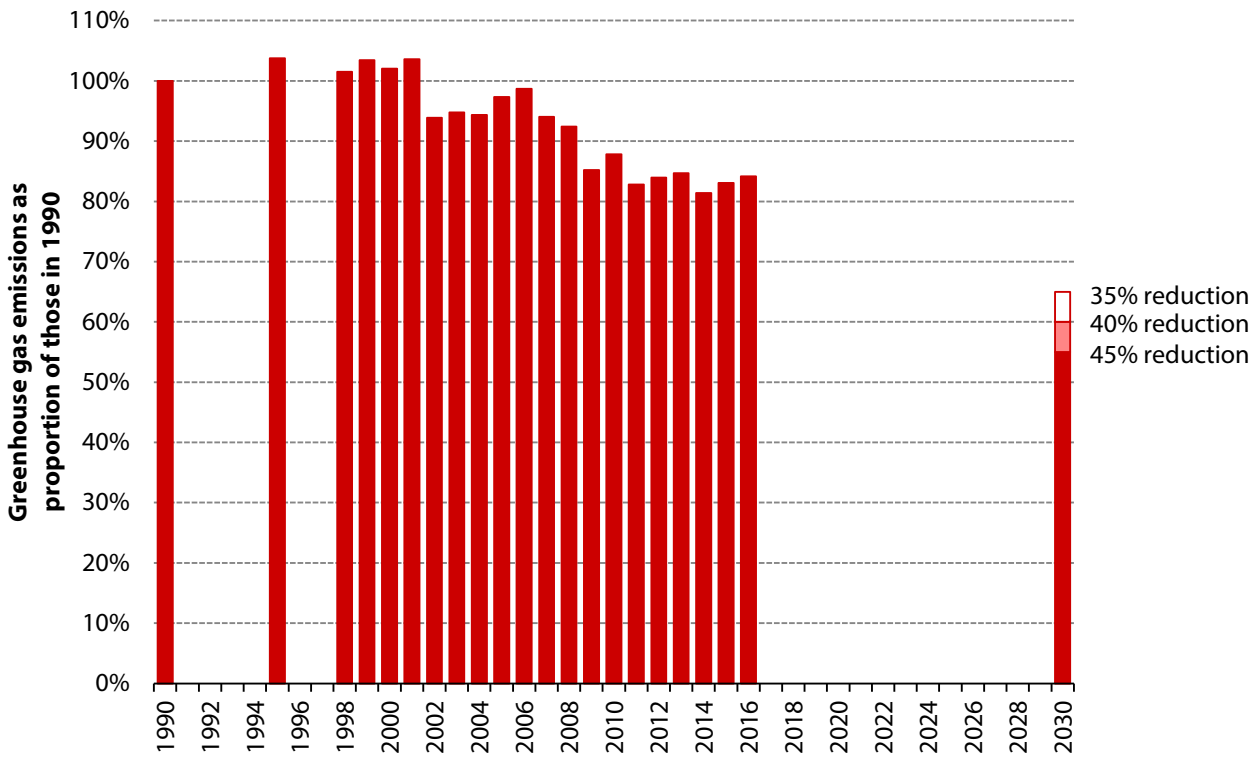
Northern Ireland does not currently have any separate climate change legislation, but greenhouse gas emissions from Northern Ireland contribute to the UK total under the Climate Change Act 2008, and it has a key role to play in meeting our obligations under the Paris Agreement.

DAERA requested advice on possible policies and strategies that could deliver economy-wide emissions reductions of 35%, 40% and 45% against 1990 levels by 2030 (Figure 1). In addition, DAERA included a number of sector-specific policy questions which we have addressed throughout this report.

The proposals in this report are not a prescriptive list of policy actions over the next decade. Instead, they serve as a starting point for the general principles and policy areas that policymakers could prioritise to deliver the necessary long-term decarbonisation of the Northern Ireland economy. Northern Ireland has ground to make up with other parts of the UK, where there are more ambitious and distinctive plans to reduce emissions.

Any future decarbonisation strategy for Northern Ireland is best decided by the devolved government, who have a more detailed understanding of the policies that will be both effective and politically feasible at a local, regional, and national level.

Figure 1. Emissions in Northern Ireland relative to the 1990 baseline



Source: National Atmospheric Emissions Inventory (2018) *Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990 - 2016.*

Unlike the Committee's annual progress reports or advice on carbon budgets and devolved administration targets, this report does not contain formal advice on legislative emissions targets.

In light of increased global ambition under the Paris Agreement, the Committee will publish new advice on the UK's long-term targets in the first half of 2019. This will include an assessment of the contribution of Northern Ireland towards any more ambitious UK-wide target. The results of this work may have implications for the recommendations set out in this report, including the need to increase ambition emissions reductions in Northern Ireland.

The analysis presented in this report is based on our previous advice for Northern Ireland's contribution to meeting the UK fifth carbon budget,[1] accounting for any significant new evidence and policy developments since that advice was published.

Northern Ireland has unique characteristics that bring different opportunities and challenges for decarbonisation compared to the rest of the UK.

Any approach to decarbonisation strategy must take into account the particular economic and political circumstances in Northern Ireland. In particular:

- Nearly 30% of all greenhouse gas emissions in Northern Ireland are from agriculture, compared to 10% in the rest of the UK, and the farming sector in Northern Ireland is also much more heavily livestock-based. Agriculture will be more challenging to decarbonise in the next decade than most other sectors in our cost-effective path to the fifth carbon budget.
- Unlike the other devolved administrations, Northern Ireland has devolved responsibility for energy policy.[2] Northern Ireland is a member of the all-island Integrated Single Electricity Market (I-SEM) shared with the Republic of Ireland. Energy policy must enable an efficient, interconnected energy market to operate on both sides of the border.
- The gas network in Northern Ireland is not nearly as extensive as in Great Britain, and around three-quarters of homes in Northern Ireland are heated by oil or electric sources. Some pathways to decarbonise heat that rely on modifying the gas network may be less suitable for Northern Ireland, but significant emissions savings could be made by switching conventional oil boilers to heat pumps.
- The geographical size of Northern Ireland presents an opportunity for more rapid uptake of electric vehicles because range anxiety may be less of a concern for consumers. However, this is offset by the prevalence of longer cross-border journeys and the need for adequate public charging infrastructure on both sides of the border.
- Unlike the rest of the UK, the land use, land-use change and forestry sector is a net carbon source rather than a net sink. Forest coverage is around 40% lower in Northern Ireland than the UK as a whole. The future inclusion of emissions from degraded peatland in the UK emissions inventory could add around 9% to Northern Ireland's total emissions - higher than in England and Wales, but lower than Scotland.

This report is written in the context of the ongoing negotiations around the UK's decision to leave the EU. Additionally, since 2 March 2017 there has not been a sitting Executive in Northern Ireland. These factors could have a significant impact on the ability of Northern Ireland to implement decarbonisation policies in the near future.

[1] CCC (2015) *The Fifth Carbon Budget - The next step towards a low-carbon economy.*
[2] Apart from nuclear energy.

Northern Ireland's contribution to the fifth UK carbon budget requires emissions reductions of at least 35% against 1990 levels by 2030.

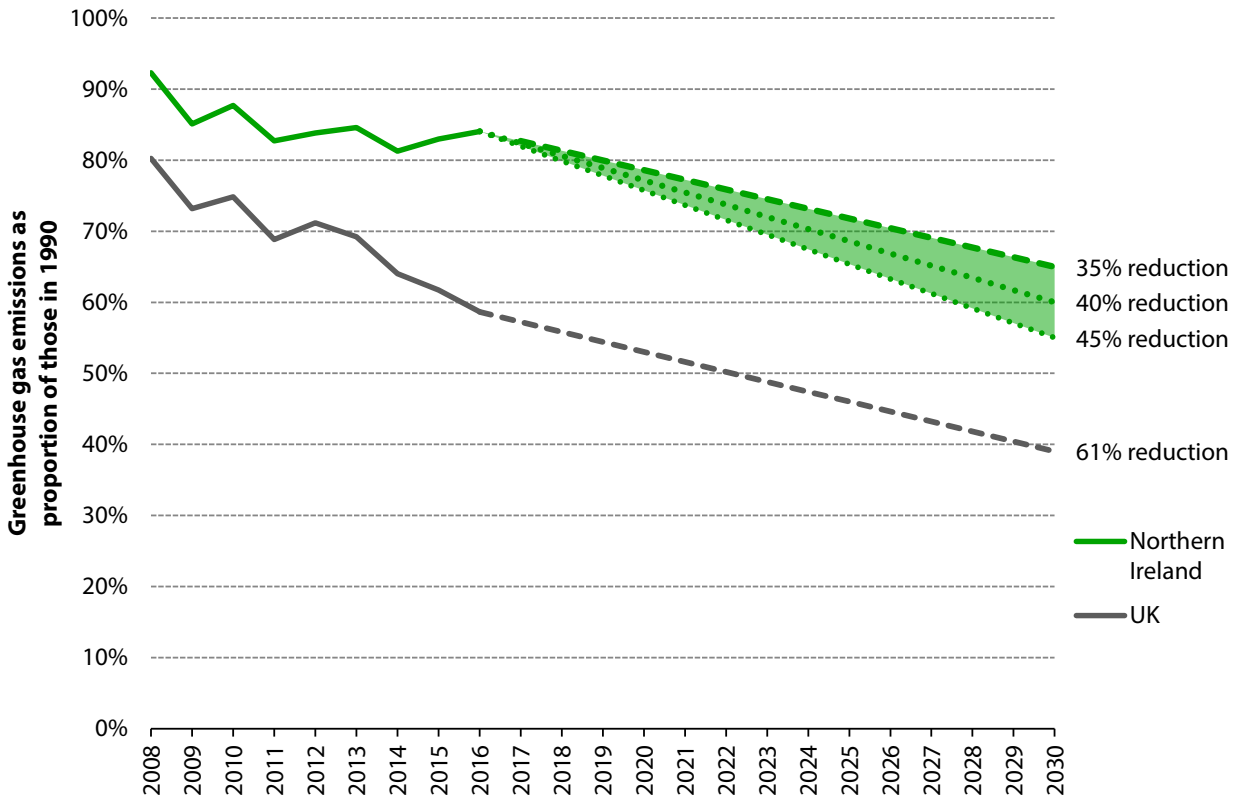
Northern Ireland contributed 4% of UK emissions in 2016, and has a key role to play in meeting the UK's legislated emissions reduction targets and obligations under the Paris Agreement.

The Committee's 2015 advice on the fifth carbon budget contained an assessment of Northern Ireland's fair contribution to the legislated limit on UK greenhouse gas emissions in the period 2028-32.

After accounting for the most recent evidence on emissions from Northern Ireland, we assess that Northern Ireland's contribution to the fifth UK carbon budget requires at least a 35% reduction in emissions against 1990 levels by 2030.

This 35% reduction is a smaller reduction against the 1990 baseline than targets the Committee has recommended in other parts of the UK. However, the rate of reduction from 2016 to 2030 is similar to the rate recommended by the Committee for the UK as a whole in the same time period (Figure 2).

Figure 2. Rates of reduction in Northern Ireland and the UK potentially required from 2016 to 2030

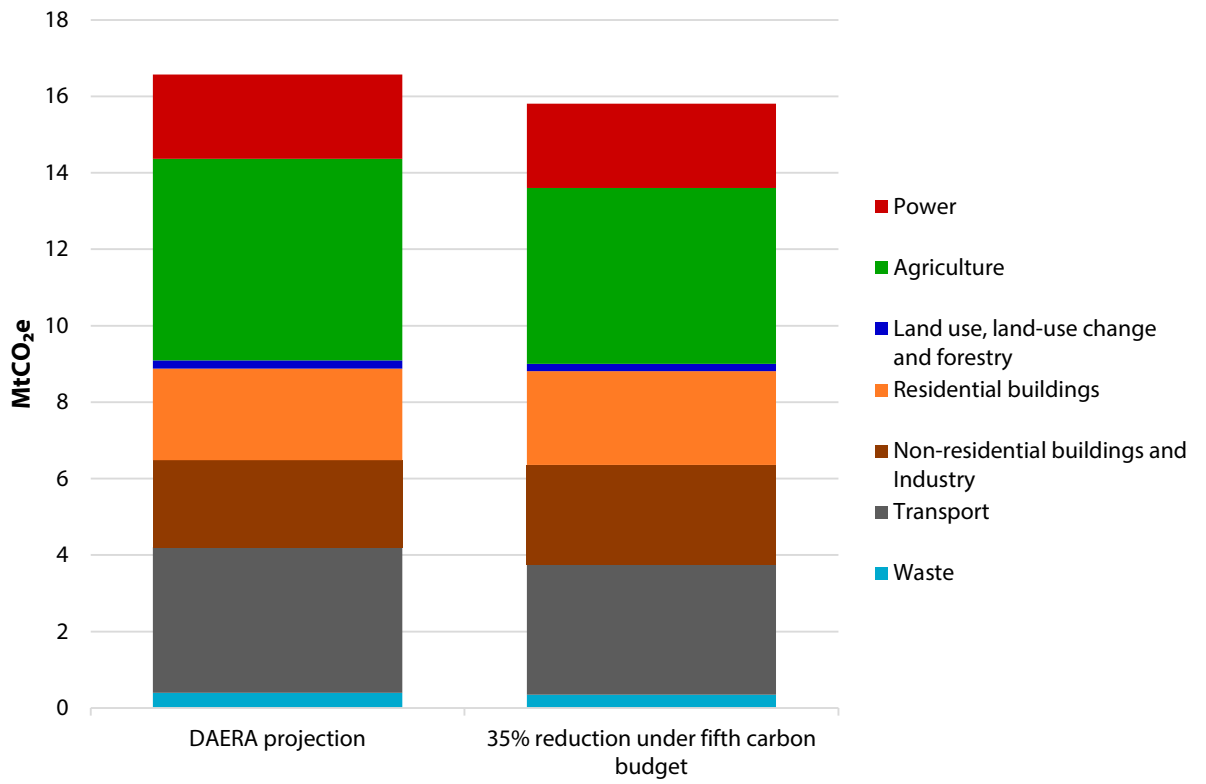


Source: NAEI (2018); CCC (2015) *Sectoral scenarios for the fifth carbon budget.*
Notes: The green range is defined by straight-line trajectories for emissions from 2016 to reductions of 35% and 45% by 2030 against 1990 levels. The UK reduction of 61% by 2030 on 1990 levels is consistent with the reduction in actual (gross) emissions set out in the Committee's 2015 advice on the fifth carbon budget.

Existing reserved and devolved policies in Northern Ireland are not enough to deliver this 35% reduction, but this gap can be closed and there are excellent opportunities to go beyond 35%.

The most recent DAERA projections of greenhouse gas emissions (Figure 3) show that Northern Ireland is unlikely to achieve this level of emissions reduction by 2030 through existing devolved and reserved policies. Northern Ireland is currently projected to achieve a reduction of 32% on 1990 levels.[3]

Figure 3. DAERA projections compared to the Committee's assessment of Northern Ireland's contribution to the UK fifth carbon budget



Source: DAERA (2018) *Northern Ireland Greenhouse Gas Projections Update*; CCC analysis.
Notes: DAERA projections have been adjusted to account for agriculture and LULUCF methodology changes in latest NAEI inventory. Unadjusted, the figure is 17.6 $MtCO_2e$ in 2030.

[3] Adjusted for agriculture and LULUCF methodology changes. As published, projections suggest a 30% decrease.

This leaves a net 'policy gap' of around 0.8 $MtCO_2e$ compared to our fifth carbon budget scenario in 2030, largely driven by the agriculture and transport sectors (Figure 3). The latest DAERA projections show an out-performance of our scenario by around 0.3 $MtCO_2e$ in the non-residential buildings and industry sectors.[4]

We have also identified and quantified cost-effective measures that have potential to deliver further emissions reductions in Northern Ireland, to go beyond a 35% reduction (Figure 4).

Policymakers in Northern Ireland should focus on the following areas to close the policy gap and go beyond a 35% reduction:

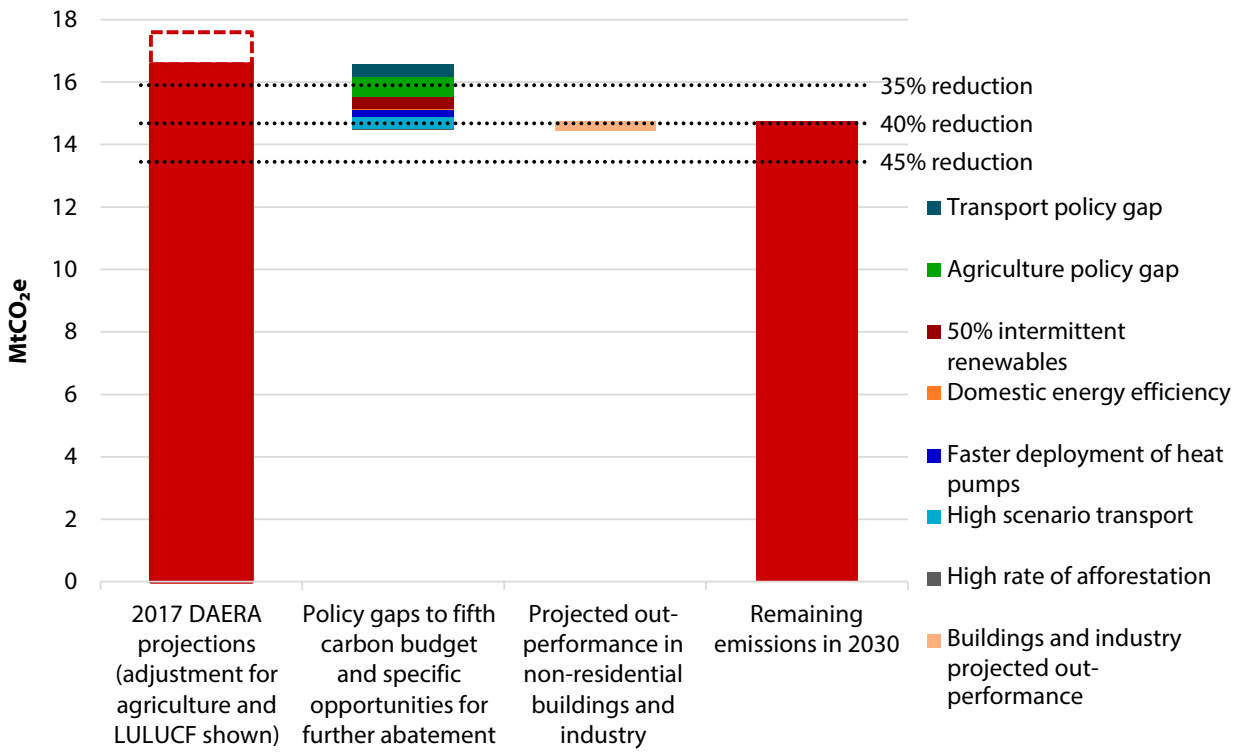
- The lack of a route to market for new **low-cost intermittent renewables**, especially onshore wind, in the electricity sector.
- **Emissions from agriculture** have risen year on year since 2009 in Northern Ireland despite efficiency improvements in dairy farms. The post-CAP framework is an opportunity to more closely link financial support to agricultural emissions reduction and increased carbon sequestration, including afforestation.
- The current **rate of tree planting** falls well short of meeting the Committee's recommendations for the fifth carbon budget or the average rate targeted in Northern Ireland's most recent Forestry Strategy.
- There is no **policy support to incentivise consumers to install low-carbon heating**, especially heat pumps, in homes off the gas grid. There is considerable potential to switch households off the gas grid from use of oil boilers to heat pumps.
- Policies to incentivise **energy efficiency improvements in homes** are largely targeted at low-income households. Northern Ireland should consider policy options to deliver an attractive package for able-to-pay householders aligned to trigger points (such as when a home is sold or renovated).
- More rapid deployment of **electric vehicles, tighter conventional vehicles standards, and transport behaviour change**.

Combined, these measures have the potential to deliver a reduction of 40% in Northern Ireland against the 1990 baseline by 2030.

Northern Ireland will have to reduce emissions well beyond 45% in the long-term. We have not identified a full set of individual measures to achieve these reductions by 2030 in this report, but that does not mean a 45% reduction by this date is impossible.

[4] Unlike the Committee's assessment of the fifth carbon budget in Northern Ireland, the DAERA projections account for abatement in non-CO_2 gases in business and industry. If UK-wide action on F-gases in our fifth carbon budget scenario were proportionally allocated to Northern Ireland, this could bring a further 0.1 MtCO2e of abatement, reducing this difference.

Figure 4. Policy gap to Northern Ireland's contribution to the UK fifth carbon budget and opportunities to go further



Source: DAERA (2018) *Northern Ireland Greenhouse Gas Projections Update;* CCC analysis.
Notes: DAERA projections have been adjusted to account for agriculture and LULUCF methodology changes in latest NAEI inventory. Unadjusted figure is 17.6 $MtCO_2e$ in 2030.

The cost-effective path to decarbonisation in Northern Ireland requires action across all sectors of the economy and a joined-up approach.

The cost-effective path to delivering emissions reductions in Northern Ireland requires emissions reductions in all sectors of the economy. Reducing emissions across power, agriculture and LULUCF, buildings and industry, transport, and waste will require close co-ordination between the UK government and multiple government departments in Northern Ireland.

More detailed information on mitigation measures required in each sector is given in our 2015 report *Sectoral scenarios for the fifth carbon budget*. This report describes the individual measures deployed in our Central Scenario and an assessment of cost effectiveness and abatement potential.

The total annual cost of meeting the fifth carbon budget in 2030 is less than 1% of GDP for the whole of the UK. Unless there is evidence to the contrary, we assume that that individual mitigation measures have a similar level of cost-effectiveness in Northern Ireland and the UK as a whole, though the relative size and characteristics of sub-sectors in Northern Ireland means there are different levels of abatement potential in each sector of the economy.

Chapter 1: Overview

In response to a request for advice by the Department for Agriculture, Environment and Rural Affairs (DAERA), this report sets out to analyse the different levels of emissions reduction that Northern Ireland can achieve by 2030, and to give an indication of the policies that could achieve these.

The proposals in this report are not a prescriptive list of definite actions over the next decade, but serve as a starting point of the general principles and policy areas that policymakers could focus on to deliver the necessary long-term decarbonisation of the Northern Ireland economy.

For the UK to achieve its legislated carbon targets in the most cost effective way, it will require emissions reductions in all sectors of the economy and across all the devolved administrations. The most recent draft Programme for Government in Northern Ireland does not set any targets for climate change reduction but contains an indicator for reductions in greenhouse gas emissions as a measure of environmental sustainability.

In our 2015 report on the fifth carbon budget, the Committee advised on the opportunities and challenges for devolved administrations to reduce their greenhouse gas emissions throughout the 2020s, as well as an assessment of how Northern Ireland could contribute to the UK cost-effective path.[5]

The Committee will publish a report on the long-term emissions targets for the UK in the first half of 2019. In the absence of a Minister, senior Northern Irish officials indicated their support for seeking this advice.[6] The report will assess whether the UK should set 'net-zero' emissions targets for carbon dioxide and/or all greenhouse gases as a contribution to increased global ambition under the Paris Agreement, whether any such target should be set now, the implications for the existing UK 2050 targets, and an updated assessment of the costs and benefits of decarbonisation. As part of this work, will consider the required contribution of Northern Ireland towards any UK-wide target.

Key areas of policy responsibilities devolved to Northern Ireland include transport demand-side measures, energy efficiency, agriculture, land use and waste (Box 1.1). Northern Ireland also has an important role in implementing UK policy (such as renewable energy deployment) through the provision of additional incentives, the role of the public sector and a policy approach in areas such as planning policy.

This chapter is structured in four sections:

1. Overview of emissions in Northern Ireland

2. Economic and political differences between Northern Ireland and the rest of the UK

3. Northern Ireland's role in meeting the fifth UK carbon budget

4. Key policy questions to reduce emissions by 2030

[5] CCC (2015) *The Fifth Carbon Budget: The next step towards a low-carbon economy*.
[6] BEIS (2018) *UK climate targets: request for advice from the Committee on Climate Change*

1. Overview of emissions in Northern Ireland

Northern Ireland has an important role to play in achieving the UK's carbon budgets. Northern Ireland accounted for 4% of UK emissions in 2016, whilst accounting for 3% of the UK's population and 2% of economic output (Gross Value Added).

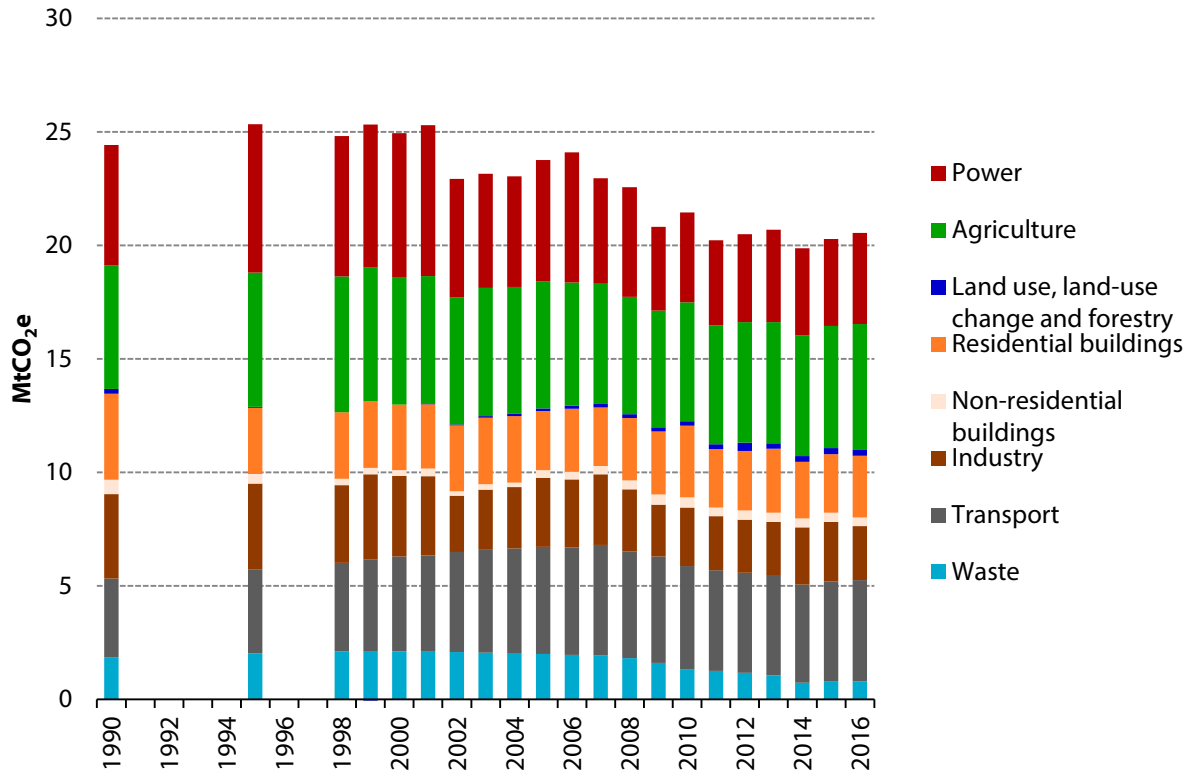
Past and current emissions

Emissions in Northern Ireland (excluding international aviation and shipping) increased to 20.6 $MtCO_2e$ in 2016. Since the 1990 baseline, emissions have fallen by 16% (Figure 1.1).

Emissions have fallen much more slowly in Northern Ireland since the Climate Change Act 2008 compared to the UK as a whole. Emissions fell by 9% from 2008 to 2016 in Northern Ireland compared to a 27% fall for the whole of the UK, 35% in Scotland and 4% in Wales.

Emissions per capita are also higher in Northern Ireland, at 11 tCO_2e per capita compared to 7 tCO_2e per capita for the whole of the UK and for Scotland, and 15 tCO_2e per capita in Wales.[7]

Figure 1.1. Emissions in Northern Ireland (1990 - 2016)



Source: NAEI (2018) *Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990 - 2016.*
Notes: No inventory data are available for devolved administrations for 1991-1994 or 1996-1997.

[7] Excluding international aviation and shipping (IA&S)

2. Economic and political differences between Northern Ireland and the rest of the UK

Devolved powers

Northern Ireland has the most wide-ranging set of devolved powers of any of the devolved administrations (Box 1.1). Importantly, Northern Ireland has devolved control of the power sector, where effective policy is crucial to deliver long term decarbonisation.

Box 1.1. Overview of devolved matters for key sectors

The balance of powers that are reserved (i.e. issues upon which only the UK Parliament can make laws):

- **Economic and fiscal**: Mostly reserved
- **Energy** (apart from nuclear): Fully devolved
- **Planning**: Fully devolved
- **Local government and housing**: Mostly devolved (including domestic and public energy efficiency and fuel poverty).
- **Industry**: Mostly reserved.
- **Transport**: Vehicle standards and taxation is reserved. Demand side measures are mostly devolved.
- **Agriculture and land use**: Mostly devolved.
- **Waste**: Fully devolved.

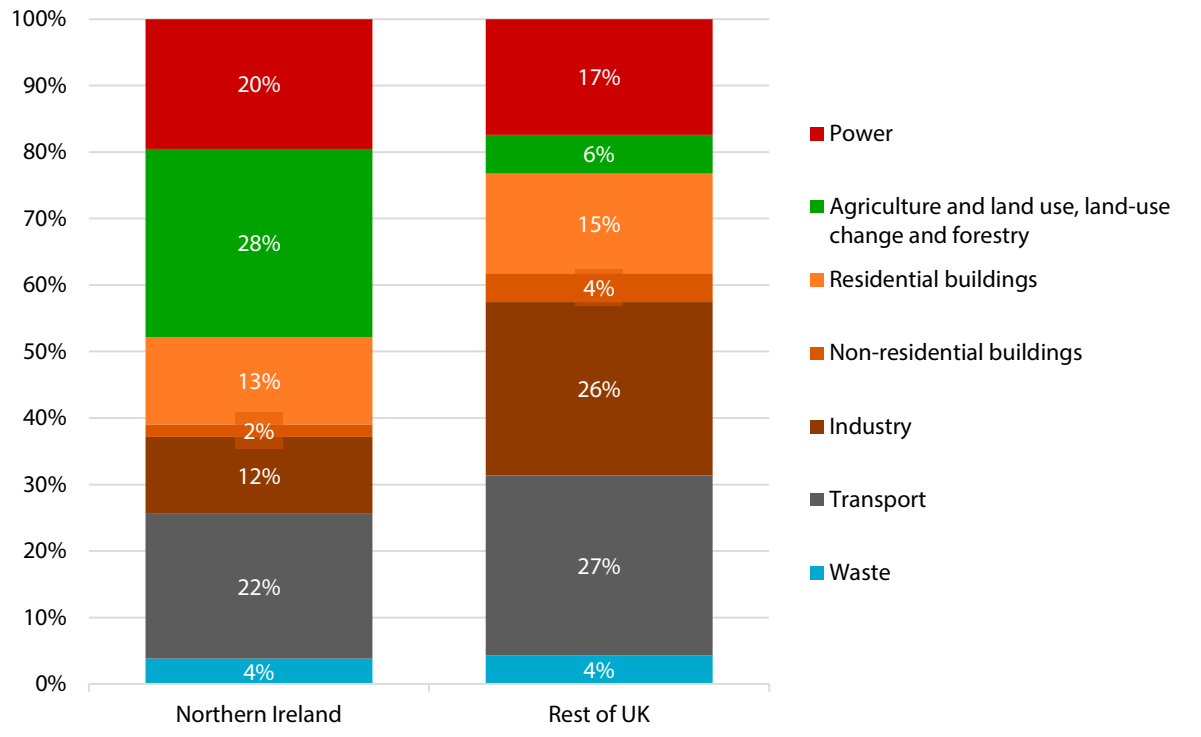
Source: Northern Ireland Office (2018) *Devolution settlement: Northern Ireland.*

Relative size of emitting sectors

The Northern Irish economy is structured differently to the UK as a whole, and the balance of greenhouse gas emissions across sectors is therefore different (Figure 1.2):

- The largest difference is the combined agriculture and land use, land-use change and forestry (LULUCF) sectors, which makes up a total of 28% of emissions in Northern Ireland, compared to just 6% in the UK.
  - This is due to proportionally larger agricultural sector in Northern Ireland, the high proportion of farming in Northern Ireland that is livestock-based, and the fact that LULUCF is a net source of emissions in Northern Ireland.
  - Conversely, the greater forest coverage in the UK means that LULUCF acts as a net carbon sink, and a higher proportion of the agricultural output is from less carbon-intense arable farming.
- Conversely, the rest of the UK has a much higher proportion of emissions from industry (26%) and transport (27%) compared to Northern Ireland (12% and 22% respectively).

Figure 1.2. Emissions in 2016 by sector in Northern Ireland compared to the rest of the UK



Source: NAEI (2018).
Notes: Agriculture and LULUCF have been combined to demonstrate the net contribution of both sectors to emissions. Unlike Northern Ireland, LULUCF acts as a net carbon sink in the rest of the UK.

Within these broader sectors of the economy, Northern Ireland has particular characteristics that must be considered when assessing their role in UK-wide decarbonisation. These include:

- In the **power** sector:
  - The energy sector (apart from nuclear) is devolved to Northern Ireland.
  - Northern Ireland is a member of the all-island Integrated Single Electricity Market (I-SEM), shared with the Republic of Ireland.
- In **agriculture and LULUCF**
  - There is a relatively low area of forest coverage (8%) compared to the whole of the UK (13%).
  - Northern Ireland has a much higher proportion of livestock-based agriculture (83% by share of output compared to 49% in the UK).
  - Analysis for our recent *Land use* report[8] suggests that the inclusion of emissions from degraded peatland to the UK inventory could add 1.9 $MtCO_2e$ per year to Northern Ireland. As a proportion of total annual emissions, degraded peatland is expected to impact Northern Ireland more than England and Wales, but less than Scotland.

[8] CCC (2018) *Land use: Reducing emissions and preparing for climate change.*

- In **buildings** Northern Ireland has a much higher percentage (76%)[9] of homes off the gas grid compared to those in Great Britain (13%).[10]
- In **transport**, the geographical size of Northern Ireland may mean that range anxiety is less of a concern for consumers. However, this is offset by the prevalence of longer cross-border journeys.

Political uncertainty

This report is written in the context of the ongoing negotiations around the UK's decision to leave the EU. Additionally, since 2 March 2017 there has not been a sitting Executive in Northern Ireland. These factors could have a significant impact on the ability of Northern Ireland to implement decarbonisation policies in the near future.

3. Northern Ireland's role in meeting the fifth UK carbon budget

Advice on the fifth UK carbon budget

Under the 2008 Climate Change Act, the Committee is legally required to advise on the level of carbon budgets, taking into account factors including the differences in circumstances between England, Wales, Scotland and Northern Ireland.

In our 2015 advice[11] the approach to assessing differences in national circumstances for Northern Ireland through the 2020s involved three steps:

- For Northern Ireland, we derived a projection of emissions to 2030 in the absence of policy action to reduce emissions (i.e. a 'baseline' projection), taking into account, as far as possible, differences in current and projected trends compared to the rest of the UK.
- We assessed opportunities to reduce emissions (i.e. abatement potential) across a range of sectors, highlighting where particular opportunities and challenges exist.
- Combining the baseline and abatement potential provided an indicative Central Scenario for 2030.

Our assessment covered the great majority of emissions in Northern Ireland (Table 1.1). For this report we have considered the same sectors, as these are areas where a reliable baseline and abatement potential can be assessed.

In addition, we assume that baseline power sector emissions follow the latest DAERA projections based on capacity and demand forecasts from the electricity network operators.

For all remaining emissions for which we have no baseline and abatement projection, we have made a simplifying assumption to fix emissions at 2016 levels, in order to allow direct comparison to the DAERA projections.

[9] Department for Communities (2018) *Northern Ireland Housing Statistics 2017-18.*
[10] BEIS (2018) *Sub-national estimates of households not connected to the gas network 2015-2017.*
[11] CCC (2015) *The Fifth Carbon Budget: The next step towards a low-carbon economy.*

Table 1.1 Sectors where emissions abatement potential has been quantified

Included	Not included (held constant at 2016 levels)
92% of emissions in Northern Ireland in 2016: • CO_2 emissions from buildings, road transport, and land use, land-use change and forestry. • Non-CO_2 emissions from agriculture and waste. • Emissions from the power sector.	8% of emissions in Northern Ireland in 2016: • Emissions from non-road domestic transport. • Non-CO_2 emissions from buildings, road transport, and forestry. • CO_2 emissions from agriculture and waste.

Source: NAEI (2018).
Notes: Emissions from international aviation and shipping are not included in the scope of this report.

Since our advice was published in 2015, new emissions data for recent years and methodology changes (Box 1.2, Figure 1.3) have given additional information on emissions in Northern Ireland. To account for this new evidence, we have adjusted our assessment for 2030 in the agriculture, LULUCF and waste sectors (Table 1.2).

Box 1.2. New evidence on Northern Irish emissions since fifth carbon budget advice

Our advice on the fifth carbon budget used the emissions inventory published in 2015 (NAEI, 2015) which provided estimates of emissions in Northern Ireland from 1990 to 2013.

