CLIMATE CHANGE PLAN
The Third Report on Proposals and Policies 2018-2032

February 2018

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In 2009, the Scottish Parliament passed unanimously the most ambitious climate change legislation anywhere in the world. Eight years on, we are now publishing our Third Report on Proposals and Policies, the Climate Change Plan (CCP), which will take us to 2032.

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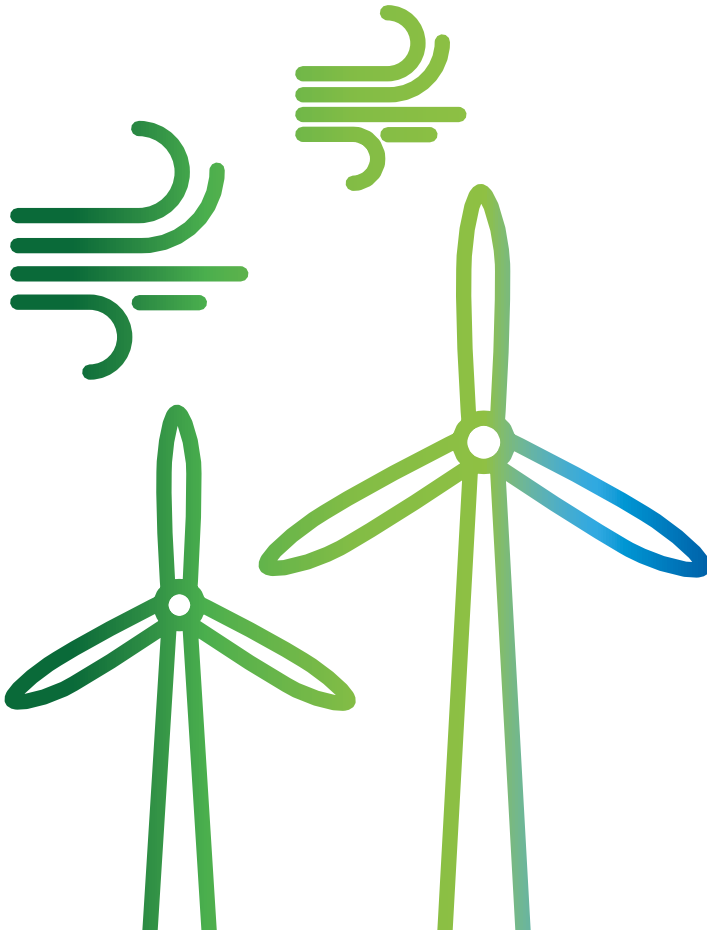
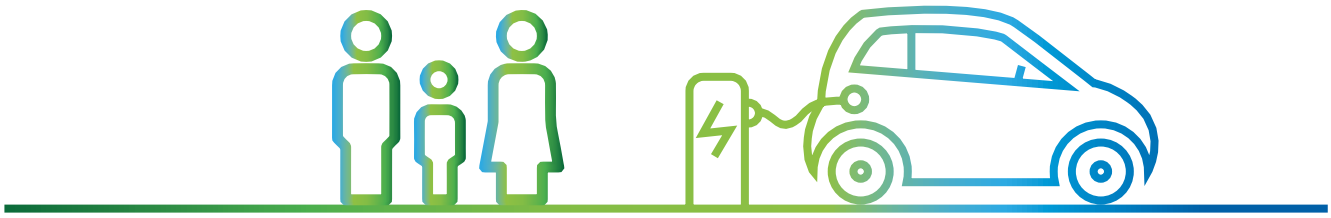


MINISTERIAL FOREWORD

In 2009, the Scottish Parliament passed the most ambitious climate change legislation anywhere in the world. That Act set the target of a 42% reduction in emissions by 2020 and an 80% reduction in emissions by 2050. We are now well on track to meet that 2020 target, and, eight years on from the Act receiving royal assent, I am proud to be publishing our Third Report on Proposals and Policies – this Climate Change Plan – which sets out our ambitious decarbonisation plans to 2032.

2018 is Scotland's Year of Young People. It is fitting that we are setting out our plans now. Many of Scotland's young people are leaders in their own right in tackling climate change. The 2050 Climate Group, for example, aims to equip Scotland's young people with climate change knowledge and leadership skills, so that they can lead the way to a sustainable, low carbon society by 2050. The Group inspires people to act both in Scotland and abroad, and I hope that our young people will continue to be leading, passionate and innovative partners as we implement this Plan.

In Scotland we are already starting to feel the impacts of a changing climate, and more serious impacts are being felt across the world, particularly by communities that are already vulnerable. No-one should be in any doubt about the determination of Scotland to discharge our moral responsibility to deal with climate change.



In November last year, the international community met in Bonn for the annual United Nations climate change conference. The First Minister and I attended and were heartened to be part of the growing global commitment to tackle climate change. We took the opportunity to highlight Scotland's leadership to an international and influential audience at the highest level. This leadership, of course, has to be translated into delivery. As the First Minister said when pledging to work with nations, regions, cities and businesses to create a coalition for action, "our ambitions must live up to the scale of the challenge, and our actions must live up to our ambitions." This Climate Change Plan sets out our domestic plans to ensure we continue to be leaders and collaborators in this coalition.

"Our ambitions must live up to the scale of the challenge, and our actions must live up to our ambitions."

Of course, tackling climate change is not just about our moral responsibility. Scotland must provide certainty to businesses and investors in order to seize the economic opportunities offered by the transition to low carbon technologies, products and services. Recent analysis by the International Finance Corporation indicates that the 2015 UN Paris Agreement will help open up $23 trillion worth of opportunities between now and 2030.

We have abundant renewable energy resources that – with our careful stewardship – give us huge natural advantages. We have a strong track record in engineering and technological innovation that we are already building on. The low carbon and renewable energy sectors now support 49,000 jobs in Scotland. Today, workers in Scottish yards are manufacturing the components that will power the future. Our world class universities are thriving and our supply chains are growing.

My Cabinet colleagues and I are determined to draw on all of these assets to set Scotland on a decarbonisation path that protects and grows the Scottish economy, while ensuring that opportunities and challenges are spread evenly across all parts of society. Through this Plan, and other companion documents such as our Energy Strategy, we are creating the best possible business environment in Scotland, sending a clear signal that Scotland is the place to be for investment in low carbon and associated technologies.

A healthy economy is of course dependent on a healthy natural environment. Our precious wildlife and ecosystems are already being affected by the changing climate. However, the conservation and restoration of biodiversity and ecosystems, such as peatlands and woodlands, can help regulate the climate by sequestering carbon. Healthy ecosystems also have the potential to mitigate some of the vulnerabilities caused by a changing climate, for example as part of flood management practices. With my responsibilities for Environment, Climate

Change and Land Reform, I will continue to ensure that our policies in these areas are intimately linked to the benefit of all.

In finalising this Climate Change Plan, my Cabinet colleagues and I have selected the path that we believe is the most beneficial to the people of Scotland, maximising opportunities and minimising disruption for households, communities, business and industry. There are of course different emissions reduction pathways that could be followed. To help us decide on the optimal pathway for Scotland and deliver the best value for money we used the Scottish TIMES model. TIMES models are accepted by the international community as an international standard for modelling greenhouse gas emission reductions and energy use. Scottish TIMES has been calibrated with Scottish data and sector intelligence. The model has helped us decide how best to allocate effort, or reduce emissions, across the whole economy by using a pathway broken down into emissions envelopes.

"This Plan builds on our considerable success to date in sectors such as renewable electricity, and paves the way for further transformational change."

This Plan builds on our considerable success to date in sectors such as renewable electricity, and paves the way for further transformational change. Our new Energy Strategy commits us to delivering 50% of all Scotland's energy needs from renewables by 2030. By 2030, Scotland's electricity system, already largely decarbonised, will be increasingly important as a power source for heat and transport. System quality and resilience will be ensured through diverse generation technologies, including gas generation, increased storage, smart grid technologies and improved interconnection. Emissions from electricity generation are expected to fall by 28% over the lifetime of the Plan. The Scottish Government is continuing to support the development of Carbon Capture and Storage (CCS) as a vital technology to meet our long-term emissions reductions targets.

Recognising the importance of energy use in buildings in achieving climate change and fuel poverty objectives, in 2015 we designated energy efficiency as a National Infrastructure Priority. The cornerstone of this is Scotland's Energy Efficiency Programme (SEEP) which, once fully operational, will significantly improve the energy efficiency of domestic and non-domestic buildings, as well as decarbonise the heat supply of buildings. We will publish a route map for SEEP in 2018 setting out our long term ambition for the programme as well as milestones we expect it to meet along the way.

In non-domestic buildings – referred to as 'services' in the Plan – we will need to reduce emissions by 53% over the lifetime of the Plan. This will require increasing uptake of both conservation measures and low carbon heating sources, gradually to 2025, and increasing the rate of uptake thereafter. In domestic buildings, emissions will fall 23% over the lifetime of the Plan. Our approach is similar to services although the rate of emissions reduction is slower, particularly until 2025, where the focus, in the early years, is on energy efficiency, with a greater uptake of low carbon heating sources (heat pumps,

electrical resistance and district heating) and energy efficiency measures after 2025.

Our bold new plans for transport were announced in the Programme for Government 2017-2018. There, we set a new target for phasing out the need to buy petrol and diesel engine cars and vans by 2032, a full eight years ahead of the UK Government. We also announced a doubling of the budget that supports active travel, from £40 million to £80 million a year. We envisage significant decarbonisation of transport by 2032 with emissions reducing by 37% over the lifetime of the Plan. Low emission cars and vans will be widespread and becoming the norm and freight infrastructure will feature more efficient HGVs operating from out of town freight consolidation centres.

For the industrial sector our plans are broadly consistent with the existing EU and UK regulatory frameworks, with a fall in industrial emissions of 21% over the lifetime of the Plan through a combination of fuel diversification, cost saving energy efficiency and fuel recovery, and participation in the EU Emissions Trading System (EU ETS). We will continue to press the UK Government for clarity on its plans for emissions trading as it prepares to leave the EU.

Technologies critical to further emissions reduction will be demonstrated by 2030 and have the potential to drive even faster emissions reductions.

In the waste sector emissions will fall 52% over the lifetime of the Plan. Landfilling of biodegradable municipal waste will have been phased out by 2021. In the longer term, we aim to be delivering emissions reductions through a circular economy approach – which will mean more productive businesses, new markets and reduced reliance on scarce resources.

Our ambition for agriculture is for Scotland to be among the lowest carbon and most efficient food producers in the world. Our agricultural emissions will decline by 9% over the lifetime of the Plan through efficiency measures and a focus on low carbon produce. We will also drive up peatland restoration and woodland planting rates to increase our natural carbon sinks.

Clearly these ambitious plans cannot and should not be delivered by Government alone. Scotland's public sector will increasingly demonstrate its leadership in emissions reductions and we will continue to ensure that public bodies are empowered to take the action needed as we press forward. Public bodies do, of course, have obligations under our climate change legislation. However, I am delighted that many of them go well beyond these, for example as public champions of action in events such as Earth Hour and Scotland's Climate Week.

Individuals, families and communities will continue to be essential partners. We cannot do this without the people of Scotland alongside us. Through our Climate Challenge Fund (CCF), now in its tenth year, we support communities to develop and implement their own locally relevant solutions. And we support individuals, households and communities to make a difference with a range of resources, from our innovative Climate Conversations that allow groups to discuss climate change in a safe, non-technical way, through to Greener Scotland with its practical guidance and support.

Through this Plan and other associated Government strategies and policies, our intention is to provide certainty and credibility to the businesses, industries and investors that are vital partners in our transition to a low carbon economy. The Scottish Government has been working hard to understand the challenges and opportunities facing Scottish businesses and last year commissioned a study by EY to explore this area in more depth. I was pleased that we were able to use the findings of the study to talk with business leaders at the National Economic Forum in Inverness in May 2017, as well as at the Energy Intensive Industries Roundtable and Working Group in Edinburgh in November.

This Climate Change Plan, a statutory document, sets out how we will meet the emissions reduction targets under the current legislation. The Scottish Government has committed to playing its part in delivering the Paris Agreement and intends to introduce a new Climate Change Bill this year with even more ambitious targets than those prescribed by the 2009 Act. The requirements of the new legislation, as determined by the Scottish Parliament, will be reflected in future climate change plans.

Finally, on behalf of my Cabinet colleagues, I would like to offer a sincere thank you to everyone who has contributed their views and expertise as we have developed and finalised this Plan: the Scottish Parliament, which provided us with an extensive range of recommendations following its scrutiny of the draft Plan; the Committee on Climate Change for its independent advice; our Climate Change Plan Advisory Group, who provided valuable insights into how we might develop a positive vision to motivate the people of Scotland to join us; and the broad array of stakeholders and partners from communities, business, industry, academia and the third sector who've given us so much to consider.

Roseanna Cunningham
Cabinet Secretary for Environment, Climate Change and Land Reform

EXECUTIVE SUMMARY

Introduction

Climate change is one of the greatest global threats we face. Scotland must play its part to achieve the ambitions set out in the Paris Agreement, which mandates concerted, global action to deal with the threat.

The path towards a low carbon future will require great effort across all parts of our society and economy, but it also presents tremendous opportunities. The Scottish Government believes that the transition to a low carbon society is an essential investment for the future welfare of the people of Scotland, our economy, environment, and for those generations yet to be born. We see Scotland as a responsible global citizen with a moral obligation to contribute to the challenge and influence others to do the same. We lead by example with our ambitious statutory targets, strong progress to date and commitment to maintaining this position by bringing forward new legislation to implement the Paris Agreement.

Statutory duty

Section 35 of the Climate Change (Scotland) Act 2009 requires Scottish Ministers to lay a report in Parliament setting out their proposals and policies for meeting annual emissions reduction targets. This Climate Change Plan (the Plan) is the Scottish Government's third report on proposals and policies for meeting its climate change targets. It sets out how Scotland can deliver its target of 66% emissions reductions, relative to the baseline, for the period 2018–2032.

The Plan was laid in draft in the Scottish Parliament on 20 January 2017 and was subject to a 60-day period for scrutiny by four parliamentary committees. This final Plan incorporates Ministers' changes to the draft Plan following Parliamentary consideration and reflects feedback from the Committee on Climate Change (CCC) and a wide range of other stakeholders. This final Plan was laid in Parliament on 28 February 2018.

The Plan comprises three parts: **Part One sets out the context for the Scottish Government's climate change proposals and policies**. It shows the emissions reductions pathway to 2032 and the crucial roles that will be played by local authorities and the wider public sector (and the planning system), communities and individuals; we describe the wider impacts of our climate change policies along with the behaviour changes in behaviour required to reach our decarbonisation goals.

Part One also addresses the impacts on the economy of both action and inaction. We discuss how certain sections of the economy are likely to be affected, consider the threats and opportunities arising from climate change and make clear in this chapter that Scotland offers long-term stability to businesses and investors.

Finally, Part One describes the Scottish Government's international ambitions and activities, along with an assessment of the importance of international cooperation on climate change, not least with the rest of the European Union (EU); cooperation which is threatened by the UK Government's plans for leaving the EU.

The Scottish Government's statutory duties are covered in Part Two (Statutory duties, methodologies and monitoring), alongside our annual emissions targets to 2032. This includes details of the TIMES model, which we have used to generate the pathway to 2032 and the emissions envelopes for each sector of the economy. The TIMES model is a powerful tool for identifying a least-cost pathway, containing a suggested mix of technologies, fuels and other carbon reduction measures for achieving our climate change targets. This has helped us to define policy outcomes in each sector in terms of real life, tangible changes in technologies, fuels and other measures, allowing us to visualise the low carbon economy of the future.

Part Two also includes details of the monitoring framework and indicators that will enable us to measure progress against the policies set out in the Plan.

Part Three of the Plan provides detailed information on the emissions envelopes and emissions reduction trajectories for each sector. Each chapter sets out the proposals and policies for sectors, alongside the indicators that will allow us to measure progress and adjust policies to keep us on track. The sector chapters of Part Two are, in order: Electricity; Buildings (combining the Services and Residential chapters of the draft Plan); Transport; Industry; Waste; Land Use, Land Use Change and Forestry (LULUCF); and Agriculture.

Scotland's progress to date

Scotland is leading the way in the transition to a low carbon society. Latest data on Scotland's performance from the 2015 Greenhouse Gas Inventory show that Scotland's actual emissions, including international aviation and shipping – unadjusted for the European Union Emissions Trading System (EU ETS) – fell by 3% between 2014 and 2015, and were 38% below 1990 emissions, compared with a reduction of 35% for the UK as a whole[1].

The latest UK Government data shows that the equivalent of 54% of Scotland's gross electricity consumption came from renewable sources in 2016, compared to 12.2% in 2000, ensuring that we are well on the way to achieving our targets of generating 100% of our electricity demand from renewables by 2020 and 50% of all energy for Scotland's heat, transport and electricity consumption from renewables by 2030. Our path towards a more circular economy is well underway as a result of more efficient reuse and recycling of waste materials and the fall in emissions from landfill – the waste sector saw a 75% emissions reduction between 1990 and 2015. Scotland's manufacturing and industry sector saw emissions fall by 49% between 1990 and 2015.

We have made significant progress in increasing the energy efficiency of our residential buildings – up to 2015 we have seen a 24% decrease in emissions from 1990, although there has also been a 14% rise in emissions from non-residential buildings. Scotland has already created one of the most comprehensive electric

1 Based on 1990-2015 GHG Inventory.

vehicle charging networks in Europe, and we will build on the good progress to date as technological improvements come online and our plans for electric vehicles take effect. Through sustained efficiency improvements in farming and better fertiliser management, we have reduced emissions in the agriculture sector by 3.8 $MTCO_2e$ (25.8%) between 1990-2015 (the definition of the sector used by TIMES shows the decline between 1990 and 2015 levels to be 14%[2]). The LULUCF sector was a net carbon source in 1990, but the 2015 Greenhouse Gas Inventory shows that LULUCF is now a net carbon sink. Our policies to increase forestry cover, restore peatland and increase carbon sequestered in harvested wood products will ensure that this continues until at least 2032.

Our collaborative approach

Passed unanimously by the Scottish Parliament in 2009, Scotland's climate change legislation anticipated that reducing greenhouse gas emissions would be required across all major sectors of the economy and society. The Cabinet Sub-Committee on Climate Change, chaired by the Cabinet Secretary for the Environment, Climate Change and Land Reform, has overseen the development of this Climate Change Plan, ensuring a cross-government approach. Scottish Ministers have worked collaboratively to develop proposals and policies for emissions reductions across sectors in ways that maximise opportunities and minimise costs. However, the Scottish Government cannot, and should not, attempt to deliver this Climate Change Plan on its own. Local government, other public bodies, the private sector, the third sector, communities, households and individuals all have important roles to play.

Our **public sector** will increasingly demonstrate how its own operations are driving down emissions, in part through the Public Bodies Climate Change Duties. The public sector will play a critical role in the delivery of this Plan, and the Scottish Government will continue to work with local government and wider public sector organisations to empower them to continue to make a valued contribution to the delivery of the proposals and policies in this Plan.

The role of **communities** in both urban and rural Scotland will be crucial in delivering Scotland's emission reduction targets, and access to resources is an important enabler of local action. Through the CCF, the Scottish Government supports communities in locally-run projects that aim to reduce emissions, improve local communities and help adapt to the impacts of climate change. Since the launch of the CCF in 2008, the Scottish Government has awarded £85.8 million to 986 communities and 2018 will see the award of the 1000th CCF project. Although the main aim of the Fund is reducing emissions and adapting to a changing climate, climate change projects at community level have additional social and economic benefits, such as increased community cohesion and job opportunities.

Scotland's **private sector** will meet the challenges of decarbonisation, as the benefits of investing in energy efficiency measures and meeting the demands of climate-aware consumers and supply chains

2 The difference between the Inventory and TIMES is down to Agriculture Related Land Use, which is captured in the Agriculture and Related Land Use Category in the Inventory and in the LULUCF sector envelope in TIMES.

become increasingly apparent. The Scottish Government will continue to work closely with businesses to provide an economic environment that encourages and supports them in their efforts to decarbonise.

The **third sector** also has a central role to play in the transition to a low carbon economy. Third sector organisations can weave environmental issues into their overall purpose, promoting action in response to climate change to a wide audience. This sector also has the capability to encourage the behaviour change necessary in transitioning to a low carbon society and influence public engagement.

The transition to a low carbon Scotland will require all of us to take action: changing the ways we get around; the ways we insulate and heat our homes; and the ways we purchase products and services to support the circular economy. Delivering these changes in our **individual behaviours** will require cultural shifts and major infrastructural and technological advances over the coming years and we will continue to encourage public discussion about climate change and support people to take low carbon actions in their everyday lives.

Understanding how and why people behave the way they do is crucial to designing interventions that encourage the uptake of low carbon initiatives. People's choices and behaviours are influenced in various ways – within the values and attitudes that we hold, the habits we have learned, the people around us, and the tools and infrastructure available to us in our day-to-day lives. To support development and the implementation of proposals and policies in this Climate Change Plan, we have used the ISM approach. This method helped us to understand the **Individual, Social and the Material drivers** that shape people's behaviours. Where suitable, we have used behaviour change as an enabler in delivery of policy outcomes in this Plan.

The Scottish economy

The Scottish Government's purpose[3] is to create a more successful country, with opportunities for all of Scotland to flourish, through increasing sustainable economic growth. **Scotland's Economic Strategy** is the strategic plan for current and future Scottish Government policy. It sets out an overarching framework for how we aim to achieve a more productive, cohesive and fairer Scotland: prioritising boosting investment and innovation; supporting inclusive growth; and maintaining our focus on increasing internationalisation.

Sustainable and inclusive business growth is at the core of Scotland's Economic Strategy. Successful implementation of this Plan and the transition to a low carbon economy depends on promoting and empowering changes over time in every business across Scotland. We aim to provide the leadership that will give businesses confidence to invest and grow and to make the most of the opportunities offered by decarbonisation. Businesses that can demonstrate to consumers that they follow a low carbon route will secure a competitive advantage over those that do not and will save costs through efficiencies along the way.

Our vision for a low carbon and more sustainable future in Scotland builds on the benefits that this transition will realise

3 The Scottish Government's Purpose http://www.gov.scot/About/Performance/scotPerforms/purpose

for businesses, households, communities and individuals. A low carbon economy, which sustainably utilises natural resources to increase the wellbeing of people while protecting the environment, is a resilient economy better adapted to handle a changing climate and any disruption in global markets. The Scottish Government's plans for decarbonisation of our economy, as set out in this Plan, will strengthen Scotland's position as an international destination for investment and innovation. We will work to deliver an inclusive, socially just transition, based on equal opportunity, a fair and inclusive jobs market, regional cohesion and safe and secure communities.

Scotland has enviable natural resources, such as water, wind and the sea, and over the last decade we have made significant progress in sustainably harnessing benefits from those natural resources. Along with enduring government, ministerial and political support towards transition to a low carbon economy and an increasing proportion of Scottish adults (just over half) agreeing that climate change is an immediate and urgent problem, businesses can have confidence that investing in renewables and other low carbon technologies is a wise long-term strategy.

By setting a pathway towards decarbonisation now, we are placing our economy at the forefront of the low carbon future that the world economy needs. The solutions Scottish businesses develop to address these challenges will have export potential. Scotland's Energy Efficiency Programme, for example, in addition to saving consumers money on fuel bills, will support thousands of jobs, creating a substantial domestic market and supply chain for energy efficient and renewable heat services and technologies and related expertise which can transfer to international markets.

Scotland has a well-established oil and gas sector and a proud engineering heritage which will help our transition to a low carbon, sustainable economy. Supporting continued investment in oil and gas exploration and production and in renewable and low carbon solutions will provide Scotland with the energy system we need for the 21st century. Scotland's rich energy history and expertise will support greater internationalisation by strengthening our renewable supply chains and research dissemination. All of these factors will work towards our overarching aim of producing sustainable, inclusive growth.

International

Promoting Scotland as a world leader on climate change and engaging with the international community on climate related issues are key aspects of our external outreach activity. The Scottish Government has established a strong presence within the global climate action debate, built up over many years through continued ministerial attendance at annual United Nations Framework Convention on Climate Change (UNFCCC) Conferences of the Parties (COPs) and through active participation in international climate programmes.

At the heart of this international activity is our determination for Scotland to move towards early, ambitious and binding commitments to reduce our emissions, reinforced with forward-looking policies to make the transition to a genuine low carbon economy. Our leadership is setting an example to other governments in concrete action to minimise global temperature rises.

The Scottish Government supports the Paris Agreement, which sets the standard for the international response to climate change. Scotland contributes to international action in a number of ways: our domestic emissions reductions form the basis of our direct contribution; our work with international partners is building and maintaining momentum around global climate action; and our innovative Climate Justice Fund supports some of the poorest and most vulnerable communities in Africa.

The current pledge under the Paris Agreement to limit the global average temperature rise to less than 2° Celsius requires governments around the world to take action to decarbonise their economies. In 2015, Scotland had reduced its emissions by 41%, including international aviation and shipping, compared to 1990 levels, on an adjusted basis to account for Scotland's participation in the EU ETS. On an unadjusted basis, that is, based on actual emissions and removals in Scotland, Scotland had reduced its emissions in 2015 by 38%, from 1990 levels, including international aviation and shipping. We are on track to meet our 42% emissions reduction target by 2020. In the EU-15, only Sweden and Finland have done better in reducing emissions over this period. These represent a direct contribution to EU emissions reduction targets for 2020, and we expect to continue helping the EU meet its targets – if the UK continues to participate in EU climate change frameworks after leaving the EU.

Until it is clear what the UK's exit from the EU means for climate frameworks, we expect Scotland to continue to participate in the EU ETS. The EU ETS is a 'cap and trade' system, aimed at mitigating climate change by limiting greenhouse gas emissions from power and heat generation, energy-intensive industry sectors and commercial aviation. Participants include more than 11,000 heavy energy-using installations in power generation, the manufacturing industry and airlines across 31 countries in the European Economic Area (EEA). As the number of emission allowances decreases over time, prompting industries to adopt low carbon technologies, the EU ETS will be the primary driver of emissions reductions in the traded sector in Scotland. We rely on it to drive emissions reduction from dozens of installations in Scotland, accounting for around 35% of our territorial emissions. We will continue to press the UK Government for clarity on its plans for emissions trading as it prepares to leave the EU.

The Scottish Government is proud of our work to champion climate justice and we hope the Paris Agreement will drive global action to avoid the worst impacts of climate change falling on the poorest and most vulnerable people across the world. Climate justice is a key issue for human rights and the UN's Sustainable Development Goals[4]. Over £6 million from Scotland's innovative Climate Justice Fund has already supported 11 projects in some of Africa's most vulnerable communities, and in 2016 the First Minister pledged a further £15 million over five years to support developing countries in the Global South.

4 United Nations Sustainable Development Goals http://www.un.org/sustainabledevelopment/sustainable-development-goals/

Cooperation with other nations is critical to delivering global climate ambitions. This is evident now more than ever, particularly at sub-national level as the importance of devolved governments, states, regions, cities and wider society has become widely accepted. A critical focus of our international action is through Scotland's membership of the Under2 Coalition – a group of 205 jurisdictions from 43 countries across six continents representing 1.3 billion people and almost 40% of the global economy, committed to climate leadership.

Scotland has signed a cooperation agreement with California to support the Coalition with the intention of sharing expertise on offshore wind and delivering a major summit in 2018. Scotland's Cities Alliance has also agreed to support Scotland's membership of the Coalition. Alongside this action, Scotland has been an active member of *The Climate Group States and Regions Alliance* for over a decade, and is supporting their Futures Fund to help developing countries participate in the network.

Vision by sector

By 2032, Scotland's **electricity** system will supply a growing share of Scotland's energy needs and by 2030, 50% of all Scotland's energy needs will come from renewables. Emissions from the electricity sector are expected to fall by 28% over the period covered by this Plan. Electricity will be increasingly important as a power source for heat and in transport to charge Scotland's growing fleet of ultra-low emission vehicles (ULEVs). Innovative energy systems will improve efficiencies and deliver secure, clean and affordable electricity. Smart domestic energy applications and systems will allow consumers to increase control over their energy use and avoid excessive costs. Scottish communities will be empowered by growing development of innovative and integrated local energy systems. The transformation of our electricity system will attract investment and stimulate the growth of highly skilled employment, benefiting people in both rural and urban areas of Scotland. Harnessing electricity from land, seas, lochs, rivers and the sun will increase Scotland's resilience against future changes in global energy markets.

Scotland's first Energy Strategy
Our new Energy Strategy, *The future of energy in Scotland*, published in December 2017, sets out the Scottish Government's long-term vision for the future energy system in Scotland.

The first publication of its kind, the Strategy is intended to guide the decisions that the Scottish Government, working with partner organisations, will make over the coming decades.

The Strategy's vision for 2050 is built around six priorities:

- Promote consumer engagement and protect consumers from excessive or avoidable costs;
- Improve the energy efficiency of Scotland's homes, buildings, industrial processes and manufacturing;
- Ensure homes and businesses can continue to depend on secure, resilient and flexible energy supplies;
- Empower communities by supporting innovative local energy systems and networks;
- Champion Scotland's renewable energy potential, creating new jobs and supply chain opportunities; and
- Continue to support investment and innovation across our oil and gas sector, including exploration, innovation, subsea engineering, decommissioning and carbon capture and storage.

The Strategy's proposed 2030 'all-energy' target to supply the equivalent of 50% of the energy for Scotland's heat, transport and electricity consumption from renewable sources captures our ambition to adopt a system-wide approach. Our analysis underpinning the target shows that renewable electricity – which has already outperformed the interim 2015 target of 50% – could rise to over 140% of Scottish electricity consumption by 2030.

Alongside the renewables target, we also announced a commitment to increase the productivity of energy use across the Scottish economy by 30% by 2030. The previous energy efficiency target was to reduce final demand for energy by 12% by 2020 (from a 2005-07 baseline). This target was achieved six years early, and final energy demand in 2015 was 15.4% lower than the baseline.

This Strategy includes a range of actions that will create opportunities for both suppliers and consumers of energy. These include a £20 million Energy Investment Fund, which will build on the success of the Renewable Energy Investment Fund, and a £60 million Low Carbon Innovation Fund, to provide dedicated support for renewable and low carbon infrastructure over and above wider interventions to support innovation across the economy.

The energy efficiency of Scotland's residential and non-residential **buildings** will ensure that we keep our homes, schools and businesses warm while conserving energy. Over the period of the Plan, we expect to see an overall reduction in emissions of 33% from Scotland's buildings. To achieve this, emissions from Scotland's residential and non domestic buildings will need to fall by 23% and 53% respectively. 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. By 2032:

- 35% of heat for domestic buildings will be supplied using low carbon technologies[5], where technically feasible, and all buildings – both in the residential and services sectors – will be insulated to the maximum appropriate level;
- 70% of heat and cooling for non-domestic buildings will be supplied using low carbon heat technologies[6];
- improvements to the building fabric of Scotland's buildings will result in a 15% reduction in residential and 20% in non-residential heat demand.

Increases in the deployment of measures such as cavity wall, floor and loft insulation, secondary glazing, smart meters and programmable thermostats will provide consumers with opportunities for cost savings from reducing heat demand, help to alleviate fuel poverty and make businesses more competitive by releasing savings from fuel bills that can be invested in frontline services. Raising the energy efficiency of Scotland's building stock will help to minimise the impact of any fuel price rises in future.

A growing market and supply chain for energy efficiency services and technologies will stimulate innovation and entrepreneurship, and ensure the people of Scotland live and work in warm buildings in both urban and rural areas.

In the **transport** sector emissions will be expected to fall by 37% over the period of the Plan. We are phasing out the need to buy petrol and diesel engine cars and vans by 2032, a full eight years ahead of the UK Government. This will be driven by a significant increase in the uptake of ultra-low emission electric and hydrogen vehicles, which may also play a role in management of the wider energy system. Our vision is that by 2050, Scotland will be free from harmful tailpipe emissions from land transport, resulting in a significant reduction in overall transport emissions and we will be enjoying the social, health and economic benefits of noticeably improved air quality. Low emission zones in Scotland's largest cities will limit the access of vehicles that exceed emissions benchmarks, while permitting unrestricted access for low emission cars, vans and buses, as well as smaller goods vehicles relaying goods from consolidation centres. Scotland will be a friendlier and safer place for cyclists and pedestrians. Decarbonisation of the transport system will lead to positive wellbeing outcomes for the people of Scotland as we transition to a cleaner, greener and healthier country.

5 This includes the electrification of heat. Currently, around 12% of domestic buildings' heat is supplied using electricity which, over time, will see an increase in the low carbon feedstock.

6 This includes the electrification of heat. Currently, around 50% of non-domestic buildings' heat is supplied using electricity which, over time, will see an increase in the low carbon feedstock

Emissions from the **industrial** sector in Scotland will fall by 21% over the lifetime of the Plan, through a combination of fuel diversification, cost saving energy efficiency, heat recovery and participation in the EU ETS. The introduction of innovative technologies will present significant economic opportunities by stimulating investment and increasing productivity to better compete on a global scale. Industrial energy efficiency will enable heat recovery, which could provide businesses with an additional income stream, enhance productivity, increase resilience and reduce risk arising from volatile energy prices. Industrial clustering will help to decrease costs by sharing infrastructure, such as district heating networks, and creating more efficient supply chains. Continuing participation in the EU and UK regulatory frameworks will stimulate decarbonisation and provide certainty for business investment in low carbon technologies. Outcomes are now monitored by measures that embed our support of economic activity within our ambition to decarbonise industrial processes. We will continue to press the UK Government for clarity on its plans for emissions trading as it prepares to leave the EU.

In the **waste** sector emissions are expected to fall by 52% over the lifetime of the Plan. By 2021 the landfilling of biodegradable municipal waste will have been phased out. By 2030 we expect to be meeting the UN Sustainable Development Goal aim to reduce food waste by 50%. In the longer term, we aim to be delivering emissions reductions through a circular economy approach in our business and industry sectors. By 2050, products will be designed for longer lifetimes, second hand goods will be seen as a good value, mainstream option, and major industrial sectors will be optimising the value of used equipment, such as the reuse of elements of energy infrastructure. Emissions from closed landfill sites in Scotland will be captured, where possible, with long-term plans for wider methane utilisation. Through a more circular economy, businesses will increase their productivity, new markets will stimulate the jobs market and Scotland will reduce its reliance on scarce resources. The people of Scotland will benefit from the greater availability of lower cost options; access to second hand or refurbished goods; and will make savings through repairing items rather than replacing them, bringing opportunities for social enterprise.

The **Land Use, Land Use Change and Forestry** (LULUCF) sector will increasingly act as a net carbon sink. By 2020, 50,000 hectares of degraded **peatland** will have been restored, and by 2030 we will have increased this to 250,000 hectares – an improvement of valuable soils in around 20% of Scotland's landmass. By 2050, Scotland's expanded peatlands will be thriving habitats, sustaining a diverse ecosystem.

By 2032, Scotland's **woodland** cover will increase from around 18% to 21% of the Scottish land area. We will increase our planting rates over time up to 15,000 hectares per year in 2024-2025. We will promote the greater use of Scottish timber in UK construction to around 3 million cubic metres by 2031-2032 from 2.2 million cubic metres today. By 2050, Scotland's woodlands will be delivering a greater

level of ecosystem services, such as natural flood management and biodiversity enhancement.

On **agriculture** our ambition is for Scotland to be among the lowest carbon and most efficient food producers in the world. Scotland will be a world class producer of high quality food: sustainably, profitably and efficiently in environmental and economic terms. Growing numbers of farmers and crofters will adopt low carbon farming practices. Low carbon farming will not only achieve greenhouse gas emissions reductions but will generate improvements in animal health and welfare, provide cleaner water and air, increase the volume of our national carbon sink and give farmers more financial security through increased cost savings. By 2020, we will work with farmers so that they know the pH of the soil on a third of their improved land to help increase the efficient use of nitrogen fertiliser. We will encourage farmers producing a substantial proportion of Scotland's agricultural output to complete a carbon audit, and by 2030 most farmers will know the nutrient value of their improved soil and will be implementing best practice in nutrient management and application. More efficient farming approaches will improve air and water quality and enhance biodiversity, and increased forestry cover will alleviate flooding. Farmers will have the option of reducing costs by adopting renewable energy systems. Agriculture emissions are expected to fall by 9% over the lifetime of the Plan.

By 2050, Scottish farmers will be making full use of technology to apply precision farming techniques across the board, and Scotland's land will be producing sustainable, healthy, nutritious and high quality food while providing a substantial contribution to Scotland's national carbon sink that offsets emissions elsewhere in our economy.

Conclusion

Since the Scottish Parliament unanimously passed the Climate Change (Scotland) Act in 2009, we have made good progress on climate change action, both at home and abroad, and Scotland is now well placed to reap the benefits of being one of the first economies in the Global North to take steps towards transitioning to a low carbon society.

The transformation of the way we generate and use our energy, insulate our buildings, grow our food, treat our waste, use our land and travel will create a healthier, more resourceful and resilient Scotland, able to withstand future changes in climate and fluctuations in global markets. Our decarbonisation pathway towards 2032 will be a challenging one, requiring collective efforts from all sectors of the society, but addressing climate change is both a moral and economic imperative, and the Scottish Government is determined to contribute to the global effort for the benefit of our own citizens, and humanity in general.

Introduction

This document is the Scottish Government's Third Report on Proposals and Policies, the Climate Change Plan, for meeting greenhouse gas emissions reduction targets 2018-2032.

Finalising the Climate Change Plan

We laid the draft Plan before Parliament on 20 January 2017. It was scrutinised by four Scottish Parliamentary Committees, a process which generated over two hundred recommendations for the Scottish Government as we worked to produce the final Plan. We have considered these recommendations in the preparation of this Plan and have published a written statement in pursuant of Section 35 of the Climate Change (Scotland) Act which provides our responses to the Committee reports.

We also received advice from:

- the Committee on Climate Change (CCC)
- our Climate Change Plan Advisory Group
- a broad range of stakeholders across many events and meetings, both in terms of the general Plan and at a sectoral level

The Plan has also benefited from the opinions and recommendations of respondents to the Energy Strategy consultation. Scottish Ministers are grateful to all the institutions, groups and individuals who have helped us to improve and refine the Plan, and the proposals and policies it contains.

This Plan also takes into account policy and statistical developments, such as the new policies announced in A Nation with Ambition: The Government's Programme for Scotland 2017-2018 (hereafter referred to in this document as 'the Programme for Government 2017-2018") and relevant data published during 2017.

PART ONE:
Scotland's path to a sustainable, inclusive low carbon society

The Scottish Government's purpose is to create a more successful country, with opportunities for all of Scotland to flourish, through increasing sustainable, inclusive economic growth.

CONTEXT

Scotland's Economic Strategy (2015)[7] is the strategic plan for current and future Scottish Government policy. It sets out an overarching framework for how we aim to achieve a more productive, cohesive and fairer Scotland. It prioritises boosting investment and innovation, supporting inclusive growth and maintaining our focus on increasing diplomatic and economic internationalisation. This ambition underpins the approach and commitments in this Climate Change Plan.

Our vision

By 2032, Scotland will have reduced its emissions by 66% against 1990 levels. This will be an enormous transformational change – achieved by Government and the public, private and third sectors alongside families and communities. It is an exciting time for Scotland with tremendous opportunities, not only in reducing emissions but in growing and diversifying our economy, improving the wellbeing of our people, and protecting and enhancing our natural environment.

Our energy sector will be flourishing and competitive, delivering secure, affordable, clean energy for Scotland's households, communities and businesses. Our industrial sector, which accounts for half of our exports, will continue to lead the way in decarbonisation, with reduced carbon intensity from techniques such as reusing waste heat, adopting new technologies and increasing energy productivity.

Homes and buildings will be more efficient, with less energy required to heat and cool them – critical to both reduce fuel poverty and costs for businesses. In transport, people and businesses will have access to cleaner forms of travel and transport, and our urban air quality will have improved. People will have significantly more opportunities to walk and cycle, important for both their physical and mental health as well as improving our urban environment.

The landfilling of biodegradable municipal waste will have been phased out and our circular economy will mean more productive businesses, new markets and reduced reliance on scarce resources. Our agriculture will be among the lowest carbon and most efficient producers of food in the world, and our ambitious peatland restoration and woodland planting programmes will enhance biodiversity and ecosystems as well as providing wonderful natural places for local people and visitors to enjoy and relax.

Of course, we cannot predict with certainty exactly how we will get there. We do not know how global and regional market forces will evolve or how some technologies will develop. The Scottish Government's role is to chart a path through this uncertainty – putting the welfare of our people, the health

7 Scotland's Economic Strategy, 2015. https://beta.gov.scot/publications/scotlands-economic-strategy/

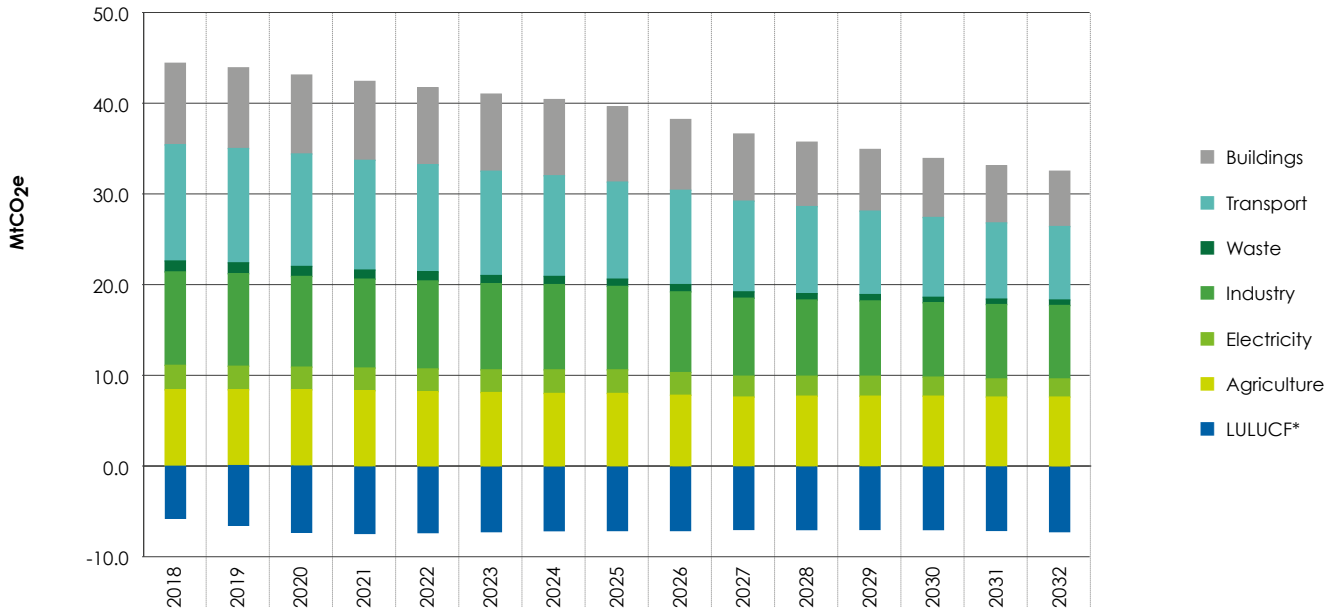
of our economy, and the protection and enhancement of our natural environment at the heart of our transformation. This Climate Change Plan lays out how we will do that, maximising benefits and minimising disruptions and costs to benefit current and future generations.

This Climate Change Plan presents proposals and policies to meet Scotland's annual emissions targets to 2032. Based on the most recent Scottish Greenhouse Gas Inventory (2015), these annual targets represent an emissions reduction of 66% compared to baseline levels by 2032. This level of transformational change presents Scotland with significant challenges and opportunities, and we have explored these through the development of the Plan.

The graph below illustrates our decarbonisation pathway to 2032. Sector-specific pathways can be found in the sector chapters in Part Three of this document.

The development of this pathway has been underpinned by the TIMES model. TIMES is powerful tool for understanding the carbon cost-effectiveness of technologies, fuels and other carbon reduction measures. It provides a consistent comparison of the costs of action across all sectors and help us develop a least-cost pathway for meeting our climate change targets. This pathway suggests changes that could happen on the ground, right across the economy, to meet our emissions targets. These include changes to the energy system, as well as to non-energy sectors, including components of the agricultural sector, waste, land use, land use change and forestry.

Figure 1: Pathway to 2032



*Land Use, Land Use Change and Forestry

Our decarbonisation pathway to 2032

By 2032, Scotland's **electricity system** will be largely decarbonised and be increasingly important as a power source for heat and transport. Emissions from the electricity sector are expected to fall by 28% over the period covered by this Plan. Emissions reduction and security of supply will be ensured through diverse generation technologies, including gas generation, increased storage, smart grid technologies and improved interconnection. While Carbon Capture and Storage (CCS) is not a requirement until after 2030, it remains a key technology, supported by the Scottish Government, to meet our long-term emissions reductions targets.

In **services** (non-domestic buildings) we will need to reduce emissions by 53% over the lifetime of the Plan. This will require increasing the uptake of both conservation measures and low carbon heating sources, gradually to 2025, and increase the rate of uptake thereafter. In the **residential** sector, the approach is similar to the services sector although the rate of emissions reduction is slower, particularly until 2025. The focus is on energy efficiency, in early years, with a greater uptake of low carbon heating sources (heat pumps and district heating) and energy efficiency measures from 2025. Residential emissions are expected to fall by 23% over the lifetime of the Plan. Residential and non-residential emissions are dealt with together in our Buildings chapter.

We envisage significant decarbonisation of **transport** by 2032, with emissions reducing by 37% over the lifetime of the Plan. With our commitment to phase out the need to buy petrol and diesel cars and vans by 2032, low emission vehicles will be widespread and becoming the norm, and freight infrastructure will feature more efficient HGVs operating from out of town freight consolidation centres.

For the **industrial** sector our plans are broadly consistent with the existing EU and UK regulatory frameworks, with a fall in industrial emissions of 21% over the lifetime of the Plan, through a combination of fuel diversification, cost saving energy efficiency and fuel recovery, and participation in the EU ETS (where we are pressing the UK Government for clarity on its plans for emissions trading as it prepares to leave the EU). Technologies critical to further emissions reduction will be demonstrated by 2030 and have the potential to drive even faster emissions reductions.

In the **waste** sector, the landfilling of biodegradable municipal waste will be phased out. By 2030, we expect to be in tandem with the UN Sustainable Development Goal to reduce food waste by 50%. There will be a fall in waste emissions of 52% over the lifetime of this Plan.

Our ambition for **agriculture** is for Scotland to be among the lowest carbon and most efficient food producers in the world. Our agricultural emissions will decline by 9% over the lifetime of the Plan, through efficiency measures and a focus on low carbon produce.

The **land use** sector will increasingly act as a net carbon sink. By 2030 we will have restored 250,000 hectares of degraded peatland, and Scotland's woodlands will be delivering a greater level of ecosystem services, such as natural flood management and biodiversity enhancement.

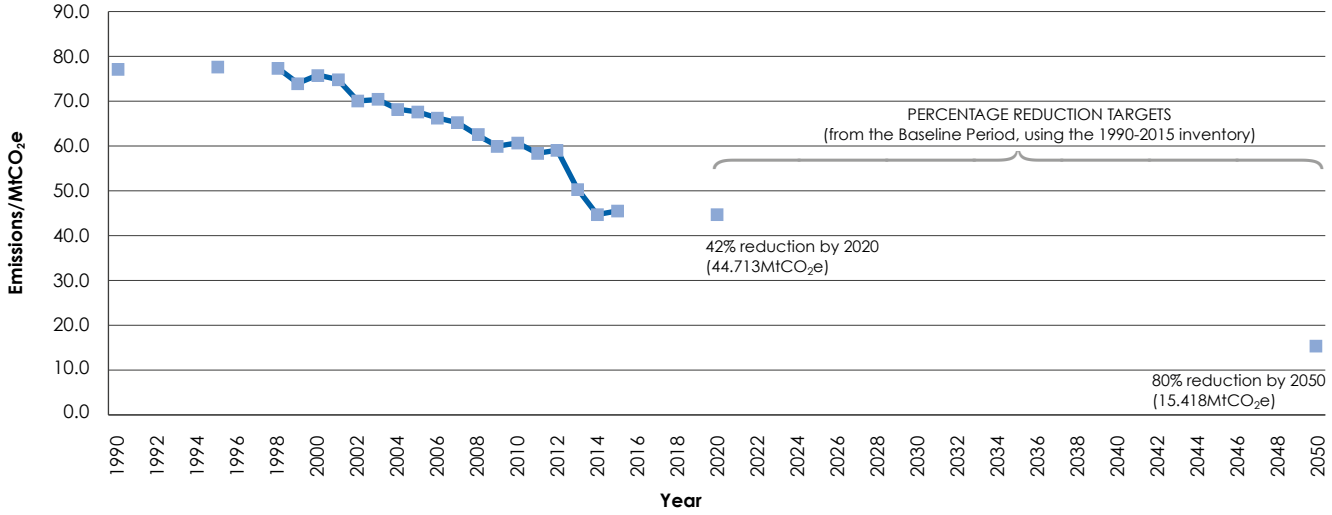
Scotland's achievements

Scotland's people and businesses can be proud of what we've achieved in lowering our emissions to date. In 2015, Scotland had reduced its adjusted emissions by 41%, including international aviation and shipping, compared to 1990 levels, and we are on track to meet our 42% emissions reduction target by 2020.

For over a decade, the Scottish Government has provided political and financial support for renewable energy generators. Together with industry, local authorities, regulators and communities, we have taken huge steps towards decarbonising our electricity supply. In 2015, 17.8% of total Scottish energy consumption came from renewable sources – more than double the level in 2009.

In 2016, 42.9% of our electricity was generated by renewables, predominantly onshore wind. The expansion in onshore wind is comparable to the rollout of hydro power in the post-war period, which transformed for the better the lives of so many. This growth continues to drive innovation and adaptation in the management and control of power on the grid. This innovation, both technological and regulatory, will play a crucial role in accommodating the continuing growth of embedded generation, and a wider transformation in how we use the grid to heat and cool our buildings and power our transport systems.

Figure 2: Scotland's greenhouse gas emissions reduction over time (based on adjusted emissions)



Aerial view of Hunterston offshore wind turbine test facility, North Ayrshire. Credit: Alan McAteer for Scottish Enterprise.

The National Offshore Wind Turbine Test facility (NOWTTF) at Hunterston is the UK's only onshore test facility for offshore wind turbines. It has been instrumental in securing Scotland's place as an international leader in offshore wind energy research and development.

The great progress Scotland has made in renewable electricity generation has been the main driver in the development of a low carbon economy sector worth £11 billion in turnover and supporting 49,000 jobs[8].

Scotland's world leading climate change legislation

The Climate Change (Scotland) Act 2009[9] ('the Act'), passed unanimously by the Scottish Parliament, sets targets to reduce Scotland's emissions of seven greenhouse gases[10] by at least 42% by 2020 and 80% by 2050, compared to the 1990-1995 baseline. As well as domestic emissions, Scotland's share of emissions from international aviation and shipping are included in the targets.

The Act requires Scottish Ministers to set annual emissions reduction targets for each year in the period 2010-2050, consistent with achieving the long-term targets. Almost nine years on, the level of Scotland's ambition enshrined in this legislation remains among the highest in the world.

This Climate Change Plan presents the proposals and policies for meeting annual targets, in accordance with Section 35 of the Act.

8 According to 2016 ONS figures.

9 Climate Change (Scotland) Act 2009 http://www.legislation.gov.uk/asp/2009/12/contents

10 The basket of greenhouse gases comprises carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), for which the baseline is 1990; and hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6), and nitrogen trifluoride (NF_3), for which the baseline is 1995. Nitrogen trifluoride was added to the greenhouse gas emissions covered by the Act by The Climate Change (Additional Greenhouse Gas) (Scotland) Order 2015.

Later in 2018, the Scottish Government will introduce a new Climate Change Bill with even more ambitious targets than those prescribed by the 2009 Act and, in so doing, Scotland will become one of the first countries in the world to legislate to support the aims of the Paris Agreement. We sought advice from the Committee on Climate Change on the form, mechanisms and levels of emissions reduction targets that we should include in the Bill. Advice from the CCC was published in March 2017[11] and was supplemented by updated advice[12] published in January 2018.

Global costs

The Intergovernmental Panel on Climate Change's (IPCC) Fifth Assessment Report[13] makes it clear that 'business as usual' is not an option: either significant action is taken on a global scale to limit climate change, or economic activity will have to adjust to the costs imposed by a changing climate.

Such costs could be significant. The Stern Review on the Economics of Climate Change[14] estimated that, if policies are not put in place to reduce emissions, the impacts would be equivalent to losing at least 5% of global per capita consumption, now and forever. This rises to as much as 20% when wider impacts and risks, such as flooding and heightened climate sensitivity, are included.

The Stern Review also found that strong and early action to tackle climate change would outweigh the costs, pricing the annual cost of cutting total greenhouse gas emissions to about three quarters of current levels (at the time of the report) by 2050 would be in the range of -1.0% to +3.5% of global (Gross Domestic Product) GDP, with an average estimate of approximately 1%.

We have estimated the cost of meeting the Scottish Government climate change targets using TIMES. To do this, we have subtracted the system cost, out to 2050, of a TIMES model run with no targets from the cost (out to 2050) of the model run underpinning this Plan. This gives us the estimated cost of meeting our climate change targets over and above the cost of taking no action. The resulting cost was approximately 1% of cumulative GDP out to 2050, in line with the Stern Review estimate. It is not possible to disaggregate the system cost into individual sector costs, given the interdependence between sectors.

Wider impacts in Scotland of the Climate Change Plan

There is increasing recognition and acceptance that policies designed to reduce greenhouse gas emissions not only mitigate the risks of climate change but can also have other positive societal impacts improvements in air quality and health outcomes. Developing a more detailed understanding of potential wider impacts has been an important part of the development of this Plan.

11 The CCC Advice on the new Scottish Climate Change Bill https://www.theccc.org.uk/publication/advice-on-the-new-scottish-climate-change-bill/

12 The CCC Independent Advice to government on building low carbon economy and preparing for climate change http://www.gov.scot/Resource/0053/00530182.pdf

13 The IPCC Fifth Assessment Report https://www.ipcc.ch/report/ar5/

14 The Stern Review, Final Report http://webarchive.nationalarchives.gov.uk/+/http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm

The Scottish Government commissioned three evidence reviews of the potential wider impacts of climate change mitigation options, focusing on: agriculture, forestry, waste and related land use; the built environment; and transport. The reviews highlighted the potential for positive social, economic and environmental impacts from the Plan. The full documents were published alongside the draft Plan in January 2017.

We have used these evidence reviews to assess the potential wider impacts of the policies within this Plan.

Example 1: The Scottish Energy Efficiency Programme (SEEP)
There is evidence that improving the energy efficiency of people's homes can improve their physical and mental health, particularly among households affected by fuel poverty. Scottish Government energy efficiency grants will continue to target low income and fuel-poor households, whose occupants have the greatest potential to benefit. The SEEP programme will support Scottish jobs and help businesses take up energy efficiency services and technologies.

