December 2022

Progress in reducing emissions in Scotland

2022 Report to Parliament

Climate Change Committee

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Contents

Acknowledgements

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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). Lord Deben also runs Sancroft, a corporate responsibility consultancy working with blue-chip companies around the world on environmental, social and ethical issues.

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Scotland Champion

Keith Bell is a co-Director of the UK Energy Research Centre (UKERC), a Chartered Engineer and a Fellow of the Royal Society of Edinburgh. He has been at the University of Strathclyde since 2005, was appointed to the Scottish Power Chair in Smart Grids in 2013 and has been involved in energy system research in collaboration with many academic and industrial partners.

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Michael Davies is Professor of Building Physics and Environment at the UCL Institute for Environmental Design and Engineering (IEDE). At UCL his research interests relate to the complex relationship between the built environment and human wellbeing. He is also Director of the Complex Built Environment Systems Group at UCL and a member of the Scientific Advisory Committee of 'Healthy Polis'.

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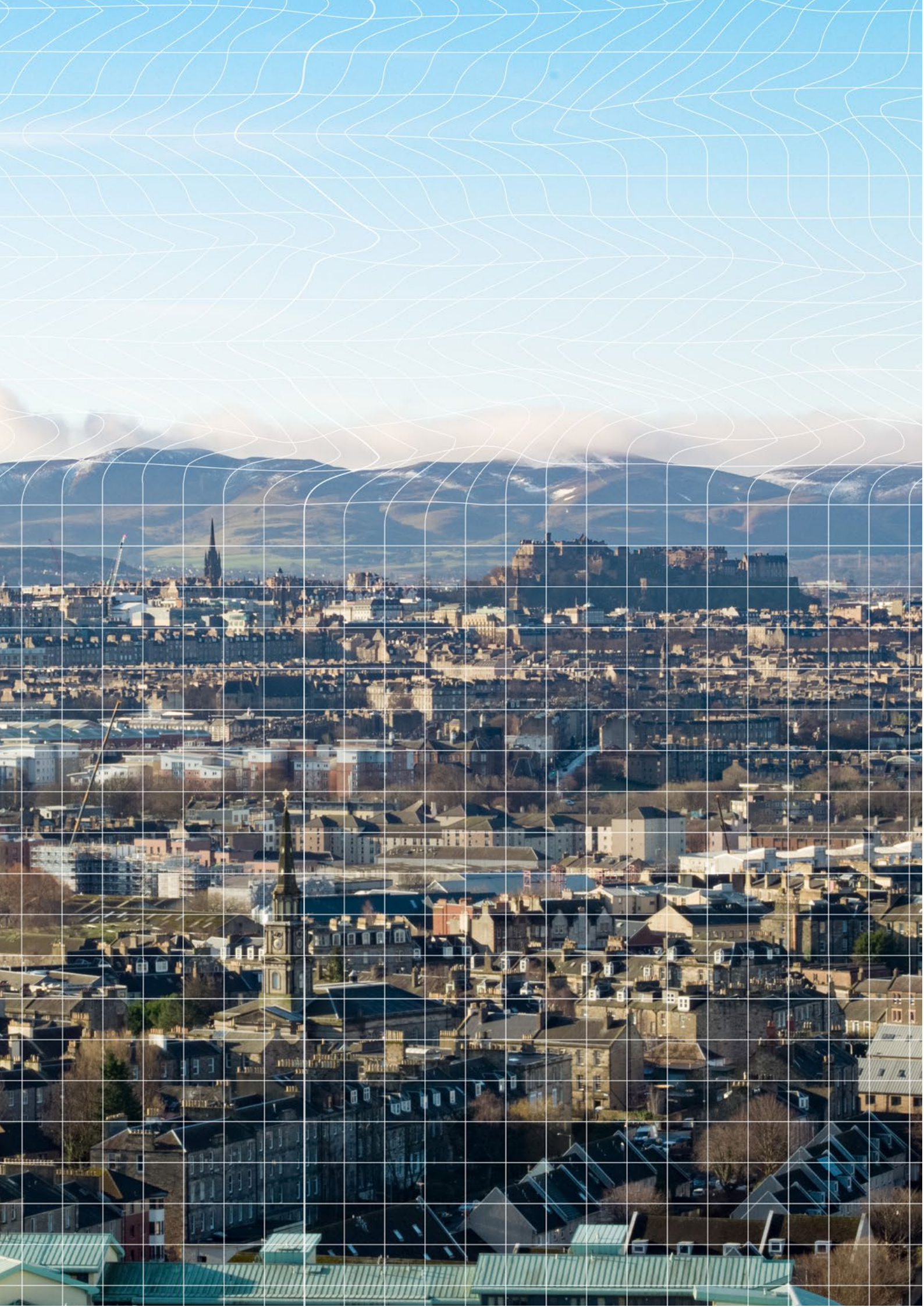


Executive summary

Scotland's emissions reduction targets are amongst the most stretching in the world and the Scottish Government has placed a welcome focus on a fair and just transition. Key milestones are ambitious, but a clear delivery plan on how they will be achieved is still missing and there is no quantification of how policies combine to give the emissions reduction required to meet Scotland's targets.

In these two reports we first review Scotland's targets in light of changes to the methodology for estimating emissions since our previous target advice. We then assess Scotland's progress in emissions reduction, policy plans, and delivery of those plans in the last year. Our focus is shifting to monitoring a set of quantified indicators of decarbonisation progress.

Our key messages in these reports are:

- **Changes in emissions accounting methodology do not imply the need to change the Net Zero and 2030 and 2040 interim targets, as legislated by the Scottish Parliament.** Changes in emissions accounting methodology since the assumptions in our 2019 Net Zero advice to Scotland have not significantly changed the feasibility of the targets. We continue to advise that these targets should be achieved through domestic action, without the use of emissions credits.

  - **The 2030 interim target.** In 2019, the Scottish Parliament legislated an interim target of a 75% reduction on 1990 levels by 2030, going beyond CCC advice. Our updated pathway to Net Zero confirms that this remains extremely challenging and suggests a 65-67% reduction in Scotland's emissions by 2030 is both feasible and consistent with Scotland's Net Zero commitment. The legislated 2030 target means that policies must go further than the CCC pathway. Despite the scale of the challenge in the 2020s, Scotland is still not delivering on key milestones such as energy efficiency in homes and peatland restoration.

  - **Net Zero and the 2040 interim target.** The Net Zero date of 2045 and 2040 interim target of a 90% reduction remain appropriate. Under the Climate Change (Scotland) Act (the Act), underperformance against targets (e.g. in the 2020s and early 2030s) requires equivalent outperformance of later targets (e.g. in the early 2040s) to compensate. Our updated pathway indicates that reductions beyond the legislated targets may be feasible from the mid-2030s onwards. However, until the extent of the required overperformance is clearer, we do not recommend that the targets be changed.

- **Scotland's annual targets in the 2020s should be adjusted.** The annual targets from 2021 to 2029 are set by a straight line between the 2020 and 2030 interim targets. However, the level of the 2020 interim target was based on our 2017 advice using an older accounting methodology, before significant changes to the treatment of peatland emissions in the inventory were introduced. We therefore recommend that the annual targets be adjusted to align with a translation of the legislated 2020 target to the new inventory basis. Without this adjustment, these already challenging annual targets will be made much more difficult to achieve, simply as an artefact of emissions accounting.

- **The 2020 interim target was achieved.** On the basis of the latest greenhouse gas (GHG) inventory, emissions in 2020 fell by 12% from 2019 to 40.6 $MtCO_2e$ and by 51% since 1990. On the 'GHG Account' basis, on which performance against the legislated targets is assessed, emissions were 59% lower than in 1990 and the 2020 interim target of 56% was achieved. The fall in emissions in 2020 was largely due to travel restrictions during the COVID-19 pandemic, without which it is unlikely the target would have been met. The annual targets in the 2020s will be much harder to achieve as emissions rebound.

- **A quantified plan is urgently needed**. The Scottish Government urgently needs to provide a quantified plan for how its polices will combine to achieve the emissions reduction required to meet the challenging 2030 target. The plan must detail how each of Scotland's ambitious milestones will be achieved.

- **Working with the UK Government**. Many aspects of policy, especially in the industry, engineered removals and electricity supply sectors, are reserved to the UK Government. Nevertheless, industry is Scotland's second-highest-emitting sector and the Scottish Government has chosen to place a heavy reliance on engineered removals. Finding a way to cooperate with the UK Government effectively is key for realising both Scotland's ambitions and the full potential of Scotland's contribution to the UK's own decarbonisation plans.

- **Transport.** Plans to decarbonise transport in Scotland are falling behind. While sales of electric vehicles are increasing fast in Scotland, they are behind those of the UK as a whole and the CCC's updated pathway. Scotland has a laudable aim to reduce car-kilometres by 20% on 2019 levels by 2030 which, if delivered, would bring benefits to the wellbeing of Scottish citizens. This is a challenging goal and current plans lack a full strategy with sufficient levers to deter car use. Scotland has also committed to growth in aviation following the pandemic, which will make emissions targets increasingly difficult to meet.

- **Buildings.** Scotland has ambitions to decarbonise buildings much faster than the UK as a whole. However, despite substantial funding commitments and good progress on enabling measures such as local energy and heat network planning, there are not yet adequate policies in place to deliver low-carbon heat and energy efficiency improvements at the required rate.

- **Agriculture and land use.** Detail on low-carbon agriculture policy following exit from the EU Common Agricultural Policy is needed urgently. Scotland currently has no aim to shift to lower-carbon diets, increasing the challenge in this sector. Progress in the land use sector is mixed:

  - While Scotland's tree-planting rates are higher than those in the rest of the UK combined, rates have recently plateaued and are off track to meet Scotland's 2024/25 target of 18,000 hectares per year. Significant barriers such as land availability and skills shortage remain.

  - With 80% of Scotland's peatlands being degraded, peatland emissions are significant. Despite this, restoration rates are less than half of Scotland's own target of 20,000 hectares per year, which is in turn much less ambitious than our recommendation of 45,000 hectares per year by 2022. Barriers such as skills shortages and contractor availability need to be addressed to ensure the required rapid scale-up.

The rest of this executive summary is set out in three sections:

1. Target advice
2. Emissions in 2020
3. Policy progress

We provide a full set of recommendations to the Scottish Government in Annex 2 at the end of this report and on our website.

Changes to methods for estimating emissions affect Scotland disproportionately, due to the frequent and often significant changes to estimated emissions in the land use sector and the relatively high importance of that sector to total emissions. To avoid changes to estimation methodologies affecting the achievability of the targets, a 'Greenhouse Gas Account' methodology is used, so that targets are judged against a frozen 'base inventory' which is reset to align with the latest methodology every five years.

The base inventory will be reset in 2023 to align with the 1990-2020 inventory (published in June 2022). Here we review Scotland's current targets. Once Parliament has expressed its ambition by legislating targets, we apply the principle that methodological updates should only lead to a reduction in ambition in those targets where they have a material impact on their achievability. A recommendation for increasing ambition would only be given if there is a clear case that this is achievable.

Current targets
Scotland's 2030 and 2040 interim targets and the Net Zero date were legislated in 2019 following our 2019 Net Zero advice. While the Net Zero date of 2045 and the 2040 interim target for a 90% emissions reduction are both in line with our advice, the 2030 interim target for a 75% reduction goes significantly beyond our advice. The 2020 interim target for a 56% reduction was in line with our 2017 Advice on the Scottish Climate Change Bill. Annual targets are set by taking a straight line between the interim targets.

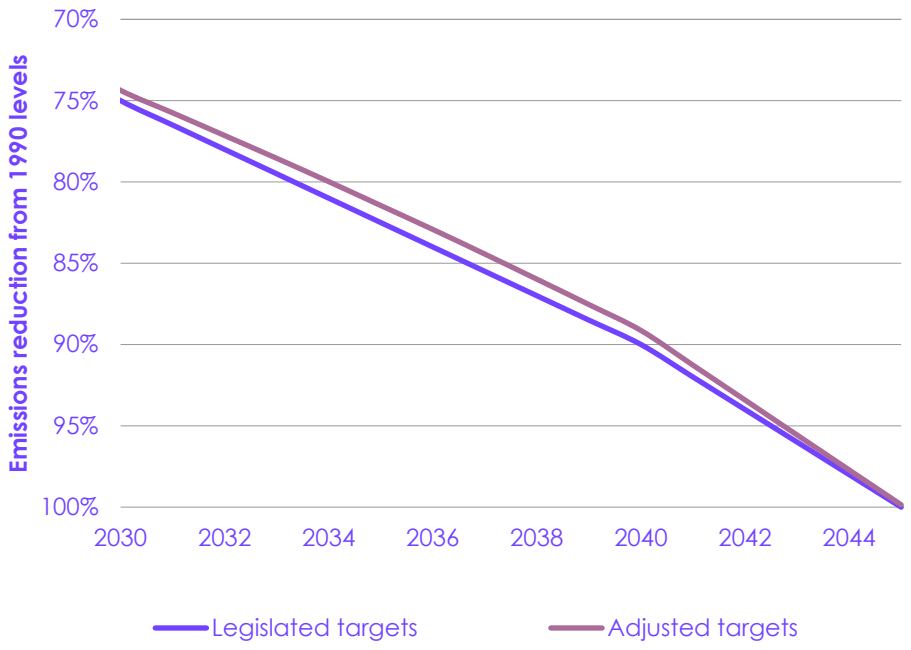
(a) Target recommendations based on methodology changes

- **Changes in emissions accounting methodology do not imply the need to change the Net Zero and 2030 and 2040 interim targets, as legislated by the Scottish Parliament.**

  – Our advice in 2019 included a forward-looking estimate of anticipated changes to the reporting of emissions from peatlands. The other methodological changes are relatively minor and do not lead to significant changes in the achievability of the targets. Therefore, changes in accounting methodology do not justify changing the percentage reduction targets now (Figure 1).

  – We continue to advise that crediting of carbon units should not be used to meet Scotland's targets. Our general principle is that targets should be achieved with domestic action. Instead, we recommend that Scotland rapidly ramps up delivery. Any shortfall to the 2030 target and the annual targets would need to be compensated by extra emissions reduction, beyond the legislated targets, by 2045.

Figure 1 Targets before and after methodological changes



Source: Scottish Government (2019) *Climate Change (Emissions Reduction Targets) (Scotland) Act 2019;* CCC analysis.

- **Annual targets in the 2020s should be adjusted.**
  - The annual targets for 2021 to 2029 are set by a straight line between the 2020 and 2030 interim targets. However, the level of the 2020 interim target was based on an older accounting methodology, before the updated treatment of peatland emissions in the inventory. The 2020 target for a 56% reduction equates to a reduction of 48.5% on the new basis.
  - Setting the challenging annual targets for 2021 onwards on the basis of a straight line from the 2020 target of 56% immediately makes them much harder to achieve. This is not about ambition, but rather an unfortunate and unforeseen consequence of the interplay between the procedure for setting the annual targets in the Act and timing of this advice, which is one year too late to allow for a change to the 2020 interim target.
  - Technical changes leading to the targets becoming unachievable is not the intention behind the Act. Indeed, the reason for its mechanisms around emissions accounting and the five-yearly reviews is to ensure that inventory changes on their own do not make the targets unachievable. Should the annual targets in the 2020s not be corrected, there is a real risk that the targets being missed every year would undermine the credibility and strength of the Scottish framework for emissions reduction.
  - We therefore recommend that the path for annual targets through the 2020s is drawn not based on the 56% target (which was on the old methodology) but on a translation of that 2020 target to the new

inventory basis (i.e. 48.5%). This is appropriate, as these targets will be assessed against the new inventory methodology. The new recommended annual targets are given in Table 1. These should be updated even if it requires an adjustment to the Act to allow it. We also recommend that future advice on the level of the targets is requested in time to avoid a similar situation occurring again.

- **Scotland's fair and safe emissions budget should be aligned with the interim targets.** The Act currently sets a limit of total emissions in the period 2010 to 2050 to 1,240 $MtCO_2e$. This is the level we advised in our 2020 letter to be consistent with our Balanced Pathway, but this is inconsistent with Scotland's legislated 2030 target. We recommend it is changed to 1,028 $MtCO_2e$, making it consistent with the legislated interim targets and our recommended annual targets in the 2020s (Table 1).

Table 1
Recommended annual targets in the 2020s

Year	Current target	Recommended target
2021	57.9%	51.1%
2022	59.8%	53.8%
2023	61.7%	56.4%
2024	63.6%	59.1%
2025	65.5%	61.7%
2026	67.4%	64.4%
2027	69.3%	67.0%
2028	71.2%	69.7%
2029	73.1%	72.3%

Source: CCC analysis; Scottish Government.

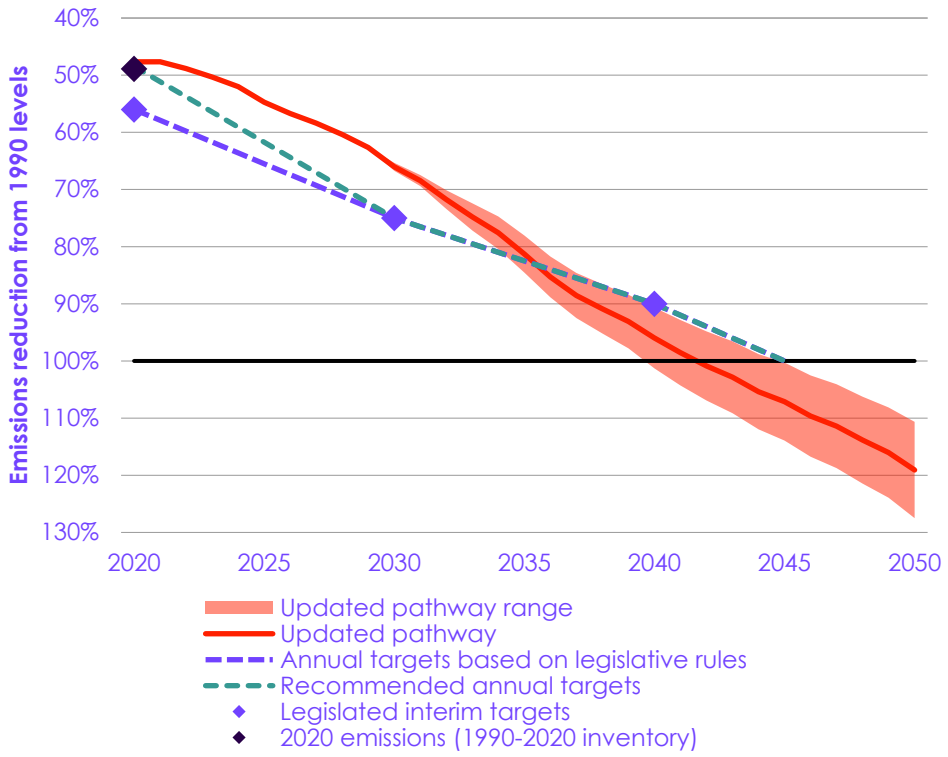
(b) The CCC's updated pathway

In order to assess how feasible Scotland's targets are, and whether any increase in ambition might be appropriate, we have provided an updated pathway for Scotland. Starting from the Balanced Pathway for Scotland, developed as part of our UK Sixth Carbon Budget analysis, we have updated to reflect the latest emissions estimation methodology, allocated engineered removals to Scotland and increased ambition in some sectors to align with our highly ambitious Tailwinds scenario (Figure 2).

- Our updated pathway achieves a reduction of 65-67% from 1990 levels by 2030, and continues to show that the 2030 target of a 75% reduction is extremely challenging.

- The 2040 and 2045 targets remain appropriate, with our updated pathway indicating that it may be possible to outperform these, although this is uncertain.

Figure 2 Our updated pathway for Scotland compared to 2020 emissions and the targets



Source: Scottish Government (2019) *Climate Change (Emissions Reduction Targets) (Scotland) Act 2019;* CCC analysis.
Notes: The range in the updated pathway comes from a range in our pathway for engineered removals. All values based on 1990-2020 inventory methodology.

(c) Aviation multiplier

We recommend that Scotland sets a minimum goal of no further warming after 2050 from non-CO_2 effects in aviation. However, we recommend that the aviation CO_2 emissions multiplier remains at one (equal to no multiplier). This is because of the short lifetime of non-CO_2 effects and their uncertainties, which mean that policies designed around a multiplier risk encouraging strategies that may create perverse incentives to increase CO_2 emissions.

2. Emissions in 2020

On the basis of the latest (1990-2020) GHG emissions inventory, Scottish territorial emissions fell by 12% between 2019 and 2020 to 40.6 $MtCO_2e$ and by 51% on 1990 levels. On the 'GHG Account' basis, on which performance against the legislated Scottish targets is assessed, emissions were 59% below 1990 levels and so the 2020 interim target for a 56% reduction was achieved (Figure 3).

The fall in emissions in 2020 was largely due to the travel restrictions during the COVID-19 pandemic and it is unlikely the target would have been achieved without the impacts of the pandemic.

There is now a significant risk of Scotland failing to meet its annual targets in the 2020s and the interim 2030 target. This is due to three factors (Figure 3):

1. The expected rebound in emissions following the pandemic. The UK as a whole saw a 4% increase in overall emissions in 2021 due to increased activity, especially in the transport sector, and a similar rise is expected in Scotland.

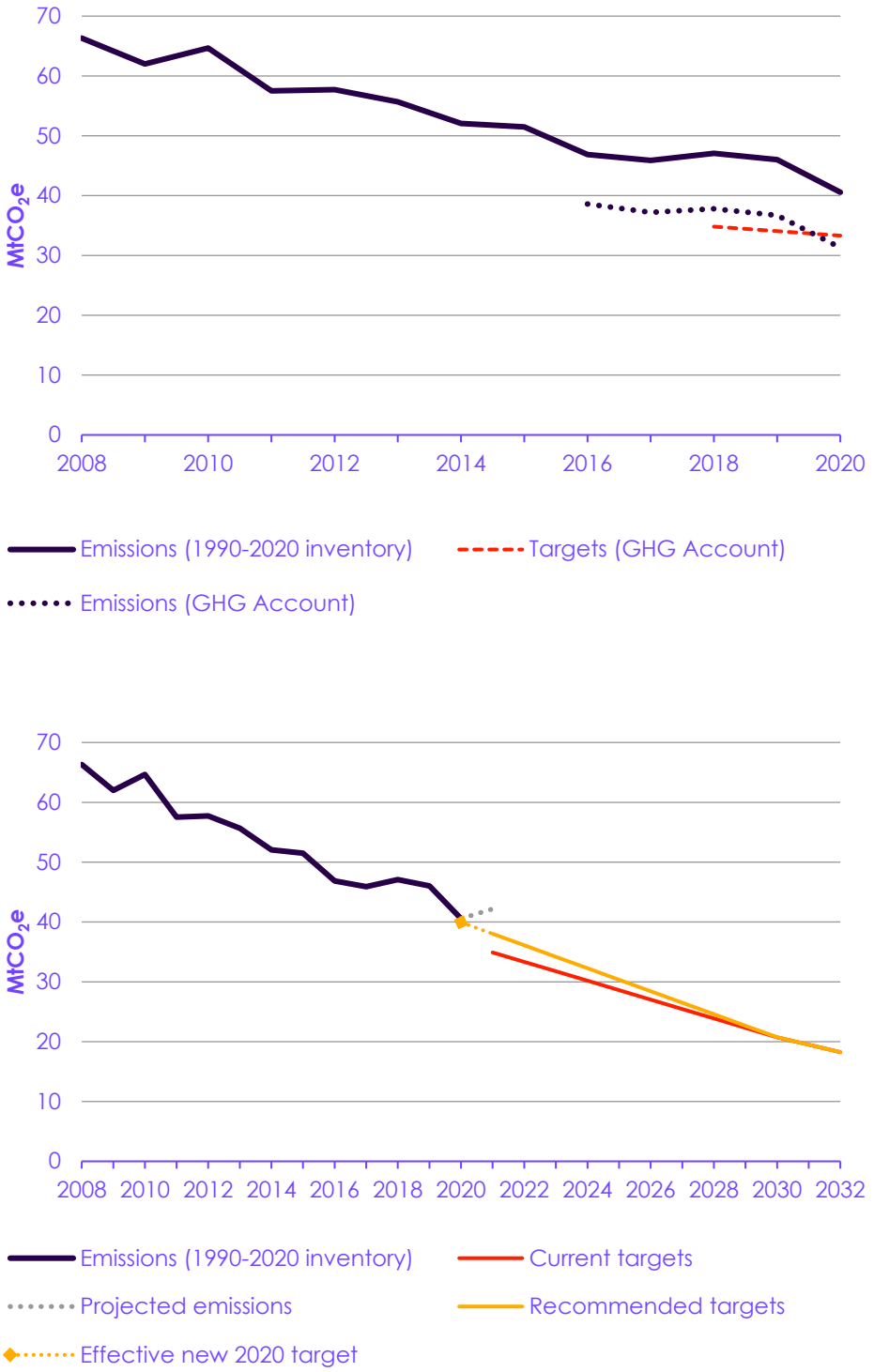
2. When the GHG Account base inventory is reset next year, the targets will be much harder to achieve, largely due to the updated treatment of peatland emissions in the inventory. This effect will be mitigated if our recommendation to adjust the annual targets to align with the latest inventory is accepted.

3. A very rapid reduction in emissions is required anyway in order to meet the challenging 2030 interim target.

Scotland has failed to achieve seven out of eleven of its targets to date. The trend of failure will continue without urgent and strong action to deliver emissions reductions, starting now. Figures 4 and 5 show the scale of the challenge, with the Scottish Government's 2020 update to its Climate Change Plan (CCPu) projecting fast decarbonisation in the 2020s, especially in the transport and buildings sectors.

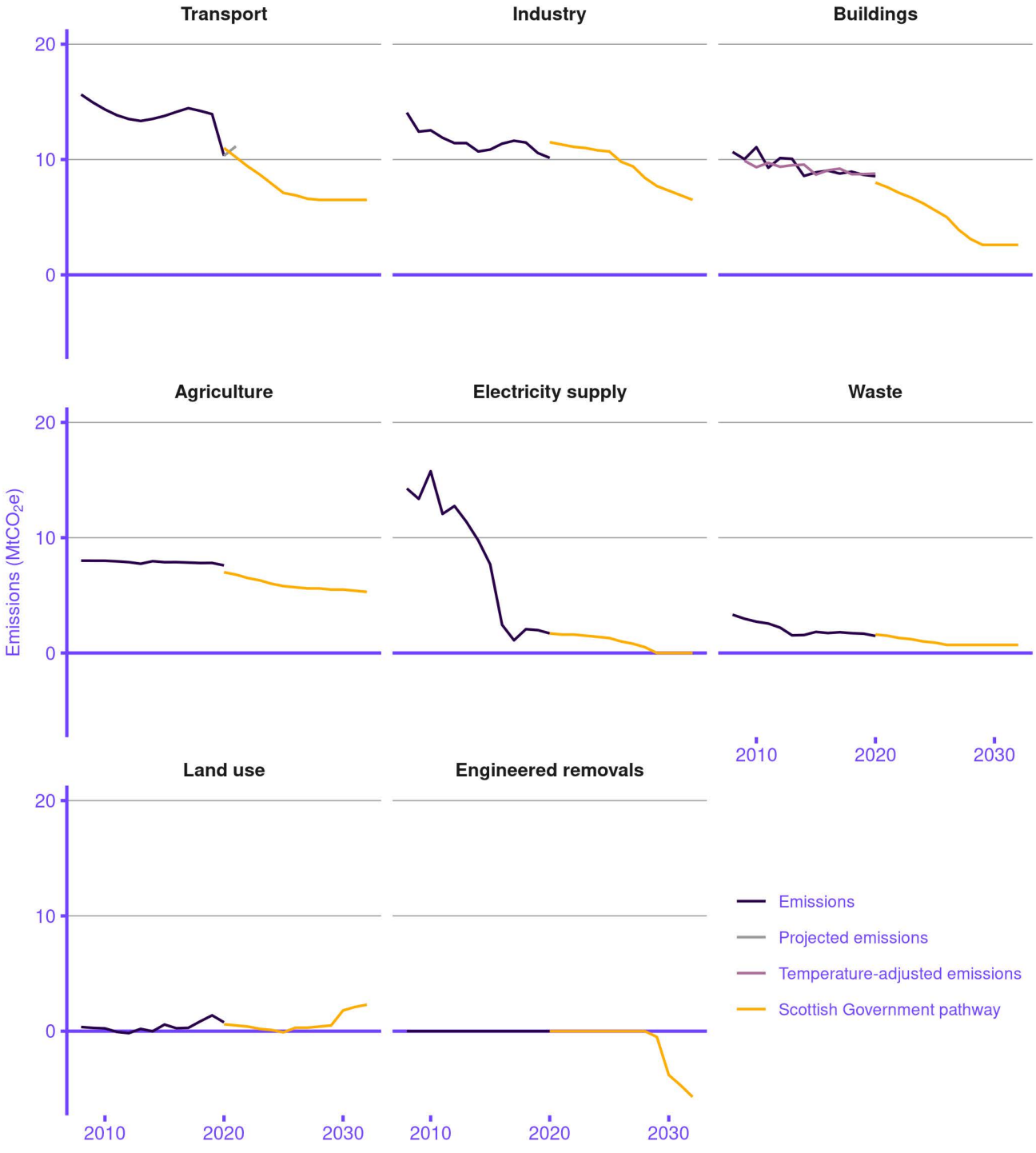
In 2018 Scotland's consumption emissions grew 3% to 70 $MtCO_2e$, which is 50% higher than territorial emissions. This corresponds to an average of 13 tCO_2e per person, 22% higher than the UK average per person.

Figure 3 Scotland's emissions and targets



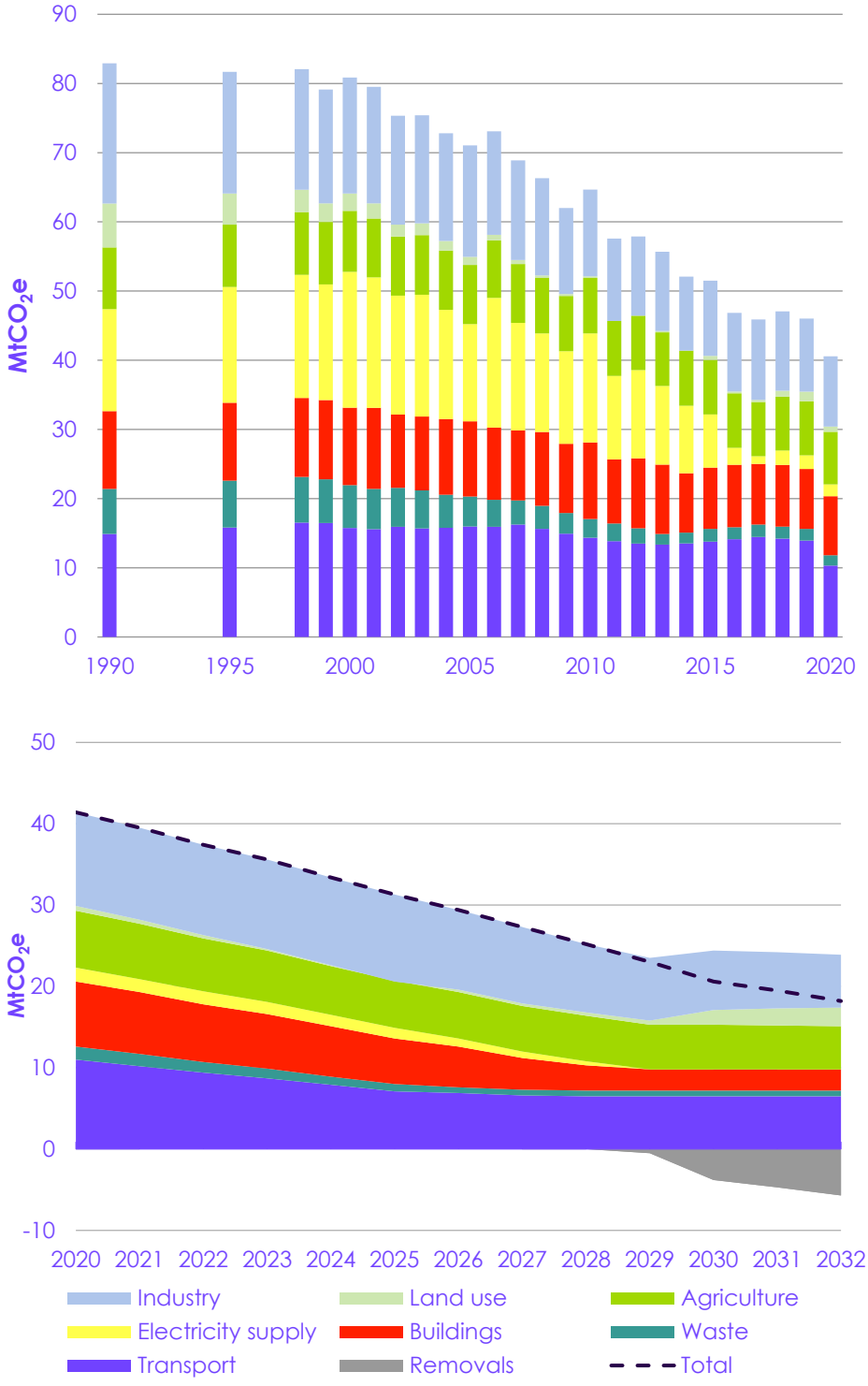
Source: NAEI (2022) Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland, CCC analysis, Scottish Government; Scottish Government (2019) *Climate Change (Emissions Reduction Targets) (Scotland) Act 2019;* Scottish Government (2020) *Scottish Greenhouse Gas Statistics*; CCC analysis.
Notes: Projected in emissions in 2021 assume the same 4% increase seen in the UK.

Figure 4 Scotland's historical emissions (2008-2020) compared to the Scottish Government's pathway (2020-2032) by sector



Source: NAEI (2022) *Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2020*; Scottish Government (2020) *Securing a green recovery on a path to Net Zero: Climate Change Plan 2018-2032 – update*; CCC analysis.
Notes: The transport emissions in 2021 are a projection assuming Scottish emissions in surface transport, aviation and shipping rose by the same proportion as those in the UK.

Figure 5 Scotland's historical emissions (1990-2020) and the Scottish Government's pathway (2020-2032) by sector



Source: NAEI (2022) *Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2020*; Scottish Government (2020) *Securing a green recovery on a path to Net Zero: Climate Change Plan 2018-2032 – update.*
Notes: Historical emissions are not available for the years 1991-1994, and 1996-1997.

3. Policy progress

The Scottish Government has committed to extraordinary ambition to decarbonise the economy over the next decade, with a welcome focus on a fair and just transition. Key milestones are ambitious, but there is no clear delivery plan on how they will be achieved and no quantification of how policies combine to give the emissions reduction required to meet Scotland's 2030 target.

Many aspects of policy to decarbonise the industry, engineered removals and electricity supply sectors are reserved to the UK Government. Nevertheless, industry is the second-highest-emitting sector in Scotland and the Scottish Government has chosen to place a heavy reliance on engineered removals in its decarbonisation plans. Finding a way to cooperate effectively with the UK Government in these areas is key for realising both Scotland's ambitions and the full potential of Scotland's contribution to the UK's own decarbonisation plans.

For key sectors in which policy is significantly devolved, our indicators show that progress towards meeting these milestones is not happening fast enough, and policies and plans are not yet sufficient to speed things up to the required rate (Table 2).

Table 2
Progress against Scotland's milestones

Sector	Milestone	Ambition	On track?
Transport	No new fossil-fuel car sales by 2030	High	Slightly off track
	20% reduction on 2019 car-kms by 2030	High	Significantly off track
	Aviation demand	None	N/A
Buildings	Low-carbon heat	High	Too early to say
	Energy efficiency	High	Significantly off track
Agriculture and land use	Afforestation	High	Slightly off track
	Peatland restoration	Low	Significantly off track
Waste	Recycling rates	High	Significantly off track

(a) Transport

10.3 $MtCO_2e$ in 2020, down 26% since 2019 and down 3% from 2010 to 2019
While transport emissions fell sharply in 2020 due to the pandemic, there had been no real reduction in emissions prior to that. The Scottish Government now plans for emissions in the transport sector to be roughly half those in 2019 by 2030. This requires a transition to electric vehicles at a faster rate than our updated pathway and the UK as a whole, together with major progress on the demand side. These plans are now falling behind.

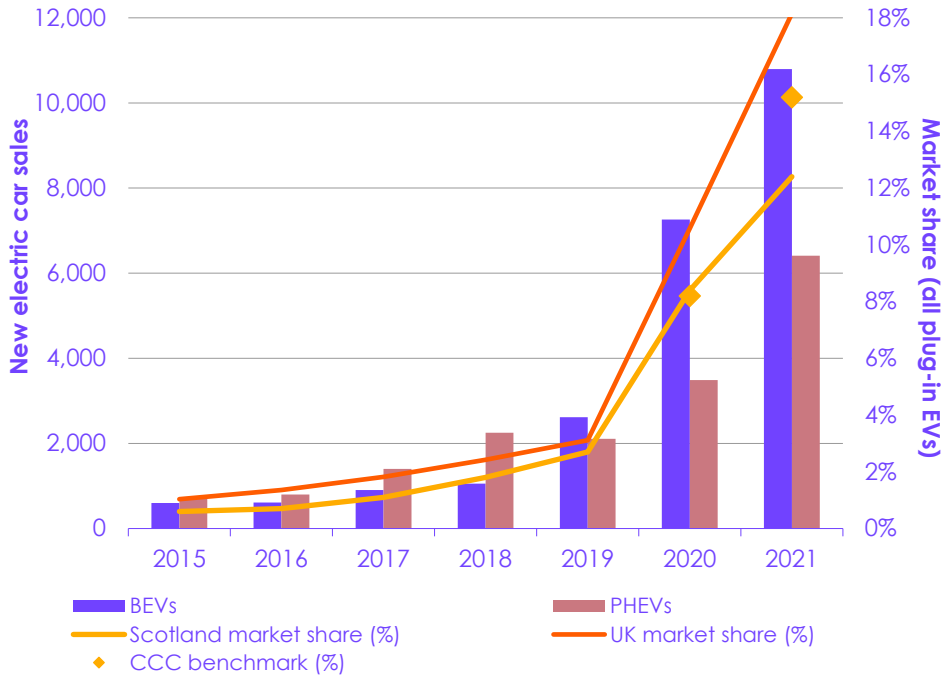
- **Zero-emission vehicle sales**. Scotland plans to transition to 100% battery electric vehicle car and van sales by 2030, going beyond the UK plans which allow a continued role for plug-in hybrids. To support this, interest-free loans for purchasing both new and second-hand electric vehicles are available. However, sales are lower than the UK as a whole and are off-track compared to our pathway (Figure 6).

- **Charging infrastructure**. Scotland has more public charge-points per vehicle than any other UK nation and offers grants for installing home chargers. However, concerns over user experience, price disparities and suitability for van use need to be addressed to ensure the transition is on course to reach all of the consumer base.

- **Car demand**. Scotland has a laudable aim to reduce car-kilometres by 20% compared to 2019 levels by 2030. If achieved this would provide significant co-benefits to Scottish citizens through reduced congestion and air pollution, and increased cycling and walking. However, car use was steadily increasing prior to the pandemic (Figure 7). In order to meet this milestone Scotland needs a full strategy with plans to deter car use, to accompany current plans to encourage active travel and the use of public transport.

