



Reducing emissions in Scotland

2018 Progress Report to Parliament

Committee on Climate Change
September 2018



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The Committee



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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 founded and chairs Sancroft, a corporate responsibility consultancy working with blue-chip companies around the world to help them improve their environmental, social and ethical impact. He is Chairman of Valpak Limited and the Personal Investment Management and Financial Advice Association.



Baroness Brown of Cambridge FRS

Baroness Brown of Cambridge (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 Committee on Climate Change's Adaptation Sub-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, she led the King Review on decarbonising transport (2008), and she is the UK's Low Carbon Business Ambassador. 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.



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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.

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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.

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Jim Skea is Professor of Sustainable Energy at Imperial College, with research interests in energy, climate change and technological innovation. He is currently Co-chair of Working Group III (Mitigation) of the Intergovernmental Panel on Climate Change (IPCC) and Chair of the Scottish Just Transition Commission. He was the Research Council's UK Energy Strategy Fellow (2012 to 2017), President of the Energy Institute (2015 to 2017), Research Director at the UK Energy Research Centre (2004 to 2012), and Director of the Policy Studies Institute (1998 to 2004). He was awarded a CBE for services to sustainable energy in 2013 and an OBE for services to sustainable transport in 2004.

Executive Summary



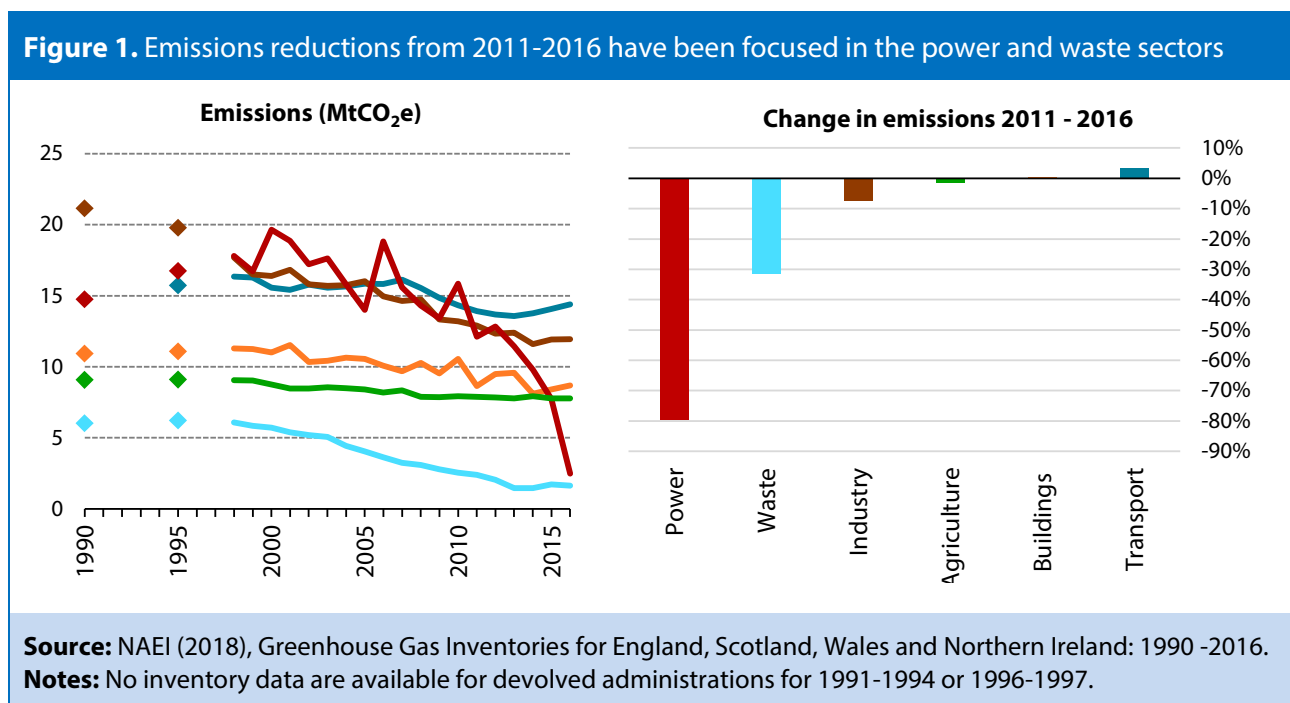
Scotland is performing well on reducing greenhouse gas emissions compared to the rest of the UK, and met its annual legislated target for 2016. Overall, Scottish emissions are now 49% below 1990 levels, and Scotland is on course to outperform the interim emissions reduction target for at least a 56% reduction in actual emissions by 2020.¹

The Scottish Government introduced the Climate Change (Emissions Reduction Targets) (Scotland) Bill to the Scottish Parliament in May 2018 following advice from the Committee on the definition and levels of the new targets.² As introduced, the Bill would increase Scotland's ambition for emissions reduction by 2050 from 80% to 90% against 1990 levels, and adjust the way emissions are accounted for within the targets.

In the last five years, decarbonisation of the power sector and reductions in emissions from waste in Scotland have helped drive down emissions. However, this masks a lack of progress in other areas. The closure of Scotland's last remaining coal-fired power station in 2016 means the challenges of decarbonisation have shifted to other sectors. Scotland's ambitious emissions targets will only be achieved if effective policy extends beyond waste and power into sectors that have not yet seen significant reductions.

Emissions data for Scotland are published with a significant delay compared to the UK as a whole. We therefore focus on progress to 2016 in this report, while noting any significant subsequent developments that are not yet reflected in the latest emissions data.

Sectoral progress to reduce emissions in the five-year period from 2011 to 2016 has been uneven (Figure 1). In 2016, emissions in the transport, buildings, and LULUCF sectors have increased, whilst power and waste emissions have fallen and emissions in agriculture and industry were broadly flat.



¹ Target as introduced to the Scottish Parliament in the 2018 Climate Change Bill.

² CCC (2017) *Advice on the Scottish Climate Change Bill*.

Our seventh annual report, required by Scottish Ministers under the Climate Change (Scotland) Act 2009, assesses Scotland's progress in achieving its legislated and proposed targets to reduce greenhouse gas emissions. Our key messages on Scotland's progress are:

- **Scotland met the 2016 annual emissions targets.**

- The 2016 target for 'net' emissions is 44.9 MtCO₂e. Net Scottish emissions in 2016 were 41.5 MtCO₂e, below the level of the annual target. Net emissions account for trading of allowances in the EU Emissions Trading Scheme (EU ETS).
- Emissions on the net basis in 2016 were 45% below 1990 levels. Scotland is currently outperforming the interim target for at least a 42% reduction in net emissions by 2020.
- Actual emissions in 2016 were 49% below 1990 levels. Scotland is on track to meet the interim target in the Climate Change Bill, as introduced to the Scottish Parliament in 2018, for a reduction of at least 56% in actual emissions by 2020.

- **Good progress in the power sector is masking a lack of action in other areas, particularly in agriculture**

- There were no significant emission reductions in most sectors outside electricity generation and waste over the five years to 2016 (Figure 1). Progress needs to be extended to a range of other sectors in order to meet Scotland's ambitious climate targets.
- In the agriculture sector, there is currently no regulatory approach in place and the Scottish Government is relying on voluntary measures alone to reduce emissions.
- Targets for tree planting and peatland restoration targets have been consistently missed, yet ambitions remain higher than ever.
- The commitment in the Plan to regular monitoring against clear performance indicators is welcome. Further actions must be taken to stay on track against these indicators.

- **Scotland's Climate Change Plan for emissions reductions until 2032 has been significantly improved:**

- As required by the 2009 Act, the Scottish Government published the Climate Change Plan in February 2018. After an extended consultation the Plan has been significantly improved since the draft, leading to a more balanced set of plans and proposals.
- The most pressing issues resolved since the draft Plan include rebalancing the level of effort required across sectors, a more realistic deployment of low-carbon heating and an increase in ambition on electric vehicle sales.
- As a path to meet the existing legislated targets to 2032, the emissions envelopes in the Plan are stretching, credible, and well-balanced across most sectors.
- Not all our recommendations have been implemented. In the agriculture sector, ambitions for emissions reduction have been further scaled back from the draft Plan.

- **More policy clarity is required to meet new targets across sectors – the Energy Efficiency Scotland programme is a good example of best practice.**

- The Energy Strategy is ambitious with a 50% renewable energy production target measured against the system-wide consumption from electricity, buildings, and transport. The 2050 scenarios align well with the UK Clean Growth Strategy.

- More needs to be done to deliver the targets laid out in the Energy Efficient Scotland programme, but it stands as a good example of best practice to Scotland and the rest of the UK. Strengths include standards set well in advance, the provision of a regulatory backstop, and a statutory underpinning to commitments.
- Transport is now Scotland's biggest sectoral challenge. The Scottish Government's ambition is good but we need to see much more action, particularly on road transport, if Scotland is to achieve more rapid emissions reductions than the rest of the UK. Some progress has been made on developing the necessary infrastructure to support electric vehicle targets of 100% of new car and van sales by 2032. The number of public charging points increased by 41% in 2017 and an additional £15m of funding for charging infrastructure was announced in September 2018, but electric vehicle sales in Scotland are currently behind the rest of the UK. A clear plan should set out where and when public charging infrastructure will be introduced to ensure it meets demand in 2032
- If the emissions reduction to 2032 is to be achieved, similar policy advancements must be made across sectors including low-carbon heat, non-domestic buildings, agriculture, forestry, and waste.
- **Potentially more stringent future targets mean that policy should make plans for step changes in Scotland's ambitions**
 - The nature of the ambition embodied in Scotland's new climate legislation means that further policy effort may be required. Our assessment of the Climate Change Plan is with reference to a 90% reduction target in 2050. This target is at the limits of feasibility identified to date.
 - Scotland's Climate Change Plan is not adequate for achieving a target beyond 90% in 2050. More effort would be required should the Scottish Parliament choose to set an even more ambitious target.
 - The latest land use, land use change and forestry (LULUCF) sink estimates suggest a lower level of emission reductions may now be required to meet existing targets. The latest inventory update, incorporating an increased forestry carbon sink, means that the estimated reduction in emissions between 1990 and 2015 was revised from 38% to 43%. This makes near-term emissions targets significantly easier to achieve.
 - The methodology change has allowed a reduction of effort in other sectors in the final Climate Change Plan. Scotland's ability to achieve future targets should not be overly reliant on the LULUCF sink. Methodologies for estimating LULUCF emissions are regularly revised and may become less favourable with future revisions, in particular those to peatland emissions.
 - The Scottish government should set out where further carbon savings could be made across sectors, as a contingency should a more stretching target be set (whether now or later), revisions to the LULUCF sink make current targets harder to achieve, or policy measures underperform against targets in some sectors.
 - The Committee will consider the appropriate level of emissions reduction for the UK under the Paris Agreement, following a request in October 2018. As part of this, we would hope also to consider the implications for Scottish targets and action.

Table 1 sets out short term policy requirements for Scotland to achieve its ambitious targets set out in the Climate Change Bill and Plan, and the long-term targets set out in the Energy Strategy.

Table 1. Policy requirements for the Scottish Government's plan to meet future annual targets		
Policy requirement	New policy required	Stronger implementation required
Power		
Act on stated intention to support the repowering of onshore wind farms that are reaching the end of their lives, including considering the important 'existing use' context in granting planning permission.		x
Buildings		
Strengthen new-build standards to ensure they are designed for a changing climate, are future-proofed for low-carbon heating and deliver high levels of energy efficiency. The compliance and enforcement framework should also be strengthened.		x
Finalise non-domestic buildings policy for Energy Efficient Scotland programme following consultation by 2019.	x	
Strengthen support for low-carbon heat in the short term. Policies are in place to support RHI, but more clarity is needed on how low-regret options consistent with long-term decarbonisation will be supported through Energy Efficient Scotland.		x
Finalise the framework for delivering Scotland's ambitions on energy efficiency and reform monitoring metrics and certification to reflect real-world performance.		x
Transport		
Set out a clear plan describing where and when public charging infrastructure will be introduced to ensure it meets demand in 2032.	x	
Consider implementation of non-financial incentives for electric vehicle users such as preferential road access and free parking.	x	
Agriculture & Land Use, Land-Use Change and Forestry (LULUCF)		
Set a target for reducing nitrogen emissions from fertiliser use.	x	
Introduce plans for compulsory soil testing and assess whether fertiliser use falls; otherwise consider compulsory limits on fertilisers.	x	

Table 1. Policy requirements for the Scottish Government's plan to meet future annual targets		
Policy requirement	New policy required	Stronger implementation required
Set out post-CAP framework which includes incentives for emissions reductions in agriculture, forestry, peatland and other land use areas.	x	
Monitor whether certainty in funding schemes improves tree-planting rates to target levels next year. If targets continue to be missed, raise the level of financial support available as part of National Forestry Strategy.		x
Waste		
Further clarity on policies to achieve the targets detailed in the Plan, including systems to handle the biodegradable waste ban.	x	

Chapter 1: Overview



This is our seventh report on Scotland's progress towards meeting emission reduction targets, as requested by Scottish Ministers under the Climate Change (Scotland) Act 2009.

In this report, we assess the progress that Scotland has made against the targets set out in that Act:

- The Climate Change (Scotland) Act sets a long-term target to reduce emissions of greenhouse gases (GHGs) by at least 80% in 2050 relative to 1990, with an interim target to reduce emissions by 42% in 2020.
- Secondary legislation passed in October 2010, October 2011 and October 2016 also set a series of annual emission reduction targets for 2010 to 2022, 2023 to 2027 and 2028 to 2032 respectively, following advice from the Committee. These annual targets require a reduction of 66% by 2032 against 1990 emissions.

In May 2018, the Scottish Government introduced new climate change legislation to the Scottish Parliament, which included changes to the way that emissions are accounted for within legislated targets and increasing the ambition of the targets following the Paris Agreement. The Committee previously advised on the design of the new targets and on their levels in March 2017³ and December 2017.⁴

This new Climate Change (Emissions Reduction Targets) (Scotland) Bill is currently subject to parliamentary scrutiny and will not become law before 2019. As introduced, the Bill proposes a tighter 2050 target of 90% reductions relative to 1990, with powers given to Scottish Ministers to specify the year for a net-zero emissions target. The Bill also changes emissions targets from the current 'net' targets which account for EU Emissions Trading Scheme allocations (EU ETS) to an 'actual' emissions basis.⁵ This report therefore considers progress on the basis of what will be required to meet the new targets as introduced to the Scottish Parliament, as well as those under existing legislation.

We also assess the third report on policies and proposals, the Climate Change Plan, published by the Scottish Government in 2018. This Plan sets out how the Scottish Government intends to meet the emissions targets out to 2032. In addition, we comment on other important policy developments since our previous report, including the Energy Strategy, which sets out a longer-term energy strategy to 2050 and the Energy Efficient Scotland programme.

Chapter 1 gives an overview on the latest Scottish emission trends in relation to the emission reduction targets. In Chapter 2, we assess the final Climate Change Plan against the advice previously given by the Committee on the draft Plan. The subsequent chapters focus on the different sectors of the Scottish economy. In each sectoral chapter we first present a summary of progress against targets, followed by a consideration of emission trends, commentary on policy developments since our previous report, and a sector-level analysis of the final Climate Change Plan proposals.

³ CCC (2017) *Advice on the Scottish Climate Change Bill*.

⁴ CCC (2017) *Letter: from Lord Deben to Roseanna Cunningham MSP advising on Scottish climate target framework*.

⁵ 'Actual' emissions are total emissions from Scotland without adjustment for trading or retention of EU allowances.

Summary of progress

Actual emissions fell by 10% in Scotland in 2016, and are now 49% below 1990 levels. Scotland met its most recent annual target, and is on track to meeting the interim target for 2020 under the Climate Change (Scotland) Act 2009 (Table 1.1).

Table 1.1. Scotland's targets and progress to date	
Target	Progress to date
<p>2050 and interim targets</p> <p>The Climate Change (Scotland) Act 2009 sets a target to reduce emissions of greenhouse gases by at least 80% by 2050 against 1990 levels. The Act also establishes an interim target for 2020 of 42%.</p> <p>New Climate Change Bill</p> <p>In May 2018 Scottish Government introduced the new Bill to the Scottish Parliament. This contained more ambitious targets on the basis of actual emissions, including emissions from international aviation and shipping: at least 56% reduction by 2020 and 90% by 2050.</p>	<p>Net emissions targets</p> <p>Scotland is outperforming its interim target for at least a 42% reduction by 2020. In 2016 the reduction from the 1990 baseline was 45%.</p> <p>Actual emissions</p> <p>Actual Scottish emissions in 2016 were 38.6 MtCO₂e, a 49% reduction on 1990 levels.</p> <p>With an anticipated drop in power emissions in 2017 due to the closure of Longannet, the proposed 2020 target is in reach but also requires reductions in sectors other than power.</p>
<p>Annual target</p> <p>Secondary legislation passed in October 2010, October 2011 and October 2016 also set a series of annual emission reduction targets for 2010 to 2022, 2023 to 2027 and 2028 to 2032 respectively.</p> <p>The 2016 target for net emissions is 44.9 MtCO₂e.</p>	<p>Net Scottish emissions in 2016 were 41.5 MtCO₂e, which is below the annual target. This is the third annual target to be met.</p>
<p>Domestic effort target</p> <p>The Climate Change (Scotland) Act 2009 requires that reductions in net Scottish emissions of greenhouse gases account for at least 80% of the reduction in the net Scottish emissions account in any target year.</p>	<p>No credit purchases were made in 2016. The domestic effort target was met.</p>

Actual emissions

Actual Scottish emissions (including Scotland's share of international aviation and shipping emissions) fell by 10% to 38.6 MtCO₂e in 2016. Emissions in 2016 were 49% below 1990 levels. This compares to a 4% reduction for the UK as a whole in 2016 and a 38% reduction against 1990 levels (including international aviation and shipping).

Scotland has different challenges and opportunities compared to the UK and the other devolved nations. Scotland has made strong progress in decarbonising the power sector – emissions data from 2016 showed a further sharp reduction in emissions due to the closure of the Longannet

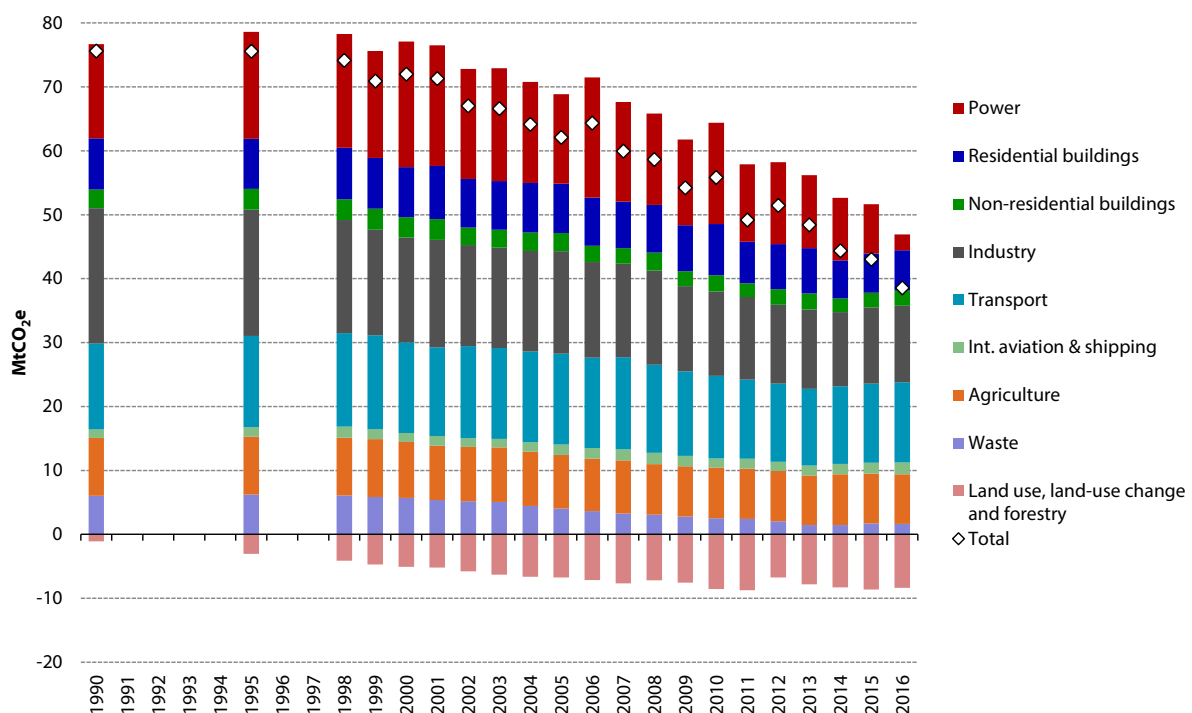
coal-fired plant in March 2016. EU ETS data shows that Longannet produced 1.6 Mt whilst operational in 2016, which will drop out of the emissions inventory once the 2017 data are published.

Scotland's land use, land-use change and forestry (LULUCF) sector is a significant net sink, due to the extent of forest coverage. Conversely, emissions from agriculture in Scotland have a larger share than compared to the UK as a whole⁶ and are particularly challenging to reduce (Figure 1.1).

The fall in total emissions in 2016 was not spread evenly across all sectors. Strong progress in the power sector dominated, with smaller reductions in some sectors and increases in others:

- There were strong falls in emissions in 2016 from the power sector (-68%) and the waste sector (-5%), whilst industry and agricultural sectors remained flat.
- There was a moderate increase in emissions from residential buildings (+3%) and non-residential buildings (+3%) and from the transport sector (+2%).
- The size of the land use, land-use change and forestry (LULUCF) sink decreased by 0.3 MtCO₂e

Figure 1.1. Scottish greenhouse gas emissions (1990-2016)



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

Notes: No inventory data are available for devolved administrations for 1991-1994 or 1996-1997.

⁶ Only Northern Ireland has a higher proportion of its total emissions from the agriculture sector.

The Scottish Net Emissions Account

The emissions targets under Scotland's existing climate legislation have been set on a 'net' basis. 'Net' emissions are calculated under the Net Scottish Emissions Account (NSEA), taking into account non-traded emissions, surrendered units and Scotland's assigned EU ETS cap (known as the specified amount):

- For 2016, the NSEA was 41.5 MtCO₂e, well below the annual target of 44.9 MtCO₂e.
- The reduction from the 1990 baseline was 45% in 2016. Scotland is outperforming its interim target for a reduction of at least 42% by 2020.
- Emissions under the NSEA rose by 1.0 MtCO₂e (+2.5%) in 2016, due to a slight rise in Scottish emissions outside the EU ETS (mainly transport and buildings), together with an increase in Scotland's allocation of allowances in the EU Emissions Trading System.⁷

Inventory changes

Inventory improvements are designed to increase the transparency, accuracy, consistency, comparability, and completeness of the inventory. Changes to the emissions inventory published in 2018 mainly affected the forestry, shipping, agriculture and waste sectors:

- **Forestry.** Methodological changes have increased the estimated forestry carbon sink. These largely reverse the changes made in the inventory published in 2017, which caused the forestry sink to be underestimated. This has resulted in an increase in the magnitude of the sink from forest land across the time series.
- **Shipping.** Improvements to the methodology for estimating emissions, now partly based on GPS data rather than fuel sales, has resulted in an increase in the estimates for gas oil and fuel oil used. This has led to revisions in estimated emissions from domestic navigation and fishing vessels.
- **Agriculture.** Incorporation of the 'smart' inventory changes at UK level are reflected for Scotland, generally leading to slightly lower estimates of agriculture emissions.
- **Waste.** Improved models specific to waste composition in Scotland have now been developed, leading to recalculations across the time series.

As we highlighted in 2017,⁸ estimates of Scottish emissions are more uncertain ($\pm 10\%$) than those for Wales ($\pm 3\%$), Northern Ireland ($\pm 7\%$) or the UK as a whole ($\pm 3\%$). Inventory revisions can mean large changes to estimates of Scottish emissions, reflecting the relatively large uncertainty in estimates of Scottish emissions. Together with inter-annual variations in winter temperatures, they mean that Scottish targets can be missed, even with strong policy effort to meet them.

Scottish emissions have been revised to a significantly greater extent than for the UK as a whole or the other devolved administrations, due to the importance of its shipping and forestry sectors:

- The latest estimate for Scottish emissions in 1990 is largely unchanged, due to offsetting changes. LULUCF emissions in 1990 have been revised down by 2.6 MtCO₂e, while shipping

⁷ Scotland's share of EU ETS allowances increased in 2016 relative to 2015, due to an increase in the total number of allowances being auctioned at EU level, which reflects the timing of the 'backloading' initiative.

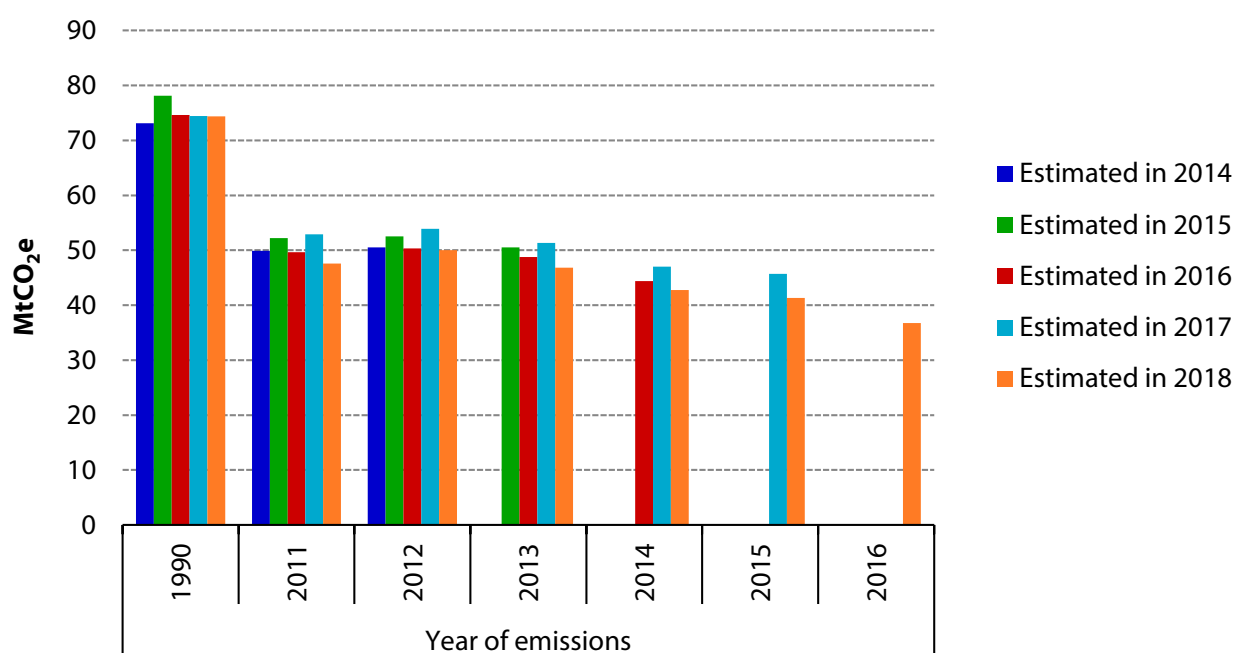
⁸ CCC (2017) *Quantifying Greenhouse Gas Emissions*.

emissions have been revised up by 2.7 Mt (+25%). Including offsetting revisions to waste (+7%) and agriculture (-7%), the overall revision to estimated emissions for 1990 is a reduction of 0.1 Mt (-0.2%).