Example 2: Transport Policy
There is evidence that increasing the uptake of electric vehicles will improve air quality in towns and cities, resulting in reduced levels of illness caused by pollution and thereby improved health. An increase in the number of journeys made by active travel modes (walking and cycling) can also result in health benefits.

Adapting to Scotland's changing climate

This Climate Change Plan sets out how we will reduce our greenhouse gas emissions; it is not a plan for adapting to a changing climate. It is, however, important to understand that climate change is already affecting us. In Scotland the average temperature in the 2000s was 0.90°C warmer than the 1961-1990 average and warmer than any other decade since records began in 1910[15]. Annual rainfall has increased by around 11% over the past century. Extreme weather and flooding are immediate and major climate risks; and in the longer term, sea level rise is likely to pose a significant threat for Scotland[16].

An independent assessment[17] in 2016 by the Adaptation Sub-Committee of the Committee on Climate Change of Scotland's Adaptation Programme (SCCAP) highlighted that Scotland's unique geography creates both resilience and vulnerabilities to the impacts of extreme weather and climate change. Scotland's iconic industries, including forestry, fisheries and whisky, rely on climate-sensitive natural resources. Changes in weather patterns and sea level rises will test our transport, communication, fuel, and energy networks and challenge the delivery of health and social care services.

15 High Level Summary of Statistics Trend http://www.gov.scot/Topics/Statistics/Browse/Environment/TrendTemperature

16 Climate Ready Scotland Scottish Climate Change Adaptation Programme http://www.gov.scot/Publications/2014/05/4669

17 The CCC, Scottish Climate Change Adaptation Programme: An independent assessment for the Scottish Parliament https://www.theccc.org.uk/wp-content/uploads/2016/09/Scottish-Climate-Change-Adaptation-Programme-An-independent-assessment-CCC-September-2016.pdf

Supported by the Scottish Government-funded Adaptation Scotland programme[18], climate change adaptation is already well integrated within many key policy areas. Recent developments which are strengthening our adaptation response include: the establishment of Scotland's National Centre for Resilience[19], new Flood Risk Management Plans[20], mapping of flood disadvantage, new public body reporting duties that include adaptation, new indicators developed by ClimateXChange to show how well Scotland is performing across sectors, and important locally-based initiatives such as Edinburgh Adapts[21], Climate Ready Clyde[22] and Aberdeen Adapts[23].

Adapting to the impacts of climate change is, of course, a global challenge faced by all countries. The Paris Agreement on climate change links mitigation and adaptation and sets a global goal of reducing vulnerability to climate change. All countries must plan for and take action on adaptation. In Scotland, we will continue to strengthen our adaptation to climate change in the years and decades ahead, working with partners across sectors on the priorities for the next update of the adaptation programme in 2019. In doing so, Scotland will also retain a strong focus on climate justice recognising that climate change impacts tend to impact most severely on poorer people and vulnerable communities.

Natural Capital

In 2015, the United Nations adopted the Sustainable Development Goals[24] which aim to end poverty, protect the planet, ensure prosperity for all and shift the world onto a sustainable development pathway by 2030. This global ambition is now integral to the Scottish Government's overall purpose to increase sustainable economic growth and create a more successful country with opportunities for all of Scotland to flourish. The transition to a low carbon economy by 2050 will help us to deliver this ambition. Our progress towards a sustainable and low carbon economy is well underway: renewable energy supplied 54% of Scottish gross electricity consumption in 2016 and we are taking wider action under our circular economy strategy.

Natural capital is defined as a country's stock of natural resources and environmental assets including plants, animals, air, water, soils and minerals.

People derive a wide range of benefits from natural capital. These benefits are often called "ecosystem services". Ecosystem services are vital to society and the economy, providing benefits such as the food we eat, the water we drink, climate regulation, carbon storage, natural flood defences, pollutant control, timber and crop pollination; and less tangible benefits such as aesthetic enjoyment, recreational and educational value.

18 Climate Ready Scotland Scottish Climate Change Adaptation Programme http://www.gov.scot/Publications/2014/05/4669

19 National Centre for Resilience https://www.readyscotland.org/ready-government/ncr/

20 Local Flood Risk Management Plans https://www.sepa.org.uk/environment/water/flooding/local-frm-plans/

21 Edinburgh Adapts - driving adaptation actions for the capital http://www.adaptationscotland.org.uk/get-involved/our-projects/edinburgh-adapts

22 Climate Ready Clyde http://www.adaptationscotland.org.uk/get-involved/our-projects/climate-ready-clyde

23 Aberdeen Adapts – an adaptation strategy for Aberdeen https://www.adaptationscotland.org.uk/get-involved/our-projects/aberdeen-adapts

24 UN Sustainable Development Goals http://www.un.org/sustainabledevelopment/sustainable-development-goals/

Caledonian pine woodland at Glen Affric National Nature Reserve. ©Lorne Gill/SNH

Over time, the use of natural capital beyond sustainable supply levels typically leads to depletion and/or degradation. In some instances, degraded or depleted natural capital can regenerate or replenish, but some stock may lose this ability, and pose a threat to our prosperity and well being. Protecting the environment and safeguarding Scotland's natural capital are crucial fro the transition to a low carbon economy.

Scotland's rich and diverse natural environment is a national asset and a source of significant international competitive advantage. Its continuing health and improvement is fundamental to sustainable economic growth. Our natural capital is believed to account directly for more than 60,000 jobs here in Scotland, and its direct benefits are realised in our tourist industry, which employs more than 200,000 people across the country[25]; and it is essential to our food and drink sector which is a major contributor to the economy, for example in the whisky and aquaculture industries.

There are many other less tangible ways in which our natural assets sustain us, by contributing to our health and wellbeing, enjoyment of the outdoors, sense of place and who we are as a nation. Scotland has shown leadership on natural capital. Natural capital underpins Scotland's Economic Strategy, and it is embedded within our National Performance Framework. To further acknowledge the importance of natural

25 Tourism in Scotland, Statistics http://www.gov.scot/Topics/Statistics/Browse/Tourism?utm_source=website&utm_medium=navigation&utm_campaign=statistics-topics

capital, we support the Scottish Forum on Natural Capital which brings together the private, public and third sectors, and aims to ensure that the concept of natural capital influences decision making at all levels.

In 2011, Scotland was the first country in the world to publish a Natural Capital Asset Index[26], which monitors annual change in natural capital based on the environment's ability to provide vital ecosystem services. Recent assessment indicates that our stock of natural capital was in decline until the late 1990s but has since stabilised and slightly improved since 2000.

According to the Millennium Ecosystem Assessment[27], by the end of this century climate change is likely to become a significant driver of biodiversity loss and will cause adverse changes on land and in our seas. Natural environment and biodiversity are inherently linked with action on climate change mitigation and adaptation[28]. Ecosystems and species diversity are essential in the global carbon cycle as they capture and store carbon. Degraded ecosystems and decline in species diversity affects the provision of ecosystem services essential to human wellbeing and the effective removal and storage of atmospheric carbon.

Climate change can shift the natural carbon cycle towards annual net emissions by reducing the ability of terrestrial ecosystems and oceans to capture carbon, thus further accelerating climate change[29]. The conservation and restoration of biodiversity and ecosystems can help to regulate the climate by preventing emissions and by capturing carbon in plants, oceans and soil. Healthy and resilient ecosystems have the potential to mitigate some of the vulnerabilities caused by future effects of climate change both in Scotland and abroad. The combined efforts of preservation, conservation and restoration of Scotland's ecosystems offer opportunities to meet the overall objectives of the Convention on Biological Diversity[30], Scotland's Biodiversity Strategy, Scotland's emissions reduction targets and the Sustainable Development Goals.

We know that Scotland's climate is already changing. Our transition to a low carbon economy will help to mitigate vulnerabilities caused by future changes in our natural assets, help to protect Scotland against emerging environmental risks affecting the economy and improve our resilience, particularly among vulnerable communities both in Scotland and abroad. Scotland's path towards decarbonisation will create a positive environment for green investment, help encourage natural capital to be taken into account in business decision making and encourage innovation and low carbon technologies.

26 Scotland Performs, National Indicators http://www.gov.scot/About/Performance/scotPerforms/indicator/naturalcapital

27 Millennium Ecosystem Assessment https://www.millenniumassessment.org/en/index.html

28 European Commission, Nature's Role in Climate Change https://ec.europa.eu/clima/sites/clima/files/docs/nature_and_climate_change_en.pdf

29 Secretariat of the Convention on Biological Diversity, Managing Ecosystems In The Context Of Climate Change Mitigation: A review of current knowledge and recommendations to support ecosystem-based mitigation actions that look beyond terrestrial forests https://www.cbd.int/doc/publications/cbd-ts-86-en.pdf

30 Convention on Biological Diversity, The Aichi Targets https://www.cbd.int/sp/targets/default.shtml

OUR APPROACH

The Cabinet Sub-Committee on Climate Change, chaired by the Cabinet Secretary for the Environment, Climate Change and Land Reform has overseen the development and production of this Climate Change Plan. Scottish Ministers have worked collaboratively to develop proposals and policies for emissions reductions across sectors in ways that maximise opportunities and minimise costs. However, the Scottish Government cannot, and should not, attempt to deliver this Climate Change Plan on its own. Local government, other public bodies, the private sector, the third sector, communities, households and individuals all have important roles to play.

The public sector

We expect Scotland's public bodies to lead by example in combatting climate change and make a valuable contribution towards achieving our emissions reduction targets. The public sector is critical to the successful delivery of the Climate Change Plan: influencing and enabling positive behaviours; driving change; and acting as an exemplar of climate action and low carbon innovation.

The leadership role of the Scottish Government is complemented by the concerted action of public bodies and, in particular, local government. Scottish local government is fully committed to dealing with the causes and effects of climate change. The Scottish Government works with public sector leadership networks, including the Scottish Leaders Forum, Chief Executives' Forum and the Scottish Government Delivery Bodies Group, to promote action on climate change. We will collaborate with the Environment and Economy Leaders' Group, which comprises Chief Executives of Scotland's environment public bodies, in considering how to widen engagement and action to help achieve our climate change ambitions.

In 2007, Scottish local authorities demonstrated clear leadership by voluntarily creating and signing the Scottish Climate Change Declaration[31]. This document set out local authorities' intent to work across all areas in order to drive the behaviour and technological changes necessary to reduce carbon emission levels to those required to meet national targets. Since then, emissions directly attributable to council actions and estates have fallen substantially, demonstrating both the commitment of Scottish local authorities and the power of public statements of intent.

As major players under the Climate Change (Scotland) 2009 Act, local authorities play a critical role in the delivery of the Public Bodies Climate Change Duties. The 2016-2017 Analysis Report[32], produced by the Sustainable Scotland Network on the public bodies climate change reporting duties, has highlighted the efforts of 180 public bodies across Scotland in reducing carbon emissions from the public sector in 2016-2017. While it is too early to comment on trends, overall the direction of travel by public bodies on emissions reductions is positive and remains in step with national reduction targets.

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31 Scottish Public Bodies Climate Change Reporting https://www.keepscotlandbeautiful.org/sustainability-climate-change/sustainable-scotland-network

32 Scottish Public Bodies Climate Change Reporting: Analysis Report 2016-2017 https://www.keepscotlandbeautiful.org/sustainability-climate-change/sustainable-scotland-network/climate-change-reporting/analysis/201617-analysis/

Aerial view of Glasgow University, West End. Credit: Alan McAteer for Scottish Enterprise

It is important to note that it is not only with regards to directly attributable emissions that councils have played their part. The work of local authorities affects all sectors of Scottish society, and influences individuals and communities across the country.

Our climate change ambitions are shared with the entire Scottish public sector. Over the course of this Plan and beyond, the Scottish Government will work with the wider public sector in Scotland so that it continues to make a valuable contribution to Scotland's climate change targets, proposals and policies.

The planning system

Decisions we take about the places in which we live, work and play last for decades and sometimes hundreds of years. These decisions can, therefore, have an impact on people for their entire lives. The planning system must provide the framework in which decisions about "place" can support low carbon lifestyles and the transformative change needed to deliver emissions reduction targets.

Buildings, streets and spaces are the ingredients of place, and 'placemaking' is a useful way of thinking about how the planning system can help Scotland decarbonise. Placemaking is fundamentally about people, communities, neighbours and families. It can provide people with the opportunity, power and support to talk about their place and use this to inform future action.

A review of the planning system commenced in 2015, and the **Planning (Scotland) Bill**, which sets out the desired changes to planning law, was introduced to the Scottish Parliament in December 2017. The Bill proposes making the development plan less complicated, with national leadership under a combined National Planning Framework and Scottish Planning Policy. The intention is for the Framework and Policy to be co-produced with planning authorities to reflect regional priorities across the country, replacing the current strategic development plans covering only the four city regions and providing the policy basis for making decisions locally. This Climate Change Plan will be a fundamental information source for the preparation of the next National Planning Framework and Scottish Planning Policy, which we expect to publish in 2020.

The Planning Bill includes a range of measures to empower communities, including a new right enabling communities to prepare their own plan for their place. This creates opportunities for communities to use the planning process to consider how to access funds for change, for example from the Climate Challenge Fund.

This Plan considers the behaviours of people and the choices they make. These are informed by the access people have or do not have to the things that would help them live lower carbon lifestyles. The planning system is a means by which the missing infrastructure which would assist low carbon choices to be made, can be identified and developed in the future. The planning system provides a means of thinking about this at a street, neighbourhood, village, town, city, region and national scale. It is about enabling conversations and plans for the types of places we share as a society, and designing infrastructure in a way that encourages decarbonisation.

For emissions reductions, probably the most important decision the planning system makes is where new development should be built. From that decision all the other related impacts flow: how people travel to and from the development; how it improves an area; the social and economic impacts which occur; and how all of this impacts on the emissions produced.

All buildings will need to become more energy efficient. Changes have already been made to the planning system which means that many efficiency measures, in particular for our homes, do not require planning permission in advance. These 'permitted development rights' were considered as part of the review of the planning system and support for more permitted development rights was identified.

Our streets are already changing to accommodate electric vehicle charging and active travel infrastructure. Continued engagement about how best to support sustainable forms of travel through new development will be an essential component of emissions reduction. Where we get our low emission energy from is also critical and we will continue to need to find room for large scale infrastructure such as wind and

Exterior view of Inovo at ITREZ (International Technology and Renewable Energy Zone), Glasgow.
Credit: Alan McAteer for Scottish Enterprise

solar farms, as well as more locally based equipment, such as heat networks and energy centres.

At a broader scale the planning system provides a framework for thinking about how we use space to gain a variety of benefits: for example, green networks can be important for wildlife, recreation and travel; and woodland creation can help absorb carbon dioxide and slow down the rate of water movement into burns and rivers, helping to reduce flooding in built-up areas.

Given the wide range of impacts from planning, local political commitment to development plans is crucial to ensuring that decisions are consistent and the beneficial outcomes which result from delivery of the plans can be achieved. Using the placemaking approach and design-led principles can help to create places where sustainable and active lifestyles become the obvious and easy option.

The nature of the planning system means that it will be more influential for some sectors identified in this Plan than others. A lot is already being done, as highlighted above. The specific role of the planning system in delivering the aims of the sectors is highlighted in each of the individual chapters.

Activity session at Climate Challenge Fund Transport Networking event in 2017. Credit: Keep Scotland Beautiful

The role of communities

Scotland has achieved much over the last few years in terms of galvanising community action and putting more decisions and resources in the hands of communities. We believe that the best people to decide the future of our communities are the people who live in those communities.

Where communities are empowered, we see a range of benefits: local democratic participation is boosted; confidence and skills among local people are increased; higher numbers of people volunteer in their communities; and satisfaction with quality of life in local neighbourhoods is improved. This leads ultimately to the delivery of improved, more responsive services and better outcomes for the communities themselves.

Our ambitions in the Plan are backed up by investment in local communities and their ability to lead change at a local level through the Climate Challenge Fund (CCF), which is funded by the Scottish Government.

The CCF supports communities across Scotland to run locally-led projects that reduce emissions, improve their local communities and help adapt to the impacts of a changing climate. At the time of publication, the CCF had awarded £85.8 million to 986 communities since its launch in 2008 and 2018 will see the award of the 1000th CCF project. Continued Scottish Government investment in the CCF helps ensure that communities are empowered, equipped and supported to deliver low carbon solutions to local issues on their own terms.

The CCF supports a wide range of community-led action by, for example, arts groups, sports clubs, community councils, faith groups, student unions, residents associations, local charities, food groups, housing associations and development trusts. The Fund supports a range of activity and has helped communities to reduce, reuse and recycle their waste, increase the energy efficiency of homes and community buildings, encourage active travel and the use of low carbon transport, and produce local food.

The CCF's core aims are climate change related but, as with so many other climate change policies and activities, the positive benefits have been found to be wide reaching. These include social and health benefits, the creation of employment and training opportunities, financial savings for individuals and reductions in fuel poverty through home energy efficiency measures.

Behaviour change and public engagement

Public understanding, engagement and action are critical to the social and economic transformations required to achieve a low carbon society. We are seeing an increase in people's understanding of the urgency of climate change, and about the contribution which they can make to help tackle it. The Scottish Household Survey shows that an increasing proportion of Scottish adults (just over half) state that climate change is an immediate and urgent problem; and a similar proportion acknowledge that their behaviour and everyday lifestyle contribute to climate change. Around three quarters state that they understand what actions people like themselves should take to help tackle climate change. Our aims are to encourage public discussion about climate change, and to engage and support people to take low carbon actions in their everyday lives.

Engaging with people on climate change

As part of our ongoing engagement with the public on climate change, the Scottish Government initiated a series of Climate Conversations across Scotland. The purpose of these conversations has been to encourage discussion about climate change among people who do not generally talk about it; and to assess public views about climate change and the actions that might be needed to tackle it. The conversations have included discussions about ten 'low carbon scenarios', showing what life in a low carbon Scotland in 2030 might look like in the context of a changing climate.

Conversations have been held with members of the public, local community and voluntary groups and local faith groups. Key findings from them include:

- People do have some knowledge about climate change and its potential impacts, though levels of awareness and understanding vary.
- People want reliable information about climate change, in order to help them to engage more with the issues and to motivate them to take action themselves.
- People acknowledge that action is needed to tackle climate change, and that individuals need to play their part.

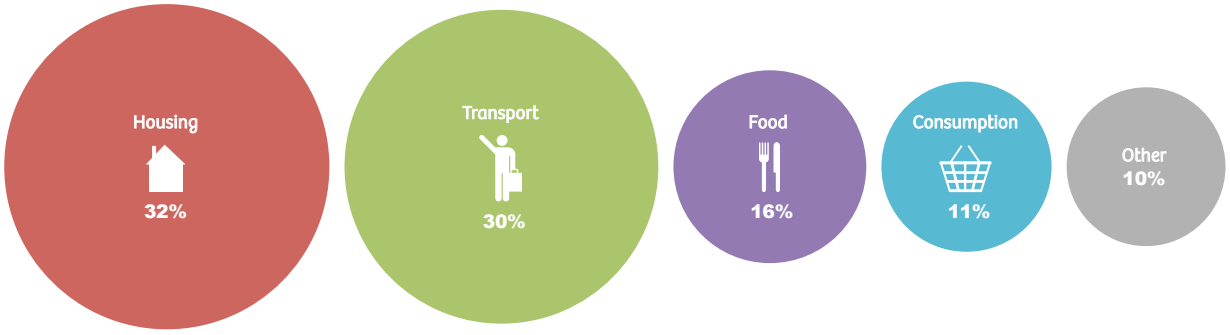
- People want the Scottish Government to lead action to tackle climate change. They will be more motivated to adopt low carbon behaviours themselves if they can see that government and other sectors are playing their part.
- Low carbon options need to be easy and fair choices for people.

These climate conversations are continuing through local groups across Scotland, and the findings will inform the development of government policy. We will also consider other forms of engagement to reach wider audiences. As part of the implementation of the Energy Strategy, communities will also be encouraged and supported to hold local conversations about local energy systems.

The role of individuals and households in reducing emissions

Individuals and households account for over three quarters of Scotland's consumption emissions (all the emissions for which we are responsible as consumers of goods and services, including those we import into Scotland), which break down into the following themes.

Consumption emissions associated with individuals and households by theme



Individuals and households therefore have a significant role to play, alongside the public sector and businesses, in reducing Scotland's emissions.

The four consumption emissions themes have been broken down further into 10 Key Behaviour Areas, showing specific behaviours where changes by individuals and households can contribute to reducing Scotland's carbon footprint.

10 Key Behaviour Areas

1. Keeping the heat in (insulation, draught proofing, double glazing)
2. Better heating management (turning down heating thermostat to between 18° and 21°, reducing the hours the heating is on, and turning down hot water thermostat to a maximum of 60°)
3. Saving electricity (buying energy efficient appliances, lightbulbs, TVs and other products when they need to be replaced, washing clothes at low temperatures)
4. Installing a more energy-efficient heating system or generating your own heat by replacing inefficient boilers with condensing boilers and/or microgeneration (e.g. solar water heating, biomass boiler, heat pump)
5. Becoming less reliant on the car (walking, cycling, using public transport and/or car-sharing instead of driving)
6. Driving more efficiently (using a low carbon vehicle (fuel efficient, hybrid, alternative fuel or electric), and/or following fuel-efficient driving principles)
7. Using alternatives to flying where practical (e.g. train or teleconferencing for business)
8. Avoiding food waste
9. Eating a healthy, sustainable diet, high in seasonal food
10. Reducing and reusing in addition to the efforts we already make on recycling

Influencing behaviours: The ISM approach

People's choices and behaviours are influenced in various ways – within the values and attitudes that we hold, the habits we have learned, the people around us, and the tools and infrastructure available to us in our day-to-day lives. A package of interventions, designed to influence the way we all behave, that takes account of the wider aspects of our daily lives, is likely to be more successful.

The ISM approach was developed to help understand all of the contexts that shape people's behaviours – the **individual**, the **social** and the **material**. By understanding the different contexts and the multiple factors within them that influence the way we act every day, more effective policies and interventions can be developed.

The **individual context** includes an individual's values, attitudes and skills, the **social context** includes factors that influence us through networks, relationships and social norms, and the **material context** covers factors like infrastructure, technologies and regulations.

Experience of using the ISM approach, across a range of policy areas including housing, energy, transport and forestry, has highlighted key benefits including:

- providing greater understanding of the wide range of factors that will impact on successful delivery of policies
- giving clarity on the areas to be targeted and prioritised
- highlighting the relative importance of different factors in effecting change and using these as levers to change, in particular, the importance of considering the social context in delivering and developing policies

The ISM approach has been used across policy areas to support the implementation of proposals and policies in the Plan, and delivery of policy outcomes. Workshops covered topics including: creating a demand for energy efficiency in housing; encouraging loan uptake; engaging householders with their heating controls; factors influencing tree planting and woodland creation; the school run; and low carbon heating.

We also built on the initial ISM workshops. For example, following the ISM workshop on factors influencing tree planting and woodland creation we undertook an ISM framed literature review to deepen understanding. In another example, following an initial workshop that brought together a range of key stakeholders on heating controls, we developed an ISM style workshop to engage the public on the same behaviour. This workshop was successful in engaging the public on policies and policy development and supplemented the initial workshop findings with a public point of view.

The findings which emerged from the two heating control workshops are now helping to inform the advice provided by Home Energy Scotland. These findings will also be factored into the design and update of our advice services as SEEP is developed further. In particular, the public facing ISM workshop on heating controls has helped us frame information for the public audience.

Engaging with people on low carbon behaviours

People across Scotland need to understand fully the changes we need to make, and how to incorporate these changes into everyday lives, to ensure everyone is both willing and able to take the actions required for low carbon living. This will be challenging, but low carbon initiatives being taken forward aim to make the transition as seamless and straightforward as possible, as well as providing a host of other benefits which are referenced throughout this Plan.

Alongside this we need to engage with the public on the impacts of climate change, bringing them along as active participants in the transition.

Through the Greener Together campaign[33], which engages and motivates the public on a range of actions that can be taken to tackle climate change, we found that three quarters of those surveyed acknowledged that their behaviour could help tackle climate change and over 50% of the general public reported having a conversation on climate change in the past month.

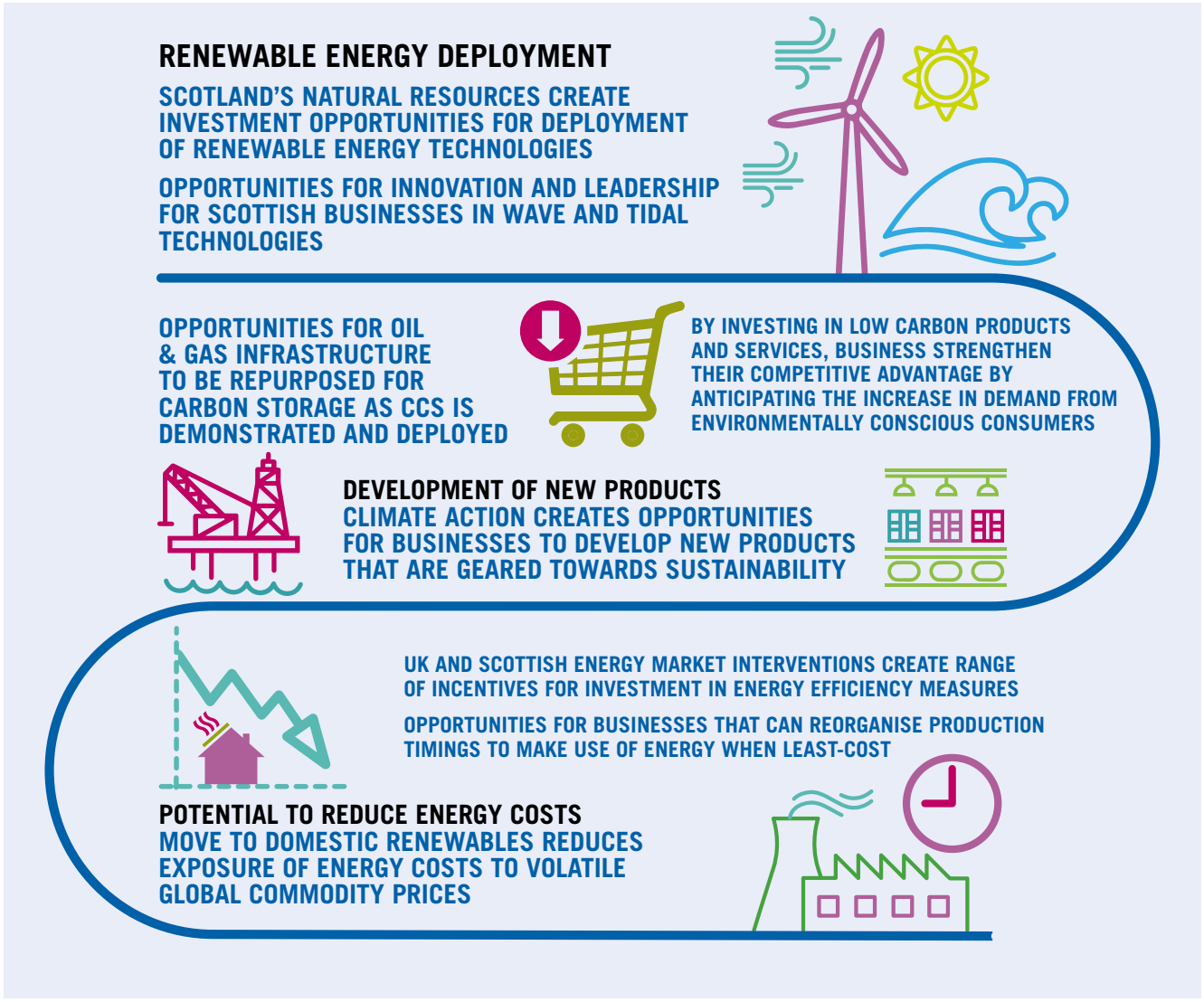
The Scottish Household Survey shows a significant increase in the proportion of young people (age 16-24) who see climate change as an immediate and urgent problem: up from 38% in 2013 to 53% in 2016. A recent survey by Young Scot found that nearly half (42%) of young people consider that they themselves have some responsibility to tackle climate change, but only a third are aware of the practical actions they could take.

We will continue our support for the Eco Schools programme, which encourages pupil-led action for the environment, alongside our work with key stakeholders to promote young people's engagement on climate change. We recognise the achievements of our young people, such as the 2050 Climate Group, who are preparing young leaders through their development programme to take forward the low carbon transition while also representing Scotland on the global stage. As part of the Year of Young People 2018, we are working with our partners to further increase young people's engagement in Scotland's climate change agenda.

Overall, attitudes are changing and people are engaging with climate change issues. To increase the pace of change we need to clearly set out the changes that lie ahead and why they are important, along with associated infrastructure and services, as part of the support we are offering to communities and households across Scotland. Following the publication of the Plan, we will review the Low Carbon Behaviours Framework, setting out what the Scottish Government will do to drive and support the transition to a low carbon Scotland.

33 Greener Scotland http://www.greenerscotland.org/

THE TRANSITION TO A LOW CARBON ECONOMY



Our environment and economy are intrinsically linked, and Scotland's transition to a more prosperous, low carbon economy is already well underway. We have created jobs and backed innovative, new industries while winning international respect for our ambition and leadership on climate change.

The Paris Agreement will support a worldwide market for low carbon goods and services, as other countries have also committed to reducing their carbon footprint. Analysis by the International Finance Corporation indicates that the Paris Agreement will help open up $23 trillion worth of opportunities for climate-smart investments in emerging markets

between 2016 and 2030. The Agreement will enhance the long term international competitiveness of low carbon business in Scotland by ensuring that more eco-friendly business practices are adopted elsewhere.

The Scottish Government aims to provide the leadership that will give businesses confidence to invest in new techniques and practices. However, there must be a collaborative approach to securing the opportunities offered by decarbonisation, from the SMEs at the heart of local economies, to the investors and multinationals that power the national economy to a significant degree, and the growing firms in between.

Our ambitions for a low carbon economy are embedded throughout the Scottish Government's strategies. The vision for Scotland set out in these documents, including our Economic Strategy and Digital Strategy, sets the blueprint for us to drive and deliver decarbonisation across the economy as a whole.

Our approach to decarbonisation is rooted in our Economic Strategy, which recognises that a more inclusive, sustainable economy improves the opportunities, life chances and wellbeing of Scotland's citizens. We will work to deliver an inclusive, socially just transition, based on equal opportunity, a fair and inclusive jobs market, regional cohesion and safe and secure communities.

The Programme for Government 2017-2018 makes clear the economic benefits of Scottish Government's climate change ambitions, and states that "Scotland's ambition is to be the inventor and the producer, not just a consumer, of the innovations that will shape the lives of our children and grandchildren". It also notes that low carbon technologies will revolutionise the global economy and that we must act quickly and with purpose to grasp these opportunities or be left behind.

The Scottish Government offers specific support to accelerate low carbon infrastructure projects through our Low Carbon Infrastructure Transition Programme (LCITP), which has already provided over £50 million to over 50 low carbon projects across Scotland. In January 2018, LCITP launched the Low Carbon Innovation Fund with a further £60 million available for low carbon heating solutions, integrated energy systems, and ultra-low emission vehicle charging infrastructure that will be operational by 2021.

Our ambition under the current Act is to reduce emissions of greenhouse gases by 80% from 1990 levels by 2050. This represents a fundamental transition of all sectors of the economy and a long-term strategy for economic growth: reducing the cost to the Scottish economy of climate change, while maximising opportunities to export our technology innovations and knowledge as other economies make their own low carbon transition.

Central to this transition is the effective and sustainable management of our natural resources and secondary materials. By improving resource efficiency we can reduce energy demand and overall greenhouse emissions. Resource-efficient homes are less likely to face fuel poverty; resource-efficient businesses are more productive. Our Circular Economy Strategy, 'Making Things Last' is a key aspect of our Economic Strategy.

A largely decarbonised economic system by 2050, which meets our climate change targets, can be achieved in a number of ways, and will be influenced by innovations and developments we cannot forecast. It will depend on global and regional markets, geopolitics, consumers' willingness and ability to adapt to new opportunities and behaviours, and on the underlying costs of primary energy sources and related infrastructure.

The role of enterprise agencies

The purpose of Scotland's enterprise agencies is to generate long-term, sustainable and inclusive growth for the economy. In order to implement national ambitions on investment, innovation, inclusive growth and internationalisation, the agencies focus their activities on helping build a competitive and low carbon economy. Scotland already has competitive advantages and important strategic assets that will form the basis for long-term growth by companies.

The agencies will work towards achieving the ambitious targets set out in the Energy Strategy and Climate Change Plan by continuing to work with companies to realise the significant opportunities in the low carbon economy, including opening up important new opportunities such as the circular economy and in water treatment in new, overseas markets. The Scottish Manufacturing Advisory Service has a key role here in helping to make industry more efficient. Similarly, sustainability specialists are focused on working with businesses to reduce their carbon impact whilst increasing their overall productivity. Highlands and Islands Enterprise will continue to support the Government's new programme of community energy empowerment.

The agencies are partners in the LCITP, leading on private sector led projects and area based projects. They collaborate with partners to accelerate the development and delivery of low carbon projects across Scotland which will in turn attract new investment into the sector.

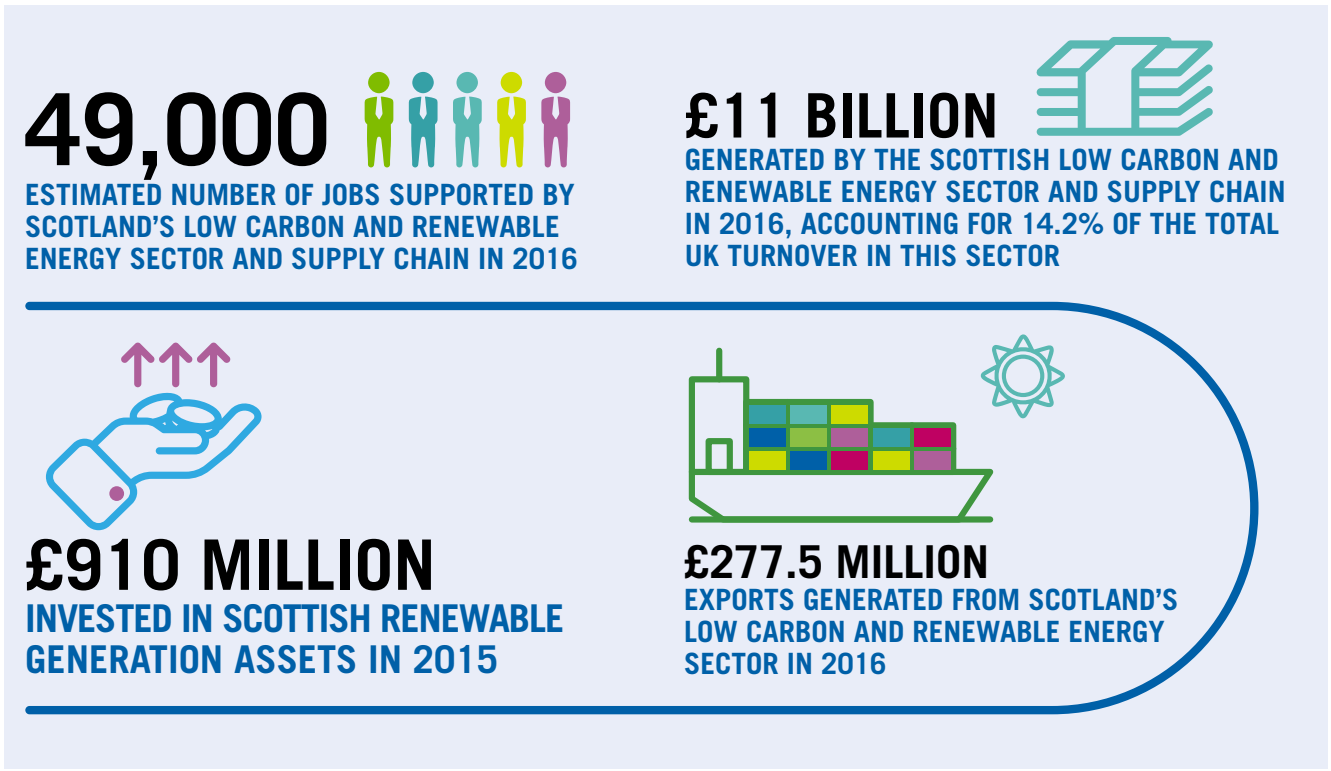
Challenges and opportunities

In 2017, alongside the publication of the draft Climate Change Plan, the Scottish Government commissioned a study into the challenges and opportunities of the low carbon economy in Scotland.[34]

This report helped to identify Scotland's strengths in areas of growth, both domestically and overseas. As the market opportunities relating to low carbon continue to grow, this will provide a platform for innovation for Scottish companies in renewables, transport and energy and resource efficiency. Scotland is well placed to take advantage of opportunities in emerging industries including marine energy, offshore wind and carbon capture, utilisation and storage, and indeed, benefits are already being realised from some of these areas.

34 Transitioning to a Low Carbon Economy - Presentation and Report. http://www.gov.scot/Topics/Environment/climatechange/meetingemissionstargets/climate-change-plan/transitioning-to-a-low-carbon-economy

THE VALUE OF RENEWABLES AND LOW CARBON TECHNOLOGIES TO THE SCOTTISH ECONOMY[35]



Along with the physical impacts arising from our changing climate, industry faces commercial challenges where the investment required to update existing assets, build new infrastructure, and develop and purchase new technologies, will be significant. Dealing with increasing amounts of intermittent generation could pose challenges to manufacturers, as power system operators develop smart grids where demand is altered to match generation, not the reverse as is the case today.

Scotland's energy intensive industries may face particular challenges in adapting to a low carbon economy, as the cost of energy continues to rise in response to worldwide market signals. We recognise the importance of investment in driving down energy costs (and therefore emissions) in these industries. Cost and availability of energy is a key factor in the competiveness of these businesses. We also recognise the importance of encouraging energy efficiency measures and working collaboratively on decarbonisation opportunities.

35 Figures taken from ONS UK Environmental Accounts: Low Carbon and Renewable Energy Economy Survey: 2016 final estimates: https://www.ons.gov.uk/economy/environmentalaccounts/bulletins/finalestimates/2016 and Scottish Renewables, Renewables in numbers, 2017 http://www.scottishrenewables.com/sectors/renewables-in-numbers/

To reduce the risk of carbon leakage, we will work with industry to ensure our approach enhances Scotland's industrial and manufacturing sectors, improves competitiveness, and fosters sustainable economic growth in Scotland.

The Scottish Government will continue to support Scotland's energy intensive industries. This Climate Change Plan is based on a clear and transparent long term decarbonisation pathway that has been developed in conjunction with stakeholders and puts economic growth at the centre of our long-term strategy. We want to deliver a stable, long-term investment environment that allows industry to maximise the opportunities arising from the low carbon transition.

While supporting our established industries, we will nurture our growing ones. There is still potential for further growth in offshore wind, marine, and hydro, and onshore wind opportunities remain. From the work that has been done by industry – supported by the Scottish Government and our agencies – on skills and employment, we have developed deep reserves of skills among the Scottish people; in 2016, 49,000 jobs were supported by the low carbon and renewable energy industry.

We expect growth in other aspects of the low carbon economy over the lifetime of this Plan, including Carbon Capture and Storage – which offers huge possibilities for Scottish industry, with the potential of North Sea networks to store CO_2 in the future – and in renewable heat, which we expect to create economic and social benefit as surplus industrial heat is redirected to communities to heat homes, healthcare facilities and schools.

The Scottish Government is supporting these opportunities through funding to develop Carbon Capture and Storage facilities at the existing gas processing plant at St. Fergus and connect them to existing North Sea infrastructure and by working with the UK Government to deliver off-gas grid renewable heating through the Renewable Heating Incentive.

Scotland's Energy Efficiency Programme will help to create a substantial Scottish market and supply chain for energy efficiency services and technologies. With SEEP, we will help to realise economies of scale, thereby helping to drive down the cost of energy efficiency measures. There will be opportunities for SMEs and third sector organisations to deliver, and support the delivery, of energy efficiency measures.

Working with and support for businesses

We will continue the work that we have been doing with businesses in Scotland to support the low carbon economy – helping businesses use their experience, adaptability and willingness to diversify in order to become more competitive.

In our Programme for Government 2017-2018, the Scottish Government announced the establishment of a Scottish National Investment Bank. The First Minister appointed an industry expert to lead work to develop an Implementation Plan who has convened a small advisory group to support him in the development of this plan. This work will define the bank's purpose and role and the Implementation Plan will be published in early 2018.

In the Scottish Budget 2018-2019 the Scottish Government has committed to providing the bank with initial capitalisation of £340 million over 2019-2021. This commitment will ensure the bank can make an immediate impact once operational. The Bank will be a key partner for government and business, supporting our economic ambitions including transformational investment to address climate change.

The Bank will provide and catalyse investment – creating opportunities for Scotland, increasing innovation and accelerating the transformation to a low carbon, high-tech, connected, globally competitive and inclusive economy.

The Scottish Government, and its enterprise agencies, will continue to deepen engagement with Scotland's business community to better understand the opportunities and to build a supportive regulatory and business development environment within which Scottish businesses can thrive.

With the publication of this Climate Change Plan and the Energy Strategy – alongside our commitment to establish a Just Transition Commission – now is the right time to review how we engage with all sectors on this issue.

Scotland's role as a global citizen

Over the timescale covered by this Plan, Scotland will continue to be a vibrant, diverse country that faces outwards and is a confident and responsible global citizen. Consistent with our internationalisation agenda (as set out in 'Scotland's International Framework'[36]) we will continue to implement progressive social policies and environmental measures, playing our part in making the world a safer, fairer and more sustainable place.

By adopting an outward-looking and participative approach to engaging with our global partners, we will expand our diplomatic reach and strengthen our global ties. There is clear scope to use Scotland's expertise and international reputation as a vehicle for furthering coordinated, global interaction on climate change. This is of particular relevance when looking at Scotland's ambitious climate targets and the steps we are taking to ensure a greener future.

36 Scotland's International Framework, 2017 https://beta.gov.scot/publications/scotlands-international-framework-9781788514033/documents/00527955.pdf

While our scope for action is constrained by the current constitutional framework, there is much that the Scottish Government can continue to do to achieve our ambitions on climate change:

- we will continue to engage with the UK Government, pushing for close and meaningful dialogue and the opportunity to share best practice and research with government and business
- we will seek to deepen our relationships with current EU Member States to help steer policy decisions and find shared interest in our global climate goals
- on the international stage, we will continue to exchange knowledge and experience with countries and regions whose challenges are similar to our own and whose solutions can help to inform our own approach

The Scottish Government supports the Paris Agreement, which provides the framework for global climate action. Scotland is a member of the Under 2 Coalition led by California and Baden Wurttemberg and representing over 200 jurisdictions covering over 1 billion people and around 40% of global GDP. We are also supporting the UNFCCC's Gender Action Plan to strengthen the role of women in the international climate negotiations.

Global climate justice

Scotland champions climate justice, and the Scottish Government hopes the Paris Agreement will drive global action to avoid the worst impacts of climate change falling on the poorest and most vulnerable people across the world.

The Scottish Government has pledged to implement the UN Global Goals both at home in Scotland and contribute to their achievement in our partner countries. To meet that commitment, climate action is important for Scotland itself and, as a part of our international development 'Beyond Aid' agenda, to mitigate the Global North's impact on the poorest and most vulnerable people in developing countries in the Global South – a "do no harm" approach.

We are continuing to deliver the First Minister's pledge to the Paris climate conference to provide £3 million each year through our Climate Justice Fund programmes. These include our Climate Challenge Programme Malawi and our Climate Justice Innovation Fund, which announced its first six projects in Malawi, Zambia and Rwanda in September 2017.

Scotland's innovative Climate Justice Fund has already supported 11 projects worth £6 million in some of Africa's most vulnerable communities. The First Minister has pledged a further £15 million over five years to support developing countries, with an initial £2 million announced for clean water for vulnerable communities in Malawi and £1 million to help developing countries engage with the Paris Agreement.

Scotland and the European Union

The challenges posed by the EU referendum result are unprecedented. Climate policy has domestic, regional and global implications and connections and the EU's legislative reach, market influence and climate diplomacy are extensive. Through the UK's membership, Scotland has benefited from being a direct part of the EU's considerable diplomatic clout in the climate negotiations, projecting our domestic climate leadership internationally through collective effort with our EU partners.

The Scottish Government has been clear that the referendum result on EU membership does not affect our desire or ability to maintain, enhance and protect our environment. The forthcoming negotiations to determine the UK and Scotland's future relationship with Europe will therefore need to consider this important area of policy in detail with a view to safeguarding Scotland's key interests and maintaining our place as a progressive leader on climate action.

In January 2018 the Scottish Government published Scotland's Place in Europe: People, Jobs and Investment[37], a set of proposals designed to mitigate the risks for Scotland of being taken out of the EU. The Scottish Government believes Scotland's future is best served by continued EU membership, in line with the wishes of 62% of Scotland's voters as expressed in the referendum in 2016. However, if Brexit proves to be inevitable, our interests are best protected by the UK remaining inside the European Single Market and Customs Union.

A 'hard' Brexit would have significant consequences for a range of policy objectives and aspirations we share with our EU partners including EU environmental policy, social policy, research and innovation policies and policies in the area of workers' rights, consumer protection and consumer safety. Brexit will risk a divergence in these standards and lessen the effectiveness of policy collaboration on these key issues as well as lessening the standards and protections that we are accustomed to. This approach will also jeopardise the tangible gains we enjoy through continued collaborations with our EU partners, including in justice and home affairs issues, research, social policy, and security.

As the UK Government embarks on what will be the most crucial set of international negotiations of recent years, it is essential that it is the economic and social interests of the country that shape our future relationship with the EU and not narrow and transient political considerations. Also essential is that the UK negotiating position fully reflects the interests of all parts of the UK. There are very few certainties with regards to Brexit, but Scotland's climate change ambitions are clear and are a priority of the Scottish Government.

37 Scotland's Place in Europe: People, Jobs and Investment, 2018 http://www.gov.scot/Publications/2018/01/6407

Continued Scottish participation in the EU ETS

The Paris Agreement includes provisions to facilitate increasing interconnection of existing carbon markets (e.g. the RGGI and WCI in North America, the South Korea ETS, New Zealand ETS, the Swiss ETS, the EU ETS and the Chinese ETS due to launch in 2018)[38].

At the time of publication, the UK Government had not yet indicated its preferred position on future participation in the EU ETS after the UK is scheduled to exit the EU on 29 March 2019. The Scottish Government considers that access to international carbon markets enable Scottish industries to determine the most cost effective way to decarbonisation and provide access to a level playing field with international competitors.

We believe that it is vital for Scottish industry to be able to access these expanding international markets as they link up in future. We support continued participation in the EU ETS, which provides protection against deindustrialisation through carbon leakage, demonstrates continued global leadership on climate and our commitment to the Paris Agreement, and provides the best opportunity for future Scottish participation in emerging global carbon markets. We will continue to press the UK Government to provide clarity to industry on its plans for emissions trading as it prepares to leave the EU.

38 Paris Agreement Article 6 makes provision for linking carbon markets http://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf. For more information on the Regional Greenhouse Gas Initiative (RGGI), the Western Climate Initiative (WCI) and other carbon markets operating at international, national and regional level, see the World Bank Report https://openknowledge.worldbank.org/bitstream/handle/10986/25160/9781464810015.pdf?sequence=7

PART TWO:
Statutory duties, methodologies and monitoring

STATUTORY DUTIES AND METHODOLOGIES

Setting the targets

The Climate Change (Scotland) Act 2009 ('the Act') sets targets to reduce Scotland's emissions of the basket of seven Kyoto Protocol greenhouse gases by at least 42% by 2020 and 80% by 2050, compared to the 1990-1995 baseline. The Act also requires that the Scottish Ministers set, by Order, annual emissions reduction targets for each year in the period 2010-2050, consistent with achieving the long-term targets. These annual targets are set in batches at least 12 years in advance.

Before setting a batch of annual targets, Scottish Ministers must request advice from the Committee on Climate Change (CCC). The CCC is an independent expert body established by the UK Climate Change Act 2008 to provide climate change advice to the UK Government and devolved administrations.

Following advice from the CCC in March 2016 and then again in July 2016, the Scottish Parliament passed legislation setting the third batch of annual targets in October 2016, for the years 2028 to 2032. The targets set an emissions reduction pathway to 2032 and in doing so establish a 2032 target that represents a 66% reduction below 1990 levels[39].

The basket of Kyoto Protocol greenhouse gases comprises carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), for which the baseline is 1990; and hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitrogen triflouride (NF_3), for which the baseline is 1995[40].

39 Climate Change (Scotland) Act 2009 http://www.legislation.gov.uk/asp/2009/12/contents

40 Scottish emissions targets 2028-2032 http://www.gov.scot/Topics/Environment/climatechange/scottish-emissions-targets-2028-2032

CCC updated advice on Climate Change (Scotland) Act http://www.gov.scot/Topics/Environment/climatechange/legislation/CCC-updated-advice

The Climate Change (Annual Targets) (Scotland) Order 2016 http://www.legislation.gov.uk/ssi/2016/328/contents/made

Table 1: Annual targets 2010-2032

The table below sets out the annual Greenhouse Gas emissions targets set by the Scottish Parliament, in accordance with the Climate Change (Scotland) Act 2009. Prior to setting these targets, the Committee on Climate Change (CCC) provided advice to the Scottish Ministers on the appropriate levels of these targets.

	Annual target (tCO_2e)	% reduction year-on-year	% reduction from baseline
2010	53,652,000		-30%
2011	53,404,000	-0.46%	-31%
2012	53,226,000	-0.33%	-31%
2013	47,976,000	-9.86%	-38%
2014	46,958,000	-2.12%	-39%
2015	45,928,000	-2.19%	-40%
2016	44,933,000	-2.17%	-42%
2017	43,946,000	-2.20%	-43%
2018	42,966,000	-2.23%	-44%
2019	41,976,000	-2.30%	-46%
2020	40,717,000	-3.00%	-47%
2021	39,495,000	-3.00%	-49%
2022	38,310,000	-3.00%	-50%
2023	37,161,000	-3.00%	-52%
2024	35,787,000	-3.70%	-54%
2025	34,117,000	-4.67%	-56%
2026	32,446,000	-4.90%	-58%
2027	30,777,000	-5.14%	-60%
2028	29,854,000	-3.00%	-61%
2029	28,958,000	-3.00%	-62%
2030	28,089,000	-3.00%	-64%
2031	27,247,000	-3.00%	-65%
2032	26,429,000	-3.00%	-66%

The percentage reductions against baseline levels are shown on the basis of the most recent (2015) Scottish Greenhouse Gas Inventory. Revisions to the Inventory (which have occurred every year for which Official Statistics are available) have the effect of changing the percentage reduction from baseline figures, as the annual targets remain fixed but the baseline level of emissions is revised.

The large drop in 2013 reflects Phase III of the EU ETS coming into effect.

The Act requires that, as soon as reasonably practicable after setting a batch of annual targets, Ministers publish a report setting out proposals and policies for meeting those targets. This Climate Change Plan is the third report on proposals and policies and lays out how Scotland can deliver annual targets for reductions in emissions from 2018-2032.

Compensating for excess emissions

Based on the 2015 Scottish Greenhouse Gas Inventory[41], there is a cumulative emissions shortfall of 17.9MtCO_2e across the annual targets for 2010-2015. In accordance with Section 36 of the Act, this Climate Change Plan includes proposals and policies to compensate, in future years, for this shortfall. The pathway includes an additional 17.9MtCO_2e of abatement, over and above what is required to meet the statutory annual targets out to 2032.

Accounting for emissions

All the emissions reduction targets set out in the Act are based on the Net Scottish Emissions Account (NSEA). The NSEA is defined in the Act as the amount of net Scottish emissions of greenhouse gases, reduced or increased by the amount of carbon units credited to or debited from it. The proposals and policies laid out in this Climate Change Plan are designed to reduce the level of the NSEA.

Net Scottish emissions cover all emissions from sources within Scotland plus domestic and international aviation and shipping, reduced by any greenhouse gases removed from the atmosphere by Scottish sinks, such as woodland.

Carbon units can be credited to or debited from the NSEA through the operation of the EU Emissions Trading System (EU ETS), or credited to it by the purchase of international carbon units by Scottish Ministers.

How we account for the traded sector (the EU ETS)

The EU ETS is a 'cap and trade' system, aimed at mitigating climate change by limiting greenhouse gas emissions from power and heat generation, energy-intensive industry sectors and commercial aviation. Participants include more than 11,000 heavy energy-using installations in power generation, the manufacturing industry and airlines across 31 countries in the European Economic Area (EEA). Participating organisations trade emissions allowances within a decreasing overall cap. This provides an incentive for participants to find the most cost-effective way to reduce emissions. By 2020, the volume of emissions permitted within the system at EU level, will be 21% lower than in 2005[42].

41 Global Atmosphere – Greenhouse Gas Emissions. High Level Summary of Statistics Trend. http://www.gov.scot/Topics/Statistics/Browse/Environment/TrendGasEmissions

42 The EU Emissions Trading System (EU ETS) https://ec.europa.eu/clima/policies/ets_en

For accounting purposes under the Act, emissions are split into 'traded sector' emissions covered by the EU ETS and 'non-traded sector' emissions that do not fall under the EU ETS. The approach to accounting for traded sector emissions is defined under the Act's Carbon Accounting Regulations and explained in Scottish Greenhouse Gas Emissions 2015[43], published in 2017.

Future emissions reduction in the traded sector

The EU ETS continues to be the primary driver of emissions reductions in the traded sector in Scotland. We rely on it to drive emissions reduction from around 79 installations in Scotland (accounting for around 35% of our territorial emissions), by promoting decarbonisation in the power sector, creating price signals for long term investment, ensuring a level playing field for industry through access to an EU-wide carbon market, and by providing protection for industry against competitors outside the EU who don't bear carbon costs (carbon leakage) through free allocation of allowances.

At the time of publication, negotiations on reforms for Phase IV (2021-2032) have just concluded with the overarching principle of delivering at least a 40% reduction on 2005 EU emission levels by 2030[44].

How TIMES deals with the EU ETS

In the years to 2020 an ETS cap is imposed on the traded sector in Scotland that has been calculated using the same methodology that is employed in the Scottish Government's Greenhouse Gas Statistics. Our whole systems energy model TIMES searches for the least-cost way to meet the overarching climate change targets, as well as the EU ETS cap. In the years after 2020 our modelling includes actual emissions from the traded sector as Scotland's notional share of the EU ETS phase IV cap is yet to be determined. The EU ETS is, however, expected to continue to contribute to Scotland's emission reductions post-2020. This approach is consistent with that taken in RPP2.

The impact of the UK's exit from the European Union on the role of emissions trading is not factored into the Plan, since the UK Government has not yet (at the time of publication) taken a position on the UK's future relationship with the EU ETS, nor commenced specific negotiations on this issue. The EU ETS remains a fundamental part of UK and Scottish climate change legislation, and, as the UK Government prepares to leave the EU, the Scottish Government will continue to press for clarity on emissions trading for Scottish industry.