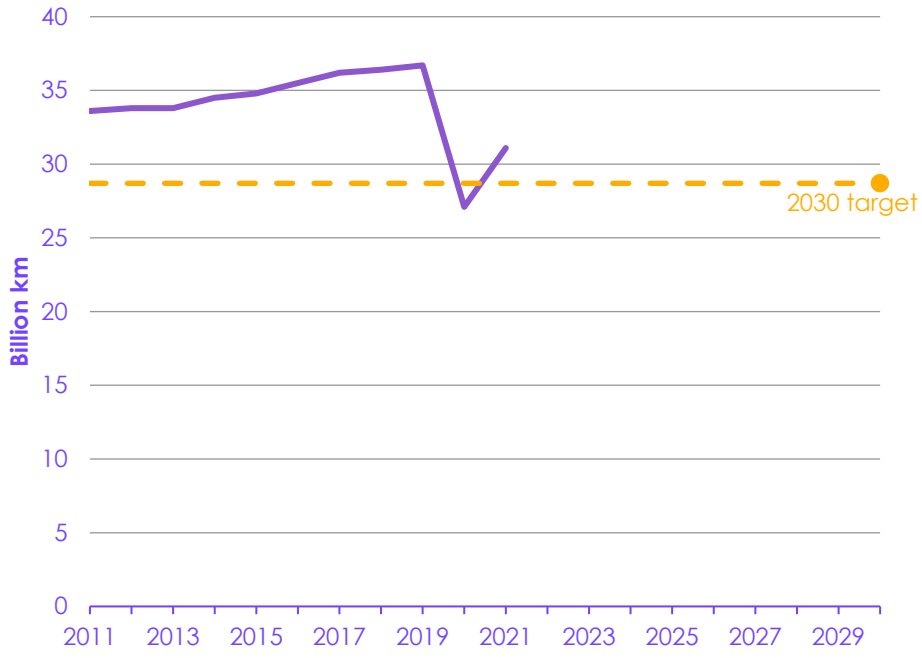
- **Aviation demand**. The Scottish Government has committed to growth in aviation demand following the pandemic, which runs counter to the very challenging emissions reduction targets. It has made no commitments to use its devolved powers, such as airport expansion control and Air Departure Tax, to curb aviation growth.

Figure 6 Number of new electric car and market share of total car sales in Scotland



Source: DfT (2022); CCC analysis.

Figure 7 Car use over time, versus 20% reduction target



Source: DfT (2022); CCC analysis.

(b) Industry

10.1 $MtCO_2e$ in 2020, down 4% since 2019 and 19% since 2010
Industry is the second-highest-emitting sector in Scotland. The Scottish Government plans to reduce the sector's emissions by around a third by 2030, but many policy levers are reserved to the UK Government. While good progress has been made in supporting innovation and skills in this sector, policies are needed to improve resource efficiency. Improvements to the collection and reporting of industrial decarbonisation data is essential to enable effective monitoring of progress.

(c) Buildings

8.5 $MtCO_2e$ in 2020, down 1% since 2019 and 6% (on a temperature adjusted basis) since 2010
The Scottish Government has set out an ambition to reduce emissions from buildings by around 70% in the next decade but policies are not yet sufficient to deliver this.

- **Low-carbon heat in homes**. Scotland aims to reach 1.2 million homes with low-carbon heating by 2030, considerably faster than our updated pathway and the ambition of the UK as a whole. Good progress in heat network planning has been made but, overall, policies are not yet in place to support the transition beyond the risky UK-wide market-based approach.

- **Energy efficiency in homes.** Funding is in place to improve efficiency in social housing and fuel-poor homes, and the Scottish Government has consulted on proposals to reform Energy Performance Certificates (EPCs). However, there is a lack of regulations and incentives in place to drive improvements to energy efficiency. Policies for minimum efficiency standards for private-rented and owner-occupied homes are not in place.

- **Monitoring and evaluation.** It is currently very difficult to monitor progress against the necessary measures for decarbonising the buildings sector due to a lack of adequate and up-to-date data. This must be addressed in the Scottish Government's proposed framework for monitoring and evaluating policy progress, which is now overdue.

(d) Agriculture

7.6 $MtCO_2e$ in 2020, down 3% since 2019 and 5% since 2010
There has been minimal progress in reducing agricultural emissions in the past decade, yet the Scottish Government plans to reduce emissions by nearly 30% in the next decade.

- **Low-carbon farming.** Detail on low-carbon agriculture policy following exit from the EU Common Agricultural Policy is needed urgently. Although a consultation on the forthcoming 2023 Agriculture Bill opened in 2022, timescales and incentives remain short-term. This severely constrains the time available to meet the required emissions reduction.

- **Demand and consumption.** Scotland has no commitment to introduce policy to reduce meat and dairy consumption. While there is an ambition to reduce 2013 food waste levels by one third by 2025, policy is needed to support a shift to healthier, lower-carbon diets.

(e) Electricity supply

1.7 $MtCO_2e$ in 2020, down 14% since 2019 and 89% since 2010
Emissions from electricity supply have fallen significantly. Policy is primarily reserved, with a UK target to fully decarbonise the sector by 2035, but more clarity from the Scottish Government is needed on how a fully decarbonised and resilient Scottish electricity system will operate, and in particular how adequate network capacity will be delivered to utilise expected increases in renewable electricity generation.

In the past year there has been a number of developments which will help contribute to reducing electricity emissions in both Scotland and the wider UK:

- **ScotWind.** In the 2022 ScotWind leasing round, seabed rights for 28 GW of offshore wind capacity were procured. If delivered this would be significantly in excess of the Scottish Government's ambition for 8-11 GW by 2030.

- **Transmission network developments.** Ofgem has approved two new subsea link projects between Scotland and England. These are expected to be operational in the second half of the 2020s and will help connect future Scottish renewable generation to demand centres in England.

(f) Waste

1.5 $MtCO_2e$ in 2020, down 12% since 2019 and 45% since 2010
Scotland plans to reduce waste emissions by more than half by 2030. Some progress in waste-reduction policies has been made, for example consulting on a Circular Economy Routemap and introducing a moratorium for incineration and energy from waste facilities. However, we have not yet seen the necessary progress in our indicators, and Scotland is significantly off-track on recycling rates.

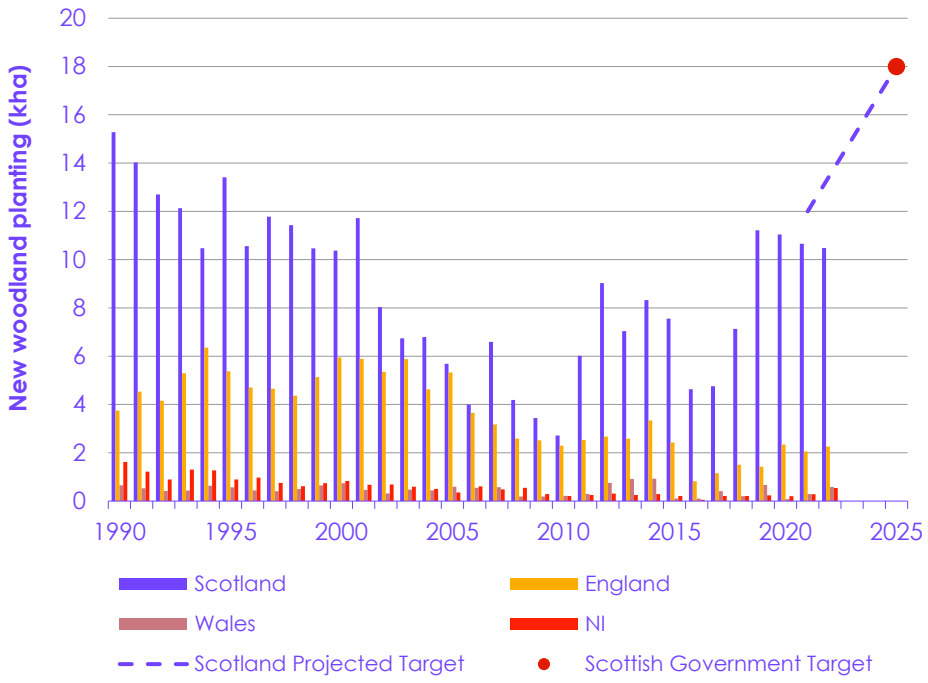
(g) Land use

0.8 $MtCO_2e$ in 2020, down 0.6 MtCO2e since 2019 and up 0.5 $MtCO_2e$ since 2010
Scotland has small net emissions from land use, as land use sources (11.9 $MtCO_2e$ in 2020) are similar in extent to land use sinks (-11.2 $MtCO_2e$ in 2020). Action is needed now to ensure the necessary reductions to net emissions in this sector.

- **Trees and woodland.** Scotland has consistently planted trees at a faster rate than the rest of the UK combined. However, rates have plateaued recently and are off track to meet the Scottish Government's target of 18,000 hectares per year by 2024/25 (Figure 8). Significant barriers from insufficient skilled workforce capacity, availability of land and contract restrictions on tenant farmers need to be overcome to deliver the required scale-up.

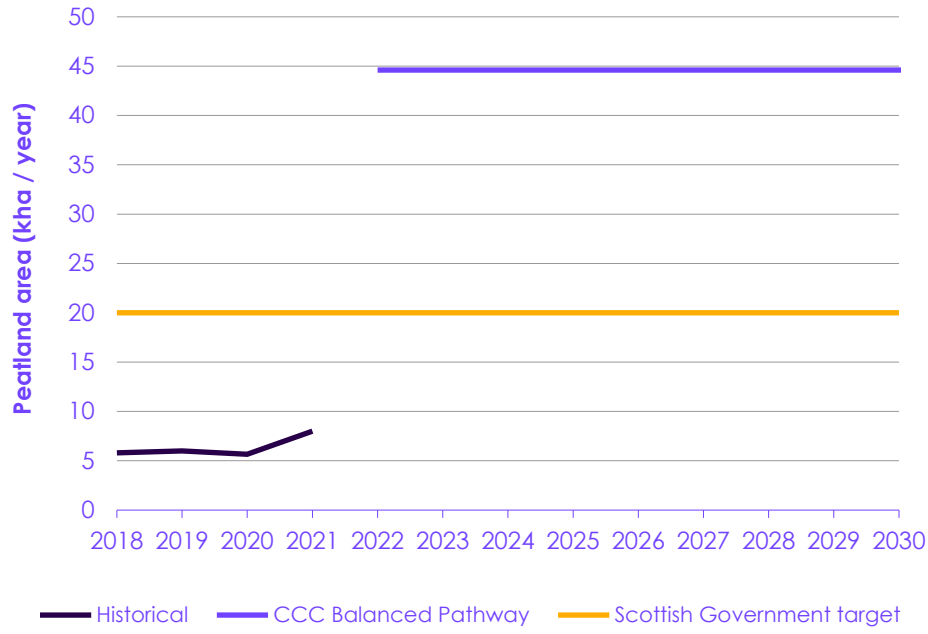
- **Peatlands.** Around 80% of Scotland's peatlands are degraded and contribute significantly to land use emissions. Scotland's targets for peatland restoration are not ambitious enough and are not being met (Figure 9). If ambition is not increased and delivery barriers, such as skills shortages and contractor availability, are not overcome, emissions in the land use sector will be well above the necessary contribution to Scotland's 2030 target.

Figure 8 UK afforestation rates and Scottish Targets



Source: Scottish Government (2020) *Securing a green recovery on a path to Net Zero: Climate Change Plan 2018-2032 – update;* Forest Research (2022).

Figure 9 Peatland area under restoration management – historical delivery and targets



Source: Scottish Government (2022) *Climate Change Plan: monitoring reports.*
Notes: Restoration management has occurred in Scotland pre-2018. The values reported here reflect reporting in the Climate Change Plan Monitoring reports.

(h) Engineered removals

The Scottish Government has chosen to rely heavily on engineered removals to meet its 2030 target, with plans assuming approximately two-thirds of the UK's stated ambition will be delivered in Scotland. With the Scottish Cluster on the reserve list for Track 1 of the UK's Carbon Capture, Utilisation and Storage (CCUS) cluster sequencing programme, the developers must now focus on securing a successful Track 2 Cluster sequencing bid once that process is launched, ensuring that engineered removals projects make up part of their proposal.

Chapter 1

Progress in reducing emissions

Introduction

Scotland has a legislated target to reach Net Zero greenhouse gas emissions by 2045, with interim targets in 2020, 2030 and 2040 as well as annual targets. This chapter outlines Scotland's progress towards these targets based on the latest available territorial emissions data, which cover the period to 2020. We also present the most recent data on Scotland's consumption emissions, covering the period to 2018.

Our key messages are:

- **Emissions in 2020.** Scotland's territorial greenhouse gas emissions were 40.6 $MtCO_2e$ in 2020, 12% below 2019 levels and 51% below 1990 levels. The reduction in 2020 was largely due to the effects of the COVID-19 pandemic.

- **The 2020 interim target**. Using the 'base inventory', against which emissions targets in Scotland are measured, emissions have fallen by 59% since 1990. Scotland has therefore met the 2020 interim target for a 56% reduction in emissions. However, this included a substantial contribution from the effects of the pandemic, and it is unlikely that the target would have been met without them.

- **Future targets**. There is a significant risk of Scotland failing to meet its annual targets in the 2020s. This is due to three factors: the expected rebound in emissions following the pandemic, switching the 'base inventory' to the latest accounting methodology which will increase reported emissions and the very rapid reductions in emissions required by the legislated targets. This risk will be somewhat reduced if our recommendation to adjust the annual targets to be consistent with the latest accounting methodology is accepted (see our accompanying Target Advice[1]). Scotland has missed seven of its eleven targets – urgent action is required now to prevent this continuing.

- **Consumption emissions.** In 2018, Scotland's consumption emissions grew 3% to 70 $MtCO_2e$, which is 50% higher than territorial emissions. This corresponds to an average of 13 tCO_2e per person, 22% higher than the UK average per person.

The rest of this chapter is laid out as follows:

1. Progress in reducing Scotland's territorial emissions

2. Progress in reducing Scotland's consumption emissions

(a) Total emissions and the 2020 target

Scotland has achieved its 2020 interim target, but this was largely due to the effects of the COVID-19 pandemic.

On the basis of the latest GHG emissions inventory for Scotland, published in June 2022,[2] total emissions in Scotland fell by 12% between 2019 and 2020 to 40.6 $MtCO_2e$, which is a reduction of 51% on 1990 levels (Figure 1.1). The reduction in 2020 was primarily due to travel lockdowns during the COVID-19 pandemic.

Using Scotland's 'base inventory' methodology for GHG emissions accounting (Box 1.1), which is the methodology used to determine compliance with Scotland's legislated climate targets, emissions in 2020 have fallen 59% since 1990,* and therefore Scotland has met its 2020 interim target for a 56% reduction in emissions (Figure 1.1).

Scotland has failed to achieve seven out of eleven of its targets, which will become increasingly difficult to meet in the 2020s.

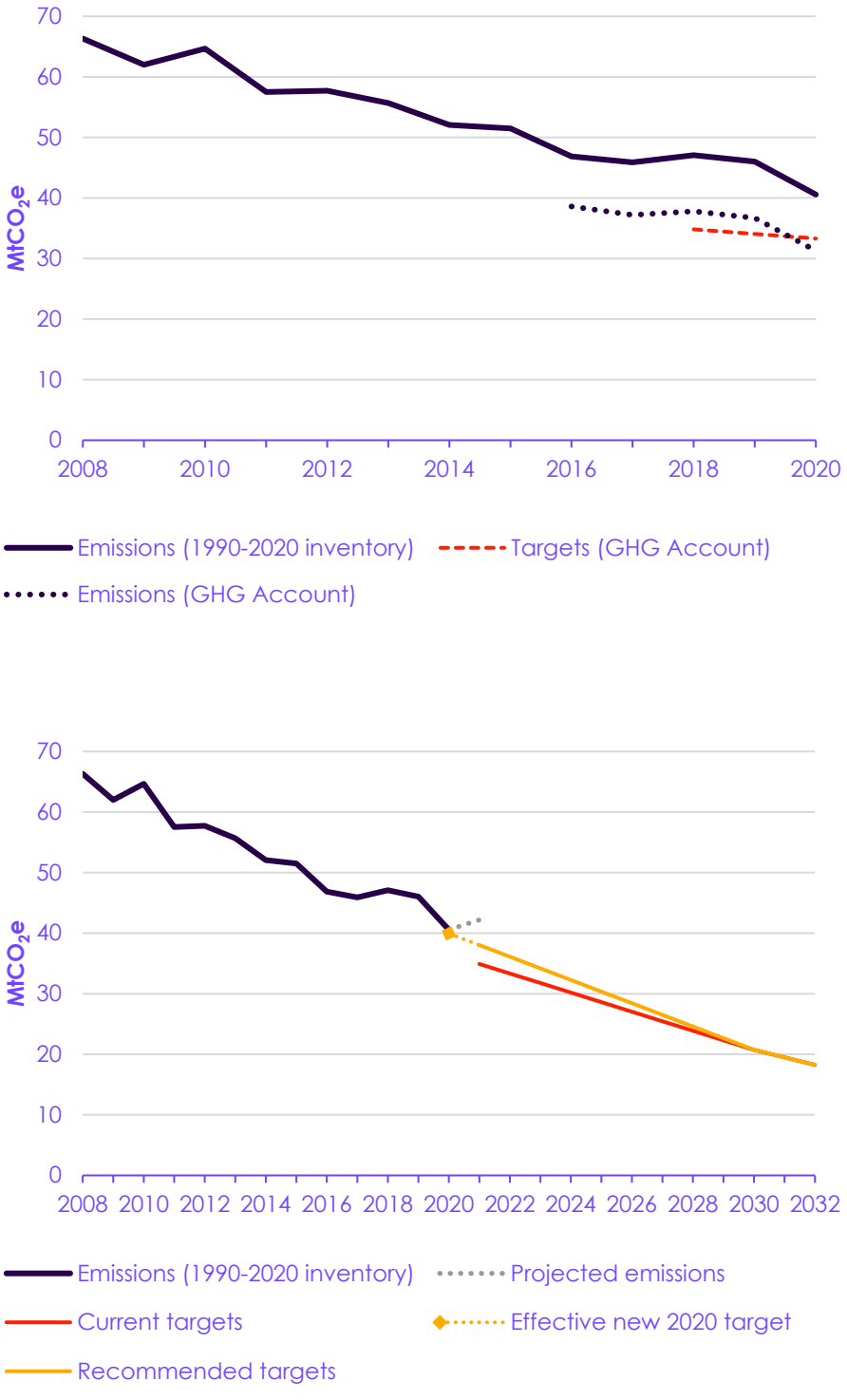
Emissions data for 2021 are not yet available for Scotland, although the UK as a whole saw a 4% increase from 2020. If emissions in Scotland have rebounded by a similar amount, then the 2021 annual target of a 57.9% will not have been met. With the base inventory moving to the latest inventory methodology next year, the target is likely to be missed by a very significant amount unless the recommendation in our accompanying Target Advice to align the annual targets in the 2020s with the latest methodology is accepted (Figure 1.1).

Scotland has failed to meet seven out of eleven of the legislated annual targets since 2010 (Box 1.2) and there is a major risk that they will continue to be missed unless the annual targets for the 2020s are adjusted in accordance with our recommendation and strong action to reduce emissions across the economy is taken now. Repeated missing of targets has the potential to undermine the framework for emissions reduction in Scotland and confidence in the Scottish Government's ability to deliver effective policy.

* The percentage targets discussed in this report are relative to 1990 for all gases except fluorinated gases, which are relative to 1995. For simplicity we refer to the reference year as 1990.

Scotland achieved its 2020 target with emissions falling 12% since 2019. This was largely due to the effects of the pandemic and the targets in the 2020s will be very difficult to meet as emissions rebound.

Figure 1.1 Scotland's emissions and targets



Source: NAEI (2022) Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland, CCC analysis, Scottish Government; Scottish Government (2019) Climate Change (Emissions Reduction Targets) (Scotland) Act 2019; Scottish Government (2020) Scottish Greenhouse Gas Statistics; CCC analysis.
Notes: Projected in emissions in 2021 assume the same 4% increase seen in the UK.

Box 1.1
Scotland's GHG Account and annual adjustment mechanism

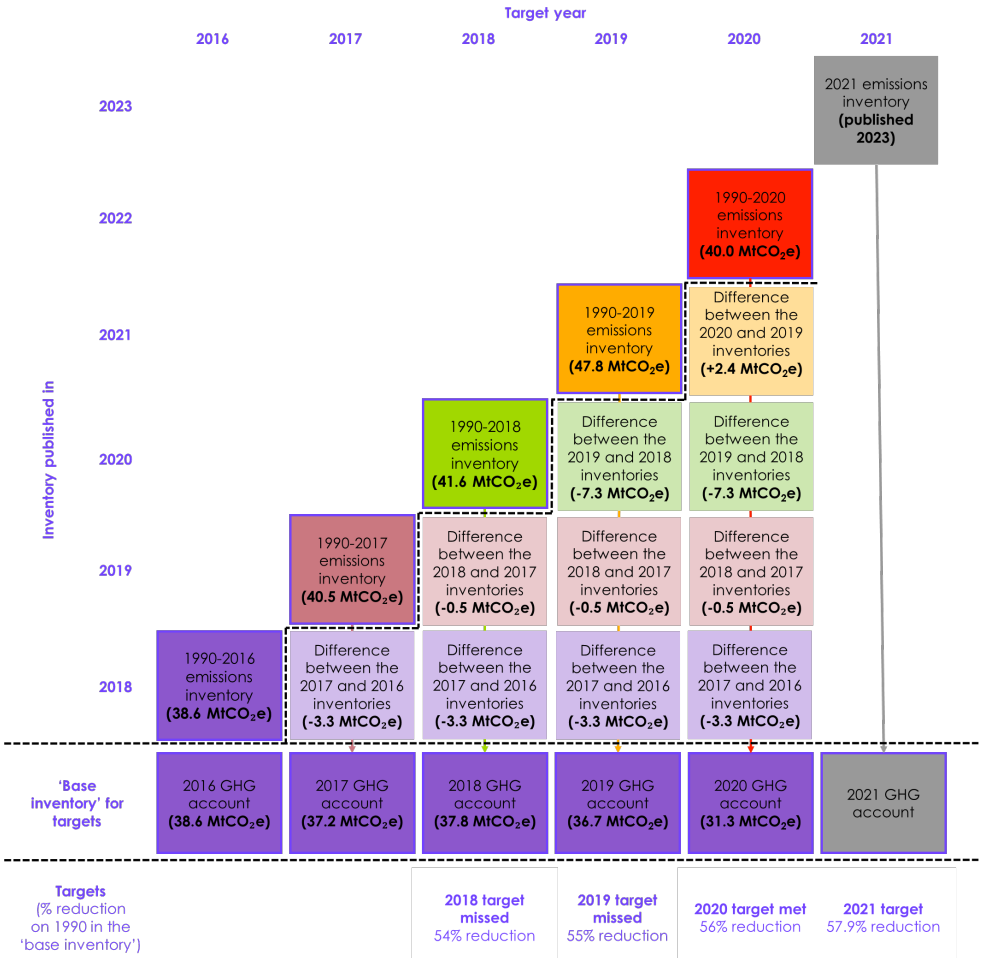
Scotland's emissions targets are assessed against the Scottish Greenhouse Gas (GHG) Account, a methodological approach used to adjust annual emissions to the methodology of the 'base inventory', which is currently the 1990-2016 inventory. This way, the impact of changes in methodology in determining whether Scotland has met each annual target is minimised.

Methodology changes to the emissions inventory are designed to increase the transparency, accuracy, consistency, comparability and completeness of emissions estimates. These can come from updates to use more accurate emissions factors and/or activity data, from changes to the internationally agreed global warming potentials of greenhouse gases, and to changes in the scope of the inventory, such as the recent update to the treatment of emissions from peatlands. Scotland is particularly susceptible to changes due to the large contribution from the land use sector, which has large uncertainties and tends to change more significantly than other sectors.

The GHG Account allows for annual emissions data to be assessed against targets while accounting for inventory changes, but not changing the target. In any given year the GHG Account is estimated by the following steps (illustrated in Figure B1.1):

- Take the new emissions inventory, which includes estimates of emissions in the most recent year and revised estimates of emissions in previous years (which have also been estimated in previous inventories).
- Calculate the difference in emissions between the last two inventories in the year before the most recent one (this is the latest year which is covered by both inventories).
- Use this difference to estimate what the latest year's emissions would be if calculated with the older inventory methodology.
- Repeat these steps until the reference inventory is reached. This is the GHG Account.
- Compare the GHG Account to 1990 levels in the reference inventory, comparing this to the annual percentage target to assess whether it was met.
- Every five years reset the latest inventory to be the new reference inventory. At this point the targets are also reviewed.

Figure B1.1 Scottish GHG Account



Source: CCC analysis.

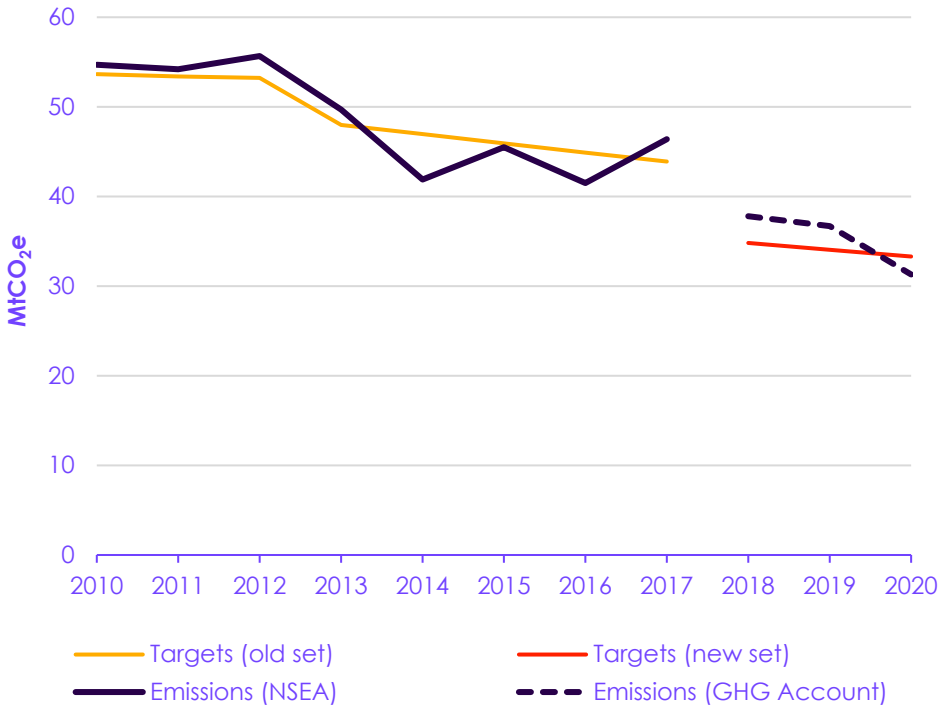
Source: Climate Change Committee (2018) *Letter from Lord Deben to Roseanna Cunningham MSP advising on Scottish climate target framework.*

Box 1.2
Scottish targets

Scotland has had eleven targets over the period 2010 to 2020 and has failed to achieve seven of them (Figure B1.2). Prior to 2018 the targets were based on absolute emissions in $MtCO_2e$ and used the latest available greenhouse gas inventory's reported emissions, adjusted to take into account the impact of EU ETS licences. Some of these targets were made significantly more difficult to make by changes to the inventory methodology for estimating emissions.

Based on our advice,[3] this changed from 2018 onwards to use the GHG base account (Box 1.1) with targets based on a percentage reduction on 1990 levels. This was to reduce the dependence of achieving the targets on changes to accounting methodology. Despite this, Scotland has still not achieved two of its targets since 2018, with the 2020 interim target being achieved largely due to the temporary reduction in emissions due to the effects of the pandemic.

Figure B1.2 Between 2010 and 2020, Scotland only met its legislated targets four times



Source: Scottish Government (2019) *Climate Change (Emissions Reduction Targets) (Scotland) Act 2019;* Scottish Government (2020) *Scottish Greenhouse Gas Statistics*; CCC analysis.
Note: Between 2010 and 2017, the Scottish targets in place where set in absolute $MtCO_2e$. Emissions were reported after having been adjusted to account for EU ETS licences, known as the Net Scottish Emissions Account (NSEA). On this basis, Scotland met its legislated targets three times until 2017. Following advice from the Committee in 2017, the new set of targets was set on a percentage reduction basis from 1990 emissions as reported in the 1990-2016 GHG inventory, using the GHG Account methodology. It was also agreed that actual emissions would be reported on, instead of adjusting for ETS licences. To account for changes in the inventory methodology that increased the volatility of emissions reported, the Scottish Government adopted the Committee's advice to use the GHG Account methodology.

(b) Sectoral emissions

Figures 1.2 and 1.3 show reported emissions in each sector compared to the projections in Scotland's update to the Climate Change Plan (CCPu).[4] Historically, the largest drop in emissions has come from the electricity supply sector due to the phase-out of coal and ramp up of renewable electricity, with significant reductions also in the waste and industry sectors. Little progress has been seen in the other sectors. Urgent action is now needed across the economy to ensure decarbonisation at the required rate. The transport and buildings sector pathways are particularly challenging (Chapter 3).

Changes in sectoral emissions from 2019 to 2020 (Figures 1.2 and 1.3) were as follows:

Transport saw the biggest fall in emissions in 2020. These are expected to have rebounded significantly in 2021.

- **Transport** emissions fell by 26%, due to the pandemic affecting surface transport (-21%), aviation (-64%) and shipping (-13%). The UK has seen a significant rebound in this sector in 2021 with a further rise expected in 2022. The trends in Scotland are likely to be similar.

- **Land use** emissions fell by 0.6 $MtCO_2e$, driven by an increase in the area of peatland under restoration management.

Outside of the transport sector, land use, electricity supply and waste saw the most significant relative decrease in emissions, all driven by progress in decarbonisation policy.

- **Industry** emissions fell by 4% overall: manufacturing and construction emissions increased by 2%, while fuel supply emissions fell by 13%.

  – Most manufacturing and construction sectors saw a decrease in emissions in 2020, in line with the wider trend in the UK as a result of the pandemic. The overall increase of 2% was driven by the chemicals sector, though this was partly due to a temporary plant closure causing lower emissions in 2019.

  – The fall in fuel supply emissions in Scotland was similar to the UK-wide reduction driven by a marked decrease in fossil fuel consumption during the pandemic.

- **Buildings** emissions fell by 1% overall due to an 8% decrease in non-residential buildings and a 2% increase in homes. The balance of residential and non-residential emissions was altered by changing working patterns during the pandemic. Emissions were suppressed due to heating demand being reduced by a particularly mild winter: on a temperature-adjusted basis overall emissions from buildings rose slightly.

- **Electricity supply** emissions fell by 14% due to a continuing decline in gas-fired generation, while low-carbon generation increased.

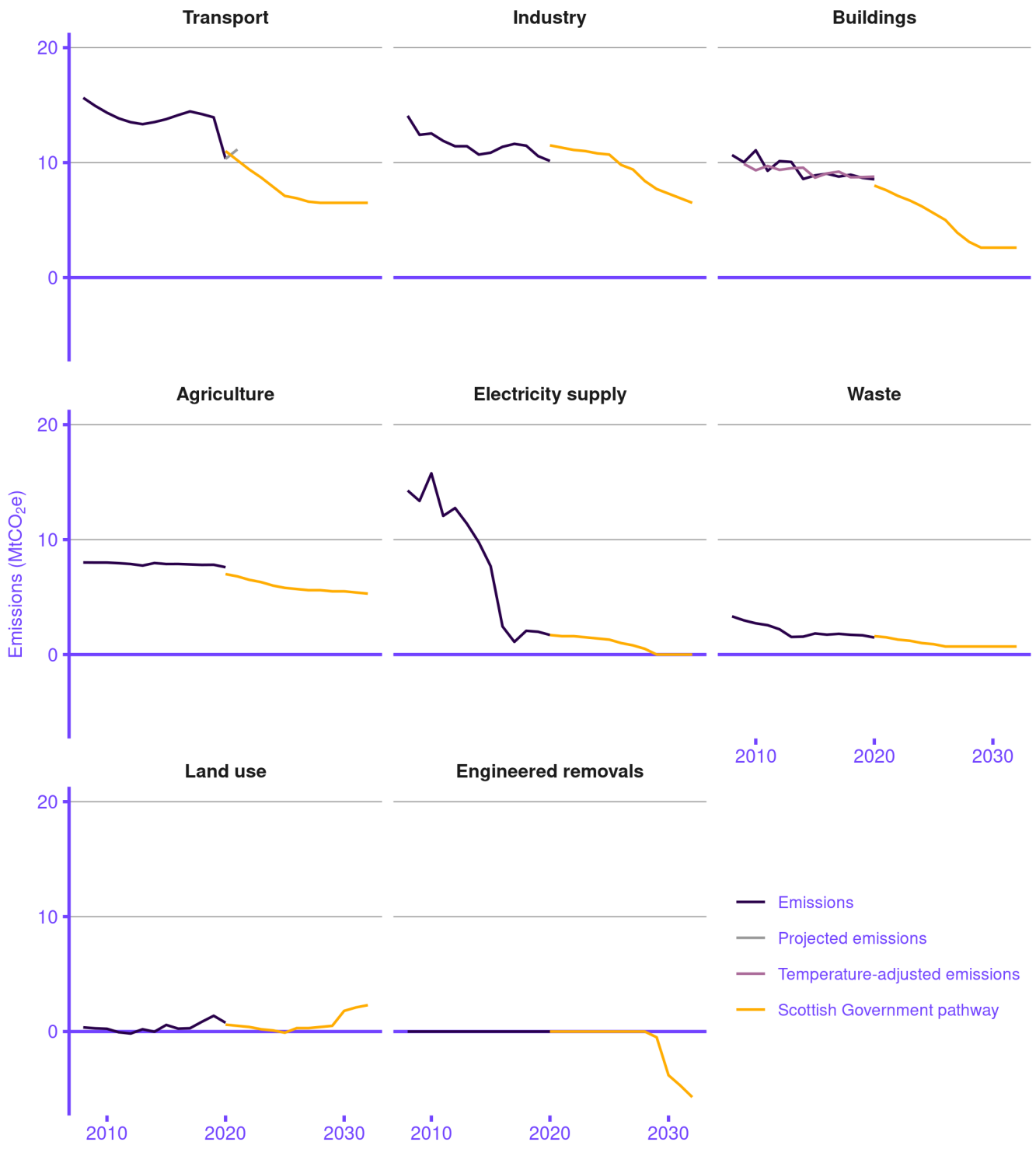
  – This is similar to the fall in emissions seen across the UK in 2020. UK emissions subsequently saw a 10% increase in 2021, in part due to low wind speeds and a post-pandemic bounce-back in demand. We would expect to see a similar trend in Scotland.

  – Net exports of electricity from Scotland (primarily to England) have been increasing in recent years and rose 22% in 2020 to 19 TWh, helping utilise higher levels of low-carbon generation. Around 4 TWh of Scottish wind generation was unable to be utilised due to transmission network limitations.

- **Agriculture** emissions fell by 3%, similar to the UK-wide change. The fall was mainly due to a decline in soils emissions, which accounts for around a quarter of the sector's emissions.

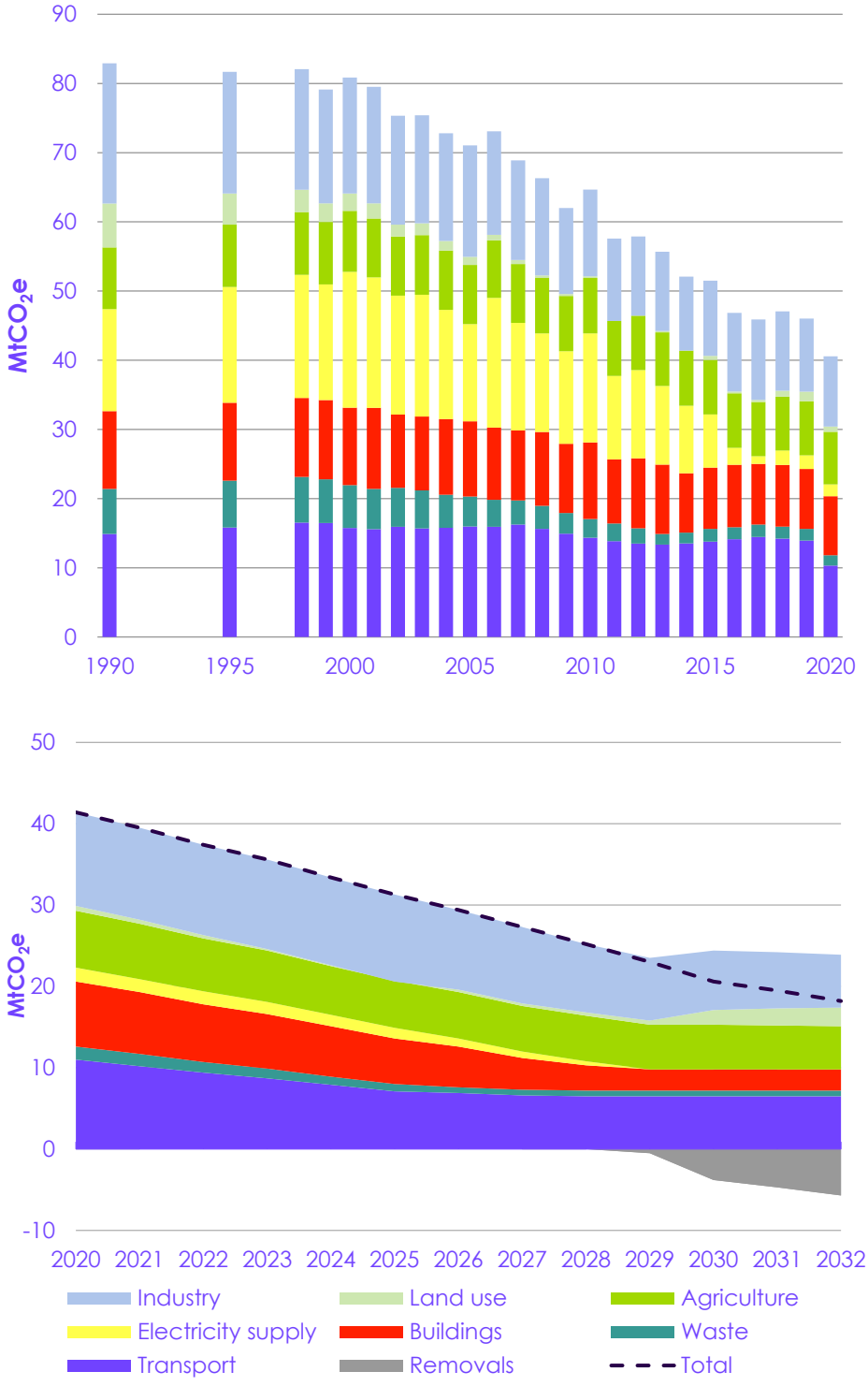
- **Waste** emissions fell by 12%, predominantly driven by a reduction in the methane emitted from landfill. In recent years the amount of waste disposed of in landfill has generally decreased in Scotland, driven by the Scottish Landfill Tax and forthcoming ban. However, there has simultaneously been growth in waste being incinerated in energy from waste facilities (used to raise power and heat). The emissions associated with energy from waste are not reflected in estimated waste sector emissions and are instead reported under heat and electricity generation (Scotland's inventory does not report these separately from other forms of generation). We have recommended reporting be improved in this area to better enable monitoring.

Figure 1.2 Scotland's historical emissions (2008-2020) compared to the Scottish Government's pathway (2020-2032) by sector



Source: NAEI (2022) *Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2020*; Scottish Government (2020) *Securing a green recovery on a path to Net Zero: Climate Change Plan 2018-2032 – update.*
Notes: The transport emissions in 2021 are a projection assuming Scottish emissions in surface transport, aviation and shipping rose by the same proportion as those in the UK.

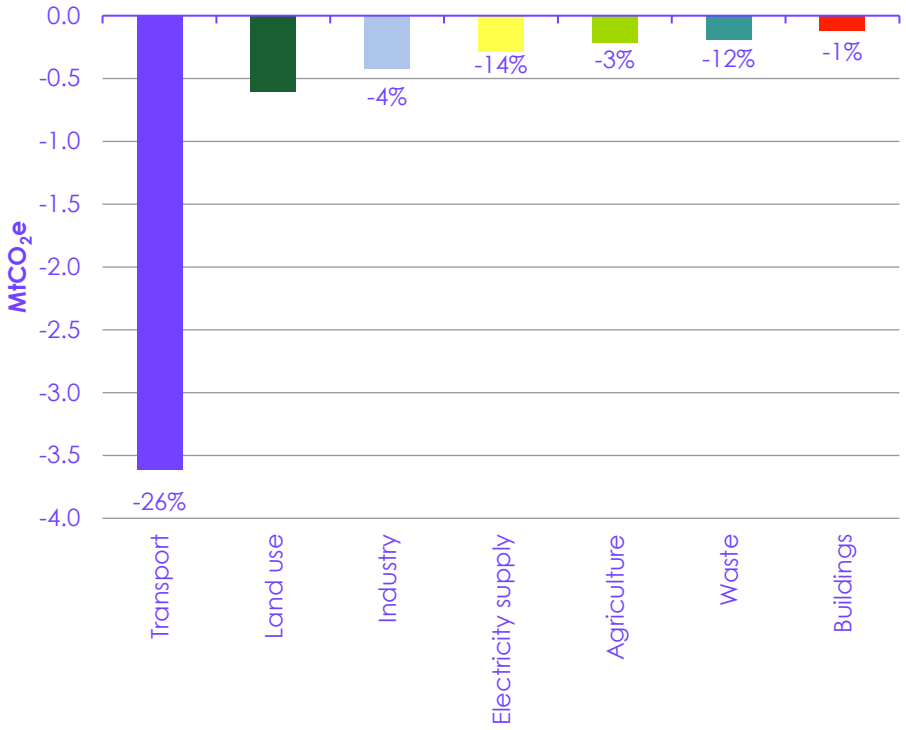
Figure 1.3 Scotland's historical emissions (1990-2020) and the Scottish Government's pathway (2020-2032) by sector



Source: NAEI (2022) *Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2020*; Scottish Government (2020) *Securing a green recovery on a path to Net Zero: Climate Change Plan 2018-2032 – update.*
Notes: Historical emissions are not available for the years 1991-1994, and 1996-1997.

