The Scottish Parliament
Pàrlamaid na h-Alba

SPICe The Information Centre
An t-Ionad Fiosrachaidh

SPICe Briefing
Pàipear-ullachaidh SPICe

Update to the Climate Change Plan - Key Sectors

Kate Berry, Anna Brand, Greig Liddell, Alexa Morrison, Alan Rehfisch, Alasdair Reid

This briefing considers the Scottish Government's Draft Update to the Climate Change Plan.For each of the key sectors, it sets out the expected outcomes of the Climate Change Plan published in 2018, recent reports and recommendations, and what changes have been made in light of the adoption of the net-zero emissions target, set by the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019.

12 January 2021
SB 21-02

Contents

Executive Summary

The Scottish Government's draft update to the Climate Change Plan 2018 – 2032 sets out Scotland's path, across eight key sectors, to achieving a 75% reduction in greenhouse gas emissions by 2030, and ultimately net-zero emissions by 2045. The draft update is a crucial staging post in Scotland's trajectory to net-zero, as it encompasses the interim 2030 target, which independent advisers the Climate Change Committee consider to be "extremely challenging".

The draft plan anticipates a 56% reduction in total Scottish emissions over its lifetime. By 2032, the following sectoral changes are expected:

The production of electricity accounted for 5% of total emissions in 2018. **Emissions in the Electricity Sector are expected to reduce by 376%** with the help of technologies that permanently remove carbon from the atmosphere. These are currently untested at scale; without these technologies, this sector is expected to achieve a 100% reduction. This major reduction in emissions will take place alongside a significant increase in renewable electricity capacity, which is critical to decarbonising other sectors. Key policies and proposals include: new financial support for energy technology innovation, an ongoing focus on local and community energy projects; supporting significant increases in offshore wind by 2030; continuing to press the UK Government to support and invest in energy systems, infrastructure and markets (which are reserved); and a new focus on jobs and the supply chain to ensure that the benefits of this investment can support a green recovery from Covid-19 in Scotland.

Emissions from buildings amounted to 23% of the total in 2018. In the **Buildings Sector, emissions are forecast to drop by 68%**. This is due to standards and regulations requiring buildings to be more energy efficient, and progress towards a substantial decarbonisation of heat, backed by significant investment and supply chain support. Two new policy outcomes are introduced, centred on green gas (hydrogen and biomethane) supply and a fair heat transition that does not increase fuel poverty, which are also intended to stimulate employment opportunities. Further details will be set out in a Heat in Buildings strategy due to be published later this year.

Transport emissions are Scotland’s single largest source of greenhouse gases, accounting for 36% of the total in 2018; they have only reduced by 0.5% since 1990. For the **Transport Sector a reduction in emissions of 41% is expected**. The fall is driven by a number of factors, principally a 20% reduction in distance travelled by car and a significant uptake in ultra-low emission vehicles – including buses, railway rolling stock and goods vehicles. Whilst Covid-19 travel restrictions imposed during 2020 have produced a significant temporary reduction in transport emissions, a rebound in emission levels is expected. However, the draft CCPu does not appear to predict any bounce back in emissions following the end of the pandemic.

In 2018, the industry sector was responsible for 28% of Scotland’s greenhouse gas emissions, and these have increased by 6% since the publication of the 2018 CCP; they are second only to the transport sector. In **Industry, emissions are anticipated to be 43% lower (52% lower with Negative Emissions Technologies)**. This shift in ambition is driven by an expectation that an almost total decarbonisation of industry is possible over the next twenty years with the development and widespread adoption of carbon capture, hydrogen energy and negative emissions technologies.

Greenhouse gases from waste accounted for 4% of emissions in 2018 but are more significant in terms of Scotland's carbon footprint, taking into account emissions associated with imported goods and materials. In the **Waste Sector, emissions are expected to reduce by 56%**. Policies on food waste and circular economy have been upgraded to form two new Policy Outcomes. Key commitments include to embed circular economy principles across sectors; reduce food waste and end the landfilling of biodegradable municipal waste; to take steps to ban problematic plastics and to work with the UK Government to reform producer responsibility.

Currently, emissions in land use, land use change and forestry are a net sink – they absorb greenhouse gases; accounting for -13% in 2018. However, this is set to change, and **Land Use, Land Use Change and Forestry emissions are expected to rise by 283%** due primarily to the inclusion of emissions from peatlands, which have not been accounted for up until this point. The two main emissions reduction activities in this sector are forestry planting and peatland restoration. The peatland restoration target remains the same as in the 2018 CCP (250,000ha by the early 2030s), while the woodland creation target has increased from 15,000ha per year in 2024-5 to 18,000ha per year in 2024-5.

Emissions from agriculture contributed to 18% of the total in 2018. In the **Agriculture Sector, a 24% reduction in emissions is anticipated** – a large increase in ambition since the 2018 CCP, which anticipated only a 9% reduction. The draft CCPu includes one new outcome and a number of new policies and proposals. Policies and proposals include: linking emissions reduction activities to future rural policy, enhanced advisory services, introducing environmental conditionality for support payments, and exploring and developing a range of low-carbon farming interventions. However, the details of some of these policies remain unclear.

Negative Emissions Technologies (e.g. using biomass to generate electricity, coupled with Carbon Capture and Storage) are planned to start permanently remove carbon dioxide from the atmosphere by 2029, and significantly ramp up emissions removal in the electricity and industrial sectors from 2030 onwards; **equivalent to 23.8% of gross emissions**. Whilst these technologies have been proven in test facilities and at small scales, they do not currently exist at scales necessary to remove significant volumes of carbon. Timescales for developing and commissioning are therefore exceptionally tight. Proposals include: a feasibility study to identify specific sites, followed by support for commercial partners; work with the UK Government; investment in research and development, demonstrator projects, and integrating negative emissions technologies with carbon capture and storage infrastructure.

Introduction

The Climate Change (Scotland) Act 2009 requires the Scottish Government to produce a plan setting out proposals and policies for meeting future greenhouse gas (GHG) emissions reduction targets. Known as the Climate Change Plan (CCP), it is published every five years and generally covers a 15 year timespan. The most recent CCP was published in 2018, and covers the period out to 2032 [1] .

The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 amends the Climate Change (Scotland) Act 2009 and significantly increases Scotland's GHG emissions reduction target (against a 1990 baseline) to net-zero emissions by 2045 [i], with interim targets for reductions of:

- 56% by 2020
- 75% by 2030
- 90% by 2040.

Following the adoption of new targets, the Scottish Government had undertaken to revise the 2018 CCP within 6 months of the Act, however this was postponed due to the Covid-19 pandemic, and Securing a Green Recovery on a Path to Net Zero: Climate Change Plan 2018–2032 - update (draft CCPu) was finally published on 16 December 2020 **[2] .**

In the same week as the draft CCPu, a Scottish Biodiversity Strategy post-2020: statement of intent was also published. This sets out the Scottish Government's direction for a new biodiversity strategy, and recognises an "increased urgency for action to tackle the twin challenges of biodiversity loss and climate change", which are inextricably linked [3] .

The draft CCPu is widely regarded as a crucial staging post in Scotland's trajectory to net-zero emissions, as it encompasses the interim 2030 target, which independent advisers the Climate Change Committee (CCC) consider to be "extremely challenging", and "may not be feasible" [4] .

The draft CCPu provides further clarity on Scotland's path to net-zero emissions across the following key sectors:

- Electricity
- Buildings
- Transport
- Industry
- Waste
- Land Use, Land-Use Change and Forestry (LULUCF)

i Net zero refers to achieving a balance between the amount of GHG emissions produced and the amount removed from the atmosphere. There are tandem routes to achieving this; reducing existing emissions and actively removing GHG

- Agriculture
- Negative Emissions Technologies (a new sectoral chapter).

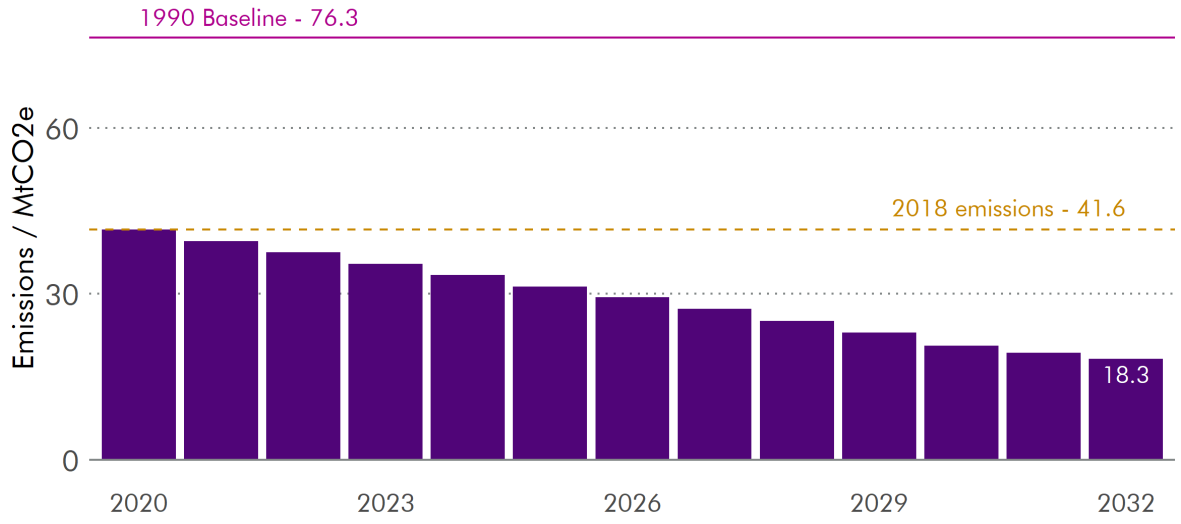
The draft CCPu also contains new information in chapters on Green Recovery from Covid-19, and Coordinated Approach, which encompasses cross-sectoral issues such as energy systems, circular economy, transport, planning and a wellbeing economy.

This briefing summarises existing Key Outcomes in the above sectors, considers recent recommendations, and explores the draft CCPu. It should be read in conjunction with SPICe Briefing Update to the Climate Change Plan – Background Information and Key Issues. Figure 1 shows the anticipated emissions reduction pathway out to 2032.

N.B. Due to the breadth of subjects covered and the cross-economy need for decarbonisation, this briefing, if printed or read in PDF format, is 100 pages long. To aid understanding, readers are advised to navigate to the relevant section and to read online.

Figure 1 - Anticipated Emissions Reductions 2020 - 2032

$MtCO_2e$ - million tonnes of carbon dioxide equivalent



Emissions Statistics

Emissions statistics for Scotland are published every year and each publication covers emissions up until two years prior. In other words, emissions statistics published in 2018 accounted for 2016 emissions; statistics published in 2020 accounted for 2018 emissions. The draft CCPu states [2] :

> " the current modelling makes use of the most recently published Scottish greenhouse gas inventory data and best current expectations for known upcoming technical changes to the UK inventory"

The most recent emissions statistics [5] show that Scotland produced 41.6 MtCO2e in 2018, and the draft CCPu uses this as the baseline for 2020 emissions, however there are some

notable differences within the sectors. These are explored in detail in each of the relevant sectors.

Draft CCPu Sectoral Detail

The draft CCPu contains eight chapters covering Scotland's anticipated emissions by key sector. These are summarised in the following figures.

Figure 2 - Anticipated Sectoral Change 2020 - 2032

$MtCO_2e$ - million tonnes of carbon dioxide equivalent. The effect of Negative Emissions Technologies are included in the figures for the Electricity and Industry Sectors. This takes the Electricity Sector from being a source of emissions to negative emissions.

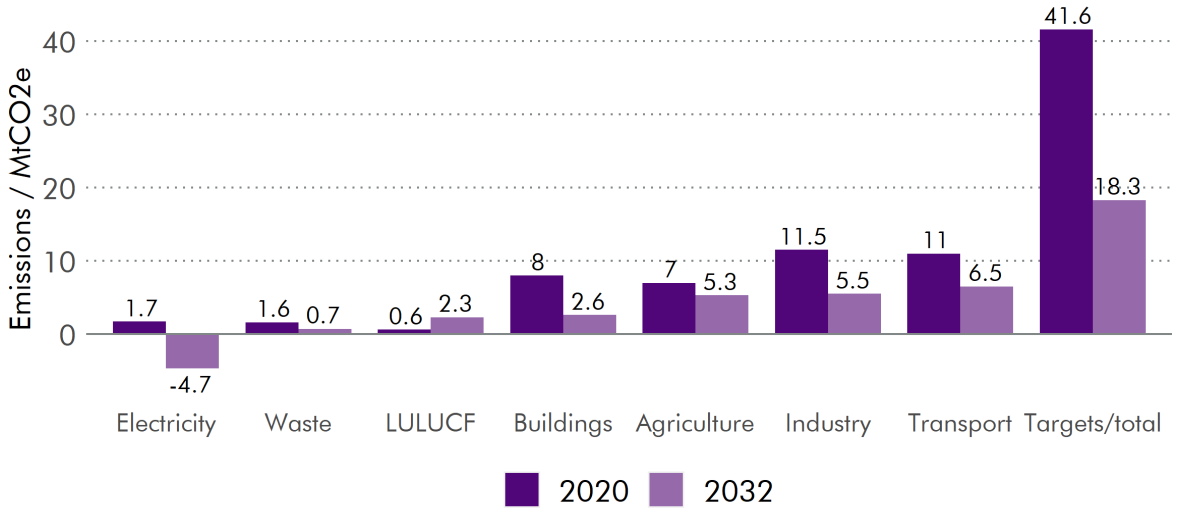
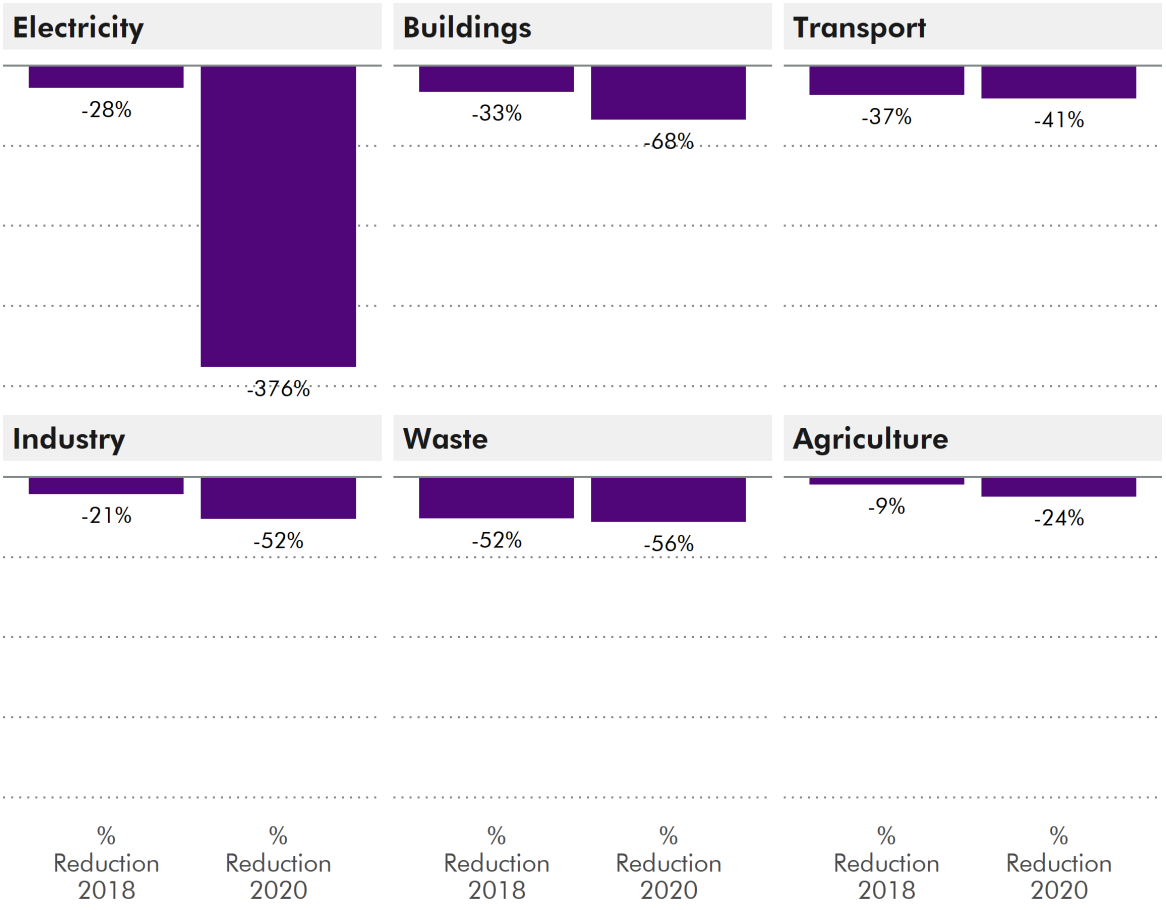


Figure 3 - Comparison of Changes to Ambition Between 2018 CCP and Draft CCPu in Anticipated Percentage Reduction in Emissions

N.B. Due to changes in methodology, it is not valid to compare the change to LULUCF ambition - this is explored in more detail in the relevant section. The effect of Negative Emissions Technologies are included in the 2020 figures for the Electricity and Industry Sectors. This takes the Electricity Sector from being a source of emissions to negative emissions.



Deriving Sector Emissions Envelopes

The Scottish TIMES model is a high-level analytical model, covering the Scottish energy system, as well as non-energy sectors, including Agriculture, Waste, and LULUCF. It helps to understand key inter-relationships across relevant sectors, and relies on a specific set of data inputs which capture the characteristics of the system being studied, a series of constraints being applied to reflect practical or policy constraints and a set of results being generated that are informed by those inputs and constraints [2 6] .

Annex C of the draft CCPu is crucial in understanding how each of the sectoral GHG emissions envelopes[ii] were derived. It states that [2] :

ii The term used to describe the set of figures that make up the pathway to 2032 for each sector

> “ It identifies the least-cost pathway for deployment of technologies, fuels and other carbon abatement measures to meet our final demands and emissions targets. [...] These envelopes have been developed through an iterative process which combines evidence, analytical modelling and the application of judgement in the face of considerable uncertainty.”

Key points include:

- The TIMES model was unable to identify a set of sector pathways consistent with the statutory targets
- Therefore, in order to ensure the envelopes met the cross-economy statutory targets, a decision was taken to allocate the necessary additional emissions reductions pro-rata to some sectors
- Two sectors were exempted from this additional allocation; Agriculture and Industry
- Agriculture was exempted on the grounds of "technical feasibility" and those which would have been allocated to this sector were allocated to LULUCF
- Industry was exempted to avoid "carbon leakage"; this refers to the possibility of high-carbon businesses relocating to other countries with weaker emissions targets, potentially resulting in higher global greenhouse gas emissions overall
- The emissions envelope for Industry was constrained in the TIMES model to the current EU Emissions Trading System[iii] cap to 2020 and then to the assumed rate of a projected EU/UK cap to 2025. Thereafter this envelope followed a linear path to a 90% reduction in 2050, based on the CCC’s advice for that sector.

Electricity

Electricity policy is complex, and the generation and consumption of electricity in Scotland should be considered within the framework of the GB wide grid, which is itself an integral part of a wider European network of interconnectors.

As well as reducing GHG emissions and tackling climate change, key themes in this chapter include: ensuring secure and affordable supplies through demand reduction; addressing fuel poverty; skills development and increased employment; and improved infrastructure.

The promotion of renewable energy, the consenting of electricity generation and transmission development, and energy efficiency are devolved, allowing considerable attention to be focussed on advancing research, development and deployment in these key areas, and giving Scottish Ministers some powers in directing the overall energy mix, including nuclear and other thermal generation via consenting powers. The Scottish Government's Energy Strategy states [7] :

---

iii The EU's key tool for reducing GHG emissions cost-effectively. A cap is set on the total amount of certain GHGs that can be emitted and is then reduced over time. Companies receive or buy emission allowances, which they can trade with one another as needed.

> " […] there is a great deal of common ground between the Scottish and UK Governments. We will continue, and build upon, our existing inter-governmental partnerships to make sure that we deliver the goals and ambitions in this Strategy."

Context

Scotland is consistently a net exporter of electricity to the rest of the UK – amounting to 28% of all Scottish generation in 2018. Figures for 2018 show that electricity accounted for 22% of overall energy consumption in Scotland. Within this, renewables accounted for 55% of electricity generation, nuclear for 28%, and gas for 15% [8] .

The Scottish Government has a target to generate the equivalent of 100% of domestic electricity demand from renewable sources by 2020. This does not mean that Scotland will be fully dependent on renewables, but that they will be the backbone of a broader electricity mix. In 2019, the equivalent of 90.1% of gross electricity consumption[iv] was from renewables, rising from 76.7% in 2018 [9] .

Another relevant target is to produce the equivalent of 50% of the energy for heat, transport and electricity use from renewables by 2030. In 2018 this was 21%, rising from 19% in 2017 [9] .

Of the 41.6 $MtCO_2e$ emitted in 2018, electricity generation accounted for 2.2 $MtCO_2e$ or 5.2% of total emissions - the second lowest after the waste sector (4.1%) [10] . This represents an 85% reduction on 1990 levels, but a rise of 7% since 2017 due to an increased use of gas generation at Peterhead. The overall reduction on 1990 levels is due primarily to the closure of both Longannet and Cockenzie coal fired power stations, as well as a reduced reliance on gas [2] .

2018 CCP - Electricity

The 2018 CCP [1] has the following key ambitions for the electricity sector:

- By 2032, Scotland's electricity system will be largely decarbonised and will come from renewable sources including onshore and offshore wind, hydro, solar, marine and bioenergy
- Smart grid technology and better connection will improve the electricity system
- At least 1GW of renewable energy will be in community or local ownership by 2020.

Two Policy Outcomes are set out, with various supporting policies and associated 'development milestones':

- From 2020 onwards, Scotland's electricity grid intensity will be below 50 grams of carbon dioxide per kilowatt hour (gCO_2/kWh). The system will be powered by a high penetration of renewables, aided by a range of flexible and responsive technologies
- Scotland's energy supply is secure and flexible, with a system robust against fluctuations and interruptions to supply.

iv Gross electricity consumption refers to total electricity generation minus net exports

The 2018 CCP also highlights Carbon Capture and Storage (CCS), as a key technology "to provide low carbon flexible power generation". CCS is asuite of technologies and processes which can decarbonise fossil fuel generation. It involves capturing CO_2 emitted from high-producing sources, transporting it and storing it in secure geological formations deep underground. The transported CO_2 can also be reused in processes such as enhanced oil recovery or in the chemical industry, a process sometimes known as carbon capture and utilisation (CCU) [11] . The IPCC considers that it would cost 138% more to limit warming to within 2°C without CCS [12] .

The 2018 CCP expects that, over the lifetime of the Plan (i.e. by 2032) emissions in the electricity sector will have fallen by 28% [1] .

CCP Monitoring Report

The 2019 Climate Act requires individual sector by sector monitoring reports to be laid before the Scottish Parliament annually.

In relation to **Policy Outcome One** the Scottish Government's most recent monitoring report shows that, in 2017, Scotland's grid intensity was 24 gCO_2/kWh, a fall of 56% since 2016. The report states [13] :

> “ Renewable electricity generation capacity in Scotland has more than trebled in the last ten years; as of June 2019, there was 11.6 GW of installed capacity across the country.”

For **Policy Outcome Two** the monitoring report states that electricity and gas supplies "remain secure", noting that, in winter 2018/19 peak electricity demand in Scotland was 5.3GW, well "within Scotland’s maximum supply capacity from non-intermittent[v] sources, which was 10.0 GW". The report states [13] that:

> “ [...] the Scottish Government will continue to engage with network operators and owners, as well as with Ofgem and the UK Government, to ensure that network investment, innovation and regulation remains sufficient to ensure a secure and resilient transmission network, with stronger interconnectors between Scotland and Europe.”

Further key points include:

- In 2018, electricity generated from renewables increased 6% on 2017 levels (an already record year); this is due primarily to an increase in generation from onshore wind
- Installed capacity of renewable generation increased from 10.5 GW to 11.6 GW (10%) from 2018 to 2019
- Whilst not all projects will be commissioned, there is 13.0 GW of renewable electricity capacity either under construction (1.1GW), awaiting construction or in planning (10.9GW) - the majority of this is onshore and offshore wind

---

v Including dispatchable on demand generation in Scotland (gas, nuclear, hydro and pumped storage) plus the secure import capability from the Island of Ireland (which is one electricity market) over the Moyle interconnector, and over the GB transmission system from England and Wales. Not including wind and solar.

- Wave and tidal is the next largest renewable technology, with 0.38 GW awaiting construction or in planning. There is currently 0.02 GW of this technology operational in Scotland
- It is however expected that recent changes to subsidy schemes for renewables will impact on potential new projects, of all sizes
- In 2018, an estimated 697 MW of community and locally owned renewable energy capacity was operational. This is a 6% increase on 2017 figures
- The Scottish Government targets 1 GW of community and locally owned energy by 2020 and 2 GW by 2030. The 697MW estimated above was 70% and 35%, respectively, towards these targets.

Recent Reports - Electricity

As the backbone of a decarbonised power sector, delivering significant renewable electricity capacity is crucial to achieving net-zero emissions. This section sets out recent scrutiny of progress.

Climate Change Committee Reports

The CCC has published two key pieces of advice, and its annual Progress Report to Parliament in recent months.

Advice on building a resilient recovery from the pandemic

Advice on building a resilient recovery from the COVID-19 crisis to the Scottish Government [14] encourages "major stimulus to an economic recovery that is built around sectors that are green and growing", and to sectors that "would improve air quality, which is critical to public health, and reduce society's exposure to external shocks (e.g. oil price volatility)".

In relation to skills development, Scotland is considered to have a "crucial role to play in delivering training and apprenticeships to develop the new and updated skills that are needed in the transition to net-zero and for the changing climate", including in:

- Low-carbon heating (especially heat pumps)
- Energy efficiency
- Future low-carbon industries (including CCS)
- Offshore and remote island wind
- Research into and management of the changing energy system.

Specifically, the advice states [14] :

> “ **Strengthening energy system networks.** Electricity networks must be significantly strengthened across the UK to accommodate electrification of heat and transport. There is also an urgent need for measures to provide for more orderly and cooperative onshoring of offshore wind energy. New hydrogen and CCS infrastructure will be needed to support the next phase of the net-zero transition. Post-COVID-19 economic recovery presents an opportunity for governments, regulators and the industry to work together to accelerate these investments. The costs of these will need to be borne at some point as part of the net-zero transition in any case and can be recovered through modest increases in customer bills over periods of several decades.”

2020 Progress Report to the Scottish Parliament

The CCC's **Reducing emissions in Scotland – 2020 Progress Report to Parliament** [15] notes the significant decarbonisation in the electricity sector, with renewable generation "almost tripling" and fossil fuel generation falling by 70%. It states:

> “ As Scotland enters its second decade with climate legislation, the Scottish economy has decarbonised more quickly than the rest of the UK, and faster than any G20 economy since 2008. Emissions have fallen rapidly while the economy has grown. However, the vast majority of emissions reductions have been limited to the power [electricity] sector.”

A "new era" for climate action is considered to be commencing this decade with the "prospective end of unabated fossil-fuelled electricity generation and the rapid rise of cheap low-carbon electricity". Therefore, the challenge is now to decarbonise other sectors, predominantly through electrification, and to "increase flexibility in the power system to help meet the challenge of operating a system using large amounts of energy from renewables" [15] .

The CCC notes that the Scottish Government has achieved the key policy milestone of launching the first round of seabed leasing for offshore wind in Scottish waters in over a decade, and that a refreshed Energy Strategy is expected to be published in 2021.

The CCC also recommends that the Scottish Government [15] :

- 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.

The CCC further recommends that the National Planning Framework (NPF4) aligns with a net-zero energy system - publication of NPF4 has been delayed due to the pandemic, and is currently expected in autumn 2021.

The UK Government has made partial progress in relation to renewable electricity with 6 GW of offshore wind having been procured at record low prices – of which 740 MW is in Scottish waters – and onshore wind and solar are to be given the chance to bid for new Contracts for Difference[vi].

---

vi The UK Government’s main mechanism for supporting low-carbon electricity generation which guarantees a fixed price for generation

The CCC however notes that there are "remaining gaps" in the UK Government's approach, in particular:

> “ Near-term and longer-term investable mechanisms must be developed for industrial decarbonisation, especially for carbon capture and storage (CCS) and fuel switching.”

The UK Government has also made policy progress in 2019/20; including:

- A third CfD allocation round for offshore wind, leading to record low prices for electricity
- Consulting to changes to the CfD scheme to aid the development of floating offshore wind
- Reversing the previous exclusion of onshore wind and solar PV from subsidy schemes; they will now be included in the next round of CfD auctions
- Requiring electricity networks to demonstrate to Ofgem how their business models are compatible with Net Zero.

The Progress Report states:

> “ As of March 2020, Scotland has 11.9 GW of installed renewable generation capacity operational with a further 13.5 GW in the pipeline. Scotland produced 90.1% of its gross electricity consumption from renewable sources in 2019, putting the 2020 target of 100% within reach.”

Advice on achieving 2030 interim target

The CCC's **advice to the Scottish Government on achieving the interim 2030 target of a 75% reduction in GHG emissions** [4] was published alongside the CCC's advice on the UK's Sixth Carbon Budget[vii] [16] which sets out five scenarios for how net-zero can be achieved by 2045 (Scotland) and 2050 (UK). The CCC states [4] :

> “ we find that the legislated 2030 target of a 75% reduction in Scottish emissions goes beyond any of our five scenarios for emissions reduction by that date.”

