Draft Climate Change Plan: The Draft Third Report on Policies and Proposals 2017-2032

Draft Scottish Energy Strategy: The Future of Energy in Scotland

Strategic Environmental Assessment Environmental Report

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Introduction

The Climate Change (Scotland) Act 2009 sets out Scotland's commitment to global efforts to stabilise greenhouse gas concentrations in the atmosphere. The Act requires Scottish Ministers to identify proposals and policies for meeting annual greenhouse gas emissions reduction targets. The draft Climate Change Plan: The draft third report on policies and proposals 2017 – 2032 published by the Scottish Government on 19th January 2017 presents a range of policies, policy development milestones and proposals to meet the emissions targets set by Ministers for the period from 2017 – 2032.

The draft Scottish Energy Strategy: The future of energy in Scotland was also launched for consultation by the Scottish Government on 24th January 2017. The draft Energy Strategy has been informed by the development of the draft Climate Change Plan. It sets out a vision for the future of energy in Scotland in line with the ambitions laid out by the Climate Change (Scotland) Act 2009.

A Strategic Environmental Assessment (SEA) of the draft Climate Change Plan and draft Energy Strategy has been undertaken under the Environmental Assessment (Scotland) Act 2005. The findings of the SEA process are set out in the Environmental Report. This Non-Technical Summary describes the content of the Environmental Report and includes a description of the significant environmental effects expected as a result of the draft Climate Change Plan and draft Energy Strategy.

The Environmental Report has been made available for comment alongside the draft Climate Change Plan and draft Energy Strategy.

What is Strategic Environmental Assessment (SEA)?

Strategic Environmental Assessment (SEA) is the assessment of the likely significant environmental effects that a public plan, programme or strategy will have on the environment if implemented.

The Scottish Government has undertaken a joint SEA of the draft Climate Change Plan and draft Energy Strategy.

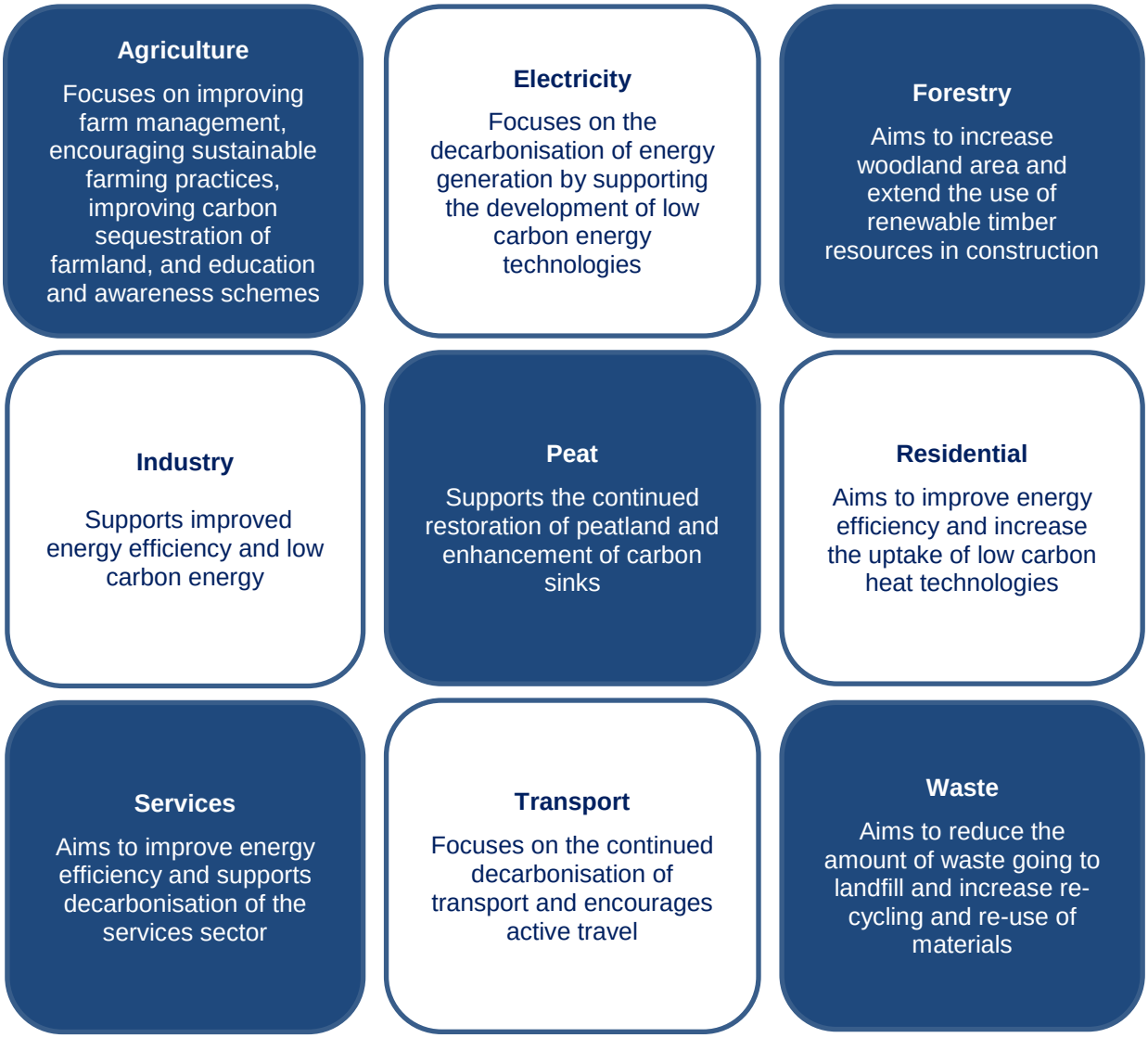
What is the draft Climate Change Plan?

The draft Climate Change Plan is the third such report required under the Climate Change (Scotland) Act 2009. It builds on the previous reports which set out the Scottish Government's proposals and policies for reducing annual greenhouse gas emissions. It sets out Scotland's ambitious approach to mitigating the effects of climate change across a range of sectors, specifically: agriculture, electricity generation, forestry, industry, peat, residential, services, transport and waste.

The draft Climate Change Plan has been developed using economic modelling. This has helped to determine the least-cost ways of achieving emissions reductions by assessing how effort is best shared across the economy, taking into account both individual sectors and how those sectors interact. The draft Climate Change Plan provides a system-wide view of how the emissions reduction targets can be most effectively delivered.

Once finalised, the Climate Change Plan will complement existing policies and programmes, such as the recently published 2017 UK Climate Change Risk Assessment and the forthcoming Scottish Climate Change Adaptation Programme, due in 2019.

A high-level overview of the policies and proposals set out by the nine sectors considered in the draft Climate Change Plan is detailed below.



Previous reports on proposals and policies

The Climate Change (Scotland) Act 2009 requires Scottish Ministers to lay a report in Parliament setting out their proposals and policies for meeting annual greenhouse gas emissions reduction targets.

The Climate Change Plan will be the third such report, building on the policies, proposals, actions and measures set out in the previous reports.

In 2011, the Scottish Government published Low Carbon Scotland: Meeting the Emissions Reduction Targets 2010 – 2022: The Report on Proposals and Policies.

In 2013, the Scottish Government published Low Carbon Scotland: Meeting Our Emissions Reduction Targets 2013 – 2027: The Second Report on Proposals and Policies.

What is the draft Energy Strategy?

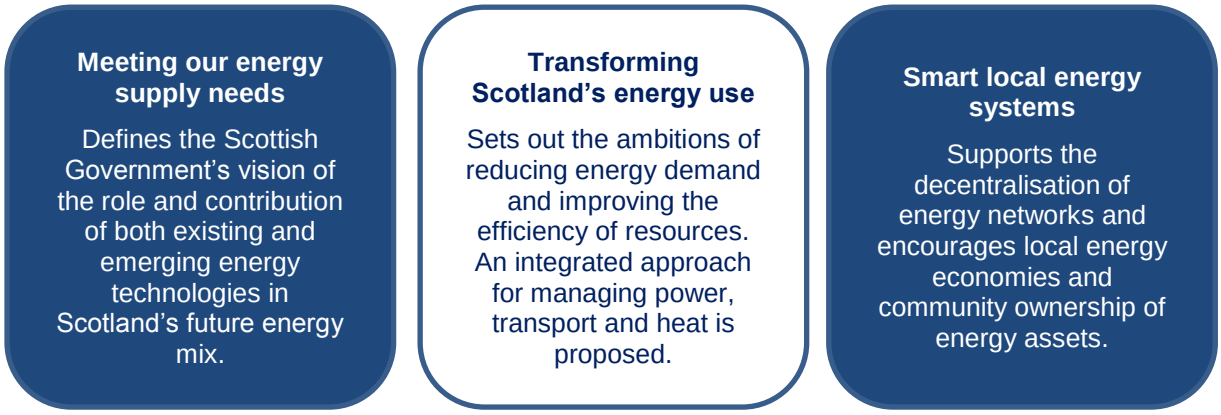
In September 2015, Scotland's Minister for Business, Energy and Tourism announced the development of a Scottish Energy Strategy. The emerging Climate Change Plan requires the Scottish Government to develop energy policies and proposals which further help to achieve a transition to a low carbon economy and reduce greenhouse gas emissions.

The draft Energy Strategy draws together existing Scottish energy policies and new ambitions within a single overarching Strategy. It sets a long term vision for the energy system in Scotland and lays the foundation for a comprehensive 'whole-system' approach to realising Scotland's energy ambitions into the future.

The draft Energy Strategy explores the need for a stable and managed energy transition, for adaptation to the effects of climate change and for ensuring resilience and security of supply into the future. Many of the policies and proposals set out in the draft Energy Strategy are reflected in the relevant sectors of the draft Climate Change Plan.

The draft Energy Strategy draws together common policy ambitions set out in existing Scottish energy policy, including the Electricity Generation Policy Statement, 2020 Routemap for Renewable Energy in Scotland (as updated 2015), and the Heat Policy Statement.