Transport emissions decreased by 26% during the pandemic, with smaller decreases seen in all other sectors.

Figure 1.4 Change in Scottish emissions 2019-2020



Source: NAEI (2022) *Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2020;* CCC analysis.
Note: Scotland has small net emissions from land use, as land use sources (11.9 $MtCO_2e$ in 2020) are similar in extent to land use sinks (-11.2 $MtCO_2e$ in 2020) therefore a percentage reduction in emissions is less meaningful.

2. Progress in reducing Scotland's consumption emissions

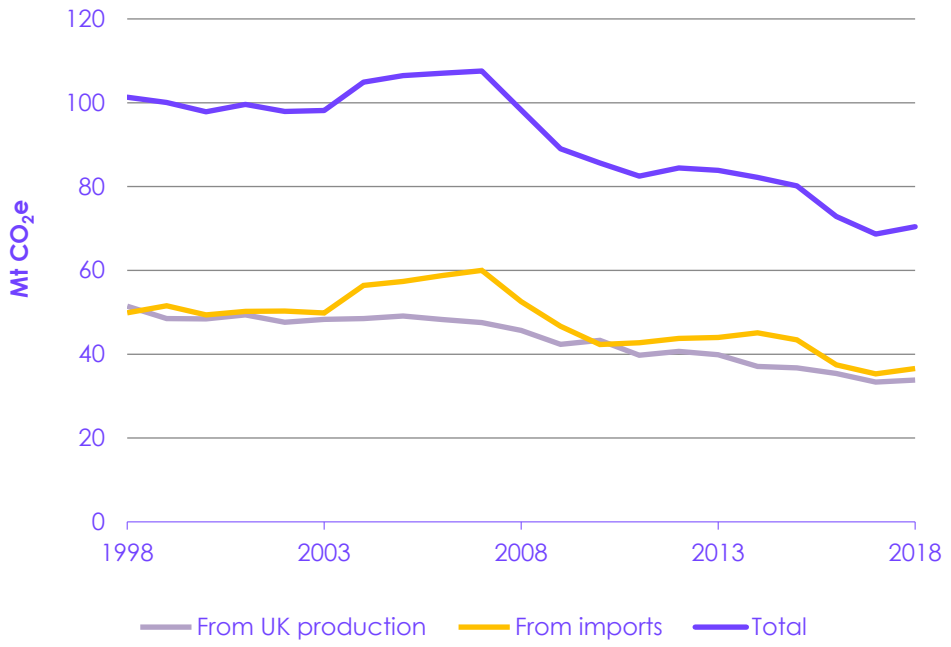
Scotland's consumption emissions rose 3% in 2018, driven by increases in the manufacturing and fuel supply sectors.

In this section we report on progress in reducing Scotland's consumption emissions, those associated with the production, transportation, use and disposal of products and services by Scottish consumers, no matter where in the world they occur.

In 2018 Scotland's consumption emissions were estimated to be 70 $MtCO_2e$* (Figure 1.5), which is 50% higher than Scotland's territorial emissions. On a per-capita basis, Scotland's consumption emissions (13 tCO_2e per person) are 22% higher than those for the UK[5] as a whole (11 tCO_2e per person).† Scotland's consumption emissions grew by 3% between 2017 and 2018, driven by increases in the manufacturing and fuel supply sectors. Over the longer term, Scottish consumption emissions have fallen by 30% since 1998.

Emissions embedded in imports contributed 52% of 2018 consumption emissions, up 4% on 2017 levels. The remaining 48% were from emissions produced within the UK, including directly by Scottish households (e.g. for heating and personal transport).

Figure 1.5 Scottish consumption emissions by origin, 1998-2018



Source: *Scotland's Carbon Footprint 1998-2018*; CCC analysis.

* The latest data available at the time of writing (published March 2022). Consumption emissions statistics are published with a longer lag than territorial emissions. Consumption emissions data do not include emissions associated with land use, land use change and forestry.

† For the UK, we use the previous year's data rather than the most recent data published in November 2022, as that was published nearer to the latest Scottish data so should have a more similar methodology to allow for better comparison.

Endnotes

[1] Climate Change Committee (2022) *Scottish Emission Targets – first five-yearly review*.

[2] Scottish Government (2022) *Scottish Greenhouse Gas Statistics 2020*, https://www.gov.scot/publications/scottish-greenhouse-gas-statistics-2020/

[3] Committee on Climate Change (2017), *Advice on the new Scottish Climate Change Bill* https://www.theccc.org.uk/publication/advice-on-the-new-scottish-climate-change-bill/

[4] Scottish Government (2020) *Securing a green recovery on a path to net zero: climate change plan 2018–2032 – update,* https://www.gov.scot/publications/securing-green-recovery-path-net-zero-update-climate-change-plan-20182032/documents/

[5] Defra (2022) *UK's Carbon Footprint 1997-2019* https://www.gov.uk/government/statistics/uks-carbon-footprint

Chapter 2

Progress on cross-cutting issues

Introduction and key messages

Scotland's emissions reduction targets are amongst the most stretching in the world. The Scottish Government has committed to ambitious milestones for measures to decarbonise Scotland's economy in the next decade, with a welcome focus on a fair and just transition. But a clear delivery plan on how each of these milestones will be achieved is missing, and there is no quantification of how the various measures combine to give the emissions reduction required to meet Scotland's targets.

Meeting its emissions targets over the next decade will require monumental efforts from the Scottish Government to roll out climate policy and act effectively to cut emissions. Fundamental challenges in coordinating action, assigning responsibility and putting in place the necessary governance structures for such a task are now more pressing than ever.

Our key messages are:

- **Embedding Net Zero in core policy.** Net Zero is more prominent in the decision-making cycle of allocating funding to policy, even in a year dominated by a cost-of-living crisis, with the Scottish Government's Programme for Government allocating significant sums to policies aligned with low-carbon principles that can deliver co-benefits across economic sectors.

- **A quantified plan is urgently needed**. The Scottish Government urgently needs to provide a quantified plan for how its various polices and plans will combine to achieve the emissions reduction required to meet its challenging 2030 target. The plan must detail how each of Scotland's ambitious milestones will be achieved.

- **Gaps in local governance structures.** There are still important gaps at a local authority level, which might cause detrimental delays in rolling out the sufficient policy across the nation. A lack of coordination from the Scottish Government, as well as barriers to properly implementing climate policy that are ingrained in the policy cycle, have left local authorities to their own devices to do the best they can. The resulting risk is Net Zero policy being rolled out at different speeds depending on the local area.

- **Co-operation with UK Government**. Policy-making in all economic sectors in Scotland is subject to a mixture of powers reserved to the UK Government and those devolved to the Scottish Government. Some sectors are reserved to a greater extent, but the Scottish Government can still influence them in substantial ways. Given the dependence of Scottish decarbonisation on these key sectors, a functioning working relationship and effective input on plans is of paramount importance for meeting Scotland's targets. While the Scottish and UK Governments' have enough structures in place for effective consultation to happen, coordination between the two has been insufficient so far. This lack of cooperation, could also prove detrimental for the UK plans if Scotland's full potential to its contribution to the UK's decarbonisation plans is not realised.

- **A just transition**. Consideration of the impacts of decarbonisation on the Scottish workforce has featured prominently in the Scottish Government's plans so far, and for good reason: the Scottish economy is highly reliant on industries that will need to change rapidly and fundamentally to cut emissions.

So far, there has been some focus on ensuring the transition to a green economy is just, with funding to retrain workers to respond to the new demands of the labour market and plans for the assessments of the impact of decarbonisation on all economic sectors. The Scottish Government should maintain this emphasis on the transition being fair and inclusive to everyone, including consumers amidst a cost-of-living crisis.

In Chapters 3 and 4, we look at progress made in Scotland in the sectors where key policy decisions are made by the Scottish Government, and as those where action is reserved to the UK Government, respectively.

The rest of this chapter is laid out as follows:

1. Cross-economy progress
2. Governance
3. Just transition
4. Adaptation
5. Future steps in Scottish policy

(a) UK policy context

Over the past year, the UK policy context has shifted towards providing support to households and businesses in the midst of a cost-of-living crisis.

Since Russia's invasion of Ukraine, the focus of the UK Government's energy policy has shifted towards faster deployment for non-fossil energy generation and financial support for households and business to cope with very high energy prices and the cost-of-living crisis.

Energy policy is an area where policy levers are mostly reserved; as a result, while the Scottish Government can influence the development of energy policy through using those policy levers that are devolved (e.g. planning and many areas of energy demand), decisions taken by the UK Government have a significant impact on progress in Scotland.

The UK Government has provided a £400 discount to the energy bills of every household with a domestic electricity connection through the Energy Bills Support Scheme and has capped the unit cost of electricity and gas through the Energy Price Guarantee. Support for businesses and non-domestic energy users will be provided through the Energy Bill Relief Scheme.

In July 2022, the UK Government launched a consultation on the design of the electricity market in Great Britain. The results of the consultation will feed into a review of the GB-wide market design which will aim to ensure that the electricity market structure is fit for future use and will be able to deliver the UK's medium-term goal of completely decarbonising the British power sector by 2035 while maintaining the security of supply.

(b) Policy developments in Scotland

The focus on responding to the cost-of-living crisis has framed all policy development and introduced new priorities for the Scottish Government:

This year's Programme for Government included funding pledges for low-carbon policies that also work towards addressing the cost-of-living crisis, which will be the primary focus over the next year.

- **2022/23 Programme for Government**. As expected, given the wider UK context, the main challenge the Scottish Government aimed to address this year has been rising inflation and providing financial support to those most in need. The Programme for Government (PfG) set out some bold steps to do so, linking certain solutions to the cost-of-living crisis to climate mitigation and long-standing commitments to emissions-cutting policies (Box 2.1).
  - The PfG indicated a renewed emphasis on renewable generation through support for supply chains for offshore wind, funding for hydrogen production, and regulatory adjustments to further encourage the development of onshore wind. This is in line with the Scottish Government's focus in recent years on moving towards homegrown green energy and is setting the ground for the Scottish energy strategy due by the end of 2022.
  - Energy demand is also partially addressed through the launch of the Public Energy Agency that will be coordinating the decarbonisation of heat across Scotland. Energy efficiency will also be part of the Heat and Buildings Bill that is planned to be introduced in the Scottish Parliament in 2022/23.

– Further measures to keep the cost of transport down and encourage a modal shift from cars towards active travel and public transport will also have a positive impact on the continued emissions reduction.

The Fourth National Planning Framework can be a useful tool for coordinating the implementation of policy on a local level, if used correctly.

- **Fourth National Planning Framework.** The Scottish Government published its draft fourth National Planning Framework (NPF4) in early 2022.[1] This was an important step towards embedding Net Zero in the planning process and setting the direction of movement for the built environment and major projects in Scotland.

  – NPF4 sets the groundwork for the realisation of key policies presented in the update to the Climate Change Plan (CCPu), such as the expansion of renewable generation (particularly onshore wind), energy-efficient homes, 20-minute neighbourhoods and the use of nature-based solutions.

  – Certain aspects of adaptation policy were also included in the Framework, particularly around coastal change, overheating buildings and surface water flooding. Other important aspects related to the location of new infrastructure and building on flood plains were less well-developed.

  – While NPF4 was a welcome step towards linking mitigation and adaptation policy to investment through its alignment with Scotland's Infrastructure Investment Plan, there are remaining concerns over its impact on planning decisions and policy-making in real terms. Without a clear line of responsibility and accountability, the weight of its implementation, along with its implicit risk, remains on local decision-makers. In March 2022, the Committee wrote to the Scottish Government to express these concerns and provide a more detailed response to the Framework.[2]

Other policy developments include progress in embedding just transition across sectors and aligning infrastructure investment with Net Zero.

- **Infrastructure Investment Plan and Infrastructure Commission for Scotland.** The Infrastructure Commission was established by the Scottish Government in 2019 to take stock of existing infrastructure and identify key future challenges and how to address them. Among the Commission's objectives were specific considerations on helping Scotland transition towards a more resource-efficient, lower-carbon economy while maintaining inclusive economic growth and competitiveness.

  – The Commission published its findings in two phases, with its key findings report, A Blueprint for Scotland, arriving in January 2020, followed by a Delivery Findings report in July 2020.

  – Scotland's current Infrastructure Investment Plan (2021/22 to 2025/26) was developed as the Scottish Government's response to the first phase of the Commission's work and recommendations, focusing on ambition and strategic priorities for Scottish infrastructure. The Plan is structured on three pillars: transitioning to Net Zero emissions and environmental sustainability; inclusive economic growth; and building resilient and sustainable places.[3] As such, the Plan places Scotland's Net Zero target at the heart of its infrastructure investment strategy, and links it to wider planning policy. The Scottish Government is currently in the process of developing its response to the second phase of the Commission's recommendations.

Box 2.1
The 2022/23 Programme for Government

The focus in the 2022/23 PfG was on measures to address high inflation and the cost-of-living crisis, with the Scottish Government announcing a six month-long rent freeze and additional help with household energy bills to that offered on a UK level.

Climate policy was also present in the PfG, with the Scottish Government increasing support for renewable generation, cutting emissions from transport, and improving the natural environment.

- Over the next year, the Scottish Government is planning to publish an Energy Strategy and Just Transition Plan for the sector, along with a Hydrogen Action Plan and an accompanying Investment Proposition, supported by £100 million in funding to accelerate the creating of a hydrogen economy.
- The newly launched Public Energy Agency has the aim of driving forward investment in energy efficiency and low-carbon heat.
- Scotland will be using devolved energy policy levers to enable the development of up to 12 GW of onshore wind and the supply chain for offshore wind, which will support up to 28 GW of offshore wind generation.
- Following last year's Heat in Buildings strategy, a Heat and Buildings Bill is currently in the works. A £25 million heat decarbonisation fund was also announced.
- Further focus on the just transition comes in the form of a Just Transition Plan for the Grangemouth Industrial Cluster, £20 million allocated through the North East and Moray Just Transition Fund, and the extension of the Green Jobs Workforce Academy.
- In the transport sector, continued investment in active travel infrastructure and access to bike schemes, along with a six month-long freeze in ScotRail fares and the extension of free bus travelling and bus franchising target accelerating a modal shift.
- Support for private sector investment into expanding 20mph zones as well as the size of the public charging network over the next four years aims at cutting car emissions.

The PfG also scheduled the introduction of the Circular Economy Bill in 2022/23, along with the launch of a Biodiversity Strategy and the development of the Land Reform Bill, which will aim at diversifying land ownership and helping local communities benefit from nature restoration.

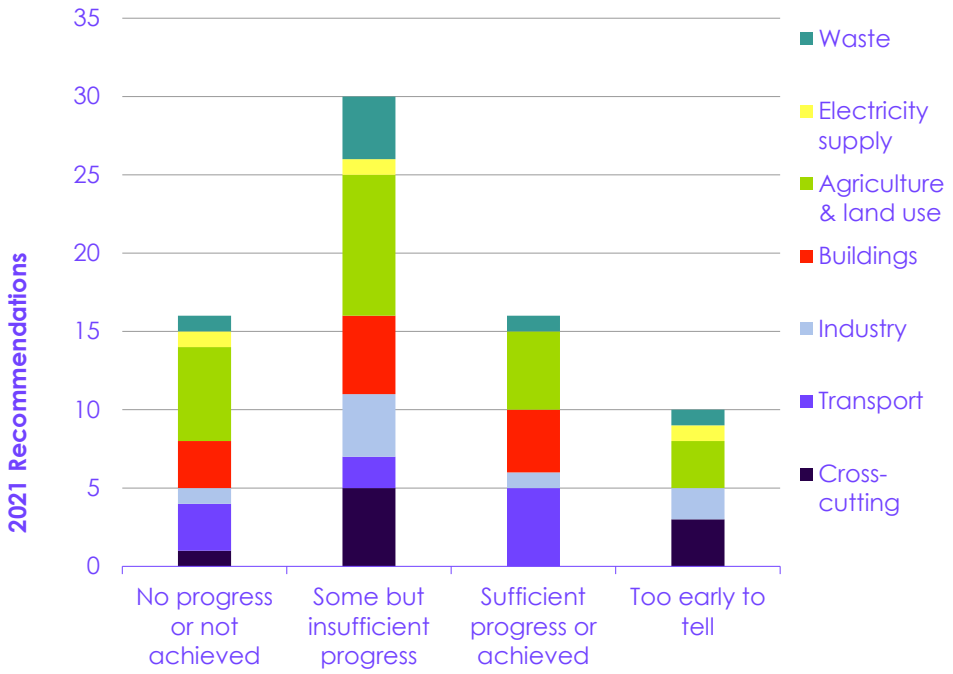
Source: Scottish Government (2022) *A Stronger & More Resilient Scotland: The Programme for Government 2022-23.*

(c) Progress on recommendations

Just under a quarter of the recommendations made to the Scottish Government in our 2021 Progress Report have made sufficient progress or been achieved in full.

Of the 73 recommendations we made in last year's progress report just under a quarter have made sufficient progress or been achieved in full. Around 40% have made some but insufficient progress with just under a quarter making no progress at all. The rest were assessed as being too early to tell (Figure 2.1).

Figure 2.1 2021 recommendations by score



Source: CCC (2021) *Progress reducing emissions in Scotland*; CCC analysis.
Notes: 1) Recommendations scored on the basis of having been achieved within the timeframe specified in the 2021 Scotland Progress Report. 2) Figure does not include one recommendation on agriculture and land use that has not been scored. That recommendation originally included multiple elements and was later split into more targeted recommendations that allowed each element to be scored separately.

2. Governance

Some progress has been made in embedding Net Zero across Scottish policy, including in planning and the Programme for Government.

The Scottish Government has committed to stretching decarbonisation plans and has made some progress in embedding Net Zero across Scottish policy (Box 2.2). However, there are currently significant gaps in the structures required to ensure the delivery.

Climate policy and the Net Zero target need to be at the core of policy-making and considered at the design stage of each new policy. The principles of all Government policies should be fully aligned with delivering a low-carbon economy, and the Scottish Government needs a systematic way of assessing such alignment and potential impacts when a policy is designed. Evaluation of policy and the assessment of outcomes must be adjusted to take into account longer-term results and impacts, to allow for longer timeframes of implementation with more diversified indicators of success than those of the policy cycle so far.

Similarly, the funding commitments made annually in the PfG should account for the need for long-term action on both mitigation and adaptation, and should be designed in such a way as to support policies that can deliver co-benefits across all sectors. A good example of such a synergistic approach is investment in increasing active travel, which will both reduce emissions from the transport sector and have a positive impact on air quality and improving people's health.

Box 2.2
Net Zero structures in Scotland

Following the setting of the 2045 Net Zero target in 2019 the Scottish Government moved to introduce structures to embed decarbonisation in its functions.

- The 2020 update of Scotland's 2018 Climate Change Plan adjusts Scottish decarbonisation to the Net Zero target and sets out sectoral emissions pathways to meet the legislated 2030 interim emissions target.
- The First Minister established a new position for a Secretary for Net Zero, Energy and Transport within the Scottish Cabinet. This minister has cross-cutting oversight of the decarbonisation of the energy and transport sectors. The First Minister also established new ministerial portfolios on green skills and circular economy, zero-carbon buildings and active travel, and the Just Transition. The cooperation agreement between the Scottish National Party and the Scottish Green Party saw some of these portfolios assigned to Green Members of the Scottish Parliament (MSPs).
- The Scottish Government Executive Team has established a post of Director General for Net Zero, with responsibility for those Directorates in the Scottish Government that are key to the delivery of Net Zero in Scotland.
- The Scottish Government reconvened the Just Transition Commission to advise on the effects of decarbonisation across all economic sectors, with particular reference to implications for employment and the workforce in each economic sector.
- Inter-ministerial groups among the UK Government and the devolved administrations provide channels for the coordination of action across sectors (particularly in areas where policy is reserved to the UK Government).

Source: CCC analysis.

(a) Coordination with local government

Momentum on a local level is increasing, but local action is uncoordinated.

Momentum for the Net Zero transition is building at a local government level. As of November 2022, the majority of Scottish local authorities have declared a climate emergency (23 out of 32 local authorities)[4] and are taking some form of action on mitigation and adaptation. Ambition is high overall, and Net Zero is often connected to fairness and making the local area a better place to live for communities.

There are some examples of good practice in delivering cross-cutting decarbonisation policy.

When it comes to delivery, however, the picture is mixed. Despite some positive early examples of good practice, such as local energy efficiency and low-carbon heat planning, frequently, the combination of an absence of a direction from the Scottish Government and a dearth of strategic design and financial support on a local level means that, when there is action, it is often uncoordinated across geographic and policy areas.

- **The Local Heat and Energy Efficiency Strategy.** The launch of the Local Heat and Energy Efficiency Strategy (LHEES) pilot programme yields valuable insights in rolling out delivery of cross-cutting policy across Scotland in a coordinated manner. Progress in Scotland has been better than in the rest of the UK, partly due to the legislative and governance support provided by the Climate Change (Scotland) Act, which places an obligation on local authorities to publish their actions on energy and climate change. As a result, all Scottish local authorities have engaged with the subject to some extent. LHEES, in combination with NPF4, provide the necessary platform for local authorities to plan the long-term delivery of policy that tackles an array of demands, including the decarbonisation of buildings. Early outcomes have both highlighted areas of good practice and innovative problem-solving, and identified critical gaps that will need to be addressed:

The LHEES pilots are a source of valuable lessons on the benefits of designing and delivering policy through the programme, but also the gaps in governance and coordination that will need to be addressed.

  - Improving understanding of decarbonisation and energy efficiency, as well as extensive stakeholder engagement required throughout the pilot phases, helped increase visibility and the strategic priority of decarbonisation within local government. Participating authorities were not only able to build their knowledge basis and identify new opportunities for decarbonisation but also experienced first-hand how working towards the delivery of such a project can increase cross-departmental cooperation, help build local buy-in in similar projects and build analytical and technical skills in house.[5]

  - Conversely, the process of developing a LHEES pilot was not always clear; for example, participating local authorities were occasionally unable to identify a regional focus for the pilot, and greater clarity and direction on responsibilities from central government was often missing. The pilots also drew attention to a lack of the necessary skills in data analysis and project management to carry out the delivery of complex projects, as well as a frequent absence of engagement of senior management in non-core local authority work, such as energy planning. Both financial and non-financial resource scarcity were also significant and ever-present hurdles.[6]

Lack of support from central government means that local authorities face many challenges, including difficulties securing funding and investment to drive policy, and a lack of awareness of how their actions contribute to the wider national decarbonisation efforts.

- **Aligning the policy cycle to Net Zero.** A number of local authorities have highlighted to us the challenges posed by a short policy cycle that has not been designed to deliver results across policy areas with a longer-term outlook. Embedding Net Zero into policy design and evaluation requires rethinking the policy cycle to integrate longer-term action and redefining successful to give consideration to harder-to-quantify outcomes that promote co-benefits.

- **Bringing onboard the right people**. Engagement with, and buy-in from, senior management, as well as political support for low-carbon policies are critical to making decarbonisation less of an add-on and more of an integral part of policy implementation. This lesson is recorded on evaluations of projects such as the LHEES pilot, and it was also observed during the Committee's visit to Dundee City Council. It also extends to ensuring those responsible for making decisions on the ground, including project managers, are informed and fully onboard with how their work contributes to decarbonisation, and actively include Net Zero in the design and deliverables of projects.

Funding policy, both through public means and private investment, is a hurdle that is exacerbated by the lack of certainty and the nature of the policy cycle.

- **Funding policy.** Public funding tends to have the biggest impact on early delivery of policy, as private investment is harder to procure. With the pool of financial resources continuously shrinking, and increasing competition for them, securing sufficient funding is an ever-growing challenge. Funding also tends to be closely tied to outcomes; as a result, securing funding for climate-related programmes suffers from the same issues of fragmentation and short-termism that plague policy design. This approach means that, often, projects are completed without addressing climate issues. Ensuring multi-year funding of work that delivers Net Zero-aligned outcomes and provides the necessary certainty to allow local authorities to plan work that spans beyond a few months into the future is desperately needed.[7]

- **Mobilising private investment.** The uncertainty caused by the wider lack of coordination makes it extremely challenging to attract the much-needed private investment in areas where it will be vital for going beyond what state support can provide.

  - Some councils are addressing the issue by establishing "strategic climate partnerships" of local employers, Distribution Network Operators (DNOs), utilities companies, housing providers and the local public sector to aggregate opportunities and resources and provide the anchoring for investment by committing locally to climate goals. While this can be a successful solution, it is not the product of a systematic approach across all Scotland, and it is subject to the technical expertise and resources available to each local authority.[8]

  - A good example of such a partnership is that between Dundee City Council and a number of important local stakeholders. The Dundee Climate Leadership Group has been leading on the successful delivery of schemes for district heating, the electrification of transport and the expansion of infrastructure needed to support it. The establishment of Michelin Scotland Innovation Parc, acting as an incubator for projects focusing on skills development while repurposing an old manufacturing site, has also created the opportunity for buy-in on innovation and reskilling from the private sector.

While local authorities put in the effort to make progress, they lack a sense of how their actions fit in the wider national framework, and often feel like they have been left to deliver Net Zero unsupported. Without an understanding of how to access low-carbon energy from outside their area, or how local development can support neighbouring regions, it is difficult to maintain commitment and a sense of contribution to a bigger vision.

- **Coordination.** The lack of a coordinated approach and a template for climate action[9] from the Scottish Government will likely prove a major barrier in rolling out the fast, systemic change required for reaching Scotland's climate targets. Local authorities are taking the initiative to drive action where possible, but this should be accompanied by strong direction from the national government, along with the necessary powers on a local level – for example, giving local authorities the core responsibility to organise energy provision.[10]

Scotland already has some structures in place that can be used to coordinate action towards Net Zero.

In some ways, the foundations to address the issues of coordination and engagement with local authorities already exist to a greater degree in Scotland compared to the rest of the UK regions:

- There are already some structures in place in the form of the Convention of Scottish Local Authorities (COSLA), which provides a voice for local authorities in policy-making and legislative processes, champions their action, and can be used as a coordination tool to address shared issues and secure the necessary resources for doing so.

- Planning in Scotland is likely to be better aligned with Net Zero than in the rest of the UK after the publication of NPF4. As the new focus on planning for a low-carbon future is established, local authorities should be enabled to design and implement local action which addresses climate change, provided that NPF4 is enforced and filters through effectively in local planning.

Despite the existence of some governance structures, the need for agreement on the role for local authorities remains. A clearer line of responsibility for delivery on the local level from the national government, along with the establishment of robust structures for sharing knowledge and coordination, using existing governance structures to their full potential where possible, are all necessary for driving local action. Tighter central coordination to ensure local targets collectively build towards national targets, as well as empowering local government with the necessary levers to deliver local policy need to be addressed urgently to see meaningful progress towards meeting national ambition.

(b) Coordination with UK Government

Despite the availability of communication and engagement channels, the Scottish Government has had limited input in the UK Net Zero Strategy.

The UK Government's Net Zero Strategy recognised the need for joined-up action across the UK to deliver the Net Zero pathways. This has been supported by the introduction of coordinating structures, although it is not clear that these are yet leading to effective engagement between the nations.

- The UK Government has established a bi-monthly Net Zero, Energy and Climate Change Inter-Ministerial Group to bring together ministers from all four nations to discuss emerging policies. This is supported by a cross-departmental official-level board, as well as direct engagement between corresponding departmental officials.

It is unclear, however, how frequently the Group meets, what it discusses, and how effective it is a tool for coordination and engagement between the UK Government and the devolved administrations.

- However, the Scottish Government's ability to effectively engage with the process of developing the Net Zero Strategy has been limited. Similarly, despite the reliance of the UK Government's Energy Security Strategy on increases in onshore wind – with the implication that much of this will be in Scotland – the Scottish Government's involvement in its development, if any, was minimal.

The Scottish Government should prioritise maintaining an effective working relationship with the UK Government to be able to co-develop critical policy in all areas.

In order to deliver the UK and Scottish Governments' shared interest in delivering ambitious emissions reductions, better coordination and alignment of approaches are needed.

- The structures that enable collaboration between the nations should be used to involve the devolved administrations in early-stage development and decision-making on policy areas that will affect their jurisdictions. These discussions should explore synergies between the respective governments' goals and plan to maximise the benefits that can be delivered across the UK.

- The Scottish Government should feed into co-development of updates to the UK-wide Net Zero Strategy, to ensure that it accurately reflects the emissions reductions that will be delivered through its domestic plans and that it takes full advantage of the opportunities for delivery in Scotland.

- Lack of coordination between the two governments can undermine both UK and Scottish progress. Ramping up delivery necessitates going beyond action that is already being taken; as moving towards a greener economy will require increasingly complex interactions between policy areas and economic sectors, so making sure that devolved and reserved levers are set up to work synergistically to amplify and speed up gains is essential.

  - Whitehall and Holyrood should also assess potential future impacts of decisions: the most recent example of failure to coordinate, with far-reaching consequences, was the exclusion of a Scottish cluster from Track 1 funding in the UK's CCS strategy. We assessed the adverse impact of this decision for the Scottish 2030 target in our 2021 Scotland Progress Report, but it will also have implications on a UK level due to the late development of infrastructure and skills in Scotland, the region with the most favourable geographic conditions for large-scale carbon storage.

  - At the same time, policy devolved to the Scottish Government has an important role to play in helping the UK Government meet its own targets. A significant amount of UK carbon sinks, including peatlands, are located in Scotland, which also has the highest tree-planting rate of any UK region. Increasing and maintaining these carbon sinks is almost entirely devolved, and there is currently little evidence that shows an attempt to coordinate approaches across the UK regions.

Decarbonisation in Scotland depends on complex interactions between devolved and reserved powers in all sectors.

- Delivery of Scotland's pathways depends on a range of complex interactions between devolved and reserved powers. As an example, we set out a summary of the key areas of such interactions for the transport sector, emphasising that there are risks posed by Scotland's dependency on the UK Government for ambitious regulation as well as on wider UK markets and shared UK infrastructure (Table 2.1). The Scottish Government should conduct a similar mapping exercise across all sectors and should use this to develop a plan for how it will manage areas in which these dependencies pose significant risks to the deliverability of its pathways.

Table 2.1
Interactions between UK and Scottish powers

Subsector	Dependencies on reserved powers	Dependencies on UK markets	Dependencies on shared UK infrastructure	Outcomes that are independent of the wider UK
Zero-emission vehicles	Significant dependencies beyond devolved powers			
	Regulations on what vehicles can be sold (e.g. ZEV mandate) likely to be based on trajectories required for UK. Main price signals (e.g. vehicle taxes/subsidies and fuel duties) are set by the UK Treasury.	Manufacturing strategies based on larger UK/EU market – could restrict ability to go faster. UK-focused vehicle advertising strategies will influence consumer demand (e.g. for hybrids).	Low-carbon power for use in EVs comes from a shared electricity grid. Hydrogen supply and refuelling facilities are likely to be planned nationally.	Procurement of ZEVs for public fleets. Developing workforce skills to build and maintain ZEVs.
Reducing demand for carbon-intensive travel	Minor dependencies beyond devolved powers			
	Decisions on national taxation schemes (e.g. road pricing) that could shape demand are made by the UK Government.	Many public transport services are operated by UK-wide businesses. Public behaviours likely shaped by both UK and Scottish engagement.	Improvements to cross-border rail links and services depend on UK investment.	Investment to improve public /active/shared travel infrastructure. Local schemes to manage traffic. Education policy and public information campaigns can influence public choices.

3. Just transition

Scottish legislation makes a just transition to a low-carbon economy a pillar of Scottish decarbonisation.

Decarbonising Scotland in a fair and inclusive way that also addresses the challenges to pivotal Scottish economic sectors (e.g. oil and gas production) is one of the pillars of the Scottish Government's plans. The 2019 Climate Change (Scotland) Act places an obligation on the Scottish Government to consider the impact of its Climate Change Plan for each of the sectors of the economy, including any specific implications for employment and the workforce by region. It must show how decarbonisation will satisfy the just transition principles of environmentally and socially sustainable jobs, and decent, fair and high-value work, as defined in the Act.

To ensure proper consideration of all just transition aspects in the decarbonisation plans across the economy, the Scottish Government reconvened *the* Just Transition Commission in early 2022, after a limited run between 2019 and 2021. The Commission now has statutory footing in Scottish legislation, with the aim to provide scrutiny of the Scottish Government's transition plans.

In July, the reconvened Commission published its initial report, setting out strategic priorities for the decarbonisation of the Scottish economy, including a focus on industrial planning, tackling inequalities and monitoring and reporting.[11]

At the time of writing, the Scottish Government is also in the process of preparing the first of a number of detailed sectoral transition plans, focusing on energy. The plan will be part of a wider energy strategy that is aiming at identifying challenges to a sector that is of particular importance to the Scottish economy.

Emerging evidence indicates that ensuring the right skills are in place and upskilling the workforce to meet the demands of a low-carbon economy is one of the fundamental conditions of delivering Net Zero, in Scotland and across the UK. Review of progress across the economy is showing that a number of sectors have identified the skills shortage or necessity to focus on transitioning the relevant workforce as a key enabler of meeting delivery goals.

(a) Skills

The Scottish Government is taking initial steps towards linking its skills plans to future demands from a transitioning economy.

Scotland's 2020 Climate Emergency Skills Plan (CESP) has started to shape how relevant skills and qualifications will be delivered to take advantage of the employment opportunities created by the transition to Net Zero. This plan will be further developed in the CESP review, due in spring 2023.

- The Scottish Government has set out a strategy to develop an evidence base to identify the upskilling and reskilling that specific sectors will require if they are to secure green job opportunities as they emerge.[12]

- The strategy recognises and references the key partners that will be needed to drive forward the development of the skills and qualifications required, such as Skills Development Scotland, the Scottish Funding Council, and the Scottish Cities Alliance. It also lays out how these organisations will work together to ensure that the annual investment in skills is fully aligned with Scotland's climate ambitions. The strategy has already been recognized in partners' plans, such as the Transition to Net Zero Carbon Action Plan[13] and Skills for Changing the World Strategic Plan.[14]

- The Green Jobs Workforce Academy[15] announced in CESP is designed to provide targeted support to communities and parts of the population that are most likely to lose out from structural changes in employment. Launched in August 2021, the Academy is now developing support for workers in carbon intensive industries with a 'skills guarantee', which will provide career guidance and training opportunities, enabling people to seek employment in other sectors. The implementation of a skills guarantee has been announced but it is unclear when and how the services it promises will be made available.

- The 2023 review should start to develop a more detailed delivery plan, focusing on agreed timelines for the completion of relevant evidence bases and the development of training and qualification frameworks and packages of support for those most affected by structural changes. These plans should evidence how skills and training will be in place in advance of when sectors will require them. In turn, this should be reflected in increased student enrolment targets and in the capital and revenue spend available for training and education providers.

Sectors will see substantial changes in the skills needed for delivering Net Zero, including energy, construction and agriculture.

The Scottish Government has taken some steps to identify skills needs in sectors that are particularly relevant to Net Zero.

- **Energy transition**. The Energy Skills Alliance and the Scottish Offshore Wind Energy Council's Skills Group are already undertaking sectoral research to identify the skills the sector will require in the short, medium and long term.

- **Construction**. An Energy Efficiency Skills Matrix has been developed and is being embedded in Scotland's construction skills framework, creating cohesion with industry standards like MCS, PAS 2030 and PAS 2035. The date by which these standards will become mandatory should be clarified.

- **Transport.** UK Government[16] research has highlighted that up to 65,000 people could require training. The CESP recognises that most of the training will need to focus on baseline skills (e.g. maths, English, IT), enabling those working on fossil fuel-based engines to transition.

- **Manufacturing**. The National Manufacturing Institute Scotland is leading the development of an evidence base, focusing on the sector's skills needs, as well as providing training and professional development courses. In addition, projects that emphasise the creation of green jobs in manufacturing have already received funding and are in the initial launching stages, such as the Michelin Scotland Innovation Parc Skills Academy, the Net Zero Transition Managers programme pilot, and projects through the Just Transition Fund and the Green Jobs Fund.

- **Agriculture and land use**. The Agriculture Bill consultation sets out proposals to provide support for knowledge transfer, innovation and skills development for the agriculture sector, funded through the Knowledge Transfer and Innovation Fund (KTIF). Approaches to upgrade skills and capacity must also be addressed in the land use sector, particularly with regard to woodland creation and peatland restoration.

Box 2.3
The CCC's Workers and Skills brief – key messages for Scotland

Few enabling factors are likely to have a bigger impact on delivering Net Zero by 2050 than the ability to shape the UK's workforce in time to meet the demands of the transition.

In order to better understand the effect of decarbonisation on workers and existing skills across current economic sectors, as well as how these sectors will be affected, the Committee will be publishing analysis setting out the potential implications of the Net Zero transition to the UK labour market, assessing risks and opportunities for workers. Our emerging findings consider the geographical and regional distribution of impacts, and how the devolved administrations might experience these differently.

- The dependency of the Scottish economy on high-emitting sectors for employment, such as fuel supply and agriculture, means that the transition in Scotland should be carefully planned to help mitigate the impact of declining sectors on employment.
- The transition of high-emitting sectors to low-carbon alternatives offers many opportunities for new types of employment to affected workers.
- The biggest trends in labour market changes across the UK will also be felt in Scotland, and they will be mainly driven by the need to decarbonise buildings (i.e., by the skills required in construction).

Our full analytical report, along with the detailed analysis and a further breakdown of geographical impacts, is currently being finalised and will be available soon after this publication.

Source: Climate Change Committee (Unpublished), *The Impacts of Net Zero on Workers.*

(a) A resilient Net Zero society

Focus should be on adapting to ongoing changes, to make sure the new low-carbon economy is resilient.

Further climate change in Scotland over the coming decades is inevitable. The extent of this change in the global and Scottish climate beyond the next few decades depends on the success of global emissions reduction efforts with more rapid reductions in global emissions leading to a significantly lower range of possible global and Scottish temperatures in the second half of the century. The fact, however, remains that we will have to adapt to a new climate reality.

The evidence of climate change in Scotland is already clear, with the average temperature increasing by 0.5ºC compared to 30 years ago, winters becoming wetter, and the sea level around the coast of Scotland rising by 10 – 30 mm per decade. These changes are now having clear impacts on Scotland's people and ecosystems and further climate change in Scotland over the coming decades is inevitable no matter how rapidly global greenhouse gas emissions are reduced.[17]

Over the coming decades, these changes will lead to risks that will have impacts on all areas of Scotland's society and landscapes:

- **Natural Environment:** An increase in the range, quantities and consequences of pests, pathogens and invasive species as the climate warms could have significant negative economic consequences for Scottish agriculture and for forestry. A significant proportion of agricultural land in Scotland has been impacted by fluvial flooding in recent years, and this will continue to increase up to the 2050s.

- **Infrastructure:** More frequent flooding and increased coastal erosion will cause damage to infrastructure services, including energy, transport, water and Information and Communication Technologies (ICT).

- **Built environment and health:** Increasing frequency and intensity of heatwaves will pose risks to people's health and wellbeing. Heat related deaths in Scotland could rise to well over 100 a year by 2050. Significant increases in the severity and frequency of flooding of homes and businesses are expected, and in particular locations sea level rise could require communities to relocate further from the coast due to extremely high costs of coastal flooding and coastal erosion protection.[18]

(b) Extending the focus on Net Zero to include climate adaptation

Ambitious greenhouse gas emissions reductions targets have been set by the Scottish Parliament and are raising awareness of the need to reduce emissions right across Scottish society and the Scottish economy. This growing awareness of the need to tackle climate change must now extend to climate change adaptation, which will be required no matter how rapidly Scotland reduces its own greenhouse gas emissions.