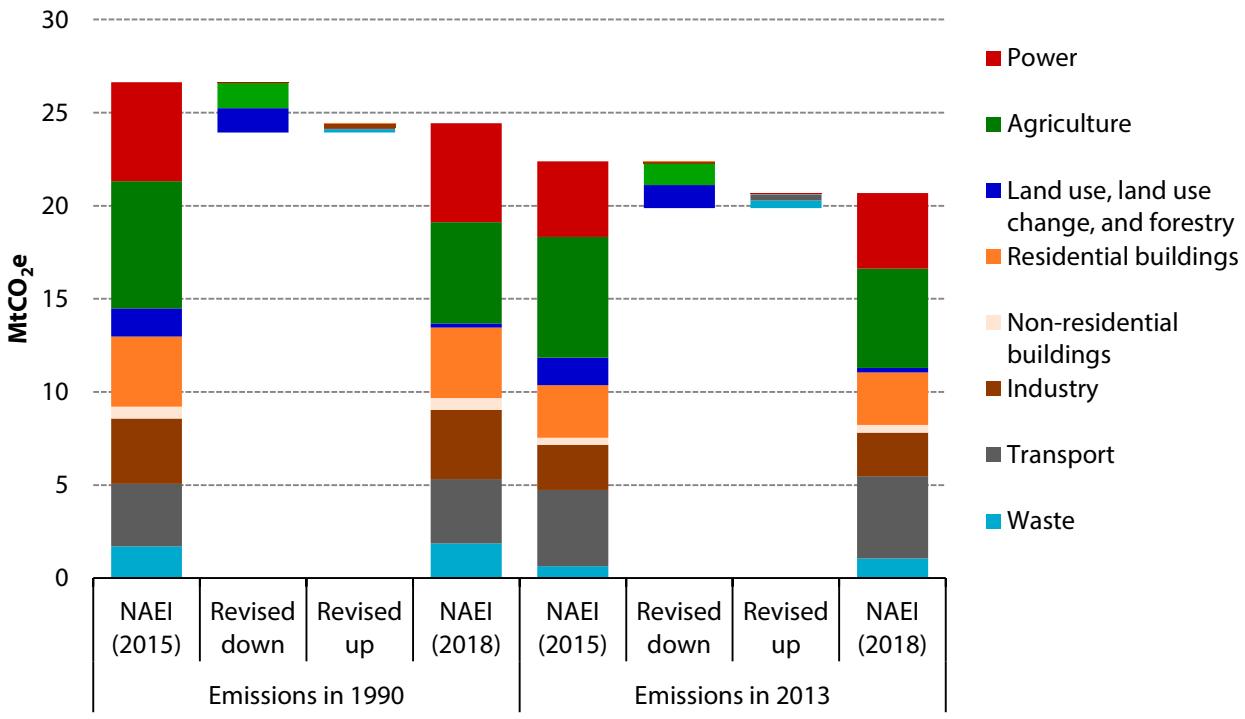
The emissions inventory methodology is continually updated, to include improvements designed to increase the transparency, accuracy, consistency, comparability, and completeness of the inventory.

Changes to the emissions inventory published in 2018 compared to the 2015 inventory have mainly affected the forestry and agriculture sectors, with large reductions in estimates. There were small increases in estimates of emissions from all other sectors:

- The changes have been similar in both the 1990 baseline and in the most recent year. The estimated reductions against the baseline are largely unchanged. NAEI (2015) data showed a 15.3% reduction since the 1990 baseline in 2013, whereas the latest estimate (NAEI, 2018) shows a 14.9% reduction against the 1990 baseline (Figure 1.3).
- The NAEI (2018) inventory also includes emissions estimates for the years 2014 - 2016. The new data shows there has been a minor (-0.6%) decrease in total emissions since 2013 (Figure 1).

Source: NAEI (2018) *Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990 - 2016*; NAEI (2015) *Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990 - 2013*.

Figure 1.3. Impact of methodology changes on emissions estimates for 1990 and 2013



Source: NAEI (2018); NAEI (2015).

Our original advice assessed that, excluding the power sector, a cost effective path for the UK to meet the fifth carbon budget would require a 28% reduction in emissions in Northern Ireland by 2030 against the 1990 baseline.

After accounting for the most recent evidence on emissions from Northern Ireland since our previous advice (Box 1.2, Table 1.2), our assessment of **Northern Ireland's contribution to UK carbon budgets is at least a 35% reduction in emissions by 2030.**

We use this assessment as a baseline for the minimum expected contribution from Northern Ireland to meet the UK's legislated targets under the fifth carbon budget.

Table 1.2 Adjusted assessment of 2030 contribution

Sector	Adjustment for methodology changes since 2015 advice on fifth carbon budget ($MtCO_2e$)	Adjusted emissions contribution in 2030 ($MtCO_2e$)
Power		2.2
Buildings (CO_2)		2.5
Industry (CO_2)		2.0
Road transport (CO_2)		2.9
LULUCF (CO_2)	-1.4	0.2
Agriculture (Non-CO_2)	-0.8	4.1
Waste (Non-CO_2)	+0.1	0.3
All other emissions (held constant from 2016 to 2030)		1.6
Total		**15.8**

Source: NAEI (2018); CCC analysis.
Notes: In agriculture, the non-CO_2 baseline and abatement have been adjusted for new NO_2 emissions factors. LULUCF has adjusted by applying the same level of abatement effort against the latest published baseline. In waste, the central target adjusted for new emissions factors to be consistent with 2016 CCC indicator (emissions from waste to fall by 56% between 2016 and 2030).

A 35% reduction in emissions is not an upper bound on what can be achieved. Scotland and Wales have set their own ambitious targets, which go beyond their minimum contributions to UK targets. Targets and policies from devolved administrations can be used as examples of best practice to encourage further action from the UK government:

- Scotland has a draft bill before Parliament that targets a 90% reduction by 2050 and contains provisions for Scottish Ministers to set a net-zero target date.
- Wales has committed to an 80% target for emissions reduction by 2050, despite the Welsh economy being more challenging to decarbonise than the UK as a whole due to the concentration of heavy industry in South Wales.

In the rest of the report, we look sector-by-sector at the types of policies that could be implemented to achieve these reductions, as well as stretching policies which could go beyond 35% by 2030 if Northern Ireland were to be more ambitious.

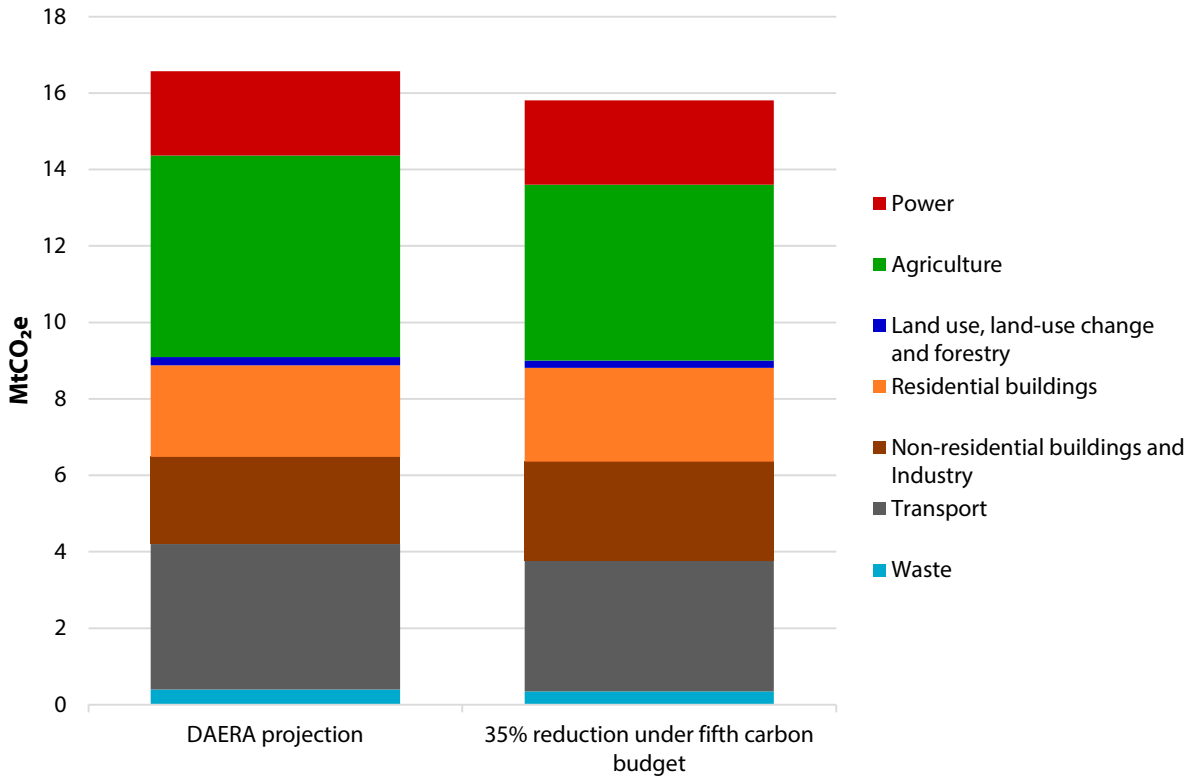
Projection of Northern Irish emissions in 2030 under existing policies.

DAERA produces an annual publication projecting emissions in Northern Ireland out to 2030 using the Northern Ireland Greenhouse Gas projection tool. These projections are made on the basis of existing policies at a UK and devolved level.

The most recent DAERA projections of greenhouse gas emissions (Figure 1.4) show that Northern Ireland is unlikely to achieve a 35% emissions reduction by 2030 through existing devolved and reserved policies. Northern Ireland is currently projected to achieve a reduction of 32% on 1990 levels.[12]

This leaves a net 'policy gap' of around 0.8 $MtCO_2e$ compared to our fifth carbon budget scenario, largely driven by the agriculture and transport sectors (Figure 3). The latest DAERA projections show an over-performance of around 0.3 $MtCO_2e$ in the non-residential buildings and industry sectors. However, our assessment of the fifth carbon budget in Northern Ireland did not include abatement in non-CO_2 gases in business and industry. Including the Northern Irish share of UK-wide action on F-gases could bring a further 0.1 $MtCO_2e$ of abatement into our projections, reducing this over-performance.

Figure 1.4. Comparison of latest DAERA projections and 35% reduction in 2030



Source: DAERA (2018) *Northern Ireland Greenhouse Gas Projections Update*; CCC analysis.
Note: DAERA projections have been adjusted to account for agriculture and LULUCF methodology changes in latest NAEI inventory. Unadjusted, the figure is 17.6 $MtCO_2e$ in 2030.

[12] Adjusted for agriculture and LULUCF methodology changes. As published, projections suggest a 30% decrease.

4. Key policy questions to reduce emissions by 2030

The recommendations in this report are not a prescriptive list of policy actions over the next decade. Climate change policies for Northern Ireland are best decided by the devolved government, who have a more detailed understanding of the policies that will be both effective and politically feasible at a local, regional, and national level in Northern Ireland.

Where possible, we provide examples of effective policy design elsewhere in the UK and the emissions reductions they are expected to achieve, identify areas of the Northern Irish economy where intervention is likely to be most effective, and suggest possible policy approaches to decarbonising each sector of the Northern Irish economy. This should serve as a starting point for devising a decarbonisation strategy and highlight areas for policymakers to prioritise.

Key policy questions by sector

As part of the request for this advice, DAERA provided a number of sector-specific policy questions which we address throughout this report:

- In the **power** sector (Chapter 2):
  - What policies, strategies, measures or schemes could help decarbonise the energy sector and promote the uptake of renewable energy, energy efficiency and low carbon technologies?
  - How can energy policies provide support for the future transition to ultra-low-emission vehicles (ULEVs)?
  - Are there opportunities for renewable energy generation, supply and low carbon technologies at a local or communal level that may have the potential to provide income, support transition to ULEVs or the development of low carbon heat structures supported by smart technologies?
- In the **agriculture and land-use, land-use change and forestry** sectors (Chapter 3):
  - In the context of the 'Going for Growth' ambitions set out by the agri-food industry, what further agricultural and environmental strategies and measures could be introduced to mitigate Northern Ireland's agricultural GHG emissions?
  - Given the major role of agriculture in terms of land management, what mechanisms can be developed to enhance the role of agriculture as a significant carbon sink?
  - What policies, strategies and measures are required to support and incentivise increases in tree planting in any post-Brexit policy on the countryside of which forestry will form a part?
  - Are there any other policies strategies and measures within LULUCF that may help in reducing greenhouse gas emissions?
- In the **buildings and industry** sectors (Chapter 4):
  - What policies, strategies, measures or schemes could help support a transition from fossil fuel heating systems to low carbon heating systems?
  - What further steps can be taken to encourage the take up and introduction of energy efficient and renewable energy technologies in old and new residential and non-residential buildings?

- In the **transport** sector (Chapter 5):
  - What policies, strategies and measures, over and above the already recommended non-financial incentives, are needed to build upon the public charging infrastructure, facilitate the deployment of private or communal charge points and accelerate the take up of ULEVs?
  - Are there any additional strategies, measures or schemes that could be considered to support the policies in place to promote the shift to walking, cycling and public transport?
- In the **waste** sector (Chapter 6):
  - Are there any policies, strategies or measures that should be considered in the forthcoming review of Northern Ireland's Waste Management Strategy?
- Within each chapter, we also consider the role of the **public sector** in delivering a low carbon economy in Northern Ireland by providing climate leadership through public procurement and by managing its estate in a sustainable way:
  - How can public procurement policy be enhanced to promote further the use of renewable and energy efficient technologies when securing goods and services with contractors?
  - What measures should the public sector (local and central) consider to promote the use of renewable energy technologies, energy efficiency technologies, low carbon heat, tree planting and the uptake of ULEV's across all its estate?

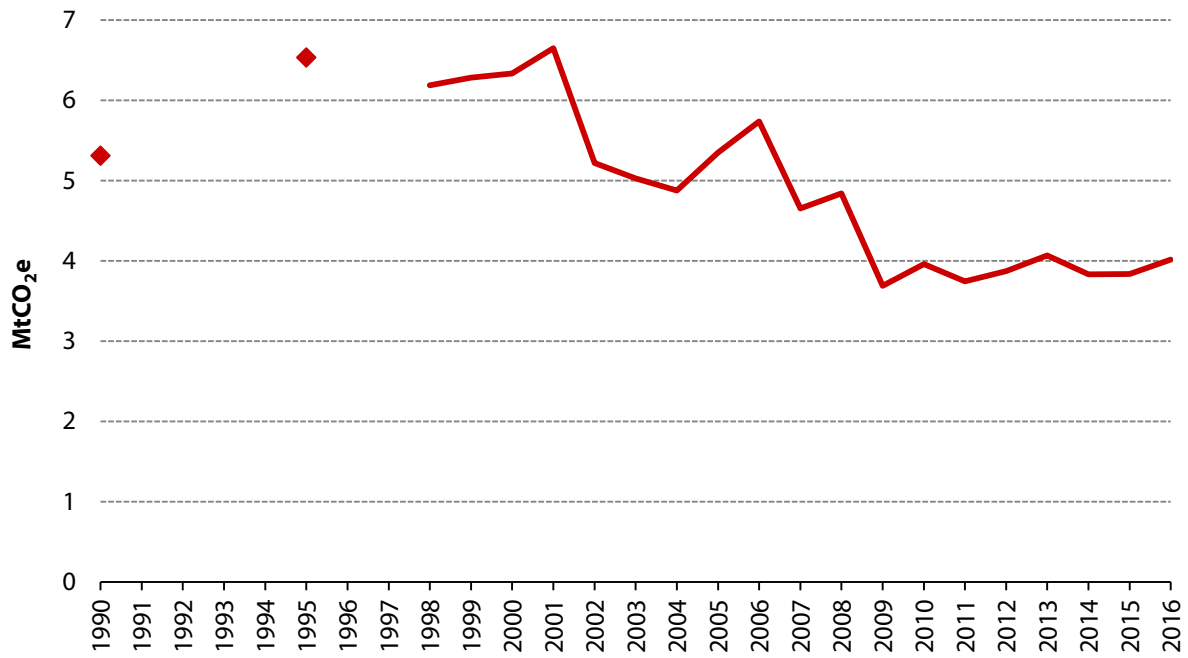
Chapter 2: Power

Overview of power sector in Northern Ireland

Latest emissions trends and drivers

Emissions increased to 4.0 $MtCO_2e$ in 2016, with a total decrease of 17% between 2008 and 2016. Emissions were 24% lower than 1990 levels (Figure 2.1). The power sector accounted for 20% of total Northern Irish emissions in 2016.

Figure 2.1. Power sector emissions in Northern Ireland (1990 - 2016)



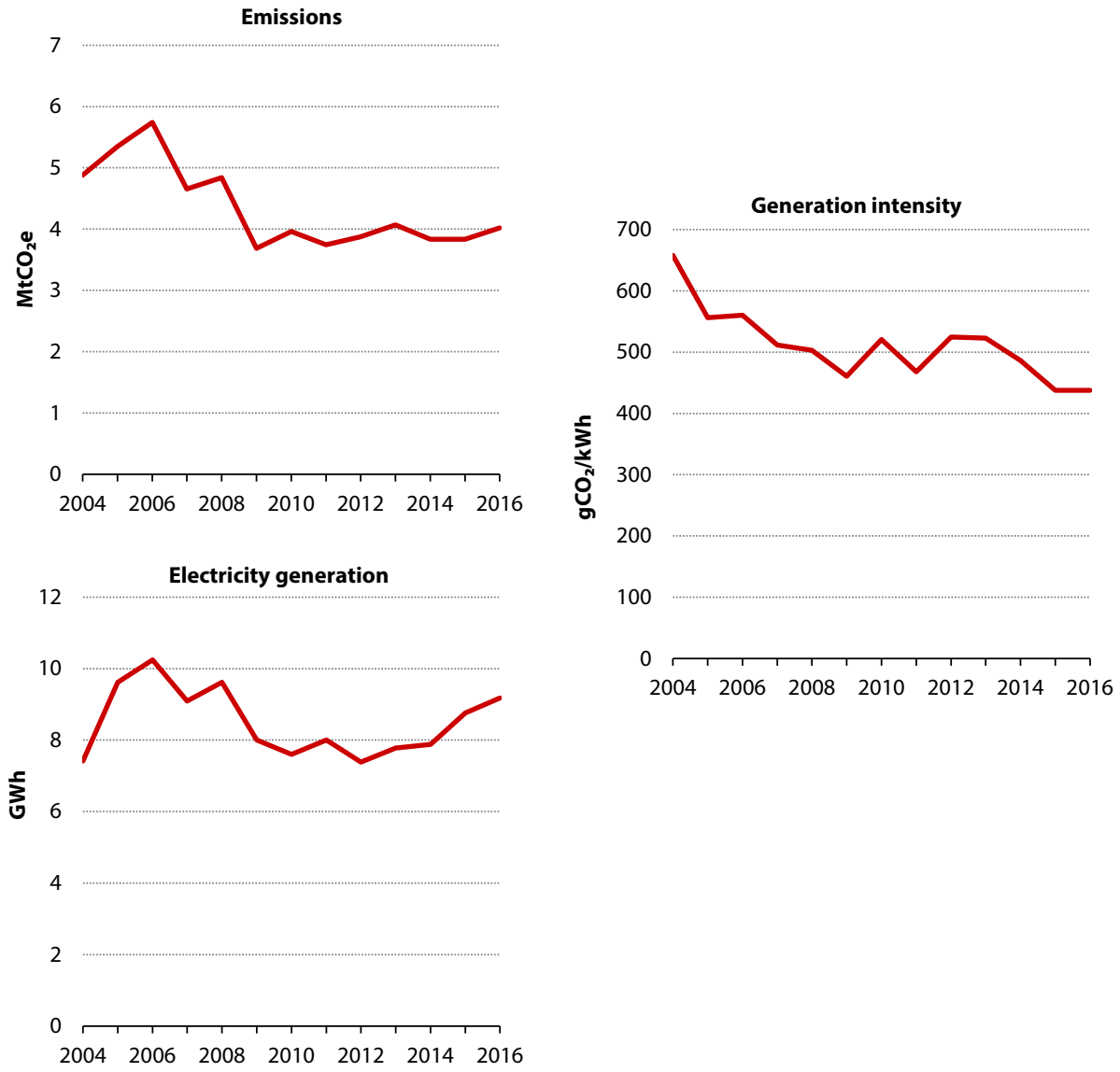
Source: NAEI (2018).

The generation mix in Northern Ireland changed from 2015 to 2017, with increases in gas and renewable generation offsetting a significant fall in coal generation that led to an overall 1.0 TWh increase (11%) in annual generation over two years (Figure 2.2) to match increasing demand:

- Gas generation increased in consecutive years, by 0.3 TWh (7%) from 2015 to 2016 and by a further 7% in 2017. Gas now makes up the majority (51%) of total electricity generation in Northern Ireland.
- Electricity generation from coal was unchanged from 2015 to 2016 but fell by 0.8 TWh (-35%) from 2016 to 2017.
- A moderate (4%) rise in renewable electricity generation between 2015 and 2016 was followed by a substantial increase of 1.0 TWh (42%) in 2017. Northern Ireland's 3.3 TWh of renewable electricity generation in 2017 accounted for one third (34%) of all generation. This was largely driven by a 33% increase in wind generation capacity and a 16% increase in average wind load factors.

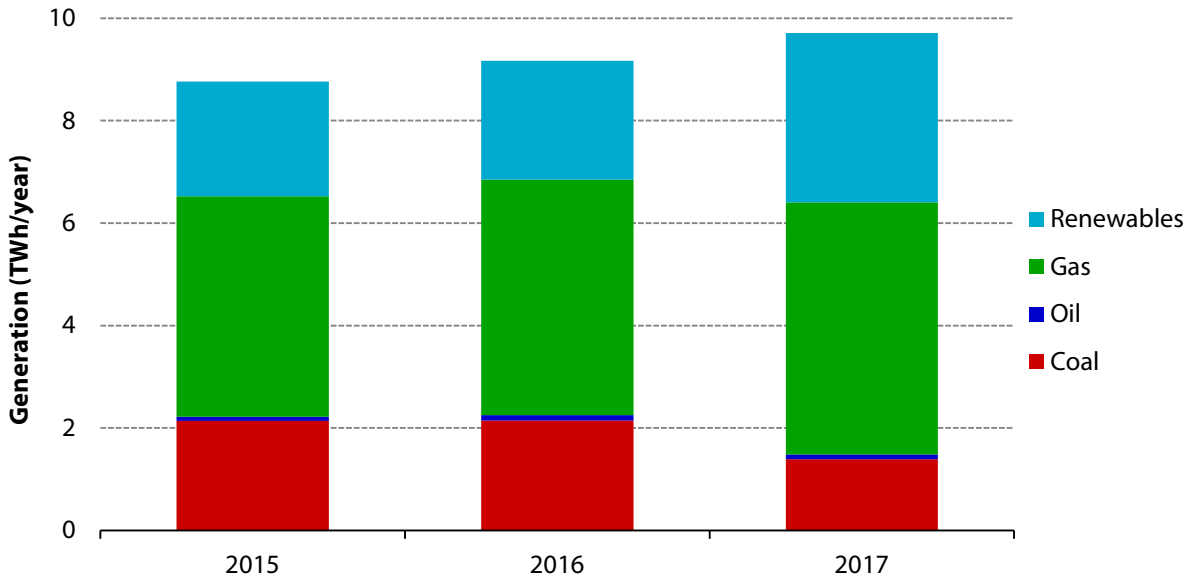
The average electricity generation emissions intensity was 440 gCO_2e/kWh in 2016, unchanged from 2015 but 30% more carbon efficient than in 2006. A substantial displacement of carbon-intense coal generation by renewable energy is expected lead to a fall in generation emissions intensity in 2017, although final emissions data have not yet been published.

Figure 2.2. Annual emissions, generation and carbon intensity of generation (2004 - 2016)



Source: NAEI (2018); BEIS (2018) *Electricity generation and supply figures for Scotland, Wales, Northern Ireland and England, 2004 to 2017.*

Figure 2.3. Electricity generation mix in Northern Ireland



Source: BEIS (2018) *Electricity generation and supply figures for Scotland, Wales, Northern Ireland and England, 2004 to 2017.*
Notes: Chart excludes 'other' generation (hydro pumped storage, waste and other thermal). Northern Ireland does not have any Nuclear generation capacity.

The I-SEM network

The Integrated Single Electricity Market (I-SEM) is the new all-island electricity market which went live in October 2018. The primary aims of the market reforms are to integrate the all-island market with the European Internal Energy Market, increase opportunities to trade in different time frames, and to increase the efficiency of cross-border interconnectors (Table 2.1):

- The nature of the all-island market means that any energy policies in Northern Ireland that affect the supply-side of energy must be compatible with Republic of Ireland policy, and vice-versa, in order to avoid market distortions that incentivise inefficient generation.
- Capacity in the I-SEM is procured via a competitive Capacity Remuneration Mechanism (CRM):
  - The CRM allows for participation by wind and solar PV. Constraints on the all-island network mean that the CRM must be geographically constrained, to ensure a minimum quantity of capacity is available where constraints on the network are identified.
  - Auction winners are subject to a price cap set somewhat above the variable cost of the most expensive generator. The wholesale price can still rise to high levels to signal scarcity value, but consumers are protected because generators must pay back any excess of the market price above the cap.
  - Electricity generators benefit from an upfront payment, whilst consumers benefit from security of supply and reduced exposure to price spikes.

Table 2.1. Key differences between the SEM and I-SEM		
	SEM	**I-SEM**
Market structure	One pool and timeframe.	Different markets with different timeframes.
Market price	Suppliers are price takers. The most expensive generator required to meet demand sets the price that suppliers pay.	Suppliers are price makers. They set limits on what they are willing to pay in each market and, where this crosses what generators are willing to accept, this sets the market price
Trading with Great Britain	Capacity on interconnectors can be reserved, which may not deliver a cost-effective flow.	Interconnection capacity is allocated based on prices with electricity always flowing from the cheaper to the more expensive market.
Capacity payments to generators	The Capacity Payment Mechanism gives capacity payments to cover generators' fixed costs, and are paid if the generator declares that it is available to run.	Generators are paid only when their output is required to meet demand and only if they can.
Source: SEM Committee (2018) *Quick Guide to the I-SEM.*		

Carbon price floor

Since 2013, the UK government has set a Carbon Price Floor (CPF) that increases the total price of carbon for the UK power sector above the EU Emissions Trading System (EU ETS) price in order to further incentivise low carbon investment.

The current CPF is set at £18/tCO_2 on top of the EU ETS price, which tripled in 2018 to reach €25/tCO_2 at the start of January 2019.[13] Previous EU ETS prices of under €10 were not high enough to effectively incentivise low-carbon generation, but the higher prices seen recently may make the scheme more effective.

In December 2012, the Northern Ireland Executive secured an exemption from the CPF to avoid distorting the all-island market:

- The Executive secured the exemption on the basis that the CPF would create a competitive disadvantage for market participants in Northern Ireland, and increase electricity prices by 10-15% over those in the Republic of Ireland.
- As a consequence, the total carbon price facing generators in Northern Ireland is the EU ETS price. This is lower than in the rest of the UK, meaning there is less incentive to move away from fossil fuels.
- Despite the exemption, the CPF has had some knock-on effects on the electricity market in Northern Ireland, as the imbalance in carbon price has incentivised exports to Scotland

[13] https://www.theice.com/products/197/EUA-Futures

through interconnectors. In 2016, for the first time, Northern Ireland was a net exporter of electricity to Scotland (although the net difference was small at 250 GWh).[14]

- The CPF, along with the closure of the Northern Ireland Renewables Obligation (Box 2.1), highlights the potential for unintended consequences of UK government policy on the power sector in Northern Ireland.

Fossil fuel electricity generation

The System Operator for Northern Ireland (SONI) and EirGrid, the transmission operator for the Republic of Ireland, provide an annual report on the generation capacity in the all-island network for the next decade (Table 2.2).

Table 2.2. Registered capacity of major dispatchable generation in Northern Ireland in 2018

Plant	Fuel type	Registered capacity (MW)	Note
Ballylumford B	Gas	290	Contracted to the end of 2018. Has been granted a derogation to close by the Utility Regulator for Northern Ireland.
Ballylumford C	Gas	600	
Kilroot	Coal	480	SONI and EirGrid statement assumes this capacity will be unavailable after 2024.
Coolkeeragh	Gas	410	

Source: SONI and EirGrid (2018) *All-Island Generation Capacity Statement 2018-2027.*
Notes: Generators under 100 MW are not included. A proposed 490 MW combined cycle gas turbine plant in Belfast Harbour has not been included in this table.

- Northern Ireland's major coal plant, Kilroot, did not win a capacity contract in the first auction to supply the all-island integrated single electricity market (I-SEM) to October 2019:
  - In 2016, Kilroot generated 2.1 TWh of electricity and released 2.1 $MtCO_2e$, which fell to 1.4 TWh and 1.5 $MtCO_2e$ in 2017.[15,16]
  - The operators initially announced the closure of the plant in mid-2018 but, in order to meet security of supply requirements from the Utility Regulator, a contract was negotiated to keep Kilroot open until October 2019.

[14] House of Commons Northern Ireland Affairs Committee (2017) *Electricity sector in Northern Ireland.*
[15] BEIS (2018) *Electricity generation and supply figures for Scotland, Wales, Northern Ireland and England, 2004 to 2017.*
[16] European Commission (2018) *EU ETS Verified Emissions for 2017.*

  - Kilroot was awarded a one-year contract for 440 MW of coal generation in the most recent auction, so will operate until at least October 2020.
  - SONI and EirGrid assume that coal capacity from Kilroot will be unavailable after 2024.
- Ballylumford B gas plant is scheduled to close in late 2019 and has been granted permission to close by the utility regulator.
- A proposed 480 MW combined cycle gas turbine plant in Belfast Harbour has applied for grid connection and planning permission, but this has not yet been granted and was not included in the SONI and EirGrid analysis of generation capacity to 2027.[17]

Low-carbon electricity generation

Northern Ireland's Strategic Energy Framework (SEF)[18] set a target for 40% of electricity consumption to be met from renewables by 2020. An interim target of 20% was met in 2015 and reached 35% in December 2017.[19] If all projects with accepted grid connection offers become operational the 40% target is likely to be achieved.

The SEF is being reviewed and is to be replaced by a new energy strategy which will (subject to Ministerial agreement) set out Northern Ireland's energy ambition for the period to 2050.

The majority (78%) of Northern Ireland's low-carbon generation capacity in 2017 was onshore wind. Despite continued growth in onshore wind capacity this share was down from 94% in 2011 due to the growth of other renewable technologies.

There has been a substantial rise in installed solar PV capacity from 2 MW in 2011 (equivalent to 0.4% of all installed renewable capacity in 2011) to 136 MW in 2016 (equivalent to over 12% of renewable capacity in 2016).

Northern Ireland does not currently have any offshore wind capacity. The SONI and EirGrid capacity statement assumes that this will not have changed by 2027. Plans for the County Down offshore wind farm, which could have supplied up to 13% of Northern Ireland's electricity, were cancelled in 2014.

Following the closure of the Northern Ireland Renewables Obligation (Box 2.1) in April 2017 and the decision not to join the UK Contracts for Difference (CfD) scheme, there is currently no route to market for new onshore wind in Northern Ireland. The SONI and EirGrid forecast of renewable capacity (Figure 2.4) therefore includes further deployment of onshore wind until 2020 based on projects that are already in progress, but does not include any additional deployment beyond this date.

[17] http://evermoreenergy.com/belfastpowerstation/
[18] DETI (2010) *Energy - A strategic framework for Northern Ireland.*
[19] Department for the Economy (2018) *Electricity consumption and renewable generation in Northern Ireland.*

Box 2.1. Closure of NIROs and introduction of Contracts for Difference

The Renewables Obligation (RO) was introduced by the UK Government in 2002 as a financial support scheme for renewable electricity, providing a subsidy per unit of renewable electricity generated at a relatively stable rate for 20 years.

The Northern Ireland Executive launched its own version of the RO, the Northern Ireland Renewables Obligation (NIRO), in 2005. Certificates issued in Northern Ireland (NIROCs) were fully tradeable with Renewables Obligation Certificates issued in Great Britain (GBROCs), allowing the costs of NIROs to be shared across the whole of the UK.

The UK Government announced the replacement of the RO with a new scheme, Contracts for Difference (CfD), in which the level of subsidy varied according to the wholesale price of electricity. However, in June 2015 it announced that it would close the RO for onshore wind in 2016, one year earlier than anticipated.

The UK Government informed the Northern Ireland Executive that if the NIRO did not also close to small-scale onshore wind, it would not allow GB suppliers to meet their annual RO quotas by using NIROCs produced by schemes accredited after 1 April 2016. This would likely have considerably increased the cost of subsidising renewable energy for consumers in Northern Ireland.

Northern Ireland had originally planned to close the NIRO in 2017, in line with the original plans for the closure of the RO, but followed the UK Government by closing the NIRO to new onshore wind from April 2016.

The Northern Ireland Affairs Committee criticised how the closure of the RO affected Northern Ireland, stating that:

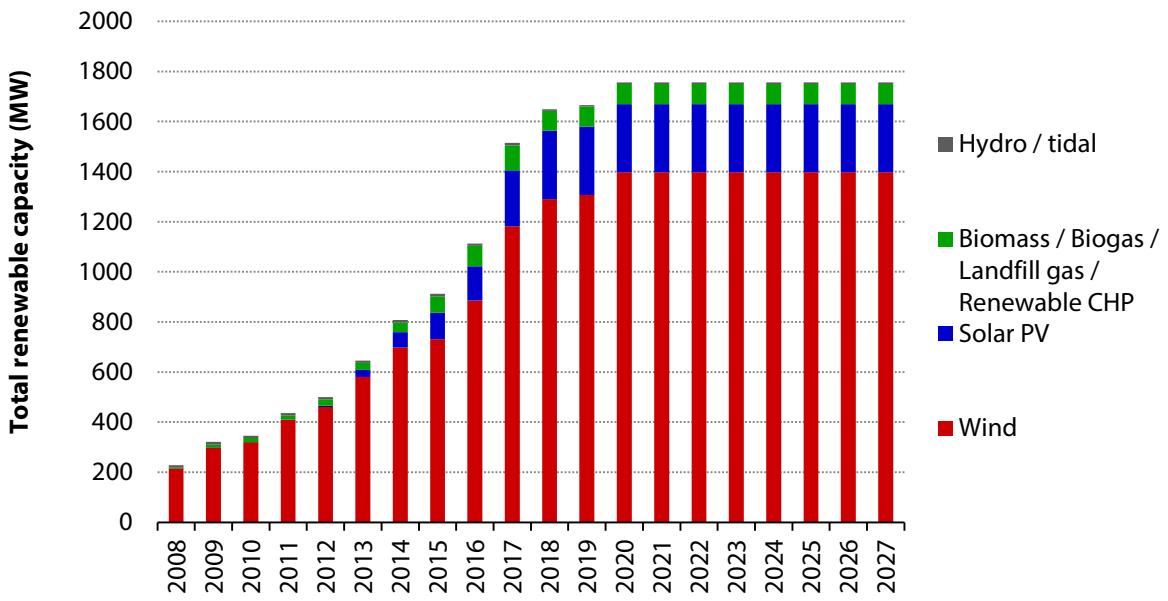
"There was a lack of coordination and collaboration between the UK Government and the Northern Ireland Executive on the closure of the Renewables Obligation (RO), and no clarity until late in the process regarding the consequential effect on the Northern Ireland Renewables Obligation (NIRO). This led to significant uncertainty for electricity market participants in Northern Ireland, damaging investor confidence and putting projects at risk. This could and should have been avoided with greater foresight and a more joined-up approach between the UK Government and Northern Ireland Executive."

Whilst the RO was replaced with the Contracts for Difference (CfD) policy in the rest of the UK, Northern Ireland did not choose to participate in the CfD scheme. This decision was based on concerns that, due to the auction process, CfDs would definitely increase the cost of renewable subsidies faced by Northern Irish consumers without any guarantee of new renewable electricity projects being built in Northern Ireland.

The closure of the NIRO has left Northern Ireland as the only part of the UK not to have a support mechanism for the renewables industry. To date, the Northern Irish government has not revealed how or whether it will support the renewables industry in the future.

Source: House of Commons Northern Ireland Affairs Committee (2017) *Electricity sector in Northern Ireland.*

Figure 2.4. Past and forecast capacity of major generation in Northern Ireland in 2018



Source: BEIS (2018) *Renewable electricity capacity and generation (ET 6.1)*; SONI and EirGrid (2018) *All-Island Generation Capacity Statement 2018-2027*.
Notes: BEIS statistics are shown before 2017, whilst SONI and EirGrid assessment of future capacity is used from 2018 onwards.

North-south interconnection

The electricity transmission network operates on an all-island basis. However there is currently only one major interconnector, which limits the transmission capacity of the network to 100 MW North to South and 200 MW South to North.

The Tyrone to Cavan Interconnector (the second North South Interconnector) is a 400 kV interconnector (transmission capacity of 1,500 MW), planned to be commissioned in 2023, will remove the transmission constraint and allow the all-island network to operate much more efficiently:

- This is expected to have a positive impact on electricity prices and create significant savings for consumers of around £25 million per year for the whole island.[20]
- As well as increasing efficiency and reducing costs, the second interconnector is expected to increase security of supply and allow greater levels of renewable energy to be generated in both countries due to greater grid flexibility.
- Planning approval for the connector has been granted in both Northern Ireland and the Republic of Ireland, though these are currently subject to legal challenges on both sides of the border.

