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Climate Change - Subject Profile

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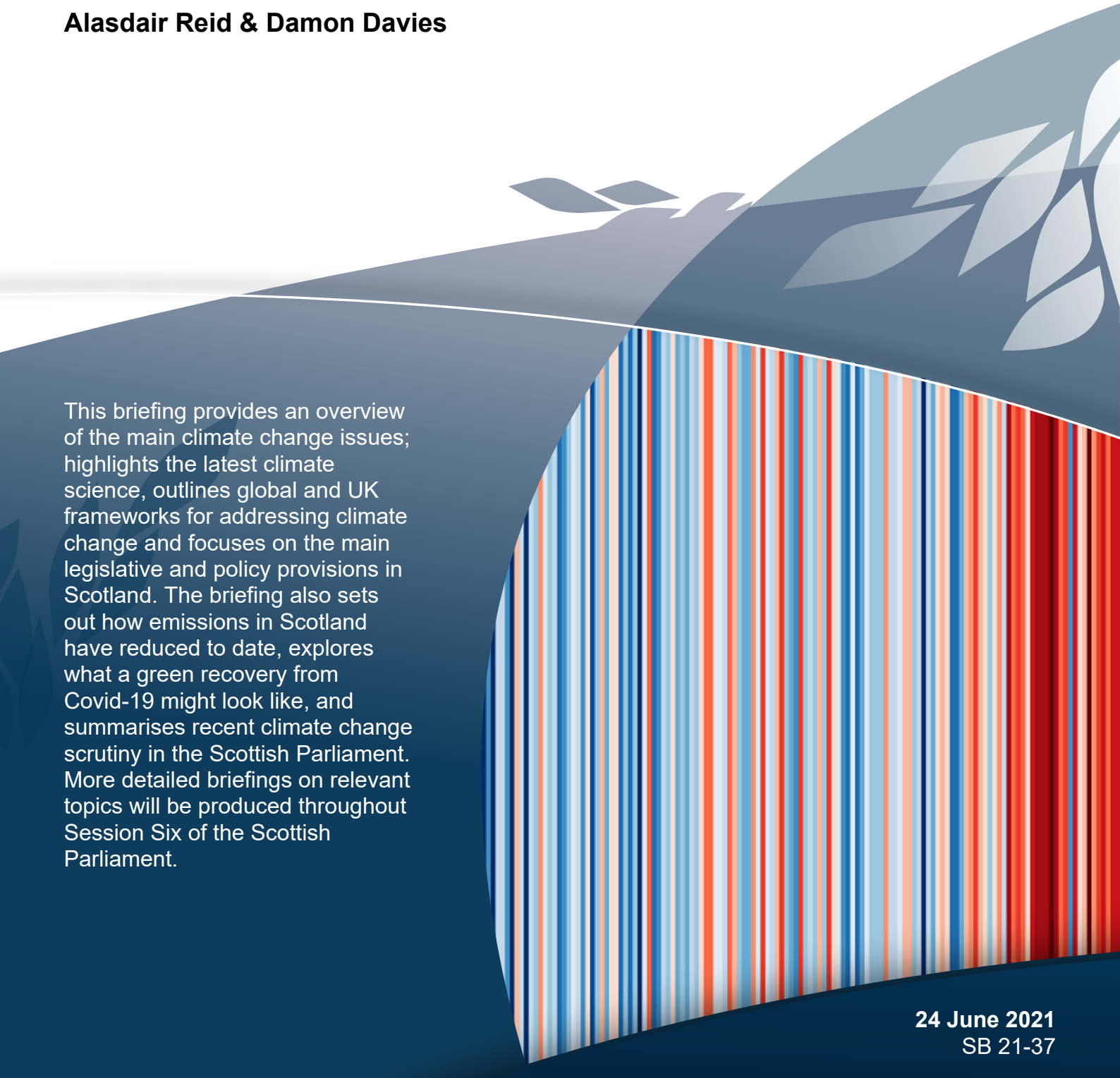

This briefing provides an overview of the main climate change issues; highlights the latest climate science, outlines global and UK frameworks for addressing climate change and focuses on the main legislative and policy provisions in Scotland. The briefing also sets out how emissions in Scotland have reduced to date, explores what a green recovery from Covid-19 might look like, and summarises recent climate change scrutiny in the Scottish Parliament. More detailed briefings on relevant topics will be produced throughout Session Six of the Scottish Parliament.

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Contents

Executive Summary

- **The climate and ecological crises pose a real and existing threat to human safety, health and wellbeing, economies and natural ecosystems.** Mitigating and adapting to the climate crisis will require a complete transformation of society and the economy. This is increasingly recognised across Europe, with courts in Holland, Spain and Germany recently ruling that climate protection is a human right and setting end dates for fossil fuel extraction.

- **The release of greenhouse gases (GHG) is causing global temperatures to rise and long-term changes in our climate** - including the average temperature of the Earth's surface rising by over 1°C since the pre-industrial period. 2020 tied with 2016 as the hottest year on record, and 17 of the 18 warmest years on record occurred this century. Impacts include sea level rise, flooding, and heat-waves.

- **Scotland has slightly more than halved it's GHG emissions in the last 30 years, but will have to more than half them again in the next decade to come close to achieving domestic targets**, and contribute to achieving UK and international goals. The "hard yards" of decarbonisation will therefore fall within this parliamentary session, and will require detailed, strategic and co-ordinated scrutiny across multiple portfolios.

- **The United Nations Framework Convention on Climate Change commits industrialised countries to limit and reduce GHG emissions in accordance with agreed individual targets.** However, the global response to climate change has been fraught with difficulty, and whilst agreed action at an international level has been notable, implementation at a national level has been uneven.

- **The United Nations Paris Agreement agrees to limit global temperature rises to "well below" 2°C and to "pursue efforts" to limit temperature increase to 1.5°C above pre industrial levels.** Subsequent scientific evidence has shown that going past 1.5°C would seriously affect the planet's liveability; therefore global net-zero emissions must be achieved by 2050. Net zero refers to achieving a balance between the amount of GHG emissions produced (e.g. transport and agriculture) and the amount removed from the atmosphere (e.g. trees and peat).

- **Recent modelling has shown that new climate promises from some nations, along with plans from the USA to re-enter the Paris Agreement mean that the rise in world temperatures could be held to 2°C by the end of this century.** There is however an implementation gap between what has been agreed, and concrete action.

- **COP26, a major UN climate conference is scheduled to be held in Glasgow in November 2021; a key priority is full implementation of the Paris Agreement, which requires all parties to prepare, communicate and maintain national GHG reduction targets.** Known as Nationally Determined Contributions (NDCs) these should set out efforts to reduce national emissions. The summit will also have to put real targets in place to phase out coal, protect forests, and to champion clean energy and transport so that the world can transition to net-zero in a way that is fair and just.

- **Whilst climate change mitigation and adaptation policy is devolved to Scotland, the UK is signatory to international treaties, and has set an overall target of**

achieving net-zero emissions by 2050. Following independent advice from the UK Climate Change Committee, Scotland has set a target (against a 1990 baseline) of net-zero emissions by 2045, with crucial interim targets of a 75% reduction by 2030, and 90% by 2040. Annual targets are also set, and Scotland has not achieved these in the last three years (2017 - 2019), with the most recent statistics showing a 51.5% reduction in emissions against a target of 55%.

- **The Scottish Government regularly publishes Climate Change Plans (CCP) - required by law - which set out how emissions will be reduced across key sectors.** An update to the current CCP was published in late 2020 to set out a pathway to net-zero; this anticipates a 56% reduction in emissions by 2032.
- **Parliamentary scrutiny of the CCP update noted that the scale of change needed has no precedent in human history and made a number of detailed recommendations**, including:
    - calling for clarity on the modelling, evidential base and assumptions that underpin the plan
    - calling for clarity on timescales for commitments that "reflect the urgent nature of the climate emergency and the immediate opportunities to progress a green recovery"
    - reviewing the credibility of reliance on new and untested technologies
    - calling for clear recognition that land is a finite resource, with a more integrated approach to cutting emissions across agriculture and land use, land-use change and forestry.
- **The Scottish Government has recently undertaken to publish a new and full CCP as soon as possible, as well as a catch-up report on the missed 2019 target within 6 months.**
- **Projections for the next century indicate that climate trends observed over the last century will both continue and intensify. There are unavoidable consequences of historic emissions and significant changes projected over the coming decades.** Adapting to climate change is therefore necessary regardless of how swiftly emissions are cut. The Scottish Government's Climate Change Adaptation Programme has three overarching themes (natural environment, buildings and infrastructure networks, and society), with related priorities.
- **Climate governance refers to the set of processes and institutions created to reduce GHG emissions and to manage the impacts of climate change.** Climate governance can be seen at a global level - for example, the Paris Agreement - down through national governments to the most local level. The Scottish Parliament can play a key role in promoting and scrutinising climate governance through consideration of draft laws, proposed budgets or government action (or inaction). This is particularly the case in areas that may not traditionally be considered as relevant, e.g. justice, health, education, where there are GHG emissions from spending and governance decisions in relation to buildings, land and other operations.
- **'Green recovery' seeks to achieve the dual aims of lifting an economy out of recession, and society out of a crisis, alongside protecting and improving the environment.** Rebuilding from the Covid-19 pandemic provides an opportunity for

green recovery. Any transition to a decarbonised economy must be a Just Transition, to ensure that decent, fair and high-value work is created in environmentally and socially sustainable industries.