The draft Energy Strategy has three main sections:



What are the predicted effects of climate change in Scotland?

Over the last 50 years, it has become increasingly apparent that the world's climate is changing at an unprecedented rate. Everyday activities such as travel, energy generation, food production and waste disposal all have the potential to generate greenhouse gas emissions.

As a result of climate change, the UK is predicted to experience more extreme weather events, high temperatures and heat waves, large increases in flood risk, shortages in the public water supply and availability of water for agriculture, challenges to energy production and industry, and substantial risks to UK wildlife and natural ecosystems. Climate change is also considered to be one of the most serious environmental threats to sustainable development, with changes such as rising sea levels, milder and wetter winters, and hotter and drier summers, potentially impacting on health, food security, economic activity, natural resources and physical infrastructure.

There is evidence that climate change is already having an effect. Records indicate a recent and rapid warming trend in temperature coupled with changes in rainfall patterns since the 1960s, and temperature increases in Scotland are predicted to exceed 4°C by the end of this century. Warmer sea temperatures and salinity in Scotland's marine areas has also been reported, with further impacts on biodiversity and ecosystems in also observed. As land use sectors like agriculture, forestry, planning, water and coastal management further adapt to climate change, there may be further impacts on biodiversity.

Air pollution often originates from the same activities that contribute to climate change, notably transport, energy generation and can lead to effects on population and human health. Whilst air quality in Scotland has improved considerably over the last few decades, there are still many urban areas where air quality has been identified as a serious concern.

Increased temperatures, changes to patterns of rainfall and increased frequency of extreme weather could affect flows in rivers and impact on water availability. Climate change could have significant impacts on hydrology, affecting water quality, changes to habitats, and presenting substantial risks to wildlife and natural ecosystems nationally

What are Scotland's Greenhouse Gas Emissions Targets?

The Climate Change (Scotland) Act 2009 Act requires that annual greenhouse gas emissions targets are set, by Order, for each year in the period 2010 – 2050. When setting each batch of targets, Scottish Ministers are required to have regard to advice they received from the Committee on Climate Change.

Following the initial phase of target-setting, annual targets have previously been set for up to 2027.

The third and most recent batch of annual targets, covering the years 2028 – 2032, was agreed by the Scottish Parliament in October 2016. These annual targets have formed the foundation for the development of the Climate Change Plan and the policies and proposals that it sets out.

and globally. A changing climate could have other ecological impacts, such as an increasing risk of non-native species becoming established and spreading both on and offshore.

Changes in climate can have a direct influence on soil formation and function, posing a threat to Scotland's soils. The loss of valued soils in particular, such as peatlands and highly productive agricultural soils, could have significant impacts which would be difficult to reverse. Any negative impact on soil could also influence other aspects of the environment; notably biodiversity and water resources.

Since the end of the 20th century, the effects of climate change on Scotland's landscape have become noticeable. Changes in soil properties, and differing land uses and practices could also have impacts on the character of Scotland's landscapes. This could lead to the loss of land and soils through coastal erosion and flooding, as well as less direct effects such as gradual landscape change arising from changing habitats and land use. The greatest changes are likely to be seen in areas close to where people live, such as lowland and coastal areas, rather than upland areas where landscape change may be less sudden or obvious.

Certain cultural heritage assets and sites could be affected by increased weathering of stone, rotting of timbers and corrosion of metals. The installation of climate change adaptation and energy efficiency measures could also have damaging effects on the fabric of some historic buildings and their setting.

How is Scotland’s energy sector changing?

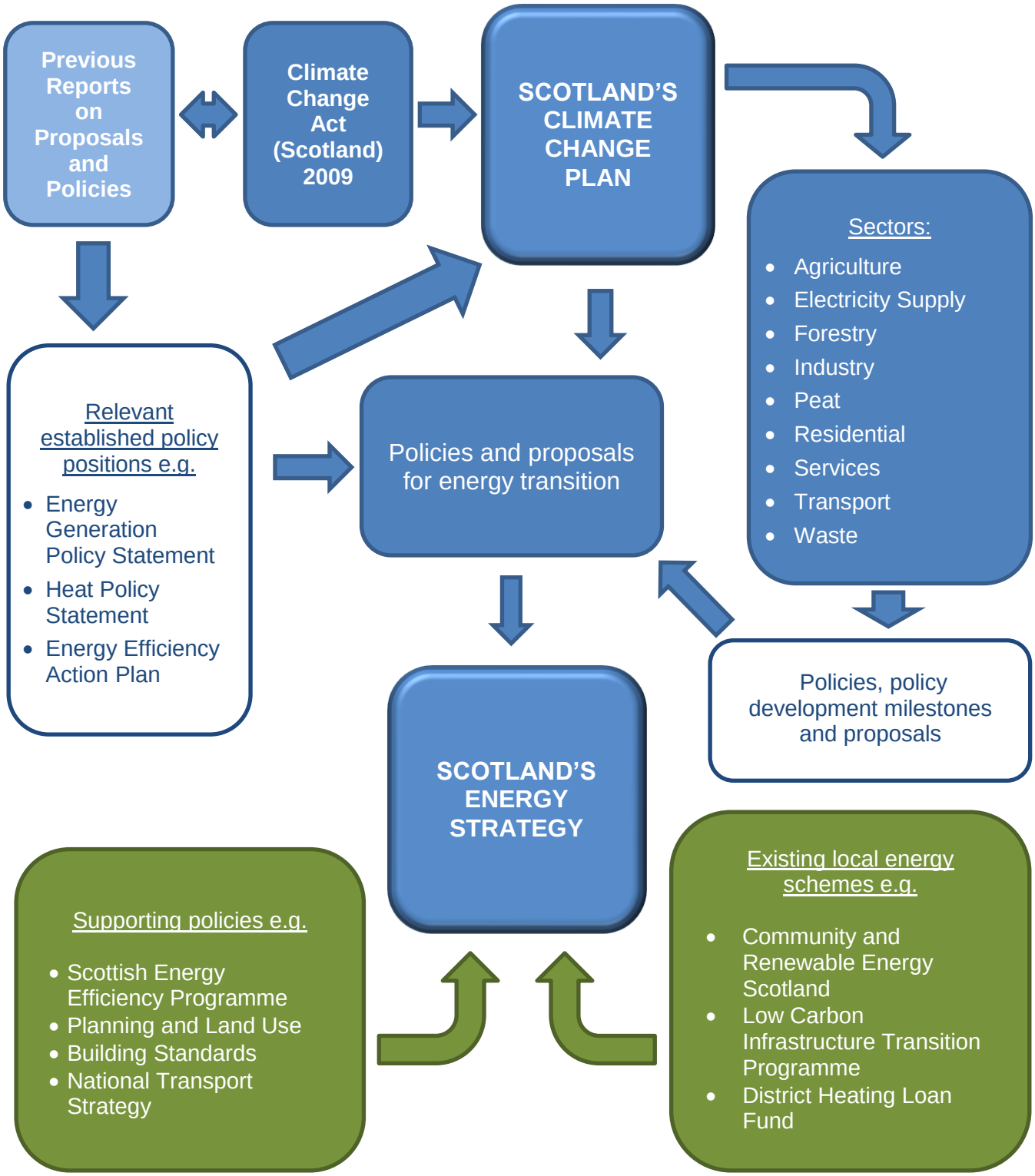
Energy is needed to keep Scotland's businesses, hospitals and schools running. It provides heat and electricity to our workplaces and homes and plays a vital role in supporting Scotland’s economy by enabling our industry and facilitating the transportation of goods and people.

Scotland’s energy mix has historically been dominated by fossil fuels and nuclear power. Oil and gas fields in the North Sea and coal fields across Scotland’s central belt have provided important fuel sources for heat and electricity. However, the last few decades have seen marked changes and the next few decades will see more.

Alongside Scotland’s climate change commitments, these changes have underlined the need to improve the security of energy supply and the decarbonisation of energy generation. Scotland is now a leader in low carbon and renewable energy technologies, and is in the midst of developing an increasingly diverse and dynamic energy mix.

In 2014, renewables energy became the single largest contributor to electricity generation, exceeding both nuclear and fossil fuel-generation for the first time. Emerging energy sources such as hydrogen and bioenergy are also likely to become increasingly important for meeting future energy demand from continued population growth and more use of electricity in other sectors (e.g. transport, industry).

How will the Climate Change Plan and Energy Strategy sit within wider Policy?



What are the likely environmental effects of the draft Climate Change Plan and draft Energy Strategy?