Emissions-cutting measures should be combined with strong adaptation policies to respond to the new climate reality and limit further change.

This means seizing opportunities to address linked challenges for emissions reduction and climate adaptation, and broadening sector climate change plans to go beyond considering emissions reduction alone.

- **Peatland restoration** is needed to make these habitats resilient to climate risks as well as to sequester carbon. Further degradation of peatlands under a warmer climate could lead to higher carbon emissions, as well as the loss of vital ecosystems, with damaging impacts for biodiversity and the capacity to adapt to climate change further.

- **Buildings.** The increasing frequency and intensity of extreme high temperatures are not being adequately considered in key housing and buildings strategies, despite opportunities to tackle overheating alongside energy efficiency measures.

- **Energy system.** As was noted in our recent adaptation report for Scotland, the Scottish Government currently does not have any policy documents considering adaptation or resilience of energy networks. Although policy for energy is reserved to the UK Government, the Scottish Government holds clear policy positions and has published plans for reserved areas relating to greenhouse gas emissions reductions, for example in its Energy Strategy, but not for adaptation. Increasing reliance on electricity on the path to Net Zero emissions magnifies the consequences of power outages.

Box 2.4
Is Scotland climate ready? The CCC's Adaptation Progress Report and key findings

In March 2022, the Committee published a progress report assessing the second Scottish Climate Change Adaptation Plan (SCCAP), which sets out the Scottish Government's intentions to support Scotland's people and ecosystems to adapt to climate change.

We found that the SCCAP outcomes are insufficient, by themselves, to drive the necessary adaptation response, and more needs to be done to define a set of objectives and a plan for a 'well adapted Scotland' that will drive delivery:

- **Targets.** The Scottish Government should set specific and quantified targets for levels of resilience across Scottish society under each top-level SCCAP outcome. This would allow the Scottish Government to measure progress against targets and increase accountability on their delivery.
- **Clear framework.** Each outcome under the SCCAP lists a set of activities and actions beneath it. However, it is currently not clear how the implementation of these activities will lead to the overall outcome being achieved. A clearer framework is needed to link these activities to outcomes. This would also enable better assessments of whether adaptation actions are happening at sufficient scale as well as where key gaps exist.
- **Clear responsibilities.** Currently there is insufficient clarity regarding which part of the Scottish Government has overall responsibility for delivering on each SCCAP sub-outcome. Ownership of each outcome should be clearly assigned to a specific part of Government to ensure accountability.
- **Monitoring and evaluation** must be implemented with urgency. It needs to be prioritised and addressed urgently as without this the SCCAP risks being ineffective. The Scottish Government's comprehensive monitoring and evaluation framework developed for reaching greenhouse gas emission reduction goals in Scotland should serve as a benchmark that needs to be replicated for tracking adaptation progress.

The Scottish Government responded to the CCC's progress report in May 2022, agreeing with the need for a focus on delivery and for improved evidence. The response also accepted recommendations to operationalise a monitoring and evaluation framework; undertake analysis of public sector action on adaptation; and ensure adaptation is fully integrated into just transition planning. All other recommendations are under active review.

Source: Climate Change Committee (2022) *Is Scotland climate ready? 2022 Report to the Scottish Parliament.*

5. Future steps in Scottish policy

This will be a delivery decade, and it will be critical for achieving Scottish targets.

This decade is crucial for achieving Net Zero in Scotland. The pathway to meet current ambition set out in the update to the Scottish Climate Change Plan, however, is based on rapid action across all economic sectors that is not yet occurring, and relies heavily on progress in areas of reserved policy.

Achieving Net Zero in Scotland by 2045, as well as meeting interim emissions targets, requires considerable effort on two fronts:

- Ensuring that all levers devolved to the Scottish Government are being pulled to align Scottish domestic policy with the Scottish targets. Decarbonisation as a target needs to be fully embedded in all areas of Scottish policy-making to its full potential.

- Finding more effective ways for the Scottish Government to engage with the UK Government in those areas where it relies heavily on powers reserved to Westminster to meet Scottish targets. Progress in reserved policy areas has been a significant driver behind reducing Scottish emissions so far, and will continue to play this role, particularly when it comes to industry and engineered removals. It is therefore in the best interests of the Scottish Government to develop strong collaborative links to the UK Government that will allow it to influence, and shape reserved policy to boost Scottish decarbonisation. However, it should also be noted that success in reducing emissions in Scotland in both sectors for which powers are reserved to Westminster and those where they are devolved to Scotland is essential to meeting UK targets.

The Scottish Government should be working towards turning its ambition into concrete and building up the governance mechanisms needed to clarify and accelerate delivery.

Even in areas of policy mostly devolved to the Scottish Government, however, progress has been slow (Chapter 3). In order to begin addressing these challenges and to have a chance to meet emissions targets, the focus in Scottish climate policy over the next year should be on:

- Providing sectoral pathways developed based on robust and transparent evidence of what is possible and necessary. There should be a clear and quantified link between policies and milestones and the emissions reduction they correspond to.

- Putting in the necessary legal and governance structures required to ensure that action in all sectors is aligned with the Net Zero and the interim targets and will be fully embedded and prioritised in policy-making. This will start with introducing critical pieces of legislation, such as the Circular Economy Bill and the Heat in Buildings Bill.

- Ensuring proper consideration has been given to the fairness and distributional impacts, as well as the effects on employment and the workforce of the transition to a low-carbon economy across all economic sectors. The Scottish Government has committed to publishing just transition plans for all major sectors, starting with the energy sector. The Energy Strategy and Just Transition Plan can provide a blueprint for sectoral transition plans to follow and should address not only jobs and investment within the energy sector but also the affordability of the transition for energy users.

- Setting out clear lines of responsibilities between central government and local authorities to enable swift delivery of policy. Scotland already has some structures in place to enable the robust and effective governance system that is pivotal to the speedy and coordinated roll-out of policy required to meet its ambitious targets. The Scottish Government should be focusing on using existing structures to their maximum potential and exploring where these structures need to be fortified to embed its decarbonisation pathway in all government functions. A transparent system of responsibilities should be put in place that will ensure all parts of central and local government are aware of their role in delivering Net Zero and are taking appropriate action.

Endnotes

[1] Scottish Government (2021), *Scotland 2045 – fourth National Planning Framework – draft: consultation*. https://www.gov.scot/publications/scotland-2045-fourth-national-planning-framework-draft/pages/5/

[2] Climate Change Committee (2022), *Letter: Scottish Government's draft Fourth National Planning Framework (NPF4)*. https://www.theccc.org.uk/publication/letter-scottish-governments-draft-fourth-national-planning-framework-npf4/

[3] Scottish Government (2021), *A National Mission with Local Impact: Infrastructure Investment Plan for Scotland 2021-22 to 2025-26*. https://www.gov.scot/publications/national-mission-local-impact-infrastructure-investment-plan-scotland-2021-22-2025-26/

[4] Climate Emergency UK, https://data.climateemergency.uk/councils/?name=&declared_emergency=&has_plan=&promise_combined=&authority_type=&region=2&geography=&population=&sort=name

[5] Scottish Government (2022) *Synthesis evaluation of the Local Heat and Energy Efficiency Strategy (LHEES) pilot programme - Final Report*. https://www.gov.scot/publications/synthesis-evaluation-local-heat-energy-efficiency-strategy-lhees-pilot-programme/documents/

[6] Scottish Government (2022) *Synthesis evaluation of the Local Heat and Energy Efficiency Strategy (LHEES) pilot programme - Final Report*. https://www.gov.scot/publications/synthesis-evaluation-local-heat-energy-efficiency-strategy-lhees-pilot-programme/documents/

[7] Climate Change Committee, Evans, L. M. (2022), *Climate Conversation: Delivering a Net Zero, Climate Resilient UK*. https://www.theccc.org.uk/publication/climate-conversation-delivering-a-net-zero-climate-resilient-uk-louise-marix-evans/

[8] Climate Change Committee, Evans, L. M. (2022), *Climate Conversation: Delivering a Net Zero, Climate Resilient UK*. https://www.theccc.org.uk/publication/climate-conversation-delivering-a-net-zero-climate-resilient-uk-louise-marix-evans/

[9] Climate Change Committee, Evans, L. M. (2022), *Climate Conversation: Delivering a Net Zero, Climate Resilient UK*. p. 24. https://www.theccc.org.uk/publication/climate-conversation-delivering-a-net-zero-climate-resilient-uk-louise-marix-evans/

[10] UK Energy Research Centre (2017) *What We Know about Local Authority Engagement in UK Energy Systems; Ambitions, Activities, Business Structures & Ways Forward.* https://ukerc.ac.uk/publications/what-we-know-about-local-authority-engagement-in-uk-energy-systems/

[11] Just Transition Commission, https://www.gov.scot/groups/just-transition-commission/

[12] Scottish Government (2022) *Scotland's National Strategy for Economic Transformation; Delivering Economic Prosperity.*

[13] Scottish Cities Alliance (2021) *Transition to Net Zero Carbon Action Plan.* https://scottishcities.org.uk/wp-content/uploads/2021/01/Transition-to-Net-Zero-Carbon-Action-Plan.pdf

[14] Skills Development Scotland (2022) *Skills for a Changing World.* https://www.skillsdevelopmentscotland.co.uk/media/49796/sds-strategic-plan-2022-27.pdf

[15] My World of Work (2022) *The Green Jobs Workforce Academy.* https://careers.myworldofwork.co.uk/green-jobs-workforce-academy

[16] Office for Low Emission Vehicles & Department for Transport (2015) *Ultra low emission vehicles: evidence review of uptake in the UK*. https://www.gov.uk/government/publications/ultra-low-emission-vehicles-evidence-review-of-uptake-in-the-uk

[17] CCC (2022) *Is Scotland climate ready? – 2022 Report to Scottish Parliament*. https://www.theccc.org.uk/publication/is-scotland-climate-ready-2022-report-to-scottish-parliament/

[18] CCC (2022) *Is Scotland climate ready? – 2022 Report to Scottish Parliament*. https://www.theccc.org.uk/publication/is-scotland-climate-ready-2022-report-to-scottish-parliament/

Chapter 3

Progress in sectors with significant devolved powers

Introduction and key messages

Scotland's highly ambitious 2030 target of a 75% reduction of emissions on 1990 levels requires a step change in action across all sectors of the economy. While the 2020 update to the Climate Change Plan (CCPu) laid out plans for extremely fast emissions reduction in this decade, most notably in buildings and transport, it did not quantify how this will be achieved.

This chapter discusses progress in Scottish climate policy in sectors with significant powers devolved to the Scottish Government (see Annex 1 for the devolution of powers). For each sector we summarise policy developments in the past year, then assess the progress Scotland has made in the form of a policy scorecard table. Where possible, we track progress against quantitative indicators of the transition and, finally, we discuss important next steps the Scottish Government should take.

Our key messages are:

- **Transport**. Scotland plans to reduce transport emissions by around 53% by 2030 relative to 2019 levels, faster than our highly ambitious Tailwinds scenario.
  - **Zero-emission vehicles**. Battery electric car sales increased 49% in 2021, and represented 8% of cars sold. While this is good progress, it is slightly below the UK as a whole, and is slower than our Tailwinds scenario.
  - **Charging infrastructure**. Scotland has more public charge-points per vehicle than any other nation in the UK. However, more detail is required to address concerns on consumer experience, inconsistent charging provision, price disparities between home and public charging, and suitability for van use.
  - **Car travel.** Scotland has an ambitious target to reduce car-kilometres by 20% on 2019 levels by 2030. While we support this laudable ambition, car-kilometres were steadily increasing prior to the pandemic and current plans are lacking a full strategy with sufficient levers to deter car usage, predominantly relying on measures that incentivise low-carbon modes.
  - **Aviation demand**. The Scottish Government has committed to growth in aviation following the pandemic. It has made no commitments to use its devolved powers, such as airport expansion control and Air Departure Tax, to curb aviation growth.
- **Buildings**. Scotland plans to reduce emissions in the buildings sector by 70% compared to 2020 levels by 2030, considerably faster than our ambitious Tailwinds scenario. This is not yet backed by policies to deliver low-carbon heat and energy efficiency at the required rates.
  - **Enabling measures.** Scotland is making good progress with enabling measures such as local energy and heat network planning, reforms to EPCs, and supply chain development.

  - **Low-carbon heat.** The Scottish Government plans to transition to low-carbon heat in homes considerably faster than the UK as a whole. It is developing credible plans to expand the use of heat networks. However, it does not have sufficient policies in place to deliver low-carbon heat beyond the UK-wide market-based mechanism and funding to decarbonise fuel-poor homes.

  - **Energy efficiency.** Funding is in place to improve energy efficiency in social housing and fuel-poor homes. However, there is a lack of regulations and incentives in place to drive improvements to the energy efficiency of buildings, and policies for minimum efficiency standards for private rented and owner-occupied homes are not in place.

- **Agriculture and land use.** With an ambition to reduce agriculture emissions by 28% compared to 2020 levels by 2030, policy implementation is required now. In the CCPu's pathway, emissions from the land use sector rise to 1.8 $MtCO_2e$ in 2030, from the 0.8 $MtCO_2e$ in 2020, despite setting out a programme to deliver land use change to protect and take up carbon.

  - **Low-carbon farming.** Detail on post-Common Agricultural Policy (CAP) low-carbon agricultural policy is urgently required to ensure the required emissions reduction in the agriculture sector in the next few years.

  - **Trees and woodlands.** Scotland's planting rates have been consistently higher than the rest of the UK combined. Annual planting rates have plateaued in recent years and significant barriers, such as land availability and skills shortages, remain to the scale-up required to reach the Scottish Government target of 18,000 hectares per year by 2024/25.

  - **Peatland restoration.** Scotland has consistently missed its peatland restoration targets, and while 2021 saw a significant increase to 8,000 hectares restored, this was still far from the 20,000-hectare target, which is in turn significantly less ambitious than our recommendation of 45,000 hectares annually by 2022. £250 million has been pledged over the next ten years for peatland restoration but detail is required on how barriers, such as skill shortages and contractor availability, will be overcome.

  - **Demand and consumption.** The 'Eat Well Your Way' campaign focuses on the role of the consumer to make healthy and sustainable choices, but Scottish Government has not addressed the food system impact across health, nature and climate. The 'Good Food Nation' plans should be used to set a clear pathway in this area.

- **Waste.** Our indictors show that progress in improving waste treatment in Scotland has largely stalled in recent years. Nevertheless, Scotland has made positive policy progress over the past year to reduce waste and improve recycling, for example consulting on a Circular Economy Routemap and introducing a moratorium for incineration and energy from waste facilities. Given Scotland's highly ambitious 2030 target, there is a need to firm up the detail of policies with a view to delivering the levels of abatement set out in our Tailwinds scenario.

The rest of this chapter is set out in four sections:

1. Transport
2. Buildings
3. Agriculture and land use
4. Waste

The Scottish CCPu aims to reduce emissions from the transport sector by around 53% by 2030, relative to 2019 levels. This is more ambitious than the UK Government's Net Zero Strategy, which aims for reductions of 23-36% over this period. It also exceeds the 40% reduction by 2030 in our updated transport pathway for Scotland in our accompanying advice on emissions targets. This updated pathway decarbonises more rapidly than our Balanced Pathway by following our ambitious Tailwinds scenario for surface transport and for demand management in aviation.

(a) Policy developments

Delivering these emissions savings requires effective policy both to drive rapid uptake of zero-emission vehicles and to enable people to reduce their use of high-carbon modes of transport. This section reviews progress in Scottish policy and implementation over the past year in each of these areas.

As well as the developments reviewed here, there have been important developments in UK-wide policy which apply to Scotland, including the proposed introduction of a Zero-Emission Vehicle Mandate requiring manufacturers to sell a rising share of electric cars and vans (EVs), the confirmation of end-of-sales dates for new non-zero emission heavy goods vehicles (HGVs), and the publication of the Jet Zero Strategy.

(i) Surface transport

Zero-emission vehicles

ZEV uptake has advanced considerably with the proposed introduction of the ZEV mandate.

UK-wide regulation to enable the uptake of zero-emission vehicles (ZEVs) has advanced considerably with the proposed introduction of the ZEV Mandate. Scotland will need to build upon this, given its more ambitious aim to remove the need for anyone to buy any car or van that uses petrol or diesel by 2030. This would mean transitioning to 100% battery-electric sales by 2030, rather than allowing a continued role for plug-in hybrids as under the UK proposals.

- While the UK-wide plug-in car grant has been phased out, the Scottish Government confirmed £30 million in support for EV uptake this year. This includes continuing to offer interest-free loans, which apply to both new and used EVs, and providing grants for community car clubs to purchase EVs. The 2022/23 Programme for Government (PfG) announced a plan to test a new mobility and scrappage scheme targeted at helping low-income households replace a high-emitting vehicle with more sustainable means of travel.

The Scottish Government published a new vision for public EV charging, focusing on a fair, accessible and reliable network.

- In January 2022, the Scottish Government published a new vision for public EV charging, focusing on delivering a network that is fair, accessible and reliable. This was accompanied by a new £60 million fund (matched between public and private investment) that aims to support local authorities to double the size of Scotland's public charging network over the next four years.
  - The vision also seeks to enable further investment from the private sector, with public funds increasingly being targeted at market failures.

  - There are now around 2,800 public EV charge points across Scotland, with around 600 installed in the last year. The 2022/23 PfG set an ambition to increase this to at least 6,000 over the next four years. Further increases may be needed to support Scotland's ambition for faster EV uptake by 2030.

- The PfG also expressed support for private sector investment into expanding 20mph zones.

- In August 2022, the Scottish Government announced its intention to revise building regulations to require all new homes, including flats, that are built with parking to provide adequate EV charging.

Scotland is also aiming to play a part in delivering decarbonisation of heavy-duty vehicles. This includes committing funding to support bus operators in purchasing zero-emission buses and to help Scottish companies develop and test zero-emission HGVs.

62 million has been allocated to help bus operators replace diesel buses with battery-electric models.

- The first phase of the Zero-Emission Bus Challenge Fund (ScotZEB) allocated £62 million to help bus operators replace diesel buses with battery-electric models in February 2022. More recently, £500,000 of further funding has been made available to help smaller operators prepare business cases ahead of the next phase of this fund in 2023.

- The Bus Decarbonisation Taskforce, a collaboration between the Government and industry, has published a pathway for decarbonising Scotland's bus sector. A key feature of this pathway is that it identifies the interdependencies between various other sectors and organisations that will need to be managed to deliver its ambition.

- The Scottish Government, in consultation with industry leaders, recently announced the introduction of a £28 million Zero-Emission Mobility Innovation Fund to support Scottish businesses designing and testing zero-emissions HGV technologies.

Transport Scotland introduced four Low-Emission Zones (LEZs) across Aberdeen, Dundee, Edinburgh, and Glasgow in May 2022. These aim to improve urban air quality by restricting access to vehicles with high emissions of nitrogen dioxide and particulate matter. Grants are offered to local residents and businesses who need to scrap vehicles that are not compliant with the LEZ standards.

Plans to decarbonise Scotland's rail sector are set out in the Rail Decarbonisation Action Plan, which aims to remove diesel from all passenger services by 2035. This year has seen the first steps taken in implementing this strategy through the commencement of a programme of network electrification. Construction work to electrify a section of railway between Edinburgh Haymarket and Dalmeny, estimated to cost £55 million, began in June 2022.

More sustainable travel choices

Transport Scotland published a route map consultation on interventions that could be used to deliver their ambitious 20% reduction in car use by 2030, relative to 2019 levels. This urgently needs to be developed into a full delivery plan.

A key part of the decarbonisation pathway for the Scottish transport sector is the ambition to reduce car use in Scotland by 20% by 2030, relative to 2019 levels. The Scottish Government has begun to develop plans for delivering this over the past year, in parallel with measures to support the recovery of sustainable transport modes following the pandemic. Demand for road travel had been steadily increasing until the pandemic.

Lockdown restrictions led to bigger reductions in public transport than in car, van and HGV use, and car travel rebounded much more quickly and completely following the lifting of lockdown restrictions than public transport did.

- In January 2022, Transport Scotland, in collaboration with the Convention of Scottish Local Authorities (COSLA), published its route map consultation on potential interventions that could be used to deliver the 20% reduction. This presents a good discussion of the change that is needed and approaches that should be considered to achieve this, and evidence gathered through the consultation urgently needs to be developed into a full delivery plan, setting out measurable targets, milestones and allocated funding for interventions.

  - The route map summarises the variety of interventions currently being developed across Scotland. It will be important for the Scottish Government to review emerging evidence from these schemes to enable those that are working effectively to be rolled out more widely across Scotland.

  - The measures considered largely focus on supporting alternatives to car travel, rather than interventions that directly reduce the appeal of private cars.

- Scotland's draft fourth National Planning Framework mentions the aim to reduce car demand by 20% and embeds the concept of the 20-minute neighbourhood, indicating that planning authorities should aim to configure neighbourhoods to reduce the need for carbon-intensive travel. The updated National Transport Strategy delivery plan, published in June 2022, announced the intent to integrate this further within upcoming guidance on Regional Spatial Strategies.

Given the short timescales to 2030, it is important to begin implementing schemes with urgency in order to embed the behavioural changes that are required. Several schemes have been introduced over the past year to make more sustainable alternative modes more widely available and appealing. This includes investment in active travel and schemes to reduce public transport fares for certain user groups.

- In January 2022, Scotland launched its free bus travel scheme for five- to 21-year-olds. Uptake to date has been slow, so further work might be needed to ensure that all young people feel able to benefit from this scheme. A Fair Fares Review is underway, looking into the cost and availability of services across Scotland. This should consider how best to attract drivers to switch their journeys to public transport. In the meantime, ScotRail fares have been frozen until March 2023, as outlined in the PfG.

- A challenge in the public transport space at present is the need to simultaneously help the sector recover from the impacts of the pandemic and improve services to make them more appealing and lower-carbon. The Scottish Government has provided funding and support to address both of these aspects.

  - The Network Support Grant Plus has been extended to October 2022, but will end after this point. The Scottish Government will need to work with the sector beyond this to ensure this does not lead to damaging reductions in service provision or quality.

  - The Bus Partnership Fund continues to support local authorities and bus operators to improve bus services, for instance by implementing bus priority measures. Beyond this, changes to regulations have now empowered local authorities to run their own bus services directly, which could enable new innovative services.

- Scotland's Minister for Active Travel recently announced increased funding to support the expansion of the National Cycle Network, provide improved cycling infrastructure and guidance around schools, and deliver community e-bike schemes. This takes total annual investment in this part of the sector to £150 million, almost halfway to the Scottish Government's 2024/25 target.

- Scotland's transport vision sees the greatest effect of sustainable transport as coming from an integrated network of public transport, active travel, and shared mobility.

  - In December 2021, Transport Scotland allocated the final award from its Mobility as a Service Investment Fund, which aims to support innovative technologies that make it easier for people to understand the alternative modes that are available for their journeys.

  - Local schemes such as the introduction of Low-Emission Zones in four cities this year aim to encourage the public to think more about alternatives to private car travel.

(ii) Aviation

There has been minimal progress in developing policies to reduce emissions from aviation in Scotland in the last year.

There has been minimal progress in the last year in developing policies to reduce emissions from aviation in Scotland. Much of the power for the sector is reserved, but the Scottish Government is yet to publish a strategy for aviation decarbonisation or commit to using its powers to reduce demand growth for aviation.

There is no plan for managing aviation demand growth in Scotland.

Demand management

Aviation demand management is not included in the CCPu or the UK Jet Zero Strategy beyond carbon pricing (through the UK ETS and CORSIA) and information to consumers.

- The UK Jet Zero Strategy saw the commitment to consult on providing information on the environmental impact of flying to consumers.

- Air transport in Scotland is taxed through UK Air Passenger Duty (APD), a reserved policy. The Scottish Government has committed to reviewing APD rates to manage demand ahead of the introduction of the devolved Air Departure Tax (Scotland's planned replacement for Air Passenger Duty for which it has had powers since 2016). Beyond this, the Scottish Government does not have legal powers to implement a frequent flyer levy or cap, or frequent flyer or air-mile bonuses.

- The Scottish Government is also committed to encouraging take-up of lower-emission transport options (see Surface Transport section).

The Scottish Government has introduced its own commitments on low-/zero-emission aviation that go beyond the UK Government commitments.

Zero-emission aviation

Zero-emission aircraft are a key element of the UK Government's strategy for decarbonising aviation. So far, it has committed £685 million of R&D funding to the Aerospace Technology Institute Programme for the next three years to support the development of low-emission aircraft technology.

In addition to this, the Scottish Government has introduced its own commitments on low-/zero-emission aviation that go beyond those by the UK Government.

- It has committed to decarbonise scheduled flights within Scotland by 2040 and work to encourage sustainable growth as the sector recovers from the COVID-19 pandemic.

- In collaboration with Highlands and Islands Airports Limited (HIAL), it has committed to create a zero-emission aviation region, including acting to decarbonise the airports' operations.

- It commits to facilitating trials of low- or zero-emission aircraft in Scotland as part of their plans for a Just Transition by securing economic opportunities.

- The Sustainable Aviation Test Environment (SATE) project led by the Highlands and Islands Airports Ltd (HIAL) secured £8.9 million funding for its second phase from UK Research and Innovation (UKRI) as part of the Future Flight Challenge competition, which awards funding to innovation projects demonstrating integrated aviation systems and novel air vehicles.

- It plans to explore the potential for purchasing zero- or low-emission aircraft to lease back to operators, with the potential to upgrade fleets outside of their natural replacement cycle.

Sustainable Aviation Fuel

The responsibility for sustainable aviation fuel (SAF) is reserved. The UK Government have committed to a SAF mandate to be in place by 2025. The Scottish Government has committed to exploring options to incentivise its use.

UK ETS and CORSIA

The interaction between the UK and EU ETS and CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation) is a reserved matter. However, the Scottish Government works with their UK ETS Authority partners to ensure the schemes are effective at incentivising decarbonisation.

(iii) Shipping

The first steps towards testing and deploying low-carbon technologies in Scotland's shipping sector are beginning to be taken. The Scottish Government holds joint responsibility for shipping, with direct influence over the ferry contracts that it controls. Wider maritime decarbonisation is dependent on UK and international policy.

- Two research projects – Hydrogen in an Integrated Maritime Energy Transition (HIMET) in Orkney and NEPTUNE in Shetland – aim to assess the viability of zero-carbon shipping options for the islands and trial hydrogen-based fuels in commercial operation. These have continued to gain innovation funding and progress their implementation plans over the past year.

- CalMac, Scotland's main ferry provider, has recently placed an order for two hybrid ferries, which incorporate electric batteries alongside a conventional gas oil engine to improve fuel efficiency and reduce emissions. The first of these is expected to enter service around 2025.

The 2022/23 PfG committed to consulting on an Islands Connectivity Plan, which will set out the long-term strategy for Scotland's ferries.

- The 2022/23 PfG committed to consulting on an Islands Connectivity Plan, which will set out the long-term strategy for Scotland's ferries. Consideration of fuel technologies and decarbonisation options should be a key part of this plan, along with an assessment of the opportunity for these routes to lead the way on wider maritime decarbonisation.

- Aberdeen Harbour secured a £400,000 investment through the UK Government's Clean Maritime Demonstration Competition to install shore power – connections to the local electricity grid that vessels can use while berthed in port – at the port. The port recently published a study[1] showing that green shore power could reduce emissions from ports by over 90%.

Two multilateral agreements on shipping decarbonisation were signed at COP26 in Glasgow. The Scottish Government should seek to build upon this, and Scotland's historic importance in shipbuilding, to support their implementation and enhance their impact.

- The Clydebank Declaration commits signatory nations to work together to establish green shipping corridors – zero-emission maritime routes between ports – and deploy the infrastructure to support these.

- Operation Zero is an agreement between businesses operating in the North Sea for zero-emission vessels to be deployed to service offshore windfarms by 2025, with suitable infrastructure put in place to support their operation. Scottish ports and generators are included within the list of signatories.

(b) Assessment of policy progress

Policy progress is relatively strong on the technology side of the surface transport sector, with credible policies in place or being developed. However, risks remain on the demand side. There are significant risks for both the shipping and aviation sectors, with insufficient detail on plans being made in the aviation sector to make a complete judgement of progress (Table 3.1).

Table 3.1
Policy scorecard for surface transport, aviation and shipping

Sub-sector	Delivery mechanism and responsibilities	Funding and other financial incentives	Enablers in place and barriers overcome	Timeline for future policies	**Overall sub-sector assessment**
Cars and vans – zero-emission vehicles Mostly reserved	G	G	Y	Y	G
Heavy-duty vehicles – zero-emission vehicles Mostly reserved	Y	G	O	G	Y

Cars and vans – zero-emission vehicles

Good progress:

Scotland aims to remove the need for consumers to choose models that use fossil fuels by 2030, including not choosing plug-in hybrids, which is more ambitious than the wider UK goals.

- To support this, the Scottish Government offers grants for installing home-chargers and interest-free loans, on top of support available from the UK Government. Uniquely, interest-free loans also extend to second-hand vehicles, which is a positive step in widening access to the EV transition.
- Scotland has more public charge-points per vehicle than in any other nation of the UK. The Scottish Government recently published its vision for how this network will continue to expand, which will be necessary to facilitate the EV transition.

To be addressed:

- Progress in EV deployment to date in Scotland is slightly behind the UK. Although battery-electric car sales are scaling up quickly, they are slightly behind our Tailwinds assumptions.
- To enable scale-up at the pace required, Scotland needs to extend its charging vision and address concerns throughout the transition, on its pathway to reach all of the consumer base.

Concerns include consumer experience, inconsistent charging provision (Scottish Government should consider how to use planning and building regulations to facilitate the provision of charge-points at existing buildings, particularly where this is more challenging, e.g. flats), price disparities between home and public charging, and suitability for van use.

Risk due to UK Government action: medium

Regulation of the new-vehicle market is reserved to the UK Government and Scotland is dependent on the establishment of a robust UK-wide market for EVs. The recent acceleration in sales, coupled with the planned phase-out dates and ZEV Mandate, gives confidence that this will occur.

Heavy-duty vehicles – zero-emission vehicles

Good progress:

Transport Scotland recently published a pathway to a zero-emission bus sector. This contains a strong identification of the tasks that are required and the roles and responsibilities for delivering these. Funding has been committed to implement these and also to support innovation in zero-carbon HGV development, which should help Scottish businesses contribute to the development of these markets, including through ongoing UK-wide HGV decarbonisation trials.

To be addressed: Technology development and commercialisation for zero-emission HGVs is still at an early stage.

Risk due to UK Government action: medium

Decarbonisation of the fleet will depend on UK-wide markets, which are expected to expand through ongoing UK demonstrations and as a result of UK Government phase-out dates.

Rail – efficiency and technology Joint responsibility	G	G	Y	G	G
	Good progress: Transport Scotland aims to fully decarbonise Scotland's passenger rail services by 2035, five years sooner than the equivalent UK Government ambition. Credible delivery plans for this are set out through the Rail Services Decarbonisation Action Plan, which identifies the potential decarbonisation options for each segment of the mainline. The first electrification projects towards delivering these have begun. **To be addressed:** Further challenges remain around decarbonising rail freight. **Risk due to UK Government action: low** There remain uncertainties around the interdependencies between Scotland and the UK through Network Rail and the new Great British Railways.				
Conventional vehicle efficiency Fully reserved	Reserved				
	Risk due to UK Government action: high Regulation of the new vehicle market is reserved to the UK Government, and current proposals are unlikely to deliver the emissions savings required from this portion of the market.				
Cars – demand reduction and modal shift Mostly devolved	O	Y	Y	Y	Y
	Good progress: Scotland's ambition to reduce car-kilometres by 20% by 2030 goes considerably beyond the UK Government's plans. This represents laudable ambition and is a good example of a plan being co-developed between central and local governments, which will be vital in producing implementable policies across several sectors. Scottish Government has taken the first steps towards delivering this by aligning the recommendations in the second Strategic Transport Projects Review to this goal, embedding the 20-minute neighbourhood concept within the revised national planning framework, and publishing a route map of potential interventions to reduce car use. **To be addressed:** However, this falls short of a complete strategy, and clearer packages of measures now need to be designed and implemented. Achieving a 20% reduction will require concerted action across all areas of the country, combining measures that incentivises alternative modes with those that deter car usage. Deferring consideration of interventions that could discourage car usage to 2025 is not likely to be sufficient. A comprehensive delivery plan is needed, which must be delivered at pace and with ambition if it is to achieve the 20% objective. **Risk due to UK Government action: low** Demand policy is largely devolved. However, there remains a risk that the lower ambition and reluctance to consider demand-side measures in the wider UK could hinder public acceptance of Scotland's demand-reduction plans.				

Freight – demand reduction and modal shift Mostly devolved	O	O	O	O	O
	Good progress: Both the Scottish and UK Governments have pledged to explore opportunities for logistics and efficiency improvements and increased use of rail freight. **To be addressed:** So far, this area has received little attention from both Governments, and concrete policy is lacking. It is important that the opportunities to manage demand in the freight sector are not overlooked amid the priority to deliver the 20% car demand reduction target. **Risk due to UK Government action: medium** Cross-border freight and UK-wide haulage companies will be influenced by policies imposed by both the Scottish and UK Governments.				
Aviation - Demand Joint Responsibility	R	R	R	R	R
	Good progress: N/A **To be addressed:** The Scottish Government has committed to expand demand and restore the country's 'connectivity' in the recovery from COVID-19. There is no commitment to manage transport demand, despite the delivery risk of technologies required to decarbonise aviation. Despite Air Departure Tax (replacing Air Passenger Duty) having the potential to be devolved, the tax is yet to be implemented. This is a missed opportunity to implement a fiscal policy that could contribute to the management of demand for flights, particularly domestic flights within Scotland and subsidise lower-emission forms of transport. Alongside fiscal policies, demand can also be managed through airport expansion controls, a further devolved power. **Risk due to UK Government action: high** Lack of commitment to use fiscal policy to address demand management within the sector.				
Sustainable Aviation Fuel (SAF) Fully reserved	Reserved				
	Good progress: The Sustainable Aviation Fuel Mandate is reserved to UK Government, which has provided additional detail in its most recent SAF Mandate consultation response. Scottish Government has committed to explore options to incentivise the use of more SAF (while recognising that levers in this area are reserved). **To be addressed:** Release the aviation strategy as soon as possible with more details on how SAF can be incentivised specifically in Scotland. **Risk due to UK Government action: medium** The recent response to SAF consultation has provided evidence of a mandate with strong potential. There are still some significant risks that required supply will be insufficient to meet demand.				

Low- and Zero-Emission Aircraft Mostly reserved	Y	Y	O	O	O
	Good progress: The Scottish Government is committed to working to decarbonise scheduled flights within Scotland by 2040 and aims to create the world's first zero emission aviation region. It is also committed to support trialling and introduction of low-/zero-emission aircraft and is exploring the potential to purchase zero-/low-emission aircraft, for lease back to operators. It is using enterprise agencies to work with businesses in Scotland to support bids for funding from the Aerospace Technology Institute. A Sustainable Aviation Champion has been appointed to identify and coordinate activity across Scotland. **To be addressed:** More detail is needed on the scheme for Scottish Government's purchase of low emission aircraft in the upcoming Aviation Strategy. **Risk due to UK Government action**: **high** FlyZero only gives a very early indication of potential technologies which will require extensive testing before being commercially viable. Furthermore, these will only have a small impact on total aviation emissions, especially in the near-term. The roll-out of technologies will also require high levels of international cooperation to be successful, which is a considerable risk within this sector.				
System/Airport Efficiencies Joint responsibility	O	O	Y	O	O
	Good progress: The Scottish Government has committed to take action to decarbonise the Highlands and Islands Airport Limited's airport operations. Some progress has been made to reduce emissions from people travelling to and from Scottish airports. **To be addressed:** More detail is needed on how other small internal flights can be made more efficient and how the larger airports will implement the infrastructure required for decarbonisation. Further progress is required to increase public transport connectivity to Scottish airports, particularly smaller airports. **Risk due to UK Government action: medium** The UK Government is working to include tankering avoidance alongside the SAF mandate and looking to reduce the incidence of "ghost flights" (i.e. flights with no passengers, or less than 10% of passenger capacity).				
Offsets/removals Joint responsibility	R	O	O	Y	O
	Good progress: N/A **To be addressed:** There is no decision on the interaction between the UK ETS and CORSIA. **Risks due to UK Government action: high** Significant risks that CORSIA is not stringent enough and the offsets are of insufficient quality and additionality to be an acceptable contribution to UK carbon budgets. They also will not develop a market sufficiently large to deal with the future requirements for removals within the sector.				

Shipping Joint responsibility	O	Y	O	O	O
	Good progress: Scotland is home to several innovative projects seeking to explore and demonstrate low- and zero-emission vessels in commercial operation. **To be addressed:** The Scottish Government does not yet have a clear strategy for delivering its target for 30% of Scottish Government-owned ferries to be low-emission by 2032. This needs to be a core consideration in the upcoming Islands Connectivity Plan. **Risk due to UK Government action: medium** Scotland holds direct influence over the ferry contracts that it controls, but wider maritime decarbonisation is dependent on uptake of zero-emission vessels by national and multinational shipping operators and provision of the required refuelling infrastructure at destination ports across the rest of the UK and overseas.				

Note: Refer to table A2 for full descriptions of the scoring criteria.

(c) Indicators of progress

Progress on key indicators of surface transport and aviation decarbonisation for Scotland is shown in Table 3.2 and Figures 3.1-3.6. For surface transport and aviation, the CCC pathways are for our Tailwinds scenario rather than our Balanced Pathway scenario, to match our recommended pathway in our accompanying Target Advice, which accompanies this report.

- Battery electric car sales increased by 49% in 2021, although market share remains slightly below that across the UK as a whole and below our Tailwinds assumptions, with plug-in hybrids still representing around 40% of the electric vehicle market share (Figure 3.1). Market share of battery electric van sales was around 6% lower than our Tailwinds pathway in 2021.

- Scotland's public charging network is more extensive than those in the other nations of the UK, although it is behind London and patchy. Installation rates will need to accelerate further if Scotland is to provide its share (24,000, based on relative car- and van-kilometres) of the UK-wide infrastructure strategy's aim for 300,000 nationwide by 2030.

- Prior to the pandemic, car demand in Scotland had been steadily increasing. A paradigm shift will be required to reverse this – and quickly – if the Scottish Government is to deliver on its commitment to reduce car demand by 20% by 2030 (Figure 3.3). Van and HGV kilometres also rebounded quickly and completely following the lifting of pandemic restrictions.

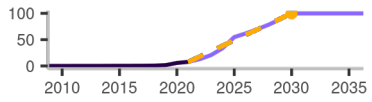
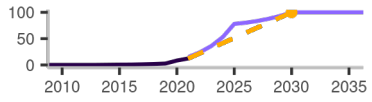
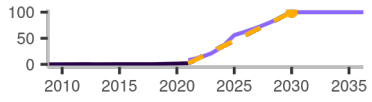
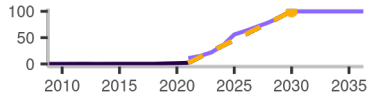
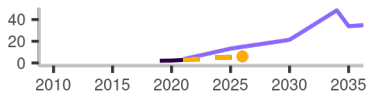
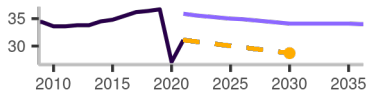
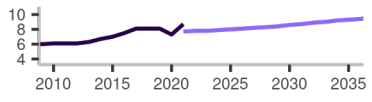
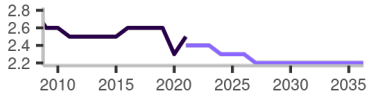
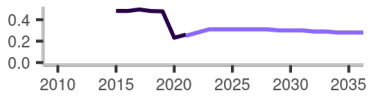
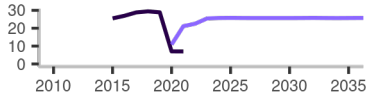
- Modal shift from cars to public transport and active travel will need to play a role in this. Bus ridership in Scotland has continued to decrease over the past decade, driven by increasing bus fares and cheaper relative private transport costs. Rail ridership in Scotland steadily increased until the pandemic, which saw a large decrease and slow recovery. Cycling saw a surge during the pandemic, and e-bikes could widen access to cycling if supported by investment in cycling infrastructure.