43 Scottish Greenhouse Gas Emissions, 2015 http://www.gov.scot/Publications/2017/06/9986/downloads

44 EU ETS, Revision for phase 4 (2021-2030) https://ec.europa.eu/clima/policies/ets/revision_en

The domestic effort target

The Act places a duty on Scottish Ministers to ensure that reductions in net Scottish emissions of greenhouse gases account for at least 80% of the reduction in the NSEA in any target year. Carbon units surrendered by participants in the EU ETS are counted as part of domestic effort for the purpose of this target, in line with international practice.

The Climate Change (Limit on Use of Carbon Units) (Scotland) Order 2016[45] means that international carbon units purchased by Scottish Ministers cannot be used to help meet targets over the period 2018-2022. In line with previous commitments, we have no proposals or policies to purchase such carbon units across the remainder of the period of this Climate Change Plan, although this does remain an option for potential future consideration. Our focus is on measures that seek to reduce our emissions at source and for the long term. We intend, therefore, that the proposals and policies will be consistent with meeting the domestic effort target in each target year without any purchase of carbon units.

Revisions to the baseline

The Scottish Greenhouse Gas Inventory provides the source of data from which the Official Statistics on Scottish emissions are compiled. The inventory is the key tool for understanding the origin and magnitudes of emissions. The Inventory is compiled in line with international guidance on national inventory reporting from the Intergovernmental Panel on Climate Change (IPCC).

The Inventory is updated every year to reflect technical improvements in the underpinning science, data and modelling. These updates result in successive revisions to the entire time-series of Scottish emissions for all years back to 1990 and the baseline period.

At the time the Act was passed, the most up-to-date inventory covered the years from 1990-2008. This is the inventory upon which the long-term targets in the Act and the first two batches of fixed annual targets covering 2010-2027 were set. Subsequent revisions to this inventory, resulting from improved science and international reporting requirements, have shown that Scotland has historically been emitting lower amounts of greenhouse gas than was understood to be the case at the time.

Consumption emissions

Consumption-based emissions are all emissions attributable to the goods and services we consume in Scotland (as opposed to the domestic emissions on which our targets are based). The Act requires that Scottish Ministers report, in so far as is reasonably practicable, the emissions of greenhouse gases (whether in Scotland or elsewhere) which are produced by, or otherwise associated with, the consumption of goods and services in Scotland. These reports on consumption emissions must be laid before the Scottish Parliament in respect of each year in the period 2010-2050, and can be accessed on the Scottish Government's website[46].

45 The Climate Change (Limit on Use of Carbon Units) (Scotland) Order 2016 https://www.legislation.gov.uk/sdsi/2016/9780111032640

46 Scottish Environment Statistics http://www.gov.scot/Topics/Statistics/Browse/Environment

The wider public sector – mandatory reporting

The Climate Change (Scotland) Act 2009 places duties on public bodies relating to climate change. Further to the Act, in 2015 the Scottish Government introduced an Order[47] requiring all 180 Public Bodies who appear on the Major Player[48] list to report annually to Scottish Ministers on their compliance with the climate change duties. The first mandatory reports were submitted on 30 November 2016. Annual reporting supports compliance with the public bodies' duties and consolidates climate change information from the public sector.

The Public Bodies Climate Change Duties Reporting mechanism provides a basis for tracking public sector action on climate change, improving data consistency and driving continuous improvement. Reports and analysis are publicly available, increasing accountability and transparency, and making it easier for the public and other parties to understand an organisation's climate performance. This in turn is helping improve leadership and engagement, while raising awareness of the impact of climate change with senior management, ensuring climate change objectives are integrated in corporate business plans and action embedded across all departments.

The reporting framework also assists better decision making and strategic planning and helps identify opportunities for financial efficiencies and cost savings. We will establish a baseline from the 2016 reporting data to identify future trends in performance.

The Scottish Government funds the Sustainable Scotland Network (SSN) to provide operational support for this reporting process as well as other climate change activities. SSN acts as a single point of contact for all public bodies on reporting, providing training and support to bodies completing their reports, coordinating returns and analysing the data.

The TIMES Whole System Energy Model

TIMES is a Whole System Energy Model (WSEM). These models aim to capture the main characteristics of an energy system and are particularly useful for understanding the strategic choices that are required to decarbonise an economy. The Scottish TIMES model is high-level, covering the entire Scottish energy system, as well as non-energy sectors, including agriculture, Land Use, Land Use Change and Forestry, and waste. It contains many thousands of variables covering existing and future technologies, fuels and abatement measures, such as availability, cost and greenhouse gas emissions factors.

The model uses this information to identify the carbon cost-effectiveness of these technologies, fuels and other abatement

47 The Climate Change (Limit on Use of Carbon Units) (Scotland) Order 2016 https://www.legislation.gov.uk/sdsi/2016/9780111032640

48 Public Sector Sclimate Change Reporting http://www.gov.scot/Topics/Environment/climatechange/publicsectoraction/publicsectorreporting

measures in order to provide a consistent comparison of the costs of action across all sectors and to develop a least-cost pathway for meeting our climate change targets. The pathway includes a set of suggested technologies, e.g. electric vehicles, fuels, such as biomass, and other carbon reduction measures, including hectares of woodland planted. TIMES also produces a set of emissions envelopes that limit emissions for each sector of Scotland's economy, in a way that is consistent with the least-cost pathway. The system-wide approach taken by the model ensures that the results are internally consistent, for example, there is a fixed amount of each resource available to the model; if more is used by one sector, then less is available to other sectors.

The pathway and envelopes suggested by the model are a guide. While the model is a powerful tool for considering the implications of changes in the energy system and non-energy sectors, it does not give a prediction of the future. Engagement with sector experts to consider the wider implications of the emissions reduction pathway has therefore been an important part of the process of developing the analysis for the Plan. The final model run underpinning the emissions envelopes presented in the Plan reflects these discussions. It should also be noted that the final envelopes are one potential option for achieving our climate change targets, and should not be considered sector targets.

Further detail on the modelling approach taken in the Plan is outlined in the accompanying Technical Annex.

A new approach

Previous reports on proposals and policies (RPP1 and RPP2) took an alternative approach, identifying abatement associated with proposals and policies and deducting this from the business-as-usual emissions trajectory, that is, the pathway emissions could be expected to follow in the absence of any action on climate change.

TIMES does not work on the basis of deducting abatement from projected emissions; instead, it identifies the most efficient parts of the system to remove carbon and allocates sector envelopes accordingly. Sectors then develop their proposals and policies to ensure their emissions remain within these limits.

The consequence of employing TIMES is that it does not present annual emissions abatement for individual proposals and policies as was the case in the two previous reports on proposals and policies. There is no counterfactual from which to deduct abatement.

Furthermore, attributing abatement to any one sector is problematic when considering the whole energy system. TIMES tells us the amount by which emissions need to fall over time to meet our targets and while it does produce suggested sector envelopes for meeting these targets, these cannot necessarily be translated into abatement by sector. For instance, does a reduction in electricity demand in one sector equate to abatement for that sector or for the electricity generation sector? Similarly does an increase in electric vehicles result in emissions abatement from transport, an increase in demand from the generation sector or a reduction in emissions from refineries? TIMES addresses this challenge by taking a system-wide view.

A constraint associated with the previous approach was that while sectors could individually consider where they could most cost-effectively abate emissions, they could not see how the impacts of their efforts compared on a consistent basis with other sectors. TIMES allows us to identify sectors of the economy that can be decarbonised most cost-effectively and to direct our efforts accordingly.

A further benefit of the TIMES approach is that the resulting pathway and sector envelopes will be internally consistent, so a demand for, say, electricity in one sector needs to be met by increased generation and any fuel required for that additional electricity generation needs to be sourced from finite supplies.

The emissions reduction pathway, when combined with further sector analysis, allows us to identify policy outcomes (such as penetration rates of low emissions vehicles or carbon intensity of energy generated at fixed time points) that need to be delivered across sectors over the 15 year period, in order to meet the statutory targets. Specifying the policy outcomes that need to be delivered, rather than simply stating our proposals and policies, improves transparency and accountability as well as enabling the public to have a better understanding of what we will achieve 'on the ground'. This will also help us in the design, costing and delivery of policies.

Providing a concrete set of policy outcomes also provides a direct link to Scottish Government action. As circumstances change, this means it will be easier to identify when we need to take informed and timely corrective action to ensure the Climate Change Plan stays on track following publication.

In the absence of abatement numbers, the verification of the projected emissions consequences of a particular policy or proposal will be provided by the results of the monitoring framework and the Greenhouse Gas Inventory. The monitoring framework will describe whether the policy outcome has occurred and the Inventory will show whether overall emissions have reduced for the relevant sector as anticipated. This makes it a more robust and more transparent approach than for previous RPPs.

Monitoring implementation of the Climate Change Plan

Monitoring the implementation of the Climate Change Plan is vital to ensure effective implementation of progress towards meeting the emissions reduction targets set under the Climate Change (Scotland) Act 2009. Our proposed monitoring framework builds on approaches to assess the previous reports on proposals and policies and on the method applied by the Committee on Climate Change to monitor progress against the UK carbon budgets and Scotland's emissions reduction targets. This monitoring framework marks a new approach to understanding the implementation of the Climate Change Plan and we will continue to develop the approach as we learn from the implementation process.

As recommended by the Scottish Parliament's Environment, Climate Change and Land Reform Committee, we have embedded monitoring into the policies across the Plan. In some sectors, there is currently limited data

available and as more data and associated monitoring arrangements are being developed, these will be incorporated into the monitoring framework. The Committee on Climate Change will also continue producing an independent statutory report on Scotland's progress towards meeting emissions reduction targets.

Developing the Monitoring Framework

The following principles have been used to design and develop this framework:

PRINCIPLE 1: The monitoring framework will focus on both policy implementation and policy outputs. This is necessary to describe progress and also to support learning and continuous improvement in policy delivery.

PRINCIPLE 2: In addition to monitoring policy implementation, progress on the development of proposals will also be monitored, where appropriate, to ensure that the Plan is on track for its longer-term goals.

PRINCIPLE 3: Our aim is to ensure that all of our policies are SMART (Specific, Measurable, Attainable, Realistic and Time limited), which will help us to monitor progress in implementation.

PRINCIPLE 4: An annual monitoring report will be published from 2018 onwards. Our intention is to publish the first annual report in October 2018 aligning it with the timing of the statutory target report on the 2016 annual target required under the Climate Change (Scotland) Act 2009. The timing of subsequent monitoring reports will be kept under review, in an effort to streamline reporting processes where possible.

PRINCIPLE 5: While the monitoring framework will apply a consistent approach across the Plan, it will be proportional in its data and indicator demands to reflect the range of different policies within the Climate Change Plan. For some sectors, data may be available annually but for others data collection may occur in two or three yearly cycles.

PRINCIPLE 6: Improvement and learning underpins the framework. We will continue developing and refining our monitoring approach and the findings from the annual report will support improvement in policy design and delivery.

Indicators

We have developed a suite of implementation and output indicators to allow us to gauge how the implementation of policies is progressing against the relevant milestones set out in the Climate Change Plan and what lessons can be learnt from this process to inform further policy development and implementation. Policy output indicators are used to identify whether we are on track to achieve our policy outcomes e.g. number of hectares of restored peatland per year. Implementation indicators are employed to check that the measures are in place to deliver the final policy outcomes e.g. number of projects approved for funding from the Peatland Action restoration project funding. The Plan describes proposals as having a potential to make a significant contribution in future years when their development allows them to be converted to policies. Where possible, the monitoring report will provide an update on the development of proposals across the Plan.

We will use the following indicators to monitor progress against the policies in the Plan:

- **Policy output indicators.** These indicators will measure progress against achieving the policy outcomes. For example, has commercial and industrial emissions intensity fallen by 30% by 2032 relative to 2015; has the electricity grid intensity reached 50g CO_2/kWh by 2020? We will use policy output indicators to determine whether implementation of the Climate Change Plan is on track and will flag any policy area that needs particular attention. In some cases it will be possible to measure the policy output indicator on an annual basis; in others it will be necessary to provide qualitative data to describe progress. Where possible, an indicative trajectory has been included for policy output indicators in the Plan. Instead of focusing on long-term trajectories which provide a high level of uncertainty, we have, where possible provided short-term trajectories for the next three to five years to drive the action required now.
- **Policy implementation indicators.** These indicators will assess the progress in policy implementation. These interim indicators allow us to check the progress of the policy towards delivering its ultimate outcome and to take action where needed. In some cases these will be measurable quantitative indicators, for example, in the electricity sector, the amount of electricity generated from renewable sources in Scotland. In other cases, these may be qualitative indicators describing progress made, for example, in the industry sector, improving the evidence base of the industrial sector in Scotland through initiatives under the Manufacturing Action Plan and SEEP.
- **Annual greenhouse gas emissions statistics.** These statistics are published every year and inform the Scottish Government's report of whether each annual emissions reduction target has been met. These statistics are the ultimate measure of our progress in meeting our overarching aim to reduce emissions. The Scottish annual greenhouse gas emissions statistics are published 18 months following the end of the year to which they relate, and reflect policies and actions implemented prior to that. Some of the data used in the monitoring framework will relate to the same time period but other data will relate to the 12 months directly preceding publication, in which case it will not be possible to directly link the data from the monitoring framework and the annual greenhouse gas emission statistics.
- **External drivers.** Policy outcomes will be achieved as a result of policies working in combination with external drivers including political, economic, technological and societal factors. For example, the UK's departure from the European Union is likely to have a significant impact across a range of policies in the Plan. Where appropriate, external drivers will be included to provide an explanation for progress, such as relevant technological advances.

- **Monitoring reserved climate policies.** Implementation of the Climate Change Plan is reliant on a combination of international, EU, UK and Scottish policy. The monitoring framework has been designed to understand and improve the delivery of Scottish Government climate policy. However, it will also capture the progress made under UK, EU and international policy direction, where relevant.
- Further indicators will be considered as the policies in this Plan mature and proposals are developed into policies. For example, Scotland's Energy Efficiency Programme (SEEP) is being developed and we will publish a route map in 2018 setting out clear milestones for the programme; the monitoring framework will be updated to take these milestones into account.

Governance of the Monitoring Framework

We made a commitment in the draft Plan to set up a Governance Body to oversee the monitoring and implementation of the Climate Change Plan. The Governance Body will have an important role in ensuring that we remain on track towards delivering our policy outcomes and continue to improve policy design and implementation.

The key functions will be:

- Reviewing monitoring information and other relevant data to assess progress against policy outcomes in the Climate Change Plan.
- Providing advice to Scottish Ministers on the monitoring information – including where significant adjustments to policy might be required and how those adjustments might be made.
- Producing an annual monitoring report for publication on the Scottish Government website.

This Body will be made up of senior Scottish Government officials representing the key sectors in the Plan, and a non-Scottish Government representative to provide an independent overview and external scrutiny of the monitoring process. The Body will report to the Scottish Ministers and may engage with and seek input or advice as appropriate from any external body including the Committee on Climate Change, who will continue to provide independent advice to the Scottish Government.

The suite of monitoring indicators in this Plan and our overall monitoring approach will be subject to ongoing review and we will continue working with the Committee on Climate Change and the Scottish Parliament to ensure robust and effective monitoring of the Plan's implementation.

PART THREE:
Sector Pathways

Chapter 1
Electricity

Fair Isle. Credit: Highlands and Islands Enterprise

The electricity sector covers generation and the wider electricity system of Scotland.

WHERE WE ARE NOW

48% fall
in electricity generation emissions between 1990 and 2015

Scotland's electricity generation mix has changed significantly since 1990 – emissions had fallen 48% by 2015, to 7.7MtCO_2e.

The volume of Scottish electricity generated from renewable sources has increased almost fourfold since 2002, accounting for 42.9% of Scottish electricity generation in 2016.

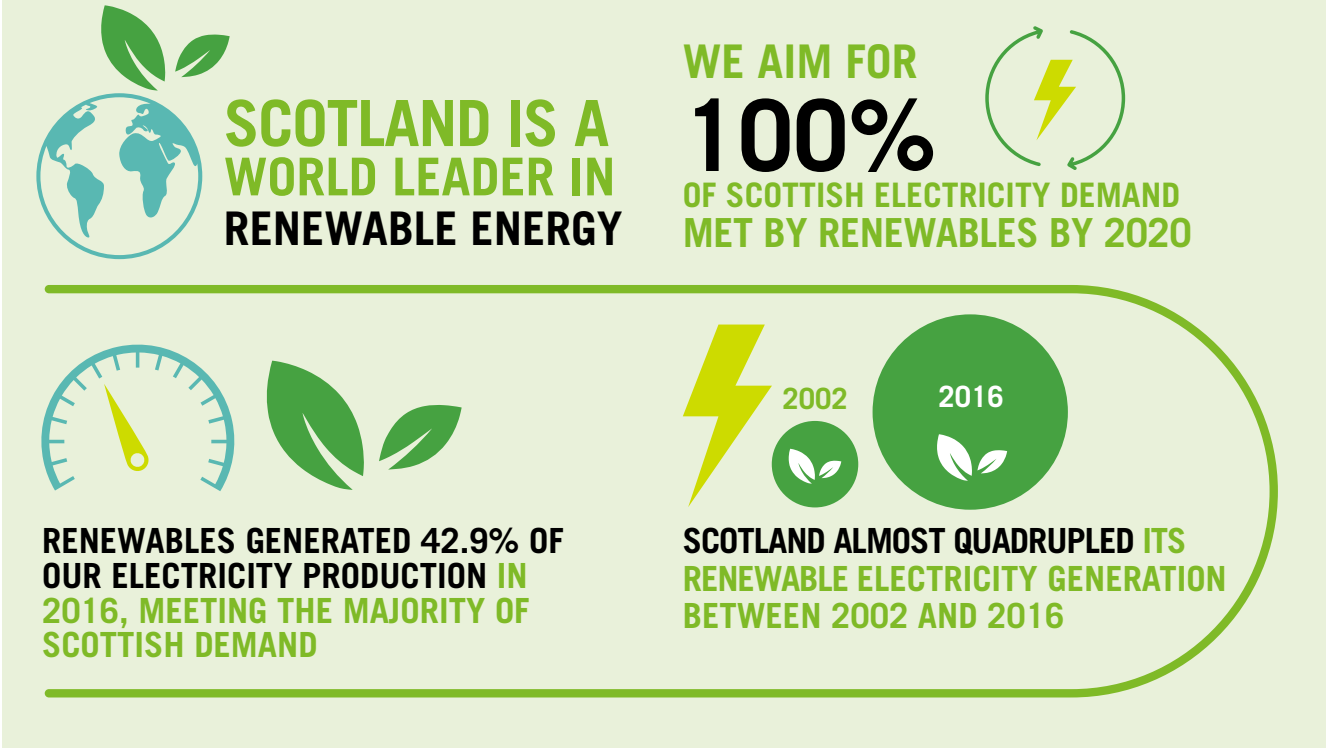
Renewables generated the equivalent of 54.0% of Scotland's electricity demand in 2016, from just over 12% in 2000 – which means we have met our interim target to deliver the equivalent of 50% of Scotland's electricity needs from renewables by 2015, with strong growth reported in the latest three quarters of 2017.

Generation located in Scotland has successfully contributed toward Scottish and UK renewable energy targets, and a large pipeline of projects remain that could continue to provide cost-effective, carbon-free generation to the GB network.

By 2016, 42.8% of Scotland's electricity supply came from nuclear energy. This represents an increase from 2007, when nuclear energy represented 25.7% of Scotland's electricity supply.

Figure 3: Electricity generation historical emissions

IN THE ELECTRICITY SYSTEM



Fossil fuel powered electricity generation as a whole has decreased from 31.9% in 2013 to 13.2% in 2016. This reflects, in part, the closure of Cockenzie coal-fired power station in 2013 and the closure of Longannet coal-fired power station in March 2016.

Scotland has consistently been a net exporter of electricity over the past decade, exporting 20% of the electricity generated in 2016 to the rest of the UK (despite the closure of Longannet Power Station) – down from 29% in 2015.

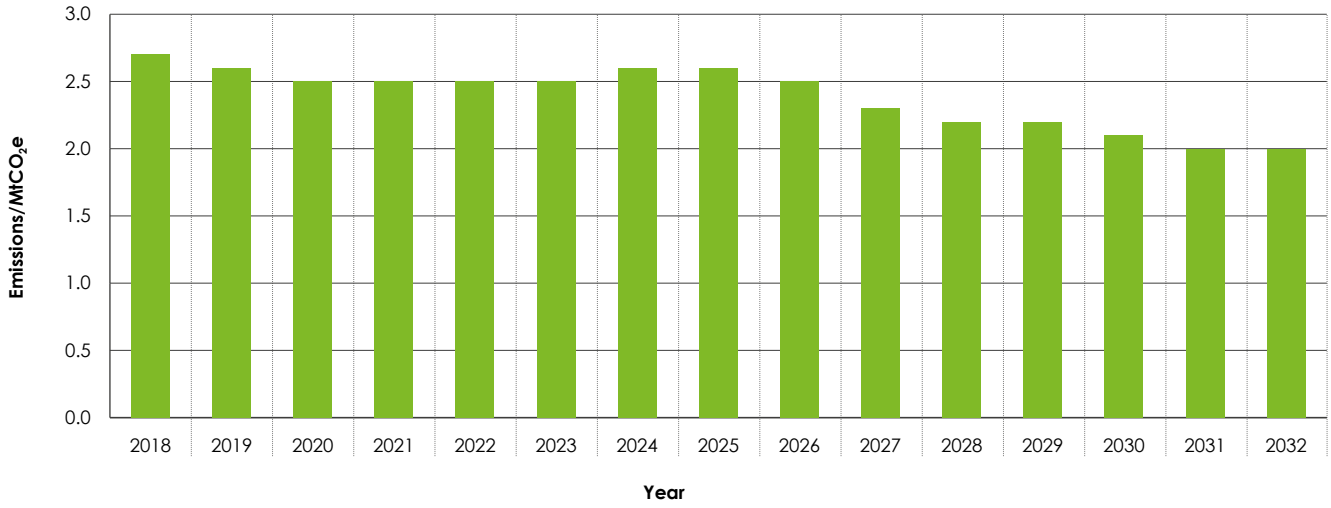
Emissions from the electricity sector are entirely covered by the EU Emissions Trading System (EU ETS).

PROGRESS SINCE RPP2

RPP2 set out the ambition to have a largely decarbonised electricity system with a grid-intensity of 50 grams carbon dioxide per kilowatt hour (gCO_2/kWh) of generation by 2030. The carbon intensity of Scottish electricity generation has reduced from 318gCO_2/kWh in 2010, to 151gCO_2/kWh in 2015. The closure of Longannet coal fired power station in 2016 will have further reduced this figure considerably, and this will be reflected when the relevant statistics become available (mid-2018). This will bring the carbon intensity figure close to the RPP2 target level.

OUR AMBITION

Figure 4: Electricity generation emissions envelopes



Our ambition for the electricity sector, as set out in this chapter, is consistent with the Scottish Government's Energy Strategy[49] published in December 2017.

In 2032, Scotland's electricity system will be largely decarbonised. The system will be powered by a high penetration of renewables, with security of supply and system resilience aided by a range of flexible and responsive technologies. Emissions are expected to fall by 28% (0.8MtCO2e) over the period covered by this Plan.

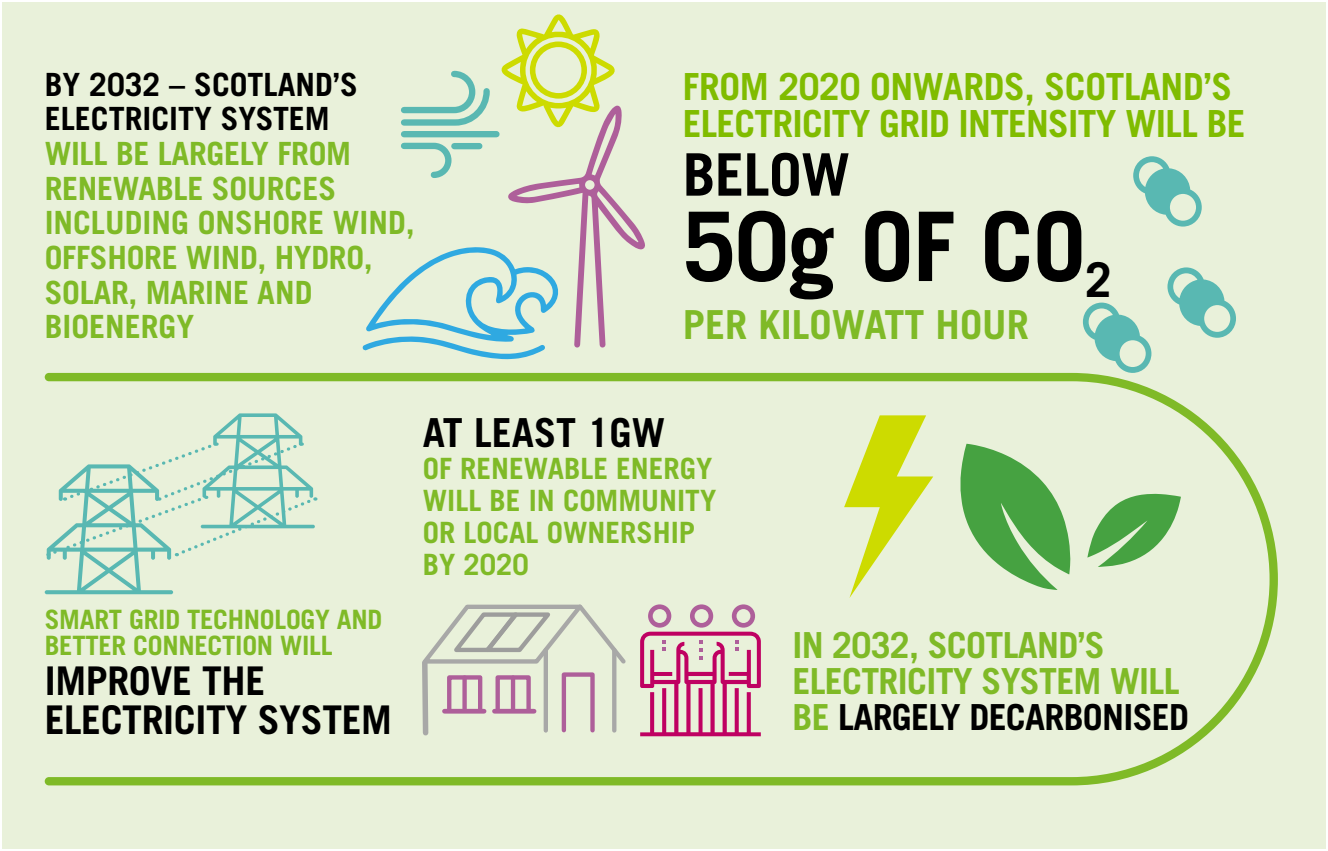
Electricity will meet a growing share of Scotland's energy needs. Alongside lighting our buildings and powering household appliances, electricity will be increasingly important as a power source for keeping our homes warm and our vehicles on the move.

Efforts to reduce demand and achieve efficiencies in Scotland's electricity use will affect the amount of electricity we consume. However, the electrification of heat and transport will place additional demands on the electricity sector and the networks that support it. As a result, the total volume of electricity supplied within Scotland will increase to 2032, based on 2015 actuals.

Our growing use of electricity will increase the value we place on a secure system that produces, stores and distributes clean, affordable electricity. Our ambition supports a diverse range of generation and storage technologies working alongside innovative, smarter networks to deliver sufficient supply and ensure an efficient, resilient system.

49 Scotland's Energy Strategy, 2017 http://www.gov.scot/Topics/Business-Industry/Energy/energystrategy

OUR AMBITIONS IN THE ELECTRICITY SECTOR



A range of renewable technologies will deliver clean, affordable electricity, including onshore, offshore and island wind, hydro, solar, marine and bioenergy. The electricity generation emissions envelope set out in this Plan allows for a renewables-dominant power system to be supported by cleaner, more efficient and flexible gas generation.

Scotland's lead in electricity network innovation will continue, allowing our networks to evolve and meet new demands in a way that delivers value for consumers. The integration of storage, smart technologies and innovative approaches to network management at scale will enable our energy assets to be used effectively, and ensure we get the greatest benefit from our generation and network infrastructure.

Carbon Capture Storage (CCS) is not required for the delivery of the electricity generation emissions envelope out to 2032. It does, however, represent the only viable technology capable of mitigating industrial scale CO_2 emissions in some of the world's most carbon intensive industrial processes. CCS may also help unlock the potential for large scale hydrogen production. The near-term demonstration of small scale CCS projects, along with the development of CO_2 Utilisation (CCU) applications, will be critical for the cost-effective decarbonisation of heat, power and industry.

We are contributing £100,000 of funding towards the feasibility study ACORN CCS Project, a small scale CCS demonstrator targeting CO_2 emissions from industrial gas–processing at St. Fergus in Aberdeenshire.

We are participants in the ALIGN-CCUS project, a European collaboration including the Netherlands, Germany, Norway, Romania, the United Kingdom, industry representatives, academics, and NGOs. Objectives are designed to enable the acceleration of CCUS in specific industrial regions, including Grangemouth and Teesside in the UK.

We are funding Scottish Carbon Capture Storage (SCCS) to carry out a programme of work to assess opportunities to support the delivery of demonstration facilities for CCS and CO_2 Utilisation on the ground in Scotland.

The UK Government holds many of the key levers necessary to bring CCS forward. We continue to press for the right policy and framework to be put in place to support this technology. Scottish Government officials are participating in the UK Government's recently formed Ministerial-led CCUS Council and the CCUS Cost Reduction Taskforce.

The United Nations Inter-Governmental Panel on Climate Change (IPCC), the International Energy Agency (IEA) and the Committee on Climate Change have all identified CCS as an essential lowest cost climate mitigation technology. The IPCC Fifth Assessment Report[50] states that it would cost 138% more to achieve a 2°C scenario without CCS.

50 IPCC, Fifth Assessment Report https://www.ipcc.ch/report/ar5/

Our ambition will be realised as part of a long-term process of sector development. This is largely a reserved area of policy, with key regulatory changes determined and implemented by the regulator, Ofgem. We will seek to influence and guide changes to market and regulatory arrangements and encourage technical innovation in a manner that supports our policy aims and delivers a positive outcome for the Scottish electricity sector.

We will continue to work with the UK Government and Ofgem to promote a smart, flexible energy system and support investment in low carbon electricity by working with our public sector partners and industrial trade associations.

POLICY OUTCOMES, POLICIES, DEVELOPMENT MILESTONES AND PROPOSALS

Policy outcome1:

From 2020 onwards, Scotland's electricity grid intensity will be below 50 grams of carbon dioxide per kilowatt hour. The system will be powered by a high penetration of renewables, aided by a range of flexible and responsive technologies.

There are two policies, five policy development milestones and five proposals from the Energy Strategy which will contribute to the delivery of policy outcome 1.

Policies which contribute to the delivery of policy outcome 1

1) Support the development of a wide range of renewable technologies by addressing current and future challenges, including market and policy barriers.

The Scottish Government's ability to influence the future energy mix is limited, as the relevant support and market mechanisms

are under the UK Government's control. The Feed-In Tariff, the Renewables Obligation and Contracts for Difference (CfD) are UK-wide subsidy schemes that provide a route to market for renewable electricity projects.

The UK Government's Clean Growth Strategy (October 2017) has committed up to £557 million for further Pot 2 CfD auctions from 2019. This will provide an opportunity to support the deployment of less established renewable technologies in Scotland. These include offshore wind, island wind (subject to State Aid approval), marine technologies, advanced conversion technologies, anaerobic digestion and biomass with combined heat and power, although the Scottish Government knows that minimal ring fenced funds could have been set aside for marine and other less well established technologies that may struggle to compete with offshore wind.

To accommodate UK subsidies, we have a suite of renewable policies and levers designed to maximise the support available to the renewable energy industry in Scotland.

Scotland is leading the way across the UK in its support for community and locally owned energy, providing comprehensive support, available under our Community and Renewable Energy Scheme (CARES). Since 2013, £45 million has been made available through CARES, to support almost 600 operational community and locally-owned energy projects, of which 265 were community schemes. The main components of CARES are local energy ownership and shared ownership, both of which are facilitated through a range of interventions from start-up grants to pre- and post-planning loans, and by bespoke advice and support free at the point of use.

Over the past four years, the Renewable Energy Investment Fund (REIF) has given vital support to most of the major projects deployed in the community energy sector in Scotland. Scottish Enterprise has worked closely with the CARES contractor Local Energy Scotland, and with other partners, including Social Investment Scotland and commercial lenders, to facilitate deals and streamline diligence costs. REIF has also been vital to the development of the marine energy sector in Scotland, and has been recognised in Europe in this regard as a template for investment. To date, £60 million has been invested through REIF to support over 30 projects, leveraging in more than twice this amount in private investment.

Under section 36 of the Electricity Act 1989, the Scottish Government determines renewable electricity applications for projects with an installed capacity of over 50 Megawatts. Below this threshold, decisions are made by the relevant local authorities under the provision of the Town and Country Planning Act 1990.

The Scottish Government has taken a number of steps through planning policy and the consenting process to ensure renewable technologies are located correctly, minimising the impacts on environmental and residential amenities.

We have supported offshore wind development in deeper waters through an enhanced level of support under the Renewable Obligation (Scotland) Order, leading to the deployment of the world's first floating offshore wind farm and the development of the European Offshore Wind Development Centre in Aberdeen, with further consented projects in the pipeline.

We have supported innovation and cost-cutting in the sector, by hosting and providing financial support for the work of the Offshore Renewable Energy Catapult (OREC). Wave Energy Scotland (WES) was established at the end of 2014 and has allocated over £25 million to support projects around Europe. WES provides up to 100% funding for the development of innovative technologies to produce low cost, efficient and reliable components and subsystems. It is fully funded by Scottish Government and delivered by Highlands and Islands Enterprise (HIE).

The participation of the Scottish Government in the Carbon Capture Utilisation and Storage (CCUS) Council and Taskforce, proposed in the UK Clean Growth Strategy document (October 2017), to produce a deployment pathway for CCUS in 2018 will ensure that Scotland's priorities, opportunities and interests, such as the preservation of critical infrastructure and the demonstration of CCS pilot projects in Scotland, are reflected in this work.

2) Support improvements to electricity generation and network asset management, including network charging and access arrangements that encourage the deployment and viability of renewables projects in Scotland.

Scotland has been at the forefront of network innovation, with Active Network Management schemes operated by the network companies now 'business as usual'. Smart technologies and innovative approaches to network management are enabling network and generation assets to be used more effectively. This delivers benefits as capacity and constraints on Scotland's networks are better managed, generators are offered faster and cheaper connections, and consumers avoid paying for costly grid reinforcements.

Continued progress in this area will help secure the greatest benefit from network infrastructure and investment, supporting the connection of more renewable capacity. The evolution of Distribution Network Operators (DNOs) to Distribution System Operators (DSOs) will play a key coordinating role in ensuring we maximise the benefits of transitioning to a low carbon energy system. This is likely to see the current DNOs take on additional roles and responsibilities and play a more active role in facilitating the matching of local supply with local demand. The development of DSOs raises a number of regulatory and policy issues that need to be explored and understood to ensure that future DSOs are able to meet the needs of consumers and society. These issues include the split of roles and responsibilities between industry parties, and the design of new governance and commercial arrangements.

These are being considered through industry and Ofgem-led processes, in which the Scottish Government will remain actively engaged.

Both Ofgem and National Grid as the System Operator are currently pursuing comprehensive reviews of network charging, with Ofgem considering future network access arrangements. These often act as a barrier to renewables deployment in Scotland. For example, current transmission network charging arrangements (reserved to the UK Government) do not account for the reality that many of the best renewable energy resources are far from centres of

demand, or that certain system requirements have strong locational characteristics.

Forthcoming changes to the charging regime and network access arrangements could have a significant impact on renewable energy investment in Scotland.

The Scottish Government will play an active part in these and future reviews. We will engage with stakeholders and the key determining bodies to ensure that the potential impacts on Scotland's energy system are understood and that Scotland's interests and energy ambitions are well represented in decision-making processes.

Policy development milestones

1) UK Government delivers a viable route to market for a wide range of renewable technologies, including onshore wind in Scotland, and provides long term funding for projects commissioning after 2025 under the Levy Control Framework.

The Scottish Government will continue to make the case to the UK Government for a stable, supportive regulatory regime that provides appropriate support for investment in renewable energy. This will include the need for a route to market for lowest cost renewable technologies, including onshore wind.

We will press the UK Government to provide clarity on the Levy Control Framework post-2025 to ensure long-term support and certainty for investment in the renewables sector.

We will also continue to pursue policies and goals within our own gift to secure this route to market, and to ensure that as wide a range of onshore and offshore renewable technologies as possible are able to develop in the right places – securing as much economic and industrial benefit for Scotland as possible.

2) The £557 million CfD budget for Pot 2 technologies delivers new renewable generation capacity in Scotland, including on the remote islands.

The Scottish Government will work with the UK Government, industry, local authority partners and communities to maximise the support available to Pot 2 renewable technologies in Scotland.

3) By 2020, at least 1GW of renewable energy will be in local or community ownership.

CARES will support Local and Community Owned Energy projects, including through a focus on opportunities for community stakes in commercial schemes.

4) Successful delivery of Renewable Energy Investment Fund (REIF), Community and Renewable Energy Scheme (CARES), and Low Carbon Infrastructure Transition Programme (LCITP).

REIF and CARES will continue to build on their success to date, and to be ready to adapt to meet emerging priorities and market changes. By 2018, the LCITP will have supported a large number of projects to demonstrate technologies that will deliver low carbon energy solutions.

5) The evolution of Distribution Network Operators to Distribution System Operators.

We will continue to work with all energy stakeholders, the regulator and UK Government to ensure that future electricity network arrangements meet the needs of Scotland's energy system and society.

Case Study

Garmony hydro scheme.
Source:
Community Energy Scotland

Mull's ACCESS (Assisting Communities to Connect to Electric Sustainable Sources) project shows how communities can develop local electricity networks in areas where the grid has limited capacity to connect renewable generation.

Mull has rich resources of renewable energy, but limited access to the national grid. ACCESS aims to balance local generation with local demand on the distribution network level, a model that has great potential for the future of electricity supply and demand in Scotland.

The Mull and Iona Community Trust have worked with Community Energy Scotland to develop a local network that offers benefits to local homes and businesses, in an area which is off the gas grid and therefore dependent upon heating oil or electric storage heaters.

Renewable energy from the Garmony hydro scheme is used locally, balanced with local demand by a smart distribution network developed for the project.

The ACCESS project will demonstrate these new distribution network technologies and develop financial models with the potential to be duplicated across Scotland, reducing fuel poverty and supporting renewable energy.

Policy proposals

The Scottish Energy Strategy contains proposals that will increase the level of renewable electricity generation, including new targets and commitments to continue supporting the key renewable generation technologies. These include:

1) A new renewable, all energy consumption target of 50% by 2030, covering electricity, heat and transport.

2) Renewed efforts to secure routes to market for a range of renewable technologies.

3) The development of a whole-system bioenergy action plan.

4) Continued support for offshore wind development and innovation.

5) Renewed focus on developing local energy systems and models.

Monitoring

Policy output indicator for policy outcome 1

1) For the duration of the Plan Scotland's electricity grid intensity will be below 50g CO_2 per kilowatt hour, powered by a high penetration of renewable technologies, including onshore wind, offshore wind, island wind, hydro, solar, marine and bioenergy.

Year	2018	2025	2032
Electricity Grid Intensity (g CO_2 per kilowatt hour)	Below 50	Below 50	Below 50

Policy outcome 2:

Scotland's energy supply is secure and flexible, with a system robust against fluctuations and interruptions to supply.

There is one policy, six policy development milestones, and five proposals from the Energy Strategy which will contribute to the delivery of policy outcome 2.

Policy which contributes to the delivery of policy outcome 2

1) We will support the development of a range of technologies in Scotland that aid system security, flexibility and resilience.

We will support the deployment of a wide range of generation technologies in Scotland to allow for a high penetration of renewables and provide a resilient, secure and flexible power system.

We will continue to press the UK Government for changes to the transmission charging regime and wider market arrangements that improve the prospects for new gas-fired generation in Scotland. Cleaner, more efficient and flexible gas-fired generation is a natural complement to a high renewables future. Gas-fired generation can be scheduled and controlled, meaning that it can be instructed to power up or down depending on rising or falling demand. It provides "synchronous" power, helping to maintain a stable frequency across the network and increase its resilience. The location of synchronous generation throughout the network provides system-wide benefits – but this locational value is not fully reflected in existing charging and market mechanisms. Stronger and fairer

location incentives and signals will help realise a resilient, low carbon electricity system in Scotland. Policy outcome 1, for Scotland's grid intensity to remain below 50 grams of carbon dioxide per kilowatt hour, allows for continued gas-fired generation in Scotland.

The application of storage technologies will be strategically important and can deliver real benefits for Scotland. Storing electricity offers the opportunity to firm up renewable generation, provide ancillary services, and support further renewables deployment in areas where network capacity is limited or weak. Delivery of the UK Smart Systems and Flexibility Plan[51], jointly published by BEIS and Ofgem in July 2017, includes a strong commitment to improve the prospects for and uptake of electricity storage. We will work with BEIS and Ofgem to deliver a Plan that works for Scotland. We will continue to support innovation and the deployment of storage by working with the energy sector and academic stakeholders on steps to accelerate the penetration of storage across Scotland.

We will support industry calls for the UK Government to deliver a level-playing field for Pumped Storage Hydro (PSH) and de-risk investment for new projects. PSH is a proven technology that can deliver flexibility at scale. Scotland's existing pumped hydro stations will continue to operate, providing electricity supply and ancillary services. Further investment in PSH will greatly enhance the flexibility and resilience of our electricity network and power supplied. Several Scottish sites identified for future investment are able to more than double current GB capacity, with significant benefits in terms of enhancing GB's 'black start' capacity.

Scotland's long-standing interconnection with England and Northern Ireland will continue. This will enable Scotland to benefit from and contribute towards the operation of a GB-wide electricity market. This will be complemented by enhanced interconnection with other power markets and networks. Increased interconnection can facilitate lower electricity prices, support the transition to a low carbon economy and increase diversity of supply. There are currently several UK interconnector projects at various stages of development. These include the NorthConnect cable that would enable renewable electricity to be traded directly between Scotland and Norway.

Paired with CCS, natural gas has the potential to be used in future to provide low carbon flexible power generation. The successful deployment of CCS, alongside the development of gas from plant material and biomass waste, has the potential in the longer term to deliver an overall emissions envelope for electricity which removes carbon dioxide from the atmosphere. We are supporting Scottish Carbon Capture Storage (SCCS), the largest CCS research group in the UK, to continue important research and studies in this field. We are contributing funding to the ACORN Project, which is completing detailed feasibility work on the

51 Upgrading our Energy System: Smart Systems and Flexibility Plan, 2017. Ofgem/BEIS: https://www.ofgem.gov.uk/system/files/docs/2017/07/upgrading_our_energy_system_-_smart_systems_and_flexibility_plan.pdf

practicalities of repurposing existing assets for CCS in Scotland. We will continue to build on Scotland's world-renowned academic and research reputation, including the links between the Scottish Government and European projects proposed in the North Sea Basin in Norway and the Netherlands, and applying the learning from the collaborative CCUS research work being developed in Guangdong Provence in China.

Policy development milestones

1) Delivery of UK Smart Systems and Flexibility Plan[52] jointly published by BEIS and Ofgem in July 2017, which encourages storage, flexibility and demand-side response.

New regulatory and commercial arrangements allow flexibility for technologies to compete fairly in the market. These arrangements should support the benefits of a smart, flexible energy system being captured across the GB energy system, especially in areas where significant value can be derived.

2) Changes to regulatory and market mechanisms that provide a sufficient and fair incentive to maintain – or to invest in new – synchronous generation in Scotland, such as efficient thermal generation.

Changes to current market and regulatory arrangements, which are reserved to the UK Government, support a spread of synchronous generation across GB and in Scotland.

3) New investment in Scotland's Pumped Storage Hydro potential.

Strategic investment in Scotland's Pumped Storage Hydro is brought forward, which requires progress on providing investor certainty on routes to market.

4) Increased GB interconnection with other power networks and markets.

Ofgem's cap and floor regime has encouraged investment in electricity interconnectors, with current GB capacity set to double by the mid-2020s. We will continue to work closely with projects such as NorthConnect, and consider its potential economic and supply chain benefits for Scotland, as well as its implications for investment in domestic capacity and security of supply.

5) The evolution of Distribution Network Operators to Distribution System Operators.

DSOs will play an important coordinating role in maximising the benefits of our transition to a low carbon power system.

6) Encouraging the demonstration and commercialisation of Carbon Capture and Storage (CCS) in Scotland.

CCS depends upon a committed and robust policy framework from the UK Government to support the delivery of this technology. The UK Government has committed in its Clean Growth Strategy (October 2017) to set up a Ministerial-led CCUS (Carbon Capture Utilisation & Storage) Council, and to

52 Upgrading our Energy System: Smart Systems and Flexibility Plan, 2017. Ofgem/BEIS: https://www.ofgem.gov.uk/system/files/docs/2017/07/upgrading_our_energy_system_-_smart_systems_and_flexibility_plan.pdf

convene a CCUS Cost Challenge Taskforce to produce a deployment pathway in 2018. The participation of the Scottish Government in these groups, working closely with the Department of Business Energy and Industrial Strategy (BEIS), will ensure that Scotland's priorities, opportunities and interests such as the preservation of critical infrastructure and the demonstration of CCS pilot projects in Scotland are reflected in this work.

Policy proposals

The Energy Strategy underlines our determination to work with the UK Government, electricity sector, the regulator, grid owners and system operator to maintain a balanced and secure electricity supply and system.

The Strategy includes proposals to:

1. **Press for market mechanisms and incentives which recognise locational value, and which do not create undue barriers for investment in Scotland.**
2. **Collaborate on actions to support investment in new pumped storage hydro capacity.**
3. **Work with all parties to secure maximum benefits from the move towards smarter and more flexible electricity systems and networks.**
4. **Support innovation and deployment of storage technologies and capacity.**
5. **Ensure that increased interconnection enhances Scottish system security while considering effects on domestic capacity and investment.**

Monitoring

Policy output indicator for policy outcome 2

1) Scotland's energy supply is secure and flexible, with a system robust against fluctuations and interruptions to supply.

Over the period of the Climate Change Plan, Scotland's energy system will evolve and the Scottish Government will use all available levers, while collaborating with and influencing all key stakeholders and partners, to ensure that the regulatory and technological changes support a robust and flexible system that meets the needs of people in Scotland. These changes will be regularly monitored and reported on as part of the overall monitoring framework.

Implementation indicators for policy outcomes 1 and 2

1) Increase amount of electricity generated from renewable sources in Scotland.

2) Increase the installed capacity of sites generating electricity from renewable sources in Scotland. By 2030, it is expected that the installed capacity of renewable electricity generation sources will be between 12GW and 17GW.

3) Increase total community and locally owned renewable energy capacity operational, and in development, in Scotland.

4) Increase total renewable capacity in Scotland by planning stage.

5) Increase the share of electricity generated from renewable sources, as a proportion of total electricity generated in Scotland.

Explanation for selection of indicators

- Continued growth in renewable generation sources will reduce the carbon emissions from electricity generation.
- An increased penetration of installed renewable capacity will contribute to reducing the carbon intensity of Scotland's electricity grid.
- The Scottish Government wishes to maximise the benefits for communities from renewable energy and believes that a community can gain from renewable projects, over and above the energy generated and financial benefits.
- The number and installed capacity of renewable generation installations in the planning pipeline gives an indication of the future level of penetration of these generation technologies in the energy mix in Scotland.
- Increasing the share of electricity generated from renewable sources as a proportion of total electricity generated highlights the increase in low carbon generation compared to fossil fuel generation.

ENABLING FACTORS AND WIDER IMPACTS

There are wider benefits for consumers and businesses arising from a smarter, more flexible energy system. The National Infrastructure Commission estimates that a 'smart' system could provide gross benefits to consumers of between £3 billion and £8 billion a year to 2030, consistent with the outcomes of other research in this area. Scottish companies and academic institutions have been active early in the smart sector, and there is the potential to secure economic benefits if the pace of change is maintained.

£3-£8 billion a year
to 2030 estimated gross benefit delivered to consumers from smart grid electricity system.

The costs of renewable electricity generation technologies have steadily fallen in recent years, and the results of recent power auctions have signalled that cost reductions are set to continue into the 2020s.

Recent analysis conducted by the International Renewable Energy Agency[53] found that renewable power is becoming an increasingly competitively priced way to meet our electricity needs. Between 2010 and 2017, the cost of generating electricity from solar PV fell by over 70%, from onshore wind by around a quarter and from offshore wind by 18%. Among the main drivers of these cost reductions have been falling technology costs, technology improvements, competitive procurements and a larger base of internationally experienced project developers.

Investment to enhance the competitiveness and productivity of Scotland's low carbon electricity generation and network sector will contribute to the Scottish Government's wider objectives of sustainable economic growth. This will ensure that highly skilled employment opportunities continue to be located in Scotland, benefiting all people across Scotland, in both urban and rural areas.

Scotland is recognized internationally as a knowledge hub for energy exploration and production, for power system engineering and a host of modern, renewable energy

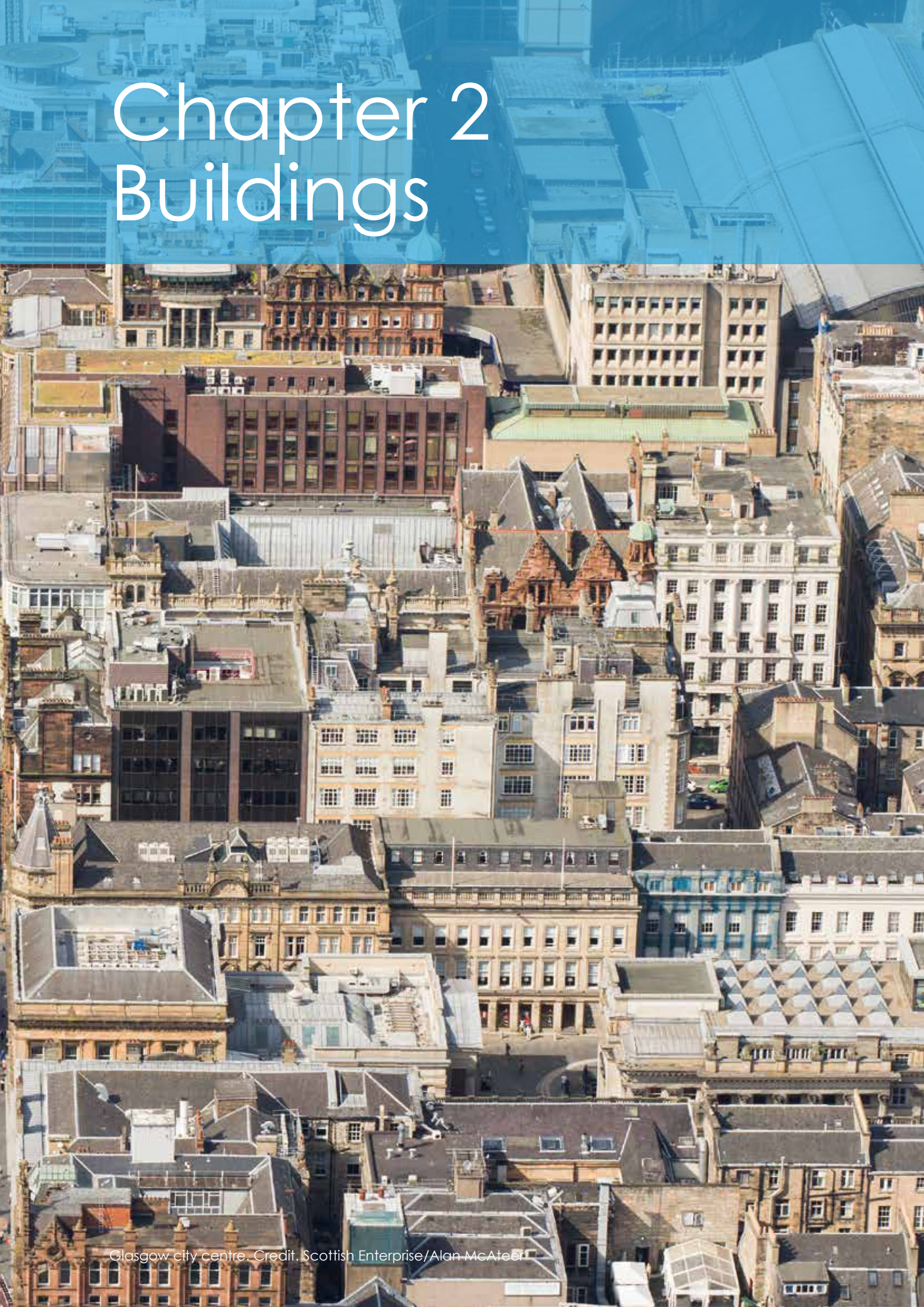
53 IRENA Renewable Power Generation Costs in 2017

technologies and systems. We are at the forefront of the challenge to decarbonise the global economy. We wish to combine the mutual strengths, capacities, skills and ideas of communities, industry, and other stakeholders in shaping and delivering Scotland's future energy system.

As with any industry requiring significant capital investment, there may be the potential for impacts to arise from the construction, operation and decommissioning of new renewable or low carbon developments (e.g. risks of impacts to air, soil, water, biodiversity and visual impacts to cultural heritage and landscape, displacement of other land or marine users, amongst others).

The Scottish Government will continue to ensure that adverse impacts are considered as part of the planning process, and that developments are permitted in the appropriate locations.

Chapter 2
Buildings



Glasgow city centre. Credit. Scottish Enterprise/Alan McAteer

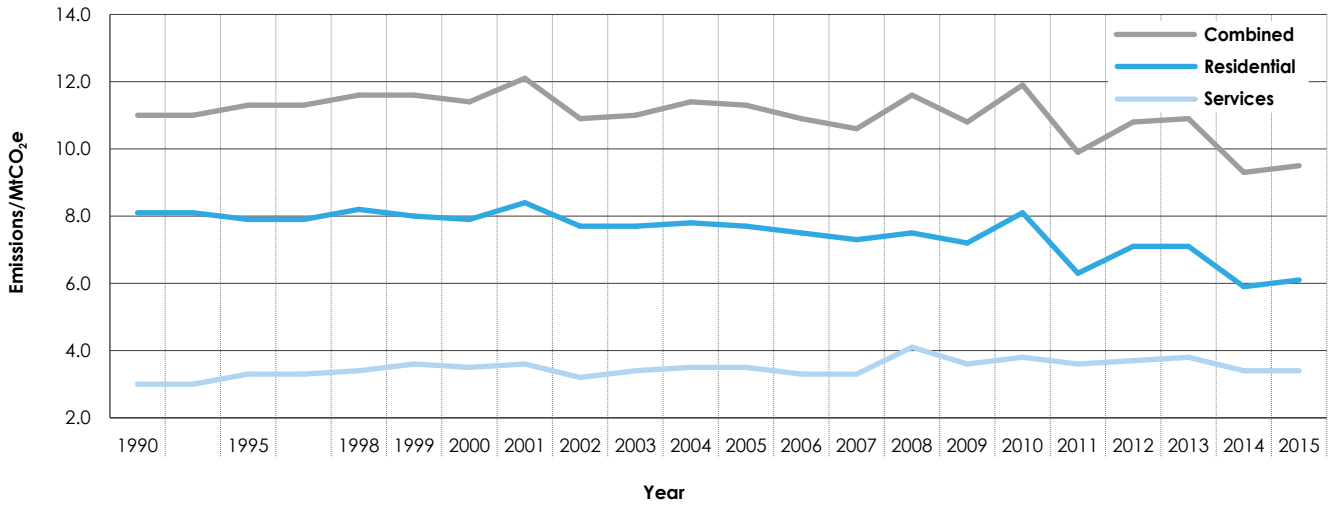
This chapter combines the residential sector (all of Scotland's housing including owner occupied, private and socially rented homes) and the services sector (all non-domestic buildings in the public and commercial sectors).