The CCC's "Balanced Net Zero Pathway", which is its recommended route to net-zero, is "consistent with the Scottish 2040 and 2045 targets, but is likely to fall well short of the legislated 75% target in 2030". Their highly optimistic "tailwinds" scenario which "would be extremely challenging in a wide range of areas and goes beyond the current evidence in others" aims to achieve net-zero as early as possible, and would only achieve a 68 - 73% reduction in emissions by 2030.

Nevertheless, the CCC recognises that the "2030 target is a statutory target and must be met". A series of possibilities for consideration are set out, however these relate predominantly to other sectors. The key recommendation, in relation to electricity is:

- **Early decarbonisation of the Grangemouth cluster**[viii] . Earlier availability of

vii A carbon budget places a restriction on the total amount of GHG the UK can emit over a 5-year period; in this case 2032 - 2037

> infrastructure for hydrogen and for CO_2 transportation and storage, together with accelerated electrification, at the Grangemouth cluster – alongside policy incentives that avoid detrimental impacts on competitiveness – could conceivably bring forward emissions reductions from the 2030s to the late 2020s. Bringing these emissions reductions around the Grangemouth cluster six years earlier than we have assumed could, if feasible, provide a further 2.3% of abatement.

Parliamentary, and Other Scrutiny

In June 2020, the Environment, Climate Change and Land Reform Committee launched an **inquiry to establish the principles that should underpin a green recovery**, to identify key actions for change, immediate priorities, potential barriers to implementation and the governance arrangements needed to deliver this. The Committee's report was published in November 2020 [17] .

The Committee heard that significant investment in distribution and transmission grid infrastructure as well as high voltage, direct current (HVDC) electric power transmission is needed – there was concern that Ofgem's forthcoming price control will restrict funding for energy networks.

Further market support for renewables was also considered to be necessary, as well as a robust carbon pricing regime, progressively funded through taxation rather than consumer bills to limit the impact on fuel poverty levels.

In relation to planning, the Committee considered that there should be a presumption in favour of renewables projects set out in National Planning Framework 4 (NPF4). The climate emergency and the achievement of net-zero should also be made material considerations in any planning application.

The Committee urged [17] :

> " [...] the Scottish Government to continue to press both the UK Government and Ofgem to invest in, and enable, the swift development of infrastructure and the energy network to effectively deliver a low carbon transition. Enabling much of this investment relies on action at UK Government level, but is critical to the green recovery, and Scotland's response to the climate emergency."

Throughout Session 5, the Economy, Energy and Fair Work Committee has scrutinised energy policy in Scotland. Most recently, the **Three-Part Energy Inquiry**, linked an overview of the Royal Society of Edinburgh's Scotland's Future Energy Report with consideration of electric vehicle infrastructure, and local energy systems (including community and locally owned energy) [18] . Relevant findings include:

- No energy policy, however well considered, can solve all of the paradoxes of energy demand and supply, the Committee recognised the challenges in balancing the competing issues of the energy quadrilemma (climate change/affordability/security/ sustainability)

---

viii Focused around the Ineos refinery complex, this cluster annually produces around two million tonnes of chemical products and is Scotland's sole crude oil refinery. It is the proposed site of the Caledonia Clean Energy Project

- Given the scale and complexity of the energy quadrilemma, there is a need for a long-term strategic framework; one covering all aspects of energy, taking a continuous and whole systems approach, and which could include the establishment of an independent expert advisory commission as previously recommended by the Committee.

  “ The foundations for such a framework must be built on good governance, policy expertise, cross-party buy-in (as has been the case for climate change), a whole systems approach, and long-term ownership.”

The Economy, Energy and Fair Work Committee also has an ongoing interest in the offshore wind sector and Scottish supply chain, in particular why Burntisland Fabrications (BiFab) has failed to gain contracts from recent, local, offshore wind projects [19] .

Climate Emergency Response Group

A group of "like-minded leaders spanning Scotland’s private, public and third sectors, delivery organisations and membership bodies" came together to form the **Climate Emergency Response Group** (CERG) in August 2019. CERG's Green Recovery and Climate Emergency Response: interim assessment of progress [20] concurs largely with the issues highlighted by the CCC in their Progress Report to Parliament [15] , and considers that in relation to electricity, proposals have been met in part but gaps remain, with the scale of response inadequate and/or delayed. CERG states:

> “ The integrated decarbonisation of heating and transport will require very significantly increased renewable electricity generation and an energy systems approach. The new Sectoral Marine Plan for Offshore Wind and combined Scottish Planning Policy and National Planning Framework currently being prepared by Scottish Government should be designed to deliver the potential renewable energy requirements of a net zero Scotland, across all types of renewable electricity generation, all scales of generation, and all forms of ownership (including local and community owned, as well as commercially developed).”

Gaps and concerns remain in relation to:

- Assessing electricity generation capacity without clearer government policy direction on options to decarbonise heat

- Delay to NPF4 and a lack of interim policy in relation to the climate emergency and planning decisions.

There is therefore a need to refocus the planning process to deliver net-zero, with NPF4 ensuring that the climate emergency is a material consideration in planning decisions.

Draft CCPu- Electricity

As previously noted, increasing Scotland's renewable electricity capacity is critical to enabling decarbonisation in other sectors i.e. transport, buildings and industry.

The draft CCPu [2] recognises this, and also notes a continued desire to export to the rest of the UK and to the rest of Europe. Substantial challenges exist, such as maintaining

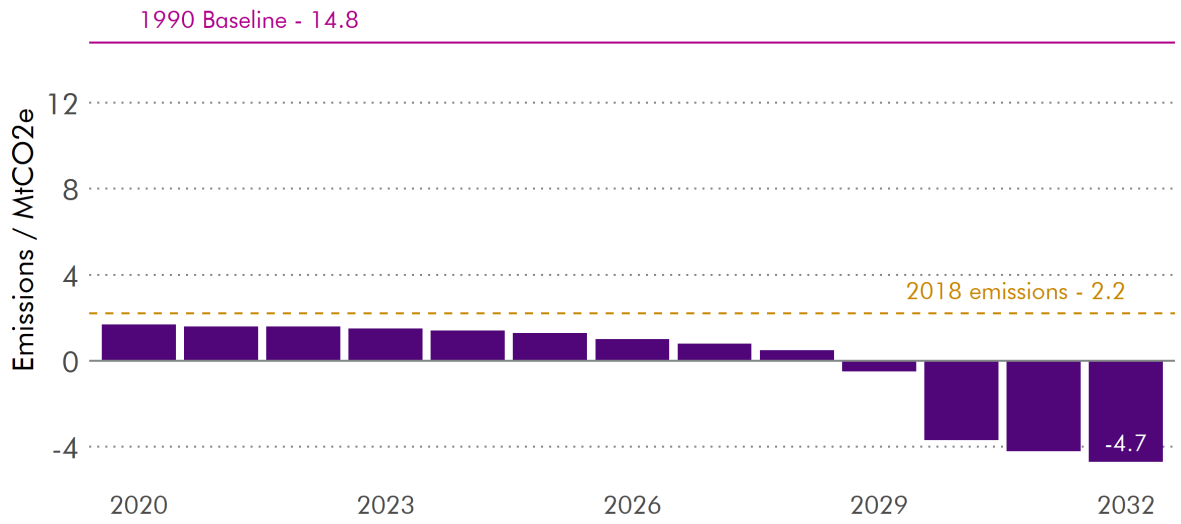
security of supply and resilience[ix] in the electricity system without fossil fuels and nuclear.

An existing technology, which is considered to be crucial, is pumped storage hydro power, as it can release stored electricity when needed. New technologies will also be needed to move from the existing low carbon system to deliver negative emissions (negative emissions technologies - NETs) initially with a technology known as bioenergy with carbon capture and storage (BECCS)[x].

The draft CCPu [2] anticipates that, via a range of policies and proposals across three key outcomes, and combined with NETs (considered later in this briefing), the following emissions reduction pathway can be achieved:

Figure 4 - Anticipated Emissions Reductions Electricity 2020 - 2032

$MtCO_2e$ - million tonnes of carbon dioxide equivalent



A 376% reduction in emissions out to 2032 is expected (100% excluding NETs), in comparison to a 28% reduction in 2018's CCP. The draft CCPu assumes that emissions in 2020 will be 1.7$MtCO_2e$ - 23% lower than in 2018.

As with many of the key sectors, the outcomes, policies and proposals included in the electricity sector of the CCPu have changed from the 2018 CCP, making direct comparisons difficult.

Outcome One

Outcome 1 states that the "electricity system will be powered by a high penetration of renewables, aided by a range of flexible and responsive technologies". New policies in relation to this include publishing a revised Energy Strategy, and a Hydrogen Policy Statement followed by an Action Plan in 2021. The key 2030 target of 50% of all energy consumption (electricity, heat and transport) being from renewables is maintained.

---

ix Grid resilience is the ability to withstand and reduce the magnitude and/or duration of disruptive events, and to rapidly recover from these [21]

x The role of BECCS and other Negative Emissions Technologies (NETs) is explored in more detail in the relevant section

Key proposals in relation to Outcome 1 include:

- Introducing new support for energy technology innovation, through the the £180 million Emerging Energy Technologies Fund. This is expected to deliver a "a step change in emerging technologies funding to support the innovation and commercialisation of renewable energy generation, storage and supply"
- Ongoing focus on local energy projects through the Community and Renewable Energy Scheme which supports the targets of 1 GW and 2 GW of renewable energy being in local or community ownership by 2020 and 2030. It is not clear why this is included as a proposal, when it is a long established target with associated funding
- Researching the potential to deliver negative emissions from the electricity sector
- Supporting the development of 8 - 11 GW of offshore wind by 2030 through the actions set out in the Offshore Wind Policy Statement.

The success of these policies and proposals is measured by three indicators; the installed capacity and planned capacity of renewable generation, and the carbon intensity of the electricity grid. This latter indicator was one of the key outcomes of the 2018 CCP.

Outcome Two

Outcome 2 aims for Scotland's electricity supply to be "secure and flexible, with a system robust against fluctuations and interruptions to supply". This is essentially the same as in 2018's CCP, and the key policy related to this is to:

> “ Support the development of technologies which can deliver sustainable security of supply to the electricity sector in Scotland and ensure that Scottish generators and flexibility providers can access revenue streams to support investments.”

A series of proposals support this outcome, the majority of which are reserved to the UK Government, and which are maintained from the previous CCP. These include: pressing for favourable market conditions and incentives to support investment in infrastructure; collaboration to ensure that systems and networks use data and digital technologies to become smarter and more flexible; and supporting (within devolved competence) increased interconnection to aid security of supply.

New proposals include consulting on technologies that can support the delivery of sustainable security of supply (e.g. energy storage and smart grid technologies) and developing a series of whole system energy scenarios to guide investment.

The success of these policies and proposals is measured by loss of load expectation in hours per year. In short, this is the expected time for which available generation is insufficient to meet demand. It is a standard security of supply metric used in the electricity market, and the current GB standard is below 3 hours per year.

Outcome Three

Outcome 3 expects that Scotland will secure "maximum economic benefit from the continued investment and growth in electricity generation capacity and support for

the new and innovative technologies which will deliver our decarbonisation goals". This new focus on jobs and the supply chain appears to respond to many of the concerns and issues that have been raised by the Parliament's Economy, Energy and Fair Work Committee in relation to the BiFab, the offshore wind sector and Scottish supply chain Inquiry [19] .

No policies, but three proposals are set out:

- Press the UK Government to reform the subsidy mechanism (known as Contracts for Difference) so that more economic benefits are available to domestic supply chains
- Introduce new requirements for developers to include supply chain commitments when applying to the ScotWind leasing process run by Crown Estate Scotland
- Identify and support major infrastructure improvements to support the Scottish supply chain.

There are no indicators associated with this outcome.

Buildings

Context

The buildings chapter of the draft CCPu includes the residential sector (all of Scotland's homes) and the services sector (all non-domestic buildings in the public and commercial sectors).

There around 2.48m homes in Scotland and 200,000 non-domestic buildings in Scotland, including around 20,000 public sector buildings.

In 2018, direct emissions from buildings accounted for 9.4 $MtCO_2e$, around 23 % of total Scottish emissions. Direct emissions from buildings increased by 4% from 2017, which is likely to be driven by the extreme cold weather event, the 'Beast from the East', in March 2018 [5] [15] .

Most emissions from buildings are generated from heating space and heating water. In 2018, 81% of Scottish households (around 2.0 million) used mains gas for heating and cooking, 10% used electricity and 6% used oil [22] . In the service sector, the majority of energy is used for cooling.

Policies which can help to reduce emissions from buildings are governed by a mix of reserved and devolved powers. Under the 1998 Scotland Act, heat policy, energy efficiency building standards and planning consent for infrastructure are devolved. However, regulation of energy markets, oil and gas, electricity and gas networks and consumer protection remain reserved to the UK Government.

As the Scottish Government's 2020 Programme for Government noted [23] , to achieve Scotland’s net-zero emission targets, emissions from space and water heating need to be effectively eliminated by 2040-45. This will require action to continue to reduce demand for heat in homes and buildings through energy efficiency measures. It will also require fossil fuel heating systems to be replaced with renewable or zero emissions sources such as

heat pumps, solar water heating and biomass boilers.

2018 CCP - Buildings

The 2018 CCP is focussed on improving the energy efficiency of buildings and increasing the use of low carbon heating systems.

The plan has four policy outcomes (which appear to have been replaced by new policy outcomes in the draft CCPu):

Table 1 - 2018 Climate Change Plan: Buildings Policy Outcomes

2018 Climate Change Plan: Buildings Policy Outcomes
1. By 2032, the energy intensity of Scotland's residential buildings will fall by 30% on 2015 levels
2. By 2032, the emissions intensity of residential buildings will fall by at least 30% on 2015 levels
3. By 2032, non-domestic energy productivity to improve by at least 30% on 2015 levels
4. By 2032, the emissions intensity of the non-domestic sector will fall by at least 30% on 2015 levels

N.B. Energy intensity relates to the amount of energy required and therefore relates to the energy efficiency of buildings. Reducing heat demand from insulation measures is one factor that contributes to reducing total energy consumption but other factors, including efficiency improvements in boilers or other household equipment, also contributes.

Emissions intensity relates to the greenhouse gas emissions associated with how heat is produced, and is therefore linked to the carbon intensity of the heating source.

Scottish Government, 2018[1]

Other targets were outlined in the 2018 plan, including that:

- Low carbon technologies (e.g. heat networks) will supply heat to 35% of domestic and 70% of non-domestic buildings by 2032
- Where technically feasible by 2020, 60% of walls will be insulated and 70% of lofts will have at least 200mm of insulation in the residential sector.

There is a wide range of policy action to meet these outcomes and targets. This briefing does not attempt to cover all these in detail. However, the following summarises some of the main policies and policy developments since publication of the plan.

Buildings: policies and recent developments

Many of the policies in the 2018 CCP are encompassed in the Scottish Government's Energy Efficient Scotland programme Energy Efficiency Scotland. The Programme will run to 2040 and brings together strategies and action to remove poor energy efficiency as a driver of fuel poverty and reduce carbon emissions through more energy efficient buildings and decarbonising heat supply.

In relation to **energy efficiency** specific policies include:

- **Home Energy Efficiency Programmes**

- **Energy efficiency standards for social housing**
- **The Non Domestic Public Sector Energy Efficiency** (NDEE) Framework designed to support public and third sector organisations procure Energy Efficiency retrofit work
- Under the UK Government's Energy Company Obligation scheme, medium and larger energy suppliers fund the installation of energy efficiency measures in British households (powers over their design and delivery have been devolved).

The Energy Efficient Scotland Route Map , published in May 2018, proposed a set of longer-term energy performance standards for all buildings in Scotland, including specific targets for properties with fuel poor households [24] . These standards are based on an Energy Performance Certificate Rating (EPC) which present the calculated greenhouse gas emissions for buildings on a scale from A (highest) to G (lowest):

- All homes should be Energy Performance Certificate -Efficiency Rating Band C by 2040 (where technically feasible and cost effective)
- All homes with households in fuel poverty to reach EPC C by 2030 and EPC B by 2040 (where technically feasible, cost effective and affordable).

How this standard will be implemented will vary between tenures, with social rented housing expected to achieve higher energy efficiency standards earlier than other tenures.

The Scottish Government has also announced that all new buildings given consent from 2024 will need to be zero-emission. Its recently launched scoping consultation on the New Build Heat Standard sets out its high-level vision for this [25] .

The Fuel Poverty (Targets, Definition and Strategy) (Scotland) Act 2019 set a target to eliminate fuel poverty as far as possible, with no more than 5% of households to be in in fuel poverty and no more than 1% in extreme fuel poverty by 2040.

Local authorities have also been piloting the development of local heat and energy efficiency strategies to establish authority area-wide plans and priorities for systematically improving the energy efficiency of buildings and decarbonising heat.

Low carbon heating policies include:

- The Scottish Government's **District Heating Loan Fund ,** designed to help address financial and technical barriers to district heating projects by offering low interest loans. **A Heat Network Partnership** also aims to boost the uptake of low carbon heat technologies in Scotland and focuses the efforts of a number of agencies working in this area
- The Heat Networks (Scotland) Bill provides a framework for regulation and licensing of district and communal heating networks across Scotland. Heat networks can use a variety of heat sources and are often more efficient than individual fossil fuel heating systems They can also be run fully from renewables, recovered waste, or surplus heat sources where appropriate
- The Low Carbon Infrastructure Transition Programme (LCITP), co-funded by the European Regional Development Fund (ERDF), supports investment in decarbonisation of business and the public sector. Additionally, the UK Government Renewable Heat Incentive promotes the use of renewable heat.

Buildings: 2020 Programme for Government

In its 2020 Programme for Government, the Scottish Government committed nearly £1.6bn over the next Parliament towards eliminating emissions from heating by 2040 [26] .

This investment includes existing capital commitments in heat and energy efficiency of £900 million, together with a further £425m of capital spend and £225 million of investment in wider heat and energy efficiency, low-carbon, and renewable programmes. This will include the decarbonisation of the public sector estate, a £50m Green Recovery Low Carbon Infrastructure Transition Programme, and £25m for zero carbon energy infrastructure and heat networks for residential and commercial premises.

Recent Reports: Buildings

The Climate Change Committee's 2020 Progress Report to Parliament acknowledged that some progress with emissions from buildings over the longer term has been made reflecting genuine improvements. Total emissions have fallen by 16% from 2008 to 2018, with progress mainly seen in residential buildings [15] .

The Scottish Government’s 2019 Climate Change Plan Monitoring report also identified increasing energy efficiency levels of buildings, with a 6% increase in dwellings rated as EPC band C or better between 2015 and 2017 [13] . The Report also monitors progress towards the 2018 Plan’s four policy outcomes through output indicators. For all four indicators the report concluded that it was too early to assess whether the targets were on track to be met.

Despite progress with improvements in energy efficiency, the Climate Change Committee states that the bulk of the challenge to decarbonise buildings in Scotland remains. There is a need to shift away from fossil gas to low-carbon heat solutions and to improve the energy efficiency of existing homes at a faster rate.

> “ The bulk of the challenge to decarbonise buildings in Scotland remains, with the greatest challenge on decarbonising heating and hot water:”
>
> - **Low-carbon heat in existing homes**. The major challenge for the buildings sector remains the need to shift homes away from fossil gas to low-carbon heat solutions. The last decade has seen limited progress in this area under the Renewable Heat Incentive (RHI), although Scotland has a proportionately higher number of accreditations on the GB-wide RHI scheme relative to its population. There were fewer than 13,500 heat pumps in Scotland in 2018. Scotland is not currently on track to meet its 2020 target of 11% of non-electric heat from renewable sources, let alone a level of low-carbon heat that is consistent with Net Zero”
>
> - **Energy efficiency in existing homes**. The major challenge of widespread building renovation and retrofit to increase building heat efficiency is yet to be addressed, although some progress in improving EPC of homes has been made, particularly in houses moving out of EPC bands D and E and into band C”
>
> - **New homes. Scotland's new build standards** – due to be legislated in 2021 – must ensure that all new homes use low-carbon heat, are ultra energy efficient and are designed for a changing climate.”
>
> Climate Change Committee, 2020[15]

In terms of non-residential buildings, the Committee noted that the Scottish Government was yet to set out its proposals for non-domestic buildings, including a benchmarking mechanism to create a long-term energy efficiency standard and setting regulatory ‘backstop’ dates as milestones for non-residential buildings.

The Climate Emergency Response Group's report, published in November 2020, made a similar assessment of Scottish Government progress. It identified areas of positive progress including, large multi-year funding commitments, doubling of heat pump installations and heat pump sector deal and the target of zero emissions from heating buildings by 2040 [20] .

On the other hand, the report identified gaps and concerns including a lack of policy signal in terms of regulating energy performance standards for existing buildings and that the strategy for non-domestic buildings remains unclear. In their report the Group argued that issues around public sector capacity to deliver heat networks remain unresolved, preventing increased capital spend in the long run.

In their advice to the Scottish Government on achieving the interim 2030 target of a 75% reduction in GHG emissions, the CCC indicated that this target might not be feasible. However, as this is a statutory target it provided advice on how progress could be made including the additional retrofit of hybrid heat pumps.

It also suggested that there could be accelerated scrappage of high-carbon assets, for example, gas boilers could be replaced before they reach the end of their natural life. However, it also identified risks to this approach as it, “carries extra cost to consumers or public expenditure and risks undermining popular support for the transition. It also increases embedded emissions through the production of new assets” [4] .

Recent Parliamentary scrutiny of a Green Recovery from Covid - 19 by the Environment, Climate Change and Environment Committee made a key recommendation that [17] :

> “ The Scottish Government, develop, fund and mandate a comprehensive programme to bring Scotland’s existing housing stock, particularly pre-1919 tenements and other hard to treat homes, up to an improved and sustainable level of energy efficiency, in line with the recommendations of the CCC. A fresh approach is required to ensure that those living in conservation areas and listed buildings have access to the best performing technologies, and that their decarbonisation efforts are not hampered by historic designations.”

Draft CCPu - Buildings

The draft CCPu emphasises the transformational change needed to progress to net-zero carbon by 2045.

> “ The zero emissions heat transition will involve changing the type of heating used in over 2 million homes and 100,000 non-domestic buildings by 2045, moving from high emissions heating systems, reliant on fossil fuels, to low and zero emissions systems such as heat pumps, heat networks and potentially hydrogen [...] We estimate that around 50% of homes, or over 1 million households, will need to convert to a low carbon heating system by 2030 to ensure our interim statutory targets are met […] [...] up to an additional 50% of non-domestic buildings will need to be converted to low and zero emissions heating by 2030.”
>
> Scottish Government, 2020[2]

Within the context of the green recovery and fair and just transition, the update places a greater emphasis on the economic impact of investments in energy efficiency and low carbon heating technologies than the 2018 plan did. It also makes more closer links to the fuel poverty agenda with an emphasis that delivery on targets will need to be developed:

> “ in a way that carefully coordinates the dual challenges of decarbonisation and tackling fuel poverty to ensure a fair and just transition.”
>
> Scottish Government, 2020[2]

The plan identifies the key things that are needed to deliver the necessary changes, including:

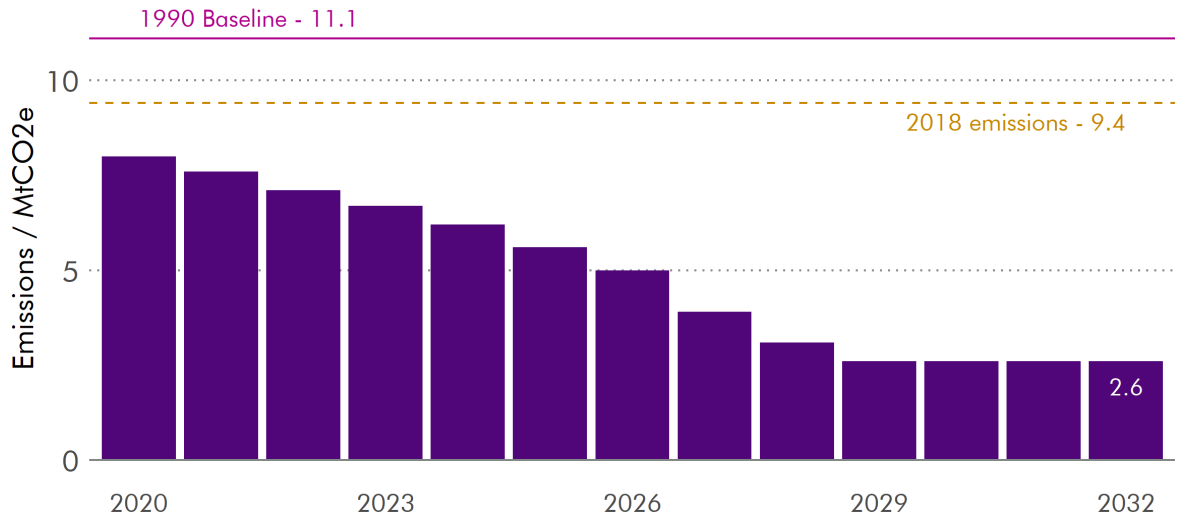
- Rapid growth in the supply chain ahead of the mass rollout of zero and low emissions heating systems commencing in the mid-2020s
- Further technology innovation
- Cost reductions and increased familiarity with and adoption of zero emissions heating technologies by people and businesses
- The wider energy system will have to transform to be able to supply secure and affordable zero emissions electricity at scale. Furthermore, they depend upon the right market and pricing signals and regulations being in place
- Designing policies that do not increase energy debt.

Figure 5 shows the anticipated emissions reductions in buildings between 2020 and 2032. By 2032 emissions from buildings are expected to reduce by 67.5% to 2.6 $MtCO_2e$. This reduction is substantially greater than the 32.6% reduction (from 2018 to 2032) projected

in the 2018 CCP. Emissions in 2020 are projected to be 8 $MtCO_2e$ - 15% lower than in 2018.

Figure 5 - Anticipated Emissions Reductions Buildings 2020 - 2032

$MtCO_2e$ - million tonnes of carbon dioxide equivalent



Scottish Government, 2020[2]

Policy Outcomes and Policies

The draft CCPu sets out 4 policy outcomes which appear to replace those in the 2018 plan. Outcomes 1 and 2 are similar to the 2018 plan and relate to low carbon heating and energy efficiency. However, unlike the 2018 plan, there is no distinction between residential and non-residential buildings.

The second two outcomes relating to green gas supply and a fair heat transition that stimulates employment opportunities are new.

Outcome 1: The heat supply to our homes and non-domestic buildings is very substantially decarbonised, with high penetration rates of renewable and zero emissions heating.

Outcome 2: Our homes and buildings are highly energy efficient, with all buildings upgraded where it is appropriate to do so, and new buildings achieving ultra-high levels of fabric efficiency.

Outcome 3: Our gas network supplies an increasing proportion of green gas (hydrogen and biomethane) and is made ready for a fully decarbonised gas future.

Outcome 4: The heat transition is fair, leaving no-one behind and stimulates employment opportunities as part of the green recovery.

The draft CCPu sets out 47 policies to achieve the above policy outcomes. Of these, nine have been maintained from the 2018 plan, 17 have been ‘boosted’, 19 new polices have

been introduced as have 2 new UK Government policies. The new policies mainly support the development of heat networks and policy outcome 4.

As recommended by the Climate Change Committee, the Scottish Government set out its intention to publish a Heat in Buildings Strategy which brings together the proposed Heat Decarbonisation Policy Statement with the Energy Efficient Scotland Route Map (publication of this has been delayed to January 2021).

The draft CCPu provides a summary of the policies that will be set out in more detail in the Heat in Buildings Strategy. Early action to 2025 will focus on increasing deployment rates of zero and low emissions heating through three broad mechanisms (listed below in bold). This briefing does not summarise all the relevant policies but provides some examples:

1. **Standards and Regulation:** the Scottish Government commits to putting in place standards and regulation for heat and energy efficiency, where it is within legal competence, to ensure that all buildings are energy efficient by 2035 and use zero emission heating and cooling systems by 2045. This represents an acceleration of the current aim of all buildings meeting EPC band C by 2040. However, some groups (such as the Existing Homes Alliance) have argued that this target should be accelerated even further to 2030

2. **Significant investment:** the plan references the 2020 Programme for Government's announcement of £1.6bn investment in heat energy efficiency in the next parliament. There is a commitment to design programmes so as not to exacerbate fuel poverty. Future delivery programmes will be designed to significantly accelerate retrofit building with new programmes to be in place from 2025. The rate of zero emissions heat installations in new and existing homes is planned to double every year to 2025

3. **Supply chain support:** over the next 12 months the Scottish Government plans to build a more detailed understanding of the potential for supply chain growth. Other actions include setting out a supply chain strategy and new skills requirements for installers, designers and retrofit coordinators.

The update recognises that a large part of emissions reductions is predicated on some kind of individual, or societal behavioural change. It refers to plans to set out clear messages and support for building owners on what delivering a net zero emissions buildings will mean for them. Furthermore, the Scottish Government will provide enhanced support to households through existing programmes such as Home Energy Scotland.