- For emissions in 2015, the estimate of the LULUCF sink has been revised upwards by 5.8 Mt. This is offset to a degree by an increased estimate of shipping emissions by 1.6 Mt (+15%). The overall revision to total emissions for 2015 is a decrease of 4.4 Mt (-10%).
- Previous inventory changes have tended to affect estimates for both 1990 and more recent years in similar ways (Figure 1.2), often leaving the percentage change against 1990 emissions largely unaffected. However, inventory changes in both 2017 and 2018 have had a much larger impact on more recent years than on 1990, resulting in large movements in percentage reductions on 1990 levels.
- Accordingly, although last year's data indicated that total Scottish emissions had fallen by 38% between 1990 and 2015, this is now estimated at 43% following the inventory change.

Further revisions to the greenhouse gas inventory methodologies are anticipated over the coming years. We provided advice to the Scottish Government in December 2017 on how to handle this under the new Scottish target framework.⁹

Figure 1.2. Revisions to Scottish emissions estimates between inventories published in 2014-2018



Source: NAEI (2014, 2015, 2016, 2017, 2018).

Note: Total emissions excluding international aviation and shipping.

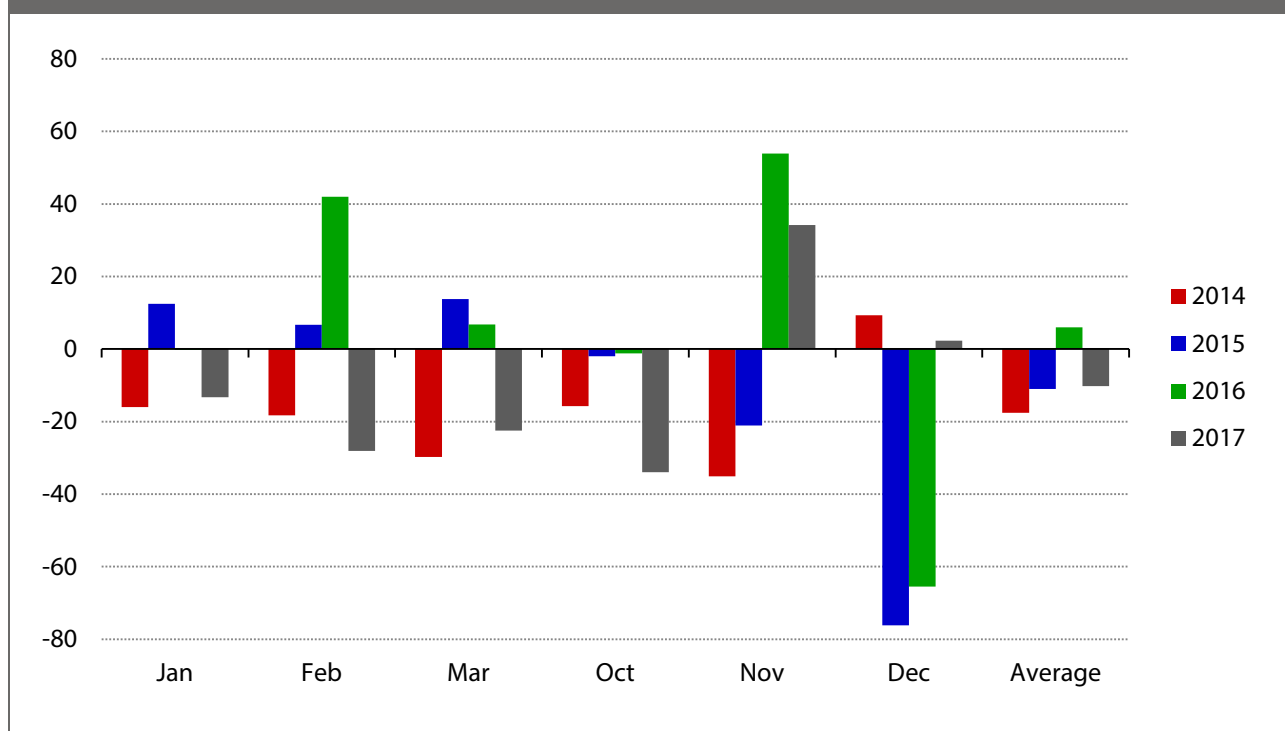
⁹ CCC (2017) *Letter from Lord Deben to Roseanna Cunningham MSP advising on Scottish climate target framework*.

Outlook for emissions in 2017

Data on Scottish emissions in 2017 will be available in June 2019. To the extent possible, we will report on 2017 Scottish emissions in our UK progress report at the end of June 2019. In this section, we draw on other data that can provide an indication of what is likely to have happened to emissions in Scotland in 2017:

- **Closure of the Longannet coal-fired station.** We expect emissions from the power sector to drop further due to the closure of the Longannet coal-fired station in March 2016. In 2015, Longannet emitted around 7.5 MtCO₂e, and the emissions in the first three months of 2016 prior to its closure were 1.6 MtCO₂e. We therefore expect a reduction of approximately 1.6 Mt in power sector emissions for 2017.
- **Renewable generation.** Renewable power generation in Scotland increased by 27% to 25 TWh from 2016 to 2017. This increase in low-carbon generation may further reduce emissions from the power sector.
- **Temperature in 2017.** Winter temperatures in 2017 were slightly higher than the long-run average (Figure 1.3). The decrease in heating degree days in 2017 compared to 2016 may have led to reduced emissions in 2017.

Figure 1.3. Number of heating degree days variation from the long-run average (2014-2017)



Source: Degree day data (2018) <http://www.enmanreg.org/freedd/>

Notes: Heating degree days (HDDs) are calculated relative to a baseline temperature, typically 15.5 degrees Celsius, which is the outside temperature above which a building needs no heating. One HDD is the number of degrees centigrade deviation from the base temperature of the actual temperature on a given day. This figure compares HDD in winters from 2014 to 2017, with the long-run average (1987-2016). Points above the horizontal axis reflect colder than average temperatures and points below indicate higher than average temperatures.

Chapter 2: Policies to deliver emissions reductions



Following the legislation of annual targets, the Climate Change (Scotland) Act 2009 requires the Scottish Government to publish policies and proposals for how these targets are to be met.

The annual targets for 2028 to 2032 were legislated in 2016. In February 2018 the Scottish Government published the Climate Change Plan, which sets out how it intends to meet them, together with a wider and longer-term Energy Strategy published in December 2017.

The Scottish Government intends to increase the level of 2050 ambition to a reduction in greenhouse gas emissions of 90% on 1990 levels, with provision for Ministers to introduce a net-zero target, to be placed in law by 2019. The Climate Change (Emissions Reduction Targets) (Scotland) Bill, as introduced, requires Ministers to keep the net-zero target date under review by seeking expert advice on the issue every five years, and set a legally binding target date as soon as there is sufficient evidence to demonstrate the date is credible and achievable.

The Climate Change Plan is required under the existing Scottish climate change legislation, and therefore relates to targets on the path to an emissions reduction of at least 80% by 2050. Nevertheless, it remains important that near-term plans and policies recognise that emissions reductions beyond 80% will be necessary under the new targets, and prepare suitably for these.

In order to provide the strongest basis on which to meet the targets, the plan must also be robust to key uncertainties and flexible enough to adapt as circumstances change.

In our last Progress Report¹⁰ we commented on the draft Climate Change Plan and the draft Energy Strategy. In the past year, significant progress has been made and the final versions of the Climate Change Plan, Energy Strategy, and Energy Efficient Scotland Route Map have been published. This chapter makes an assessment of the final Climate Change Plan, with reference to other policy developments where relevant.

We also make more detailed comments on sector-specific aspects of the Climate Change Plan, and other major policy developments in the sectoral chapters.

The Climate Change Plan

In this section, we consider the actions taken by the Scottish Government, and whether they address the advice of the Committee in its previous Progress Report.

The draft Climate Change Plan had a different balance of emission reductions across sectors to that in the Committee's 'High Ambition' scenario for how the targets can be met. This was not necessarily an issue, as part of the purpose of the 2009 Climate Change Act's economy-wide emissions targets is to allow for flexibility and for Government to determine the balance of action between sectors. However, the Committee provided additional advice on changes which would help to ensure that the final Plan was credible both in meeting medium-term targets and being on track to 2050.

Table 2.1 summarises our key recommendations based on the draft Plan, and assesses the extent to which this advice has been reflected in the final Plan. In some areas, such as addressing the balance of effort across sectors, our advice has been fully implemented, whereas little progress has been made in other areas such as agriculture.

¹⁰ CCC (2017) *Reducing emissions in Scotland, 2017 Progress Report to Parliament*.

Table 2.1. Progress against CCC recommendations on the draft Climate Change Plan

CCC recommendation	Progress
Policies and proposals. The draft Climate Change Plan contains little beyond existing policy and commitments, although there have been some subsequent high-level announcements. Without firm new policies, reductions in Scottish emissions are unlikely to continue in the 2020s. The final version of Scotland's plan should also build as fully as possible on the UK Government's Clean Growth Plan, which will set out how UK emissions targets to 2032 will be met.	Partially implemented. Some policies have been announced, and there has been progress in some areas such as building efficiency through the Energy Efficient Scotland Route Map. There is still progress to be made on the policy side, including electric vehicles, waste, agriculture, and non-domestic buildings.
Balance of effort across sectors. The balance of sectoral emissions reduction in the draft Climate Change Plan should be revised. Greater ambition will be required to reduce emissions in the transport sector, as announced in the recent Programme for Government, with less reliance on rapid deployment of low-carbon heating. The Plan as it stands lacks credibility in meeting the emissions targets to 2032 and fails to prepare properly for deeper decarbonisation in the longer term. The final version of the Plan will also need to be compatible with the Scottish Government's proposal to move to a 90% emissions reduction target for 2050 under the new climate change legislation.	Implemented. The balance across sectors in the final Plan has been addressed, with a significantly more ambitious roll out of electric vehicles, and less reliance on low-carbon heating (Figure 2.1). The final plan represents a much more credible route to 2032 targets.
Ambition on electric vehicles. The draft Climate Change Plan envisages ultra-low-emission vehicles (ULEVs, e.g. electric vehicles) reaching 40% of new car and van sales by 2032, which is not ambitious enough to achieve the deep decarbonisation required by 2050 given the time it takes to turn over the vehicle stock. The 2017 Programme for Government announcement that petrol and diesel vehicle sales will be phased out by 2032 is a far stronger commitment, and is commensurate with the challenge set by Scotland's ambition on climate change. The final version of the Plan will need to set out the policies that will build the market for ULEVs over the next 15 years to the point that sales of petrol and diesel vehicles can be phased out.	Partially implemented. Since the draft Plan, the Scottish Government has made commitments to continue to invest in the ChargePlace Scotland network until at least August 2019 and provide further loan funding for electric vehicles until 2020. The Energy Strategy commits to additional policy measures including expanding electric charging infrastructure up to 2022, and a further £15m of funding for charging points was announced in the 2018 Programme for Government.
Power sector. The Plan for low-carbon power generation is suitably ambitious, and is well aligned with the Committee's analysis on the importance of early power sector decarbonisation, both to provide near-term emissions reduction and to facilitate reductions in other areas through electrification (e.g. electric vehicles).	Implemented. The plan has restricted the use of carbon capture and storage before 2030. The final Plan closely matches the CCC scenario.

Table 2.1. Progress against CCC recommendations on the draft Climate Change Plan

CCC recommendation	Progress
<p>Low-carbon heating. The draft Plan includes a large contribution to emissions reduction from the buildings sector, including ambitious but achievable levels of energy efficiency improvement. However, heat decarbonisation is highly challenging, and the assumed share of low-carbon heat of 80% by 2032 is very unlikely to be feasible. Relying on this scale of emissions reduction from heat decarbonisation would call into question the credibility of the overall strategy.</p> <p>The Committee recommends that the final version of the Plan relies on low-carbon sources providing no more than 50% of heat by 2032. This would not stop the Scottish Government aiming for a stretch target that goes beyond 50%, but meeting the overall emissions targets should not rely on doing so.</p>	<p>Implemented. Additional modelling of low-carbon heating has been undertaken. The final Plan requires 35% of domestic buildings' heat to be supplied from low-carbon sources by 2032, compared to 80% in the draft Plan, and 70% of non-domestic compared to 94% in the draft. This represents an overall uptake of around 45% across the domestic and non-domestic sectors, and is in line with the Committee's recommendations.</p> <p>In the final Plan energy efficiency improvements to the fabric of Scotland's domestic buildings will result in a 15% reduction in heat demand by 2032 (compared to 6% in the draft Plan).</p>
<p>Carbon capture, usage and storage (CCS). The commitment to Scottish deployment of CCS within the Climate Change Plan and Energy Strategy is very welcome. It is important that the Scottish Government works with the UK Government on how this can be done during the 2020s, especially the crucial first step of establishing CO₂ transportation and storage infrastructure.</p>	<p>Partially implemented. The UK Government has set up a CCUS Council and established a CCUS Cost Challenge Taskforce. Scottish Government officials are participating in both of these forums. The Scottish Government is supporting (£100k) the €1.9m EU Acorn CCS Project, and has provided £250k funding to Scottish Carbon Capture Storage (SCCS).</p>
<p>Forestry. The Plan's ambition to increase tree-planting rates to 15,000 hectares per year by the mid-2020s is positive. However, the Plan has a substantially higher level of forestry emissions in 2032 than the Committee's scenarios for meeting future targets, partly due to use of out-dated analysis. This analysis should be revisited for the final version of the Plan.</p>	<p>Implemented. Emissions projections have been updated in line with the latest data available, and is now broadly in line with the CCC scenario (Figure 2.1).</p>
<p>Agriculture. There has been little recent progress in reducing agricultural emissions in Scotland. The draft Plan sets out voluntary measures to reduce emissions, building on the Farming for a Better Climate initiative. The Scottish Government should look again at going beyond a voluntary approach, in order for agriculture to make the necessary contributions to meeting Scotland's ambitious climate targets.</p>	<p>Not implemented. The Scottish Government has committed to monitor progress on soil testing in 2020 and will look at further incentives if they are not on track to meet targets. The Annual Progress Report on the Monitoring Framework of the Plan will detail how each sector, including Agriculture, is performing against the indicators set out in the Plan.</p>

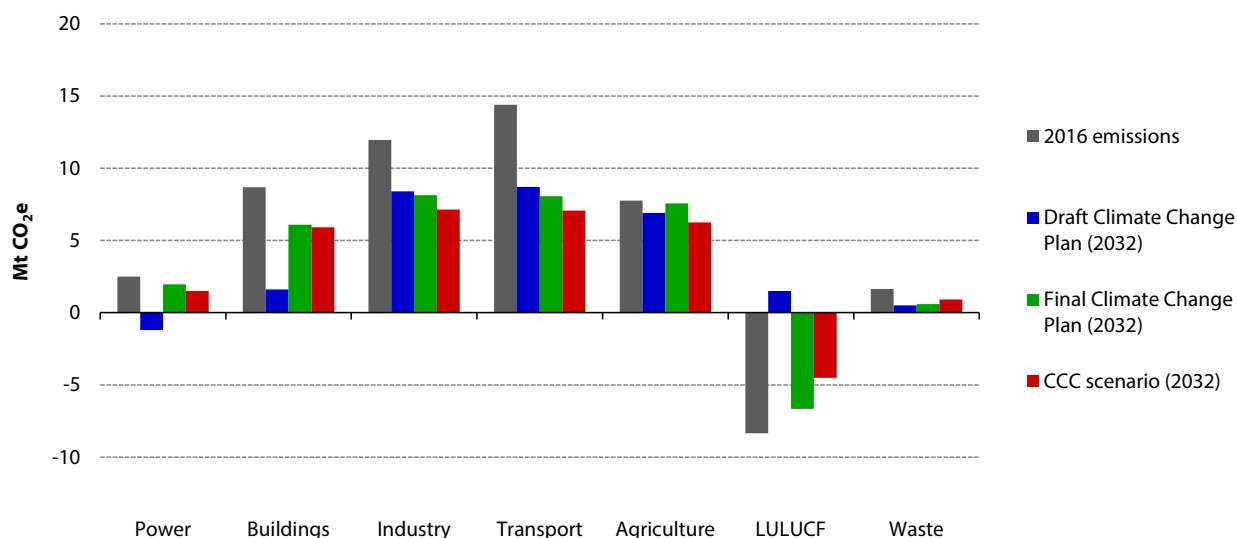
Overall the balance of effort across sectors in the final Plan has improved and is closer to the CCC scenario¹¹ to reach 90% emissions reductions by 2050 (Figure 2.1). In particular, buildings emissions in the Plan are much closer to our scenario (Figure 2.2):

- In **Power**, the use of CCS has been heavily rolled back in the Plan, with limited uptake before 2030, and the use of biomethane and other biomass in electricity generation processes fitted with CCS has been constrained to zero. This removes any negative emissions in the electricity sector in the period to 2032. Projections in the final Plan now closely match the CCC scenario. In 2032, the Power sector emissions envelope is 0.5 MtCO₂e higher than the CCC scenario.
- In **Buildings**, overall emissions are much higher than in the draft Plan. The balance of emission across sectors is now much more in line with the CCC scenario, largely due to a reduction in assumed deployment of low-carbon heating. The final Plan now requires 35% of domestic buildings heat to be supplied from low-carbon sources by 2032, compared to 80% in the draft Plan, and 70% of non-domestic buildings heat, compared to 94% in the draft. Buildings emissions in the Plan are marginally higher (0.2 MtCO₂e) in 2032 than the CCC scenario.
- In **Industry**, emissions in the final Plan have been reduced but are still 1.0 MtCO₂e higher in 2032 than the CCC scenario.
- In **Transport**, emissions have been reduced since the draft, but are still higher (1.0 MtCO₂e) than the CCC scenario even with an assumed 2032 date for phase-out of new petrol and diesel car sales compared to 2035 in the CCC scenario. The CCC scenario has a more gradual profile for electric vehicle (EV) sales growth compared with the steep uptake forecast in the Plan, which is very back-ended (see Chapter 6). The cumulative number of EV sales by 2032 is approximately 20% lower in the Plan than the CCC scenario despite higher in-year sales in 2032.
- In **Agriculture**, emissions were already higher than the CCC scenario in the draft Plan, and have since increased in the final version. Agriculture emissions in the Plan in 2032 are now 1.3 MtCO₂e higher than the CCC scenario. The final Plan did not implement our advice to go beyond a voluntary approach to meet more ambitious climate targets.
- In **LULUCF**, the size of the carbon sink is bigger than the CCC scenario, and much larger than in the draft Plan due to changes in GHG inventory methodologies. The size of the LULUCF sink in the Plan is 2.2 MtCO₂e larger in 2032 than the CCC scenario.
- In **Waste**, the final emissions envelope is more ambitious (-0.3 MtCO₂e) than the CCC scenario. The targets within the Plan are stretching, so firm policies will need to be in place to meet these targets.

This increase in the LULUCF sink in the final Plan has created scope for emissions in other sectors to be higher than in the draft Plan whilst achieving the required level of economy-wide emissions (Figure 2.2). Estimates of LULUCF emissions and sinks have varied significantly from year to year, and this latest change should not be relied upon to allow reduced ambition in other sectors, especially given anticipated changes to the emissions inventory (e.g. relating to peatland) and the greater long-term ambition proposed in the current Bill.

¹¹ CCC (2017) *Advice on the new Scottish Climate Change Bill*, Box 2.2.

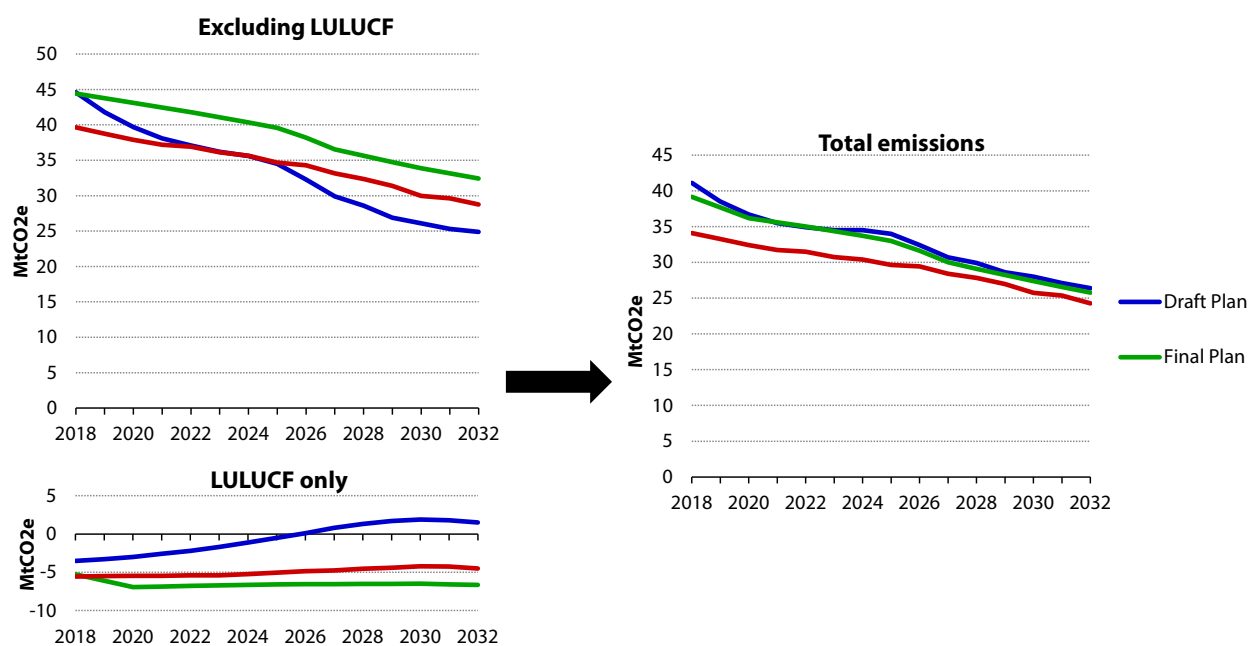
Figure 2.1. Sectoral emissions in 2016 and 2032 under the draft and final Climate Change Plan and CCC Scenario



Source: Draft Climate Change Plan, Climate Change Plan, CCC analysis.

Notes: The draft Plan had emissions in the power sector going negative from the late 2020s, as a result of combining biomethane grid injection with deployment of gas CCS power plants. The CCC scenario also deploys both of these, but allocates the biomethane to the buildings and industry sectors, resulting in positive overall power sector emissions. The use of CCS has been reduced in the final Plan and bioenergy used outside CCS power generation, so power sector emissions in 2032 are now much more closely aligned with the CCC scenario.

Figure 2.2. Total emissions to 2032 under the draft and final versions of the Climate Change Plan and the CCC Scenario



Source: Draft Climate Change Plan, Climate Change Plan, CCC analysis.

Conclusions and key messages

- Some of the most pressing issues raised in last year's progress report have been addressed, including rebalancing of effort between sectors, more realistic assumptions for deployment of low-carbon heating, and an increase in ambition on electric vehicles sales targets.
- Overall, the Plan is ambitious in scope and contains strong commitments to achieving Scotland's emissions reduction targets to 2032, and provides a starting point for reducing emissions by 90% by 2050.
- Increased clarity on policy is needed across sectors, for example a strategy for supporting energy efficiency in non-domestic buildings. Requirements are further highlighted in individual sector chapters.
- The emissions envelopes for LULUCF have been updated. This is in line with our previous recommendations, but has allowed reduced ambition in the Plan across other sectors. Future inventory changes could increase estimated LULUCF emissions. Contingency planning to achieve increased emissions savings in other sectors should be in place so that achieving future targets is not overly reliant on LULUCF sinks.
- The CCC scenario is based on a 90% reduction in 2050 and is very stretching across all sectors. Achieving a net-zero target would require considerably more effort and policy action sooner rather than later.

Chapter 3: Power



Table 3.1. Summary of progress in the power sector

Milestone	Progress
Grid intensity from 2020 onwards below 50 gCO ₂ e per kWh	In 2015, Scotland's grid intensity was 150 gCO ₂ e/kWh, down from 196 gCO ₂ e/kWh in 2014. The grid intensity in 2016 was approximately 55 gCO ₂ e/kWh. ¹²
Equivalent of 100% of gross electricity consumption in 2020 to be met from renewables, with an interim target for the equivalent of 50% of gross electricity consumption to come from renewables by 2015.	In 2016 the share was 54% (down from 60% in 2015). This fall was despite an increase in capacity, and is partly due to adverse weather conditions for renewable generation. The provisional estimate ¹³ for 2017 is much higher, at 68%. The interim target has been outperformed and the 2020 target is in reach, if the projects currently under construction or consented are built.
50% of Scotland's total energy consumption to be met by renewable energy by 2030 Interim target of 30% of total Scottish energy consumption from renewables by 2020.	In 2016, 17.8% of total Scottish energy consumption came from renewable energy, up from 15.2% in 2013. Scotland is outperforming the UK as whole, and is now ahead of the EU average of 16.7%. The 2030 target is achievable but consistent progress will be required. Despite a 5 TWh increase in renewable electricity generation in 2017, at least 8 TWh more would be required to meet the 2020 target if total energy consumption remained unchanged.
Community Energy targets: <ul style="list-style-type: none"> • 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 	As of June 2017, estimated capacity of at least 666 MW of community and locally owned renewable energy capacity was operational in Scotland, a 12% increase from June 2016. The previous 2020 target of 500 MW has already been surpassed. The Energy Strategy updated the targets to be more ambitious. A further 496 MW of community or locally-owned renewable energy capacity is estimated to be in different stages of development (under construction, consented but not built, in planning, or in scoping). Shared ownership projects make up 168 MW (34%) of this capacity under development. The updated targets are therefore achievable if progress continues at the current rate.