The majority of emissions from buildings are generated by the use of energy, particularly for space and water heating in the residential and services sectors, and cooling in the service sector.

In the draft Climate Change Plan and in previous Reports on Proposals and Policies, the residential and services chapters were presented separately. However, in 2015 Ministers designated energy efficiency as a National Infrastructure Priority and committed to the development of Scotland's Energy Efficiency Programme (SEEP), which is an integrated approach to improving the energy efficiency and supporting decarbonisation of the heat supply across the residential and services sectors. As such the residential and services chapters have been brought together as a single 'Buildings' chapter in order to better articulate our integrated policy response. The pathway graph below shows all pathways – residential, services and combined.

WHERE WE ARE NOW

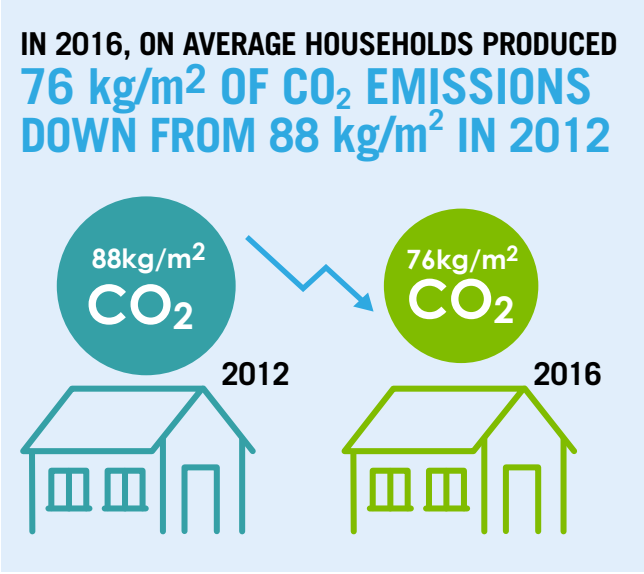
Figure 5: Buildings historical emissions



Emissions from Scotland's buildings in 2015 were 9.5MtCO$_2$e, accounting for about 20% of the total. Between 1990 and 2015 emissions from Scotland's buildings had fallen by 14%. Of these, emissions from residential buildings in 2015 were 6.1MtCO$_2$e, or about 13% of Scotland's emissions. Residential emissions have fallen 24% between 1990 and 2015, although they vary annually, driven by the severity of winter weather which fluctuates from year to year. Since 2009 when the Climate Change (Scotland) Act was passed, emissions have fallen by 15% – a reduction of 1.1MtCO$_2$e.

In the services sector total emissions in 2015 were 3.4MtCO$_2$e. Since 2009 when the Climate Change (Scotland) Act was passed emissions have fallen by 6%.

In 2016 there were 2.58 million residential dwellings in Scotland. The residential sector is very diverse varying in tenure, age, primary heat source and level of energy efficiency. In total, 23% of Scotland's occupied homes are socially rented, 15% privately rented and 61% owner occupied. It is likely that more than 80% of housing in use today will still be in use in 2050. Three-quarters of our homes were built before 1982 and one-fifth before 1919. Space heating and the provision of hot water account for over three-quarters of the energy we use in our homes. At present 79% of households use mains (natural) gas as their primary heating fuel, 11% of households use electric heating, 6% oil, while the remainder use other fuels such as biomass.



The energy efficiency of Scotland's homes has improved in recent years. In 2016, around two fifths (39%) of homes achieved an EPC rating of Band C or above. Scotland now has, proportionately, 32% more homes with the top three EPC ratings (A-C) than England[54]. The Scottish House Condition Survey (SHCS) estimates that, in 2016, 94% of lofts had at least 100 mm of insulation, while the proportion of dwellings with cavity walls (which constitute 75% of the housing stock) recorded as insulated by the SHCS increased from 62% in 2010 to 72% in 2016. For the remaining 25% of dwellings, which have solid or other wall types, the proportion with insulation was 15% in 2016.

Historical data on the profile of non-domestic building stock for the services sector, and its energy use, is limited. An increasing amount of data is now available for those non-domestic buildings which have already had an EPC assessment, as required by the EU Energy Performance of Buildings Directive 2004, for the period since data was first recorded in 2013. The Scottish Government is undertaking analysis to establish a baseline for the energy efficiency of Scotland's non-domestic buildings. This work is due to be completed in 2018 and will be essential in helping monitor improvements in energy efficiency and in supporting the further development of policies targeted at the non-domestic sector.

54 Scottish House Condition Survey, 2016 and English Housing Survey, 2016-17, based on SAP 2012.

PROGRESS SINCE RPP2

This section sets out the progress that has been made since the publication of the second report on proposals and policies (RPP2[55]) in 2013.

Smart meters

The rollout has commenced and 4.2 million meter installations have taken place across the UK. Some meters being rolled out do not meet the highest specification due to delays by the Data and Communications Company, who provide the communications platform for the technology. The Scottish Government supports the aims of the smart meter rollout, however, we continue to press the UK Government to ensure that the programme is delivered to the greatest number of Scottish consumers, at the lowest possible cost, while enhancing the benefits to the most vulnerable in our society and those at risk of fuel poverty.

We are keen to maximise the opportunities presented by the programme and are exploring the potential for synergies across energy efficiency programmes, including through encouraging signposting to Home Energy Scotland at installation stage and funding Home Energy Scotland to use smart meter data to improve customer's understanding of their consumption patterns and help reduce energy bills.

Domestic Building Energy Standards (2010) New Build Properties

This policy was implemented in 2010 and results in lower emissions from new buildings. Standards set under this policy were further strengthened by a subsequent review which introduced further improvements to energy standards in October 2015 (see RPP2 proposals). Improved energy standards encourage both innovation and the deployment of low carbon solutions in construction.

Renewable Heat Incentive (RHI)

The Scottish Government, through its various programmes, fully endorses and actively promotes the GB-wide RHI scheme to the benefit of householders and businesses across Scotland. Programmes include the Resource Efficient Scotland's Small and Medium Enterprise Loan Scheme (SMEL), which, as of February 2018, provides a cashback incentive for energy efficiency measures in non-domestic buildings. The Home Energy Scotland Loan Scheme (HESL) which is administered by the Energy Saving Trust (EST), was amended in May 2017 to allow for an increased loan amount available for the installation of renewable technology, and since then these loans are also interest free. Scotland currently accounts for 19% of all accreditations under the non-domestic scheme and 20% of accreditations under the domestic scheme, well above pro-rata. The Scottish Government will monitor the supply of wood pellets for domestic biomass systems as part of its wider approach to the bioenergy sector in Scotland, which will include the development of a Bioenergy Action Plan.

55 Low Carbon Scotland: Meeting our Emissions Reduction Targets 2013-2027. The Second Report on Proposals and Policies http://www.gov.scot/Publications/2013/06/6387

Energy Company Obligation (ECO) and Green Deal

Scotland has received more than its proportionate share of ECO measures, with latest statistics showing that by the end of June 2017 nearly 260,000 measures had been installed in Scotland, representing 12% of all ECO measures across Great Britain, which is above Scotland's population share of 9%. The UK Government ceased funding for the Green Deal Finance Company in July 2015, effectively bringing an end to the Green Deal, which had significantly underperformed against the UK Government's expectations.

Home Energy Efficiency Programmes for Scotland

Our Home Energy Efficiency Programmes for Scotland (HEEPS) has made available over £500 million since 2013 (including the budget for 2018-2019) in tackling fuel poverty and improving the energy efficiency of Scotland's housing stock. It has also leveraged additional funding from the Energy Company Obligation and the public sector of over £400 million to date. Including 2017-2018 activity, almost 120,000 households in Scotland will have received an energy efficiency installation through HEEPS contributing to a reduction in domestic CO_2 emissions and helping to save millions of pounds from fuel bills.

The SEEP transition will build on the success of HEEPS and will offer local authorities incrementally greater opportunities to deliver integrated energy efficiency projects.

District Heating Loan Fund

Since 2011, the District Heating Loan Fund has offered capital loans to support the development of district heating networks in Scotland. The scheme is available to provide loans for both low carbon and renewable technologies in order to overcome a range of technical and cost barriers. To date, we have offered over £12 million in loans to 45 projects.

CRC Energy Efficiency Scheme

The UK Government announced in the March 2016 Budget its intention to abolish the CRC and replace it with increased rates of Climate Change Levy (CCL) and a new business energy reporting framework, commencing from 2019. The 2016 announcement only gave detail on the CCL rates for 2019-2020, and the UK Government announced in the November 2017 Budget that the subsequent CCL rates for 2020-2021 and 2021-2022 would be set in the 2018 budget. The proposed new energy reporting framework for the private sector was subject to consultation by the UK Government in December 2017 and the corresponding UK Regulations are expected to be introduced in 2018.

EU Products Policy

EU Products Policy is addressed through the Eco-design Framework Directive. An important element of this is improving the energy efficiency of products. This reduces electricity consumption and heat output. The emissions savings from using less electricity are factored into the Plan calculations in the electricity sector. The reduced heat output is shown in this section, reflected in a slight increase in emissions resulting from compensatory use of space heating. The overall effect, however, is to reduce total emissions. These policies continue.

Low Carbon Heat

The Scottish Government published the Heat Policy Statement (HPS) in June 2015, setting out our heat hierarchy, and the actions and policies we are taking to reduce demand for heat and ensure its decarbonisation. The development of SEEP will continue to deliver the actions set out in the HPS, alongside those in the Scottish Energy Strategy, including ongoing support for the Heat Network Partnership and funding for district heating via the District Heating Loans Fund.

Domestic Buildings Energy Standards (2014) New Build Properties

This proposal is now a policy, implemented in October 2015, and is delivering intended outcomes. Emissions from new homes are now in the region of 75% lower than for buildings constructed to the standards applicable in 1990. Standards continue to encourage both innovation and the deployment of low carbon solutions in construction.

Regulation of Private and Social Housing

The Energy Efficiency Standard for Social Housing (EESSH) is currently being reviewed to consider progress towards 2020 and the setting of any subsequent milestone(s) towards 2050. Consultation was undertaken in the first half of 2017 on energy efficiency standards in the private rented sector. The Minister for Housing and Local Government informed the Local Government and Communities Committee in November 2017 that standards would be set out in the SEEP route map to be published in 2018. Proposals will allow for an appropriate lead in time for the sector to prepare. Following public engagement over winter 2017-2018, the SEEP route map will also set out how the Scottish Government will incentivise energy efficiency in owner occupied homes

New build Non-Domestic Energy Standards for 2014

This proposal is now a policy, implemented in October 2015, and is delivering its intended outcomes. Our higher energy standards for new non-domestic buildings are resulting in emissions approximately 75% lower than for buildings constructed to the standards applicable in 1990.

Assessment of Energy Performance and Emissions Regulations (Non-Domestic Buildings)

This proposal is now a policy. Since September 2016, The Assessment of Energy Performance of Non-Domestic Buildings (Scotland) Regulations 2016 require owners of buildings over 1,000m² offered for sale or rental to assess, and ultimately improve, the energy performance and emissions of their building. Under these initial regulations, improvement may be deferred by reporting of annual operational energy use.

Public Sector (Additional Potential)

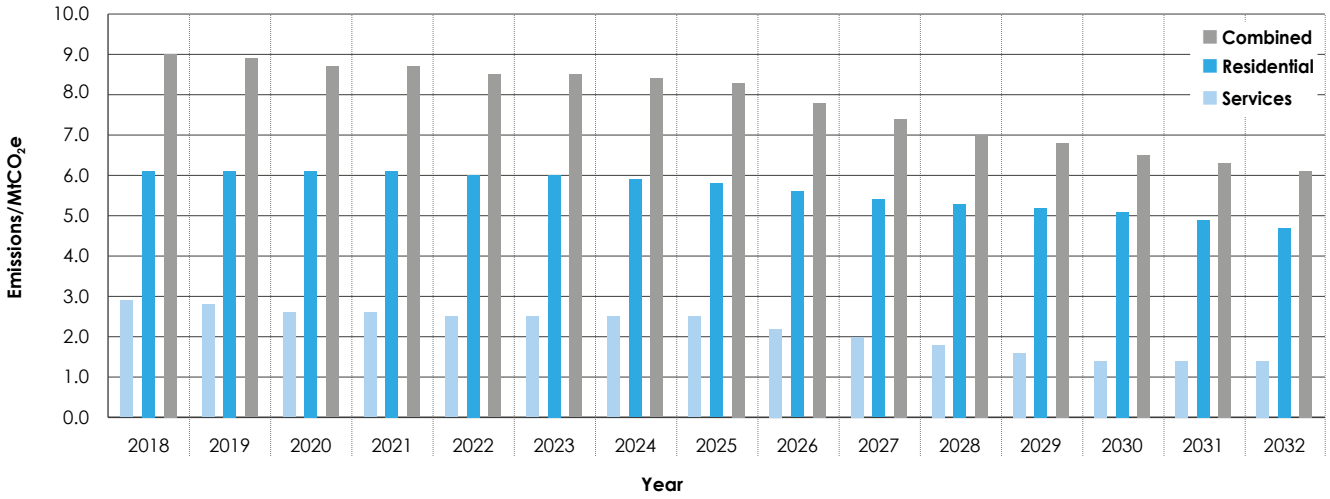
The Scottish Government launched the Non-Domestic Public Sector Energy Efficiency (NDEE) Framework in March 2016. This framework has been designed to support public and third sector organisations procure energy efficiency retrofit work. The development of the framework highlighted the potential to support up to £300 million of energy efficiency retrofit activity across the Scottish public sector estate. The economies of scale and standardised approach offered by the pan-public sector framework is attractive to both the public sector and private sector – offering both better solutions and better value for money. The Scottish Government has established a NDEE Support Unit to accelerate the number of projects and the delivery timescales of public sector energy efficiency projects using the NDEE Framework, and support our wider ambitions around energy demand reduction. The Support Unit launched in October 2016 and is a four year single supplier contract, led by Mott Macdonald with value of up to £2 million.

Working with the Scottish Futures Trust, COSLA, Resource Efficient Scotland and the NHS, and supplemented by public sector loans funding through Salix, we are supporting the delivery of energy efficiency projects across the public sector estate and will continue to support delivery of the greener street lighting programme and delivery of district heating projects.

This proposal was implemented in March 2016.

OUR AMBITION

Figure 6: Buildings emissions envelopes



Over the period of the Plan, we expect to see an overall reduction in emissions of 33% (2.9MtCO$_2$e) from Scotland's buildings. To achieve this, emissions from Scotland's residential and non-domestic buildings will need to fall by 23% and 53% respectively.

In the short term (to 2020) emissions from Scotland's buildings are expected to fall to 8.7MtCO$_2$e, primarily driven by energy efficiency improvements, including wall and loft insulation, smart meters and programmable heating controls. Emissions are also reduced through continued deployment of low carbon heat in off-gas properties and other low regret options[56] in on-gas properties over the period of the plan. From 2025, the pace of emissions reduction increases as we begin to supply an increasing proportion of heat to on-gas buildings using lower carbon fuels, where they are a low or no regrets option.

This trajectory takes us towards our long term 2050 ambition that will see our buildings transformed so that they are near zero carbon wherever feasible. To help guide us towards our ambition and meeting our climate change targets we aim to achieve the following:

- 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.
- By 2032, 35% of domestic buildings' heat will be supplied using low carbon technologies[57], where technically feasible, and the buildings will be insulated to the maximum appropriate level.

56 The CCC describes low regrets options as measures to increase energy efficiency and decarbonise heat that are sensible regardless of which long-term options are chosen.

57 This includes the electrification of heat. Currently, around 12% of domestic buildings' heat is supplied using electricity which, over time, will see an increase in the low carbon feedstock.

- By 2032, 70% of non-domestic buildings' heat and cooling will be supplied using low carbon heat technologies[58].
- By 2032, improvements to the building fabric of domestic buildings will result in a 15% reduction in domestic heat demand.
- By 2032, improvements to the building fabric of non-domestic buildings will result in a 20% reduction in non-domestic heat demand.

As mentioned, the Scottish Government recognises the importance of energy efficiency in achieving our climate change and fuel poverty objectives and has accordingly designated it a National Infrastructure Priority. The cornerstone of this is SEEP, which, when fully operational, will significantly improve the energy efficiency of domestic and non-domestic buildings, as well as decarbonise the heat supply of buildings where this is a local decision. This will include off-gas grid buildings and on-gas grid buildings where they are a low regrets option. By doing this it will make our homes, shops, offices, schools and hospitals warmer and easier to heat.

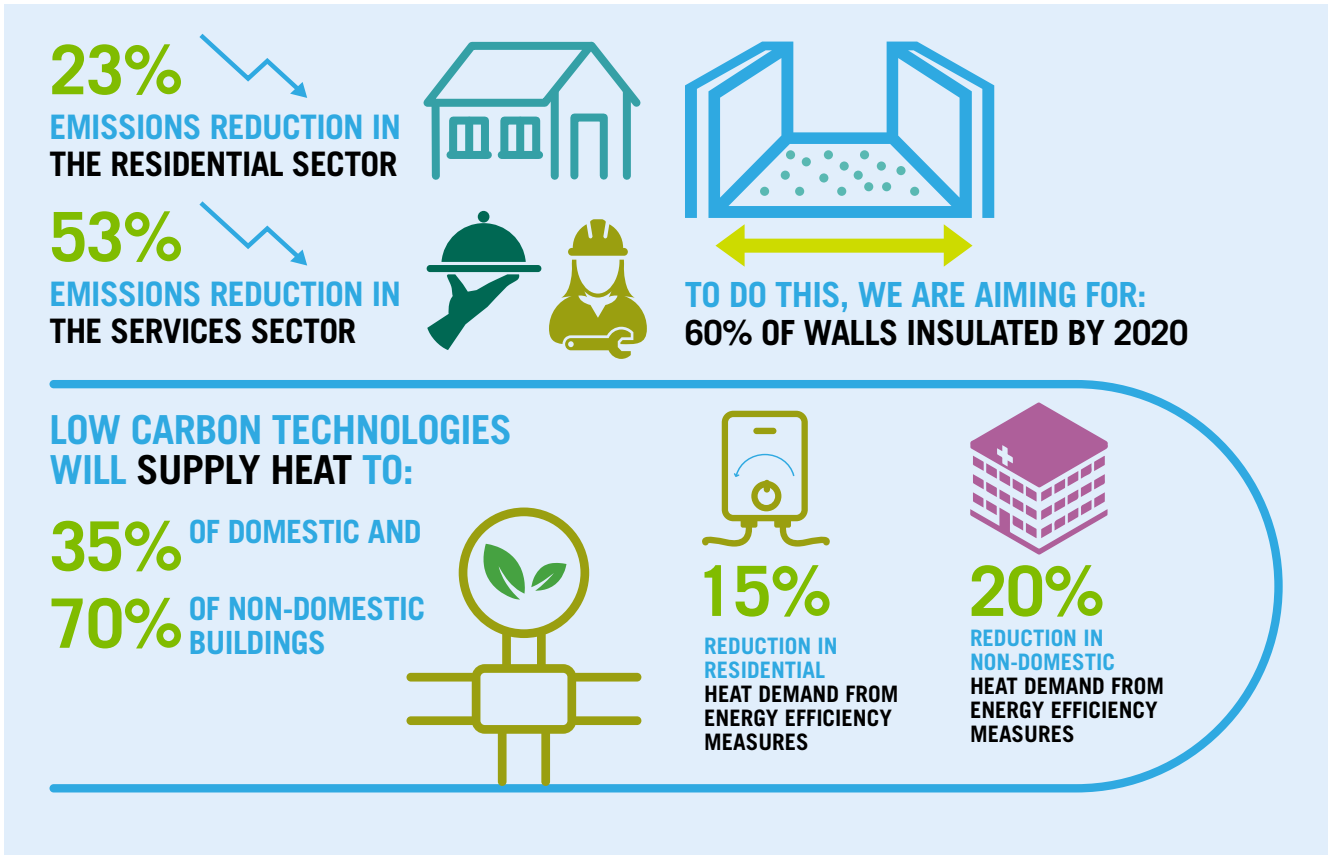
SEEP brings together and builds on our existing successful programmes, including our Home Energy Efficiency Programmes for Scotland, the Energy Efficiency Standard for Social Housing (EESSH), and our Public Sector Non-Domestic Energy Efficiency Framework. To the mid-2020s SEEP will focus primarily on energy demand reduction in all buildings across Scotland helping to tackle fuel poverty and making our businesses more competitive. In addition, during this period SEEP will establish solutions for switching heating supplies from high to lower carbon or renewable sources for properties off the mains gas grid, as well as encouraging appropriately-sited district heating. Beyond that we will review and further develop SEEP in the context of wider changes to heat policy, including on the future of the mains (natural) gas network, set by the UK Government[59].

We consulted on the principles of SEEP in 2017 to support development of the programme. We also consulted on the role that Local Heat and Energy Efficiency Strategies could play in improving the energy efficiency of our buildings and decarbonising their heat supply, as part of SEEP. Consultation analysis reports on both consultations were published in November 2017. We will publish a route map for the Programme in 2018 outlining our long-term ambition for SEEP and milestones to meet this.

58 This includes the electrification of heat. Currently, around 50% of non-domestic buildings' heat is supplied using electricity which, over time, will see an increase in the low carbon feedstock

59 UK Clean Growth Strategy, 2017 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/651916/BEIS_The_Clean_Growth_online_12.10.17.pdf

BY 2032 WE AIM TO ACHIEVE



Case Study

Standby heat exchangers at the North British Distillery in Edinburgh.

Credit:
North British Distillery Ltd.

Tynecastle High School and North British Distillery (NBD) teamed up to benefit from heat recovery technology, which harnesses waste heat from beverage production and utilises it by supplying total duty heat and hot water demand for a school of 560 pupils, eliminating the need for fossil fuel use under normal conditions.

The equipment installed consists of a 1.5MW standby heat exchanger at the NBD end connected via insulated stainless steel pipework to a heat exchanger within the school boiler house. The system was designed as part of the school's construction. The heat is supplied as hot water through pipework leading from NBD at a temperature of around 85 degrees Centigrade. Heat is transferred to the school heating circuits with a sophisticated control system.

Operational costs are minimal. Tynecastle High School benefits from significant cost savings and North British Distillery meets its commitment to maximise resource utilisation under the Scotch Whisky Association's Environmental Strategy[60].

60 Scotch Whisky Association Environmental Strategy http://www.scotch-whisky.org.uk/what-we-do/environmental-strategy/

POLICY OUTCOMES, POLICIES, DEVELOPMENT MILESTONES AND PROPOSALS

This Plan introduces energy and emissions intensity as policy outcomes. These outcomes are already measured and allow us to show reductions in energy use and falling emissions which do not come at the expense of growth in economic output and the number of Scottish households, thus capturing the more efficient use of energy across the sectors.

Energy intensity in the residential sector measures the amount of energy required per household. It is calculated by total energy consumption divided by the number of households. 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 contribute.

Emissions intensity measures emissions per unit of output. In the residential sector the number of households is taken as the measure of output, while Scottish Gross Value Added (GVA) is used as the measure for non-domestic output. Supplying heat from low carbon sources contributes to reducing emissions intensity but other factors, including energy efficiency improvements, can also reduce emissions and therefore reduce emissions intensity.

Energy productivity in the non-domestic sector measures the level of economic activity for each unit of energy being used. It is calculated as Scottish GVA divided by total energy consumption in the non-domestic sector. Enhanced energy efficiency contributes to improving energy productivity, which in turn helps businesses become more competitive, with investment in energy efficiency reducing operating costs and protecting against any rise in energy prices.

Policy outcome 1:
By 2032, the energy intensity of Scotland's residential buildings will fall by 30% on 2015 levels.

Policy outcome 2:
By 2032, the emissions intensity of residential buildings will fall by at least 30% on 2015 levels.

There are three policies that contribute to the development of policy outcomes 1 and 2.

Policies which contribute to the delivery of policy outcomes 1 and 2

1) Energy Company Obligation (ECO) requires obligated energy supply companies to deliver energy efficiency measures in homes – mainly insulation-based measures and boiler replacements.

ECO is funded via a levy on energy bills and is a market-based mechanism allowing for delivery where it is most cost effective. From 2017 the scheme is worth £640 million per annum across Great Britain and is committed out to March 2022. Historically, 12% of measures have been delivered in Scotland, exceeding our household share. The UK Government's Clean Growth Strategy[61], set out that they would "support

61 UK Clean Growth Strategy, 2017 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/651916/BEIS_The_Clean_Growth_online_12.10.17.pdf

around £3.6 billion of investment to upgrade around a million homes through the ECO, and extend support for home energy efficiency improvements until 2028 at the current level of ECO funding". The Scotland Act 2016 devolved some limited powers to Scottish Ministers over the delivery of ECO in Scotland. Utilisation of these powers is being considered by the Scottish Government.

2) The Scottish Government allocated £116 million in the Budget for 2018-2019 to support delivery of energy efficiency measures via the Home Energy Efficiency Programmes for Scotland (HEEPS).

HEEPS brings together a range of funding streams including our area-based schemes which are delivered by local authorities, Warmer Homes Scotland which is the national fuel poverty scheme delivered by Warmworks Scotland and HEEPs loans, and helps to lever maximum investment under the ECO in Scotland.

3) Social landlords will meet the Energy Efficiency Standard for Social Housing in 2020.

Introduced in 2014, social landlords must ensure their properties meet the first milestone for minimum energy efficiency standards by 2020. Standards are based on Energy Performance Certificate (EPC) Energy Efficiency Rating and vary by property type. EESSH is currently being reviewed to consider progress towards the 2020 milestone and the setting of further milestone(s) towards 2050.

Policy outcome 3:
By 2032, non-domestic energy productivity to improve by at least 30% on 2015 levels.

Policy outcome 4:
By 2032, the emissions intensity of the non-domestic sector will fall by at least 30% on 2015 levels.

There are two policies that contribute to the development of policy outcomes 3 and 4.

Policies which contribute to the delivery of policy outcomes 3 and 4

1) 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 through £76 million funding to 2018, with an additional £60 million allocated from 2018-2020.

LCITP offers a range of support mechanisms including project development, expert advice and funding (where applicable) to support the development of substantive private, public and community low carbon projects across Scotland. The intervention focuses on supporting the acceleration of projects to develop investment grade business cases allowing them to secure existing streams of public and private capital finance. In addition, the programme collates evidence on recurring barriers and challenges to projects and shares this intelligence with investment communities to ensure the refinement of all parts of the system to support the transition to a low carbon economy where possible.

2) The Scottish Government launched the Non Domestic Public Sector Energy Efficiency (NDEE) Framework in March 2016. This four year framework has been designed to support public and third sector organisations procure Energy Efficiency retrofit work.

The development of the framework highlighted the potential to support up to £300 million of energy efficiency retrofit activity across the Scottish public sector estate. The economies of scale and standardised approach offered by the pan public sector framework is attractive to both the public sector and private sector – offering both better solutions and better value for money.

3) The Scottish Government has established a NDEE Support Unit to accelerate the number of projects and the delivery timescales of public sector energy efficiency projects using the NDEE Framework and support our wider ambitions around energy demand reduction.

The Support Unit launched in October 2016 and is a four year single supplier contract, led by Mott Macdonald with value of up to £2 million.

Policy outcomes 1, 2, 3 and 4.

There are six policies, three policy milestones and three proposals which contribute to the delivery of all policy outcomes.

Policies which contribute to the delivery of Policy outcomes 1, 2, 3 and 4

1) SEEP will radically improve the energy efficiency of Scotland's homes, and buildings in the commercial, public and industrial sectors. It will build upon a transition programme which offers local authorities incrementally greater opportunities to deliver integrated energy efficiency projects.

Our Programme for Government (2016-2017) confirmed a minimum of £0.5 billion for SEEP over the four years from 2017-2018. In 2017-2018 our investment is in our existing programmes which are supporting delivery of measures on the ground.

2) The Scottish Government is already funding SEEP Pilot projects in 22 local authorities.

The Scottish Government awarded £9 million funding in 2016-2017 and £4.6 million in 2017-2018 for SEEP pilots to test integrated solutions to improve the energy performance of residential, commercial and public buildings, and investments to decarbonise the heat supply. Within the SEEP pilots, 12 local authorities are also considering approaches to Local Heat & Energy Efficiency Strategies (LHEES) supported by Resource Efficient Scotland, Scottish Futures Trust and our Enterprise Agencies. The pilots will be evaluated and contribute evidence to support the design of SEEP.

3) All homes and businesses will be offered a smart meter by 2020 under a UK Government initiative, providing the opportunity for a greater understanding of final energy consumption.

We are keen to ensure an effective rollout of smart meters and that it occurs in such a way as to maximise benefits to consumers – particularly those who are vulnerable or in fuel poverty.

4) The Renewable Heat Incentive (RHI) is a GB-wide scheme created by the UK Government (with the agreement of the Scottish Government).

The domestic RHI was launched in April 2014 and provides financial support to the owner of the renewable heating system for seven years. The non-domestic RHI provides finance to the owner of the renewable heat technology for 20 years, including where this is supplied to householders through district heating schemes. The scheme covers England, Wales and Scotland and is targeted at – but not limited to – off-gas heat use. There is no commitment by the UK Government to fund the RHI beyond 2020-2021. During the development of SEEP we will consider what sort of funding mechanisms are needed into the 2020s and 2030s to enable continued take-up of these technologies. Uptake of the RHI is supported by Scottish Government programmes including Resource Efficient Scotland's (RES) advice and support service and loan funding via the RES Small and Medium Enterprise Loan Scheme (SMEL).

5) The District Heating Loan Fund helps address the financial and technical barriers to district heating projects by offering low interest loans.

The scheme is open to local authorities, registered social landlords, small and medium sized enterprises and energy services companies with fewer than 250 employees. During the development of SEEP, we will consider what sort of funding mechanisms are needed to continue to support the expansion of district heating networks.

6) The Heat Network Partnership is a collaboration of agencies focused on the promotion and support of district heating schemes in Scotland.

Through its support to local authorities and practitioners, it is building capacity and project development capability to support heat planning and programme delivery work that will be developed by local authorities, the Scottish Government and its partners, as part of the wider SEEP programme in future.

Policy development milestones which contribute to the delivery of all policy outcomes

SEEP is the cornerstone of our efforts to reduce emissions from Scotland's buildings. The Scottish Government undertook an initial consultation on the principles and initial design of SEEP in early 2017. The responses to these consultations have been considered for the development of SEEP.

1) SEEP will put in place regulation and standards providing long-term certainty and making it the norm to invest in energy efficiency.

Respondents to the SEEP consultation in 2017 indicated that standards and regulations should be clear and long term in order to promote confidence amongst both investors and consumers. We also consulted on proposals for minimum energy efficiency and condition standards in private rented housing in 2017 and published a Consultation Analysis Report in November 2017. We will set out our next steps in the SEEP route map in 2018.

2) SEEP will make an offer of support to all building owners.

The route map will set out the steps we will take to deliver our commitments on energy efficiency and low carbon heat. As SEEP develops we will provide continuity through our existing programmes, including our national advice services (Resource Efficient Scotland and Home Energy Scotland); and financial support such as HEEPS loans, SME loans, District Heating Loans and Salix loans for the public sector.

3) SEEP will be delivered nationally and by local authorities

We will continue to evaluate and monitor the ongoing SEEP Pilots to influence the SEEP transition programme and final design of the SEEP programme.

The Scottish Government will publish a route map for Scotland's Energy Efficiency Programme in May 2018 setting out our long term ambition for the programme as well as milestones to meet this.

Policy proposals which contribute to the delivery of all policy outcomes

1) Review of energy standards within building regulations.

Staged improvements to energy standards within building regulations have resulted in emissions from buildings built to current standards being, on aggregate, around 75% lower than those of buildings built to standards in force in 1990. A further review of energy standards will commence in 2018 and will investigate a number of measures that offer the potential for further abatement from new buildings and where work is undertaken in existing buildings.

2) The Assessment of Energy Performance of Non-domestic Buildings (Scotland) Regulations 2016 now requires assessment and improvement in the energy performance and emissions of larger non-domestic buildings (those over 1,000m²).

Initially, an option to defer improvement where reporting on annual operational energy use is available to building owners. Improvement delivered under these regulations will be monitored to inform early review of both the scope and level of improvement sought from existing buildings with the intention to review from 2018 leading to amended regulations in 2020.

3) We will work with our partners, including the UK Government, local authorities and utility providers to determine the best approach to heat decarbonisation for buildings currently heated by natural gas.

The gas transmission network is reserved (regardless of the gas transported through those pipes) and the UK Government is considering solutions to long term heat decarbonisation post 2030. This will involve gathering evidence and analysis to fill key knowledge gaps in the options available, such as the future of the gas grid, electrification of heat and district heating, and the significant impacts on infrastructure that any one or a mix of these options would require. Policy decisions are not expected to be made by the UK Government until the next parliament, i.e. from 2022. We will look to put forward a more detailed proposal on how we will realise this potential in subsequent climate change plans as our understanding of the best approach develops.

Monitoring

Policy output indicator for policy outcome 1

1) Change in energy intensity of residential buildings from 2015[62].

Year	2020	2025	2032
Change in energy intensity from 2015	-10%	-17%	-30%

Policy output indicator for policy outcome 2

1) Change in emissions intensity of residential buildings from 2015[63].

Year	2020	2025	2032
Change in emissions intensity from 2015	-5%	-13%	-30%

Policy output indicator for policy outcome 3

1) Change in non-domestic energy productivity from 2015[64].

Year	2020	2025	2032
Change in energy productivity from 2015	10%	20%	30%

Policy output indicator for policy outcome 4

1) Change in emissions intensity of non-domestic sector from 2015[65].

Year	2020	2025	2032
Change in emissions intensity from 2015	-10%	-20%	-30%

62 Energy intensity in the residential sector measures the amount of energy required per household. Therefore, if energy intensity falls this means that on average households are using less energy.

63 Emissions intensity in the residential sector measures the amount of emissions per household. Therefore, if emissions intensity falls this means that on average households are emitting fewer emissions.

64 Energy productivity in the non-domestic sector measures the level of economic activity for each unit of energy being used. Higher energy productivity means more economic activity for each unit of energy being used.

65 Emissions intensity in the non-domestic sector measures the amount of emissions per unit of output. Therefore, if emissions intensity falls this means that fewer emissions are emitted per unit of output.

Implementation indicators for policy outcomes 1, 2, 3 and 4:

1) Average energy efficiency levels of domestic buildings increases.

2) Grouped domestic energy efficiency ratings improve.

3) Percentage of domestic properties with loft and wall insulation increases.

4) Total renewable heat generation in Scotland increases.

5) Installed capacity of non-domestic RHI increases.

6) Amount of renewable heat paid for under the domestic RHI scheme in Scotland increases.

7) Further analysis to establish a baseline for non-domestic buildings' energy efficiency and emissions data.

Explanation for selection of indicators

- An increase in the average energy efficiency of domestic buildings will contribute to reducing energy intensity and emissions intensity in the residential sector.
- An improvement in the energy efficiency profile of the domestic building stock will contribute to reducing energy intensity and emissions intensity in the residential sector.
- An increase in insulation levels will contribute to reducing energy and emissions intensity in the residential sector.
- An increase in the level of renewable heat generation will contribute to reducing the carbon intensity of Scotland's heat generation in both the domestic and non-domestic sector.

- The installed capacity of renewable heat receiving payment under the non-domestic RHI shows the level of non-domestic renewable heat supported through the RHI scheme, which contributes to reducing the emissions intensity of Scotland's heat generation.
- The level of renewable heat supported through the RHI scheme contributes to reducing the emissions intensity of Scotland's heat generation.
- The Scottish Government is currently undertaking further analysis to establish a baseline for non-domestic buildings' energy efficiency and emissions data against which progress under the Climate Change Plan can be measured, drawing on UK-wide data sets and building-specific meter-point data.

ENABLING FACTORS AND WIDER IMPACTS

SEEP can help create multiple benefits, including:

- A substantial Scottish market and supply chain for energy efficiency services and technologies. SEEP will help to support jobs and businesses within the local and national economy. Every £100 million spent on energy efficiency improvements in 2018 is estimated to support approximately 1,200 full-time equivalent jobs across the Scottish economy[66]. SEEP will help to realise economies of scale, thereby helping to drive down the cost of energy efficiency measures. There will be opportunities for SMEs and third sector organisations to deliver and/or support the delivery of energy efficiency measures.
- Health and early years improvements through people living in warmer homes. These proposals will affect the majority of households, however they will provide the biggest benefit to households living in poverty, both in rural and urban areas, who struggle to pay their bills, and who spend more time at home or where they require higher indoor temperatures.
- Improving the energy efficiency of homes will also help households collectively to save hundreds of millions of pounds on their fuel bills over the lifetime of this Climate Change Plan, money which is then available to be recycled into local economies. Some of the measures needed to improve a building's energy efficiency, e.g. external wall insulation, lead to

66 Applying the latest construction sector multiplier (for 2014) from the Scottish Government input-output tables, and deflating 2018 spend to 2014 prices using the GDP deflator.

changes to its outward appearance, which contribute to community regeneration objectives.

- Regeneration of communities through upgraded building stock. Investment in building fabric improvements for commercial and public buildings can support wider regeneration and better place outcomes.
- Enhanced business competitiveness and cost savings for frontline public services. Support through SEEP for investment to improve the energy efficiency of non-domestic buildings has the potential to deliver improved energy productivity and therefore enhanced competitiveness for business and the third sector, if costs are lower.

We are aware, however, of the potential risks arising from decarbonising the buildings sector. If the capital costs of improving the energy performance of domestic buildings and of installing low carbon heat technologies, and the operating costs of running them, are higher than current systems, then households could find energy bills are less affordable, which could have adverse effects on fuel poverty. Current energy prices mean that gas is the cheapest heating fuel for many households. Running costs for heating homes in the future will depend greatly on energy prices at that time which cannot be predicted with certainty in the long term.

inbalancing these risks is the reasonable expectation that improvements in technology and manufacturing processes will continue to result in significant reductions in the cost of energy efficiency measures. For example, UK Government data show that the average cost of small-scale solar PV panels fell by a cumulative 15% to 20% in real terms over the 3 years to 2016-2017.

Any increase in running costs is mostly likely to have adverse effects on households already living in poverty, particularly those households that spend on average more time at home, including households where members are retired, living with a disability or have young children cared for at home, as well as households living in the least energy efficient homes.

Similarly, any increase in the capital and/or running costs of energy efficiency improvements and low carbon heat technologies in non-domestic buildings in the public and commercial sectors could make energy bills less affordable, which could have adverse effects on business competitiveness and provision of frontline services.

Scottish Government grants will continue to target low income and fuel poor households, as has been the focus through HEEPS to date. SEEP will also develop a range of support and incentives, including loans for households able to make a contribution.

Case Study

External wall insulation in Dunfermline.

Credit:
McAteer Photograph for Changeworks.

In 2014, Fife Council secured almost £3 million from the Scottish Government to reduce fuel poverty and carbon emissions by making homes in its area cheaper to heat. A key aim was to install external wall insulation in 540 homes in Dunfermline, saving householders an estimated £83,000 a year in energy bills and cutting carbon emission by 1,020 tonnes of carbon dioxide per property, per year.

Depending on the balance of cost, need and potential for improvement, external wall insulation is offered free or at a heavily subsidised rate in selected areas under the Scottish Government's Home Energy Efficiency Programmes: Area Based Schemes (HEEPS:ABS). Fife Council worked with Changeworks to manage and deliver the project, in partnership with Home Energy Scotland.

The Scottish Government will work with end users and delivery partners to ensure that SEEP's delivery programmes are designed to emphasise cost-effective energy efficiency and heat decarbonisation measures that reduce energy bills and enhance competitiveness. We will work with households, businesses and the public sector to ensure SEEP supports these cost-effective measures, including on evidence and evaluation where needed.

Planning system

Residential

The planning system is already well-placed to support the addition of energy efficiency measures to existing buildings. National Planning Framework 3 and Scottish Planning Policy are supportive of development that is resource efficient and which creates distinctive places. Where external changes are required, extensive permitted development rights are in place which allow for measures such as external insulation without the need for a planning application. Where a building is in a conservation area or is 'Listed' then consents will often be required, and in such cases the climate change benefits will need to be balanced against the special features which form the basis of a conservation area or listed building. There is also scope for innovation in development of energy efficient product to improve efficiency of buildings in heritage settings. Scottish Planning Policy is clear in its support for the development of heat networks in as many locations as possible.

Services

A planning application will generally be required for energy efficiency measures which affect the external appearance of non-residential buildings. Our National Planning Framework 3 and Scottish Planning Policy are supportive of development that is resource efficient and which creates distinctive places.

Behaviour Change in Scotland's Energy Efficiency Programme

The following three key behaviours are identified by the Scottish Government's Behaviours Framework[67] and are the objectives of SEEP:

- keeping the heat in (insulation, draught proofing, double glazing, etc.)
- better heating management
- installing more energy efficient heating systems or generating your own heat.

Behaviour change is already at the heart of our energy efficiency programmes and will continue to be so as SEEP is developed and rolled out. Our delivery programmes are installing insulation and more efficient heating systems on the ground and helping property owners invest in energy efficiency. The Scottish Government also funds Home Energy Scotland and Resource Efficient Scotland who provide free, impartial advice to property owners including on energy saving behaviours. Advice is also embedded into our domestic area-based schemes to help households maximise the benefits of energy efficiency improvements, for example by adjusting heating systems.

As we develop SEEP the Scottish Government continues to review how we can best act to influence behaviours. To support this we have undertaken a series of ISM workshops examining how to:

- create demand for energy efficiency in housing,
- encourage uptake of loans (for energy efficiency improvements),
- engage householders with their heating controls.

The findings of these workshops are helping to inform the development of SEEP, which will be set out in more detail in a route map in 2018. In addition, during 2016 and 2017, we undertook a series of Climate Conversations[68] with the Scottish public to assess public views on climate change and on potential actions to tackle it. The conversations included discussion of what life might look like in Scotland in the year 2030. These conversations showed that people have generally positive attitudes towards energy efficiency and renewable energy.

The sustained effort outlined here over the period to 2032 will support and encourage low carbon behaviours discussed in the Climate Conversations, taking account of the different factors which influence behaviour in different housing tenures and building types. Energy efficiency and a low carbon heat supply will be considered desirable attributes and, in many cases, the social norm for home improvement, business competitiveness and public sector efficiency. The high energy efficiency of the building stock will help to minimise the impact of any fuel price rises which may impact on bills in future.

67 Low Carbon Scotland: A behaviours framework. http://www.gov.scot/Resource/0041/00415744.pdf

68 Climate Change Public Conversation Series; Findings From Climate Conversations, 2017 http://www.gov.scot/Resource/0052/00524893.pdf

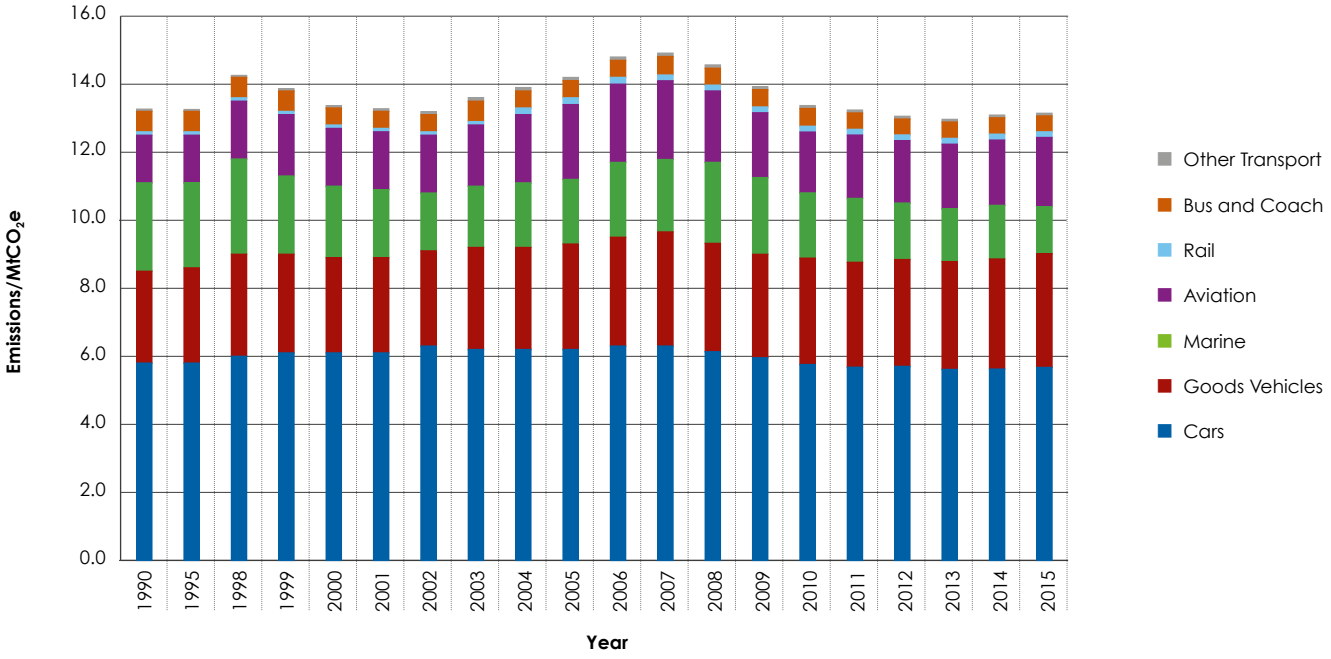
Chapter 3
Transport

Electric bus, Inverness. Credit: Transport Scotland

The transport sector covers all transport modes in Scotland, including public transport, freight, aviation, shipping, private motoring, active travel and the regulations, policies and infrastructure designed to support all of these.

WHERE WE ARE NOW

Figure 7: Historical transport emissions by mode



In 2015, transport emissions (including those from international aviation and shipping) amounted to 13.1MtCO_2e, marginally below the 1990 baseline figure of 13.3MtCO_2e. Currently, transport accounts for 27% of total Scottish emissions[69]. Within that long-term profile, we have seen significant reductions more recently: since transport emissions peaked at 14.9MtCO_2e in 2007, they have fallen by a total of 1.8MtCO_2e, although in the last two years emissions from transport have risen marginally, driven by increases from cars, goods vehicles and international aviation.

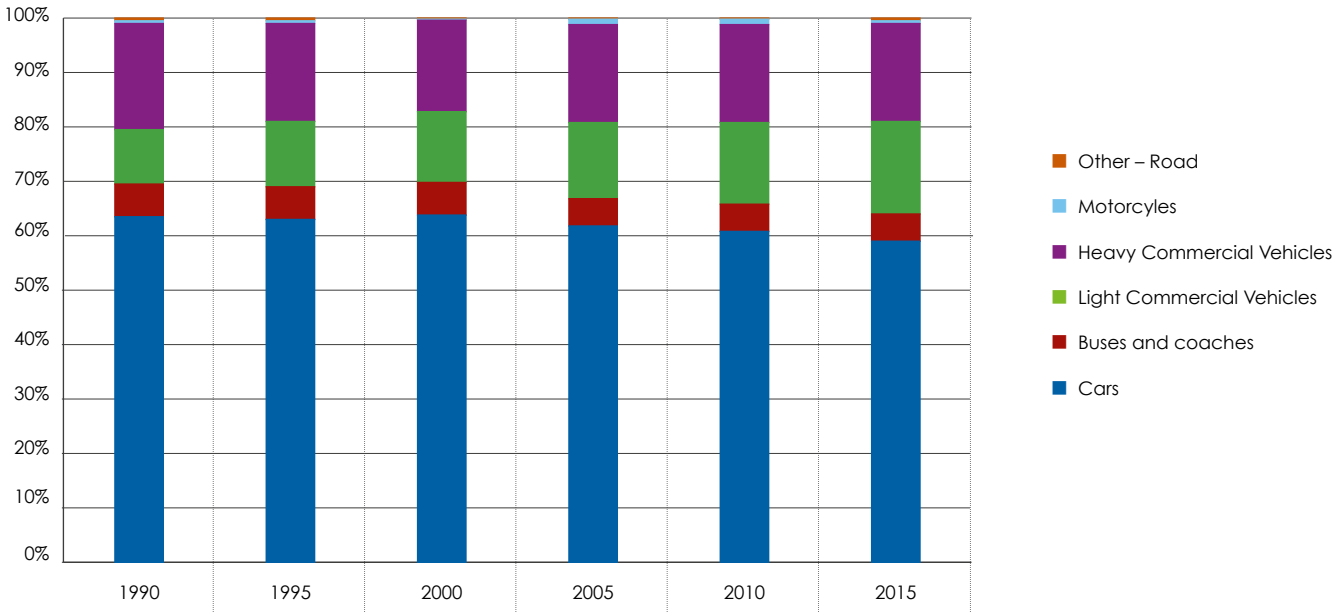
The composition of total emissions has changed over time. International maritime emissions have seen the most marked reduction. Emissions from cars fell by 115kt between 1990 and 2015. Light commercial vehicles have seen a growth in kilometres and emissions and there have been increases in both international aviation emissions and domestic aviation emissions.

69 Excluding adjustments for the EU Emissions Trading System.

Road transport emissions

The largest contributor to transport emissions is the road sector. In combination, cars, lorries, vans, buses and motorcycles accounted for 9.6MtCO_2e in 2015 (73% of total transport emissions). This compares with 9.3MtCO_2e and 69% in 1990.

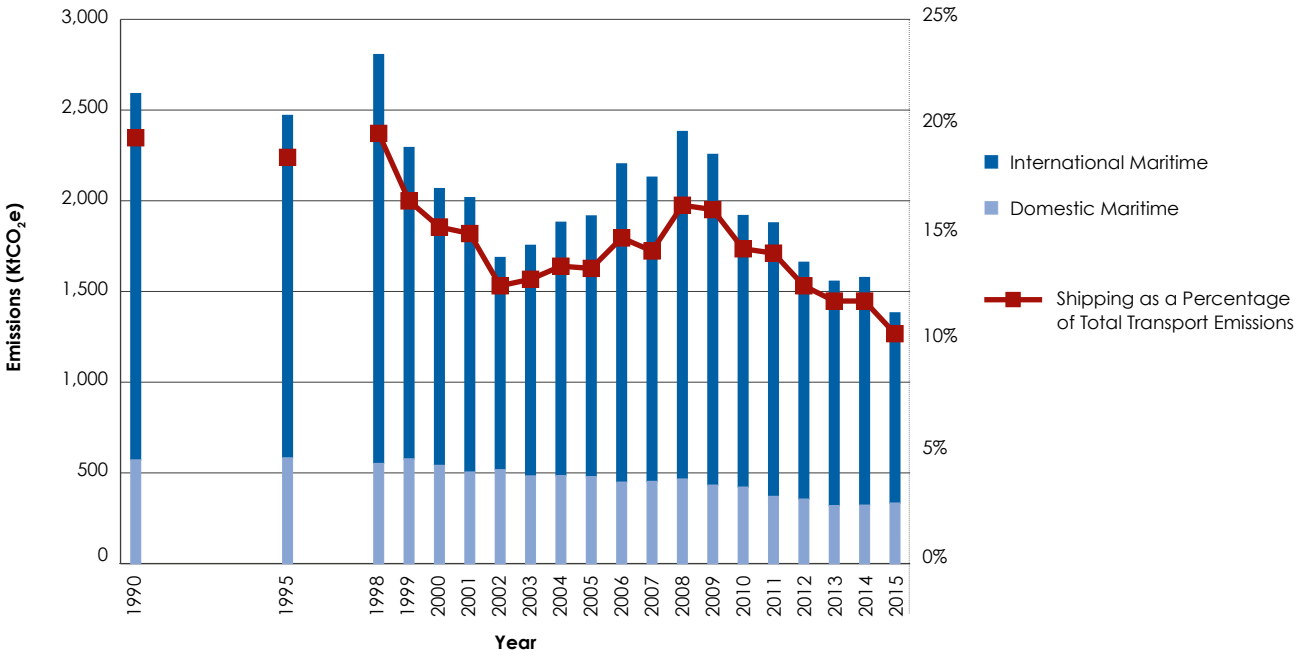
Figure 8: Road transport emissions



Maritime emissions

Emissions from maritime transport in 2015 are estimated to be 1.4MtCO_2e, or 11% of total transport emissions. This compares to 2.6MtCO_2e and 20% in 1990. Within that profile, emissions from international shipping have been volatile year on year, while emissions from domestic shipping have decreased more steadily since 1990.

Figure 9: Maritime emissions

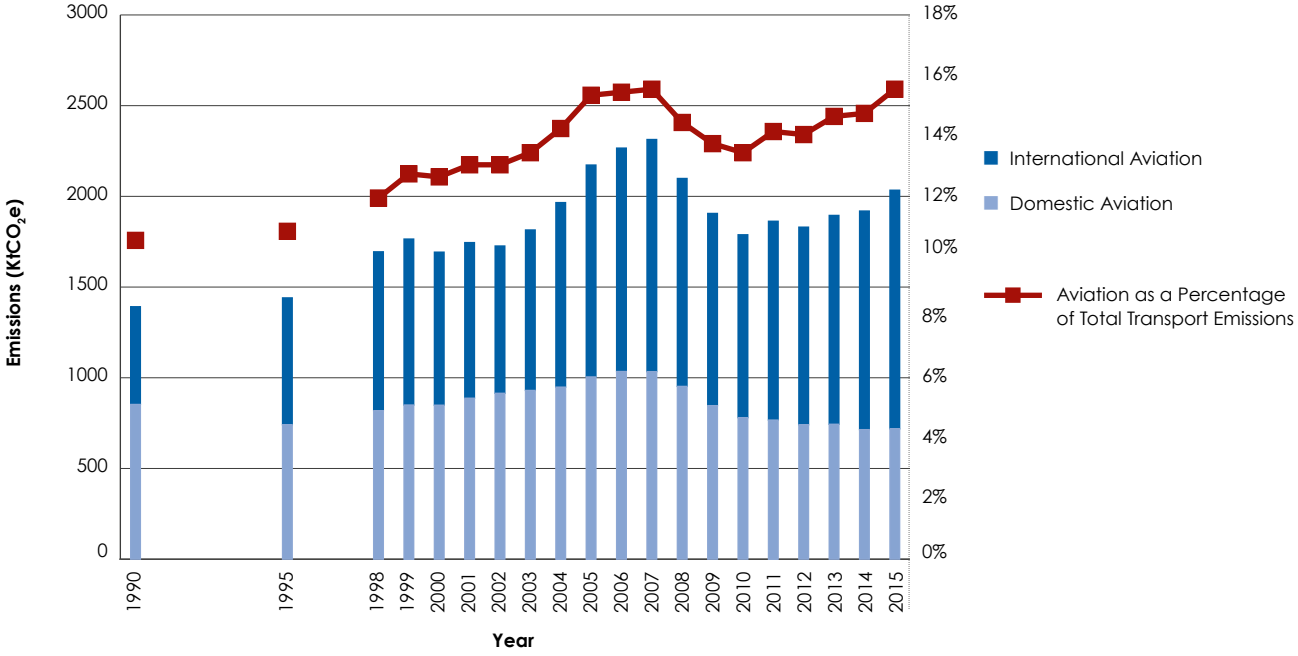


Aviation emissions

In 2015, aviation emissions stood at 2.0MtCO_2e, or 15% of total transport emissions. This compares with 1.4MtCO_2e or 11% in 1990. Passenger numbers in that period increased from just over 10 million to 25.5 million. The growth in demand of 155% is thus associated with a significantly lower growth in emissions of 43% reflecting effective efficiency improvements, including increased load factors.