Asks of the UK Government

As some of the matters affecting the progress of emissions reductions from buildings are reserved, the draft CCPu sets out the Scottish Government's 'asks' of the UK Government. Of relevance to the buildings chapter, the Scottish Government has asked the UK Government to:

- Accelerate the development of negative emissions technologies, carbon capture and storage, and hydrogen as essential components of our energy system

- Accelerate demonstration of the technological solutions to cutting emissions from our homes and buildings, and in particular set out clear timescales for taking strategic decisions about the future scale and pace of decarbonisation of the gas network to

support delivery of our targets for heat in buildings

- Update energy regulation by giving Ofgem a statutory objective to support the delivery of net zero and interim statutory greenhouse gas emissions targets and address the imbalance in pricing for electricity and gas to better incentivise the deployment of zero emissions heating technologies.

Revised Monitoring Framework

The outcomes indicators for the 2018 Plan have been reviewed. This has led to a revised set of eight indicators for the Buildings chapter reflecting changes to the policy outcomes (see page 246 of the draft CCPu).

The changes in energy intensity and EPC ratings will still be measured as they were in the 2019 monitoring report. There is ongoing work in developing the monitoring framework. One of the indicators is the % of heat in buildings from low greenhouse gas emission sources. The target for indicator will be determined in 2021.

A policy tracker monitoring implementation of specific policies and proposals will also be developed.

Transport

Context

In 2015, transport became Scotland's [27] single largest source of greenhouse gas emissions. In 2018, Scottish transport produced emissions equivalent to 14.8 million tonnes of CO_2 – just 0.5% lower than was produced in 1990. By contrast, total Scottish greenhouse gas emissions fell by 45.5% over the same period.

The biggest generator of Scottish transport emissions in 2018 were cars, accounting for 39% of total transport emissions, followed by shipping (16%), aviation (15%), light goods vehicles (13%), heavy goods vehicles (13%), bus/coach (4%) and rail (1%) – the total does not equal 100 due to rounding.

The Climate Change Committee note in its 2020 Progress Report to Parliament [15] that:

- The current trend on transport emissions is off-track for meeting Scotland's interim emissions reduction targets and net zero
- Despite policies such as Smarter Choices Smarter Places and the Cycling Action Plan, there has been no significant behavioural shift away from cars towards public transport, walking and cycling in Scotland in the last decade
- The ambition in the 2019-20 Programme for Government to aim for zero emission or ultra-low-emission city centres by 2030 will require the provision of ultra-low-carbon public transport options, cycling routes, and extensive deployment of electric vehicle recharging infrastructure to support a shift away from the use of conventional vehicles.

2018 CCP - Transport

The current version of the Climate Change Plan, published in 2018, predicted a 37% reduction in transport emissions between 2018 and 2032, falling from 12.8 $MtCO_2e$ to 8.1 $MtCO_2e$. This fall would be delivered through the achievement of eight transport policy outcomes. These are set out below, along with an indication whether they have been carried over, superseded or no longer feature in the draft Climate Change Plan update:

Table 2 - 2018 CCP Policy Outcomes

	Policy outcome	Status in CCPu
1	Average emissions per kilometre of new cars and vans registered in Scotland to reduce in line with current and future EU/UK vehicle emission standards:	Does not feature
2	Proportion of ultra-low emission new cars and vans registered in Scotland annually to reach 100% by 2032.	Date brought forward to 2030
3	Average emissions per tonne kilometre of road freight to fall by 28% by 2032.	Does not feature
4	Proportion of the Scottish bus fleet which are low emission vehicles has increased to 50% by 2032.	Superseded by new bus decarbonisation outcome
5	By 2032 low emission solutions have been widely adopted at Scottish ports and airports	Carried forward
6	Proportion of ferries in Scottish Government ownership which are low emission has increased to 30% by 2032.	Carried forward
7	We will have electrified 35% of the Scottish rail network by 2032.	Superseded by new rail decarbonisation outcome
8	Proportion of total domestic passenger journeys travelled by active travel modes has increased by 2032, in line with our Active Travel Vision, including the Cycling Action Plan for Scotland Vision that 10% of everyday journeys will be by bike by 2020.	Does not feature

The delivery of these eight outcomes was reliant on 35 policies and proposals. Of these 35, the draft CCPu includes four polices or proposals that have been “boosted” and 12 that are unchanged. The other 19 do not feature in the draft CCPu.

Initial progress towards meeting the outcomes set in the 2018 CCP was reported in the 2019 Monitoring Report. However, this notes that:

> “ ..it is too early to make an assessment on the majority of indicators.”

This was largely due to transport data being either unavailable or insufficient for any assessment to be made.

Recent Reports - Transport

Transport Scotland sets out the vision for the development of Scotland’s transport system over the next 20 years in the [28] National Transport Strategy 2 (NTS2), published in February 2020. The vision being:

> “ We will have a sustainable, inclusive, safe and accessible transport system, helping to deliver a healthier, fairer and more prosperous Scotland for communities, businesses and visitors.”

This vision is supported by four priorities, one of which is “takes climate action”. The form

of this action is set out in six policies:

1. Reduce emissions generated by the transport system to mitigate climate change
2. Reduce emissions generated by the transport system to improve air quality
3. Ensure the transport system adapts to the projected climate change impacts
4. Support management of demand to encourage more sustainable transport choices
5. Facilitate a shift to more sustainable and space-efficient modes of transport for people and goods
6. Improve the quality and availability of information to enable all to make more sustainable transport choices.

NTS2 also embeds an overarching sustainable transport hierarchy, and associated sustainable investment hierarchy, in Transport Scotland decision making. This involves:

> " …promoting walking, wheeling, cycling, public transport and shared transport options in preference to single occupancy private car use for the movement of people. We will also promote efficient and sustainable freight transport for the movement of goods, particularly the shift from road to rail."

Transport Scotland published the NTS2 Delivery Plan in December 2020, which highlights action to deliver the six policies set out above [29] . This outlines many collaborative working arrangements with local authorities, transport operators and others aimed at decarbonising cars, buses, rail and freight vehicles and encouraging greater use of public transport, walking and cycling. It also mentions several investment and subsidy schemes, such as a £120m investment over five years to support the deployment of battery-electric and hydrogen buses. However, it also briefly refers to projects that will significantly expand the capacity of the trunk road network, such as the dualling of the A9 between Perth and Inverness and A96 between Inverness and Aberdeen. These projects are predicted to increase greenhouse gas emissions, e.g. as set out in the [30] A9 Dualling Case for Investment, and run counter to the recommendation of [31] Infrastructure Commission for Scotland that NTS2 and STPR2 should include:

> " …a presumption in favour of investment to future proof existing road infrastructure and to make it safer, resilient and more reliable rather than increase road capacity."

The delivery of the vision and policies set out in NTS2 is, at a national level, reliant on investment priorities that will be identified in the [32] Strategic Transport Projects Review 2 (STPR2). STPR2 involves an evidence-based review of Scotland's strategic transport network to identify interventions that will support the delivery of Scotland's Economic Strategy. The results of the review will be published in two phases:

- **Phase 1:** To be published in winter 2020/21, will set out projects that can be delivered within two to three years and assist in recovery from Covid-19
- **Phase 2:** To be published in Autumn 2021, will set out recommendations for the development of the transport system over the next 20 years.

More generally, many organisations, such as the [15] Climate Change Committee and [33]

IPCC, have looked at what policy and practical interventions work in stabilising and then reducing transport emissions. While there are many individual policy, budget and fiscal approaches, these can generally be categorised under three broad headings:

- Travel demand management - reducing the need to travel, particularly by car
- Modal shift from car to walking, cycling and public transport
- Decarbonising motorised vehicles – replacing the internal combustion engine with electric and hydrogen fuelled power plants.

Parliamentary, and Other Scrutiny

The Scottish Government's transport policies and projects are scrutinised by the Parliament's Rural Economy and Connectivity Committee. This Committee has "mainstreamed" consideration of climate issues – which means it regularly questions witnesses, including Scottish Ministers, on the climate implications of policy and investment decisions.

More specifically, the Environment, Climate Change and Land Reform Committee's recent Green Recovery Inquiry Report [17] made four climate and transport related recommendations, which can be summarised as follows:

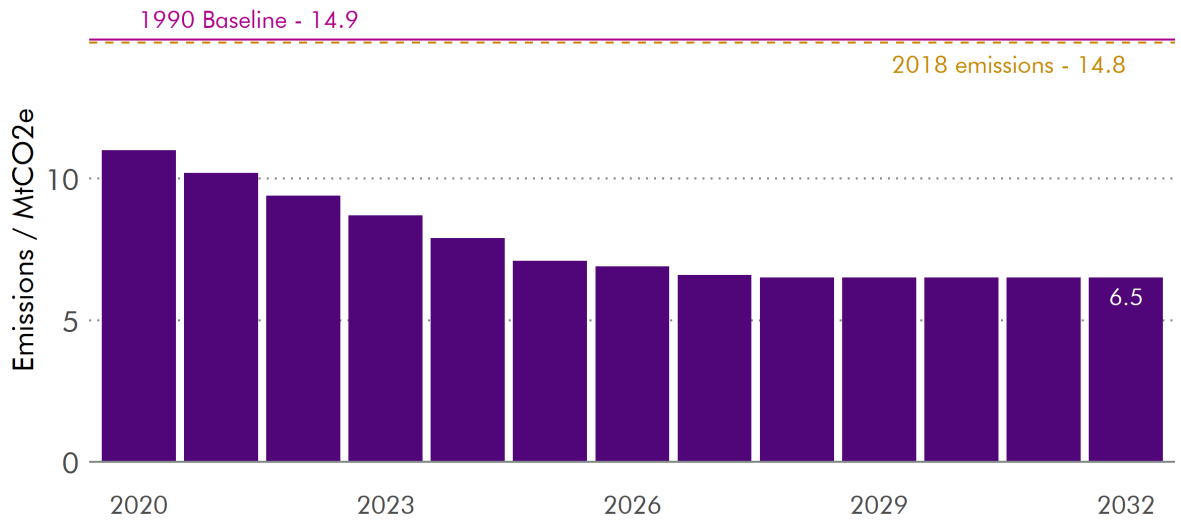
1. The Scottish Government should promote public transport use as part of any green recovery
2. The Scottish Government should support Scottish public transport vehicle manufacturers
3. Transport budgets and fiscal incentives should be targeted at reducing demand for travel by car and encouraging walking, cycling and public transport use
4. The Scottish Governments should support the development of:
    a. comprehensive, uninterrupted networks of safe walking and cycling routes in cities, towns and villages
    b. integrated land-use and transport planning with the aim of creating "20- minute neighbourhoods" where people can access work, leisure and essential services on foot, bike or public transport in no more than 20 minutes.

Draft CCPu - Transport

The draft CCPu predicts a 41% fall in transport emissions between 2020 and 2032, from 11 $MtCO_2e$ to 6.5 $MtCO_2e$, as set out below.

Figure 6 - Anticipated Emissions Reductions Transport 2020 - 2032

$MtCO_2e$ - million tonnes of carbon dioxide equivalent



Scottish Government

The 2032 target is 2.2 $MtCO_2e$ (25.3%) lower than the 8.7 $MtCO_2e$ target set in the 2018 CCP. It is also worth noting that estimated transport emissions of 11 $MtCO_2e$ in 2020 is 3.8 $MtCO_2e$ (25.7%) less than actual transport emissions in 2018 – which would be an unprecedented reduction in such a short period. While [34] Covid-19 travel restrictions imposed during 2020 have produced a significant temporary reduction in transport emissions, a rebound in emission levels is expected. However, the Scottish Government does not appear to predict any bounce back in emissions following the end of the pandemic, when restrictions on local, national and international travel will be lifted (see above graph).

The transport outcomes, policies and monitoring scheme set out in the draft CCPu are significantly different from those in the 2018 CCP as briefly explained below.

The draft CCPu sets out eight policy outcomes:

Table 3 - Draft CCPu Transport Policy Outcomes

	Policy outcome	Change since CCP 2018
1	To address our over reliance on cars, we will reduce car kilometres by 20% by 2030	New outcome
2	We will phase out the need for new petrol and diesel cars and vans by 2030	Date brought forward from 2032
3	To reduce emissions in the freight sector, we will work with the industry to understand the most efficient methods and remove the need for new petrol and diesel heavy vehicles by 2035.	New outcome
4	We will work with the newly formed Bus Decarbonisation Taskforce, comprised of leaders from the bus, energy and finance sectors, to ensure that the majority of new buses purchased from 2024 are zero-emission, and to bring this date forward if possible.	Supersedes previous bus decarbonisation outcome
5	We will work to decarbonise scheduled flights within Scotland by 2040	New outcome
6	Proportion of ferries in Scottish Government ownership which are low emission has increased to 30% by 2032.	No change
7	By 2032 low emission solutions have been widely adopted at Scottish ports	No change
8	Scotland's passenger rail services will be decarbonised by 2035.	Supersedes previous rail decarbonisation outcome

Significant changes in the focus of the policy outcomes set out in the draft CCPu, when compared with those in the 2018 CCP, are briefly highlighted below:

- The focus has shifted from reducing average greenhouse gas emissions from new cars in the period up until 2032 to reducing the total distance travelled by car by 20% by 2030. This commitment is considered in more detail in the SPICe Spotlight post – [35] Back to the Future: reducing car travel in Scotland

- The target of a 28% reduction in emissions for each tonne-kilometre of road freight carried by 2032 has been replaced by a commitment for the Scottish Government to work with the freight industry to remove the need for new petrol and diesel heavy vehicles by 2035. Heavy Goods Vehicles accounted for 13% of Scottish transport emissions in 2018

- The focus on bus decarbonisation has shifted from a target of 50% of all buses being low emission by 2032 to an ambition that most new buses purchased from 2024 will be zero emission. It is worth noting that in 2018/19, the average age of a bus in Scotland was 7.9 years and that buses have an [36] estimated useful service life of 11 years. Buses being brought into service today are likely to still be in service into the 2030's

- Aviation is brought within the outcomes for the first time, with a commitment that scheduled flights within Scotland will be decarbonised by 2040. In 2018, just 5% of passengers flew between two Scottish airports. Given that these are relatively short flights, often made using smaller aircraft, they are likely to account for less than 5% of Scottish aviation emissions

- The focus on rail has shifted from a target of electrifying 35% of the rail network by 2032 (32.4% of which was electrified as of 2017/18), to complete decarbonisation of passenger rail vehicles by 2035. Details of how this will be achieved are set out in a separate [37] Rail Services Decarbonisation Action Plan, published in July 2020.

The eight policy outcomes are to be delivered through 49 policies and proposals, which can be found on pages 221 to 226 of the draft CCPu. 33 of these policies and proposals are new, with only 16 appearing in the 2018 version of the Plan.

Progress towards meeting the policy outcomes will be measured using nine indicators. However, no interim annual figures marking progress towards the eight policy outcomes are set out in the draft CCPu. Progress is simply defined as either “Year-to-year change” or “Progress towards target”.

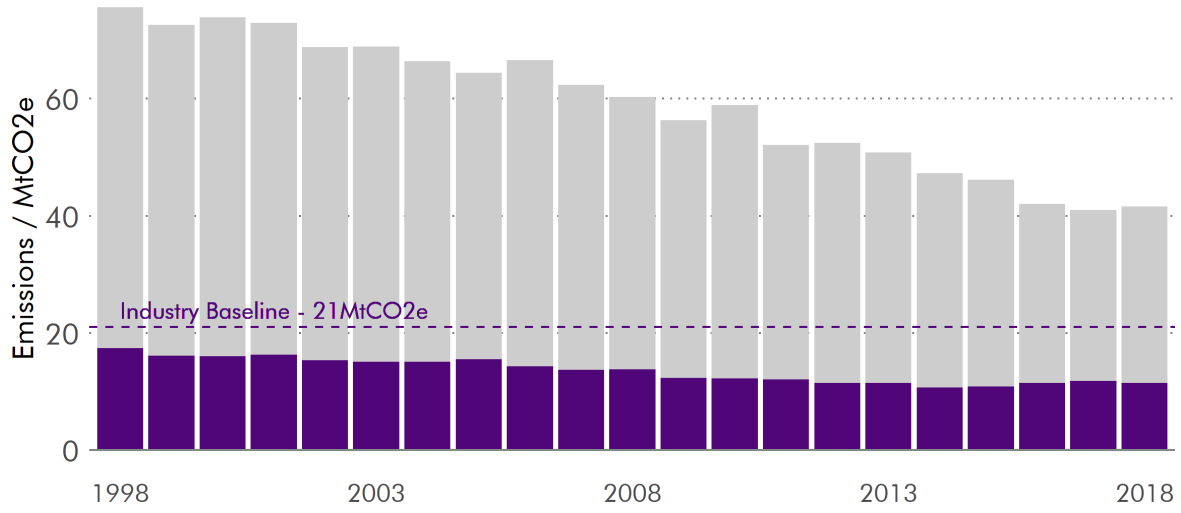
Industry

The draft CCPu reminds us that industry – defined here as manufacturing, construction, refining of petroleum products and a range of activities linked to energy supply - is responsible for almost 30% of Scotland's total GHG emissions, second only to transport.

Data published by the Scottish Government earlier this year reveals some interesting trends [38] . It shows, for example, emissions from the ‘industry’ sector fell from 21 $MtCO_2e$ in 1990 (the baseline year) to 11.5 $MtCO_2e$ in 2018, a 45% reduction over the past 28 years.

Figure 7 - Industry GHG Emissions Since 1998 With Total Emissions

$MtCO_2e$ - million tonnes of carbon dioxide equivalent



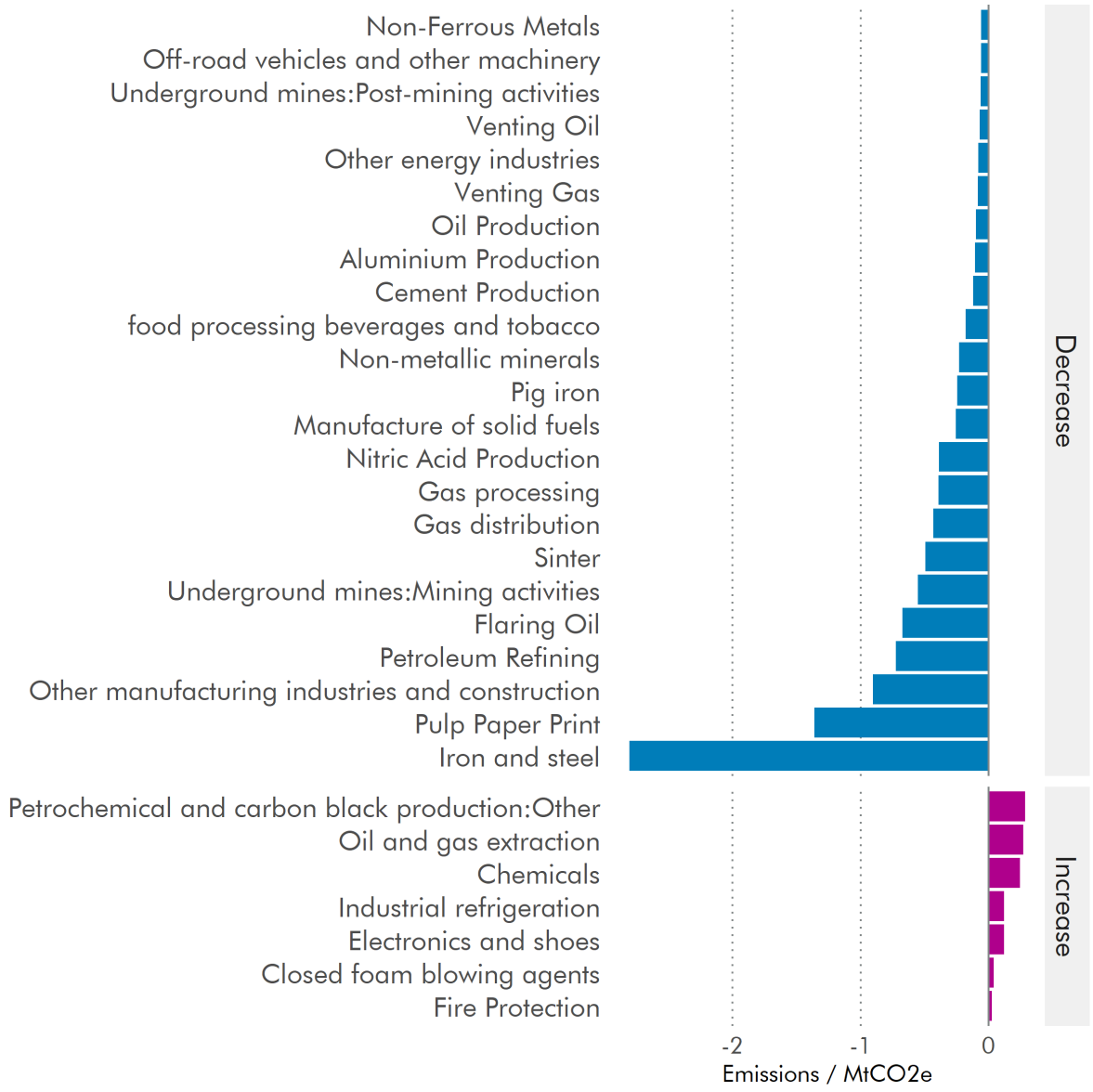
Much of the 9.5 $MtCO_2e$ reduction in industrial emissions over the period can be explained by the total disappearance of some major polluting industries, such as steel, coal mining and paper production. It’s worth remembering that Ravenscraig closed in 1992 and Scottish underground coal mining limped on until 2002.

Given the changes in Scotland’s economy over the period – with the continued demise of heavy industry and the growth of the services sectors – the fact that industry is responsible for the same proportion of total emissions now (27.6%) than in 1990 (27.5%) is perhaps surprising.

Some industrial sectors have actually seen an *increase* in the amount of GHG emissions over the past 30 years. For example, chemicals, oil extraction (emissions associated with **onshore** oil and gas terminals; specifically combustion of gas oil and untreated natural gas at these sites), electronics and petrochemical production have all seen significant increases since 1990. Others, such as food and drink production, have seen steady reductions in their emissions, whilst maintaining or even expanding output.

Figure 8 - Changes in GHG Emissions Between 1990 and 2018 by Sub-sectors of Industry

$MtCO_2e$ - million tonnes of carbon dioxide equivalent



As highlighted by the Committee on Climate Change in 2019, the largest single geographical source of emissions in Scotland is the cluster of industry in and around Grangemouth, which accounted for over 30% of industrial emissions in Scotland (3.6 $MtCO_2$ in 2017) [39] . We also know that natural gas combustion is the biggest source of industrial emissions, followed by the use of internal fuels (i.e. industry by-products generally burned on-site and with limited or no alternative use) within the oil and gas and

petrochemical industries [40] .

Table 4 shows the largest GHG emitting sectors in 2018. Unsurprisingly, petrol refining, oil and gas extraction (onshore operations) and chemicals are amongst the most carbon-intensive sectors. Food and drink, despite significant reductions since 1990 is also one of the highest emitting industrial sectors in Scotland.

Table 4: Largest GHG Emitters by Industrial Sector 2018

Sector	Million tonne CO_2 equivalent (2018)	% of total industrial emissions
Petroleum Refining	2.1	18%
Other industrial combustion (more info)	2.1	18%
Oil and gas extraction (onshore operations)	1.6	13%
Petrochemicals	1.5	13%
Chemicals	1.1	9%
Off-road vehicles and other machinery	0.5	4%
Food and drink	0.5	4%
Cement_Production	0.4	3%
Flaring Oil	0.3	3%

Context

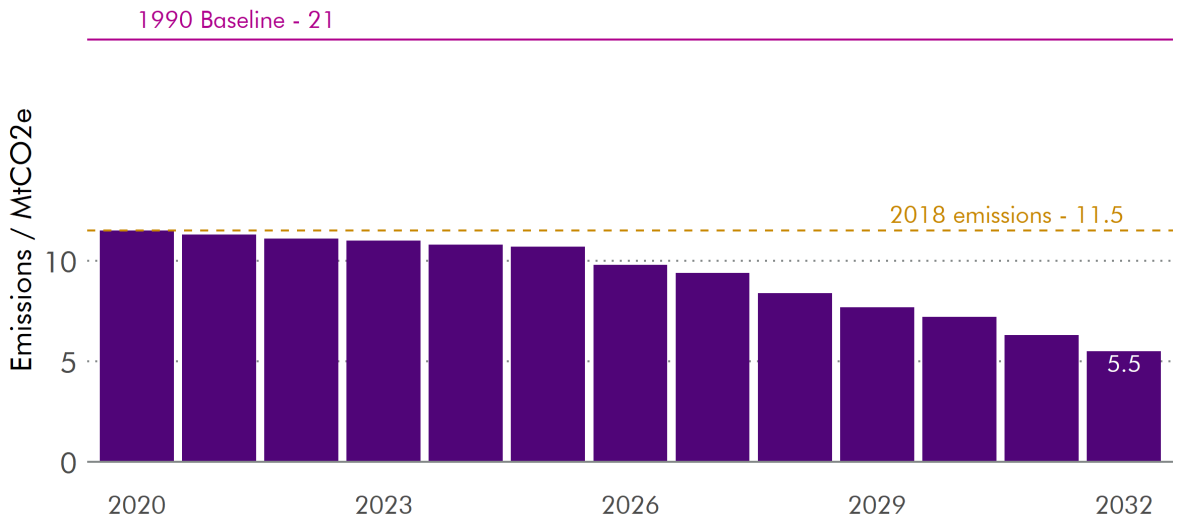
The draft CCP update aims for a 43% reduction in industrial emissions between 2018 and 2032 (52% if NETS[xi] are included) . This is considerably more ambitious than the 21% reduction set out in the 2018 Climate Change Plan.

As noted in the section on Deriving Sector Emissions Envelopes, the envelope set out below has been constrained so that it remains consistent with allowed emissions set by international carbon markets. Assumed emissions in 2020 are the same as actual emissions in 2018.

xi Negative Emissions Technologies - see relevant section for more details

Figure 9 - Anticipated Emissions Reductions in Industry 2020 - 2032

$MtCO_2e$ - million tonnes of carbon dioxide equivalent



The 2020 draft CCPu highlights research commissioned by the Government showing that emissions from Scotland's large industrial sites "could feasibly reduce by 80% or more by 2045, while maintaining output". There are various ways emissions from Scotland's industrial sectors could be cut over the next 25 years, for example by improving energy efficiency, replacing fossil fuels with hydrogen, electricity or bioenergy (collectively termed 'fuel switching') and implementing carbon capture, utilisation, and storage (CCUS).

Recent Reports - Industry

The Committee on Climate Change's Progress Report to Parliament, published in October 2020, reminds us that "responsibility for policy design and implementation falls mainly under the UK government" [15] . Nevertheless, economic development, planning and environment are devolved policy areas, and the Scottish Government has an important role to play in supporting/encouraging industry to cut its GHG emissions.

There is also scope for the Scottish Government to work in partnership with other governments, influencing the course and ambitions of UK-wide efforts. For example, the CCC calls on the Scottish Government to work closely with the UK Government, Welsh Government and Northern Ireland Executive on developing a UK Emissions Trading System that is aligned to Net Zero. This was a recommendation strongly supported by the Scottish Parliament's Environment, Climate Change and Land Reform Committee in its Green Recovery Inquiry report [17] .

Recognising the importance of Scotland's skills and education systems - entirely devolved policy areas - the CCC recommends the Scottish Government [15] :

> “ Develop a strategy for a net-zero workforce that ensures a ‘just transition’ for workers transitioning from high-carbon to low-carbon and climate resilient jobs, integrates relevant skills into the UK's education framework and actively monitors the risks and opportunities arising from the transition.”

The Scottish Government, and its agency Skills Development Scotland (SDS), responded with their Climate Emergency Skills Action Plan 2020-2025 [41] , published alongside the draft CCPu. Introducing the Plan, Cabinet Secretary for Environment, Climate Change and Land Reform highlighted the employment opportunities presented by a green recovery:

> “ “Enhancing access to skills training is critical for successful decarbonisation and will help create new, high-quality green jobs, enhanced regional growth, and improved access to growing ‘green markets’ across the globe for Scotland’s diverse businesses.””

Defining what is meant by “green jobs”, the Plan includes jobs [41] :

> “ …in renewable energy, the circular economy and zero waste, and the nature based sector with wider ‘green skills’ sitting on a spectrum ranging from highly specific requirements in sectors directly supporting the transition to net zero such as energy, transport, construction, agriculture, and manufacturing, through to more generic requirements across all sectors to thrive in a net zero economy.”

Scotland’s skills system has an important role to play in ensuring people of all ages have the skills required to benefit from the green transition opportunities. The Plan includes a number of new or updated policies aimed at developing the future workforce for the transition to net zero. These include:

- Establishing a Green Jobs Workforce Academy in September 2021
- The co-design and development of a Construction Retrofit national training programme
- Supporting the development of leadership and management skills required for a net zero future
- Access to these green jobs will be supported by recovery skills programmes including the National Transition Training Fund, Young Person’s Guarantee, Fair Start Scotland and No One Left Behind
- Aligning education and training opportunities in schools, colleges and universities to net-zero opportunities and maximising their uptake.

Potential for Hydrogen and Carbon Capture

The draft CCPu sets great store in the potential of hydrogen energy, negative emissions technologies and carbon capture and storage to help Scotland meet its industrial emissions targets. However, despite there being much talk about these technologies over a number of years there has been very little in the way of significant roll-out anywhere in the UK.

Citing research by Strathclyde University's Centre for Energy Policy, the draft CCPu

quotes an estimate of between 7,000 and 45,000 UK jobs potentially being associated with carbon storage by 2030. The CEP report does not specify how many of these will be in Scotland. The Government informs us that they have commissioned further research specific to Scotland "which will consider the associated jobs within a broad range of scenarios for the development of CCUS" [42] .