- **The Scottish Government has received advice on green recovery from their Just Transition Commission, Infrastructure Commission, and the Advisory Group on Economic Recovery.** A new Scottish National Investment Bank has a core mission to address the climate emergency, "and to invest in rebalancing the economy towards leadership in sustainable technology, services and industries".

Introduction - the time is now

Alongside immediate recovery from Covid-19, the climate and ecological crises are the biggest short and medium-term issues facing Scotland and the planet; the impacts of climate change and how to tackle it have risen up the political and public agenda significantly in recent years. Climate change poses a real and existing threat to human safety, health and wellbeing, economies and natural ecosystems. Mitigating and adapting to it will require a complete transformation of society and the economy [1] [2] .

During the recent Scottish Parliament election campaign, BBC News asked Is this Scotland's climate election? and noted IPSOS Mori research showing that two thirds of citizens agree climate change is as serious a crisis as Coronavirus [3] [4] .

There has been a notable recent rise in climate change activism, with protests on the streets and Greta Thunberg's solo school strike for climate action becoming Fridays for Future, a globally co-ordinated movement, bringing together concerned young people from across the world [5] . Six Extinction Rebellion protesters were also recently cleared by jury of causing criminal damage, despite the judge instructing that there was no defence in law for their actions. The protesters, defending themselves, had argued that their actions were a "necessary" and "proportionate" response to the harm being caused [6] .

Further legal cases across Europe have focussed on state support for fossil fuel companies and human rights [7] [8] [9] :

- In Holland, the Supreme Court ruled that the Government must act urgently to reduce emissions and to bring them in line with their human rights obligations
- Again, in Holland, a civil court has ruled that by 2030, Shell must cut its CO_2 emissions by 45% compared to 2019 levels
- In Germany, the Constitutional Court ruled that climate protection is a human right, and that the actions of current generations are to the detriment of future generations
- In Spain, the Parliament has passed a law banning new permits for fossil fuel exploration and extraction, and for an end to all extraction by 2042
- A High Court action has also been lodged in the UK which challenges the tax breaks given to domestic oil and gas companies, and the official policy of maximising economic recovery.

The role of the general public in shaping governmental, structural and societal responses to climate change has also never been greater, with a type of deliberative public engagement in the form of climate assemblies recently taking place in Scotland, at a UK level and further afield. These assemblies give participants time to consider and discuss the issues in depth before coming to a considered view, and making recommendations to Government.

Scotland's Climate Assembly has recently reported, with wide ranging recommendations from decarbonising internal flights to de-incentivising imports and establishing more innovative businesses and low carbon manufacturing industries in Scotland [10] .

Scotland has slightly more than halved it's greenhouse gas (GHG) emissions in the last 30 years, but will have to more than half them again in the next decade to come close to achieving domestic targets, and contribute to achieving UK and international goals. The "hard yards" of decarbonisation will therefore fall within this parliamentary session, and will require detailed, strategic and co-ordinated scrutiny across multiple portfolios. This is explored in more detail below.

This briefing provides an overview of the main climate change issues. It highlights the latest climate science, outlines global and UK frameworks for addressing climate change and focuses on the main legislative and policy provisions in Scotland. It also sets out how emissions in Scotland have reduced to date and some of the ways that climate change has recently been considered in the Scottish Parliament.

Global Science and Policy

The release of greenhouse gas emissions (GHGs) is causing global temperatures to rise and long-term changes in our climate. The main GHGs are:

- Carbon dioxide (CO_2) from burning fossil fuels e.g. oil, gas and coal, and from deforestation
- Methane from waste management, ruminant digestion (e.g cows, sheep and deer) and animal waste
- Nitrous oxide from agricultural practices
- Fluorinated gases (F-gases) from industrial processes.

Each gas is weighted by its global warming potential (its warming influence relative to CO_2), so that total GHG emissions can be reported on a consistent basis in units of carbon dioxide equivalent (CO_2e); most commonly as millions of tonnes of carbon dioxide equivalent ($MtCO_2e$) [1] .

Effects of Climate Change

The Intergovernmental Panel on Climate Change (IPCC) is the UN body for assessing the science related to climate change. It was established in 1988 to provide policymakers with regular scientific assessments concerning climate change, its implications and potential future risks, as well as to put forward adaptation and mitigation strategies; it has 195 member states. IPCC assessments provide governments, at all levels, with scientific information to inform the development of climate policies, and are a key input into relevant international negotiations. International teams of scientists, including those from Scottish universities, draft and review IPCC reports in several stages to ensure objectivity and transparency.

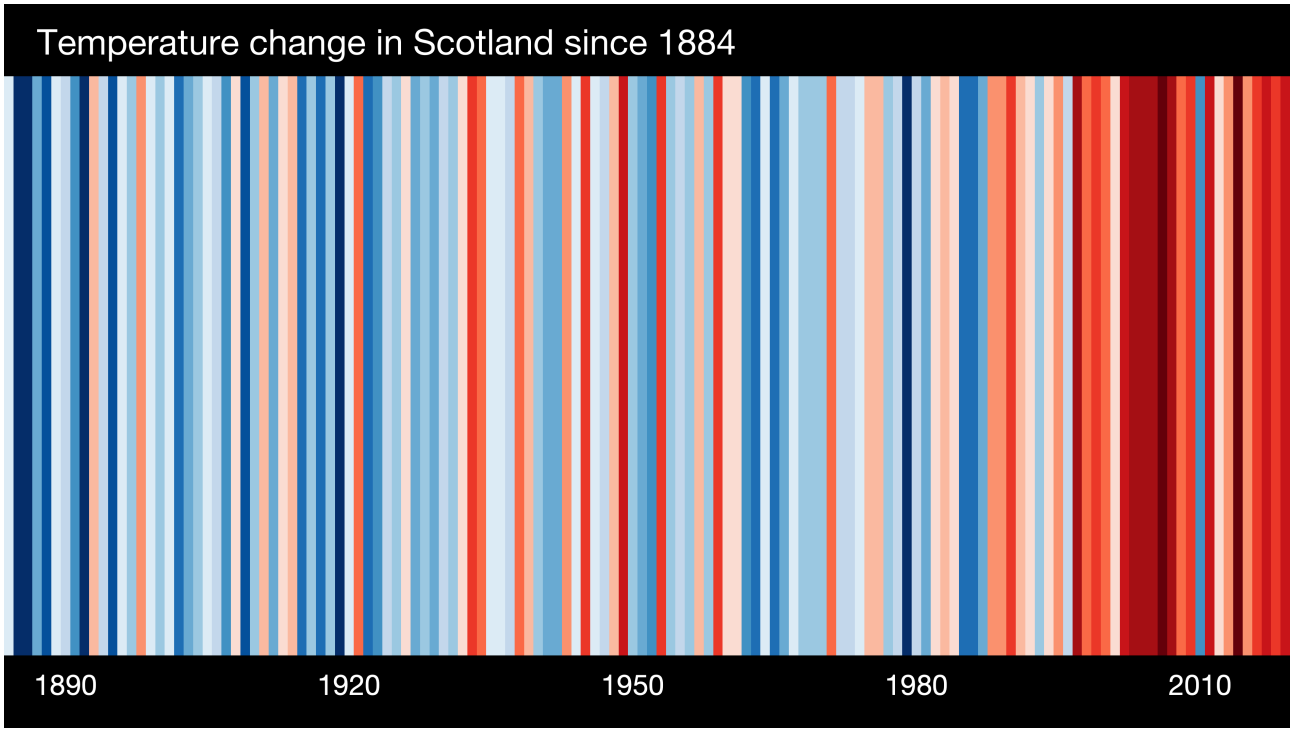
The effects of climate change are already extremely serious, representing a significant threat to the Earth's natural systems, and those who rely on them. The impact of burning fossil fuels, and releasing other GHGs on the climate system is clear, and evidence shows that it is "extremely likely" that human influence has been the dominant cause of increased global temperatures, and related climate change since the middle of last century [11] .

Measurements show that [12] [11] :

- 2020 tied with 2016 as the hottest year on record
- Each of the last 3 decades have been hotter than the previous one
- 17 of the 18 warmest years on record have occurred in the 21st century.

Figure 1 below provides a graphical representation of temperature change in Scotland since 1884. Each stripe represents one year. Red colours indicate warmer years and blue cooler years [13] :

Figure 1: 'Warming Stripes' for Scotland



Source: Professor Ed Hawkins (University of Reading) - licensed under CC-BY 4.0

A recent IPCC Special Report on the Ocean and Cryosphere[i] notes that it is virtually certain that the global ocean has warmed unabated since 1970 and has taken up more than 90% of the excess heat in the climate system. The IPCC states with high or very high confidence [14] that:

> " Over the last decades, global warming has led to widespread shrinking of the cryosphere, with mass loss from ice sheets and glaciers, reductions in snow cover and Arctic sea ice extent and thickness, and increased permafrost temperature."