[20] Grant Thornton (2017) *Strengthening the all island electricity network by 2020.*

Northern Ireland's contribution towards UK targets

Indicators for UK-wide decarbonisation of the power sector

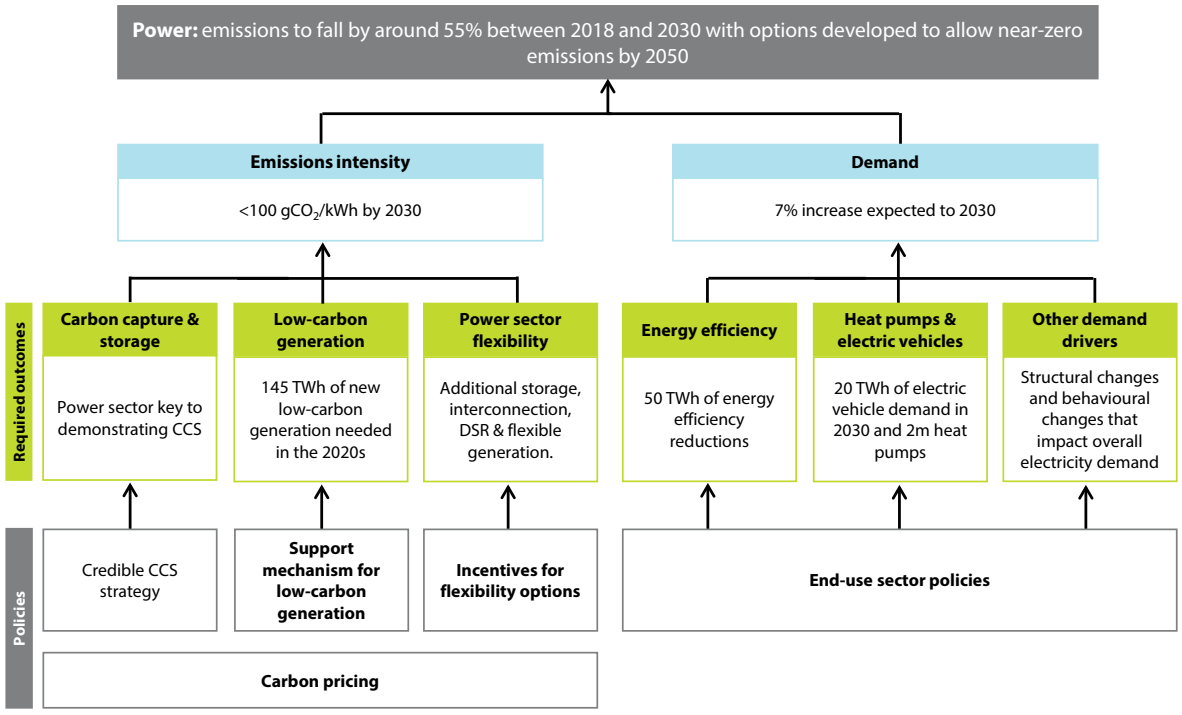
On a UK-wide basis, the Committee monitors the power sector against a set of indicators that reflect underlying progress towards climate targets. The indicator framework contains a possible set of actions that would follow the cost-effective path for emissions reduction and prepare for the 2050 target. For the whole of the UK:

- Our progress indicators for the power sector cover the expansion of low-carbon generation and the successful integration of low-carbon sources into the electricity system.
- To further reduce emissions from the power sector requires the continued expansion of low-carbon generation (including nuclear), from 52% of generation in 2017 to at least 75% in 2030, at a similar rate to that seen between 2008 and 2017. This accounts for projected growth in demand to 2030 of around 31 TWh. Between 45% and 60% of total generation could be met by intermittent renewables.

Figure 2.5 shows this set of indicators, and policy areas where the Northern Irish government has devolved responsibility are in bold. Apart from Carbon Capture and Storage (CCS) strategy and nuclear energy, the main policy levers are devolved to the Northern Irish government, although other fiscal levers are still reserved.

As noted from previous examples, Northern Irish energy policy can be influenced by UK policy despite its devolved nature. The interconnected nature of the I-SEM also means that Northern Irish energy policy must be compatible with the Republic of Ireland to ensure an efficient market can operate on a 'level playing field'.

Figure 2.5. Committee on Climate Change indicators for UK-wide decarbonisation of the power sector



Notes: Areas where devolved policies have a significant role to play are in bold.

Emissions from the power sector in Northern Ireland in 2030

Figure 2.6 shows Northern Ireland's current projection for emissions from the power sector in 2030. By 2030, emissions are expected to fall to 2.2 $MtCO_2e$:

- This projection assumes that there is no coal generation in Northern Ireland beyond 2025.
- It assumes that if all currently committed renewable energy projects deploy, but in the absence of any further policy support for renewables, 40% of all Northern Irish electricity consumption will be met by intermittent renewable sources in each year from 2020 to 2030.
- This is below the Committee's current assessment that 45-60% of electricity generated in the UK could be from intermittent low-carbon sources by 2030.[21]

The Committee did not produce an estimate of emissions for the power sector in Northern Ireland in its work on the fifth carbon budget, instead focusing on UK-wide scenarios. The principles discussed later in this chapter should be a basis for Northern Ireland's route to further decarbonisation of the power sector.

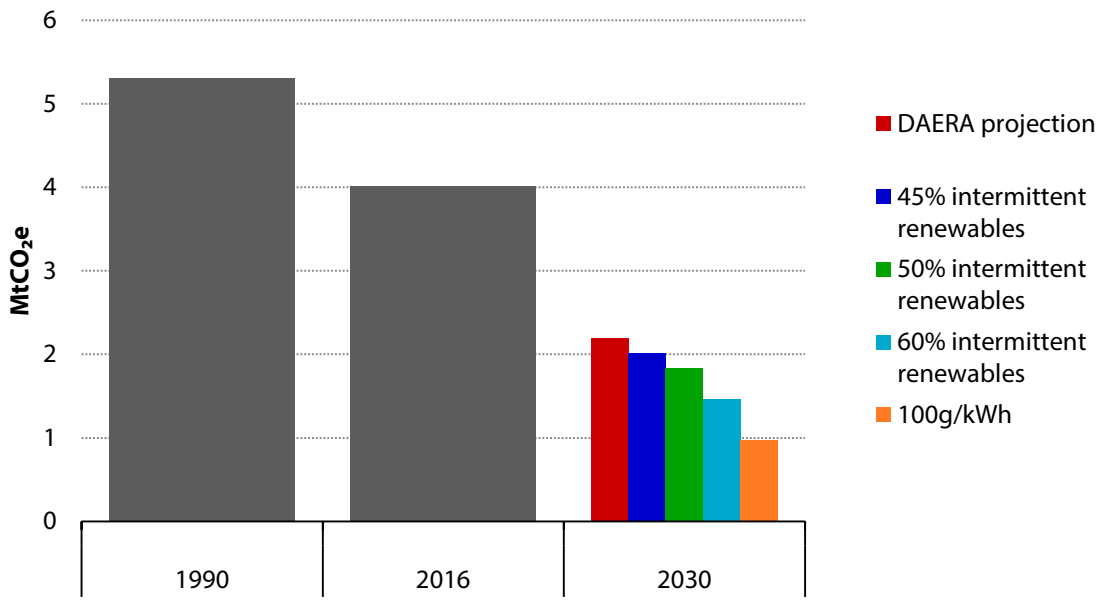
A reduction to 2.2 $MtCO_2$ per year whilst producing 9.6 TWh of electricity in 2027 as forecast by SONI and EirGrid (Box 2.2) under a medium demand scenario would mean an average grid intensity of 230 gCO_2/kWh in 2027. This would significantly under-perform against the Committee's target indicator of less than 100 gCO_2/kWh by 2030 for the whole of the UK.

There is potential to further decarbonise the power sector in Northern Ireland through broader support for intermittent renewables (Figure 2.6):

- Scenarios in which 45% to 60% of generation are met by intermittent low-carbon sources in 2030 would save between 0.2 and 0.7 $MtCO_2e$ against the DAERA projection.
- In April 2018, following a five-month trial, EirGrid and SONI confirmed that up to 65% variable renewable energy can be handled on the all-island grid at any given time. This was predominantly made up of wind power, along with contributions from solar and interconnector imports.[22]
- Meeting the Committee's indicator for UK-wide electricity generation intensity of 100 gCO_2/kWh by 2030 would reduce emissions to under 1 $MtCO_2e$. The lack of nuclear generation makes this intensity target more stretching in Northern Ireland.

[21] CCC (2018) *Reducing UK Emissions, Progress Report to Parliament.*
[22] http://www.eirgridgroup.com/newsroom/record-renewable-energy-o/

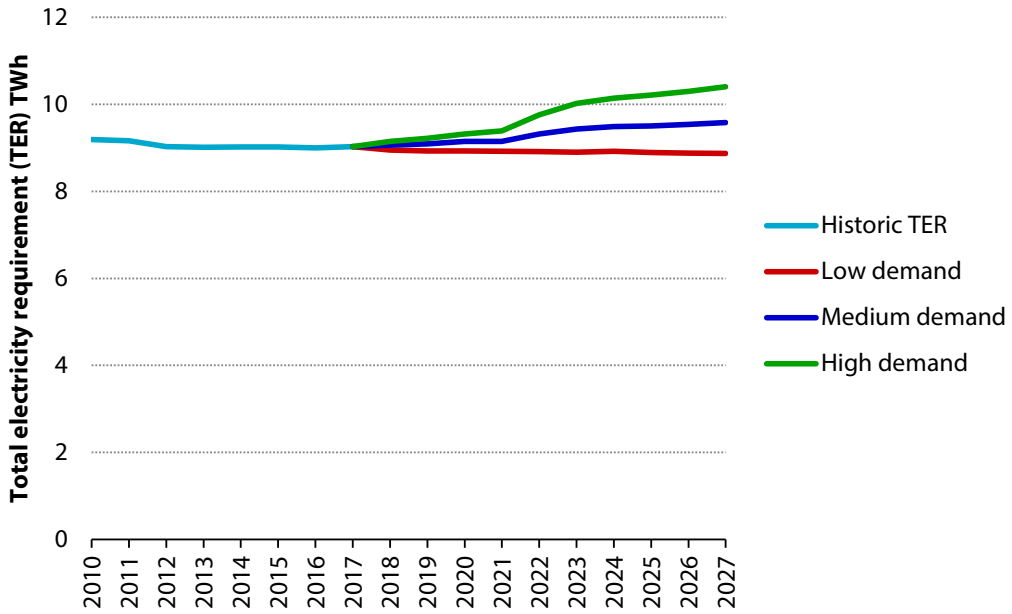
Figure 2.6. 2030 scenarios for the power sector in Northern Ireland



Source: NAEI (2018); DAERA (2018) *Northern Ireland Greenhouse Gas Projections Update*; CCC analysis.
Notes: The Committee did not produce a scenario for the power sector in Northern Ireland as part of the work on fifth carbon budget.
The grid intensity 100g/kWh assumes a total electricity requirement of 9.8 TWh.

Box 2.2. Total electricity supply and demand forecast for Northern Ireland

Figure B2.2. Total electricity requirement forecast for Northern Ireland



Source: SONI and EirGrid (2018) *All-Island Generation Capacity Statement 2018-2027*.
Notes: TER is the total electricity required by Northern Ireland, i.e. it includes all electricity produced by large-scale, dispatchable generators, all small-scale exporting generators, and an estimate of electricity produced by self-consuming generators.
The median demand forecast is based on an average temperature year and assumes a central estimate of energy efficiency and economic conditions. The low and high demand forecasts are based on adjusting temperature, energy efficiency, and economic conditions to produce a range of future demand.

The SONI and EirGrid analysis of future supply and demand trends in Northern Ireland and the Republic of Ireland shows that:

- Total electricity demand in Northern Ireland has been relatively flat in the last few years, and this is not projected to rise significantly in the near future.
- The electricity generation mix will change in Northern Ireland. SONI make the assumption that Northern Ireland's last remaining coal-fired power station, Kilroot, will close by the end of 2024 to meet environmental standards. This mirrors UK government policy to end coal-fired generation in Great Britain by 2025, although there is no official policy to replicate this in Northern Ireland.
- Northern Ireland should have 1,400 MW of wind capacity by 2020, but SONI have not assumed any further deployment between 2021 and 2027. This level of deployment would be sufficient to meet Northern Ireland's target of 40% generation by 2020.
- A proposed 490 MW combined cycle gas turbine (CCGT) plant in Belfast has not been included in supply forecasts, but progress in bringing this forward will be monitored. It will not be sustainable to be reliant on natural gas in the long-term. Northern Ireland could explore the opportunities to use H_2 or gas CCS generation.

Source: SONI and EirGrid (2018) *All-Island Generation Capacity Statement 2018-2027*.

Principles and policy options for decarbonising the power sector

When commissioning this report, DAERA requested sector-specific policy advice on the following questions:

- What policies, strategies, measures or schemes could help decarbonise the energy sector and promote the uptake of renewable energy, energy efficiency and low carbon technologies?
- How can energy policies provide support for the future transition to ULEVs?
- Are there opportunities for renewable energy generation, supply and low carbon technologies at a local or communal level that may have the potential to provide income, support transition to ULEVs or the development of low carbon heat structures supported by smart technologies?

This section will address these questions by first focussing on general principles that should be followed when planning policy to decarbonise the power sector in Northern Ireland, and then specific policy areas which could lead to carbon savings.

Principles for decarbonising the power sector in Northern Ireland

Whilst specific policy design is outside the scope of this report, there are several principles for decarbonising the power sector in Northern Ireland that would useful for policy makers to consider:

- **Develop consistent and co-ordinated policies with the Republic of Ireland to allow an efficient all-island market.** The nature of the I-SEM and the increased interconnectivity of the Republic of Ireland and Northern Ireland means that any market incentives, for example renewable energy subsidies or carbon pricing, must be balanced on either side of the border to ensure an efficient market can operate and minimise costs for consumers.

  Northern Ireland must therefore ensure its policies develop in a way that is consistent and co-ordinated with the Republic of Ireland. It is important that many of the policy options discussed in this chapter are considered on a cross-jurisdictional basis to avoid a 'two speed' electricity market developing.

- **Phase out coal generation while maintaining security of supply.** The use of coal to generate electricity is not compatible with the UK's carbon targets. There is a GB-wide commitment to remove all unabated coal fired power stations by 2025, and the Committee recommends that this is replicated in Northern Ireland.

  Whilst it is crucial that Northern Ireland maintains security of supply, the SONI and EirGrid statement affirms that Northern Ireland will have sufficient capacity (primarily from natural gas and wind) to meet domestic demand following the closure of Kilroot from 2025.

- **Provide competitive, long-term support for low-carbon generation.** A key principle of any renewable energy policy in Northern Ireland should be to provide a route to market for the lowest-cost low-carbon generation (e.g. onshore wind and solar PV), as well as other low-carbon generation projects by providing long-term certainty to renewable energy developers.

  The closure of the NIRO and decision not to join the CfD scheme has left Northern Ireland as the only part of the UK without a support mechanism for the renewables industry.

Without a support mechanism, the Committee does not anticipate that a sufficient volume of low-carbon generation will come forward, and those that do could lead to higher costs for consumers:

  - A small number of onshore wind and solar PV projects have begun to develop in Great Britain with potential to go forward without a CfD. However, without a contract the overall volume is likely to remain low given the higher risks involved (i.e. exposure to wholesale price risk when not able to access long term contracts, or the risk of default on long-term contracts that are not backed by Government).
  - Any increase in the cost of capital as a result of the increased risks is likely to be passed onto consumers, resulting in higher bills than necessary.
  - The development of the Republic of Ireland's Renewable Electricity Support Scheme (RESS) and increased interconnectivity under I-SEM, combined with a lack of a route to market for low-carbon energy in Northern Ireland, is likely to lead to an inefficient market for renewable energy in the all-island network.

- **Ensure that the carbon price incentivises low-carbon generation.** Power generators in Northern Ireland are subject to the EU ETS carbon price but not to the additional Carbon Price Floor that applies to the rest of the UK. In order to maintain a 'level playing field' in the I-SEM, Northern Ireland cannot introduce an additional carbon price without an equivalent commitment from the Republic of Ireland. However, if a bilateral agreement were made to increase the total carbon price on the island, this may be an effective mechanism to further incentivise low-carbon electricity generation.

  If Northern Ireland were to leave the EU ETS, it should ensure that an equivalent carbon price remains in place on both sides of the border to ensure that generators receive a price signal that incentivises lower-carbon generation.

- **Incentivise flexibility options to complement intermittent renewable energy.** Achieving deep decarbonisation of the power sector at efficient cost will require a significant increase in system-wide flexibility from the current levels, alongside the expansion of low-carbon capacity.

  Increasing flexibility is a low-regret option, reducing the overall cost even in a system that is less decarbonised (e.g. reaching 200 g/kWh in 2030), while maintaining security of supply requirements.[23]

- **Support industry and supply chains for renewable electricity.** Supporting domestic supply chains for the renewable energy industry can reduce the cost of renewable projects in Northern Ireland, and generate jobs and growth in Northern Ireland. For example, Belfast Harbour has been used as manufacturing hub for offshore wind projects in the Irish Sea.[24] Analysis by NIRIG has estimated that onshore wind has created 500 jobs and £32 million in gross value added (GVA) in the Northern Irish economy.[25]

- **Make preparations to deploy Carbon Capture and Storage (CCS) at scale in Northern Ireland in the 2030s.** It will be necessary for CCS to be deployed at scale in the 2030s across the UK in order to meet our legislated climate targets. We have called on the UK government

[23] Imperial College and NERA (2015) *Value of Flexibility in a Decarbonised Grid and System Externalities of Low-Carbon Generation Technologies.*
[24] Belfast Harbour (2018) *Renewables Off Shore Wind Report.*
[25] NIRIG (2017) *Onshore wind: Economic benefits in Northern Ireland.*

to deliver a new strategic approach to deploy CCS at scale in the 2030s, which requires a programme of CCS deployment reaching 10 $MtCO_2e_2$ per annum by 2030, on the path to at least 20 $MtCO_2e$ per annum in 2035.

- **Build capacity for electrification of other sectors.** On the basis of vehicle kilometres travelled in Northern Ireland relative to the whole of the UK, we assess that Northern Ireland will require an additional 0.8 TWh per year for electrification of transport in 2030, in addition to of heat pumps. The grid operator will need to ensure the necessary network upgrades are in place to support new technologies.

Policy options to decarbonise power sector

These principles suggest Northern Ireland should focus on the following policies:

1. Phase out coal generation before 2025

Northern Ireland is not obligated by the GB-wide ambition to end unabated coal generation by 2025, but should commit to this same target. SONI and EirGrid assume that Kilroot will not be operational beyond 2024 in their assessment of future capacity on the all-island network:

- In 2017, Kilroot power station emitted 1.5 $MtCO_2$ and generated 1.4 TWh of electricity. Assuming this annual generation is replaced by a mixture of natural gas and intermittent renewable energy, the closure of Kilroot could deliver emissions reductions in the range of 1.0 and 1.5 $MtCO_2$ per year.[26]
- The closure must be done in a way that maintains the security of supply in Northern Ireland. Whilst replacing Kilroot with a CCGT plant in Belfast is an option, it will not be sustainable to be reliant on natural gas in the long-term. Northern Ireland could explore the opportunities to use H_2 or gas CCS generation.
- Where possible, coal generation should be replaced by lowest-cost onshore wind and solar PV, but no framework is currently in place to support a route to market for these technologies.

2. Introduce a competitive, long-term support mechanism for low-carbon generation

Against the counterfactual of generation from a new CCGT natural gas plant,[27] each additional TWh of low-carbon generation could save around 0.4 $MtCO_2$ per year. Supporting an additional 100 MW of onshore wind capacity could therefore generate savings of at least 0.1 $MtCO_2$ per year.[28]

Low-carbon electricity generation has become increasingly cost effective in recent years, and this trend is expected to continue:

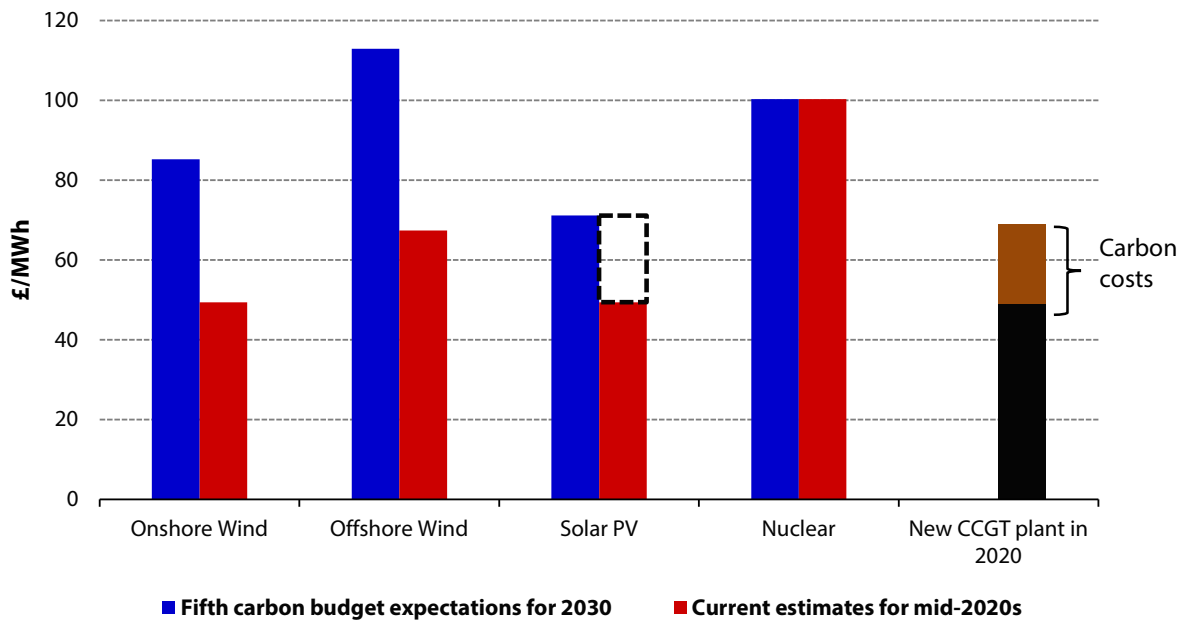
- The latest evidence suggests that onshore wind and solar PV are already lower cost than new fossil-fired generation (Figure 2.7). Prices awarded to offshore wind in the latest CfD auction for the rest of the UK were also lower. There is good evidence to suggest that onshore wind

[26] Range of replacing coal generation entirely with natural gas at 400 gCO_2/kWh or with intermittent renewables.
[27] Assumed 365 gCO_2e/kWh for minimum value of generation intensity from a new CCGT. Source: Parliamentary Office of Science and Technology (2011) *Carbon Footprint of Electricity Generation.*
[28] Assumed capacity factor of 32% for onshore wind.

and solar PV projects could already be brought forward without subsidy or increases in consumer bills if further auctions are run.[29]

- It may be the case that - due to lower wholesale electricity prices, lack of the carbon price floor, differences in the cost of land, or differences in supply chain for renewable technology - onshore wind and solar PV could not yet exist on a subsidy-free basis in Northern Ireland. However, the cost of these technologies is expected to continue to fall throughout the 2020s and it is likely that subsidy-free renewable generation will be possible in Northern Ireland well before 2030.
- The most recent CfD auctions in the UK procured contracts for offshore wind at around £62/MWh for delivery in the early 2020s - in line with prices elsewhere in Europe. This is significantly cheaper than the Committee's previous projection of the technology cost in 2030 (Figure 2.7).

Figure 2.7. Cost reductions in low-carbon technologies



Source: CCC analysis based on BEIS (2016) *Electricity Generation Costs*; Baringa (2017) *An analysis of the potential outcome of a further 'Pot 1' CfD auction in GB.*
Notes: All money in £2017, assuming an inflator of 1.083 between 2012 and 2017 and 1.046 between 2014 and 2017. The lower estimate of solar costs is equal to the costs of onshore wind from Baringa (2017), the higher bound is from on BEIS (2016).

Northern Ireland should ensure that any mechanism to support low-carbon generation meets the following criteria:

- Provides long-term certainty and a fixed revenue stream for generators whilst protecting consumers from price spikes.

[29] CCC (2018) *Progress Report to Parliament, Box 2.3.*

- Maintains compatibility with the all-island network and provides equal incentives for generation either side of the border, avoiding a 'two speed' market.

The Republic of Ireland will use the Renewable Electricity Support Scheme (RESS) to incentivise renewable projects. The first auction, RESS 1, is scheduled to take place in 2019. All projects looking for support under the new RESS will need to meet pre-qualification criteria including offering the community an opportunity to invest in and take ownership of a portion of renewable projects in their local area.

Northern Ireland could potentially join CfDs or adopt all-island approach by RESS or forming a combined renewable energy auction with the Republic of Ireland. The feasibility of these two approaches was explored in the Northern Ireland Affairs Committee report[30] on the electricity sector in Northern Ireland:

- Participate in a UK-wide CfD mechanism:
  - The Northern Irish Renewable Industry Group (NIRIG) has said that it "made sense" for Northern Ireland to join the CfD scheme, arguing that the industry would be able to compete with schemes in Scotland and Wales, whilst benefiting from the socialisation of costs across the UK.
  - However, there is a risk that costs of renewable subsidies faced by Northern Irish consumers could increase without any guarantee of new renewable electricity projects being built in Northern Ireland or connecting to the all-island network. This was cited as the primary reason Northern Ireland did not opt-in to the CfD mechanism.
- Create an all-island renewable support mechanism or a Northern Irish mechanism that complements RESS:
  - Policies designed for Great Britain can have unintended consequences within all-island market. An alternative solution could be to develop an all-island renewables scheme specifically designed to operate within the I-SEM.
  - The cost of renewable projects could be shared between both countries and would ensure that capacity is added to the all-island network where it is most cost effective, ultimately reducing costs for consumers on both sides of the border.
  - SSE have urged the Northern Ireland Executive to look at the Republic of Ireland's renewables support scheme, which it described as one of the most successful and cost-effective in Europe, whilst Power NI described a potential all-island scheme as "a very cost-effective means" of supporting renewable generation in Northern Ireland.

Any renewable support mechanism in Northern Ireland should be developed closely with the Republic of Ireland to ensure it will lead to efficient distribution of renewable energy in the all-island network, and the potential for an all-island auction mechanism should be explored.

3. Continue to support grid flexibility and smart system upgrades

The transition to a low-carbon electricity system will bring new challenges in grid management, due to higher levels of intermittent and variable renewable generation (e.g. wind and solar), and higher demand from other sectors via electricity of heat and transport. These system challenges include the need for back-up firm capacity for wind and solar generation, the risk of excess generation at times of low demand, and the need for additional infrastructure to transmit power

[30] Northern Ireland Affairs Committee (2017) *Electricity sector in Northern Ireland.*

generated in more remote locations. The costs of these measures are included in our assessment of intermittency and system costs in the fifth carbon budget, although this is not disaggregated to devolved administration level.

It is possible to manage a deeply decarbonised UK power system in 2030 with high levels of intermittent renewables (e.g. up to 60% of total generation) while maintaining security of supply. Managing this transition at lowest cost while ensuring security of supply will require investment in flexible gas-fired generation capacity alongside expansion of international interconnection, flexible demand response and electricity storage.[31]

The Delivering a Secure Sustainable Electricity System (DS3) programme run by SONI and EirGrid has been successful in increasing the flexibility of the all-island grid. So far the DS3 Programme has enabled SONI to increase levels of renewable generation possible on the system at any given time from 50% to 65%, with the aim of increasing this incrementally to 75% over the coming years.[32]

Northern Ireland should support the continued deployment of energy storage and demand-side response (DSR) technologies. There is a cost to deploying these measures and managing intermittency, which for our scenarios we estimate at around £10 per MWh of intermittent renewable output. Costs would be likely to increase at much higher penetrations of intermittent renewables, however evidence on the precise system cost implications of higher levels of renewables penetration is scarce. This suggests that scenarios with higher levels of renewables are only possible if progress is made in integrating renewables into the system at acceptable cost.

4. Make steps to enable further decarbonisation after 2030

The Committee has previously recommended that CCS is deployed at scale in the 2030s across the UK. Northern Ireland should consider how a UK-wide CCS strategy will be implemented in its power sector, including further assessment of the feasibility of storage sites.

In our 2018 report *Hydrogen in a low-carbon economy,*[33] the Committee has identified the opportunity for hydrogen to replace natural gas power systems by the 2040s. This would be helped if new gas plants can be made 'hydrogen ready', including being located close to potential hydrogen supplies. Northern Ireland can also take steps to investigate whether new natural gas power stations, such as the one planned in Belfast Harbour, can be hydrogen and/or CCS compliant.

The UK government has established the CCUS Council and CCUS Cost Challenge Taskforce, and Northern Irish officials should seek to contribute to these forums to ensure that any UK-wide CCS strategy takes Northern Ireland into consideration.

Researchers have identified a number of potential sites for carbon storage around the island. In total the Raithlin, Portpatrick/Larne and Peel basins on the east coast of Northern Ireland have 70,000 Mt of theoretical storage capacity, and a further 2,000 Mt was identified in the Loch Neagh basin.[34] Further work should be taken to identify suitable sites in Northern Ireland.

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[31] CCC (2015) *Sectoral scenarios for the fifth carbon budget.*

[32] http://www.soni.ltd.uk/how-the-grid-works/ds3-programme/

[33] CCC (2018) *Hydrogen in a low-carbon economy.*

[34] Lewis, D., Bentham, M., Cleary, T., Vernon, R., O'Neill, N., Kirk, K., Chadwick, A., Hilditch, D., Michael, K., Allinson, G., Neal, P. and Ho, M. (2009). Assessment of the potential for geological storage of carbon dioxide in Ireland and Northern Ireland. *Energy Procedia*, 1(1), 2655-2662.

5. Maintain an all-island carbon price that incentivises low-carbon generation

The use of a Carbon Price Floor in the rest of the UK has been effective in delivering the phase-out of coal generation. The carbon price in Northern Ireland is constrained by the I-SEM and the need to have an equal carbon price either side of the border.

If Northern Ireland chooses to use a similar carbon price mechanism to further disincentivise coal generation, an all-island total carbon price would need to be agreed between Northern Ireland and the Republic of Ireland. Alternatively, other mechanisms could be explored to ensure that coal generation is phased out by 2025.

Policy options to facilitate ULEVs

6. Ensure the electricity network is prepared to allow expansion of charging infrastructure

With the roll out of electric vehicles, Northern Ireland is expected to require an additional 0.8 TWh per year for the electrification of transport by 2030 (Chapter 3). The grid operator in Northern Ireland should assess the capability of the grid to deal with required expansion of vehicle charging and ensure the necessary network upgrades are in place to support new technologies.

As the speed of chargers increases, available grid capacity at key locations such as motorway service areas will increasingly become an issue when installing new chargers. As an indication of the possible technology cost in Northern Ireland, National Grid has estimated that to upgrade 50 motorway sites with sufficient power to accommodate 350 kW rapid chargers could cost between £500 million and £1 billion in the UK (£10-20 million per site).

To increase confidence in cross-border travel, Northern Ireland should work with the Republic of Ireland to ensure there is an adequate and level of electric vehicle chargepoints.

7. Adopt the Automated and Electric Vehicles Act 2018 to ensure all chargers are 'smart'

The Automated and Electric Vehicles Act 2018 passed through the UK Parliament in July 2018. It gives the UK government powers to:

- Require motorway services and large fuel retailers to install charging points and to ensure that all chargers are 'smart', providing grid flexibility by adjusting the rate of charge when necessary and practical for the consumer.
- Mandate the method of payment for electric vehicle charging points, ensure charging points are compatible with all vehicles and also to set standards for reliability.
- Ensure that all UK-funded domestic chargers are 'smart', including those installed in Northern Ireland.

The Act has been welcomed by the Committee.[35] A legislative consent motion is being sought from the Northern Ireland Assembly to apply these provisions in Northern Ireland. The Committee recommends that Northern Ireland should adopt this legislation in line with the rest of the UK.

[35] CCC (2018) *Lord Deben letter to Chris Grayling and Greg Clark on Road to Zero.*

To increase consumer confidence in the ability to make cross-border journeys in electric vehicles, Northern Ireland should work closely with the Republic of Ireland to ensure there is an adequate supply of public charging points on both sides of the border with consistent standards and a shared access system.

Policy options for local and community power generation

8. Include a community element in any renewable support mechanism, and provide information and financial support to local and community generators

Analysis from NIRIG has suggested that that over one-quarter of the economic benefits from the offshore wind industry in Northern Ireland – 191 jobs and £9.5 million GVA – have been felt within the local authority areas where developments are located.[36]

Community and locally-owned low-carbon energy can play a useful role in progress towards meeting carbon targets. Evidence from other countries suggests that increased engagement of communities helps gain acceptance and support for large low-carbon infrastructure and increases awareness of climate change issues.[37]

Scotland in particular has been successful in encouraging local and community generation by setting clear targets and providing free access to advice, information and resources as well as loan support to community developers. Scotland has also successfully encouraged developers of onshore wind projects to provide annual voluntary "community benefits" of at least £5000 per MW installed (Box 2.3).

The Republic of Ireland has used a more formal approach to ensuring local communities benefit from low-carbon generation projects. Any renewables scheme bidding for funding under RESS will need to meet pre-qualification criteria that include offering the local community an opportunity to invest in and take partial ownership of renewable projects.

In parallel with RESS scheme in the Republic of Ireland, Northern Ireland should ensure that any renewable support mechanism includes community support. This could be on a voluntary basis if clear guidelines for 'good practice' are provided by the Northern Irish government and accepted by developers.

[36] NIRIG (2017) *Onshore wind: Economic benefits in Northern Ireland.*
[37] DECC (2014) *Community Energy Strategy.*

Box 2.3. Case studies: supporting local and community energy projects

Scotland

The Scottish Government has clear targets for local and community ownership of renewable energy:

- 1 GW of community and locally-owned renewable energy by 2020.
- 2 GW of community and locally-owned renewable energy by 2030.
- At least half of newly consented renewable energy projects to have an element of shared ownership by 2020.

Scotland successfully met its original target of 500 MW by 2020. The Scottish Government has a number of programmes and policies in place to support community-led energy generation:

- Local Energy Scotland provides free support and resources to developers, as well as the CARES loan scheme which provides up to £150,000 to community groups and rural businesses that want to generate renewable energy.
- Local Energy Scotland also managed the Local Energy Challenge Fund that provided development and capital support to large scale demonstrator projects which show a local energy economy approach linking energy generation to energy use.

In addition, Local Energy Scotland also encourages developers to pay "community benefits" in their good practice advice through CARES. For onshore wind projects, developers are requested to pay at least the equivalent of £5,000 per installed MW per year to local communities for the project lifetime. While not legislated, this is now expected as good practice. Over £10 million in community benefit funds has been paid this year. For recent projects the average payment has been £6,140 per MW per year.

Republic of Ireland

The Republic of Ireland has taken a dual approach to local and community support. It will require all developers to meet certain criteria to ensure benefits are felt in local communities:

- Under RESS, all projects will need to meet pre-qualification criteria including offering the community an opportunity to invest in and take ownership of a portion of renewable projects in their local area.
- The mechanism will also include a Mandatory Community Benefit Fund and Register standardised across the sector. It is proposed that this contribution is set at €2/MWh for all generation under RESS.

In parallel, the Republic of Ireland will provide additional support directly to community-led projects:

- It will provide grants and legal and technical assistance for community-led projects across early phases of project development including feasibility and development studies.
- It has proposed a ring-fenced 'community' category for the RESS auction. It is proposed that this capacity would be limited to up to 10% of the second auction (around 300 GWh) which will be subject to review for future auctions. Projects would need to meet community-led criteria to qualify.

Source: Local Energy Scotland (2016) *CARES Progress and Impact*; Government of Ireland (2018) *Renewable Electricity Support Scheme (RESS) High Level Design.*

Chapter 3: Agriculture and land use, land-use change and forestry

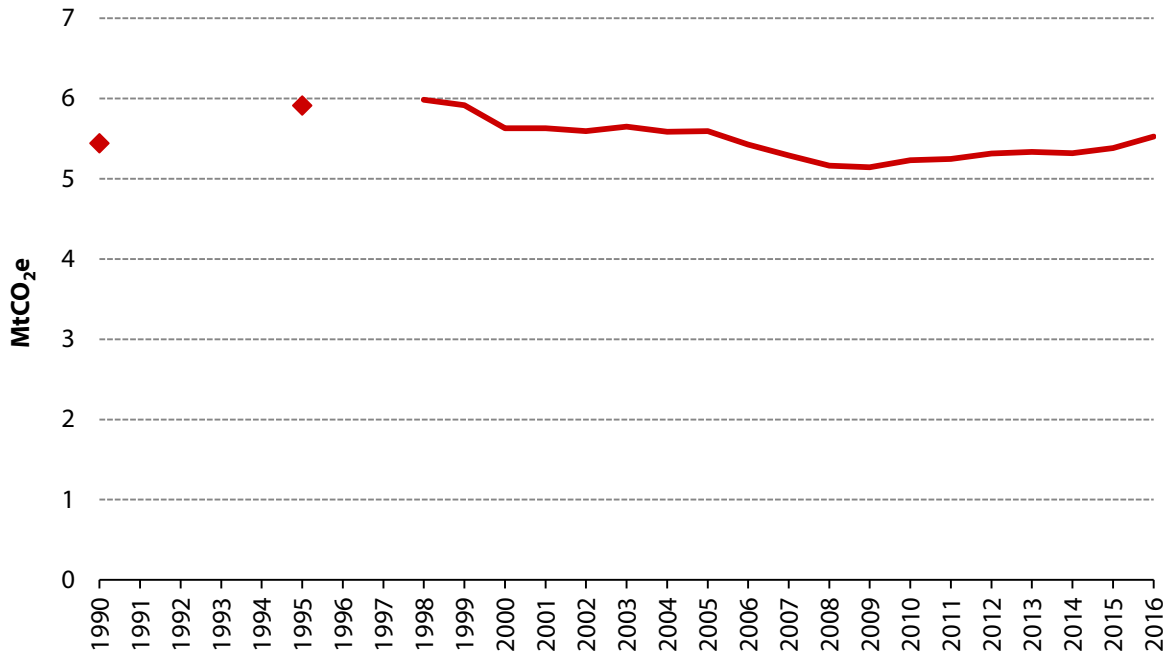
Overview of agriculture in Northern Ireland

Latest emissions trends and drivers

Emissions from agriculture were 2% higher than the 1990 baseline, and accounted for 27% of all emissions in Northern Ireland in 2016. Emissions increased by 3% from 2015 to 2016, with a total increase of 7% from 2008 to 2016 (Figure 3.1).