Latest emission trends and drivers

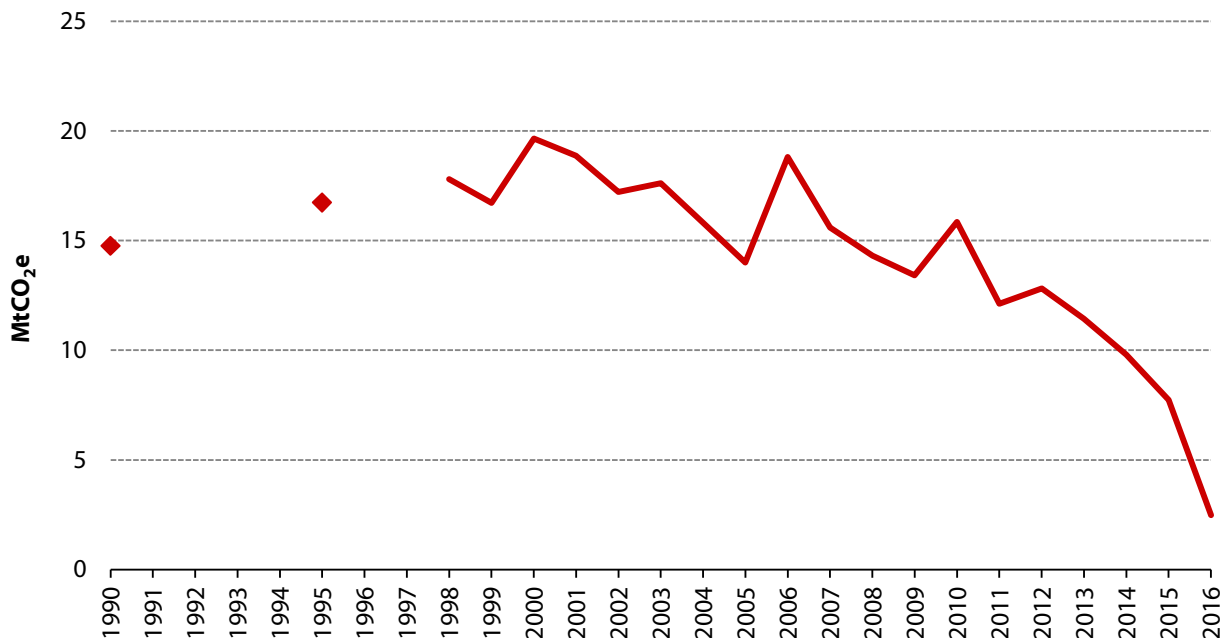
The additional one-year lag to publish Scottish emissions data compared to UK-wide data affects the assessment of energy-related emissions. This section focuses on the latest official data, which go to the end of 2016. Where possible, we take into account more recent developments, such as the latest data on renewable electricity generation, in commenting on progress.

¹² Based on total power sector emissions of 2.5 MtCO₂e and 45.8 TWh of generation (Figure 3.2).

¹³ Based on 2017 generation compared to gross electricity consumption in 2016.

In 2016, emissions from power accounted for 2.5 MtCO₂ (6%) of Scotland's actual emissions. These decreased significantly between 2015 and 2016 (68%) and were 83% below 1990 levels. Emissions decreased by an average annual rate of 21.4% between 2009 and 2016 (Figure 3.1).

Figure 3.1. Scottish power sector emissions (1990-2016)



Source: NAEI (2018).

The reduction in emissions occurred alongside an overall decrease in electricity generation by 11% between 2015 and 2016. This fall was mainly due to a fall in coal generation and a fall in renewable generation caused by adverse weather conditions (Figure 3.2):

- Coal generation in 2016 was 78% lower than in 2015, due to the closure of Longannet. This was partially offset by increases in gas and nuclear generation (+63% and +11% respectively).
- Renewable electricity generation decreased by 10% as a result of lower average wind speeds in 2016, though still made up 43% of all generation in Scotland, up from 42% in 2015. Renewable generation increased by 27% from 2016 to 2017 (Figure 3.2).

Scotland's last large coal-fired plant, Longannet, closed in March 2016. In 2016, Longannet emitted 1.6 MtCO₂e, 64% of total Scottish power emissions.¹⁴ We therefore expect that power sector emissions will have fallen again in 2017 (data will be available mid-2019), but with power sector emissions now very low, rapid decarbonisation rates seen in the past few years are not expected to continue.

For renewable electricity generation and capacity, data are available up to 2017. Scotland accounted for 25% of UK renewable generation in 2017. Renewable electricity generation grew

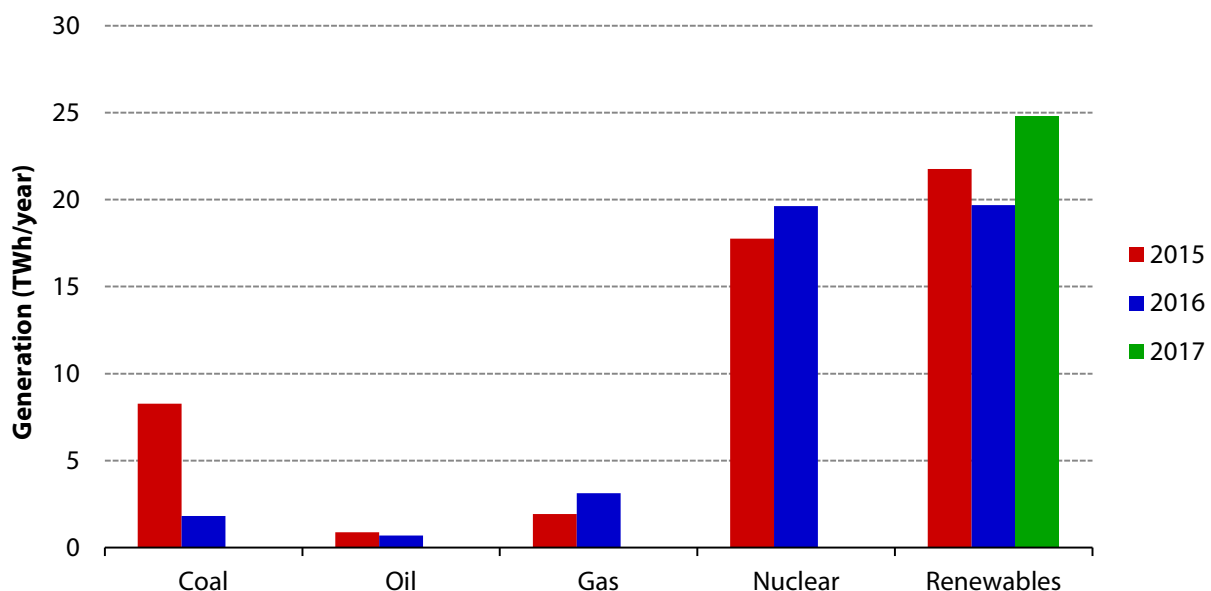
¹⁴ Excluding autogeneration, which is accounted for the industry sector.

by 27% from 2016, faster than renewable capacity in the same period (13%). The increase in generation was due to an increase in average wind speeds compared with 2016:

- As of March 2018, an additional 10.9 GW of renewable electricity projects are either in planning (2.2 GW), awaiting construction (7.2 GW) or under construction (1.5 GW). This is a decrease in the project pipeline: in March 2017, a total of 11.9 GW capacity was either in planning (5.5 GW), awaiting construction (4.9 GW) or under construction (1.6 GW).
- 90% of the capacity in the pipeline is wind projects, 4.0 GW offshore and 5.8 GW onshore. If all of this additional wind capacity were to be realised, it could increase generation from renewables by approximately 33 TWh per year, equivalent to an additional 90% of current Scottish gross electricity consumption.¹⁵

Despite this progress, the 2020 renewable electricity target remains challenging, as it is unlikely that all the projects consented will progress to the commissioning stage.

Figure 3.2. Scottish power generation by type (2015, 2016, and 2017)



Source: BEIS (2017) *Electricity generation and supply figures for Scotland, Wales, Northern Ireland and England, 2004 to 2016*, BEIS (2018) *Energy Trends 6.1 Renewable electricity capacity and generation*.

Notes: Chart excludes 'other' generation (hydro pumped storage, waste and other thermal). Renewables generation data is available for 2017.

The September 2017 Contracts for Difference (CfD) auction awarded a contract for the 950 MW Moray East offshore wind farm, which is expected to generate around 4 TWh/year, at a price of £57.5/MWh (2012 prices) upon completion in the first half of the 2020s. The Neart na Goithe offshore wind farm (450MW) recently overturned a legal challenge to its CfD from RSPB, and is set to come online in 2023.¹⁶

¹⁵ Using capacity factors of 32% for onshore wind and 48% for offshore wind.

¹⁶ <https://www.businessgreen.com/bg/news/3031700/edf-buys-embattled-neart-na-gaoithe-wind-farm>

In July 2018, BEIS announced further CfD auctions will take place in 2019, with further allocation rounds in 2021 and every two years thereafter, for technologies including offshore and remote island wind.

Transmission and interconnection

Investment in electricity infrastructure is crucial to realising Scotland's renewable energy potential, allowing power to flow from remote areas of high resource, where grid connections are often weak, to major centres of demand. This is particularly the case for the Highlands and Islands, where weak or non-existent connections to the mainland grid network have been a challenge to the deployment of renewable technologies. The additional location and transmission costs of onshore island wind are the reason for their inclusion in the bracket of CfD auctions that also includes offshore wind.

To support the future growth of renewable generation, large-scale investment into Scotland's transmission system is being delivered by a series of network development and reinforcement projects:

- In 2013, National Grid and Scottish Power began construction on the £1bn Western Link High Voltage Direct Current (HVDC) 'bootstrap' project. Power first flowed through the link in December 2017, but was shut down in May 2018 due to a fault found during testing. It is anticipated that the Link will be put back into operation at full capacity in September 2018. The new link has a capacity of 2.2 GW which will support the export of renewable energy from Scotland to England and Wales.
- The new Caithness-Moray HVDC transmission link is on schedule to be commissioned by the end of 2018. Following completion, the link will provide an additional 1.2 GW of transmission capacity in the north of Scotland. The project represents the largest investment in the electricity network in the north of Scotland since the hydro development era of the 1950s.
- Scottish and Southern Electricity Networks (SSEN) plan to connect Shetland to the National Electricity Transmission System for the first time by 2021. The proposal includes a sub-sea, 260-km long, 60 MW cable with on-island backup generation to replace Lerwick power station. Ofgem is yet to approve the project.
- In August 2018, SSEN submitted a final needs case to Ofgem to obtain permission for a 600MW subsea cable transmission link between the Western Isles and the Scottish mainland. The company referenced the UK Government's decision to allow remote island onshore wind to be included in future Contracts for Difference (CfD) auctions. The existing Western Isles network is close to full capacity and it is unlikely that further generation could connect without significant reinforcement.

The Energy Strategy acknowledges the network challenges that are a result of decarbonisation and decentralisation. Commitments in the draft Climate Change Plan to invest at least £7 billion in Scotland's electricity networks from 2013 to 2021 were removed from the final version of the Plan.

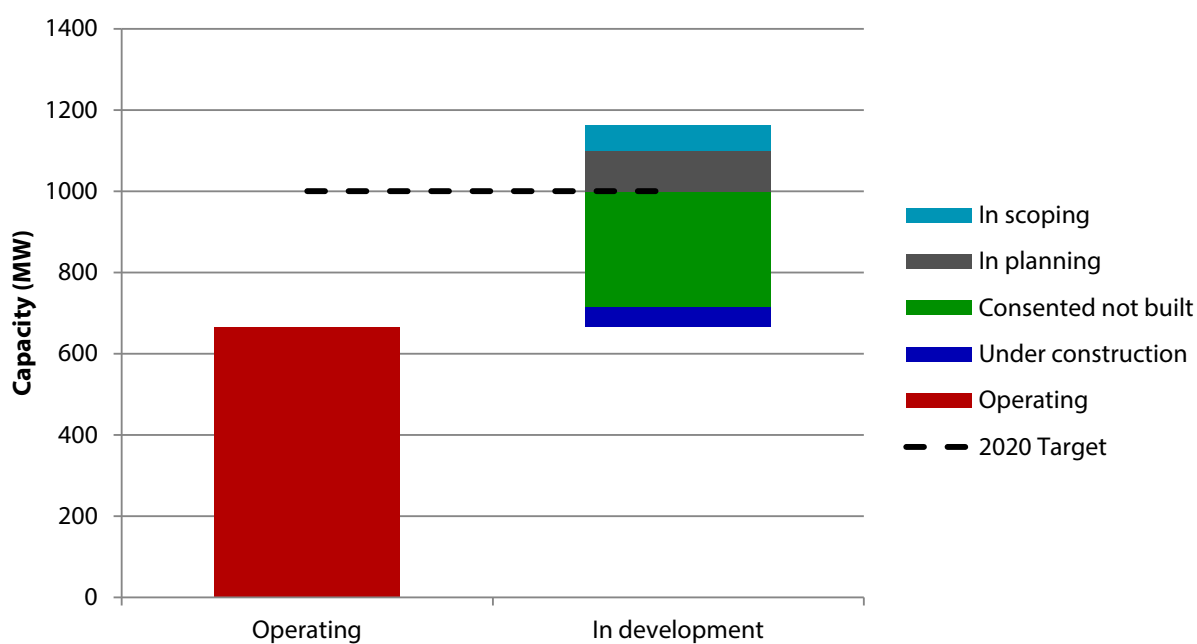
Community and locally-owned renewable generation

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.¹⁷ The Scottish Government has a target for local and community ownership of at least 500 MW of renewable energy by 2020. This target was met in 2015, so the Energy Strategy has increased the ambition of those targets:

- 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.

In June 2017, an estimated minimum of 666 MW of community and locally owned renewable energy capacity was operational in Scotland. This figure includes both electricity (403 MW) and thermal (254 MW) capacity. A further 496 MW is in various stages of development (Figure 3.3). Farms and estates own 40% of the operational renewable capacity (Figure 3.4) and the main technologies deployed are wind turbines (47%) and biomass (27%).

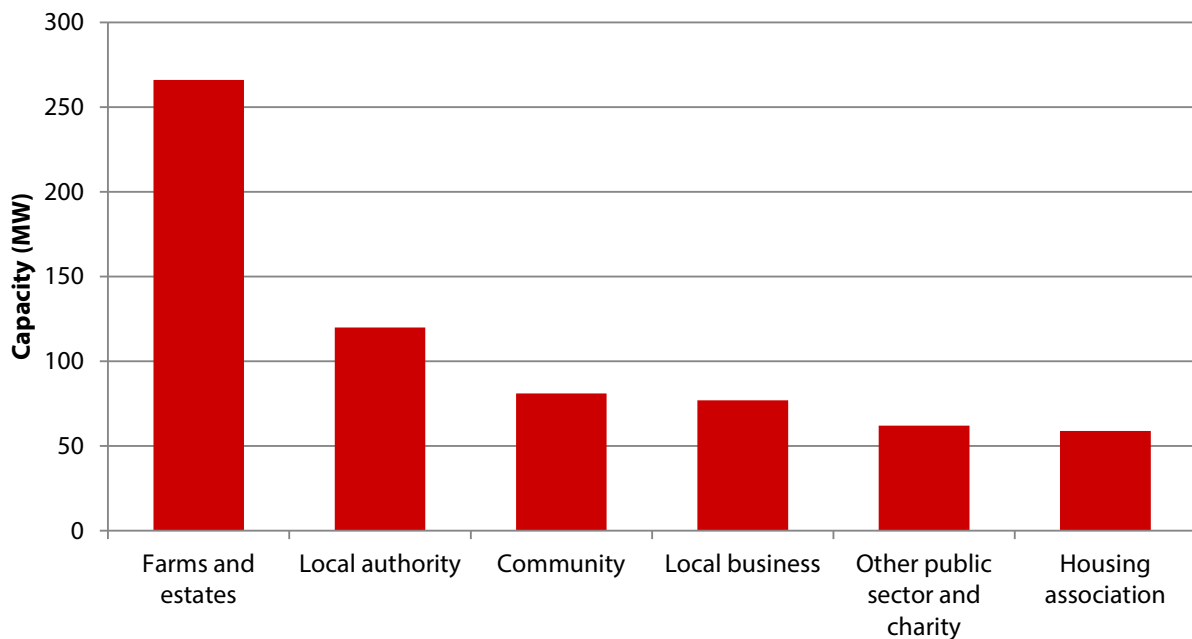
Figure 3.3. Community/locally-owned renewable capacity at different development stages, June 2017



Source: Energy Saving Trust (2017) *Community and locally owned renewable energy in Scotland at June 2017*.

¹⁷ DECC (2014) *Community Energy Strategy*.

Figure 3.4. Operational community/locally-owned renewable capacity by ownership (MW), June 2017



Source: Energy Saving Trust (2017) *Community and locally owned renewable energy in Scotland at June 2017*.

The Scottish Government has a number of programmes and policies to support community energy.

- The Scottish Government's CARES (Community and Renewable Energy Scheme) programme, managed by Local Energy Scotland, provides support, advice and loans to community groups and rural businesses that want to generate renewable energy.
- CARES manages the Local Energy Challenge Fund that provides development and capital support to projects which show a local energy economy approach linking energy generation to energy use.

The Feed-in-Tariff (FiT) scheme is set to close from April 2019. Many current community energy generators use Scotland's support programmes in conjunction with the FiT. CARES should be reviewed to ensure it can provide adequate support to new community projects in the absence of the FiT.

Opportunities to reduce emissions

Scotland is leading the UK on renewable electricity. The scenario for power sector emission reductions to 2030 presented in our annual targets advice to the Scottish Government in March 2016 showed that power sector emissions could decrease to very low levels, corresponding to an average emissions intensity of generation below 20 gCO₂/kWh; outperforming both the Scottish Government's intensity target of 50g/kWh and levels which are possible at a UK level.

As Scottish power generation will have been largely decarbonised by 2017, there will be limited opportunities to reduce emissions from fossil-fired power stations. Despite this, further increases in Scottish low-carbon generation would be valuable:

- Meeting overall targets will require further reductions in emissions from other sectors. Extension of low-carbon electricity generation to other sectors (e.g. electric vehicles and heat pumps) will be an important decarbonisation pathway, potentially implying increasing electricity consumption over the longer term.
- Scotland can also contribute to wider UK decarbonisation by exporting low-carbon electricity to the rest of the GB power system.

There is considerable potential for Scotland to increase renewable generation in future, including the possibility of onshore wind projects proceeding without subsidy.¹⁸ Recent auction results show that offshore wind is also now in a strong position to compete on cost.

In May 2018, Crown Estate Scotland announced new draft proposals to lease seabed as part of efforts to stimulate the renewables sector. The Crown Estate controls the rights to offshore renewable energy and gas and CO₂ storage out to 200 nautical miles. The final leasing process is expected to be launched by late 2018 or early 2019.¹⁹

In December 2017 the Scottish Government produced an Onshore Wind Policy Statement. This includes a section on the potential to repower onshore wind farms that are coming to the end of their lives (Box 3.1).

Box 3.1. Repowering onshore wind

In its Onshore Wind Policy Statement, the Scottish Government acknowledged the need to develop more onshore wind capacity in locations where it can be accommodated:

- This capacity should be developed at no additional subsidy cost to consumers, with some limited competition-based market intervention to protect projects against variations in the wholesale price of power.
- The Scottish Government also called upon the UK Government to deliver further support for onshore island wind using the reserved powers and market mechanisms which are currently established and well understood by the sector and investors.

The typical lifetime of an onshore wind plan is twenty years. After this period, operators typically have three options:

- Dismantle the site.
- Extend the land lease and planning consent, and use the existing equipment if financially viable.
- ‘Repower’ the site – upgrading to the latest and most efficient equipment.

Over fifty projects on the UK grid, with a combined capacity of more than 440MW, are reaching the end of their lifetimes by 2022.²⁰ Around 80% of this capacity is in Scotland and Wales:

- There are 18 onshore wind installations in Scotland, with a combined capacity of 193MW, that will have been operational for twenty years or more by 2022.
- The average turbine size at these sites is 740 kW, roughly one third of the average turbine size used in the most recent UK onshore wind installations.

¹⁸ Baringa (2017) *An analysis of the potential outcome of a further ‘Pot 1’ CfD auction in GB*.

¹⁹ Crown Estate Scotland (2018) *New offshore wind leasing for Scotland, Discussion Document*.

²⁰ ECIU (2018) *Repower to the people*.

Box 3.1. Repowering onshore wind

- Repowering sites would allow larger, more efficient turbines to be installed, delivering around 390 MW of additional renewable capacity.²¹

The Scottish Government's position is one of "clear support in principle" for repowering at existing sites, but it wishes to approve repowering on a case-by-case basis. Scottish Natural Heritage (SNH) are currently consulting²² on its new guidance on assessing repowering applications. The current baseline for Environmental Impact Assessments (EIAs) will be the 'expected restored state' of the site, excluding the existing turbines. Industry groups have expressed concern with this baseline, anticipating that obtaining planning permission for repowering will be much more difficult compared to an 'existing use' baseline.²³

The draft SNH guidance accepts that current use of the site as a wind farm will be a material planning consideration and that information which compares the effects on the environment of a repowered site with those for the existing site will be helpful. Such comparison may find that there are many similarities between the two schemes, and this may influence decision-makers.

If the 'expected restored state' baseline is used, the Committee urges the Scottish Government to ensure that the important 'existing use' context is factored into decision making on a case-by-case basis, and that planning permission for repowering is granted wherever possible.

Scotland is also very well placed for carbon capture and storage (CCS), which will be important in achieving decarbonisation towards 2050 across a number of sectors. The UK Government has set up a CCUS Council and established a CCUS Cost Challenge Taskforce. Scottish Government officials are participating in both of these forums.

The Scottish Government is supporting (£100k) the Acorn CCS Project, an industrial CCS project that has secured €1.9m under an EU science funding stream to Accelerate CCS Technologies (ACT). The Scottish Government has also provided £250k funding to Scottish Carbon Capture Storage (SCCS).

Assessment of the final Climate Change Plan

The Climate Change Plan and Energy Strategy set out the ambition for further deployment of renewable capacity, together with an initial roll-out of carbon capture and storage (CCS) applied to gas plant starting in 2030. This is consistent with the Committee's recommended path for the Scottish power sector.

The draft Plan's path for the power sector had emissions going negative from 2028, unlike in the CCC's High Ambition scenario for Scotland (Figure 3.5). This was due to the draft Plan's assumption that some of the gas used in conjunction with CCS is biomethane, which was attributed to power generation leading to negative emissions, whereas the CCC analysis allocates emissions savings from biomethane to the buildings and industry sectors.

In the final Plan, the use of CCS in the power sector has been heavily rolled back, with no deployment before 2030. The use of biomethane and other biomass in electricity generation

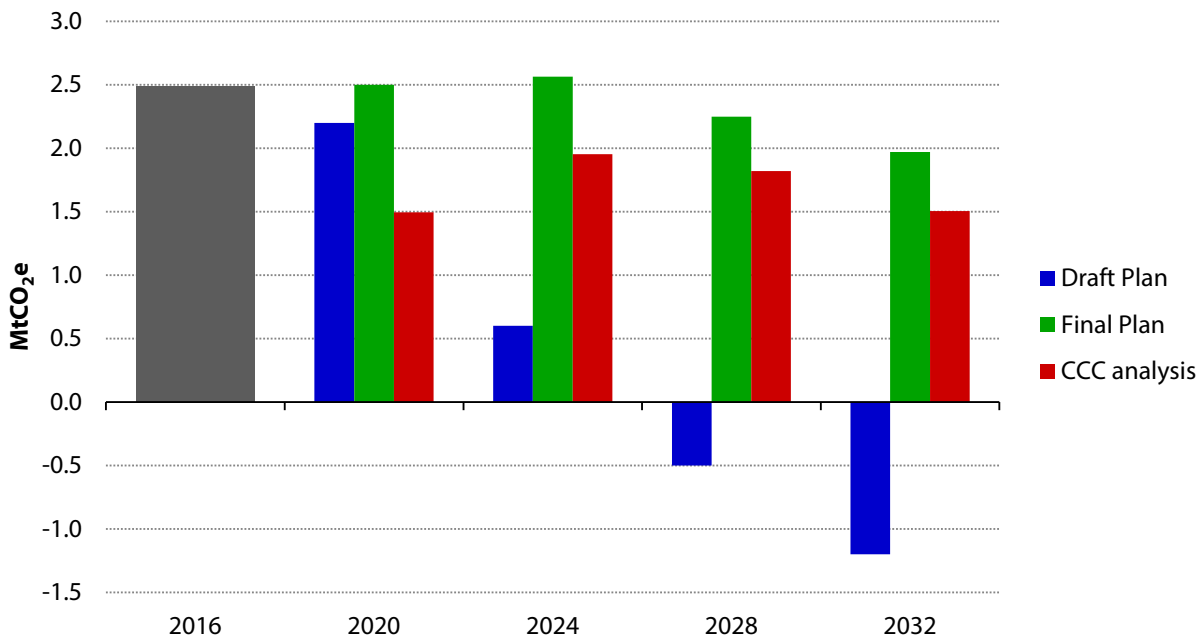
²¹ Data from <http://www.renewableuk.com/page/UKWEDSearch>, with for capacity constructed in 2002 or earlier extracted. Units that have already repowered were removed.

²² SNH (2018) *Assessing the impact of repowered wind farms on nature*.

²³ Scottish Renewables (2017) *Repowering Position Paper*.

processes fitted with CCS has also been constrained to zero. Projections in the final Plan now closely match the CCC scenario. In 2032, the Power sector emissions envelope is 0.5 MtCO₂e higher than the CCC scenario.

Figure 3.5. Comparison of power sector emissions in the Climate Change Plan and CCC scenario



Source: Draft Climate Change Plan, Climate Change Plan, CCC analysis.

Note: The draft Plan had emissions in the power sector going negative from the late 2020s, as a result of combining biomethane grid injection with gas CCS power plants. The CCC scenario also deploys both of these, but allocates the biomethane to the buildings and industry sectors, resulting in positive overall power sector emissions, as a result of small residual emissions from the (fossil) CCS plants. The final Plan contains limited deployment of CCS before 2030 and is therefore broadly in line with the CCC scenario.