The UK is already affected by rising temperatures. The average temperature in the UK is now about 1°C higher than in the 1960s. All ten of the warmest years in the UK have occurred since 1990 with the eight warmest occurring since 2002. The impacts of this include sea-level rise, flooding, and heat-waves; extreme weather events are increasing in frequency and intensity [15] .

The IPCC states that [11] :

> " Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased."

These facts are not disputed by any scientific body of national or international standing [16] .

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i Part of the earth's surface characterised by the presence of frozen water

Global Response

United Nations climate change conferences have grown significantly since the first meeting in Kyoto, Japan in 1997, and they are now among the largest international meetings in the world, taking place at least twice and sometimes three or four times a year [17] .

The Kyoto Protocol was adopted in December 1997, however owing to a complex ratification process, it only entered into force in February 2005. This protocol puts the United Nations Framework Convention on Climate Change (UNFCCC) into operation, and commits industrialised countries to limit and reduce GHG emissions in accordance with agreed individual targets. It places a heavier burden on developed countries under the principle of “common but differentiated responsibility and respective capabilities”, because it recognises that they are largely responsible for the current high levels of GHG emissions in the atmosphere [17] .

The global response to climate change has been fraught with difficulty, and whilst agreed action at an international level has been notable, implementation at a national level could, at best, be described as uneven. Since the 1990s, global emissions and global temperatures have continued to rise [17] [18] . World Politics Review notes [19] :

> “ Persistent climate skepticism from key global figures, motivated in part by national economic interests, is slowing diplomatic efforts to systematically address the drivers of climate change.”

Climate change mitigation and adaptation policy is devolved to Scotland. However, it is the UK that is signatory and party to the UNFCCC and other international treaties.

Paris Agreement

Annual meetings on climate change (Conferences of the Parties (COP)) are held as part of the UNFCCC. In December 2015 the Paris Agreement was adopted under the UNFCCC at COP21. The key provisions of the agreement are:

- Global temperature rises should be limited to “well below” 2°C and to “pursue efforts” to limit temperature increase to 1.5°C above pre industrial levels
- Parties to the agreement are to aim to “reach global peaking of greenhouse gas emissions as soon as possible”
- Parties are to take action to “preserve and enhance” carbon sinks
- To conduct a “Global Stocktake” every five years, starting in 2023
- Developed countries to provide financial support for developing countries to mitigate climate change
- Creates a goal of “enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change”.

The Agreement also requires all parties to prepare, communicate and maintain national GHG reduction targets. Known as Nationally Determined Contributions (NDCs) these should set out each party’s efforts to reduce national emissions, and are the basis for

tracking action and alignment with targets.

Following the adoption of the agreement, Scotland's First Minister (who attended the Paris summit) welcomed the agreement and said [20] :

> " COP21 has, as we had hoped, achieved a big step forward in the international fight against climate change. [...] Devolved administrations, like the Scottish Government, will be strong drivers of a progressive climate agenda. We look forward to working with our international partners to secure the successful implementation of the Paris agreement."

In November 2021, Glasgow will host COP26, this is considered below and in detail in SPICe Briefing COP26 - An Introduction.

Warming to 1.5°C

For many years, limiting global warming to no more than 2°C above pre-industrial levels was the de-facto target for global policymakers. However in 2015, the UN published a new report that warned that the 2°C limit was not adequate for avoiding some of the more severe impacts of climate change [21] .

As a result of the 2015 report, in October 2018 the IPCC published a Special Report on Global Warming of 1.5°C [22] . This notes that every extra bit of warming matters to the Earth's ecosystems and those who depend on them, and sets out in detail the difference between allowing temperatures to rise towards 2°C, or keeping them nearer to 1.5°C. Key points include:

- Going past 1.5°C would seriously affect the planet's liveability, and on the current trajectory, this temperature "guard rail" could be exceeded by 2030
- By 2100, global mean sea-level rise will be around 10cm lower for warming of 1.5°C compared with 2°C. This could mean up to 10 million fewer people exposed to the risks of rising seas
- In a world that is warmed by up to 1.5°C, about 14% of the population are exposed to a heat wave every five years. That increases to 37% of the population at 2°C.

To stay within the 1.5°C "guard rail", all of the following must happen:

- Global emissions of GHG must decline by 45% from 2010 levels by 2030
- Renewables should provide up to 85% of global electricity by 2050
- Coal use must reduce to close to zero
- Up to seven million km^2 of land will be used for energy crops (a bit less than the size of Australia)
- Global net zero emissions must be achieved by 2050.

This study differs from previous IPCC approaches in that it clearly links lifestyle choices with warming. The report's authors say that rapid changes must take place in four key

parts of society:

- Energy generation
- Land use
- Cities
- Industry.

The report is clear that whilst new technologies have a role to play, many of these are unproven at scale, expensive and uncertain. Professor Jim Skea, an IPCC co-chair, and former member of the CCC states [23] :

> “ Frankly, the more we are prepared to make changes to behavioural patterns that reduce greenhouse gas emissions, the less we would need to rely later on more difficult options that we don't yet fully understand [...].”

More recently, in May 2021, the International Energy Agency published a comprehensive energy road map which notes that current pledges - even if fully achieved - "would fall well short of what is required to bring global energy-related CO_2 emissions to net zero by 2050 and give the world an even chance of limiting the global temperature rise to 1.5 °C", and recommends that there should be [24] :

> “ [...] from today, no investment in new fossil fuel supply projects, and no further final investment decisions for new unabated coal plants.”

Room for Optimism, not Complacency

The past eight months have seen some key developments and cause for optimism according to a report by Climate Action Tracker[ii] (CAT) [25] .

Announcements at US President Biden’s Leaders Summit on Climate, alongside further commitments since September 2020, have improved end of century warming estimates, with an "Optimistic Targets Scenario" now projecting global warming as low as 2.0°C. CAT states [25] :

> “ 131 countries, covering 73% of global GHG emissions, have adopted or are considering net zero targets [...]. However, it is the updated 2030 [...] targets, rather than these four additional countries, that contribute the most to the drop in projected warming [...], highlighting the importance of stronger near-term targets. [...] While all of these developments are welcome, warming based on the targets and pledges, even under the most optimistic assumptions, is still well above the Paris Agreement’s 1.5˚C temperature limit.”

These targets have however yet to be supported by adequately ambitious policies, with all adopted national policies taking warming to 2.9°C. Figure 2 shows CAT's most recent modelling [25] :

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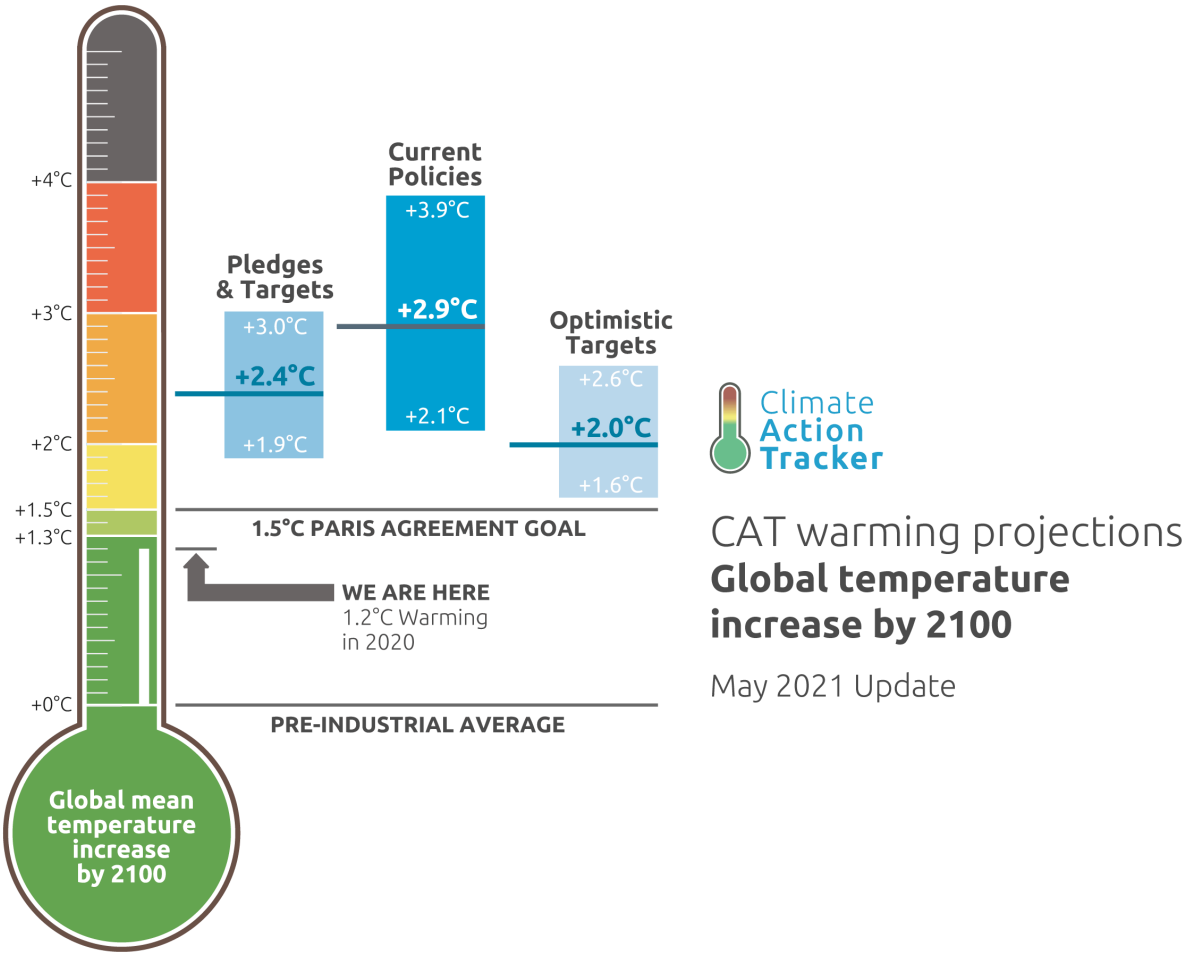
ii The Climate Action Tracker is an independent scientific analysis that tracks government climate action and measures it against the globally agreed Paris Agreement