Airport terminal passengers were increasing prior to COVID-19 but aircraft movements were stable.

- Airport terminal passengers were increasing between 2011 and 2018 (with a small decrease in 2019) before the pandemic. Numbers saw a significant fall during the pandemic, and we are yet to see if these are returning to 2019 levels.

- On the other hand, the number of aircraft movements remained relatively stable over the same period, and the fall during the pandemic was not as pronounced as with terminal passengers. This indicates lower load factors during the pandemic, which we expect to have recovered towards the end of 2022 as demand recovers. The pattern prior to the pandemic suggests efficiency improvements in the number of passengers carried per journey.

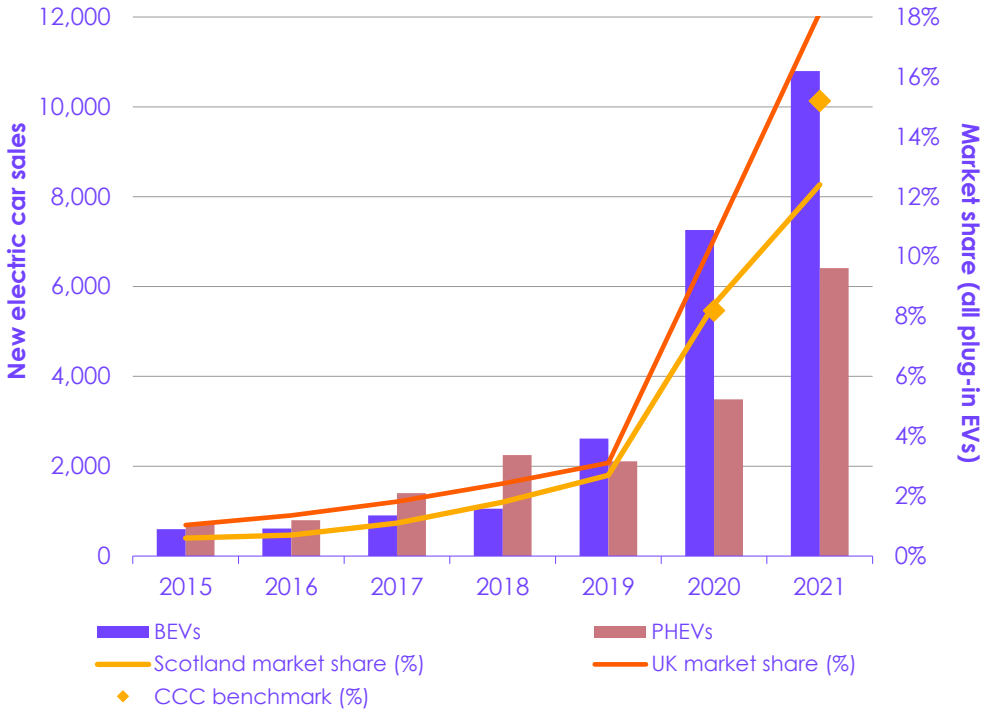
Table 3.2
Key indicators for surface transport

Surface transport indicators		Most recent value & benchmark			Trend
Group	**Name**	**Year**	**Value**	**Change**	**Key: Historical - CCC - Gov**
Zero-emission vehicle uptake	Battery Electric Vehicles - % of new car sales	2021	7.8%; CCC benchmark: 7.9%	+49% from 2020	
	All plug-in Electric Vehicles - % of new car sales	2021	12%; CCC benchmark: 15%	+60 from 2020	
	Battery Electric Vehicles - % of new van sales	2021	2.1%; CCC benchmark: 8%	+125% from 2020	
	All plug-in Electric Vehicles - % of new van sales	2021	2.2%; CCC benchmark: 11%	+120% from 2020	
Electric vehicle charging infrastructure	Number of public charge-points	2021	2.8 thousand; CCC benchmark: 3.5	+27% from 2020	
Surface transport demand	Km travelled by cars	2021	31 billion km; CCC benchmark: 36	+15% from 2020	
	Km travelled by vans	2021	8.7 billion km; CCC benchmark: 7.7	+19% from 2020	
	Km travelled by Heavy Goods Vehicles	2021	2.5 billion km; CCC benchmark: 2.4	+9% from 2020	
Aviation demand	Air Transport Movements	2021	0.26 million/year; CCC benchmark: 0.25	+12% from 2020	
	Terminal passengers	2021	7 million/year; CCC benchmark: 21	-1% from 2020	

Notes: All values are rounded to 2 significant figures; Solid lines represent pathways; Points represent in-year benchmarks; Dotted lines show the linear rate of change required to meet in-year benchmarks.

Sales of battery-electric vehicles and plug-in hybrid vehicles have increased year on year. Plug-in hybrid sales continue to outpace battery-electric vehicle sales in Scotland. Market share of battery-electric vehicles remains slightly below our Tailwinds assumptions and below the UK as a whole.

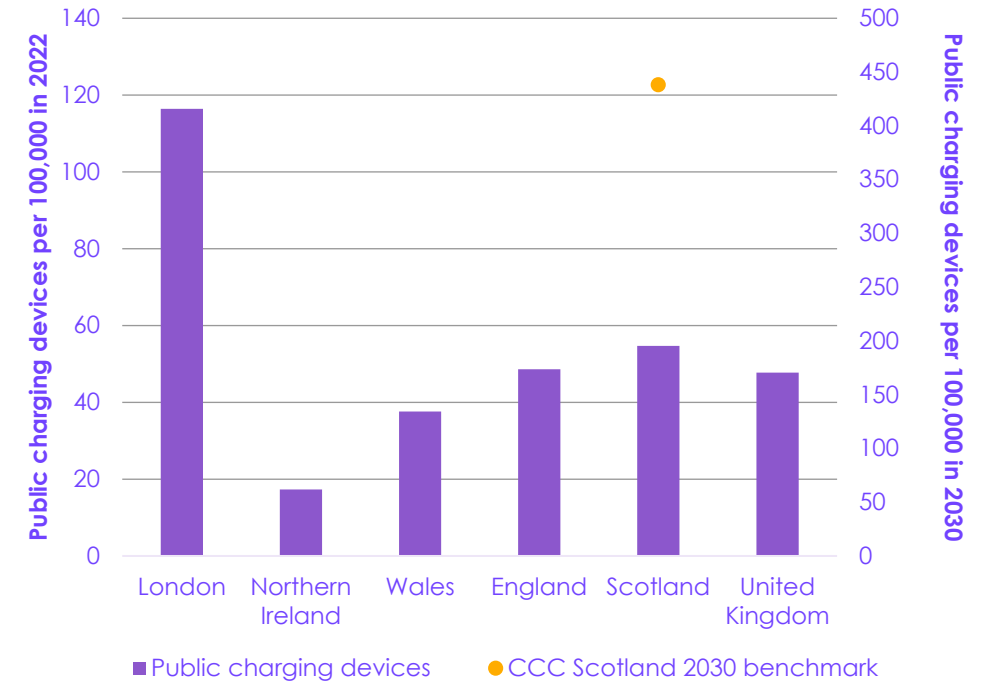
Figure 3.1 Number of new electric cars and market share of total car sales in Scotland



Source: DfT (2022); CCC analysis.

Deployment of Scotland's public charging network will need to continue at pace to ensure that infrastructure is available ahead of need.

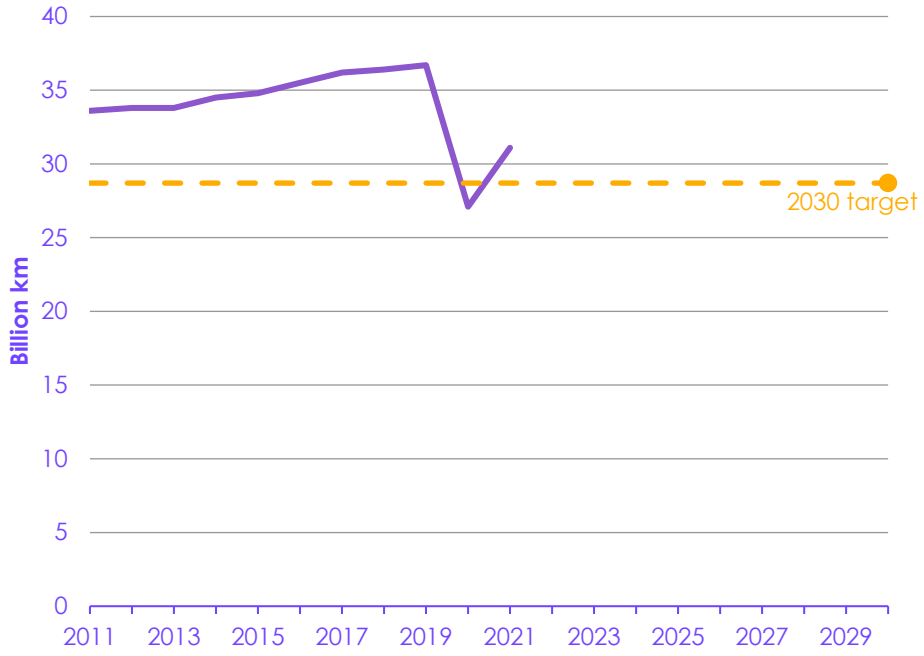
Figure 3.2 Public charging devices per 100,000 of population, by region, 2022



Source: DfT (2022); CCC analysis.

Car demand had been steadily increasing prior to the pandemic. To deliver on the 20% car demand reduction by 2030, the Scottish Government must focus on reversing this.

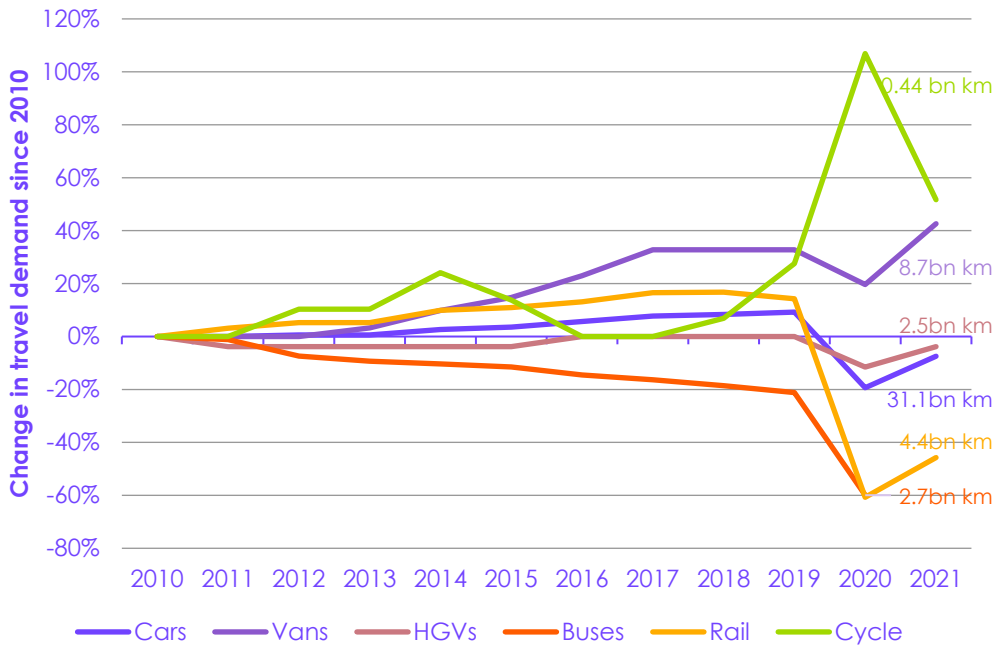
Figure 3.3 Public charging devices per 100,000 of population, by region, 2022



Source: DfT (2022); CCC analysis.

The total kilometres driven by cars in 2021 is four times higher than the equivalent distance travelled by rail and bus. Lockdown restrictions led to reductions in all transport modes, apart from cycling. Private transport rebounded much more quickly and completely following the lifting of restrictions than public transport.

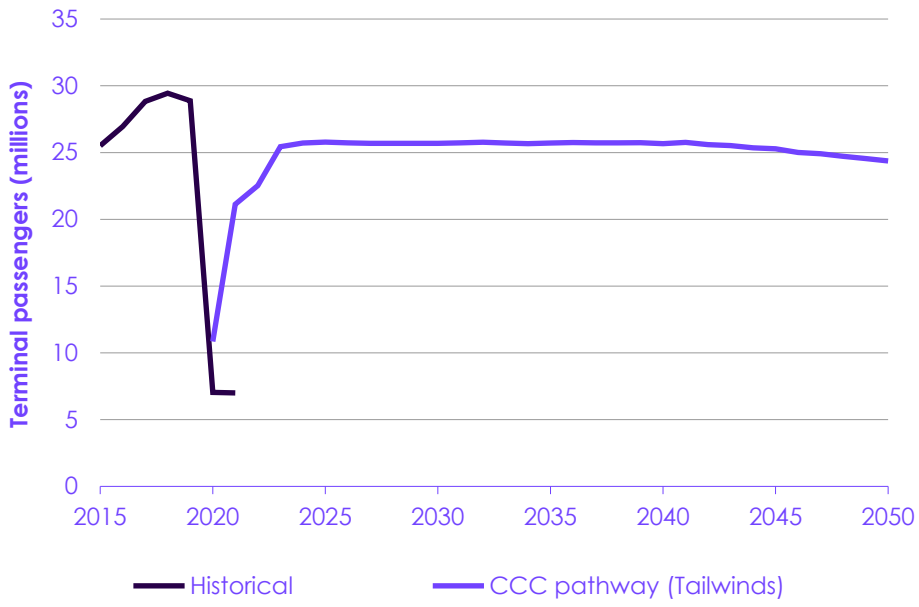
Figure 3.4 Demand for travel by mode since 2011



Source: DfT (2022) *Road traffic statistics and Bus statistics*; ORR (2022) *Passenger rail usage statistics*; CCC analysis.

The number of terminal passengers from Scottish airports increased prior to the COVID-19 pandemic.

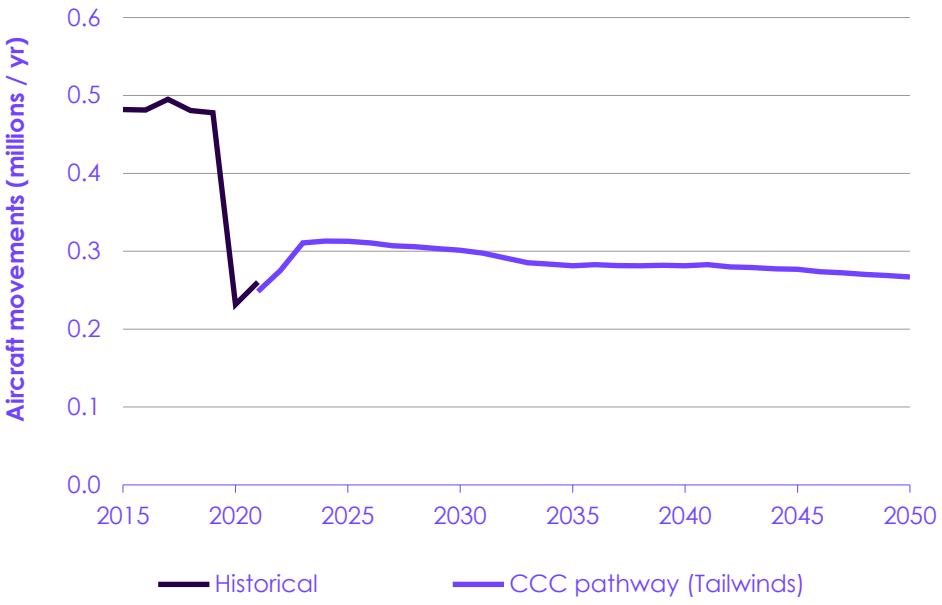
Figure 3.5 Terminal Passengers from Scottish airports (millions)



Source: Civil Aviation Authority (2022) *Terminal passengers*; CCC analysis.
Notes: For the CCC pathway we use our Sixth Carbon Budget Tailwinds scenario to be consistent with our Targets Advice.

Aircraft movements from Scottish airports increased slightly in the decade before 2020 but slower than the increase in passengers.

Figure 3.6 Aircraft movements from Scottish Airports



Source: Civil Aviation Authority (2022) *Aircraft movements*; CCC analysis.
Notes: For the CCC pathway we use our Sixth Carbon Budget Tailwinds scenario to be consistent with our Targets Advice.

(d) Future steps

(i) Surface transport

The priority must now be on developing detailed policies to achieve the outcomes set out in the Climate Change Plan update, and ensuring that local authorities have the tools and resources to implement these quickly.

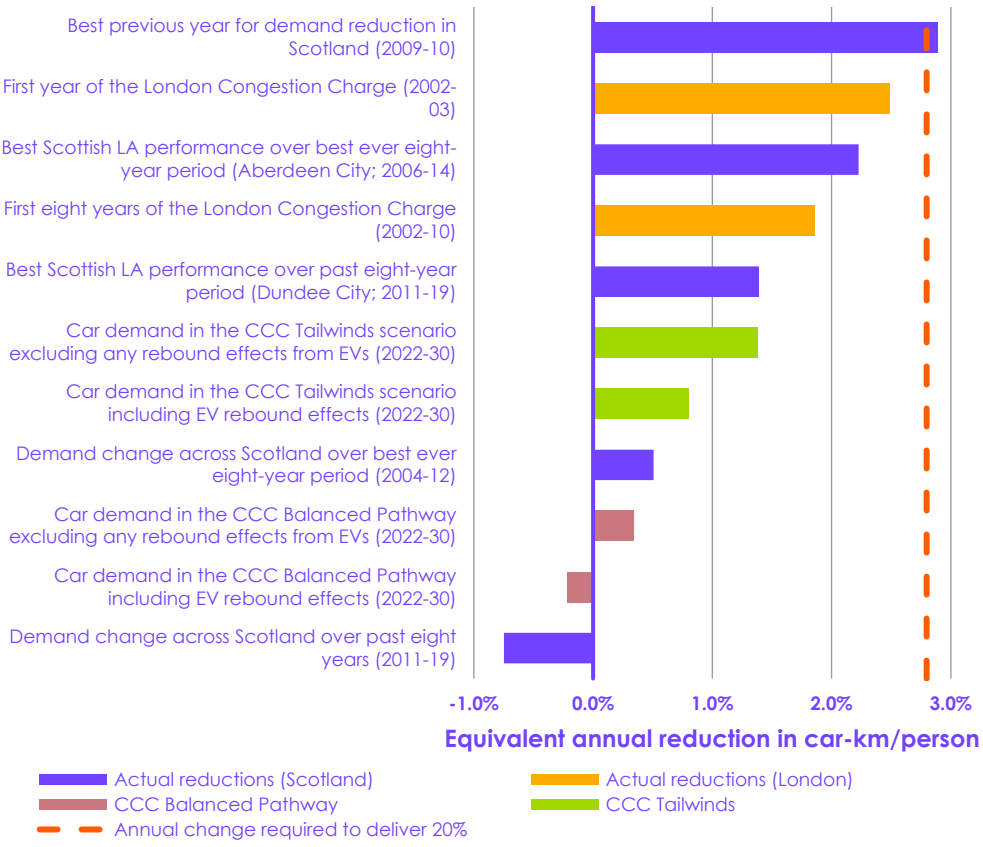
A full strategy is needed for reducing car demand by 20% on 2019 levels by 2030.

- **Publish a full strategy for reducing car demand by 20% on 2019 levels by 2030.** Car demand prior to the pandemic was increasing. Reversing this and achieving a 20% reduction in car-km within a decade represents a major challenge (Box 3.1). The Scottish Government must develop its route map consultation into a full delivery plan rapidly, in order to give sufficient time for its implementation.
  - **Encouraging alternatives and discouraging car use.** It is our assessment that delivering a 20% reduction is likely to require both measures that support and improve alternatives to car travel and interventions that discourage car use. Postponing consideration of the latter group of options to 2025 is not likely to lead to delivery in time – a full suite of options should be developed now in order to develop a comprehensive Car Demand Management Framework as soon as possible.
  - **Embed this ambition within supporting documents.** The delivery plan for achieving the 20% reduction must be embedded across all key enabling mechanisms and policies if it is to succeed. The Scottish Government has made a good start through including the 20-minute neighbourhood at the heart of its fourth National Planning Framework, and this approach must now be extended to the forthcoming Strategic Transport Projects Review.
- **Continue to support innovation.** Scotland has been progressive in its support for innovators in the transport sector, for instance shared mobility providers and e-bike retailers. Continuing this will be important to enable the sorts of innovations which could help enable shifts away from private car travel.
- **Address barriers to enable ambitious ZEV uptake.** Scotland should continue to build upon its strong public charging network, while access to EV loans for new and second-hand vehicles should be maintained as long as higher upfront purchase costs present a barrier. Scotland should work closely with the UK Government to ensure that the details of the ZEV mandate will help deliver the deployment rates needed in Scotland and to share lessons from the ongoing freight decarbonisation trials with Scottish businesses.

Box 3.1
Delivering a 20% reduction in car-kilometres

The Scottish Government's target to reduce aggregate car-kilometres by 20% by 2030, relative to 2019 levels, represents a laudable ambition which – if delivered – will play a significant role in delivering Scotland's emissions pathway and offering a range of important co-benefits. However, it is important to be aware of the scale of the challenge that achieving this target represents – it will require concerted action across the sector, building upon lessons that can be learned from past experience across Scotland and beyond, which must begin urgently. The challenge is outlined in Figure B3.1.

Figure B3.1 Comparison between the 20% car-kilometre reduction ambition and examples of demand reduction in Scotland and elsewhere



Source: DfT (2021) *Road Traffic Statistics*; CCC analysis.
Notes: Levels of aggregate reduction in road traffic (in terms of car-kilometres travelled) have been converted into the implied average annual change in car-kilometres per unit population, to enable comparison between figures over different time periods and on different geographies. The red dashed line represents the annual reduction that will be required to reach the target of 2030 car-kilometres being 20% lower than in 2019, on the assumption that total car-kilometres in 2022 rebound to 2019 levels and the reduction is delivered over the following eight years.

Figure B3.1 sets out how the annual car demand reduction that is required to achieve the 20% target compares to various historical and modelled rates:

- The annual reduction required to deliver the 20% commitment is the average yearly reduction required over the eight years from 2022-2030 to reach aggregate demand 20% lower than 2019 levels in 2030, assuming that 2022 traffic is equal to 2019.
- Notably, car demand over the eight years prior to the pandemic had increased by 6%. This trend will need to be reversed rapidly if the 20% target is to be achieved.

- Scotland's ambition goes considerably beyond what we assumed in our scenarios developed in 2020 as part of our advice on the UK's Sixth Carbon Budget, which included aggregate demand reductions over the period 2022-30 of up to 8%. This difference is primarily driven by the fact that our scenarios assume actions to reduce demand are applied relative to expected baseline growth. This suggests that the key to going beyond our scenarios could be to reverse the preconditions, such as investment in road-building and planning processes that lock in car dependency, that enable this underlying tendency towards increasing car demand.
- However, the chart also shows that the annual reduction required is in the range of changes that have been seen previously.
  - While the reduction across Scotland from 2009-10 was likely driven by external economic factors, reductions of a similar scale have previously been seen through the implementation of the London Congestion Charge and in cities such as Aberdeen and Dundee over sustained periods. Lessons will need to be learned from these success stories, and policy action will be needed to embed these across the whole country if the target is to be met.
  - There are other comparisons of relevance that are not shown on the chart. For instance, the drop in car demand in Scotland during the pandemic was 26%, while the UK Climate Assembly recommended that we should look to reduce our car use by 2-5% per decade.

(ii) Aviation

A strategy should be developed for aviation decarbonisation in Scotland.

The priority should now be developing a strategy for aviation decarbonisation and increasing ambition to reduce the sector's emissions.

- **Publish a full strategy on aviation decarbonisation.** This should include details on how measures can be implemented to reduce demand for flights, particularly on alternatives to air travel.
- **Look in detail at ways to incentivise sustainable aviation fuel and zero emission aircraft use for Public Service Obligations (PSOs).** As the Scottish Government has power to influence these routes, they should look at ways to increase the effectiveness of reserved policies (e.g. the SAF mandate) for PSOs.
- **Consider the environmental impact of airport expansion in the upcoming National Planning Framework.** Despite the fact that no Scottish airports have plans to expand, there is not a guarantee that no future proposals will be put forward. The Scottish Government should commit to including protections against this to manage aviation demand in the National Planning Framework update.
- **Continue to push the UK Government on the interaction between the UK ETS and CORSIA**, and for the UK Government to push for a more ambitious form of CORSIA, to ensure that carbon pricing mechanisms are as effective as possible at adequately accounting for the environmental cost of aviation.

The Scottish Government should commit to encouraging alternative modes of travel.

- **The Scottish Government should commit to encouraging alternatives to air travel.** For example, support in developing video conferencing infrastructure or encouraging use of lower-emission forms of surface transport where alternatives are available.

- **Implement the Air Departure Tax as soon as possible at a rate that adequately reflects the cost of air travel.** Use the review of Air Passenger Duty rates to understand the impact of APD on demand and use the ADT as a way of reducing demand for flights departing Scotland.

- **Commit to stopping warming from non-CO_2 effects after 2050.** See our accompanying Target Advice for more detail on our recommendations for the non-CO_2 impacts of aviation.

(iii) Shipping

Scotland should show leadership in decarbonising its domestic maritime sector, to help make the case for more ambitious international action.

The Scottish Government should push for stronger ambition on shipping decarbonisation.

- **Push for stronger ambition on shipping decarbonisation.** The Scottish Government should support the UK Government in pushing for inclusion of a Net Zero 2050 target for international shipping, along with mechanisms to deliver this, in the International Maritime Organisation's upcoming update of its Greenhouse Gas Strategy. Scotland should use its Islands Connectivity Plan to show leadership in this space.

2. Buildings

This section covers the buildings sector, which by the Scottish Government's definition includes residential, public, and commercial buildings, as well as some fluorinated gas emissions (including those for non-industrial refrigeration, air-conditioning, heat pumps, and inhalers).

Scotland has set ambitious targets for decarbonising buildings. By the late 2020s it aims for 200,000 low-carbon heating system installations per year and for most homes to reach EPC C.

The Scottish Government aims to reduce emissions from buildings by 70% compared to 2020 levels by 2030 and reach zero emissions in 2045. Meeting these targets will be very challenging:

- Achieving the target emissions reductions will require the Scottish Government to develop new policies in time to meet the required milestones for implementation.
- The targets will require the rapid deployment of energy efficiency and low-carbon heating. The Scottish Government has not demonstrated that its deployment targets align with its emissions reduction ambitions.
  - The Scottish Government is aiming for at least 124,000 homes to receive low-carbon heating systems by 2026, and 1.2 million homes and 50,000 non-domestic buildings by 2030. It is aiming to achieve installation rates of over 200,000 per year in the late 2020s.[2]
  - The Scottish Government is aiming for practically all existing homes to reach the equivalent of an EPC C rating by 2033, an increase of around 1.4 million homes, or 55% of the existing stock.[3]
- The targets represent greater ambition than we included in any of our Sixth Carbon Budget scenarios.

Achieving Scotland's targets implies double the amount of annual deployment which we considered realistic in our most ambitious scenario.

  - Scotland reaches 1.2 million homes with low-carbon heating in 2035 in our Balanced Pathway and 2034 in our Tailwinds scenario. Our updated pathway for Scotland includes deployment in line with our Tailwinds scenario; see the accompanying Target Advice.
  - While an ambition to drive faster decarbonisation is commendable, these deployment rates are extremely stretching. The Scottish targets imply around double the annual deployment rates we considered realistic, even in our most ambitious scenario. This rate of deployment slightly exceeds the natural replacement rate of heating systems, implying a requirement for scrapping some boilers before they reach their end of life.
  - However, continuing high fossil fuel prices coupled with electricity market reforms would make low-carbon heating more competitive and could drive adoption at higher rates than in our scenarios.
  - The Scottish Government has limited policy levers to drive higher adoption of low-carbon heat. Many relevant powers (relating to areas such as funding, finance and product standards) are reserved.

Most F-gas emissions from the UK are covered by The Fluorinated Greenhouse Gases Regulations 2015, which mandate a reduction in the consumption of most hydrofluorocarbons (HFCs) by 2030, ban the use of F-gases in certain applications and mandate various F-gas emission reduction measures.[4] We made recommendations for changes to these regulations in our 2022 UK Progress Report.

(a) Policy developments

The Scottish Government has made good progress in developing and delivering some of the policies required to meet its targets:

A legal framework, delivery plan and assessment of local potential for heat networks as well as a delivery plan to build up low-carbon heat supply chains have been published.

- **Low-carbon heat:**
  - The 2021 Heat Networks (Scotland) Act sets out a legal framework for delivering new heat networks and a system for their regulation and licensing. [5] As required by the Act, the Scottish Government has published a Heat Networks Delivery Plan, along with the First National Assessment of Potential Heat Network Zones.[6,7] The delivery plan sets out mechanisms for delivering heat networks across Scotland, and the assessment identifies the areas most suited to development of new heat networks.
  - The Scottish Government recently published a Heat in Buildings Supply Chain Delivery Plan.[8] This sets out current and planned policies for growing the supply chains and workforce required to deliver low-carbon heating and energy efficiency.

Proposals to reform EPCs, including a new energy use rating and work to develop metrics that incentivise energy efficiency improvements in homes, are underway.

- **Energy efficiency**. The Scottish Government has consulted on proposals to reform EPCs, to include a new energy use rating.[9] Work is underway to ensure that EPCs include a metric to improve their suitability as a tool for delivering energy efficiency improvements.

- **Fuel-poor homes**. Scotland's Fuel Poverty Strategy was published in December 2021.[10] The strategy recognises the role of energy efficiency and low-carbon heat in tackling fuel poverty. The Scottish Government has committed £200 million for decarbonisation of social housing and £465 million to support decarbonisation of fuel-poor homes to 2026, delivered through existing schemes, in addition to funding through the Great Britain-wide Energy Company Obligation (ECO) scheme.[11]

- **New buildings:**
  - In summer 2022 the Scottish Government consulted on plans to prohibit the use of 'direct emissions heating systems' from 2024 in new residential and non-residential buildings.[12]
  - Improved energy standards for new buildings come into force in December 2022, although it is not clear if these will drive uptake of low-carbon heating prior to the ban on direct emissions heating systems.[13] The new standards also introduce a requirement to assess and mitigate overheating risks in new homes.

A call for evidence on regulation of energy efficiency in non-residential buildings has been published.

- **Non-residential buildings**. In spring 2022, the Scottish Government published a call for evidence on regulation of energy efficiency in non-residential buildings, considering three options for assessing a building's compliance: EPCs, implementation of measures, or actual energy use and emissions.[14]

- **Funding and financing:**

  - In 2021 the Scottish Government committed public funding of £1.8 billion for heat and energy efficiency projects to 2026.[15] In the CCC pathway investment over this period is £3.3 billion.

  - The Scottish Government established a Green Heat Finance Task Force in early in 2022, to develop financial solutions to enable decarbonisation of buildings. The membership and remit of the Task Force has been set and it is due to publish interim findings in March 2023.[16]

Legislation requiring local authorities to produce heat and energy efficiency strategies and delivery plans by the end of 2023 has been put in place.

- **Planning:**

  - The Scottish Government has legislated to require every local authority to produce a Local Heat and Energy Efficiency Strategy and Delivery Plan by the end of 2023.[17] These are intended to set out long-term frameworks for delivering low-carbon heating and improving the energy efficiency of buildings within each local authority area.

  - Scotland's draft fourth National Planning Framework (NPF4),[18] published in November 2021, included an intent to 'rebalance' the planning system to include climate change and nature recovery as guiding principles. The framework's development proposals for homes set out six qualities of successful places, which directly consider climate adaptation and mitigation and include a focus on resource-efficient design and a sustainable environmental footprint.

- **Coordination and public engagement:**

A virtual energy agency to support change in buildings energy use was set up, and a commitment to publish a public engagement strategy for heat in buildings by early 2023 was made.

  - The Scottish Government has taken steps to establish a National Public Energy Agency to support change in how energy is used in buildings. In spring 2022 a call for evidence was conducted, and in October 2022 a virtual energy agency was launched.[19] The agency will have a remit to raise public awareness, coordinate delivery of investment, and coordinate delivery of energy efficiency and heat decarbonisation.

  - The Scottish Government has committed to publish a Heat in Buildings Public Engagement Strategy in early 2023 to raise the profile of energy efficiency and zero emissions heating system options.[20]

- **Supply chains and skills**. The Heat in Buildings Supply Chain Delivery Plan[21] outlines policies to help meet the workforce requirements for deploying energy efficiency and low-carbon heating measures. It is not clear if these will deliver the skilled workforce required. Further work will be required to ensure that policies and funding are sufficient to ensure that these workforce requirements are met.

- **F-gases**. NHS Scotland has announced plans to reduce F-gas emissions from medical inhalers in Scotland (which are not covered by UK F-gas regulations) by 70% by 2028 compared to 2020/21.[22]

(b) Assessment of policy progress

The Scottish Government has ambitions to decarbonise buildings faster than our pathways and the UK as a whole but does not have sufficient policies in place to deliver on these ambitions. It has made substantial funding commitments, and good progress on enabling measures such as local energy and heat network planning, however it does not have adequate policies in place to deliver low-carbon heat and energy efficiency at the required rates and lacks the powers required to implement certain policy levers. Our assessment of policy progress in this sector is given in the policy score card (Table 3.3).

Table 3.3
Policy scorecard for buildings

Sub-sector / policy area	Delivery mechanism and responsibilities	Funding and other financial incentives	Enablers in place and barriers overcome	Timeline for future policies	**Overall sub-sector assessment**
Low-carbon heat in existing homes (non-fuel-poor) Joint responsibility	O	Y	Y	O	O
Energy efficiency in existing homes (non-fuel-poor) Joint responsibility	R	R	Y	O	R

Low-carbon heat in existing homes (non-fuel-poor)

Good progress:

- The Green Heat Finance Task Force has been established to develop long-term solutions for financing low-carbon heat and energy efficiency.
- Legislation is in place requiring local authorities to produce Local Heat and Energy Efficiency Strategies.
- The Heat in Buildings Supply Chain Delivery Plan outlines policies to help meet the workforce requirements for deploying low-carbon heating.
- The Social Housing Net Zero Fund will provide £200 million to support projects to install low-carbon heat or energy efficiency in social housing. Awards can cover up to 50% of the capital cost for these projects.

To be addressed:

- No plausible policies are yet in place to support uptake of low-carbon heating, beyond delivery through the UK-wide market-based mechanism. The Scottish Government intends to prohibit the use of fossil fuel boilers by 2045 but does not have powers to restrict the sale of replacement fossil fuel boilers. The Heat in Buildings Strategy committed to phasing out installation of replacement fossil fuel boilers from 2025 in off-gas properties and 2030 for on-gas properties[23] but it is currently unclear whether this commitment is likely to be delivered and how the required deployment might be achieved otherwise.
- Policy solutions are required to enable the delivery of low-carbon heating in tenements.

Risk due to UK Government action: **High**

- Details of the market-based mechanism have yet to be finalised – the approach is complex and carries significant risks. It is unclear whether this policy will be adequate to deliver the deployment required, in particular given Scotland's more ambitious deployment targets.
- Restrictions on the sale of replacement fossil fuel boilers will require implementation by the UK Government, which is currently proposing later dates for such restrictions.

Energy efficiency in existing homes (non-fuel-poor)

Good progress:

- Work is underway to reform EPCs to better align with delivering energy efficiency improvements.
- The policies and proposals set out above (i.e. the Green Finance Task Force, Local Heat and Energy Efficiency Strategies, and the Heat in Buildings Supply Chain Delivery Plan) all cover energy efficiency as well as low-carbon heat.

To be addressed:

- Policies for minimum energy efficiency standards for private-rented and owner-occupied homes are not in place, although target dates are proposed in the Heat in Buildings Strategy.
- Policy solutions are required to enable the delivery of energy efficiency standards in tenements.

Risk due to UK Government action: High

Policy solutions which rely on regulation of finance providers would require implementation by the UK Government.

<table>
<tr><td rowspan="2">Heat networks

Joint responsibility</td><td>G</td><td>G</td><td>Y</td><td>O</td><td>Y</td></tr>
<tr><td colspan="5">Good progress:
Announced Government funding appears sufficient to meet ambitions to 2027.
The Heat Networks Delivery Plan sets out mechanisms for delivering heat networks. The First National Assessment of Potential Heat Network Zones identifies the areas most suited to development of new heat networks.
The requirement for local authorities to produce Local Heat and Energy Efficiency Strategies will support delivery of heat networks.
To be addressed:
Issues need resolving around aligning the UK and Scotland's regulatory frameworks and giving Ofgem authority over consumer protection and licensing.
Risk due to UK Government action: Medium
The appointment of Ofgem to regulate and license heat networks in Scotland is reliant on the UK Government. The required legislation has yet to be enacted.</td></tr>
<tr><td rowspan="2">New homes

Mostly devolved</td><td>O (to 2024)
Y (from 2024)</td><td rowspan="2">G</td><td rowspan="2">Y</td><td rowspan="2">O</td><td>O (to 2024)
Y (from 2024)</td></tr>
<tr><td colspan="5">Good progress:
Improved energy standards will come into force in December 2022.
Consultation undertaken on plans to prohibit fossil fuel heating systems in new buildings from 2024.
To be addressed:
Under current plans, direct emissions heating systems may continue being installed for three years after implementation of the new regulations, in schemes which apply for approval prior to the new regulations coming into force. This transition period ought to be reduced (following the approach being planned in England).
There is scope for further improvements to energy efficiency standards for new buildings, beyond those coming into force in December 2022, but no plans have been announced.
Energy standards could be improved by using absolute targets for energy use rather than comparison against notional buildings.
Improvements to building standards enforcement are needed, including expanding the use of performance testing, to ensure that the actual performance of new buildings aligns with expectations and to hold contractors to account for quality and performance.
Risk due to UK Government action: Low
Improvements to the accuracy of modelled performance of new homes relies on delivery of SAP 11 by the UK Government.</td></tr>
</table>

Fuel-poor homes Mostly devolved	Y	Y	G	Y	Y
	Good progress: • Scotland's Fuel Poverty Strategy recognises the role of energy efficiency and low-carbon heat in tackling fuel poverty. • The Scottish Government has committed funding of £200 million for decarbonisation of social housing, and £465 million for fuel-poor households. **To be addressed**: • Funding may need to be reviewed as high fuel costs increase the number of households in fuel poverty and in need of support. • Policy solutions are required to enable the delivery of energy efficiency standards in tenements – 22% of fuel-poor households in inefficient homes live in tenements, **Risk due to UK Government action: Medium** Funding provided through ECO may not be sufficient, given record high fuel prices.				
Commercial buildings Mostly devolved	O	O	O	O	O
	Good progress: • A call for evidence on energy efficiency in non-residential buildings has been published. • A consultation has been undertaken on plans to prohibit fossil fuel heating systems in new buildings from 2024. **To be addressed**: • It is not yet clear whether the proposed performance-based rating scheme for large commercial buildings in England and Wales will be extended to cover Scotland. • There has not yet been a consultation on proposals to improve energy efficiency in non-residential buildings, despite this being planned for summer 2022. • Plans for phasing out fossil fuel heating in existing buildings have not yet been made. • The proposed backstop dates for energy efficiency roll-out in non-residential buildings are late. • Improvements to building standards enforcement are needed, including expanding the use of performance testing, to ensure that the actual performance of new buildings aligns with expectations and to hold contractors to account for quality and performance. **Risk due to UK Government action: High** • Slow development of proposals by the UK Government for energy efficiency measures in non-residential buildings could make it difficult for the Scottish Government to plan. • Details of the market-based mechanism for low-carbon heat have yet to be finalised. The policy approach is complex and carries significant risks. • Restrictions on the sale of replacement fossil fuel boilers will require implementation by the UK Government.				

Public buildings	O	Y	Y	O	Y
Mostly devolved	**Good progress:** • The policies and proposals set out above cover public as well as commercial buildings. • £200 million allocated for public sector estate decarbonisation to 2026. • The NHS has implemented a sustainability strategy, with transparent monitoring on progress for CO_2 and non-CO_2 greenhouse gases. **To be addressed:** • The issues identified above cover public as well as commercial buildings. **Risk due to UK Government action: Medium** The risks set out above apply to public as well as commercial buildings. Funding for public sector decarbonisation is determined by the Scottish Government.				

Note: Refer to table A2 for full descriptions of the scoring criteria.