Agriculture accounted for a much bigger proportion of total emissions in Northern Ireland than the rest of the UK, where emissions from agriculture were 10% in 2016.

Figure 3.1. Emissions from agriculture in Northern Ireland (1990 - 2016)



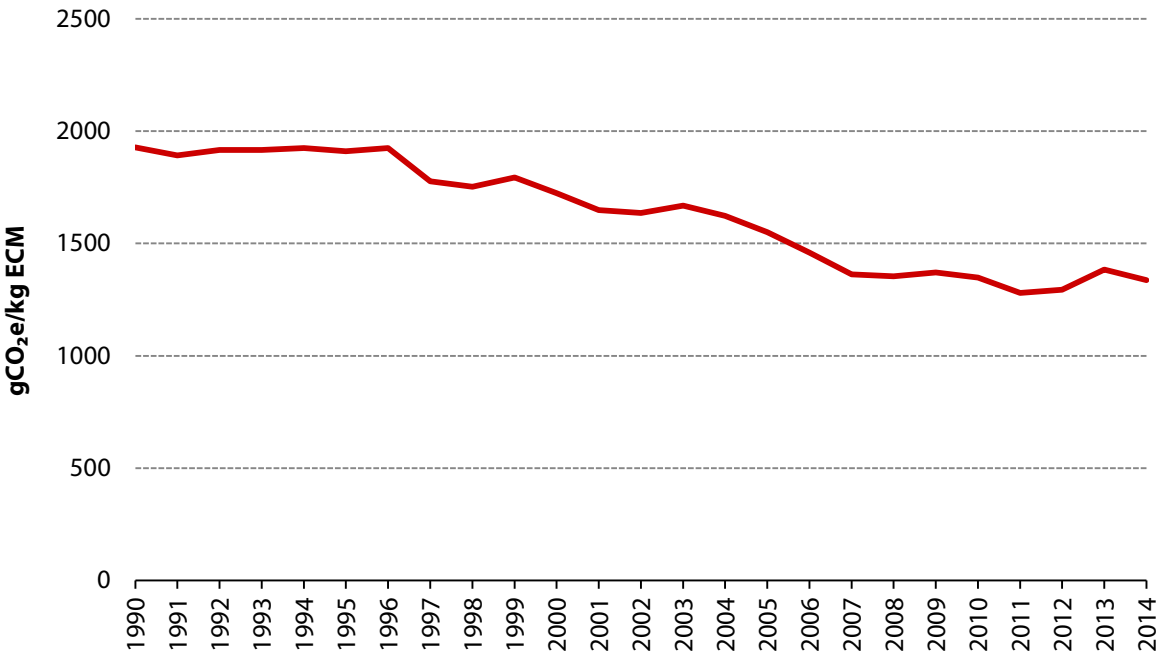
Source: NAEI (2018).

The emissions intensity of agriculture has fallen since 1990, because total agricultural output has increased whilst emissions have been held largely static. The dairy sector is a clear example of this:

- The dairy farming sector in Northern Ireland has made substantial progress in reducing its emissions per unit of production (31% reduction since 1990), but has also seen continual growth in its total milk production over the period (67% increase since 1990) which was driven primarily through increases in milk yield per cow.
- The emissions per dairy cow have therefore been spread over a greater volume of production (Figure 3.2).[38]

[38] DAERA (2017) *Greenhouse Gas Emissions on Northern Ireland Dairy Farms - A carbon footprint time series study.*

Figure 3.2. Emissions intensity of dairy farming in Northern Ireland (1990 – 2014)



Source: DAERA (2017) *Greenhouse Gas Emissions on Northern Ireland Dairy Farms - A carbon footprint time series study.*
Notes: Intensity is measured as gCO_2e per kg of energy corrected milk (ECM) produced.

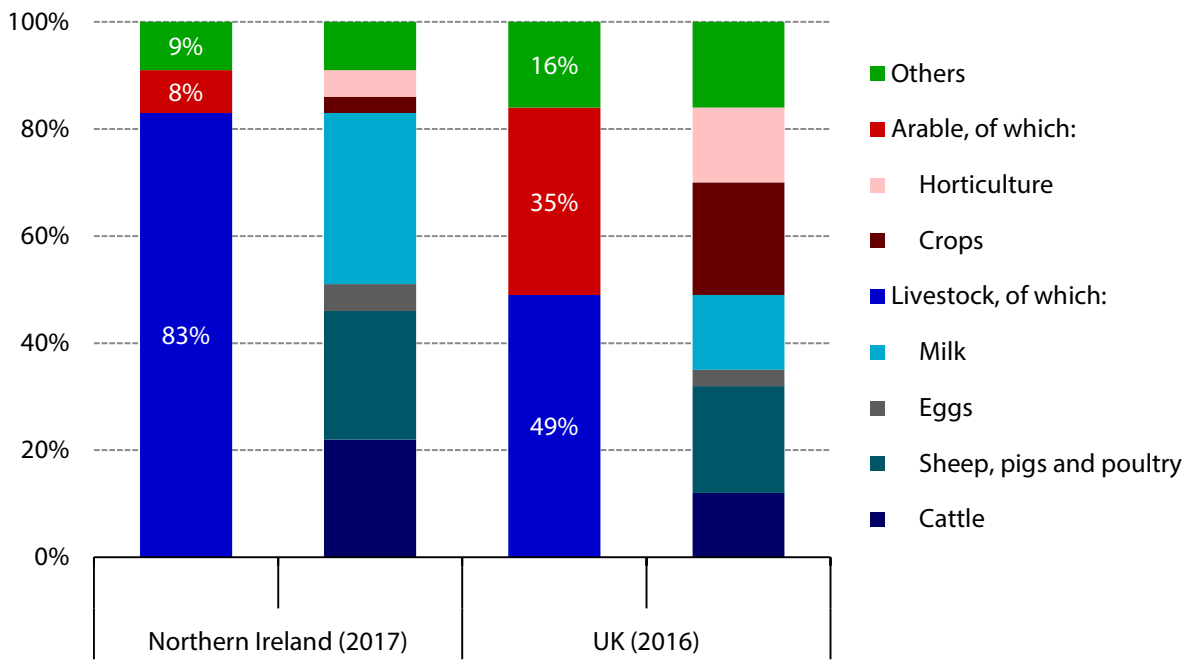
The structure of the agriculture sector in Northern Ireland is very different to that in other parts of the UK (Figure 3.3):

- Livestock-based farming made up the significant majority (83%) of gross agricultural output in Northern Ireland 2017, compared to 49% in the UK as a whole in 2016.
- Northern Ireland has a much greater proportion of total cattle and sheep (78%) and dairy (11%) farms compared to England (44% and 7%).[39]
- The typical farm in Northern Ireland is also smaller than the rest of the UK. 19,000 (76%) of Northern Ireland's are classified as 'very small'.[40] By comparison, 34% of farms in England are 'very small'.

Much of the land farmed in Northern Ireland is located in Less Favoured Areas (LFA) where agricultural production is more difficult. Around 75% of all agricultural land and 69% of Northern Ireland's farms were classified as LFA in 2017. Farm businesses in these regions receive additional payments under the Common Agricultural Policy (CAP).

[39] House of Commons Northern Ireland Affairs Committee (2018) *Brexit and Agriculture in Northern Ireland.*
[40] Defined as needing fewer than 1,900 hours of labour per year to maintain.

Figure 3.3. Proportion of farming by gross output in Northern Ireland and the UK



Source: DAERA (2018) *Statistical Review of Northern Ireland Agriculture 2017.*

Agri-environment funding and the Common Agricultural Policy

Northern Ireland has devolved control of the agricultural sector, and will have a key role in the design and implementation of any post-CAP framework:

- The total allocation of CAP funds to Northern Ireland during the CAP period 2014 to 2020 was €2,500 million, 9% of the total UK allocation. Over 90% of this funding was 'Pillar 1' funding in the form of direct income support payments to farmers based on the amount of land they farm and farming methods. In order to qualify for Pillar 1 payment, farmers have to meet certain standards on environmental management, animal welfare, and traceability.
- 'Pillar 2' payments are tied to rural development objectives, such as improving competitiveness in agriculture and agri-environmental schemes, and are administered through the Rural Development Programme.

In 2015, around 300,000 hectares (ha) of farmland in Northern Ireland was managed under agri-environment scheme agreements, but this fell by 85% to 46,000 ha (approximately 5% of total farmland) in 2016 and maintained this level in 2017. This was primarily due to previous agreements under older environmental schemes expiring.[41]

In 2017 DAERA launched its new agri-environment scheme - the Environmental Farming Scheme (EFS). This voluntary scheme operates under the Northern Ireland Rural Development Programme 2014-2020, which is part financed by the EU. It offers participants a 5-year agreement to deliver a range of environmental measures.

[41] DAERA (2017) *Statistical Review of Northern Ireland Agriculture.*

Policy framework for emissions reduction in agriculture

The Greenhouse Gas Implementation Partnership (GHGIP), a partnership between the DAERA and the agricultural industry, updated the Efficient Farming Cuts Greenhouse Gases Plan in 2016.[42] The focus of the plan is on minimising the emissions per unit output of the agricultural sector, whilst allowing for increases in total output, by encouraging on-farm actions in four priority areas:

- Nutrient Management.
- Livestock Management.
- Improving Land and Carbon Management.
- Increasing Energy Efficiency.

Within the plan, these themes are further broken down into specific carbon efficiency measures that farmers can implement (for example the use of soil analysis or changing fertiliser types).

In addition to providing financial support for efficiency measures via the Northern Ireland Rural Development Programme, DAERA provides support for the strategy through funding research, communicating best practice and providing training, and monitoring and reporting progress.

There are currently no firm commitments to go beyond a voluntary approach to greenhouse gas reduction measures in the agriculture sector in Northern Ireland.

Going for Growth

The 2013 Going for Growth strategy[43] sets targets to increase the overall level of output in the agri-food industry, which includes both farming and food processing, in Northern Ireland between 2010 and 2020:

- Increase annual turnover by 60% to £7 billion.
- Increase annual value-added by 60% to £1 billion.
- Increase employment by 15% to 115,000.
- Increase annual external sales by 75% to £4.5 billion.

Although primarily focused on growth and productivity, the strategy has some focus on sustainability:

- It recommends a review of the incentive schemes for renewable energy to ensure that policies are complementary to the Agri-Food industry. In particular, the report highlights:
  - The risk of bioenergy crops competing for land with food production leading to higher food prices.
  - The lack of support in Northern Ireland for larger biomass combined heat and power (CHP) plants for converting waste into energy.
- The potential for switching 'less favourable land' areas to forestry to provide a sustainable source of biomass and increase biodiversity.

[42] DAERA (2016) *Efficient Farming cuts Greenhouse Gases Implementation Plan 2016 – 2020.*
[43] DAERA (2013) *Going for Growth: A strategic action plan in support of the Northern Ireland agri-food industry.*

- The need for a strategic regional land management policy to determine the most productive use of land. This would identify areas that are best suited for specific agricultural use whilst maintaining and enhancing environmental sustainability.
- The strategy recommends that agri-environment schemes should promote increased woodland and biodiversity, and incorporate clearer recognition of instances where agricultural producers are involved in the production of public goods as well as food.

If the strategy is successful, the level of output from the agricultural sector will continue to rise in Northern Ireland. This will put additional pressure on efforts to reduce total carbon emissions from the sector, and emphasise the need for continual improvements in emissions intensity that outpace the level of growth in output.

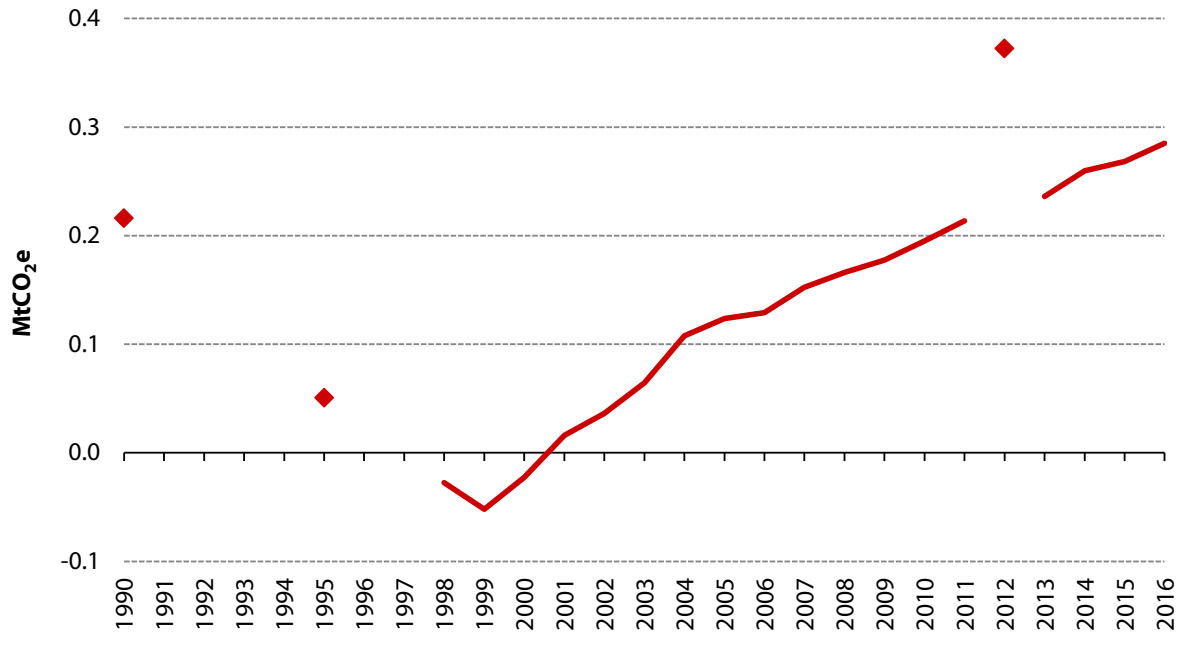
Overview of land use, land-use change and forestry in Northern Ireland

Latest emissions trends and drivers

Net emissions from the land use, land-use change and forestry (LULUCF) sector were 0.3 $MtCO_2e$ in 2016, with a total increase of 0.12 $MtCO_2e$ between 2008 and 2016. The sector accounted for 1.4% of total emissions in Northern Ireland in 2016. Emissions from LULUCF have increased by 32% since 1990.

Unlike the rest of the UK, the LULUCF sector in Northern Ireland is a net emitter rather than a carbon sink. This is due to much lower forest coverage in Northern Ireland (8%) when compared to the UK as a whole (13%).[44]

Figure 3.4. Emissions from LULUCF in Northern Ireland (1990 - 2016)



Source: NAEI (2018).
Notes: Value for 2012 may be an anomaly in NAEI source data.

[44] Forestry Research (2018) *Woodland Area, Planting and Publicly Funded Restocking: 2018 Edition.*

Afforestation

Tree planting rates in Northern Ireland have fallen steadily since 1990 (Figure 3.5). In 2016/17, 208 hectares (ha) of new woodland were planted in Northern Ireland:

- In the last five years, there has been almost no new planting on state-owned land (an average of 1 ha per year has been restocked). Tree planting has primarily been driven by the private sector.
- Grant support to encourage afforestation and sustainable management of privately-owned woodlands is provided by forestry measures in the Rural Development Programme.
- There was a fall in planting rates to 54 ha in 2015/16. This can be attributed to the closure of the 2006-2013 Rural Development Programme and the opening of the 2014-2020 Rural Development Programme.

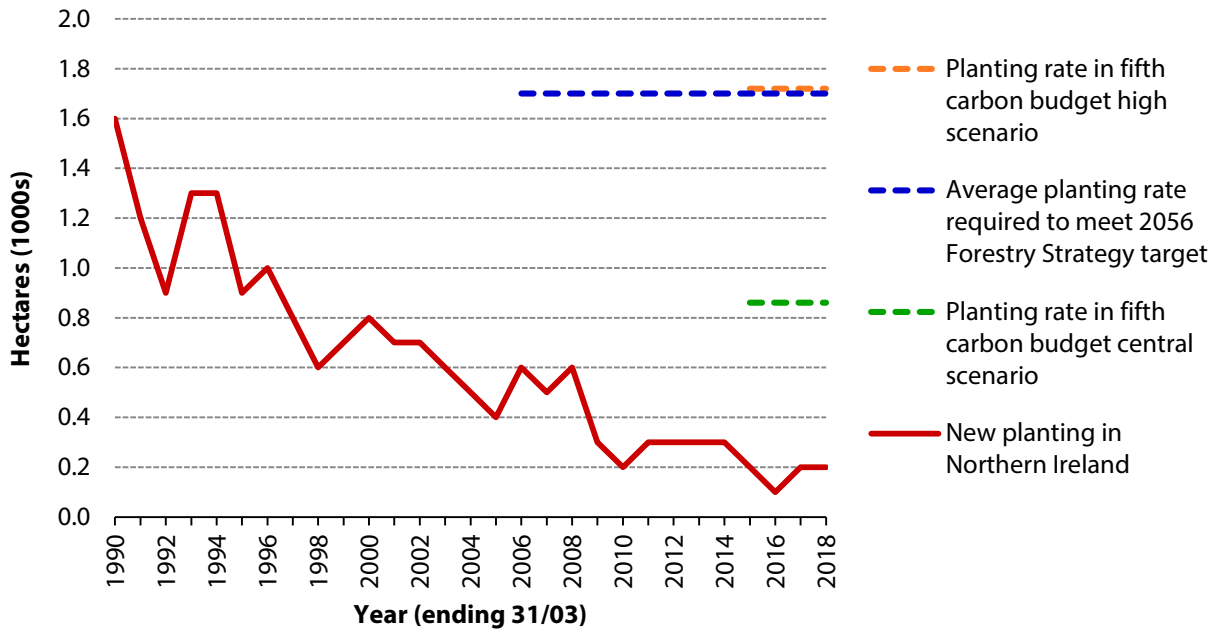
DAERA currently runs forestry grant schemes to promote the aim of the Northern Ireland Forestry Strategy[45] to deliver a steady expansion of tree coverage from 6% to 12% between 2006 and 2056.

This would require average planting rates of almost 1,700 ha per year over fifty years. Recent planting rates of 200 ha per year are not nearly sufficient to meet this long-term aim. The primary grant schemes to support private forestry are:

- The Forest Expansion Scheme encourages the creation of new forests blocks of at least 5 hectares and larger, with the primary goal of increasing carbon sequestration.
- The Forest Protection Scheme provides support for the prevention of pest and disease outbreaks and for restoration of forests following pest and disease outbreaks.
- The Woodland Investment Grant scheme supports sustainable forest management practices, including improvements to the environmental value of woodlands and building resilience to climate change through replanting.

[45] Forest Service (2006) *A strategy for sustainability and growth.*

Figure 3.5. New tree planting in Northern Ireland (1990 - 2018)



Source: Forest Research (2018) *Forestry Statistics 2018*; Forest Service (2006) *A strategy for sustainability and growth;* CCC (2015) *Sectoral scenarios for the fifth carbon budget*; CCC analysis.

Peatland

In contrast to mineral soils, peatland is able to continuously accumulate carbon under water-logged conditions at a rate of around 1mm per year. Peatlands are therefore an important and potentially growing reservoir of carbon, and land-use changes that degrade or damage peatland can release a significant amount of carbon into the atmosphere.

From the early 2020s, peatland emissions will be included in the NAEI inventory. Analysis to support the Committee's recent report on land use suggest that peatland emissions under a 'business as usual' scenario with zero peatland restoration would be around 1.9 $MtCO_2e$ in each year from 2016 to 2030.[46] The inclusion of peatland emissions in the inventory could increase the total assessment of emissions from Northern Ireland by around 10% in the early 2020s.

Support will be offered via DAERA's Environmental Farming Scheme (subject to necessary approvals) for peatland management and restoration.[47]

[46] CEH (2018) *Quantifying the impact of future land use scenarios to 2050 and beyond - Final Report.*
[47] DAERA (2016) *Efficient Farming cuts Greenhouse Gases Implementation Plan 2016 – 2020.*

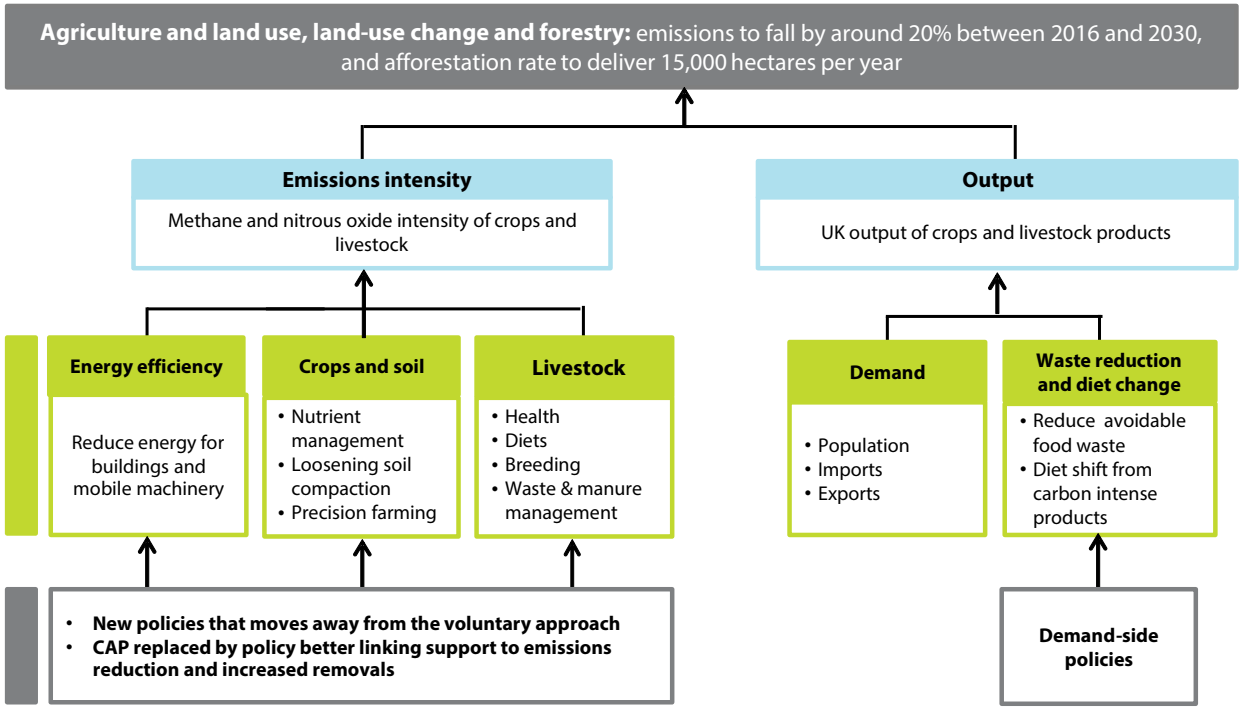
Northern Ireland's contribution to UK targets

Indicators for UK-wide decarbonisation of agriculture and LULUCF

The cost-effective path to meeting the UK's legal carbon emissions targets requires a reduction in agriculture emissions of 20% from 2016 to 2030, and afforestation of 15,000 hectares per year (900 hectares in Northern Ireland) across the UK. Our analysis for the fifth carbon budget identified a set of cost-effective measures that could be deployed to abate both non-CO_2 and CO_2 emissions, saving around 7 $MtCO_2e$ across the UK by 2030.[48]

The measures cover soils and crop management; livestock diets, health and breeding; waste and manure management and energy efficiency. We have developed an indicator framework that can be tracked to monitor progress in reducing emissions to 2030 (Figure 3.6).

Figure 3.6. Committee on Climate Change indicators for UK-wide decarbonisation of agriculture and LULUCF



Notes: Policy areas where devolved policy has a significant role to play are shown in bold.

[48] This value accounts for 'smart inventory' methodology improvements since our 2015 advice.

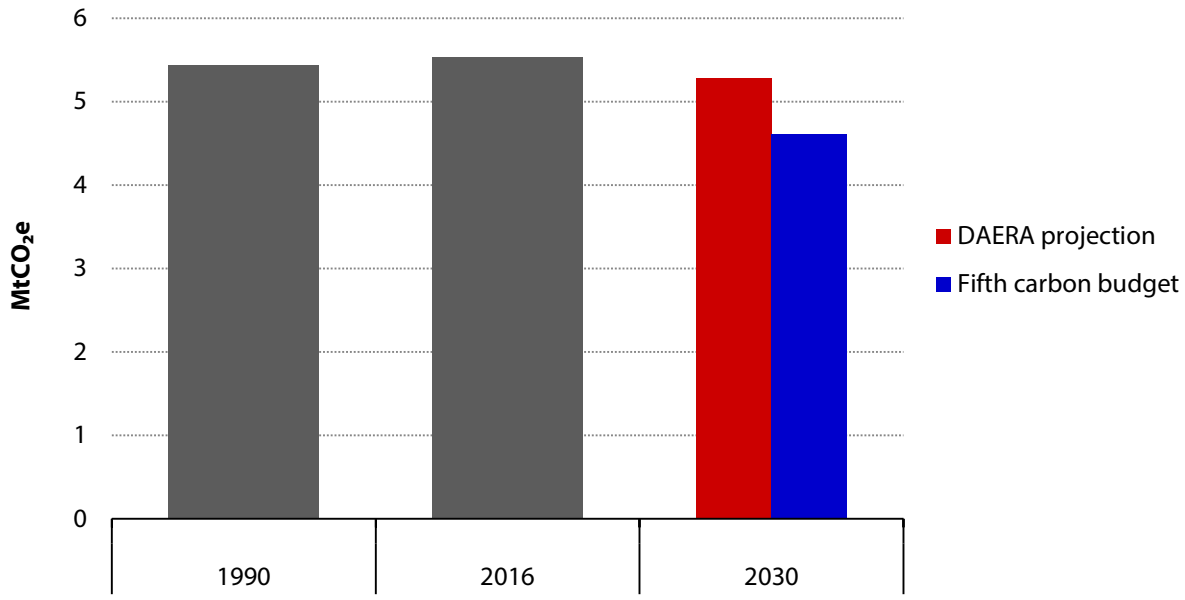
Emissions from agriculture and LULUCF in Northern Ireland in 2030

Emissions from agriculture

The Committee's advice for the fifth carbon budget stated that Northern Ireland's contribution to meeting the UK's legal emissions reduction targets would require 4.1 $MtCO_2e$ of non-CO_2 emissions[49] from agriculture in 2030 (Figure 3.7):

- This level of emissions in 2030 would require that non-CO_2 emissions from agriculture were 15% below the latest estimate of the 1990 baseline (18% below 2016 levels).
- The main opportunities for reducing emissions from agriculture through the 2020s are through energy efficiency, crop and soil management, measures to reduce livestock intensity, and demand-side measures.
- Cost-effective measures to reduce CO_2 emissions (which represented 9% of all emissions from agriculture in Northern Ireland in 2016) would largely target direct emissions from buildings and stationary and mobile machinery (e.g. heating systems and tractors).

Figure 3.7. 2030 scenarios for agriculture in Northern Ireland



Source: NAEI (2018); DAERA (2018) *Northern Ireland Greenhouse Gas Projections Update*; CCC analysis.
Notes: DAERA projection has been adjusted for new methodology so that emissions in 2030 are set to 3% below 1990 levels. 0.5 Mt of CO_2 emissions, based on unabated 2016 levels, has been added to 4.1 $MtCO_2e$ in the fifth carbon budget scenario.

[49] This value has been adjusted for methodology changes in the latest inventory. The original value was 4.9 $MtCO_2e$.

Emissions from LULUCF

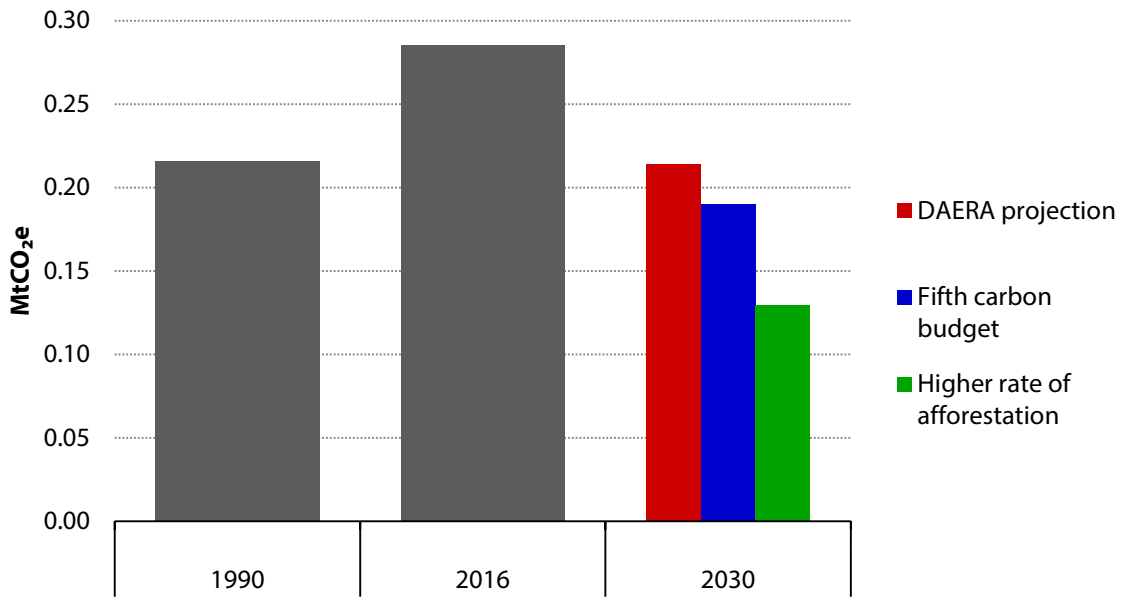
Northern Ireland's contribution to meeting the UK's fifth carbon budget would require 0.10 $MtCO_2$ of abatement from forestry by 2030. This would leave total LULUCF emissions at 0.19 $MtCO_2e$[50] (Figure 3.8):

- This level of ambition in 2030 would require that emissions from LULUCF were 12% below the latest estimate of the 1990 baseline (33% below 2016 levels).
- This assessment of abatement opportunities in LULUCF through the 2020s is based on afforestation and agro-forestry.
- Peatland restoration and land management practices will also have a role to play in UK decarbonisation, but were not included in the Committee's fifth carbon budget scenarios due to uncertainty in quantifying their abatement potential.

Our Central Scenario for the fifth carbon budget assumes 15,000 hectares of afforestation per year in the UK, around 900 of which are in Northern Ireland. We assess that Northern Ireland could go beyond this in a way that is consistent with the aims of their Forestry Strategy.

In our high scenario, the UK afforestation rate increases to around 30,000 ha per year. Doubling the annual afforestation rate in Northern Ireland by 2030 would bring an additional 0.06 $MtCO_2e$ of abatement, with overall emissions from the LULUCF sector around 0.1 $MtCO_2e$. This level of afforestation would also be consistent with Northern Ireland's targets to double woodland coverage to 12% between 2006 and 2056 (Figure 3.5).

Figure 3.8. 2030 scenarios for LULUCF in Northern Ireland



Source: NAEI (2018); DAERA (2018) *Northern Ireland Greenhouse Gas Projections Update*; CCC analysis.
Notes: DAERA projection has been adjusted for new methodology so that emissions in 2030 are set to 1% below 1990 levels.

[50] This figure has been adjusted for the latest published BAU projection for the LULUCF sector.

Principles and policy options for decarbonising agriculture and LULUCF

When commissioning this report, DAERA requested sector-specific policy advice on the following questions:

- In the context of the 'Going for Growth' ambitions set out by the agri-food industry, what further agricultural and environmental strategies and measures could be introduced to mitigate Northern Ireland's agricultural GHG emissions?
- Given the major role of agriculture in terms of land management, what mechanisms can be developed to enhance the role of agriculture as a significant carbon sink?
- What policies, strategies and measures are required to support and incentivise increases in tree planting in any post-Brexit policy on the countryside of which forestry will form a part?
- Are there any other policies strategies and measures within LULUCF that may help in reducing greenhouse gas emissions?

Principles for reducing emissions from agriculture and LULUCF in Northern Ireland

Our recent *Land Use: Reducing emissions and preparing for climate change* described how fundamental reform is required to ensure land becomes a more effective carbon store. Early action is needed to maximise the benefits from changing how land is used without decreasing per capita agriculture production. Our key recommendations from the report are directly applicable to policy Northern Ireland:

- **Land use policies should promote transformational land uses and reward landowners for providing public goods that deliver climate mitigation and adaptation objectives**. New policies should also reflect better the value of the goods and services that land provides. Measures that have clear, multiple benefits include:
  - Low-carbon farming practices.
  - Afforestation and forestry management.
  - Restoration of peatlands.
  - Improving soil and water quality.
  - Reducing flood risks.
  - Improving the condition of semi-natural habitats.

  These measures should be rewarded if they go beyond a minimum standard that land-owners should already be delivering.
- **Support should be provided to help land managers transition to alternative land uses.** This includes help with skills, training and information to implement new uses of land, and support with high up-front costs and long-term pay-backs of investing in alternative uses. It should also include action to address barriers to the take-up of innovative farming practices, which will drive productivity improvements. A structured approach to incorporating the potential impacts from a changing climate into long-term planning is essential for land managers to adapt successfully to climate change.

Within this framework, any policy framework in Northern Ireland to reduce emissions from the agriculture and LULUCF sectors should use the guiding principles:

- **Pursue immediate opportunities for low-carbon practices in agriculture.** There are immediate opportunities to implement cost-effective, low-carbon practices in agriculture that go some way to reduce emissions. Whilst their scope is limited, options aimed at increasing the take-up of low-carbon farming practices (e.g. better soil and livestock management) could deliver up to 9 $MtCO_2e$ emissions reduction annually for the whole of the UK. This would still leave agriculture as one of the largest emitting sectors by 2050.
- **Release agricultural land for alternative uses where possible.** Achieving significant cuts in land-based emissions rests on the capability to release agricultural land for alternative uses. There are options to achieve this while preserving other essential goods and services of land - including food production - through reducing food waste across the supply chain, implementing sustainable improvements to livestock and crop productivity, and encouraging healthier diets.
- **Use land effectively to increase carbon sequestration and restore natural habitats.** Alternative uses of the land released from agriculture could deliver significant reductions in emissions, which is especially important in the long term. Sequestration measures include afforestation, forestry management and agro-forestry, the growth of bioenergy crops, and peatland restoration.
- **Address the barriers to transitioning to different patterns of land use and management.** These barriers include inertia in moving away from the status quo and lack of experience and skills in alternative land uses, under-investment in research and innovation, lack of information about new low-carbon farming techniques, high up-front costs, uncertainty over future markets for new products, and little or no financial support for the public goods and services provided by land that do not have a market value.
- **Recognise and reward the role of agriculture in decarbonising other sectors.** Emissions from agriculture in Northern Ireland have increased 2% since 1990 and are only expected to deliver around 1 $MtCO_2e$ of abatement in our Central Scenario for the fifth carbon budget. However, it is important to recognise the role of the agricultural sector in driving emissions reductions that are accounted for in other sectors such as LULUCF.
- **Go beyond a voluntary approach.** Across the UK, emissions reduction measures are largely supported through an industry-led voluntary approach. These voluntary frameworks have failed to deliver necessary emissions reductions to date, and the Committee has consistently recommended implementing a stronger framework across the UK.[51] The Greenhouse Gas Implementation Partnership and the design of the Northern Ireland Rural Development Programme have led to a closer relationship between government and industry than in England, but most greenhouse gas mitigation measures remain voluntary in Northern Ireland.

[51] CCC (2018) *Progress report to Parliament.*

Policy options to decarbonise agriculture and LULUCF

1. Incentivise the immediate options opportunities for low-carbon practices in agriculture

Northern Ireland already has an existing framework for reducing emissions from agriculture, delivered through the Efficient Farming Cuts Greenhouse Gases and Northern Ireland Rural Development Programme.

Many of the measures below are eligible for support under existing schemes, but the cost effectiveness estimates can be used to identify priority areas for emissions reduction in Northern Ireland.

The cost effectiveness estimates for the measures presented in Table 3.1 are taken from our advice on the fifth carbon budget, and not updated for any methodology changes since.[52]

Our 2015 *Sectoral Scenarios* report[53] provides an in-depth description of the individual mitigation measures:

- **Soil mitigation measures** include improved synthetic fertiliser use, improved manure management practices, and loosening compacted soils.
- **Crop mitigation measures** aim to improve the efficiency of nitrogen use through planting specialised crop varieties, targeted timing of fertiliser uptake, or the use of technology to more accurately match soil and climate conditions to crop nutrition requirements.
- **Livestock mitigation measures** aim to improve the reduce emissions from livestock through diet, health and selective breeding measures. These mitigation measures are likely to be particularly important for reducing emissions in Northern Ireland.
- **Other measures** fall into two groups, waste and manure management and energy efficiency. The energy efficiency measures are largely measures that reduce CO_2 from fossil fuel use in buildings and machinery.