The Centre for Energy Policy believes Scotland is uniquely placed to take advantage of the opportunities presented by CCUS [42] :

> " ...with world class offshore geological sites with large CO_2 storage potential in the Scottish continental shelf and the presence of existing skills, knowledge, capacity and infrastructure to deliver CO_2 transport and storage services...It would utilise existing onshore and offshore energy supply industry, pipeline infrastructure and associated extensive supply chain links, and provide attractive upskilling and reskilling opportunities for existing workers in the sector and appealing career prospects in a low carbon industry context for the next generation."

In addition to CCUS, the Scottish Government sees great opportunity in developing a hydrogen energy industry in Scotland. In its Hydrogen Policy Statement published in December 2020 the Government cites research estimating the hydrogen industry has the potential to be worth £25 billion a year to the Scottish economy with between 70,000 to 300,000 jobs "protected or created" by 2045 [43].

Focussing on the role of hydrogen in industrial processes, the Scottish Government sees hydrogen combustion as a way of creating high temperatures without the direct emission of greenhouse gases (it is worth remembering that heating processes account for 74% of all industrial emission). In its policy statement, the Government believes hydrogen could replace natural gas for those industrial users connected to the gas network [43]. Of course, hydrogen is already used extensively in certain industries - for example in oil refining, chemicals and cement production - and it is often the case that the current production of hydrogen is relatively carbon-intensive with high levels of CO_2 emissions.

The draft CCPu points to greener ways of hydrogen production, with the Acorn hydrogen project in St Fergus presented as a potential model which could "reform North Sea natural gas into clean-burning hydrogen". This will be possible using carbon capture technology; CO_2 emitted during the process of converting gas to hydrogen will be captured and then stored in depleted North Sea gas fields via the CCUS development also being developed at St Fergus. The draft CCPu case study states that the Acorn Hydrogen project will be operational in 2025, "creating a low carbon fuel which presents various market opportunities" [44] .

Decarbonisation of Existing Industries

The Scottish Government outlines that there are four main ways in which to decarbonise industrial processes: through electrification, energy efficiency, CCUS and hydrogen [43] . It is known that decarbonising some industrial processes will be difficult, especially when they require intense heat or when a particular hydrocarbon feedstock is used in a chemical process. Nevertheless, research commissioned by the Scottish Government and published last month states that emissions from Scotland's most carbon-intensive industries can be

reduced by over 80% by 2045 [40].

Depending on the industry, decarbonisation could be achieved through a combination of three "abatement contributions"; CCUS, fuel-switching (to electricity or hydrogen) and energy efficiency. For example, it is anticipated that 60% of CO_2 reductions in food and drink will come from fuel-switching, whilst almost 80% of the reductions relating to cement production will come from carbon capture. Unsurprisingly, the largest reductions will be seen in the oil and gas and chemicals industries where all three will have some role to play.

It is worth noting that this research, produced by Element Energy for the Scottish Government, had inputs from some major Scottish industrial players, including Ineos Chemicals, Petroineos and the Scotch Whisky Association [40] . Researchers were told by industry that policy support is"critical" for establishing a business case for investment in decarbonisation. Furthermore [40] :

> “ Without policy intervention there is a risk that a strongly increasing carbon price could affect industrial competitiveness and induce certain industrial sites to shut down. In some cases, industrial sites may relocate to regions with a lower carbon price, which would not result in any carbon abatement.”

Draft CCPu - Industry

In its draft CCPu, the Government sets out a range of policies and proposals they believe will lead to the following two outcomes:

> Outcome 1: Scotland’s Industrial sector will be on a managed pathway to decarbonisation, whilst remaining highly competitive and on a sustainable growth trajectory.

And

> Outcome 2: Technologies critical to further industrial emissions reduction (such as carbon capture and storage and production and injection of hydrogen into the gas grid) are operating at commercial scale by 2030.

The following table sets out the policies the Scottish Government list under each outcome with some additional information provided about funding/partners and when the policy was first announced.

Table 5 - Draft CCPu Industry Policy Outcome 1

Outcome 1 – pathway to decarbonisation

Policy	***Details and funding (if relevant)***	***When announced?***
Emissions Trading Scheme (ETS)	UK Government and devolved administrations	Announced in June 2020– 'boosting' 2018 Plan
Energy Transition Fund (ETF) – for the North East	£62 million funding package available to support Net Zero projects	New – First announced in June 2020
Scottish Industrial Energy Transformation Fund (SIETF)	£34 million match-funding for capital projects over next 5 years, supporting decarbonisation of industrial and manufacturing sectors	First announced in Programme for Government 2020/ 21
Low Carbon Manufacturing Challenge Fund (LCMF)	£26 million support to a broader group of manufacturers and their supply chains. Policy still being developed	First announced in Programme for Government 2020/ 21
Making Scotland's Future – a recovery plan for manufacturing	Plan developed by the Scottish Government, enterprise and skills agencies, industry partners, trades unions and academics – currently out for consultation	New –consultation announced on 4th December
Renewable Heat Incentive (RHI)	A GB-wide scheme created by the UK Government (with the agreement of the Scottish Government). UK Government is extending scheme to 2022	Changes announced by UK Gov in August 2020– 'boosting' 2018 CCP
Proposals		
Scottish Industrial Decarbonisation Partnership (SIDP)	Scottish Government - stakeholder forum with representatives from manufacturing sites	New – announced in the 2020 draft CCP update
Net Zero Transition Managers Programme	To be launched in 2021. The SG hopes to facilitate new managerial roles into energy intensive industries, tasked with recommending decarbonisation options	New – announced in the 2020 draft CCP update
Grangemouth Future Industry Board (GFIB)	Scottish Government, Falkirk Council and Scottish Enterprise, engaging with businesses. Launched in 2020 to co-ordinate support aimed at decarbonisation and growth	First announced in Programme for Government 2020/ 21
Develop policy on providing market-benefit for Scottish industries that invest to decarbonise production	Details uncertain. A study has started that will contribute to policy development on options to influence market conditions for manufacturers producing relatively lower carbon products than their competitors	New – announced in the 2020 draft CCPu
Green Jobs Fund, to help businesses create new, green jobs	A £100 million fund. Enterprise agencies distributing £50 million to businesses that provide sustainable or low carbon products and services	First announced in Programme for Government 2020/ 21

Table 6- Draft CCPu Industry Policy Outcome 2

Outcome 2 – Technologies operating at commercial scale by 2030

Policy	***Details and funding (if relevant)***	***When announced?***
ACORN CCS Project: support the delivery of the CCS and Hydrogen capability at St. Fergus Gas Processing complex by 2025	Further support and investment in CCUS	Maintained – been in development for a number of years
Carbon Capture and Utilisation (CCU) Challenge Fund	£5 million – to be initiated in 2022 and concluding in 2024	First announced in Programme for Government 2020/21
Proposals		
Emerging Energy Technologies Fund	£180 million fund – first tranche of funding available in 2021. £100 million available to support hydrogen projects, and a further £80 million directed to projects supporting the CCS and NETs	New – announced in the 2020 draft CCP update
Carbon Capture Utilisation and Storage (CCUS)	Working with the UK Government "to get commercial, policy and regulatory frameworks required to support CCUS at scale in the UK." SG will also commission research that will help shape policy to support the development of new CCUS infrastructure	Programme for Government 2020/21 – 'boosting' 2018 Plan
Forums for CCUS and Blue (low-carbon) Hydrogen: to bring together industry, academics and membership organisations	Commitment between the Scottish Government and the North East Carbon Capture, Usage and Storage Alliance	Formation of NECCUS in 2019- 'boosting' 2018 CCP
Building the evidence base for CCUS and 'blue' hydrogen	PfG committed SG to expand evidence base on CCUS and commissioned an economic assessment	Programme for Government 2020/21 – 'boosting' 2018 CCP
Strategic development of Scotland's hydrogen economy and hydrogen energy demonstration	A number of demonstration plans and other policy commitments set-out in the Hydrogen Policy Statement published December 2020	Hydrogen Policy Statement– 'boosting' 2018 Plan

As is clear from the table above, almost all the policies and proposals highlighted in the draft CCPu were previously announced elsewhere, for example in the Programme for Government published in September. Perhaps the most striking *new* announcement is the £180 million Emerging Energy Technologies Fund. Interestingly, this is listed as a 'proposal' in the CCP update and not a 'policy', i.e. it is a suggested course of action which will become policy once development work has been completed or financial resources allocated.

Monitoring Progress

Industrial emissions have actually *increased* – by 0.6 $MtCO_2e$, or 6% - since the publication of the 2018 CCP. Indeed, the most recent data available shows industrial emissions were the same in 2018 as they were in 2012 [10] .

The CCPu monitoring framework has only three indicators for the industry section. These are:

- Increase industrial energy productivity (£GVAm per GWh[xii]) by 30% by 2032 (from 2015 baseline)
- Reduce industrial emissions intensity (tCO_2e per £GVAm) by 30% by 2032 (from 2015 baseline)
- % of Scottish gas demand accounted for by biomethane and hydrogen blended into the gas network.

The first two indicators are regularly reported in the Scottish Government's Scottish Energy Statistics Hub [45] , and the third indicator is still in development.

Data shows that industrial energy productivity in Scotland stood at £0.53 million GVA per GWh in 2018. This is the same as it was in the 2015 baseline year. Industrial emissions intensity, on the other hand, rose by 2.9% from 2015 to 2018 to 454 tonnes of CO2/£ million GVA [45] , thus indicating a slight deterioration in performance.

Given that industrial emissions are second only to the transport sector, it is perhaps surprising that only three industry indicators are included in the draft CCPu's monitoring framework (one of which is still in development). The agriculture sector, with two-thirds of the emissions of the industrial sector has *eight* indicators. The waste sector, responsible for only 4% of emissions has five.

Waste and the Circular Economy

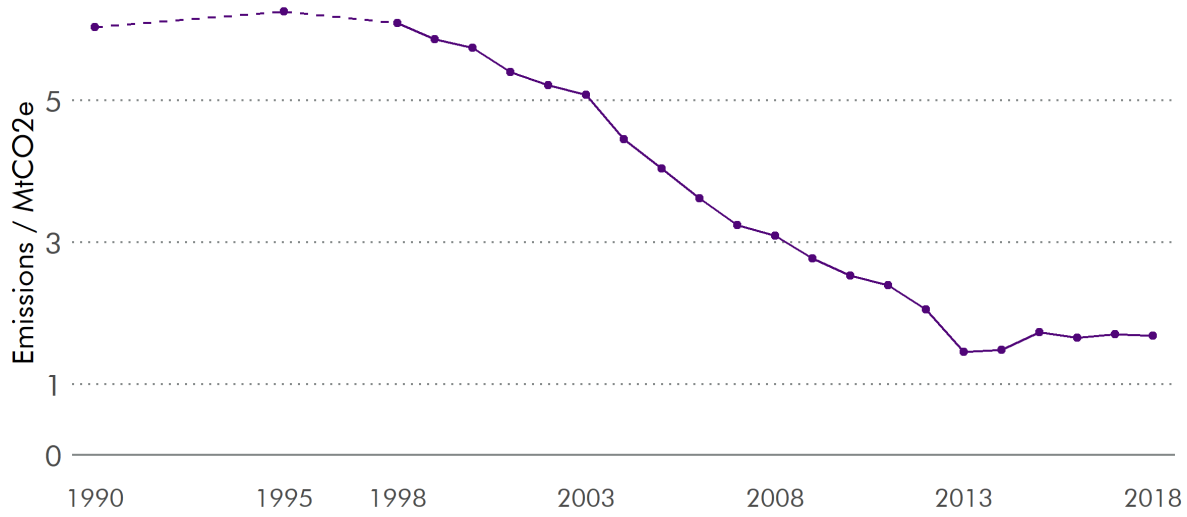
Context

In 2018, emissions from waste represented around 4% of total Scottish GHG emissions, compared to around 8% in 1990 [46] . The majority of GHG emissions from waste are methane from landfill sites. Significant reductions from 1990 to 2018 (approximately 72%) were achieved mainly due to more landfill gas being captured, reduction in biodegradable waste going to landfill, and increases in recycling. Emissions reductions have stalled since 2013 and slightly reversed, increasing from 1.5 $MtCO_2e$ in 2013 to 1.7 in 2018 (see Figure below).

xii GVA - Gross Value Added. GWh - Gigawatt Hour of Energy

Figure 9 - Emissions from Waste in Scotland 1990 - 2018

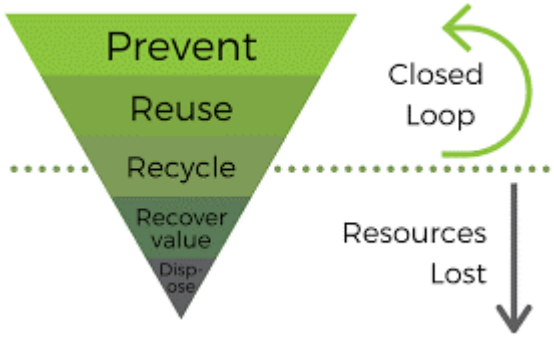
$MtCO_2e$ - million tonnes of carbon dioxide equivalent



Data source: NAEI 2020. No emissions data available for devolved administrations for 1991-1994 or 1996-1997.

Waste management policy seeks to divert waste away from landfill and move up the 'waste hierarchy', set out in the Environmental Protection Act 1990. Measures should prioritise waste prevention through efficient use and re-use, followed by recycling and recovery of value, with landfill a last resort (see Figure below).

Figure 10 - Waste Hierarchy



Source: Creative Carbon Scotland

Circular economy policy is broader than waste management and can be applied across the economy, to energy for example, industry or agriculture – as it relates to the circularity of resource use. The Scottish Government set out its ambition for Scotland to transition to a circular economy in its 2016 Making Things Last strategy [47] .

Circular economy policy also relates to the significant issue of consumption emissions. Statutory climate targets are based on emissions from sources in Scotland. However, consumption of products (often sourced from abroad) accounts for an estimated 74% of Scotland's carbon footprint when those emissions are factored in [48] . The Scottish Government commits in its Environment Strategy to Scotland having "a sustainable international footprint", noting that if everyone on Earth consumed resources as we do, we

would need three planets [49] . Whilst domestic emissions in Scotland fell by 44.7% between 1998 and 2016, during the same period Scotland's carbon footprint only fell by 12.3% [50] .

2018 CCP - Waste

The 2018 CCP aimed to reduce emissions in the waste sector by 52% between 2018 and 2032. There are two Policy Outcomes, summarised in the sections below:

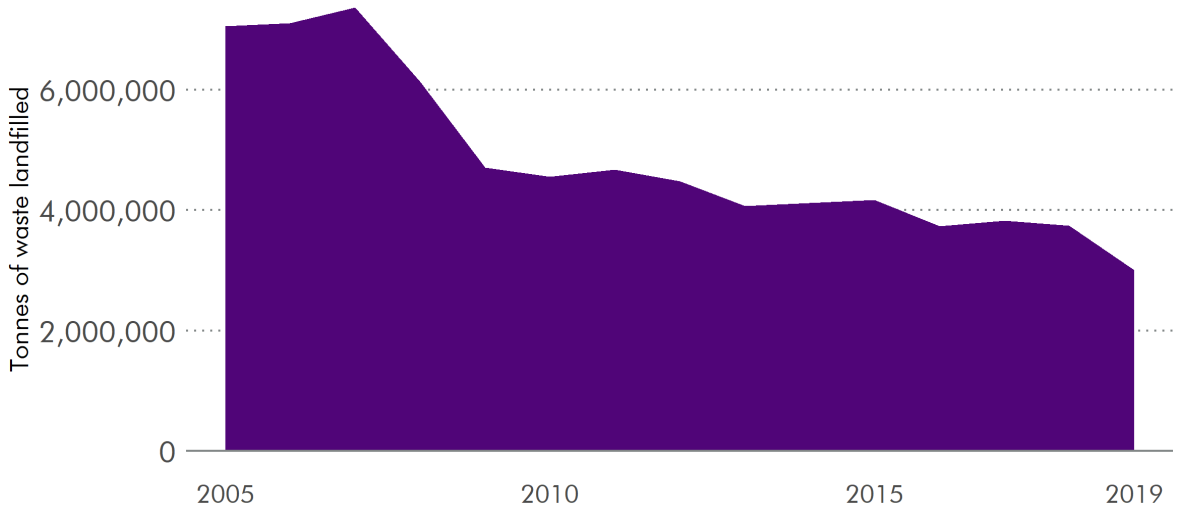
- **Policy Outcome 1: Reduction in waste sent to landfill**
- **Policy Outcome 2: Reduction in emissions from closed landfill sites.**

Policy Outcome 1: Reduction in waste sent to landfill

The 2018 CCP states that the majority of planned emissions reductions in the waste sector are a consequence of this policy outcome. Policy Outcome indicators are the tonnes of waste landfilled (household and non-household), and a target that by January 2021, the landfilling of biodegradable municipal waste will be phased out.

The 2019 CCP Monitoring Report states that this **Policy Outcome is not on track [13] .** Recycling increases and escalating landfill tax have reduced the amount of waste sent to landfill, but reductions anticipated in the 2018 CCP have not been achieved. Scotland sent 3 million tonnes of waste to landfill in 2019, a reduction of 20% from 2018 and 57% from 2005 [51] (see Figure below).

Figure 11 - Waste Landfilled in Scotland



SEPA, 2020[52]

Part of this reduction is due to an increase in recycling but also due to waste being diverted to incineration. 1.23 million tonnes of waste was incinerated in Scotland in 2019, an increase of 72% from 2018, and an increase of 199% from 2011. SEPA has said that

this is likely to be the start of an increasing trend as local authorities prepare for the ban of biodegradable municipal waste going to Scottish landfills in 2025 [53] . Environmental groups have raised concerns about increased reliance on incineration [54] [55] .

Ending the landfilling of biodegradable municipal waste by 2021

The landfilling of biodegradable municipal waste has progressively reduced in Scotland but will not be ended in 2021. In 2019, 0.70 million tonnes of biodegradable municipal waste were disposed to landfill in Scotland, a decrease of 32% from 2018 [56] .

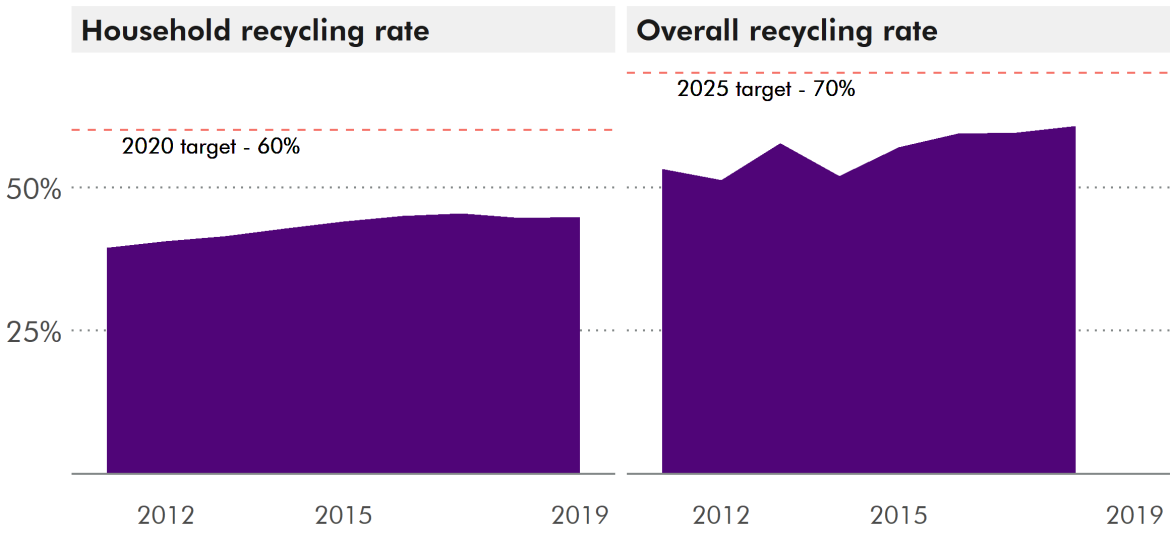
The landfilling of biodegradable municipal waste is prohibited from January 2021 under the Waste (Scotland) Regulations 2012 but the Government announced in 2019 that enforcement will be delayed until 2025. A lack of reprocessing infrastructure meant that enforcement would result in reliance on landfill in England, with financial implications for local authorities. The 2019 CCP monitoring report states that the delay will allow for procurement and planning of processing infrastructure, and that Scottish Landfill Tax will be used to incentivise the transition [13] .

Progress towards implementation indicators in the 2018 CCP for Policy Outcome 1 are further summarised below.

Recycling targets: 70% of waste by 2025, 60% of household waste by 2020

The recycling rate for all waste in 2018 was 60.7%, an increase from 59.6% of waste recycled in 2017. In 2018 the household waste recycling rate was 44.7%, a decrease from the 45.5% rate achieved in 2017 (see Figure below). The CCC considers that the 2020 household recycling target of 60% is unlikely to be met.

Figure 12 - Recycling Rates in Scotland



Data source: SEPA waste data

The CCP 2019 monitoring report says that the slowing of progress on recycling in recent years is partly due to loss of capacity in global recycling markets, combined with economic challenges [13] .

Food waste reduced by 33% by 2025 from 2013 baseline

Up to date data is not available to enable monitoring of this indicator. The CCP 2019 monitoring report states that the work required to analyse waste composition is complex, so it is taking time to develop a model . Figures used in the CCP 2019 Monitoring Report are from 2014-2015, which showed that food waste decreased 21.5% from 420,000 tonnes in 2009 to 330,000 tonnes in 2014-2015 [13] . In 2019, a Food Waste Reduction Action Plan was published by Zero Waste Scotland [57] .

Policy Outcome 2: Reduction in emissions from closed landfill sites

Landfill gas capture tackles emissions of methane, a gas which tonne for tonne is 25 times more damaging than carbon dioxide (but shorter lasting in the atmosphere). Gas emissions from landfill can continue for decades after waste has been deposited. Captured gas can be used to support heat networks nearby, or the gas can be flared. The 2018 CCP states that 12 potentially suitable sites had been identified by SEPA and sets this as an implementation indicator.

The 2019 CCP Monitoring Report states that this **Policy Outcome is not on track [13] .** The report states that 5 sites have been fitted with gas capture since 2017, but that fewer sites have been fitted than planned “mainly because the response from local authorities to an offer of funding in 2017 was not good”.

Recent Reports - Waste

This section summarises some key strategic advice provided to the Scottish Government in relation to tackling emissions from waste and transitioning to a circular economy.

Zero Waste Scotland’s Decoupling Advisory Group

Zero Waste Scotland set up an expert forum, the Decoupling Advisory Group, who published a 2020 report on how Scotland can use resources sustainably in a wellbeing economy [58] . The Group concluded that this means rapidly reducing consumption of goods and materials. Recommendations included:

- Setting targets to reduce consumption emissions
- Putting the circular economy at the heart of the public sector
- Developing national strategies to secure high-risk and critical materials
- Banning ecologically destructive products or industrial practices
- Supporting innovative business based on local cooperation
- Establishing taxation policies for equal access to and redistribution of resources.

Climate Change Committee advice

The Climate Change Committee's 2020 Progress Report to Parliament [15] said that “achieving significant emission reductions in the waste sector requires a step-change towards a circular economy”, moving away from landfill and energy from waste, and

towards waste reduction, reuse and recycling.

The CCC recommended that a Circular Economy Bill should be introduced in the next Parliament. Prior to the pandemic, the Scottish Government committed to introducing a Circular Economy Bill and consulted on proposals in 2019, with a range of proposed measures to encourage waste reduction, including delegated powers to enable charges to be applied to certain products. This followed 2019 recommendations from an Expert Panel on Environmental Charging [59] . The Bill was postponed in 2020 due to the pandemic.

Other CCC recommendations included:

- To implement the 2025 landfilling ban for biodegradable municipal waste and extend this ban to biodegradable non-municipal waste by 2025
- To introduce mandatory business food waste reporting
- That from the mid-2020s, Energy from Waste plants should begin retrofitting carbon capture and storage (CCS), and new Energy from Waste plants should be built 'CCS ready'.

The Infrastructure Commission for Scotland

The Infrastructure Commission for Scotland looked at waste management [60] and said that complex and fragmented waste collection and recycling systems, as well as limited data on specific waste streams needs to be addressed in order to design effective systems. It recommended that waste management should be designed around opportunities for reprocessing, and incentives are needed to enable the required pace of change in consumption of resources.

Report of the Advisory Group on Economic Recovery

The Scottish Government appointed Advisory Group on Economic Recovery reported in 2020 [61] . The Group emphasised the importance of addressing Scotland’s global carbon footprint through “taking carbon out of our economy and out of our lifestyles” so that emissions are reduced, not relocated. The report said that “there is a case for having a more explicit focus on consumption-based emissions”, which could be in the form of targets or a greater role for consumption-based measures in decision-making.

The report also looked at the resilience of different sectors in light of the pandemic, stating that firms with poor liquidity may be less resilient and require support to build working capital and enable innovation. Sectors considered to have the poorest liquidity included water supply, waste management and construction – all key sectors in relation to developing the circular economy and reducing waste.

The ECCLR Committee’s Green Recovery Inquiry

The need for a circular economy was raised during the Scottish Parliament Environment, Climate Change and Land Reform Committee's (ECCLR) recent Green Recovery Inquiry [17] . In its report, the Committee recommended:

- The next iteration of Scotland’s Economic Strategy should be brought forward and built on the concept of a net zero, circular and wellbeing economy

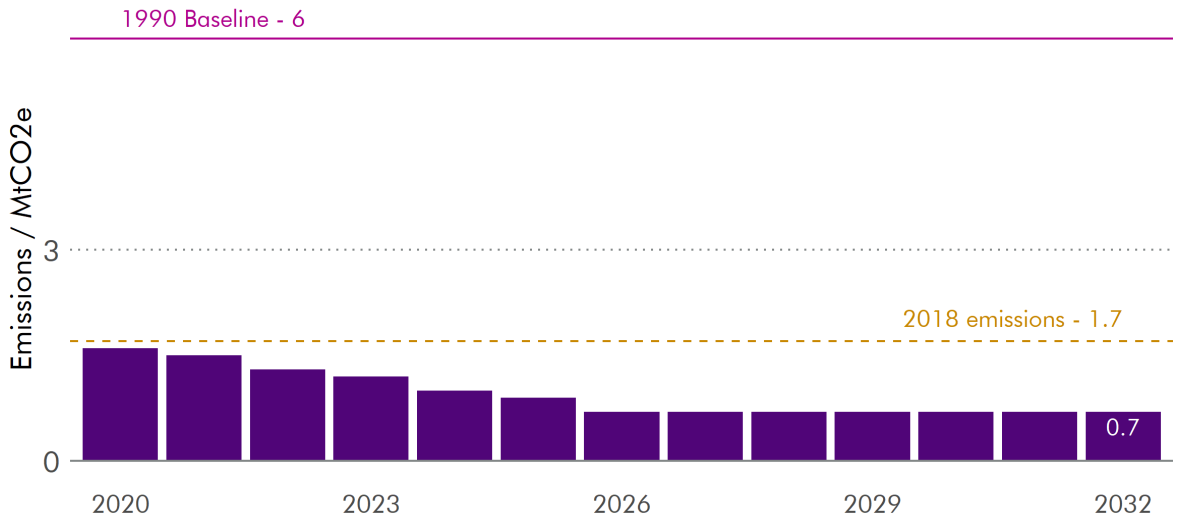
- An expansion of the Zero Waste Scotland Circular Economy Investment Fund
- A circular economy approach to procurement policy and practice.

Draft CCPu - Waste

The 2018 CCP aimed to reduce emissions from waste by 52% between 2018 and 2032, reaching emissions of 0.6 $MtCO_2e$ by 2032. The draft CCPu sets out an ambition for a 56% reduction over the lifetime of the plan, reaching 0.7 $MtCO_2e$ by 2032 (see below). Emissions in 2020 are assumed to be 1.6 $MtCO_2e$ - 6% lower than in 2018.

Figure 13 - Anticipated Emissions Reductions Waste 2020 - 2032

$MtCO_2e$ - million tonnes of carbon dioxide equivalent



There are four Policy Outcomes in the draft CCPu for waste and circular economy. Two are existing outcomes in the 2018, and two are new.

- **Revised Outcome 1:** Reduction in waste sent to landfill
- **Revised Outcome 2:** Reduction in emissions from closed landfill sites
- **New Outcome 3:** A reduction in food waste
- **New Outcome 4:** Reduce waste and establish a more circular economy, where goods and materials are kept in use for longer.

The draft CCPu also sets out a vision for 2032 and 2045:

- By **2032** (and before), to have tools in place to equip individuals, businesses and organisations to make a fundamental shift in how we use and re-use materials
- By **2045**, to have moved completely from a ‘take, make and dispose’ linear economy to a fully circular economy.

Revised policy outcome 1: Reduction in waste sent to landfill

This is the same Policy Outcome as in the 2018 CCP. The Outcome indicators are also the same (total amount of landfilled waste and total amount of biodegradable landfilled waste) although the aim to end the landfilling of biodegradable municipal waste is delayed from 2021 to 2025 as described above. It is unclear why the implementation indicator is for zero tonnes of biodegradable municipal waste to be landfilled by 2026, given the target is to end this practice by January 2025.

The target to recycle 70% of all waste by 2025 is also repeated in the draft CCPu but it is unclear if it is a formal implementation indicator. A recycling target for household waste is not mentioned – the current target is 60% by 2020 (unlikely to be achieved).