Figure 2: Climate Action Tracker Warming Projections



Nevertheless, there are also significant concerns that this long-term optimism is not matched by short-term plans to cut greenhouse gas emissions; Professor Niklas Höhne who worked on the modelling, and is a founding partner of NewClimate Institute states [26] :

> " Countries have not yet adjusted their short-term actions to be on a pathway towards the long-term target [...] Long-term targets are easier, they are far away. But short-term actions are happening right now and they affect citizens, they affect voters. And that's why this is much more difficult."

The recent UN Emissions Gap Report 2020 notes that GHG emissions continued to increase in 2019, and makes the following key points [27] :

- Emissions could decrease by about 7% in 2020 compared with 2019 levels, due to Covid-19, however this will not contribute significantly to emissions reductions by 2030 unless countries pursue an economic recovery that incorporates strong decarbonisation
- In line with CAT's assessment (above), recently announced net-zero commitments are welcome, but current policies and associated actions remain seriously inadequate, and are not consistent with achieving net-zero
- Covid-19 related spending is unprecedented in its scale, currently amounting to

roughly 12% of global gross domestic product in 2020. To date, the use of fiscal rescue and recovery measures to stimulate the economy while simultaneously accelerating a low carbon transition has largely been missed

- Lifestyle changes are a prerequisite for sustaining reductions in GHG emissions and for bridging the emissions gap; this requires both system change and individual action - it must also be equitable. The emissions of the richest 1% of the world's population account for more than twice the combined share of the poorest 50%.

In relation to this emissions gap, and the extraordinary economic slowdown that occurred in 2020, alongside a similar drop in emissions, Professor Niklas Hohne stated [28] :

> “ The reductions that we have seen in 2020 are in the order of magnitude of the reductions that we need to achieve each year until 2030 or even longer; but they need to be structurally completely different to the reductions that have happened now. Right now we are addicted to fossil fuels, Our whole economy is running on coal, oil and gas.”

Green recovery from Covid-19 in Scotland is explored in detail later in this briefing.

COP 26

The 26th United Nations Conference of the Parties (COP 26), to be held in Glasgow in November 2021, is the largest international negotiation ever to be held in the UK.

This summit, chaired by the UK Government and held in partnership with Italy, aims to bring heads of state, climate experts and campaigners together to "accelerate action towards the goals of the Paris Agreement and the UN Framework Convention on Climate Change". Originally scheduled for November 2020, this is considered to be one of the most important climate conferences ever, with the talks widely considered to be the last opportunity to deliver on commitments to keep global temperature rise to within 1.5 – 2°C [29] [30] [31] .

A key priority for COP26 is full implementation of the 2015 Paris Agreement, which requires all parties to prepare, communicate and maintain national GHG reduction targets. Known as Nationally Determined Contributions (NDCs) these should set out each party’s efforts to reduce national emissions. NDCs are expected to show a progressive reduction in GHGs, known as the "ratchet mechanism".

Tangible progress towards climate change adaptation is also a priority, as is delivering US$100 billion per year for climate action in developing countries. For the UK it is also a significant test of its new role in the world after leaving the EU. Many parties have yet to set out adequate emission cuts within their NDCs to keep global warming within "safe" limits. Global temperature rise is driven by cumulative emissions over time. Therefore, immediate reductions of GHGs are considered to be essential [29] [30] [31] .

COP26 also offers a crucial opportunity to address how a just, resilient and green recovery from Covid-19 is delivered. To achieve the 1.5°C temperature goal, GHG emissions must be reduced by all parties across all sectors of society and the economy [29] [30] .

Previously, Scotland and the UK were part of a joint European Union (EU) NDC, which set

an EU-wide emissions target. As a result of leaving the EU, the UK Government formally submitted an individual NDC in December 2020; this commits to reducing GHG emissions by at least 68% by 2030, compared to 1990 levels [32] ; 1990 is the internationally agreed baseline year against which emissions reductions are calculated.

As part of the UK, Scotland does not need to calculate or submit an NDC, however the Scottish Government has undertaken to publish an indicative NDC in the spirit of the Paris Agreement as [33] :

> " a clear indication of Scotland's commitment to joining and leading the international effort on tackling climate change and ensuring a more sustainable future for our planet."

Christiana Figueres, former Executive Secretary of the UNFCCC, believes that [34] :

> " If governments put health, nature regeneration and climate action at the core of every decision they make in recovering from this pandemic, we can emerge as a stronger and more resilient society, and ensure the COP26 puts us on track to a safer climate future."

Further information and analysis is provided in SPICe Briefing COP26 - An Introduction.

Brexit - post EU

As previously noted, the UK's carbon reduction commitments to the UNFCCC used to be included in the EU's. However, having now left, the UK has submitted its own NDC [iii].

Nevertheless, having played a leading role in the EU for over 40 years, including in the development and delivery of the EU's climate and environment policies and targets, there are still many common areas of interest and agreement, and the UK has undertaken to continue its commitment to many of the targets set whilst a member state. The EU-UK Trade and Cooperation Agreement reaffirms the commitment to fight against climate change and recognises the need for "a robust level playing field" [35] :

> " by maintaining high levels of protection in areas such as environmental protection, the fight against climate change and carbon pricing, social and labour rights, tax transparency and State aid, with effective, domestic enforcement, a binding dispute settlement mechanism and the possibility for both parties to take remedial measures."

United Kingdom

As previously noted, whilst climate change mitigation and adaptation policy is devolved to Scotland, it is the UK that is signatory and party to the UNFCCC and other international treaties.

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iii Scotland is part of the UK, and therefore cannot formally submit an NDC, however the Scottish Government has undertaken to publish an indicative one in the near future, which will centre on "Scotland's world-leading target to reduce emissions by 75% by 2030".

Therefore, efforts in the devolved nations count within and towards the UK's overarching international target to reach net-zero emissions by 2050, and the recent undertaking to reduce emissions by at least 68% by 2030, compared to 1990 levels [36] [37] .

The Climate Change Act 2008 [as amended] provides the main legal framework in the UK for both mitigating and adapting to climate change. In brief, it requires that:

- Specified GHG emissions are reduced by a certain amount every five years (known as carbon budgets)
- An overall target of net zero emissions is reached by 2050[iv]
- The Government assesses and prepares for climate change risks and opportunities (such as flooding and impacts on ecosystems and agriculture).

UK action on reducing emissions largely focusses on decarbonising individual sectors such as power, industry, waste, buildings, transport and agriculture. Independent advisers to the UK and devolved nations, the Climate Change Committee's (CCC) latest Progress Report to the UK Parliament noted that whilst some advances had been made in relation to setting headline goals, and a Cabinet Committee and Treasury Funding Review were ongoing, there were still gaps in relation to crucial sectoral policies e.g. for industry or hydrogen, woodland and peat, and transforming heating [38] . More recently, the House of Commons Public Accounts Committee published a report on Achieving Net Zero and stated [39] :

> “ Government lacks a plan for how it will achieve net zero greenhouse gas emissions by 2050 despite setting the target almost two years ago. At present, there is no coordinated plan with clear milestones towards achieving the target, making it difficult for Parliament and the general public to understand or scrutinise how the country is doing in its efforts to achieve net zero emissions. Government intends to publish a plethora of strategies this year setting out how it will reduce emissions in different sectors ranging from transport to the heating of buildings culminating in an overall net zero strategy.”

Scotland

Impacts in Scotland

Adaptation Scotland, the Scottish Government funded programme which provides advice and support to adapt to climate change impacts states [40] :

> “ The last century has been a period of rapid climate change across Scotland. In particular, records show that over the last few decades: temperatures have increased - with the last decade the warmest ever recorded; rainfall patterns have changed - with increased rainfall and more heavy downpours; sea-level rise is accelerating; and there have been fewer days with frost and snow cover.”

Key statistics include:

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iv The Act originally included an 80% emissions reduction target by 2050 which was increased to 100% in 2019.