In 2015 international aviation emissions accounted for 65% of total Scottish aviation emissions, almost the reverse of the proportion in 1990, when it was domestic aviation that accounted for 61% of aviation's emissions total.

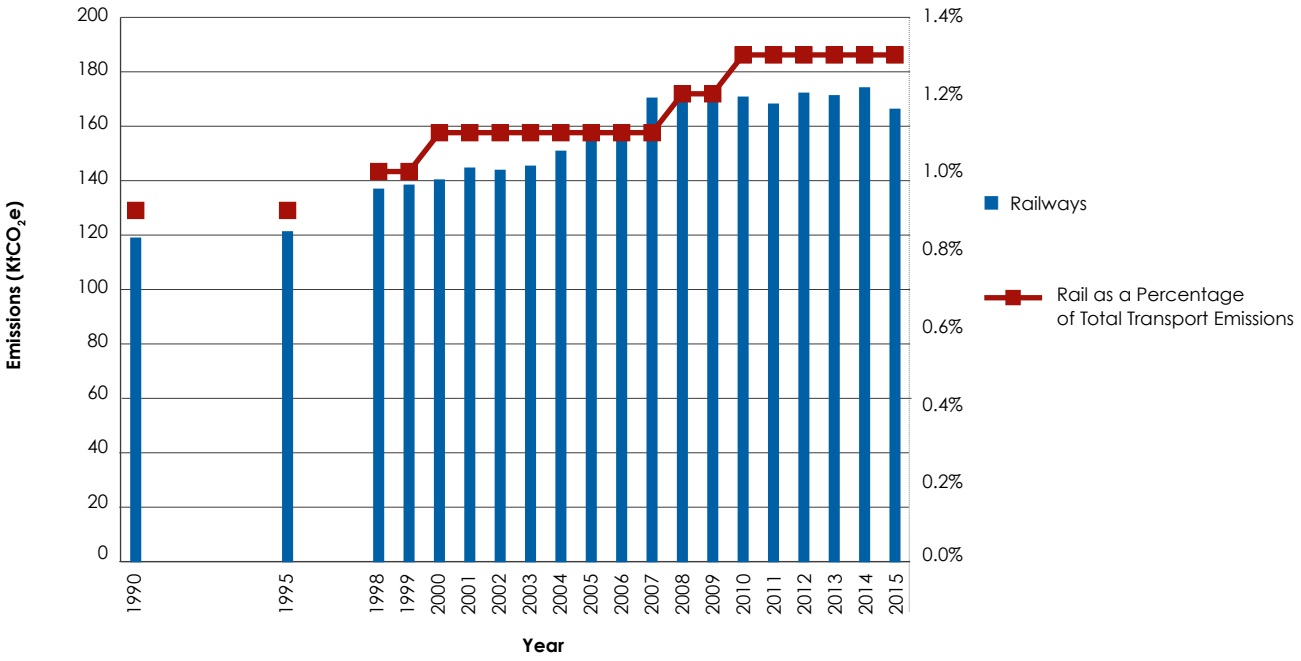
Figure 10: Aviation emissions



Rail emissions

At 0.2MtCO$_2$e in 2015, rail accounts for about 1.3% of transport emissions. The 2015 figure is 40% above the equivalent 1990 figure of 0.1MtCO$_2$e, and rail emissions have followed a generally rising trend over the period 1990 to 2014, dropping slightly in 2015.

Figure 11: Rail emissions



Active travel

In 2015, 1% of journeys had cycling as the main mode of transport and the average (mean) journey length was 4.7km. For walking, the equivalent proportion cited in the Scottish Household Survey travel diary was 22%, with 14% of adults usually walking to work and 49% of children usually walking to school as their main mode of transport.

PROGRESS SINCE RPP2

Progress on RPP2 policies

EU Cleaner Vehicle Directives

EU regulations specify average emissions of new cars in 2021 must be 95g CO_2/km. These regulations have been the primary driver of reduced emissions in cars. The annual rate of car emissions reduction increased from 1% per year in the year before implementation to 4% per year in years afterwards. Efficiency improvements in fossil-fuelled cars will likely be significant in reaching the 2021 emissions targets.

Progress on RPP2 proposals

EU Biofuels target as implemented through the UK Renewable Transport Fuel Obligation (RTFO)

The main mechanism for the promotion of biofuel use, the Renewable Transport Fuel Obligation (RTFO) legislation places a requirement on transport fuel suppliers to ensure that a percentage of all road vehicle fuel is supplied from sustainable renewable sources. A Statutory Instrument is currently going through the UK legislative process that will revise the RTFO – currently expected to be implemented in April 2018. This will cover the period until 2032, and introduce an increasing obligation level; an additional target for advanced "development fuels"; a cap in eligibility of crop-derived biofuels reducing over the period; and will bring renewable aviation fuels and renewable fuels of non-biological origin into the scheme.

Scottish Ministers support the use of this legislative mechanism, which could mean that sustainable biofuel penetration into certain sectors could reach higher percentages than the expected maximum average across the wider transport sector.

Continued rollout of EV charge points through ChargePlace Scotland

We have continued to expand our network of EV charge points since this proposal. The ChargePlace network now comprises over 1,200 charging points, including 150 'rapid' chargers, one of the most comprehensive networks of rapid charge points in Europe.

Switched-on Fleets

Switched-on Fleets offers evidence-based analysis to identify opportunities for the deployment of EVs in each of Scotland's 32 Community Planning Partnerships. Transport Scotland has provided £2.5 million to enable local authorities to buy or lease plug-in vehicles. The first phase of Switched-on Fleets resulted in over 240 EVs being introduced across 50 public sector fleets.

Scottish Green Bus Fund[70] (SGBF)

There have been seven rounds of the SGBF. Funding amounting to £16.1 million has supported the introduction of 361 low carbon buses to the fleet. The Fund is complemented by the Bus Service Operator's Grant which currently pays an additional 10.1p/km over the standard rate of 14.4p/km grant for services operated by low carbon vehicles.

Ferries Plan

Three diesel-electric hybrid ferries using a combination of battery and conventional diesel power have been procured and delivered within the last six years and are now all operating daily scheduled ferry services on the west coast.

70 Scottish Green Bus Fund https://www.transport.gov.scot/public-transport/buses/scottish-green-bus-fund/#

Case Study

MV Hallaig hybrid ferry.
Credit:
Caledonian Maritime Assets Ltd.

Caledonian Maritime Assets Ltd (CMAL) has awarded £35.8 million of hybrid ferry contracts so far.

Three diesel-electric hybrid ferries (MV Hallaig, MV Lochinvar and MV Catriona) have been procured and delivered within the last six years. These ferries use a combination of battery and conventional diesel power and are now all operating on daily scheduled services to island communities on the west coast.

These include the Sconser to Raasay route (MV Hallaig), the Tarbert – Portavadie route (MV Lochinvar) and the Claonaig – Lochranza route (MV Catriona).

The hybrid ferries procurement has brought a number of economic and environmental benefits, including:

- Scottish Government investment has secured jobs for people in Port Glasgow and the Inverclyde area.
- Equipment used in in the ferries has been procured primarily from Scottish companies, where possible.
- Reduced CO_2 emissions and environmental impact.
- Able to operate in zero emission mode when at port improving local air quality.
- The provision of charging infrastructure which may potentially be used by other vessels in the future.
- Potential future fuel savings depending on the future price of oil.

Use of Intelligent Transport Systems (ITS) and Average Speed Cameras on the Trunk Road Network

Transport Scotland has utilised ITS to inform transport network users of issues, alternative routes and methods of travel to minimise transport disruption. Variable message signs located at key points along the trunk road network and regularly spaced overhead lane signals advise drivers of incidents and delays. Traffic Scotland provides real time information in response to traffic problems through their website, mobile app and radio.

Development of community based travel planning strategies

Personalised travel planning was provided to over 5,000 households, 49 employers and 2101 staff across 85 schools in 2015 through the Smarter Choices, Smarter Places programme. Further behaviour change measures, including personal travel planning were delivered under the additional £5 million of funding for SCSP enhanced roll-out in 2016-17. In total, since 2015/16 over £15 million has been invested attracting a further £15 million in match funding and delivering over 450 local initiatives that change people's behaviour.

Cycling and walking

The second Active Travel Summit took place in November 2017 in Stirling and the third iteration of our Cycling Action Plan was published in early 2017, reaffirming the Scottish Government's commitment to the 10% vision of everyday trips by bike by 2020. The Programme for Government 2016-2017 further commits to maintaining record levels of funding to support active transport, such as cycling and walking for the remainder of the parliamentary term, and the Programme for Government 2017-2018 went further, doubling the annual budget from £40 million to £80 million.

Car Clubs

There are car clubs in 25 locations in 16 Local Authority areas. There are approximately 10,000 members across Scotland, with access to 342 vehicles. 23% of the Scottish Car Club fleet is electric.

Support for Workplace Travel Planning and fuel efficient driving

A new Scotland-wide travel planning site, 'TravelKnowHow Scotland', was launched in September 2016 with 100 organisations registered. In addition, over 20 Business Improvement Districts took part in European Mobility week events. The Energy Savings Trust has trained over 13,400 drivers in fuel efficient driving techniques, which deliver an average 15% improvement in efficiency.

Freight Efficiencies

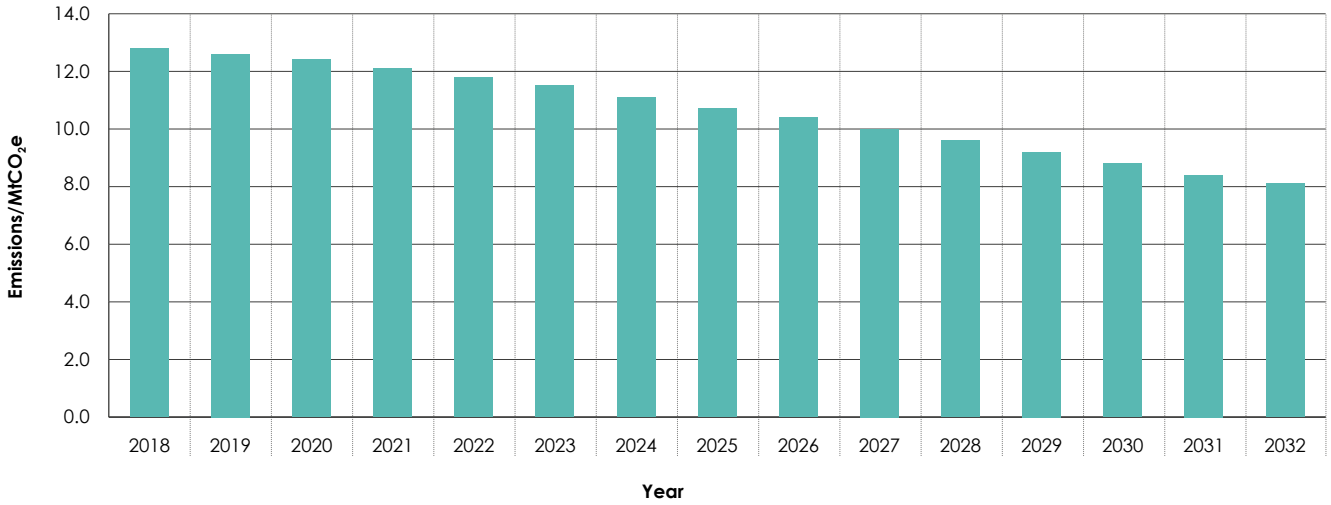
Annually, Mode Shift Revenue Support enables around 2.5 million tonnes of freight to move by rail rather than road, removing 100,000 HGV road journeys and delivering more than £7 million in environmental benefits. In addition, Freight Facilities Grants funded operations deliver around £3.5 million in environmental benefits. Through the Scottish Freight and Logistics Advisory Group (ScotFlag) and its Urban Freight and Last Mile Connections sub groups, we continue to engage with the industry and key stakeholders to increase efficiencies in respect of urban deliveries and connectivity to intermodal hubs.

Additional Emissions Reduction Potential from Transport in 2025

We will continue to explore and consider alternative proposals and policies to achieve additional emissions reduction potential in transport.

OUR AMBITION

Figure 12: Transport emissions envelopes

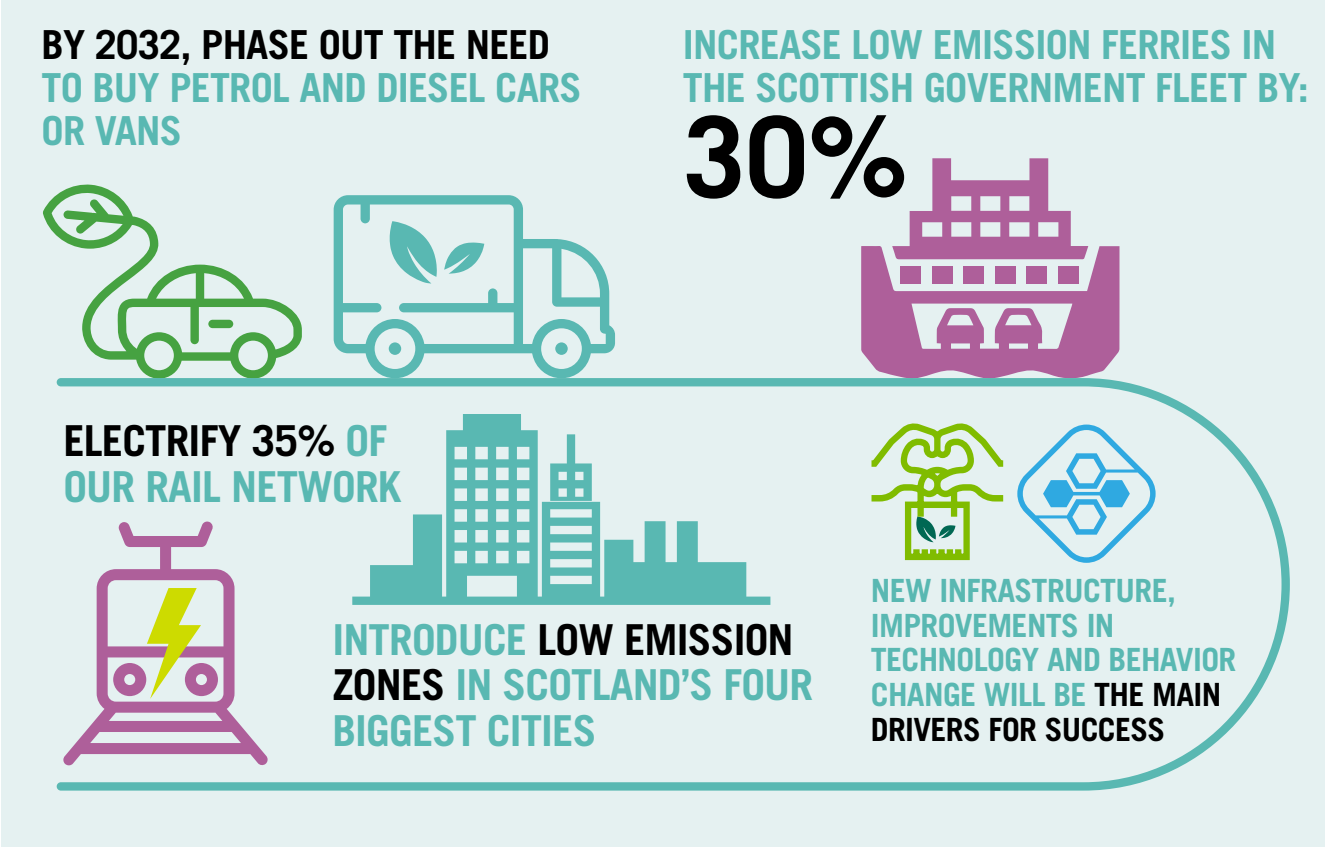


Emissions in the transport sector will fall by 4.7 $MtCO_2e$ (37%) over the lifetime of the Plan. Our ambition is to reduce emissions from transport in ways that promote sustainable environmental and socio-economic wellbeing. To achieve this, we will phase out the need to buy petrol or diesel cars or vans in Scotland by 2032, introduce low emission zones in Scotland's cities to improve air quality and make our towns and cities friendlier and safer spaces for cyclists and pedestrians.

We know that economic and population growth increases demand for the movement of people, goods and services. However we expect the pace of technological change to accelerate, and, together with changes in behaviour, our approach will reduce emissions while encouraging economic growth.

Future abatement will vary significantly across the individual transport modes. The availability of new technology; the cost of implementing technological, logistical and behavioural change measures alongside significant investment in electric vehicle infrastructure; and the return on such investment will all have a bearing on which particular interventions we prioritise.

IN TRANSPORT, WE WILL



The role of technology

In exploring the potential impact of future technologies and fuels on emissions, Transport Scotland commissioned and published research produced independently[71]. The report (Greenhouse Gas Emissions Reduction Potential in the Scottish Transport Sector from Recent Advances in Transport Fuels and Fuel Technologies, 2017) was used to provide the technological underpinning of our policy development and informed the broader TIMES modelling work on transport.

In general terms, the research demonstrated two key things: first, that the natural pace of technological change is likely to deliver substantial abatement without further government intervention; and secondly, that it is possible to accelerate the pace of such change further by targeted interventions.

The importance of the climate change agenda means we must focus our efforts and resources on where there will be the biggest impact in reducing emissions, and where there is technological potential to underpin these efforts. Our behaviour change initiatives (such as our Smarter

71 Greenhouse Gas Emissions Reduction Potential in the Scottish Transport Sector From Recent Advances in Transport Fuels and Technologies – www.transport.gov.scot/publication/greenhouse-gas-emissions-reduction-potential-scottish-transport-sector

Choices, Smarter Places programme[72]) have been designed to complement technological change, with one adding value to the other. These initiatives will deliver improvements in urban infrastructure and greater integration between transport modes, particularly in urban areas. These developments were strongly supported in the programme of Climate Conversations[73].

On the basis of this and other work, the Scottish Government has identified key technological, economic and commercial trends which will form the baseline against which to measure future policy interventions, whether in relation to technology or behaviour change. The Scottish Government will continue to collect and interpret such baseline data. For example, air passenger numbers will be one data source that will allow us to evaluate the impact of changes to Air Departure Tax (currently thought to be marginal in emissions terms and easily offset by other policy interventions).

Traffic growth assumptions

Transport Scotland's Transport Model for Scotland (TMfS) forecast a 27% growth in car kilometres between 2015 and 2035. The key assumptions underpinning this growth forecast are:

- Growth in the population and economy – cumulative 10% growth in population on 2012 levels by 2037 and an increase in GVA of 25% by 2032 (a rate of 1.5% GVA per annum). Higher incomes result in more travel opportunities for people, including increased car growth.
- Number of trips per person stays the same.
- New homes and businesses are built where permitted, on the most accessible land first.
- No fundamental change in behaviour – for example, the desire to own a car or have a driving licence.
- Fuel prices will remain stable, but not constant and parking costs remain constant in real terms. Public transport fares will be stable following the rail pricing model.
- Only committed improvements in road and rail capacity are included in the model.
- All travel time is assumed to be as productive as it was when the model was calibrated.
- The 27% growth assumption assumes no change in behaviour between now and 2035. However, the measures outlined in this Plan are designed to encourage behaviour change where possible across the Scottish population. These measures, combined with our approach of encouraging technological innovation and development, will allow us to accommodate increased population, economic growth and travel demand while reducing emissions.

Element energy

The assumptions outlined in the following sections – on cars, road freight, shipping and aviation – are based on analysis commissioned from Element Energy.

72 Smarter Choices, Smarter Places – www.transport.gov.scot/our-approach/active-travel/smarter-choices-smarter-places

73 Low Carbon Behaviours – Findings from Climate Change Conversations – www.gov.scot/Topics/Environment/climatechange/lowcarbonbehaviours/findings-from-climate-conversations

Cars

With petrol and diesel cars, we expect fuel efficiency improvements of 30% – 40% by 2035; and with hybrids and electric vehicles we expect battery costs to halve and their performance to double incrementally over the period to 2035, with a step change in market penetration from 2020 onwards driven primarily by decreasing costs of electric vehicles.

Road freight

With conventional HGVs, efficiency improvements of around 25% are possible by 2035, based on improved aerodynamics, transmissions and operations. Low carbon HGVs (such as diesel-electric hybrid and liquid natural gas) will become more common from the mid-2020s.

Shipping

We might expect up to a 35% improvement in the efficiency of new, larger shipping by 2035, based on hybrid and gas-powered engines, battery-electric engines, and the potential use of assistive technology, such as sails, kites, rotors and aerofoil hulls. Gradual uptake and stock differences mean that this may equate to 10% at the fleet level.

Aviation

We might expect to see a 15% improvement in the efficiency of new aircraft by 2035, based on fleet modernisation, operational improvements, and improved aerodynamics and fabrication techniques (such as the use of composites). Step changes may occur in the 2030s and beyond, based on new engine technology (such as open rotors) and new aircraft designs (such as blended wing technology).

Policy implications

The Element Energy analysis[74] underpinning these brief summaries suggests that technological change will be transformational, significantly reducing emissions while incorporating growth in the economy and population. Supporting such change remains a high priority and forms the basis of our approach as this will have the greatest impact in terms of reducing emissions.

Our research indicates that road transport can contribute the highest level of abatement, essentially because its high share of emissions is matched by the relative availability of technological and behaviour change interventions.

We have focused our policy actions on encouraging increased uptake of new technologies, particularly for road transport as that is where research suggests the greatest impact can be made. This includes greater support for electric vehicles to end the need to purchase a petrol or diesel car or van by 2032, further support for greening the bus fleet and improving the efficiency of road freight.

74 Greenhouse Gas Emissions Reduction Potential in the Scottish Transport Sector From Recent Advances in Transport Fuels and Technologies – www.transport.gov.scot/publication/greenhouse-gas-emissions-reduction-potential-scottish-transport-sector

Transport in 2032

Transport emissions will fall by 4.7MtCO_2e (37%) over the lifetime of the Plan.

We will have phased out the need to purchase petrol or diesel powered cars or vans by 2032 – with low emission cars and vans being the norm – and a third of the ferries owned by the Scottish Government will be low carbon. We expect that aircraft fleets will be on the cusp of radical new designs; and ground operations at airports and ports will already involve low carbon solutions.

Low emission zones in Scotland's major cities will see air quality noticeably improved; and we will be enjoying the social, health and economic benefits from better transport systems.

By 2050, Scotland will be free from harmful tailpipe emissions from land transport, with other transport modes decarbonising at a slower pace, resulting in a significant reduction in overall transport emissions.

By 2032, we expect fully functioning market solutions for low carbon transport. Freight infrastructure will feature more efficient HGVs operating from out-of-town consolidation centres. Plug-in vehicles will be commonplace, with improved battery technology providing longer ranges and infrastructure supporting both electric and hydrogen powered vehicles.

For major transport infrastructure projects, the Scottish Transport Appraisal Guidance[75] will consider the impact of potential transport infrastructure options against a range of criteria, including the environment.

Journeys made on our road network will be more efficient due to the deployment of Intelligent Transport Systems (designed to improve the flow of traffic), increased uptake of fuel efficient driver training and widespread use of electric vehicles.

Low emission zones in Scottish cities will limit the access of vehicles that exceed emissions benchmarks, while permitting unrestricted access for low emission cars, vans and buses, as well as smaller goods vehicles relaying goods from consolidation centres.

Low emission vehicles will also play a role in the wider energy system. Electric and hydrogen vehicles will have a role in energy storage. The adoption of smart technologies could allow battery electric vehicles to play a wider role in balancing the grid.

POLICY OUTCOMES, POLICIES, DEVELOPMENT MILESTONES AND PROPOSALS

Policy outcome 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.

There are four policies, one policy development milestone and two proposals that will contribute to the delivery of policy outcome 1.

Policies which contribute to the delivery of policy outcome 1

1) With the EU and UK, negotiate stretching emission standards for new cars (and vans) beyond 2020 (and 2021).

75 Scottish Transport Analysis Guide (Scot-TAG) – www.transport.gov.scot/our-approach/industry-guidance/scottish-transport-analysis-guide-scot-tag

Vehicle emission standards are currently set at a European level. Vehicle efficiencies have improved considerably over recent years driven in large part by existing EU emission standards. The current standards specify that the average emission of new cars must be 95g/CO_2/km and for new vans 147g/CO_2/km by 2020 (2021). We will work with the EU and UK Government to press for strong future emissions standards beyond those currently in place.

2) With the UK, negotiate Vehicle Excise Duty differentials between ultra-low emission vehicles (ULEVs) and diesel/petrol vehicles to support and encourage the uptake of ULEVs.

Vehicle Excise Duty (VED) differentials are in place for lower emission vehicles compared to higher emitting petrol and diesel vehicles. Zero emission vehicles are exempt with a graded scale of differential for vehicles up to 100g/CO_2/km. Changes coming into force on 1 April 2018 may impact on the adoption of low carbon vehicles as only zero emission vehicles will have reduced VED after year one of the vehicles life. It will be important to maintain this VED differential into the 2020s as although the total cost of ownership premium between a ULEV and petrol or diesel vehicle is likely to decrease in this period, some level of premium will remain.

VED is set by the UK Government, and we will continue to work with them and press the need for a VED differential for ULEVs through the 2020s.

3) With the UK, negotiate biofuels policies that will enable them to be used sustainably in the decarbonisation of the whole transport sector.

The EU biofuels target is implemented in the UK through the Renewable Transport Fuel Obligation (RTFO) legislation, which is in the process of being revised and will ensure that biofuels from sustainable feedstocks and renewable fuels of non-biological origin (such as electrolytic hydrogen made using renewable energy) will make up a growing proportion of transport fuel and enable them to be used most effectively as a finite resource in the decarbonisation of transport.

4) Continue to support fuel-efficient driver training until at least March 2019.

We will continue to fund fuel efficient driver training, improving fuel efficiency in petrol and diesel cars, range in electric vehicles and encouraging safer driving. Almost 6,000 drivers completed training between 2014 and 2016.

Policy development milestone

1) With local authorities and others, evaluate the scope for incentivising more rapid uptake of electric and ultra-low emission cars and vans, through public procurement policies and preferential local incentives (such as access management and parking policies).

Procurement policies can be used to increase penetration of ULEVs through direct procurement by the public sector or by setting contract conditions for companies operating services for local authorities.

Since 2014, Transport Scotland's Switched On Fleets initiative has provided £3.5 million to enable Scottish local authorities and their community planning partners to introduce an estimated 350 new electric cars and vans into the Scottish public sector fleet. There is potential to build on this strong foundation by strengthening public procurement policies in Scotland to positively favour ULEVs.

We will therefore work with Scotland Excel, COSLA and others to determine whether a new procurement policy could be introduced in Scotland which introduces a presumption that all new vehicles purchased by public sector organisations in Scotland are ULEVs, unless there are operational or technical reasons for not doing so. We will also encourage the public sector in advance of this work to set contract conditions for their suppliers, specifying the requirement for ULEV use. We will align this to the work on the Programme for Government 2017-2018 commitments on EVs.

Policy proposals which contribute to the delivery of policy outcome 1

1) Collaborate with a local authority to model reductions in congestion and improvements in use of public transport, in possible association with a low emission zone.

Engagement, including with local authorities, on the National Transport Strategy (NTS) began in 2017 and the strategy will be published in 2019. More formal engagement is being delivered through workings groups, such as the Greener and Healthier working group. We have also begun collaborating with local authorities in advance of the implementation of low emission zones in Glasgow and Edinburgh through the creation of a Low Emission Zone Leadership Group and will continue to work with them over the coming months.

2) Introduce low emission zones (LEZs) into Scotland's four biggest cities between 2018 and 2020 and into other Air Quality Management Areas by 2032 where the National Low Emissions framework appraisals advocate such mitigation.

LEZs set an environmental limit on certain road spaces, allowing access to only the cleanest vehicles. We will work in partnership with local authorities and regional transport partnerships to deliver LEZs that are well designed to consistent national standards. The National Low Emissions Framework document will set the framework within which LEZs are introduced and will be published in line with the commitments of the Cleaner Air for Scotland strategy.

Relative significance of policies, policy development milestones and proposals to the delivery of policy outcome 1

Outcome 1 will account for a significant proportion of overall emissions reduction, as cars currently emit 43% of all transport emissions.

Monitoring

Policy output indicator for policy outcome 1

1) Average emissions of new cars registered in Scotland have continued to reduce in line with EU/UK standards.

2) Average emissions of new vans registered in Scotland have continued to reduce in line with EU/UK standards.

3) Annual share of biofuels as a percentage of total petrol and diesel sales in the UK.

Year	2018	2019	2020	2021
Total change in average gCO_2e/ km (cars)	107	103	99	95
Total change in average gCO_2e/ km (vans)	165	156	147	-
Biofuels as % of total petrol and diesel sales*	n/a	n/a	n/a	n/a

*At the time of publication, the UK Government is taking a Statutory Instrument through the UK Parliament to amend the RTFO system, which will likely result in new targets being set in this area.

Implementation indicators for policy outcome 1:

1) Average emissions per kilometre of cars and vans registered in Scotland.

2) The outcome of changes in VED at each budget.

3) Negotiations regarding biofuels are ongoing within the context of an EU framework. Scotland has engaged in the development of the approach.

4) Number of individuals and organisations who have completed fuel efficient driver training.

Policy outcome 2:
Proportion of ultra-low emission new cars and vans registered in Scotland annually to reach 100% by 2032.

There are eight policies and four proposals that will contribute to the delivery of policy outcome 2.

Policies which contribute to the delivery of policy outcome 2

1) With the EU and UK, negotiate stretching emission standards for new cars (and vans) beyond 2020.

Vehicle emission standards are currently set at a European level. Vehicle efficiencies have improved considerably over recent years driven in large part by existing EU emission standards. The current standards specify that the average emission of new cars in 2021 must be 95g/CO_2/km and for new vans 147g/CO_2/km by 2020. We will work with the EU and UK Government to press for strong future emissions standards beyond those currently in place.

2) With the UK, negotiate Vehicle Excise Duty differentials between ultra-low emission vehicles (ULEVs) and diesel/petrol vehicles to support and encourage the uptake of ULEVs.

VED differentials are in place for lower emission vehicles compared to higher emitting petrol and diesel vehicles. Zero emission vehicles are exempt with a graded scale of differential for vehicles up to 100g/CO_2/km. Changes that came into force on 1 April 2017 may impact on the adoption of low carbon vehicles as only zero emission vehicles will have reduced VED after year one of the vehicles' life. It will be important to maintain this VED differential into the 2020s as although the total cost of ownership premium between a ULEV and petrol or diesel vehicle is likely to decrease in this period, some level of premium will remain.

VED is set by the UK Government, and we will continue to press the need for a VED differential for ULEVs through the 2020s.

3) Enhance the capacity of the electric vehicle charging network (ChargePlace Scotland):

- continue to grow the network up to 2022
- provide support for home charge points for consumers
- provide support for workplace charge points
- work with each of our delivery partners to create Scotland's 'Electric A9', including charging points along the route and demonstrating that electric vehicles offer important advantages to motorists in rural and urban Scotland
- provide funding for towns and cities to become 'Switched On' – working with partners, local authorities will get funding to meet local EV transition needs such as supporting charging initiatives for tenements and EV incentives.

Given the importance of an extensive and reliable EV charging network across Scotland to enable the widespread adoption of EVs, Transport Scotland will continue to provide funding to support the ongoing expansion of the EV charging network. Transport Scotland will also continue to support the installation of domestic and workplace charge points and work with partners to identify solutions for households without off street charging.

The composition of this funding package will be reviewed annually to ensure funding is deployed in such a way as to maximise support for EV uptake. A review will be undertaken before August 2019 prior to the end of the current agreement with our network operator, ChargeYourCar. Delivery of this policy will be supported by changes to the Scottish planning system, such as no longer needing planning permission for on-street charging points.

Case Study

An electric vehicle being charged at one of ChargePlace Scotland's network of charge points.

Credit: ChargePlace Scotland.

In ChargePlace Scotland[76], we already have one of the most comprehensive EV charging networks in Europe, with over 800 public charge points. This includes over 175 rapid chargers which can charge a vehicle in as little as 20 – 30 minutes.

Since 2012, the Scottish Government has invested approximately £15 million in the development of this network. This has been done in partnership with all 32 Scottish local authorities and the Energy Saving Trust, developing and strengthening the network to ensure EV drivers have the confidence to complete their journeys without experiencing 'range anxiety'. A host is the designated owner of the charge points they have installed and are also responsible for their maintenance and general upkeep.

The ChargePlace Scotland network is operated on behalf of the Scottish Government through a procured framework agreement. The charging infrastructure is one part of an integrated package of incentives to accelerate the uptake of electric vehicles in Scotland.

76 ChargePlace Scotland www.chargeplacescotland.org

4) Provide interest-free loans through the Energy Saving Trust to enable the purchase of EVs by both consumers and businesses until at least March 2020.

In addition to the UK Government's plug-in car and van grant, Transport Scotland is providing over £8.2 million of funding to the Energy Saving Trust (EST) in 2017-2018 for a Low Carbon Transport Loan Scheme for both consumers and businesses. Currently, individuals can apply for a loan of up to £35,000 to cover the cost of purchasing an EV, while businesses can apply for a loan of up to £100,000, which can be used towards a wide range of measures to reduce the business' transport footprint (including the purchase of ULEVs of up to £35,000 per vehicle). Current loan provision will continue until at least March 2020 and will be reviewed on a yearly basis.

5) With local authorities, review licensing regulations and consider introducing incentives to promote the uptake of ULEVs in the taxi and private hire sector, with loan funding for vehicle purchase until at least March 2020.

There are more than 20,000 taxis and private hire cars in Scotland, offering potential for increased adoption of EVs. Transport Scotland will continue to fund the EST's Low Carbon Transport Loan which offers an interest-free loan of up to £100,000 to businesses including licensed taxi and private hire operators to encourage them to switch to EVs. In addition, 'Hackney cab' operators can apply for a loan to replace vehicles that are at least eight years old with a lower emission alternative. Transport Scotland will also consider expanding the loan scheme to include ultra-low emission 'Hackney cabs' when they are available to buy.

Following extensive engagement over recent years, almost all of Scotland's local authorities now allow EVs to be licensed as taxis and private hire vehicles. We will work with the EST to encourage the remaining local authorities to review their interpretation of licensing regulations, learning from areas such as Dundee and Edinburgh where EVs are already being used as taxis or private hire vehicles.

6) Promote the benefits of EVs to individuals and fleet operators (exact nature of promotion to be decided annually).

A combination of the Scottish Government's Greener Scotland marketing campaigns, major annual events such as Greenfleet Scotland/Evolution and a series of EV road shows have enabled engagement with a significant number of individuals and businesses. This engagement has focused on promoting EV benefits, dispelling myths and providing test drives in a wide range of vehicles. This will help normalise the EV driving experience and help dispel range anxiety for many drivers.

This activity will continue with the exact nature and composition of the communication and marketing initiatives being determined on an annual basis to ensure maximum level of engagement from the available budget.

7) We will support the public sector to lead the way in transitioning to EVs, putting in place procurement practices that encourage EVs.

Procurement policies can be used to increase penetration of ULEVs through direct procurement by the public sector or by setting contract conditions for companies operating services for local authorities.

Between 2014-2017 Transport Scotland's Switched On Fleets initiative has provided £3.5 million to enable Scottish local authorities and their community planning partners to introduce an estimated 350 new electric cars and vans in the Scottish public sector fleet. There is potential to build on this strong foundation by strengthening public procurement policies in Scotland to positively favour ULEVs.

We will therefore work with Scotland Excel, COSLA and others to determine whether a new procurement policy could be introduced in Scotland which introduces a presumption that all new vehicles purchased by public sector organisations in Scotland are ULEVs, unless there are operational or technical reasons for not doing so. We will also encourage the public sector in advance of this work to set contract conditions for their suppliers, specifying the requirement for ULEV use.

8) We will establish by 2019 an innovation fund to support innovation in business, academia and industry around EV adoption.

We will provide financial support for local solutions and small scale research and development to address the particular challenges to expanding the charging infrastructure in Scotland, such as in tenement properties and capitalising on opportunities such as better linking electric vehicles with renewable energy storage systems in Scotland.

Policy proposals which contribute to the delivery of policy outcome 2

1) Consider draft proposals in the Energy Performance of Buildings Directive (EPBD), relating to the provision of EV charge points/ wiring in new residential and commercial developments. Investigate how such measures could potentially be trialled in Scotland and consider developing guidance on charge point provision to support planning authorities.

The review of the Energy Performance of Buildings Directive (EPBD), contains proposals regarding the provision of pre-cabling and charging points in new residential and non-residential developments respectively (and those undergoing major renovations). Building on this work, the Scottish Government will consider the draft proposals in the EPBD, and investigate undertaking a trial with a developer in Scotland. The outputs of any trial would help shape a potential national rollout of such provisions.

2) In advance of a decision as to whether charging points will be a feature of building standards, Transport Scotland will consider developing guidance on charge points to support planning authorities.

Scotland's Statutory National Planning Framework 3[77] and non-statutory Scottish Planning Policy[78] (both published 2014) recognise and support the rollout of plug-in vehicles and the charging infrastructure. Scottish Planning Policy is clear that electric vehicle charge points should always be considered as part of any new development and provided where appropriate. The National Planning Framework and Scottish Planning Policy are anticipated to be subject to review from 2018.

3) Continue to investigate the role that other alternative fuels, such as hydrogen, gas and biofuel can play in the transition to a decarbonised road transport sector. Consider the scope for market testing approaches to alternative fuels infrastructure and supply.

Building on our investment in both the Aberdeen H2 bus project and the Levenmouth community energy project, we will continue to work with key partners to investigate the use of hydrogen as a transport fuel, as well as exploring wider environmental and economic opportunities of using hydrogen for energy applications, especially in promoting renewables, energy balancing and storage.

We will also continue to engage with our partners, including fuel supply companies, local authorities and developers on the role lower carbon intensive fuels such as liquid petroleum gas, compressed natural gas and biofuels can play in the transition towards a near zero emission road transport sector by 2050.

4) Work with Scottish Enterprise, the UK Government, and other bodies to investigate the potential to undertake trials of connected and autonomous vehicles in Scotland.

Over the next few years, advances in connected and automated vehicle technology will likely have an impact on our transport system with the potential to deliver major benefits: fewer crashes on our roads; freedom to travel for those who currently find that difficult; more efficient road networks that are safer, smoother and swifter; reduced environmental impact; and new jobs in the technology and automotive sectors. We want to make sure that Scotland is prepared for this potential transformation. We will work with partners and investigate the possibility of Scotland hosting large scale autonomous and connected vehicle trials.

Relative significance of policies, policy development milestones and proposals to the delivery of policy outcome 2

Policy outcome 2 will account for a significant proportion of overall emissions reduction, as cars currently emit 43% of all transport emissions.

77 Scotland's National Planning Framework 3, 2014 https://beta.gov.scot/publications/national-planning-framework-3/

78 Scotland's Planning Policy, 2014 https://beta.gov.scot/publications/scottish-planning-policy/pages/2/

The proposals and policies under policy outcome 2 are focused on removing some of the key domestic barriers identified to a more rapid take-up of, in particular, battery electric vehicles. There is a strong read across to the measures in policy outcome 1.

Monitoring

Policy output indicators for policy outcome 2

1) Percentage of grant funding for charge points utilised each year.

2) Percentage of charge point installs completed each year.

3) Annual utilisation of the CPS network.

Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Total % share of car sales that are classified as low emissions	2.1	3.6	4.7	6.1	7.8	10.1	13.0	16.8	21.7	28.0	36.1	46.6	60.1	77.5	100.0
Total % share of van sales that are classified as low emissions	0.7	1.0	1.4	2.0	2.9	4.1	5.8	8.3	11.9	16.9	24.1	34.4	49.1	70.1	100.0

Implementation indicators for policy outcome 2

1) Percentage of grant funding for publically available charge point installations that is utilised each financial year.

2) Percentage of grant funding for domestic/workplace charge point installations that is utilised each financial year.

3) Percentage of publically available charge point installs that are completed each financial year.

4) Percentage of domestic/workplace charge point installs that are completed each financial year.

Policy outcome 3:
Average emissions per tonne kilometre of road freight to fall by 28% by 2032.

There are four policies and two proposals which will contribute to the delivery of policy outcome 3.

Policies which contribute to the delivery of policy outcome 3

1) With the EU and UK, negotiate an emission standard for Heavy Goods Vehicles (HGVs) from 2025.

We will work with the UK Government and our EU partners to encourage the introduction of a new binding carbon emission standard for new HGVs registered and operating in Scotland (and the rest of the UK/EU). Currently new HGVs must meet Euro VI[79] standard but this is focused on pollutants and does not include a CO_2 standard. The introduction of a fuel efficient standard for newly registered HGVs will encourage HGV manufacturers to bring forward new models which are more efficient and produce lower levels of carbon emissions. As these new vehicles penetrate the HGV fleet operating in Scotland and replace higher emission vehicles, more road freight miles will be driven in the most up to date fuel efficient vehicles, thereby leading to a reduction in CO_2 emissions from the freight sector.

The EU European Strategy for Low Emission Mobility[80] proposes a post-2020 strategy for lorries, buses and coaches. Given the 10 year average life of an HGV, the Commission argues that steps to address emissions must be in place by 2020. A first step will be the proposed legislation on monitoring/reporting of heavy duty vehicle fuel consumption and CO_2 emissions with further proposals due later in 2017. We will support efforts at this level to reduce emissions.

2) With the UK, negotiate biofuels policies that will enable them to be used sustainably in the decarbonisation of the whole transport sector.

The EU biofuels target is implemented in the UK through the Renewable Transport Fuel Obligation (RTFO) legislation, which is in the process of being revised and will ensure that biofuels from sustainable feedstocks and renewable fuels of non-biological origin (such as electrolytic hydrogen made using renewable energy) will make up a growing proportion of transport fuel and enable them to be used most effectively as a finite resource in the decarbonisation of transport.

79 European Commission, Reducing CO_2 emissions from Heavy-Duty Vehicles https://ec.europa.eu/clima/policies/transport/vehicles/heavy_en

80 European Commission, A European Strategy for low-emission mobility http://europa.eu/rapid/press-release_MEMO-16-2497_en.htm

3) Deliver our Rail Freight Strategy.

Delivering the Goods[81], Scotland's Rail Freight strategy was published in March 2016 and set out 22 actions that Transport Scotland and/or industry partners will take with a range of organisations to develop a sustainable rail freight industry with identifiable growth potential over time. Currently, per tonne of freight, rail freight produces 76% less CO_2 than road freight[82] so there is potential to reduce emissions by switching freight from road to rail. A report setting out progress against the Strategy's six critical success factors is due for publication in June 2018 including the success factor of: longer, faster, greener freight trains. In the short-term, a number of actions in the Strategy relate to the Scottish Government's planning for the next rail control period and the Office of Rail and Road's (ORR) periodic review both of which relate to the period 2019-2024.

These plans were outlined in the Scottish Ministers' High Level Output Specification (HLOS)[83] published in 2017, and require Network Rail to develop a plan with the wider industry to facilitate the growth of new rail freight to business. The plan should include both maximising the use of existing flows and the development of new business/terminal facilities. The HLOS also looks to improve the attractiveness of rail freight with challenging performance targets and a requirement for Network Rail to develop a freight journey time metric to increase the average speed of freight trains by 10%.

4) Continue to support local authorities in delivering the ECO Stars[84] programme, reducing fuel consumption for HGVs, buses, coaches and vans (reviewed annually).

ECO Stars is a UK wide fleet recognition scheme covering HGVs, buses, coaches, vans and taxis. The ultimate aim is to reduce fuel consumption and thereby lower emissions of both CO_2 and air pollutants. The scheme provides recognition of best operational practices and guidance for making improvements. In 2017-2018, the Scottish Government is providing funding support for 11 local authorities to operate ECO Stars schemes for HGVs, buses, coaches and vans, and three authorities for taxis.

81 Delivering the Goods – Scotland's Rail Freight Strategy – www.transport.gov.scot/publication/delivering-the-goods-scotlands-rail-freight-strategy

82 Delivering the Goods, Scotland's Rail Freight Strategy Scotland Rural Development Programme (SRDP) 2014-2020 Stage 2: Final Proposals https://www.transport.gov.scot/media/5362/ts-rail-freight-strategy-a4-aw3.pdf

83 The Scottish Minister's High Level Output Specification for Control Period 6 https://www.transport.gov.scot/media/39496/high-level-output-specification-hlos-for-control-period-6-final.pdf

84 ECO Stars Fleet Recognition Scheme https://www.ecostars-uk.com/

As of May 2016, these schemes collectively covered 148 unique members and 13,070 vehicles, representing approximately 11% of Scotland's HGV fleet and 23% of the public transport fleet.

Policy proposals which contribute to the delivery of policy outcome 3

1) Work with the freight sector to examine the scope for new freight logistics and infrastructure (potentially including freight consolidation centres on the outskirts of cities and urban areas following the introduction of LEZs); and to support market testing of local initiatives.

Through ScotFLAG we are working with our partners across the public and private sector to identify and facilitate any opportunities to increase the efficiency and sustainability of freight movements, including exploring opportunities for load consolidation.

A ScotFLAG Urban Freight sub-group has been set up with a remit to identify opportunities, share best practice and coordinate activity aimed at increasing the sustainability, safety and efficiency of freight movements in Scotland's urban areas. This sub-group is chaired by the Freight Transport Association.

2) Introduce low emission zones into Scotland's four biggest cities between 2018 and 2020 and into other Air Quality Management Areas by 2032 where the National Low Emissions framework appraisals advocate such mitigation.

LEZs set an environmental limit on certain road spaces, allowing access to only the cleanest vehicles. We will work in partnership with local authorities and regional transport partnerships to deliver LEZs that are well designed to consistent national standards. The National Low Emissions Framework document will set the framework within which LEZs are introduced and will be published in line with the commitments of the Cleaner Air for Scotland strategy.

Relative significance of policies, policy development milestones and proposals to the delivery of policy outcome 3

Policy outcome 3 will account for a moderate proportion of total emissions reduction. Road freight carried on HGVs accounts for 1.7MtCO_2e, and implementation of all the proposals and policies could reduce emissions from HGVs by 28% by 2032[85].

Monitoring

Policy output indicators for Policy Outcome 3:

1) Average emissions of HGVs per tonne kilometre.

2) Report on the number of ECO Stars member organisations and impact on emissions and fuel savings.

3) Report qualitatively against the actions outlined in the Rail Freight Strategy.

85 Greenhouse Gas Emissions Reduction Potential in the Scottish Transport Sector From Recent Advances in Transport Fuels and Technologies – www.transport.gov.scot/publication/greenhouse-gas-emissions-reduction-potential-scottish-transport-sector

Policy outcome 3	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Total emissions (gCO_2e) per tonne kilometre of Road Freight Index 2017=100	98	96	94	92	91	89	87	85	83	81	79	78	76	74	72

Implementation indicators for policy outcome 3

1) Uptake of the ECO Stars programme.

2) Progress in delivering the Rail Freight Strategy.

Explanation for selection of indicators

Data on freight and freight kilometres is published annually within the Scottish Transport Statistics, as are the emissions associated with HGVs. It is possible to measure the emissions per tonne kilometre from these data, however work will be undertaken to try and improve the indicator to better reflect the desired outcome.

Policy outcome 4:
Proportion of the Scottish bus fleet which are low emission vehicles has increased to 50% by 2032.

There is one policy, one policy development milestone and one proposal which contribute to the delivery of policy outcome 4.

Policy which contributes to the delivery of policy outcome 4

1) Provide financial support for the purchase and operation of low carbon buses.

Transport Scotland has developed targeted interventions to encourage operators to purchase and operate low emission buses in the Scottish fleet. These help the Government to meet its aims for improved air quality and reductions in emissions of greenhouse gases.

A review of the Scottish Green Bus Fund (SGBF) is currently underway as of early 2018 and we are considering changing the basis for assessing applications, widening the criteria to include aspects such as technological ambition, amount of carbon saved per passenger per vehicle, value for money and previous organisational experience. Infrastructure is unlikely to be included as other funding processes (such as the Bus Investment Fund[86]) could be used to help with these costs if funding is available. The SGBF will likely remain an annual fund.

86 Scottish Transport, Bus Investment Fund https://www.transport.gov.scot/public-transport/buses/bus-investment-fund/#

Policy development milestone

1) In the context of the review of the National Transport Strategy and Transport Bill, we will examine the scope for climate change policies, in relation to buses, across the public sector in high-level transport legislation strategies and policies.

National Transport Strategy engagement began in 2017 and the Strategy will be published in 2019.

Policy proposals which contribute to the delivery of policy outcome 4

1) With local authorities and others, model and pilot reductions in congestion and improvements in use of public transport, in possible association with a low emission zone.

Engagement, including with local authorities, on the National Transport Strategy (NTS) began in 2017 and the strategy will be published in 2019. More formal engagement is being delivered through workings groups, such as the Greener and Healthier working group. We have also begun collaborating with local authorities in advance of the implementation of low emission zones in Glasgow and Edinburgh through the creation of a Low Emission Zone Leadership Group and will continue to work with them over the coming months.

2) Introduce low emission zones into Scotland's four biggest cities between 2018 and 2020 and into other Air Quality Management Areas by 2032 where the National Low Emissions Framework[87] appraisals advocate such mitigation.

LEZs set an environmental limit on certain road spaces, allowing access to only the cleanest vehicles. We will work in partnership with local authorities and regional transport partnerships to deliver LEZs that are well designed to consistent national standards. The National Low Emissions Framework document will set the framework within which LEZs are introduced and will be published in line with the commitments of the Cleaner Air for Scotland strategy.

Relative significance of policies, policy development milestones and proposals to the delivery of policy outcome 4

Policy outcome 4 will account for a small proportion of overall emissions reductions, as bus and coach emissions account for less than 4% of total transport emissions.

There is potential for behavioural switch as bus is a mode with the ability to scale up flexibly in response to increased demand, but to achieve significant change from car use would mean a step change increase in bus journeys.

87 Cleaner Air for Scotland - The Road to a Healthier Future http://www.gov.scot/Publications/2015/11/5671/14

Monitoring

Policy output indicator for Policy Outcome 4

1) Proportion of bus fleet made up of low emission vehicles is 50% by 2032.

Policy outcome 4	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Proportion of bus fleet made up of low emission vehicles (%)	13	15	18	20	23	25	27	30	33	36	39	42	45	48	50

Implementation indicators for policy outcome 4

1) Number of low carbon buses purchased including those through the Scottish Green Bus Fund.

2) Annual low carbon bus expenditure through Scottish Green Bus Fund and Bus Service Operators Grant incentive.

3) Numbers of kilometres run by low emission buses as a percentage of total bus kilometres.

Explanation for the selection of indicators

Data on the number of green buses purchased is available and, providing qualifying buses claim the Bus Service Operators Grant top up for low carbon buses, the percentage of the fleet share will also be known.

Policy outcome 5:
By 2032 low emission solutions have been widely adopted at Scottish ports and airports.

There is one proposal that will contribute to the delivery of policy outcome 5.

1) Encourage and support Scottish port authorities and airports to adopt low emission solutions.

We will work with port authorities, the shipping industry, and airports to encourage and support them to introduce low emission solutions on a voluntary basis. For example, we will work with port authorities to identify the potential costs and benefits of cold ironing (the use of shore power by ships while in harbour) and other low emission measures to ship owners and operators.

Similarly, we will work with airport owners (and operators) to identify measures that can be taken to reduce emissions associated with ground operations and planes while on the ground (such as single engine taxiing, the use of ground power for planes at stand, and low emission ground vehicles). We will work with ports and airports, ship owners and operators and airlines to overcome barriers to the voluntary adoption of these measures and ensure they are taken into account when considering their future investment plans.

Relative significance of proposal to the delivery of policy outcome 5

Policy outcome 5 will accounts for a small proportion of overall emissions reduction. The key drivers in emissions reduction from aviation and shipping will come from international agreements and from ongoing improvements in design and materials.

Monitoring

Policy output indicator for policy outcome 5

1) Qualitative report on Transport Scotland's input into port and airport strategies.

Implementation indicator for policy outcome 5

1) Qualitative annual report on Transport Scotland's engagement with Scottish port authorities and airports.

Policy outcome 6:
Proportion of ferries in Scottish Government ownership which are low emission has increased to 30% by 2032.

There is one policy development milestone that will contribute to the delivery of outcome 6

Policy development milestone

1) Examine the scope for procuring hybrid and low carbon powertrains in the public sector marine fleet as part of our vessel replacement programme.

We are developing a programme of procurements to replace vessels in the Caledonian Maritime Assets (CMAL) ferry fleet with lower emission powertrains. For each project we will consider diesel-electric hybrid and liquid natural gas (LNG) fuelling options; in addition CMAL will continue to pursue technical designs which improve fuel efficiency and CalMac Ferries Ltd will continue its operational work on reducing fuel consumption. We are supporting the Scottish-based Hyseas consortium with its initiative to trial a hydrogen powered 'ro-ro' (roll-on, roll-off) vehicle ferry. We publish annual Vessel Replacement and Deployment Plans which set out our evolving plans and projects in more detail.

Relative significance of policies, policy development milestones and proposals to the delivery of policy outcome 6

Policy outcome 6 will account for a small proportion of overall emissions reduction, as domestic maritime activity only accounts for 0.3MtCO2e or 2.5% of transport's total emissions.

Monitoring

Policy output indicator for policy outcome 6

1) Number of low emission ferries in Scottish Government ownership.

Policy outcome 6	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Number of low emission ferries in Scottish Government ownership	3	4	4	5	5	5	6	6	7	7	7	8	8	9	9

Implementation indicator for policy outcome 6

1) Update on programme of procurement through the Vessel Replacement Plan.