New policies to achieve this outcome include:

- To develop a new route map to meet 2025 waste and recycling targets
- To provide £70m to improve local authority recycling collection infrastructure
- To ensure separate collection of textiles by 2025 and bio-waste e.g. garden waste by 2023
- In response to CCC advice, to extend the ban on landfilling biodegradable municipal waste to include all biodegradable waste, subject to consultation
- To work with COSLA to evaluate the Household Recycling Charter
- To take steps to improve waste data.

The Scottish Government have previously stated that a key challenge in tackling resource use and waste is to address data gaps [62] . A UK-wide electronic system for tracking waste is currently being developed with the participation of SEPA.

Revised Policy Outcome 2: Reduction in emissions from closed landfill sites

This is the same Policy Outcome and indicator as in the 2018 CCP, but the target to have 12 sites in place is pushed back from 2020-21, to 2025. The draft CCPu states that the policy will be 'boosted' through funding in the Low Carbon Fund.

New Policy Outcome 3: A reduction in food waste

This is the same 2025 target as that in the 2018 CCP, but food waste reduction has been ‘upgraded’ from an implementation indicator to a Policy Outcome. The 2025 target to reduce food waste by 33% by 2025 is not new - it was set out in the 2016 Making Things Last strategy [47] .

The 2018 CCP said that a Food Waste Action Plan was being considered, which could include legislative measures that would need to be consulted on. A Food Waste Reduction Action Plan was published in 2019 which contains a number of the new policies in the draft CCPu. The Government did consult in 2018 on proposals for legislation around its ‘Good Food Nation ambition’, which included proposals to require Ministers to publish a policy statement on food covering waste. However plans for a Bill were cancelled in 2020 because of the pandemic (as with plans for circular economy legislation). The following new **policies** to achieve this outcome include:

- To consider a mandatory national food waste reduction target and mandatory reporting of food surplus and waste by food business (a key CCC recommendation on waste)
- To consult on the current rural exemption for food separation requirements
- To develop best practice guidance for public sector procurement teams
- To deliver a sustained approach to public engagement to enable behavioural change.

New Policy Outcome 4: Reduce waste and establish a more circular economy

The draft CCPu states that the concept of a circular economy is relevant across all sectors and to public procurement. The overall aim to transition to a circular economy, and target to reduce total waste by 15% by 2025 against 2011 levels, are not new. They are both represented in the 2018 CCP but have been 'upgraded' to a Policy Outcome and implementation indicator respectively.

The CCPu contains the following new proposals:

- To examine the range of fiscal measures used by other countries to incentivise positive behaviours and to develop proposals to go further in this area
- To update planning policies in NPF4 to reflect circular economy opportunities
- To take measures to encourage more sustainable consumer purchasing, including to increase the carrier bag charge from 5 to 10p
- To consider measures to ensure new energy from waste plants are more efficient, and 'future-proofed' for CCS (a key CCC recommendation on waste emissions)
- To work with local authorities and the future Deposit Return Scheme scheme administrator(s) to explore options to unlock reprocessing investments
- To consult on banning problematic plastic items
- To develop public procurement tools to support a circular economy
- To continue to work with the UK Government and other devolved administrations on reforms to the packaging extended producer responsibility regime.

Implementation of a Deposit Return Scheme for single-use drinks is described as a **proposal** being 'maintained'. The Deposit and Return Scheme for Scotland Regulations 2020 mean that from July 2022, people in Scotland will be required to pay a deposit when buying a drink in certain single-use containers. Aims include to boost recycling and reduce emissions. It is unclear why this is described as a proposal rather than a policy, given regulations have been passed.

Producer responsibility schemes place obligations on producers in relation to product end of life management. Schemes are already in place for packaging waste, waste electrical and electronic equipment, batteries and end of life vehicles.

UK-wide measures and call for action on environmental fiscal reform

Waste is generally a devolved area. However, some areas of waste regulation have been

pursued at UK-level by agreement, such as producer responsibility schemes. Some areas of waste regulation fall under reserved areas of product standards or import and export control. The draft CCPu recognises that some of the policies required for a circular economy depend on UK-wide action and calls on the UK Government to:

- Introduce new fiscal measures to influence behaviour
- Reduce consumption of unsustainable material
- Boost the competitiveness of recycled materials
- Bring forward measures to influence global markets and reduce imported emissions.

Some areas of circular economy policy have also previously been heavily driven by EU standards such as the EU Circular Economy Package. The Scottish Government recognises this in the draft CCPu and re-commits to maintaining or exceeding EU environmental standards post EU exit. The UK and devolved governments have been developing post EU-exit common frameworks including on waste to establish a ‘common floor’ of standards in areas where powers intersect, or to support UK-wide approaches. The compatibility of UK-wide measures with Scottish climate targets may require consideration. The UK Internal Market Act 2020 may also raise implications for circular economy policy in Scotland. This is explored in more detail in a SPICe blog.

Land Use, Land Use Change and Forestry

Context

The land use, land use change and forestry (LULUCF) sector refers to activities on land which alter the ability of vegetation and soils to sequester (i.e. absorb) and store carbon from the atmosphere. The way land is used and managed, and changes in land use, including for forestry, can either contribute to, or mitigate, climate change.

In this sector, policies have been largely focused on planting trees and restoring peatlands to create new carbon sinks (meaning areas where carbon is absorbed from the atmosphere and stored). Both forestry and peatlands have been a focus of Scotland's climate change efforts and investments for some time. It is the only sector where emissions are currently negative - meaning more carbon is taken out of the atmosphere than is emitted (though this is set to change).

Some activities in the LULUCF sector are also often referred to as 'nature-based solutions' to climate change, meaning using the earth's natural processes to sequester carbon.

Nature-based solutions have been a key focus of the Environment, Climate Change and Land Reform Committee's scrutiny of a green recovery from the Covid-19 pandemic, as well as being a way to tackle the twin challenges of climate change and biodiversity loss together, when done sensitively [17] .

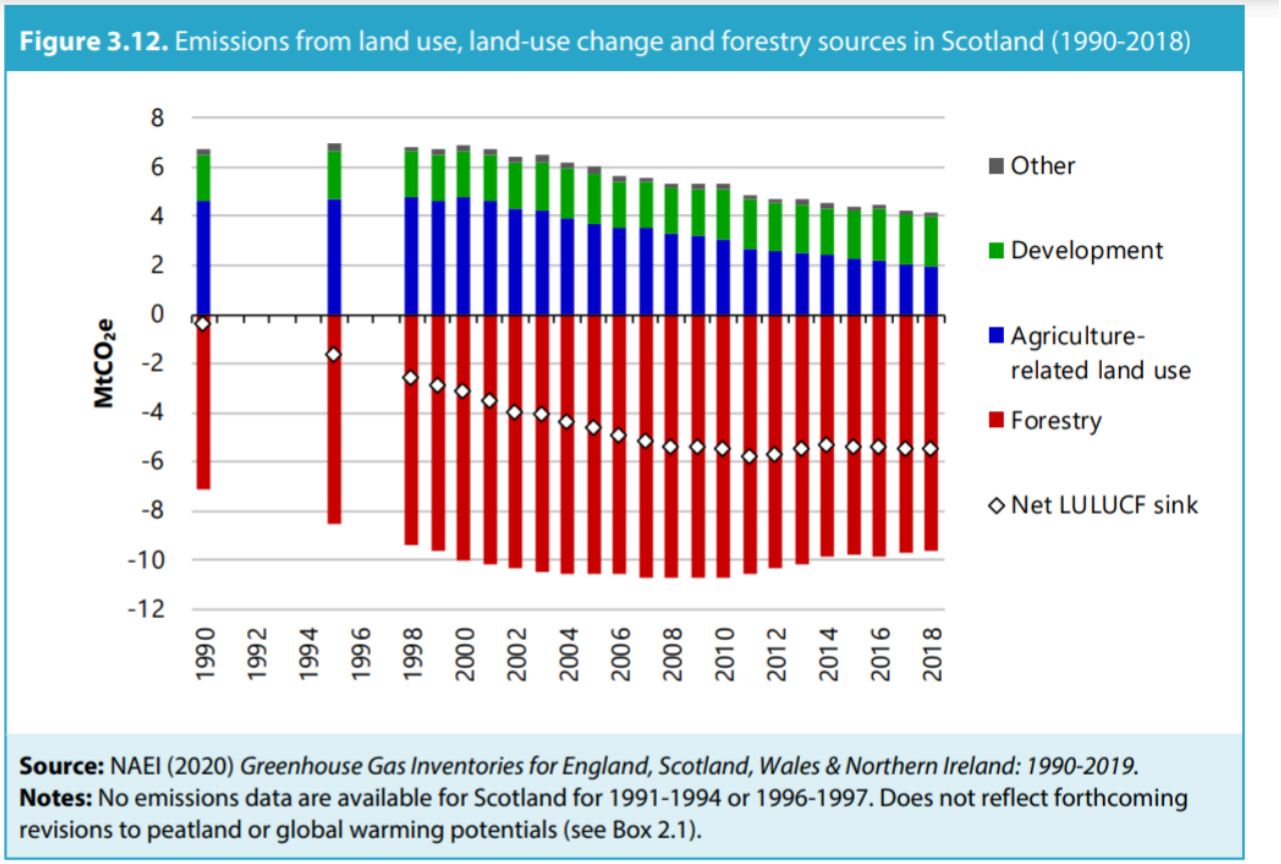
2018 CCP - Land Use, Land Use Change and Forestry

Emissions in this sector

The LULUCF sector represents -13% of total Scottish greenhouse gas emissions in 2018 . The chart below from the CCC's 2020 progress report for Scotland illustrates the source of both positive and negative emissions in this sector:

Figure 14 - Emissions from Land use, Land Use Change and Forestry 1990-2018

$MtCO_2e$ - million tonnes of carbon dioxide equivalent



Climate Change Committee, 2020[15]

According to the most recent Scottish Government emissions statistics, the LULUCF sector accounted for -5.4 $MtCO_2e$, meaning that the sector sequesters more carbon than it emits. The sector does both emit and sequester carbon; in 2018, emissions from the sector were 7.6 $MtCO_2e$, but it sequestered 13.1 $MtCO_2e$ leaving a net sink of -5.4 $MtCO_2e$. The 2018 CCP stated that:

> " Updated projections for the LULUCF sector, alongside proposals and policies, show that the sector will be a sink of around -6.9$MTCO_2e$ by 2020, dipping slightly after 2021, and then fairly constant until 2032."
>
> Scottish Government, 2018[1]

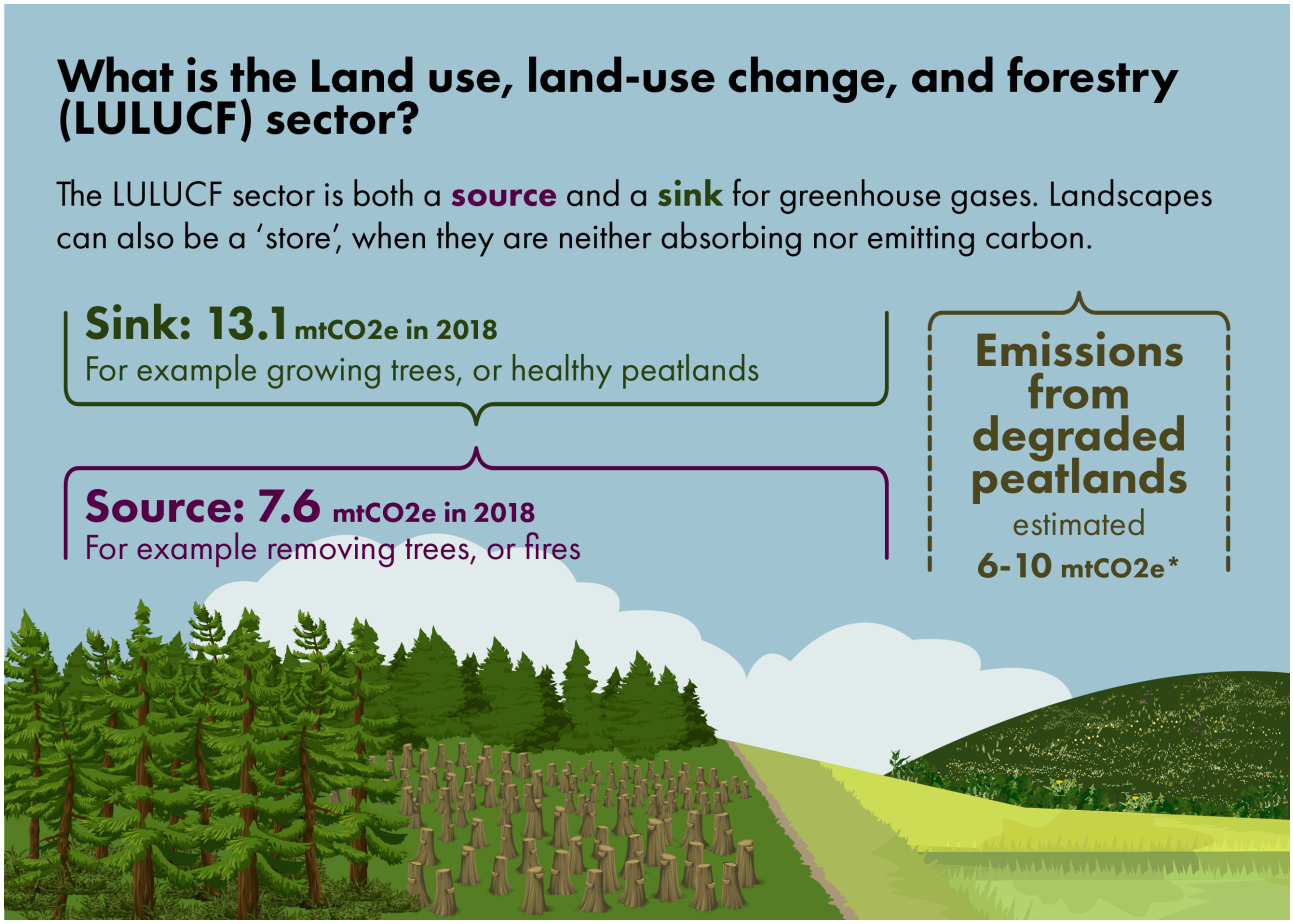
However, emissions *from* peatlands are not yet included in these statistics. Healthy peatlands sequester carbon, while degraded peatlands can emit greenhouse gases. This happens when peatlands have been drained, burned, or where the peat has been exposed by erosion or human activities. 80% of Scotland's peatlands are thought to be degraded to

some extent [63] .

According to the 2018 emissions statistics, which do not include emissions from peatlands, the LULUCF sector sequestered more carbon than it emitted. However, the CCC anticipates that including emissions from peatlands will add 6-10 $MtCO_2e$ to the sector's emissions [15]. Figure 15 illustrates this.

Figure 15: Emissions from the Land Use, Land Use Change, and Forestry Sector

$MtCO_2e$ - million tonnes of carbon dioxide equivalent



*As estimated by the Climate Change Committee in its October 2020 progress report to the Scottish Parliament.

Key Ambitions, Policies and Proposals

Table 7 - Summary of Emissions Reductions and Ambitions for LULUCF from the 2018 Climate Change Plan

Expected GHG Emissions Reduction	Key Ambitions for 2032
In 2018, it was estimated that after an initial decrease in sequestration to around -13% (due to the decreasing rate of woodland creation over the last 40 years), sequestration from LULUCF is expected to be fairly constant at around -15% to 2032. However, this did not yet account for emissions from peatlands and this sector over this period is expected to become a net source of emissions	• Increase woodland cover from around 18% to 21% by 2032 and increase annual woodland creation to 15,000ha per year by 2024-25 • Increase the use of sustainably sourced wood fibre and encourage the construction industry to use timber • Restore 50,000 hectares of Scotland's peatland by 2020 and 250,000 hectares (40%) by 2030.

Policies and proposals are set out for each of the three key ambitions summarised in the table above.

Forestry

Policies

- Forestry grants: provide funding via a grant scheme to establish woodlands
- Woodland creation on the National Forest Estate
- Awareness-raising of the integration between farming and forestry
- Maintain and develop a UK Forestry Standard that articulates the consistent UK-wide approach to sustainable forestry
- Raise the profile of the Woodland Carbon Code to increase investment into the forestry sector
- Develop forestry and woodland strategies, prepared by the planning authorities.

Proposals

- Working with community, public and private sector investors to explore new partnership funding models (2018-2019)
- Develop further targeted grants measures (2018-2019)
- Review Forest Enterprise Scotland’s woodland creation activity on the National Forest Estate (2019-2020).

Timber

Policies

- Implement the Timber Development Programme to support the promotion and development of wood products for use in construction.

Peat

Policies

- Provide grant funding to land managers to deliver peatland restorations. The Scottish Government committed to a level of funding that would deliver at least 20,000 hectares per year from 2018-19
- To raise awareness, knowledge and skills of peatland restoration among land managers, contractors and others.

Progress

The Scottish Government published a monitoring report in December 2019. It assessed that:

- The woodland creation policy outcome was on track
- That it was too early to assess progress on the use of timber in construction
- That the peatland restoration policy outcome was not on track.

Forestry

To meet the target of increasing forest cover to 21% by 2032, the Scottish Government had aimed to create 10,000 hectares of woodland per year, rising to 12,000 hectares per year in 2020-21, 14,000 hectares per year from 2022-23, and 15,000 hectares per year from 2024-25 and thereafter.

The 2019 monitoring report indicates that the Scottish Government met the 2018-19 target and created over 10,000 hectares, and ambitions were increased in the 2019-20 Programme for Government to create 12,000 hectares that year [13] . This target was not met due to Covid-19 and prolonged bad weather, though the original target of 10,000 hectares was met [64] . The Scottish Government credited a new approach to grant funding proposals with supporting increased woodland planting.

The CCC stated in their assessment of Scottish progress on climate change in December 2019 that:

> “ Scotland met its tree-planting targets for the first time in 2018/19 (planting over 11,000 hectares of new trees) but this must continue to rise to a minimum of 15,000 hectares by the mid-2020s and stay there if Scotland is to achieve net-zero. This will require a stable and long-term support mechanism for afforestation.”
>
> Committee on Climate Change, 2019[65]

They state that 15,000 ha per year is an "absolute minimum" and that this should go up to 24,000ha "if feasible" [65] .

In the 2020-21 Programme for Government, the Scottish Government announced an

additional £100m for Scottish Forestry to increase new planning, and £30m for Forestry and land Scotland to "expand Scotland's national forests and land by an additional 18,000 ha per year by 2024". [26] However, it should be noted that this is over the next five years - the next Scottish Parliament term - with £6m invested in 2020/21.

The target in the 2018 CCP focusses on the hectares planted. However, forests and woodlands, depending on how they are created and managed, can provide additional benefits and contribute to climate change mitigation in different ways. A recent SPICe briefing - the Multiple Roles of Scottish Woodlands - highlights the complexity of woodland creation and management, with "suitability dependent on a number of social, ecological and economic factors" [66] . The location of the planted trees - and what existing habitats and landscapes any new woodlands replace - determines both the climate change mitigation value and the benefit for biodiversity. For example, one study from Stirling University and the James Hutton Institute found that planting trees on heather moorlands with organic and peaty soils in Scotland did not lead to an increase in net ecosystem carbon stock from 12 to 39 years after planting [67] . The same is also true for how the forest is structured and managed.

Beyond carbon storage, Scottish woodlands also play a role in ecosystem services on water supply and regulation and biodiversity. In recognition of this interconnectedness, Scotland's Environment Strategy, published in February 2020, highlights that "the climate and nature crises are intrinsically linked" and that "creating and restoring natural habitats can benefit biodiversity" as well as mitigating climate change [68] . Efforts to create new woodlands to mitigate climate change intersect with other Scottish Government targets. Scotland's Biodiversity Route Map to 2020 (published in 2015) set an objective for 3000-5000 of the hectares planted per year to be native woodland, and to increase the amount of native woodland in good condition for biodiversity [69] .

Moreover, a new Scottish Forestry Strategy was published in early 2019. Among other objectives, the strategy cites "expanding the area of forests and woodlands, recognising wider land-use objectives" and "enhancing the environmental benefits provided by forests and woodlands" [70] .

Timber

The Scottish Government's December 2019 monitoring report stated that it was too early to make an assessment on whether use of Scottish timber in construction was increasing. The target is to reach 2.6m cubic metres of timber used in construction per year by 2021-2022. In 2018 a total of 2.33m cubic metres was used for such a purpose.

Peatlands

The CCC summarises that:

> “ In their natural state, peatlands continuously sequester CO_2 from the atmosphere, transferring it into organic matter which can remain stable for thousands of years if the ground remains waterlogged. When peatlands are drained to provide fibre, fuel and land for food production, this stored carbon is released. Scottish peatlands are a vast carbon store containing over 6,500 $MtCO_2e$ of carbon, equivalent to 160 years’ worth of Scotland’s total greenhouse gas emissions in 2017.”
>
> Committee on Climate Change, 2019[65]

Emissions from degraded peatlands are not currently accounted for in the greenhouse gas inventory, but will be included by 2022 at the latest. They account for an estimated 6-10 million tonnes of CO_2 equivalent per year, which would change the LULUCF sector emissions from a net sink to a net source [15] .

Climate change itself has the potential to impact the ability of peatlands to store carbon. As the climate changes, areas that are currently optimal for peatlands may not be in the future, threatening this carbon store. Recent research has suggested that:

> " ...in 2050 more than half of the carbon currently stored in Scottish blanket bogs will be at risk of loss. This is 4.4-6.6 times the amount of carbon emitted in 2016 from all the sectors in Scotland and, if emissions from peatland occur and are taken into account, it will greatly hamper efforts to meet emission reduction targets..."
>
> Ferretto, 2019[71]

The Scottish Government has aimed to restore 10,000ha of peatlands in 2018, and 20,000 per year from 2019, largely through the Scottish Government's Peatland ACTION programme. This is consistent with the CCC's recommendation of restoring a minimum of 18,000 ha of peatlands per year.

However, this has not been achieved, with 5,800 ha restored in 2018-19 [13] . As of December 2020, 25,000 ha had been restored under the Peatland ACTION programme since it began in 2012. This is around half of the 50,000ha target for 2020 set out in the 2018 CCP, though some peatland restoration has also been carried out through the Agri-Environment Climate Scheme under the Scottish Rural Development Programme.

The Scottish Government point to a lack of contractor capacity and poor weather as barriers to restoration, and highlight action being taken to increase demand and capacity. However, the monitoring report notes that:

> " The most important action to secure this capacity would be to secure a longer term approach to the funding of projects."
>
> Scottish Government , 2019[13]

In the 2020-21 Programme for Government, the Scottish Government highlighted a commitment to spend £20m on peatland restoration in 2020-21, with a commitment to invest "more than £250m" over the next 10 years [26] . £250m is consistent with delivering 250,000ha of restoration at the average cost per ha for peatland restoration. However, the minimum and maximum costs vary widely [72] .

Recent Reports - Land Use, Land Use Change and Forestry

The UK Climate Change Committee has published several recent reports which touch on land use, land use change and forestry, including:

- The Sixth Carbon Budget: the UK's Path to Net-Zero
- Land Use: Policies for a Net Zero UK
- Advice to the Scottish Government on building a resilient recovery from Covid-19

- The CCC's 2020 Progress report to Parliament.

In addition, other reports have been published which provide recommendations in this area:

- The Scottish Parliament Environment, Climate Change and Land Reform Committee (ECCLR)'s report on a Green Recovery in Scotland.

Climate Change Committee Reports

The CCC places much emphasis on the LULUCF sector's potential, particularly in the Scottish context with potential for both forestry and peatland restoration. This is evidenced by successive recent reports.

The UK's Sixth Carbon Budget

The UK's Sixth Carbon Budget, published by the CCC on 9 December 2020, sets out pathways to net-zero for the UK with varying degrees of ambition. In it, the Committee highlight where different combinations of measures can be deployed in different places in the UK. The differences for Scotland are largely due to land uses and geography, with Scotland having the highest proportion of forestry, but also the highest emissions from degraded peatland. The Sixth Carbon Budget states:

> " For Scotland, Wales and Northern Ireland, the sectors which have the biggest impact on emissions in 2050 are:"
>
> - The size of the net land use sink in 2050 which varies based on the scale of measures to remove carbon from the atmosphere, particularly tree planting"
> - The potential for further reductions in the agriculture sector due to behaviour changes and technological innovations."

This focus is also evident in other CCC reports.

Land Use: Policies for a Net-Zero UK

The CCC report sets out the contribution required from the land use sectors to achieve the UK's net-zero target. The report outlines both agricultural and land use sector measures, which are entwined in practice and presented together in the CCC's report. However, the agricultural measures will be discussed further in the Agriculture section.

The report concludes that:

- **Current policies are not delivering on the required changes**
- **There is opportunity now to implement a new policy frameworks**, as part of transitions to new land use policies across the UK following EU Exit
- **Farmers and land managers must be well-supported in the transition to a net-zero economy.** The report states that the measures required will not be delivered if left to the market alone
- **A coherent mix of regulation, financial incentives and enabling policies is**

required. Regulation should set a robust baseline, with financial incentives covering gaps in private costs as noted above, and policies to break down non-financial barriers such as skills and training

- **A strong monitoring, reporting and verification framework is also essential,** including the strengthening of bodies responsible for regulation and enforcement; in Scotland, this would be SEPA, the Rural Payments and Inspections Directorate (RPID), and NatureScot.

The report also proposes a policy framework for land use and agriculture. For LULUCF, the CCC focuses on afforestation and agroforestry (forestry on farmland) and peatland restoration, and propose policies to support this. Within the LULUCF sector, these are:

- **Strengthen the regulatory baseline**
    - Ban practices such as rotational burning on peatland and peat extraction
    - Require water companies to restore peatland on land they own; do the same for peatland owners within a site of special scientific interest
- **Provide funding for activities which go beyond the baseline**
    - Auctioned contracts or an emission trading scheme should be used to support funding for forestry, including agroforestry. These could be funded by a greenhouse gas levy on emitting industries
    - Public funding should be provided for forestry in more difficult or costly places, and for the non-carbon benefits of forestry planting, such as for supporting biodiversity, or providing greenspaces for people
    - Public funding should be provided initially for peatland restoration, though this could also move to public auctioned contracts
- **Enabling measures to address non-financial barriers**
    - Support schemes for skills, training
    - Increasing capacity in the domestic forestry supply chain.

Advice to the Scottish Government on Building a Resilient Recovery from Covid-19

The CCC outlined recommendations for priority measures to secure a green recovery from the Covid-19 crisis. These measures are those which the CCC assess will provide significant co-benefits in terms of climate change and the environment and economic, social and public health recovery from Covid-19. Within the LULUCF sector, the CCC recommended, as part of six priority measures, that the Scottish Government **prioritise tree planting, peatland restoration and green infrastructure.**

The CCC's 2020 Progress Report to the Scottish Parliament

The CCC produces annual reports of the Scottish Government's progress on climate

change to the Scottish Parliament. The most recent report was published in October 2020. While, as noted, the Scottish Government has struggled to meet some of its LULUCF targets, particularly for peatland restoration where only approximately half of the anticipated hectares have been restored, progress in the LULUCF sector is seen more favourably compared to other sectors.

The CCC set out eleven policy milestones for which the Scottish Government is responsible in its 2019 progress report. They assessed in 2020 that the Scottish Government had delivered on five of them fully, and a further three partially. Milestones in the LULUCF sector belong to the group of milestones that the CCC assessed *has* been delivered. The two milestones related to LULUCF are:

Table 8 - CCC Milestones for LULUCF Sector

Action	Timing	Primary responsibility	On track?
Ensure a long-term policy framework and funding is in place to support a minimum of 18,200 hectares of peatland restoration per year between now and 2045	2020	Scottish Government	Yes Funding secured for the next decade and long-term restoration target set
Follow through on commitments in Scotland's 2019-2029 Forestry Strategy to increase overall annual afforestation rates to at least 15,000 hectares in the early 2020s	Early 2020s	Scottish Government	Yes Ambition raised to 18,000 hectares by 2024/25

In terms of funding, the 2020 Progress report to Scottish Parliament highlights areas, particularly within the LULUCF sector, where funding is consistent with recommendations. The CCC notes for LULUCF in particular, that:

- The level of peatland restoration currently set out by the Scottish Government is consistent with the CCC's recommendations in the 2019 report on the UK's road to net zero emissions. The 2020-21 Scottish Budget set out a commitment to invest £250 million over 10 years to restore an average of 20,000 hectares of peatlands per year
- Should the Scottish Government deliver on their commitments on tree planting then the current level of commitment would be consistent with the CCC's recommendations. The 2020-21 Programme for Government announced additional investment in forestry of £6m in 2020-21, and £100 million to Scottish Forestry to increase new planting, and £30 million to Forestry and Land Scotland to expand Scotland's national forests by 18,000 hectares per year until 2024
- Additional funding has been allocated to the Biodiversity Challenge Fund, with £3 million announced in the 2020-21 Programme for Government.

In terms of embedding net-zero and core Scottish Government objectives, the CCC recommends in relation to the LULUCF sector that the Scottish Government "deliver Scotland's increased ambition for tree planting and peatland restoration in the next decade building towards at least 18,000 hectares of trees planted per year and 20,000 hectares of peatland restored per year by 2024-25."