- Average temperatures in Scotland are now around 0.7°C higher than they were a century ago (this is in line with global trends)
- The average temperature in the first decade of the twenty first century in Scotland was 0.9°C warmer than the average for the thirty-year period 1961-1990 and it was warmer than any other decade since records began in 1910
- Scotland's warmest year on record was 2014
- In 2016 the average temperature was 0.8°C higher than the average for 1961-1990
- Scotland's annual rainfall has increased since the 1970s and is now 13% above the average for the early decades of the twentieth century. All seasons have contributed to this increase
- Long-term monitoring of sea level at stations around the UK including Aberdeen shows the mean sea level for 2006 - 2008 was more than 10cm higher than during the 1920s.

Legislative and Policy Framework

Climate Change Acts

The Climate Change (Scotland) Act 2009 set a target for Scotland to cut emissions by 80% by 2050 and required annual emissions targets to be set. The 2009 Act also 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 [41] .

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 [v], with interim targets for reductions of:

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

The net-zero target is in line with the CCC's, scientific advice as set out in their report, Net Zero – The UK's contribution to stopping global warming.

Annual Targets

Annual targets are set out by the Scottish Government, increase in increments of 1-2% [42] , and are shown in Figure 3 below.

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v Net zero refers to achieving a balance between the amount of GHG emissions produced (e.g. transport and agriculture) and the amount removed from the atmosphere (e.g. trees and peat). To achieve this, existing emissions have to be reduced, as well as actively removing GHG. Net zero is the state at which our contribution to global warming stops.

The most recent figures show that 2019's target of a 55% reduction in emissions (from a 1990 baseline) has been missed by a wide margin [43] . This is explored in more detail in the section on Scotland's Emissions Reductions to Date.

Achieving Targets - Climate Change Plan

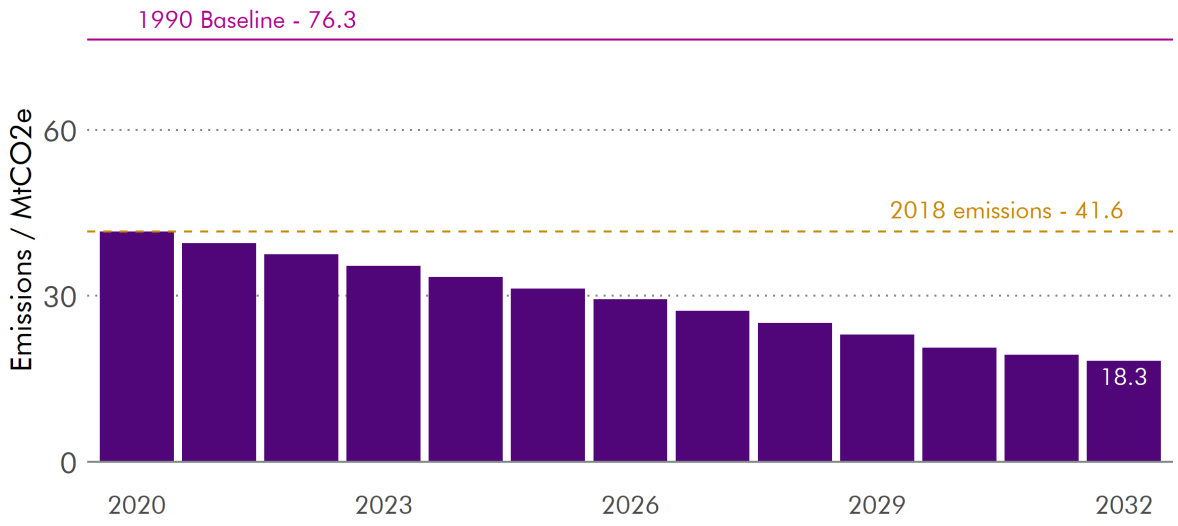
The Scottish Government had undertaken to revise the 2018 CCP within 6 months of the 2019 Act, however this was postponed due to the Covid-19 pandemic, and Securing a Green Recovery on a Path to Net Zero: Climate Change Plan 2018–2032 - update (CCPu) was finally published in draft form on 16 December 2020 [44] . This was scrutinised by four Parliamentary committees.

The CCPu was widely regarded as a crucial staging post in Scotland's trajectory to net-zero emissions, as it encompasses the interim 2030 target, which CCC considers to be "extremely challenging", and "may not be feasible" [45] . In oral evidence to the Scottish Parliament's Environment, Climate Change and Land Reform Committee, the CCC's Chief Executive Chris Stark stated [46] :

> “ The Net Zero target set a challenging new legal objective for GHG emissions in 2045, but Scotland's legislated target of a 75% reduction in emissions by 2030 – which went beyond the Committee's recommendation for a 70% target – will likely be even more challenging to achieve. [...] Scotland has halved its emissions in the past 30 years, which has been a slog, but the new target requires us to halve them again in the next decade.”

Expected emissions reductions for the lifetime of the CCPu are shown in million tonnes of carbon dioxide equivalent ($MtCO_2e$) in Figure 3 [47] :

Figure 3: Total expected emissions reductions 2020-2032



The CCPu provides further detail 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)
- Agriculture
- Negative Emissions Technologies (a new sectoral chapter).

The following SPICe briefings provide further information:

- Update to the Climate Change Plan - Background Information and Key Issues
- Update to the Climate Change Plan - Key Sectors

Reporting on Progress

Section 35B of the Climate Change (Scotland) Act 2009 requires Scottish Ministers to report on progress to the CCP.

A series of eight (sector by sector) annual reports were laid in the Scottish Parliament on 27 May 2021, and published as a compendium by the Scottish Government [48] . There are separate reports for each substantive chapter of the current CCP.

Monitoring is structured on three levels for each sector:

- Greenhouse gas emissions statistics provide the highest level measure of progress at an economy wide and sectoral level
- Policy outcome indicators measure the success of policies in achieving the changes that are needed
- Policy tracker monitors implementation of specific policies and proposals.

Official Statistics on Scottish greenhouse gas emissions determine progress towards national emissions reduction targets and also provide information on total annual emissions at a sectoral level. Statistics are published annually, typically in June, and two years in arrears. For example, the most recent figures, published in June 2020, cover emissions during 2018. Scotland's emissions reduction to date are considered below.

In relation to policy outcome indicators, the Scottish Government states [48] :

> “ The Plan includes key policy outcomes for each sector, defined as a measurable change on the ground resulting from a policy or combination of related policies. The Framework will measure progress towards achieving these with a set of policy outcome indicators. A policy outcome indicator is a specific, objective measure closely aligned to achieving the outcome. It will underpin monitoring of long-term progress towards the outcome, but should also be responsive to change in the near-term, so that it can be used to evaluate whether the Plan is on track. Specific milestones (or targets) are set, where appropriate, for the level of the indicator to be achieved at a given time.”

Figure 4 shows that there is currently insufficient information to assess progress against the majority of policy outcome indicators [48] :

Figure 4: Progress against policy outcome indicators

It is not yet clear what the "policy tracker" will look like, the Scottish Government states that it "will consistently record progress and next steps for policies, and where possible it will include implementation indicators for specific policies" [48] .

Adaptation

Whilst the changes noted above bring both risks and opportunities, projections for the next century indicate that climate trends observed over the last century will both continue and intensify. There are unavoidable consequences of historic emissions and significant changes projected over the coming decades. Adapting to climate change is therefore necessary regardless of how swiftly emissions are cut.

In oral evidence to the Parliament's Environment, Climate Change and Land Reform Committee, Baroness Brown of Cambridge, chair of the CCC's Adaptation Committee stated [49] :

> “ We would very much like to see all Government departments and all businesses thinking about the possible implications of being on a 1.5°C to 2°C trajectory, because we absolutely have to be looking at the risks that are associated with that. Even with a 1.5°C trajectory, the climate will go on changing beyond the end of the century. People should also be looking at what would happen under a 3.5°C to 4°C trajectory, because that is still a significant probability. For every decision that could be affected by a climate change impact, which could cover almost anything, those two assessments ought to have been done. People need to have faced up to what the weather and the world could look like and to have asked whether what they are doing is robust against that backdrop. That is the kind of logical risk assessment that everybody should be doing, but not everybody is looking at the 2°C trajectory, let alone thinking about the 4°C one.”

Part 5 of the Climate Change (Scotland) Act 2009 requires the Scottish Government to publish an adaptation programme:

> “ This programme must set out the Scottish Ministers’ objectives in relation to adaptation to climate change, their proposals and policies for meeting those objectives, including the timescales within which the proposals and policies will be introduced and otherwise address the risks identified for Scotland in the Secretary of State’s report. It must also outline arrangements to ensure engagement with stakeholders in delivering the programme, specifically with employers and trade unions and what mechanisms will be used to ensure the public is engaged in meeting the objectives.”