(c) Indicators of progress

Data limitations make tracking progress in decarbonising buildings challenging. The Scottish Government's framework for monitoring and evaluating policy progress is overdue.

Producing robust indicators of progress in the buildings sector is impeded by a lack of adequate data. The most robust indicators of progress currently available are temperature-adjusted sector emissions data. The picture painted by this data is discussed in Chapter 1.

A proposed framework for monitoring and evaluating policy progress[24] and outcomes has yet to be published or implemented. This means that the Scottish Government is not yet able to accurately track progress in delivering the measures required to meet its targets.

The Scottish Government's Climate Change Plan Monitoring Reports[25] contain a set of indicators relating to buildings. This is a welcome initial step, although there are issues with some of these indicators:

- The 'energy intensity of residential buildings' data is not temperature-adjusted, and the magnitude of the trend it shows is smaller than potential temperature effects.
- The 'emissions intensity of non-domestic buildings' data is a measure of CO_2e emissions per unit of economic activity. While this can usefully demonstrate decoupling of economic output from emissions, it should be considered alongside overall non-domestic emissions, as an increase in economic activity would mask a lack of progress in reducing overall emissions. Emissions must eventually reach zero, making it important to track simple total emissions figures.

Scotland's monitoring framework should incorporate progress on outcomes including deployment of energy efficiency and low-carbon heat.

The planned framework for monitoring policy outcomes should develop further indicators, and address shortcomings and data limitations in existing indicators. Properly monitoring policy delivery will require data on outcomes including deployment of energy efficiency and low-carbon heating, levels of heat demand met by low-carbon heat networks and the energy intensity (temperature-adjusted) of homes and non-residential buildings.

(d) Future steps

Publishing detailed policy proposals and frameworks
While the Scottish Government is making progress in developing policies to decarbonise buildings, it is not yet clear how or if it will be able to deliver on all its ambitions.

The design and implementation of policies needs to proceed at pace if the Scottish Government is to meet its targets. It is critical that further progress is made over the next year to turn the ambitions in the 2021 Scotland Heat in Buildings Strategy into developed policy proposals.

Significant progress on the promised regulatory framework to drive low-carbon heat and energy efficiency is needed over the next year if the ambitions laid out in the Heat in Buildings Strategy are to be achieved.

In particular, progress must be made in producing the promised regulatory framework for low-carbon heating and energy efficiency in existing buildings, and an overall framework for monitoring delivery:

- **Low-carbon heating and energy efficiency in existing buildings.** The Scottish Government must develop plausible plans to deliver energy efficiency improvements and low-carbon heating in residential buildings, aligned with Scotland's ambitious targets. This will require a combination of incentives and regulation, including using tenancy and ownership changes as trigger points. The Scottish Government should:
  - Consult on legislation to set low-carbon heating and energy efficiency targets in privately rented and owner-occupied homes and non-residential buildings.
  - Consult on and finalise plans for delivering energy efficiency improvements and low-carbon heating in non-residential buildings. These should include clear target dates for meeting standards.
  - Coordinate with UK Government on its proposed market-based mechanism for low-carbon heat and consider how it will interact with other Scottish Government policy plans.

The delayed monitoring and evaluation framework needs to be published with an expanded set of indicators. The use and effectiveness of public funding to decarbonise buildings should be tracked and reported.

- **Monitoring and evaluation**. Proper measures should be put in place for monitoring policy progress and outcomes. The Scottish Government should:
  - Publish the delayed monitoring and evaluation framework for the Heat in Buildings Strategy or expand the set of indicators in the annual climate change plan monitoring reports.
  - Monitor the use of the £1.8 billion of funding for heat and energy efficiency projects, tracking the amounts spent on heat networks, heat pumps and energy efficiency measures and how these compare to the targets set in the Heat in Buildings Strategy for low-carbon heating and energy efficiency.

Continuing progress

While good progress has been made on new buildings, fuel-poor homes, enabling measures and taken early steps towards considering embodied emissions, many policies need to be firmed up in the next year.

In the last year the Scottish Government has made good progress on policies for new buildings, fuel-poor homes, enabling measures and in considering embodied emissions within the planning framework. Over the next year the focus should be on maintaining momentum and translating consultations and proposals into firm policies:

- **New buildings**. The Scottish Government has made good progress in developing regulations to require low-carbon heating in new buildings from 2024. It should continue to move forward with these plans and consider tightening transition arrangements (in line with proposals being made for building regulations in England). The Scottish Government should:

  - Legislate to prohibit the use of 'direct emissions heating systems' from 2024 in new residential and non-residential buildings, building on the 2022 consultation.

  - Define clear transitional arrangements which will require any buildings which have not meaningfully commenced on site within one year of the implementation of new regulations on energy efficiency and low-carbon heat to comply with the new standards.

- **Fuel-poor homes**. While the level of public funding to support decarbonisation of fuel-poor homes was appropriate at the time the Fuel Poverty Strategy was published, current high fuel prices and volatility mean there is uncertainty over whether this funding will continue to be sufficient. Funding may need to be reviewed as high fuel costs increase the number of households in fuel poverty and in need of support. The Scottish Government should closely monitor the number of households in fuel poverty and expectations of future energy costs, and revise funding allocated to decarbonising fuel-poor homes to reflect levels of support required.

- **Enabling policies**. Good progress has been made on some of the crucial enablers for decarbonising buildings including skills and local authority powers. The Scottish Government needs to continue this progress and ensure local authorities have sufficient funding and enforcement powers. The Scottish Government should:

  - Progress with EPC reform by finalising proposals for improved metrics and carrying out the planned final consultation within a wider consultation on a regulatory framework for heat and energy efficiency in 2023.

  - Ensure that local authorities have the resources required to produce Local Heat and Energy Efficiency Strategies and Delivery Plans, and that these are published by the December 2023 deadline.

  - Ensure that skills requirements for decarbonising the building stock are properly quantified. Ensure that the required education and skills provisions commence and that funding and policies are in place for provision to scale up at the required pace.

- **Embodied emissions**. The intent set out in Scotland's draft fourth National Planning Framework for new homes to have a 'sustainable environmental footprint' is vague and could more explicitly aim to minimise embodied emissions. It will also be necessary to move beyond the high-level vision set out in the framework, so that intentions can feed through to planning decisions and standards for construction practices. This will require collaboration with the construction industry to introduce practices which minimise the embodied carbon of new build homes.

Addressing policy gaps

The Scottish Government has not yet committed to policies to adequately align real-world performance to building standards, or to address overheating in existing buildings and flood risk across the stock.

There are a number of areas where the Scottish Government has yet to commit to policies which are likely to be required to successfully meet its targets:

- **Aligning real-world performance to standards**. Policies are required to ensure that the actual performance of new buildings and energy efficiency measures aligns with expectations. These should include improving the accuracy of the models used to assess compliance with standards, expanding performance testing, enhancing enforcement of standards and developing mechanisms for holding contractors to account for quality and performance.

- **Adapting the building stock to a changing climate.** Despite progress in addressing overheating risk in new buildings, policies to address overheating in existing buildings and flood risk in both new and existing buildings are missing:

  – Some existing residential and non-residential buildings are at risk of overheating or will be under future climatic conditions (although this risk is lower in Scotland than the UK on average). No plans are in place to improve understanding of overheating risks in existing buildings, nor actions to retrofit these buildings with cooling measures where necessary. Plans to reduce emissions should include adaptation as a key priority.

  – While proposals in Scotland's fourth National Planning Framework include a cautious approach to development in floodplains, details on risk assessment, delivery and evaluation are needed. There is also a gap around understanding and implementing property-level flood resilience – specific requirements and standards for property-level flood resilience measures, retrofitting and monitoring are required.

Working together

Collaboration between the UK and Scottish Governments is needed across several policy areas. The UK Government should provide clarity on where Scotland can rely on UK-wide ambition.

The Scottish Government is dependent on UK-wide policies across several reserved areas, if it is to achieve its policy aims. That requires proactive collaboration and coordination between governments. It also requires the UK Government to share its plans and press ahead with its policies for energy efficiency and low-carbon heat, providing clarity to the Scottish Government on where it can rely on UK-wide policies to achieve its ambitions and where it needs to implement additional policies within its power.

Delivering the emissions reduction required in the agriculture and land use sectors will require a combination of reducing direct emissions from the agriculture sector and building the sink strength of the land.

The update to the Climate Change Plan (CCPu) sets out targets to reduce emissions from the agriculture sector by around 28% between 2020 and 2030. The Scottish Government expects that emissions from the land use sector will rise from 0.6 $MtCO_2e$ in 2020 to 1.8 $MtCO_2e$ in 2030, despite setting out a programme to deliver land use change to protect and take up carbon.

Delivering the emissions reduction pathway in the CCPu is dependent on a combination of reducing emissions from the agriculture sector via promotion of low-carbon farming measures and building the sink strength of the land via woodland creation and peatland restoration.

(a) Policy developments

Powers over the agriculture and land use sectors are mainly devolved, and over the last year the Scottish Government has continued to develop policies to deliver on the CCPu. In this section we review progress over the past year.

Scotland continues to navigate leaving the EU Common Agricultural Policy. Further details on future policy are urgently needed if Scotland is to meet its agricultural emissions reduction targets as set out in the CCPu.

Low-carbon farming

Scotland, like the rest of the UK, continues to navigate leaving the EU Common Agricultural Policy (CAP). The Scottish Government released its 'Vision for Agriculture' in March 2022, setting out ambition for the country to be a leader in sustainable and regenerative agriculture.

- It is proposed that future subsidy support will be split equally between unconditional support, similar to that provided under CAP, and conditional support, where payments to farmers, crofters and land managers would be dependent on achievement of targeted outcomes for low-carbon farming approaches, biodiversity gain and wider environmental outcomes.

- Further details on the policy and legislation that will deliver this is urgently needed if Scotland is to meet its agricultural emissions reduction targets as set out in the CCPu. A consultation on the content of the Agriculture Bill that will underpin delivery of the 'Vision for Agriculture' opened in August 2022 in advance of the Bill's planned introduction to parliament in 2023.

The Agri-Environment Climate Scheme (AECS) aims to bridge the gap between the EU CAP and future subsidy approaches within Scotland's developing agriculture and land policy framework. The scheme aims to promote land management that protects and enhances nature, improves water quality, manages flood risk and mitigates and adapts to climate change.

- The AECS opened in early 2022 for applications, with a commitment for future annual rounds up to and including 2024. The current options offered represent an expansion from what was offered in 2021 by including actions to support wider nature conservation benefits.

- The fund represents Scotland's main route of public investment into securing environmental benefits, allocating approximately £30-40 million annually. This has led to around 20% of agricultural land being managed to deliver biodiversity and climate benefits, with participation of around 20% of CAP claimants.[26]

In March 2022, Scotland enacted in law a national Nitrogen Balance Sheet which sets out a baseline figure for how efficiently nitrogen is used compared with losses to the environment. The balance sheet will next be reviewed and updated in 2023 and will offer the first understanding on progress towards efficient use of nitrogen across Scotland's economic sectors, including agriculture.

To address contractual arrangements that may constrain the uptake of mitigation measures on the 20% of agricultural land that is tenanted, proposals set out in 'Vision in Agriculture' include widening the terms of a lease to allow tenants to undertake diversified activities (e.g. planting trees), and for the value of those activities where it is deemed to improve the holding to be included in any payment made by the landlord to the tenant at the end the tenancy.

Trees and woodland

Scotland has high ambition in delivering an increase in woodland creation and has consistently reported greater planting rates than the rest of the UK combined.

Scotland has set high ambition to deliver an increase in new woodlands, with a current target to plant 13,500 hectares (ha) per year, increasing to 18,000 ha per year by 2024/25. This is higher than the CCC Balanced Pathway's rate of 15,000 ha per year.* An established programme is in place to support delivery.

- Scotland has consistently reported greater planting rates than the rest of the UK combined, with few exceptions since 1990. In 2021/22 Scotland planted over 10,000 ha of new woodland.

Planting rates in recent years have plateaued and legacy impacts from past low rates of planting are now influencing Scotland's GHG emissions.

- Despite the recent success in increasing planting rates, legacy impacts from low rates of planting in the 1990s are now influencing Scotland's GHG emissions. The net CO_2 sink has generally declined since reaching a peak in 2012.

- Fast-growing conifer species make up most of the new planting in Scotland (60%), the majority of which is carried out by the private sector, destined for use in products with a short lifespan. Broadleaf species make up the remainder, and there is scope to expand their coverage which in turn will offer benefits for the supply of hardwood timber, and environmental outcomes such as biodiversity.[27]

- Sustainable management of woodlands can support climate mitigation by improving habitat quality, boosting productivity and allowing younger trees to become established. Certified woodland (an indicator of sustainable management) has increased over time but is primarily delivered by the private sector, and more likely in commercial forestry plantations than woodlands planted with the primary objective of promoting biodiversity.

The Scottish Government has committed £150 million in funding for forestry to support an increase in tree planting to 18,000 ha per year by 2024/25. Scottish Forestry has received £100 million to increase new tree planting and Forestry and Land Scotland has been allocated £30 million to expand Scotland's national forests and woodland. £20 million is allocated to increase tree nursery capacity.

Agroforestry and hedgerows offer the opportunity to increase carbon stocks on farms while allowing agricultural production to continue.

* Woodland area increases to just over 17,000 hectares if we include the additional 15% of land used as open ground area for biodiversity assumed in the Balanced Pathway.

Funding is available for the establishment of agroforestry by mechanisms such as the Forestry Grant Scheme and AECS. However, the Scottish Government has not set a target for it and delivery is not reported making its success difficult to track.

Forestry and woodland land delivery in Scotland is underpinned by the 2019–2029 Scottish Forestry Strategy. This in turn is supported by the Implementation Plan released this year over the period 2022–2025.[28]

- The new implementation plan recognises the need for sustainable and adaptive management in Scotland's forests, as well as the role forestry can play in supporting biodiversity and other environmental benefits.

- Ministers will report to the Scottish Parliament on delivery of the Forestry Strategy every three years, with the first report due at the end of 2022. Scottish Forestry is currently coordinating extensive consultation with policy and delivery stakeholders as it develops this report.

Peatlands

Emissions from degraded peatland soils represent a significant proportion of Scotland's emissions from the land use sector. Restoration targets are consistently not met.

Peatlands represent a significant proportion of Scotland's emissions from the land use sector, and around 80% of peat soils are degraded. Restoration measures must continue to be rolled out and the rate increased if the CCPu targets are to be met.

- The Scottish Government has pledged £250 million over ten years to restore 20,000 ha of degraded peatland annually, and in total 250,000 ha by 2030. So far, this target has been missed, with around 8,000 ha delivered in 2021/22.

- A national Peatland Plan was first published in 2015, with a new Peatland Programme established in 2021. This aims to develop and deliver policies to protect peatlands, limiting negative impacts from extraction and development, restore degraded peatlands and manage them sustainably, within the context of a changing climate.

- Legislation to ban moorland burning is expected within the current parliamentary term and will be applicable to peatland habitats.

Domestic and industrial peat extraction continues in Scotland where existing permissions continue, degrading rare habitats and the vast carbon stocks they hold.

- The proposed fourth National Planning Framework states that 'new commercial peat extraction, including extensions to existing sites, should not be supported' but lists several caveats where it may continue.

- The 2021/22 Programme for Government commits to a consultation on the ban on the sale of horticultural peat products, but this has not yet happened. This will target the sale of peat related gardening products, but not directly address the extractive industry.

Biomass

The upcoming Bioenergy Action Plan should address the impact and interaction between biomass demand and land use and agriculture in Scotland.

A Bioenergy Action Plan is due to be published in 2023. This should set out an understanding of the impact and interaction between biomass demand and land use and agriculture in Scotland. The availability and use of sustainable biomass is under review by the Scottish Government, and it is expected that this will be embedded within the Action Plan.

Other policy developments relating to land use and agriculture

Since our last progress report several policy developments relating to land use and the natural environment in Scotland have emerged, seeking to deliver the policy programme as set out in November 2021:

Over the last year a number of policy announcements have addressed land use and the natural environment in Scotland.

- A high-level policy-focused Scottish Biodiversity Strategy is expected by in 2022 that will set out ambition for nature up to 2045. A consultation on its content was opened in June 2022 which recognises the link between a healthy natural environment and tackling climate mitigation and adaptation but does not set out actions for delivery.[29]

- A second round of funding via the annual Nature Restoration Fund has opened to support long-term, landscape scale projects that address restoration and protection of terrestrial and marine habitat and species. At least £12.5 million is available in 2022/23, with £65 million being invested over the course of this parliament.

- The Scottish Government has committed to bringing forward a land reform bill and a consultation into its content opened in July 2022. Alongside addressing landownership issues, the consultation explores issues relating to the barriers and opportunities of investment into natural capital.

- The Land Use Strategy 2021-2026 is a high-level strategy setting out the Scottish Government's vision, objectives and policies to achieve sustainable land use, which recognises the interaction between land use and climate change mitigation but sets out no new commitments or actions to deliver this.

- In March 2022 the CCC's Adaptation Committee published 'Is Scotland Climate Ready?', an independent assessment of Scotland's progress in adapting to climate change and preparing for the risks it will bring. An overview of the full report is presented in Box 2.4 and the key findings, risks and recommendations for the land and agriculture sectors are summarised in Box 3.2 below.

The changing climate represents a risk to Scotland's land use sector to store and sequester carbon.

Box 3.2
Is Scotland Climate Ready? Risks relating to mitigation in the land and agriculture sectors.

Scotland's changing climate
In the past 30 years, the average temperature in Scotland has risen by 0.5ºC, with the 10 warmest years on record all occurring since 1997.[30] Scotland's natural environment plays a significant role in the UK's pathway to Net Zero, and the changing climate could put both Scotland's existing carbon sinks and potential future sequestration at risk.

Natural Environment

- **Forest and woodland** cover is high compared to the rest of the UK, at 18.5%, and has led the way in woodland creation.[31] However, periods of extreme heat and drought, increased risk of wildfires and flooding, and the potential spread of pests, pathogens and invasive species present a risk to new and existing areas of forest.
- **Scotland's peat soils** are in a degraded condition and are a net source of emissions. Without effective action to protect and restore them they are at risk of irreversible damage as the climate changes. Through successful adaptive management they can be improved to reach a state in which they reduce GHG emissions, sequester carbon and help regulate water flows and enhance water quality.
  - There are plans in place for peatland restoration and woodland management which, if properly implemented, will help build resilience of terrestrial habitats. There are also opportunities for forestry productivity from new or alternative species becoming suitable under a changing climate.
- **Marine and coastal ecosystems** are not currently included in the UK's GHG inventory, however these ecosystems represent potentially very large natural carbon stores and their protection and restoration is important to prevent carbon loss through degradation.
  - The National Marine Plan includes climate adaptation, and the network of Marine Protected Areas has increased in size beyond original targets, though species indicators show mixed results.

Agricultural land

- **Intensive agricultural practices** can result in land becoming degraded, leaving it more vulnerable to the effects of climate change. As the Net Zero pathway requires land to be released from agriculture, climate threats to agricultural land put both food production and climate targets at risk.
- **Farmland habitats and species** have been flagged as high concern due to a lack of adaptation plans and insufficient data to understand how the risk is being managed, despite farmland making up 73% of land area in Scotland.[32] The agriculture sector still lacks a coherent strategy to ensure it remains productive and resilient to future climate change.
- **Approaches to ameliorate soil health**, which is crucial for improving productivity, have seen some progress. Species indicators on farmland suggest a long-term net positive increase, though with significant variation between species.

Recommendations

- Although the available data indicate that Scotland is doing relatively well in some areas, there is insufficient data available to thoroughly assess adaptation progress.
  - An overarching 'wrapper strategy' is needed, that brings together the multiple strategies and plans that are currently published or in development for the Scottish natural environment.
- The biodiversity strategy, which is in development, should consider habitats across the whole terrestrial environment, including farmland. It should also include clear, quantifiable targets and effective monitoring, and should give sufficient consideration to climate risks to habitats and species.
- Barriers to achieving peatland restoration targets should be identified and an effective monitoring framework should be developed.

Source: CCC (2022) *Is Scotland Climate Ready? – 2022 Report to Scottish Parliament*; CCC (2020) *The Sixth Carbon Budget*.

More ambition is required to address the links between diet and demand, and emissions from agriculture and land use sectors.

Diet and demand

Policy on diets has seen several significant developments over the last year:

- The launch of Food Standards Scotland's campaign 'Eat Well Your Way'. This focuses on the role of the individual to make healthy and sustainable choices but does not clearly set out the link between food choice and climate change.

- The Good Food Nation Bill received royal assent in June 2022. This requires relevant authorities to create 'Good Food Nation Plans', including a national plan to be delivered before Summer 2023.

- The Bill sets out that plans must consider environmental outcomes related to the food system but does not explicitly mention climate change. These plans present an opportunity to clearly signal a move towards healthy, low-carbon diets, set targets to drive action and monitor delivery and wider impacts on health, nature and climate.

Reducing food waste can reduce agricultural emissions by avoiding unnecessary food productions and releasing the associated land to be used differently e.g. for measures to sequester carbon. The Food Waste Reduction Action Plan set out ambition and detailed plans to reduce municipal food waste by one third against a 2013 baseline by 2025. However, due to limitations on data availability this cannot be tracked until 2023.

(b) Assessment of policy progress

Agriculture and land policy in Scotland is largely devolved, and currently in transition to a new post-CAP framework. More clarity in Scottish agriculture and its role in reducing GHG emissions should be set out via the Agriculture Bill, due in 2023. Positive steps have been made in the land sector, particularly in woodland creation and the Peatland Programme has supported the projected upscaling in peatland restoration.

Table 3.4
Policy scorecard for agriculture and land use

Sub-sector / policy area	Delivery mechanism and responsibilities	Funding and other financial incentives	Enablers in place and barriers overcome	Timeline for future policies	**Overall sub-sector assessment**
Productivity and low-carbon farming Mostly devolved	O	O	R	R	R

Good progress:

- A national Nitrogen Balance Sheet was enacted in law in Spring 2022. This sets a baseline figure for how efficiently nitrogen is used compared with losses to the environment and regularly updated to track progress.
- The Agri-Environment Climate Scheme (AECS) reopened for funding in 2022 and offers grant and capital support for measures to deliver low-carbon farming and wider environmental benefits. The AECS will be open for further funding rounds annually up to and including 2024.
- In March 2022, the Scottish Government released its statement on 'Sustainable and regenerative farming – next steps' setting out its vision for a framework that will underpin Scotland's post-Brexit support regime from 2025 onwards. This includes ambition across the agricultural sector and Scottish food system to deliver emission reduction and wider environmental benefits.

To be addressed:

- The next iteration of the Nitrogen Balance Sheet should set out how on-the-ground actions will be targeted and supported to improve the use of nitrogen and reduce its environmental impacts.
- The Agriculture Bill which will underpin delivery of the Scottish Government's vision for Agriculture is expected in 2023, with a consultation into its content that opened in August 2022. Further detail is required to assess how future support systems will integrate and address the objective for food, nature and climate.
- Timescales and incentives remain short-term, and post-CAP agriculture policy development is behind that of other regions of the UK. Implementation will not happen until 2024 at the earliest, severely limiting the time available to meet agriculture emissions reduction as set out in the CCPu.
- Future rounds of the AECS should provide detail on how the scheme will contribute to the emissions reduction required in the near term as set out in the CCPu.

Risk due to UK Government action: low

Woodland creation Mostly devolved	Y	Y	O	G	Y

Good progress:

- In 2021, the Scottish Government announced £150 million to support new tree planting, the expansion of Scotland's national forests and woodland and increase the capacity of tree nurseries. Scotland is close to meeting the CCC Balanced Pathway having planted 10.48 kha in 2022.
- The Scottish Forestry Strategy underpins delivery between 2019-2029, supported by the recently released 2022-2025 Implementation Plan.
- A diverse range of approaches are being put in place to tackle barriers to upscaling planting, such as adapting horticultural techniques to tree production, steps to support the expansion of woodland on farmland, and knowledge exchange via the Integrating trees network.[33]

To be addressed:

- Scotland has set woodland creation targets of 18 kha / year by 2024/25, with planting needing to be significantly increased from current rates if this is to be achieved. Planting rates have plateaued in recent years. Concerns remain regarding availability of skills, land and nursery capacity to support the upscaling required.

Risk due to UK Government action: medium

- Scotland is currently close to achieving its tree planting targets and has a detailed strategy in place. However, concerns remain about the feasibility of upscaling this quickly enough to deliver the GHG sequestration allocated to woodland measures. UK Government could support by addressing common issues such as nursery capacity, timber supply and finance e.g. via carbon markets.

Agroforestry and Hedges Mostly devolved	Y	Y	O	O	O

Good progress:

- Forestry Scotland offers Forestry Grant Scheme support the creation of small-scale farm woodlands within sheep pasture.
- The AECS includes measures to support hedgerow creation and management as well as small-scale tree planting and will have funding rounds annually up to and including 2024.

To be addressed:

- Financial support for measures is needed beyond 2024 to help land managers make longer term business plans. Non-financial barriers such as skills, advice and contractual constraints must also be considered.

Risk due to UK Government action: low

Peatlands Mostly devolved	O	Y	R	O	R

Good progress:

- Scottish Government has pledged £250 million over ten years to restore 20 kha of degraded peatland annually, and 250 kha by 2030. Peatland ACTION is the national programme to restore peatlands across Scotland. A Peatland Programme was established in 2021 setting out aims to develop and deliver policies protect, restore and sustainably manage peatlands.
- Around 11 kha is projected to go under restoration over 2022/23, a significant increase on previous years, but still below both the Scottish Government's Target and the Committee's advice on what is required.

To be addressed:

- Scotland has missed its restoration targets in recent years, delivering around 8,000 ha of restoration in 2021. Further detail is required on how barriers to upscaling restoration management, such as increasing skills and contractor availability, will be overcome.
- Existing permissions for domestic and commercial peat extraction continue.
- **Risk due to UK Government action: low**

Biomass Joint responsibility	R	R	O	O	O

Good progress:

- Scotland is currently reviewing the role sustainable biomass and engaging with UK Government in the development of the Biomass Strategy. There is indication that sustainable production of biomass feedstock will be recognised within future agricultural policy.

To be addressed:

- A Bioenergy Action Plan is due to be published in 2023. This should set out understanding of the impact and interaction between biomass demand and land use and agriculture in Scotland. The plan should also address constraints that relate to the production of sustainable biomass in Scotland.

Risk due to UK Government action: low

Demand and Consumption Mostly devolved	O	R	O	R	O

Good progress:

- In 2019 the Food Waste Reduction Action Plan set out ambition to reduce food waste by one third against a 2013 baseline by 2025. However, due to limitations on data availability this cannot be tracked until 2023. The 2022 Food Standards Scotland campaign 'Eat Well Your Way' focuses on the role of the consumer to make healthy and sustainable choices.

To be addressed:

- The Good Food Nation plans offer opportunity to set out moves towards healthy, low-carbon diets and set targets to drive action. Further policy should address the food system impact across health, nature and climate and seek to support public dietary shift towards plant-based alternatives to meat.

Risk due to UK Government action: low

Note: Refer to table A2 for full descriptions of the scoring criteria.

(c) Indicators of progress

There has been mixed progress across the agriculture and land use sectors. Lack of progress relating to land use change continue to be a significant concern.

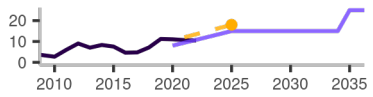
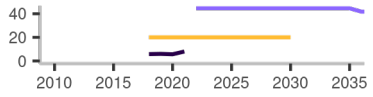
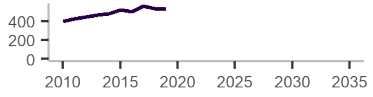
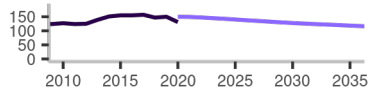
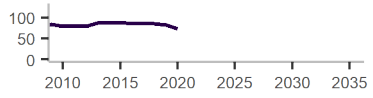
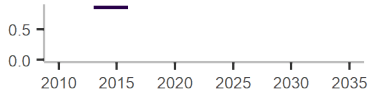
This section sets out key indicators of progress in reducing emissions in the agriculture and land use sectors in Scotland (Table 3.5). All are included within the Scottish Government's own metrics for monitoring delivery of the CCPu.[34] For agriculture, the CCC pathways are for our Tailwinds scenario rather than our Balanced Pathway scenario, to match our recommended updated pathway in our accompanying Target Advice.

The indicators show mixed progress across the agriculture and land use sectors.

- **Trees and woodland.** Scotland has led the way within the UK regarding creation of new woodland, consistently planting at higher rates than the rest of the UK nations combined over the last decade. However, annual planting rates have plateaued – in 2021/22, 10,480 hectares of new woodland were planted (Figure 3.7). This is close to the trajectory set under the CCC Balanced Pathway, but off-track for meeting the Scottish Government's annual target of 18,000 ha by 2024/25.
  - Woodland on farms has increased overall since 2010, but this has slowed since 2017, with a fall in area during 2018 and 2019.
  - In 2020, around 94% of woodland was considered to be under intermediate ecological condition, and 1% favourable.[35] Around 98% of native woodlands fall under these two categories. Data on the ecological condition of woodlands over the longer term are not available.
- **Restoration of peatlands.** Scotland is currently off-track for meeting the Scottish Government's target of putting 20,000 hectares of peat under restoration management each year. The area restored rose to a high of 8,000 hectares in 2021/22, after being quite static over the previous 3 years. Identified recent barriers include reduced capacity due to COVID-19, extreme weather, and limited availability of skilled contractors. Due to the winter season of restoration, it is too early to assess if these continue to limit restoration, but the forecast that approximately an additional 11,000 hectares of peatland will be under restoration in 2022/23 suggest that significant challenges to meeting targets remain.
- **Nitrogen use in agriculture.** Nitrogen use has decreased overall and is on track when compared against our Tailwinds scenario, while the spreading precision of nitrogen fertilisers has increased. The Scottish Nitrogen Balance Sheet passed into law in 2022. In future, this will be an important resource to disaggregate and track the use of nitrogen in Scottish farming and across the economy.
- **Management of animal wastes.** Data are limited to 2013 and 2016. The percentage of holdings with covered manure and slurry storage stayed around 87%. Recent data for this indicator is not available but is expected to be included in future data outputs.

- **Demand-side indicators.** In the 2022 UK Progress Report the CCC referenced the UK wide National Diet and Nutrition Survey as an indicator of UK diet change over time. These data cannot be disaggregated by devolved administration, and the Scottish Government does not track this themselves. Though the Food Waste Reduction Action Plan aims to reduce food waste by one third against a 2013 baseline by 2025, data to assess progress against this indicator were not available at the time of this progress report.

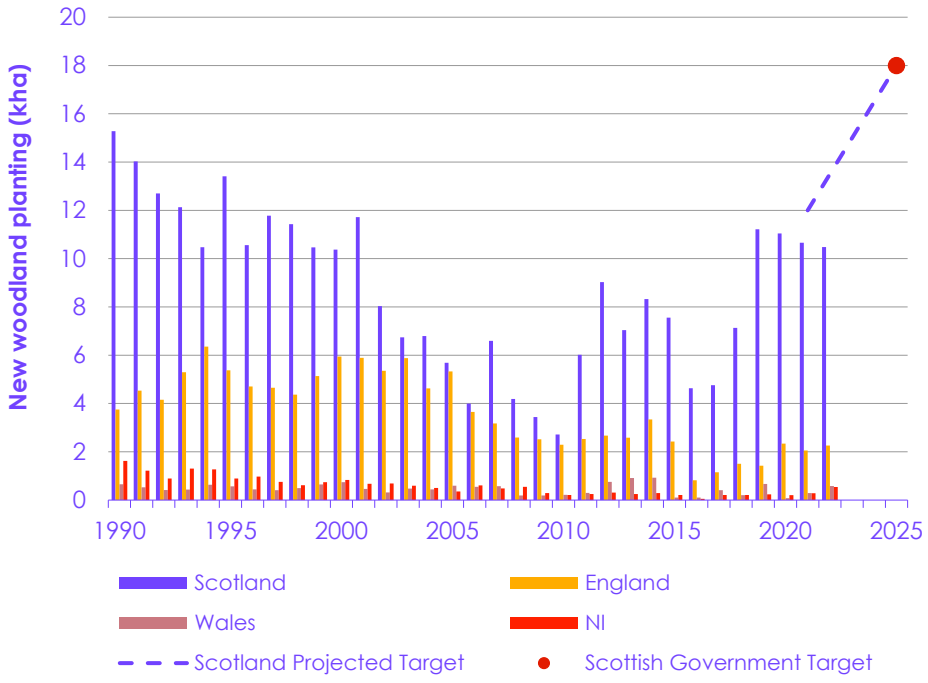
Table 3.5
Key indicators for agriculture and land use

Agriculture & land use indicators		Most recent value & benchmark			Trend
Group	**Name**	**Year**	**Value**	**Change**	**Key: Historical - CCC - Gov**
Land Outcomes	New woodland creation	2022	10 k ha; CCC benchmark: 11 k ha; Gov benchmark: 14 k ha	-2% from 2021	
	Peatland restored	2021	8 kha; Gov benchmark: 20 k ha	+41% from 2020	
	Area of woodland on agricultural land	2019	530 k ha	-1% from 2018	
Productivity and low-carbon agricultural practices	Use of Nitrogen fertilisers	2020	130 k tonnes; CCC benchmark: 150	-13% from 2019	
	Spreading precision of Nitrogen fertilisers	2020	73 kg / ha	-11% from 2019	
	Slurry storage with covers	2016	87%	+1% from 2013	

Notes: All values are rounded to 2 significant figures; Solid lines represent pathways; Points represent in-year benchmarks; Dotted lines show the linear rate of change required to meet in-year benchmarks.

Annual planting rates have plateaued in Scotland. Over 10,000 ha were planted in 2021/22. This is close to the trajectory set under the CCC Balanced Pathway, but off-track to meet the Scottish Governments target of 18,000 ha / year by 2024/25.

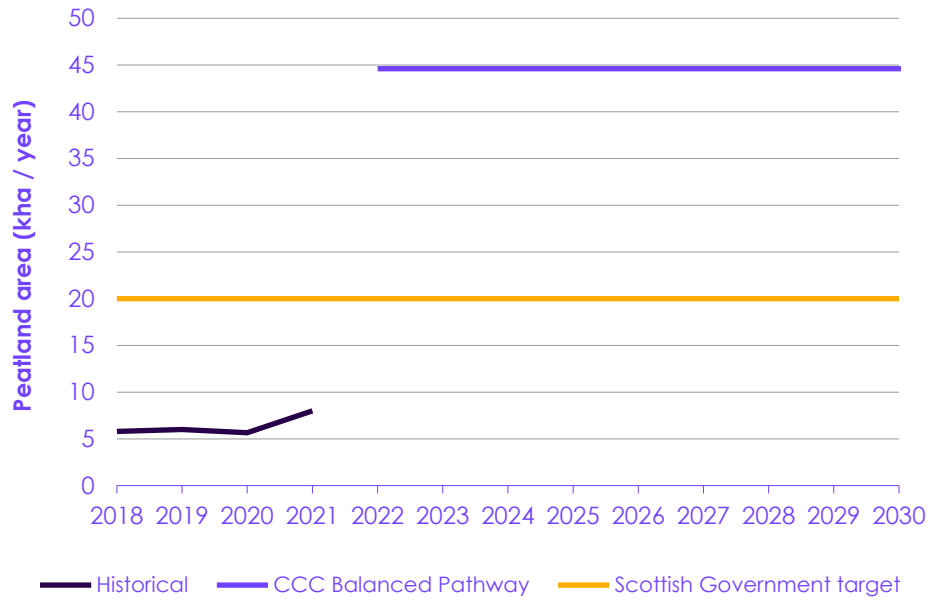
Figure 3.7 UK afforestation rates (1990–2021) and Scottish Targets



Source: Scottish Government (2020) *The Update to the Climate Change Plan (CCPu)*, Forest Research (2022) *Forestry Statistics*.

Peatland restoration rates are currently off track to meet the Scottish Government's target of putting 20,000 hectares of peat under restoration management each year.

Figure 3.8 Peatland area under restoration management – historical delivery and targets (2018 – 2030)



Source: Scottish Government (2022) *Climate Change Plan: monitoring reports*
Notes: Restoration management has occurred in Scotland pre-2018. The values reported here reflect reporting in the Climate Change Plan Monitoring reports.

(d) Future steps

The priority must now be on developing detailed policies to achieve the outcomes set out in the Climate Change Plan update and ensuring that farmers and land managers have the support required. Priorities for future steps include:

- **Detail on post-CAP low-carbon agricultural policy is urgently required.** The Scottish Government is yet to set out how measures to support low-carbon farming in Scotland will be delivered, with the consultation document on the forthcoming 2023 Agriculture Bill lacking this detail. Changes to land management and farming practices can take significant time and investment to set in place. Farmers and land managers require information and notice to underpin and support their decisions during the CAP transition.

- **Overcome barriers to maintain and upscale tree planting rates.** The CCPu has set an ambitious target of achieving 18,000 hectares / year by 2024/25. Though tree-planting rates are currently relatively high when compared with other nations of the UK, maintaining this momentum will be difficult due to the availability of land, contract restrictions on tenant farmers and provision of a skilled workforce at the scale required.

- **Address current low rates of restoration of peatland to meet annual targets.** Scotland has repeatedly missed its annual restoration targets and is at risk of not meeting their own or the more ambitious targets set out as required by the Committee's Sixth Carbon Budget, starting in 2025. The financial and non-financial barriers to implementation must be urgently addressed to support upscaling of restoration action.

- **Remove barriers for tenant farmers to engage in low-carbon agriculture and land sequestration measures.** Resolving tenancy constraints (e.g. contractual arrangements and aligning incentives between landowners and tenants) is important to allow and encourage tenanted farmers to undertake long-term investment decisions.

- **Use 'Good Food Nation' plans to set a clear path towards healthy, sustainable low-carbon diets.** This should include measures that encourage a move towards low-carbon dietary choices by reducing the consumption of meat and dairy. The review of the public sector food procurement guidance should consider climate impacts alongside wider sustainability. Future policy is urgently required that addresses the role of the food system and its impact across society, climate change and wider environmental outcomes.

- **Recognise the role of adaptation and resilience in land measures towards achieving GHG emission reduction targets.** Carbon storage and sequestration by soils, trees, wetlands and the marine environment are at risk from anthropogenic and climate pressures.[36] Healthy functioning ecosystems offer resilience in the face of a changing climate. Scottish Government should support the agriculture and forestry industries to take an adaptive approach, considering the potential of new varieties of crops, trees and land management approaches that are climate resilient.

4. Waste

In light of Scotland's ambitious 2030 target, we recommend waste as one area with scope for faster progress, in line with the CCC's Tailwinds scenario.

The CCPu aims to reduce emissions from waste, not including Energy from Waste (EfW), by around two-thirds by 2030. This is primarily planned to be achieved through a commitment to prevent biodegradable municipal waste from going to landfill by 2025 (and exploring extending this to non-municipal waste). The key challenge will be to ensure this is delivered without further increases in incineration, by delivering a step change in recycling, circularity and wider waste prevention.

More broadly, in light of Scotland's highly ambitious 2030 target, our accompanying Target Advice recommends waste as one area where there is scope to deliver additional abatement by going as fast as the CCC's ambitious Tailwinds scenario.

The following sections set out policy progress in Scotland in greater detail, and recommendations for future steps.

(a) Policy developments

In the last year Scotland has made good progress in developing policy across recycling, waste reduction and incineration.

Scotland has made good progress in the last year in developing policies to deliver on the CCPu, focused on boosting recycling, reducing waste and addressing the rise in incineration. Key developments include:

- Consulting with DEFRA and the other devolved administrations on reforms to waste collections, namely the introduction of Extended Producer Responsibility (EPR) for packaging from 2024, and a Deposit Return Scheme (DRS) from 2023.
- Consulting on a Circular Economy Routemap and accompanying Circular Economy Bill to be introduced within this Parliament which propose a wide range of statutory and non-statutory measures to prevent waste and reduce material consumption.
- Completing an independent review into the role of incineration in meeting residual waste treatment needs, and the acceptance of the review's full recommendations in the Scottish Government Response, including introducing a moratorium on further planning permissions for incineration and EfW facilities.

(b) Assessment of policy progress

Scotland should now firm up and provide greater detail on policy, with a view to delivering the ambition of our Tailwinds scenario.