Policy outcome 7:
We will have electrified 35% of the Scottish rail network by 2032.

There is one policy development milestone that will contribute to the delivery of outcome 7.

Policy development milestone which contribute to the delivery of policy outcome 7

1) Electrification of the rail network in the High Level Output Statement for Control Period 6 (2019-2024).

It is estimated that the use of electric trains across the rail network will result in a reduction in emissions when compared with equivalent diesel trains. We will also investigate hybrid trains and other emerging technologies to determine the suitability for application on Scotland's railways as a potential energy and cost-saving alternative to overhead wire electrification.

Relative significance of policies, policy development milestones and proposals to the delivery of outcome 7.

Policy outcome 7 will account for a small proportion of overall emissions reduction, as rail makes up less than 1% of total transport emissions.

Monitoring

Policy output indicator for policy outcome 7

1) The percentage of the rail track electrified

Policy outcome 7	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Percentage of rail track electrified (kilometres)	27	27	28	29	29	30	30	31	32	32	33	33	34	34	35

Implementation indicator for policy outcome 7

1) Annual information on electrification is contained within the Scottish Transport Statistics[88].

Policy 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.

There are two policies which will contribute to the delivery of policy outcome 8.

Policies which contribute to the delivery of policy outcome 8

1) Active travel: double funding for active travel from £40 million to £80 million from 2018-2019, significantly increasing our ambition on active travel.

Increasingly, we will plan place-making and infrastructure improvement projects that incorporate the needs of active travellers. As announced in the Programme for Government 2017-2018 the active travel budget for 2018-2019 will be increased from £40 million to £80 million from 2017-2018. This will enable a significant scaling up of activity around walking and cycling, ensuring we can make our towns and cities friendlier and safer spaces for cyclists and pedestrians.

We will maintain the annual budget for active travel at record levels until at least 2021. That budget will fund both improvements and extensions to infrastructure and environments for active travel throughout the country (particularly in urban areas) and a range of behaviour change initiatives to support people to choose active travel for short, everyday journeys where appropriate.

88 Scottish Transport Statistics http://www.gov.scot/Topics/Statistics/Browse/Transport-Travel/TablesPublications/ScottishTransportStats

Integration between walking, cycling and public transport will be improved (for example, through better bike parking and the development of active travel hubs at public transport interchanges). We will continue to work with a range of delivery partners to deliver behaviour change programmes that increase awareness, skills, confidence and ability to help overcome attitudinal barriers to walking and cycling. This will be achieved through significant investment and improvements in infrastructure, such as support for electric bikes and projects to allow older people to cycle.

Additionally, as announced in the Programme for Government 2017-2018, we will also appoint an Active Nation Commissioner to ensure we deliver world class infrastructure across Scotland.

Further information on how the Scottish Government will meet its active travel vision is outlined in our Cycling Action Plan for Scotland[89] and the National Walking Strategy[90]. Both strategies outline measures to change behaviours and improve infrastructure.

2) Support the Smarter Choices, Smarter Places (SCSP)[91] programme to encourage behaviour change.

The Smarter Choices, Smarter Places initiative is designed to support increased use of public transport, cycling and walking for everyday journeys. The programme has delivered more than 450 local initiatives that change people's behaviour and encourages cycling or walking. In total, since 2015-2016 over £15 million has been invested, attracting a further £15 million in match funding.

The programme focuses on locally designed initiatives including travel planning. As part of SCSP, a range of travel planning campaigns, public awareness events and mapping of active and public transport options have occurred across Scotland.

Local authorities target specific populations for travel behaviour change projects. These projects include travel planning (at work, school or home), public awareness events, signage and mapping, fuel efficient driver training, supporting car clubs and work with public transport operators. The budget for 2017-2018 is just over £5 million, all of which goes to local authorities and attracts match funding.

Relative significance of policies to the delivery of policy outcome 8

Policy outcome 8 will account for a small proportion of overall emissions reduction, as most journeys under a mile are already undertaken by walking.

89 Cycling Action Plan for Scotland – www.transport.gov.scot/publication/cycling-action-plan-for-scotland-2017-2020

90 Let's get Scotland Walking – The National Walking Strategy – www.gov.scot/Publications/2014/06/5743

91 Transport Scotland, Smarter Choices, Smarter Places https://www.transport.gov.scot/our-approach/active-travel/smarter-choices-smarter-places/#

Monitoring

Policy output indicator for policy outcome 8

1) Active travel budget for the year.

2) Progress towards active travel vision.

Implementation indicators for policy outcome 8

1) Qualitative update on what has been achieved through active travel expenditure.

2) Qualitative report on the implementation and achievements of SCSP.

Explanation for selection of indicators

There is no single quantitative metric appropriate for monitoring this policy outcome. Transport Scotland, alongside our partners, will continue to measure cycling and walking rates as part of the CAPS vision and the National Walking Strategy using detailed analysis to inform improvements.

ENABLING FACTORS AND WIDER IMPACTS

The transport sector's proposals and policies outlined in the Plan have the potential to bring additional co-benefits to communities, businesses and the third sector.

Increased uptake of electric vehicles will allow individuals and businesses to save on fuel costs, leading to journeys which are both cheaper and greener. Low emission zones, consolidation centres on the periphery of urban areas and support for the purchase of low emission buses will ensure the most polluting vehicles do not enter our towns and cities. Adverse health effects from exposure to pollutants are estimated to cause up to 50,000 deaths per year in the UK and reduce the average life expectancy by 7-8 months. Significantly reducing vehicle emissions in our towns and cities will improve health, reduce pollution related illnesses and consequently bring savings to health care providers.

Businesses and individuals will benefit from more reliable, faster deliveries in areas covered by consolidation centres. This is because the smaller, low emission vans travelling out of consolidation centres can travel directly to their destinations, whereas an HGV would travel round its delivery stops sequentially. A fleet of electric light goods vehicles will allow freight to be transported to its destination with minimal fuel costs. Freight operators will be able to make more efficient use of their vehicles as they will not be delayed in congestion when delivering to inner city areas.

The combined value of air quality improvements as a result of reduced emissions may be in excess of £500 million per year. This is in addition to further benefits coming from reduced noise pollution, which also has an impact on health and wellbeing[92].

Taking cost projections for petrol and diesel cars into account, and the expected impact of future technological change, electric vehicles should become significantly cheaper to purchase and operate. This offers everyone the opportunity to make savings through reduced fuel and vehicle operating costs. Fuel efficient driving and travel planning offer further cost savings as well as potentially reducing the risk of traffic accidents.

In the future, electric vehicles may be able to provide services to the power grid, smoothing out demand by drawing and returning power as needed by acting as a means of energy storage. An increase in the number of journeys made by active and public transport will further reduce congestion and pollution, in addition to the associated benefits that come through living an active lifestyle. Active travel and car sharing offer a potential route to combat transport poverty by increasing the availability of low cost, low carbon transport options and reducing the need to own a car. Car clubs, supported by Transport Scotland, will allow households to access efficient vehicles without the costs associated with car ownership.

A significant proportion of the up-front funding required to implement many of these policies is likely to fall on the public sector. With electric vehicles, the Scottish Government has funded the roll out of the ChargePlace Scotland network of charge points and funds their operation. It is expected that there will be a need for the public sector to continue to incentivise electric vehicle uptake until they are competitive with petrol and diesel vehicles. As the price of electric vehicles falls, individuals and businesses will be encouraged to invest in low carbon alternatives through government policy interventions.

The introduction of freight consolidation centres may present some disruption for logistics organisations, resulting from the need to relocate premises. However, there is the potential for further savings through moving to premise which are more energy-efficient. Low emission zones may also present challenges to fleet operators as it will impact on fleet renewal decision.

The potential impact of proposals and policies which necessitate increased expenditure for individuals, such as higher vehicle emission standards or the costs of upgrading to an electric vehicle, will need to be monitored to ensure they do not disproportionately impact particular groups.

Other measures, such as the implementation of low emission solutions at ports and airports and the roll out of low emission solutions in the bus and maritime sectors will likely require initial public sector support.

92 Greenhouse Gas Emissions Reduction Potential in the Scottish Transport Sector From Recent Advances in Transport Fuels and Technologies – www.transport.gov.scot/publication/greenhouse-gas-emissions-reduction-potential-scottish-transport-sector

These additional public sector costs should be balanced against the potential health, social and economic benefits arising. The Scottish Government will ensure that potential adverse impacts are appropriately managed.

Planning system

The Scottish Government's 'Designing Streets'[93] policy outlines the Government's commitment to pursue the delivery of streets as places where vehicle movement is integrated rather than prioritised. Trunk roads, motorways, and major thoroughfares retain vehicular movement as their main function. When reprioritising road space for other uses is considered, the principles outlined as part of Designing Streets should apply.

The Scottish Government has deregulated the infrastructure needed for on-street electric vehicle charging points by giving them permitted development status, which means that planning permission no longer needs to be sought. This will apply to many potential installations, making their installation quicker and cheaper.

For new development, a key principle of Scottish Planning Policy is that the development should support walkable access to local amenities and these are also accessible by bicycle and public transport. Established policy reinforces the transport hierarchy of supporting opportunities for people to walk and cycle first, followed by travel by public transport, followed by travel by private cars.

Scottish Planning Policy supports the provision for improved and additional freight facilities, including for rail freight where there is an identified need. In this way, land for freight consolidation centres and lower carbon forms of freight transport can be provided for.

93 Designing Streets – A Policy Statement for Scotland – www.gov.scot/Publications/2010/03/22120652/0

Chapter 4
Industry

Miller Fabrications, Wishaw. Credit: Scottish Enterprise/SNS

This sector includes all industrial activity in Scotland, including the energy-intensive industrial sectors covered by the EU Emissions Trading System.

WHERE WE ARE NOW

49% fall
in industry sector emissions between 1990 and 2015

The industry sector saw a 10.3MtCO_2e (49%) fall in emissions between 1990 and 2015. Much of this decrease was linked to a decline in emissions from manufacturing and the iron and steel industry between 1990 and 2000. There was a further smaller decrease between 2008 and 2009, coinciding with the recession. Emissions figures from this sector have been more level in recent years, albeit with small fluctuations since 2009. There was another slight decrease (0.5MtCO_2e; 4%) in emissions between 2013 and 2015.

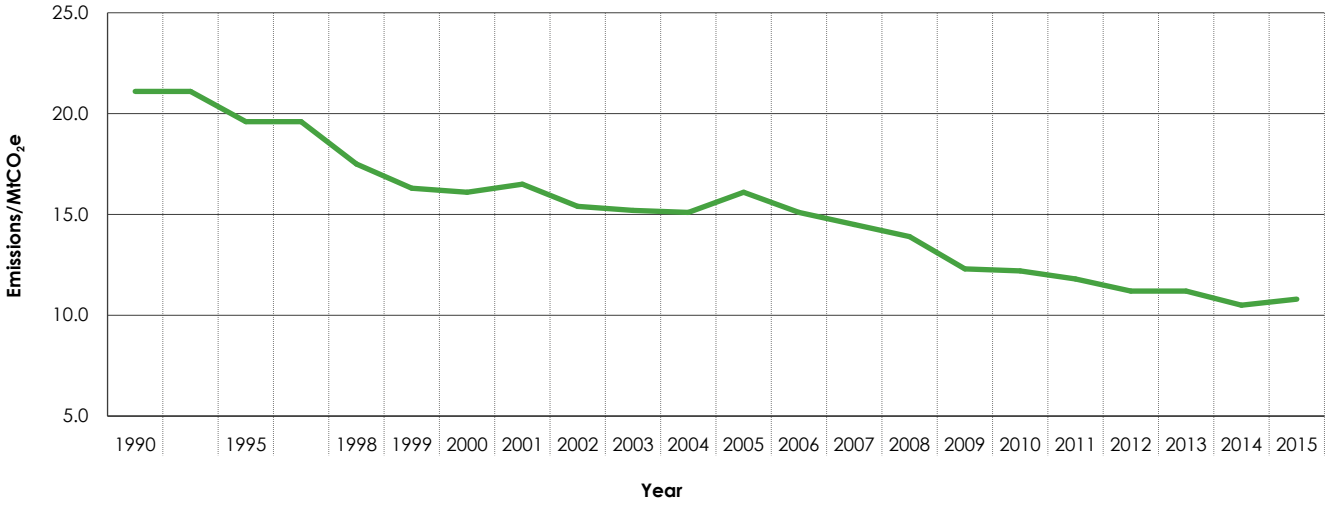
The Scottish Government is committed to protecting domestic industries at risk of relocation overseas where climate or energy regulation is less stringent (referred to as 'carbon leakage'). Scotland's Energy Strategy, published in December 2017, sets out how we will continue to manage the transition towards a future energy system in a way that reduces this risk to domestic industries. We want to collaborate with Scottish industry to strengthen the case for low carbon investment reducing emissions, in line with our global responsibilities, while at the same time improving our competitiveness and productivity.

Since 1990, decreases in emissions have been driven by a number of factors which include the adoption of technology or investing in more energy efficient equipment that, for example, utilises waste heat. However, there has been a reduction in the size of output from some industrial sectors. To place the importance of sustainable economic growth at the heart of our Plan we will be adopting new measures of emissions intensity and energy productivity.

Emissions intensity measures emissions per unit of output. In the Industrial and Commercial sectors Scottish Gross Value Added (GVA) is taken as the measure of output. Heat recovery and fuel diversification contribute to reducing emissions intensity but other factors, including energy efficiency improvements, can also reduce emissions and therefore reduce emissions intensity.

Energy productivity in the Industrial and Commercial sectors measures the level of economic activity for each unit of energy being used. It is calculated as Scottish GVA divided by total energy consumption in the Industry and Commercial sectors. Enhanced energy efficiency, fuel diversification and heat recovery all contribute to improving energy productivity, which in turn helps industry become more competitive, with investment in energy efficiency and heat recovery reducing operating costs and protecting against any rise in energy prices.

Figure 13: Industry historical emissions



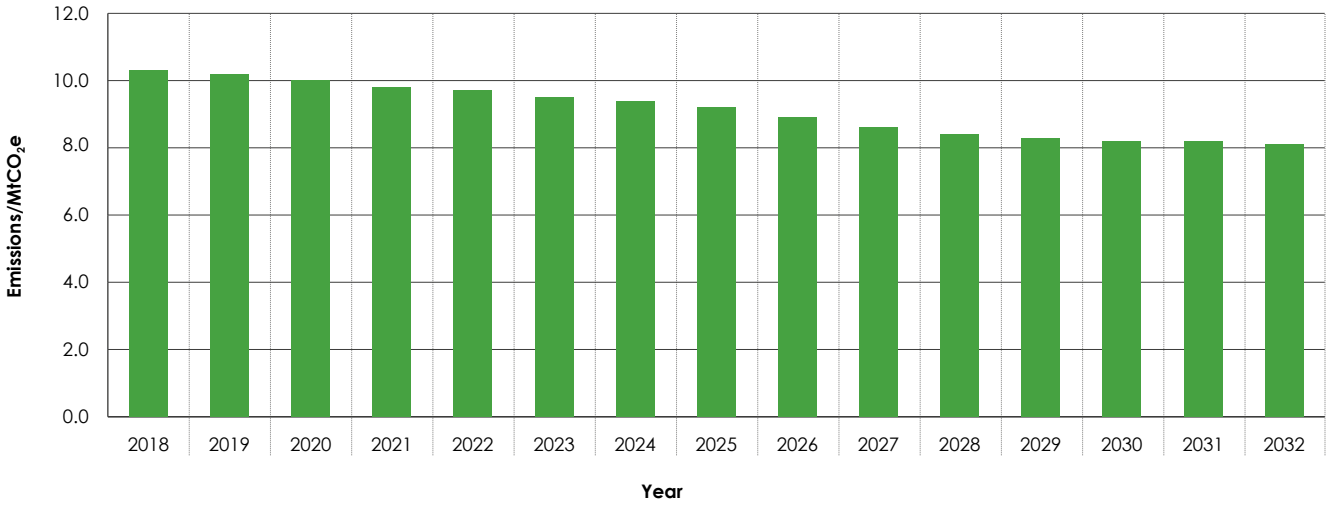
Using these measures allows us to show reductions in energy use and emissions which do not come at the expense of a growth in output, thus capturing productivity improvements that can build on existing strengths in several sectors. This allows industry sectors to encourage investment that may result in growth in economic output, with corresponding benefits for wider society across Scotland. These measures embed our support of economic activity within our ambition to decarbonise industrial processes and are consistent with the emissions trajectory outlined in the plan for this sector.

PROGRESS SINCE RPP2

Progress made on emissions cuts arising from heat policy, alongside a fuller description of Scotland's Energy Efficiency Programme (SEEP) is set out in the Buildings chapter of this Plan. We are consulting on the regulation of district heating during 2018 as part of the wider consultation on SEEP, and this will include consultation on industrial heat recovery.

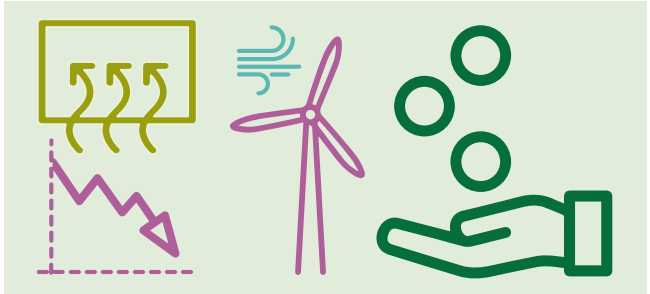
OUR AMBITION

Figure 14: Industry emissions envelopes



Scotland's industrial sector has already delivered substantial emissions reductions. The Scottish Government wants to ensure that further decarbonisation over the lifetime of the Plan (2.2MtCO$_2$e; 21% reduction) will be achieved by supporting industry to invest in measures that will enhance its productivity, improve its competitiveness, and realise new manufacturing opportunities in global markets.

Our policy outcomes in this Plan combine measures that show improvement in energy productivity as well as falls in industrial emissions intensity. In addition, an outcome will be securing new investment to enable commercial demonstration of technologies critical to further industrial emissions reduction. We will work with businesses and others to achieve these outcomes through the following principal means:



EMISSIONS WILL FALL THROUGH A COMBINATION OF FUEL DIVERSIFICATION, ENERGY EFFICIENCY, HEAT RECOVERY AND PARTICIPATION IN EU CARBON MARKETS

1) By ensuring a continued level playing field for regulation through EU and UK frameworks for industrial decarbonisation.

The regulatory environment is underpinned by existing and planned EU and UK regulatory frameworks – the EU ETS Phase III (2014-2020) and Phase IV (2021-2030), and UK carbon taxes and related reliefs (e.g. Climate Change Levy, Climate Change Agreements, Energy Intensive Industries package)[94].

These regulatory frameworks ensure continuing access to the level playing field for industry across the UK and EU, and support investment in the industrial decarbonisation pathways necessary to meet the EU and UK's contributions to the Paris Agreement, including continued access where required to free allocation of allowances for those sectors at risk of international carbon leakage[95].

The Committee on Climate Change has already confirmed that it expects that "available rules for future phases of the EU ETS will imply a reduction in Scottish net emissions in these sectors of 34% from 2013-2030"[96].

The ETS cap will therefore make a major contribution to the 21% emissions reduction envelope for industry from 2018-2032[97]. For example, at the EU level:

- By 2020 – Industrial emissions covered by the EU ETS cap will be 21% below 2005 levels, consistent with the EU's 2020 emissions reduction target and commitment to the Kyoto Protocol second period.
- By 2030 – Industrial emissions covered by the EU ETS cap will be 43% below 2005 levels, consistent with the EU's 2030 emissions reduction target and commitment to the Paris Agreement.
- By 2050 – Industrial emissions, covered by the EU ETS cap would be 90% below 2005 levels, which would be consistent with the EU's 2050 emissions reduction target.

2) By providing a coordinated approach to incentives and business support that reflects our commitment to manage the transition toward decarbonising industry. This includes:

- Our manufacturing action plan (MAP) – 'A Manufacturing Future for Scotland'[98];
- Scotland's Energy Efficiency Programme (SEEP)[99], and
- Our circular economy strategy – 'Making Things Last'[100].

94 The impact of the UK's exit from the European Union on the role of emissions trading is not factored into the Plan, since the UK Government has not yet taken a position on the UK's future relationship with the EU Emissions Trading System. The EU ETS remains a fundamental part of UK and Scottish climate change legislation. Powers exist under the Climate Change Act 2008, to create emissions trading schemes in the UK.

95 European Commission, Carbon Leakage http://ec.europa.eu/clima/policies/ets/allowances/leakage/index_en.htm

96 The CCC, Scottish Emissions Targets 2028-2032 https://www.theccc.org.uk/wp-content/uploads/2016/03/Scottish-Emissions-Targets-2028-2032.pdf

97 Figures for Phase V of the ETS (post-2030), covering the Scottish carbon budget to 2032 are not available, since the EU's contribution to the Paris Agreement is currently only set out to 2030. We can expect further tightening of the ETS cap beyond 2030 to meet the EU's 2050 target of 80% emissions reduction.

98 Scotland's manufacturing action plan https://www.scottish-enterprise.com/knowledge-hub/articles/insight/scotlands-manufacturing-action-plan

99 Scotland's Energy Efficiency Programme (SEEP) - Phase 2 http://www.gov.scot/Topics/Business-Industry/Energy/Action/lowcarbon/LCITP/SEEP

100 Making Things Last - A Circular Economy Strategy for Scotland http://www.gov.scot/makingthingslast

These plans and programmes draw together a combination of existing support from the Scottish Government, Scottish Enterprise, Highlands and Islands Enterprise and other partners.

Our engagement with industrial representatives has highlighted that many opportunities exist to increase investment in energy efficiency and decarbonisation measures. Taken together these programmes will form a policy delivery framework aimed at supporting this activity.

Existing activities covered within the Energy Efficiency and Decarbonisation workstream of MAP that identify cost-effective energy efficiency and decarbonisation measures, such as investment in equipment to improve productivity, will be reviewed during 2018.

A coordinated approach to industrial energy efficiency should enable the development of financial mechanisms for industry to invest in effective energy efficiency and decarbonisation measures. Targeted financial instruments allied to packages of business support that look only at industrial processes as part of a whole system view (as set out in the Energy Strategy) will help stimulate investment to facilitate more sustainable business models.

Coupled with this we will align the support or incentives for business and industry that are on offer within Scotland's Energy Efficiency Programme (SEEP), taking account of the more bespoke needs of industry. This will consider the behaviours and decision-making practices among intensive energy user stakeholders in industry. A joined-up approach will help to deliver our commitment to improve energy efficiency as a national infrastructure priority.

In partnership with leaders from within Scottish industry, we will publish a discussion paper during 2018 that will include consideration of financial instruments as well as how to build on existing MAP activities and commitments related to SEEP.

Our circular economy strategy, Making Things Last sets out our ambitions and priorities to keep products and materials in high value use for as long as possible. This reduces waste and carbon emissions and delivers economic benefits through improving productivity, opening new markets and improving resilience. The Waste chapter of this Plan contains a policy on delivering our suite of waste reduction, recycling and landfill diversion targets and regulations up to 2025.

Case Study

Two wind turbines supplying electricity to the Michelin tyre factory in Dundee.
Credit: Michelin.

Michelin is Dundee's largest industrial employer with approximately 850 staff located at the company's factory in Baldovie. On average a quarter of the plant's electricity needs has been met, over the year, by power produced from two 2MW wind turbines, installed in 2006.

In 2015 Michelin began an investment programme of £52m over the subsequent five years. This included upgrading machinery to make car tyres to reflect current market trends for larger diameters where the company's existing capacity was more limited. It is also their first production site to install innovative electrically-heated tyre curing presses on an industrial scale to replace traditional presses that use a combination of steam and hot water. This project, supported by Scottish Enterprise, was announced in June 2017.

Michelin developed these plans to invest in new equipment, and new buildings such as the logistics centre, to maintain its leadership position by responding to wider international changes. This has increased competitiveness, improved manufacturing efficiency and customer service, whilst at the same time safeguarding production volumes at the facility and supporting local employment.

This example of improving energy productivity illustrates where a Scottish site, as part of a multinational business, has secured investment to enable deployment of efficiency measures to lead to significant reductions in energy use. The company successfully aligned its business case with the wider case for decarbonising an essential process that is an important part of the foundation of our manufacturing base.

In March 2017, the Scottish Government's Low Carbon Infrastructure Transition Programme (LCITP) provided capital support of £1.68 million to Michelin and MVV Environment Baldovie Ltd for a project to supply direct steam from an Energy from Waste plant being constructed by MVV on adjacent land.

Michelin will use the direct steam supplied by the waste plant primarily for the vulcanisation of tyres. The project has the potential to reduce CO_2 emissions from tyre production by around 84%. Once complete, reductions in energy consumed will help lower operating costs and further embed a more sustainable industrial operation within the local community.

Whilst the end user of the project in the initial phase will be the Michelin site, Dundee City Council is in the process of developing its Sustainable Energy and Climate Change Action Plan which includes plans for a wider heat network within the Whitfield/Baldovie area.

3) By continuing to consider emerging Carbon Capture and Storage (CCS), Carbon Capture and Utilisation (CCU) and hydrogen opportunities and supporting research and international collaboration.

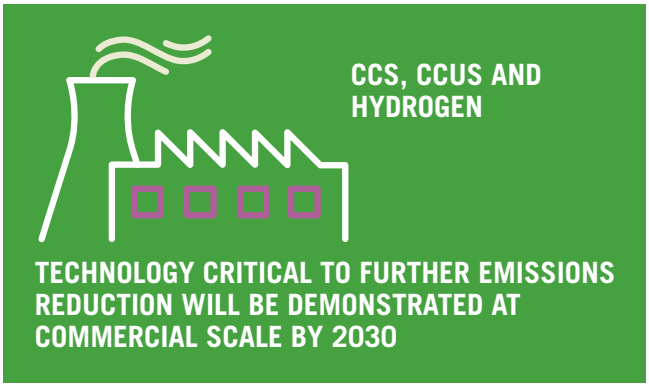
These technologies are essential to cost-effective climate policies, particularly in industries such as petrochemicals, cement production, oil and gas processing and the production of aluminium and steel.

CCU could also help Scotland shift to a lower carbon, more sustainable and more circular economy through better management and reuse of its carbon. In doing so, it can also help create new, lower carbon manufacturing processes and opportunities[101].

Scotland is one of the best-placed countries in Europe to realise CCS and CCU on a commercial scale. With support from the Scottish Government, Scotland has developed a world-leading academic and research reputation in CCS, alongside forging important international collaborations. The UK Government has renewed its commitment to Carbon Capture Utilisation and Storage (CCUS) in its Clean Growth Strategy.

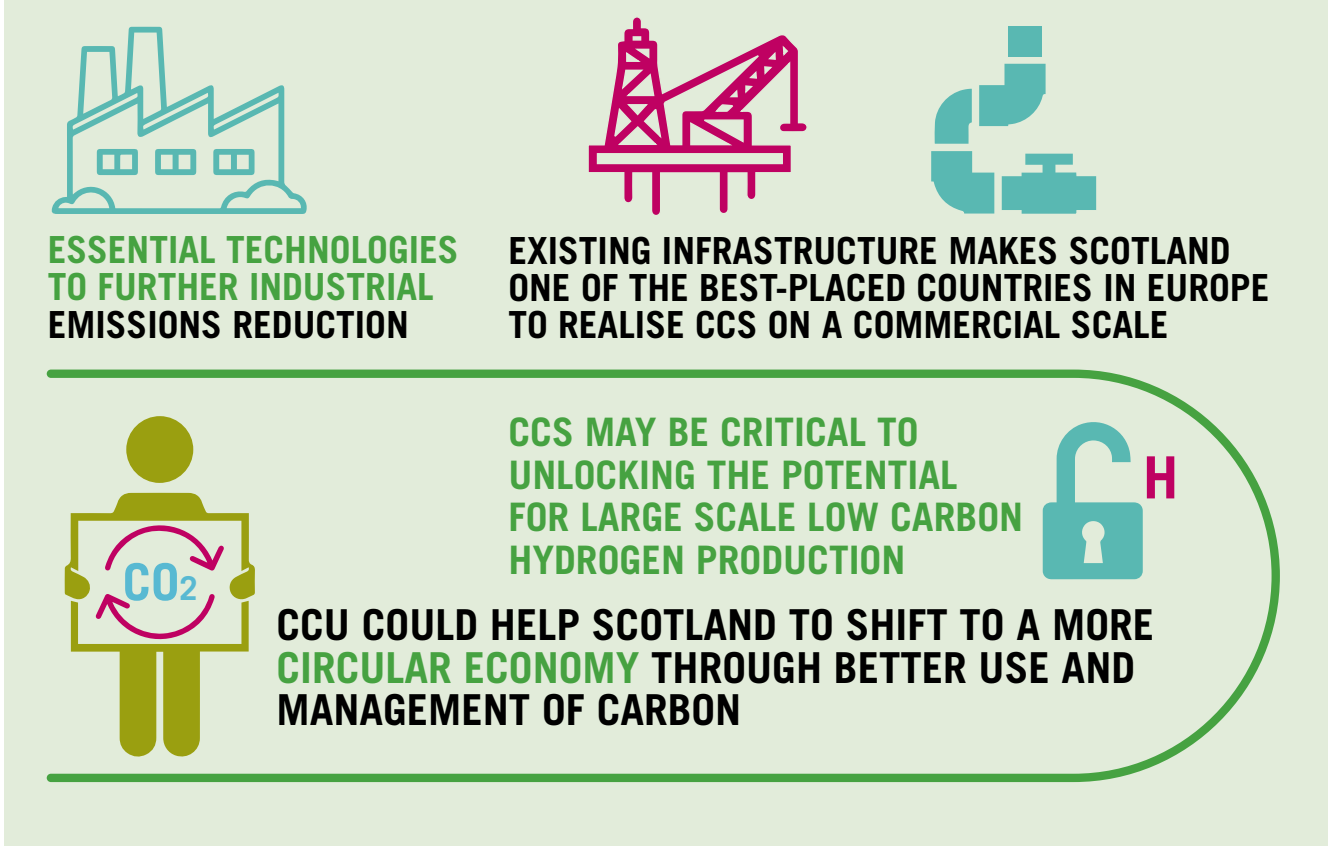
Scotland's considerable renewable energy assets and future renewable energy potential could support the emergence of a green hydrogen sector that helps industry decarbonise, provides energy network services and helps decarbonise heat and transport systems. CCS may be critical to unlocking the potential for large scale low carbon hydrogen production where Steam Methane Reforming is the principal source of hydrogen.

Hydrogen also has a variety of industrial applications that can contribute to decarbonisation. For instance, it can be used with captured CO_2 (or CO_2 from biomass) to replace fossil fuels in the production of hydrocarbon-based chemicals such as methanol and transport fuels, or in the production of 'green' ammonia, which is used in the manufacture of fertilisers.



101 Actions required to develop a roadmap towards a Carbon Dioxide Utilisation Strategy for Scotland. Scottish Enterprise, 2016

THE FUTURE OF CARBON CAPTURE, STORAGE AND UTILISATION IN SCOTLAND BEYOND 2032



POLICY OUTCOMES, POLICIES, DEVELOPMENT MILESTONES AND PROPOSALS

Policy outcome 1:
By 2032, industrial and commercial energy productivity to improve by at least 30%, from 2015 levels, through a combination of fuel diversification, energy efficiency improvements and heat recovery.

Policy outcome 2:
By 2032, industrial and commercial emissions intensity will fall by at least 30%, from 2015 levels, through a combination of fuel diversification, energy efficiency improvements and heat recovery.

There are four policies, three policy development milestones and one proposal which contribute to the delivery of policy outcomes 1 and 2.

Policies which contribute to the delivery of policy outcomes 1 and 2

1) EU ETS cap delivers a 43% reduction on 2005 EU emissions levels by 2030[102], and we will argue for a share of that cap in line with meeting Scotland's domestic ambitions.

The EU ETS will continue to cover energy intensive industries to 2030 under proposed ETS Phase IV, with an increased reduction trajectory.

102 The EU Emissions Trading System (EU ETS) https://ec.europa.eu/clima/policies/ets_en

Industrial sectors at risk of carbon leakage will continue to benefit from free allocation of allowances to avoid decarbonisation by deindustrialisation in the absence of comparative effort from other economies under the Paris Agreement.

Delivery of the EU ETS in Scotland will continue to be a partnership between the Scottish and UK Governments, and the other devolved administrations, with SEPA as the major enforcement body in Scotland.[103]

2) UK Climate Change Levy (CCL) and Climate Change Agreements (CCAs) incentivise shift from gas to alternative fuels, and deliver agreed energy efficiency and emission reduction targets for energy intensive industrial sectors.

Carbon taxation is a reserved matter, and for non-domestic organisations the UK Government intends to focus this in a single instrument (CCL) from 2019 onwards. In order to incentivise reductions in gas, to support achieving the UK climate change targets, the UK Government will rebalance the rates of CCL for electricity and gas such that they equalise by 2025.

The UK Government has confirmed that energy intensive industry will continue to benefit from CCAs until 2023, which provide a CCL discount (90% for electricity and 65% for other fuels, increasing from 2019) in return for meeting emission reduction targets.

103 The impact of the UK's exit from the European Union on the role of emissions trading is not factored into the Plan, since the UK Government has not yet commenced negotiations with the EU, and has not yet taken a position on the UK's future relationship with the EU Emissions Trading System. The EU ETS remains a fundamental part of UK and Scottish climate change legislation. Powers exist under the Climate Change Act 2008, to create emissions trading schemes in the UK.

3) Non-domestic Renewable Heat Incentive (ends 2020-2021) and associated Scottish Government supportive programmes will continue to encourage the uptake of renewable heat technologies.

The Renewable Heat Incentive (RHI) is a UK-wide scheme created by the UK Government (with the agreement of the Scottish Government). The non-domestic scheme helps businesses, public sector and non-profit organisations meet the cost of installing renewable heat technologies such as biomass, heat pumps (ground source, water source and air source), deep geothermal, solar thermal collectors, biomethane and biogas, combined heat and power (CHP) systems. Payments are made over 20 years and are based on the heat output of the system.

There is no UK Government commitment to funding the RHI beyond 2020-2021. During the development of SEEP we will consider what sort of funding mechanisms are needed into the 2020s and 2030s to enable continued take-up of these technologies by business.

4) Our manufacturing action plan (MAP) 'A Manufacturing Future for Scotland' industrial Energy Efficiency and Decarbonisation workstreams supports investment in energy efficiency and heat recovery. Funding of £63,000 has been allocated to Resource Efficient Scotland for its Energy Efficiency and Decarbonisation (EE&D) actions under the MAP. The MAP commits the Scottish Government and its partners to a programme of activity that includes:

- Supporting Scotland's energy intensive industries to develop feasible business plans for measures.

- Developing new incentive or regulatory mechanisms to deliver energy efficiency, working with the UK Government and other administrations as necessary.
- Establishing a more detailed baseline of Scottish industrial energy, heat and emissions performance.
- Exploring the scope for supporting and accessing finance for cross-sector technology demonstrator projects identified in UK road maps (CCS, heat electrification, industrial biomass etc.), including EU ETS Innovation Fund and support for industrial clustering, in key sites such as the Grangemouth area, to realise co-location and shared infrastructure benefits.

Policy development milestones

1) Establishing a coherent package of support for industry within the National Infrastructure Priority for Energy Efficiency – Scotland's Energy Efficiency Programme (SEEP).

The Programme for Government commits the Scottish Government to develop a range of policies to decarbonise the heat supply and make energy efficiency improvements in all buildings across Scotland through the national infrastructure priority. For industrial buildings, this could include support for investment in energy efficiency equipment, or in heat recovery to district heating networks alongside support, where eligible or available, via existing financial mechanisms of Scottish Ministers and Scottish Enterprise.

Our approach to supporting industrial processes as well as premises will be outlined within the route map for SEEP, which will be published during 2018.

2) Tracking progress against actions in the EE&D workstream of our manufacturing action plan (MAP) 'A Manufacturing Future for Scotland'.

Analysis of Energy Saving Opportunities Scheme (ESOS) audit pilot recommendations is one method of identifying business cases for investment in energy efficiency or decarbonisation measures to be considered as part of a coordinated approach.

ESOS audits set out cost-effective energy efficiency and decarbonisation measures. Further development could include consideration of the potential to require mandatory implementation of ESOS audit findings where they are demonstrated to save industry money and improve productivity, if this is within devolved competence. Reviewing MAP progress with agency partners, and stakeholder engagement, will be undertaken in 2018.

3) EU ETS beyond 2030.

Figures for Phase V of the ETS (post-2030), covering the Scottish carbon budget to 2032 are not available, since the EU's contribution to the Paris Agreement is currently only set out to 2030. We can expect further tightening of the ETS cap beyond 2030 to meet the EU's 2050 target of 80% emissions reduction.

The European Commission has said that under the ETS, by 2050 emissions would be reduced by around 90% compared to 2005 levels – though this is subject to further provision in EU law to extend the ETS beyond 2030.

Policy proposal

1) We will coordinate incentive mechanisms on energy efficiency and decarbonisation measures, reflecting sector road maps and sector deals.

Our MAP currently sets out our industrial policy for energy efficiency and decarbonisation. During 2018, MAP actions will be reviewed and current activities adapted or developed to reflect engagement with representatives from energy intensive industries. In addition, a working group will be convened to capture opportunities from investment in energy efficiency.

Other influencing factors include the UK Clean Growth Strategy[104] and associated Sector Deals, Scotland's Energy Strategy[105], anticipated support offers such as SEEP and the impact of Brexit on the EU ETS.

Monitoring

Policy output indicator or policy outcome 1

1) Industrial and commercial energy productivity to improve by at least 30% by 2032.

Year	2020	2025	2032
Change in energy productivity from 2015	10%	20%	30%

Policy output indicator for policy outcome 2

1) Industrial and commercial emissions intensity to fall by at least 30% by 2032.

Year	2020	2025	2032
Change in emissions intensity from 2015	-10%	-20%	-30%

Policy outcome 3:
Technologies critical to further industrial emissions reduction (such as carbon capture and storage, carbon capture and utilisation, and production and injection of hydrogen into the gas grid) are demonstrated at commercial scale by 2030.

There are two policies, two policy development milestones and four proposals which contribute to the delivery of policy outcome 3.

Policies which contribute to the delivery of policy outcome 3

1) Provide funding support for the ACORN CCS Project proposed at St. Fergus Gas Processing complex.

The ACORN CCS Project is a full chain industrial Carbon Capture and Storage concept, which proposes to use the legacy oil and gas circumstances in North East Scotland as the stepping stone to initiate CCS in the UK.

The project will seek to re-purpose the CO_2 capture facilities of an existing gas plant at St. Fergus targeting industrial CO_2 from gas processing activities and using existing offshore pipeline infrastructure to transport CO_2 to well-understood offshore CO_2 storage opportunities in the Central North Sea for sub-surface injection and permanent storage of CO_2.

104 UK Clean Growth Strategy, 2017 https://www.gov.uk/government/publications/clean-growth-strategy

105 Scottish Energy Strategy: The Future of Energy in Scotland http://www.gov.scot/energystrategy

A recent Scottish Enterprise report (2017) assessed the opportunity for growing a CCU industry in Scotland to be 'globally significant'.[106] It assessed the global early stage of many technologies as being an opportunity for Scotland to accelerate their development.

By conducting a capability and attractiveness analysis within Scotland, the Scottish Enterprise report recommends inorganic fertiliser, mineralisation of CO_2 (concrete and carbonate aggregates) and CO_2 derived liquid fuels as the best manufacturing opportunities for Scotland.

2) We have supported several projects which demonstrate how hydrogen can be renewably produced, stored, and used when needed for local energy and transport. There is potential to replicate or scale up these projects.

The Scottish Government has worked with the UK Government and other partners to develop the 2017 Hydrogen and Fuel Cells Roadmap[107].

We remain committed to supporting further research and development in this area, including proposals by SGN, which manages the gas distribution network in Scotland, to assess the viability of constructing and operating the first hydrogen distribution network in Scotland.

Policy development milestones

1) The Scottish Government will continue to consider and support emerging CCS, CCU and hydrogen opportunities.

This will include exploring funding streams such as the Low Carbon Infrastructure Transition Programme (LCITP).

2) Support research and international collaboration to support the emergence of CCS and CCU in Scotland.

Recent examples include Scottish Carbon Capture and Storage Scotland, the Global Carbon Capture and Storage Institute, and the Guangdong (China) initiative.

Policy proposals

1) The Scottish Government will continue to work closely with the UK Government and the Oil and Gas Authority to ensure that Scotland's interests are reflected in developing Carbon Capture Utilisation and Storage (CCUS) work.

This will include our participation in the UK Government's newly created CCUS Ministerial Council and the CCUS Taskforce, to work together to reduce the costs of CCS and CCUS and develop the UK's CCUS Deployment Plan. We will also work to preserve critical infrastructure and to support the demonstration of CCS and CCU projects in Scotland.

106 Actions required to develop a roadmap towards a Carbon Dioxide Utilisation Strategy for Scotland http://www.evaluationsonline.org.uk/evaluations/Search.do?ui=basic&action=show&id=606

107 Hydrogen and Fuel Cells: Opportunities for Growth – A Roadmap for the UK http://www.e4tech.com/wp-content/uploads/2016/11/UKHFC-Roadmap-Final-Main-Report-171116.pdf

The Energy Strategy includes proposals to:

1) Establish new forums to help us work with industry and academia to advance and track progress on CCS, CCU and Hydrogen.

2) Continue to commission evidence on the impact of technology, regulatory and market barriers to hydrogen and CCU opportunities in Scotland.

3) Build on our initial work carried out in 2017 to develop a road map towards a Carbon Dioxide Utilisation Strategy for Scotland.

Monitoring

Implementation indicators for policy outcomes 1, 2 and 3

1) The installed capacity of renewable heat receiving payment under the non-domestic RHI increases.

2) Improve the evidence base of the industrial sector in Scotland through initiatives under the Manufacturing Action Plan and SEEP.

3) Continued annual monitoring of energy productivity and emissions intensity.

4) The Scottish Government funded elements of the ACORN CCS Project feasibility study are completed by November 2018.

Explanation for selection of indicators

1) The installed capacity of renewable heat receiving payment under the non-domestic RHI shows the level of renewable heat supported through the RHI scheme, which contributes to reducing the carbon intensity of Scotland's heat generation – data is available annually.

2) Improving the evidence base of the industrial and non-domestic sectors in Scotland will be necessary to allow more effective monitoring of progress in the sector.

3) Annual figures for industry will give closer understanding of trends and, through analysis, could enable activity to focus on specific drivers of change.

4) The ACORN CCS feasibility study will provide analysis and insight into the practicalities of repurposing existing assets for CCS in Scotland and test the regulatory framework for future projects.

ENABLING FACTORS AND WIDER IMPACTS

There are potential co-benefits for business competitiveness of investment in industrial energy efficiency, which reduces operating costs and protects against rises in energy prices, and industrial heat recovery, which could provide a new income stream. These enhancements in the productivity of Scotland's manufacturing sector will complement wider investment in innovation and skills to contribute to the Scottish Government's purpose of increasing sustainable economic growth. Investment should ensure that more secure, high quality manufacturing jobs continue to be located in Scotland, benefiting all people across Scotland, in both urban and rural areas. For example:

- Demonstration at commercial scale of industrial emissions reduction technologies such as CCS or hydrogen would protect Scottish business against future carbon price rises. It could also secure economic benefit in the supply chain for knowledge transfer of technology expertise to other businesses in international markets.

- Investment in industrial clustering will help businesses to reduce costs through shared infrastructure, such as district heating networks and through co-location of production processes.
- Where industry is currently a producer of waste heat, deployment of district heating would create new revenue streams to help competitiveness of the business, and reduce the recipients' emissions by reducing their requirement for additional heating using fossil fuels.

The Scottish Government will maximise these co-benefits through working with our public sector partners and industrial trade associations to support the investment necessary for these improvements in energy efficiency and productivity.

Reducing global emissions to a level consistent with the Paris Agreement will require a significant reduction in the carbon intensity of the global economy – and comparative effort from other major economies. By remaining within EU and UK regulatory frameworks, we ensure that industry in Scotland retains the EU-wide and UK-wide level playing fields for emissions reduction, which avoids the risk of 'carbon leakage'. This is where business relocates from one country to another where there is more liberal emissions control. The net effect is to leave global emissions unchanged whilst damaging the economy of the country from which industry relocated.

Provisions to protect sectors at greatest risk of carbon leakage are included within the EU ETS, which is one reason why it remains our main regulatory instrument for tackling industrial emissions in the fairest way possible, as part of collective effort with our EU partners. Those working in the manufacturing sector would be at severe risk if industries were to close or relocate from Scotland as a result of carbon leakage. Energy intensive industries, that were not required to make similar emissions reductions in other locations outside Scotland, would potentially see Scotland as an unattractive location for new investment in manufacturing.

To help businesses decarbonise within the EU ETS cap and under UK carbon taxes, we will support investment in energy efficiency and heat recovery, and support business in accessing EU funding necessary for demonstration of significant technologies, such as CCS or hydrogen, that can drive further decarbonisation of manufacturing beyond the 2020s.

Chapter 5
Waste

Household food recycling. Credit: Zero Waste Scotland

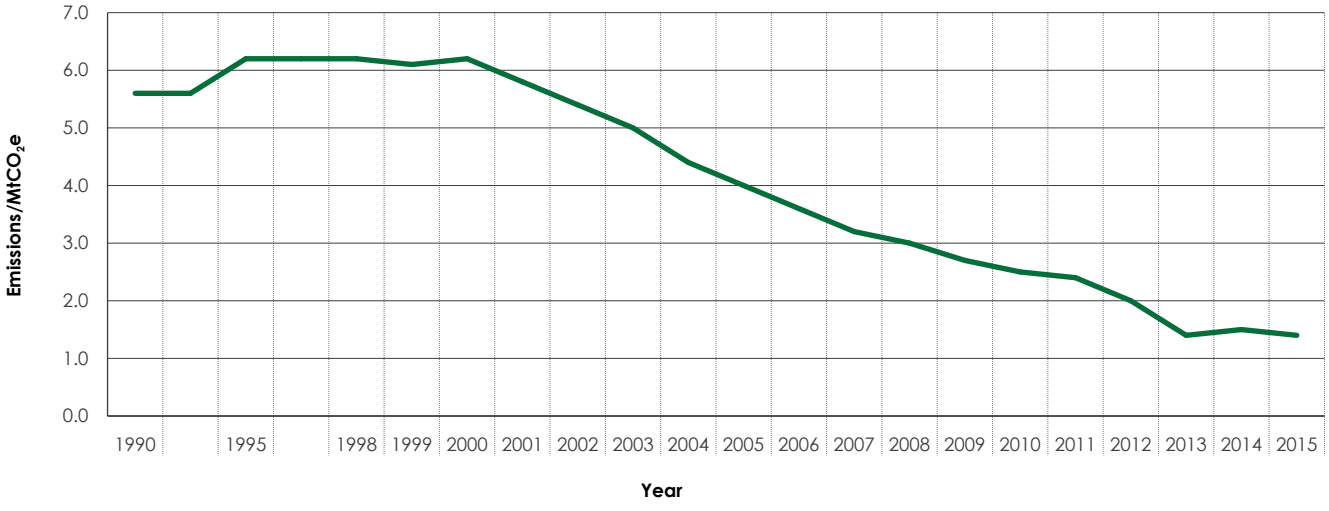
The waste sector covers the use of resources, including maximising the reuse, recycling and recovery of resources where products and materials are kept in high value use for as long as possible.

WHERE WE ARE NOW

75% fall
in waste sector emissions between 1990 and 2015

This sector has seen a 4.2MtCO_2e (75%) fall in emissions between 1990 and 2015. This is a result of the progressive introduction of landfill gas being captured and used for energy and the ongoing reduction in biodegradable municipal waste going to landfill. Other factors may contribute to this reduction, including improvements in the standards of landfill and changes to the types of waste going to landfill. Between 2014 and 2015 the sector saw a 4% fall in emissions.

Figure 15: Waste historical emissions



PROGRESS SINCE RPP2

Since RPP2 was published, most of the legislative proposals from the Zero Waste Plan have come into effect, with new legal requirements for separate collection of food and recyclable waste from households and businesses. Key achievements include the following:

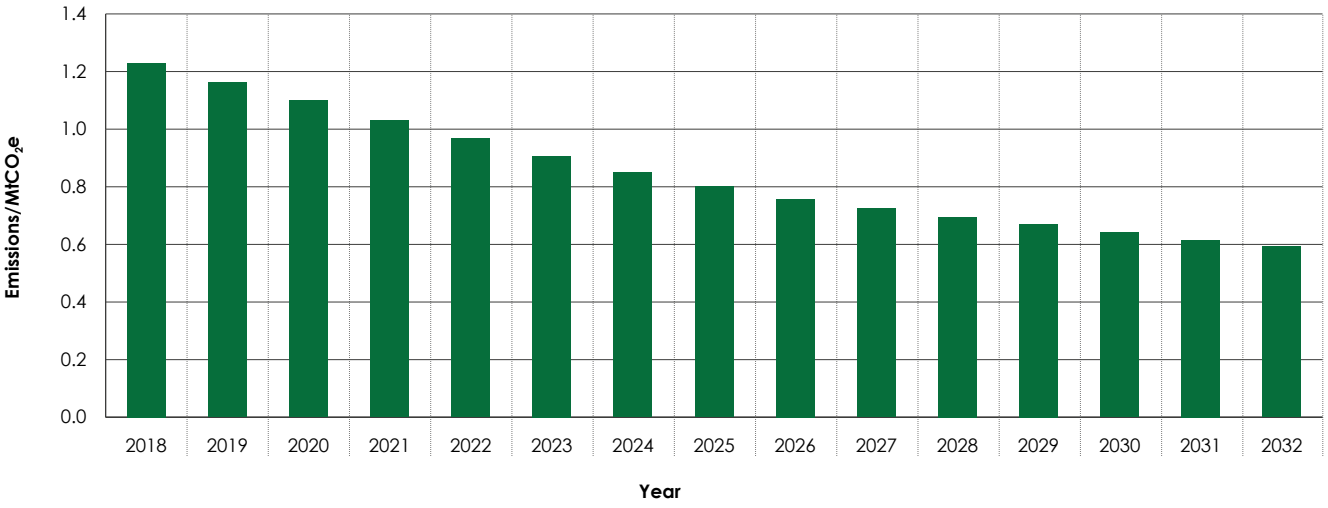
- The amount of waste from all sources landfilled in Scotland fell from 4.1 million tonnes in 2013 to 3.7 million tonnes in 2016.
- Resource Efficient Scotland[108] provides practical, on-the-ground support to help businesses eliminate unnecessary waste (water, energy and materials), save money and retain a competitive edge.
- 1.95 million households (80% of total households) now have access to a food waste collection service, up from around 575,000 in 2013.
- Since 2013, food waste processing capacity (anaerobic digestion and composting) has increased from around 230,000 tonnes per year to around 365,000 tonnes per year in 2017.
- Scotland's household recycling rate was 45% in 2016 – up from around 42% in 2013. In 2016, 14 councils had a recycling rate in excess of 50%, and East Renfrewshire council became the first Scottish council to surpass 60%.

Following installation of gas capture equipment at two closed landfill sites in the Scottish Borders, similar gas capture technology is being installed at two additional sites in Glasgow and East Lothian.

108 Resource Efficient Scotland
http://www.resourceefficientscotland.com/

OUR AMBITION

Figure 16: Waste emissions envelopes



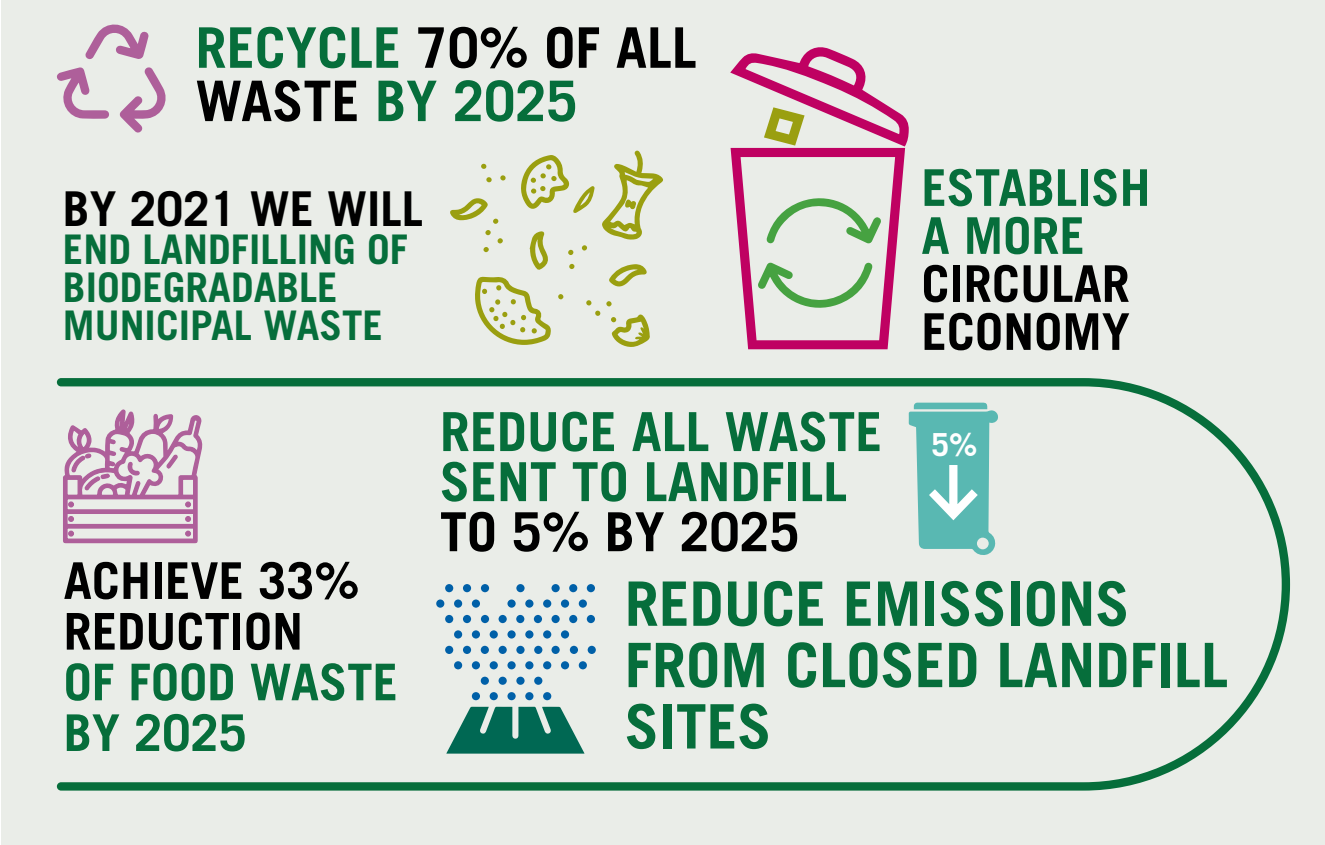
Emissions are expected to fall by 0.6$MtCO_2e$ (52%) over the lifetime of the Plan.