Our Central Scenario identifies 0.9 $MtCO_2e$ of direct non-CO_2 emissions abatement in Northern Ireland that is cost-effective (Table 3.1).

[52] These figures are based on CCC advice before changes to emissions factors and the adoption of the 'Smart' inventories. In our most recent Progress Report to Parliament, the UK-wide abatement in the Central Scenario in 2030 was adjusted on a measure-by-measure basis and is now 7.0 Mt, down from 8.6 Mt in the original advice. The largest effect was in N_2O abatement measures.

[53] CCC (2015) *Sectoral scenarios for the fifth carbon budget.*

Table 3.1. Mitigation measures in 2030, Central Scenario for fifth carbon budget

Category	Measure	Northern Ireland direct abatement in Central Scenario ($ktCO_2e$)	UK-wide cost effectiveness (£/tCO_2e)
Crops & soil management	Precision farming for crops	10	-95 to -105
	Manure planning and application	0	-155 to 125
	Grass clover crops	10	-45
	Controlled-release fertilisers	10	35 to 135
	GM crops with nitrogen use efficiency	110	-110
	Triticale	60	-160
	Loosening compacted soils	10	0
Livestock health measures	Improvements to cattle health	120	-40
	Improvements to sheep health	20	30
Livestock diets	Improved nutrition	10	-25 to -30
	Probiotics	20	-230
	Nitrate additives	100	60 to 80
Livestock breeding	Use of balanced breeding goals	20	-50
Waste and manure management	Anaerobic digestion	10	-40 to 170
	Slurry acidification	40	45 to 95
Fuel efficiency	Improved housing, drying, glazing, irrigation etc.	100	-260 to 35
Baseline	Measures already being taken-up or promoted	280	

Source: CCC (2015) *Sectoral scenarios for the fifth carbon budget.*
Notes: These figures have not been adjusted for methodology changes since 2015.

2. Release agricultural land for alternative uses through productivity improvements, encouraging healthier diets, and reducing food waste

Where possible agricultural land should be released for alternative uses. The primary means to release agricultural land in Northern Ireland include:

- **Continue to support measures that increase agricultural productivity.** The Going for Growth and Efficient Farming cuts Greenhouse Gases both recognise the importance of increasing agricultural productivity in Northern Ireland:
  - Sustainably increasing the stocking density releases rough grazing land for other uses. If accompanied by a good grazing management system, this can also maximise grass utilisation rates (the rate at which grass is consumed). Moving from set stocking or continuous grazing systems to paddock grazing, where livestock are moved frequently to select parts of the field, can increase grass utilisation rates from around 50-60% to 80% utilisation.[54]
  - Increases in crop yields rely on good agronomy practices such as optimising fertiliser application, soil management, crop rotation, and selective breeding of crop varieties resistant to pests and diseases.
- **Provide information to help shift diets towards healthier eating guidelines.** The Northern Ireland Eatwell Guide[55] gives advice on the types of food and the portions necessary to have a healthy, balanced diet. Under our analysis for the recent *Land Use* report, we assessed the impact on GHG emissions and the amount of land released out of agriculture from a reduction in demand for beef, lamb and dairy. We assume:
  - A lower reduction in the consumption of beef and lamb compared to the Public Health England 'Eatwell' guide, but we go further with dairy products, with a reduction of demand of 20% to 50% by 2050 across these products.
  - As well as assuming an increase in the consumption of more plant based food, we also include a switch to other meat proteins (pork and chicken), and 'alternative' proteins.
- **Reduce food waste throughout the food chain.** Policies to reduce food waste are also discussed in the next chapter, as they can significantly reduce methane emissions from landfill. Key initiatives to reduce food waste include:
  - The 'Courtauld 2025' voluntary commitment to reduce waste by 20% by 2025 across the supply chain from food producer (post-farm gate) to end consumer.
  - The UK Food Waste Reduction Roadmap launched in 2018 by WRAP and the Institute of Grocery Distribution (IGD) targets to halve of food waste by 2030 in line with the UN's Sustainable Development Goal 12.3.

[54] AHDB (2016) *Planning grazing strategies for better returns.*
[55] https://www.nidirect.gov.uk/articles/eatwell-guide

3. Encourage alternative uses of land that deliver emissions reductions

Alternative uses of the land released from agriculture could deliver significant reductions in emissions, but require policy support to ensure that abatement measures are implemented:

- **Afforestation.** The low level of forest coverage in Northern Ireland means that afforestation could be a priority area to explore further. Our Central Scenario for the fifth carbon budget assumes 15,000 hectares of afforestation per year in the UK.

  We have assessed that Northern Ireland's contribution to achieving this rate of afforestation would be around 900 hectares per year. The current rate of 200 hectares is below this target and below the ambitions set out in the Forestry Strategy to double woodland coverage between 2006 and 2056.

  Northern Ireland should also consider if and where there is opportunity for afforestation on public land to complement the expansion of private woodlands, and how to fund new planting on the public estate.

- **Agro-forestry.** Integrating trees and/or shrubs on to cropland and grassland can sequester additional carbon in agricultural land. Our Central Scenario assumes savings of 0.04 $MtCO_2$ can be delivered in Northern Ireland by 2030. This is focused on CO_2 from carbon sequestration in trees and soil, and excludes other greenhouse gas savings (e.g. N_2O savings from reduced fertiliser use).

  In addition to financial incentives, barriers due to lack of knowledge and awareness that currently exist among farmers about the potential benefits of agro-forestry systems would also have to be addressed.

- **Peatland.** Under a 'high' ambition scenario, peatland restoration measures could deliver around 0.3 $MtCO_2e$ of abatement in Northern Ireland.

A coherent strategy, including increased funding, incentives and policies will be required to increase private afforestation rates. Afforestation, agro-forestry, and peatland restoration measures should be subsidised as public goods within any post-CAP framework in Northern Ireland.

The Committee intends to publish a report that will provide a more in-depth look at the barriers to uptake of alternative land uses, and policy options to address these.

Land use scenarios for Northern Ireland

Our recent land use report generated several scenarios for how land use could change by 2050 (Box 3.1). These scenarios explore the technical potential for land-use change and their use in this report should not be interpreted as a policy target or recommendation.

Box 3.1. Land use scenarios for Northern Ireland

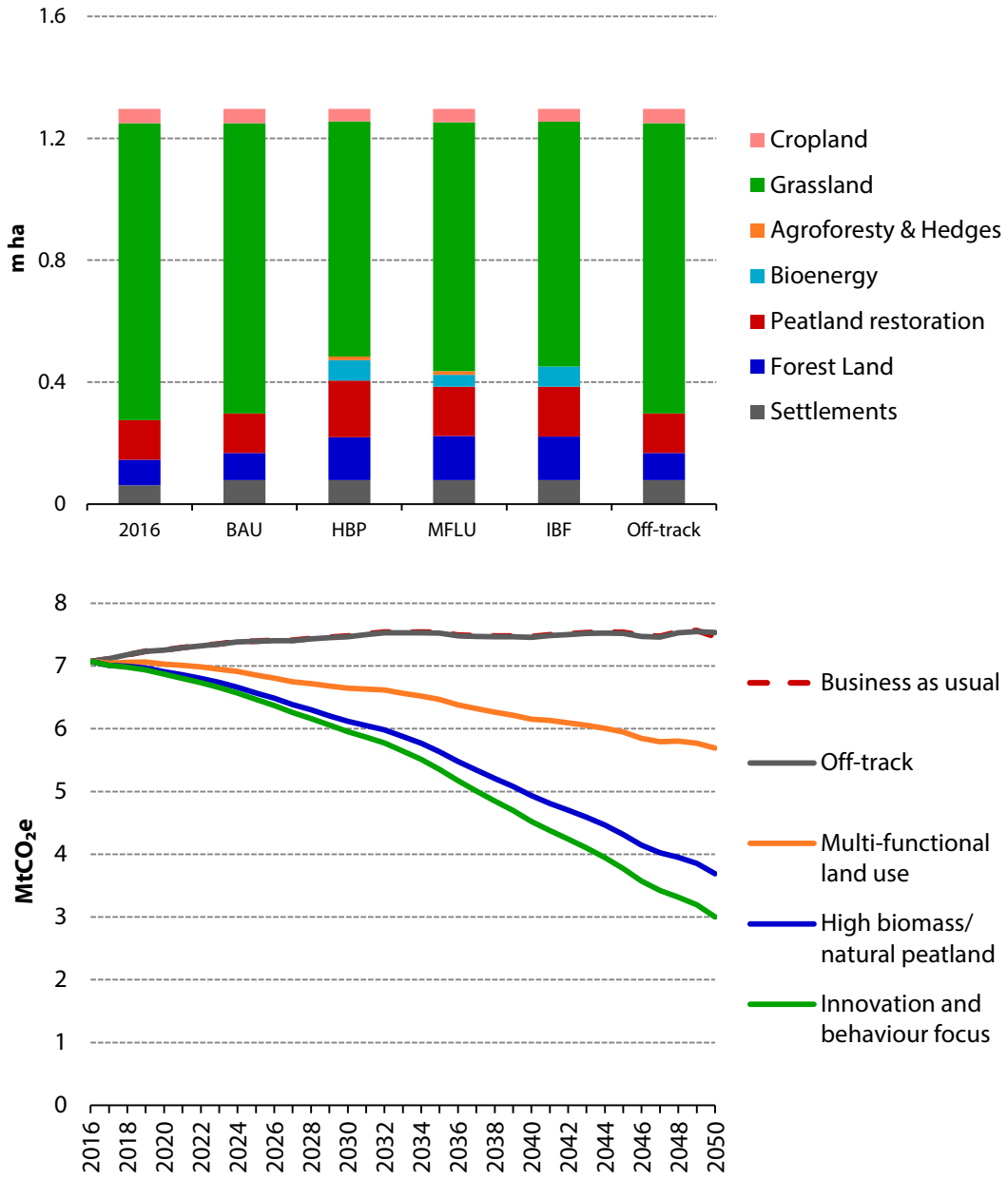
The scenarios in our land use report demonstrate interactions between the different land use sectors and illustrate alternative uses that are internally consistent so that the amount of land required for alternative uses is not greater than the amount that is released out of agricultural production.

Table B3.1. Key elements of our land use scenarios

Scenario	Description
Business as usual (BAU)	Existing trends in land use and management continue to 2050. Levels of agricultural productivity and innovation reflect past trends and little change in behaviour on diets and food waste.
High biomass/natural peatland (HBP)	Agricultural land released through higher agricultural productivity and some changes in behaviour on diets and food waste. Focus on high tree and bioenergy crops planting rates and productivity and peatland restoration.
Innovation and behaviour focus (IBF)	Maximum ambition for agriculture innovation and technology and high levels of change in behaviour towards healthy eating guidelines, and willingness to try novel food sources that could release more land. High tree planting and productivity rates helped by innovative techniques.
Multi-functional land use (MFLU)	Medium levels of ambition on innovation and behaviour to release agricultural land for other uses. High levels of hedgerows and trees on farms and areas of afforestation leading to a more diverse agricultural landscape.
Off-track	Land spared through higher agricultural productivity and technology used mainly for growing more food in the context of increasing global food demand. Focus on maximising agriculture output and exports, with low levels of ambition for afforestation and bioenergy

Box 3.1. Land use scenarios for Northern Ireland

Figure B3.1. Differences in land use in Northern Ireland and emissions from land in 2050 under scenarios



Source: *CCC (2018) Land use: Reducing emissions and preparing for climate change.*

Chapter 4: Buildings and industry

Overview of buildings and industry in Northern Ireland

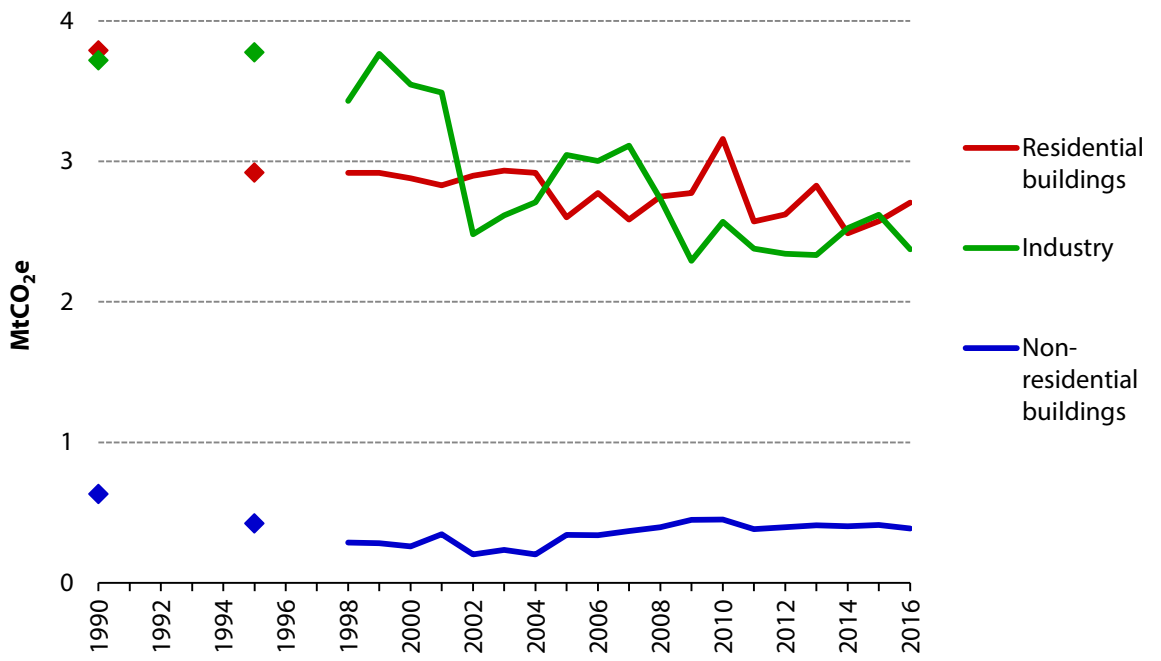
Latest emissions trends and drivers

Emissions from residential buildings in Northern Ireland were 2.7 $MtCO_2e$ in 2016, accounting for 13% of total emissions. Emissions were 2% lower than 2008 and 29% lower than in 1990.

Emissions from non-domestic buildings decreased by 6% from 2015 to 2016 to 0.4 $MtCO_2e$. The non-residential buildings sector accounted for 2% of emissions in Northern Ireland in 2016, and were 39% lower than 1990 levels.

Emissions from industry in Northern Ireland accounted for 12% (2.4 $MtCO_2e$) of total emissions in 2016 and decreased by 9% compared to 2015. They were 36% lower than in 1990. The industry sector accounted for a much smaller proportion of total emissions in Northern Ireland compared to the rest of the UK (26%) (Figure 4.).

Figure 4.1. Emissions from buildings and industry (1990 - 2016)



Source: NAEI (2018).

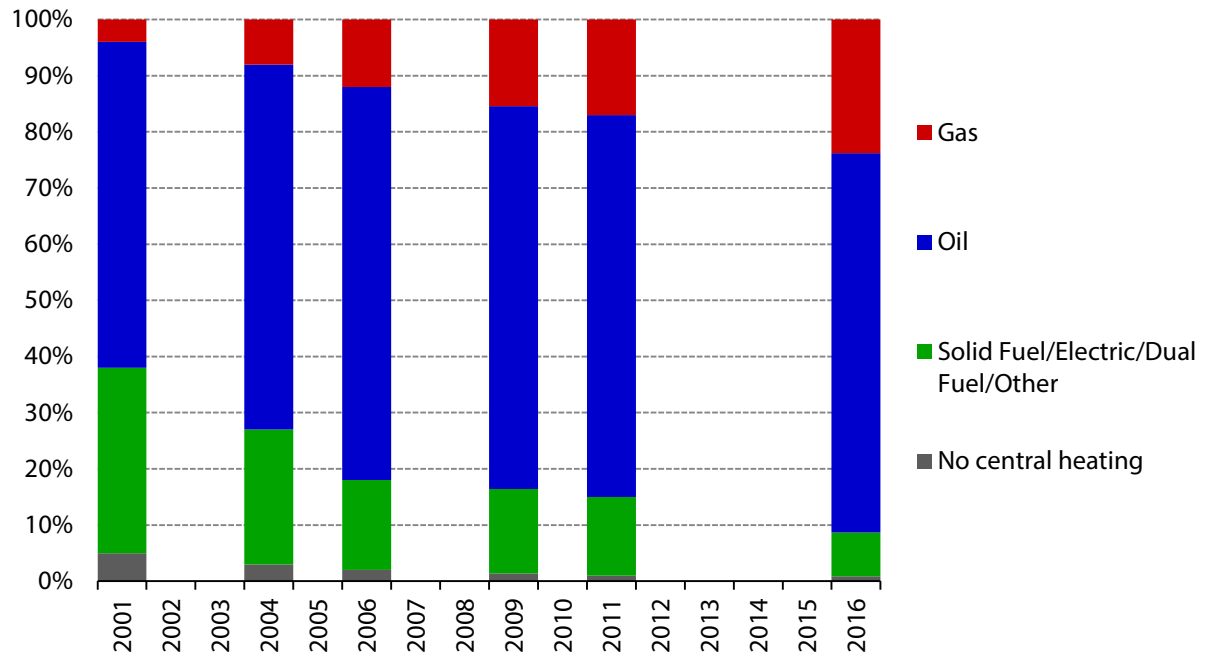
In this section, we focus on energy efficiency and heat measures in residential and non-residential buildings. Policies for heavy industrial processes are largely set at an EU ETS and UK level, so the potential for Northern Ireland to set decarbonisation strategy is more limited in this area.

Heat in Northern Ireland

Natural gas network

Northern Ireland has a significantly lower proportion of homes that are connected to the gas grid compared to the rest of the UK. In 2016, 24% of all households used gas for central heating, though this number has risen significantly from in 2001 when just 4% of households were connected to natural gas for central heating (Figure 4.2). In comparison, around 87% of households in Great Britain are connected to natural gas.

Figure 4.2. Central heating by fuel type in Northern Ireland



Source: Department for Communities (2018) *Northern Ireland Housing Statistics 2017-18.*

There have been three major expansions of the gas network in Northern Ireland since the 1990s:

- Belfast first connected to the grid via a pipeline from Scotland in 1996. By the end of June 2018, over 200,000 customers had been connected to natural gas in the greater Belfast area.
- By the end of June 2018, almost 40,000 customers had connected to the gas grid in the 10 Towns licence area (along the routes of the North-West gas transmission pipeline (completed November 2004) and the South-North gas transmission pipeline (completed October 2006).
- The latest expansion of the grid is the £250 million "Gas to the West" expansion:
  - Some households have already connected to gas in the Strabane area. Connections to seven other towns are due to become operational in the second quarter of 2019.
  - Around 40,000 consumers are expected to come on to the gas grid over several years, primarily replacing oil-fired boilers.

  - Initial evidence suggests a typical cost of switching to gas will be around £2000-3000 per household, depending on the extent of upgrade such as the optional removal of hot water tanks or provision of new heating controls.
- The vast majority of all gas-heated dwellings are located in urban areas (98% in 2016). In total, the network operator expects to have up to 300,000 connections (both domestic and non-domestic) to the gas network by 2020, compared to 220,000 in 2015.

The Northern Ireland boiler replacement scheme helps owner occupiers whose household income is less than £40,000 replace inefficient boilers that are over 15 years old. Grants of up to £1,000 are available to help with replacing an inefficient boiler with a more energy efficient condensing oil or gas boiler, switching from oil to gas, or switching to a wood pellet boiler. Between 2012-13 and 2017-18, around 38,500 grants were approved for a total of £26 million, at an average of £678 per household. To-date, 32,000 boiler replacements have been completed.

Low-carbon heat

To support the development of low-carbon heat in Northern Ireland, the Executive previously introduced the Renewable Heat Premium Payment (RHPP) and Renewable Heat Incentive (RHI) schemes, both of which are now closed.

The Northern Irish RHI is currently subject to a public inquiry into its design, governance, implementation and operation, and cost control mechanisms following the suspension of the domestic and non-domestic schemes to new applicants in February 2016.

There is therefore no specific mechanism for supporting low-carbon heat in residential buildings, non-residential buildings or industry in Northern Ireland, although funding can be obtained as part of certain energy efficiency schemes.

The domestic scheme had around 750 heat pumps, 1,150 biomass boilers and 700 solar thermal installations accredited. Installations on the non-domestic scheme were overwhelmingly biomass boilers (2,100) with fewer than 30 other heating technologies supported.[56]

Public statistics on the deployment of low-carbon heating in Northern Ireland following the suspension of the RHI scheme to new applicants are not available, though suppliers have given evidence of selling "next to nil" low-carbon heating equipment since the suspension.[57]

Energy efficiency in buildings

Existing building stock

On the whole, the type and efficiency of housing stock in Northern Ireland is comparable to the rest of the UK:

- Northern Ireland has 38% detached housing, 28% semi-detached, 25% terraced and 9% flats/apartments. In comparison, the UK as a whole had a lower proportion of detached housing (23%) and more (22%) flats/apartments, with a similar proportion of terraced and semi-detached housing.[58]

[56] Department for the Economy (2018) *Domestic and Non-Domestic Renewable Heat Incentive (RHI) - Statutory Information.*
[57] https://www.belfasttelegraph.co.uk/news/northern-ireland/next-to-nil-rhi-boilers-sold-since-cuts-37379038.html
[58] Department for the Economy (2018) *Energy in Northern Ireland 2018.*

- Based on the SAP 2012 methodology, average households in Northern Ireland in 2016 were slightly more efficient (EPC of 66.3) than in England (EPC of 61.5) in 2015.[59]

Northern Ireland has an established policy framework in place to support energy efficiency in both domestic and non-domestic buildings:

- The Bryson Energy Advice Line, funded by the Department for Communities through the Northern Ireland Housing Executive, provides independent and impartial energy advice to domestic householders in Northern Ireland plus referrals to energy grants and other local sources of assistance.
- The Affordable Warmth Scheme, introduced in September 2014, is targeted at fuel poor households in the private sector. It provides grant funding of up to £7,500 targeted at four efficiency measures, in order of priority:
  - Insulation, ventilation and draught-proofing.
  - Heating improvements (covering both low carbon heat and more efficient conventional boilers).
  - Windows (e.g. double glazing).
  - Solid wall insulation.
- Through the Northern Ireland Sustainable Energy Programme (NISEP), energy companies deliver energy saving measures to low income households:
  - The scheme provides support to households who are ineligible for other schemes such 'Affordable Warmth'. The majority (80%) of the scheme fund is targeted at low income households and those at risk of fuel poverty.
  - NISEP has recently been extended to March 2019, and options for a new energy efficiency scheme (Energy Wise) to replace the scheme from April 2019 are currently being considered. NISEP funding comes from a levy paid by all electricity customers, is delivered by energy companies, and is managed by the Utility Regulator.
- In non-domestic buildings, the Energy Efficiency Loan Fund provides interest free loans of between £3,000 and £400,000 to assist businesses to install new energy saving equipment (including more efficient heating equipment).

Northern Ireland has devolved control of buildings standards and regulations, although much of this is driven by EU directives:

- The Building Regulations (Northern Ireland) 2012 include enhanced thermal standards for all new buildings and those undergoing renovation.
- There may be further amendments in 2019 to enhance energy efficiency standards with a view to meeting the cost-optimal and nearly zero-energy building requirements of the Energy Performance of Buildings Directive 2010/31/EU.

[59] A higher SAP rating indicates better energy efficiency.

Emissions from industry

- Northern Ireland has less direct control over other emissions from heavy industry as some key fiscal policy levers are either reserved by the UK government or operate at the EU level, including EU ETS, Climate Change Levy (CCL) and Climate Change Agreements (CCAs).
- A key area where Northern Ireland has devolved powers is the regulation of industrial space and process heating.

Northern Ireland's contribution to UK targets

Indicators for UK-wide decarbonisation of buildings and industry

For the UK, the Committee monitors progress in buildings and industry against a set of indicators that reflect underlying progress against the cost-effective path for emissions reductions to meet legislated emissions targets.

Our indicator framework for buildings is designed to capture changes through decarbonising the heating supply by substituting fossil fuels with low-carbon electricity, fuels and heat sources ('low-carbon heat'), along with reducing and managing demand:

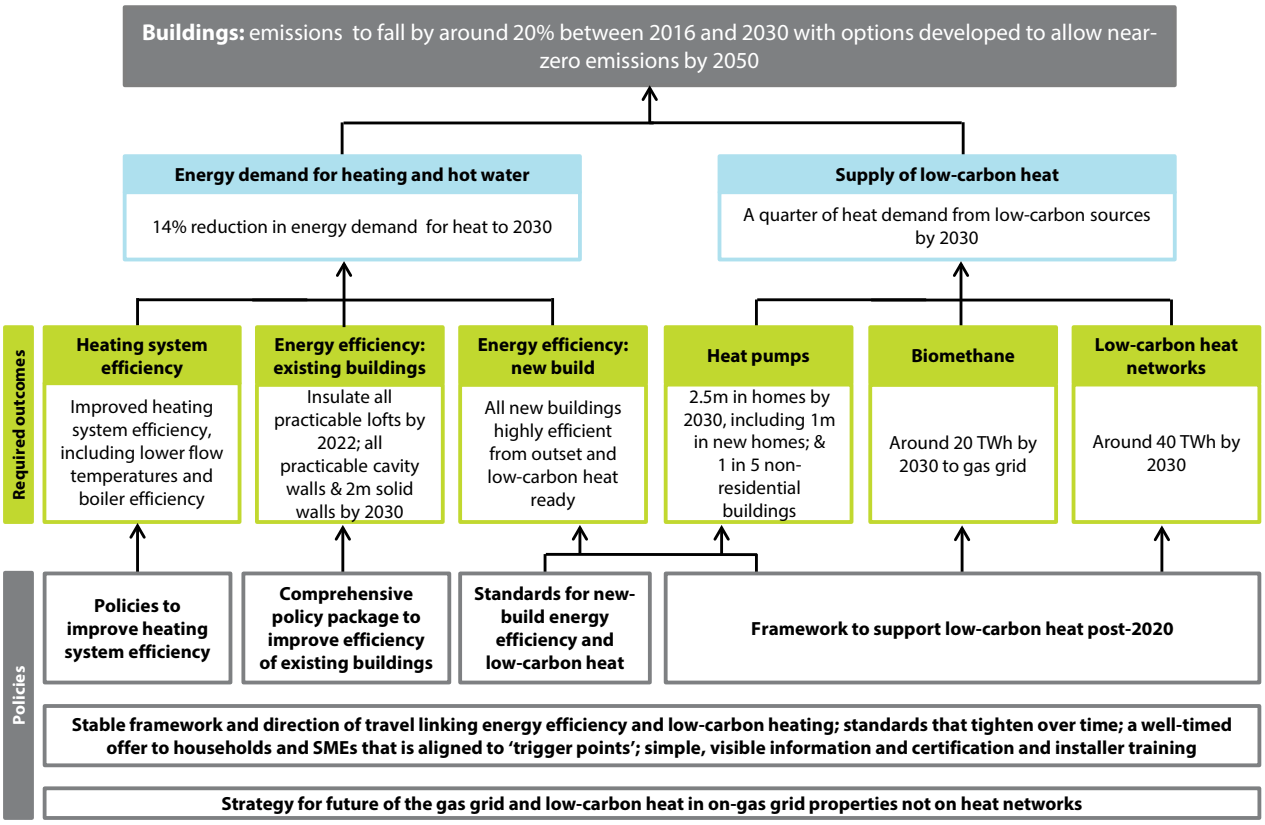
- Top-level indicators track total heat demand and the supply of low-carbon heat.
- These top-level indicators are complemented by a set of supporting indicators which track the roll-out of low-carbon measures and policy indicators that highlight necessary policy development.
- To be on track to meet the UK's current legislated emissions reduction targets, the buildings sector requires a 14% reduction in energy demand and 25% of heat demand to be met by low-carbon sources by 2030.
- Figure 4.3 shows this set of indicators, and areas where the Northern Irish government has devolved responsibility are highlighted in bold. Northern Ireland has wide range of devolved powers in the buildings sector, with potential to implement strategic sector-wide policies.

Our indicator framework for industry (Figure 4.4) is designed to capture changes through decarbonising manufacturing processes, manufacturing and refining combustion, and fossil fuel production:

- UK-wide progress requires improvements in energy intensity (TWh/GVA) and in the carbon intensity of energy (g/kWh) by 2030.[60]
- Suitable policies on energy efficiency, CCS, bioenergy and electrification are needed to drive improvements in energy intensity and carbon intensity.
- Reductions in process emissions from the manufacturing sectors are also required through CCS.
- The indicators concentrate on progress in reducing combustion emissions from the manufacturing and refining sectors, because these areas were identified as having the most abatement potential in our fifth carbon budget scenarios for the UK.

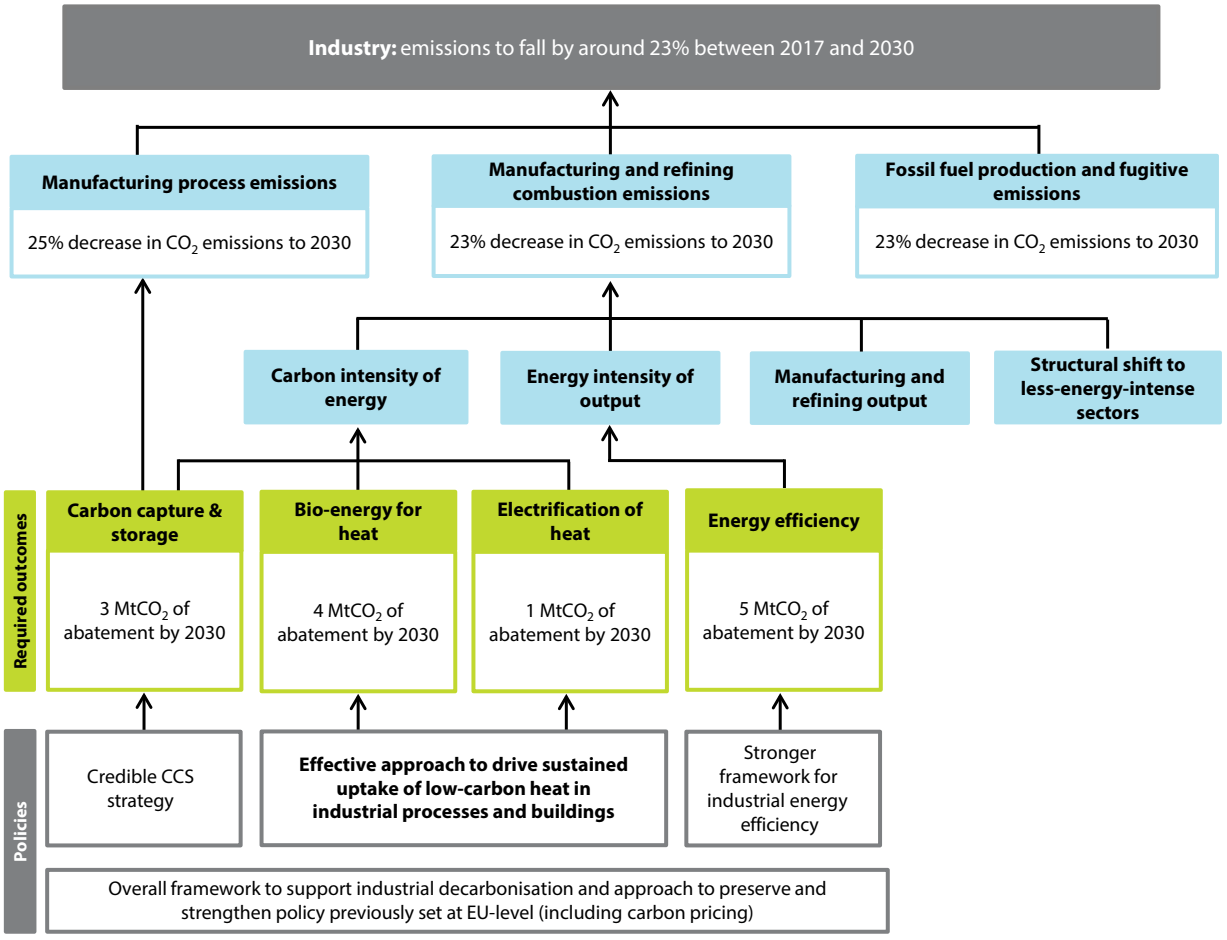
[60] In these contexts, 'energy' includes on-site electricity generation, but excludes electricity from the grid. Emissions relating to grid electricity are dealt with in Chapter 2.

Figure 4.3. Committee on Climate Change indicators for UK-wide decarbonisation of buildings



Notes: Policy areas where devolved policy has a significant role to play are shown in bold.

Figure 4.4. Committee on Climate Change indicators for UK-wide decarbonisation of industry



Notes: Policy areas where devolved policy has a significant role to play are shown in bold.

Emissions from buildings and industry in Northern Ireland in 2030

By 2030, the DAERA projections show that emissions are expected to fall to 2.4 $MtCO_2$ in residential buildings and 2.3 $MtCO_2$ across non-residential buildings, the public sector and industrial processes (Figure 4.5, Figure 4.6).[61] These projections contain a mix of UK-wide and Northern Ireland policy savings:

- In the residential buildings sector:
  - A share of UK policy savings are taken for National Products Policy and F-gas regulations.
  - Policy savings specific to Northern Ireland were included for Boiler Replacement Scheme, Code for Sustainable Homes, Heating Replacement Programme (heating), Warm Homes Scheme, Renewable Heat Incentive, Gas Extension to West, Gas Extension to East Down and Uplift of Part F (Conservation of Fuel and Power) of The Building Regulations (Northern Ireland) 2012.

[61] The Northern Ireland projection uses different classifications to the Committee. Here the combined business, public sector and industrial process are equivalent to the Committee's classifications of non-residential buildings and industry.

- In the business and industrial processes sectors:
  - A share of UK savings are taken for National Products Policy, Carbon Reduction Commitment Energy Efficiency Scheme, F-gas regulations and Energy Performance of Buildings Directive.
  - Policy savings specific to Northern Ireland are included for the RHI, Gas Extension to West, Gas Extension to East Down and Uplift of Part F (Conservation of Fuel and Power) of The Building Regulations (Northern Ireland) 2012.

In comparison, the Committee's analysis of potential abatement in CO_2 across the buildings and industry sectors suggests Northern Ireland's contribution to the fifth carbon budget would require 2.5 $MtCO_2e$ in residential buildings and 2.6 $MtCO_2e$ across non-residential buildings (0.2 $MtCO_2e$) and industry[62] (2.4 $MtCO_2e$):

- Analysis of at the UK level[63] identified 0.1 $MtCO_2$ of potential abatement in residential buildings and 0.1 $MtCO_2$ in in non-residential buildings by 2030.
- Energy efficiency measures in all buildings (residential and non-residential) could provide potential abatement of 0.4 $MtCO_2$ in Northern Ireland by 2030.
- We identified a further 0.2 $MtCO_2$ of abatement potential against the baseline in the industry sector from the expansion of biomass and biogas heating in industry.
- We did not disaggregate savings in F-gases to a devolved administration level. If UK-wide action on F-gases in our fifth carbon budget scenario were proportionally allocated to Northern Ireland, this could bring a further 0.1 MtCO2e of abatement, reducing this gap.

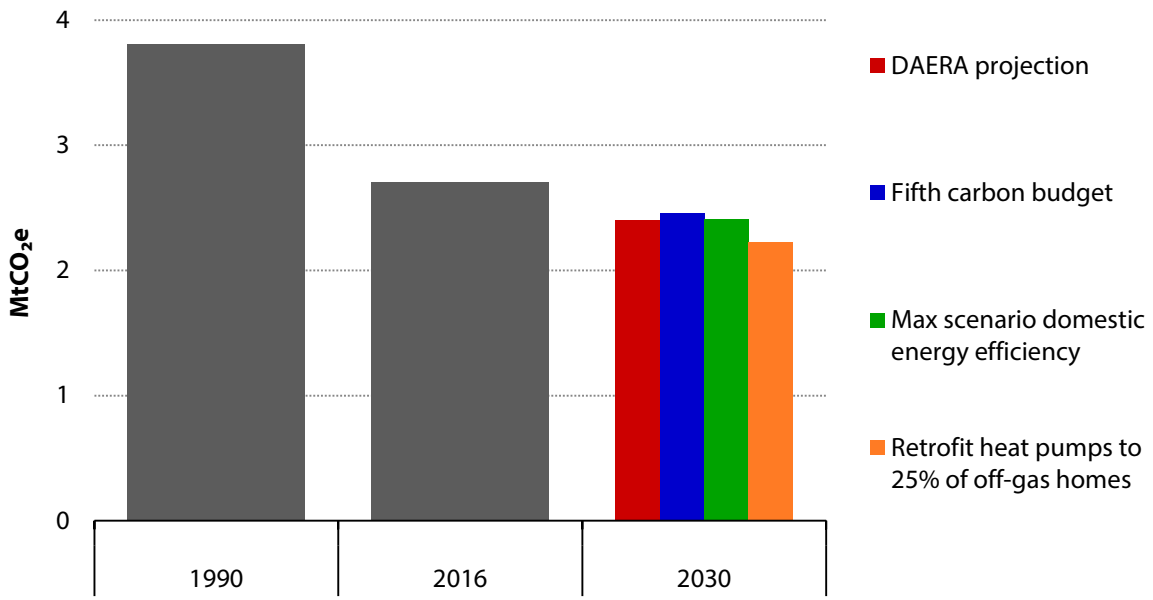
At present, the Northern Irish government's combined projections of emissions in residential buildings and industry suggests a slight out-performance against the contribution to the UK-wide legislated carbon targets identified in our fifth carbon budget assessment (Figure 4.5).