Parliamentary Scrutiny

The Environment, Climate Change and Land Reform Committee's (ECCLR) **inquiry to establish the principles that should underpin a green recovery** heard evidence and made a number of recommendations in relation to the LULUCF sector, particularly in relation to natural capital and nature-based solutions. These recommendations emphasised the role of land use in a socio-economic recovery from the Covid-19 crisis that also contributes to delivering key environmental objectives. The Committee's recommendations include [17] :

- That "delivering effective nature based solutions will require effective collaboration between the public, private, third sectors and communities. Their energy and contribution are vital in adding value and in delivering a green recovery"
- That the land reform process should continue and grow, which "will require the provision of fiscal, legislative and wider support mechanisms for more communities and individuals to deliver public and community climate benefits through land ownership (for example via peatlands restoration and management and woodland creation and management)"
- That the Scottish Government bring forward a Natural Capital Plan for Scotland, outlining Scotland's natural capital assets, identify best practices for how multiple benefits will be delivered, provide a code of practice for policy decisions related to natural capital and balance the economic and social value of communities adjacent to natural capital alongside delivery of wider public benefits
- That the Scottish Government should produce a natural capital baseline to be monitored to assess progress
- That progress should be made on a National Ecological Network
- That the Scottish Government should align plans for job creation with plans for nature-based solutions and natural capital enhancement
- That there should be conditionality in public support; in other words, that there are specific conditions that are required to be met attached to all public money
- That the role of land use in a green recovery should be recognized in the third Land Use Strategy (which is being consulted on in winter 2020-21), and in the roll-out of regional land use frameworks
- That regional land use partnerships be key delivery mechanisms for new land use policies.

Draft CCPu - Land Use, Land Use Change and Forestry

Updated Emissions Estimates for LULUCF

Sector emissions reduction pathways have been updated in the draft CCPu. This has resulted in some significant changes to the anticipated emissions, as a result of the inclusion of the best current expectations for emissions from peatlands.

As set out in the section on Deriving Sector Emissions Envelopes, and Annex C of the draft CCPu, the emissions envelope for LULUCF has also taken Agriculture's pro-rata share of extra emissions reductions in order that cross-economy statutory targets can be met.

For LULUCF, whether the sector is a sink or a source depends on how land is used and managed, and whether activities that sequester carbon outweigh those that result in emissions.

In 2018, the sector was estimated to be a net carbon sink of -5.3mtco$_2$e and the amount of carbon *sequestered* by the sector was expected to increase by 26.2% to 2032 - in other words, contributing an additional 26.2% to emissions reductions.

However, in the draft CCPu, which includes estimates for peatland emissions on the lower end of what the CCC anticipates, the sector is expected to be a small net carbon source by 2020 (accounting for 0.6mtCO_2e), and over the period 2020-2032 an increase of 283.3% is expected, contributing to an emissions increase as opposed to a reduction as previously anticipated.[xiii]

As noted, the reason for the change in anticipated 2020 emissions and the switch from a sink to a source is the addition of emissions from peatlands. As a result of these changes to how the sector is accounted for, a direct comparison between the anticipated emissions trajectory from the 2018 CCP and the draft CCPu is not a useful measure of policy ambition (this is assessed qualitatively in the following sections), and only illustrates the development of a fuller picture of emissions from the LULUCF sector.

Policies and Proposals

The draft Climate Change Plan update broadly focuses on the same interventions as the 2018 CCP: forestry and peatlands.

The key ambitions for the sector have only changed very slightly since the 2018 CCP, most significantly as a result of announcements on forestry planting targets and funding for peatland restoration in the 2020-21 Programme for Government [23] . A comparison of the key ambitions set out in the 2018 CCP and the draft CCPu are outlined below:

Table 9 - Comparison of Key Ambitions 2018 and 2020

Key ambitions in 2018 CCP	Key ambitions in draft CCPu
Increase in woodland cover from around 18% to 21% by 2032, with 15,000ha planted per year in 2024-25	Ambition to increase forest cover maintained at 21% by 2032, with planting targets increased to 18,000ha per year in 2024-25
Increase the use of sustainably sourced wood fibre and encourage the construction industry to use timber. The use of Scottish timber in UK construction should increase to around 3 million cubic metres by 2031-2032 from 2.2 million cubic metres in 2018	A specific target is not mentioned
Restore 40% (250,000 hectares) of Scotland's peatland by 2030, and 50,000 hectares by 2020	Restore 250,000ha of peatland

However, some changes from the 2018 CCPu are:

xiii See page 253 in the draft CCPu for updated projected emissions for the 2020-2032 period.

- **Increased attention on the multiple benefits of land use and integrated use of land,** by delivering additional outcomes (e.g. for biodiversity or recreation) alongside carbon sequestration and storage, as well as greater attention on the need for a just transition in land uses. However, the plan does not describe how multiple benefits will be achieved or how potential trade-offs may be managed or prioritised

- **Related, the inclusion of a new objective on establishing Regional Land Use Partnerships** over the course of 2021. This is a requirement from the Climate Change (Emissions Reductions Targets) (Scotland) Act 2019, as well as a Programme for Government commitment in 2019-20. The aim of the partnerships is to provide a forum for joined-up decision-making on land use, and ensuring maximal benefits from land [73]

- **A more explicit link between interventions for agriculture and land use, land use change and forestry,** with commitments to work with crofters and high-nature value farmers to reward peatland restoration and agroforestry, and a link to future rural policy: “peatland restoration and agro-forestry will be considered and included in our policy and approach to future rural support, which will also include sustainable food production, emissions reduction, production of biofuel crops and appropriate land use change”

- **Greater discussion of a need for land use change**; the draft CCPu highlights the need for large scale and rapid changes to land use and management, and a requirement for faster peatland restoration

- **Emphasis on links to the planning system,** with a stated role for the National Planning Framework 4 to facilitate nature-based solutions to climate change, “looking to strengthen controls on development on peatland”, and facilitate peatland restoration through permitted development rights (a recent consultation on permitted development rights explored this)

- **The role of the LULUCF sector in a green recovery from Covid-19,** with mentions of green economic and employment opportunities from increased tree planting and peatland restoration, and for providing recreation opportunities. The Climate Emergency Skills Action Plan published alongside the draft CCPu identified agriculture and land use management (including forestry) as an area of potential opportunity for jobs growth with skills implications. However, the plan does not make clear how skills development and employment opportunities in these specific areas will be implemented [41]

- **An explicit policy for phasing out horticultural peat**. Though it is suggested that this is a new policy, it reaffirms previous commitments (including in the 2018 CCP which mentioned support for phasing out horticultural peat rather than an explicit policy to do so)

- **Further attention paid to private financing,** particularly for peatland restoration, with an aim to “integrate public and private funding for woodland creation and peatland restoration and management through better coordination between the Woodland Carbon Code, Peatland Code and government grants to our delivery partners”

- **New proposals in relation to peatland restoration**, including exploring how best to restore all degraded peat on public land and on formally designated sites, including through statutory measures, and exploring the development of a Peatland Restoration

Standard to set out best practice.

Emerging areas: Blue Carbon

As in the 2018 CCP, blue carbon (carbon that is stored in marine environments such as saltmarsh, reefs, kelp forests and maerl beds) remains an area of ongoing research. The Scottish Blue Carbon Forum was launched in 2018 as a collaboration between Marine Scotland, NatureScot and a number of universities. The forum aims to understand how marine and intertidal habitats sequester and store carbon and the effects of human activities on these habitats in order to inform policy.

The draft CCPu highlights the commitment of £570,000 to the Scottish Government's Blue Carbon Research Programme. No specific policies or proposals are set out to maintain or increase carbon sequestration and storage in the marine environment. The draft CCPu focuses instead on the Scottish Government's upcoming Blue Economy Action Plan, announced in the 2020-21 Programme for Government, and aiming to "manage the shared use of the seas by Scotland's marine sectors, communities and ecosystems" and "optimise opportunities in order to unlock the significant inclusive growth potential of Scotland's marine space whilst supporting a transition to net zero".

Many of the policies and proposals from the 2018 CCP have been maintained. Some new policies have been introduced, and some are identified as having been "boosted" by various additional commitments. Policies and proposals for each outcome are outlined in tables 1-4. Note that what was referred to as "policy development milestones" in the 2018 CCP are now grouped with proposals in the draft CCPu.

Outcome 1: We will introduce a stepped increase in the annual woodland creation rates from 2020-2021 to enhance the contribution that trees make to reducing emissions through sequestering carbon.

Table 10 - Policies for Outcome 1

Policies	New/Boosted?
Forestry grants: we will provide funding via a grant scheme, to support eligible land owners establish appropriate woodlands	Boosted by the 2020-21 Programme for Government, which committed to an additional £150m for forestry over the next five years (beyond the life of this Parliament), with an additional £6m spent in 2020-21
Woodland creation on Scotland's national forests and land. Forestry and Land Scotland will deliver an annual contribution towards the overall woodland creation target by creating new sustainable woodland on Scotland's national forests and land, including through partnerships with external organisations to scale carbon capture opportunities	Maintained. However, the percentage of new woodland planted on the national forest estate has been declining in recent years. A large majority of new planting in 2018-19 and 2019-20 was private forestry, and the most recent official Forestry Statistics state that 1030ha of new woodland were planted on the national forest estate in 2018-19, and 270ha were planted in 2019-20. The draft CCPu also states that the Forestry and Land Scotland's land acquisition programme will be extended for both forestry and peatlands
Awareness-raising. We will continue to deliver a programme of farm-based events to demonstrate and support improved productivity through integration of farming and forestry enterprises	Maintained. The 2019 Scottish Government monitoring report states that 20 promotional events were held in 2018-19, though it is not clear what proportion of events were farm-based. The Farm Advisory Service has a page dedicated to farm woodlands
Woodland standards. The Scottish Government will lead on the work with the UK and other UK Governments to maintain and develop a UK Forestry Standard that articulates the consistent UK wide approach to sustainable forestry. The Standard defines how woodland should be created and managed to meet sustainable forest management principles and provides a basis for monitoring	Maintained. It is not clear what progress has been made
Woodland carbon capture. The Scottish Government will further develop and promote the Woodland Carbon Code in partnership with the forestry sector, and will work with investors, carbon buyers, landowners and market intermediaries to attract additional investment into woodland creation projects and increase the woodland carbon market by 50% by 2025	New for the draft CCPu The specific target is new for the CCPu; the existing policy on the Woodland Carbon Code related only to awareness-raising. 157 projects were participating in the Woodland Carbon Code in Scotland at March 2020, an increase of 34 projects since March 2019 (28%)
Forestry and woodland strategies continue to be prepared by planning authorities, with support from Scottish Forestry. They provide a framework for forestry expansion through identifying preferred areas where forestry can have a positive impact on the environment, landscape, economy and local people.	Maintained The draft CCPu does not identify the progress of planning authorities in developing strategies.

Table 11 - Proposals for Outcome 1

Proposals	New/Boosted?
Support forestry sector on plant and seed supply strategy to help meet the increased planting targets. A programme of technical innovation to develop and adapt modern horticultural practices will help improve seed preparation and handling, techniques to reduce environmental impacts, and increase nursery production. Funding to support increased production of young trees is available through the Harvesting and Processing grant which is now open to forest nurseries across GB with support from Defra	New for the Scottish Forestry Implementation Plan. The plan was published in mid-2020 and covers the period from 2020-2022. It outlines how the aims of the forestry strategy will be delivered Additional funding to support the Harvesting and Processing Grant was announced in July 2020. This grant is part of the Forestry Grant Scheme, the funding for which has to date been provided from the EU and will now need to be provided domestically
Forestry and Land Scotland will begin development of a new approach to woodland investment with a view to acquiring more land to establish further woodland on Scotland's national forests and land for the benefit of future generations and to optimise carbon sequestration. This includes partnering with private sector and other organisations to enhance scale and funding of carbon capture projects	New for the draft CCPu

Three proposals for this outcome are not referenced in the draft CCPu. These are:

- Working with community, public and private sector investors to explore new partnership funding models (2018-2019)
- Develop further targeted grants measures (2018-2019)
- Review Forest Enterprise Scotland's woodland creation activity on the National Forest Estate (2019-2020).

Outcome 2: Increase the use of sustainably sourced wood fibre to reduce emissions by encouraging the construction industry to increase its use of wood products where appropriate.

Table 12 - Policies for Outcome 2

Policies	New/Boosted?
In collaboration with the private forest sector and other public sector bodies the Scottish Government will implement the Timber Development Programme through an annual programme of projects that support the promotion and development of wood products for use in construction	Maintained It is unclear what progress has been made, though the CCPu route map to 2032 states that the Timber Development Programme was implemented in 2020

There are no proposals for this outcome.

Outcome 3: To enhance the contribution of peatland to carbon storage, we will support an increase in the annual rate of peatland restoration, from 10,000 hectares in 2017-2018 to 20,000 hectares per year thereafter.

Table 13 - Policies for Outcome 3

Policies	New/Boosted?
Restoration grants: We will provide grant funding to support eligible land managers to deliver peatland restoration. Levels of funding will enable at least 20,000 hectares of peatland restoration per year. We will undertake research to inform where restoration can deliver the greatest emission savings per hectare	Boosted by the 2020/21 Budget, reinforced in 2020-2021 PfG While the ambition to restore 250,000ha by the early 2030s remains the same as the 2018 CCP, the "boost" refers to an inclusion of £20m for peatland restoration in 2020-21, with a commitment to £250m for peatland restoration over the next 10 years. Studies have suggested that the median cost per hectare for peatland restoration is approximately £1000, though this can vary widely depending on the type of restoration work carried out [72] . The commitment to undertake research to inform where restoration can deliver the greatest emissions savings per hectare is new for the draft CCPu
Awareness raising: Working through partnership, we will put in place tools and information to promote peatland restoration and develop the capacity, skills and knowledge of land owners, land managers, contractors and others to deliver peatland restoration	New for the draft CCPu
With partners, refresh our vision for Scotland's peatlands and review peatland restoration support mechanisms to overcome embedded barriers and improve how we fund and deliver this activity	New for the draft CCPu The current vision for Scotland's peatlands is set out in Scotland's National Peatland Plan, published in 2015. The CCPu states that work is currently ongoing to overcome barriers, including "the need for multi-year funding, enhanced contractor capacity...and improved awareness among land owners and managers..." Lack of contractor capacity and lack of multi-year funding were two of the barriers to achieving targets identified in the 2019 Scottish Government monitoring report
Phase out the use of peat in horticulture by increasing uptake of alternative materials, undertaking stakeholder engagement to understand transitional challenges, to improve the uptake of alternatives and develop a time-scaled plan	New for the draft CCPu While the draft CCPu identifies this as a new policy, the Scottish Government has supported phasing out horticultural peat use for some time. The 2019-20 Programme for Government stated that "we will seek to phase out the use of horticultural peat by increasing uptake of alternative growing media substrate." What appears to be new for the CCPu is a commitment to carry out research on transitioning to alternative growing materials, as well as a commitment to develop a delivery plan and timetable for phasing out horticultural peat in 2021
Our Position Statement on National Planning Framework 4 confirmed our current thinking that through the planning system we will not support applications for planning permission for new commercial peat extraction for horticultural purposes, we are looking at strengthening controls on development on peatland and we will help facilitate restoration through permitted development rights	New for the draft CCPu While the draft CCPu states that this is a new policy, there has been a presumption against planning permission for new commercial peat extraction since 2014; Scottish Planning Policy (published in 2014) states that commercial peat extraction should only be allowed "in areas suffering historic, significant damage through human activity and where the conservation value is low and restoration is impossible". However, the IUCN Peatland Programme notes that this this area has been poorly regulated [74] The draft CCPu states that the role of the planning system will be strengthened in this regard

Table 14 - Proposals for Outcome 3

Proposals	New/ Boosted?
Develop opportunities for private sector investment in peat restoration, engaging with sectors to establish investment pathways, enabling both public and private sector to invest in a range of measures to help mitigate effects of climate change	New for the draft CCPu
Explore how best to restore all degraded peat in the public estate and also within formally designated nature conservation sites, including through statutory mandat	New for the draft CCPu
Explore the development of a Peatland Restoration Standard to ensure best practice and continuous development in the success and effectiveness of peatland restoration	New for the draft CCPu

Outcome 4: We will establish pilot Regional Land Use partnerships (RLUPs) over the course of 2021.

Table 15 - Policies for Outcome 4

Policies	New/Boosted?
Establishment of pilot Regional Land Use Partnerships to help ensure that we maximise the potential of Scotland's land to help achieve net zero Publication of Scotland's third Land Use Strategy	New for the draft CCPu While this is stated as a new policy for the draft CCPu, a policy to encourage the development of regional land use partnerships has been set out since 2016 in the second Land Use Strategy. Two pilots – one in Aberdeenshire and one in the Borders – have already been carried out and evaluated. Since the passage of the 2019 Climate Change (Emissions Reductions Targets) (Scotland) Act, Climate Change Plans must set out policies and proposals for the development of regional land use partnerships and the details of support and resources for the partnerships to develop frameworks

Indicators

The 2018 CCP had three policy output indicators:

- Number of hectares of woodland created
- Annual volume (in million of cubic metres) of Scottish produced sawn wood and panel boards used in construction (extrapolated from UK figures)
- Number of hectares of restored peatland per year.

The draft CCPu outlines a number of others:

- **Outcome 1:** Hectares of woodland created per year
- **Outcome 1:** Woodland ecological condition
- **Outcome 1:** Woodland Carbon Code: projected carbons equestration (validated credits)
- **Outcome 2:** Annual volume (in millions of cubic metres) of Scottish produced sawn wood and panel boards used in construction
- **Outcome 3:** Hectares of peatland restored per year
- **Outcome 3:** Peatland Carbon Code: Projected emissions reductions (validated

credits).

The new policy outcome indicators are slightly more detailed than in the 2018 CCP. Notably, the inclusion of woodland ecological condition suggests that monitoring will not focus solely on carbon sequestration, though how meaningful this is as an indicator will depend on the data that is collected and evaluated.

Agriculture

Context

This section covers emissions reductions from agriculture, which is addressed separately from other land uses in national and international accounting.

In Scotland, agriculture is the third-largest source of greenhouse gas emissions overall, after transport and industry. As part of that total, agriculture is the largest source of Scotland's methane and nitrous oxide emissions, accounting for roughly two-thirds of these. Methane emissions come largely from livestock, while nitrous oxide comes from the management of agricultural soils [10] .

2018 CCP - Agriculture

The vision for agriculture set out in the 2018 CCP emphasised an ambition for:

- Scotland to be a low carbon and efficient producer of high-quality food
- Growing numbers of farmers and crofters to adopt low carbon practices, including those which improve insight and precision such as soil testing and carbon audits, and be making full use of technology for precision farming by 2050
- Farmers and crofters to adopt renewable energy systems
- Agricultural emissions to fall by 9% between 2018 and 2032.

Key ambitions for this sector are outlined in the table below:

Table 16 - Key Ambitions in Agriculture

Expected GHG Emissions Reduction	Key Ambitions
9%	• By 2020, the efficient use of nitrogen fertilizer will increase by helping farmers to identify the pH of the soil on a third of their improved land • By 2020, farmers producing a substantial proportion of Scotland's agricultural output will have completed a carbon audit • By 2030 most farmers will know the nutrient value of their improved soil and will be implementing best practice in nutrient management and application • By 2050 Scottish farmers will be making full use of technology to apply precision farming techniques

Five policy outcomes were outlined for the agriculture sector. The outcomes, and their

underpinning policies, proposals and development milestones are set out in the following tables:

Outcome 1: More farmers, crofters, land managers and other primary food producers are aware of the benefits and practicalities of cost-effective climate mitigation measures and uptake will have increased.

Table 17 - Policies and Proposals for Outcome 1

Policies
The dissemination of information and advice on climate change mitigation measures in agriculture through a range of communication methods utilising technology and all media to best effect
An agri-tech group will be established to share, disseminate and encourage adoption of advances in agricultural science and technology as widely as possible
Young Farming Climate Change Champions will be recruited and trained to explain, promote and encourage low carbon farming
Proposals
Marketing scheme: Determine the feasibility of a Low Carbon Farming marketing scheme

In addition, there are two "policy development milestones":

- Carbon Audits: to consult in 2018 on how best to ensure maximum take up of carbon audits and how to enable tenant farmers and crofters in particular to benefit
- To explore with Scottish Tenant Farmers Association how best to engage tenant farmers to increase understanding of the environmental and economic benefits of low carbon farming.

Outcome 2: Emissions from nitrogen fertiliser will have fallen through a combination of improved understanding, efficient application and improved soil condition

Table 18 - Policies and Proposals for Outcome 2

Policies
Communicate and demonstrate the benefits of precision farming and nitrogen use efficiency in order to achieve a reduction in GHG emissions
Work with the agriculture and science sectors regarding the feasibility and development of a SMART (specific, measurable, achievable, relevant and time bound) target for reducing Scotland's emissions from nitrogen fertiliser
From 2018 we expect farmers to test the soil on all improved land every five or six years, and we will work with them to establish how best to achieve this
Proposals
Investigate the benefits and barriers of leguminous crops in rotation
Crop varieties with improved nitrogen-use efficiency

Outcome 3: Reduced emissions from red meat and dairy through improved emissions intensity.

Table 19 - Policies and Proposals for Outcome 3

Policies
Commission and publish a report into the establishment of emissions intensity figures for beef, lamb and milk
Work with Quality Meat Scotland, ScotEID and livestock producers to encourage improved emissions intensity through genotyping, improving fertility, reducing animal mortality and improving on farm management practices
Proposals
Determine the practicalities and feasibility of using livestock feed additives as a means of reducing emissions

There are two policy development milestones:

- Determine the practicality of establishing a SMART target for reduction in the intensity of emissions for beef, sheep and dairy sectors
- Consult in 2018 to determine the nature of livestock health measures that the sector will adopt from 2019.

Outcome 4: Reduced emissions from the use and storage of manure and slurry

Table 20 - Policies and Proposals for Outcome 4

Policy development milestones
Determine the potential feasibility of self-financing large-scale slurry and manure fed anaerobic digesters
Engaging with farmers to explore their support requirements, establish how they can improve the use and storage of manure and slurry, including the potential for cooperatively owned and managed anaerobic digesters
Proposals
Investigate the practicalities of livestock grazing in rotation on current arable land
Conduct a feasibility study for the establishment of manure/slurry exchange
Determine how to consistently minimise emissions from slurry storage

Outcome 5: Carbon sequestration on agricultural land has helped to increase our national carbon sink

Table 21 - Policies and Proposals for Outcome 5

Policies
Explore with the farming and forestry sectors how best to increase planting of trees and hedgerows which optimise carbon sequestration, including the role of agroforestry
Proposals
Investigate the feasibility of payment for carbon sequestration taking into account any existing schemes such as the woodland carbon code as a means of encouraging the uptake of carbon sequestration on farms
Woodland cover on suitable agricultural land

Current progress

Scottish Government's 2019 report on progress towards the ambitions in the 2018 CCP assesses that it is too early to tell whether progress has been made in reducing emissions from the agricultural sector. The CCC state that emissions in agriculture have remained largely unchanged, falling by 3% between 2008 and 2018 [15] .

The 2019 Scottish Government progress report also reports against implementation indicators. These are:

- The level of engagement within the agricultural industry to climate change themed topics through Farming For a Better Climate and the Farm Advisory Service. The report notes that 1765 farmers and crofters attended climate change events through these programmes. This is 3.5% of the holdings in Scotland[xiv]
- Increase the uptake of free carbon audits provided through the Farm Advisory Service to 200 audits delivered per year by 2019. The report indicates that 397 carbon audits had taken place between the last monitoring report and December 2019, which covers

xiv Calculations in this section have been made using the total number of holdings in the Scottish Government's Agriculture Facts and Figures booklet from 2019.

approximately 0.8% of holdings in Scotland

- Increase uptake of Integrated Land Management Plans (ILMPs) provided through the Farm Advisory Service to 300 ILMPs delivered per year by 2019. The report indicates that 144 ILMPs were delivered between the previous monitoring report and December 2019, representing 0.3% of Scottish holdings.

However, the challenge facing the agricultural sector most frequently raised by the CCC is the lack of policy framework to deliver decarbonisation. The CCC stated in its 2020 Progress Report to the Scottish Parliament that [15] :

> “ There is still an absence of policy to deliver emissions reduction in agriculture in Scotland. Unlike legislation planned for England and Wales, the Scottish Government has not yet included climate mitigation and adaptation as key 'public goods' to be paid for as part of Scotland's overhaul of agriculture and land policy.”

While a commitment was made in the 2020-21 Programme for Government to bring forward proposals for a new rural support scheme “better able to contribute towards delivering Scotland’s world-leading climate-change outcomes”, no information is yet available for the content of these schemes. It is therefore not possible to assess whether Scottish Government policies will be ambitious enough.

Some announcements have been made, for example, in relation to an Agricultural Transformation Programme, and a pilot Sustainable Agricultural Capital Grants Scheme (SACGS) to support farmers and crofters to purchase agricultural equipment aimed to improve the sustainability of farming. £40m was announced for the Agriculture Transformation Programme in February 2020 [75] , £20m of which was allocated as capital grants for 2020-21. £18m of this has been allocated to the SACGS.

However, the CCC state that funding for agriculture and land use“is not enough to drive a structural realignment of rural funding in Scotland that properly incentivises carbon reduction and sequestration, nor climate adaptation”, that the Agricultural Transformation Programme “does not fully address action” and that increased take-up of low-carbon farming practices is not yet demonstrated. [15] A similar sentiment is echoed by the Climate Emergency Response Group in their interim monitoring report [20] .

In addition, linked to the lack of future policy direction for agriculture is the precarity of existing schemes which are directed at delivering climate and other environmental outcomes, and the lack of secure funding for these.

For example, the Agri-environment Climate Scheme is the main scheme where financial support is provided for specific management activities to benefit the climate and the environment. Contracts are typically for five years; while the scheme has been open annually to new applicants, in 2020 only contract extensions were offered to those whose existing contracts were expiring, meaning that no new agreements could be made. In 2021, a restricted scheme is running, with a limited number of management interventions being funded. By contrast, other EU agricultural support schemes that do not have a specific focus on climate and environment interventions continue to be maintained.

Some progress on policy development is being made. The Farming and Food Production Future Policy Group was tasked by the Scottish Government with developing policy recommendations, and is due to report on long-term rural policy proposals. Similarly, the Suckler Beef Climate Group was tasked with developing recommendations for sustainable

suckler beef production in Scotland and reported in October 2020 with proposals for a new scheme to incentivise low carbon practices as well as enhanced minimum standards. An additional group, for the arable sector, has also been set up.

There have also been successful initiatives involving smaller numbers of individual farmers and crofters, including through Farming for a Better Climate, monitor farms, and the Young Farmer Climate Champions. These initiatives successfully demonstrate good practice and showcase the most progressive farms and crofts. However, there is less evidence of interventions which are shifting a broad base to low-carbon practices [15] .

Recent Reports - Agriculture

The agriculture sector has been in focus in a number of recent reports on progress towards reducing emissions, including from the UK Climate Change Committee. CCC reports that are relevant to agriculture include:

- Land Use: Policies for a Net Zero UK
- Advice to the Scottish Government on building a resilient recovery from Covid-19
- Advice on achieving the Scottish Government's target of 75% reduction in emissions by 2030.
- The CCC's 2020 Progress report to Parliament.

In addition, agriculture has been in focus amongst stakeholder groups and touched on as part of the Environment, Climate Change and Land Reform Committee's inquiry into a green recovery from Covid-19.

- The Agriculture (Retained EU Law and Data) (Scotland) Act 2020
- The Scottish Parliament Environment, Climate Change and Land Reform Committee (ECCLR)'s report on a Green Recovery in Scotland
- The Climate Emergency Response Group's interim progress report.
- The Farming for 1.5 Inquiry's report
- The Suckler Beef Climate Group's report.

Climate Change Committee Reports

Land Use: Policies for a Net-Zero UK

The CCC's report sets out the contribution required from the land use sectors to achieve the UK's net-zero target. The report sets out both agricultural and land use sector measures, which are intertwined in practice and presented together in the report, though land use sector measures apart from agriculture are discussed in the land use, land use change and forestry section.

The report concludes that current policies are not delivering the required changes, though there are opportunities to implement new policy frameworks that support a transition to low-carbon farming. The report stresses that farmers and land managers must be

financially supported to address the private costs required to deliver necessary public benefits.

The report identifies five key actions, all of which have implications for agriculture. These are:

- **Low-carbon farming practices**, the report cites controlled release fertilisers, improving livestock health and slurry acidification as examples
- **Afforestation and agro-forestry**. The report notes that “planting trees on agricultural land, while maintaining their primary use ("agroforestry"), could deliver a further 6 $MtCO_2e$ savings by 2050” [76]
- **Peatlands**. The report notes that “restoring at least 50% of upland peat and 25% of lowland peat would reduce peatland emissions by 5 $MtCO_2e$ by 2050, while allowing food production to continue on the most productive land" [76]
- **Bioenergy crops**. Expanding growth of energy crops would deliver emissions savings from the growth of the crop as well as from the harvested biomass, but only when used with carbon capture and storage. However the CCC also note the potential risks of bioenergy crops, for example negative impacts on biodiversity due to monocultures
- **Reducing consumption of the most carbon-intensive foods (i.e. beef, lamb and dairy)** the report notes that a reduction of “at least 20% per person and reducing food waste by 20% would save 7 $MtCO_2e$ of on-farm emissions by 2050”. The report goes on to state that “These measures imply a shift towards current healthy eating guidelines and can drive sufficient release of land to support the necessary changes in tree planting and bioenergy crops. Alongside expected population growth, they imply around a 10% reduction in cattle and sheep numbers by 2050 compared with 2017 levels. This compares with a reduction of around 20% in the past two decades” [76].

The CCC's recommendations for Scottish agriculture and land use are set out in the relevant section below.