The Scottish Government's ambition for a circular economy is set out in its strategy, Making Things Last[109]. By 2035, we expect the principles of a circular economy to be well established across Scotland. We want more products designed for longer lifetimes, second hand goods to be seen as a good value, mainstream option, and major industrial sectors to be optimising the value of used equipment, such as the reuse of elements of energy infrastructure. As landfilling decreases, the Scottish Government will help to manage the legacy of landfill sites around Scotland, minimising emissions from operational and closed sites, through the use of flaring technology.

- Ending landfilling of biodegradable municiple waste by January 2021 and reducing the percentage of all waste sent to landfill to 5% by 2025.
- By 2025, we expect to reduce food waste by 33%, and to recycle 70% of all waste, in line with our targets.
- By 2035, we aim to be delivering emissions reductions through a circular economy approach in our business and industry sectors.

109 Making Things Last: A Circular Economy Strategy for Scotland http://www.gov.scot/Resource/0049/00494471.pdf

IN WASTE SECTOR, WE AIM TO



POLICY OUTCOMES, POLICIES, DEVELOPMENT MILESTONES AND PROPOSALS

Policy outcome 1:
Reduction in waste sent to landfill.

There are four policies and one proposal which will contribute to the delivery of policy outcome 1.

The four policies are related to the delivery of our suite of waste reduction, recycling and landfill diversion targets and regulation up to 2025.

The Scottish Government has set out its priorities for action in Making Things Last, our circular economy strategy. We fund Zero Waste Scotland as the main circular economy expert and delivery partner, supporting businesses, local authorities and communities to act. The enterprise agencies also have an important role through mainstream business support; as do local authorities through their responsibilities for waste and recycling; and Scottish Environment Protection Agency (SEPA) as regulator. The Scottish Government budget in 2016-2017 was £20.4 million for waste and circular economy measures to reduce waste and encourage recycling, resuse and remanufacture and reduce the requirement to landfill waste. Actions were also taken to minimise emissions from historic landfill sites.

Delivery will be achieved through a combination of:

- Regulation, including requirements for business and local authority recycling and a ban on biodegradable municipal waste going to landfill.
- Targeted funding and the Scottish Landfill Tax.
- Support for business, local authority and community action.

The four policies below set out in more detail how policy outcome 1 will be delivered.

1) Target to recycle 70% of all waste by 2025.

The Scottish Government will work with a range of public and private partners to deliver this target. Local authorities, waste management companies and other businesses have duties to segregate food waste and other materials for recycling. We will continue to look for ways to support and strengthen recycling and food waste services in rural areas and island communities.

The Scottish Government has agreed the Household Recycling Charter with COSLA[110], which will introduce more consistent local collections, making it easier for people to recycle, therefore improving the quantity and quality of recycling. Delivery of this action is supported by funding from Zero Waste Scotland.

Through Zero Waste Scotland we are supporting local authorities to implement food waste collection and change their recycling collections in line with the Household Recycling Charter. This support is in addition to the funding that councils receive through the local government settlement.

The Programme for Government 2017-2018 set out the Scottish Government's intention to introduce a Deposit Return Scheme, which will improve both the quantity and quality of recycling of the materials collected. We will go further in our efforts to end Scotland's 'throw-away' culture, by examining how to reduce demand for single-use items, such as disposable coffee cups. The Scottish Government will appoint an expert panel to advise on the use of fiscal or other measures, similar to the successful single-use plastic bag levy, with the goal of encouraging long-term changes in consumer behaviour.

110 Charter for Household Recycling http://www.zerowastescotland.org.uk/content/charter-household-recycling

'Making Things Last – a Circular Economy Strategy for Scotland' sets out our priorities for moving towards a more circular economy – where products and materials are kept in high value use for as long as possible. It builds on Scotland's progress in the zero waste and resource efficiency agendas. A more circular economy will benefit:

- the environment – cutting waste and carbon emissions and reducing reliance on scarce resources;
- the economy – improving productivity, opening up new markets and improving resilience; and
- communities – more, lower cost options to access the goods we need with opportunities for social enterprise.

2) Target to reduce food waste by 33% from the 2013 baseline by 2025.

The Scottish Government is considering a comprehensive Food Waste Action Plan to achieve the target, to be published in 2018. This plan could include legislative measures that would need to be consulted on. The Scottish Government will clarify the timescales for any consultation once the plan is published.

3) Ending landfilling of biodegradable municipal waste by January 2021 and reducing the percentage of all waste sent to landfill to 5% by 2025.

A ban on the landfilling of biodegradable municipal waste (BMW) is due to come into force from January 2021. The Scottish Government will work with stakeholders to help address challenges associated with the 2021 deadline for banning BMW to landfill, and SEPA will provide guidance to councils and private operators on the administration of the ban and seek assurances on their plans for compliance.

Energy from waste plants has a role in managing residual BMW. The Scottish Government will seek to ensure that waste is treated appropriately and in line with the waste hierarchy set out in our circular economy strategy, helping by continuing to ensure that only appropriate material will be used for energy recovery.

The Scottish Landfill Tax already provides an incentive to reduce landfilling and prioritise more valuable options such as waste reduction and recycling.

The Scottish Government will work with SEPA and Zero Waste Scotland to continue to improve the way that we provide and present information on the anticipated capacity requirements for future alternative waste infrastructure, for use by planning authorities and industry. This will help to ensure that the capacity of waste infrastructure developed is appropriate.

4) Reduce waste and establish a more circular economy, where goods and materials are kept in use for longer.

The Scottish Government will achieve this policy through the delivery of Making Things Last, and our targets to reduce all waste by 15% and food waste by 33% by 2025. Delivery mechanisms will include:

- Resource Efficient Scotland[111] – helping businesses reduce food and construction waste.
- The Courtauld 2025[112] agreement with food businesses to cut food waste by 20%.
- The Circular Economy Investment Fund and Service[113] – helping companies transform their business models to design out waste.

Policy proposal

1) We will work with our partners to identify further opportunities for the circular economy to contribute to the implementation of the Climate Change Plan.

The Scottish Government believes that further development of the circular economy is important as we move towards a low carbon world. A more circular economy will contribute to our targets by reducing both the emissions needed to treat waste and also the emissions created from the manufacture of products in the first place.

While the targets in Making Things Last run to 2025, this proposal recognises the need to develop a strategic approach in the future.

111 Resource Efficient Scotland http://www.resourceefficientscotland.com/

112 The Courtauld Commitment 2025 http://www.wrap.org.uk/content/courtauld-commitment-2025

113 The Courtauld Commitment 2025 http://www.zerowastescotland.org.uk/circular-economy/investment-fund

Case Study

Team of volunteers at the Swap and Reuse Hub – SHRUB in Edinburgh.

Credit:
Zero Waste Scotland.

The Swap and Reuse Hub (SHRUB) is led by the student community and aims to significantly reduce waste arising from the transient student population in Edinburgh. At the end of each student year, volunteers go into the recently vacated student accommodation and remove everything that has been left behind, including furniture, bedding, kitchen equipment, clothing, books and much more. Items either go into a 'free shop' for the next intake of students, or to SHRUB's permanent swap shop facility. All of this saves items going to landfill and also reduces the amount of items students, or the community, have to buy new. SHRUB also runs a number of workshops where people can learn to upcycle or repair items to keep them in use for longer; food sharing scheme, and events such as swap shops.

In 2015-2016, the project saved 135.5 tCO2e - 39.5 from food sharing, 89.2 from swap and reuse activities, and 6.85 from bike repairs.

SHRUB has been awarded funding from the Scottish Government's Climate Challenge Fund (CCF) for a range of initiatives which aim to help build a low carbon circular economy in the heart of the city. The SHRUB won the Waste Category at the inaugural CCF Awards for their work that took place in 2016-2017.

Relative significance of policies and proposal to the delivery of policy outcome 1

The majority of emissions reductions in the waste sector are a consequence of policy outcome 1. Together, the policies contribute in an integrated way to the achievement of the policy outcome.

Monitoring

Policy output indicator for policy outcome 1

1) By January 2021, the landfilling of biodegradable municipal waste will be phased out. As a result of that, and the other policy action above, we expect the volume of land filled waste to fall significantly from the current level of 3.7 million tonnes.

Year	2018	2019	2020
Tonnes of waste landfilled (household and non-household)	2.7m	2.3m	2.0m

Implementation indicators for policy putcome 1:

1) 60% of total household waste recycled by 2020.

2) 70% of all waste recycled by 2025.

3) Household and non-household food waste reduced by 33% by 2025 from 2013 baseline.

Explanation for selection of indicators

Our success in delivering a more sustainable circular economy will be demonstrated by clear changes in how we deal with waste. We have set ambitious targets to increase recycling and our world leading target to reduce food waste by 33%. Our policy action will target these indicators which will in turn drive improved environmental performance.

Policy outcome 2:
Reduction in emissions from closed landfill sites.

There is one policy and one policy development milestone which will contribute to the delivery of policy outcome 2.

Policy which contributes to the delivery of policy outcome 2

1) Landfill gas capture on closed sites.

Landfill gas capture supports climate change objectives by tackling emissions of methane, a gas which tonne for tonne is 25 times more damaging than carbon dioxide. Twelve potentially suitable sites have been identified by SEPA. Working with site managers, many of whom are from local authorities, we are supporting installation of equipment through Zero Waste Scotland drawing on SEPA expertise. A forward work programme of projects will be developed.

Policy development milestone

1) Six suitable sites under development by 2018-2019

Relative significance of policy and policy development milestone to the delivery of policy outcome 2

Policy outcome 2 makes a smaller contribution to emissions reductions in the waste sector than policy outcome 1.

Monitoring

Policy output indicator for policy outcome 2

Year	2017-2018	2018-2019	2019-2020	2020-2021
Number of additional landfill sites with gas capture being developed each year	3	6	9	12

Implementation indicator that contributes to the delivery of policy outcome 2

1) Up to 12 landfill gas capture sites supported by 2020-2021.

Explanation for selection of indicator

We will work with our partners in the public and private sectors to ensure that all sites confirmed by SEPA as being suitable for landfill gas capture have equipment installed.

ENABLING FACTORS AND WIDER IMPACTS

A more circular economy is not just good for the climate, it is also good for the economy. It will contribute to achieving Scotland's climate change mitigation targets by helping to tackle emissions arising from consumption of goods. Furthermore, it will present significant economic opportunities for Scotland by improving productivity, opening up new markets and improving resilience.

The Ellen MacArthur Foundation has estimated that adopting circular economy practices in manufacturing higher value products with medium lifespans (e.g. motor vehicles, electronic machinery and furniture) could lead to net material cost savings of between $340 to $630 billion US dollars per year across Europe[114].

Applying the same methodology above to similar manufacturing sub-sectors in Scotland suggest annual cost savings between £0.8 and £1.5 billion – around 5% to 9% of total turnover for these sub-sectors.

The Ellen MacArthur Foundation also estimates that 20% of material input costs could be saved (up to $700 billion US dollars) in the "fast-moving consumer goods" sector, looking globally at 10 different consumer goods categories such as apparel, food, beverages or consumer health. For Scottish industry, this would translate into additional annual savings of about £1.5 billion.

114 Scotland and the Circular Economy http://www.zerowastescotland.org.uk/sites/default/files/Scotland%20and%20the%20Circular%20Economy%20%28a%20report%20for%20the%20Scottish%20Government%29.pdf

Establishing a more circular economy creates significant economic benefits. Businesses can benefit from improving productivity, opening up new markets and improving resilience in their ability to access materials, through reducing reliance on scarce resources.

Our Making Things Last strategy includes a focus on four parts of the economy where these potential benefits are greatest: food/ bioeconomy; remanufacture; reuse of energy infrastructure and construction/built environment.

Individuals can benefit from greater availability of lower cost options to access second hand or refurbished goods; or make savings through repairing items rather than replacing them. These lower cost options to access the goods we need also bring opportunities for social enterprise.

Alongside the territorial carbon emissions savings as a consequence of moving to a more circular economy, significant global emissions reductions will result from reducing Scotland's demand for imported products and raw materials.

There is modest potential for landfill gas from a minority of closed sites to be used for energy generation.

Planning System

The National Planning Framework 3 and Scottish Planning Policy recognises waste as a resource and an opportunity for the economy, as well as the environment. They support the provision of a network of infrastructure that would allow waste and secondary resources to be managed at the nearest appropriate installation, through the most appropriate methods and technologies. Scottish planning policy is clear that energy from waste facilities should enable links to be made to potential users of renewable heat and energy.

Chapter 6
Land Use, Land-Use, Change and Forestry

Caledonian forest at the river Affric walk. Credit: Forestry Commission – Isobel Cameron

Land Use, Land-Use Change and Forestry (LULUCF) is divided into afforestation, baseline forest planting, harvested wood products, peatland restoration, development emissions (from settlements) and Agriculture-Related Land Use emissions (Indirect nitrous oxide emissions from managed soils, as well as emissions/removals from Cropland, Grassland and Wetlands).

This sector has the potential to remove and store, or sequester, greenhouse gases from the atmosphere. The proposals and policies in this chapter relate to forestry and to peatland restoration.

WHERE WE ARE NOW

This chapter discusses historical emissions and removals arising from LULUCF, and sets out the Scottish Government's ambitions specifically on forestry and peatland up to 2032.

Based on the 2015 GHG Inventory, in 1990, LULUCF as a whole was emitting a net 1.5MtCO_2e. This is shown in the graph as positive emissions. Since then, there has been a significant increase in net sequestration up to -2.8MtCO_2e in 2015.

The increase in net sequestration has been driven by a fall in the size of the emissions' source resulting from the conversion of grassland to cropland, an increase in carbon sequestered by grassland and an increase in carbon stored in harvested wood products. The LULUCF sector emissions are expected to be subject to revisions in the 2016 GHG Inventory, due to be published in June 2018, increasing the scale of the sector as a sink.

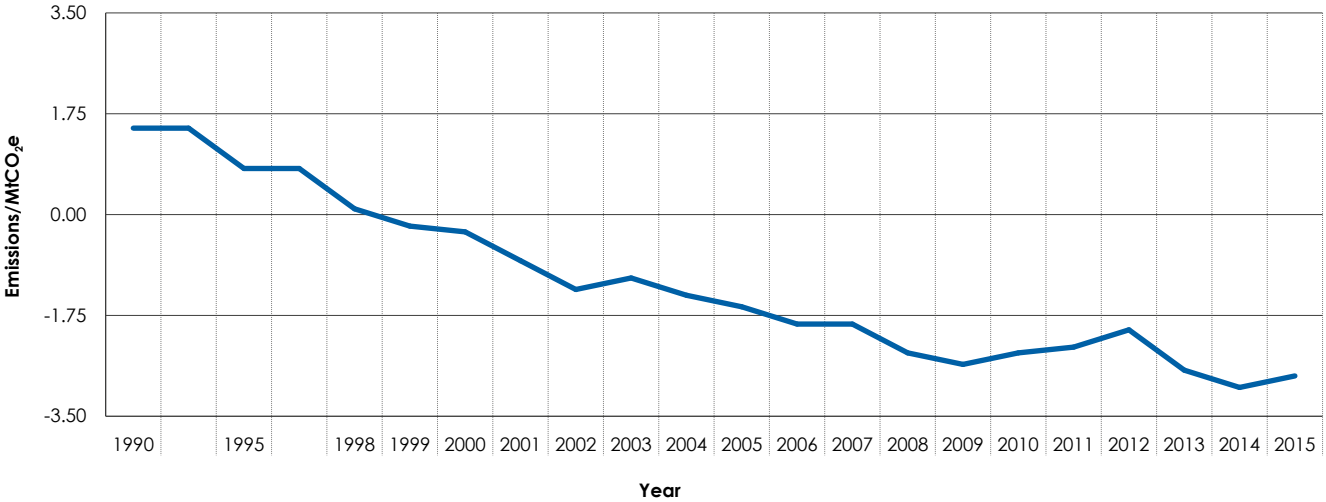
PROGRESS SINCE RPP2

Woodland creation

Create 100,000 hectares of woodland between 2012-2022 (equivalent to 10,000 hectares per year).

During the period of RPP2 the Scottish Government has supported the creation of over 32,000 hectares of new woodland, accounting for over 70% of all the woodland created in the UK. The average annual rate has been around 6,500 hectares per year. This is a lower annual contribution than the 10,000 hectare per year required to deliver the overall policy ambition of creating 100,000 hectares between 2012-2022.

Figure 17: LULUCF historical emissions



In response, the Scottish Government has initiated a number of interrelated initiatives to stimulate an increase in woodland creation including: Delivering a new Forestry Grant Scheme (FGS); commissioning an independent review to streamline the grant application process; and working with farming stakeholders to establish more woodland on appropriate land on farms. These initiatives have led to an increase in woodland creation activity indicating that the existing annual target will be achieved in the near future.

Wood Products in Construction

The proposal to increase wood products in construction started in 2013 with RPP2. Since then the Scottish Government has worked to identify if there are any regulatory barriers to the use of wood engineered products in construction in Scotland. No regulatory barriers were identified, but guidance for planners and architects was suggested, as well as promoting the benefits of wood products in construction to developers. In response to these suggestions, the Scottish Government has supported the supply chain through Scottish Enterprise and the private sector, commissioned research to investigate the viability of Scottish wood products as a structural material, and explored the development of a UK market focused on the use of Scottish wood products in order to encourage private investment.

Peatland restoration

RPP2 highlighted that it would be technically feasible to restore 20,000 hectares of peatland a year, and that £1.7 million had been identified to support peatland restoration for the period 2013-2015.

Since RPP2, the Intergovernmental Panel on Climate Change has published its technical guidance on measuring the greenhouse gas benefits of peatland restoration[115]. This has allowed us to develop peatland restoration further and understand its costs and benefits. Funding was identified in the 2013 spending review to support peatland restoration and through the SNH-led Peatland Action work over 10,000 hectares have been restored since, through support of £8.6 million to Peatland Action.

OUR AMBITION

Updated projections for the LULUCF sector, alongside proposals and policies, show that the sector will be a sink of around -6.9MTCO_2e by 2020, dipping slightly after 2021, and then fairly constant until 2032.

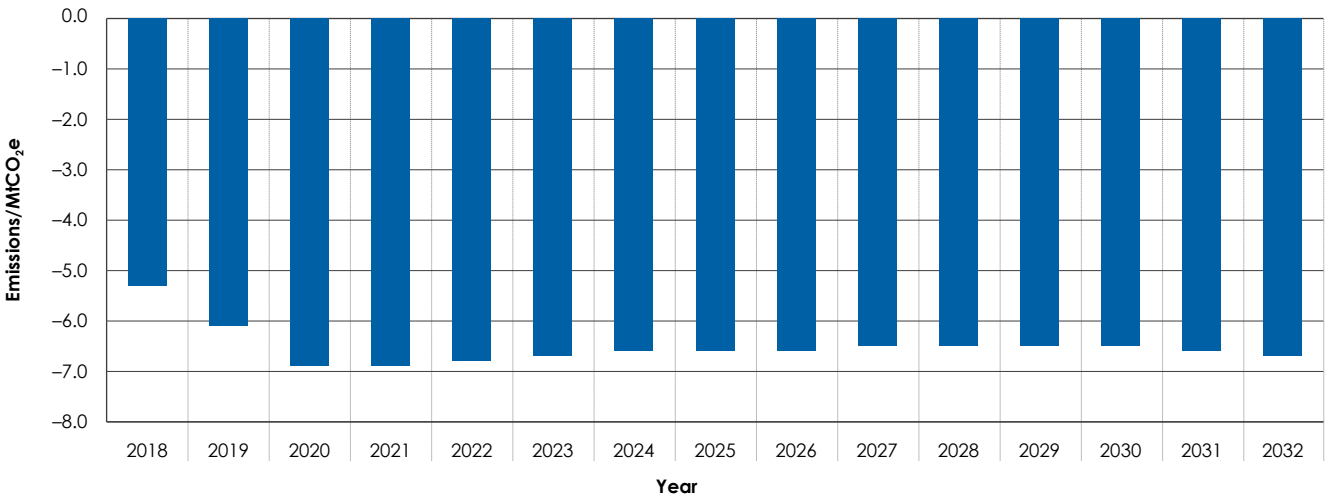
It should be noted that since publication of the draft Climate Change Plan, new projected future baseline land use areas and emissions have been provided by BEIS, consistent with its Updated Emissions Projections[116], and taken from analysis by the Centre for Ecology and Hydrology (CEH). These have had the impact of increasing baseline sequestration by the LULUCF sector by about 6MTCO_2e on average, per annum, relative to the data used in the draft Climate Change Plan.

This update will be incorporated into the 2016 GHG Inventory, which will be published in June 2018.

115 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands http://www.ipcc-nggip.iges.or.jp/public/wetlands/

116 Energy and emissions projections https://www.gov.uk/government/collections/energy-and-emissions-projections

Figure 18: LULUCF emissions envelopes[117]



The initial decrease in sequestration is a result of the decreasing rate of woodland creation over the last 40 years, and the felling and replanting of maturing conifer plantations. In years to come, this decrease will be compensated for by the increase in sequestration that will result from more woodland creation, the replanting of forests that have been felled and peatland restoration activity. The next two subsections set out the forestry and peatland elements of LULUCF in more detail.

IN THE LULUCF SECTOR, WE AIM TO

INCREASE WOODLAND COVER FROM AROUND 18% TO 21% BY 2032

INCREASE THE USE OF SUSTAINABLY SOURCED WOOD FIBRE AND ENCOURAGE THE CONSTRUCTION INDUSTRY TO USE TIMBER

RESTORE 40% (250,000 HECTARES) OF SCOTLAND'S PEATLAND BY 2030

117 The increase in the scale of the sink in the LULUCF sector between 2018 and 2020 is due to the alignment of 2015 GHG inventory data to the updated LULUCF projections. This is to ensure that all sectors start from a consistent basis, in line with the 2015 GHGI Inventory.

FORESTRY

This section covers the expansion of Scotland's forest and woodlands and the increased use of wood products as a natural renewable resource.

WHERE WE ARE NOW

Woodlands cover around 18% of land in Scotland (74% coniferous and 26% broadleaf tree species), and deliver a wide range of benefits, including inward investment and jobs, climate change adaptation and mitigation, and the enhancement of the health and well-being of Scotland's communities. The Scottish forestry sector is worth almost £1 billion per year and employs over 25,000 people[118].

Further expanding Scotland's woodlands supports the fulfilment of the Scottish Government's commitments on climate change and biodiversity and the sustainable supply of wood products. 83% of timber harvested in Scotland, based on 2015 figures, came from woodlands that are independently certified to internationally recognised standards of good practice[119].

The Scottish Government endorses and uses the UK Forestry Standard[120], a benchmark for sustainable forest management and a requirement for all woodlands created using Scottish Government funding.

The harvesting and marketing of wood products is becoming an increasingly important economic activity in rural Scotland. Sustainable wood production is currently increasing as woodlands planted in the 1960s and 1970s mature, with over 8.4 million cubic metres of wood products produced in 2015[121].

118 The economic contribution of forestry in Scotland http://scotland.forestry.gov.uk/supporting/forest-industries/economic-contribution-report

119 UK Forestry Commission, Forestry Statistics 2017 https://www.forestry.gov.uk/pdf/Ch2_Timber_FS2017.pdf/$FILE/Ch2_Timber_FS2017.pdf

120 UK Forestry Standard https://www.forestry.gov.uk/ukfs

121 Forestry Commission, Forestry Statistics 2016 https://www.forestry.gov.uk/website/forstats2016.nsf/LUContents/898C4678E271A30980257FE0004B2D20

Supporting Sustainable Forestry

The Government is committed to promoting and developing modern sustainable forestry and has developed a regulatory and policy framework, to ensure adherence to internationally recognised principles of sustainable forest management. This framework includes:

- Forestry Legislation: the Forestry and Land Management (Scotland) Bill[122] will introduce a new statutory framework for the management, development, support and regulation (including felling and restocking) of forestry in Scotland. The Bill includes a new duty on Scottish Ministers to promote sustainable forest management. The Bill, when enacted, will replace the Forestry Act 1967 in Scotland.
- The Forestry (Environmental Impact Assessment) (Scotland) Regulations 2017[123] (EIA): requires that new forestry projects take account of any significant environmental impacts.
- Scottish Forestry Strategy[124]: the Forestry and Land Management (Scotland) Bill requires Scottish Ministers to prepare a new Forestry Strategy, which will apply to all forestry and woodlands in Scotland and will set out Ministers' objectives, priorities and policies with respect to the promotion of sustainable forest management.
- Scottish Rural Development Programme[125] (SRDP): the key purpose of the SRDP 2014-2020 is to help achieve sustainable economic growth in Scotland's rural areas by providing funding for the creation and management of woodland.
- UK Forestry Standard (UKFS): sets the criteria for the sustainable creation and management of forests and woodlands and promotes good practice. Payment of SRDP grants is conditional on meeting UKFS requirements, including:
- The appropriate protection and conservation of designated sites, habitats and species;
    - Woodland creation projects designed and managed to take account of landscape context and designations;
    - Not establishing new woodlands on areas of deep peaty soils;
    - Consideration given to involving people in the development of forestry proposals;
    - And consideration of alternative species, or a greater variety of species, to mitigate the risks associated with climate change and pests and diseases.
- Control of Woodland Removal Policy[126]: aims to minimise woodland loss, protect Scotland's woodland resource and requires compensatory planting where a change of land use under the planning system allows the removal of woodland to deliver significant public benefit.

122 Forestry and Land Management (Scotland) Bill http://www.parliament.scot/parliamentarybusiness/Bills/104491.aspx

123 The Forestry (Environmental Impact Assessment) (Scotland) Regulations 2017 http://www.legislation.gov.uk/ssi/2017/113/contents/made

124 The Scottish Forestry Strategy http://scotland.forestry.gov.uk/supporting/strategy-policy-guidance/forestry-strategy

125 The Scottish Rural Development Programme (SRDP) 2014-2020 http://www.gov.scot/Topics/farmingrural/SRDP

126 Scottish Government, Policy on control of woodland removal http://scotland.forestry.gov.uk/supporting/strategy-policy-guidance/woodland-expansion/control-of-woodland-removal

Scotland's forest carbon sink increased between 1990 and 2002, to about 7.6MtCO_2e. Between 2003 and 2010, it remained fairly stable. Since then, it has reduced slightly (reaching 7.0MtCO_2e in 2015) and is expected to continue to do so. This is due to the rate of new woodland creation decreasing over the last 40 years and conifer plantations established in the mid-20th century reaching maturity and being felled and replanted. The absolute size of the sink is expected to be revised in the 2016 GHG Inventory. Scotland's forests continue to be a significant carbon sink. While this plan focuses on additional carbon reductions, the Scottish Government remains committed to ensuring that forestry in Scotland continues to be carried out sustainably to maintain this important carbon sink.

Under new arrangements proposed in the Forestry and Land Management (Scotland) Bill the Scottish Ministers will be under a duty to prepare a forestry strategy for Scotland. The strategy must set out Ministers' objectives, priorities and policies with respect to the promotion of sustainable forest management; and also with respect to the economic development of forestry, the conservation and enhancement of the environment by means of sustainable forest management, and the realisation of the social benefits of forestry.

Tree Health

The Scottish Government recognises that rapidly increasing globalisation increases the risk of exotic pests and diseases arriving in Scotland, and that climate change could also increase the risk of their establishment, spread and impact. The Scottish Plant Health Strategy[127] (2016-2021) outlines our approach to tree health management, while a revised generic Plant Health Contingency Plan, coupled with specific pest/disease contingency plans, has further enhanced our tree health readiness.

OUR AMBITION

By 2032, Scotland's woodland cover will increase from around 18% to 21% of the Scottish land area. These new woodlands will absorb greenhouse gas emissions, as well as potentially helping to mitigate flood risk and improve water quality, improve biodiversity and provide opportunities for people to improve their health and wellbeing. They will also provide confidence for the forest products industry to continue to invest in Scotland and create new jobs, through the ongoing production of sustainable raw materials.

127 The Scottish Plant Health Strategy http://www.gov.scot/Topics/farmingrural/Agriculture/plant/PlantHealth/ScottishPlantHealthStrategy

The Scottish Government support will assist with planting the right woodlands (including new productive forests and native woodlands) in the right places to deliver a range of environmental, social and economic benefits. The Scottish Government provides £2,500 per hectare of funding for woodland creation. This funding is matched by the EU. Funding from the Scottish Government and the EU together represent 80% of the total cost of establishment and maintenance.

These new woodlands will meet the requirements of sustainable forest management and complement other rural and urban land uses to support the delivery of the Land Use Strategy (2016-2021) and other existing commitments, for example those in the Scottish Biodiversity Strategy[128] and the Forest and Timber Technologies leadership group's 'Roots for Future Growth'[129].

As this sustainable woodland resource increases and produces more wood fibre, more timber will be used in construction, consequently storing more sequestered carbon in buildings and providing jobs and investment in the wood products industry.

The focus for delivering our ambition is to:

Increase our long term annual woodland creation target from the current target of 10,000 hectares per year to;

- 12,000 hectares per year from 2020-2021
- 14,000 hectares per year from 2022-2023
- 15,000 hectares per year from 2024-2025

and increase the use of Scottish wood products in construction from the current level of 2.2 million cubic metres to;

- 2.6 million cubic metres by 2021-2022
- 2.8 million cubic metres by 2026-2027
- 3.0 million cubic metres by 2031-2032

By 2050, Scotland's woodland will be delivering a greater level of carbon sequestration and ecosystem services, such as contributing to natural flood management and improving biodiversity. Forests will be making a greater contribution towards Scotland's natural capital stocks, and this renewable natural resource will be sustainably managed for the benefit of future generations.

128 Biodiversity Scotland, The 2020 Challenge for Scotland's Biodiversity http://www.biodiversityscotland.gov.uk/doing/strategy/

129 Forestry Commission Scotland http://scotland.forestry.gov.uk/

Case Study

Oak saplings planted as part of woodland creation project at Shiplaw Burn near Eddleston.

Credit: Forest Carbon Ltd.

Fuel distributor BWOC invests in woodland creation to sequester carbon dioxide

In order to reduce its carbon footprint, BWOC, through Forest Carbon Ltd, invested in woodland creation projects, such as the 13 hectare Shiplaw Burn site near Eddleston in the Scottish Borders. Over its lifetime, this new native woodland will absorb 7,000 tonnes of carbon dioxide, will mitigate flooding, improve water quality in the Tweed and benefit woodland and water species. The Woodland Carbon Code[130] provides quality assurance and gives buyers the confidence to invest in such carbon sequestration projects. By the end of 2017, there were 110 projects registered in Scotland, with a range of management and species types. These projects are predicted to sequester over 4.5 $MTCO_2e$ over their lifetime.

130 The Woodland Carbon Code www.forestry.gov.uk/carboncode

FORESTRY POLICY OUTCOMES, POLICIES, DEVELOPMENT MILESTONES AND PROPOSALS

Policy 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.

There are six policies and three proposals that contribute to the delivery of policy outcome 1.

Policies which contribute to the delivery of policy outcome 1

1) Forestry grants: we will provide funding via a grant scheme, to support eligible land owners establish appropriate woodlands.

We will do this by continuing to operate grant schemes such as the Forestry Grant Scheme[131] to provide support for woodland creation projects that meet the requirements of the UK Forestry Standard. We will make support available for different types of woodland to deliver multiple benefits including greenhouse gas mitigation, production of sustainable wood products, biodiversity and health and wellbeing outcomes.

2) Woodland creation on the National Forest Estate.

Forest Enterprise Scotland will deliver an annual contribution towards the overall woodland creation target by creating new sustainable woodland on the National Forest Estate.

3) 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. An example of this is the Sheep and Trees[132] initiative, which is a project between the Scottish Government and the forestry and sheep farming sectors.

4) 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.

5) Woodland Carbon Code

The Scottish Government will increase the promotion of the Woodland Carbon Code[133] in partnership with the forestry sector, and raise the profile of the Code as a potential vehicle for attracting additional investment into woodland creation projects.

131 Forestry Commission Scotland, Forestry Grant Scheme http://scotland.forestry.gov.uk/supporting/grants-and-regulations/forestry-grants

132 Forestry Commission Scotland, Sheep and Trees http://scotland.forestry.gov.uk/supporting/grants-and-regulations/sheep-and-trees

133 Forestry Commission, Carbon Code https://www.forestry.gov.uk/carboncode

6) Forestry and woodland strategies

Forestry and woodland strategies continue to be prepared by planning authorities, with support from Forestry Commission Scotland. 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.

Policy proposals

1) Working with community, public and private sector investors to explore new partnership funding models (2018-2019).

2) Develop further targeted grants measures (2018-2019).

We will continually review the potential for further targeted grant support to encourage specific types of woodland creation and/or woodland creation in specific areas.

3) Review Forest Enterprise Scotland's woodland creation activity on the National Forest Estate (2019-2020).

In 2019-2020 we will undertake a review of the woodland creation activity on the National Forest Estate.

Monitoring

Policy output indicator for policy outcome 1

1) Number of hectares of woodland created.

Financial Year	Until 2019-2020	From 2020-2021	From 2022-2023	From 2024-2025
Ha created	10,000	12,000	14,000	15,000

Implementation indicators for policy outcome 1

Policy 1:

1) Area of new woodland created with grant scheme support.

2) Percentage of applications that are processed within processing time agreements.

Policy 2:

1) Area of new woodland created on the national forest estate.

Policy 3 & 5:

1) Number of promotional events held.

Policy 4:

1) Number of woodland creation projects that have been issued with a UK Forestry Standard non-compliance notice within the first 10 years following creation.

Policy 6:

1) Number of planning authorities with current Forest and Woodland Strategies.

Explanation for selection of indicators

Indicators include direct measures of the scale of woodland creation activity by the private sector and Forest Enterprise Scotland. Other indicators demonstrate progress against delivering the enabling actions required to support woodland creation. These include promotional activities of the financial, environmental and social benefits of creating woodlands for land owners/ managers, supporting the regional approach to identifying where new woodlands should be located and a clear demonstration that new woodlands funded by the Scottish Government meet recognised standards of sustainable forest management.

Policy 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.

There is one policy that contributes to the delivery of policy outcome 2.

Policy which contributes to the delivery of policy outcome 2

1) In collaboration with the private forest sector and other public sector bodies the Scottish Government will implement the Timber Development Programme[134] through an annual programme of projects that support the promotion and development of wood products for use in construction.

The main aim of the Timber Development Programme is to increase use of wood products in construction. The outputs of the Programme are closely aligned to the objectives of "Roots for Future Growth" the Forest and Timber Technologies industry leadership group strategy, and Scotland's Economic Strategy. The Programme is developed and ratified through engagement with industry representatives on an annual basis and implementation is focused on increasing market demand across the UK.

134 Forestry Commission Scotland, Timber Development Programme 2014-2015 http://scotland.forestry.gov.uk/images/corporate/pdf/timber-development-programme-report-2014-15.pdf

Case Study

The Turf House, Isle of Skye.
Credit: Nigel Rigden.

To promote the potential for timber in construction, the Scottish Government has worked in partnership with Wood for Good to publish "The Modern Timber House"[135], which aims to inspire developers and architects to consider specifying wood in construction.

Approximately 5000 copies will be distributed to construction professionals and education establishments that run architecture courses.[136] Follow-up exhibitions and continued professional development events are planned to further distribute the publication throughout the UK.

135 Wood for Good
https://woodforgood.com/

136 Modern Timber House
https://woodforgood.com/training-and-development/publications/the-modern-timber-house

Monitoring

Policy output indicator for policy outcome 2

1) Annual volume (in million of cubic metres) of Scottish produced sawn wood and panel boards used in construction (extrapolated from UK figures).

Reporting Financial Year	2021-2022	2026-2027	2031-2032
Volume	2.6 million cubic metres	2.8 million cubic metres	3.0 million cubic metres

Implementation indicators for policy outcome 2

Policy 1:

1) Number of knowledge exchange events held each year involving members of the construction industry e.g. designers, specifiers and engineers.

2) Annual Timber Association figures for the adoption of timber framed for new build houses across the UK.

Explanation for selection of indicators

The indicators were selected to demonstrate a sample of the activity under the Timber Development Programme that will support the delivery of the policy outcome. The key activity is the development and delivery of knowledge exchange events to inform and build the understanding of the properties of wood products in construction and the carbon storage benefits. The annual percentage of houses built using timber frame provides a direct measures of whether more wood products are being used in construction. The annual indicators will allow progress to be reported on a regular basis.

ENABLING FACTORS AND WIDER IMPACTS

Contributing almost £1 billion to Scotland's economy and supporting over 25,000 jobs, sustainably managed forestry delivers substantial economic benefits. It helps mitigate flood risk, improves water quality and it has beneficial effects on soil. It improves biodiversity and, as accessible woodland, improves people's health and wellbeing.

Our woodland creation ambition will directly benefit all those that work in forestry (management, wood product supply and recreational activities) as well as the farmers, crofters and land managers who create woodland on land they manage. It could also improve the stewardship of land that has been poorly managed in the past. This ambition will be supported by ongoing work to ensure the complementary nature of farming and forestry grants. People across Scotland will benefit from access to new woods for recreation.

The majority of forests producing wood products in Scotland are independently certified against internationally recognised standards of sustainable forest management. Greater use of building materials obtained from renewable sources could reduce greenhouse gas emissions. A further benefit is that the revenue from these wood products can be re-invested in sustainable forest management, ensuring a continued cycle of benefits.

Additional benefits may also be gained from reducing the volume of construction waste materials, by weight one of the most significant waste material flows in Scotland. The waste from construction using wood products is lower and it can readily be recycled, reducing the amount of construction waste being disposed of in landfill.

An increase in the production of more wood products for construction will increase economic activity in rural Scotland.

Designing and managing woodland creation schemes in line with the requirements of the UK Forestry Standard and the guidance on appropriate sites as set out in regional Forestry and Woodland Strategies will deliver public benefits and minimise adverse environmental and landscape impacts. Furthermore, woodland creation proposals must meet the requirements of statutory processes for assessing impact on designated habitats or the wider environment such as the EIA process.

National Planning Framework 3 notes that timber transport networks and requirements for processing facilities will need to be considered as forests mature. Planning authorities should take account of the National Planning Framework in the preparation of development plans for their area. The Scottish Government is working to improve existing infrastructure through working with the forestry sector and local authorities, and providing support under the Scottish Government Strategic Timber Transport Scheme.

Planning system

Forestry Commission Scotland is the competent authority for forestry in Scotland and forestry does not fall within the definition of development. However, buildings, structures and access tracks associated with forest operations may need planning permission from the relevant planning authority for the area.

Under the Scottish Planning Policy, planning authorities have been advised to consider preparing Forestry and Woodland Strategies to guide appropriate areas and types of woodland creation. Where a planning application proposes the removal of forest and woodland cover, planning authorities have a legal duty to consider applying conditions that would safeguard, preserve or replace trees.

Seaweed at Ganavan Sands, Oban on the west coast of Scotland. Credit: Alan McAteer for Scottish Enterprise.

Blue Carbon

The term blue carbon refers to the carbon sequestration and storage benefits of marine ecosystems. Although knowledge has advanced in the last five years, blue carbon remains a relatively new concept. Further scientific research is required to fully understand these complex processes. The current evidence base suggests that some marine ecosystems may be as important as forests and peatland are for carbon capture and storage on land.

Current literature states that blue carbon habitats and species may be relatively abundant in Scottish waters, when compared to other coastal areas in the UK and Europe. The degradation or damage of these ecosystems may cause carbon to be released from stores, and compromise their ability to sequester carbon in the future. Marine ecosystems have historically suffered degradation from human activity.

Current protection of blue carbon

Many of the key habitats and species that research has identified as being important for blue carbon are Priority Marine Features. This means they are given general protection by policies in the National Marine Plan, which requires decision makers to consider climate change mitigation and adaptation. Many of these habitats and species are also safeguarded within Scotland's Marine Protected Area Network. This provides potential to enhance these important marine ecosystems to ensure they continue to capture and store carbon.

Over the last five years, progress has been made to improve our understanding.

Research published by Scottish Natural Heritage (SNH) in 2014[137] provided the first attempt at assessing blue carbon stores and budgets. This estimated that Scotland's seas had stored more than 2,000 million tonnes of carbon, at a rate of around 7 million tonnes per year.

Further research published by SNH in 2017[138] estimated that coastal marine protected areas had stored the equivalent of four years of Scotland's emissions. This research highlights that maerl beds, kelp forests, living reefs, and other habitats are of particular importance.

Separate research by St Andrew's University published in 2016[139] estimated that Loch Sunart alone had almost 27 million tonnes of carbon stored in muddy habitats. In a paper by Smeaton et al. 2017, entitled *Scottish Forgotten Carbon: A National Assessment of Mid-Latitude Fjord Sedimentary Carbon Stocks*, that is currently in review, it is estimated that over 600 million tonnes of carbon are stored in the sediment of Scotland's 111 fjordic sea lochs at a rate of 31,000 – 40,000 tonnes per year.

Next steps

The research undertaken so far has developed better understanding of blue carbon, and established new methodologies for undertaking assessments. However, these need further development, and a better understanding of the processes involved is required to provide sufficient confidence in blue carbon estimates.

The new research programme[140] has been developed by Marine Scotland in partnership with SNH, St Andrew's University, Glasgow University, Heriot-Watt University, and the Scottish Association for Marine Science. The programme consists of one post-doctoral study and six Doctorates to further understanding of blue carbon capture and storage, and begin developing knowledge of how disturbance affects these processes. A further three Doctorates are funded by SNH.

137 Burrows et al. 2014 http://www.snh.org.uk/pdfs/publications/commissioned_reports/761.pdf

138 Burrows et al. 2017 https://risweb.st-andrews.ac.uk/portal/en/researchoutput/assessment-of-blue-carbon-resources-in-scotlands-inshore-marine-protected-area-network(61658325-51d1-4345-803a-e4539a208071).html

139 Smeaton et al. 2016 https://www.biogeosciences.net/13/5771/2016/bg-13-5771-2016.pdf

140 Marine Scotland, Topic Sheet 64, Blue Carbon http://www.gov.scot/Resource/0053/00531293.pdf

PEAT

Peatlands cover around 20% of land in Scotland or around 1.7 million hectares. Degraded peatland can act as a source of greenhouse gas emissions. The restoration of degraded peatlands will considerably reduce this source of greenhouse gas emissions.

WHERE WE ARE NOW

It is currently estimated that over 600,000 hectares of Scotland's peatlands are in a degraded condition as a result of historic land management decisions.

Since 2013, through the Peatland Action Initiative, around 10,000 hectares of peatlands have been restored through Scottish Government-funded action, coordinated by Scottish Natural Heritage. The most recently available estimates suggest that degraded peatland (excluding peatlands used for forestry or agriculture) produces 6MtCO_2e of emissions per year. Almost all of these emissions have yet to be accounted for in the national GHG inventory.

OUR AMBITION

By 2030, 250,000 hectares of degraded peatland will have undergone restoration. The restored peatland will help mitigate flood risk and improve water quality, as well as helping to increase biodiversity in restored areas.

This large-scale peatland restoration delivery across Scotland will also produce multiple benefits for communities and the economy. The key sectors expected to see benefits are tourism, food and drink and the environment.

To make progress towards this ambition, we will focus on achieving a significant increase in the scale of degraded peatland restored, from a 1990 baseline to:

- 50,000 hectares restored by 2020
- 250,000 hectares restored by 2030

Our longer term ambition is that by 2050, Scotland's expanded peatlands will be thriving habitats and sustaining a diverse ecosystem.

Case Study

Sandy Loch, Shetland. The eroding peat has been transformed into bog pools and re-planted with bog vegetation.

Credit: Sue White, PeatlandACTION, Shetland Amenity Trust

The purpose of SNH Peatland ACTION is to provide funding for projects that restore or lead to the restoration of peatlands and/or wider public engagement with peatlands in Scotland.

Land within the Sandy Loch catchment is typical rough grazing which has been modified over decades, possibly centuries, from peat cutting for domestic fuel and pasture improvement for livestock. The loch provides drinking water for Lerwick and much of the Shetland mainland – that's approximately 12,000 customers.

Areas of bare peat around the loch eroded when exposed to rain and the peaty soils ended up in nearby waterways, contributing to the high organic loading and brown discoloured water entering Sandy Loch, and ultimately Scottish Water treatment works. Treating the water at Sandy Loch before piping it to the islander's mains water supply was proving to be environmentally and financially costly. Restoring the peat would help to improve and protect water quality in the catchment and reduce the amount of chemical treatment.

Following consultation and advice from SNH Peatland ACTION, restoration of peatland at Sandy Loch involved creating bog-pools over the area of exposed peat with the aim of slowing the flow of water, and trapping and reducing the loss of peaty sediments into the loch. The restoration will result in improved drinking water supply before it enters Sandy Loch and water treatment works. The restored peatland at Sandy Loch will protect the ground from future erosion and reduce the flashiness of flood waters, creating suitable conditions for new peat to form and enhancing biodiversity, and contributing to and maintaining Scotland's natural carbon storage and resilience to climate change.

Phase one of the project was completed in March 2017 and restoration work is to be extended with SNH Peatland ACTION funding over a larger area of the catchment.

PEAT POLICY OUTCOME, POLICIES AND DEVELOPMENT MILESTONES

Policy outcome 1:
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.

There are two policies which will contribute to the delivery of the policy outcome.

1) 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 from 2018-2019.

Public sector action will be led by SNH through the Peatland Action initiative. In addition to providing support and advice, this will offer financial support to peatland restoration projects initiated by individual land managers. Experience from the Peatland Action Initiative to date demonstrates significant interest in restoration projects.

2) Awareness raising: Working through partnership, we will put in place tools and information to develop the capacity, skills and knowledge of land managers, contractors and others, to deliver peatland restoration.

To support peatland restoration in 2018-19, we will make available £2 million to the Scottish Rural Development Programme. An additional £4 million funding will be made available, including through the Sustainable Action Fund and the Land Managers' Renewable Fund, to the SNH Peatland Action initiative to deliver restoration projects. Our intention is to find additional resource during the year to support peatland restoration.

This action will be carried out jointly with wider partners, particularly land managers and NGOs. Delivery will be supported through the provision of information and tools on peatland restoration.

Relative significance of policies to the delivery of policy outcome 1

These two policies are mutually interlinked. Growing the capacity and skills of land managers and others will be essential to delivering practical restoration across Scotland. In addition, the increased involvement and interest of land managers in peatland restoration can also help draw in other forms of funding, including private initiatives such as the Peatland Code.

Monitoring

Policy output indicator for policy outcome 1

1) Number of hectares of restored peatland per year

Date	2018	2019	2020	2021	2022
Output	10,000ha	20,000ha	20,000ha	20,000ha	20,000ha

Implementation indicators for policy outcome 1

1) Number of hectares on the road to recovery through Peatland Action at the conclusion of the preceding financial year.

2) Total number of applications received for Peatland Action restoration project funding.

Date	2018	2019	2020	2021	2022	2023	2024	2025
No. of grant applications	100	120	130	140	150	150	150	150

3) Number of projects approved for funding from the Peatland Action restoration project funding.

Date	2018	2019	2020	2021	2022	2023	2024	2025
No. of successful applications	90	110	115	120	125	130	130	130

4) Number and area of restoration feasibility plans supported through the Peatland Action programme.

5) Number of contractors trained to carry out the restoration.

6) Number of land managers/consultants trained through the Peatland Action programme.

7) Number of dedicated Project officers.

Explanation for selection of indicators

Indicators are based on the outcome required, physical restoration and the supporting actions that are required; e.g. maintaining awareness and building capacity to deliver the physical restoration, e.g. amongst contractors.

ENABLING FACTORS AND WIDER IMPACTS

Peatland restoration will provide a number of co-benefits, including supporting increased biodiversity which, in turn, will help to maintain and improve the status of protected sites. Tick populations have been shown to reduce following restoration, benefitting both human and animal health.

Restoration will contribute to the water environment through reducing sources of diffuse pollution. This will help improve the ecological status of water bodies and help reduce the costs of treatment costs of public water supplies. For households and businesses using private water supplies, restoration may also help reduce the water discolouration. Restoration of peatlands can be an important component of natural flood management, by reducing and displacing flood peaks.

Additional economic benefits may also accrue given the importance of peatlands to Scotland's environmental image, critical to key sectors such as food and drink and tourism. Reduced sources of diffuse pollution will provide benefits to sectors such as fresh water fisheries.

Communities near peatlands also play a valuable role in their restoration and may benefit from the improved access to peatlands. In many parts of the Central Belt, bogs provide open space and places for people to walk away from traffic.

Individual businesses and environmental non-governmental organisations (eNGOs) that manage peatlands will benefit from their restoration. Undertaking restoration action at the large, landscape scale aimed for by this policy outcome should help deliver greater co-benefits than smaller scale and more fragmented restoration projects. Peatland restoration will provide a common focus for a wide range of upland interests to come together. The restoration activity can be a catalyst for improvements to the wider landscape.

At the general level, there are no adverse effects. However, at individual site level there might be divergent views locally on the relative merits of restoration compared to alternative land uses.

The wider context

The National Peatland Plan[141] sets out Scotland's wider vision for peatlands and their multiple benefits; and the work to protect and support good management and, where required, restoration.

This work includes supporting the phasing out of peat in horticultural compost. This is a global challenge, as most of the peat used for this purpose is sourced from outside Scotland.

The Scottish Government is supporting industry led work to develop and promote alternative sources of compost, and

141 Scotland's National Peatland Plan https://www.snh.scot/climate-change/taking-action/carbon-management/restoring-scotlands-peatlands/scotlands-national-peatland-plan

demonstrate their effectiveness. This is work which the National Peatland Group will continue to support and pursue.

Planning system

Our National Planning Framework 3 already identifies peatlands as a significant carbon store, and recognises that peatland restoration is planned on a large scale. The Peatland Plan will guide planning decisions to ensure that we protect and enhance the multiple benefits of peatland.

Developments should aim to minimise the release of emissions from disturbed peatland and policy requires applicants to assess the likely effects of development on carbon dioxide emissions. Scottish Planning Policy states that commercial extraction of peatland should only occur in areas suffering historic, significant damage through human activity and where the conservation value is low and restoration impossible.

Land Use Strategy

The Scottish Government Land Use Strategy is a statutory commitment under the Climate Change (Scotland) Act 2009. The first Land Use Strategy was produced in 2011, and the most recent (2016-2021) provides the policy context for climate change adaptation and mitigation in relation to land use. Scottish Planning Policy also makes clear that the application of planning policies should have due regard to the principles for sustainable land use as set out in the Strategy.

The current Strategy contains proposals and policies which support actions in this Climate Change Plan period. These include better understanding and managing our natural resources for sustainable and productive use; reviewing the Scottish Forestry Strategy; developing measures to improve climate friendly farming and crofting (see Chapter Seven); and exploring the potential of Scotland's uplands to deliver multiple benefits and contribute to climate change targets. The forestry and peat policies in the Climate Change Plan complement each other and will help to deliver the Land Use Strategy's objectives and principles:

Objectives

- Land-based businesses working with nature to contribute more to Scotland's prosperity.
- Responsible stewardship of Scotland's natural resources delivering more benefits to Scotland's people.
- Urban and rural communities better connected to the land, with more people enjoying the land and positively influencing land use.

Principles

- Opportunities for land use to deliver multiple benefits should be encouraged.
- Regulation should continue to protect essential public interests while placing as light a burden on businesses as is consistent with achieving its purpose. Incentives should be efficient and cost-effective.

Land Use Strategy (continued)

- Where land is highly suitable for a primary use (for example food production, flood management, water catchment management and carbon storage) this value should be recognised in decision making.
- Land use decisions should be informed by an understanding of the functioning of the ecosystems which they affect in order to maintain the benefits of the ecosystem services which they provide.
- Landscape change should be managed positively and sympathetically, considering the implications of change at a scale appropriate to the landscape in question, given that all of Scotland's landscapes are important to our sense of identity and to our individual and social wellbeing.
- Land use decisions should be informed by an understanding of the opportunities and threats brought about by the changing climate. Greenhouse gas emissions associated with land use should be reduced and land should continue to contribute to delivering climate change adaptation and mitigation objectives.
- Where land has ceased to fulfil a useful function because it is derelict or vacant, this represents a significant loss of economic potential and amenity for the community concerned. It should be a priority to examine options for restoring all such land to economically, socially or environmentally productive uses.
- Outdoor recreation opportunities and public access to land should be encouraged, along with the provision of accessible green space close to where people live, given their importance for health and wellbeing.
- People should have opportunities to contribute to debates and decisions about land use and management decisions which affect their lives and their future.
- Opportunities to broaden our understanding of the links between land use and daily living should be encouraged.

Chapter 7
Agriculture

Farmland near Biggar. Photographer – Matt Cartney. Crown Copyright

The agriculture sector includes activities related to livestock production and cultivation of land for food or energy crops.

Agriculture also contributes to climate change mitigation through areas that are not defined as agriculture in the Climate Change Plan. The sector provides benefits to land use and forestry through contributing to and managing a significant part of Scotland's national carbon sink. Around 73% of Scotland's land area is designated as agricultural[142] making its contribution to these areas crucial, as is the role that the industry plays in taking forward environmental and biodiversity actions, with farmers actively engaged in agri-environment schemes and with other public bodies such as SEPA on improving water quality and flood management. Agriculture also contributes to the decarbonisation of Scotland's energy sector through the production of renewable energy, with the largest proportion of operational community and locally owned capacity being located on Scottish farms and estates.

WHERE WE ARE NOW

25.8% fall
in agriculture sector emissions between 1990 and 2015

The Agriculture and Related Land Use sector as defined in the GHG inventory has seen a fall of 3.8MtCO_2e (25.8%) in emissions between 1990 and 2015, reducing them to 10.8MtCO_2e (the definition of the sector used by TIMES shows the decline between 1990 and 2015 levels to be 14%[143]). This fall is mostly attributable to four factors:

- efficiency improvements in farming, such as higher milk yields per cow
- fewer cattle and sheep
- a reduction in the amount of nitrogen fertiliser being applied
- a reduction in grassland being ploughed for arable production

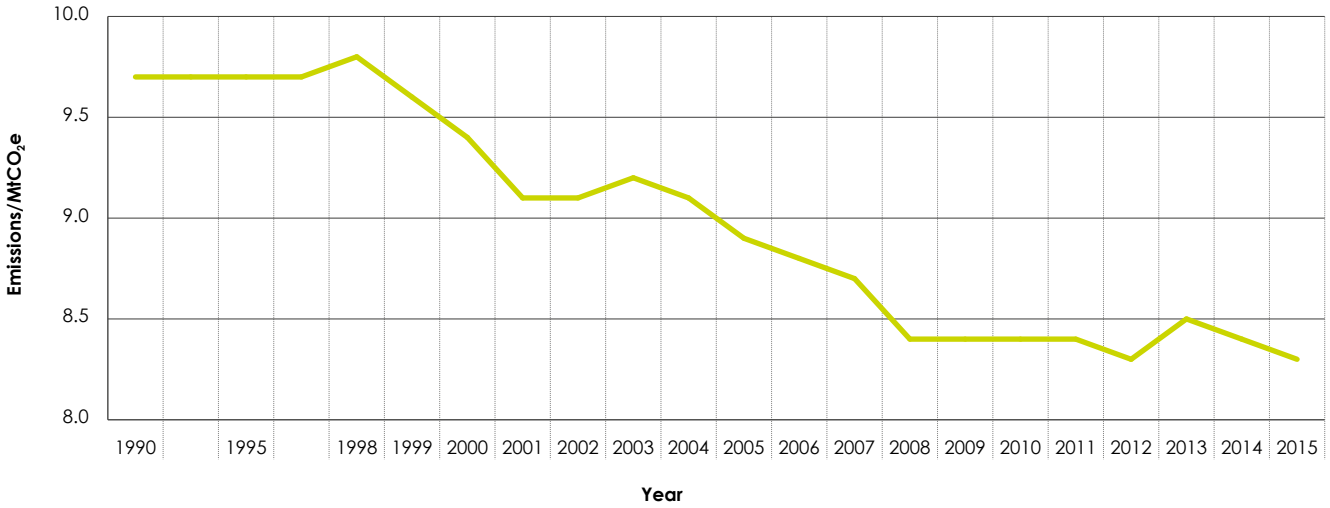
Almost half of the global warming impact of emissions from agriculture is from methane, which has 25 times the global warming effect of carbon dioxide, and around a quarter is from nitrous oxide, which has 298 times the warming effect of carbon dioxide. The types of gases and their high level impact is why agriculture differs from other sectors where the main GHG emitted is carbon dioxide. This means that what is required of agriculture is different to other sectors.