In 2019, the Scottish Government published the second Scottish Climate Change Adaptation Programme 2019 – 2024 [50] . This has three overarching themes, with related priorities:

Table 1 - Scottish Climate Change Adaptation Programme 2019 – 2024; Key Themes

Overarching Theme	Adaptation Priority	
Natural Environment	Terrestrial species and habitats Forestry Soils and agriculture	Freshwater rivers and lochs Marine and coastal ecosystems
Buildings and Infrastructure Networks	Flooding and coastal erosion risk management Surface water and sewer flooding Development in flood risk areas Resilience of buildings to extreme wind and rain Water demand in the built environment Design and location of new infrastructure	Energy networks – generation, transmission and distribution Public water supplies Ports, airports and ferry services Roads and the rail network Digital infrastructure Infrastructure interdependencies
Society	Resilience of the population to changes in temperature Resilience of people to pathogens, air pollution, UV radiation Public understanding of climate related risks Emergency planning and response Recovery from extreme weather events	Health and social care services Business impacts from extreme weather Business opportunities from climate change Supply chain disruptions Water demand by industry

The Climate Adaptation Programme takes an outcomes based approach, derived from both the UN Sustainable Development Goals and Scotland's National Performance Framework. The Plan states:

> " An outcomes-based approach means focusing on what the policy should achieve, rather than inputs and outputs. It is positive and forward-looking, thinking about what type of Scotland we want in the future. It encourages Government to work across traditional boundaries and increases transparency and accountability."

The Plan sets out seven outcomes linked to the UN Sustainable Development Goals, shown in Figure 5 below [50] :

Figure 5: Scottish Government climate change adaptation programme outcomes linked to the National Performance Framework and UN Sustainable Development Goals

The CCPu recognises that "adaptation and resilience are therefore also key components of our green recovery", and that "adaptation investment is also a key driver of economic growth and jobs [...] and presents opportunities [...] to attract inward investment".

Furthermore, the value of nature-based solutions, and of the land as "the cornerstone of our society and economy" is recognised [44] :

> “ Climate change is one of the main drivers of biodiversity loss, and nature-based solutions can also protect, sustainably manage, and help restore ecosystems. These solutions have the potential to enable climate change mitigation, resilience, adaptation and positive social change, providing benefits for both people and biodiversity.”

Annual Progress Report 2021

The Scottish Government published its second annual progress report on the climate change adaptation programme in May 2021. [51] The report recognises that the COVID-19 pandemic has highlighted the need to build resilience to systematic risks such as climate change. It states:

> “ The pandemic has presented an unprecedented challenge to individuals, communities, and businesses across Scotland. It has also clearly indicated that national conversations about identifying and building resilience to systemic risks are more real and pressing than ever before. During that same month of May 2020, the Scottish Government sought advice from the *UK* Climate Change Committee (*CCC*) on a green recovery for Scotland from *COVID-19*. The *CCC* advised that increased resilience to the impacts of climate change must be at the centre of a green recovery, alongside an ongoing focus on reducing emissions in a way that is fair and just.”

The report provides an overview of policies and proposals implemented to meet each of the seven outcomes as set out above in the climate change adaptation programme. This includes:

- Spending commitments
- Implementation of relevant legislation
- Development/completion of projects
- Development of public sector policies and strategies to address climate change adaptation
- Infrastructure investment (e.g. flood management, transport)
- Land management to improve biodiversity and provide nature-based solutions (e.g. tree planting to reduce flood risk).

Climate Change Committee Assessment of Scotland’s Climate Change Adaptation Programme

The CCC published its Final assessment of Scotland’s first Climate Change Adaptation Programme in 2019 [52] .

The key findings are:

- The most notable progress since the first assessment includes peatland restoration, increasing marine resilience and an improved understanding of flood risk in Scotland
- The areas of greatest continued concern include increases in pests and diseases in

Scottish forests, declines in seabird populations and soil health

- Key data and evidence gaps remain that make it difficult to assess progress for a number of adaptation priorities, including the extent of housing and other infrastructure development in flood risk areas and health impacts from climate change.

Climate Change Committee - Assessment of Climate Risk

The CCC published an Independent Assessment of UK Climate Risk in June 2021 [53] . In relation to Scotland, this states:

> " The risk of flooding to people, communities and buildings remains among the most severe risk for Scotland and is the costliest hazard to businesses. Flooding remains a key risk to infrastructure, and water scarcity in summer is an issue, particularly for private water supplies. Climate change also continues to affect the natural and marine environment across Scotland, as well as its agriculture and forestry, landscapes and regulating services such as pollination. High temperatures also have the potential to affect a wide range of health and social outcomes. Interactions between risks are also increasingly recognised."

In short, significant risks of climate change in Scotland, having considered existing adaptation responses, include:

- Impacts on the natural environment, including terrestrial, freshwater, coastal and marine species, forests and agriculture
- An increase in the range, quantities and consequences of pests, pathogens and invasive species, negatively affecting terrestrial, freshwater and marine priority habitats species, forestry and agriculture
- More frequent flooding and coastal erosion, causing damage to infrastructure services, including energy, transport, water and Information and Communication Technologies
- Extreme temperatures, high winds and lightning on the transport network
- Increasing impact of high temperatures on people's health and wellbeing and changes in household energy demand due to seasonal temperature changes
- Increased severity and frequency of flooding of homes, communities and businesses
- The viability of coastal communities and the impact on coastal businesses due to sea-level rise, coastal flooding and erosion
- Damage to cultural heritage assets as a result of temperature, precipitation, groundwater and landscape changes
- Impacts internationally that may affect the UK, such as risks to food availability, safety and security, risks to international law and governance from climate change that will affect the UK, international trade routes, public health and the multiplication of risks across systems and geographies.

Scotland's Emissions Reductions to Date

According to the most recent calculations [43] , Scotland's GHG emissions were estimated to be 47.8 $MtCO_2e$[vi] in 2019[vii]. This is 1.1 $MtCO_2e$ lower than in 2018, equivalent to a drop of 2.3%, and mainly due to marginal decreases in emissions from business, energy supply and domestic transport.

As previously noted, 1990 is the baseline year from which emissions reduction calculations are made. From 1990 - 2019, there was a 51.5% reduction in emissions; not adequate to achieve Scotland's target of a 55% reduction. This is the third year in a row that targets have been missed, with figures for 2018 showing a 4% deficit, and for 2017 a 5.6% deficit [54] [55] .

Section 36 of the 2009 Act (as amended) requires the Scottish Government, having missed the target, to publish "as soon as reasonably practicable", a report "setting out proposals and policies to compensate in future years for the excess emissions".

The methodologies which underpin climate science are not "fixed", and are subject to continuous revision as new research and information becomes available. Therefore, whilst year-on-year emissions are falling in Scotland, figures for all years have been revised up significantly, meaning more GHGs were released than previously thought. Peatlands (within the Land Use, Land Use Change and Forestry - LULUCF sector), have contributed most to this upward revision of emissions estimates.

LULUCF has traditionally been considered to be a "carbon sink", which absorbs and stores CO_2. However, a new assessment of peatlands shows that historical draining and rewetting of these areas means Scotland's land use is actually a net-contributor to emissions [48] .

The Scottish Government states [48] :

> “ The greenhouse gas inventory covers a wide variety of anthropogenic sources of greenhouse gas emissions. There is therefore a wide variety of emissions sources which require different approaches to their estimation. There are a large number of data sources used in its compilation, obtained from Government statistics, regulatory agencies, trade associations, individual companies, surveys and censuses. The methods used to compile the greenhouse gas inventory are consistent with international guidance on national inventory reporting from the Intergovernmental Panel on Climate Change. [...] Revisions to emission inventory estimates reflect the continuous development of scientific understanding of emissive processes, and the improvement to underlying data and methods to generate accurate emission estimates; few revisions to the Greenhouse Gas Inventories arise as a result of 'errors' in the popular sense of the word. The compilation of the inventory is governed by a rigorous quality assurance process and is subject to a great deal of third party scrutiny, such as annual reviews by the UNFCCC of the UK inventory.”

Figure 6 shows total emissions reductions in million tonnes of carbon dioxide equivalent

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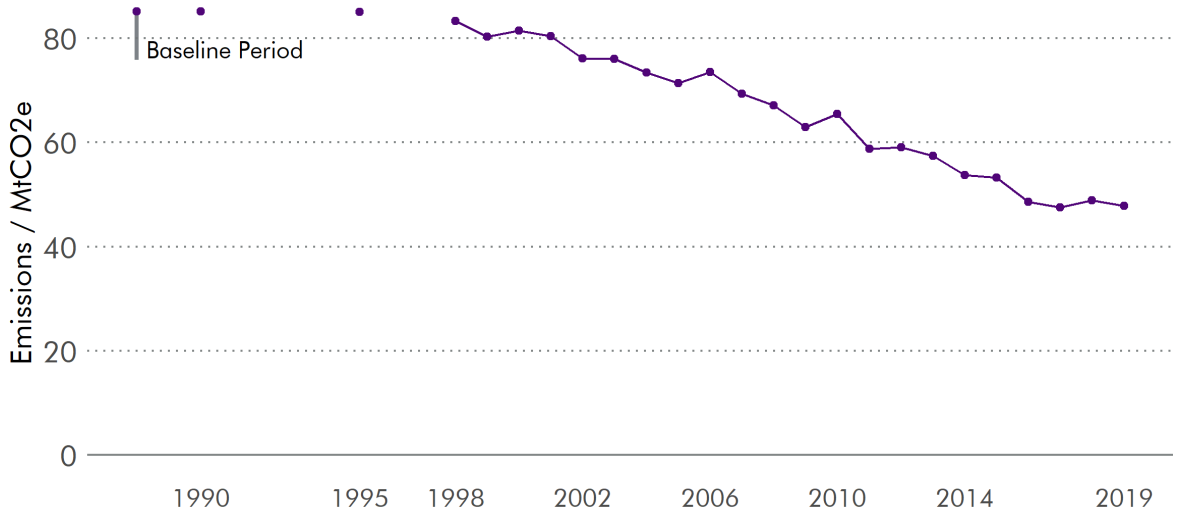
vi Millions of tonnes of carbon dioxide equivalent - explained in more detail in Global Science and Policy.

vii Adjusted to include international aviation and shipping, but not adjusted for the EU Emissions Trading Scheme, which is no longer used to track progress against statutory emissions reduction targets

($MtCO_2e$) to date [43] .