Chapter 4: Buildings



Table 4.1. Summary of progress in the buildings sector

Milestone	Progress
11% of non-electrical heat demand to be met from renewable sources by 2020.	<p>In 2016, the provisional estimated share of non-electrical heat demand met by renewable sources is 4.8-5.0%²⁴, down from 5.4% in 2015.</p> <p>To meet the 2020 target, low-carbon heat output would need to increase by 96%-129% on 2016 levels in the next four years. The previous four years (2012-2016) saw growth of 83%.</p>
Every home to have loft and cavity wall insulation, where this is cost-effective and technically feasible, plus simple measures such as draught-proofing and pipe lagging.	<p>In 2016, the proportion of homes with loft insulation of more than 200mm (close to the recommended level of 275mm) was 65%. The share of cavity wall dwellings with cavity wall insulation was 72%. These figures both increased by one percentage point on 2015.</p>
<p>Energy Performance Certificate (EPC) targets:</p> <ul style="list-style-type: none"> • All homes to EPC band C by 2030 (where technically feasible and cost effective). • Maximise the number of social rented homes achieving EPC band B by 2032. • Private rented homes to EPC band E by 2022, to EPC band D by 2025, and to EPC band C by 2030 (where technically feasible and cost effective). • All homes with households in fuel poverty to reach EPC band C by 2030 and EPC band B by 2040 (where technically feasible and cost effective). 	<p>Based on the 2016 Scottish Housing Survey:</p> <ul style="list-style-type: none"> • 39% of homes were rated EPC band C or better • 2% of social rented homes were rated EPC band B or better • 93% of private rented homes were rated EPC band E or better • 34% of owner occupied homes were rated EPC band C or better • 21% of all fuel-poor households were rated EPC band C or better (based on 2002 Scottish Government definition of fuel poverty)²⁵
Low-carbon ²⁶ heat technologies to supply 35% of domestic buildings and 70% of non-domestic buildings by 2032.	<p>In 2015, approximately 22% of total heat demand in Scotland was low carbon.²⁷</p>

²⁴ Statistics for heat demand in 2016 have yet not been published.

²⁵ Scottish Fuel Poverty Statement 2002.

²⁶ The definition of low-carbon heat used in the Plan includes resistive electric heating (e.g. storage heaters), which currently meets around 12% of domestic heat and 50% of non-domestic heat in Scotland. The Committee usually excludes resistive electric heat when presenting proportions of low-carbon heat, but have used the Plan's definition here for comparison purposes.

²⁷ Heat demand in domestic and non-domestic sectors.

Table 4.1. Summary of progress in the buildings sector

Milestone	Progress
Reduce energy consumption (across all sectors) by 12% by 2020, against a 2005-2007 baseline.	In 2015, residential energy consumption was 20% below the baseline, while combined consumption in industry and commercial sectors was 23% below the baseline.
<p>The Scottish Government previously had a statutory target to eradicate fuel poverty, as far as reasonably practicable, by the end of November 2016. In June 2016, this target was dropped.</p> <p>The draft Fuel Poverty Strategy published in 2018 sets targets of:</p> <ul style="list-style-type: none"> • An overall fuel poverty rate of less than 15% by 2030 (non-statutory target). • No more than 5% of households in fuel poverty by 2040 	Based on the new definition of fuel poverty used in Scotland, ²⁸ the 2015 Scottish House Condition Survey (SHCS) showed that around 584,000 (24%) households were in fuel poverty.

Latest emission trends and drivers

Direct residential emissions increased by 3% in 2016 to 6.3 MtCO₂e.²⁹ Emissions from residential buildings accounted for 16% of total emissions and emissions were 21% lower than 1990 levels (Figure 4.1):

- On an unadjusted basis,³⁰ residential emissions increased by 3% in 2016, following a 16% decrease in 2014 and a 3% increase in 2015. The weather in 2016 was colder than the long-run average, whereas both 2014 and 2015 were warmer than average (Figure 1.3).

Direct non-residential emissions increased by 3% to 2.4 MtCO₂ in 2016. They accounted for 6% of total Scottish emissions in 2016 and were 19% lower than in 1990 (Figure 4.2):

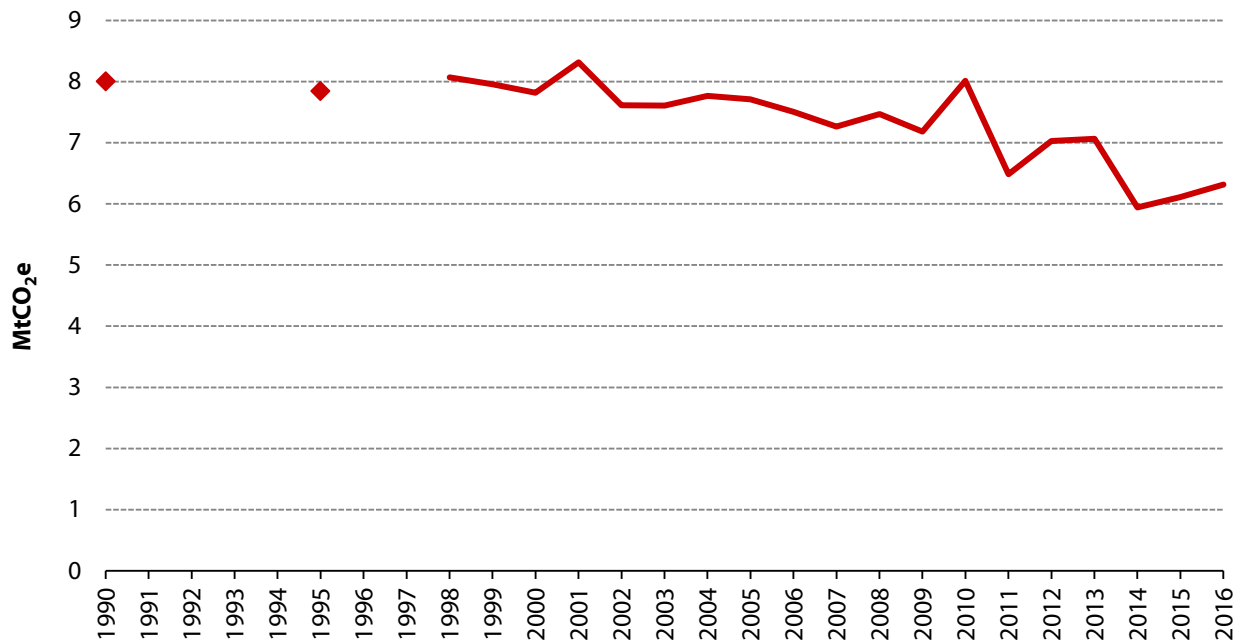
- Emissions from commercial buildings increased by 4% from 2015, leaving 2016 emissions 4% above 1990 levels.
- Emissions from the public sector increased by 2% and were 36% below 1990 levels. The reduction since 1990 was largely driven by a reduction in the use of oil and coal for space heating.

²⁸ Under the '10% definition' of fuel poverty, a household is in fuel poverty if, in order to maintain a satisfactory heating regime, it would be required to spend more than 10% of its income on all household fuel use.

²⁹ Direct emissions exclude power sector emissions resulting from buildings electricity consumption.

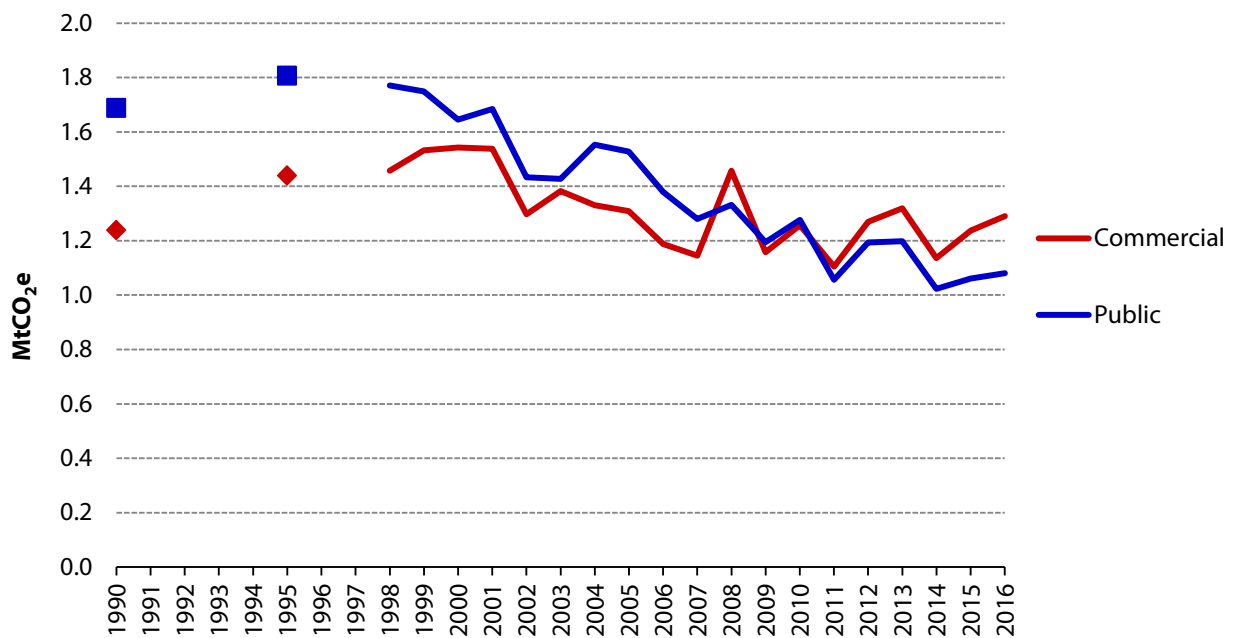
³⁰ Building emissions depend on winter temperatures, as emissions are higher when more heating is necessary. In order to identify the trend in building emissions it is necessary to adjust emissions to exclude the impact of year-to-year variations in winter temperatures.

Figure 4.1. Residential buildings emissions (1990-2016)



Source: NAEI (2018).

Figure 4.2. Non-residential buildings emissions (1990-2016)



Source: NAEI (2018).

Progress on low-carbon heat

The Scottish Government has set a target to source 11% of non-electrical heat demand from renewable sources by 2020, and to have a largely decarbonised heat sector by 2050. The provisional estimated share of non-electrical heat demand met by renewable sources in 2016 is between 4.8% and 5.0%, down from 5.4% in 2015, largely due to decreases in heat output from a small number of large non-domestic sites.

The majority of progress against this target to date has been due to reductions in non-electrical heat demand caused by rising gas prices, higher winter temperatures, and energy efficiency improvements. The Scottish Government estimates that between 3.6 TWh and 4.8 TWh of additional low-carbon heat output will need to be deployed between 2016 and 2020 to meet the target (Figure 4.3).³¹

The 2020 target is still achievable, but will require faster deployment of low-carbon heat than recent years:

- Low-carbon heat output will need to double (96-129%)³² in the next four years. The previous four years (2012-2016) saw growth of 83%.
- In Scotland, biomass combustion, including biomass combined heat and power, supplied 83% of low-carbon output and 84% of capacity in 2016. This level of biomass consumption for heating is not building towards long-term decarbonisation of heat, as bioenergy will need to be prioritised elsewhere in the energy system in order to achieve the deep reductions in economy-wide emissions by 2050.³³ This implies that many consumers or businesses may need to switch to another form of low-carbon heating in the future as competing demand drives up prices for biomass.
- In 2016, 1.7 GW of low-carbon capacity produced 3.7 TWh of heat. This is an 11% decrease in generation from 2015, despite a 13% increase in capacity. This is largely due to changes in output at a small number of large (>1MW) non-domestic sites. Low-carbon heat capacity and generation have both significantly increased since 2008/09, when Scotland had a capacity of 0.2 MW and generated 863 MWh.
 - The rise in low-carbon capacity from 2015 to 2016 is largely due to further deployment of biomass combustion and biomass CHP, which accounts for 73% of the total increase in capacity.
 - Biomass capacity increased by 14% (0.13 GW) and output by 14% (300 GWh), and biomass CHP capacity increased by 3% (0.01 GW) whilst output fell by 63% (-963 GWh). The fall in output from biomass CHP is in part due to a reduction in operations from one large site and in part due to improved data availability for a separate site.
 - Although making up a relatively small proportion of the total low-carbon capacity and output, the contribution from heat pumps also increased between 2015 and 2016. Capacity increased by 17% (0.022 GW) and output by 21% (50 GWh).
 - Energy from waste currently accounts for only 9% of low-carbon output, but was the fastest growing in terms of proportional increase in 2016. Capacity has increased by 52% (0.027 GW) between 2015 and 2016, and output has increased by 78% (150 GWh).

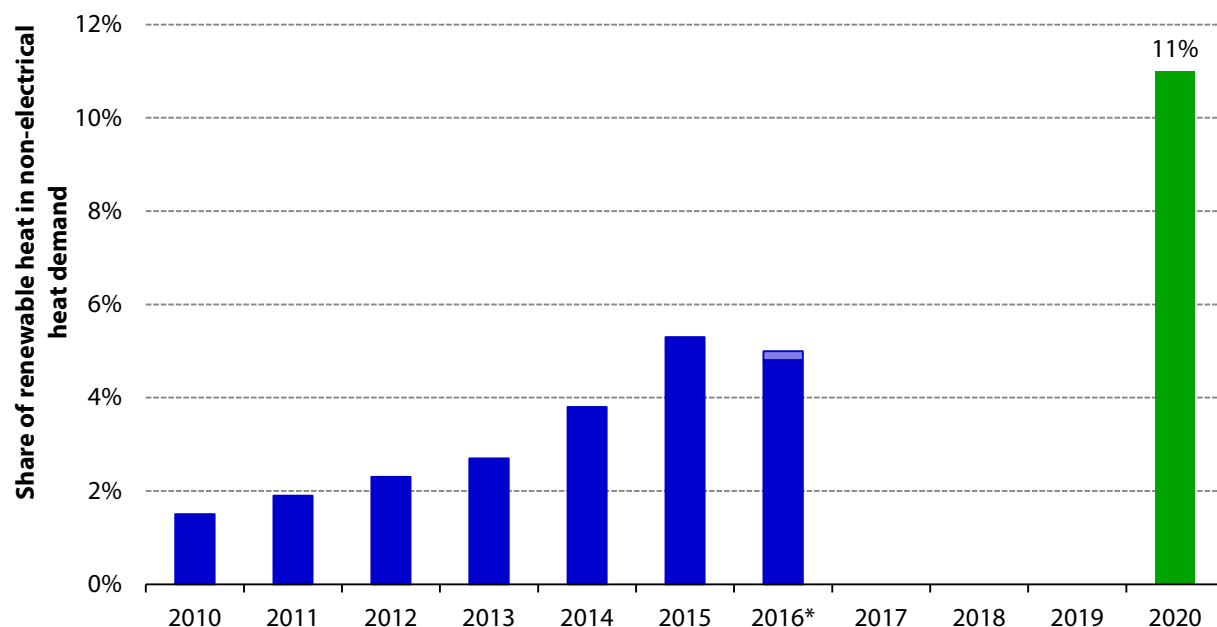
³¹ Energy in Scotland 2018.

³² The range for the required increase reflects uncertainty in the level of final energy consumption in 2020.

³³ See CCC (2011) *Bioenergy Review* and CCC (2016) *Next Steps for UK Heat Policy*.

- By the end of December 2017, nearly 12,000 domestic RHI installations were accredited in Scotland, with 86% of these installed in off-grid areas.

Figure 4.3. Share of renewable heat in non-electrical heat demand (2010-2016, 2020 target)



Source: Scottish Government (2018) *Energy in Scotland 2018 - Data, Charts & Sources*.

Notes: Share in 2016* is provisional estimate of 4.8% - 5.0% due to uncertainty in total heat demand in 2016.

The Energy Strategy has targets that 35% of domestic heat and 70% of non-domestic heat will be renewable by 2032, although these figures include resistive electric heating (e.g. storage heaters). Resistive heating currently meets around 12% of domestic heat and 50% of non-domestic heat in Scotland. The Committee usually excludes resistive electric heat when presenting proportions of low-carbon heat.³⁴

Progress in energy efficiency

Energy efficiency policy in Scotland is a mix of devolved and reserved policy. Minimum energy efficiency standards for electrical appliances, boilers³⁵ and other heating technologies are set at EU level, while the main energy efficiency scheme aimed at improving the thermal performance of existing homes, the Energy Company Obligation (ECO), is GB-wide. The Scottish Government has responsibility for building standards in Scotland.

³⁴ Resistive heating generally represents a more costly route to decarbonising relative to heat pumps. This is due to the lower efficiency of the technology, resulting in greater energy use, higher bills and higher energy system costs.

³⁵ Since 2007, Scottish Building Standards increased the efficiency requirements for all new and replacement boilers above EU standards.

The Scottish Government provides funding for additional energy efficiency and low-carbon programmes:

- Scotland was successful in leveraging funding from the ECO. The share of funding to Scotland is higher than the share of the housing stock.
- In April 2017 the Scottish Government announced a £30m interest-free loan scheme under the Home Energy Efficiency Programme Scotland (HEEPS), supporting energy efficiency measures including solid wall insulation (internal and external), cavity wall, loft and roof insulation, draught proofing and boilers.
- The Energy Efficient Scotland programme (formerly SEEP), is the main policy to improve energy efficiency of existing domestic and non-domestic buildings (Box 4.2). The 20-year programme is currently in its initial phases, with pilot schemes in place. Phase 2 of the pilot scheme is currently underway, supporting pilot projects for delivery by the end of February 2019. A consultation on the energy standards framework within the Route Map closed in July 2018. In the Route Map, the Scottish Government stated that by the end of 2021 they will have invested more than £1 billion on tackling fuel poverty and improving energy efficiency since 2009.

Progress on implementation of insulation and efficiency measures

The proportion of Scottish homes with insulation has increased steadily over time. However, levels of insulation have been flat since 2014 and there is still significant potential for an increased rate of loft and cavity wall insulation:

- **Loft insulation.** The 2016 Scottish House Condition Survey³⁶ (SHCS) shows that the proportion of eligible homes with loft insulation of more than 200mm (close to the recommended level of 275mm³⁷) was 65%, a slight increase from 64% in 2014. The proportion of lofts with insulation of 300mm or more decreased by 2 percentage points to 30% in 2016. 1% of lofts had no insulation, unchanged from 2015. In total, 464,000 loft insulation measures have been installed under UK Government schemes between 2008 and 2016.
- **Cavity walls.** Around three-quarters of dwellings in Scotland have external cavity walls. The SHCS indicates that in 2016, the share of properties with cavity wall insulation increased by one percentage point to 72%. The SHCS notes that it is becoming increasingly difficult for SHCS surveyors to identify the presence of cavity wall insulation and that the number of homes with cavity wall insulation might be underestimated.
- **Solid walls.** Around a quarter of properties in Scotland have solid or other types of walls (including timber frame), compared to a third of properties in the UK as a whole. 15% of these dwellings had insulated walls in 2016, compared to 11% in 2015.³⁸
- **Gas and oil boilers.** The percentage of homes with gas and oil boilers installed has increased 4 percentage points to 86% since 1998, when the European Boiler Efficiency Directive Minimum came into effect. In 2016, 61% of gas and oil boilers were condensing (an increase of five percentage points since 2015), while 52% meet the minimum efficiencies specified by the current Building Standards (a five percentage point increase since 2015).

³⁶ Small percentage point changes may not be statistically significant due to sample size.

³⁷ As recommended by the Energy Saving Trust (EST).

³⁸ This increase is not statistically significant due to small sample size.

Fuel poverty

In 2016, the SHCS showed that 584,000 households in Scotland (24%) were in fuel poverty according to the new definition in the Fuel Poverty Bill (Box 4.1). Against the previous definition³⁹ fuel poverty rate was 26.5%. This was 4.3 percentage points lower than 2015, and the lowest recorded since 2008.

- The majority of the reduction (2.7 percentage points) between 2015 and 2016 can be attributed to the drop in the price of domestic fuels.
- A further 1.5 percentage points reduction can be attributed to improvements in the energy efficiency performance of the housing stock, and the remainder by changes in household income.
- The rates of fuel poverty for households using oil as primary heating fuel and for those living off the gas grid are not significantly different from the levels seen in the previous year.

Box 4.1. New Fuel Poverty Bill and draft Fuel Poverty Strategy

In June 2018, Scotland introduced the Fuel Poverty (Target, Definition and Strategy) (Scotland) Bill. The Bill set out a statutory target that by 2040, no more than 5% of households in Scotland will be in fuel poverty. It introduced a new definition for fuel poverty.

A household is considered fuel poor if, once it has paid for its housing costs it needs more than 10% of its remaining income to pay for its energy needs, and if this expenditure then leaves the household in poverty.

This new definition is better aligned with low income, and more focused on those most likely to struggle to pay their fuel bills. Under the new definition, there are fewer fuel poor households in total, but a larger overlap between those that are both fuel and income poor (Figure B4.1.).

The Bill also mandates a long-term fuel poverty strategy. The draft Fuel Poverty Strategy was produced in June 2018 and includes a non-statutory interim target of a 15% fuel poverty rate by 2030.

Figure B4.1. Households in fuel and income poverty under the new definition



Source: Fuel Poverty (Target, Definition and Strategy) (Scotland) Bill 2018: guide.

Notes: Fuel poverty figures under for the new definition are provisional.

³⁹ Historical numbers are only available on the basis of the previous definition of fuel poverty: “a household is in fuel poverty if, in order to maintain a satisfactory heating regime, it would be required to spend more than 10% of its income on all household fuel use.” This is a different definition to that used in England.

Policy progress

The main GB support scheme for low-carbon heat is the Renewable Heat Incentive (RHI). This scheme provides payments to those who generate and use renewable energy to heat their buildings:

- Scotland performed well compared to the GB average in terms of installations under the RHI. Out of all RHI-accredited installations up to December 2017, Scotland had 21% of non-residential capacity and 20% of residential capacity. These are higher proportions of installations than would be expected based on GVA (8%) and housing shares (9%).
- This is partly due to Scotland's larger share of off-grid homes, with 86% of all residential accreditation in Scotland from off-gas-grid properties (compared to 72% in GB overall). In 2016, 20% of homes in Scotland were off the gas grid, representing 13% of all off-grid domestic properties in GB.

Scotland has implemented further policies to encourage the uptake of low-carbon and district heating:

- The SME Loan Scheme provides low- or no-cost loans to businesses of up to £100,000 for the installation of efficiency measures and renewables. Since 2008, the scheme has financed over 800 projects resulting in estimated heat and electricity energy savings of 339 GWh.
- The Home Energy Scotland Loan Scheme provides interest-free loans of up to £35,000 for energy efficiency measures and renewables. There have been 1,325 loans offered from the Scottish Government since it was launched in May 2017, paying £3.4 million to date.
- The District Heating Loan Fund offers loans to support the development of district heating networks in Scotland. Since 2011, the fund has lent more than £15 million to 50 different projects across Scotland. In 2017/18, the scheme awarded £4.2 million of funding to four district heating projects which will deliver 5MW of heating capacity.
- The Scottish Government's Climate Challenge Fund supports local projects that help tackle climate change. This includes energy efficiency advice to households, greener travel, waste reduction recycling, local seasonal food-growing and improvements to community-owned properties. It has awarded £78m to 873 community-led projects since March 2016.
- The Low Carbon Infrastructure Transition Programme (LCITP), launched in May 2015, provides financial support for low-carbon projects covering a wide range of technologies, including low-carbon heat. The LCITP has already offered over £40 million of funding to 13 low-carbon demonstrator projects supporting low-carbon energy generation.
- Local Heat and Energy Efficiency Strategies (LHEES) aim to link long-term targets and national policies with delivery of energy efficiency and heat decarbonisation in local authorities. They provide a structured way for local authorities to identify and implement the most appropriate energy efficiency and heat decarbonisation options in a given area.

Scotland is successful in securing UK-wide funding and has more developed and comprehensive energy efficiency policies than available in the rest of the UK. Even though progress has been made from a low base, more needs to be done to meet the targets. The Energy Efficient Scotland programme will be the main driver for further progress in existing buildings (Box 4.2).

Box 4.2. Energy Efficient Scotland Route Map and Consultation

In March 2018 the Scottish Government published their route map and consultation on delivering an 'Energy Efficient Scotland'.

Ambition

The route map sets out an ambition to ensure all Scottish homes achieve an EPC band 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 to 2030. 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 band 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 band 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. The Scottish Government has consulted twice on a statutory requirement for local authorities to prepare LHEES. As part of the Phase 2 pilot of Energy Efficient Scotland, the Scottish Government has funded nine local authorities to produce LHEES, and is seeking to fund a further five LHEES before August 2019.

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 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 band C), to place duties on Local Authorities, and to regulate district heating.

The Route Map sets out three distinct phases:

- **2018-2019:**
 - Allocate funding for fuel poverty programmes
 - Funding for local authorities to support development of LHEES
 - Integrate funding streams
- **2020-2034:** Support building owners to achieve required efficiency ratings.
- **2035-2040:** Provide advice and support, and begin enforcing ratings by introducing or increasing penalties for those buildings that haven't met standards.

Box 4.2. Energy Efficient Scotland Route Map and Consultation

Example of best practice

In our 2018 Progress Report to Parliament, the Committee highlighted the Energy Efficient Scotland programme as an example of best practice, in particular due to standards set well in advance, the provision of a regulatory backstop for owner occupied homes, and a statutory underpinning to commitments.

The Scottish Government should aspire to apply similar principles of long-term clarity and a strong regulatory underpinning when designing climate policy across all sectors.

Progress must be maintained

The route map demonstrates a strong example of an effective policy package to drive emissions reductions. The focus now must be on 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 further intervention 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:
 - The route map states that the Scottish Government will continue "to support the deployment of low regrets, low-carbon heat options (such as individual renewable heat technologies for those buildings not connected to the gas grid or heat networks where they make sense)". Further detail will be needed on the package of measures. It is important that the deployment of low-carbon heat technologies is consistent with long-term decarbonisation goals. The current dominance of biomass remains an issue because this is not the long-term best use of finite bioenergy resources.
 - The RHI will stop operating in April 2021. The 2018 UK progress report recommended that the UK Government make a decision on the post-2021 successor to the RHI in 2018. The UK Government has indicated a desire to transition away from reliance on direct subsidies and that regulation could play a role in phasing out high-carbon heating.⁴⁰ The Scottish Government will continue to support RHI-driven delivery through its existing loans to consumers and businesses, but the route map does not currently contain any specific proposals of how low regrets options will be supported post-RHI.
 - As stated in the Energy Efficient Scotland route map, the Scottish Government should respond to the UK Government's decisions on the future of the gas grid which are expected in the mid-2020s, and integrate the UK's position for on-gas properties when it is available.

In addition to the commitments made to drive energy efficiency and low-carbon heating in existing buildings, earlier this year the Scottish Government commenced a review of new-build energy standards in Scottish Building Regulations. The proposed scope includes investigating steps to drive further carbon abatement, improve the efficiency of existing heating systems and increase the focus on 'as-built' performance.

Standards will need to be set which ensure new buildings are fit for 2050 and beyond. This includes making sure they are designed for a changing climate, are future-proofed for low-

⁴⁰ BEIS (2018) *A future framework for heat in buildings - Call for evidence*.

carbon heating, and deliver high levels of energy efficiency.⁴¹ It also includes tightening standards in 2025 to drive low-carbon heat. The scope of the review should be expanded to ensure these outcomes can be realised. Clear forward trajectories for the evolution of standards should be set well in advance. The framework which underpins building standards, the Standard Assessment Procedure (SAP), should also evolve to focus on meeting long-term objectives.