We have identified two further areas with potential for greater abatement by 2030:

- In the 'Max' scenario of our fifth carbon budget advice, a greater roll out of energy efficiency measures in residential properties leads to an additional (+18%) abatement from domestic energy efficiency in 2030. Such an increase in Northern Ireland would lead to a further 0.05 $MtCO_2$ of carbon savings.
- In the fifth carbon budget advice, abatement potential from low carbon heat in residential buildings in Northern Ireland was apportioned on the basis of total emissions. However, this did not directly account for the additional opportunities arising from the high proportion of off-gas properties in Northern Ireland:
  - Our UK-wide Central Scenario for the fifth carbon budget included the retrofit of 1.2 million heat pumps in off gas grid properties, providing a total carbon abatement of 2.0 $MtCO_2e$.[64]
  - By applying the UK-wide average level of abatement per retrofit, if an additional 25% of Northern Ireland's 530,000 households with oil boilers switched to heat pumps by 2030, this could lead to savings of around 0.3 $MtCO_2$ per year against current DAERA projections (Figure 4.5).

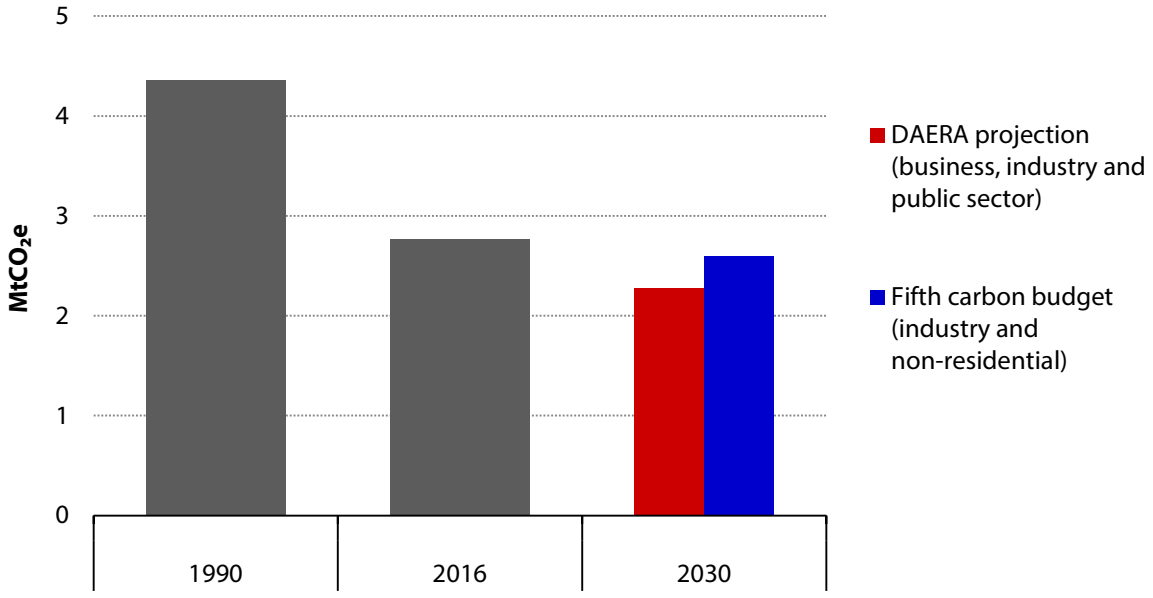
[62] CO_2 emissions only
[63] CCC (2015) *Sectoral scenarios for the fifth carbon budget.*
[64] CCC (2016) *CCC fifth carbon budget: Central Scenario data.*

Figure 4.5. 2030 scenarios for residential buildings in Northern Ireland



Source: NAEI (2018); DAERA (2018) *Northern Ireland Greenhouse Gas Projections Update*; CCC analysis.

Figure 4.6. 2030 scenarios for non-residential buildings and industry in Northern Ireland



Source: NAEI (2018); DAERA (2018) *Northern Ireland Greenhouse Gas Projections Update*; CCC analysis.
Notes: DAERA and the Committee use different methods to split emissions into sectors. The DAERA projection is the sum of 'business', 'industrial processes' and 'public sector' emissions. The Committee scenario contains emissions from 'non-residential buildings' (covering business and public sector) and 'industry'.

Principles and policy options to decarbonise buildings and heat in industry

When commissioning this report, DAERA requested sector-specific policy advice on the following questions:

- What policies, strategies, measures or schemes could help support a transition from fossil fuel heating systems to low carbon heating systems?
- What further steps can be taken to encourage the take up and introduction of energy efficient and renewable energy technologies in both old and new residential and non-residential properties?

This section will address these questions by first focussing on general principles that should be followed when planning policy to decarbonise buildings and industry in Northern Ireland, and then specific policy areas which could lead to carbon savings.

Aside from heating, we do not include an assessment of additional policy measures to decarbonise the industrial sector because the major policy levers in Northern Ireland involve supporting low-carbon heat in industry. Emissions from industrial processes are largely controlled by EU policy and UK fiscal levers.

Principles for decarbonising buildings

In our 2016 report, *Next Steps for UK Heat Policy*, the Committee identified five low-regret routes to reducing emissions from heating buildings:

- **Energy efficiency improvement to existing buildings.** There is considerable potential to improve the energy efficiency of buildings at reasonable cost. Our scenarios include around a 15% reduction in energy used for heating existing buildings by 2030 through efficiency improvements, requiring insulation of about 7 million walls and lofts in homes, and heating controls and other insulation measures in homes and non-residential buildings.
- **New-build.** Buildings constructed now should not require retrofit in 15 years' time. Rather, they should be highly energy efficient and designed to accommodate low-carbon heating from the start, meaning that it is possible to optimise overall system efficiency and comfort at building level. By 2025 no new homes should connect to the gas grid, and should instead rely on low-carbon heating systems such as heat pumps.
- **Heat pumps in buildings not on the gas grid.** Heat pumps are the leading low-carbon option for buildings not connected to the gas grid. Together with new-build properties, installation of heat pump in buildings off the gas grid can help create the scale needed for supply chains to develop, potentially in advance of accelerated heat pump roll-out in on-gas grid properties after 2030.
- **Low-carbon heat networks.** District heating schemes require a certain density of heat demand in order to be economic, which means that they are suited to urban areas, new-build developments and some rural areas. Low-carbon heat sources can include waste heat, large-scale (e.g. water-source) heat pumps and geothermal heat.
- **Biomethane.** Injecting biomethane into the gas grid is a means of decarbonising supply without requiring changes from consumers, and provides a route for capture and use of methane emissions from biodegradable wastes. Its potential is limited to around 5% of current gas consumption at UK level.

We also identified a particular challenge around decarbonising existing buildings that are on the gas grid but not in areas of high heat demand that would suit a heat network. We said at that point that strategic decisions would be need by the mid-2020s on the respective roles of electrification (i.e. heat pumps) and hydrogen in decarbonising this segment.

In our recent report on *Hydrogen in a Low-Carbon Economy*, we identified a further opportunity for on-gas buildings (Figure 4.7), with deployment of hybrid heat pump systems that operate alongside existing gas boilers. This would allow heating to switch to electricity for most of the time, with lesser challenges around public acceptability and grid capacity than a switch to full heat pumps. It would leave the existing boiler mainly operating on colder winter days, as well as potentially at times of low renewable electricity generation.

A large-scale deployment of hybrid heat pumps, alongside an equivalent amount of low-cost renewable power generation (i.e. onshore or offshore wind) would reduce gas consumption and emissions substantially (e.g. by over 70%). For much of the UK, one possibility would then be that for the remaining amount of gas, required for heating on colder winter days, this could later be switched over to hydrogen.

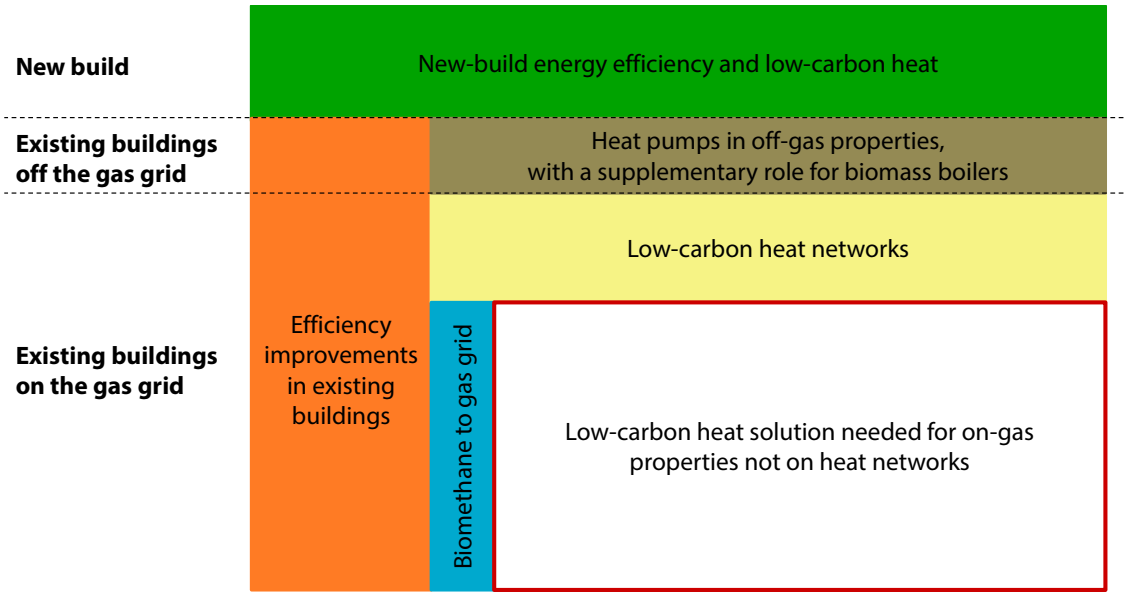
The Committee's advice to Government does not support biomass for heat in urban areas because of the air quality impacts, although biomass boilers can play a role in certain niches (for example, hard-to-insulate rural properties where heat pumps are not viable).[65] In the long-term, biomass will need to be prioritised elsewhere in the energy system in order to achieve the deep reductions in economy-wide emissions by 2050.[66]

The UK housing stock is not well-adapted for the current or future climate. Around 20% of homes overheat even in cool summers; 1.8 million homes are located in areas of significant flood risk; and the average water consumption per person per day across the UK is higher than many other European countries at around 140 litres. A joint report by the Committee on Climate Change's Mitigation and Adaptation Committees addressing these issues will be published in February 2019:

- The report aims to assess the measures, including their costs and wider benefits, that should be adopted in the housing sector to manage climate change impacts and reduce greenhouse gas emissions.
- The report considers the current state of play and what is needed for low-carbon heat; energy efficiency, cooling and ventilation; broader life-cycle carbon associated with homes; peak electricity demand management; water efficiency; property level flood resilience; surface water flood alleviation; green spaces and infrastructure; and sustainable transport.
- The Committee will present a set of recommendations on the role of building standards, funding, local authorities and planning.

[65] CCC (2018) *Biomass in a low-carbon economy*.
[66] CCC (2011) *Bioenergy Review and CCC (2016) Next Steps for UK Heat Policy*.

Figure 4.7. Low-regret measures and remaining challenges for existing buildings on the gas grid



Source: CCC (2016) *Next Steps for UK Heat Policy*.
Notes: The sizes of the blocks broadly reflect the scale of emissions reduction, but not precisely. Some potential for heat networks will be in new-build and off the gas grid, rather than all on-grid as presented.

It is important to consider the differences in the context for heat decarbonisation in Northern Ireland compared to the rest of the UK:

- Northern Ireland has a much higher share of buildings off the gas grid (76% of homes) compared to the rest of the UK (13% of homes).
- The large share of agriculture that is livestock-based in Northern Ireland means there may be more manure available for anaerobic digestion to produce biomethane:
  - Northern Ireland has potential to generate between 130 - 580 million m^3 of biomethane per year, which could provide up to 2000 GWh of heat or electrical energy. Manure has potential to be the largest feedstock source for anaerobic digestion in Northern Ireland, providing 50 - 300 million m^3 per year.[67]
  - However, the less-developed gas network in Northern Ireland means that biomethane injection to the grid may be more difficult, and anaerobic digestion may be limited to space and process heating or CHP microgeneration on-site in locations without easy access to grid injection points.
- Northern Ireland has a relatively new and modern gas network, consisting primarily of polyethylene (PE) pipe, whereas around 27% of the current GB network consists of iron pipes[68] that are gradually being phased out over the period to 2032. A polyethylene network is easier to convert to hydrogen compared to iron or steel pipes which are susceptible to corrosion and subsequent leaks.[69]

[67] Groom and Orozco (2014) *Northern Ireland Biogas Research Action Plan 2020.*
[68] Utility Regulator (2017) *Price Control for Northern Ireland's Gas Distribution Networks GD17.*
[69] CCC (2018) *Hydrogen in a low-carbon economy.*

In combination, the lesser extent of gas distribution networks and greater availability of biomethane suggests a smaller potential role for hydrogen in providing low-carbon heat for buildings in Northern Ireland compared to its potential role in the rest of the UK.

A cost-effective pathway for heat decarbonisation in Northern Ireland is therefore likely to focus much more on a combination of increased energy efficiency alongside widespread electrification, based on both hybrid and full heat pump systems, with a more important (but still small) roles for biomethane or other biofuels in meeting demand on the coldest winter days.

Policy options to improve energy efficiency and support low-carbon heating

1. Take a joined-up approach to energy efficiency and low-carbon heat, focusing on real-world performance where possible

Northern Ireland already has some schemes in place that support both insulation measures and heating technology such as the Affordable Warmth Scheme.

The Committee has previously highlighted the Energy Efficient Scotland programme as an example of 'best practice' (Box 4.1), in particular because the programme:

- Combines energy efficiency measures and low-carbon heating across all buildings.
- Sets standards well in advance.
- Includes a regulatory backstop for owner-occupied homes.
- Reinforces the targets with a statutory commitment.

Box 4.1. Case Study: Energy Efficient Scotland

Ambition

The Energy Efficient Scotland route map sets out an ambition to ensure all Scottish homes achieve an EPC C rating by 2040, where technically feasible and cost-effective. Since publication of the route map, the Scottish Parliament has given majority backing for proposals to bring forward these energy efficiency targets by a decade. This sits alongside commitments to maximise the number of social-rented homes achieving EPC band B by 2032 (becoming carbon neutral by 2040 as far as reasonably practical), and a detailed trajectory for private-rented homes to reach EPC C by 2030 where technically feasible and cost - effective. Finally, a target is set to bring all homes with households in fuel poverty to EPC C by 2030 and EPC band B by 2040, where technically feasible and cost-effective.

In the commercial sector, the route map commits to building on the current regulations in the Climate Change (Scotland) Act, extending them to all non-domestic buildings and requiring buildings to be improved to the extent technically feasible and cost-effective by 2040. For public buildings, an energy efficiency baseline will be established, with the aim of ensuring all public sector buildings achieve the relevant benchmark ahead of 2040 (where technically feasible and cost-effective).

While the route map contains a range of commitments around energy efficiency, it also builds on existing proposals for low-carbon heat, in particular Local Heat and Energy Efficiency Strategies (LHEES) which aim to link long-term targets and national policies with delivery of energy efficiency and heat decarbonisation in local authorities.

Framework for achieving the ambition

The proposed delivery framework includes a mix of existing and new measures. These include continuing the existing programme of grants and loans, funding support for fuel poverty programmes, local authorities and LHEES, and for nationally delivered support to cover those households and

Box 4.1. Case Study: Energy Efficient Scotland

businesses not covered by area-based schemes. Alongside this there is a broader framework for consumer protection, skills and training, the supply chain and quality assurance as well as assessment. The roadmap recognises the need to make sure EPCs more accurately record the energy efficiency of buildings.

The Scottish Government is consulting on giving the proposals a legislative underpinning, in particular to set long-term standards for improved energy efficiency and heat decarbonisation (e.g. a backstop mandatory requirement for properties to meet EPC C), to place duties on Local Authorities, and to regulate district heating.

The route map demonstrates a strong example of an effective policy package to drive emissions reductions. The focus for the Scottish government must now be finalising proposals and delivering against targets in the route map and the Climate Change Plan, including:

- Ensuring efficiency measures are being delivered in homes, and intervening if targets are not achieved. There is a need for an increased focus on high 'as-built' performance, with monitoring metrics and certification reformed to support this.
- Setting out final proposals for non-domestic policy in 2020, following consultation in 2019.
- Setting out more detail on low-carbon heat.

Source: CCC (2018) *Reducing emissions in Scotland - 2018 Progress Report to Parliament.*

2. Support energy efficiency improvements in existing buildings and legislate energy efficiency targets

To drive energy efficiency improvements in homes and buildings, Northern Ireland should:

- Set a clear timetable of standards to drive energy efficiency improvements in owner-occupied, social and private-rented homes.
- Policies to incentivise energy efficiency improvements in homes are largely targeted at low-income households. Northern Ireland should consider policy options to deliver an attractive package for able-to-pay householders aligned to trigger points (such as when a home is sold or renovated).
- Improve consumer access to data and advice, implementing the Green Finance Taskforce proposal on Green Building Passports, improving EPCs and access to data underpinning EPCs and SAP.[70]

Table 4.1 shows a summary of the central estimates of retrofit costs for energy efficiency measures in UK houses. Assuming there are not drastic differences in technology or supply chains, these costs are likely to be reasonable estimates for the technology costs of retrofitting the existing housing stock in Northern Ireland through the 2020s.

Support for energy efficiency improvements could be delivered through a combination of possible policy approaches:

- High quality information and advice
- Energy and/or carbon taxes

[70] Green Finance Taskforce (2018) *Accelerating Green Finance.*

- Financial support such as grants, tax incentives, supplier obligations and feed-in tariffs.
- Measures improving access to capital, such as low-cost loans or preferential-rate mortgages.

Any such of measures should be consistent, transparent and easy to understand by consumers. The Committee further discuss "what works" for residential energy efficiency, including a review of international case studies, in *Next steps for UK heat policy*.[71]

Table 4.1. Summary of retrofit cost estimates

Household type	Internal wall insulation	External wall insulation	Cavity wall insulation	Loft insulation (joists)	Loft insulation (rafters)	Double glazing
Small flat (<54m^2)	£2,800	£5,300	£380	£320	-	£2,400
Large flat (>54m^2)	£3,500	£6,700	£430	£430	-	£3,600
Small mid-terrace house (<76m^2)	£3,700	£6,800	£460	£350	£1,600	£3,900
Large mid-terrace house (>76m^2)	£4,000	£7,500	£505	£420	£1,900	£5,000
Small semi-detached or end-of-terrace (<80m^2)	£6,800	£7,800	£529	£360	£2,200	£5,500
Large semi-detached or end terrace (>80m^2)	£7,000	£8,400	£660	£470	£2,300	£6,400
Small detached house (<117m^2)	£7,200	£10,200	£680	£510	£2,300	£5,900
Large detached house (>117m^2)	£9,400	£11,500	£950	£600	£3,100	£8,300
Bungalow (around 117m^2)	£6,300	£9,800	£650	£620	£2,800	£6,600

Source: CAR for DECC (2016) *Domestic retrofit cost assumptions study.*
Notes: Medium estimate of costs. The costs presented are on an installed cost to household basis. They exclude 'hassle costs' and search costs.

[71] CCC (2016) *Next steps for UK heat policy, Annex 3 - Best practice in residential energy efficiency policy: A review of international experience.*

The Republic of Ireland's Better Energy Homes scheme (Box 4.2) provides a good case study of a sustained and simple funding scheme that encourages homeowners to install multiple efficiency measures.

Box 4.2. Case Study: Better Energy Homes - Republic of Ireland

Better Energy Homes is run by the Sustainable Energy Authority of Ireland (SEAI). It incentivises people to improve the energy efficiency of their homes through grants. Grants covering part of the cost of energy efficiency improvements are available for a range of insulation measures, heating controls and solar heating. The scheme has recently added a bonus grant for homeowners taking up several measures at a time, to encourage a 'whole-house' approach.

The impacts of the scheme have been positive:

- Almost 190,000 homes had energy efficiency work completed from March 2009 to June 2016.
- A sample study of homes participating in BEH showed a 20% net gas consumption saving compared to a control group.
- Survey results from 2010 were positive, with 65% of respondents believing the value of their home had increased and 98.5% saying they would recommend the scheme to other people.

The scheme has several strengths that has helped deliver these successful outcomes:

- The application process is transparent and relatively simple
- The SEAI carried out extensive consumer research to guide the scheme design and subsequent revisions.
- The scheme provides a sustained source of funding and consistent approach

Whilst the scheme has been successful in delivering residential energy efficiency improvements in the Republic of Ireland, the cost-effectiveness of the policy may be reduced by funding measures that households would have installed without the scheme being in place.

Source: CCC (2016) *Next steps for UK heat policy, Annex 3*; SEAI (2013) *Better Energy Homes Scheme: Impact Report – Billing Analysis*; SEAI (2010) *Bringing Energy Home: Understanding how people think about energy in their homes*; Ricardo AEA for ClimateXChange (2015) *A Comparative Review of Housing Energy Efficiency Interventions.*

3. Provide support for 'low-regret' heat technology in the early 2020s

Northern Ireland can support moves away from oil boilers and resistive electric heating through financial support for low-carbon alternatives in both residential and non-residential properties:

- Heat pumps, including hybrid heat pumps.
- Low-carbon district heating.
- Biomethane gas-to-grid where technically feasible and anaerobic digestion (AD) where it can replace fossil-fuel space or process heating.
- Biomass for heating in urban areas should not be supported due to air quality concerns.

There is potential for a large expansion of 'low-regret' low-carbon heating due to the high proportion of households off the gas grid that are currently fitted with oil boilers. Applying the average carbon savings per household of retrofits from our fifth carbon budget advice, we

calculate that retrofitting 25% of Northern Ireland's oil-heated homes to heat pumps by 2030 could bring additional savings of 0.5 $MtCO_2$ (Figure 4.5).

This could not be achieved without a policy framework to support low-carbon heat in residential properties. A financial support mechanism must be present for installers to overcome increased capital costs and conversion costs of installing low-carbon heating (Table 4.2), accounting for any lifetime operational costs or savings:

- Financial support could be delivered in a variety of forms, including one that follows an RHI-style mechanism of fixed payments over time, up-front grants or loans to purchase equipment.
- The lack of up-front payment in an RHI style mechanism makes it harder for householders without ability to meet initial capital costs. Loans, grants, or assignment of rights mechanisms[72] enable a greater proportion of the population to switch.

Table 4.2. Costs of alternative heating technologies

	H_2 heating including gas pipe upgrade	**Heat pump (5 kWth) with resistive heating, preheating, and thermal storage**	**Hybrid heat pump (4 kWth), gas boiler (10 kWth) and thermal storage**	**Small heat pump (5 kWth) with supplementary electric heating**	**District heating**	**Resistive heating (10 kWth)**
Appliance cost	£3,000	£5,000	£6,000	£6,000	£6,800	£1,500
Conversion costs	£1,000	£1,000		£1,500	£1,000	£2,500
Total costs	**£4,000**	**£6,000**	**£6,000**	**£7,500**	**£7,800**	**£4,000**

Source: Strbac et al. for the CCC (2018) *Analysis of Alternative UK Heat Decarbonisation Pathways*.
Notes: Medium estimate of costs. The costs presented are on an installed cost to household basis. They exclude 'hassle costs' and search costs.
Indicative maximum annual space heating demand for all heat pump options is 10 MWh per year.

4. Determine the long-term future of low-carbon heat in Northern Ireland

The Committee has called on the UK Government to make decisions in the 2020s on the future of heat in the UK. Northern Ireland should take a decision on a similar time frame. This includes consideration of the future role of the electricity and gas networks:

- Balancing energy supply and demand is easier when considering both the electricity and gas networks in tandem, rather than in isolation. Future thinking on energy transitions should

[72] Ofgem (2018) *Essential Guide to Assignment of Rights.*

reflect this. As part of this work, Northern Ireland should assess the capability of the all-island electricity network to deal with future heat pump roll-out on both sides of the border.

- Any decision will also require an assessment of whether any future expansion of the gas network is compatible with what is needed to contribute to UK long-term climate goals. Natural gas boilers are less carbon-intense than oil boilers, but are not compatible with long-term decarbonisation and could lead to lock in to fossil fuel heating. Rather than an approach that moves households from oil to natural gas and will then require a further policy push to switch them to low-carbon heating, where possible it would be better to go directly from oil to low-carbon heating solutions (e.g. full or hybrid heat pumps based primarily on low-cost renewable generation).

5. Implement the Committee's upcoming advice on energy efficiency regarding compliance, new-build regulations, and the performance gap.

The way new homes are built and existing homes are retrofitted often falls short of stated design standards, with consumers paying the price of for poor quality build and retrofit. To tackle this, greater levels of inspection and enforcement of building standards are required, alongside tougher penalties for non-compliance. The 'as-built' performance of homes, for example how thermally efficient they are, must also be monitored in a more effective way.

The Committee will publish its Housing report in February 2019, with recommendations on how compliance, regulations and the performance gap can be improved. It is important that this is advice is implemented in Northern Ireland to ensure consistent standards across the UK.

6. Lead on energy efficiency and low-carbon heating in the public sector

Building efficiency is an area where the public sector can provide leadership. Energy efficiency improvements in the public sector are a cost-effective and visible way to reduce emissions:

- The Northern Irish government could encourage central and local government agencies to adopt the UK Clean Growth Strategy voluntary public sector target of a 30% reduction in carbon emissions by 2020/21.
- Since the closure of the Central Energy Efficiency Fund (CEEF) in Northern Ireland, there has been no financial support scheme for energy efficiency in the public sector. Salix finance is available in the rest of the UK:
  - This government-funded organisation provides interest-free capital loans to public sector organisations for energy efficiency measures. Since 2004 Salix has helped over 2,300 clients to commit over 17,000 projects valued at £742 million,[73] saving an estimated 0.8 $MtCO_2e$ per year and providing additional bill savings of £164 million.
  - Providing financial support to local authorities and other public sector bodies in Northern Ireland could drive similar improvements in energy efficiency.
- The upcoming Energy Management Strategy may be an opportunity to strengthen measures. Northern Ireland could support the role of its public sector by setting clear guidelines for energy efficiency measures in buildings and procurement of goods and services.

[73] Salix (2018) *Successes to date.*

Chapter 5: Transport

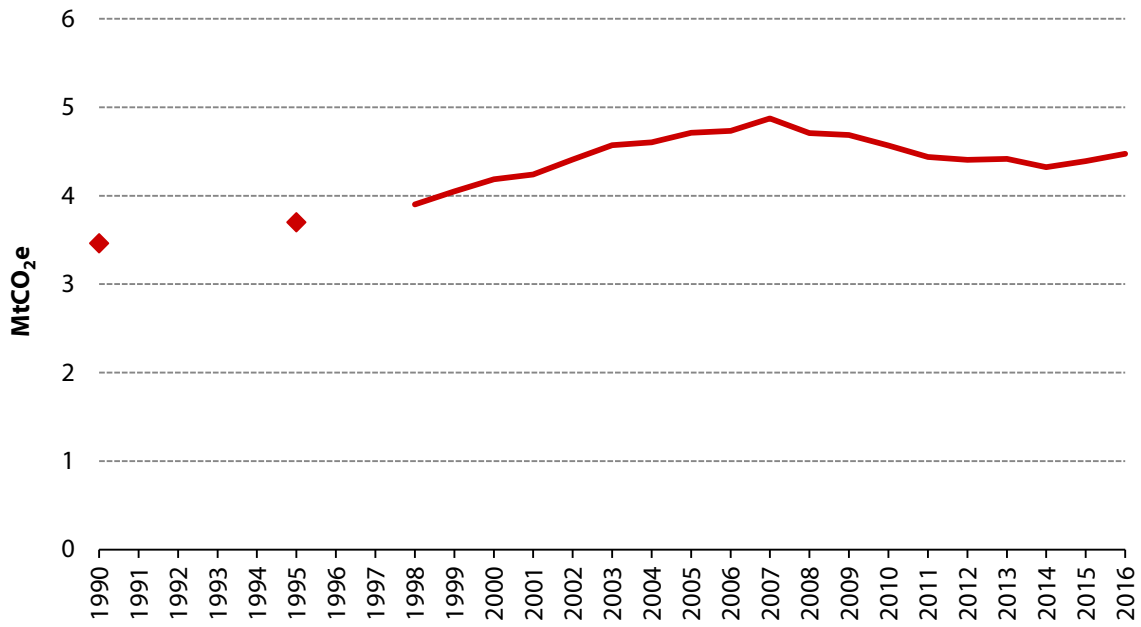
Overview of the transport sector in Northern Ireland

Latest emissions trends and drivers

Emissions from transport increased in 2016 to 4.5 $MtCO_2$. Despite a third consecutive increase in annual emissions, overall there has been a total decrease of 5% between 2008 and 2016 (Figure 5.1):

- Transport emissions in 2016 were 29% higher than in 1990, and represented 22% of all emissions in Northern Ireland in 2016. This is a smaller proportion than the rest of the UK (27%).
- The increase in emissions since 1990 largely reflects an increase in car ownership rates in Northern Ireland, which are now comparable with the UK average.

Figure 5.1 Emissions from transport in Northern Ireland (1990 - 2016)



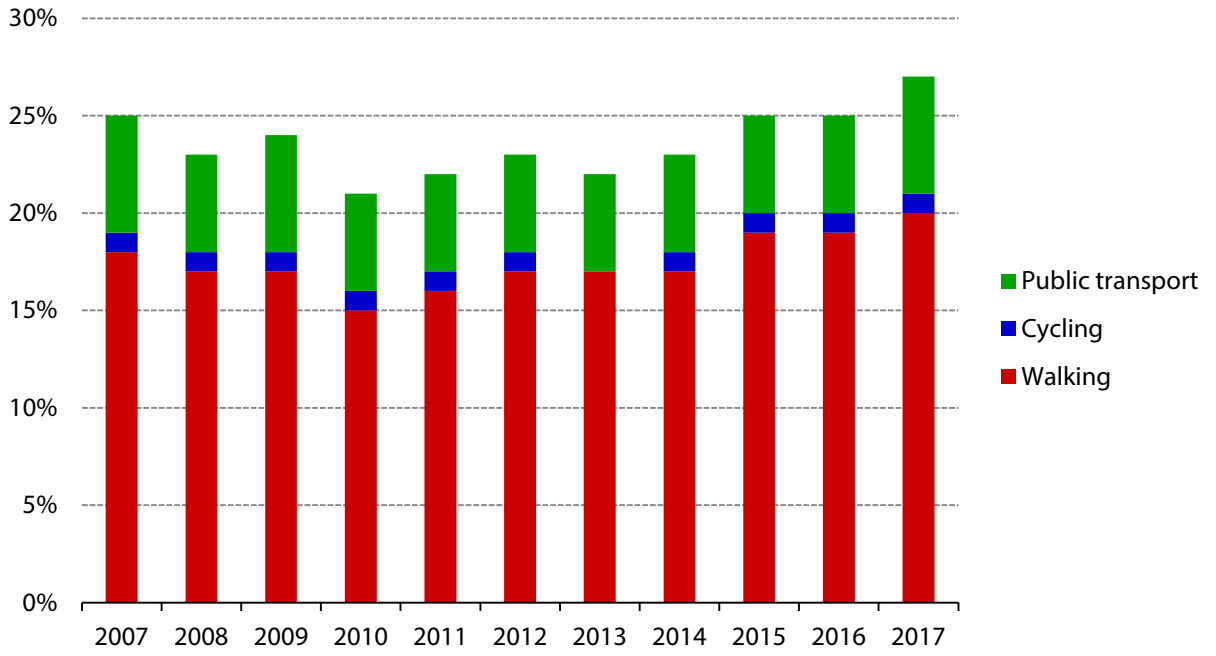
Source: NAEI (2018).

From 2015-2017, 70% of all journeys in Northern Ireland were by car,[74] compared to 61% in England.[75] A lower share of journeys were on public transport in Northern Ireland (5% compared to 8% in England). This reflects the relatively dispersed population, reliance on private rather than public transport, and the less extensive rail network in Northern Ireland.[76]

The proportion of all journeys which are made by walking, cycling or public transport was 26% in 2017. There was not a significant net change from 2017 to 2007, but the rate is up from 20% in 2010.

[74] DfI (2018) *TSNI Headline Report 2015-2017.*
[75] DfT (2018) *National Travel Survey: England 2017.*
[76] CCC (2015) *The appropriateness of a Northern Ireland Climate Change Act – December 2015 Update.*

Figure 5.2 Proportion of all journeys that were walking, cycling or by public transport in Northern Ireland (2007 - 2017)



Source: Department for Infrastructure (2018) *Travel Survey for Northern Ireland (TSNI) in-depth report 2015-2017.*

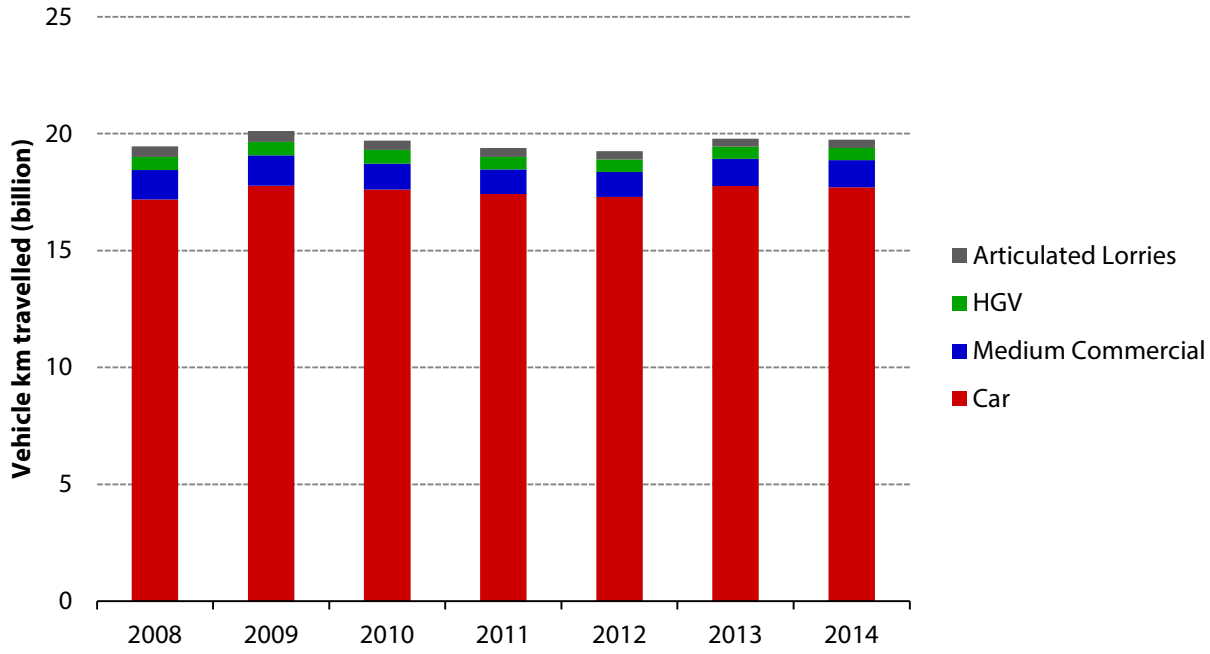
Road traffic data for Northern Ireland expressed as vehicle-km travelled are not available after 2014 (Figure 5.3):

- Inventory calculations of emissions from road vehicles in Northern Ireland now rely on applying trends from vehicle-km data from Great Britain to Northern Ireland.
- The lack of data for Northern Ireland is likely to become more of an issue for estimating total emissions in future. There is currently no means of verifying whether the underlying trends in the demand-side of transport in Northern Ireland have or have not diverged from trends in the rest of the UK.

Vehicle emissions intensity decreased by 7.5% in Northern Ireland from 2008 to 2014. The Committee is not able to calculate the emissions intensity post-2014 due to the lack of road traffic data (Figure 5.4).

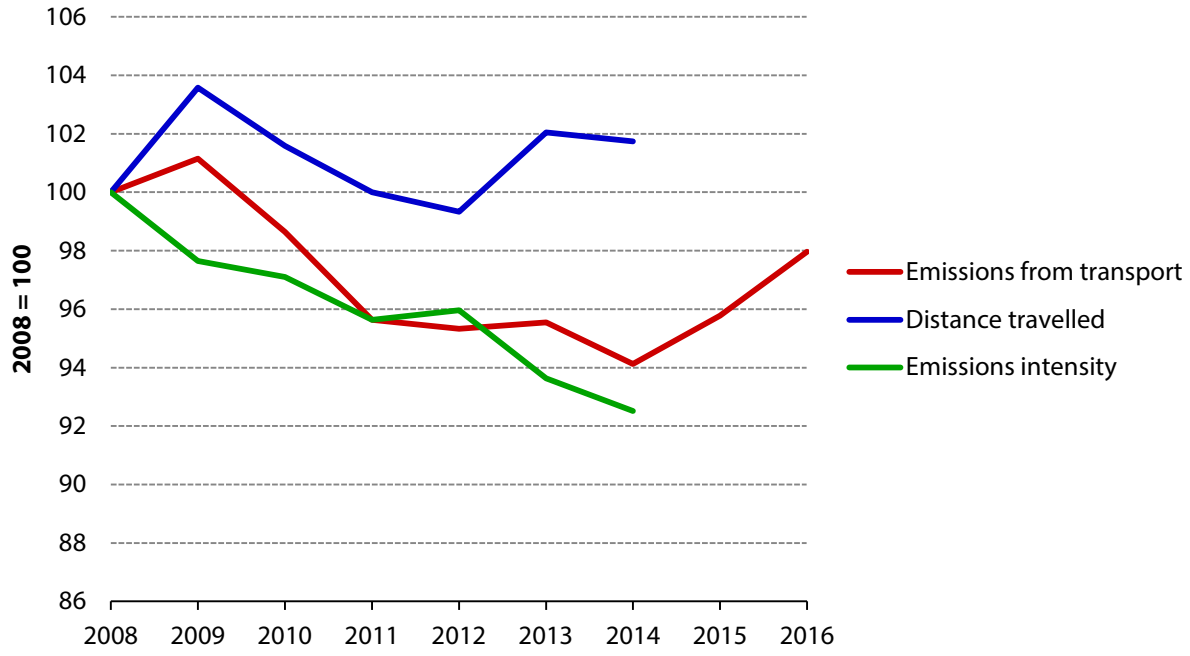
We strongly encourage the Northern Irish government to resume collecting vehicle traffic data. It is an essential tool for planning decarbonisation strategies and monitoring progress in reducing emissions from road transport.