Progress has been made across the actions we recommended in our 2021 Progress Report, for which Scotland has primary responsibility. Taken together, Scotland looks set to put in place an ambitious and comprehensive plan to reduce emissions from solid waste which is in line with the ambition of the CCPu. Given Scotland's highly ambitious 2030 target, there is a need to firm up policies with a view to delivering the levels of abatement set out in our Tailwinds scenario. Further detail on specific policies is also needed, such as on the provisions outlined in the Circular Economy Bill and Routemap; and on how the projected 2025 residual waste capacity gap will be managed.

Our 2021 Progress Report recommendation on preparing for and deploying CCS in EfW plants is yet to be delivered. This is an area of joint responsibility across UK and Scottish Governments. There is a need for greater coordination between the UK Government and devolved administrations on CCS.

Our detailed assessment of policy progress is set out in the below policy scorecard (Table 3.6).

Table 3.6
Policy scorecard for waste

Sub-sector / policy area	Delivery mechanism and responsibilities	Funding and other financial incentives	Enablers in place and barriers overcome	Timeline for future policies	**Overall sub-sector assessment**
Landfill Mostly devolved	O	G	O	G	Y
	Good progress: The Scottish Government has already committed to end the landfilling of municipal bio-degradable waste from 2025 and has said it will consult in 2023 on extending this to cover non-municipal sources in line with our recommendation. The Climate Change Plan update also states ambitions to scale up the capture of landfill gas. **To be addressed:** The recent review into incineration indicated that there is expected to be a short-term gap in residual waste treatment capacity in Scotland when the 2025 landfill ban is introduced because current recycling targets are unlikely to be met. Additional support is needed to enable landfill gas capture. **Risk due to UK Government action: Low**				
Energy from Waste, incineration Joint responsibility	O	R	O	R	O
	Good progress: Scotland's independent review into incineration provides a valuable assessment of residual waste treatment needs and the role of incineration. Key recommendations from the review have been accepted by the Scottish Government including a moratorium on further planning permissions for incineration and EfW facilities. **To be addressed:** Scotland doesn't yet have a plan for decarbonising EfW/incineration facilities, and the Scottish CCS cluster remains on reserve for track 1 of the UK Government's industrial CCS cluster programme. There is a need for greater coordination between the UK Government and devolved administrations on CCS. A further study looking into decarbonisation of waste infrastructure has been promised. Separate reporting of EfW emissions is needed. **Risk due to UK Government action: High,** due to reserved powers on CCS support and deployment as well as emissions trading.				

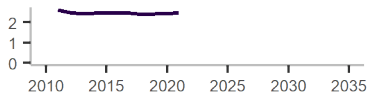
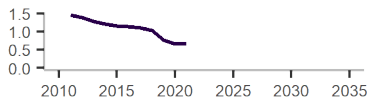
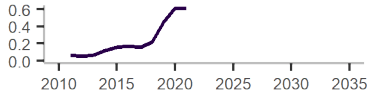
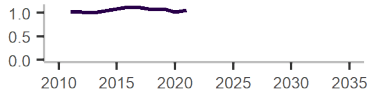
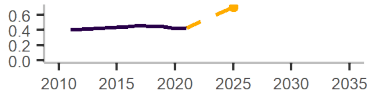
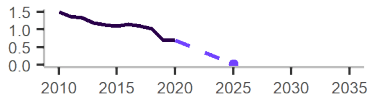
Sub-sector / policy area	Delivery mechanism and responsibilities	Funding and other financial incentives	Enablers in place and barriers overcome	Timeline for future policies	**Overall sub-sector assessment**
Waste prevention, recycling and circular economy Joint responsibility	G	O	O	G	Y
	Good progress: A consultation on a Circular Economy Route map and associated Circular Economy Bill provide a comprehensive set of initial proposals to reduce waste arisings and improve resource efficiency in Scotland, including new targets, statutory obligations (e.g. on consistency of recycling collections), incentives, public engagement and business support. Progress has been made on the planned Deposit Return Scheme and Extended Producer Responsibility. Bans and charges for single use items have been introduced. **To be addressed:** Further detail on the specifics of the circular economy proposals is needed. Despite progress on EPR and DRS, timely implementation of these remain at risk due to their dependence on UK Government policy and must not be further delayed. Scotland should set separate recycling targets for household/municipal, commercial & industrial and construction waste. **Risk due to UK Government action**: **Medium**, due to UK wide approach to forthcoming waste management reforms, which are at risk of further delay.				
Wastewater Mostly devolved	O	O	O	G	Y
	Good progress: In 2020, Scottish Water published an ambitious and comprehensive plan to achieve Net Zero by 2040, and the Water Industry Commission for Scotland (the Scottish water regulator) has identified enabling this as a top priority. **To be addressed:** There is limited detail on how the Scottish Government will support and enable the water industry to decarbonise and it appears activity in the last year has focused mainly on improving the evidence base. **Risk due to UK Government action: Low**				
Note: Refer to table A2 for full descriptions of the scoring criteria.					

(c) Indicators of progress

Indicators largely show stalled progress in improving Scotland's waste treatment.

Whilst there has been progress over the last year in developing policies to reduce waste and improve recycling, these will not deliver results until they are implemented. As such our indicators reflect recent trends, which largely show stalled progress in improving waste treatment in Scotland (Table 3.7, Figures 3.9-3.11).

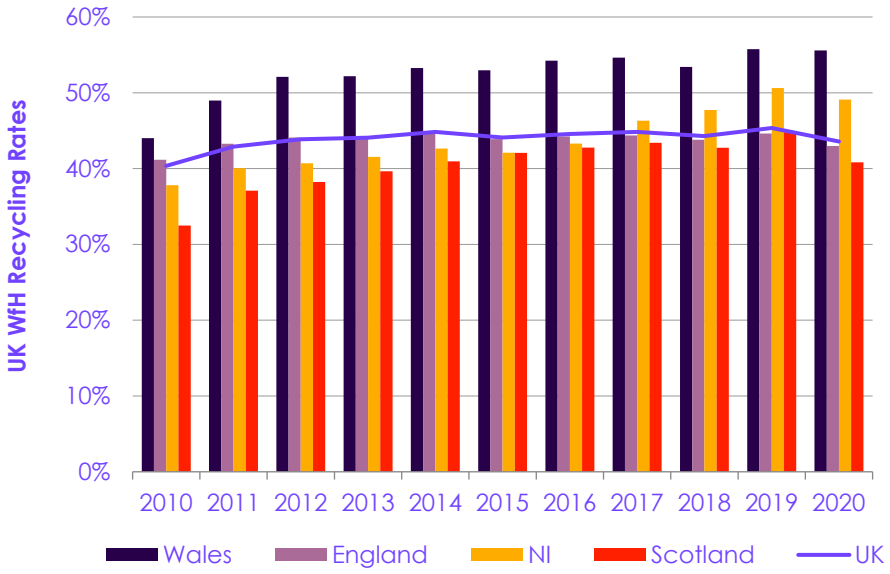
Table 3.7
Key indicators for waste

Waste indicators		Most recent value & benchmark			Trend
Group	Name	Year	Value	Change	Key: Historical - CCC - Gov
Reduce waste arisings (Waste arisings)	Household Waste total, Scotland	2021	2.5 million tonnes (Mt)	+2% from 2020	
Stop landfilling biodegradable waste	Household Waste Landfilled, Scotland	2021	0.66 million tonnes (Mt)	+1% from 2020	
Reduce fossil waste to EfW (Tonnes of residual waste to EfW)	Household Waste Incinerated (including EfW), Scotland	2021	0.61 million tonnes (Mt)	0% from 2020	
Reduced waste arisings (Recycling)	Household Waste Recycled or Composted, Scotland	2021	1.1 million tonnes (Mt)	+4% from 2020	
	Proportion of Household Waste recycled or composted, Scotland	2021	43%	+2% from 2020	
Stop landfilling biodegradable waste	Biodegradable municipal waste to landfill, Scotland	2020	0.69 million tonnes (Mt)	-1% from 2019	

Notes: All values are rounded to 2 significant figures; Solid lines represent pathways; Points represent in-year benchmarks; Dotted lines show the linear rate of change required to meet in-year benchmarks.

Based on the latest UK-wide data, Scotland's recycling rate remains the lowest of any UK nation.

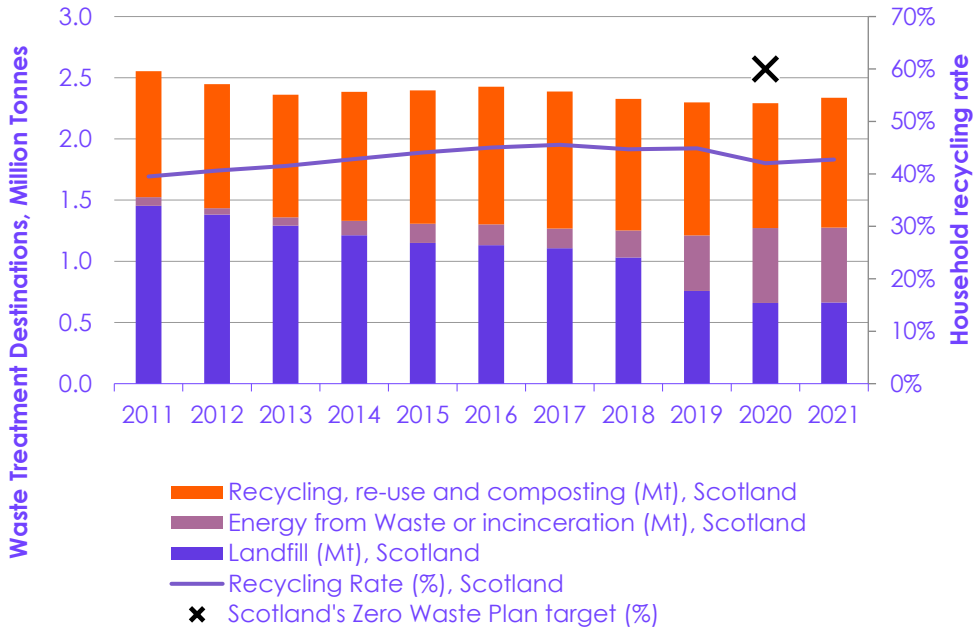
Figure 3.9 Waste from Household's recycling rates across the UK



Source: Defra (2022) *UK Statistics on Waste Dataset*; CCC analysis.
Notes: Waste from Household is the agreed definition for comparison of recycling rates across nations of the UK. Individual UK countries other than England publish household recycling estimates using alternative measures and as such may differ from the estimates published here. There are subsequently small differences in the Scottish recycling rates set out in this figure, relative to those in Table 3.7 and figure 3.10, which draw on Scottish data.

Incineration of household waste in Scotland has been increasing in recent years while the recycling rate dropped from 45% in 2019 to 43% in 2021. It remains well below the 2020 target of 60%.

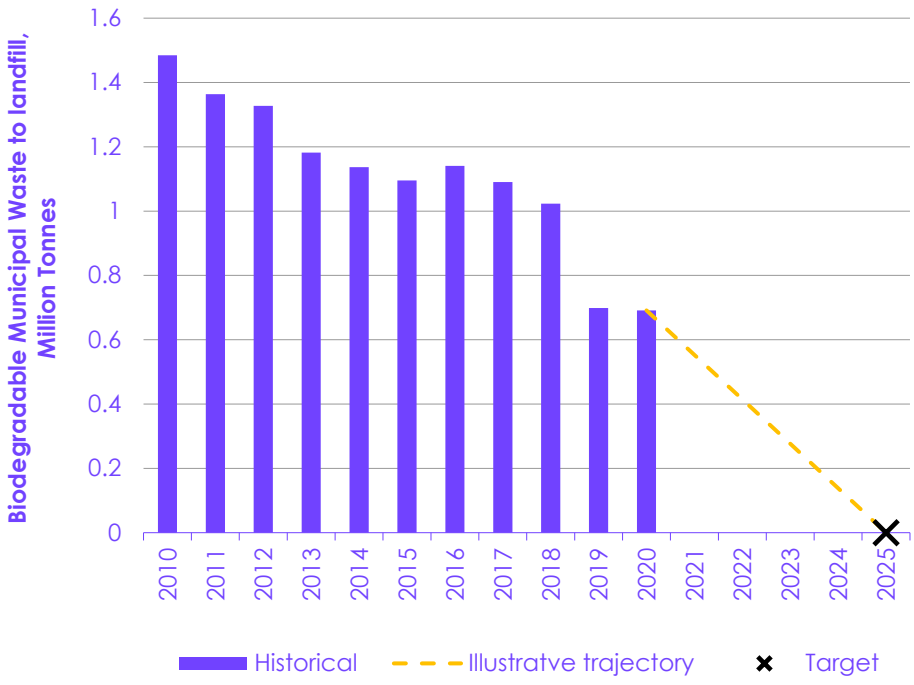
Figure 3.10 Household waste treatment, Scotland



Source: SEPA (2021) *Household Waste Statistics*.
Notes: Scotland's 2025 recycling target is set on the basis of 'All Wastes', including construction waste which typically has relatively high recycling rates. Statistics for 'All waste' management have not been published in recent years, but we recommend Scotland separates targets within the 'All waste' category.

Scotland has committed to end the landfilling of biodegradable municipal waste from 2025. The independent review of incineration found that there is likely to be a short-term gap in residual waste treatment capacity if the 2025 ban is to be met.

Figure 3.11 Biodegradable municipal waste to landfill, Scotland



Source: Defra (2022) *UK Statistics on Waste Dataset*; CCC analysis.

(d) Future steps

Detailed policies must now be developed with a view to delivering the CCPu and Circular Economy Routemap in line with the levels of ambition set out in our Tailwinds pathway.

Given Scotland's highly ambitious 2030 target, we have recommended in our accompanying Target Advice that waste is one area where there is scope to deliver additional abatement by going as fast as the CCC's ambitious Tailwinds scenario. The focus for the next year must be on developing detailed policies to achieve the outcomes of the CCPu and Circular Economy Routemap, with a view to the levels of ambition set out in our Tailwinds pathway. This must be in tandem with driving local implementation. Specific gaps to be addressed include:

- **Firming up ambition on the scope of the 2025 landfill ban**, and explaining how the expected gap in residual waste capacity in 2025 will be avoided or mitigated. The Scottish Government's commitment to consult in 2023 on extending the landfill ban provides scope to align with our Tailwinds scenario, which includes a 2025 ban on biodegradable wastes to landfill, with a full ban by 2035.

- **The independent review into incineration** rightly identified a short-term gap in residual waste treatment capacity and the risk of long-term overcapacity of incineration, while also acknowledging the lack of confidence in recycling targets being delivered. The Government should set out what additional measures and contingencies will be introduced to ensure the bio-waste-to-landfill ban is achieved without further delay, and how the expected gap in residual waste capacity will be avoided or mitigated.

- **The CCPu states ambition to accelerate plans for capture of landfill gas**. Additional support is needed to enable this. Relative to the Balanced Pathway, our Tailwinds scenario sees more rapid deployment of methane capture and oxidation at landfill sites (delivering 0.6 $MtCO_2e$ of abatement in Scotland in 2030).

- **Fleshing out detail in the Circular Economy Routemap**, passing the Circular Economy Bill and ensuring key reforms are on track for implementation. Details of the proposed targets to reduce waste and improve recycling beyond 2025 should be confirmed. These should be set on the basis of separate waste streams rather than 'All waste' and, where possible, consider opportunities to move away from weight-based targets. Full consideration of possible changes to incentives and regulations should be set out while DRS and EPR should be introduced as planned in 2023 and 2024.

- **Setting out a plan to decarbonise EfW / incineration facilities.** A plan is needed on delivery. The plan should consider the extent to which non-CCS measures can deliver decarbonisation, whilst also outlining initial assumptions around the viability and timing of CCS deployment at EfW facilities in Scotland, and the key funding needs and planning changes that will be necessary to deliver this. Greater coordination between the UK Government and devolved administrations on CCS is needed. The Scottish Government should work with the UK Government to develop a policy and funding framework to retrofit existing EfW plants with CCS from the mid-2020s and ensure any new EfW plants are all built 'CCS-ready'.

- **Providing detail as to how the water industry will be supported to achieve its 2040 Net Zero goal**, and how industrial wastewater emissions will be reduced. Whilst the CCPu identified potential emissions reductions from increased renewable energy use and energy efficiency, it didn't consider how the Government and regulators will enable emissions from wastewater treatment processes will be reduced.

Endnotes

[1] Port of Aberdeen (2022) *Green shore power could reduce emissions in ports by more than 90%.* https://www.portofaberdeen.co.uk/news/green-shore-power-could-reduce-emissions-in-ports-by-more-than-90/

[2] Scottish Government (2021) *Heat in Buildings Strategy – Achieving Net Zero Emissions in Scotland's Buildings,* pp.15-16, https://www.gov.scot/publications/heat-buildings-strategy-achieving-net-zero-emissions-scotlands-buildings/

[3] Scottish Government (2021) *Heat in Buildings Strategy – Achieving Net Zero Emissions in Scotland's Buildings,* p.91, https://www.gov.scot/publications/heat-buildings-strategy-achieving-net-zero-emissions-scotlands-buildings/

[4] *The Fluorinated Greenhouse Gases Regulations 2015*, https://www.legislation.gov.uk/uksi/2015/310/

[5] *Heat Networks (Scotland) Act 2021*, https://www.legislation.gov.uk/asp/2021/9/2021-03-31

[6] Scottish Government (2022) *Heat Networks Delivery Plan,* https://www.gov.scot/publications/heat-networks-delivery-plan/documents/

[7] Scottish Government (2022) *First National Assessment of Potential Heat Network Zones,* https://www.gov.scot/publications/first-national-assessment-potential-heat-network-zones/documents/

[8] Scottish Government (2022) *Towards an Industry for Green Heat: heat in buildings supply chains delivery plan,* https://www.gov.scot/publications/heat-buildings-supply-chains-delivery-plan-towards-industry-green-heat/

[9] Scottish Government (2022) *Domestic EPC Reform Consultation Analysis Summary Report – August 2022,* https://www.gov.scot/publications/heat-buildings-strategy-domestic-epc-reform-consultation-analysis-summary-report/documents/

[10] Scottish Government (2021) *Tackling fuel poverty in Scotland: a strategic approach*, https://www.gov.scot/publications/tackling-fuel-poverty-scotland-strategic-approach/

[11] Scottish Government (2021) *Heat in Buildings Strategy – Achieving Net Zero Emissions in Scotland's Buildings,* pp.72-74, https://www.gov.scot/publications/heat-buildings-strategy-achieving-net-zero-emissions-scotlands-buildings/

[12] Scottish Government (2022) *New Build Heat Standard Consultation Part II,* https://www.gov.scot/publications/new-build-heat-standard-consultation-part-ii/

[13] Scottish Government (2022) *Building regulations,* https://www.gov.scot/policies/building-standards/monitoring-improving-building-regulations/

[14] Scottish Government (2021) *Regulation of energy efficiency in existing non-domestic buildings: call for evidence*, https://www.gov.scot/publications/regulation-energy-efficiency-existing-non-domestic-buildings-call-evidence/

[15] Scottish Government (2021) *Heat in Buildings Strategy – Achieving Net Zero Emissions in Scotland's Buildings,* p.7, https://www.gov.scot/publications/heat-buildings-strategy-achieving-net-zero-emissions-scotlands-buildings/

[16] Scottish Government (2022) *Heat in Buildings – Green Heat Finance Taskforce: terms of reference,* https://www.gov.scot/publications/heat-in-buildings-green-heat-finance-taskforce-terms-of-reference/

[17] Scottish Government (2022) *The Local Heat and Energy Efficiency Strategies (Scotland) Order 2022,* https://www.legislation.gov.uk/ssi/2022/171/contents/made

[18] Scottish Government (2021) *Scotland 2045 - fourth National Planning Framework - draft: consultation,* https://www.gov.scot/publications/scotland-2045-fourth-national-planning-framework-draft/

[19] Scottish Government (2022) *National Public Energy Agency: call for evidence* https://consult.gov.scot/heat-in-buildings/national-public-energy-agency-call-for-evidence/

[20] Scottish Government (2021) *Heat in Buildings Strategy – Achieving Net Zero Emissions in Scotland's Buildings,* p.7, https://www.gov.scot/publications/heat-buildings-strategy-achieving-net-zero-emissions-scotlands-buildings/

[21] Scottish Government (2022) *Towards an Industry for Green Heat: heat in buildings supply chains delivery plan,* https://www.gov.scot/publications/heat-buildings-supply-chains-delivery-plan-towards-industry-green-heat/

[22] NHS Scotland (2022) *NHS Scotland climate emergency and sustainability strategy: 2022-2026,* https://www.gov.scot/publications/nhs-scotland-climate-emergency-sustainability-strategy-2022-2026/

[23] Scottish Government (2021) *Heat in Buildings Strategy – Achieving Net Zero Emissions in Scotland's Buildings,* p.95, https://www.gov.scot/publications/heat-buildings-strategy-achieving-net-zero-emissions-scotlands-buildings/

[24] Scottish Government (2021) *Heat in Buildings Strategy – Achieving Net Zero Emissions in Scotland's Buildings,* p.123, https://www.gov.scot/publications/heat-buildings-strategy-achieving-net-zero-emissions-scotlands-buildings/

[25] Scottish Government (2022) *Climate Change Plan: monitoring reports 2022,* https://www.gov.scot/publications/climate-change-plan-monitoring-reports-2022/

[26] NatureScot (2021) Scotland's Agri-Environment and Climate Scheme – Summary, https://www.nature.scot/doc/scotlands-agri-environment-and-climate-scheme-summary

[27] Forest Research (2022) Forestry Statistics 2022, https://www.forestresearch.gov.uk/tools-and-resources/statistics/forestry-statistics/

[28] Scottish Forestry (2019) Forestry Strategy 2019 to 2029, https://www.gov.scot/publications/scotlands-forestry-strategy-20192029/documents/

[29] Scottish Government (2022) Biodiversity Strategy: consultation, https://www.gov.scot/publications/scotlands-biodiversity-strategy-consultation/

[30] CCC (2022) Is Scotland climate ready? – 2022 Report to Scottish Parliament, https://www.theccc.org.uk/publication/is-scotland-climate-ready-2022-report-to-scottish-parliament/

[31] Scottish Forestry (2019) Forestry Strategy 2019 to 2029, https://www.gov.scot/publications/scotlands-forestry-strategy-20192029/documents/

[32] European Commission (2021) Factsheet on 2014-2020 Rural Development Programme for Scotland (UK), https://ec.europa.eu/info/sites/default/files/food-farmingfisheries/key_policies/documents/rdp-factsheet-scotland_en.pdf

[33] Scottish Forestry (2019) Forestry Strategy 2019 to 2029, https://www.gov.scot/publications/scotlands-forestry-strategy-20192029/documents/

[34] Scottish Government (2022) Climate Change Plan: monitoring report 2022 https://www.gov.scot/publications/climate-change-plan-monitoring-reports-2022/

[35] Forest Research (2020) National Forest Inventory, https://www.forestresearch.gov.uk/tools-and-resources/national-forest-inventory/what-our-woodlands-and-tree-cover-outside-woodlands-are-like-today-nfi-inventory-reports-and-woodland-map-reports/nfi-woodland-ecological-condition/

[36] CCC (2022) Is Scotland climate ready? – 2022 Report to Scottish Parliament, https://www.theccc.org.uk/publication/is-scotland-climate-ready-2022-report-to-scottish-parliament/

Chapter 4

Progress in largely-reserved policy areas

Introduction and key messages

This chapter discusses progress in Scottish climate policy in sectors with significant powers reserved to the UK Government (see Annex 1 for devolution of powers). For each of these sectors we summarise policy developments and then assess the progress Scotland has made in the past year, noting where progress is contingent on UK-wide policy. Where possible, we track progress against quantitative indicators of the transition and, finally, we discuss important next steps the Scottish Government should take in those areas where it can influence policy.

Our key messages are:

- **Co-operation with the UK is key.** Success in decarbonising reserved sectors in Scotland relies on the Scottish and UK Governments finding a way to work together. Scottish emissions have halved in the past decade, largely due to decarbonising electricity supply. Cutting emissions from industrial activity is going to be one of Scotland's next biggest challenges; additionally, meeting Scottish emissions targets will require significant use of carbon capture and storage (CCS). Legal, planning and implementation powers, however, still lie in Westminster, making it imperative for the Scottish Government to find a way of influencing UK Government policy that will impact Scotland.

- **Industry** is the second highest-emitting sector in Scotland and emissions will need to rapidly decrease in the next decade. The Scottish Government should continue to support innovation and skills in this sector and needs to ensure that key policies to improve resource efficiency are in place well before 2025. The collection and reporting of industrial decarbonisation data is essential to enable effective monitoring of progress.

- **Electricity supply.** Emissions from electricity supply have fallen significantly. Policy is primarily reserved, but more clarity from the Scottish Government is needed on how a fully decarbonised and resilient Scottish electricity system will operate.

- **Engineered removals.** The Scottish Government has chosen to rely heavily on engineered removals to meet its 2030 target, with plans assuming approximately two thirds of the UK's stated target will be delivered in Scotland. With the Scottish Cluster on the reserve list for Track 1 of the UK's Carbon Capture, Utilisation and Storage cluster sequencing programme, the developers must now focus on securing a successful Track 2 Cluster sequencing bid once that process is launched, ensuring that engineered removals projects make up part of their proposal.

The rest of this chapter is laid out as follows:

1. Carbon capture and storage
2. Industry
3. Electricity supply
4. Engineered removals

1. Carbon capture and storage

The UK Government has not selected the Scottish Cluster as one of the two industrial cluster projects it will be taking forward as part of Track 1of its Carbon Capture, Utilisation and Storage (CCUS) cluster sequencing programme. The Scottish Cluster has instead been placed on the reserve list, meaning that the proposal has met the process eligibility criteria but is not currently being taken forward for development. The Scottish Government has since pledged up to £80 million from its Emerging Energy Technologies Fund to support the UK Government in establishing the Scottish Cluster on Track 1 timelines. However, there have been no announcements of progress in this area.

The Scottish Cluster not being taken forward on Track 1 timelines will mean delays in the development of CCS infrastructure in Scotland, which also delays the delivery of engineered removals, power CCS, industrial CCS and Energy from Waste plants with CCS. In some cases, this may impact Scotland's ability to deliver CCS-dependent measures to the timescales set out in the Scottish Government's update to the Climate Change Plan (CCPu). The Scottish Cluster should apply through the Track 2 process once details are released by the UK Government, noting that any delays to the launch and delivery of this process will create further risk around Scotland's ability to remove and store carbon by 2030.

Delays in the development of CCS infrastructure in Scotland will require contingency planning to identify the additional emissions reduction effort that may be needed from other sectors to meet Scotland's 2030 target. This is explored further in our accompanying Target Advice[1].

2. Industry

The Scottish Government plans to reduce emissions from industry by 38% by 2030, relative to 2020 levels.

The Scottish Government plans to reduce emissions from industry (comprising the CCC's manufacturing and construction and fuel supply sectors, as well as some of the F-gas sector) by 38% by 2030, relative to 2020 levels.

Industrial policy remains largely reserved to the UK Government. However, the Scottish Government has taken steps to drive decarbonisation in devolved policy areas. The UK Government will need to accompany these with policy action at a UK level and provide certainty for the Scottish CCUS cluster over timings for the Track 2 cluster sequencing process.

(a) Policy developments

The Scottish Government has announced funding to support innovation in hydrogen and low-carbon products or processes.

Innovation
The Scottish Government has announced funding to support innovation in hydrogen and low-carbon products or processes, and to support the adoption of low-carbon products.

- As part of the Emerging Technologies Fund, the Hydrogen Innovation Scheme was announced with £10 million over four years up to 2025/26. Stream 1 of the scheme is expected to fund feasibility studies into hydrogen storage, distribution and integration into the energy system, whilst Stream 2 is for the development and demonstration of the technology.

- A £5 million CO_2 Utilisation Challenge Fund was launched in April 2022 to support the development and commercialisation of valuable products such as synthetic fuels and proteins from waste CO_2.

- The Low-Carbon Manufacturing Challenge Fund was launched as a £26 million R&D fund to encourage the adoption and deployment of low-carbon products, technology, or processes.

The Scottish Government has continued its support for developing skills within industry and a just transition for workers.

Skills and jobs
The Scottish Government has continued its support for developing skills within industry and a just transition for workers. Funding has been t allocated to programmes emphasising green job creation and worker upskilling, such as projects through the Just Transition Fund and the Michelin Scotland Innovation Parc Skills Academy (see section on Just Transition in Chapter 2).

Co-ordination
The Scottish Government is launching forums and networks to enable greater discussion and coordination between business and government. At COP26 it was announced that the Net Zero Industrial Cluster Exchange (NICE) would form to allow knowledge sharing between business, the Scottish Government, and other parties. The network was launched in September 2022.

Some funding to deliver improvements in industrial energy efficiency is available.

Energy and resource efficiency
A third application window for the Scottish Industrial Energy Transformation Fund (SIETF) closed in November 2022. The SIETF, via matched funding, aims to incentivise investment by private firms to reduce energy costs and emissions through greater energy efficiency.

The Scottish Government has announced funding to reduce the environmental impact of textiles via the £2 million Circular Textiles Fund. Additionally, the Scottish Government consulted on proposals for a Circular Economy Bill and Waste Route Map, which will support future resource efficiency policy. See further details in the Waste section in Chapter 3.

(b) Assessment of policy progress

An assessment of the existing policy landscape for industry in Scotland is presented in Table 4.1 in the policy scorecard.

Table 4.1
Policy scorecard for industry

Policy area	Delivery mechanism and responsibilities	Funding and other financial incentives	Enablers in place and barriers to overcome	Timeline for future policies	**Overall assessment**
Industrial resource efficiency Joint responsibility	G	O	Y	Y	Y
	Good progress: • The Circular Economy Bill and roadmap have set out the Scottish Government's plans and timelines for policy on resources and waste. This will have some impact on industrial resource efficiency through the commitments on reducing consumption and enabling recycling and reuse. • The National Lightweighting Centre (as part of the National Manufacturing Institute Scotland) will help manufacturing firms to innovate and develop lighter and more resource-efficient components for high value industries. **To be addressed:** • The focus of the Circular Economy bill is not on industry, though some of the actions will help to reduce industrial emissions. There is limited funding available for resource efficiency in manufacturing, other than the £2 million Circular Textiles fund. In general, more industry-specific resource efficiency work could be done, enabled by greater join-up between the Circular Economy and Industry teams within the Scottish Government. **Risk due to UK Government action: Medium** • Wider resource efficiency and industry policy powers sit with UK Government, and detailed proposals for meeting UK industrial emissions reduction targets through resource efficiency are lacking.				
Industrial energy efficiency Mostly reserved	Y	Y (up to 2025) O (from 2025)	Y	O	Y
	Good progress: • Some funding to deliver improvements in industrial energy efficiency is available through the SIETF, alongside broader industrial innovation funding such as the Low-carbon Manufacturing Challenge fund and the Advanced Manufacturing Challenge fund. • Some knowledge sharing and support for SMEs is also provided through the National Manufacturing Institute Scotland and the Scottish Manufacturing Advice service, which address barriers such as innovation and skills. **To be addressed:** • The SIETF is expected to end by 2025. There is no clear strategy or timeline for industrial energy efficiency after this. **Risk due to UK Government action: Low** • Although the majority of powers on industry are reserved to the UK Government, there are several UK-wide policy mechanisms in place such as the UK ETS and Climate Change Agreements, alongside the IETF and SIETF.				

Industrial electrification Mostly reserved	O	O	R	O	O
	To be addressed: • There is currently no strategy, policy or funding directly targeting industrial electrification, other than general manufacturing support such as the Advanced Manufacturing Challenge Fund, the Low-carbon Manufacturing Challenge Fund, and the National Manufacturing Institute Scotland. **Risk due to UK Government action: High** • The majority of powers on industry are reserved to the UK Government, including those on the electricity grid and infrastructure. Industrial electrification is also an area for the UK Government that has been highlighted as a policy gap, with less developed policy mechanisms in place.				
Hydrogen Mostly reserved	Y	G (up to 2026) Y (from 2026)	G	G	G
	Good progress: • The Scottish Government has set out its intended strategy, ambition, and timelines for the hydrogen economy in Scotland through their draft Hydrogen Action Plan, which includes a route map to 2030 and 2045. This also considers end-uses in different sectors and enablers such as innovation, skills, and supply chain. • Extensive assessments into the potential for hydrogen in Scotland have also been carried out. • There is funding available to support innovation and infrastructure in hydrogen, most notably through the Hydrogen Innovation Scheme, though this ends in 2026. **Risk due to UK Government action: Medium** • Though Scotland is doing a lot of thinking on hydrogen, the hydrogen business model is ultimately within control of the UK Government, which will be a key factor in determining actual end-use of hydrogen. The hydrogen business model is progressing, though there are risks of delays.				
Industrial CCUS Mostly reserved	Y	G	Y	O	Y
	Good progress: • The Scottish Government has committed funding to supporting the Scottish Cluster and specific projects such as Acorn and NECCUS (including through the Energy Transition Fund). • The Scottish Government is a key partner in networks working towards operation of the Scottish Cluster, such as the Grangemouth Future Industry board. • There is a substantial programme of funding to stimulate innovation in CCUS, including the Emerging Energy Technologies Fund and the CO_2 Utilisation Challenge Fund, though current funding is expected to end by 2026 or earlier. **Risk due to UK Government action: High** • The Scottish Government doesn't have the powers to support the development of CCUS and the Scottish Cluster alone. The UK Government's decision not to award the Scottish Cluster Track 1 status, and their lack of transparency on the timings and process for the Track 2 sequence, provides further uncertainty to firms who are planning their decarbonisation strategies, and may even harm investment in the region.				

Bioenergy Mostly reserved	O	O	Y	O	O
	Good progress: • The Scottish Government has made a commitment to publish a Bioenergy Action Plan by 2023, and has established working groups and an expert panel to capture a comprehensive range of perspectives on bioenergy to feed into this. Workstreams have been set up to consider key barriers such as biomass availability, competing demands, sustainability, and technology readiness. **To be addressed:** • The Bioenergy Action Plan should set out key delivery mechanisms, funding, and future timelines. **Risk due to UK Government action: Medium** • The majority of powers are reserved to the UK Government. The UK Government also previously committed to publishing a Biomass Strategy in 2022, which would inform the Scottish Government's Action Plan. However, this is not yet published.				
Fossil fuel supply Mostly reserved	O	Y	G	O	Y
	Good progress: • There are several economy-wide sources of funding aimed at job creation and upskilling to support a just transition, including the Green Jobs fund, the Just Transition Fund, and the National Transition Training Fund. • The Scottish Government is also currently running calls for evidence on future exploration of onshore conventional oil and gas and coal extraction in Scotland. **To be addressed:** • Crown Estate Scotland to facilitate planning of electrification projects. **Risk due to UK Government action: High** • Scottish powers on oil and gas are limited other than on skills and training. The UK Government is responsible for the fiscal regime and regulation of the oil and gas industry. It is also responsible for the health and safety of the offshore oil and gas industry operating on the UK Continental Shelf.				
Remaining industry Reserved	Reserved				
	Risk due to UK Government action: Medium UK Government has reserved powers over the majority of fiscal and regulatory policy relating to manufacturing and fuel supply, including key levers such as carbon pricing, business models, and the cluster sequencing process – which Scottish industrial firms will rely on. Particular risk surrounds the Scottish Cluster and its reliance on the UK Government's decisions regarding Track 2 of the cluster sequencing process, the timings of which are currently unclear. This provides substantial uncertainty to industrial firms planning their decarbonisation strategies and may even harm investment in the region.				
Note: Refer to table A2 for full descriptions of the scoring criteria.					

(c) Indicators of progress

A lack of available data means producing indicators is challenging.

A limited set of indicators for Scottish industry has been developed, which aims to measure progress on key decarbonisation areas including emissions, energy efficiency, resource efficiency and CCS.

A lack of available data means producing indicators is challenging. However, data availability is improving, and we expect the Scottish Government to continue to improve their data and reporting in line with our recommendations.

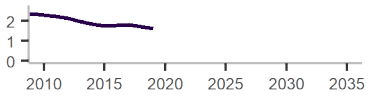
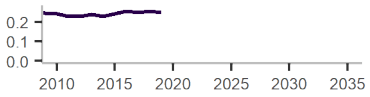
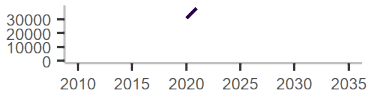
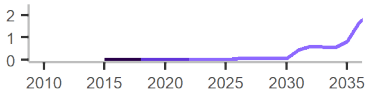
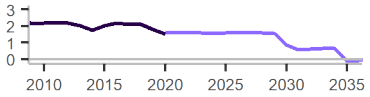
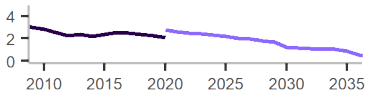
Progress on the key indicators is illustrated in Table 4.2.

The key indicators show:

- **Energy efficiency.** Indicators for energy efficiency showed some improvements in 2019, with both the energy-intensity of input and the carbon-intensity of energy used in industry falling on 2018 levels. The data is not yet available for 2020, so the impact of the disruption to industrial production due to the pandemic is unclear. There is no benchmark to monitor whether this is on track to deliver longer-term required emissions savings.

- **Resource efficiency.** Tracking progress on resource efficiency is very challenging due to a lack of data. We include an indicator on car club membership in Scotland, which provides an insight into levels of product sharing. This indicator shows that car club members have increased by 24% in 2020 on 2019 levels. However, to assess true progress on industrial resource efficiency, a wider set of metrics is needed.

Table 4.2
Key indicators for industry

Industry indicators		Most recent value & benchmark			Trend
Group	**Name**	**Year**	**Value**	**Change**	**Key: Historical - CCC - Gov**
Energy intensity of output	Energy consumption per unit of GVA in industry	2019	1.6 TWh/GVA	-6% from 2018	
Carbon intensity of energy	Carbon intensity of energy consumed in industry	2019	0.25 $MtCO_2e$/TWh	-2% from 2018	
Resource efficiency	Car club members	2021	38,000	+24% from 2020	
CCS	Industrial CO_2 stored	2022	0 $MtCO_2e$; CCC benchmark: 0	0% from 2021	
Fossil fuel supply emissions	Refineries emissions	2020	1.5 $MtCO_2e$; CCC benchmark: 1.6	-16% from 2019	
	Oil and gas production emissions	2020	2.1 $MtCO_2e$; CCC benchmark: 2.8	-10% from 2019	

Notes: All values are rounded to 2 significant figures; Solid lines represent pathways.

(d) Future steps

Recommendations for industry are mainly focused on devolved policy areas. There has been progress against most past recommendations across manufacturing, construction and fuel supply, although most have not been fully achieved. We therefore continue our recommendations across resource efficiency, energy efficiency, innovation, and low-carbon fuel supply.

We recommend that the Scottish Government:

Good progress in supporting innovation was seen in 2022 and this should continue.

- **Continues to support innovation and demonstration of key decarbonisation technologies for industry,** including hydrogen, CCS and electrification. Good progress was seen in 2022, including the launch of the Hydrogen Innovation Scheme, the CO_2 Utilisation Challenge Fund, the Low-carbon Manufacturing Challenge Fund, and the Net Zero Industrial Cluster Exchange. This should continue.

Future steps for Scotland include improved reporting of industrial data, encouraging longer use of products and improving resource efficiency.

- **Improves the collection and reporting of industrial decarbonisation data,** where possible (i.e. where data is not commercially sensitive), to enable progress to be monitored effectively**.** This should build on the progress made so far in the CCPu monitoring report 2022, and existing resources such as the Scottish Energy Statistics Hub.

- **Works with business to encourage consumers to use products for longer.** This should meet the Scottish Government's ambition of delivering a significant change by 2023 and should build on existing policy such as reuse and repair schemes and the new Circular Textile Fund.

- **Ensures that key policies to improve resource efficiency are on track to be in place well before 2025**, such as Extended Producer Responsibility (EPR). The Scottish Government has made progress on this in the past year, including consulting on the planned circular economy package and a circular economy route map. EPR is currently due to be phased in from 2024.

- **Sets new ambitious targets for 2030 to improve resource efficiency, recycling and waste prevention.**

- **Formalises the governance and planning processes for infrastructure decisions** regarding the conversion of the gas transmission and distribution networks to hydrogen. Priority candidate areas for hydrogen conversion should also be identified. We expect this to be included in the planned update to the Energy Strategy.