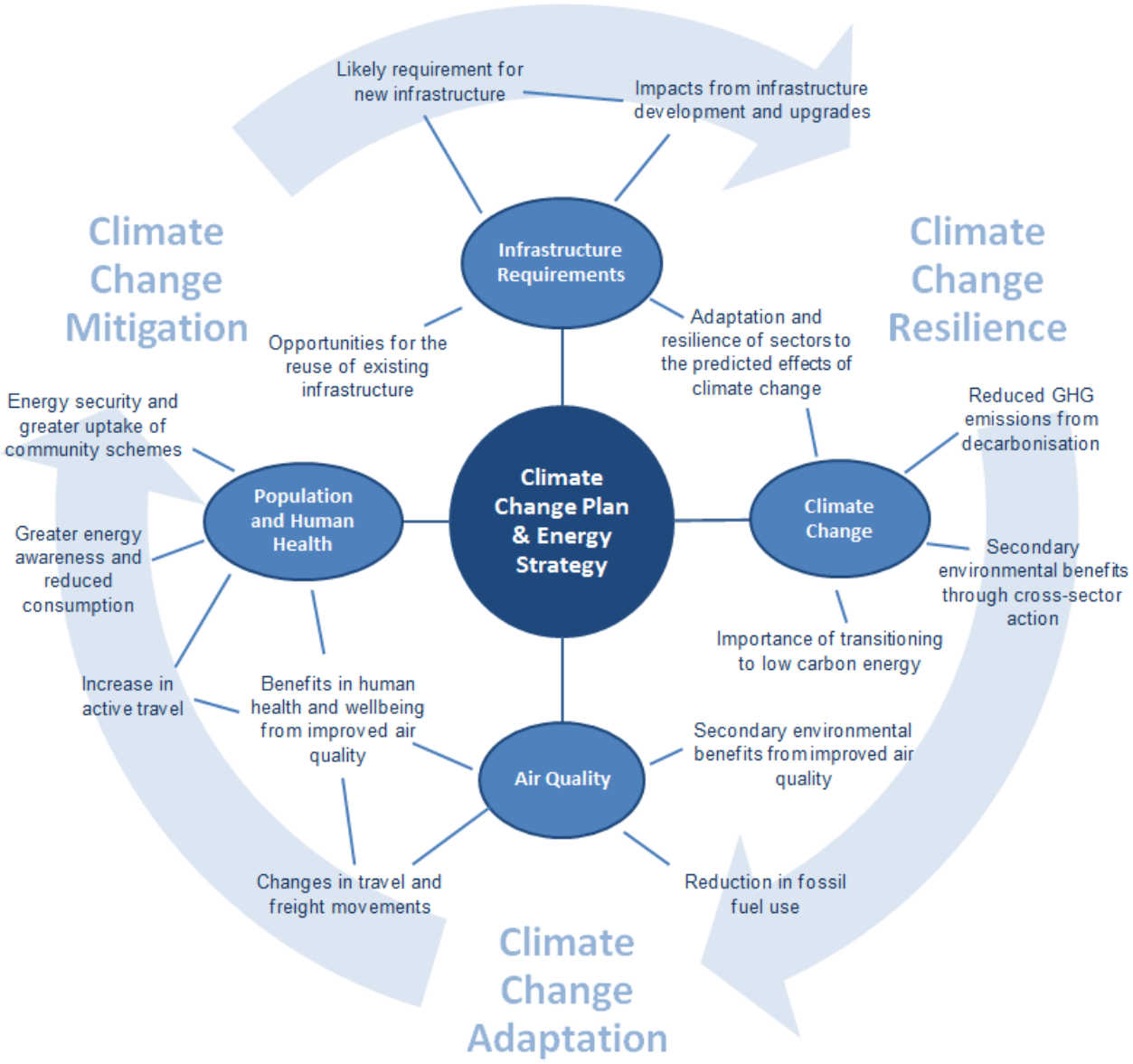
The draft Climate Change Plan and draft Energy Strategy are expected to make a significant contribution to Scotland's commitment to greenhouse gas emissions reduction. The contribution of individual sectors to Scotland's climate change targets will vary. However, by developing and implementing them together, their effects can be optimised.

The majority of the energy policies, policy development milestones and proposals relate to decarbonisation of energy supply, increased uptake of renewable and low carbon technologies and improving energy generation. These, together with wider sectoral action such as peat restoration and changing agricultural practices, should make a significant contribution to meeting the climate change targets. Whilst the draft Climate Change Plan and draft Energy Strategy are not specifically focused on climate change adaptation, this will also be supported through improvements in the energy efficiency of housing stock, improvements in the resilience of energy supply and distribution infrastructure, and the restoration of peatland.

The draft Climate Change Plan and draft Energy Strategy also support wider Scottish Government objectives, particularly those seeking to improve health. In particular, decarbonising transport and reducing vehicle emissions will help to reduce air pollution. Implementation of energy efficiency measures in buildings should also help to reduce energy consumption and benefit the environment.

A greater mix of energy technologies will be needed in the future. The draft Energy Strategy will influence this by setting an ambitious new "all energy" target for the equivalent of 50% of Scotland's heat, transport and electricity consumption to be supplied from renewable sources by 2030. This will influence the uptake of renewable technologies and may lead to the construction of new renewable generation and infrastructure, which in turn could have environmental impacts. Environmental effects arising from the development and operation of other technologies, such as Carbon Capture and Storage and hydrogen, will also need to be considered further.

New or improved infrastructure will be required to deliver many of the policies and proposals set out in the draft Climate Change Plan and draft Energy Strategy. Impacts will be mixed. For example, those that aim to reduce energy demand and improve energy efficiency should help to reduce pressure on existing energy infrastructure. There will also be a need to ensure that appropriate infrastructure is in place to support projected increases in demand, particularly through decarbonisation of transport and heat. In some instances, existing infrastructure may be re-used. For example, Carbon Capture and Storage could make use of existing oil and gas infrastructure. The assessment identified the potential for negative environmental impacts from construction and development work, and from the presence of new or upgraded infrastructure. These effects may arise in the short-term or long-term, and include adverse effects on soil, water, air and biodiversity, amongst others. The uptake of many technologies and changes in land use could also have visual and landscape impacts.



How have alternatives been considered in the assessment and what environmental effects have been identified?

Draft Climate Change Plan

The assessment has considered the High Ambition Scenario developed by the Committee on Climate Change in its 2016 Scottish progress report as a reasonable alternative to the draft Climate Change Plan. There is much common ground between the policies and proposals set out in the draft Plan and those put forward by the Committee on Climate Change. It is therefore unsurprising that if implemented, the High Ambition Scenario would be expected to deliver primarily positive environmental effects, including similar overall reductions in Scottish GHG emissions to those set out in the draft Plan.

When looking at some sectors in isolation, the High Ambition Scenario could result in further reductions in GHG emissions over a shorter timeframe. This includes higher rates of woodland creation, stronger levers for agriculture and greater take up of ultra-low emissions vehicles in the short-medium term. In turn these could accelerate any associated environmental benefits (e.g. improved carbon sequestration, air quality benefits and positive effects for population and human health). However, the scenario could also result in significant negative environmental effects as it would depend on the development of more new or improved infrastructure in a shorter-timeframe.

Draft Energy Strategy

The proposal for a new 'all energy' renewables target for 2030 presented in the draft Energy Strategy has also been considered. The assessment compared two options: the proposed development of this new ambitious target for 50% of all energy generated from renewable sources, and not setting this target.

This target could mean a greater focus on, and commitment to, renewable energy in the decarbonisation of Scotland's future energy mix beyond 2020. While the sector is expected to continue to grow without such a target in place, an ambitious target could promote and facilitate further renewable energy projects with associated positive environmental effects. Increased diversification in the energy system as a whole and greater diversity in the renewable technologies is likely, and alongside other proposals to improve system flexibility, would contribute to ambitions for decarbonisation of the sector. However, increased or accelerated uptake of certain technologies also has the potential for adverse environmental effects. In some cases, these could be combined to amplify adverse environmental effects. The importance of existing processes, such as Environmental Impact Assessment in consenting processes, will have an important role to play by assessing the potential for environmental effects as developments come forward.

The potential role of new technologies such as Underground Coal Gasification in Scotland's future energy mix, and their environmental impacts, has also been considered in the assessment. The Scottish Government put in place a moratorium on Underground Coal Gasification on 8 October 2015 to allow the necessary time for full and careful consideration of the potential impacts of this new technology. In light of the potential risks and likelihood of environmental effects identified, the SEA findings support the policy position that Underground Coal Gasification will not be taken forward in Scotland.

How can potential environmental effects be effectively managed, mitigated or enhanced?

The draft Climate Change Plan and draft Energy Strategy set out policies and proposals that work together to reduce impacts on climate change. They aim to meet Scotland's climate change commitments whilst improving energy security and delivering on a wider range of policy objectives, including adaptation to climate change in the future. Reducing energy demand is a key component of both, and if widely implemented through the draft Climate Change Plan and draft Energy Strategy, this should help to manage Scotland's energy systems more efficiently and effectively and reduce the need for energy and additional infrastructure.

Potential adverse environmental effects associated with the large scale deployment of some technologies, retrofitting of older buildings and development or upgrading of infrastructure will be addressed as appropriate at a project level. Existing mechanisms such as planning and consenting processes, marine licensing, Environmental Impact Assessment, Habitats Regulations Appraisal and regulations relating to the management of protected species will help to manage the potential for environmental effects prior to works commencing. Ensuring appropriate design and construction management measures are implemented at the project level will also help minimise potential impacts to nearby receptors.

Area-based co-ordinated schemes such as Scottish Energy Efficiency Programme will also help to mitigate potential impacts by addressing combined impacts on specific places. This will be particularly relevant in areas that are designated for their cultural heritage.

What monitoring is proposed?

The proposed development of a monitoring framework as set out in the draft Climate Change Plan and the planned publication of an Annual Energy Statement outlined in the draft Strategy will provide opportunities to monitor progress. These should complement current monitoring of many of the individual policies, policy development milestones and proposals. For example, the Energy in Scotland series reports on changes to Scotland's energy mix, and provides information on how energy is both generated and consumed. Other policies and proposals, such as the creation of new woodland and forestry are routinely monitored, with performance reported against annual targets.

A wide range of existing national and local programmes already monitor environmental status and assess performance against established environmental indicators. Many of these could help to inform the proposals for monitoring set out in the draft Climate Change Plan and draft Strategy. For example, annual monitoring and reporting of Scotland's overall greenhouse gas emission abatement is undertaken by the Committee on Climate Change, and the annual Key Scottish Environment Statistics Report provides information on a wide range of environmental topics and indicators.

As new policies and proposals are brought forward and developed in more detail, further specific monitoring proposals may emerge.

What were the conclusions and recommendations of the SEA?