Figure 5.3 Annual distance travelled by road vehicles in Northern Ireland (2008 - 2014)



Source: Department for Infrastructure (2018) *Annual road traffic estimates: vehicle kilometres travelled in Northern Ireland 2014.*

Figure 5.4. Distance travelled, emissions and emissions intensity of road transport in Northern Ireland



Source: NAEI (2018); Department for Infrastructure (2018) *Annual road traffic estimates: vehicle kilometres travelled in Northern Ireland 2014.*

Conventional vehicles in Northern Ireland

The average test-cycle efficiency of new cars sold in Northern Ireland in 2017 was 119.4 gCO_2/km. This was the lowest of any country in the UK, but represented a 0.6% increase from 2016. The primary policy levers for improving conventional vehicle efficiency are at a UK and EU level:

- Fiscal levers such as road tax breaks for lower-emission vehicles are a reserved matter.
- Conventional vehicle standards are driven by EU legislation, aiming for a target of 95 gCO_2/km by 2020.
- The established policy framework means that, whilst Northern Ireland does have some scope to further incentivise efficiency improvements in new conventional vehicles, policy is likely to be more effective in other areas such as providing the necessary infrastructure for ultra-low emissions vehicles (ULEVs) or encouraging the use of public transport and active travel.

Ultra-low emission vehicles (ULEVs) in Northern Ireland

Current and future UK government policy will have a significant impact on the ULEV market in Northern Ireland:

- Tax and vehicle standards are set at a UK and EU level.
- The Office for Low Emission Vehicles (OLEV) operates a number of schemes that Northern Irish consumers qualify for (such as the Plug-in Car Grant, several grant schemes for electric vehicle chargers, Go Ultra Low).
- The Road to Zero is a UK-wide strategy and includes measures that will apply to the whole of the UK.
- Supply-side measures to support ULEV manufacturers are covered by UK-wide policy (e.g. the Industrial Strategy Automotive Sector Deal).[77]

However, the Northern Irish government has a significant role to play through devolved policy matters and actions that further encourage the uptake of ULEVs:

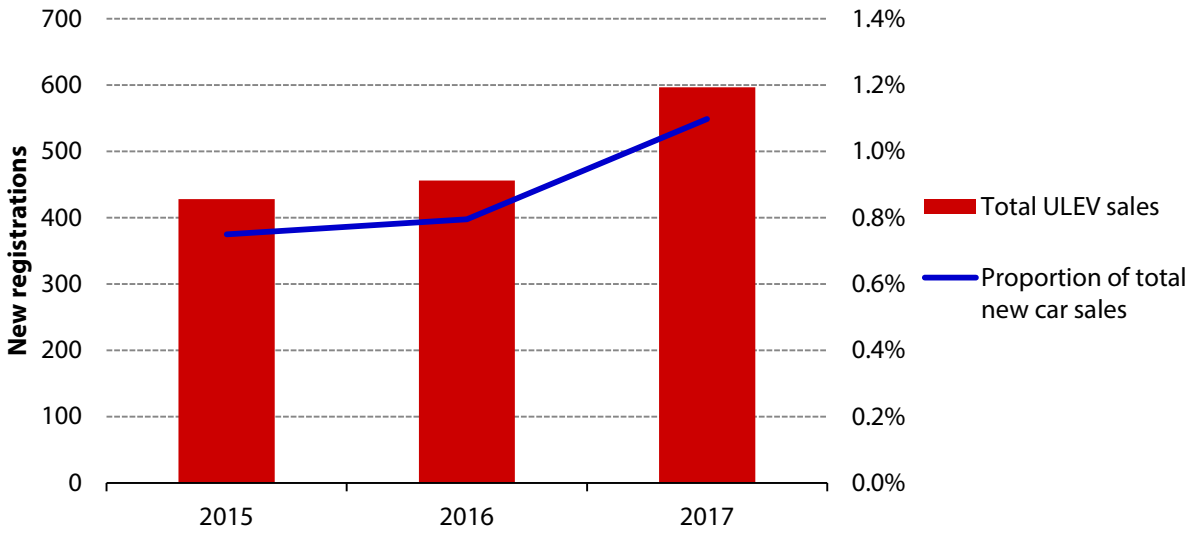
- Operating and promoting specific schemes that have secured funding from the UK government, such as the ecarni scheme.[78]
- Identifying and pursuing opportunities to secure funding from UK-wide funds for ULEV infrastructure in Northern Ireland.
- Providing leadership by decarbonising the public sector and bus fleets.
- Use of the infrastructure budget on electric vehicle charging infrastructure.
- Setting targets for ULEV sales that go beyond those laid out in the Road to Zero Strategy.
- Taking steps to address non-financial barriers for electric vehicles, including local measures such as parking, use of priority lanes, and public awareness campaigns.

Northern Ireland has 470 charging points as of June 2018, a 2.8% share of UK charging points. The number of charging points in Northern Ireland grew by 3% from June 2017 to June 2018.[79]

[77] BEIS (2018) *Industrial Strategy Automotive Sector Deal.*
[78] Ecarni (2018) *Origins of the project.*
[79] https://www.zap-map.com/statistics/

The Committee's indicator suggests 2.1% of new sales in 2017 should be ULEVs in order to be on track for the 2030 target. Northern Ireland fell short of this indicator in 2017, where 600 new ULEV sales made up 1.1% of total car sales (Figure 5.5).

Figure 5.5. ULEV sales in Northern Ireland

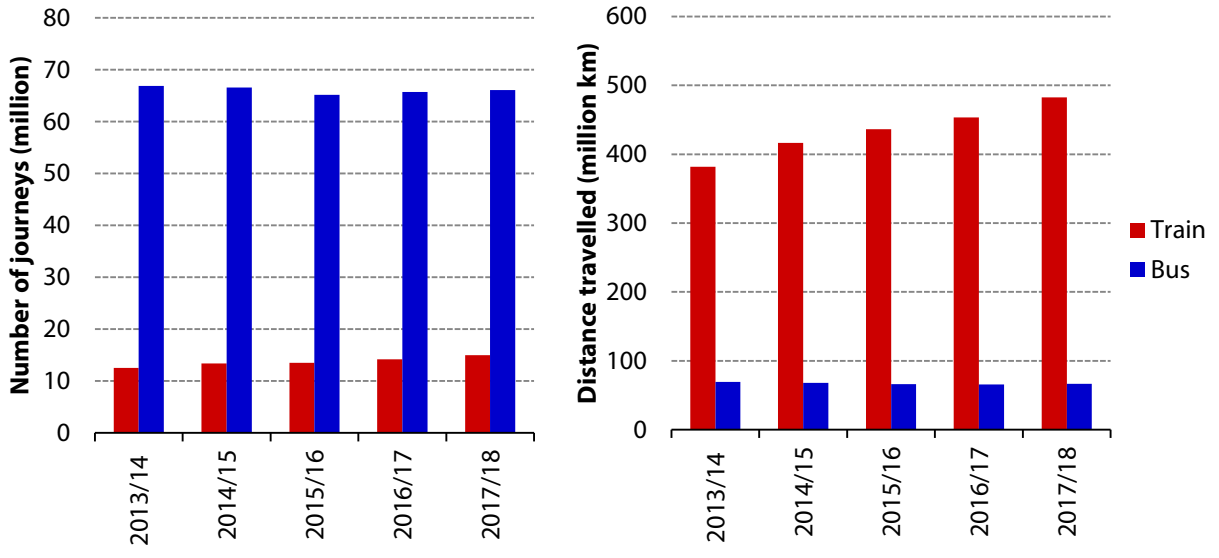


Source: SMMT (2018) *SMMT vehicle data - EV & AFV Registrations.*

Public transport

There were 66 million bus passenger journeys in 2017-18 (+1% from 2015-16) and 15 million rail journeys (+6%). Rail travel has grown significantly in the last five years, with total distance travelled increasing by 26% from 2013-14 to 2017-18 (Figure 5.6).

Figure 5.6. Number of journeys and distance travelled by train and bus



Source: Department for Infrastructure (2018) *Northern Ireland Transport Statistics 2017-2018.*

The Northern Ireland Transport Holding Company (NITHC) is a public corporation established to oversee the provision of public transport in Northern Ireland. It operates the Metro and Ulsterbus services and Northern Ireland Railways (NIR) under the Translink name:

- The total publically-owned vehicle stock of Ulsterbus / Metro transport is almost 1,400 buses with an average age of 9.2 years.[80]
- Subsidies in the UK make up a higher proportion of bus operator revenue than in Northern Ireland. Fare paying passengers contribute a higher proportion of operating revenue in Northern Ireland (75%) than in England (58%), Scotland (48%) or Wales (58%).[81]
- NIR operates all rail services and owns, maintains and develops all rail infrastructure. The rail network covers 211 miles with14 locomotives.

Active travel

The annual Walking, Cycling and Public Transport survey[82] highlights a number of key barriers to active travel in Northern Ireland. The majority (64%) of respondents were satisfied with facilities for pedestrians, but there were a number of common factors that led to dissatisfaction:

- Poor lighting at night (51%).
- Fast moving traffic (49%).
- Poor footpath conditions (43%).
- Not enough footpaths (43%).

Respondents were less satisfied overall (55%) with cycling infrastructure, citing:

- Lack of cycle lanes (69%).
- Too much traffic (42%).
- Fast moving traffic (41%).

The Department for Infrastructure (DfI) Cycling Unit was established in November 2013 to provide a focus and co-ordination role for cycling issues and cycling related activities, and Northern Ireland has a policy framework in place to encourage walking and cycling:

- *Exercise, Explore, Enjoy* is a strategy for developing greenways in Northern Ireland. It sets out a high level plan to enable people to link to places locally, regionally and nationally by active modes of travel.[83]
- The Public Health Agency *Making life better 2013 – 2023* strategy[84] supports increasing opportunities for walking and cycling.

[80] Department for Infrastructure (2018) *Northern Ireland Transport Statistics 2017-2018.*
[81] Northern Ireland Assembly (2016) *Planning, financing and delivering transport infrastructure.*
[82] Department for Infrastructure (2018) *Walking, Cycling and Public Transport in Northern Ireland 2017/18.*
[83] DfI (2016) *Exercise Explore Enjoy: A Strategic Plan for Greenways.*
[84] PHA (2014) *Making life better: A whole system strategic framework for public health, 2013-2023.*

- The Bicycle Strategy[85] sets out how Northern Ireland can increase levels of cycling through a "three pillar" approach:
  - **Building** cycling infrastructure such as cycle lanes, greenways and storage.
  - **Supporting** people who choose to cycle with measures such as education, training, cycle-to-work schemes, and maps.
  - **Promoting** cycling through marketing campaigns.
- The Department for Infrastructure (DfI) works with local councils to ensure that local development plans and planning decisions take account of existing regional strategic planning, transport policies and guidelines that encourage the use of walking and cycling.

Northern Ireland's contribution to UK targets

Indicators for UK-wide decarbonisation of domestic transport

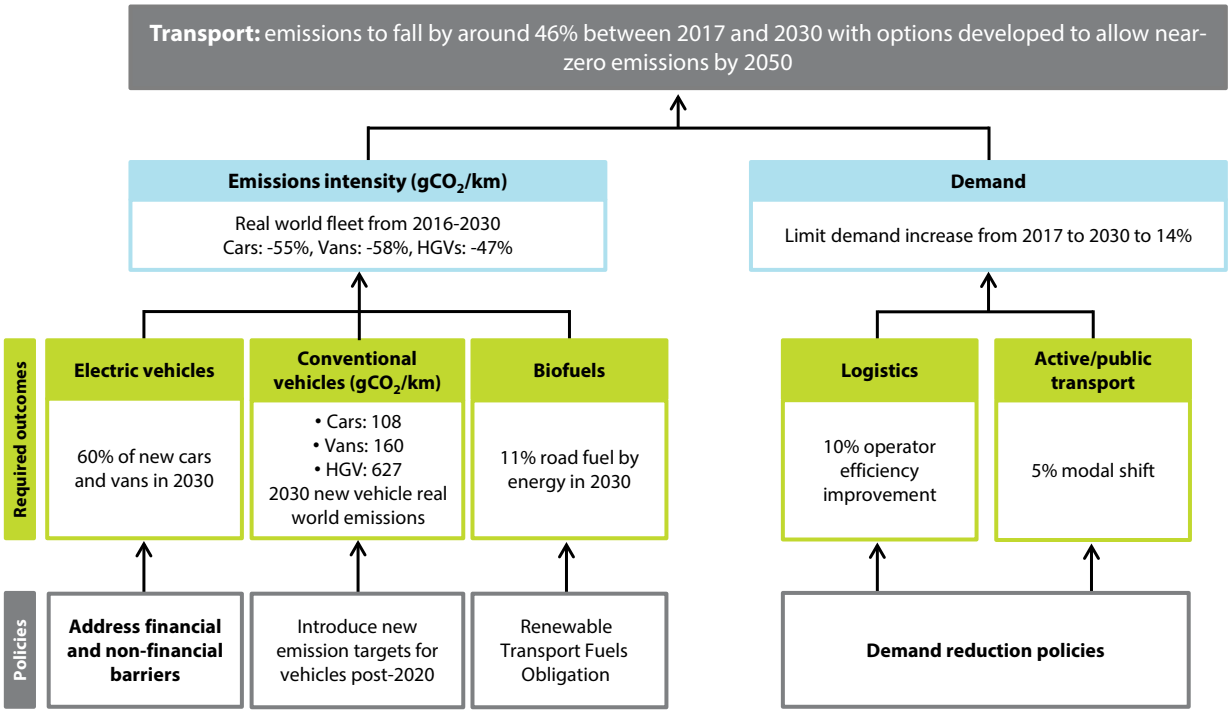
The Committee's indicators for decarbonising UK-wide domestic transport by 2030 show the four key policy areas that could facilitate a 46% reduction in transport emissions between 2017 and 2030 (Figure 5.7):

- The policy measures towards improving overall emissions intensity (gCO_2/km) of cars (-55%), vans (-58%) and HGVs (-47%) focus on improving the efficiency of conventional vehicles and replacing the conventional fleet with electric vehicles and biofuels.
- There is also a focus on policies that would limit the increase in transport demand to 14% between 2017 and 2030 through shifts to active and public transport and efficiency improvements for logistics operators.

The UK government has a central role in setting vehicle standards, subsidising biofuels and setting road and fuel tax rates. Northern Irish policy can have a significant impact on demand reduction policies and encouraging the uptake of electric vehicles through policies that address the financial and non-financial barriers to ULEVs and complement UK-wide actions.

[85] DfI (2015) *A Bicycle Strategy for Northern Ireland.*

Figure 5.7. Committee on Climate Change indicators for UK-wide decarbonisation of surface transport



Notes: Policy areas where devolved policy has a significant role to play are shown in bold.

Emissions from road transport in Northern Ireland in 2030

The Committee's previous advice on transport in Northern Ireland in the fifth carbon budget focused on CO_2 emissions from road transport only:

- In 2016, CO_2 emissions from road transport accounted for the large majority (88%) of all emissions from transport in Northern Ireland, so any effective mitigation strategy must prioritise this area.
- Emissions projections and abatement potential in rail transport and domestic aviation and shipping were not disaggregated to Northern Ireland level in the Committee's fifth carbon budget scenarios, as these sectors are relatively small in Northern Ireland compared to the rest of the UK.

Our previous analysis of potential abatement of CO_2 from road transport suggests Northern Ireland's contribution to the fifth carbon budget would require CO_2 emissions from road transport to be 2.9 $MtCO_2$ by 2030 (Figure 5.8):

- This level of emissions in 2030 would mean road transport emissions were 3% below the latest estimate of the 1990 baseline.
- Achieving this contribution would require 3.1 $MtCO_2$ of abatement against the Committee's projected business as usual baseline.[86]

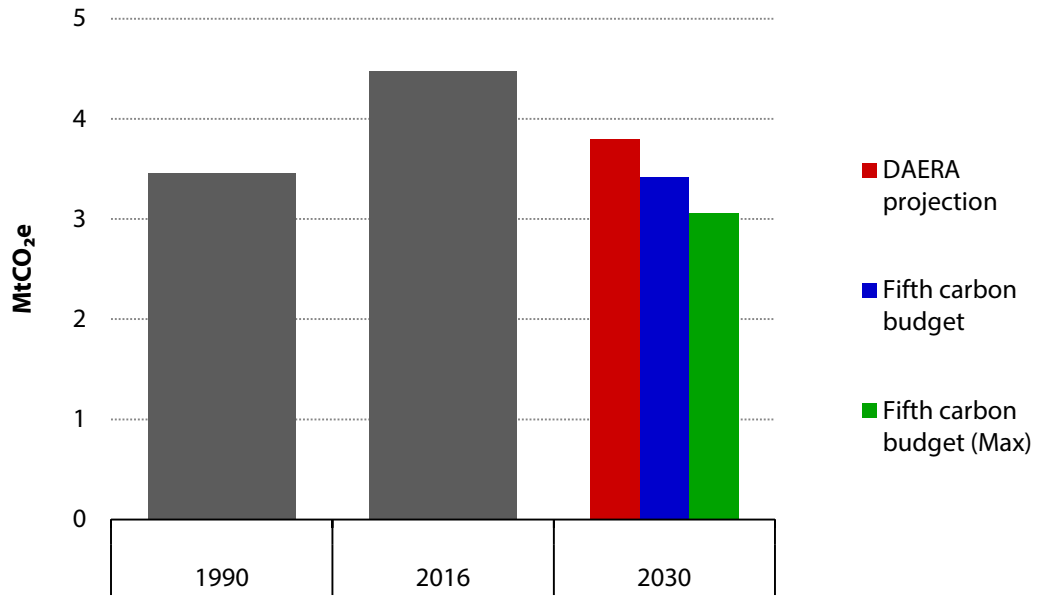
[86] Road transport emission projections for Great Britain were generated using the Department for Transport (DfT) National Transport Model, and Northern Ireland's emissions assumed to increase proportionally on the basis of road transport fuel consumption.

- The main opportunities for reducing transport emissions through the 2020s are more efficient conventional vehicles, increased penetration of electric and plug-in hybrid vehicles and biofuels. Demand-side measures such as the promotion of 'Smarter Choices' including the use of public transport, eco-driving and developing cycling infrastructure, would add to abatement.

We have identified further potential for abatement by 2030:

- The Committee's 'Max' scenario for transport reflects the level of emissions that could be achieved if ambition were sufficiently high or conditions were more favourable than in our Central case. The following measures are included in this scenario in 2030:
  - **Improved testing of cars and vans** that drives real-world conventional new vehicle efficiency improvements. Conventional efficiency improvements of 44% for new cars and 40% for new vans between 2010 and 2030.
  - **Battery costs fall more rapidly**, driving higher sales of new electric cars and vans in 2030 (35% of new car sales are plug-in hybrids and 30% battery electric).
  - **More car journeys are replaced by walking, cycling and public transport.** By 2030, 10% of passenger vehicle-km are displaced by active travel and public transport relative to our baseline scenario.
  - **More efficient driving on the roads**. The speed limit is reduced to 60 mph on motorways and dual carriageways. Improved freight logistics provide an 18% reduction in distance travelled by heavy goods vehicles relative to our baseline scenario and 100% of the fleet use of driver training and other fuel saving technologies by 2030.
- In Northern Ireland, these measures could provide an additional 0.4 $MtCO_2$ of abatement compared to our Central Scenario, resulting in road transport emissions of 2.5 $MtCO_2$ in 2030 (Figure 5.8).

Figure 5.8. 2030 scenarios for transport in Northern Ireland



Source: NAEI (2018); DAERA (2018) *Northern Ireland Greenhouse Gas Projections Update*; CCC analysis.
Notes: The Central and Max fifth carbon budget figures include abatement in the road transport sector, plus emissions from all non-road transport set at 2016 levels (0.6 $MtCO_2e$).

Principles and policy options for decarbonising transport

DAERA has requested sector-specific policy advice on the following questions:

- What policies, strategies and measures, over and above the already recommended non-financial incentives, are needed to build upon the public charging infrastructure, facilitate the deployment of private or communal charge points and accelerate the take up of ULEVs?
- Are there any additional strategies, measures or schemes that could be considered to support the policies in place to promote the shift to walking, cycling and public transport?

This section will address these questions by first focussing on general principles that should be followed when planning policy to decarbonise transport in Northern Ireland, and then specific policy areas which could lead to carbon savings.

Principles for decarbonising transport in Northern Ireland

The Committee recommends that any programme to decarbonise transport in Northern Ireland aligns with the following principles:

- **Act to reduce the real-world emissions intensity of conventional vehicles.** Due to the lifetime of new cars, vehicles sold in early 2020s will have a significant impact on emissions in 2030 so action should be taken on conventional vehicle efficiency as soon as possible.

  Our indicators for road transport require new conventional cars sold in 2030 to have an average real-world intensity of 108 gCO_2/km (Table 5.1):

  – In order to be on track for this real-world target, the average test-cycle efficiency of new cars sold in 2017 should be below 112 gCO_2/km.

  – The average test-cycle efficiency in Northern Ireland was just below 120 gCO_2/km, which was the best in the UK but still behind the required rate of improvement.

  – In order to meet UK emissions targets, vehicles standards must be more ambitious, with a more effective enforcement regime and increased tax incentives to choose lower emitting vehicles.

  The key policy levers are tighter vehicle emissions standards and incentives to purchase more efficient vehicles through road tax and fuel duty. These issues are largely determined by EU standards (2020/21, 2025 and 2030) and UK-wide fiscal levers.

  In 2017, new cars sold in each devolved administration had better average test-cycle intensities than the UK average. Northern Ireland could encourage the UK government to implement more rigorous test-cycle standards such as a real-world test or on-road performance monitoring of vehicles to restore public confidence in emissions standards and deliver real-world emissions reduction.

  Northern Ireland can take action to reduce the emissions intensity of vehicles under public ownership, including the public sector fleet and bus network. This could either be through purchasing more efficient conventional and hybrid vehicles, or replacing the fleet with electric vehicles.

Table 5.1. Conventional vehicle efficiency improvements in 2030

Mode	Average new vehicle CO_2 intensity in 2030 (gCO_2/km)	Percentage improvement 2010-2030	Average new vehicle abatement cost in 2030 (£/tCO_2)
Cars	108 (86)	37% (41%)	13
Vans	160 (127)	33% (37%)	-27
HGVs	627	24%	-79

Source: CCC (2015) *Sectoral scenarios for the fifth carbon budget.*
Notes: CO_2 intensity values are on a real-world basis (test-cycle values shown in brackets).

- **Remove financial and non-financial barriers to ULEVs to support a 60% market share by 2030.** The Committee has set an indicator that by 2030, 60% of all new cars and vans sold should be electric vehicles, to be on track to end sales of conventional petrol and diesel vehicles by 2035. The Road to Zero strategy has set a target to achieve this in 2040.

  This recommendation applies across all parts of the UK, including Northern Ireland. The Committee's indicator suggests 2.1% of new sales in 2017 should be ULEVs in order to be on track for the 2030 target. Northern Ireland fell short of this indicator in 2017, where 600 new ULEV sales made up 1.1% of total car sales.

  In order to achieve this target, action must be taken to the address barriers to uptake of ULEVs. The principal barriers to ULEVs in Northern Ireland include:

  – **ULEVs have a high price premium over conventional vehicles.** Vehicle price is the most important factor influencing vehicle choice, so financial incentives are currently essential to offset the higher purchase price of ULEVs and reduce the total cost of ownership. Our last published estimate of ULEV costs in 2030 suggest a capital cost premium of £2,400 for a battery electric car compared to a conventional car (Table 5.4).

    However, battery costs have fallen since then, and other projections on the costs of electric vehicles suggest prices may become competitive without subsidy in the mid-2020s.[87] We will consider the falling costs of electric vehicles in our upcoming report on long-term targets.

  – **Consumer concerns about vehicle range, charging times, and chargepoint availability and reliability.** Evidence shows that electric vehicle owners tend to prefer overnight charging at home and workplace charging rather than public charging infrastructure. The level of access to overnight charging locations is relatively high among new vehicle buyers in the UK (70% for new private cars and 60% for new vans).[88]

    However, electric vehicle owners and potential buyers frequently demand more public charging infrastructure, which is based on the perceived need to drive longer distances than currently offered by battery electric vehicles. Recharging time is consistently reported as a barrier by electric vehicle users, regardless of the ability to recharge overnight.[87]

    As well as ensuring a sufficient volume of rapid chargers are installed to offset consumer concerns about range anxiety, sufficient maintenance must be in place to ensure that chargepoints are reliable and available to electric vehicle owners whenever needed.

  – **Lack of vehicle choice.** The 2013 report *Pathways to high penetration of electric vehicles* for the Committee highlighted a lack of choice across both brands and vehicle segment (i.e. small, medium or large car), but this has improved in the last five years. As of August 2018, the range of models has grown to 77 plug-in cars and vans available, compared to 25 in 2013,[89] though this still represents a low share of all available models.

  – **Cross-border travel.** Whilst the smaller geographical area of Northern Ireland could reduce consumer concerns about range as fewer long journeys are made, cross-border travel may prove to be another barrier to ULEV uptake**.** A total of 14,800 people

[87] Bloomberg (2018) *Electric Vehicle Outlook 2018.*
[88] Element energy for the CCC (2013) *Pathways to high penetration of electric vehicles.*
[89] House of Commons BEIS Committee (2018) *Electric vehicles: driving the transition.*

commuted regularly between the two jurisdictions for work or study, with 6,500 travelling to Ireland from Northern Ireland and 8,300 travelling in the other direction.[90] The majority of cross-border journeys starting in Northern Ireland were either to Dublin and surrounding area, or the border region counties. Public chargepoints in Northern Ireland and the Republic should have consistent standards and cross-compatibility to minimise hassle and increase confidence in taking longer journeys across the border.

- **Encourage behaviour shifts to active travel and public transport.** The Committee's previous analysis suggests that across the UK, 24% of car trips – primarily short journeys representing 5% of total car kilometres – could be switched to bus, cycling or walking given the appropriate policy support and investment. In a high scenario this could increase to 36% of total car trips (10% of car kilometres).

  The potential for switching travel modes depends on a number of factors, such as the split between the urban and rural population. Our analysis was based on DfT travel survey data covering journeys in Great Britain, but is a reasonable benchmark for Northern Ireland.

  Public transport has a key role to play in decarbonising transport in Northern Ireland, both in transport behaviour change and improving the carbon intensity of public transport:

  – Switching journeys to public transport and active travel could reduce road transport demand by up to 10% in our Max Scenario. Where possible, changes to public transport systems should be made that make the use of public transport a viable alternative to the car.

  – Reducing the carbon intensity of public transport by introducing more efficient or ultra-low emissions buses and electrifying the rail network can have a further impact.

  A shift to active travel reduces carbon emissions and brings wider social co-benefits:

  – Displacing car journeys with walking and cycling and will reduce direct emissions from vehicles and reduce congestion. The Committee's modelling indicates that 9% of all car journeys across the UK could be replaced with cycling and replaced 6% with walking, leading to a total reduction in distance travelled of 1.6%.

  – Active travel also has important health and well-being benefits. Measures that increase the amount of active travel will generally be cost-effective when the wider co-benefits are considered alongside the impact on carbon emissions.

Policy options to support ULEVs

Removing the financial and non-financial barriers to ULEVs in Northern Ireland should largely be addressed by supporting charging infrastructure, providing financial incentives to purchase ULEVS, and other non-financial incentives.

1. Provide, and leverage, financial support for charging infrastructure

One of the barriers to take-up of electric vehicles is the availability and reliability of public charging points to users, either for long journeys or top-up chargers in towns, cities and local areas. Research conducted for the Committee indicated that across Great Britain 1,200 rapid chargers near major roads may be required by 2030 to meet current service levels, as well as 27,000 chargers around local towns and regions (Table 5.2).

[90] NISRA and CSO (2014) *Census 2011 Ireland and Northern Ireland.*

Table 5.2. Public charging infrastructure

Location	Rapid chargers near major roads		Top-up chargers in towns and local areas	
	Total	Per million vehicles	Total	Per million vehicles
Great Britain	1,200	31	27,000	731
Scotland	80	26	2,100	719
Wales	60	29	1,600	826

Source: SYSTRA (2018) *Plugging the Gap: An Assessment of Future Demand for Britain's Electric Vehicle Public Charging Network;* DfT (2017) *Licensed vehicles by body type and local authority: United Kingdom*; CCC analysis.

Applying the minimum and maximum range of chargers required per vehicle, the analysis for Great Britain suggests that **Northern Ireland may require between 30 to 35 public rapid chargers on major roads, and 800 to 950 public top-up chargers.** Northern Ireland has 470 charging points as of June 2018, a share of 2.8% of UK charging points.

However, this is a high-level estimate and does not account for any geographical differences between Northern Ireland and Great Britain (e.g. average journey distances, average number of journeys per vehicle, or the distribution of road vehicles in urban or rural locations).

As well as focusing on the total number of charging points, it is important that reliability issues are addressed to ensure that public chargepoints are providing an effective service. Public concerns about charging infrastructure reliability[91] are a barrier to uptake for consumers.

Identify opportunities to secure UK-wide funding and manage schemes in Northern Ireland:

- The ecarni scheme received initial funding of £850,000 under the Office for Low Emission Vehicles (OLEV) Plugged in Places scheme, followed by an additional £800,000 of public and private investment. This has led to the installation of 160 chargers plus 16 rapid chargers, at a total cost of £9k per charging point. The operation of the scheme has since been taken over by the state-owned energy company ESB in the Republic of Ireland.
- The £400 million UK Charging Infrastructure Investment Fund, split equally between public and private finance, delivers charging infrastructure throughout the UK.
- Similar opportunities for funding should be identified in the future. The Northern Irish government has a clear role to play in supporting bidders

Provide additional funding for public and private charging infrastructure, leveraging finance from other sources where possible. Examples from the rest of the UK include:

- The Scottish Government provides a 'top-up' grant of £300 on top of the OLEV Electric Vehicle Homecharge scheme for private chargepoints.

[91] Belfast Telegraph (2016) *Concerns as one in eight Northern Ireland electric car chargers are currently out of service.*

- The Switched on Towns and Cities Challenge Fund is managed by Transport Scotland to find schemes which will "incentivise, encourage and promote the use of plug-in electric vehicles in a single town or city." It is expected that up to five awards will be made through the first round of funding with eligible costs per project in the range of £1.5 million to £2.5 million, with support in place for twenty towns and cities by 2025.
- The Programme for Government in Scotland announced a £20 million scheme to fund 1,500 charge points, 150 of which will be public charging points. Across the whole scheme, the cost to the exchequer is approximately £13k per charging point.
- The Welsh Government has announced a £2 million scheme to fund electric charging points, primarily focused on North-South and East-West journeys where infrastructure is currently less developed.

Estimates of the cost of charging infrastructure range from £10,000 standard 'top-up' chargers to £112,000 for Rapid 3 chargers for motorway use (Table 5.3). These estimates include the costs of both the technology and installation, but not additional grid upgrades as these are location-specific.

Table 5.3. Indicative installation costs for charging infrastructure

Charger category		**Cost of new charger**	**Cost of first charger at site (en route charging only)**
Public 'top-up' chargers in local areas	Standard (7kW)	£10,000	
	Fast (22kW)	£12,000	
	Rapid (43kW)	£34,000	
'En route' chargers on motorways	Rapid 1 (43kW)	£34,000	£52,000
	Rapid 2 (150kW)	£64,000	£82,000
	Rapid 3 (350kW)	£94,000	£112,000

Source: SYSTRA (2018) *Plugging the Gap: An Assessment of Future Demand for Britain's Electric Vehicle Public Charging Network.*

Lamppost chargers are emerging as a cheap alternative to slow chargers. These depend on lampposts having spare capacity (having switched to more efficient LED lighting) and being located adjacent to parking spaces. Dún Laoghaire-Rathdown County Council in the ROI has one of the first public lighting poles which can be used for charging electric vehicles as part of a pilot study.[92] Northern Ireland should investigate any potential for public lamppost charging.

The Committee previously welcomed the commitment in the Road to Zero Strategy to improve the availability of charging infrastructure by requiring that all new build homes in England have a chargepoint available, where feasible.[93] Matching this requirement in Northern Ireland could be an effective means to support electric vehicle infrastructure development.

To increase consumer confidence in the ability to make cross-border journeys in electric vehicles, Northern Ireland should work closely with the Republic of Ireland to ensure there is an adequate supply of public charging points on both sides of the border with consistent standards. The existing ecar (Republic of Ireland) and ecarni (Northern Ireland) schemes, operated by ESB, are a good example of this. Users can use the same access card either side of the border and there is a shared map for all 1,100 chargepoints on the network.

2. Offer 'top-up' financial support, in the form of loans or grants, for ULEVs

The Plug-in Car grant scheme run by OLEV is likely to remain the main financial support mechanism for private vehicles. However, there are examples of additional incentives for individuals and organisations to purchase ULEVs:

- In Scotland, the Electric Vehicle Loan and Low Carbon Transport Business Loan schemes both provide interest free loans of up to £35,000 spread over six years towards the cost of an electric vehicle:
  - These loans can be used on top of the OLEV plug-in grant scheme.
  - The overall budget for the Low Carbon Transport Loan increased from £8 million to £20 million for 2018/19.
  - Both programmes will expire in March 2019, though the Scottish Government has pledged to continue providing loans until at least 2020.

Table 5.4 shows our most recent published estimates of the costs of plug-in hybrid (PHEV) and battery (BEV) electric vehicles in the UK 2030.

The cost of batteries has fallen since our advice on the fifth carbon budget was published. The Committee will consider the falling costs of electric vehicles in the net-zero project, due for publication in the first half of 2019.

[92] DLR (2018) *DLR one of the first councils to lead the way in public electric vehicle charging.*
[93] CCC (2018) *Government's Road to Zero Strategy falls short, CCC says*

Table 5.4. Costs and characteristics of electric vehicles in 2030

Mode		Capital cost premium	Lifetime social fuel cost saving	Lifetime private fuel cost saving	Electric range (km)	Average new vehicle abatement in 2030 (£/tCO_2)
Cars	PHEV	£1,200	£900	£3,900	30	10
	BEV	£2,400	£2,100	£7,300	230	34
Vans	PHEV	£600	£3,000	£10,100	30	-74
	BEV	£2,500	£4,800	£17,000	300	-51
Small HGVs	PHEV	£12,100	£9,800	£45,400	100	20
	BEV	£19,000	£22,700	£96,300	240	-12

Source: CCC analysis from 2015.
Notes: For cars, figures are averages weighted according to 2013 sales splits for fuel type (petrol or diesel) and size (small, medium or large).
The cost of batteries has fallen since our advice was published. The Committee will consider the falling costs of electric vehicles in the net-zero project, due for publication in the first half of 2019.

3. Work with local authorities to provide additional, non-financial support for ULEVs

Local planning policies should require chargepoints in new buildings (both residential and non-residential) and facilitate on-street charging:

- To encourage uptake of electric vehicles, the government should consult on regulations to include the appropriate cabling ready for installation of electric vehicle chargers or electric vehicle chargers themselves in all new parking spaces for housing developments with off-street parking.
- The recent EU Energy Performance of Buildings Directive requires pre-cabling for all parking spaces in new residential buildings and pre-cabling for one-fifth of spaces and at least one chargepoint in new non-residential buildings. In the context of an exit from the European Union, Northern Ireland and the rest of the UK should align with this legislation to ensure ease of charging for those without off-street access.

Other non-financial options that the Northern Irish government and local authorities could explore include:

- Providing priority access to parking in urban areas and use of priority lanes. For example:
  - The City of London has introduced emissions-based parking charges to encourage the use of lower emissions vehicles.[94]
  - As part of the Go Ultra Low City Scheme, Milton Keynes will open up 20,000 parking bays for free to electric vehicles and co-brand bus lanes as low emission lanes, giving ULEVs the same priority at traffic lights as local buses.
  - Bristol will offer residents free residential parking for ULEVs and access to 3 carpool lanes in the city.
  - Nottinghamshire and Derby will use £6 million of funding to install 230 chargepoints and offer ULEV owners discount parking and access to over 13 miles of bus lanes along key routes across the city. [95]
- Raising awareness of electric vehicles and their benefits through a coordinated and sustained promotional campaign, which goes well beyond solely providing information.