We also recommend that the Scottish Government works with the UK Government to:

- Implement policies to enable delivery of substantial improvements in industrial energy efficiency. The third round of the SIETF was launched in August 2022, and will closed in November, however no other new policy has been announced.

- Develop policies to drive more resource-efficient construction, including encouraging greater use of low-carbon materials and developing plans for phasing in mandatory whole-life reporting and minimum whole-life standards for all infrastructure. This should build on evidence gathered from consultations in the last year on the NPF4 and circular economy route map.

- Support the sustainable production of biomass feedstocks and conversion of bioenergy in a way consistent with Net Zero, including setting dates for new and retrofitted CCS. This should be set out in the forthcoming Bioenergy Action Plan.

3. Electricity supply

The Scottish CCPu aims to reduce emissions from electricity supply to zero by 2032. Electricity supply is a reserved policy area, but is substantially influenced by devolved policies over planning and consenting of key infrastructure and leasing of offshore sites for renewable generation on the Scottish Crown Estate. This section sets out policy progress in Scotland and relevant developments at the UK-level, and recommendations for future steps.

(a) Policy developments

The main development in the past year has been the announcement of the outcome of the ScotWind offshore leasing round process. In addition, provisional approval has been granted for two new subsea transmission links between Scotland and England.

The ScotWind leasing round auctioned seabed rights for development of 28 GW of new offshore wind capacity.

- **ScotWind.** In 2022 Crown Estate Scotland released the results of the ScotWind leasing round, which auctioned seabed rights for future offshore wind projects. Options for 28 GW of capacity were procured, of which over half is expected to deploy floating offshore wind turbines. If this were all to be delivered it would be significantly in excess of the Scottish Government's ambition for 8-11 GW of offshore wind capacity by 2030. Revenues from the leasing round were around £750 million. Further leasing rounds are expected in the coming years.

Ofgem has approved two new projects to strengthen the transmission network between Scotland and England.

- **Transmission network developments.** Ofgem has approved two new subsea link projects – Eastern Green Links 1 and 2 - between Scotland and England, each with a capacity of 2 GW. These are expected to be operational by 2027 and 2029 respectively, and will help connect future Scottish renewables generation to demand centres in England.

Given electricity policy is primarily reserved, other relevant recent developments at the UK-level include:

The UK Government published its Energy Security Strategy, which increases ambition for renewables deployment.

- **Energy Security Strategy.** In response to increases in global gas prices linked to Russia's invasion of Ukraine, the Government published its Energy Security Strategy (ESS).[2] This increased ambition across a range of areas with the aim of reducing dependence on fossil fuels, in particular through faster deployment of renewables. The target for installed offshore wind capacity in 2030 was raised from 40 GW to up to 50 GW.

- **Contract for Difference (CfD) auctions.** Results from the fourth round of auctions for long-term electricity contracts were announced in summer 2022. These procured 10.8 GW of generation capacity for delivery to 2027, of which 3 GW was for Scottish projects. All 0.9 GW of onshore wind projects successfully winning CfD contracts were located in Scotland, as were 20% of the successful offshore wind projects.

Other important UK-wide developments include publication of new network strategies, an assessment of resilience of the electricity system, and a Government consultation on ensuring the design of electricity markets is appropriate for Net Zero.

- **Networks.** There have been several announcements over summer 2022 aimed at developing the network infrastructure required for Net Zero:
  - The UK Government and Ofgem published a strategic framework setting out how the required network infrastructure will be delivered.[3]
  - The UK Government appointed an Electricity Networks Commissioner to advise Government on the policies and regulatory changes needed to accelerate progress on network infrastructure.
  - The National Grid Electricity System Operator published its Holistic Network Design, which sets out a blueprint for coordinated connections for offshore wind farms to the onshore network to 2030.[4]
- **Resilience.** Electricity supply resilience will become increasingly important over the coming decades as existing thermal generation is retired and the economy becomes increasingly electrified. In a report published in October 2022,[5] the Joint Committee on the National Security Strategy highlighted the importance of improving the resilience of energy supply and the need for relevant parties, including national and local government, to coordinate resilience actions.
- **Electricity Market Design.** Moving to an electricity system based around variable renewables will have a range of implications for the design and operation of electricity markets. The UK Government published a consultation on a Review of Electricity Market Arrangements (REMA), looking at these issues and potential solutions in more depth. To feed into this process the Committee commissioned an independent expert group to produce a report on the key questions and challenges market reform should be aiming to address. This was published in September 2022.[6]

(b) Future steps

Policy is primarily reserved, but more clarity from the Scottish Government is needed on how a fully decarbonised and resilient Scottish electricity system will operate.

Recommendations for the next year in electricity supply are focused on devolved policy areas. They are primarily continuations of recommendations made in the progress in reducing emissions in Scotland 2021 report.

- In its CCPu the Scottish Government committed to publishing a revised Electricity Generation Policy Statement by 2022. The 2022 annual monitoring report indicated this work has not yet been progressed. This work should still be taken forward, given the significant recent developments in policy, either separately or as part of the forthcoming Energy Strategy and Just Transition Plan.
- The Scottish Government should work with network owners and the system operator to understand what is required to ensure adequate resilience, identify any gaps and prepare a plan for addressing those.

The Committee intends to publish a new report in early 2023 on how an operable, low-carbon UK electricity system can be delivered by 2035 – in the new context of the Government's recent interventions to tackle energy prices and rapidly reform various aspects of the wholesale market. We will update our monitoring indicators and recommendations next year in light of this report.

4. Engineered removals

Engineered removals play a substantial role in delivering Net Zero in Scotland. Removals will need to be carried out in a sustainable way and be pursued as a complement and not a replacement to deep decarbonisation in other sectors.

Scotland's pathway for engineered removals involves Scotland delivering around two thirds of the 2030 ambition for the whole UK and lacks a detailed plan for delivery.

There are currently no engineered removals in Scotland. The Scottish Government pathway is very ambitious, targeting deployment of around 3.8 $MtCO_2$ per annum of removals by 2030. If achieved, Scotland's 2030 engineered removals would make up roughly two thirds of the 5.6 $MtCO_2$ per annum removals target for the whole of the UK in the same year under the UK Net Zero Strategy.

The Scottish Government has not set out detailed plans on how this volume of engineered removals will be achieved by 2030. The Scottish Cluster proposal holds promise for the development of CCS networks in Scotland, though its placement on the reserve list for Track 1 of the process signals delays to its development. Even if successfully taken forward, further plans for engineered removals are needed: delivery of the current proposal for this Cluster in line with Track 1 or 2 timelines still leaves significant gaps to meeting the Scottish Government's pathway for engineered removals in the late 2020s and early 2030s.

Further information on the contribution of engineered removals to Scotland's target achievement is provided in Chapter 3 or our accompanying Target Advice. Underachievement of these removals targets will have knock on impacts on other sectors in Scotland, requiring additional effort elsewhere to meet Scottish Government's 2030 target.

UK Government progress on engineered removals can help in bringing forward large-scale deployment in Scotland. In July 2022, the UK Government released a consultation on business models for greenhouse gas removals technologies. This consultation explores how UK Government support in the form of contract-based business models can effectively incentivise stable investment in long-term projects. Scottish projects will be eligible to apply for these business models.

Some international progress is being seen in deployment of engineered removals, with a full-chain direct air capture with CCS (DACCS) plant opening in Iceland in 2021, which has the potential to capture and geologically store up to 4,000 tCO_2/year. Large-scale DACCS plants are presently proposed in the United States and Norway, and bioenergy with CCS (BECCS) technologies are being tested in North Yorkshire by Drax. Technological learning and lessons from the development processes of these technologies could lead to faster progress for similar projects in Scotland.

Scotland has good potential for engineered removals and scope for deployment this decade, given its access to high volumes of potential geological CO_2 storage under the North Sea. To achieve this potential, progress is needed on cluster development in Scotland, UK Government funding models, governance and coordination between HMG and the devolved administrations. The next section sets out recent progress in some of these areas.

(a) Policy developments

Cluster development
Delivery of engineered removals in Scotland is reliant on the development of conveniently located CCS infrastructure with adequate capacity. Scotland does not have all the necessary regulatory and legislative powers to develop these networks and is therefore required to bid into the UK Government cluster process to develop and fund this infrastructure.

As the Scottish Cluster is not being taken forwards in Track 1 of the UK Government's CCUS cluster sequencing process, Scotland will need to be successful in future rounds of the process to deliver on their engineered removals ambitions. A successful Track 2 bid would leave open the possibility of large-scale deployment of engineered removals in the early 2030s and could realise the potential of the Carbon Engineering DACCS plant proposed as part of the Cluster.

(b) Indicators of progress

There are currently no engineered removals projects in operation in Scotland. The CCC has produced a pathway range for engineered removals as part of the Scottish Target Advice. This pathway range sees fewer removals being deployed in the late 2020s and early 2030s than in the targets proposed as part of the Scottish Climate Plan update.

(c) Future steps

Priorities for Scotland over the next year for engineered removals include continued engagement in the UK Government's cluster sequencing process and pursuing improved coordination with the UK Government on siting and governance of engineered removals to prepare for large-scale deployment this decade.

A Track 2 CCUS cluster in Scotland could facilitate engineered removals deployment in the early 2030s.

- **Cluster development.** A successful Track 2 CCUS cluster sequencing bid keeps open the possibility of deploying engineered removals in Scotland in the early 2030s. Progress on the development of the Scottish Cluster will require both the UK Government to deliver information and guidance on this process in a timely manner and for NECCUS to continue development of the Scottish Cluster bid and, specifically, the Carbon Engineering DACCS proposal.

UK and devolved governments should explore how engineered removals located in one geographic area might count towards targets for the devolved administrations.

- **Coordination with the UK Government.**
  - As engineered removals are expected to contribute to emissions reduction targets for both the UK as a whole and individual constituent nations, improved coordination is needed between HMG and the devolved administrations. Initial UK delivery of engineered removals is likely to be operating on just a handful of sites (e.g. as part of CCUS clusters), which could be concentrated in specific areas of the UK in initial years of deployment.
  - In the next year, HMG and the devolved administrations should work together to publish a joint position on the allocation of engineered and other removals towards contributing to UK-wide and devolved administration targets.

Specifically, the relevant governments should explore options for engineered removals in one nation to count towards the emissions reduction in another nation in the early years of deployment and discuss the legal, financial and governance-related questions associated with these potential arrangements.

- **Engineered removals potential**. Scoping for potential sites for engineered removals in Scotland should continue, including for future DACCS plants and for the addition of CCS through the retrofit of existing biomass plants.

Endnotes

[1] CCC (2022) *Scottish Emissions Targets - first five-yearly review.*

[2] HM Government (2022) *British Energy Security Strategy,* https://www.gov.uk/government/publications/british-energy-security-strategy/british-energy-security-strategy

[3] BEIS and Ofgem (2022) *Electricity Networks Strategic Framework,* https://www.gov.uk/government/publications/electricity-networks-strategic-framework

[4] National Grid ESO (2022) *Pathway to 2030: Holistic Network Design,* https://www.nationalgrideso.com/future-energy/the-pathway-2030-holistic-network-design

[5] HC and HL Joint Committee on the National Security Strategy (2022) *Readiness for storms ahead? Critical national infrastructure in an age of climate change*

[6] CCC Expert Group (2022) *Net Zero Electricity Market Design,* https://www.theccc.org.uk/publication/net-zero-electricity-market-design-expert-group/

Annex 1

Devolution of powers in Scotland

The Scottish Government's powers to design and implement policy are determined by the devolution agreement solidified by the 1998 Scotland Act as summarised in Table A1.

Table A1
Balance of devolved and reserved powers in Scotland

Largely devolved areas	Partially devolved areas (key powers reserved)	Largely reserved areas
• **Agriculture, forestry** and **fisheries** • Economic development • **Environment** (climate change policy, air quality, water policy) • **Waste** policy and management • Biodiversity and conservation • **Local government** and housing (local government funding, renovation, housing policy) • **Planning** (planning policy, local planning authority guidance, **land use planning system**, planning for major **electricity generators** and **offshore wind**)	• **Buildings** (building standards and rating, fuel poverty, domestic energy efficiency, public sector energy efficiency, promoting business energy efficiency) • **Surface transport** (highways construction and maintenance, freight transport, bus services, rail transport and railway services and regulation, active travel – road transport is reserved) • **Infrastructure** (nationally significant infrastructure, **EV charging infrastructure**, **CCS**, **hydrogen, engineered removals**)	• Economic and fiscal policy, financial services, and financial markets • Home affairs • **Power** (generation, transmission, distribution and **electricity supply – coal – nuclear energy**) • **Energy supply** (security of supply, **oil and gas** ownership, exploration, exploitation of deposits, offshore installations, and pipelines) • Trade and **industry** (regulation of competition, import and export control, product standards, safety and liability) • **Shipping** and **aviation** (except for Air Passenger Duty, which is devolved) • **F-gases**

(a) Key for policy scorecards

The credibility of the Scottish Government's policies and plans is scored using the criteria in Table A2. In addition, we have scored the risk to progress posed by UK Government action in each policy area. This is highly relevant in sectors where policy is mostly reserved to Westminster; for sectors where decision-making is devolved to the Scottish Government, the score is meant to account for indirect impacts that can affect progress in that sector (for example, through the development of relevant market forces).

Our scoring criteria for the risk due to UK Government action are as follows:

- **High:** there is a high dependency on the UK Government for progress in this area, and a high probability of them not taking the action necessary in time for Scotland to make sufficient progress.
- **Medium:** there is either a high dependency on the UK Government but a low probability of that being an issue, or a low dependency but a high probability of it being an issue.
- **Low:** there is both a low dependency on the UK Government and a low probability of that being an issue.

Table A2
Scoring criteria for assessing policies and plans

	Delivery mechanism and responsibilities	Funding and other financial incentives	Enablers in place and barriers overcome	Timeline for future plans	**Overall score**
Credible plans	Proven delivery mechanism that covers all the important elements in the sector	The combination of public funding and plans to encourage private funding is credible	Plans consider enablers, such as governance, fair funding, public engagement, and workers & skills; potential barriers are overcome	Appropriate timelines are given for future decisions and policy development	Credible plans with funding, enablers and timelines in place
Some risks	Mostly based on proven delivery mechanism, but missing a small number of key elements	Combination of public funding and plans to encourage private funding are credible, but some risks remain	Plans consider some, but not all, of the enablers and/or some barriers remain	Timelines are proposed for some future decisions and policy development, but questions remain	Some adjustment to plans may be needed to mitigate uncertainties and delivery or funding risks
Significant risks	Some plans based on proven mechanism, but several key elements are missing	Some funding commitments but unclear where significant part of the funding will come from	Plans do not address significant key enablers and barriers	Plans provide only partial indication of the timeline for future decisions and policy development	Plans under development and/or further work needed to enact policies and overcome uncertainties and delivery or funding risks
Insufficient plans	No comprehensive plan or strategy; or plan/strategy missing most key elements	Unclear where the bulk of funding will come from; not yet considered incentives to address these	Plans give negligible consideration of the enablers and barriers	Plans do not indicate when gaps will be filled, or when future decisions will be made	Plans are either missing, clearly inadequate, or lack funding, and new proposals are needed

Notes: Scores are allocated with near- and mid-term policy in mind (i.e., the period covered by the updated Scottish Climate Change Plan, with a focus on the next two years).

Annex 2

Recommendations

Cross-cutting recommendations

Topic	Cross-cutting recommendations	Responsibility	Timing
Delivery	Increase transparency around Government's expected pathways to Net Zero. This should involve publishing more details on the assumptions that underpin these pathways and how the abatement set out in the Scottish Climate Change Plan update will be achieved by planned policies, setting out the quantified abatement expected to be achieved by each policy.	Mostly devolved	2023 Priority
Governance	Map out interdependencies between reserved and devolved powers and how they might impact decarbonisation in all economic sectors. Use the results to identify significant risks to the delivery of Net Zero and construct a plan to manage them.	Mostly devolved	2023 Priority
Governance	In parallel with the Convention of Scottish Local Authorities, address the question of what aspects of Net Zero central and local government are responsible for and how these will be coordinated. As well as sharing local best practice, this should lead to a clearer shared understanding of roles and responsibilities which can be communicated across local government.	Mostly devolved	2023 Priority
Delivery	Scale up action to deliver targets across all sectors in line with the ambition set out in the recent Climate Change Plan update.	Mostly devolved	Ongoing
Governance	Ensure that all policies, funding, and delivery mechanisms are properly aligned to the pace of transition required and work together constructively towards Net Zero, for example through introduction of a Net Zero Test.	Mostly devolved	Q1 2023
Governance	Extend the delivery of climate skills training across the Civil Service and wider public sector. Consider what wider supporting skills (delivery, coordination, legal, financial) will be needed in the public sector to enable effective delivery of the transition to Net Zero.	Mostly devolved	Ongoing
Governance	Review how effective existing mechanisms for coordinating delivery with the devolved administrations (including the Inter-Ministerial Group, the Nations Board, and departmental-level engagement) have been at securing input to the design of and buy-in to implementation of recent major strategies relating to Net Zero.	Mostly devolved	H1 2023
Governance	Make clear the importance of ensuring that all developments consider how best to minimise lifetime emissions and adapt to climate change as part of the planning process. This should be achieved by embedding Net Zero alignment as a core requirement within the planning reforms in the upcoming Levelling Up and Regeneration Bill and the supporting frameworks and guidance documents.	Equal responsibility	2023
Planning; networks	Work closely with the new Electricity Networks Commissioner to ensure that Scotland's spatial planning regime adequately balances local impacts on natural capital with the need for sufficient electricity network capacity, delivered in a timely fashion, to accommodate expansion of renewable electricity generation capacity in line with UK Government targets and Scottish Government ambition.	Mostly reserved	H1 2023

Topic	Recommendations for agriculture & land use	Responsibility	Timing
CAP reform	Provide detail on how post-CAP agricultural subsidies and schemes in Scotland will target funding and delivery for climate mitigation alongside wider environmental goals such as climate change adaptation and biodiversity.	Mostly devolved	H1 2023 Priority
Forestry	Ensure that funding and incentives are set at the correct level to meet the Scottish Government afforestation target of 18,000 hectares per year by 2025	Mostly devolved	Ongoing Priority
Peatlands	Ensure incentives are set at the correct level to set a trajectory to achieve 58% of peatland restored by 2035, and 79% under restoration by 2050. All upland peat should be under restoration management by 2045.	Mostly devolved	Q1 2023 Priority
CAP reform	Put in place robust frameworks for monitoring, reporting and verification of post-CAP farm subsidies and agriculture environment schemes to assess their effectiveness in delivering their environmental objectives, including for climate change mitigation and adaptation.	Mostly devolved	2023
Forestry	Ensure the forestry sector and government agencies continue to support tree nurseries to increase domestic production of trees to meet the planting ambition and reduce reliance on imports, along with the associated risks of pests and diseases.	Mostly devolved	2023
Forestry	Scottish Government should continue support to develop and promote the Woodland Carbon Code, to attract private finance and additional investment to incentivise woodland creation and diversification of the forest estate in Scotland.	Mostly devolved	2023
Forestry	Develop a comprehensive plan to increase the production and use of UK sourced timber and support the long-term economic viability of domestic woodlands.	Equal responsibility	Q1 2023
Peatlands	Implement a comprehensive delivery mechanism to address degraded peatland and extend current restoration ambition set out by the Scottish government beyond the existing timeframe of 2030. Peat restoration targets include the need to remove all low-productive trees (i.e. less than YC10) from peatland, and restore all peat extraction sites by 2035.	Mostly devolved	2025
Peatlands	Set out clear timeframes to end domestic and industrial peat extraction in Scotland. Provide a mechanism to ensure the peat extraction industries restore extraction sites to protect the peat resource.	Mostly devolved	2023
Peatlands	Consult on and introduce the regulations to ban the retail sale of peat in horticulture in Scotland. Government must work with the horticultural industry to end use by the professional sector.	Mostly devolved	2023
Peatlands	Introduce policy to end rotational burning on peatland before the start of the 2023 burn season.	Mostly devolved	H1 2023
Peatlands	Introduce baseline regulations to ensure lowland peat soils are not left bare by mandating the use of appropriate vegetation cover.	Mostly devolved	2023
Peatlands	Where peat soils remain under agricultural use, set out how they will be managed in a more sustainable way. This should include raising water levels on 8% of lowland grassland by 2025, reaching 25% by 2035, and 12% of arable crops by 2025, reaching 38% by 2035.	Mostly devolved	Q1 2023

Topic	Recommendations for agriculture & land use	Responsibility	Timing
Farming practices	Put in place action to overcome financial barriers that prevent take-up and innovation in low-carbon farming practices. This should include management incentives under CAP replacement schemes and grants for capital items and infrastructure, and support for research and development.	Mostly devolved	2023
Farming practices	Move beyond the voluntary nature of current CAP replacement schemes by setting a strong regulatory baseline that strengthens rules such as those under Basic Payment Scheme and retains them in Scottish legislation.	Mostly devolved	2023
Farming practices	As part of strengthening the regulatory baseline, extend coverage of Nitrate Vulnerable Zones across all of Scotland in order to promote best practice in management of inorganic fertilisers and organic manure and slurry.	Mostly devolved	2024
Farming practices	Maintain and enhance programmes and initiatives to deliver advice and knowledge exchange on climate change mitigation and adaptation measures for Scotland's farmers, crofters and land managers.	Mostly devolved	2023
Farming practices	Continue to support research and development into low-carbon farming practices, including behavioural, innovation and productivity measures. The risk of a high dependency on innovation and technology to meet GHG emission reductions should be assessed, and integrated with demand-side measures such as diet change and waste reduction.	Equal responsibility	2023
Agroforestry and hedgerows	Maintain and enhance incentives to support agroforestry and hedgerows on Scottish farms. Plant trees on 2% of farmland by 2025 while maintaining its primary use, rising to 5% by 2035, and extend hedgerows by 20% by 2035 and better manage existing hedgerows.	Mostly devolved	2023
Non-financial barriers	Set in place action to overcome non-financial barriers that prevent adoption of low-carbon farming measures and land-use change to deliver emission reduction and carbon benefits. These include streamlining application processes and providing support for skills, training, and knowledge exchange in order to provide confidence to farmers to take up new measures.	Mostly devolved	Q1 2023
Non-financial barriers	Develop understanding on how the transition to Net Zero in the agriculture and land will affect employment in these sectors, including a timeframe of change and the scale of impact. Set out how the change will be managed to be fair and equitable, ensuring new skills and training are widely available to both support communities, but also to facilitate the meeting of targets in these sectors.	Mostly devolved	2023
Non-financial barriers	Provide support to tenant farmers to overcome contractual issues that restrict the long-term commitment and investment required to reduce emissions and sequester carbon on the land they manage.	Mostly devolved	Q1 2023
Land use change	Scottish Government should work with private and voluntary sectors, and through agricultural colleges and universities to provide skills training, demonstration and increase capacity to promote delivery of sustainable farming practices and land management.	Mostly devolved	2023

Topic	Recommendations for agriculture & land use	Responsibility	Timing
Finance	Set out how public and private funding for agricultural and land-based measures will be aligned, how opportunities to attract increased private finance for habitat creation and restoration will be developed, and promote the use of existing verifiable standards (such as the Woodland Carbon Code and Peatland Code) whilst also considering the need to develop new ones.	Equal responsibility	2023
Energy crops	The Bioenergy Action Plan should set out the role that sustainable domestic production of perennial energy crops and short rotation coppice will play to contribute towards Scotland's emission reduction targets.	Mostly devolved	H1 2023
Diet and demand	Take low-cost, low-regret actions to encourage a 20% shift away from all meat by 2030, rising to 35% by 2050, and a 20% shift from dairy products by 2030, demonstrating leadership in the public sector whilst improving health.	Mostly reserved	2023
Diet and demand	Deliver on Food Waste Reduction Action Plan to reduce food waste by one-third by 2025. This should be upscaled to reach 50% by 2030.	Mostly devolved	2025

Topic	Recommendations for buildings	Responsibility	Timing
Residential buildings	Publish developed plans to deliver energy efficiency improvements and low-carbon heating in residential buildings, aligned with Scotland's ambitious targets. This will require a combination of incentives and regulation, including using tenancy and ownership changes as trigger points for change. Policies should also factor in the UK Government's proposals for a market-based mechanism for low-carbon heat.	Mostly devolved	H1 2023 Priority
Non-residential buildings	Consult on and finalise plans for delivering energy efficiency improvements and low-carbon heating in non-residential buildings. These should include clear target dates for meeting standards. Consider the role of targets that look beyond EPCs to more reliable measures of performance and emissions reductions, and clarify whether Scotland will be part of the UK performance-based rating scheme for non-residential buildings.	Mostly devolved	H1 2023 Priority
Progress monitoring and data	Publish the delayed monitoring and evaluation framework for the Heat in Buildings Strategy, or expand the set of indicators in the annual climate change plan monitoring reports. Include clear indicators for deployment of energy efficiency measures, heat pumps, and low-carbon district heating, across residential and non-residential buildings. Use the development of the framework to identify data gaps and make plans to address them. Track implementation and its costs and use this information in updates to the Strategy.	Mostly devolved	2023 Priority
Low-carbon heat	Work with the UK Government in 2023 to deliver proposals set out in the Scottish Heat in Buildings Strategy to phase out replacement fossil fuel boilers in 2025 for off-gas buildings, and 2030 for on-gas buildings.	Equal responsibility	2023
Residential buildings	Consult on legislation to set low-carbon heating and energy efficiency targets in privately rented and owner-occupied homes.	Mostly devolved	2023
Progress monitoring and data	Publish more detail on the modelled pathway for low-carbon heat, and planned breakdown of funding announced in the Scotland Heat in Buildings Strategy.	Mostly devolved	2023
Low-carbon heat	Table legislation to prohibit the use of 'direct emissions heating systems' from 2024 in new residential and non-residential buildings, building on the 2022 consultation.	Mostly devolved	2023
Low-carbon heat	Coordinate with the UK Government to develop and implement proposals for a market-based mechanism for heat pump deployment. Evaluate the likely impact of this policy and if needed develop additional plans in to deliver heat pump installations at the rate required by Scotland's Heat in Buildings Strategy.	Equal responsibility	2023
Standards and enforcement	Progress with EPC reform by finalising proposals for improved metrics, and carrying out the planned final consultation within a wider consultation on a regulatory framework for heat and energy efficiency.	Mostly devolved	2023
Heat networks	Work with the UK Government to resolve issues around aligning the UK and Scotland's regulatory frameworks for heat networks, and appointing Ofgem to deal with consumer protection and licensing.	Equal responsibility	2023
Fuel-poor homes	Closely monitor the number of households in fuel poverty and expectations of future energy costs, and revise funding allocated to decarbonising fuel-poor homes to reflect levels of support required.	Mostly devolved	2023

Social housing	Complete the review of the Energy Efficiency Standard for Social Housing, assessing progress to date, and aligning with the 2040 target for low-carbon heat in homes.	Mostly devolved	H1 2023
Workers and skills	Ensure that skills requirements for decarbonising the building stock are properly quantified, and that delivery can be monitored. Ensure that the required education and skills provisions commence, and that funding and policies are in place for provision to scale up at the required pace.	Mostly devolved	H1 2023
Governance	Ensure that local authorities have the resources required to produce Local Heat and Energy Efficiency Strategies and Delivery Plans, and that these are published by the December 2023 deadline. [Publish guidance on production and content]	Mostly devolved	2023
New buildings	Define clear transitional arrangements which will require any buildings (including individual houses in multiple-unit residential schemes) which have not meaningfully commenced on site within one year of the implementation of new regulations on energy efficiency and low-carbon heat to comply with the new standards.	Mostly devolved	2023
Funding and finance	Monitor the use of the £1.8 billion of funding for heat and energy efficiency projects, tracking the amounts spent on heat networks, heat pumps and energy efficiency measures and how these compare to the targets set in the Scotland Heat in Buildings Strategy for low-carbon heating and energy efficiency.	Mostly devolved	Ongoing
Standards and enforcement	Develop policies to ensure that the actual performance of new buildings and energy efficiency measures aligns with expectations. These should include improving the accuracy of the models used to assess compliance with standards, expanding performance testing, enhancing monitoring and enforcement of standards (including through providing adequate funding for local authorities), and developing mechanisms for holding contractors to account for quality and performance.	Mostly devolved	Ongoing
F-gases	Publicly set targets to end the use of Metered Dose Inhalers (MDIs) for all patients where alternatives can be used, by the mid-2020s, for all NHS and private healthcare services across Scotland. For patients where MDIs are necessary, end the use of MDIs that use propellant gases with 100 year Global Warming Potentials above 200 times that of carbon dioxide. Publish a plan setting out how the Scottish Government will meet these targets.	Mostly devolved	Q3 2023
Funding and finance	Develop proposals for long term funding and financing solutions to deploy low-carbon heating in existing buildings, taking into account recommendations made by the Green Heat Finance Task Force	Mostly devolved	2023

Topic	Recommendations for surface transport	Responsibility	Timing
Car demand	Publish a detailed strategy, building on the Route Map consultation of 2022, setting out how the Scottish Government will achieve a 20% reduction in car-kilometres by 2030 and deliver 20-minute neighbourhoods. This should include both investment in more sustainable modes of travel and measures to reduce the attractiveness of driving.	Mostly devolved	2023 Priority
Public transport	Deliver the public transport fares review outlined in the Route Map. This should consider: prioritising delivery of a new, transparent fare structure that offers more affordable and reliable travel, ensuring fairness in relation to more carbon-intensive choices, and a more interlinked public transport system between operators.	Mostly devolved	H1 2023 Priority
EV charging	Develop an implementation plan to deliver the Scottish Govermnent's vision for the public EV charging network. This should ensure the EV transition works for all road users in Scotland and accelerates in line with EV uptake, delivering 6,000 charge points by 2026 and approximately 24,000 charge points by 2030.	Mostly devolved	2023 Priority
Car demand	Embed the 20% car demand-reduction target within key upcoming policy documents, such as the second Strategic Transport Projects Review and the fourth National Planning Framework, to ensure that all transport investment and spatial planning decisions give appropriate consideration to this ambition.	Mostly devolved	H1 2023
Active travel	Publish the Cycling Framework and Delivery Plan for Active Travel in Scotland. This should set out how the increasing funding for active travel will be directed to contribute to reducing car traffic by 20% and delivering 20-minute neighbourhoods.	Mostly devolved	2023
EV charging	Set out clear expectations and targets as to what local authorities should do to develop and implement local charging strategies, along with milestones for the rate at which charge point provision is expected to expand. Ensure that local authorities all have the capacity and capability to develop these strategies and implement the actions required.	Equal responsibility	2023
Zero-emission vehicles	Continue to support the delivery of Scotland's transition to electric cars and vans. This will require working with the UK Government to ensure that the ZEV mandate will deliver the deployment rates required in Scotland and securing sufficient supply of and demand for vehicles in Scotland to ensure that sales rise throughout the 2020s to meet the 2030 phase-out commitment. The Scottish Government should seek opportunities to influence consumers to choose fully electric vehicles over plug-in hybrids wherever possible.	Equal responsibility	Ongoing
Zero-emission vehicles	Invest in developing new technologies and support innovation for emerging technologies, for example battery manufacturing and recycling, zero-emission HGVs, and shared mobility solutions.	Equal responsibility	Ongoing
Public transport	Continue to support the public transport and shared mobility sectors to recover from the COVID-19 pandemic, including through maintaining recovery funding where required and positive communication and messaging. Work with operators and local transport authorities to avoid detrimental reductions in service provision or increases in fares.	Mostly devolved	Ongoing
Car demand	Work with local authorities to embed sustainable transport changes and deliver the interventions set out in the Route Map, offering support through financial means, resourcing, and with appropriate skills and knowledge-sharing.	Mostly devolved	2023

Recommendations for aviation

Topic	Recommendations for aviation	Responsibility	Timing
Aviation demand	Implement the Air Departure Tax (ADT) as soon as possible. Once implemented, use the tax to address price imbalances between aviation and alternative, lower-emissions forms of surface transport (e.g. rail) to encourage modal shift. Also consider other policy levers, such as information provision, to encourage a reduction in the number of flights taken.	Equal responsibility	2023 Priority
Cross-cutting	Publish a detailed strategy for decarbonising aviation in Scotland as soon as possible in 2022. Amongst other things, this strategy should set out a roadmap of how the decarbonisation of scheduled flights within Scotland will be achieved by 2040, including which technologies will be prioritised to achieve this and when the capability of these technologies will need to be demonstrated.	Mostly devolved	H1 2023
Aviation demand	Go further than the UK Government on information provision to travellers on the environmental cost of air travel. Look at requiring the provision of emission comparisons between different modes of transport (not just alternative flights) for flights operating within and leaving Scotland.	Mostly devolved	2024
SAF	Consider how Scotland can incentivise Sustainable Aviation Fuel (SAF) use by Scottish airlines, to meet or go beyond the UK SAF mandate. This should be done in the next year as the UK Government develops its SAF mandate further.	Mostly reserved	2023
Aviation technology	Develop a detailed strategy for the decarbonisation of Public Service Obligation routes, including looking at ways to incentivise the use of SAF/zero-emission aircraft for these routes.	Mostly devolved	2023
Aviation technology	Continue to provide funding and support for the development of zero emission aircraft for domestic flights in Scotland.	Equal responsibility	Ongoing
Non-CO_2 effects	Do not apply a non-CO_2 factor to aviation emissions but commit to stopping warming from non-CO_2 effects after 2050.	Mostly reserved	2025
Airport expansion	Consider the environmental impact of airport expansion under the upcoming Scotland National Planning Framework, including a strategy to limit airport expansion in the event that proposals to expand Scottish airports are submitted.	Mostly devolved	H1 2023
Indirect emissions	Reduce the emissions from people traveling to and from Scottish airports. Further encourage the use of public transport for travel to and from Scottish airports to avoid car use and reduce overall emissions from the sector. Encourage Scottish airports to reduce their own on-site emissions (e.g. by adopting low-carbon surface transport and implementing low-carbon energy sources).	Mostly devolved	Q3 2023
Carbon pricing	Continue to work with the UK Government to develop a policy on the interaction between the UK ETS and the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) interaction as soon as possible, ensuring it is sufficiently environmentally stringent and that no credits from CORSIA are used for flights currently covered by the UK ETS unless and until they can satisfy strict eligibility criteria (equivalence, additionality, permanence, sustainability). The interaction should avoid double-compliance.	Mostly reserved	2023

Recommendations for shipping

Topic	Recommendations for shipping	Responsibility	Timing
Cross-cutting	Use the upcoming Islands Connectivity Plan and Strategic Transport Projects Review to set out a plan for meeting the commitment to 30% of Scottish Government-managed ferries being low-emission by 2032 and for achieving full decarbonisation of Scotland's maritime sector. This should include consideration of zero-carbon fuels, vessel technologies, and the necessary supporting infrastructure.	Mostly devolved	2023
Cross-cutting	Support the UK Government in pushing for inclusion of a Net Zero 2050 target in the International Maritime Organisation's 2023 update of its Greenhouse Gas Strategy.	Equal responsibility	2023
Electrification	Develop a plan for deploying shore power and electric recharging infrastructure at all of Scotland's major ports. This should include identifying roles and responsibilities for delivery and providing support and incentives to drive investment.	Equal responsibility	H1 2023

Recommendations for industry

Topic	Recommendations for industry	Responsibility	Timing
Innovation	Continue to support innovation and demonstration of technologies for decarbonising manufacturing and construction; ensure that learning is disseminated as widely as possible within industry.	Mostly reserved	2023
Energy efficiency	Implement policies to enable substantial improvements in industrial energy efficiency	Mostly devolved	2023
Resource efficiency	Work with business to encourage and enable consumers to share, lease and use products for longer whilst discouraging 'disposable' business models.	Mostly reserved	2023
Resource efficiency	Develop policies to drive more resource-efficient construction and use of existing low-carbon materials. This should include setting out a plan for phasing in mandatory whole-life reporting followed by minimum whole-life standards for all buildings, roads and infrastructure by 2025, with differentiated targets by function, scale, and public/private construction.	Equal responsibility	2023
Cross cutting	Ensure that key policies to improve resource efficiency, recycling and waste prevention, such as Extended Producer Responsibility, are on track to be in place well before 2025	Mostly devolved	2023
Cross cutting	Renew efforts to improve resource efficiency, recycling and waste prevention by setting new ambitious targets for 2030.	Mostly devolved	2023
Data	Improve the collection and reporting of industrial decarbonisation data to allow for progress to be monitored more effectively, particularly on energy and resource efficiency.	Mostly reserved	2023
Hydrogen	As part of the planned update to the Energy Strategy, and supported by the proposed new National Public Energy Agency, formalise the planning process, governance framework and timeline for decisions on infrastructure for the conversion to hydrogen of the gas transmission and distribution networks. Alongside this, identify priority candidate areas for hydrogen conversion and areas which are unlikely to be suitable to hydrogen conversion (such that electrification and alternatives can be prioritised), ensuring consistency with least-regret forward views on demand for hydrogen within Scotland and across the rest of the UK.	Mostly devolved	2023
Bioenergy	Together with UK Government, review existing – and, if necessary, develop new – schemes that support the sustainable production of biomass feedstocks and conversion of bioenergy in a way consistent with Net Zero. This should include dates beyond which new facilities should be built with CCS, and dates for when CCS will need to be retrofitted to biofuel facilities already in operation.	Mostly reserved	2023

Recommendations for waste

Topic	Recommendations for waste	Responsibility	Timing
Energy from Waste / Incineration	Work with the UK Government to develop a policy and funding framework to retrofit existing Energy from Waste plants with CCS from the mid-2020s, and ensure any new Energy from Waste plants are all built 'CCS-ready'.	Equal responsibility	2023 Priority
Energy from Waste / Incineration	Set out further detail on actions and implementation timelines to ensure all recommendations from the incineration review can be delivered. This should include explaining how the projected residual waste capacity gap in 2025 will be managed whilst ensuring commitments to end the landfilling of biodegradable waste are met.	Mostly devolved	H1 2023 Priority
Cross-cutting	Work with the waste industry to develop a plan to decarbonise waste treatment assets in Scotland in line with emissions and waste reduction objectives, including identifying asks of UK Government in reserved areas.	Equal responsibility	2023
Energy from Waste / Incineration	Start reporting emissions from Energy from Waste as a separate source within the Scottish greenhouse gas inventory.	Mostly devolved	Q1 2023
Infrastructure	Review planning policies for waste infrastructure to ensure they enable delivery of recycling targets, support future residual waste needs and consider decarbonisation requirements. This includes clarifying siting requirements for incinerators to enable CCS adoption.	Equal responsibility	2023
Waste prevention	Implement initial Extended Producer Responsibility, the Deposit Return Scheme and consistent collections of recycling and food waste without further delay. Complete an independent review of the impact of the schemes within 2 years of implementation (i.e. by 2026).	Equal responsibility	Q1 2024
Waste prevention	Legislate the Circular Economy Bill and set targets to reduce waste and improve recycling rates beyond 2025, ensuring these are more ambitious than existing targets. Targets should be set on the basis of separate waste streams (rather than 'All waste') and where possible consider carbon-based metrics.	Mostly devolved	2023
Wastewater	Set out how Scottish Water will be supported to deliver its plan to achieve Net Zero, as well as how emissions from industrial waste water facilities will be reduced.	Mostly devolved	H1 2023

Recommendations for electricity supply

Topic	Recommendations for electricity supply	Responsibility	Timing
Emissions strategy	Set out an updated assessment of how much renewable and low-carbon electricity generation will be required to meet Net Zero in Scotland and contribute cost-effectively to Net Zero in the UK, with a clear trajectory to 2045.	Mostly devolved	H1 2023
Networks	In conjunction with the electricity network owners and the electricity system operator, outline what will be required to ensure adequate electricity supply resilience across Scotland in the late 2020s and into the 2030s as thermal generation in Scotland is retired.	Mostly reserved	H1 2023

Recommendations for engineered removals

Topic	Recommendations for engineered removals	Responsibility	Timing
Delivery	Carry out a detailed scoping exercise on the potential for engineered removals in Scotland that identifies potential sites for new build and retrofit engineered removals projects and takes into account proximity to biomass stocks, access to future CCS networks and impacts on energy systems.	Mostly reserved	H1 2024
Governance	Work with the Interministerial Group for Net Zero, Energy and Climate Change to publish a joint position on the contribution of engineered removals and CCS to meeting UK-wide and DA targets to 2030.	Equal responsibility	2023

December 2022

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