The assessment set out the following conclusions and recommendations:

- The draft Climate Change Plan and draft Energy Strategy are likely to lead to significant reductions in greenhouse gas emissions. The SEA supports their cross-sectoral approach. The renewed focus in improving efficiency across a wide range of sectors is also supported.
- Although they focus on reducing emissions, the draft Climate Change Plan and draft Energy Strategy could also help Scotland to adapt to climate change and build future resilience.
- There is potential for significant benefits for air quality, population and human health, particularly through changes to transport and the built environment. Opportunities to maximise these benefits should be explored further.
- The transition to low carbon energy, and the opportunity for diversification and decentralisation of Scotland's energy mix, will make an important contribution to reducing greenhouse gas emissions.
- Existing infrastructure should be re-used where practicable, and an integrated approach to planning of Scotland's electricity network is recommended. This could help to maximise benefits from re-use or co-location where possible, as well as minimising negative environmental effects.
- Many of the policies and proposals could impact on cultural heritage, biodiversity, landscape and soil. These effects would be largely mitigated at the project level through existing regulatory mechanisms and construction management measures. In some instances, impacts will be considered further at the national level if more detailed plans emerge.
- Robust monitoring to ascertain the environmental effects of the draft Climate Change Plan and draft Energy Strategy will be required. This can make use of existing data sources where available, to avoid duplication. The SEA supports the proposals in the draft Climate Change Plan and draft Energy Strategy to take forward monitoring.
- Taking into account the findings of recent reports on Underground Coal Gasification[1],[2] the SEA supports the policy position that it will not be taken forward in Scotland.

[1] Campbell Gemmell (2016) Independent Review of Underground Coal Gasification – Report [online] Available at : http://www.gov.scot/Publications/2016/10/2704/downloads#res507473 (accessed 25/10/2016)

[2] Atkins (2015) Underground Coal Gasification - Evidence Statement of Global Warming Potential, Prepared for DECC, 28 November 2015 [online] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/575940/Underground_Coal_Gasification___Evidence_Statement_of_Global_Warming_Potential.pdf (accessed 06/01/2017)

How can I comment on this Environmental Report?

Public views and comments are invited on the draft Climate Change Plan, draft Energy Strategy and this Environmental Report. In preparing their responses, respondents should note the following:

- There are different deadlines for providing comments on this Environmental Report relating to the draft Climate Change Plan and draft Energy Strategy.
- Should a respondent wish to make a joint response on the Environmental Report for both the draft Climate Change Plan and draft Energy Strategy, if possible they should do so by the earlier deadline to ensure that these comments can be collated and taken on board in the finalisation of the Climate Change Plan and Energy Strategy. To ensure that they are attributed correctly, we also ask that respondents clearly indicate those comments that relate to the Climate Change Plan and Energy Strategy in their responses.

Providing comments on this Environmental Report relating to the Draft Climate Change Plan

Respondents are asked to submit responses on the Environmental Report in relation to the draft Climate Change Plan by **20th March 2017** to the Scottish Government, Draft Climate Change Plan, Area 3-J (South) Victoria Quay, Edinburgh EH6 6QQ, Email: climate.change@gov.scot.

Providing comments on this Environmental Report relating to the Draft Scottish Energy Strategy

Respondents are asked to submit responses on the Environmental Report in relation to the draft Energy Strategy by **30th May 2017** to the Energy Strategy Consultation, Energy and Climate Change Directorate, The Scottish Government, 4th Floor, 5 Atlantic Quay, 150 Broomielaw, Glasgow G2 8LU, Email: energystrategy@gov.scot.

How will responses be considered?

The responses received on this Environmental Report and on the draft Climate Change Plan and draft Energy Strategy will be collated, analysed and reported. Key messages and findings of the responses received will be taken into account in the finalisation of the Climate Change Plan and Scottish Energy Strategy.

Post-adoption SEA Statements will be prepared and published for the Climate Change Plan and Scottish Energy Strategy. These Statements will reflect on the findings of the assessment and consultation, and will explain how the issues raised have been considered and addressed in the preparation of the finalised documents.

1 Introduction

1.1 The Climate Change Plan and Energy Strategy

1.1.1 The Climate Change (Scotland) Act 2009 (the '2009 Act') requires Scottish Ministers to lay a report in Parliament setting out their proposals and policies for meeting annual greenhouse gas (GHG) emissions reduction targets. The draft Climate Change Plan: The draft third report on policies and proposals 2017 – 2032 (the 'draft Plan') is the third report of policies and proposals and builds upon the actions and measures that the previous reports set out. It outlines the range of policies, policy development milestones and proposals to meet annual targets set by Ministers for the period from 2017 – 2032.

1.1.2 In September 2015, Scotland's Minister for Business, Energy and Tourism announced the development of a Scottish Energy Strategy. The preparation of the Climate Change Plan has been a catalyst for this, requiring the Scottish Government to develop energy policies and proposals which further facilitate the transition to a low carbon economy. The draft Scottish Energy Strategy: The future of energy in Scotland (the 'draft Strategy') sets out a description of Scotland's current energy system and its policy context, draws together the common threads set out in existing Scottish energy policy, and presents a direction of travel for the future.

1.1.3 The draft Strategy has been developed in close alignment with the draft Plan, building upon common ambitions and focusing on the key role that the energy sector can play in meeting Scotland's climate change commitments whilst ensuring future security of supply.

1.2 Strategic Environmental Assessment (SEA)

1.2.1 Strategic Environmental Assessment (SEA) is the assessment of the likely significant environmental effects that a public plan, programme or strategy will have on the environment if implemented.

1.2.2 The Scottish Government has undertaken a SEA of the draft Plan and draft Strategy and its findings are set out in this Environmental Report. The SEA was undertaken in accordance with the Environmental Assessment (Scotland) Act 2005 (the '2005 Act') and in parallel with the development of the draft Plan and draft Strategy. This iterative process enabled the SEA to inform and influence the development of the two documents by considering how the adoption of the policies, policy development milestones and proposals they set out may impact on the environment.

1.3 Report Structure

1.3.1 This Environmental Report is set out as follows:

- Section 1 – Provides an introduction to assessment and an overview of the SEA process.
- Section 2 – Sets out the approach taken for the SEA of the draft Plan and draft Strategy, and the consideration of reasonable alternatives.
- Section 3 – Sets out information on climate change and its environmental effects, and provides information on the development of the draft Plan.
- Section 4 – Sets out background information relating to the draft Strategy.
- Section 5 – Provides an overview of the wider policy context for the draft Plan and draft Strategy, including relevant plans, programmes and strategies set out at EU, UK and Scottish levels.
- Section 6 – Presents the findings of the assessment including the consideration of potential cumulative and in-combination effects from the draft Plan and draft Strategy and proposed mitigation measures.
- Section 7 – Sets out proposals for monitoring the effects identified in the assessment.
- Section 8 – Presents the conclusions and recommendations of the assessment.
- Section 9 – Sets out information on the consultation including how to provide views on the Environmental Report and how these responses will be taken into account in the finalisation of the draft Plan and draft Strategy.
- Appendix A – Details the Environmental Baseline used to inform the SEA, including a summary of relevant environmental protection objectives.
- Appendix B – Provides background information on Scotland's energy sector and an overview of relevant energy technologies.
- Appendix C – Sets out assessment tables prepared in considering the potential for environmental effects arising from implementation of the policies, policy development milestones and proposals within the draft Plan.
- Appendix D – Sets out assessment tables prepared in considering the potential for environmental effects arising from the development and adoption of the draft Strategy.
- Appendix E – Presents a list of abbreviations used in this Report.
- Appendix F – Presents a compliance checklist setting out the sections of this Report that address the requirements of the 2005 Act.

2 The Approach to the Assessment

2.1 A Combined Approach

Common Elements of the draft Plan and draft Strategy

2.1.1 Scotland's low carbon ambitions and commitments to reducing GHG emissions are well-established across Scottish Government policy. They include reducing overall resource consumption and maximising efficiency and sustainability in the use of resources. These ambitions are relevant to a wide range of sectors including energy, transport, agriculture, industry and housing. In particular, a shift towards decarbonising energy generation and increasing efficiency in how electricity and heat are used are key aspects of delivering these Scotland's ambitions.

2.1.2 The draft Plan sets out the policies, policy development milestones and proposals (herein referred to as 'policies and proposals') the Scottish Government will implement to reduce GHG emissions, in line with the Government's statutory annual targets out to 2032. The draft plan includes policies and proposals across the energy system, including generation, transport and energy efficiency. These are also incorporated into the narrative of the draft Strategy, establishing the potential route for a stable and managed transition to a low carbon economy. This is one of the overarching themes of the Strategy.

2.1.3 The potential to combine the assessments of the draft Plan and draft Strategy was discussed in the Screening and Scoping Report submitted to the SEA Gateway on 12th September 2016. As the draft Plan and draft Strategy both fall under Section 5(4) of the 2005 Act and could have significant environmental effects, the Scottish Government determined that SEA would be required. This determination was submitted to the SEA Gateway on 2nd November 2016 and was formally advertised as required by the 2005 Act.

The Screening and Scoping Report set out initial information on the likelihood of significant effects arising from the policies and proposals likely to be included in both the draft Plan and draft Strategy, and the proposed evidence base to inform the assessment. It also confirmed that all environmental topic areas would be scoped into the assessment[3]. The report also set out a proposed methodology for undertaking a combined assessment of the draft plan and draft Strategy.

[3] Climatic Factors, Population and Human Health, Air, Soil, Water, Biodiversity, Flora and Fauna, Cultural Heritage, Landscape and Material Assets (Waste, Energy, Transport and Land use).

Consideration of Previous SEA Work

2.1.4 Previous SEA work has been used to inform the assessment. Several policies and proposals included within the draft Plan and the draft Strategy have been subject to SEA previously, including those drawn forward from Low Carbon Scotland – Meeting our Emissions Reduction Targets 2013-2027[4].

A Staged Approach to the Assessment

2.1.5 Figure 2.1 sets out a staged and iterative approach to the assessment. The assessment involved a three-stage process.

Stage 1

Assessment tables were developed for each sector considered in the draft Plan[5]. These tables set out the potential for impacts across a range of environmental receptors for each proposed policy, policy development milestone and proposal included within that sector (see Appendix C).

2.1.6 Similarly, three assessment tables were used to record the potential impacts from the draft Strategy across the same environmental receptors (see Appendix D). The tables reflect the three broad groupings of policies and proposals set out in the draft Strategy: Meeting Our Energy Supply Needs, Transforming Scotland's Energy Use, and Delivering Smart, Local Energy Systems.