The compliance and enforcement framework should be strengthened to drive action and ensure that policies are able to deliver their intended carbon and bill savings. Work is already underway in Scotland with the recently launched consultation on Building Standards Compliance and Fire Safety. We support the principles recommended in the Hackitt review,⁴² in particular: an outcomes-based approach that sees buildings as a system; a clear model of risk ownership (with risk placed with those able to control it); transparent information and a clear audit trail; and effective oversight, inspection and sanctions underpinning the framework.

Assessment of the final Climate Change Plan

The advice on the previous draft has largely been followed, including more realistic trajectories of low-carbon uptake which make buildings emissions envelopes more credible.

The final Plan requires 35% of domestic buildings' heat to be supplied from low-carbon sources by 2032, compared to 80% in the draft Plan, and 70% of non-domestic compared to 94% in the draft. This is an overall share of 45% across the domestic and non-domestic sectors, compared to our recommendation that the Plan relies on low-carbon sources providing no more than 50% of heat by 2032.

The Scottish Government counts electric resistive heating as a low-carbon measure. This definition is acceptable for Scotland, given the context of progress made in decarbonising the power sector, but more efficient low-carbon options such as heat pumps must be prioritised.

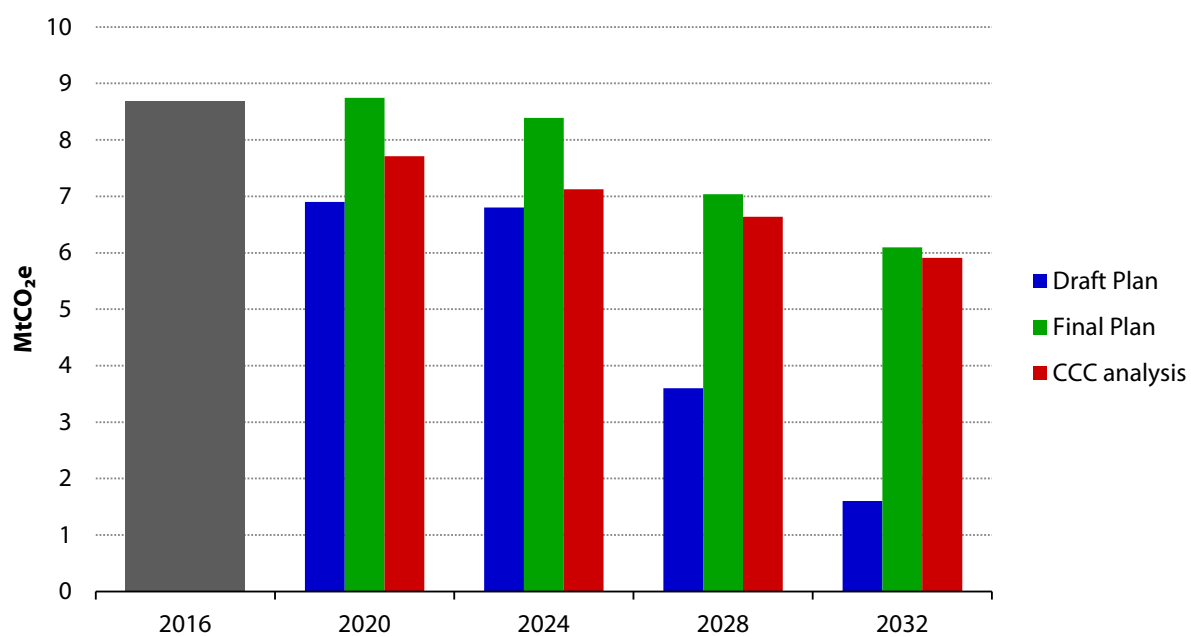
Targets in the buildings sector are sufficiently stretching and, if achieved, will be a key part of delivering against Scotland's targets for 2032 and beyond. Progress to date must be maintained through delivery of efficiency improvements, clarification of non-domestic policy, and progress on low-carbon deployment. The CCC recognises the difficulty of setting a clear plan for on-grid buildings without a position from UK Government, but plans for pursuing low-regret options in the short term and regulations on LHEES should be pursued.

In total, buildings emissions in the Plan are marginally higher (0.2 MtCO₂e) in 2032 than the CCC scenario (Figure 4.4).

⁴¹ CCC (2018) *Reducing UK emissions - 2018 Report to Parliament*, Box 3.6.

⁴² Hackitt (2018) *Independent Review of Building Regulations and Fire Safety: Final Report*.

Figure 4.4. Comparison of buildings emissions in the Climate Change Plan and CCC scenario



Source: Draft Climate Change Plan, Climate Change Plan, CCC analysis.

Chapter 5: Industry and F-gases



Table 5.1. Summary of progress in the industry sector

Milestone	Progress
Reduce energy consumption (across all sectors) by 12% by 2020 (against a 2005-2007 baseline).	In 2015, combined industrial and commercial energy consumption was 23% lower than the baseline. This target has been achieved.
Industrial and commercial energy productivity ⁴³ and emissions intensity ⁴⁴ to improve by at least 30% by 2032 compared to 2015 levels.	Energy productivity increased by approximately 31% between 2005 and 2015. A similar rate of progress must be maintained to meet targets in 2030.

Latest emission trends and drivers

Direct⁴⁵ emissions from industry⁴⁶ were broadly flat in Scotland, increasing by 0.3% to 11.9 MtCO₂e in 2016, compared to an overall 9% fall at UK level. Emissions from the sector accounted for 31% of total Scottish emissions and have decreased by 44% since 1990 baseline (Figure 5.1):

- The chemicals sector, refineries and oil and gas extraction/production are the main sources of emissions in the industry sector and together make up almost half of total industry emissions (Figure 5.4):
 - From 1990, emissions from chemicals increased significantly but peaked in 2000 and have since decreased. Emissions decreased by 6% from 2015 to 2016 to 2.2 MtCO₂e. Chemical sector emissions in 2016 were 9% lower than 1990.
 - Emissions from refineries increased by 7% in 2016 to 2.2 MtCO₂e, following a 14% increase in 2015. Emissions in 2016 were 23% lower than 1990 levels.
 - Emissions from fossil fuel production increased by 15% to 1.8 MtCO₂e. Emissions in 2016 were 6% lower than 1990 levels.
- The largest reductions in emissions since 1990 have occurred in the iron and steel sector. Emissions from iron and steel have decreased by over 99% from 3.6 MtCO₂e in 1990 to very close to zero in 2016. Around two-thirds of this reduction came before 1995, due to the Ravenscraig steelworks closing in 1992.
- Scottish Gross Value Added (GVA) grew by 1.2% in the 2016 calendar year.⁴⁷ In the last decade emissions have fallen whilst industry output has increased (Figure 5.2).

⁴³ Energy productivity in the Industrial and Commercial is calculated as Scottish GVA divided by total energy consumption in the Industry and Commercial sectors.

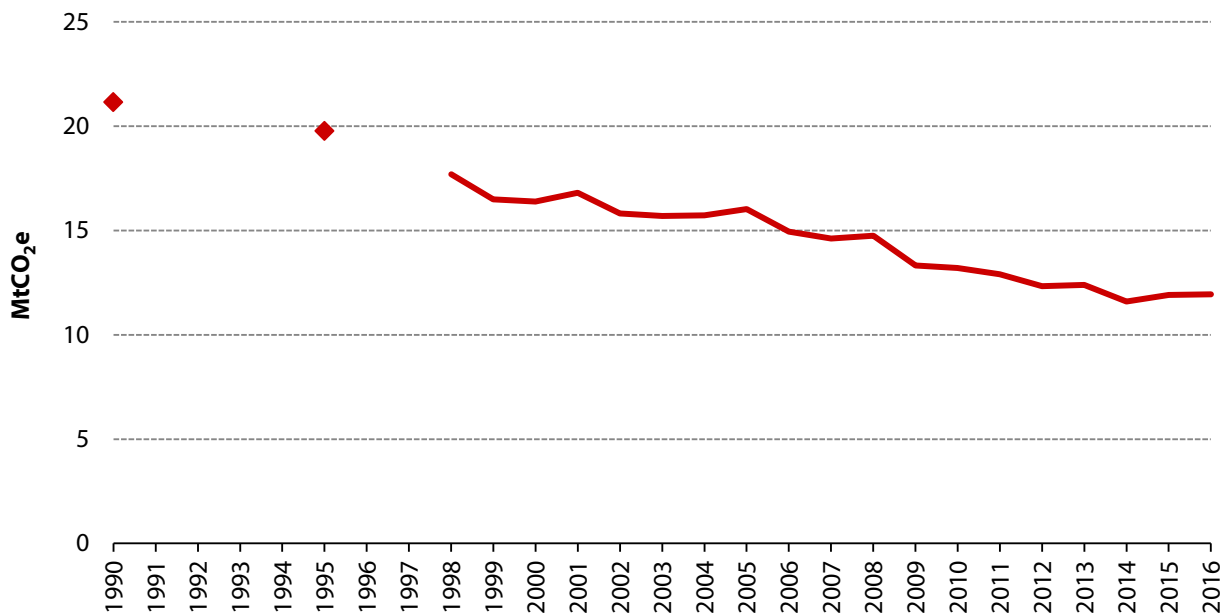
⁴⁴ Defined as total emissions in the Industry and Commercial sectors divided by Scottish GVA.

⁴⁵ Direct emissions include autogeneration but exclude emissions from generation of electricity supplied through the grid, which are covered in Chapter 3.

⁴⁶ Industrial activity includes manufacturing, construction, water and waste management, refining of petroleum products and a range of activities linked to energy supply (extraction and production of oil, gas and solid fuels).

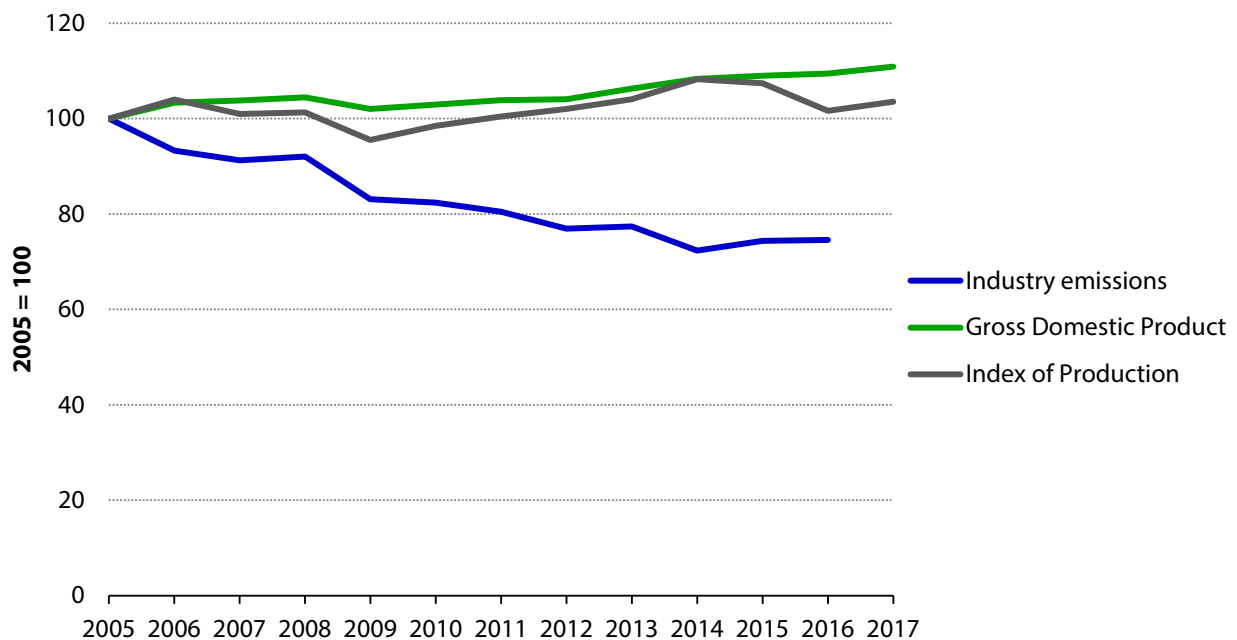
⁴⁷ Scottish Parliament (2018), Scotland GVA, current basic prices, 1998-2016.

Figure 5.1. Industry emissions 1990-2016



Source: NAEI (2018).

Figure 5.2. Industry emissions, Scottish GDP and Index of Production (2005-2017)



Source: NAEI (2018) and Scottish Government (2018) *Scotland's Gross Domestic Product Quarter 1 2018*.

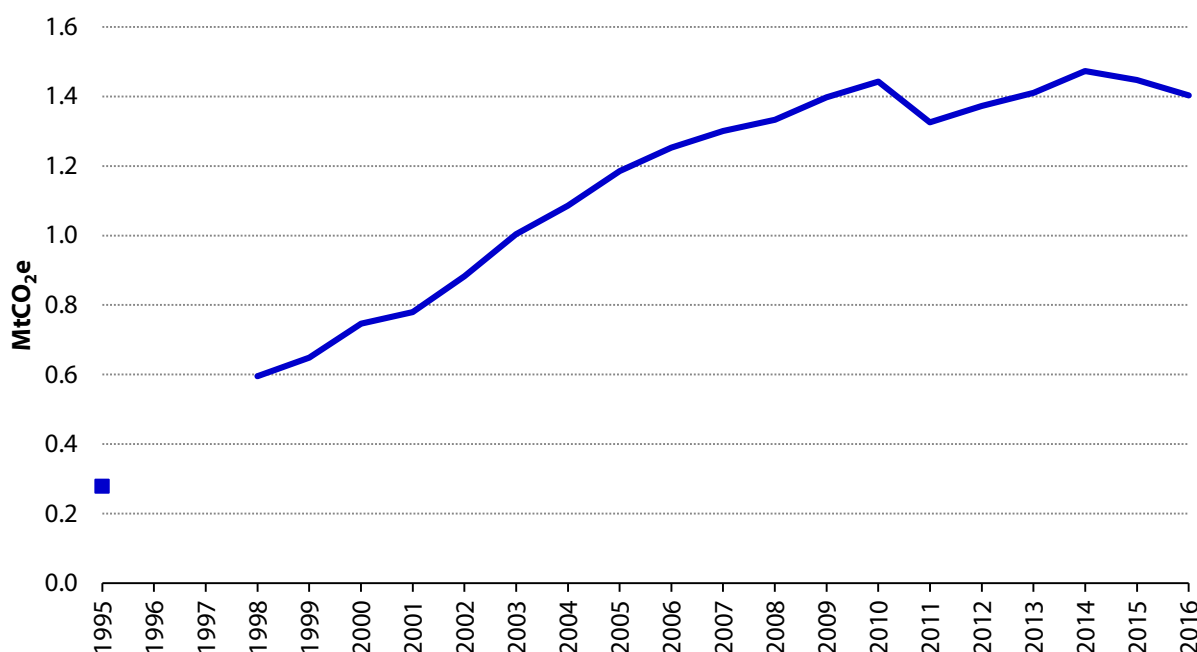
Note: The Index of Production measure covers production in the mining, quarrying, manufacturing, energy supply, water supply, and waste management sectors.

F-gases

F-gas emissions are currently mainly accounted for within the Industry sector, although some sources of F-gas emissions also occur in transport or commercial buildings:

- F-gas emissions accounted for 3.6% (1.4 MtCO₂e) of total Scottish emissions in 2016.
- In contrast to F-gas emissions in the UK as whole, F-gas emissions in Scotland did not peak in 1997. Rather, they have increased almost continuously since 1995, with a total increase of over 400% (Figure 5.3). F-gas emissions fell by 3.1% in 2016.
- Around 35% of F-gas emissions stem from refrigeration, 38% from air conditioning and 10% from residential emissions.
- A large part of the increase in F-gas emissions is due to use in commercial and industrial refrigeration together with an increase in air conditioning. These emissions have increased from 0.05 MtCO₂e 1995 to over 1 MtCO₂e in 2016:
 - Of the 0.5 MtCO₂e emissions in 2016 from refrigeration, around 55% occur in commercial refrigeration, 31% in industrial refrigeration and 12% in refrigerated transport.
 - The 0.5 MtCO₂e emissions in 2016 from air conditioning were split between mobile (51%) and stationary (48%) air conditioning.

Figure 5.3. Emissions from F-gases in Scotland (1995-2015)



Source: NAEI (2018).

Without policy intervention it is likely that F-gas emissions would continue to increase due to increasing use of products and appliances using F-gases, such as refrigeration and air conditioning. Many applications already have cost-effective alternatives to F-gases available.

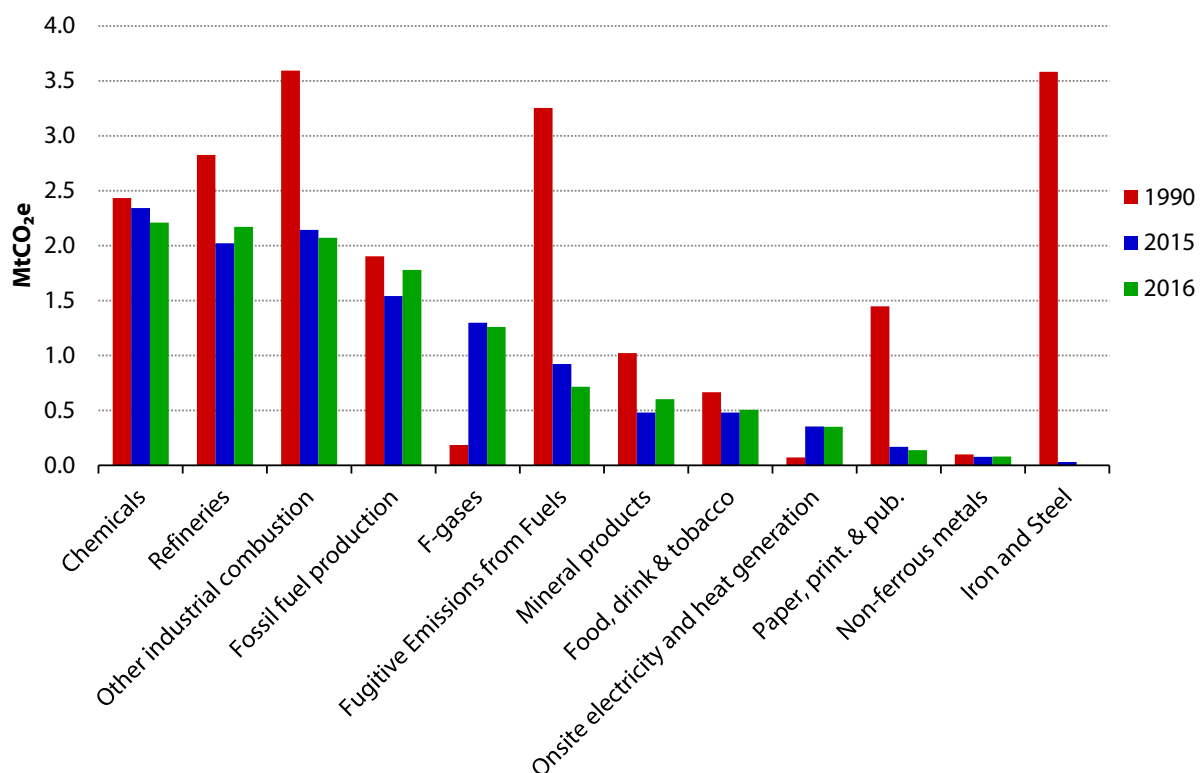
EU regulation currently exists to significantly reduce F-gases by 2030. The UK's decision to leave the EU causes uncertainty about the future of the F-gas regulation. F-gases are not a devolved matter, with regulation determined at the UK and EU level.

Progress in reducing emissions

In 2016, industry emissions were 45% lower than 1990, mainly due to a large decrease in iron and steel emissions (more than -99%) and emissions from paper, print and pulp (-90%). Emissions from refineries and the oil and gas extraction sector have also reduced emissions significantly. In contrast, emissions from on-site electricity and heat generation (i.e. autogeneration) and F-gas emissions have increased since 1990 (Figure 5.4).

The industry sector is strongly dependent on UK-wide policies (e.g. on carbon capture and storage) and EU policies (e.g. the EU Emissions Trading System and F-Gas Regulation). The Scottish Government has some direct influence on decarbonisation progress, primarily through energy efficiency policies.

Figure 5.4. Sources of industry emissions 1990, 2015, and 2016



Source: NAEI (2018).

Assessment of the final Climate Change Plan

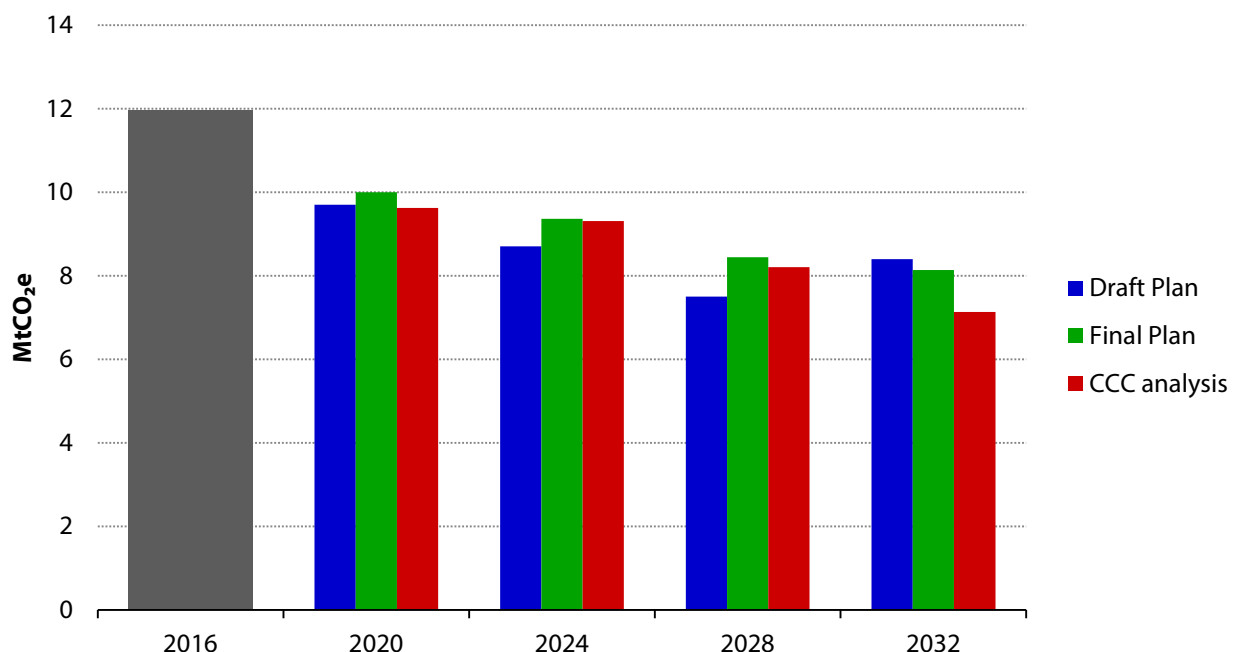
The Climate Change Plan does not assume radical reductions in emissions from the industry sector over the period to 2032. In part, this reflects the reserved nature of many of the policy levers and reliance on the EU emissions trading system (EU ETS), together with constraints on the extent to which industry itself has the capacity to fund the more expensive measures while competing internationally.

In the near term, this means that the Plan envisages a continuation of incremental deployment of energy efficiency measures and low-carbon heat, achieving a 32% reduction in emissions between 2016 and 2032 (Figure 5.5).

In the longer term, decarbonisation of industry will be required, including through the deployment of carbon capture and storage (CCS) on Scottish industry. Scotland is well placed to deploy CCS, given its proximity to potential CO₂ storage sites in the North Sea. The Energy Strategy's vision for the role of CCS in long-term decarbonisation is appropriate, emphasising the importance of its application to industrial processes, as well as potential roles in power, supporting heat decarbonisation and its combination with bioenergy for negative emissions.

Whilst the strategy remains to kick-start the deployment of CCS with power sector projects, Scotland is reliant on the UK Government to award funding and/or Contracts for Difference to power CCS projects.⁴⁸ If Scottish CO₂ transport and storage infrastructure can be developed, whether on the back of power projects or through other means, industry projects could then connect to this. The Plan limits the uptake of CCS until after 2030.

Figure 5.5. Comparison of industry emissions in the Climate Change Plan and CCC scenario



Source: Draft Climate Change Plan, Climate Change Plan, CCC analysis.

⁴⁸ Award of Contracts for Difference are a reserved matter.