Figure 6: Emissions Reductions 1990 - 2019



The most significant contributors to this overall reduction were:

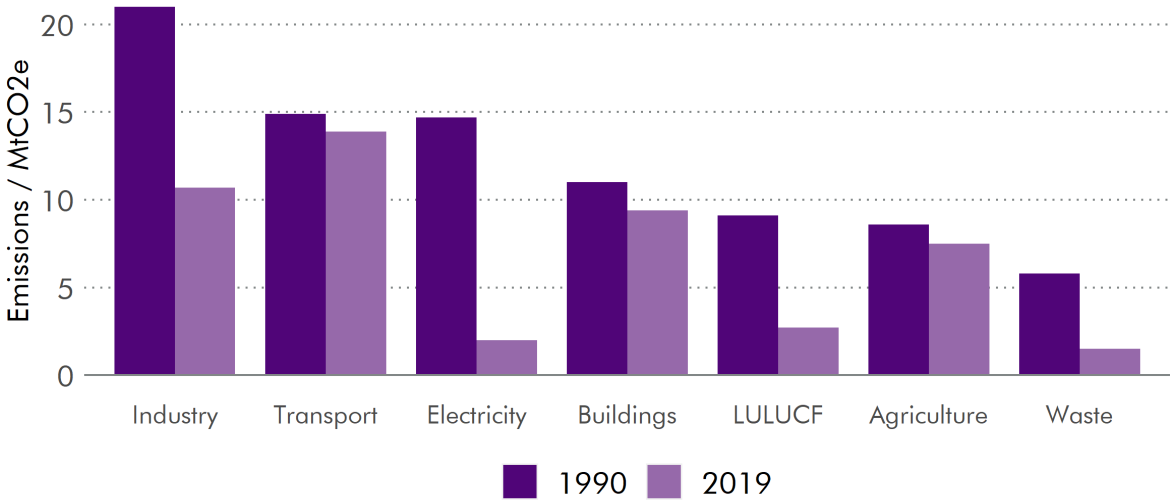
- A 72% reduction in Energy Supply emissions i.e. from power stations
- A 74% reduction in waste management emissions
- A 37% reduction in business emissions (mostly included in the Industry sector of the CCPu).

The sector playing the largest part in slowing the overall reduction in emissions is Transport, which has been Scotland's leading polluter since Longannet Power Station closed in March 2016. Domestic transport emissions have decreased by only 2.5% in the last year, and by 11.3% since 1990. International Aviation and Shipping emissions have increased over the period by 46%.

Following transport, the next most significant emitters in 2019 were business (included in the Industry sector in CCPu) and agriculture. Significantly more offshore wind capacity means emissions from the electricity sector fell after a slight rise the previous year. Most sectors saw a slight decrease in emissions, but there was virtually no change from agriculture and international aviation and shipping. Emissions from residential properties fell slightly, driven by a warmer than usual first three months of 2019.

Sectoral emissions from the baseline year (1990), and most recent modelling are shown in million tonnes of carbon dioxide equivalent ($MtCO_2e$) in Figure 7 [48] :

Figure 7: Sectoral Scottish Greenhouse Gas Emissions Reductions, 1990 and 2019



Mainstreaming Climate Change Governance

Climate governance refers to the set of processes and institutions created to reduce GHG emissions and to manage the impacts of climate change. Climate governance can be seen at a global level - for example, the Paris Agreement - down through national governments to the most local level.

The core aspects of climate governance in Scotland are political, legal and institutional, and some of these are explored in this briefing, e.g. legally binding emissions reduction targets, and statutory plans for mitigation and adaptation; others include:

- Cabinet-level responsibility and political support for climate action across all sectors
- Institutional knowledge, expertise and access to scientific advice
- Public sector duties
- A UK-wide carbon pricing scheme for industry.

The Scottish Parliament can play a key role in promoting and scrutinising climate governance through consideration of draft laws, proposed budgets or government action (or inaction). This is particularly the case in areas that may not traditionally be considered as relevant, e.g. justice, health, education, where there are GHG emissions from spending and governance decisions in relation to buildings, land and other operations.

The SPICe briefing, How to count to net-zero: climate governance of the Scottish Budget considers this in more detail.

Sustainable Development Impact Assessment Tool

Parliaments also have a wider role in ensuring Governments deliver on commitments to achieve the UN Sustainable Development Goals, which aim to provide a shared blueprint

for peace and prosperity for people and the planet. The Scottish Government seeks to implement these goals via its National Performance Framework.

The Parliament has committed to establish sustainable development as a scrutiny lens. This involves scrutinising the relationships between social, environmental and economic issues, and identifying joined-up solutions. The Parliament's Convenors Group Session 5 Legacy Report stated that [56] :

> “ Sustainable development is perhaps the most prominent of cross-cutting issues, wide-reaching in its scope and interpretation, covering environmental, climate change policy areas but also of relevance to the equal opportunities and public participation agenda. In Session 5, some committees used the lens of sustainable development to inform this integrated approach to scrutiny. This will be an area of increased focus in Session 6 and work is underway to produce an impact assessment tool, along with guidance for Members and officials, to help them with their work. In terms of public policy impact, the Group recommends that committees will want to look both at their own practices and also the obligations on the Government. For example, there is merit in considering what changes might be made to the Standing Orders in respect of pre-legislative sustainable development requirements to help achieve a step-change in public policy in this area.”

The Parliament has statutory duties (under the Climate Change (Scotland) Act 2009) to act in a way which helps the achievement of the UN Sustainable Development Goals by 2030, to help achievement of climate change targets, and to ensure equalities and human rights are prioritised in parliamentary scrutiny.

Using the National Performance Framework to scrutinise the work of the Scottish Government is explored in more detail in SPICe Briefing Key Issues for Session 6: .

Green Recovery from Covid - 19

One of the leading architects of the 2015 Paris Agreement, Christiana Figueres believes that [57] :

> “ Moments of crisis are always moments of opportunity. Many crucial decisions will be made over the next few months. As options are considered, we should ask ourselves what is the most effective way to overcome the immediate threat and how to dovetail those decisions into the making of a future where we not only survive, but actually thrive together with nature.”

Green recovery seeks to achieve the dual aims of lifting an economy out of recession, and society out of a crisis, alongside protecting and improving the environment. The concept first emerged after the 2008-2009 financial crisis. Several years of research on the impacts of green recovery policies employed through and after that recession have revealed that, what was promised in many nations, did not fully live up to expectations.

Twelve years on, the context has changed - there is now a very different degree of understanding of environmental problems and solutions, and awareness of both climate and biodiversity challenges. For climate change especially, there is a visibility of climate impacts, higher level of societal ambition, more readiness for structural change, financial viability of new low-carbon technologies, and a shared global aspiration under the 2015

Paris Agreement [58] .

The Scottish Parliament's Environment, Climate Change and Land Reform Committee carried out an Inquiry into Green Recovery in the autumn of 2020 [59] . Their report makes specific sectoral recommendations.

A number of overarching findings and recommendations were also made in relation to climate governance and cohesive policy making, including that "Scotland has shown it can be bold in the face of a crisis", and must be "equally bold in putting systemic change at the heart of the climate and ecological crises". There is considered to be an "implementation gap" between what has been recommended to the Scottish Government (e.g. by the Just Transition Commission and the Infrastructure Commission), and what is actually taking place. Overall budgetary alignment with net-zero was also found to be vital. Furthermore:

- A green recovery should be about building a more resilient Scotland. This is vital to ensure Scotland is better equipped to deal with multi-faceted and complex shocks and challenges e.g. pandemics, climate change, biodiversity loss and geopolitical change - and to deliver a more just, equitable and healthy society and environment
- A human rights based approach to recovery is necessary, this should be underpinned by the key principles of participation, accountability, non-discrimination, empowerment and law
- Covid-19 has demonstrated that policy realignment can be done at pace when required. A green recovery brings significant opportunity to improve public policy alignment.