Stage 2:

2.1.7 Drawing on the findings from the first stage of assessment, summary tables show the combined effect of the individual polices and proposals. Findings are displayed for each sector included in the draft Plan, and for the three policy groupings established in Stage 1 for the draft Strategy (See Section 6).

Stage 3:

2.1.8 The third stage consolidates the information set out in the summary tables and undertaken in the previous two stages. This stage provided an overarching and strategic level analysis of the likely significant environmental impacts of the entire draft Plan and draft Strategy and the potential for cumulative and in-combination effects. Information on the management and mitigation of the identified environmental effects, proposals for monitoring, and the conclusions and recommendations of the assessment are also included.

[4] The Scottish Government (2013) Low Carbon Scotland - Meeting our Emissions Reduction Targets 2013-2027 [online] Available at: http://www.gov.scot/Topics/Environment/climatechange/scotlands-action/lowcarbon/meetingthetargets (accessed 24/01/2017)

[5] Agriculture, Electricity Supply, Forestry, Industry, Peat, Residential, Services and Transport.

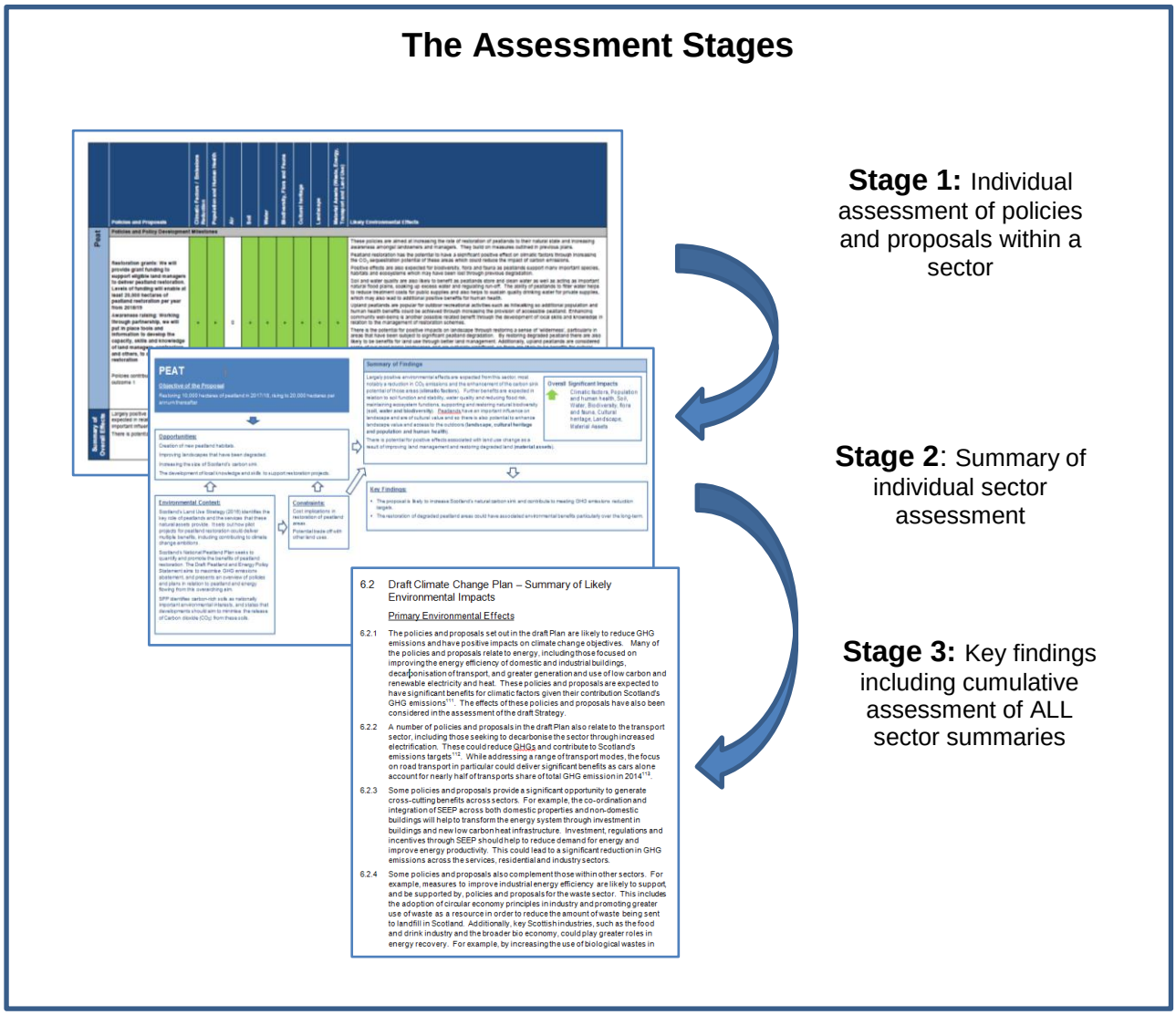


Figure 2.1 The Assessment Stages

2.1.9 This stage is written in a narrative format (see Section 6), and includes the consideration of primary and secondary effects. A series of questions were devised to focus on potential environmental effects of the adoption of the draft Plan and draft Strategy. These questions were used to focus the assessment on the primary environmental issues that were identified as the assessment was undertaken, and covered all environmental topic areas scoped into the assessment.

2.1.10 The seven questions, presented in the box below, also aided the consideration of potential cumulative and in-combination effects likely to arise from both policies and proposals, and the wider policy context.

Key Questions for the Assessment

1. How will the draft Plan and draft Strategy contribute to meeting Scotland's climate change commitments?
2. How will the draft Plan and draft Strategy contribute to climate change adaptation?
3. Are the policies and proposals set out in the draft Plan and draft Strategy likely to improve air quality and population and human health?
4. What are the likely implications of the draft Plan and draft Strategy in terms of infrastructure?
5. Are the policies and proposals set out in the draft Plan and draft Strategy likely to have indirect or secondary environmental effects?
6. How can these potential effects be effectively managed, mitigated or enhanced?
7. How have alternatives to the draft plan and draft Strategy been considered in this assessment and what potential environmental effects have been identified?

2.2 Consideration of Reasonable Alternatives

2.2.1 The 2005 Act requires those preparing a public plan, programme or strategy to consider and also outline the likely environmental effects of any reasonable alternatives. This section outlines the reasonable alternatives that have been considered both in the draft Plan and draft Strategy.

Draft Plan – Reasonable alternatives

2.2.2 In the early stages of the development of the draft Plan, the Committee on Climate Change (the Committee) advised the Scottish Government on the setting of annual targets for the reduction of GHG emissions for the period 2028 – 2032 in March and July 2016[6]. In this advice the Committee also set out two broad scenarios for emissions reduction in Scotland: a Central Scenario and High Ambition Scenario. These scenarios were not intended to prescribe the precise route that should be taken to meet a reduction in emissions, but to illustrate broad indicative packages of measures that could be used to meet varying overall levels of emission reduction.

[6] Committee on Climate Change (2016) Scottish emissions targets 2028 – 2032, The high ambition pathway towards a low-carbon economy, March 2016 [online] Available at: https://documents.theccc.org.uk/wp-content/uploads/2016/03/Scottish-Emissions-Targets-2028-2032.pdf (accessed 28/11/2016)

2.2.3 The **Central Scenario** was developed by the Committee as a cost-effective path to the UK's 2050 target for GHG emissions abatement, and was adapted to the specific circumstances in Scotland and the 2009 Act. However, the Committee noted that this scenario "may be insufficient for Scotland" to meet the requirement of the 2009 Act, in part because Scotland has a "higher share of hard-to-reduce sectors like agriculture" compared to the rest of the UK[7]. On this basis, the sectoral measures outlined in the Committee's Central Scenario were not considered to offer a reasonable alternative to the development of the policies and proposals set out in the draft Plan.

2.2.4 The **High Ambition Scenario** set out the approach that the Committee felt was "required to be on the way to meeting existing annual targets". It was developed based upon the Committee's UK 'Max' scenario for the 5th UK carbon budget (for 2028 – 2032) and adapted in line with specific Scottish circumstances[8]. While the High Ambition Scenario was developed to be "stretching"[9], the Committee noted that the Scenario would still fall slightly short of meeting the annual targets required under the 2009 Act for a minimum 3% annual reduction in each annual target from 2020[10].

2.2.5 In this assessment, the High Ambition Scenario has been considered as an alternative approach to the development of the policies and proposals set out in the draft Plan. This is discussed in Section 6.

Draft Strategy – Reasonable alternatives

2.2.6 Consideration has been given to the energy system that will be required in the future in order to meet the ambitions of the draft Strategy, and the range of different energy technologies that would be required. The assessment therefore explored the potential positive and negative environmental effects likely to arise from the introduction of new technologies, as well as the continuing evolving role of those that already form the current energy system, such as the oil and gas and renewable energy sectors.

[7] Committee on Climate Change (2016) Reducing emissions in Scotland – 2016 Progress report, September 2016 [online] Available at: https://www.theccc.org.uk/wp-content/uploads/2016/09/Reducing-emissions-in-Scotland-2016-Progress-Report-Committee-on-Climate-Change.pdf (accessed 25/11/2016)

[8] This adaptation process included making adjustments for factors such as the make-up of the Scottish building stock, existing industrial installations and power plants, agricultural activity and land-use, Scottish driving patterns, and more ambitious Scottish plans for forestry and waste disposal.