Chapter 6: Transport



Table 6.1. Summary of progress in the transport sector	
Milestones	Progress
Reduce energy consumption (across all sectors) by 12% by 2020, against a 2005-2007 baseline.	In 2015, transport energy consumption was 4% lower than the baseline, but this target was met when calculated across all sectors.
An average efficiency for new cars of less than 95 gCO ₂ /km by 2020/21.	In 2017, the mean CO ₂ test cycle intensity of new cars increased to 120.1 gCO ₂ /km from 120.0 gCO ₂ /km (+0.1%).
Proportion of ultra-low emission new cars and vans registered in Scotland annually to reach 100% by 2032.	In Scotland, 1.2% of car sales were EVs in 2017, up from 0.7% in 2016. Total EV sales increased by 67% in 2017.
10% of everyday journeys to be made by bike, by 2020, as measured by travel-to-work data in the Scottish Household Survey.	In 2016, only 3% of adults commuted by bike to work.
10% of transport fuels to be from renewables by 2020.	Biofuels had a 3.1% share of road fuels in the UK as a whole in 2016, down 0.03 percentage points from 2015. ⁴⁹

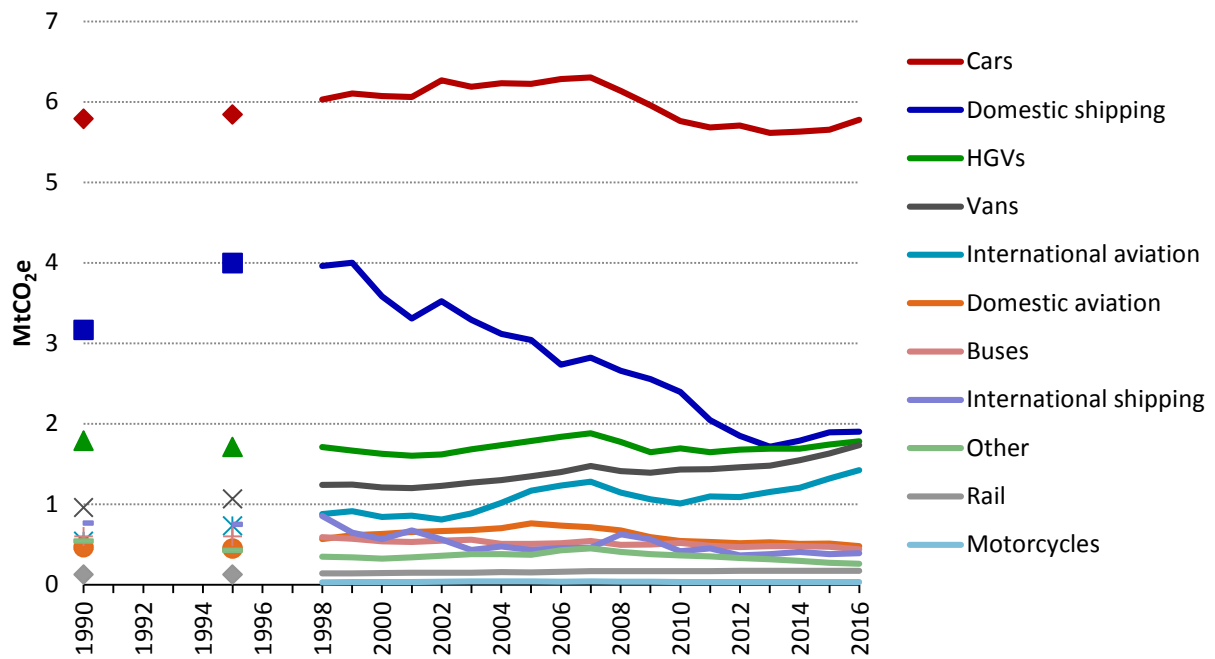
Latest emission trends and drivers

Scottish climate targets cover emissions from all transport in Scotland, including Scotland's share of international aviation & shipping (IA&S) emissions. Transport emissions increased by 2% in 2016 and accounted for 37% of all Scottish emissions:

- Domestic transport emissions increased by 1.6% in 2016, the third consecutive annual increase, to 12.6 MtCO₂e. This is 7% below the level in 1990.
- Emissions from international aviation and shipping increased in 2016 by 7% to 1.8 MtCO₂e. IA&S emissions in 2016 were 40% higher than 1990 levels.
- Cars, vans and HGVs account for 65% of total transport emissions in Scotland and are of particular importance for the achievement of existing Scottish emissions targets. Emissions from these modes have increased in recent years (Figure 6.1):
 - Emissions from cars increased by 2% in 2016 to 5.8 MtCO₂e.
 - Emissions from vans have experienced significant increases since 2010, and rose by around 6% in 2016 to 1.7 MtCO₂e.
 - Emissions from heavy goods vehicles (HGVs) increased in 2016 by 2% to 1.8 MtCO₂e.
- The increase in emissions from domestic transport reflects increasing vehicle-kilometres, both of cars (+2.0% in 2016) and light goods vehicles (+5.6% in 2016). This trend has been slow but continuous and persistent since 2010 (Figure 6.2).

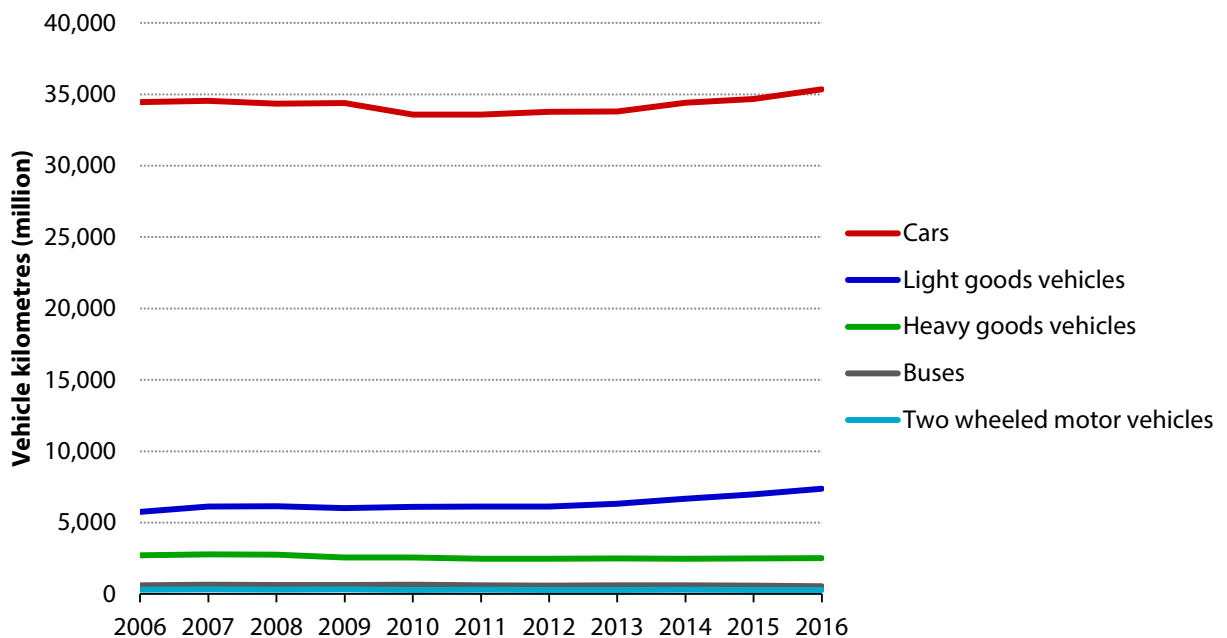
⁴⁹ Data are not available separately for Scotland, so the UK proportion is assumed to apply to Scotland.

Figure 6.1. Transport emissions by mode (1990-2016)



Source: NAEI (2018).

Figure 6.2. Vehicle-kilometres (2006-2016)



Source: Scottish Transport Statistics No 36: 2017 Edition.

Emissions from aviation and shipping

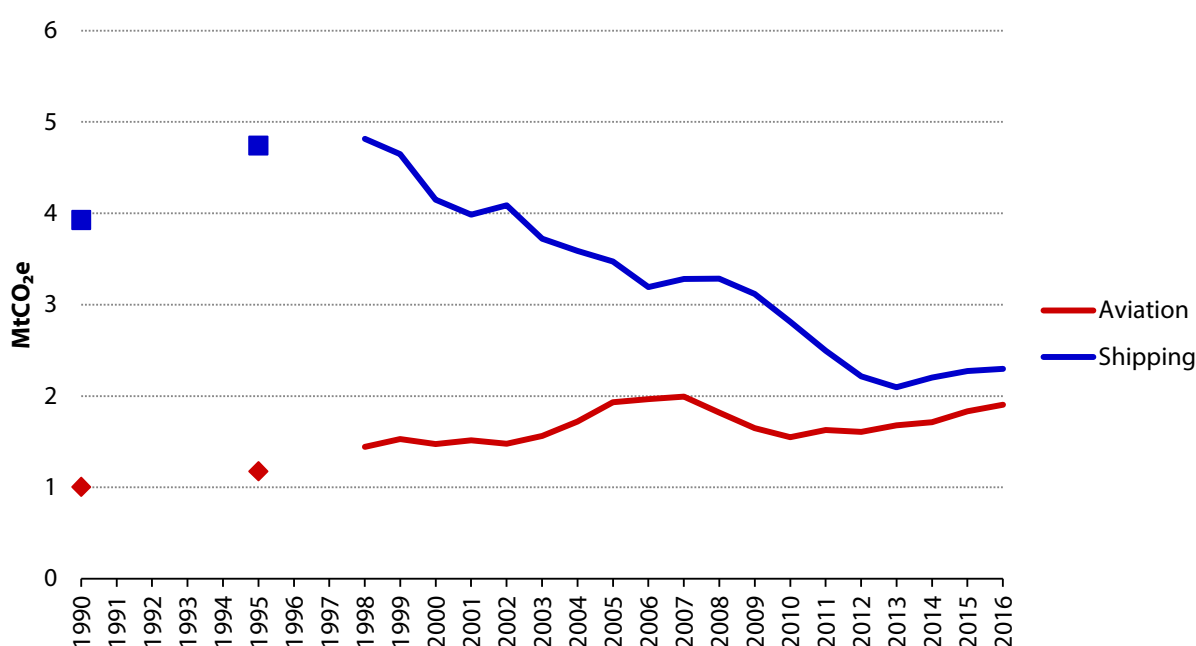
Aviation emissions grew 4% in 2016 compared to 2015, to 1.9 MtCO₂e (Figure 6.3). They are now 90% higher than 1990 levels. This has largely been due to an increase in emissions from international flights.

- Emissions from domestic flights fell by 7% to 0.5 MtCO₂e, and were 49% below 1990 levels.
- In contrast, emissions from international flights increased by 8% in 2016 to 1.4 MtCO₂e, and were 165% greater than in 1990.

Shipping emissions increased by 1% in 2016 compared to 2015, to 2.3 MtCO₂e. They are now 42% below 1990 levels. Both domestic and international shipping emissions have been falling since 1990.

- Domestic shipping emissions rose marginally by 0.4% in 2016 to 1.9 MtCO₂e, and are 40% below 1990 levels.
- International shipping emissions increased by 4% in 2016 to 0.4 MtCO₂e, and are now 49% below 1990 levels.

Figure 6.3. Aviation and shipping emissions (1990-2016)



Source: NAEI (2018).

Note: Both domestic and international aviation and shipping emissions are included.

In June 2017 the Scottish Parliament voted to replace Air Passenger Duty (APD) in Scotland with a new devolved Air Departure Tax (ADT), which it planned to cut by 50% and remove entirely when feasible. However, after legal delays, Ministers confirmed in June 2018 that this tax cut would not take place at the proposed start date of April 2019. APD will continue to apply to flights departing Scottish airports, and HMRC will continue to have responsibility for administering APD.

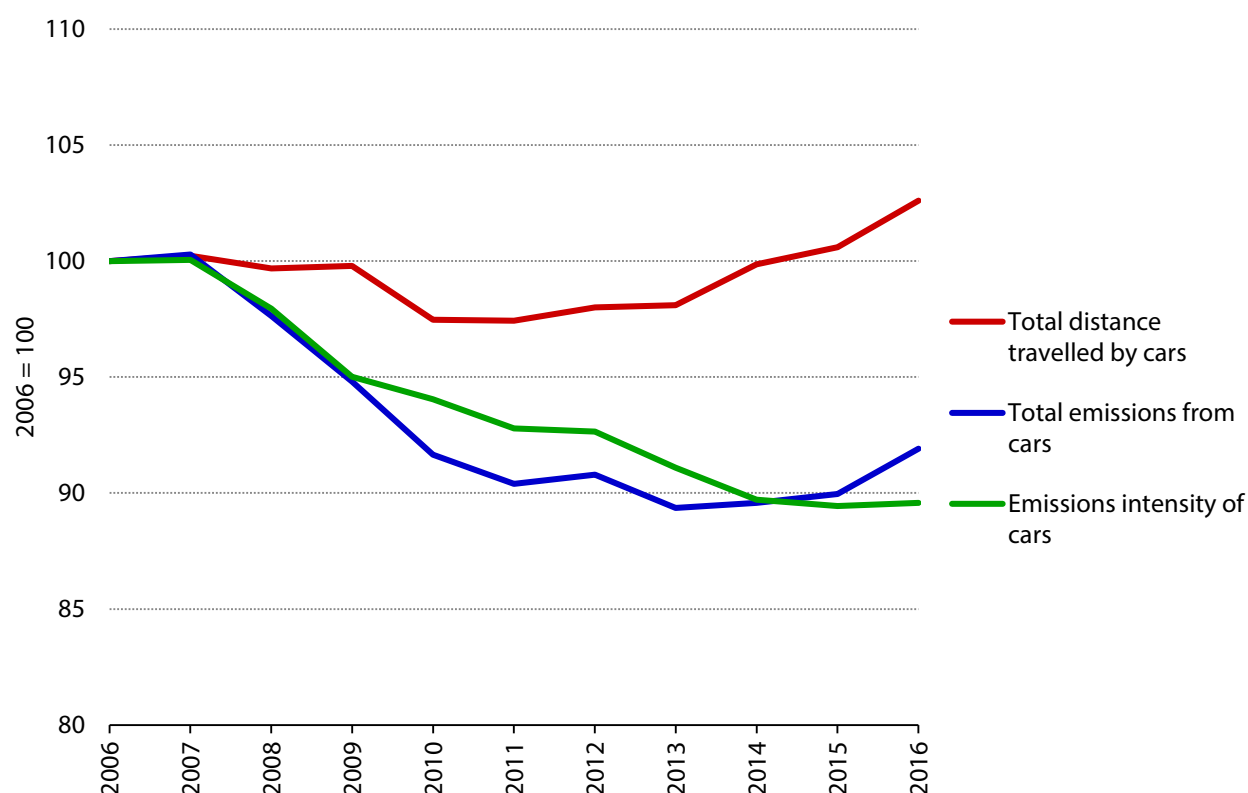
Reducing emissions from transport in Scotland

New car efficiency

There has been some progress in improving new car efficiency both in test-cycle efficiency and real-world CO₂ intensity, mainly through the EU new car CO₂ regulation targeting 95 gCO₂/km by 2020. However, progress has been slow and at the current rate the 2020 target will not be reached:

- The CO₂ test cycle efficiency of new cars in Scotland deteriorated slightly from 120.0 gCO₂/km to 120.1 gCO₂/km (+0.1%) in 2016. Progress has stalled since improvements of 3% in 2014 and 2% in 2015. The efficiency is marginally better than the UK average of 121.0 gCO₂/km.
- The overall real-world emissions intensity (emissions per km travelled) of all cars in Scotland was 163 gCO₂e/km in 2016. There has been slow progress in improving the overall emission intensity of the car fleet in Scotland, but more needs to be done. Since 2006, emissions have fallen by 8% despite a 2.6% increase in distance travelled (Figure 6.4).
- Evidence has also continued to mount that there is a large and growing gap between test-cycle and real-world emissions for new cars.⁵⁰

Figure 6.4. Overall car emissions intensity (emissions per km) 1995-2016



Source: NAEI (2018) and Scottish Transport Statistics No 36: 2017 Edition, CCC analysis.

⁵⁰ CCC (2018) *Reducing UK emissions - 2018 Report to Parliament*.

Progress developing electric vehicle markets

There has been an increase in electric vehicle (EV) sales at the UK level since 2010, although this is from a low base and has been largely driven by sales in England (which represented 92% of total EV sales in 2017):

- Sales of electric vehicles in Scotland accounted for 4.9% of UK EV sales in 2016, lower than Scotland's share of total UK vehicle sales (8.2%).
- New electric vehicle sales as a percentage of total sales were lower in Scotland (1.2%) than the UK average (1.9%).
- The proportional growth of EV sales in Scotland was faster than in England in 2017. Scottish EV sales grew by 67%, compared to smaller proportional increases in England (24%). This growth rate in Scotland showed the opposite trend to total car sales, which fell by 8% in Scotland in 2017.

Infrastructure for electric vehicles in Scotland is improving, following on from 'Plugged in Places' funding from the Department for Transport (DfT):

- Domestic charge point funding is available through the Energy Saving Trust (EST). The typical cost for a home charge point and installation is approximately £1,000.⁵¹ The Office for Low Emission Vehicles (OLEV) Homecharge scheme currently offers applicants £500 towards this cost. EST will provide up to £300 further funding on top of this.
- The ChargePlace Scotland network connects charge point networks and owners with EV drivers. Most of the charging points are currently free to use. As of August 2017, there were over 1,100 charge points in the ChargePlace Scotland network with a total of 2,100 connectors, over 300 of which were rapid chargers.⁵² The Scottish Government has pledged to invest in the ChargePlace network until at least August 2019.
- The 2018 Programme for Government strengthened support for electric vehicles, especially charging infrastructure. £15 million was allocated to fund 1,500 new charge points in homes, businesses and communities including 150 new public charge points.
- The Switched on Towns and Cities Challenge Fund was launched by Transport Scotland in June 2018. It is a competitive capital fund for schemes which will incentivise, encourage and promote the use of plug-in EVs in a single town or city. Projects containing solutions to address EV charging for residents living in tenements or with no off-street parking are particularly encouraged. 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 the 2018 Programme for Government pledging to support 20 towns and cities by 2025.

To encourage EV sales, the Scottish Government has a number of schemes and policies in place:

- The Energy Saving Trust runs schemes to subsidise the cost of electric vehicles. The Electric Vehicle Loan and Low Carbon Transport Business Loan schemes both provide loans of up to £35,000 towards the cost of an electric vehicles. This funding can be used on top of the OLEV plug-in grant scheme.⁵³ Both programmes will expire in March 2019, though the Scottish

⁵¹ <http://www.energysavingtrust.org.uk/scotland/grants-loans/domestic-charge-point-funding>

⁵² RAC Foundation (2017) *Electric Vehicle Charge Point Usage in Scotland*.

⁵³ OLEV (2018) *Plug-in car grant eligibility guidance*.

Government has pledged to continue providing loans until at least 2020.⁵⁴ The overall budget for the Low Carbon Transport Loan increased from £8m to £20m for 2018/19.

- The Switched on Fleets initiative offers free analysis of opportunities to deploy plug-in vehicles in each of Scotland's 32 Community Planning Partnerships (CPPs). Transport Scotland provided £2.5 million of grant funding for public sector organisations to buy or lease plug-in vehicles from 2014 to 2016, which resulted in over 240 new vehicles being introduced. The budget for Switched on Fleets has increased to £4.8 million in 2018/19, with a pledge in the 2018 Programme for Government to add a further 500 ULEVs to public fleets.
- The eighth round of the Scottish Green Bus Fund opened to bus operators, local authorities and regional transport partnerships in May 2018. The fund operates as a challenge fund, offering grants for up to 80% of the price differential compared to a diesel equivalent. The previous seven rounds of the fund have provided over £16 million of funding, resulting in over 360 low-carbon emission buses joining the Scottish fleet.

The Energy Strategy also contains additional measures to help develop a market for electric vehicles in Scotland, though these are not specific in nature:

- Expand electric charging infrastructure between now and 2022.
- Create Scotland's first 'electric highway' on the A9, with charging points along the route.
- Accelerate the procurement of ULEVs in the public and private sectors, transforming public sector car and van fleets by the mid-2020s and commercial bus fleets by the early 2030s.
- Introduce large-scale pilots across the country, removing barriers and encouraging private motorists to use ULEVs.
- Address the particular challenges to expanding the charging infrastructure in Scotland, such as charging at tenement properties.
- Take steps to better integrate electric vehicle policy within wider energy systems policy including renewable generation and energy storage systems.

Combined, the policy framework above provides support for the remainder of the 'growth' phase described in the Switched on Scotland Plan from 2015-2020, and is the foundation for supporting the growth of EV market which could sustain 100% of new car sales by 2032, described in the Switched on Scotland plan as the 'take-off' period:

- As announced in our latest UK progress report, the Committee will set an indicator for the number of electric vehicle chargers required to support the levels of EV uptake required to meet the fifth carbon budget.
- Initial research conducted for the Committee indicated that across Great Britain 1,200 rapid chargers (around 100 in Scotland) near major roads may be required by 2030 to meet current service levels, as well as 27,000 chargers (2,100 in Scotland) around local towns and regions.
 - This is based on a different assumed trajectory of EV sales to than in Scotland's Climate Change Plan (Figure 6.6) so is not directly comparable, but is indicative of the level of progress that may be required to drive EV sales targets over the next twelve years.

⁵⁴ Transport Scotland (2017) *Switched On Scotland Phase Two: An Action Plan For Growth*.

- At the beginning of June 2017, there were 2,548 public charging points across Scotland (15.3% of total UK points), 737 more than in June 2017, an increase of 41%.⁵⁵
- Current support for EV infrastructure has been pledged up to 2022 at the latest, and funding for an additional 150 public charging points was announced in the 2018 Programme for Government.
- This suggests that Scotland has the right level of ambition for public charging infrastructure, but careful planning will be needed to ensure that charging points are in the right places and of the right type to meet demand throughout Scotland in 2032.
- The Scottish Government should also consider the effectiveness of non-financial incentives such as preferential road access and free parking when designing policy to increase the uptake of electric vehicles.

Behaviour change

Scottish transport statistics show that in 2016 only 3% of journeys to work were by bike, well below the 2020 ambition of 10% of all everyday journeys. The Cycling Action Plan outlines what the Scottish Government, local authorities and all key partners can do to achieve the target, mainly supporting local authorities and Regional Transport Partnerships.

The Smarter Choices Smarter Places (SCSP) programme is one of the main policies which supports behaviour change initiatives to increase 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.
- In May 2018, the fund was expanded to include a £2 million Open Fund. This funding is available for public, community and third sector organisations to encourage behaviour change.

The introduction of Low Emission Zones, as announced in the 2018 Transport (Scotland) Bill, may also help encourage behaviour change and reduce vehicle traffic in cities. Low Emission Zones are primarily an air-quality policy, but can have significant impact on emissions and transport behaviour change in cities when paired with good support for walking, cycling and public transport.

Rail electrification

The Scottish Government has a rolling programme of electrification which forms part of a wider £5bn investment package for Scotland's railway infrastructure. Of the 2,776 km of rail track in Scotland, a quarter (711 km) is electrified:

- The programme has to date delivered the Airdrie to Bathgate Railway, the Cumbernauld electrification project, and the £12m Paisley Canal electrification project.

⁵⁵ <https://www.zap-map.com/statistics/>

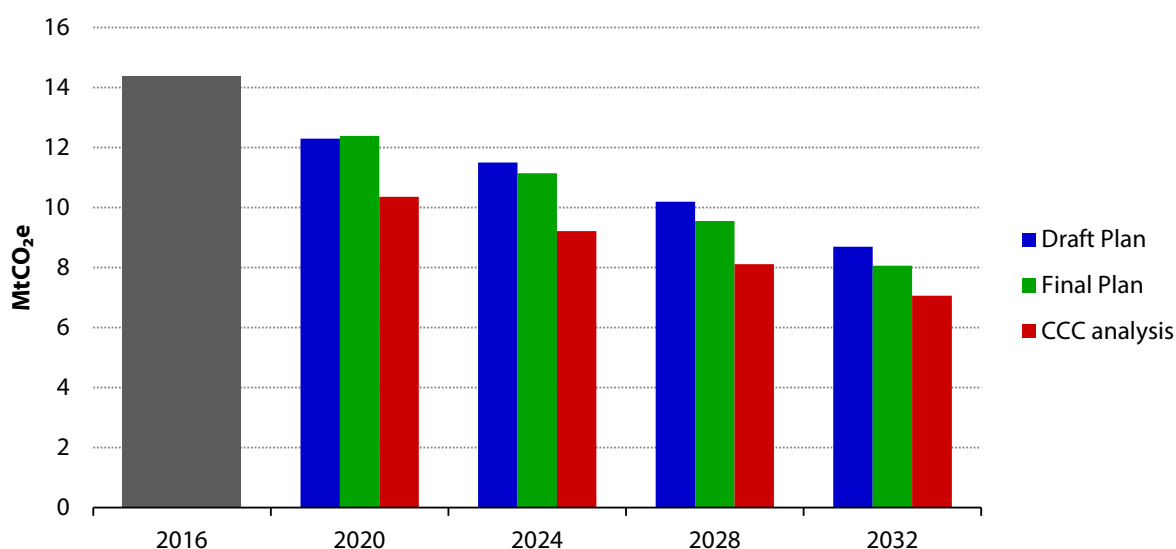
- The Edinburgh to Glasgow via Falkirk line has been fully electrified and operational since December 2017.
- The electrification of the Stirling/Alloa/Dunblane lines is planned to be completed by December 2018 and will improve journey times for passengers traveling to Edinburgh or Glasgow. The first phase went live in May 2018.
- Electrification of the Shotts line between Holytown Junction and Midcalder Junction will deliver 74km of electrified railway and is planned to be in operation by March 2019.

Assessment of the final Climate Change Plan

As recommended by the Committee, the final Plan adopts the more ambitious Programme for Government targets for ULEV sales, at 100% of new car and van sales by 2032. This is much more ambitious than the draft Plan and the UK Road to Zero target of ending the sale of conventional petrol and diesel vehicle sales by 2040.

Different assumed growth profiles in sales mean that ULEV sales in the Plan only exceed the CCC trajectory from 2030 onwards (Figure 6.6). The more back-ended sales growth profile means that the cumulative number of new EV sales by 2032 is approximately 20% lower in the Plan than the CCC scenario despite higher in-year sales in 2032 (Figure 6.7). Consequently, emissions in the Plan in 2032 are 1.0 MtCO₂e higher than the CCC scenario (Figure 6.5), although the level of ambition has been increased by 0.6 Mt since the draft Plan.

Figure 6.5. Comparison of transport emissions, including international aviation shipping, in the Climate Change Plan and CCC scenario

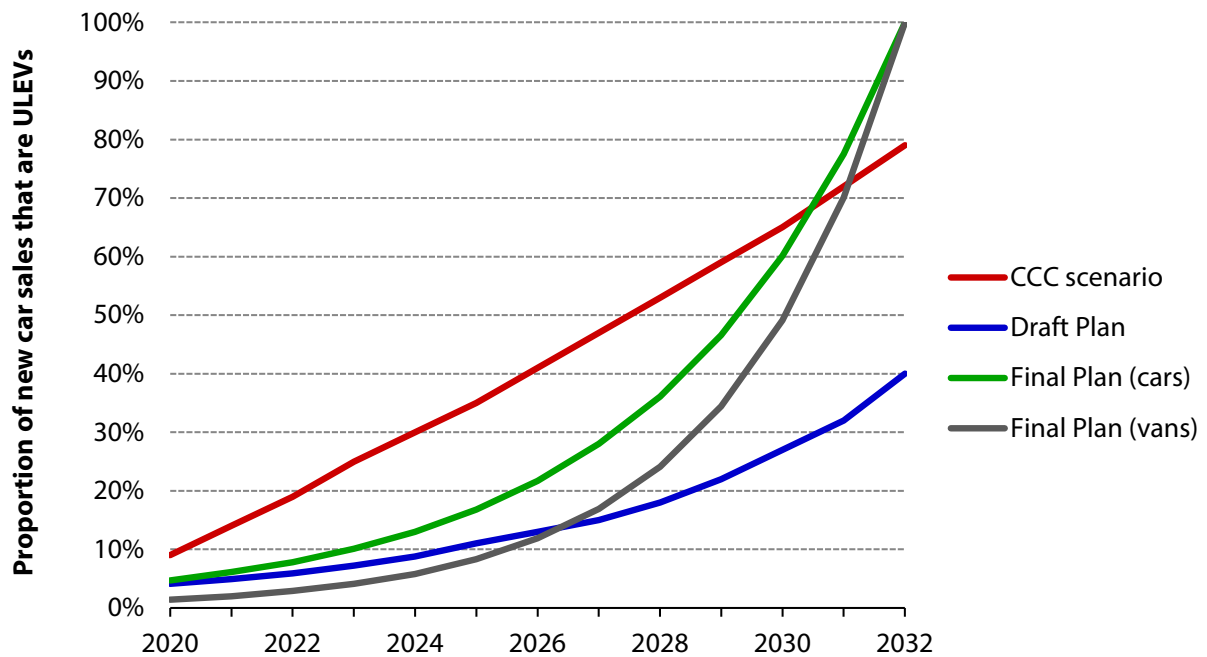


Source: Draft Climate Change Plan, Climate Change Plan, CCC analysis.