Advice on achieving the Scottish Government’s target of 75% reduction in emissions by 2030

The Scottish Government has set a target of reducing greenhouse gas emissions by 75% by 2030. The CCC has published advice on reaching this target. They note that the ambition required to deliver this is very high, and exceeds the ambition in their most stretching pathway. While proposals to accelerate emissions reductions for Scotland are not largely within the agriculture sector, the CCC notes that their most ambitious scenario includes high assumptions on reducing consumption of meat and dairy, 20% by 2030 rising to a 50% reduction in consumption by 2050.

The CCC’s 2020 Progress Report to the Scottish Parliament

The CCC’s annual report of the Scottish Government’s progress on climate change to the Scottish Parliament published in October 2020 states that there has been “no meaningful

progress on tackling agricultural emissions in Scotland", and agriculture is an "area of concern" [15] .

The CCC particularly stresses the absence of policies to deliver emissions reductions for agriculture in Scotland, and that "the Scottish Government has not yet included climate mitigation and adaptation as key 'public goods' to be paid for as part of Scotland's overhaul of agriculture and land policy" [15] . The draft CCPu does partly address this, and explicitly states that climate change mitigation is one of the objectives of a new land use policy.

The CCC states that while there are commitments to bring forward recommendations for a new policy, they cannot make an assessment on whether these will meet recommendations for agriculture as set out in their land use report (summarised above). They note that both existing policy and funding is insufficient to bring about transformational change.

As a result, one of the overall strategic priorities for Scotland is to "Develop a new rural support scheme that builds towards Scotland's climate goals" [15] .

The CCC made specific recommendations on agriculture and land use to the Cabinet Secretary for the Rural Economy and Tourism and the Cabinet Secretary for Environment, Climate Change and Land Reform. While the climate change plans separate agriculture from LULUCF, these two sectors are interrelated. Therefore, the CCC's recommendations related to agricultural and rural support also includes elements that are also relevant for LULUCF, e.g. in relation to peat. The CCC's recommendation in full is set out in the following Box.

October 2020 CCC Recommendations on Scottish agriculture and land use:

Set out new recommendations for Scotland's future rural support policy, and make provisions for Ministers to create new policy or reform existing policy. Policy to reduce emissions on farms and increase land-based sequestration should also deliver co-benefits for wider environmental goals. Scotland's rural support policy should include:

- A **strong regulatory baseline** that includes low-cost, low-regret options e.g. retain existing standards (e.g. Nitrate Vulnerable Zones) and introduce new legislation (e.g. to ban damaging practices on peat including rotational burning of peat, peat extraction and the use of peat in compost)
- **Mechanisms for private and public financing** of agricultural measures above the baseline and land-based solutions (e.g. innovative farming options, forestry, agro-forestry, peatland restoration and hedgerow creation), which should also support the clear co-benefits for wider environmental goals e.g. flooding, biodiversity, air quality etc
- **Measures to tackle non-financial barriers** to change such as retraining and awareness raising, tackling tax treatment of woodland creation and tenancy and landlord constraints
- **Policies to encourage consumers to shift to healthier diets and reduce food waste** e.g. public sector taking the lead and development of an evidence-based strategy on diets; and target setting in the public and private sector to reduce food waste
- **Interim policies should be implemented to avoid a hiatus in action before the new framework is fully in place.** It is important that a hiatus in the take-up of measures required for delivering net zero is avoided while awaiting the implementation of new policies. It is therefore critical that on-going public funding should continue, and where necessary be increased. In addition, the terms of funding available under existing programmes (e.g. Agri-Environment schemes) should be amended to incorporate measures that directly reduce emissions [15] .

In addition, the CCC provided an assessment of the policy action required. Within the agriculture sector, Scotland is not assessed to be on track in relation to policy delivery. The CCC's assessment on agriculture is set out in full below [15] :

Table 22 - CCC Assessment of Scottish Agriculture

Action	Timing	Primary responsibility	On track?
Ensure the ongoing design of the post-CAP framework in Scotland, including the testing and trialling of options, will incentivise the take-up of low-carbon farming measures and changes in land use to increase carbon removals	2021	Scottish Government	No Agricultural Transformation Fund does not fully address action, but commitments were made to outline a post-CAP rural support policy in the coming year
Increase the take-up of low-carbon farming practices and develop a strong regulatory baseline that includes low regret options, with incentives and a wider policy framework for further measures	Early 2020s	Scottish Government	Not yet demonstrated
The Industrial Strategy's Transforming Food Production Challenge Fund: ensure future calls are allocated to projects that deliver supporting emissions reduction and clean growth in the food and agriculture sectors	2020	UK Government	Partly

Parliamentary, and Other Scrutiny

- The Agriculture (Retained EU Law and Data) (Scotland) Act 2020
- The Scottish Parliament Environment, Climate Change and Land Reform Committee (ECCLR)'s report on a Green Recovery in Scotland
- The Climate Emergency Response Group's Interim Progress Report.
- The Farming for 1.5 Inquiry's report
- The Suckler Beef Climate Group's report.

Agriculture (Retained EU Law and Data) (Scotland) Act 2020

The Agriculture (Retained EU Law and Data) (Scotland) Act 2020 was passed by the Scottish Parliament in August 2020. The Act provides for Scottish Ministers to make changes to existing CAP programmes for the purpose of "simplifying or improving" them. Changes can only be made in the short term, and not after 2026. The Act was passed to deliver on the Scottish Government's Stability and Simplicity agenda, which set out a period of relative stability with only small changes to existing schemes and programmes, followed by a new policy from 2024. The Act does not provide for this new policy.

The Scottish Parliament Environment, Climate Change and Land Reform Committee 's report on Green Recovery

The ECCLR Committee heard evidence and made a number of recommendations in relation to the agriculture sector, particularly on the development of a long-term policy framework for agriculture. The Committee recommended that:

- As part of a route map to a green recovery, detailed long-term plans for agricultural policies are brought forward "which demonstrate the principle of conditionality in support, and allocate a credible level of resources towards reaching net-zero targets

and reversing biodiversity loss, while learning lessons from Covid-19 to build resilience in the sector and deliver a green recovery”

- Additional resources be provided for enhancing advisory services to support a green recovery and transition to net-zero, including the provision of free advice for farmers, crofters and other land managers
- The work under the strategic research programme should better align to advice provided to farmers and crofters
- Regional land use partnerships and frameworks be developed into regional delivery mechanisms for new land use policies
- There is a "significant opportunity in redesigning [Pillar 1] payments to be consistent with the objectives of supporting a green, just and resilient recovery, and reward existing good practice.” Pillar 1 payments refer to direct payments to farmers, greening payments, and voluntary coupled support for the beef and sheep sectors
- The Scottish Government bring forward plans to lock-in positive changes in local food economies.

The Farming for 1.5 Inquiry report

The Farming for 1.5 Inquiry is a multi-year collaborative inquiry between the National Farmers Union Scotland and Nourish Scotland, a food policy charity. The Inquiry was carried out by a panel of farmers, practitioners, scientists, researchers, environmentalists, policy experts and campaigners, and has worked towards building consensus on a pathway to net zero for Scottish agriculture. The Inquiry’s final report states:

> “ The transition of Scottish agriculture to net zero will take much more than mere tweaking current voluntary ‘Greening’ or paying for on-farm carbon accounting. The development of these tools to be used by all farmers is a first step and is included in the panel’s recommendations, but a wide-ranging, deeper, longer-term commitment with visible leadership by government and the farming industry is needed to power the transition to a net-zero future. This transition needs to be supported with policy alignment across all departments, including research prioritisation; informed by social change science; underpinned by tailored advice and adequately financed.”

The group highlighted two themes for agriculture’s transition to net-zero:

- To “revolutionise current practices to reduce agriculture’s impacts on the climate, and maximise sequestration through changes to management practices”
- To build “a positive attitude towards the multi-use of land needs to become the norm so as to sequester carbon and build biodiversity. These ‘multi-functional’ land uses include integrating agroforestry and agroecology, using wetlands as part of natural flood protection networks and building long term multispecies pastures, and restoring peatlands to keep carbon in the soil and Farming for 1.5°C Independent Inquiry 5 boost biodiversity. Planting trees also has an important role – as farm woodlands, hedges and shelter belts as well as larger blocks of forestry”.

They also propose five phases of change, from 2020 to 2045, which represent as great a

transition as “the change from horses to tractors”. The phases are:

- **Phase 1** (as soon as possible): Culture change: knowledge-sharing and advice, baseline data collection through soil testing and carbon audits, piloting, support for innovation, and ensuring advisors have training in climate change and ecology
- **Phase 2** (following on from Greening, due to end in 2021): A farmers’ mitigation menu: mandatory for all farmers and crofters, financial incentives for a menu of mitigation options (e.g. use of legumes, manure management, livestock health, soil management), supported by education, training and advice. The aim would be to ratchet up ambition over time,to be designed to allow self-audit to avoid non-compliance, and aim for national 25% emissions reductions
- **Phase 3** (to begin with new agricultural policy from 2024): System change to low-emission production: offers two pathways to farmers – production-centred management options focused on e.g. high precision farming, genetics and soil management; and multifunctional farming options focused on multifunctional land use for carbon storage, biodiversity recovery, and low inputs
- **Phase 4** (piloted now to inform post-2024 land use policies): Enabling whole farm change such as agroforestry, organics, agroecology, regenerative farming, and multifunctional landscapes
- **Phase 5** (begins now with a view to all farmers being involved in land use change by 2030): Land use change converting cropland and grassland to woodland, and restoring peatlands and wetlands.

The Climate Emergency Response Group’s Interim Progress Report

Related to the agriculture sector, as part of the eight policy packages for a green recovery, CERG recommended a rural jobs creation programme, and as part of the 12 immediate actions, the recommendations related to agriculture are:

- Produce public guidance on sustainable, climate-friendly, healthy diets
- Make regional land use plans for maximising the potential of every part of Scotland’s land to contribute to the fight against climate change
- A £100m Agricultural Modernisation Fund.

Progress against these recommendations were assessed as part of the interim report and CERG’s findings and recommendations are summarised below:

Table 23 - CERG's Findings and Recommendations

CERG Recommendation	Scottish Government progress	What CERG would like to see from the CCPu
Produce public guidance on sustainable, climate-friendly, healthy diets	No meaningful policy or budget commitments made Some good concepts, but lack of coherent strategy or approach to food Missed opportunity where work on healthy eating does not touch on sustainable diets No progress on developing guidance on sustainable diets. Good Food Nation Bill not being introduced	Sustainable diet guidelines to be agreed (e.g. short-life expert working group), including requirements for avoidance of food waste. Interim report by March 2021 with guidelines completed in 12 months Public sector food provision to be informed by these sustainable diet and food waste avoidance guidelines
Make regional land use plans for maximising the potential of every part of Scotland's land to contribute to the fight against climate change	Proposal met in part but gaps remain, scale of response inadequate and/or delayed Welcome commitment in the 2019-20 Programme for Government but unclear if progress is sufficient to roll out partnerships on time Work commencing on third Land Use Strategy; Land Commission Interim Report published for regional land use plans Lack of long-term signals that policies and incentives will align with delivery of net-zero; "short-term signals indicate a maintaining of the status quo"; delay in publication of proposals from the Farming and Food Production Future Policy Group	Opportunity for piloting good practices and nature / climate-based agri-payment systems, cross compliance requirements, payment capping under powers given through the Agriculture Act. Pilots to align to local net zero regional land use priorities / opportunities for skills diversification Post- 2024 rural support payments enable effective delivery of nature and climate outcomes and are informed by Regional Land Use Plans
A £100m Agricultural Modernisation Fund	Proposal met in part but gaps remain, scale of response inadequate and/or delayed Some good actions, including the £40m Agriculture Transformation Fund, but progress slow and not clear how interventions will be targeted or how progress will be measures Research on Decision-Support Tools ongoing but these need to be fully incorporated into policy / funding processes / advisory services Success depends on appropriate targeting / coordination through regional Land Use Frameworks, accessible and bolstered training and support services, and the focus of post-2024 rural support packages Loan programme still under development Resource constraints in comparison to significant needs for advice, training etc.	Package of policies and proposals for emissions reduction from agriculture Key interventions prioritised Supported by tailored advice Funded through Agriculture Transformation Programme Monitoring to measure outcomes
A rural job creation programme	On track for both policy and budget Met through long-term funding and incentives for investment for forestry, woodlands and peatland restoration, announcement of the Green Jobs Fund in the 2020-21 Programme for Government, and announcements for supporting rural communities through digital connectivity, 20-minute neighbourhoods, and local working hubs. However, need greater clarity on how rural jobs will link to future rural support, and regional land use plans	Policy signals that post-CAP rural policies will align with net-zero, integrate with regional land use frameworks and with a clear timeline to provide clarity for employers in rural businesses Greater clarity on forestry plans and how "the right tree in the right place" will be achieved Ban on extraction and sale of horticultural peat in Scotland to be consistent with peatland restoration

Suckler Beef Climate Group report

The Suckler Beef Climate Group was formed in early 2020 with the aim of developing recommendations for a government-funded scheme for climate-friendly suckler beef production. Emissions reductions in this sector are important – suckler beef production currently accounts for approximately one-third of Scotland's agricultural emissions [77].

The group's final report published in October 2020 states [77]:

> " A recent study conducted by S. Thomson and A. Moxey (2020)9 shows that the Scottish suckler beef sector has the potential to cut greenhouse gas emissions registered in the National Inventory by up to between 24% and 39%, and emissions abatement modelling carried out by J. Bell et al. (2020) suggests that the adoption of 10 different on-farm measures can lower greenhouse gas emissions per unit of output by almost 38%. […] Their findings are consistent with other similar studies that were carried out independently of this report and which came to similar conclusions, namely that Scotland's farmers can indeed reduce emissions by at least 35% without the need to compromise current production levels."

The final report presents recommendations for a "Suckler Beef Climate Scheme" to reduce emissions from suckler beef herds by focusing on production efficiency and carbon storage and sequestration. The scheme is proposed to be made up of:

- A set of baseline minimum requirements for participation, including completing a carbon audit, nutrient management plans, continuous professional development, data sharing, biodiversity enhancement, etc
- A suite of management options for improved production efficiency, and improved soil health, land management and nutrient management.

Draft CCPu - Agriculture

The draft Climate Change Plan Update (CCPu) is notable for having increased the ambition for emissions reduction in the agriculture sector. The **2018 CCP had outlined ambitions for a 9% reduction between 2018 and 2032**, whilst **the draft CCPu proposes emissions reductions of approximately 24% between 2018 and 2032**.[xv]

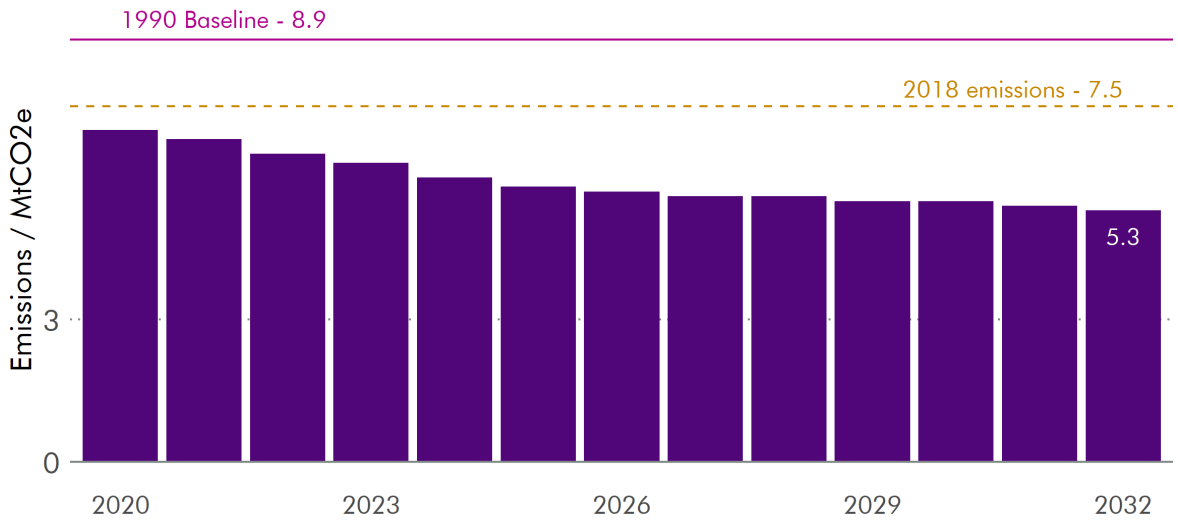
Figure 16 shows the new anticipated emissions reductions for agriculture outlined in the draft CCPu. Emissions in 2020 are assumed to be 7 $MtCO_2e$ - 7% lower than in 2018.

As set out in the section on Deriving Sector Emissions Envelopes, and Annex C of the draft CCPu, these emissions envelopes are consistent with the "core technical" modelling to derive sectoral emissions, and have not had additional reductions added in (as with other sectors - except Industry). The additional reductions were added to the LULUCF sector instead.

xv Derived from figures in Annex C (https://www.gov.scot/publications/securing-green-recovery-path-net-zero-update-climate-change-plan-20182032/).

Figure 16 - Anticipated Emissions Reductions Agriculture 2020 - 2032

$MtCO_2e$ - million tonnes of carbon dioxide equivalent



There have been some changes to this sector from the 2018 CCP. These include:

- **A new policy outcome** explicitly stating that the agriculture sector will "significantly contribute towards delivering Scotland's climate change, and wider environmental, outcomes". This is a change from the 2018 CCP, where the role of farmers and crofters in reaching net-zero was not stated
- **An explicit link to the future agriculture and land use policy** that will replace the Common Agricultural Policy and a commitment to this supporting the delivery of emissions reductions. However, while much of the intended emissions reduction relies on this new policy, the shape and detail of it remains unclear. The Scottish Government's "Stability and Simplicity" agenda sets out that broadly the same policies will remain in place with only minor changes until a new policy is in place from 2024. However, as noted above, the CCC, other experts, as well as stakeholder groups are calling for future policy to be outlined more urgently
- **Commitment to environmental conditionality.** Conditionality has been a major focus as part of discussions around a green recovery from the Covid-19 pandemic, with recommendations from the CCC, the ECCLR Committee, the Advisory Group on Economic Recovery, and other industry and third sector groups recommending that support for industries be conditional on action to generate emissions reductions. However, it remains unclear what the conditions will be and how conditionality will be implemented
- **A growth in emphasis on use of agricultural land for bioenergy crops**, including mention of this objective as part of a new rural policy. Expanding the growth of bioenergy crops is one of the CCC's recommendations; however, the CCC themselves notes the need to mitigate the risks of expanding bioenergy production, and other stakeholders note concern for adverse impacts on food production, biodiversity, and rural employment [78]

- **A greater emphasis on rural populations and communities**, including on local food supply chains, particularly as a result of changes from Covid-19, and addressing rural housing through new permitted development rights
- **Emphasis on support for both new entrants and those who wish to exit the industry.**
- Related, **greater cross-over with the wider land-use chapter**, including commitments to explore options for land use change, and support for those who wish to switch to alternative uses. However, the policies and mechanisms to support this structural change are not identified.

There are also some notable omissions, when compared to recommendations from the CCC and stakeholder groups.

- **The detail of future rural policy and funding to replace the Common Agricultural Policy.** Urgently setting out a new policy is a key recommendation from the CCC [15] . The majority of the policies and proposals for this sector in the draft CCPu are to develop or explore future options, carry out feasibility assessments, and carry out research. There continues to be little detail on how objectives and emissions reductions will be delivered on the ground and how actions will translate into emissions reductions, how the policy landscape will be designed to incentivize this shift to low-carbon farming practices and how funding for agriculture will be administered. The CCC recommended in October 2020 that there should be interim policies to avoid any slow-down in action as longer-term policies are developed
- **Details of how the Agricultural Transformation Programme** will develop. Both the CCC and the Climate Emergency Response Group (CERG) assess that while current progress on the Agricultural Transformation Programme is welcome, the programme still lacks clarity in a number of areas and CERG assess that progress is slow. [20] [15] The draft CCPu commits to scaling up the programme, but does not provide details on how this will be done or what a scaled up programme will look like
- **Details of a regulatory baseline to accompany new policies**. The CCC's recommendation is to extend the regulatory baseline, by extending "existing regulation to reduce on-farm emissions (e.g. Nitrogen Vulnerable Zones) and use new legislation to regulate additional sources of emissions not currently regulated such as enteric fermentation from livestock" and introducing new legislation, e.g. to "ban damaging practices on peat" [15] . As noted, the draft CCPu signals the introduction of environmental conditionality, though it is not clear what will be required. Conditionality also implies that it will apply to those claiming public funding, and there is no additional detail regarding the expansion of the wider regulatory baseline
- **Diet and food consumption.** The CCC's Land Use Report recommends reducing consumption of carbon intensive food, for example, dietary change with reductions in meat and dairy consumption of at least 20% per person. The report states that “These measures imply a shift towards current healthy eating guidelines and can drive sufficient release of land to support the necessary changes in tree planting and bioenergy crops. Alongside expected population growth, they imply around a 10% reduction in cattle and sheep numbers by 2050 compared with 2017 levels. This compares with a reduction of around 20% in the past two decades” [76] . The CCC recommended to the Scottish Parliament that measures to encourage dietary change

should include public sector leadership. Furthermore, the Climate Emergency Response Group assess that there have been no meaningful policy or budget commitments made but recommended in their interim progress report that sustainable dietary guidelines be agreed, including strategies to reduce food waste, with work commencing now [20] . The draft CCPu mentions encouraging the purchase of "high quality local Scottish produce - including meat and dairy" in order to "work with our food production sector to ensure it is produced in a truly sustainable manner and avoid simply off-shoring emissions to other countries".

The rest of this section outlines the policies and proposals for the agriculture sector, as compared to the 2018 CCP.

Many of the policies and proposals from the 2018 CCP have been maintained. Some new policies have been introduced, and some are identified in the draft CCPu as having been “boosted” by various additional commitments. New and boosted policies for each outcome are outlined in the following tables. Note that what was referred to as “policy development milestones” in the 2018 CCP have now been grouped with proposals in the draft CCPu.

Outcome 1: A more productive, sustainable agriculture sector that significantly contributes towards delivering Scotland’s climate change, and wider environmental, outcomes through an increased uptake of climate mitigation measures by farmers, crofters, land managers and other primary food producers.

Table 24 - Policies for Outcome 1

Policies	New/Boosted?
Scale up the Agricultural Transformation Programme across all the policies, including monitoring to assess the effectiveness of the pilot Sustainable Agricultural Capital Grant Scheme (SACGS) that will enable farmers and crofters to purchase equipment that should assist in reducing their greenhouse gas emissions, and support practice change	New Announced in the 2019-20 Programme for Government The pilot SACGS scheme opened in September 2020, with an initial £10m out of a £20m budget for the Agricultural Transformation Programme for 2020-21. This was increased to £18m in December 2020

Table 25 - Proposals for Outcome 1

Proposal	New/Boosted?
Develop rural support policy to enable, encourage and where appropriate, require the shift to low carbon, sustainable farming through emissions reduction, sustainable food production, improving biodiversity, planting biomass crops and appropriate land use change developed in line with just transition principles	New The draft CCPu was the first to outline that a new rural support policy is to have these specific outcomes, but the commitment to developing a new policy for the long term was made in 2018 with the Stability and Simplicity consultation
Develop new schemes and approaches to support low carbon, sustainable farming, including through the Programme Board for the Beef Suckler Climate Group, other farmer-led groups on arable, dairy and high nature value farming and crofting which will report in 2021	New The 2020-21 PfG stated that "We will co-develop new ways of working with our farming and crofting communities through farmer-led groups supported by scientific and economic expertise" to develop ways to better contribute to climate change goals The Suckler Beef Climate Group was set up in February 2020 and delivered its final report in October 2020. An Arable Sector Climate Group was also announced at AgriScot in November 2020 Neither dairy nor High Nature Value farming and crofting groups have been set up
Introduce Environmental Conditionality, from 2021 via implementation of the Suckler Beef Climate Report and more widely from 2022 through the review of existing CAP Greening which will extend the requirements to all farmers and crofters to undertake environmental actions	New for the draft CCPu The Suckler Beef Climate Report suggests a set of minimum conditions for participants of a proposed new Suckler Beef Climate Scheme. [77] However, this applies only to the suckler beef sector It is not clear what changes will be made for other sectors, or how conditionality will be introduced through changes to greening
Further provision of advice for farmers and crofters who wish to retire: A new commitment to work with stakeholders to provide advice, including further extending the Land Matching Service and guidance for farmers and crofters who wish to step back from agricultural businesses by providing an opportunity to consider alternative land-uses or alternative agricultural uses	New for the draft CCPu The Scottish Land Matching Servicelaunched in October 2019 and aimed to provide opportunities for new entrants and for those offering joint ventures in farming It is unclear how opportunities to consider alternative land uses will be provided

Outcome 2*:* More farmers, crofters, land managers and other primary food producers are aware of the benefits and practicalities of cost-effective climate mitigation measures and uptake will have increased.

Table 26 - Policies for Outcome 2

Policies	New/Boosted?
The dissemination of information and advice on climate change mitigation measures in agriculture through a range of communication methods utilising technology and all media to best effect	Boosted The draft CCPu states that this is boosted through the planned enhancement of advisory services highlighted below
An agri-tech group will be established to share, disseminate and encourage adoption of advances in agricultural science and technology as widely as possible	Maintained This was announced in the 2018-19 Programme for Government but it is not clear if this is yet established
Launch a new and expanded peer to peer knowledge transfer initiative based on the success of our Young Climate Change Champions work	New for the draft CCPu Four young farmer climate change champions were recruited in 2019, and their stories and best practices were shared on the Rural Payments website
Realign and enhance our established programmes and initiatives such as the Farm Advisory Service, the Knowledge Transfer and Innovation Fund and Monitor Farm Programme to create a more cohesive approach to ensure advice and support is focussed on helping industry to professionalise to support sustainable farming	New for the draft CCPu. It is unclear what an enhanced advisory service will look like

Table 27 - Proposals for Outcome 2

Proposals	New/Boosted?
Carbon Audits: in 2018, we will consult on how best to ensure maximum take up of carbon audits and how to enable tenant farmers and crofters in particular to benefit	Maintained from 2018 CCP. Carbon audits are available through the Farm Advisory Service, and are required for participants in the Beef Efficiency Scheme. The 2019 monitoring report stated that 397 free carbon audits had been provided between December 2018 and December 2019. This represents 0.8% of Scottish holdings[xvi]
Explore with stakeholders, including the Scottish Tenant Farmers Association and the Tenant Farming Commissioner, how best to engage tenant farmers to increase understanding of the environmental and economic benefits of low carbon farming	Maintained from 2018 CCP. It is not clear how this has been taken forward
Marketing scheme: Determine the feasibility of a Low Carbon Farming marketing scheme	Maintained from 2018 CCP. It is unclear what progress has been made

Outcome 3: Emissions from nitrogen fertiliser will have fallen through a combination of improved understanding, efficient application and improved soil condition.

xvi Calculated based on 51,157 holdings in Scotland according to 2019 Agriculture Facts and Figures: https://www.gov.scot/binaries/content/documents/govscot/publications/statistics/2019/06/agriculture-facts-figures-2019/documents/agriculture-facts-figures-2019/agriculture-facts-figures-2019/govscot%3Adocument/agriculture-facts-figures-2019.pdf?forceDownload=true

Table 28 - Policies for Outcome 3

Policies	New/boosted?
Communicate and demonstrate the benefits of precision farming and nitrogen use efficiency in order to achieve a reduction in GHG emissions	Boosted It is stated that a new policy on an enhanced advisory service is to boost this proposal
Work with the agriculture and science sectors regarding the feasibility and development of a SMART (specific, measurable, achievable, relevant and time bound) target for reducing Scotland's emissions from nitrogen fertiliser	Boosted through Scotland's national Nitrogen Balance Sheet The duty to produce a SNBS was made statutory in the Climate Change (Emissions Reductions Targets) (Scotland) Act 2019; this must be done, by regulations, by March 2022. A consultation on the technical and communications aspects of the SNBSwas published in December 2020
From 2018 we expect farmers to test the soil on all improved land every five or six years, and we will work with them to establish how best to achieve this	Boosted by the new policy to introduce conditionality. This suggests that soil testing may become an environmental condition, though this is not explicitly stated

Table 29 - Proposals for Outcome 3

Proposals	New/Boosted?
Investigate the benefits and barriers of leguminous crops in rotation	Maintained, though it is unclear how this is being taken forward or what outcome is intended As part of scrutiny of the draft 2018 CCP, the REC Committee called on the Scottish Government to "conduct further investigation into the nitrogen fixing potential of legume crops and to consider how it might maximise opportunities provided by the UK's exit from the European Union to relax and improve current CAP policies in this area." A Climate XChange policy briefing has been produced on the potential for nitrogen-fixing crops in Scotland .
Crop varieties with improved nitrogen-use efficiency	Maintained, though it is unclear how this is being taken forward or what outcome is intended

Outcome 4: Reduced emissions from red meat and dairy through improved emissions intensity.