[9] Committee on Climate Change (2016) Reducing emissions in Scotland – 2016 Progress report, September 2016 [online] Available at: https://www.theccc.org.uk/wp-content/uploads/2016/09/Reducing-emissions-in-Scotland-2016-Progress-Report-Committee-on-Climate-Change.pdf (accessed 25/11/2016)

[10] Committee on Climate Change (2016) Scottish emissions targets 2028 – 2032 – The high ambition pathway towards a low-carbon economy, March 2016 [online] Available at: https://www.theccc.org.uk/wp-content/uploads/2016/03/Scottish-Emissions-Targets-2028-2032.pdf (accessed 24/01/2017)

2.2.7 Consideration has also been given in the assessment to the proposal for a new 'all energy' renewables target for 2030 presented in the draft Strategy. The options are:

- **Development of a new, more ambitious longer-term target** – where by 2030, 50% of Scotland's energy needs would be met from renewable sources.
- **No new target** – 'business as usual' where the existing renewable energy target of 30% of 'all energy' by 2020 remains.

2.2.8 The consideration of these technologies and the proposed target is discussed further in Section 6 and has drawn on information presented in the assessment tables in Appendix D.

3 Scotland and Climate Change

3.1 Climate Change in Scotland

3.1.1 It is widely regarded that climate change is one of the most serious threats facing the world today. Over the last 50 years, it has become increasingly apparent that the world's climate is changing at an unprecedented rate. Evidence of an increase in average global temperatures coinciding with an increase in GHG in the atmosphere has led to the conclusion that anthropocentric activities are the main reason for this increase[11]. Everyday activities such as travel, energy generation, food production and waste disposal all have the potential to generate GHG emissions.

3.1.2 In 2014, emissions of the seven GHG created by human activities in Scotland were estimated to be 46.7 million tonnes of Carbon dioxide equivalent ($MtCO_2e$)[12]. The majority of this was generated from the energy generation, transport, agriculture and industry sectors. These sectors are therefore a key focus in addressing climate change[13].

3.1.3 The greatest direct climate change-related threats for the UK are predicted to be large increases in flood risk, exposure to high temperatures and heat waves, shortages in the public water supply and availability of water for agriculture, energy production and industry, and substantial risks to UK wildlife and natural ecosystems, amongst others[14]. Climate change is also considered to be one of the most serious environmental threats to sustainable development, with adverse impacts expected on human health, food security, economic activity, natural resources and physical infrastructure[15,16]. These effects, and impacts on other environmental topic areas, are discussed further below.

3.1.4 Records indicate a recent and rapid warming trend in temperature coupled with changes in rainfall patterns since the 1960s[17]. Whilst the extent of the effects of climate change will vary by location, it is predicted that temperature increases in Scotland may exceed 4°C by the end of this century[18], with consequences

[11] Scotland's Environment (undated) Climate change [online] Available at: http://www.environment.scotland.gov.uk/our_environment/air_and_climate/climate_change.aspx (accessed 18/10/2016)

[12] Scottish Government (2014) Scottish Greenhouse Gas Emissions 2014, An official Statistics Publication for Scotland [online] Available at: http://www.gov.scot/Publications/2016/06/2307 (accessed 20/07/2016)

[13] ibid

[14] Committee on Climate Change (2016) UK Climate Change Risk Assessment 2017 [online] Available at: https://www.theccc.org.uk/uk-climate-change-risk-assessment-2017/ (accessed 29/09/2016)

[15] ibid

[16] ICAO (undated) Climate change adaptation [online] Available at: http://www.icao.int/environmental-protection/Pages/adaptation.aspx (accessed 30/11/2015)

[17] Scotland's Environment (2016) Scotland's Climate Trends Handbook. Available at: http://www.environment.scotland.gov.uk/climate_trends_handbook/index.html (accessed 18/10/2016)

[18] UKCP09 (20151) Temperature [online] Available at: http://ukclimateprojections.metoffice.gov.uk/21678 (accessed 18/10/2018)

including milder and wetter winters, hotter and drier summers, more extreme weather events and rising sea levels[19]. Effects are expected to result in uneven and potentially significant pressure on Scotland's environment. Pockets of dense urban development, for example, will be more at risk of surface water flooding, and the effects to human health from climate change may have the greatest impact on vulnerable people; particularly those in areas of where levels of deprivation are higher[20].

3.1.5 Air pollution often originates from the same activities that contribute to climate change, notably transport and energy generation, and has associated effects on population and human health[21]. Whilst air quality in Scotland has improved considerably over the last few decades[22], air pollution is still estimated to reduce the life expectancy of every person in the UK by several months[23]. There are still many urban areas where air quality has been identified as a serious concern, such as Air Quality Management Areas[24] which have been designated primarily as a result of emissions from transport[25].

3.1.6 In terms of the natural environment, increased temperatures, changes to rainfall patterns and increased frequency of extreme weather events could affect flows in rivers and impact on water resource availability[26]. Climate change could have significant impacts on hydrology, and this could ultimately result in changes to habitat composition and distribution[27] and present substantial risks to wildlife and natural ecosystems on a national and global scale[28]. A changing climate is also expected to have other ecological impacts, such as an

[19] IPCC (2014) Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [online] Available at: http://ipcc.ch/report/ar5/syr/ (accessed 24/01/2017)

[20] Scottish Parliament (2012) SPICe Briefing: Climate Change and Health in Scotland [online] Available at: http://www.parliament.scot/ResearchBriefingsAndFactsheets/S4/SB_12-26rev.pdf (accessed 24/10/2016)

[21] Air Quality in Scotland (undated) Local air quality management [online] Available at: http://www.scottishairquality.co.uk/laqm.php?a=l&la_id=i (accessed 20/10/2016)

[22] Scottish Government (2015) Air Quality - Air Pollutant Emissions, High Level summary of Statistics Trend [online] Available at: http://www.scotland.gov.uk/Topics/Statistics/Browse/Environment/trendairpollutants (accessed 20/10/2016)

[23] ibid

[24] Air Quality in Scotland (2016) Air Quality Management Areas [online] Available at: http://www.scottishairquality.co.uk/laqm/aqma (accessed 28/11/2016)

[25] Scotland's Environment (2016) Air [online] Available at: http://www.environment.scotland.gov.uk/get-informed/air/ (accessed 11/10/2016)

[26] Scotland's Environment (2016) Climate [online] Available at: http://www.environment.scotland.gov.uk/get-informed/climate/climate/ (accessed 28/11/2016)

[27] JNCC (2010) Biodiversity and Climate Change – a summary of impacts in the UK [online] Available at: http://jncc.defra.gov.uk/PDF/Pub10_Bio_&_CC_IACCF_2010_Web.pdf (accessed 28/11/2016)

[28] Convention on Biological Diversity (undated) Climate Change and Biodiversity – Introduction [online] Available at: http://www.cbd.int/climate/intro.shtml (accessed 26/10/2016)

increasing risk of non-native species becoming established and spreading in both water and terrestrial environments[29].

3.1.7 There is evidence that climate change is already having an effect. For example warmer sea temperatures and salinity in Scotland's marine areas has been reported[30]. Further, impacts on biodiversity and ecosystems in Scottish coastal and marine areas have been observed[31]. As land use sectors like agriculture, forestry, planning, water and coastal management respond to adapt to climate change many impacts on biodiversity could arise[32].

3.1.8 In addition to providing wide range of environmental, economic and societal functions, soils play a significant role in terms of storing carbon, acting as a carbon 'sink' and helping to regulate GHG emissions[33]. Changes in climate can have a direct influence on soil formation and function, posing a threat to Scotland's soils with the potential for impacts to be experienced globally. The loss of valued soils in particular, such as peatlands and highly productive agricultural soils, could have significant impacts which would be difficult to reverse[34]. Any negative impact on soil is also likely to influence the wider environment, including biodiversity and water resources.

3.1.9 Since the end of the 20th century, the effects of climate change on Scotland's landscape have become noticeable[35]. Changes in soil properties, and differing land uses and land use practices as a result of climate change adaptation could also have impacts on the character of Scotland's landscapes. This could include direct impacts such as loss of land and soils through coastal erosion and flooding, and secondary effects such as gradual landscape change associated with changing habitats and land use. The greatest changes are likely to be seen in areas of highest population, such as lowland and coastal areas, rather than upland areas where landscape change may be less sudden or obvious[36,37].

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[29] SEPA (2015) The river basin management plan for the Scotland river basin district: 2015–2027 [online] Available at: https://www.sepa.org.uk/media/20163445/the-river-basin-management-plan-for-the-scotland-river-basin-district-2015-2027.pdf (accessed 24/10/2016)

[30] Scottish Government (2016) Scotland's Environment – Offshore Waters [online] Available at: http://www.environment.scotland.gov.uk/get-informed/water/offshore-waters/ (accessed 28/11/2016)

[31] Biodiversity Scotland (2016) Climate Change [online] Available at: http://www.biodiversityscotland.gov.uk/biodiversity/pressures/climate-change/ (accessed 28/11/2016)

[32] MONARCH (undated), Modelling Natural Resource Reponses to Climate Change, A synthesis for biodiversity conservation [online] Available at: http://www.academia.edu/27987626/MONARCH_Modelling_Natural_Resource_Responses_to_Climate_Change_a_synthesis_for_biodiversity_conservation (accessed 26/10/2016)

[33] SEPA (undated) Soil [online] Available at: http://www.sepa.org.uk/environment/land/soil/#effect (accessed 23/02/2016)

[34] Scottish Government (2016) Scotland's Soils – Impacts [online] Accessed at: http://www.soils-scotland.gov.uk/about/impact (accessed 11/10/2016)

[35] Scottish Government (2016) Scotland's Environment – Landscape [online] Available at: http://www.environment.scotland.gov.uk/get-informed/land/landscape/ (accessed 28/11/2016)

[36] SNH (2016) How will Scotland's landscapes be affected by climate change?, Researching the effects of climate change on Scotland's landscapes [online] Available at: http://www.snh.gov.uk/protecting-

3.1.10 Additional pressures on certain cultural heritage assets and sites may occur from the increased weathering of stone, rotting of timbers and corrosion of metals as Scotland becomes warmer and wetter[38]. The installation of climate change adaptation and energy efficiency measures can also have damaging effects on the fabric of some historic buildings[39].