Notes: The CCC scenario contained a considerable fall in emissions (1.2 MtCO₂e) from transport from 2014 to 2016, largely driven by improvements in road vehicle efficiency. These reductions have not materialised in outturn data which increased by 0.6 Mt from 2014 to 2016. This was primarily due to a lack of progress in new car CO₂ intensity and an increasing gap between test-cycle and real-world emissions.⁵⁶ There is now a large gap between 2016 emissions and the CCC scenario in 2020.

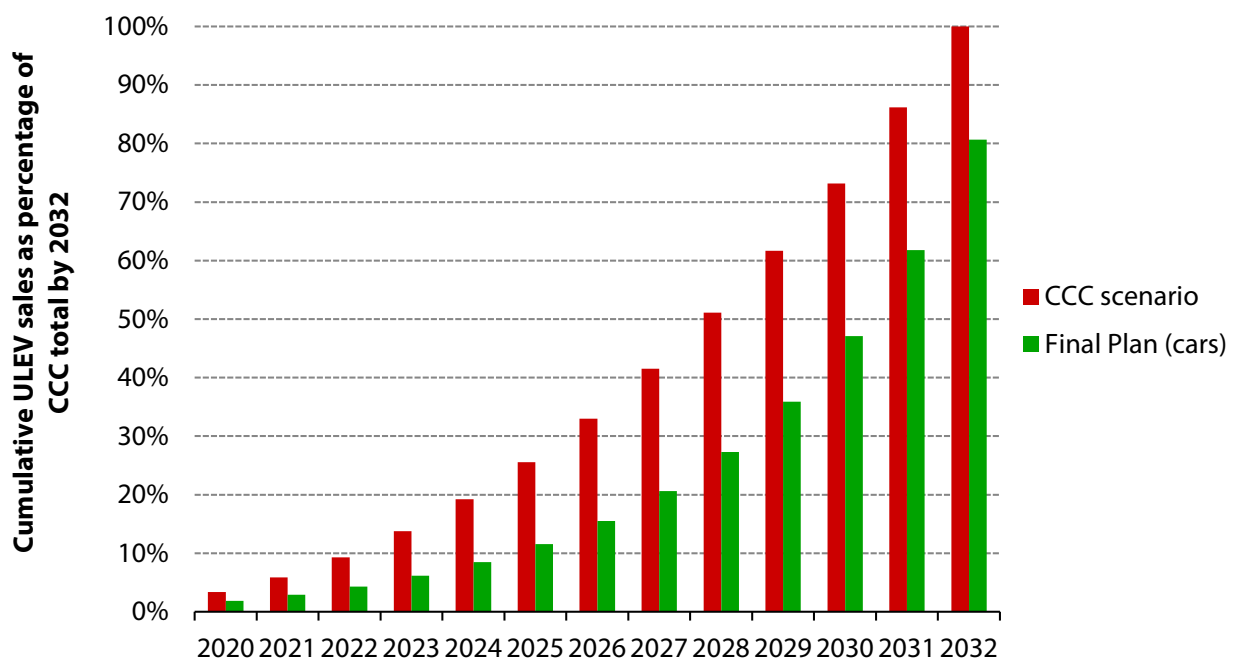
⁵⁶ CCC (2018) *Reducing UK emissions - 2018 Report to Parliament*, Box 5.3.

Figure 6.6. ULEV sales in the Climate Change Plan and CCC scenario (2020-2032)



Source: Draft Climate Change Plan, Climate Change Plan, CCC analysis.

Figure 6.7. Cumulative ULEV sales in the Climate Change Plan and CCC scenario (2020-2032)



Source: Climate Change Plan, CCC analysis.

Chapter 7: Agriculture and land use, land-use change and forestry



Table 7.1. Summary of progress in agriculture and LULUCF	
Milestones	Progress
<p>Increase the rate of afforestation to plant 10,000 hectares (ha) per year, with 100,000 ha planted from 2013-2022. This rate will increase to:</p> <ul style="list-style-type: none"> 12,000 ha per year from 2020/21 14,000 ha per year from 2022/23 15,000 ha per year from 2024/25 	<p>7,100 ha were planted in 2017/18. The annual target has been missed.</p> <p>From 2012/13 to 2017/2018, only 39,400 ha have been planted (6,600 ha per year on average).</p> <p>To reach the 100,000 ha target, an average of 15,000 ha needs to be planted in each of the next four financial years.</p>
<p>Restore 50,000 ha of degraded peatland by 2020, increasing to 250,000 ha by 2030.</p>	<p>From 2012 to 2017, more than 10,000 ha of degraded peatland received restoration activity under Peatland ACTION.</p> <p>Peatland ACTION planned to restore 8,000 ha of damaged peatlands in 2017/18. Scottish Government funding for peatland restoration was reduced by 40% in the Draft Budget for 2018/19.</p>
<p>0.8 MtCO₂e (9%) reduction in emissions from the agriculture sector from 2018-2032.</p> <p>The Climate Change Plan did not contain specific quantitative targets for measuring progress in the agriculture sector. However in the next few years, the Scottish Government also expects to see:</p> <ul style="list-style-type: none"> An increase in the share of farmers carrying out soil tests. An increase in the share of farms completing nutrient management plans. 	<p>Emissions from agriculture have been largely flat, falling by an average of 0.3% over the last five years. To achieve the emissions reductions targets in the Plan, emissions will have to fall faster, at an average rate of 0.5% per year until 2032.</p> <p>There are no public statistics available on the level of soil testing or nutrient management plans.</p> <p>A more robust reporting framework should be put in place, which includes the targets on emissions from nitrogen fertiliser and from the beef, sheep and dairy sectors suggested in the Climate Change Plan.</p>

Latest emission trends and drivers

Emissions from the agriculture sector are largely non-CO₂ gases, with over half (57%) due to methane and 30% due to nitrous oxide (N₂O). Enteric emissions make up 49%, followed by agricultural soil emissions (15%) and managing waste and manure management (14%).

Emissions have declined by 14% between 1990 and 2016, although reductions have slowed since 2008 (Figure 7.1). Overall, the majority of emissions reductions since 1990 can be attributed to efficiency improvements in farming, fewer livestock, a reduction in nitrogen fertiliser use, and a reduction in grassland ploughed for crop production:

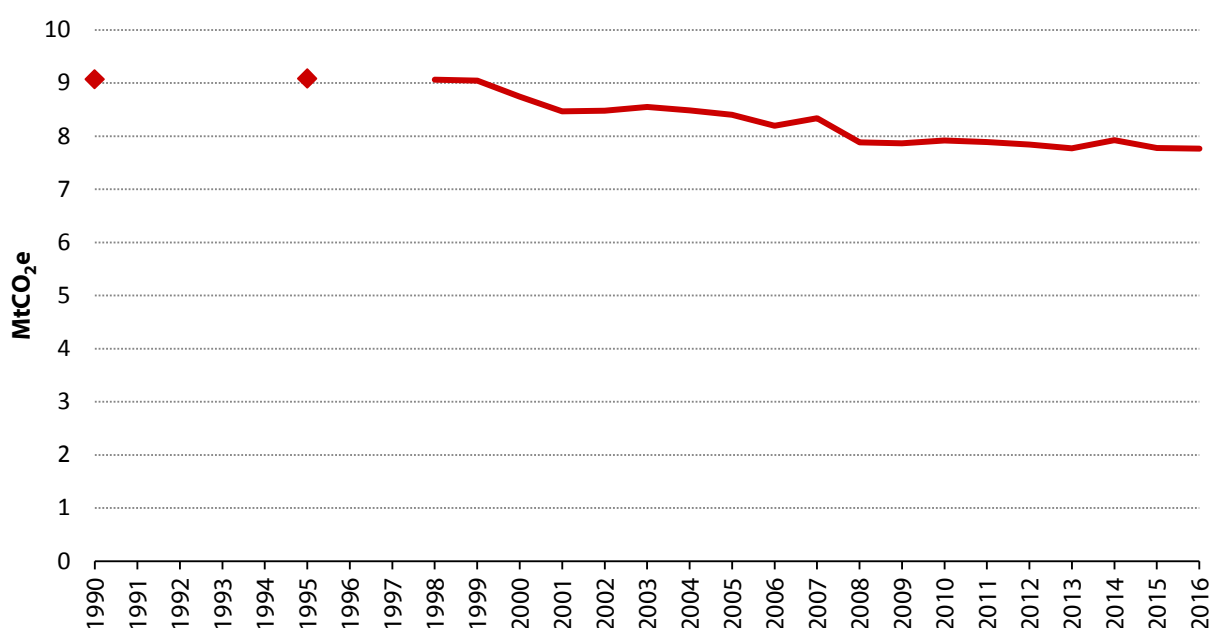
- Methane emissions fell by 15% between 1990 and 2016. The steady reduction in methane emissions reflects the falling numbers of livestock and improved livestock productivity.

- Nitrous oxide emissions have declined by 13% since 1990 due to reductions in fertiliser use, but are largely unchanged in the last five years, falling by 0.5% from 2011 to 2016.
- CO₂ emissions are only 13% of agriculture emissions, mainly from mobile machinery and have changed little in the last decade, increasing by 0.3% per year on average since 2006.

The land use, land-use change and forestry (LULUCF) sector was a net-emission sink in Scotland in 2016, absorbing 8.4 MtCO₂e.⁵⁷ This is mainly due to Scotland's large forest area, around 1.3m hectares (ha), which absorbed 12.7 MtCO₂e in 2016 (Figure 7.2):

- The main source of emissions in this sector is land use related to agriculture (i.e. cropland and grassland), emitting 2.1 MtCO₂e in 2016.
- The majority of emissions associated with peatland are not included in the current emissions accounting system. This is an issue for Scotland, where most of the UK's upland peat is located. Similarly, carbon sequestration from the restoration of peat (e.g. re-wetting of peatland) is not currently captured in the emissions inventory. It is planned to be included in future inventory updates.
- There is ongoing uncertainty in the emissions inventory for the agriculture, land use and forestry. Chapter 1 describes the impact of changes to inventory methodologies for agriculture and LULUCF.

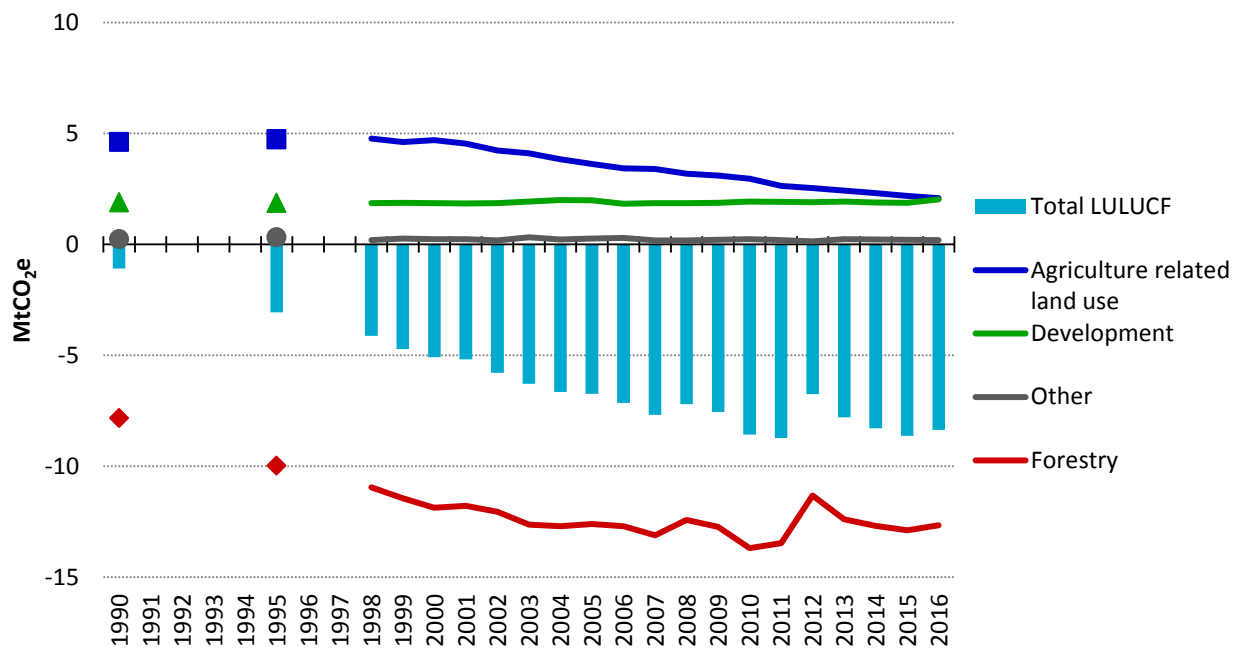
Figure 7.1. Agriculture emissions (1990-2016)



Source: NAEI (2018).

⁵⁷ The size of the estimated net-sink has changed considerably since last year's report, reflecting revisions in the inventory following improvements in the methodology. See Chapter 1 for more details.

Figure 7.2. LULUCF emissions by source 1998-2016



Source: NAEI (2018).

Note: Agriculture related land use includes emissions from croplands and grasslands.

Policy progress

Emissions from agriculture account for 20% of total Scottish emissions and agriculture-related land use accounts for a further 5%, making agriculture-related emissions the third largest emissions sector (after industry and transport). This illustrates how important it will be to reduce emissions in this sector, especially as in recent years there has not been any significant progress in reducing agriculture emissions.

Forestry acts as a carbon sink, removing 12.7 MtCO₂e in 2016. The estimated size of this sink has increased compared to the previous inventory. Under the latest business as usual projections, the carbon sink is predicted to decline in future. More action is urgently needed to utilise the carbon sequestration potential of forests and peatland, and to prevent further emissions.

Agriculture

Scottish farming post-CAP

The impact of the UK's vote to leave the EU on emissions savings in agriculture remains uncertain. The main impact on emissions savings from possible Common Agricultural Policy (CAP) withdrawal would most likely result from the changes in funding from the agri-environmental schemes under CAP Pillar Two:

- The Scottish Government consulted on its proposals for a rural funding transition period in June 2018. It did not suggest any specific climate change measures, but stated that many of the measures described in this consultation would have co-benefits for both agricultural productivity and for reducing Scotland's Greenhouse Gas Emissions.

- The consultation highlighted funding uncertainty for the Agri-Environment Climate Scheme, which operates under the Scottish Rural Development Programme (SRDP). The scheme was formed to provide £350 million of funding from 2014-2020 to promote land management practices which protect and enhance Scotland's natural heritage, improve water quality, manage flood risks, and mitigate and adapt to climate change.

The Committee recommends that the proposed post-CAP framework should contain provisions for financial support to agricultural emissions reduction and increased carbon sequestration.

This could include measures, for example, for crops and soils, sheep health, livestock diets and breeding, waste and manure management, and energy efficiency.

Culture and behavioural change

The main programme for encouraging behaviour change across farms in Scotland is the Farming for a Better Climate initiative (FFBC) launched by the Scottish Government and Scotland's Rural College in 2009. It is designed to encourage voluntary uptake of 'win-win' actions which both reduce carbon emissions and increase profitability. FFBC operates in five key areas:

- Using energy and fuels efficiently
- Developing renewable energy
- Locking carbon into soil and vegetation
- Optimising application of fertilisers and manures
- Optimising livestock management and storage of waste

Feedback to date has been positive, but a more extensive evaluation is currently ongoing. Initial evidence on the impact of the policy suggests that farmers who engage with it find it valuable, but not enough are aware of the initiative. The Climate Change Plan announced the intention to extend FFBC to enable more farmers to benefit from the lessons learned.

If the results of the evaluation are positive, FFBC should be extended and interact with as many farmers as possible. However if the programme is not producing results, the Scottish Government should consider alternatives to deliver deeper emissions reductions through behaviour change.

Policies which promote culture and behaviour change are an important lever in reducing agriculture emissions, but the voluntary-only approach has not led to significant emissions reductions to date and should be backed up with appropriate regulation.

Soils and nitrogen use

In 2015 the Scottish Government announced plans for compulsory soil testing every five to six years for arable and temporary grass. Those plans have not been implemented. Instead, farmers are encouraged to take up soil testing on a voluntary basis, through increasing awareness of the benefits. The Climate Change Plan states that farmers are expected to test the soil on all improved land every five or six years. This should be closely monitored, and compulsory testing reconsidered if voluntary action is not showing the necessary results.

The Second Report on Proposals and Policies (RPP2) proposed to achieve a 90% uptake of cost-effective nitrogen efficiency measures, but the Scottish Government no longer plans to introduce a mandatory regime. Instead, farmers are encouraged to take up better nutrient management planning through voluntary knowledge transfer and sharing of best practise

guides. The Plan commits to working with the agriculture and science sectors to assess the feasibility of and develop a target for reducing Scotland's emissions from nitrogen fertiliser.

Farmers can benefit from support through the Scottish Rural Development Programme's Farm Advisory service. This offers specialist advice, mentoring and funding, not only in soil and nutrient management but also in other climate change related measures.

Livestock efficiency

The ClimateXChange (2016) study "Nutritional strategies to reduce enteric methane emissions" showed that increasing the lipid content of diets can help to reduce enteric methane emissions:

- Those results are now being taken forward in a second study, which aims to test its feasibility and results in a practical on-farm setting. Results of the second phase of this research are expected in 2018.
- The Climate Change Plan contains plans to determine the practicality of a target for reduction in the intensity of emissions for beef, sheep and dairy sectors.

A separate ClimateXChange (2016) report "Livestock Health & Greenhouse Gas Emissions" found potential GHG emission savings for 12 livestock diseases, but some proved more manageable than others:

- Overall, the evidence suggests that emissions intensity could be reduced through a number of control measures, in particular for three diseases⁵⁸ which were considered more cost-effective and feasible to control.
- The Plan states that the Scottish Government will consult in 2018 on livestock health measures that the sector could adopt from 2019, including:
 - The establishment of one or more mandatory disease eradication schemes. This would place requirements on farmers to control the disease, similar to the approach for Bovine Viral Diarrhoea (BVD).
 - The establishment of one or more schemes focused on syndromes rather than diseases, such as calf/lamb mortality or infertility.
 - Vet-approved health plans.
 - Using market forces by requiring testing and declaration before sale of the most important production diseases.

The Scottish Government also plans to make better use of the statistical data they obtain on livestock in Scotland. Work is currently underway on how to present this data to farmers so that they can use it to increase the efficiency and performance of their livestock. The Scottish Government should look to introduce policies to drive the necessary efficiency reductions in livestock emissions that are informed by the second ClimateXChange diet study and the consultation on livestock health.

Slurry and manure

The Plan contains a policy development milestone to determine the feasibility of self-financing slurry and manure anaerobic digesters.

⁵⁸ Neosporosis (beef cattle); infectious bovine rhinotracheitis, IBR (dairy cattle); and parasitic gastroenteritis, PGE (sheep).

- Scotland's anaerobic digestion (AD) industry grew by more than two-thirds between 2014 and 2015. The Anaerobic Digestion and Bio Resources Association map⁵⁹ shows that there are at least 30 agricultural AD projects in operation in Scotland.
- A 2017 ClimateXChange report⁶⁰ found that without addition of other feedstocks (e.g. food waste or energy crops), the anaerobic digestion of slurry and farmyard manure is not robustly self-financing.
- However, the forthcoming ban on biodegradable waste going to landfill (Chapter 8) could be an opportunity to incentivise the construction and use of co-digestion facilities that include slurry and manure processing.
- Overall, the report concludes that the impact of AD alone on GHG emissions from slurry and manure in Scotland will be modest.

Improved slurry management measures could save 0.2 MtCO₂e per annum,⁶¹ approximately 2% of Scotland's agriculture GHG emissions. However, costs to farmers typically outweigh their individual benefits. Policy proposals in the Plan to determine how to consistently minimise emissions from slurry storage are therefore welcome, but a voluntary approach is likely to be insufficient due to financial barriers.

Land use

Land-use strategy

Scotland's second land-use strategy was published in March 2016. The report contained commitments to develop a more detailed reporting framework by December 2016, though this has not been published to date. The strategy contains ten indicators for success of the programme, the most relevant to climate change mitigation are monitoring of LULUCF greenhouse gas emissions and Gross Value Added (GVA) from agriculture and land use.

Peatlands

Peatlands cover over 20% of Scotland's land area. Scottish peatlands account for 60% of the UK's peatlands and 4% of Europe's total peat carbon store. Historically, these peatlands have been damaged or drained, but there has been little drainage over the past two decades.

Scottish peatlands are a vast carbon store containing over 6,500 MtCO₂e of carbon, equivalent to 140 years' worth of Scotland's total annual greenhouse gas emissions.⁶² Degraded peatlands risk significant carbon emissions whether or not they are currently accounted for in the inventory. More than half of Scotland's peatland area is damaged, 20% of which is badly degraded.

Restoring degraded peatland has potential to deliver annual GHG savings through sequestration of up to 19 tCO₂e per hectare per year in the most degraded areas. If all potential peatland restoration areas identified by ClimateXChange⁶³ are indeed restorable within a reasonable time frame and if action were to commence immediately in all areas, carbon abatement in the range

⁵⁹ <http://adbioresources.org/map>

⁶⁰ ClimateXChange (2017) *Farmyard Manure and Slurry Management and Anaerobic Digestion in Scotland*.

⁶¹ ClimateXChange (2018) *Slurry Storage on Scottish Farms – A Feasibility Study*.

⁶² SEPA (2017) *Peatland ACTION Carbon Facts and Figures leaflet*.

⁶³ ClimateXChange (2012) *Carbon savings from peatland restoration*.

of 0.5 – 4.8 MtCO₂e per year could be achieved by 2027. A realistic estimate will fall below this figure.

It is therefore important that action is taken to improve the condition of degraded soils, and to limit damaging practices such as horticultural use and intensive rotational burning on upland moors.

The Scottish Government has different policies to improve peatland condition:

- Scotland's 2014 National Peatland Plan⁶⁴ sets out proposals for research and awareness-raising. The main aim set out in the plan is to manage, protect and restore peatlands to maintain their natural functions, biodiversity and benefits. By 2020, the plan aims to see:
 - No more loss of peatlands with their condition improving rather than deteriorating.
 - A Peatland Code will be in place governing private funding of peatland conservation and restoration, and peatland management included in national carbon accounting.
 - The Flow Country (a large area of peatland and wetland in Caithness and Sutherland) will have moved towards being a fully inscribed World Heritage Site.

The objectives are reasonable, but the plan does not define a mechanism for action in these areas.

The Peatland ACTION project began in 2012 to deliver restoration. It is entering a new phase, with £8 million to spend on 8,000 ha of degraded peat restoration in 2017/18:

- From 2012 to 2017, more than 10,000 ha of degraded peatland received restoration activity under Peatland ACTION at an average cost of £815 per ha.
- Peatland restoration activities are also supported under the Agri-Environment Climate scheme within the SRDP.
- The Scottish Government 2018-19 Draft Budget saw reduced funding for peatland restoration compared to 2017/18, falling from £10m to £6m.⁶⁵

Forestry

Tree-planting rates have been declining since the 1970s, reaching a low of just 2,700 ha in 2009/10 (Figure 7.3). They have increased since then, largely as a result of the Forestry Grant Scheme under the SRDP. There is a target in place to increase the afforestation rate to 10,000 hectares per year, creating 100,000 hectares from 2012-2022. This 10,000 hectare target has yet to be achieved in any year. Despite this, the Climate Change Plan has increased the ambition to 15,000 hectares per year from 2025:

- After around 7,600 ha were planted in 2014/15, planting rates fell to 4,600 ha in 2015/16 and 4,800 ha in 2016/17.
- 7,100 ha were planted in 2017/18, meaning the annual target was missed.
- The reason for those low planting levels may be that the Scottish Government undertook a major transition from one grant scheme to another. Past evidence suggests that applicants delay submitting proposals until they are familiar with the new grant rates. Over 10,000 ha of

⁶⁴ Scottish National Heritage (2015) *Scotland's National Peatland Plan*.

⁶⁵ Scottish Government (2018) *Scottish Budget: Draft Budget 2018-19*.

new planting proposals were approved during 2017, an increase of 2,500 ha from the previous year.

- The Draft Budget for 2018/19 contained an increase of £6m for woodland creation compared to 2017/18.⁶⁶

Since 2012, only around 40,000 ha have been planted. Approximately 15,000 ha of new forest will need to be planted each year over the next four financial years if 100,000 ha are to be planted by 2022.

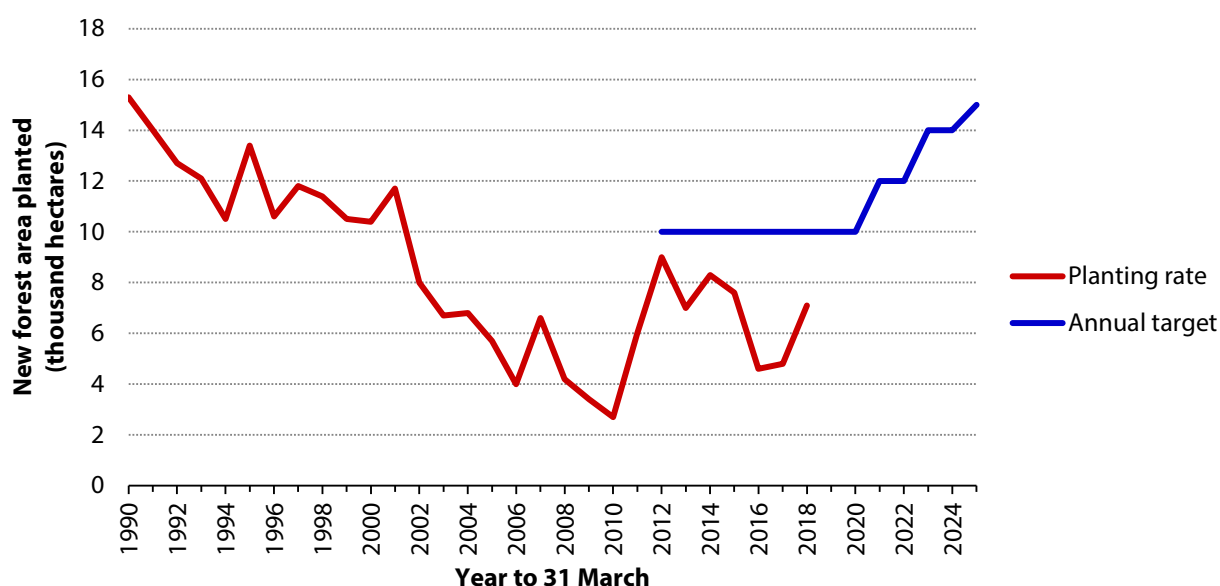
The SRDP is the main source of woodland creation in Scotland with the Forestry Grant Scheme (FGS) having £36m funding per year for 2014-2020. The scheme includes advice on types of trees to be planted. From April 2018 to March 2019, the Forestry Grant Scheme has a budget of £40 million for forest creation.