The CCPu states [44] :

> “ [...] the Scottish Government has committed to a green recovery from COVID-19: a recovery which sets us on a path to meeting our world-leading emissions reduction targets in a way that is just and improves the outcomes for everyone in Scotland, ensuring no one is left behind. COVID-19 has demonstrated the risks of abrupt, unplanned shifts and how these exacerbate inequalities in our society. However, a green recovery offers opportunities to address these inequalities, create and maintain good, green jobs right across Scotland, and empower people and communities to make decisions about their future through community wealth building. A green recovery drives action to reduce our emissions and protect and restore our natural environment.”

Just Transition

The Just Transition concept features in the Paris Climate Agreement, and has been high on the agenda in Scotland for several years, in part due to the efforts of a broad coalition of trade unions and environmental charities organising under the banner of the Just Transition Partnership. It is particularly aligned with declining industries or regions undergoing transitions, for example coal mining or oil and gas.

Section 35C of the Climate Change (Emissions Reduction Targets) (Scotland) Act 2009 [as amended] sets out "just transition principles” as the importance of taking action to reduce net Scottish emissions of greenhouse gases in a way which:

- Supports environmentally and socially sustainable jobs

- Supports low-carbon investment and infrastructure
- Develops and maintains social consensus through engagement with workers, trade unions, communities, non-governmental organisations, representatives of the interests of business and industry and such other persons as the Scottish Ministers consider appropriate
- Creates decent, fair and high-value work in a way which does not negatively affect the current workforce and overall economy
- Contributes to resource efficient and sustainable economic approaches which help to address inequality and poverty.

The Scottish Government must have regard to these when setting out plans to reduce emissions.

To support the application of just transition principles, the Scottish Government established a Just Transition Commission in 2018. This commissions is tasked with providing practical and independent advice on how to maximise the economic and social benefits of decarbonisation whilst managing the risks and challenges.

In March 2021, the Just Transition Commission published their final advice to Scottish Ministers: A National Mission for a fairer, greener Scotland [60] , which is centred around four key messages:

- Pursue an orderly, managed transition to net-zero that creates benefits and opportunities for people across Scotland
- Equip people with the skills and education they need to benefit from the transition
- Climate action needs to empower and invigorate communities and strengthen local economies
- Share the benefits of climate action widely, while ensuring that the costs are distributed on the basis of ability to pay.

The CCPu states [61] :

> “ The transition to net zero emissions will transform our society and economy, therefore the manner of our transition will be crucial. If we plan and prepare, building consensus about our collective future through dialogue and engagement, then we can ensure Scotland benefits from the opportunities of net zero. The transition can realise green jobs, a better environment and a healthy economy that supports our wellbeing. Failure to plan risks abrupt shifts, the loss of key industries and jobs, and deepening inequalities. This is why Scotland has committed to a just transition to net zero.”

Infrastructure Commission for Scotland

In early 2019, to support the delivery of a National Infrastructure Mission, and a new Infrastructure Investment Plan Scottish Ministers established an independent Infrastructure Commission for Scotland.

Overarching objectives include:

- Delivering sustainable inclusive economic growth across Scotland
- Managing the transition to a more resource efficient, lower carbon economy
- Supporting delivery of efficient, high quality, modern public services
- Increasing industry competitiveness, whilst tackling inequality
- Enhancing societal living conditions now and in the future
- Ensuring alignment with the new National Planning Framework.

In January 2020, a Key Findings Report was published, followed by a more detailed Delivery Findings Report in July. The Delivery Findings Report made a series of recommendations including the need to [62] :

- Prioritise an inclusive net-zero economy; independent long-term advice for this should be available
- Enable sustainable places; National Planning Framework 4 should align national, regional and local needs through cross-portfolio, robust evidence-based, land use appraisal and prioritisation
- Deliver a thriving construction sector; there is a need for a high performing construction sector, that underpins the National Infrastructure Mission and includes sharply focussed and coherent skills training.

Scottish National Investment Bank

The Scottish National Investment Bank (SNIB) is expected to play a key role in green recovery. It is to have a "mission oriented approach", set by Scottish Ministers to steer its investments.

It is not intended that SNIB will be a short-term lender to provide working capital to rescue business, but will play an important role in financing the long-term recovery and re-balancing the economy [63] .

Missions for the Bank were set in December 2020, with three Grand Challenges, and associated missions, as follows [64] :

1. Climate Emergency - Net Zero Mission to achieve a Just Transition to net zero by 2045 and to invest in rebalancing the economy towards leadership in sustainable technology, services and industries
2. Place-Based Opportunity - Place Mission to extend equality of opportunity through improving places by 2040 to regenerate and reduce inequality, and improve opportunities and outcomes for people and communities
3. Demographic Change - People Mission to harness innovation to enable people to flourish by 2040 by investing in innovation and industries of the future for a healthier,

more resilient and productive population.

Advisory Group on Economic Recovery

The Advisory Group on Economic Recovery (AGER) was established in April 2020 to provide expert advice on Scotland's economic recovery once the immediate emergency, created by coronavirus, had subsided. Specifically the Group was asked to advise on the economic recovery from the coronavirus pandemic, including:

- Measures to support different sectoral and regional challenges the economy will face in recovery
- How business practice will change as a result of coronavirus, including opportunities to operate differently and how Government policy can help the transition towards a greener, net-zero and wellbeing economy.

Towards a Robust, Resilient Wellbeing Economy for Scotland: Report of the Advisory Group on Economic Recovery was published in June 2020. It makes a series of detailed recommendations, and recognises that responding to climate change needs to be a "thread through every policy action", and that "there is a real opportunity to use circular economy principles to promote new ways of reducing our use of scarce natural resources". It recommends that [65] :

- The green economic recovery is central to recovery overall. The Scottish Government now needs to establish a priority on delivering transformational change with clear sector plans, where the coincidence of emissions reductions, the development of natural capital and job creation is the strongest.

Further recommendations are consistent with those of the Infrastructure Commission and SNIB's missions, and the work of the UK Climate Change Committee in this area is "strongly endorsed".

Recent Climate Change Scrutiny

The Parliament's Environment, Climate Change and Land Reform Committee led on overarching scrutiny of climate change issues in Session 5, including consideration of the Climate Change (Emissions Reduction Targets) (Scotland) Bill.

Other committees also considered specific sectoral and cross-cutting issues e.g. the Economy, Energy and Fair Work Committee scrutinised the Draft Scottish Energy Strategy, and BiFab, the offshore wind sector and Scottish supply chain, and the Rural Economy and Connectivity Committee considered the Forestry and Land Management (Scotland) Bill.

Building on the collaborative scrutiny of previous CCPs, four Parliamentary Committees agreed a joint approach to reviewing the draft CCPu in late 2020, looking at the sectors that relate to their remit. The Environment, Climate Change and Land Reform Committee led cross committee scrutiny of the CCPu, and in its report noted that the scale of change needed in emissions reductions and in social and technical systems has no precedent in

human history. The committee made a number of detailed recommendations, including calling for [66] :

- Clarity on the modelling, evidential base and assumptions that underpin how the plan was developed, and the associated policy decisions chosen
- Demonstration of how the policies and proposals deliver the predicted emissions reductions for each sector
- Clarity on timescales associated with policy and proposal commitments to ensure that these reflect the urgent nature of the climate emergency and the immediate opportunities to progress a green recovery
- Clarity on the rationale behind protecting agricultural and industrial emissions reduction pathways from carbon leakage[viii]
- Reviewing the credibility of reliance on new and untested technologies, and to set out a plan B for how equivalent abatement could be achieved
- Ongoing development of a Monitoring Framework and an associated policy tracker to outline progress against each policy and proposal, set out findings and next steps
- Clear recognition that land is a finite resource, and a more integrated approach to cutting emissions across agriculture and land use, land-use change and forestry recognising that both depend on the management of a single resource and are expected to become more closely aligned in policy and practice.

Whilst debating the update to the CCP, Ben Macpherson Minister for Rural Affairs and the Natural Environment, declined to incorporate the Parliament's recommendations into the updated Plan, and cited an "urgent need to finalise the plan update [before the recess] so that we can focus on the implementation of its policies and deliver our targets". He stated [67] :

> “ We will then look for opportunities to integrate additional policies into our overall package in due course. That will include any new policies in response to our full consideration of the committee recommendations, [...]. Ministers will make a statement in June, following the publication of the next set of greenhouse gas emissions statistics, and we will look for other opportunities to keep Parliament informed of our approach.”

Subsequently, on 15 June 2021, Michael Matheson the new Cabinet Secretary for Net Zero, Energy and Transport described missing the targets by 4.5% as "falling a little short", and stated that [68] :

> “ [...] Scotland’s climate legislation ensures that even deeper reductions will be achieved. The implementation and delivery of the update to the climate change plan must remain our priority, but we will also urgently develop a catch-up report on the missed 2019 target and aim to publish it in six months at the very latest. Looking further ahead into the session, [...] the next full climate change plan [will] be brought forward as soon as possible. That approach reflects the urgency that the climate emergency demands.”

viii Carbon leakage may occur if, due to costs related to climate policies, businesses were to transfer production to other countries with more relaxed emission constraints. This could lead to an increase in total global emissions.

Cover image

Climate warming stripes for Scotland. Source: Professor Ed Hawkins (University of Reading) - licensed under creative commons (CC-BY 4.0)

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