3.1.11 Adaptation to the effects of climate change is now acknowledged as being necessary to respond effectively and equitably to its impacts[40]. In addition to reducing GHG emissions (mitigation) further changes in climate are inevitable, and it is important that steps are taken to prepare and adapt to the likely effects of climate change (adaptation)[41]. The approach and actions taken by the Scottish Government in response to climate change is discussed further in the following sections.

3.1.12 Further relevant environmental baseline information collated during the SEA and used to inform this assessment process is set out in Appendix A.

The UK Climate Change Risk Assessment 2017 Evidence Report

Report on the effects of climate change and the progress of climate change adaptation in the UK identified six key areas of climate risk.

It noted that climate change is likely to present risks to domestic and international food production and trade, the health of our natural environment, risks to human health and productivity from high temperatures, the increased risk of flooding and coastal change as well as the availability of water. New and emerging pests and diseases, and invasive non-native species affecting people, plants and animals has also been noted as a research priority.

Source: UK Climate Change Risk Assessment 2017 Evidence Report: Synthesis Report [online] Available at: https://www.theccc.org.uk/wp-content/uploads/2016/07/UK-CCRA-2017-Synthesis-Report-Committee-on-Climate-Change.pdf (accessed 23/11/16)

scotlands-nature/looking-after-landscapes/landscape-policy-and-guidance/climate-change-landscape/ (accessed 21/10/2016)

[37] Scottish Government (2016) Scotland's Environment – Landscape [online] Available at: http://www.environment.scotland.gov.uk/get-informed/land/landscape/ (accessed 28/11/2016)

[38] Scotland's Environment (2015) Historic Environment [online] Available at: http://www.environment.scotland.gov.uk/get-informed/people-and-the-environment/historic-environment/ (accessed 04/10/2016)

[39] ibid

[40] ICAO (undated) Climate change adaptation [online] Available at: http://www.icao.int/environmental-protection/Pages/adaptation.aspx (accessed 30/11/2015)

[41] Committee on Climate Change (2015) Progress in preparing for climate change 2015 report to parliament [online] Available at: https://www.theccc.org.uk/wp-content/uploads/2015/06/6.736_CCC_ASC_Adaptation-Progress-Report_2015_FINAL_WEB_250615_RFS.pdf (accessed 26/10/2015)

3.2 Scotland's Climate Change Ambitions

3.2.1 Scotland's commitment to global efforts to stabilise GHG concentrations in the atmosphere is set out in the 2009 Act[42]. The 2009 Act creates the statutory framework for GHG emissions reductions in Scotland, and set targets for reductions in emissions of the basket of seven Kyoto Protocol greenhouse gases[43] by 80% by 2050, with an interim 2020 target of 42%, compared to the 1990/1995 baseline level. It is through this legislation, and the associated policy context, that Scotland contributes to international (EU and United Nations) efforts on climate change mitigation and adaptation.

3.2.2 Official statistics published in June 2016 show that Scottish emissions for the purposes of reporting against targets were 45.8% below the baseline level in 2014; meeting the level of the statutory interim 2020 target six years early[44]. However, there is still work to be done to reduce these emissions further, and the Scottish Government has confirmed its intention to legislate to establish a "new and more testing 2020 target"[45].

3.2.3 The 2009 Act requires that annual GHG emissions targets are set, by Order, for each year in the period 2010 – 2050. When setting each batch of targets Scottish Ministers are required to have regard to advice they received from the Committee on Climate Change. Following the initial phase of target-setting, the annual targets are set in five year batches, at least twelve years in advance. The third and most recent batch of annual targets, covering the years 2028-2032, was agreed by the Scottish Parliament in October 2016. These annual targets have formed the foundation for the development of the draft Plan and the policies and proposals that it sets out.

3.2.4 Section 35 of the 2009 Act also requires that Scottish Ministers lay a report in Parliament setting out proposals and policies for meeting these emission reduction targets, as soon as reasonably practicable after each batch of annual targets has been set. The draft Plan is formally the third report in the series, having been produced following the setting of the third batch of annual targets which cover the period 2028 – 2032[46].

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[42] The Scottish Government (2012) Climate Change (Scotland) Act 2009 [online] Available at: http://www.gov.scot/Topics/Environment/climatechange/scotlands-action/climatechangeact (accessed 16/06/2016)

[43] The basket of Kyoto Protocol greenhouse gases comprises Carbon dioxide (CO_2), methane and nitrous oxide, for which the baseline is 1990; and hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride, for which the baseline is 1995. Nitrogen triflouride has subsequently been added.

[44] The Scottish Government (2016) Purpose Target: Sustainability [online] Available at: http://www.gov.scot/About/Performance/scotPerforms/purposetargets/sustainability (accessed 05/12/2016)

[45] BBC Scotland (2016) Scotland leads UK' on climate change, 13 September 2016 [online] Available at: http://www.bbc.co.uk/news/uk-scotland-37340555 (accessed 05/12/2016)

[46] The Scottish Government (undated) Low Carbon Society [online] Available at: http://www.gov.scot/Topics/Environment/climatechange/scotlands-action/lowcarbon (accessed 01/09/2016)

3.2.5 The Scottish Climate Change Adaptation Programme (the Programme)[47] was developed in 2014 to address the impacts identified for Scotland in the 2012 UK Climate Change Risk Assessment[48]. The Programme set out Scottish Ministers' objectives in relation to adapting to climate change, their proposals and policies for meeting these objectives, the period within which these proposals and policies would be introduced, and arrangements for wider engagement in meeting these objectives. The recently published 2017 UK Climate Change Risk Assessment [49] sets out priorities for the next five years (see Section 5). The impacts identified for Scotland are expected to be addressed by the second iteration of the Programme which is due in 2019[50].

3.2.6 A more comprehensive overview of the policy context in relation to Scotland's climate change commitments and relevant environmental protection and improvement objectives contained within existing legislation, policies, plans, programmes and strategies at the EU, UK and Scottish levels, is set out in Section 5 of this report.

3.3 The RPP series

3.3.1 In 2011, the Scottish Government published Low Carbon Scotland: Meeting the Emissions Reduction Targets 2010-2022: The Report on Proposals and Policies (RPP) [51]. This set out actions to be implemented to meet the GHG emissions reduction targets set for the years in the period 2010-2022. This included a series of policies, proposals and enabling or supporting measures across the energy, waste, land use and transport sectors. A SEA was undertaken and an Environmental Report published for consultation alongside the RPP.

3.3.2 In 2013, the Scottish Government published Low Carbon Scotland: Meeting Our Emissions Reduction Targets 2013 – 2027: The Second Report on Proposals and Policies (RPP2)[52] to address the emission reduction targets for the period 2013 – 2027. The RPP2 set out an assessment of progress towards

[47] Scottish Government (2014) Climate Ready Scotland Scottish Climate Change Adaptation Programme [online] Available at: http://www.gov.scot/Publications/2014/05/4669 (accessed 18/10/2016)

[48] UK Government (2012) UK Climate Change Risk Assessment [online] Available at: https://www.gov.uk/government/publications/uk-climate-change-risk-assessment-government-report (accessed 18/10/2016)

[49] Committee on Climate Change (2016) UK Climate Change Risk Assessment 2017 [online] Available at: https://www.theccc.org.uk/uk-climate-change-risk-assessment-2017/ (accessed 29/09/2016)

[50] Committee on Climate Change (2016) Scottish Climate Change Adaption Programme: An independent assessment [online] Available at: https://www.theccc.org.uk/wp-content/uploads/2016/09/Scottish-Climate-Change-Adaptation-Programme-An-independent-assessment-CCC-September-2016.pdf (accessed 24/10/2016)

[51] The Scottish Government (2011) Low Carbon Scotland - Meeting the Emissions Reduction Targets 2010-2022 [online] Available at: http://www.gov.scot/Topics/Environment/climatechange/scotlands-action/lowcarbon/rpp

[52] The Scottish Government (2013) Low Carbon Scotland – Meeting our Emissions Reduction Targets 2013-2027 [online] Available at: http://www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/lowcarbon/meetingthetargets (accessed 15/11/2016)

implementing the proposals and policies described in the RPP and built upon those in the first report by considering the same broad sectors. In addition, RPP2 also introduced a range of new initiatives. A SEA of RPP2 was also undertaken and an Environmental Report was published for consultation alongside RPP2.

3.3.3 The development of a third report in the RPP series, the draft Plan, takes forward these ambitions and satisfies the requirement of the 2009 Act.

3.4 The Draft Climate Change Plan: The draft third report on policies and proposals 2017 – 2032 (the draft Plan)

Development of Policies and Proposals

3.4.1 To meet the annual targets covering the years 2028 – 2032 agreed in the Scottish Parliament in October 2016, it is clear that Scotland's ambitious approach to mitigating and adapting to the effects of climate change cannot be met by one sector alone. The development of the draft Plan builds upon the progress made through the development of the RPP and RPP2 and considers the role of nine key sectors and their contributions to reducing Scotland's GHG emissions and meeting these targets.

3.4.2 An overview of the policies and proposals set out by the nine sectors for inclusion in the draft Plan is detailed below:

- **Agriculture**: the policies and proposals for reducing emissions focus largely on reducing GHG emissions in the sector by improving farm management practices, encouraging sustainable, low carbon farming and animal health practices, improving carbon sequestration of farmland, and education and awareness programmes.
- **Electricity**: the policies and proposals focus on further decarbonisation of energy generation by providing support for the development of new low carbon energy technologies, improving system flexibility, and greater efficiency in the generation, distribution and consumption of energy. These also discuss the role of technologies such as Carbon Capture and Storage to further reduce emissions and to mitigate those generated in industry, including the continued role of fossil fuels in Scotland's energy mix.
- **Forestry**: the policies and proposals include increasing Scotland's woodland and forest areas, and increasing the use of Scotland's renewable timber resources in construction.
- **Industry**: the policies and proposals focus on the decarbonisation of Scottish industry by improving energy efficiency, increasing the use of low carbon energy, and greater use of waste materials in manufacturing.
- **Peat**: the policies include the continued restoration of Scotland's peatlands and enhancement of Scotland's carbon sinks.