The Scottish Government has also taken action to increase woodland through the implementation of the Mackinnon Report⁶⁷ to streamline the planting approval process, provide more attractive grant rates for native woodlands in remote areas, and increase grant funding for woodland creation by £4m in 2017/18.

The 2018 Programme for Government pledged to publish a National Forestry Strategy with a long-term vision and objectives for forestry and woodland, with new arrangements in place by April 2019.

In last year's report, we attributed the 8% reduction in planting rates in 2014 to a delay in the launch of the Forestry Grant Scheme. However, planting rates have remained below targets despite an increase in planting rates in 2017/18. More action will likely be needed if targets are to be achieved.

Figure 7.3. New tree planting in Scotland (1990-2018)



Source: Forestry Commission (2018) *Woodland area, planting and publicly funded restocking: 2018 edition*.

⁶⁶ ECCLR (2018) *Committee Report on the Scottish Government 2018-19 Draft Budget*.

⁶⁷ Mackinnon (2016) *Analysis of current arrangements for the consideration and approval of forestry planting proposals*.

Assessment of the final Climate Change Plan

Agriculture

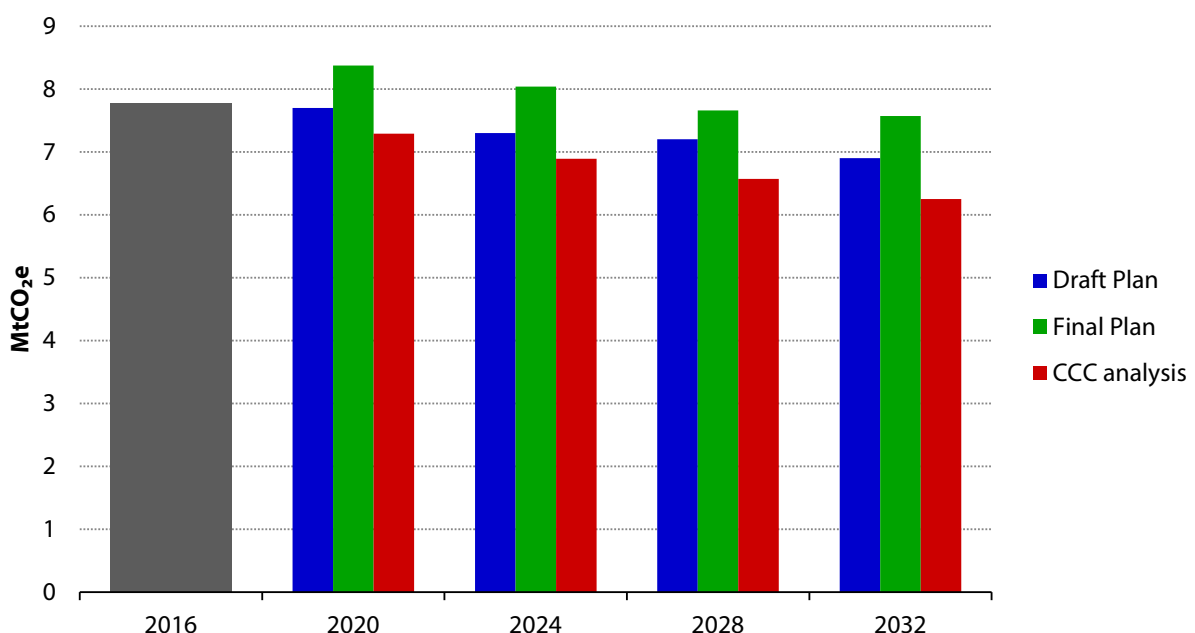
The final Climate Change Plan does not set out any non-voluntary measures and focuses on setting incentives instead of mandatory policies. Although the Plan shows a gradual decline in emissions, the reductions are less ambitious than in our scenario. Agriculture emissions in the Plan in 2032 are now 1.3 MtCO₂e higher than the CCC scenario and the draft Plan.

The plan includes policies like encouraging pH testing and carbon audits, encouraging planting of woodland on agricultural land (agro-forestry) and reducing emissions from use and storage of manure and slurry. After publishing research on an appropriate metric of the intensity of emissions for beef, sheep and dairy sectors, an annual percentage target for emission intensity will be set. Again, achieving this target would depend on non-mandatory measures, like encouraging farmers to undertake genotyping, improve fertility, reducing animal mortality and adopt improving farm management practices.

The proposal to develop a target for reducing Scotland's emissions from nitrogen fertiliser is welcome, but there are no firm commitments for timing or level of ambition. We recommend this should be pursued as soon as possible.

Overall, the ambition in the agricultural sector and the focus on voluntary measures remains concerning. Agriculture will need to make a greater contribution to meeting emissions targets, especially if Scotland is to meet a net-zero target as introduced in the Climate Change Bill.

Figure 7.4. Comparison of agriculture emissions in the Climate Change Plan and CCC scenario



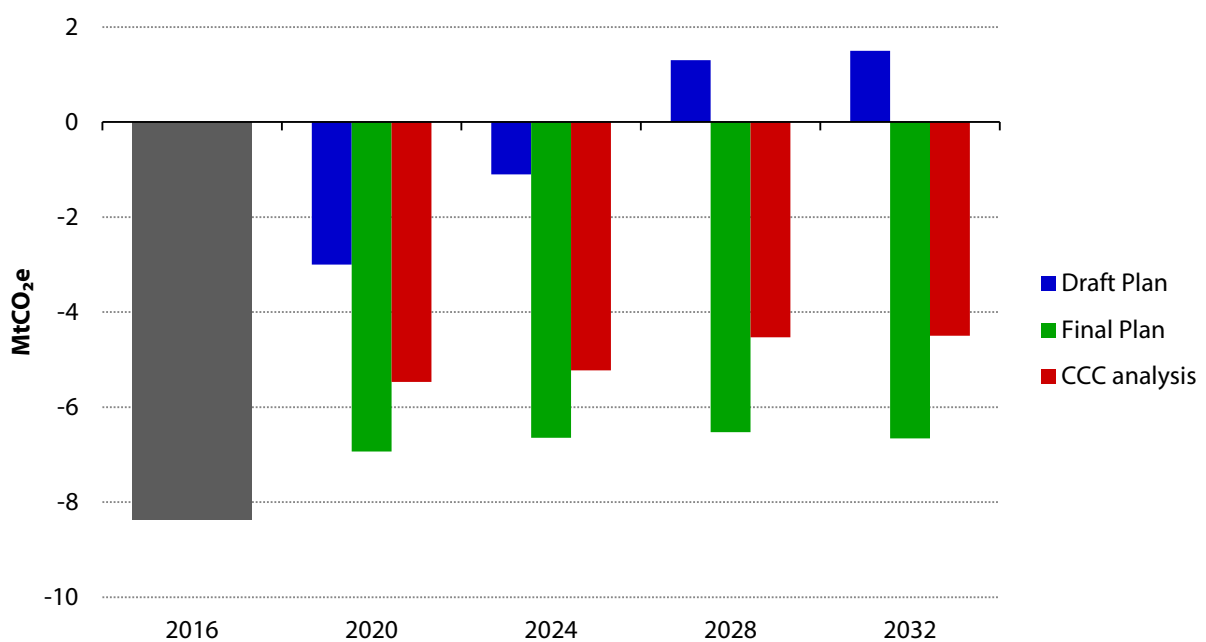
Source: Draft Climate Change plan, Climate Change Plan, CCC analysis.

LULUCF

In our advice on annual targets to the Scottish Government, we estimated that the LULUCF sector could deliver 1.6 MtCO₂e by 2032 compared to the business-as-usual projections. Since our analysis and the draft Climate Change Plan were published, there has been a significant revision in the emissions inventory for the LULUCF sector (Figure 7.5). Further significant revisions are expected in the future, once the inventory includes emissions from peatland.

The Scottish Government has updated the analysis for the final Plan with a more recent evidence base. Inventory changes have had a large effect on both historical emissions and modelling future pathways, particularly in the agriculture and land-use sector. These changes are hard to avoid and hard to predict, but the latest inventory estimates are based on the most recent scientific evidence and should ordinarily be considered the best estimate of emissions. However, regardless of revisions to the estimates due to methodology changes, this should not lead to lesser action to reduce emissions, neither in the LULUCF sector nor across other sectors, given stretching overall emissions targets.

Figure 7.5. Comparison of LULUCF emissions in the Climate Change Plan and CCC Scenario



Source: Draft Climate Change plan, Climate Change Plan, CCC analysis.

The Plan also includes abatement through peatland restoration, despite the fact that upland peatland has not yet been included in the emissions inventory. We welcome abatement efforts in this sector, which will be important for meeting the targets once peatland emissions are included in the emissions inventory. We recommend that the level of peatland abatement should be revisited following the inclusion of upland peat in the emissions inventory.

Abatement in the LULUCF sector in the Climate Change Plan mainly depends on tree planting rates. The Plan has a high ambition, with a planting target of 15,000 ha each year from 2024/2025. To achieve this, the Plan includes measures like forestry grants and a woodland creation programme on the National Forest Estate.

Recent annual planting rates have been significantly below the targets, partly due to inefficiencies in the Forestry Grant Scheme application process. We therefore welcome measures in the Plan to improve this process. In addition, the Forestry Bill has fully devolved control of Forestry policy to the Scottish Government, which may provide additional certainty for industry.

Chapter 8: Waste



Table 8.1. Summary of progress in the waste sector

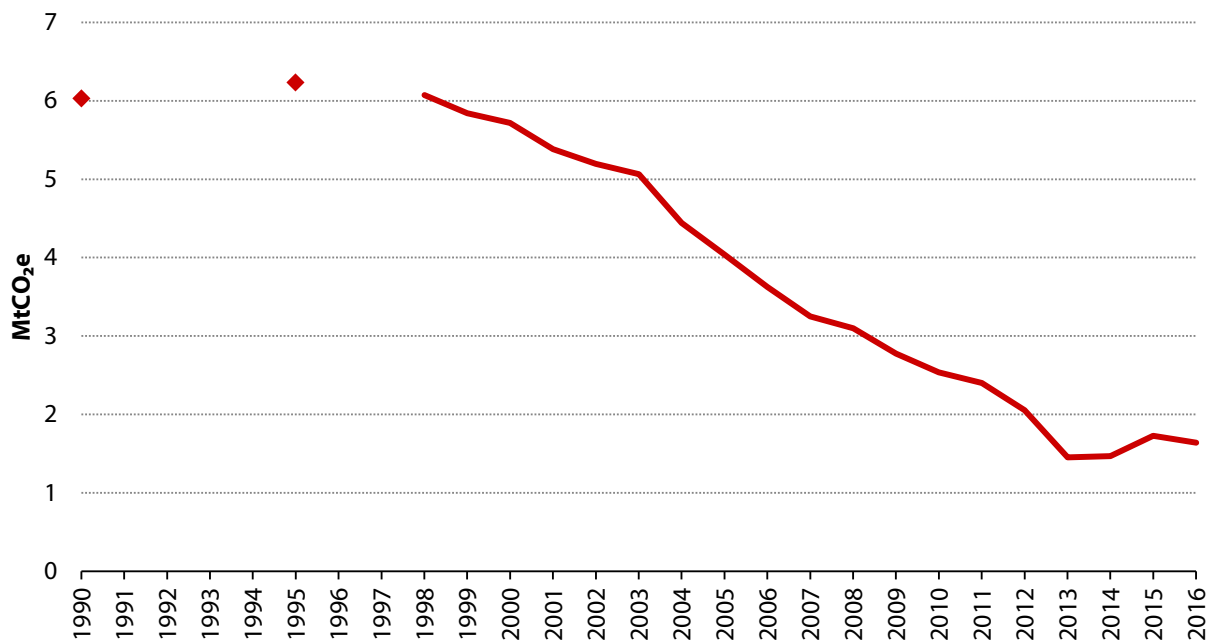
Milestone	Progress
60% of household waste recycled / composted or prepared for re-use by 2020.	45.2% of household waste was composted, recycled or reused in 2016, an increase of 1 percentage point from 2015. This target is unlikely to be met unless significant improvements are made.
Recycle 70% of all waste by 2025.	In 2016, 61.0% of all waste was recycled, composted, or reused, up 4.7 percentage points from 2015. Scotland is on track to meet the 2025 target if this rate of improvement is maintained.
Reducing the proportion of total waste sent to landfill to a maximum of 5% of all waste by 2025.	In 2016, 32.5% of all waste was sent to landfill in Scotland, a 4.6 percentage point improvement since 2015. There has been a 10.6 percentage point change since 2011. If the rate of improvement seen from 2015 to 2016 can be maintained, the 2025 target is achievable.
33% reduction of food waste by 2025, against a 2013 baseline.	The most recent estimate suggests 1.35 million tonnes of food waste were generated in 2013, 44% of which was household waste. There was an estimated 5.7% reduction in household food waste generated between 2009 and 2014.
Remove all biodegradable municipal waste sent to landfill by 2021. Interim target of less than 1.26 million tonnes by 2020.	In 2016, 1.15 million tonnes of biodegradable waste were sent to landfill in Scotland. This was an increase of 0.05 million tonnes since 2015, but is ahead of the interim 2020 target, and a 43% reduction since 2006.
Reduce total waste generated in Scotland against the 2011 baseline by: <ul style="list-style-type: none"> 7% by 2017 15% by 2025 	<p>In 2016, the level of waste generated was 10.4% lower than the 2011 baseline, a 4.4 percentage point improvement on 2015. The 2017 target would have been met in 2016, and the 2025 target is achievable.</p> <p>The total volume of waste generated is variable year on year. The record low year was in 2014 with a 17% reduction on 2011, but the 2015 generation rate rebounded back to a 6% reduction.</p>

Latest emission trends and drivers

Waste policy is fully devolved to the Scottish Government. Waste emissions account for only 4% of total emissions of Scotland, due to a sharp reduction since 1990 (when they were 8% of Scottish emissions). In 2016, emissions from waste in Scotland decreased by 4.9% to 1.6 MtCO₂e, 73% below 1990 levels, mainly due to a reduction in total waste generated. This followed an increase of 0.3 MtCO₂e between 2014 and 2015.

Methane released from waste in landfill is the main source of emissions in the waste sector, accounting for 76% of total emissions in 2016. Landfill emissions fell steadily until 2013, reflecting a reduction in the amount of waste sent to landfill through a reduction in waste arising and waste diversion. Action to capture or flare landfill methane has also contributed to a fall in emissions from waste management. Reductions in emissions have slowed since 2013.

Figure 8.1. Emissions from waste 1990-2016



Source: NAEI (2018).

In 2016, the total waste generated in Scotland was 10.8 million tonnes, which was 10.4% lower than the 2011 baseline used in waste reduction targets. This was an improvement of 4.4 percentage points on 2015. Waste production in 2015 waste was at its highest level since 2012:

- The share of total waste from all sources sent to landfill decreased by 4.6 percentage points in 2016 to 32.5% of total waste. The Zero Waste Plan target for 2025 is 5%.
- In 2016, 61.0% of all waste was recycled, composted, or reused, up 4.7 percentage points from 2015. The target for 2025 set out in the Zero Waste Plan is 70%.⁶⁸

Total waste is a very volatile indicator from year to year (e.g. total waste was 16.8% lower in 2012 compared to 2011 and 14.6% lower in 2014). There is a question of whether assessing progress against the target in one particular year is the right indicator.

The Scottish Government also has targets for specific types of waste:

- In 2016, 1.15 million tonnes of biodegradable waste were sent to landfill in Scotland. This was an increase of 0.05 million tonnes since 2015, but is ahead of the interim 2020 target of 1.26 million tonnes, and a 43% reduction since 2006. The Climate Change Plan target of zero biodegradable waste by 2021.
- Household recycling rates have increased in 2016 to 45.2%. The Zero Waste Plan set an interim target for 2013 of 50%. Despite a gradual increase in recycling rates, Scotland is still falling short of this target.

⁶⁸ Scotland revised the methodology of the measurement of the total tonnage of waste that was recycled in 2014. Prior to 2014, household waste composted that did not reach the quality standards set by PAS 100/110 was included in the recycling figures. Therefore, rates pre-2014 should not be compared with post-2014 rates.

- The Climate Change Plan confirms a target of a 33% reduction of food waste by 2025, against a 1.35 million tonne baseline in 2013. No data are currently available on progress.

Progress and policies

The Scottish Government's Zero Waste Plan⁶⁹ (2010) and Safeguarding Scotland's Resources in (2013)⁷⁰ were superseded in February 2016 with a Circular Economy Strategy.⁷¹ The Strategy carries forward existing waste reduction and recycling targets, which Scotland is currently broadly on track to meet (Table 8.1, Figure 8.2) with the exception of household recycling targets. The strategy prioritises four sectors where the biggest environmental and economic impact can be made:

- Food and drink: inclusion of a Scottish Food Waste Reduction Target to achieve a 33% reduction in food waste by 2025, estimated to save £500 million per year.
- Energy infrastructure: opportunities of equipment reuse from wind turbines and decommissioned oil and gas platforms.
- Construction and buildings: construction accounts for about 50% of all waste in Scotland, and is a major influence on efficient use of resources.
- Remanufacturing: already worth £1.1 billion to the economy, and has potential to create an additional £620 million turnover with 5,700 new jobs by 2020.

Since the strategy was published, additional progress has been made:

- The £18 million Scottish Institute for Remanufacture (SIR) is funded by the Scottish Funding Council and Zero Waste Scotland. The centre of excellence works to increase innovation in remanufacturing (increase reuse, repair and remanufacture).
- The Circular Economy Investment Fund is an £18 million fund supported by the Scottish Government and the European Regional Development Fund to support work that will help deliver circular economy growth. To date, £4.2 million of funding has been awarded to SMEs.
- The Action Plan on Zero Waste Towns launched in June 2018, and will provide £0.5 million of funding for community groups for measures to reduce plastic waste and marine litter.
- Zero Waste Scotland now lists 112 Revolve stores. The Revolve standard aims to increase consumer confidence in re-use stores through standards and quality control.
- Following installation of gas capture equipment at two closed landfill sites in the Scottish Borders, similar gas capture technology is being installed at two additional sites in Glasgow and East Lothian.
- The Scottish Government is consulting on a Deposit Return scheme for Scotland. A scoping report from Zero Waste Scotland⁷² predicted that a high scenario for such a scheme could save 86kt of waste. This represents around 0.7 percentage points of the 70% recycling target, or 3.3 percentage points on a household waste only basis. The increase relative to all waste

⁶⁹ Scottish Government (2010) *Scotland's Zero Waste Plan*.

⁷⁰ Scottish Government (2013) *Zero Waste Safeguarding Scotland's Resources*.

⁷¹ Scottish Government (2016) *Making Things Last, A Circular Economy Strategy for Scotland*.

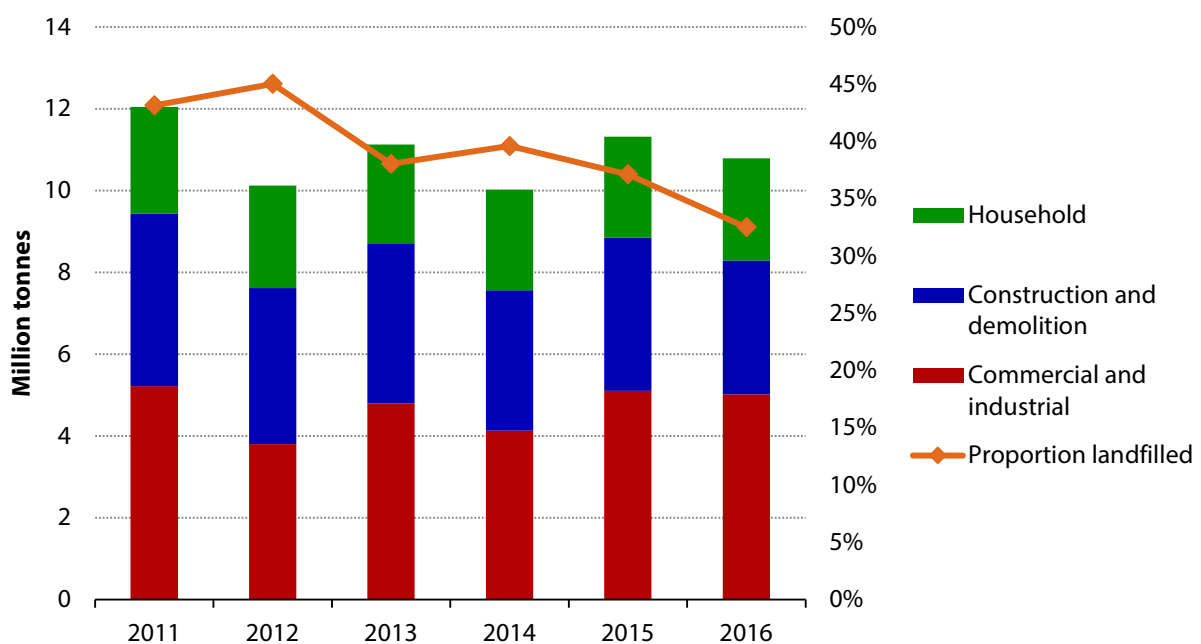
⁷² Eunomia (2015) *A Scottish Deposit Refund System, Final Report for Zero Waste Scotland*.

appears low as there is a large proportion of construction and demolition waste in all waste generated in Scotland.

Scotland has put in place detailed targets, an annual report detailing progress and programmes to help meet these targets. Continual progress is need if such ambitious targets are to be achieved:

- Scotland is not on track to meet the 2020 target of 60% of household waste being recycled, composted or reused.
- The Scottish Government has announced their intention to produce a Food Waste Action Plan in 2018, which must set out clear milestones to the 2030 target and a reporting framework to monitor progress.
- The Scottish Government should set out what systems will be in place to deal with the ban on municipal biodegradable waste going to landfill. This includes consideration of how energy from waste plants are used to deal with residual biodegradable waste.
- The number of landfill sites with gas capture being developed each year must closely match targets laid out in the Climate Change Plan, rising to twelve per year in 2020/21.

Figure 8.2. Waste generated in Scotland by source and proportion of waste landfilled (2011-2016)



Source: SEPA (2018) *Waste from all sources: waste data tables 2016*

Assessment of the final Climate Change Plan

The Climate Change Plan includes a 64% reduction in waste emissions to 0.6 MtCO₂e by 2032, from 1.6 MtCO₂e in 2016. This ambition goes further than the 45% reduction that the Committee set out in our annual targets advice (Figure 8.3).

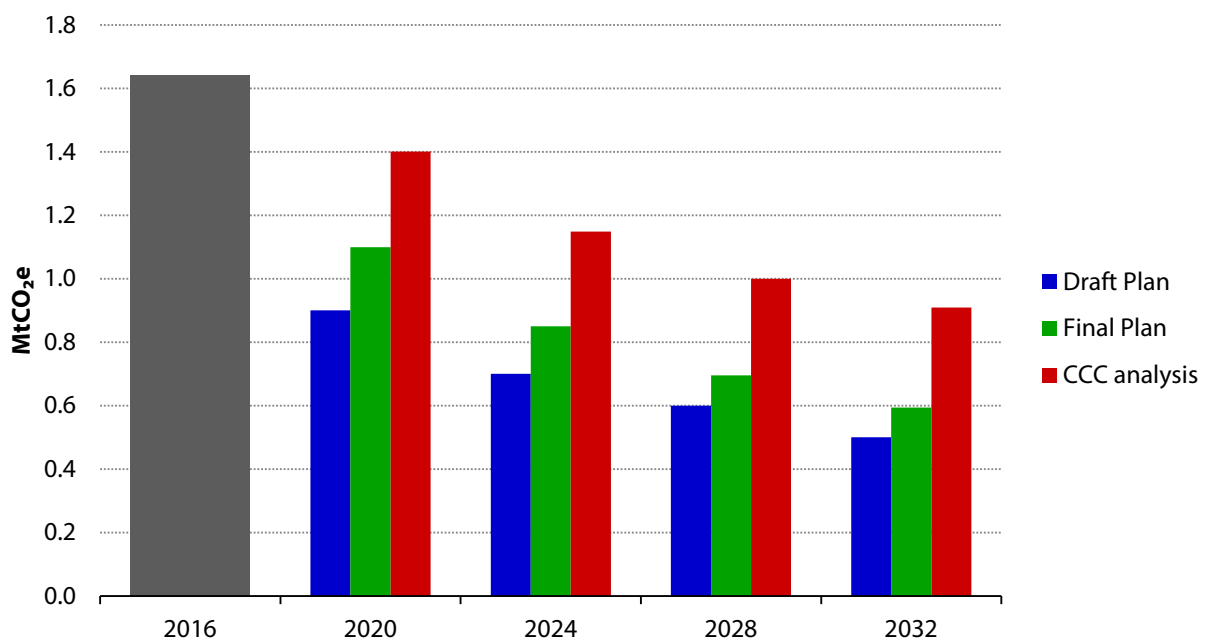
The CCC scenario assumed waste emissions could continue to fall as Scotland moves towards a circular economy through reducing waste arising, diversion from landfill and greater capture of methane at landfill sites. In the Climate Change Plan, the higher level of reduction assumes the following targets covering these same themes:

- The phase out of biodegradable municipal waste going to landfill by January 2021.
- The amount of waste going to landfill to fall to 5% by 2025, and to reduce food waste in general by 33% by 2025.
- Increase deployment of innovative technologies such as flaring to better manage emissions from existing closed and older operational landfill sites.

These targets reflect Scotland's priorities as set out in the Circular Economy Strategy and partly explains why the emissions reduction is higher than the CCC's own assessment.

Now that appropriate targets have been set, policies for delivery, including the necessary systems to handle the biodegradable waste ban, should be produced to ensure that these targets are met.

Figure 8.3. Comparison of emissions from waste in the Climate Change Plan and CCC scenario



Source: Draft Climate Change plan, Climate Change Plan, CCC analysis.



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