4. Lead in the public sector with ULEVs, green bus fleets and charging infrastructure on the public estate

Northern Ireland should take steps to ensure that new vehicles in the public sector fleet are low-emission and ultra-low-emission wherever possible:

- This would require procurement guidelines that mandate or incentivise the use of hybrid and electric vehicles in the public sector, and financial support for public sector bodies to offset any additional capital costs.
- Northern Ireland could seek to expand the charge point network on the public estate. The current network contains 41 double-headed 7kW charge points and 13 single-headed charge points and is managed under ecarni.
- As an example, the Welsh government has a target for the public sector in Wales to be carbon neutral by 2030, and expects ULEVs to have a key role in achieving this. Electric vehicle charging points have been installed at Welsh government offices, and are being planned for the wider Welsh government estate, education establishments and hospitals.

Northern Ireland Transport Holding Company owns the bus fleet in Northern Ireland. The fleet size is around 1,400 buses with an average age of 9.2 years, suggesting there is scope to replace older vehicles.

The Scottish Green Bus Fund provides a useful case study. This is a challenge fund open to bus operators, local authorities and regional transport partnerships. It provides grants for up to 80% of the price differential of a new low-carbon bus compared to a diesel equivalent. The scheme has provided over £16 million of funding, resulting in over 360 low-carbon emission buses joining the Scottish fleet at a cost to the exchequer of approximately £40,000 per bus.

[94] City of London Corporation (2018) *On-street parking.*
[95] DfT (2016) *£40 million to drive green car revolution across UK cities*.

Policy options to enable behaviour shift to active travel and public transport

5. Strengthen existing policies to increase levels of walking, cycling and use of public transport

Changing existing travel behaviour of individuals by encouraging walking, cycling and the use of public transport can help reduce emissions by reducing car use. Any schemes should address the major barriers to active travel (poor street lighting, lack of quality footpaths and cycle paths, concerns about traffic speed) and public transport (lack of services or no direct services, frequency of services).

Behaviour change to active travel and public transport is generally highly cost-effective for individuals and governments. A number of successful case studies exist:

- DfT has recently released an evaluation of the impact of the Local Sustainable Travel Fund (LSTF) which demonstrated that investment in walking, cycling and public transport represents high value for money.[96] Car use fell by 2.6% in the areas with large LSTF projects, compared to a fall of 0.3% in comparator areas.
- The Nottingham Workplace Parking Levy places an annual charge of £415 on all employers who provide 11 or more workplace parking spaces. The charge raised £9.3 million in 2015/16 which has been invested in a major set of improvements to public transport, including the second phase of the city's tram network. The operational cost of running the scheme is less than 5% of the revenue generated.[97]
- Scotland's Smarter Choices Smarter Places (SCSP) programme has supported increased active and sustainable travel:
  - £5 million of funding from Transport Scotland was available in 2018/19 for local authorities to encourage less car use and more journeys by foot, bicycle, public transport and car share.
  - The 2016 evaluation of SCSP showed that the programme mainly led to increased cycling (16 projects) and increased walking (13 projects). This included cycle promotions, events linked to cycle and walking routes, Personalised Travel Planning (PTP), and school travel.

6. Adopt the Committee's recommendations from the Housing report.

In addition to funding public transport and cycling infrastructure, new housing developments must be designed to enable new residents to travel without depending on a car. The Regional Development Strategy for Northern Ireland states that studies should be carried out to assess the potential for integrating land use and public transport and walking and cycling routes to help reduce reliance on the car.

However, a recent report by Transport for New Homes finds that the places we are building are not sustainable. Most developments were designed for car-based transport and locations were not properly connected for walking, cycling or bus use.[98]

Northern Ireland must strengthen the importance of sustainable transport plans that are integrated into developments throughout the design process, including the development of walking and cycling routes and early consultation with public transport providers.

[96] DfT (2017) *Impact of the Local Sustainable Transport Fund: Summary Report.*
[97] Nottingham City Council (2018) *Workplace Parking Levy.*
[98] Transport for New Homes (2018) *Project Summary and Recommendations July 2018*.

Our forthcoming Housing Report includes a number of other recommendations related to transport that are relevant to Northern Ireland, including:

- The Northern Irish government should review the powers of planners and develop mechanisms to fund costs of building high quality walking, cycling and public transport infrastructure, even when outside the immediate housing site boundary.
- The Department for Infrastructure (DfI) and Department for Communities (DfC) should explore the potential for new rail stations, and light rail, tram or bus (including bus rapid transit) routes to unlock areas for housing development whilst mitigating transport impacts.
- Local authorities in Northern Ireland must consult with Translink at the Local Plan stage to ensure new housing areas can be serviced by viable routes.
- For areas within walking distance of high quality public transport (such as local rail and bus rapid transit), DfI and DfC should set minimum density guidelines to ensure local authorities concentrate housing in these areas wherever possible.

Chapter 6: Waste

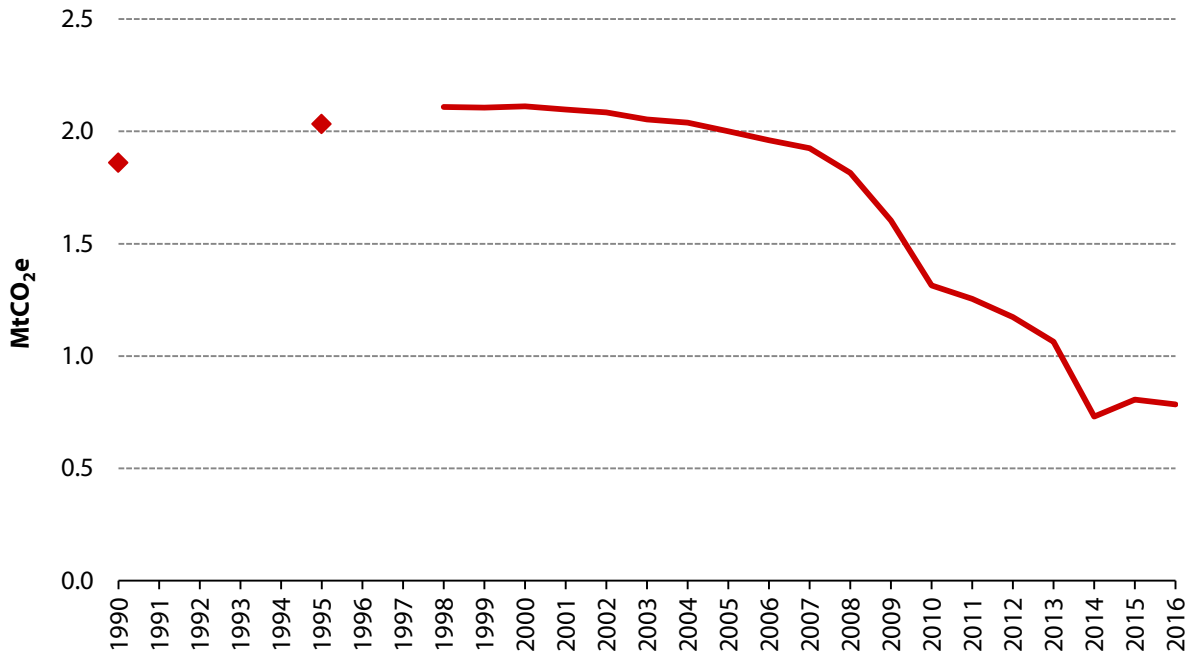
Overview of waste sector in Northern Ireland

Latest emissions trends and drivers

Emissions from waste accounted for only a small proportion (4%) of total emissions in Northern Ireland in 2016, similar to the rest of the UK (4%). Emissions fell by 57% between 2008 and 2016 to 0.8 $MtCO_2e$, and were 58% lower than 1990 levels (Figure 6.1).

Emissions from waste in Northern Ireland are almost entirely (95%) methane, the main source of which was anaerobic decomposition of biodegradable waste in landfill sites (75%).

Figure 6.1. Emissions from waste in Northern Ireland (1990 - 2016)



Source: NAEI (2018).

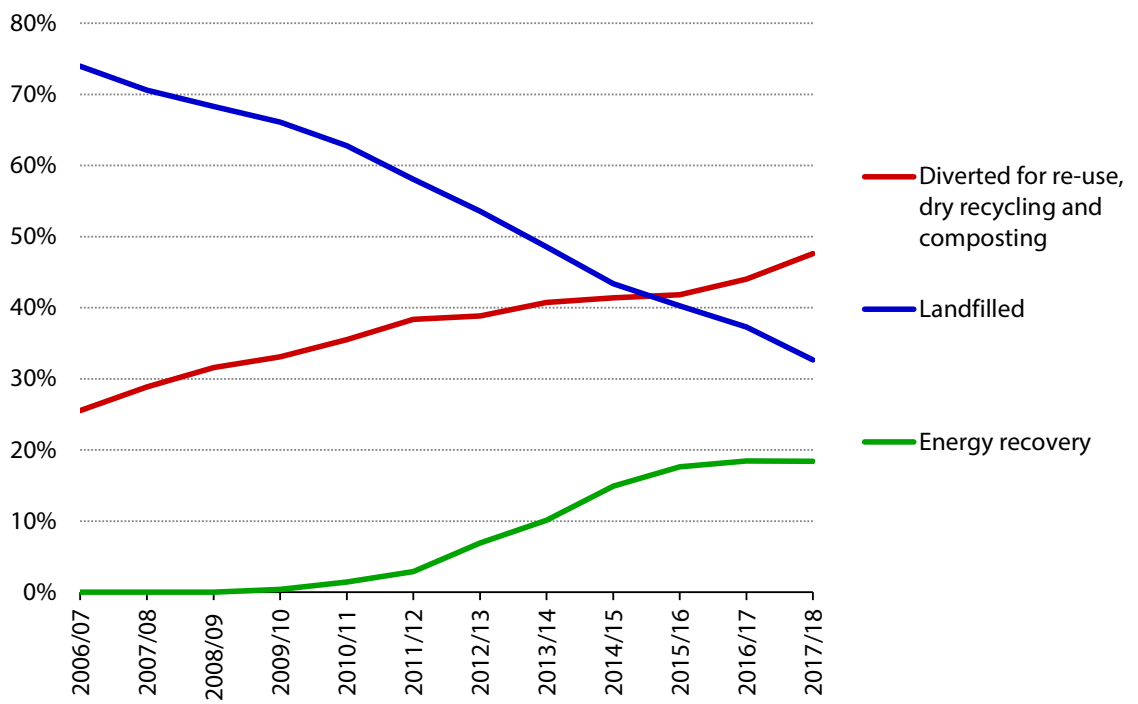
Local authority collected waste

Local authority collected (LAC) waste has been increasingly diverted from landfill and sent for re-use, recycling, composting and energy recovery in Northern Ireland:

- The landfill rate for waste recorded a new low of 33% in 2017/18, down from 74% in 2006/07.
- The LAC recycling (includes preparation for re-use, dry recycling, and composting) rate was a record high 48% in 2017/18.
- The LAC municipal waste energy recovery rate was 18% in 2017/18, similar to the rate in 2016/17.

- The household waste recycling rate was 48.1% in 2017/18. Northern Ireland is likely to meet its target of a 50% household recycling rate by 2020[99] if recent progress is maintained.

Figure 6.2. Destination of local authority collected municipal waste in Northern Ireland (2006 - 2018)



Source: DAERA (2018) *Northern Ireland Local Authority Collected Municipal Waste Management Statistics*.
Notes: Energy recovery from material undergoing anaerobic digestion is accounted for under the recycling section, since the vast majority of waste undergoing this process eventually ends up as a compost after the methane generated from the anaerobic digestion process has been collected.

Biodegradable municipal waste

Under the EU Landfill Directive, Northern Ireland has targets to reduce the amount of biodegradable municipal waste (BMW) sent to landfill to:

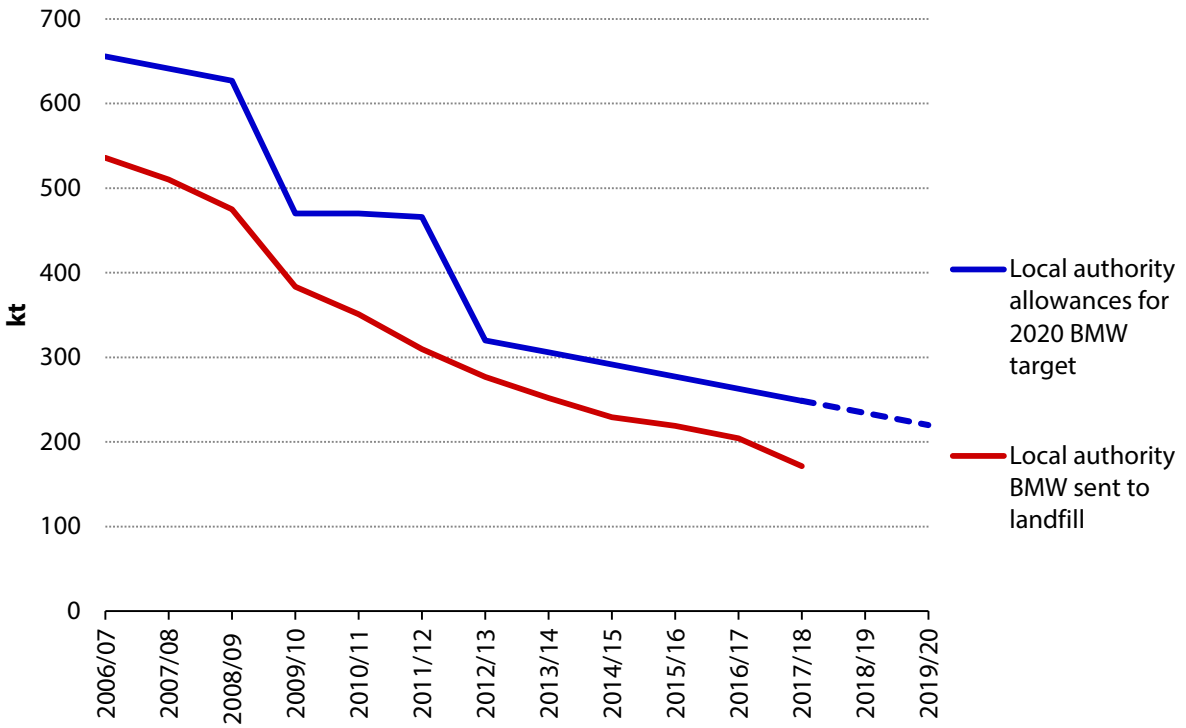
- 75% of 1995 levels by 2010.
- 50% of 1995 levels by 2013.
- 35% of 1995 levels by 2020.

The Northern Ireland Landfill Allowance Scheme (NILAS) was introduced in 2005 and translated the Landfill Directive targets into annual allowances for each District Council in Northern Ireland for each year to 2019/20.

Northern Ireland has already surpassed both these targets, and the level of biodegradable LAC municipal waste sent to landfill has continued to fall (Figure 6.3). There is no target set after 2020.

[99] DAERA (2018) *Northern Ireland Local Authority Collected Municipal Waste Management Statistics.*

Figure 6.3. Biodegradable LAC municipal waste sent to landfill



Source: DAERA (2018) *Northern Ireland Local Authority Collected Municipal Waste Management Statistics.*

Food waste

The amount of household food waste in the UK deemed to be avoidable, or under the revised definition 'edible', reached 5 million tonnes in 2015 according to the Waste Reduction Action Programme (WRAP).[100] In this report, WRAP noted that there are no estimates for household food waste in Northern Ireland due to "a lack of waste compositional data", although NI Direct states that approximately 125,000 tonnes of food was thrown away each year in Northern Ireland before food waste collection began.[101]

The Food Waste Regulations (Northern Ireland) 2015 require all businesses in Northern Ireland that generate more than 5kg of food waste to have a separate food waste collection, and that councils must provide separate food waste collection for households. [102] The regulations also prohibit the landfilling of food waste that has been collected separately.

These regulations are an excellent foundation for ending all food and biodegradable waste sent to landfill in Northern Ireland. Food waste policy in Northern Ireland is much more developed than in England, where local authorities are not yet required to provide a separate food waste collection service.

[100] WRAP (2017) *Household Food Waste in the UK, 2015.*
[101] NI Direct (2018) *Food Waste* https://www.nidirect.gov.uk/articles/food-waste
[102] May be collected alongside other bio-waste.

Northern Ireland's contribution to UK targets

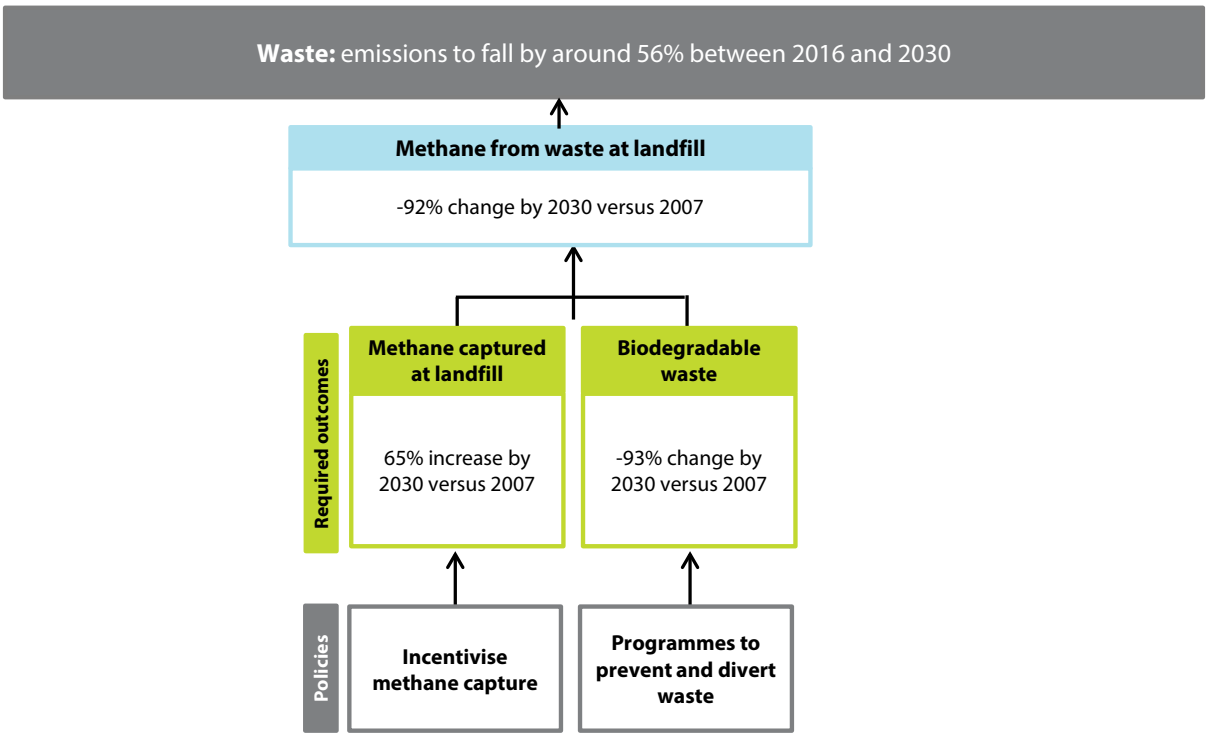
Indicators for UK-wide decarbonisation of waste

For the UK, the Committee monitors progress in waste against a set of indicators that reflect underlying progress against the cost-effective path for emissions reductions to meet legislated emissions targets.

To track progress in delivering abatement savings we have developed an indicator framework, which focuses on reducing biodegradable waste going to landfill and increasing the share of captured methane at landfill (Figure 6.4):

- The top level indicator tracks total methane emissions from waste in 2030.
- This is complemented by a set of supporting indicators which track the roll-out of emissions reduction measures and policy indicators that highlight necessary policy development.
- To be on track to meet the UK's current legislated emissions reduction targets, the waste sector requires a 93% reduction in biodegradable waste sent to landfill and a 65% increase in methane captured from landfill by 2030 compared to 2007 levels.

Figure 6.4. Committee on Climate Change indicators for UK-wide decarbonisation of waste



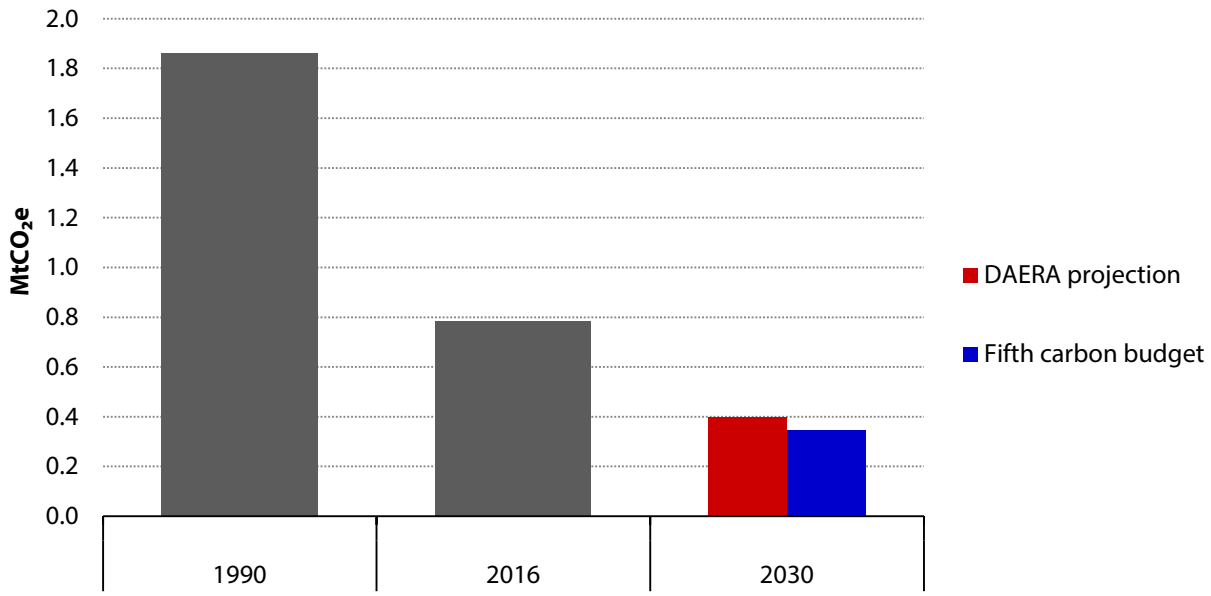
Notes: Policy areas where devolved policy has a significant role to play are shown in bold.

Emissions from waste in Northern Ireland in 2030

Our assessment of the cost-effective path to meeting carbon budgets and the 2050 target includes a 56% reduction in waste emissions between 2016 and 2030, across all areas of the UK.

Our analysis for the fifth carbon budget focused on opportunities to reduce methane emissions from landfill. We estimated that measures to prevent and divert biodegradable waste streams from landfill could reduce emissions to 0.3 $MtCO_2e$ in Northern Ireland by 2030 (Figure 6.5). This is similar to the DAERA projections of 0.4 $MtCO_2e$.

Figure 6.5. 2030 scenario for the waste sector in Northern Ireland



Source: NAEI (2018); DAERA (2018) *Northern Ireland Greenhouse Gas Projections Update*; CCC analysis.
Notes: Value presented for CCC fifth carbon budget analysis has been adjusted to represent a 56% reduction from 2016 levels, in line with our latest advice to UK.
Value presented for DAERA projection has been adjusted for methodology changes by assuming same percentage decrease (75%) from 1990 to 2030.

Policy options for decarbonising waste

DAERA has requested sector-specific policy advice on the following question:

- Are there any policies, strategies or measures that should be considered in the forthcoming review of Northern Ireland's Waste Management Strategy?

This section will address these questions by first focussing on general principles that should be followed when planning policy to decarbonise waste in Northern Ireland, and then specific policy areas which could lead to carbon savings.

Principles for decarbonising waste in Northern Ireland

There are three established approaches to reducing methane emissions from waste that should act as guiding principles for a waste management strategy in Northern Ireland:

- **Reduce the amount of waste generated.** Waste emissions can be reduced through waste prevention. Opportunities for waste prevention exist throughout the life-cycle of a product. Areas to target include:
  - Minimising waste through process design, reducing material offcuts or optimising packaging.
  - Improved design to expand the lifespan of products and to enable more repair, remanufacture, re-use and recycling.
  - Use of different business models such as take-back schemes, leasing and producer responsibility.

  Waste reduction measures are particularly important for food waste. DAERA is a signatory to the voluntary Courtauld 2025 agreement. Over 150 organisations have signed the agreement and committed to delivering a 20% reduction in food and drink waste arising in the UK from 2015 to 2025.

  Waste prevention offers substantial environmental and economic gains associated with resource efficiency beyond the benefits of reducing methane from landfill. For example, WRAP estimates that household food waste levels were 17% lower in 2015 compared to 2007, equivalent to £2.7 billion in resource efficiency savings.[103]

  Overall, where waste can be prevented it is likely to be economically beneficial and should be the first option in reducing total emissions from waste.

- **Divert biodegradable waste from landfill.** Where waste cannot be prevented, there is potential to reduce emissions by diverting waste (especially biodegradable waste) from landfill to other treatment options. This includes recycling, composting, anaerobic digestion (AD), mechanical biological treatment (MBT) and incineration with energy recovery.

  The UK-wide Landfill Tax has been a key driver of progress to date. The tax has increased year-on-year to meet targets set by EU Directives to reduce biodegradable waste going to landfill and incentivise methane capture at landfill sites. By April 2017 it had reached £86.10/tonne in England compared to £84.40/tonne a year earlier.

  The reduction, re-use and recycling of waste, rather than disposal, is associated with further emissions savings upstream (e.g. those arising from agricultural, energy, and industrial production), although the precise level of savings is often difficult to quantify.

- **Capture methane at landfill.** The EU Landfill Directive introduced the requirement to collect landfill gas (LFG) from all landfills receiving biodegradable waste which must then be treated and used. If the collected gas cannot be used to produce energy, it must be flared.

  Methane capture is the best remaining option for reducing methane emissions from waste in landfill that cannot be avoided or diverted for other treatment. Methane capture sites are expected to play a bigger role as legacy emissions from older (and less efficient) landfill sites decline.

[103] WRAP (2017) *Household Food Waste in the UK, 2015.*

Policy options for decarbonising waste in Northern Ireland

1. Extend targets to reduce waste and increase re-use and recycling rates beyond 2020.

Setting targets for waste reduction and recycling rates well in advance allows businesses and local authorities to plan ahead for waste management. Targets also hold central government and local authorities to account for delivering on waste management strategies. Where possible, setting targets in legislation can provide additional certainty and accountability.

The most recent Northern Irish waste strategy, *Delivering Resource Efficiency*, contains a number of targets up to 2020, including:

- Achieve a recycling rate of 50% (including preparing for re-use) of household waste by 2020.
- Achieve a recycling rate of 60% (including preparing for re-use) of local authority collected municipal waste (LACMW) by 2020, and consult on proposals to give this a legislative backing.

Northern Ireland looks likely to achieve the household waste target, but not the LACMW target. In addition, the EU Landfill Directive and NILAS targets of reducing biodegradable municipal waste to 35% of 1995 levels before 2020 have also been met (Figure 6.3).

There are currently no targets beyond 2020. Any Waste Management Strategy should set specific targets for reducing total waste and food waste, increasing re-use and recycling, and reducing waste sent to landfill.

This has already been put in to practice elsewhere in the UK. The Scottish and Welsh governments have both set out longer-term targets in their waste management and climate change policies:

- The Scottish Climate Change Plan sets targets to:
  - End landfilling of BMW by January 2021.
  - Reduce the percentage of all waste sent to landfill to 5% by 2025.
  - Recycle 70% of all waste by 2025.
  - Reduce food waste by 33% by 2025.
- Wales' Towards Zero Waste strategy has set targets to:
  - Reduce waste by around 1.5% of the 2007 baseline each year.
  - Recycle at least 70% of waste by 2025.
  - A 'one planet' goal to produce 65% less waste in 2050 than in 2010.
  - In addition, Wales has announced their intention to consult on halving food waste by 2025 against a 2006/07 baseline.

Northern Ireland should seek to maintain its progress by setting out specific actions and clear milestones to increase re-use and recycling, minimise the amount of biodegradable waste sent to landfill and increase methane capture rates.

2. Enforce a landfill ban on most biodegradable material no later than 2025.

The Committee has identified five waste streams - food, paper/card, wood, textiles, and garden waste - that should be banned from landfill by 2025 at the latest. Northern Ireland should set out specific strategies to meet this target for each of the waste streams in a new Waste Management Strategy.

A WRAP report on landfill bans[104] has found that meaningful enforcement requires lead-in times of no less than five to seven years before the introduction of full policy measures, especially for wastes like food, wood, or garden waste, where waste treatment infrastructure is required.

A landfill ban should therefore be announced well in advance of 2025, with clear milestones for the phase-out of biodegradable waste between now and 2025. This would allow businesses and local authorities sufficient time to prepare for collection and the necessary treatment infrastructure to develop.

The role of energy from waste plants to treat BMW diverted from landfill should be assessed, whether this is anaerobic digestion, mechanical biological treatment, or incineration with energy recovery. Energy from waste (EfW) electricity generators in the rest of the UK have a route to market through the CfD mechanism.

The lack of a support mechanism for EfW plants in Northern Ireland may restrict Northern Ireland's ability to deal with increased diversion of BMW. The Arc21 judicial review[105], in which planning permission for a £240 million waste incinerator was overturned by the High Court, may negatively impact Northern Ireland's ability to deal with waste diverted from landfill in the near term.

3. Support methane capture from new and legacy landfill sites

By 2014, landfill gas capture and flares or engines had been installed at around 20 of Northern Ireland's 95 landfill sites capturing around 10,000 m^3/hr of landfill gas.[106]

Methane capture effectiveness at modern sites can reach as high as 90%. Northern Ireland should ensure that landfill gas capture is used on any new sites.

Emissions from legacy sites must continue to be managed. The recent *Landfill Aftercare Scoping Study*[107] contains data on landfill populations across the UK, and recommendations on how to address the environmental and financial issues associated with landfill aftercare in England.

These recommendations may be applicable to legacy landfill sites in Northern Ireland. The Northern Irish government should assess whether field trials can be carried out in Northern Ireland to ascertain the viability and cost-effectiveness of landfill gas abatement methods.

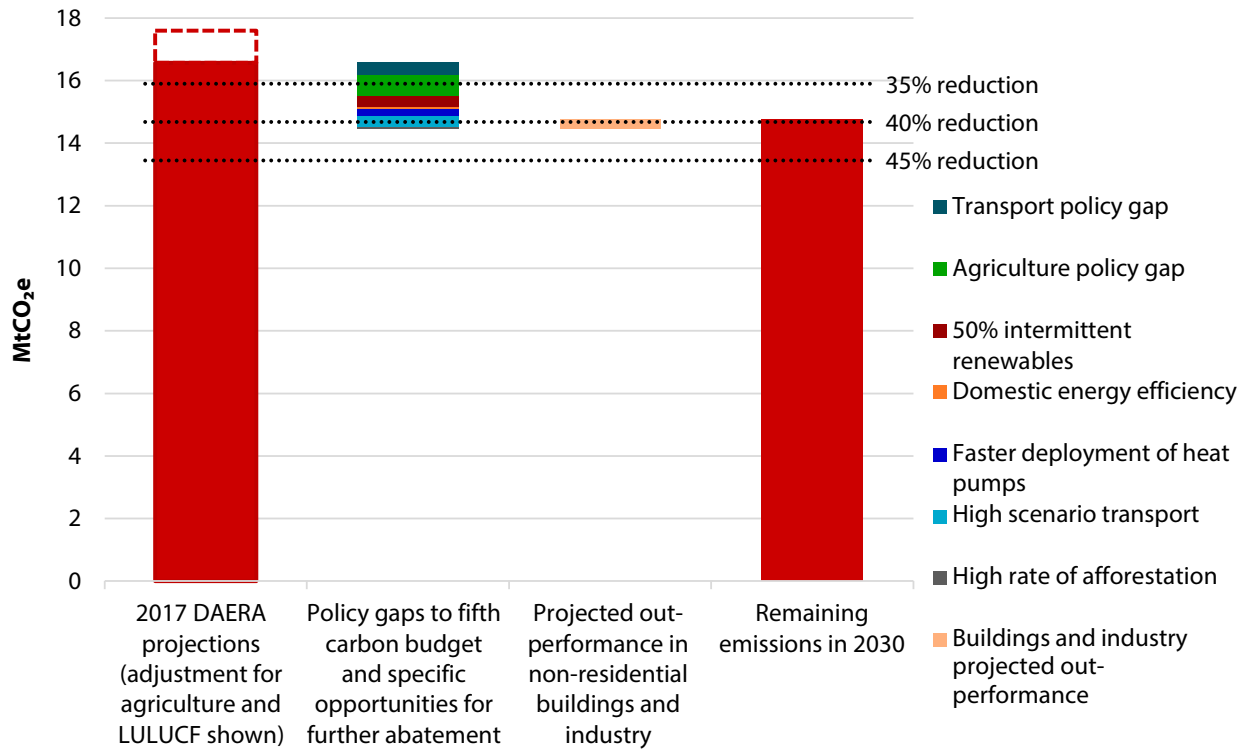
[104] WRAP (2012) *Landfill Bans: Feasibility Research.*
[105] High Court of Justice in Northern Ireland (2018) *Neutral Citation No: [2018] NIQB 43.*
[106] DoE (2013) *Northern Ireland Waste Management Strategy: Delivering Resource Efficiency.*
[107] Defra (2018) *Landfill Aftercare Scoping Study.*

7. Conclusions

After accounting for the most recent evidence on emissions from Northern Ireland, we assess that Northern Ireland's contribution to the fifth UK carbon budget requires at least a 35% reduction in emissions from 1990s levels by 2030.

The most recent DAERA projections of greenhouse gas emissions (Figure 8.1) show that Northern Ireland is not likely to achieve this level of emissions reductions through existing policies. In particular, there is a policy gap in transport (0.4 $MtCO_2e$) and agriculture (0.7 $MtCO_2e$).

Figure 7.1 The policy gap to Northern Ireland's contribution to the UK fifth carbon budget and opportunities to go further.



Source: DAERA (2018) *Northern Ireland Greenhouse Gas Projections Update;* CCC analysis.
Notes: DAERA projections have been adjusted to account for agriculture and LULUCF methodology changes in latest NAEI inventory. Unadjusted figure is 17.6 $MtCO_2e$ in 2030.

Delivering emissions reductions of 35% by 2030 can be achieved in a cost-effective way if effective policy is implemented. This will require action across the power, buildings and industry, transport, agriculture and land use, and waste sectors, and can only be achieved through close co-ordination between the UK government and multiple government departments in Northern Ireland.

There are excellent opportunities for Northern Ireland to deliver and go beyond a 35% reduction in 2030 (Figure 7.1). We have identified and quantified cost-effective measures that have potential to deliver further emissions reductions in Northern Ireland. Combined, these measures could contribute to emissions reductions of 40% by 2030.

Policymakers in Northern Ireland should focus on the following areas to close the policy gap and go beyond a 35% reduction:

- The lack of a route to market for new **low-cost intermittent renewables**, especially onshore wind, in the electricity sector.
- **Emissions from agriculture** have risen year on year since 2009 in Northern Ireland despite efficiency improvements in dairy farms. The post-CAP framework is an opportunity to more closely link financial support to agricultural emissions reduction and increased carbon sequestration, including afforestation.
- The current **rate of tree planting** falls well short of meeting the Committee's recommendations for the fifth carbon budget or the average rate targeted in Northern Ireland's most recent Forestry Strategy.
- There is no **policy support to incentivise consumers to install low-carbon heating**, especially heat pumps, in homes off the gas grid. There is considerable potential to switch households off the gas grid from use of oil boilers to heat pumps.
- Policies to incentivise **energy efficiency improvements in homes** are largely targeted at low-income households. Northern Ireland should consider policy options to deliver an attractive package for able-to-pay householders aligned to trigger points (such as when a home is sold or renovated).
- More rapid deployment of **electric vehicles, tighter conventional vehicles standards, and transport behaviour change**.

The total annual cost of meeting the fifth carbon budget in 2030 is less than 1% of GDP for the whole of the UK.

The precise costs and benefits of meeting the budget depend on a range of uncertain factors. These include the pace of innovation and the path of technology costs and performance, fossil fuel prices, wider economic performance, the level of demand and behaviour of consumers and the mix of measures used to meet the budget.

Offsetting some of these costs, there are wider benefits to climate action through reduced air pollution and other health benefits. We have previously estimated the monetary value of these to be around 0.1-0.6% of GDP in 2030.

Unless there is evidence to the contrary, we assume that that individual mitigation measures have a similar level of cost-effectiveness in Northern Ireland and the UK as a whole, though the relative size and characteristics of sub-sectors in Northern Ireland means there are different levels of abatement potential in each sector of the economy.

The social costs should not be interpreted as fiscal costs to the Northern Irish government or as costs that Northern Irish businesses or consumers have to carry. Many of the actions to reduce emissions in Northern Ireland will be paid for at UK level.

In the context of increased global ambition under the Paris Agreement, the Committee will publish a report on the long-term emissions targets for the UK in the first half of 2019. This will assess whether the UK should set 'net-zero' emissions targets for of carbon dioxide and/or greenhouse gases, whether any such targets should be set now, the implications for the existing UK 2050 targets, and an updated assessment of the costs and benefits of decarbonisation.

We will assess the contribution of Northern Ireland towards any UK-wide 2050 target. The results of this work may have implications for the recommendations set out in this report, including the need for faster emissions reductions in Northern Ireland.

Committee on Climate Change 7 Holbein Place
London
SW1W 8NR

www.theccc.org.uk

@theCCCuk