Table 30 - Policies for Outcome 4

Policies	New/Boosted?
Commission and publish a report into the establishment of emissions intensity figures for beef, lamb and milk	Maintained. A framework for benchmarking emissions intensity has been commissioned from Climate XChange, though it does not appear that emissions intensity figures have been published
Work with Quality Meat Scotland, ScotEID and livestock producers to encourage improved emissions intensity through genotyping, improving fertility, reducing animal mortality and improving on farm management practices	Boosted, as part of the draft CCPu "through finalising research into the practicalities and feasibility of using feed additive methane inhibitors at scale in Scotland; and supporting research and development into livestock greenhouse gas emissions reduction including in areas such as methane capture and breeding for low emitting livestock. This research will allow consideration, including by the farmer-led groups, of how we can support further development and uptake of emerging technologies in Scotland." [2]

Table 31 - Proposals for Outcome 4

Proposals	New/Boosted?
Determine the practicality of establishing a SMART target for reduction in the intensity of emissions for beef, sheep and dairy sectors	Maintained. Not yet developed, though a framework for benchmarking emissions intensity has been commissioned from Climate XChange
Consult in 2018 to determine the nature of livestock health measures that the sector will adopt from 2019	Maintained. It is unclear what progress has been made
Determine the practicalities and feasibility of using livestock feed additives as a means of reducing emissions	Maintained, though progress on this is unclear. Climate XChange published a review of feed additives in December 2017

Outcome 5: Reduced emissions from the use and storage of manure and slurry.

There are no policies attached to this outcome, but there are five proposals.

Table 32 - Proposals for Outcome 5

Proposals	New/Boosted
Engaging with farmers to explore their support requirements, establish how they can improve the use and storage of manure and slurry, including the potential for cooperatively owned and managed anaerobic digesters	Boosted Funding was available through SACGS for slurry equipment and slurry store covers. The Scottish Government has stated that this was "boosted" in December 2020 by the announcement of additional funding for SACGS to £18m in 2020-21 It is not fully clear how farmers are being engaged with or how the potential for cooperatively owned and managed digesters is being progressed
Investigate the practicalities of livestock grazing in rotation on current arable land	Maintained; it is not clear what progress has been made
Conduct a feasibility study for the establishment of manure/ slurry exchange	Maintained. A feasibility study was carried out by Climate XChange in 2019. It concluded that "A strategic, regional or national scale exchange model is unlikely to be cost effective for greenhouse gas abatement. However, there is some potential to support exchanges of manure through improved local distribution […] The most useful measures are those that focus on the utilisation of manure nutrient value and that form part of an integrated policy alongside other drivers such as water quality (Water Framework Directive), Nitrate Vulnerable Zones, air quality and productivity."
Determine how to consistently minimise emissions from slurry storage	Maintained. It is unclear what progress has been made
Review management of storage and application of organic materials such as silage, slurry and liquid digestate, including what support may be required to ensure best practice	New for the draft CCPu

A previous proposal in the 2018 CCP was to "Determine the potential feasibility of self-financing large-scale slurry and manure fed anaerobic digesters". This is not included in the draft CCPu.

Outcome 6: Carbon sequestration on agricultural land has helped to increase our national carbon sink.

Table 33 - Policies for Outcome 6

Policies	New/Boosted?
Explore with the farming and forestry sectors how best to increase planting of trees and hedgerows which optimise carbon sequestration, including the role of agroforestry	The draft CCPu states that this policy is boosted by a new 'on farm and croft tree integration based demonstrator network' announced in the draft CCPu and an additional £1.5 million to support the integration of small woodlands on farms and crofts across Scotland, announced in summer 2020. The £1.5m referred to was available through the Agriculture Transformation Programme and Scottish Forestry; £500,000 was added to the Harvesting and Processing Grant to part-fund the purchase of timber and forestry equipment; £1m is provided to allow farmers and crofters to develop small-scale woodlands.

Table 34 - Proposals for Outcome 6

Proposals	New/ Boosted?
Investigate the feasibility of payment for carbon sequestration taking into account any existing schemes such as the woodland carbon code as a means of encouraging the uptake of carbon sequestration on farms	Maintained. It is unclear what progress has been made
Woodland cover on suitable agricultural land	Maintained. It is unclear what progress has been made
Building on the successful work integrating woodland with farming businesses, help remove barriers for those on agriculture holdings, particularly in the tenanted sector who want to engage in woodland creation, including exploring the potential to reform legislation where appropriate	New for the draft CCPu
Work with stakeholders on options to increase peatland restoration on suitable agricultural and crofting land, to support delivery of policies in the LULUCF chapter. We will map peatland against this land which will allow modelling options for land-use change and inform opportunities for targeted support of peatland restoration and management	New for the draft CCPu
Explore options for land-use change to optimise uses beyond traditional farming and food production to multi-faceted land use including forestry, peatland restoration and management and biomass production	New for the draft CCPu

In addition, there have been some changes to the indicators used to monitor progress.

In the 2018 CCP, the policy output indicators were, for all outcomes:

- A reduction in agricultural greenhouse gas emissions in the national inventory
- An increase in the share of farmers carrying out soil tests
- An increase in the share of farms completing nutrient management plans.

By contrast, there is a new set of indicators set out in the draft CCPu. These more directly measure low-carbon agricultural practices. The new indicators set out in the draft CCPu are:

- Outcome 2: Increased engagement with Farm Advisory Services on environmental issues and climate change
- Outcome 3: Use of Nitrogen fertilisers
- Outcome 3: Spreading precision of Nitrogen fertilisers
- Outcome 4: Time taken from birth to slaughter and increased efficiency through improved health and reduced losses

- Outcome 5: Improvement in covered slurry storage
- Outcome 5: Precision application of manure and slurry
- Outcome 6: Hectares of peatland restored per year
- Outcome 6: Area of woodland on agricultural land.

There appears to be no indicator for outcome 1.

Negative Emissions Technologies

This new chapter in the draft CCPu highlights the role that Negative Emissions Technologies (NETs) may play in removing carbon from the atmosphere in both the electricity and industrial sectors. Carbon Capture and Storage (CCS) is an essential part of any NETs project.

As previously noted, the Electricity chapter in 2018's CCP provides some focus on CCS, a suite of technologies and processes which decarbonise fossil fuel generation. It involves capturing CO_2 emitted from high-producing sources, transporting it and storing it in secure geological formations deep underground [11] . The IPCC considers that it would cost 138% more to limit warming to within 2°C without CCS [12] .

The draft CCPu states:

> “ Our pathway to net zero is focused on reducing emissions from across Scotland’s economy. However, we also need to bring forward key technologies which will compensate for residual emissions. In other words, we need technologies which will not just store emissions resulting from energy or industrial processes, but deliver a net reduction in emissions.”

NETs can permanently remove carbon from the atmosphere. Plants and trees (known as biomass) naturally remove carbon as they grow, these are then used to generate electricity or other fuels, and the carbon produced is captured and stored. The following technologies are relevant:

- **Bioenergy with CCS (BECCS)**: biomass is used to generate electricity, and is coupled with CCS to prevent further emissions. BECCS can also be used in industry for industrial heat or other relevant processes
- **Biomass/Waste Gasification and CCS for hydrogen**: heat, steam and oxygen is used to convert biomass or waste to hydrogen rich synthetic gas (syngas) without combustion. Carbon in the syngas can then be separated and stored.

The potential for **Direct Air CCS (DACCS)** is also highlighted. This is a process that captures CO_2 from the atmosphere and permanently stores it.

Whilst these technologies have been proven in test facilities and at small scales, they do not currently exist at scales necessary to remove significant volumes of carbon. Timescales for developing and commissioning are therefore exceptionally tight, with the draft CCPu stating:

> “ we expect to begin removing emissions from the atmosphere through NETs by 2030 [and] the potential exists to bring forward a DACCS demonstration plant in Scotland during the 2020s”

The anticipated emissions reduction pathway for this sector shows NETs starting to permanently remove carbon from the atmosphere by 2029, and significantly ramping up emissions removal in the electricity and industrial sectors from 2030 onwards; equivalent to 23.8% of gross emissions by 2032.

Outcomes

Outcome 1 states that "detailed feasibility studies on NETS will assess the opportunities for negative emissions in Scotland, and identify applications with the greatest potential, including specific sites where possible". Four proposals are associated with this:

- Detailed feasibility study in 2021/22 to identify specific sites, applications and support for NETs and DACCS
- Based on the outcomes of feasibility work, support commercial partners to develop, design and finance NETs
- Implement continual review process for progress of NETs
- Work with UK Government to support development.

Outcome 2 aims that "the continued development of CCUS[xvii] technologies and systems is prioritised to ensure these can be rolled out commercially and at scale by the late 2020s". One broad policy to "support the development of NETs" is complemented by four proposals including three funds:

- The **Strategic Innovation Challenge Fund** aims to support investment in R&D; **it is not clear how much this fund is worth**
- The **Scottish Industrial Energy Transformation Fund** , worth £34m over 5 years to support the development of NETs demonstrators
- The **Emerging Technologies Fund** , worth £180m over 5 years, to help integrate NETS projects with CCS infrastructure.

Outcome 3 hope that " a cross-sectoral approach for the appropriate and sustainable use of biomass in energy applications is agreed and implemented (taking into account competing land and feedstock uses)". Three policies support this, all stemming from the publication of a Bioenergy Update in early 2021. This update is expected to set out the current position and understanding of the role of bioenergy in the energy system, and to set out options for future action.

A "cross sectoral Bioenergy Expert Working Group" is then expected to be established; it will:

---

xvii Carbon Capture Utilisation and Storage is a process where the CO_2 is recycled for further usage, and is explored in more detail in the Industry section.

> “ [...] consider and identify the most appropriate and sustainable use for bioenergy resources across Scotland. It will also assess the volume of bioenergy resources that we can grow or produce within Scotland, and confirm the level of import that we believe is compatible with a sustainable global trade in bioenergy.”

Thereafter, a Bioenergy Action Plan will be published before the next CCP (2023); this will set out options for the use of bioenergy in both NETS and elsewhere.

There are no indicators associated with any of these outcomes.

Bibliography

1 Scottish Government. (2018, February). Climate Change Plan: third report on proposals and policies 2018-2032 (RPP3). Retrieved from https://www.gov.scot/publications/scottish-governments-climate-change-plan-third-report-proposals-policies-2018/ [accessed 22 November 2020]

2 Scottish Government. (2020, December 16). Securing a Green Recovery on a Path to Net Zero: Climate Change Plan 2018–2032 - update. Retrieved from https://www.gov.scot/publications/securing-green-recovery-path-net-zero-update-climate-change-plan-20182032/ [accessed 16 December 2020]

3 Scottish Government. (2020, December). Scottish Biodiversity Strategy post-2020: statement of intent. Retrieved from https://www.gov.scot/publications/scottish-biodiversity-strategy-post-2020-statement-intent/ [accessed 15 December 2020]

4 Climate Change Committee. (2020, December). Advice to the Scottish Government on the Interim 2030 Target. Retrieved from https://www.theccc.org.uk/wp-content/uploads/2020/12/Lord-Deben-CCC-Letter-to-ECCLR-CabSec.pdf [accessed 9 December 2020]

5 Scottish Government. (2020). Greenhouse gas emissions 2018: estimates. Retrieved from https://www.gov.scot/publications/scottish-greenhouse-gas-emissions-2018/ [accessed 10 January 2020]

6 Scottish Government. (2018). Climate Change Plan: third report on proposals and policies 2018-2032 – technical annex. Retrieved from https://www.gov.scot/publications/climate-change-plan-third-report-proposals-policies-2018-2032-technical-9781788516761/pages/2/#:~:text=TIMES%20models%20use%20linear%20programming,over%20a%20specified%20time%20horizon. [accessed 10 January 2020]

7 Scottish Government. (2017, December). The future of energy in Scotland: Scottish energy strategy. Retrieved from https://www.gov.scot/publications/scottish-energy-strategy-future-energy-scotland-9781788515276/ [accessed 8 December 2020]

8 Scottish Government. (2020, August). Annual compendium of Scottish energy statistics. Retrieved from https://www.gov.scot/publications/annual-compendium-of-scottish-energy-statistics/#:~:text=The%20Annual%20Compendium%20of%20Scottish,in%20the%20Scottish%20Energy%20Strategy. [accessed 8 December 2020]

9 Scottish Government. (2020). Scottish Energy Statistics Hub. Retrieved from https://scotland.shinyapps.io/sg-scottish-energy-statistics/?Section=WholeSystem&Chart=RenEnTgt [accessed 8 December 2020]

10 Scottish Government. (2020, June). Greenhouse gas emissions 2018: estimates. Retrieved from https://www.gov.scot/publications/scottish-greenhouse-gas-emissions-2018/ [accessed 8 December 2020]

11 House of Commons Energy and Climate Change Committee. (2016). Future of carbon capture and storage in the UK. Retrieved from https://publications.parliament.uk/pa/cm201516/cmselect/cmenergy/692/692.pdf [accessed 9 December 2020]

12 IPCC. (2014). Synthesis Report of the IPCC Fifth Assessment Report. Retrieved from https://www.ipcc.ch/report/ar5/syr/ [accessed 2 December 2020]

13 Scottish Government . (2019, December 17). Climate Change Plan: monitoring report 2019. Retrieved from https://www.gov.scot/publications/climate-change-plan-monitoring-report-2019/ [accessed 7 December 2020]

14 Climate Change Committee. (2020, May). Letter: Building a resilient recovery from the COVID-19 crisis to Roseanna Cunningham MSP. Retrieved from https://www.theccc.org.uk/publication/letter-building-a-resilient-recovery-from-the-covid-19-crisis-to-roseanna-cunningham-msp/ [accessed 6 December 2020]

15 Climate Change Committee. (2020, October). Reducing emissions in Scotland – 2020 Progress Report to Parliament. Retrieved from https://www.theccc.org.uk/publication/reducing-emissions-in-scotland-2020-progress-report-to-parliament/ [accessed 6 December 2020]

16 Climate Change Committee. (2020, December). Sixth Carbon Budget. Retrieved from https://www.theccc.org.uk/publication/sixth-carbon-budget/ [accessed 13 December 2020]

17 Scottish Parliament Environment, Climate Change and Land Reform Committee. (2020, November). Green Recovery Inquiry Report. Retrieved from https://www.parliament.scot/parliamentarybusiness/CurrentCommittees/115470.aspx [accessed 6 December 2020]

18 Scottish Parliament Economy, Energy and Fair Work Committee. (2020, July). Energy Inquiry. Retrieved from https://www.parliament.scot/parliamentarybusiness/CurrentCommittees/113457.aspx [accessed 13 December 2020]

19 Scottish Parliament Economy, Energy and Fair Work Committee. (2019). BiFab, the offshore wind sector and Scottish supply chain. Retrieved from https://www.parliament.scot/parliamentarybusiness/CurrentCommittees/109858.aspx [accessed 31 December 2020]

20 Climate Emergency Response Group. (2020, November). Scotland's Green Recovery and Climate Emergency Response: interim assessment of progress. Retrieved from https://www.changeworks.org.uk/resources/scotlands-green-recovery-and-climate-emergency-response-interim-assessment-of-progress [accessed 11 December 2020]

21 Energy Research Partnership. (2018). Future Resilience of the UK Electricity System. Retrieved from https://erpuk.org/wp-content/uploads/2018/11/4285_resilience_report_final.pdf [accessed 30 December 2020]

22 Scottish Government . (2020, January). Scottish House Condition Survey: 2018 Key Findings. Retrieved from https://www.gov.scot/publications/scottish-house-condition-survey-2019-key-findings/ [accessed 5 January 2021]

23 Scottish Government . (2020, September). Protecting Scotland, Renewing Scotland: The Government's Programme for Scotland 2020-2021. Retrieved from https://www.gov.scot/publications/protecting-scotland-renewing-scotland-governments-programme-scotland-2020-2021/ [accessed 5 January 2021]

24 Scottish Government . (2018). Energy Efficient Scotland: route map. Retrieved from https://www.gov.scot/publications/energy-efficient-scotland-route-map/ [accessed 5 January 2021]

25 Scottish Government . (2020, December). New Build Heat Standard - Scoping Consultation. Retrieved from https://www.gov.scot/publications/new-build-heat-standard-scoping-consultation/ [accessed 5 January 2021]

26 Scottish Government. (2020, September 1). Protecting Scotland, Renewing Scotland: The Government's Programme for Scotland 2020-2021. Retrieved from https://www.gov.scot/publications/protecting-scotland-renewing-scotland-governments-programme-scotland-2020-2021/ [accessed 8 December 2020]

27 Transport Scotland. (2020, September). Carbon Account for Transport - No. 12: 2020 Edition. Retrieved from https://www.transport.gov.scot/publication/carbon-account-for-transport-no-12-2020-edition/ [accessed 31 December 2020]

28 Transport Scotland. (2020, February). National Transport Strategy. Retrieved from https://www.transport.gov.scot/media/47052/national-transport-strategy.pdf [accessed 31 December 2020]

29 Transport Scotland. (2020, December). National Transport Strategy Delivery Plan. Retrieved from https://www.transport.gov.scot/media/48839/nts-delivery-plan-2020-2022.pdf [accessed 31 December 2020]

30 Transport Scotland. (2016). A9 Dualling Programme- Case fo Investment. Retrieved from https://www.transport.gov.scot/media/6727/a9-dualling-programme-case-for-investment-main-report-september-2016.pdf [accessed 31 December 2020]

31 Infrastructure Commission for Scotland. (2020, January). Phase 1: Key findings report. Retrieved from https://infrastructurecommission.scot/storage/247/FullReport_200120a.pdf [accessed 6 February 2020]

32 Transport Scotland. (2020, December). Strategic Transport Projects Review 2. Retrieved from https://www.transport.gov.scot/our-approach/strategy/strategic-transport-projects-review-2/ [accessed 31 December 2020]

33 IPCC. (2018). Transport. Retrieved from https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_chapter8.pdf [accessed 31 December 2020]

34 Liu, Z., Ciais, P., & Deng, Z. (2020). Near-real-time monitoring of global CO2 emissions reveals the effects of the COVID-19 pandemic. *Nature Communications*. doi: https://doi.org/10.1038/s41467-020-18922-7

35 SPICe. (2020, December). Back to the future: Reducing car travel in Scotland. Retrieved from https://spice-spotlight.scot/2020/12/16/back-to-the-future-reducing-car-travel-in-scotland/ [accessed 31 December 2020]

36 National Institute of Economic and Social Research. (2017, January). Academic review of asset lives in the UK. Retrieved from https://www.niesr.ac.uk/sites/default/files/publications/DP474.pdf [accessed 31 December 2020]

37 Transport Scotland. (2020, July). Rail Services Decarbonisation Action Plan. Retrieved from https://www.transport.gov.scot/media/47906/rail-services-decarbonisation-action-plan.pdf [accessed 31 December 2020]

38 Scottish Government. (2019, June 11). Scottish greenhouse gas emissions 2017. Retrieved from https://www.gov.scot/publications/scottish-greenhouse-gas-emissions-2017/ [accessed 10 December 2020]

39 Climate Change Committee. (2019). Reducing emissions in Scotland – 2019 Progress Report to Parliament. Retrieved from https://www.theccc.org.uk/publication/reducing-emissions-in-scotland-2019-progress-report-to-parliament/ [accessed 7 2021]

40 Scottish Government. (2020, December). Deep decarbonisation pathways for Scottish industries: research report. Retrieved from https://www.gov.scot/publications/deep-decarbonisation-pathways-scottish-industries/ [accessed 22 December 2020]

41 Skills Development Scotland. (2020, December 16). Climate Emergency Skills Action Plan . Retrieved from https://www.skillsdevelopmentscotland.co.uk/news-events/2020/december/new-plan-places-net-zero-skills-at-centre-of-economic-recovery/ [accessed 6 January 2021]

42 Centre for Energy Policy, University of Strathclyde . (2019). The economic opportunity for a large scale CO2 management industry in Scotland. Retrieved from http://www.evaluationsonline.org.uk/evaluations/Search.do?ui=basic&action=showPromoted&id=689 [accessed 30 December 2020]

43 Scottish Government. (2020, December). Hydrogen Policy Statement. Retrieved from https://www.gov.scot/publications/scottish-government-hydrogen-policy-statement/ [accessed 22 December 2020]

44 Scottish Government. (2020, December). Climate Change Plan 2018-2032 - update: strategic environmental assessment - draft. Retrieved from https://www.gov.scot/publications/update-climate-change-plan-2018-2032-draft-strategic-environmental-assessment/ [accessed 22 December 2020]

45 Scottish Government. (2020). Scottish Energy Statistics Hub. Retrieved from https://www.gov.scot/publications/scottish-energy-statistics-hub-index/ [accessed 5 January 2021]

46 UK National Atmospheric Emissions Inventory. (2020). Greenhouse Gas Inventories for England, Scotland, Wales & Northern Ireland: 1990-2018. Retrieved from https://naei.beis.gov.uk/reports/reports?section_id=4

47 Scottish Government. (2016). Making Things Last: a circular economy strategy for Scotland. Retrieved from https://www.gov.scot/publications/making-things-last-circular-economy-strategy-scotland/

48 Zero Waste Scotland. (2015). The Carbon Impacts of the Circular Economy Summary Report. Retrieved from https://www.zerowastescotland.org.uk/sites/default/files/CIoCE Summary Report - FINAL - 15.06.15.pdf

49 Scottish Government. (2020). The Environment Strategy for Scotland: vision and outcomes. Retrieved from https://www.gov.scot/publications/environment-strategy-scotland-vision-outcomes/

50 Scottish Government. (2019). Scotland's carbon footprint: 1998-2016. Retrieved from https://www.gov.scot/publications/scotlands-carbon-footprint-1998-2016/pages/3/

51 SEPA. (2019). Official Statistics Publication for Scotland : Waste landfilled in Scotland – 2019 and Waste incinerated in Scotland - 2019. Retrieved from https://www.sepa.org.uk/media/527140/2019-waste-landfilled-in-scotland-and-waste-incinerated-in-scotland-statement.pdf

52 SEPA. (2020). Waste From All Sources Generated and Managed - 2018. Retrieved from https://www.sepa.org.uk/environment/waste/waste-data/waste-data-reporting/waste-data-for-scotland/

53 SEPA. (2019). Waste incinerated in Scotland - 2019. Retrieved from https://www.sepa.org.uk/media/527062/2019-waste-incinerated-commentary.docx

54 Friends of the Earth Scotland. (2020). Incineration: Friends of the Earth Scotland briefing. Retrieved from https://foe.scot/wp-content/uploads/2020/09/Incineration-Briefing-September-2020-1.pdf

55 Scottish Environment LINK. (2020). Incineration of waste continues to soar – is this the right direction?. Retrieved from https://www.scotlink.org/incineration-of-waste-continues-to-soar-is-this-the-right-direction/

56 SEPA. (2020). Waste landfilled in Scotland - 2019. Retrieved from https://www.sepa.org.uk/media/527114/2019-waste-landfilled-commentary.pdf

57 Zero Waste Scotland. (2019). Food Waste Reduction Action Plan. Retrieved from https://www.zerowastescotland.org.uk/sites/default/files/Food Waste Reduction Action Plan.pdf

58 Zero Waste Scotland Decoupling Advisory Group. (2020). Building Back Better: Principles for sustainable resource use in a wellbeing economy. Retrieved from https://www.zerowastescotland.org.uk/content/building-back-better

59 Expert Panel on Environmental Charging and Other Measures. (2019). Recommendations on Single-use Disposable Beverage Cups. Retrieved from https://www.gov.scot/publications/report-expert-panel-environmental-charging-measures-epecom-recommendations-single-use-disposable-beverage-cups-july-2019/

60 Infrastructure Commission for Scotland. (2020). Phase 1: Key findings report. A blueprint for Scotland. Retrieved from https://infrastructurecommission.scot/storage/281/Phase1_FullReport.pdf

61 Advisory Group on Economic Recovery. (2020). Towards a Robust, Resilient Wellbeing Economy for Scotland: Report of the Advisory Group on Economic Recovery. Retrieved from https://www.gov.scot/publications/towards-robust-resilient-wellbeing-economy-scotland-report-advisory-group-economic-recovery/

62 Scottish Government. (2020). Scotland and the Sustainable Development Goals A national review to drive action. Retrieved from https://www.gov.scot/binaries/content/documents/govscot/publications/progress-report/2020/07/scotland-sustainable-development-goals-national-review-drive-action/documents/scotland-sustainable-development-goals-national-review-drive-action/scotland-sustainable-development-goals-national-review-drive-action/govscot%3Adocument/scotland-sustainable-development-goals-national-review-drive-action.pdf?forceDownload=true

63 Scotland's Environment Web. (2019, June 19). Peatland Restoration. Retrieved from https://soils.environment.gov.scot/resources/peatland-restoration/#:~:text=Scotland's%20peat%20soils%20cover%20more,storing%20carbon%20in%20the%20soil. [accessed 5 January 2020]

64 Scottish Forestry. (2020, June 11). Scots tree planting “punching well above its weight” says Ewing. Retrieved from https://forestry.gov.scot/news-releases/scots-tree-planting-punching-well-above-its-weight-says-ewing#:~:text=The%20yearly%20target%20for%20native,the%20new%20woodland%20in%20Scotland.&text=The%20Scottish%20Government%2C%20as%20part,a%20year%20from%202024%2F25. [accessed 7 December 2020]

65 Committee on Climate Change. (2019, December). Reducing emissions in Scotland 2019 Progress Report to Parliament. Retrieved from https://d423d1558e1d71897434.b-cdn.net/wp-content/uploads/2019/12/Reducing-emissions-in-Scotland-2019-Progress-Report-to-Parliament-CCC.pdf [accessed 8 December 2020]

66 Yang, A. (2020, September 9). The Multiple Roles of Scottish Woodlands. Retrieved from https://digitalpublications.parliament.scot/ResearchBriefings/Report/2020/9/9/The-Multiple-Roles-of-Scottish-Woodlands-1 [accessed 7 December 2020]

67 Friggens, N.L., Hester, A.J., Mitchell, R.J., Parker, T.C., Subke, J.A., & Wookey, P.A. (2020). Tree planting in organic soils does not result in net carbon sequestration on decadal timescales. *Global Change Biology*, *26*, 5178-5188. doi: 10.1111/gcb.15229

68 Scottish Government. (2020, February 25). The Environment Strategy for Scotland: Vision and Outcomes. Retrieved from https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2020/02/environment-strategy-scotland-vision-outcomes/documents/environment-strategy-scotland-vision-outcomes/environment-strategy-scotland-vision-outcomes/govscot%3Adocument/environment-strategy-scotland-vision-outcomes.pdf?forceDownload=true [accessed 7 December 2020]

69 Scottish Government. (2015, June 25). Scotland's biodiversity: a route map to 2020. Retrieved from https://www.gov.scot/publications/scotlands-biodiversity-route-map-2020/ [accessed 7 December 2020]

70 Scottish Government. (2019, February 5). Scotland's Forestry Strategy 2019-2029. Retrieved from https://www.gov.scot/publications/scotlands-forestry-strategy-20192029/pages/1/ [accessed 8 December 2020]

71 Ferretto, A., Brooker, R., Aitkenhead, M., Matthews, R., & Smith, P. (2019). Potential carbon loss from Scottish peatlands under climate change. *Regional Environmental Change*, *19*, 2101-2111. doi: https://link.springer.com/article/10.1007%2Fs10113-019-01550-3

72 Okumah, M., Walker, C., Martin-Ortega, J., Ferré, M., Glenk, K., & Novo, P. (2019). How much does peatland restoration cost? Insights from the UK. University of Leeds - SRUC Report. Retrieved from https://environment.leeds.ac.uk/download/downloads/id/117/cost_of_peatland_restoration.pdf [accessed 6 January 2020]

73 Scottish Land Commission . (2020, November 3). Regional Land Use Partnerships to help drive urgent climate action. Retrieved from https://www.landcommission.gov.scot/news-events/news/regional-land-use-partnerships-to-help-drive-urgent-climate-action [accessed 4 January 2020]

74 IUCN Peatland Programme. (2017). Review of extant planning permissions for commercial peat extraction in Scotland. Retrieved from https://www.iucn-uk-peatlandprogramme.org/sites/default/files/Summary%20of%20ROMP%20review%20findings_EG.pdf [accessed 6 January 2020]

75 Scottish Government. (2020, February 7). Moving to low carbon farming. Retrieved from https://www.gov.scot/news/moving-to-low-carbon-farming/ [accessed 4 January 2020]

76 Climate Change Committee. (2020, January 23). Land use: Policies for a Net Zero UK. Retrieved from https://www.theccc.org.uk/publication/land-use-policies-for-a-net-zero-uk/ [accessed 4 January 2020]

77 Suckler Beef Climate Group. (2020, October 26). Suckler Beef Climate Scheme Final Report . Retrieved from https://www.gov.scot/publications/suckler-beef-climate-scheme-final-report/ [accessed 4 January 2020]

78 Farming for 1.5 Inquiry. (2020, November 9). Farming for 1.5: A transformation pathway. Retrieved from https://40a7f11d-664a-4fd7-a550-78ec00356167.filesusr.com/ugd/e828e0_59d8fc00569642acac0b21c1cd83186c.pdf [accessed 4 January 2021]

SPICe The Information Centre
An t-Ionad Fiosrachaidh

Scottish Parliament Information Centre (SPICe) Briefings are compiled for the benefit of the Members of the Parliament and their personal staff. Authors are available to discuss the contents of these papers with MSPs and their staff who should contact Alasdair Reid on telephone number 85375 or alasdair.reid@parliament.scot.

Members of the public or external organisations may comment on this briefing by emailing us at SPICe@parliament.scot. However, researchers are unable to enter into personal discussion in relation to SPICe Briefing Papers. If you have any general questions about the work of the Parliament you can email the Parliament's Public Information Service at sp.info@parliament.scot.

Every effort is made to ensure that the information contained in SPICe briefings is correct at the time of publication. Readers should be aware however that briefings are not necessarily updated or otherwise amended to reflect subsequent changes.