GHG emissions are inherent in food production due to biological processes and chemical interactions in both livestock and plant growth. In the future, uncertainties around Brexit, growing populations and increasing pressures throughout the economy and the rising cost of living may increase the tension between climate change mitigation and providing food security. A fine balance must therefore be found to ensure GHG reduction can take place while Scotland continues to produce secure and sustainable food.

142 Agricultural Land Use In Scotland http://www.gov.scot/Topics/Statistics/Browse/Agriculture-Fisheries/agritopics/LandUseAll

143 The difference between the Inventory and TIMES is down to the Related Land Use component of Agriculture which is captured in the Agriculture and Related Land Use category in the Inventory and in the LULUCF sector envelope in TIMES.

Figure 19: Agriculture historical emissions[144]



PROGRESS SINCE RPP2

Doubling the number of Climate Change Focus Farms in Farming for a Better Climate from four to eight

Nine new Focus Farmers were engaged and are currently part of Farming for a Better Climate (FFBC). Evidence on the impact of the policy suggests that farmers who engage with it find it valuable, but not enough are aware of it. We now have a policy to extend FFBC to enable more farmers to benefit from the lessons learned.

90% uptake of fertiliser efficiency measures

This proposal has been superseded by the requirement for nutrient management planning on grassland as a result of the Common Agricultural Policy (CAP) Greening and the work we will undertake through policy outcome 2 of this plan.

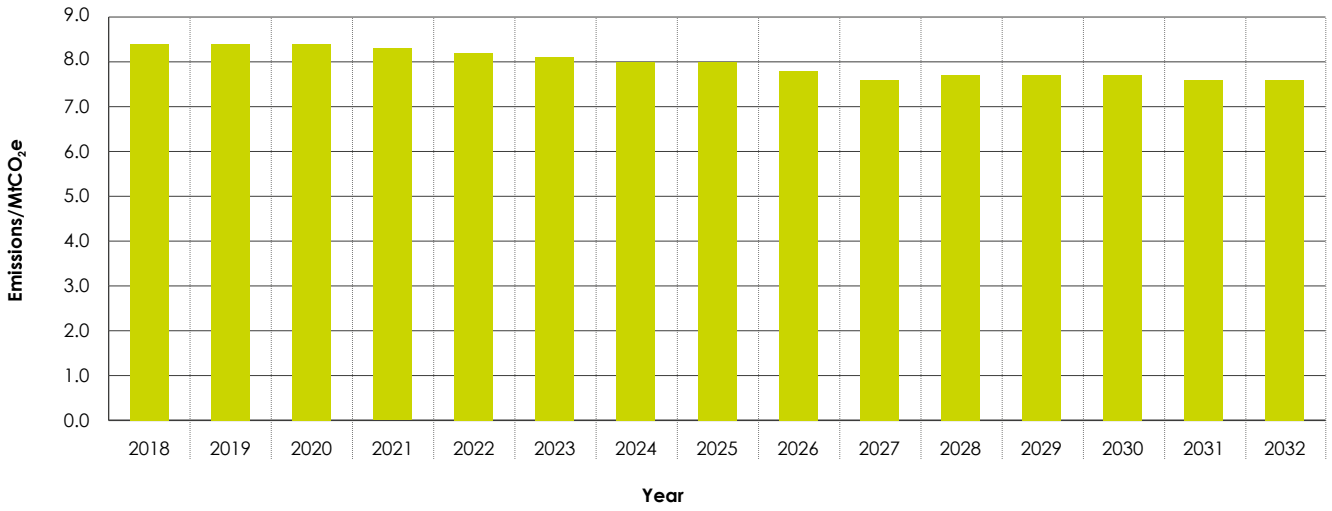
Developments in agricultural technologies post 2020

Advancements in agricultural technologies are gathering pace and it is now one of the fastest growing global markets, drawing the attention of not only the more traditional agricultural equipment companies but of companies that have been leading the technological journey across other sectors. Scotland is ideally placed to fully embrace this field as it is home to some of the most innovative and creative farmers, crofters and land managers and a world renowned scientific community. Technology has the ability to increase production values while improving efficiency and reducing climatic and environmental impacts. What we want to achieve is to maximise these opportunities and ensure that Scottish agriculture is at the forefront of this ever developing and growing market.

144 Historical emissions profiling is based upon the TIMES definition

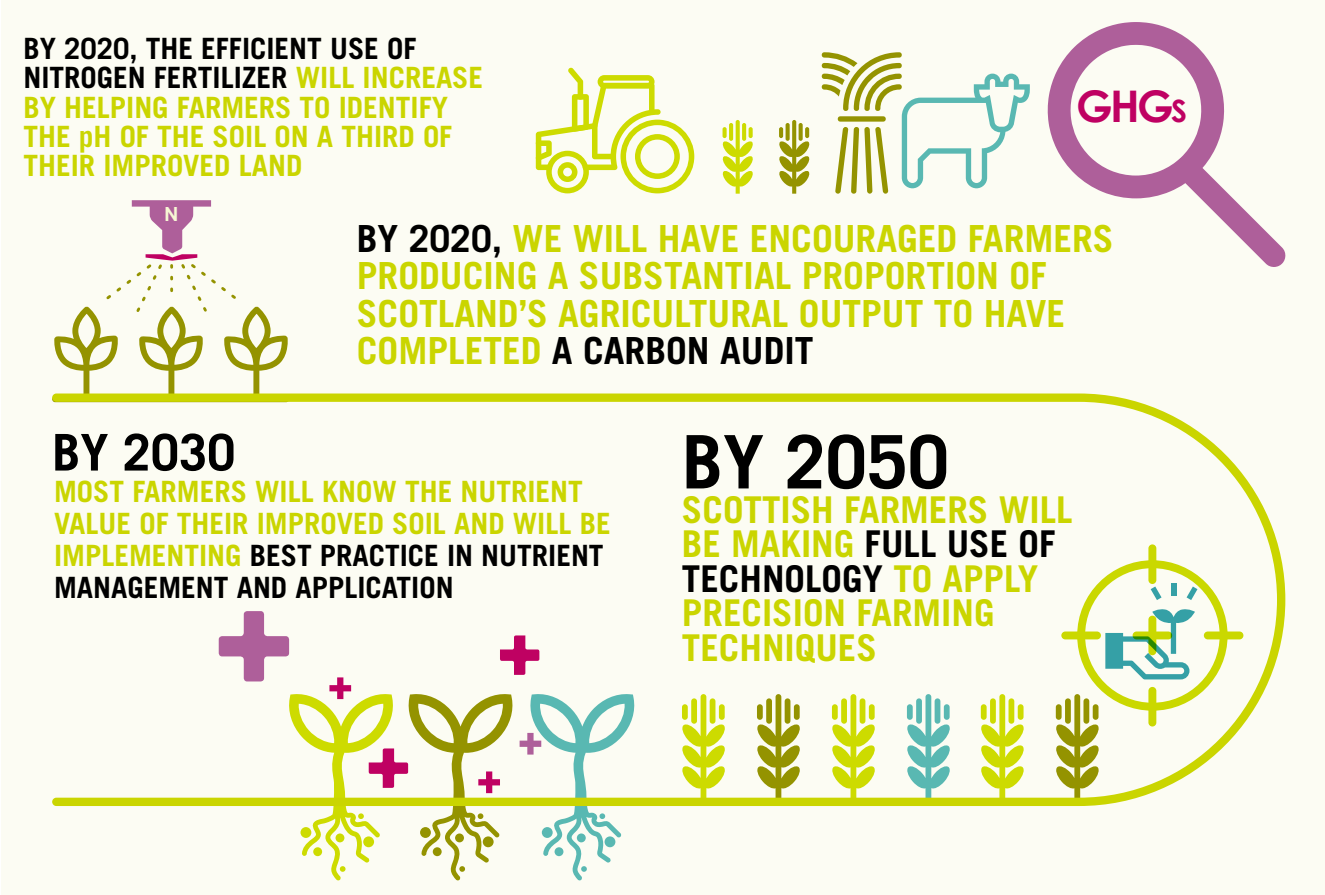
OUR AMBITION

Figure 20: Agriculture emissions envelopes



Agriculture emissions will fall by 9% (0.8MtCO_2e) over the lifetime of the Plan. Low carbon farming is not only good for the planet, but also good for food producers' pockets. We want Scotland to be a world-class producer of high quality food: sustainably, profitably and efficiently in environmental and economic terms. The farming and food production sector is central to achieving this ambition. Change will only happen with the involvement of primary food producers, so we will work with the sector, to generate solutions to barriers that present themselves such as those for tenant farmers, to recognise and realise the economic and environmental benefits of low carbon farming.

IN THE AGRICULTURE SECTOR



Due to the relationship between GHG emissions and all food production, and the need to address the unique nature of Scotland's land capabilities – with only 8% of agricultural land considered "prime land"[145], capable of supporting a wide range of crops, and the majority of the remaining land considered "rough grazing", land with severe limitations on what it can support and produce – our focus needs to be on maximising efficiency. This can be achieved by taking a holistic approach to protecting and enhancing our soil, optimising land use, tackling livestock disease, utilising the latest technology, maximising input efficiency and turning wastes into resources. The proposals and policies in this chapter take forward the position that was set out in "Getting the Best From our Land – a Land Use Strategy for Scotland 2016–2021" for agriculture.

These actions will achieve GHG emissions reductions. They can also generate improvements in animal health and welfare, provide cleaner water and air, improve soil quality while increasing the volume of our national carbon sink, increase biodiversity and give farmers more financial security.

145 Land Capability for Agriculture in Scotland http://www.hutton.ac.uk/sites/default/files/files/soils/lca_leaflet_hutton.pdf

Case Study

John Kerr at the Woodhead farm near Newmilns.
Credit: Farming For a Better Climate.

Woodhead Farm, near Newmilns in Ayrshire is a 180 cow dairy, owned and run by John Kerr and his family. Woodhead is one of nine farms across Scotland participating in the Scottish Government's Farming for a Better Climate Focus Farms initiative.

Over a three year period, host focus farmers work with SAC Consulting to identify and implement a range of practical low or no-cost mitigation measures suitable for implementation on the host farm. The focus farms also host regular discussion group meetings to share and further develop these ideas with other working farmers.

Through participation in the focus farm programme with SAC Consulting, John Kerr has been able to identify a range of measures that can benefit his farm business and reduce carbon emissions. Woodhead farm has made the following improvements:

- Assessment of pH across the farm has been carried out and helped to develop a programme for remediation.
- Assessment of soil nutrients, slurry use and targeted application, as part of the farm nutrient management plan, allowed for more efficient use of fertilisers.
- A biomass boiler has been installed to produce heat from woodchip. This reduced electricity use by 32%.
- Renewed focus on grazing and paddock management has increased utilisation and production of grass. Silage quality has improved, leading to an estimated saving of £120 per cow per winter.
- Calf housing has been improved, which has led to better animal survival rates, and improved milk cooling processes have reduced electricity use.
- Improved cow housing, including flexible lighting control and better ventilation, reduced energy bills and continues to positively influence animal health.

We will continue to work with Scotland's agricultural sector and our world renowned scientific community through the Strategic Research Programme and an ad-hoc research budget available to us of around £65,000 per annum as we strive to turn best practice into standard practice. We will continue to lead in promoting behavioural change towards low carbon farming as we have done through the establishment of the Beef Efficiency Scheme[146] and our support for Agri-Environment Schemes by ensuring that high quality advice, information and on farm demonstrations are available through the Farm Advisory Service[147] and Farming for a Better Climate. We will support peer to peer knowledge exchange and innovation from within the sector through the Monitor Farm Network[148], the Soil Nutrient Network[149] and other support mechanisms.

By 2020, to help increase the efficient use of nitrogen fertiliser, the Scottish Government will continue to work with farmers so that they know the pH of the soil on a third of their improved land, and that they are applying fertilisers in an efficient manner. By making farmers aware of the benefits that can be gained from optimal levels for pH and other essential nutrients, they can develop a targeted nutrient management plan aimed at maximising productivity and minimising the need for expensive inputs, while reducing GHG emissions. Primary food producers need to know how to cut their overall carbon footprint and to understand that doing so will also improve their profitability.

By 2020, we will have encouraged farmers producing a substantial proportion of Scotland's agricultural output to have completed a carbon audit. Due to the high quality advice and information that has been made available, many farmers will also know and understand the sources of GHG emissions from farming activities and we expect them to be taking action to reduce these. We will be monitoring progress towards this as we continue to evaluate our approach. Most livestock farmers will also be taking new steps to improve the health of their herd, to improve fertility, reduce mortality and tackle production diseases.

By 2030, most farmers will know the nutrient value of their improved soil and will be implementing best practice in nutrient management and application. The Scottish Government will have engaged with the agriculture sector to encourage optimisation of land use, which can include increased planting of woodland/forestry and hedgerows and the restoration of peatlands on appropriate agricultural land. This encouragement will include the dissemination of information on the related economic benefits of good silvo-management practices.

By 2050, Scottish farmers will be making full use of technology to apply precision farming techniques across the board, and Scotland's land will be producing sustainable, healthy, nutritious and high quality food while providing a substantial contribution to Scotland's national carbon sink that offsets emissions elsewhere in our economy.

146 Rural Payments and Services, Beef Efficiency Scheme https://www.ruralpayments.org/publicsite/futures/topics/all-schemes/beef-efficiency-scheme/

147 Scotland's Farm Advisory Service https://www.fas.scot/

148 Monitor Farm Programme http://www.qmscotland.co.uk/monitorfarms

149 Soil and Nutrient Network https://www.sruc.ac.uk/info/120605/soil_and_nutrients/1355/soil_and_nutrient_network

POLICY OUTCOMES, POLICIES, DEVELOPMENT MILESTONES AND PROPOSALS

Policy 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.

There are three policies, two policy development milestones and one proposal which will contribute to the delivery of policy outcome 1.

Policies which contribute to the delivery of policy outcome 1

1) 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.

The Scottish Government will support the provision of high quality advice to all farmers, crofters and land managers on cost-effective mitigation measures through the Farm Advisory Service, Farming for a Better Climate (FFBC)[150], the Monitor Farm network and the Soil Nutrient Network and stakeholder organisations, but these will be expanded, principally by:

- Increasing FFBC's reach within the industry through expanded communications work, and we may extend funding if there is demand. To ensure its success and measure its impact, an evaluation of this programme has begun with initial results due in 2018. FFBC works with a group of focus farmers to increase the efficiency of their business, while simultaneously decreasing its carbon footprint. It then provides farmers across Scotland with free advice through on-farm demonstrations via open days and farm visits and by using the lessons learned on each focus farm to create guides, case studies and technical notes at a cost of around £375,000 each year.
- Continuing our commitment to working with the industry by providing funding support of around £150,000 for the further development of an industry-led carbon accumulator tool that for the first time will allow farmers to measure and get credit for reducing emissions and sequestering carbon, in areas such as soils, forestry and renewable energy generation.
- Working with the Farm Advisory Service to help it provide high-quality advice on on-farm mitigation measures, fund around 1,200 free carbon audits, provide integrated land management plans and continue to support business efficiency and viability.
- Determining the feasibility of a Farming and Food roadshow. The purpose of this would be to share information with farmers and the public on the climate change issues in food and farming at agricultural shows and science events.
- Enabling dissemination of specific advice and practical demonstrations on mitigation measures, such as conservation tillage and variable rate fertiliser and lime spreading, to farmers through the Monitor Farm Network, the Soil Nutrient Network, Farming for a Better Climate and others by providing continued support.
- Continuing to investigate the possibilities to maximise climate change benefits from existing support mechanisms.

150 Farming For A Better Climate http://www.gov.scot/Topics/farmingrural/Agriculture/Environment/climatechange/Advice

2) An agri-tech group will be established to share, disseminate and encourage adoption of advances in agricultural science and technology as widely as possible.

In order to complement and maximise the potential of agri-technologies and other policy initiatives such as the UK agri-tech strategy in Scotland, we will create a group of experts including technology and data providers, industry representatives and scientists. The aim of this group will be to share learning on advances in agriculture technology, to enable farmers in Scotland to utilise the most appropriate tools, techniques and equipment to optimise crop yield and reduce their emissions intensity. Support of around £5,000 will be provided for this group.

3) Young Farming Climate Change Champions will be recruited and trained to explain, promote and encourage low carbon farming.

We will work with the Scottish Association of Young Farmers Clubs (SAYFC) to recruit volunteer Young Farming Climate Change Champions who will be trained to explain, promote and encourage low carbon farming among their peers with the associated cost estimated at around £50,000.

Peer to peer learning, which can result in behavioural change at a social level, has an important role to play in increasing the level of understanding of low carbon farming practices within the next generation of famers.

Policy development milestones

1) 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.

Carbon audits have proved to be an effective tool for highlighting cost-effective ways to reduce emissions and as such were made a requirement of the Beef Efficiency Scheme with over 1,000 Scottish beef farmers already going through the process. Our consultation will ask how best to ensure maximum take up of carbon audits, especially among tenant farmers and crofters. The results of this consultation will be used to inform future policy as we continue to pursue all avenues to reduce emissions within agriculture.

2) We will 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.

The aim will be to determine what policies, support and advice tenant farmers need to undertake measures which will help them reduce emissions at farm level.

Policy proposal

1) Marketing scheme: Determine the feasibility of a Low Carbon Farming marketing scheme.

Farmers will be more likely to apply low carbon farming techniques if they can achieve a market premium for their product. In addition, through the policies in this Plan and our existing environmental requirements, farms in Scotland will be producing some of the lowest carbon food in the world. We therefore propose to explore a marketing scheme that would generate recognition among consumers and increase demand for food produced using low carbon methods, similar to Origin Green[151] in Ireland. This work will take into account contributions that could be made from established marketing schemes.

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

There are three policies and two proposals which will contribute to the delivery of policy outcome 2.

Policies which contribute to the delivery of policy outcome 2

1) Communicate and demonstrate the benefits of precision farming and nitrogen use efficiency in order to achieve a reduction in GHG emissions.

This will be achieved through communication and demonstration of the emissions reduction and economic benefits of precision farming and nitrogen use efficiency in case studies, practical guides and on-farm demonstrations. The use of techniques such as variable rate fertiliser and lime spreading and GPS soil testing can lower the amount of excess nitrogen applied to fields. This in turn can reduce the GHG emissions as well as reducing risk of nitrates entering watercourses through run off and limit the impacts on air quality through reduced ammonia emissions. Delivery of this information will be through the Farm Advisory Service, Farming for a Better Climate, the Monitor Farm network, the Soil Nutrient Network and other stakeholder organisations.

2) 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.

Any target that may be set must be evidence based and relevant to Scottish soils and allow them to produce an economically optimal crop yield. Therefore the future work on a target shall take into account essential factors like good practice in soil management as well as other environmental and climatic constraints such as soil type, rainfall and topography.

151 Ireland's food and drink sustainability programme, Origin Green https://www.origingreen.ie/

3) 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.

Information, advice, and practical demonstrations on the benefits of soil testing will be delivered through the Farm Advisory Service, Farming for a Better Climate, the Monitor Farm network, the Soil Nutrient Network and other stakeholder organisations in order to achieve reductions. The minimum that farmers should test for is pH, however we will consult on how to increase uptake of testing for this and other nutrients, including potassium and phosphorus, as well as other indicators of good soil condition, such as organic matter content.

Wormiston farm, an upland mixed beef and sheep farm, was able to save an estimated £1,421 on spring barley production and an estimated £4,088 on silage production[152]. This has been through testing their soils' nutrient levels and structure, and by establishing good nutrient management practices (including maximising the use of organic manures that were available).

Policy proposals

1) Investigate the benefits and barriers of leguminous crops in rotation.

Legumes in rotation can reduce the need to apply synthetic nitrogen fertiliser through maximising atmospheric nitrogen fixation. However, there are considerable environmental and economic factors to consider such as land capabilities, topography, rainfall, soil type, availability of markets and new management techniques that may require significant outlay on equipment. We will explore the various opportunities and any potential drawbacks of creating a requirement that arable land has to include a leguminous crop in rotation, including any incentives that farmers would require for doing so.

2) Crop varieties with improved nitrogen-use efficiency.

We will continue to monitor for the establishment of new breeding goals and the development of breeding programmes looking at nitrogen-use efficiency. Crops which can provide an optimal yield with reduced nitrogen needs will allow for a reduction in the need for synthetic fertilisers while increasing Scotland's food security. However, the development and establishment of new breeding goals and programmes can be a long term process and this has to be considered when developing policy instruments.

We will also explore the benefits that can be gained through looking at traditional and native varieties such as bere barley, small oat and certain wheats. These types of native plant are referred to as being types of Scottish landraces as they have adapted over time to local environmental conditions throughout Scotland.

152 Soil and Nutrient Network https://www.sruc.ac.uk/info/120605/soil_and_nutrients/1355/soil_and_nutrient_network

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

There are two policies, two development milestones and one proposal which will contribute to the delivery of policy outcome 3.

Policies which contribute to the delivery of policy outcome 3

1) Commission and publish a report into the establishment of emissions intensity figures for beef, lamb and milk.

In order to reduce the carbon footprint of the food we produce, we need to lower the emissions associated with each kilo of beef, lamb or crops, and each litre of milk without reducing the amount of food we produce. The Scottish Government will publish work on metrics that will allow us to measure these figures. The work that has been commissioned on emissions intensity is based on the data that is currently collected and available and as such places no additional burden on the agricultural sector.

2) Work with Quality Meat Scotland, ScotEID[153] and livestock producers to encourage improved emissions intensity through genotyping, improving fertility, reducing animal mortality and improving on farm management practices.

By making improvements in fertility, reducing mortality and management practices the livestock sector can generate products that have a lower emissions intensity. The work of the Beef Efficiency Scheme is addressing the role of genotyping and the Farm Advisory Service and Farming for a Better Climate continue to offer high quality advice and information. The Scottish Government also continues to support industry lead innovation in this area through mechanisms such as the Scottish Rural Development Programme's Knowledge Transfer and Innovation Fund[154].

Policy development milestones

1) Determine the practicality of establishing a SMART target for reduction in the intensity of emissions for beef, sheep and dairy sectors.

Once the work on emissions intensity has been completed (see policy 1 for outcome 3 above) this will allow work to begin in order to determine the practicalities of using emissions intensity data to set industry targets for Scotland agricultural produce.

2) Consult in 2018 to determine the nature of livestock health measures that the sector will adopt from 2019.

Animal health and welfare can have an effect on the levels of GHG emissions that are emitted by agriculture. Healthier animals tend to grow faster and require fewer inputs all of which will reduce the emissions intensity per kg of meat or litre of milk that they produce. The Scottish Government has previously conducted research on animal health and GHG reductions and opened discussions with industry and will ensure that the cost benefits of any interventions is understood, the economic implications of different disease management approaches are taken into consideration and the

153 ScotEID - Scottish EID Livestock Traceability Research https://www.scoteid.com/

154 Scotland Rural Development Programme (SRDP) 2014-2020 Stage 2: Final Proposals http://www.gov.scot/Publications/2013/12/7550/291113

effectiveness of knowledge exchange methods are evaluated. In order to find a consensus on the type of scheme to be implemented a consultation will take place including four possible options before any measure is agreed:

- The establishment of one or more mandatory disease eradication schemes. This would place requirements on farmers to control the disease, similar to what the Scottish Government has done for Bovine Viral Diarrhoea (BVD).
- The establishment of one or more schemes focused on syndromes rather than diseases, such as calf/lamb mortality or infertility.
- Vet-approved health plans.
- Using market forces by requiring testing and declaration before sale of the most important production diseases.

Policy proposal

1) Determine the practicalities and feasibility of using livestock feed additives as a means of reducing emissions.

There is evidence that suggests a wide range of feed additives may have a positive impact in reducing methane emissions from enteric fermentation. We will commission and publish work on reducing emissions by including lipids (fats) in rations, and in future through new additives not yet ready for market. Further research will be undertaken to establish logistical and supply chain issues such as consumer response, land-use implications from creating the additives, and handling, transportation and storage issues. This research will provide the information needed to understand how best to address the potential that feed additives may have here in Scotland.

Policy outcome 4:
Reduced emissions from the use and storage of manure and slurry.

There are two policy development milestones and three proposals which will contribute to the delivery of policy outcome 4.

Policy development milestones

1) Determine the potential feasibility of self-financing large-scale slurry and manure fed anaerobic digesters.

We will determine the feasibility of one or more viable large-scale anaerobic digestion (AD) plants, mostly using slurry and other wastes as feedstock, accounting for end-to-end issues such as use of digestate, grid connection, feedstock availability and address any potential concerns or unintended consequences.

2) 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 co-operatively owned and managed anaerobic digesters.

We will determine the feasibility of creating a number of cooperatives of around ten farms each to operate viable AD plant, mostly using slurry and other waste as feedstock. A potential model for this cooperative would involve one farmer being responsible for the management of the AD plant as well as transport of feedstock and digestate, backed by a maintenance contract. We will encourage use of CARES funding to maximise community benefit. The number, location and timing of these will depend on factors such as planning permission and financing.

Policy proposals

1) Investigate the practicalities of livestock grazing in rotation on current arable land.

Initial evidence suggests emissions reductions could be delivered by restoring the traditional practice of livestock grazing on arable land. Having livestock in the fields between crops would provide the soil with a supply of organic manure which can reduce the amount of synthetic nitrogen fertiliser needed while improving the soils health and condition as well as increasing the level of carbon that is stored with in it. Further work is required to consider associated emissions and practicalities such as infrastructure, biosecurity and husbandry skills that would be vital to any arable farm bringing in livestock.

2) Conduct a feasibility study for the establishment of manure/slurry exchange.

Evidence suggests that moving manure or slurry from cattle farms to arable farms could be a cost-effective option that delivers abatement through a reduced need to use chemical fertilisers. We will conduct a feasibility study to consider logistics, demand, and the potential for abatement when considering storage requirements and transport.

3) Determine how to consistently minimise emissions from slurry storage.

This can be achieved by methods such as fixed roofs, slurry bags or floating covers. Initial evidence suggests the cost is high and the amount of abatement low, and there are significant potential health and safety and environmental issues to overcome. However, further evidence is required and we will commission and publish work looking at the best available technologies for both storage and application in a Scottish context as well as further internal investigation into existing and future support options.

Policy outcome 5:
Carbon sequestration on agricultural land has helped to increase our national carbon sink.

There is one policy and two proposals that contribute to the delivery of policy outcome 5.

Policy which contributes to the delivery of policy outcome 5

1) 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.

We intend to encourage the uptake of these behaviours by informing and advising the farming sector, through the Farm Advisory Service and other stakeholder organisations, of the multiple benefits of trees/woodland and hedgerows on farm land. We will promote initiatives such as Sheep and Trees, a scheme designed to integrate the benefits of trees with upland sheep farming, and the Woodland Carbon Code, which allows farmers to be paid directly for the amount of carbon being stored within their trees.

Poicy proposals

1) 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.

We will explore the possibilities of expanding and building upon mechanisms such as the Woodland Carbon Code and the Peatland Code, which pay farmers and other land managers to sequester carbon in woodland/forestry and peatland. A similar scheme that would allow farmers and land managers to benefit from payments for carbon sequestered in their soils could play a major role in working towards our climate mitigation targets. This has been a long-term ambition in many countries but working examples are very rare.

2) Woodland cover on suitable agricultural land.

The Scottish Government has ambitious woodland creation targets to contribute towards reducing emissions and agriculture has a role to play in achieving this. Through the Sheep and Trees Initiative we are investigating the benefits of integrating woodland on farm land. Using the Land Capability for Agriculture classification, local Forestry and Woodland Strategies, evidence on flood prevention and other appropriate information we will work with stakeholders to identify areas that have potential for sustainable woodland/forestry creation.

Monitoring

Policy output indicators for policy outcomes 1, 2, 3, 4 and 5

1) Our primary output indicator will be the level of emissions from the agriculture sector in the Greenhouse Gas Inventory.
This will be underpinned with a particular focus on soil testing and nutrient planning in Scotland. Over the next few years we would expect:

- *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.*

Implementation indicators for policy outcomes

1) The number of attendees at climate change-themed Farming for a Better Climate and Farm Advisory Service events, who rated them useful and have said they will put what they have learned into practice.

2) The uptake of free carbon audits provided through the Farm Advisory Service – increase the uptake of free carbon audits provided through the Farm Advisory Service to 200 audits delivered per year by 2019.

3) The uptake of Integrated Land Management Plans (ILMPs) provided through the Farm Advisory Service – increase uptake of Integrated Land Management Plans (ILMPs) provided through the Farm Advisory Service to 300 ILMPs delivered per year by 2019.

Explanation of selected indicators

Scottish agriculture faces difficult trading conditions caused by the uncertainty surrounding the UK's departure from the European Union. With this Climate Change Plan the Scottish Government is sending strong messages to the agriculture sector that increasing on-farm efficiency can increase profitability through several means: reducing input costs like expensive fertilisers and energy consumption; increasing output through higher yields and healthier livestock making weight quicker; increasing sustainability through improved soil health and condition; and by maximising on farm resources to develop resilience against input price fluctuations.

However, an understanding of the uniqueness of each farm business is imperative as there is no uniform solution. Therefore the Scottish Government has designed this suite of policies, proposals and delivery milestones to empower farmers by giving them access to the high quality information and advice they need to increase efficiency and reduce their carbon footprint across the whole farm. In order to reflect this holistic approach we have selected the national GHG Inventory emissions as a high level output indicator which will be underpinned with a detailed look at soil testing and nutrient management within Scottish agriculture, alongside a range of other data on the uptake of other low carbon farming practices.

Giving farmers, crofters and land managers the information and advice they need to continue to produce food while reducing emissions is the basis of our emissions reduction strategy. Two key drivers for doing this are Farming for a Better Climate (FFBC) and the Farm Advisory Service (FAS). Monitoring these programmes will allow us to understand if more farmers, crofters and land managers are accessing them and if our approach is delivering the results that are needed, and, if not, allow us to re-evaluate it.

Additional work on monitoring

We are working to improve the monitoring and evaluation of our Farming for a Better Climate Initiative. A detailed survey will be conducted which follows up with farmers who have made use of the programme. These farmers will act as a treatment group, while an equivalent group of non-users will act as a control group to test the programme's impact. This will test what effect the programme has on user attitude to climate change, and more importantly, their knowledge and uptake of low carbon farming techniques. This work commenced in late 2017.

We will continue to work on establishing a baseline figure for the area of improved land in Scotland that currently undergoes soil testing. We will use this to measure the progress against our future goals for soil testing within the Climate Change Plan.

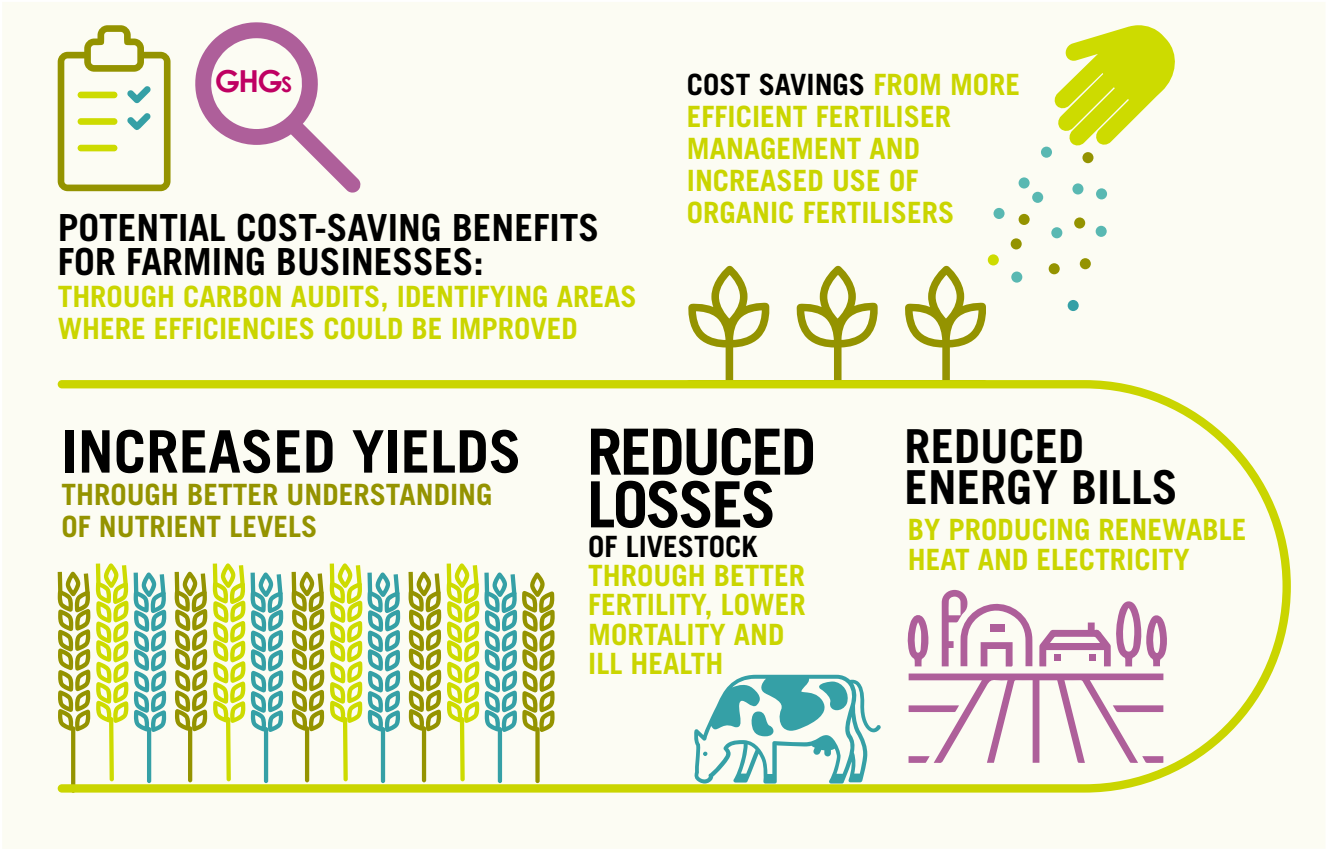
We have commissioned research to develop a method of calculating an emissions intensity figure for our agricultural produce. This would, for example, estimate the tonnes of CO_2e emitted in the production of a kilogram of meat/crop or litre of milk. The ability to calculate emissions intensity is important, as global food demands are increasing and importing food from overseas from countries that produce food less efficiently than we do may help achieve national emission reduction while damaging global efforts to combat climate change.

Understanding emissions intensity will help us understand our CO_2e efficiency relative to other countries, identify and understand the reason for changes in efficiency, identify areas of potential improvement and establish benchmark levels of efficiency for the future. It will also measure our agricultural emissions more precisely than the GHG inventory, and capture farm efficiency improvements which are typically not captured by the GHG Inventory methodology.

ENABLING FACTORS AND WIDER IMPACTS

There are substantial potential economic benefits for farm businesses and for the wider rural economy as a result of the proposals and policies in this Plan. Almost all activities farmers can undertake to reduce emissions also make or save money, what is good for the planet is good for their finances. These activities include: identifying avoidable inefficiencies through carbon audits; reducing fertiliser costs and/or increasing yields though understanding the soil pH and other essential nutrient levels and increasing them where necessary, and through making use of organic fertiliser where practicable; reducing losses in livestock through infertility, mortality and ill health; and through generating income or cutting energy bills by producing renewable heat and electricity and using energy savings schemes.

BENEFITS TO FARMERS



There are considerable potential benefits for the wider rural community through air and water quality improvements. The improved management of animal stocks and animal waste will reduce odours and ammonia from agricultural land. In addition, reducing diffuse pollution and nutrient leaching will improve the quality of ground and surface water. As well as benefits for animal welfare, soil health, and biodiversity through the policies, the woodland/forestry/carbon sequestration proposal could significantly increase the implementation of natural flood management and the creation or enhancement of new habitats through woodland creation and peatland restoration.

Farmers, crofters and land managers, other agricultural workers, and those in the agricultural supply chain will benefit from improved air and water quality.

We have received extensive advice on optimising co-benefits from environmental, scientific and industry stakeholders, and this will continue as we consult on the implementation of these policies. Opportunities to optimise economic benefits will be explored through a Business and Regulatory Impact Assessment (BRIA). Environmental benefits will be secured through close working across the public sector, and with other stakeholders. In particular, SEPA has been and will be fully engaged in the development and implementation of agricultural proposals and policies in this Plan.

Improved profitability could encourage greater intensification in farming, resulting in negative impacts on biodiversity. We do not expect this to happen, but it is a possibility. Existing agricultural regulation includes measures designed to protect biodiversity, and substantial funding is provided to encourage uptake of measures that are beneficial to wildlife. These policies can be tailored to ensure positive outcomes for biodiversity.

Planning system

The planning system recognises the benefits of renewable energy, and Scottish Planning Policy supports the development of a diverse range of electricity and heat generation from renewable energy technologies. The farm sector has been active in small scale wind turbine installation. Anaerobic digestion offers further opportunities for heat or combined heat and power. Scottish Planning Policy states that the planning system should encourage rural development that supports prosperous and sustainable communities and businesses while protecting and enhancing environmental quality.

Some communities may be concerned about the creation of new anaerobic digestion plants, and new renewable energy sources such as wind turbines. The consultation requirements linked to consenting procedures provide opportunities for communities to be involved in decision making in relation to applications for anaerobic digestion plant and wind turbines. Permitted development rights are in place for microgeneration scale anaerobic digestion plant on agricultural or forestry land, so planning permission will not always be needed for those installations. Full consultation is required on any proposed changes to development plan policy in the area.

ANNEX

ANNEX

How we got here

The table below summarises the milestones from the Scottish Government's Climate Change Delivery Plan publication in June 2009, through to the publication of this Climate Change Plan.

Date	Milestone
June 2009	The Scottish Government's Climate Change Delivery Plan published.
June 2009	Climate Change (Scotland) Act 2009 passed unanimously by the Scottish Parliament.
February 2010	Committee on Climate Change (CCC) advice to the Scottish Government on the 2020 interim target and annual emissions targets 2010-2022.
May 2010	The Climate Change (Limit on Carbon Units) (Scotland) Order 2010, setting carbon unit limits 2010-2012.
October 2010	The Climate Change Annual Targets (Scotland) Order 2010, setting annual emissions reduction targets 2010-2022.
November 2010	The Scottish Government's draft First Report on Proposals and Policies (RPP1) laid in the Scottish Parliament for scrutiny.
March 2011	The Scottish Government's Low Carbon Scotland – Meeting our Emissions Reduction Targets 2010-2022 (RPP1) published.
July 2011	CCC advice to Scottish Ministers on the second batch of annual targets 2023-2027 received.
August 2011	CCC advice to Scottish Ministers on setting carbon unit limits 2013-2017 received.
October 2011	The Scottish Government's Climate Change Annual Targets (Scotland) Order 2011 setting the annual emissions targets 2023-2027.
December 2011	The Climate Change (Limit on Carbon Units) (Scotland) Order 2011, setting carbon unit limits 2013-2017.
January 2012	CCC's first annual progress report, Reducing Emissions in Scotland, published.

Date	Milestone
October 2012	The Scottish Government's First Annual Report, The Scottish Greenhouse Gas Emissions Annual Target 2010, published.
January 2013	The Scottish Government's draft Second Report on Proposals and Policies (RPP2) laid in the Scottish Parliament for scrutiny.
June 2013	The Scottish Government's Low Carbon Scotland – Meeting our Emissions Reductions Targets 2013-2027 – Second Report on Proposals and Policies (RPP2), published.
March 2016	CCC advice to Scottish Ministers on the third batch of annual targets 2028-2032 received.
July 2016	CCC updated advice to Scottish Ministers on the third batch of annual targets.
October 2016	The Climate Change (Annual Targets) (Scotland) Order 2016.
October 2016	The Climate Change (Limit on Use of Carbon Units) (Scotland) Order 2016.
January 2017	The Scottish Government's Draft Climate Change Plan – the draft Third Report on Proposals and Policies 2017-2032 (RPP3) laid in the Scottish Parliament for scrutiny.
September 2017	CCC published its progress report, 'Reducing emissions in Scotland'.
February 2018	The Scottish Government's Climate Change Plan, Third Report on Proposals and Policies 2018-2032 (RPP3), published.

Committee on Climate Change – Reducing emissions in Scotland – 2017 progress report

The Committee on Climate Change publishes an annual report on progress towards meeting Scottish climate change targets. The Committee published its sixth report in September 2017 and observed that Scotland continues to perform well on climate change mitigation, outperforming the rest of the UK. However, it noted that progress to date has come largely from the power sector and the Committee advised that more effort is now needed in other sectors if our ambition – "amongst the highest in the world" – is to continue being delivered.

The Committee's report also offered its assessment of the draft Plan. The report was positive on the policies and trajectories for many sectors. The Committee's recommendations around re-balancing effort between the transport and renewable heating sectors are largely reflected in this final Plan.

The Climate Change Plan and the Energy Strategy

The Scottish Government's Energy Strategy should be regarded as a free-standing companion document to this Climate Change Plan.

In developing the Scottish Energy Strategy, the Scottish Government has set out its ambitious 2050 vision for energy supply and use in Scotland, aligned with our greenhouse gas emissions reduction targets.

The Scottish Energy Strategy explores the development of the main characteristics of the energy system between now and 2050 under two stylised scenarios of the 2050 energy system, acknowledging that we cannot prescribe an exact energy mix for 2050. These two relatively stylised scenarios, which are consistent with the current long term greenhouse gas targets, help us to articulate a clearer understanding of the choices that lie ahead and provide opportunities to demonstrate and consider alternative sources of low carbon energy supply that are not yet certain enough to include in the Plan, such as hydrogen with Carbon Capture and Storage. The scenarios are designed to help us understand what infrastructure and behaviours might be required under different future energy mixes.

The Scottish Energy Strategy commits to undertaking further work to establish where, with the right support and leadership from government, the emerging fuel sources and technologies explored in the Strategy can be credible alternatives in the future.

Stakeholder engagement

In developing this final Plan, the Scottish Government undertook a wide range of engagement with stakeholders. Details are provided in a letter sent by the Cabinet Secretary for Environment, Climate Change and Land Reform to the Environment, Climate Change and Land Reform Committee on the Scottish Parliament's website[155].

Climate Change Plan Advisory Group

In developing the final Plan, we also benefitted from the advice of our Climate Change Plan Advisory Group, set up in June 2017 to act as a sounding board and critical friend. The Group consisted of representatives from the following organisations:

- Stop Climate Chaos Scotland
- Scottish Futures Trust
- Edinburgh Centre for Carbon Innovation
- Transform Scotland
- Royal Town and Planning Institute
- Scottish Land and Estates
- Local Energy Scotland
- COSLA
- Energy Saving Trust
- The University of Edinburgh

Strategic Environmental Assessment

The Climate Change Plan has been influenced by a Strategic Environmental Assessment (SEA), carried out in accordance with the Environmental Assessment (Scotland) Act 2005. The purpose of SEA is to minimise potential negative effects of plans and strategies on the environment and to enhance positive effects. All documents associated with the SEA process for the Climate Change Plan are available on the Scottish Government's SEA database[156].

155 http://www.parliament.scot/S5_Environment/General%20Documents/20180123_CS_to_Conv_on_Climate_Change_Plan_WEB.pdf

156 The Scottish Government's SEA Database http://www.gov.scot/Topics/Environment/environmental-assessment/sea/SEAG

Definitions: policy outcomes, policies, development milestones and proposals

For the purpose of this Plan:

A **policy outcome** is a measure of change on the ground, resulting from a policy or combination of related policies.

A **policy** is a committed course of actions which has been wholly decided upon, and to which a policy outcome can be attributed to with a reasonable level of confidence.

A **policy development milestone** is a government action which is needed to progress or develop a final policy that will reduce emissions in a particular sector.

A **proposal** is a suggested course of action or exploratory action, the details of which might change as this course of action is exploed further. It is not possible to confidentily attribute the realisation of a policy outcome to a proposal until it is converted to a policy.

Glossary

Part I and Part 2

Adjusted emissions – Greenhouse gas emissions that have taken into account purchases/sales through the EU ETS. Adjusted emissions may be higher or lower than actual emitted emissions depending on the quantity of purchases or sales. Progress against emissions reduction targets under the Climate Change (Scotland) Act 2009 is assessed using adjusted emissions.

Decarbonisation – The process of reduction or removal of carbon from energy production.

Ecosystem services – Ecosystem services are vital to society and the economy, providing benefits such as the food we eat, the water we drink, climate regulation, carbon storage, natural flood defences, pollutant control, timber and crop pollination; and less tangible benefits such as aesthetic enjoyment, recreational and educational value.

Emissions envelope – TIMES produces an envelope that limits emissions for each sector.

Fossil fuel – A fuel derived from geological deposits of plant and animal remains, such as coal, oil, or natural gas.

ISM Approach – A tool developed to understand all of the contexts that shape people's behaviours – the individual, the social and the material. By understanding the different contexts and the multiple factors within them that influence the way we act every day, more effective policies and interventions can be developed.

Low carbon – Causing or resulting in only a relatively small net release of carbon dioxide into the atmosphere.

Natural capital – A country's stock of natural resources and environmental assets including plants, animals, air, water, soils and minerals. People derive a wide range of benefits from natural capital. These benefits are often called "ecosystem services".

Paris Agreement – The UNFCCC's Paris Agreement sets a global ambition for tackling climate change. The current pledge under the Paris Agreement to limit the global average temperature rise to less than 2° Celsius requires governments around the world to take action to decarbonise their economies, while striving to keep the temperature rise to 1.5° Celsius.

Territorial emissions – Emissions produced within a country's territory or economic sphere.

TIMES – A Whole System Energy Model (WSEM) that aims to capture the main characteristics of an energy system and are particularly useful for understanding the strategic choices required to decarbonise an economy. The Scottish TIMES model is a high-level model, covering the entire Scottish energy system, as well as non-energy sectors, including Agriculture, Land Use, Land Use Change and Forestry, and Waste. It contains many thousands of variables covering existing and future technologies, fuels and abatement measures, such as availability, cost and greenhouse gas emissions factors.

Electricity

Bioenergy – A renewable energy source created from natural, biological sources, such as wood, sugarcane, or straw.

Carbon Capture and Storage – The process of trapping carbon dioxide produced by burning fossil fuels or other chemical or biological process and storing it in such a way that it is unable to affect the atmosphere.

Contracts for Difference – A Contract for Difference is a form of subsidy support for UK renewable electricity and low carbon generation.

Feed-in tariff – The Feed-in tariff is a form of subsidy support designed to promote the uptake of small-scale renewable and low carbon electricity generation technologies across the UK.

Nuclear energy – The energy produced through nuclear fusion or fission to produce electricity.

Renewable energy – Energy produced from sources that are not depleted when used, such as solar, wind, and hydro.

Renewables obligation – The Renewable Obligation is a form of subsidy support for large-scale renewable electricity projects in the UK. The Renewables Obligation (Scotland) is devolved to the Scottish Government.

Transport

Fuel-efficient driver training – The FuelGood driver training helps employees save on fuel costs, lower their carbon emissions and drive more safely.

Mode Shift Revenue Support – Assists companies with the operating costs associated with running rail or inland water freight instead of road.

Industry

Carbon leakage – Occurs when industry relocates to countries with less stringent environmental regulation, resulting only in displacement of emissions rather than a reduction, at no benefit to the environment, or the Scottish economy.

EU Emissions Trading System – The EU ETS is a 'cap and trade' system, aimed at mitigating climate change by limiting greenhouse gas emissions from power and heat generation, energy-intensive industry sectors and commercial aviation. Participants include more than 11,000 heavy energy-using installations in power generation, the manufacturing industry and airlines across 31 countries in the European Economic Area (EEA). As the number of emission allowances decreases over time, prompting industries to adopt low carbon technologies, the EU ETS will be the primary driver of emissions reductions in the traded sector in Scotland.

Steam Methane Reforming – Most of the hydrogen produced today is made via steam-methane reforming, a mature production process in which high temperature steam is used to produce hydrogen from a methane source, such as natural gas.

Waste

Circular Economy – An alternative to a traditional linear economy (make, use, dispose) in which we keep resources in use for as long as possible, extract the maximum value from them whilst in use, then recover and regenerate products and materials at the end of each service life.[157]

Flaring technology – Flaring involves the combustion of landfill gas (primarily methane) – with recovery of the energy content, where appropriate – to form an off-gas, which is acceptable for direct discharge to atmosphere.

Land Use, Land Use Change and Forestry

Blue Carbon – stocks of carbon in marine environments accumulated over long timescales through natural processes.

Carbon sequestration – The removal and storage of carbon from the atmosphere in carbon sinks (such as oceans, forests or soils).

Agriculture

Anaerobic Digestion – The break down biodegradable material in the absence of oxygen.

Enteric fermentation – The digestive process of ruminant animals such as cows.

Silvo-management – The management and maintenance of trees/woodlands/forestry.

157 http://www.wrap.org.uk/about-us/about/wrap-and-circular-economy

List of acronyms

AD – Anaerobic Digestion

BEIS – UK Government Department for Business, Energy and Industrial Strategy

BMW – Biodegradable Municipal Waste

BRIA – Business and Regulatory Impact Assessment

BVD – Bovine Viral Diarrhea

CAPS – Cycling Action Plan for Scotland

CARES – Community and Renewable Energy Scheme

CCA – Climate Change Agreements

CCC – Committee on Climate Change

CCF – Climate Challenge Fund

CCL – Climate Change Levy

CCP – Climate Change Plan

CCS – Carbon Capture and Storage

CCU – Carbon Capture Utilisation

CCUS – Carbon Capture Utilisation and Storage

CfD – Contracts for Difference

CFL – CalMac Ferries Ltd.

CHP – Combined Heat and Power

CMAL – Caledonian Maritime Assets

CO_2 – Carbon Dioxide

COP – Conference of the Parties

COSLA – Convention of Scottish Local Authorities

CPP – Community Planning Partnerships

CPS – ChargePlace Scotland

DfT – UK Government Department for Transport

DNO – Distribution Network Operators

DSO – Distribution System Operators

ECO – Energy Company Obligation

EE&D – Energy Efficiency and Decarbonisation

EEA – European Economic Area

EESSH – Energy Efficiency Standard for Social Housing

EIA – Environmental Impact Assessment

eNGO – Environmental Non-Governmental Organisations

EPBD – Energy Performance of Buildings Directive

EPC – Energy Performance Certificate

ERDF – European Regional Development Fund

ESOS – Energy Savings Opportunity Scheme

EST – Energy Saving Trust

EU ETS – European Union Emissions Trading System

EV – Electric Vehicle

FFBC – Farming for a Better Climate

FGS – Forestry Grant Scheme

GDP – Gross Domestic Product

GHG – Greenhouse Gases

GVA – Gross Value Added

GW – Giga Watt

GWh – Giga Watt Hours

HEEPS – Home Energy Efficiency Programmes for Scotland

HES – Home Energy Scotland

HESLS – Home Energy Scotland Loan Scheme

HGV – Heavy Goods Vehicle

HIE – Highlands and Islands Enterprise

HLOS – High Level Output Specification

HPS – Heat Policy Statement

IEA – International Energy Agency

ILMP – Integrated Land Management Plans

IPCC – International Panel on Climate Change

ISM – Individual, Social, Material

ITS – Intelligent Transport Systems

KBA – Key Behaviour Area

LCITP – Low Carbon Infrastructure Transition Programme

LEZ – Low Emission Zone

LHEES – Local Heat and Energy Efficiency Strategies

LNG – Liquefied Natural Gas

LULUCF – Land Use, Land Use Change and Forestry

MAP – Manufacturing Action Plan

$MtCO_2e$ – Megatonnes of Carbon Dioxide Equivalent

N_2O – Nitrous Oxide

NDEE – Non Domestic Public Sector Energy Efficiency

NGO – Non-governmental organization

NPF – National Performance Framework

NSEA – Net Scottish Emissions Account

NTS – National Transport Strategy

OFGEM – Office of Gas and Electricity Markets

OGA – Oil and Gas Association

OREC – Offshore Renewable Energy Catapult

ORR – Office of Rail and Roads

PfG – Programme for Government

PSH – Pumped Storage Hydro

REIF – Renewable Energy Investment Fund

RES – Resource Efficient Scotland

RHI – Renewable Heat Incentive

RPP 1 – First Report on Proposals and Polices

RPP 2 – Second Report on Proposals and Polices

RPP 3 – Third Report on Proposals and Policies

RTFO – Renewable Transport Fuel Obligation

SAYFC – Scottish Association of Young Farmers Clubs

SCCAP – Scottish Climate Change Adaptation Programme

SCCS – Scottish Carbon Capture Storage

SCCS – Stop Climate Chaos Scotland

ScotEID – Scottish Electronic Identification Database

ScotFLAG – Scottish Freight and Logistics Advisory Group

SCSP – Smarter Choices Smarter Places

SEA – Strategic Environmental Assessment

SEEP – Scottish Energy Efficiency Programme

SEPA – Scottish Environment Protection Agency

SGBF – Scottish Green Bus Fund

SGN – Scottish Gas Networks

SHCS – Scottish House Condition Survey

SMART – Specific, Measurable, Achievable, Realistic, Timely

SME – Small and Medium Enterprise

SMEL – Small and Medium Enterprise Loan Scheme

SNH – Scottish Natural Heritage

SPP – Scottish Planning Policy

SRDP – Scottish Rural Development Programme

SSN – Sustainable Scotland Network

TMfS – Transport Model for Scotland

UKFS – UK Forestry Standard

ULEV – Ultra Low Emission Vehicle

UNFCCC – United Nations Framework Convention on Climate Change

VED – Vehicle Excise Duty

WES – Wave Energy Scotland

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