- **Residential**: the policies and proposals focus on improving energy efficiency in Scottish homes, and increased use of low carbon heat technologies, smart meter technologies and heat networks through a range of financial and regulatory measures. These include the Home Energy Efficiency Programme Scotland, Warmer Homes Scotland and the Scottish Energy Efficiency Programme.
- **Services**: the policies and proposals are aimed at decarbonising Scotland's public sector and improving energy efficiency in the services sector through a range of financial and regulatory measures. They include facilitating the wider development and use of renewable heat sources such as local heat networks, installing low carbon heat technologies and smart meter technologies at the local level, and improving energy efficiency standards.
- **Transport**: the policies and proposals focus on the continued decarbonisation of transport. This includes reducing vehicle emissions, increasing the take-up of ultra-low carbon vehicles, changing the way urban freight is managed, encouraging modal shift to more sustainable forms, and using technology to better manage Scotland's transport systems.
- **Waste**: the policies focus on reducing the amount of waste sent to landfill, increased recycling and capture of landfill gases. This focus also aligns with Scotland's circular economy ambitions to increase the use of waste materials in business and industry.

Role of the TIMES Model

3.4.3 Previous reports on proposals and policies (RPP and RPP2) were produced using a bottom-up approach that identified abatement for individual policies and proposals from sector specific emissions projections. A different approach has been taken in the development of the draft Plan, which has drawn significantly on the use of the Scottish TIMES model.

What is the TIMES Model?

TIMES is a Whole System Energy Model. 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 a high-level strategic model, covering the entire Scottish energy system and containing many thousands of variables covering existing and future technologies and processes.

The model can be used to identify the effectiveness of carbon reduction measures in order to provide a consistent comparison of the costs of action across all sectors.

3.4.4 By constraining TIMES with the annual emissions reductions targets, the model has helps develop an understanding of the least-cost ways of achieving emission reductions by assessing how effort is best shared across the economy, and taking account of both individual sectors and how those sectors interact. By also interacting with non-energy sectors such as land use and waste, TIMES has been able to provide a system-wide view of how the emissions reduction targets can be most effectively delivered.

3.4.5 This approach has enabled the development of an optimal pathway for meeting Scotland's statutory climate change targets. This pathway contains a carbon envelope, or budget, for each sector along with suggested policy outcomes that are needed to 'live' within the carbon envelope. Examples of policy outcomes include the introduction of new energy technologies and the penetration of electric vehicles, amongst many others. The policies and proposals for each sector were then developed to realise these outcomes.

4 Scotland's Energy

4.1 Energy in Scotland

4.1.1 Scotland's energy mix has historically been dominated by fossil fuels and nuclear power, with oil and gas fields in the North Sea and coal fields across Scotland's central belt playing important roles as fuel sources for heat and electricity. While fossil fuels and nuclear power continue to play important roles in energy generation in Scotland, the last few decades have seen marked changes.

4.1.2 Scotland's last coal-fired power station at Longannet ceased operations in March 2016[53], and oil and gas production from the North Sea is also expected to decline over the next 30 years as existing oil and gas fields mature. While the last two remaining nuclear power stations located at Hunterston B in Ayrshire and Torness in East Lothian remain in operation, the estimated end of generation for the two plants is 2023 and 2030 respectively[54,55].

4.1.3 These changes alongside Scotland's climate change commitments have reinforced recognition of the need to improve security of supply whilst decarbonising energy generation. This is to be achieved whilst ensuring energy is affordable for consumers, particularly vulnerable fuel poor. This is known as the energy 'trilemma'. This has facilitated a gradual but notable shift away from the reliance on fossil fuels towards lower carbon energy to produce heat and electricity.

4.1.4 This shift towards new, lower carbon technologies has a significant role to play in reducing GHG emissions and meeting the Scottish Government's ambitious emission reduction targets. This shift has also seen the development of a wide range of low carbon and renewable energy technologies in Scotland as part of an increasingly diverse and dynamic energy mix. A milestone was reached in 2014 when renewables were the single largest contributor to electricity generation, exceeding both nuclear and fossil fuel-generation for the first time[56]. Emerging energy sources such as hydrogen and bioenergy are also likely to be important in managing growing pressures on energy demand associated with continued population growth and a shift towards electrification in other sectors (e.g. transport).

[53] Scottish Power (2016) Longannet Closure Marks the end of Coal-Fired Electricity Generation in Scotland [online] Available at: http://www.scottishpower.com/news/pages/longannet_closure_marks_the_end_of_coal_fired_electricity_generation_in_scotland.aspx (accessed 01/12/2016)

[54] EDF Energy (2016) Hunterston B Power Station [online] Available at: https://www.edfenergy.com/energy/power-stations/hunterston-b (accessed 01/11/2016)

[55] EDF Energy (2016) Torness Power Station [online] Available at: https://www.edfenergy.com/energy/power-stations/torness (accessed 01/11/2016)

[56] Scottish Government (2016) Energy in Scotland 2016 [online] Available at: http://www.gov.scot/Resource/0050/00501041.pdf (accessed 21/10/2016)

4.2 Scotland's Energy Trends

4.2.1 Scotland consumed approximately 142 Terawatt hours (TWh) of energy in 2013. This represented a gradual decrease in final energy consumption of around 15.2% between the baseline monitoring period in 2005 – 2007 and 2014; a reduction that exceeded the established target of a 12% reduction in energy consumption by 2020[57].

4.2.2 Over the same period, changes have also been observed in the patterns of consumption amongst consumers. In 2014, the domestic and transport sectors together accounted for over half of the total energy consumed in 2014, with reductions in consumption of 17% and 9% respectively since the 2005 – 2007 baseline. A clear gradual reduction in heat and electricity use by industry was also observed over the same period[58].

4.2.3 Although the demand for heat in Scotland fell by around a fifth between 2005 – 2007 and 2014, heat is still estimated to account for over half of Scotland's total energy use[59]. Excluding transport, around 41% of heat demand was attributed to domestic use compared to 59% consumed in the industrial and commercial sectors[60]; with this demand for heat met primarily by fossil fuels[61]. However, this too is changing. Estimates published for the UK indicate that electricity generated from renewable and non-renewable sources now accounts for larger proportions of all heat demand in the industrial (25%) and commercial sectors (19%) than ever before[62]. There is also growing diversity and progress in the range of heat and electricity sources available for many domestic users. However, there remains much work to do in increasing the generation and use of renewable heat[63].

4.2.4 While overall electricity consumption decreased gradually between 2000 and 2015, total electricity generated in Scotland remained largely constant over this period.

4.2.5 Further relevant environmental baseline information used to inform this SEA is set out in Appendix A with information on energy technologies considered in the development of the draft Strategy is presented in Appendix B of this report.

[57] Scottish Government (2016) Energy Statistics for Scotland, September 2016 [online] Available at: http://www.gov.scot/Resource/0050/00507078.pdf (accessed 13/01/17)

[58] Scottish Government (2016) Energy in Scotland 2016 [online] Available at: http://www.gov.scot/Resource/0050/00501041.pdf (accessed 12/10/2016)

[59] ibid

[60] ibid

[61] ibid

[62] ibid

[63] ibid

4.3 Scotland's Current Energy Policy

4.3.1 There is a well-established framework for energy policy in Scotland. This includes ambitious renewable energy generation targets, existing plans to improve energy efficiency across a wide spectrum of sectors and users, and ambitious targets for GHG emissions reduction[64]. This framework reflects the Scottish Government's recognition of the important role of energy in contributing to sustainable growth, tackling inequality and the sector's important role in delivering on climate change ambitions.

4.3.2 The Low Carbon Economic Strategy for Scotland[65] set out Scotland's vision for transitioning to a low carbon economy, and provided a key link between Scotland's GHG emissions reduction ambitions and the opportunities in the energy sector for contributing to these. Scotland's Heat Policy Statement[66] detailed policy ambitions for how heat is used (heat demand and its reduction), how it is distributed and stored (heat networks and heat storage) and where it comes from (heat generation). It also set out a clear framework for investment in heat supply and delivery networks in the future. The Electricity Generation Policy Statement[67] examined the way in which Scotland generates electricity, and set the pathway for the Scottish Government to deliver the equivalent of at least 100% of gross electricity consumption from renewables by 2020. It also explored the changes needed to ensure that these targets are met.

4.3.3 These are supported by a wide range of other relevant plans, programmes and strategies including the Energy Efficiency Action Plan[68] which targeted a reduction in overall energy demand through increasing efficiency; the 2020 Routemap for Renewable Energy in Scotland[69] and the Draft Sectoral Marine Plans for Offshore Renewable Energy in Scottish Waters[70] which took forward the Scottish Government's ambitions for increasing renewable energy

[64] The Scottish Government (2016) Energy in Scotland 2016 [online] Available at: http://www.gov.scot/Resource/0050/00501041.pdf (accessed 01/09/2016)

[65] Scottish Environmental Protection Agency (SEPA), Highlands and Islands Enterprise (HIE) and Scottish Enterprise (SE) and The Scottish Government (2010) A Low Carbon Economic Strategy for Scotland [online] Available at: http://www.gov.scot/Resource/Doc/331364/0107855.pdf (accessed 27/06/2016)

[66] Scottish Government (2015) The Heat Policy Statement: Toward Decarbonising Heat: Maximising the Opportunities for Scotland [online] Available at: http://www.gov.scot/Publications/2015/06/6679 (accessed 01/09/2016)

[67] Scottish Government (2013) Electricity Generation Policy Statement 2013 [online] Available at: http://www.gov.scot/Publications/2013/06/5757 (accessed 01/09/2016)

[68] The Scottish Government (2013) Energy efficiency Action Plan [online] Available at: http://www.gov.scot/Topics/Business-Industry/Energy/Action/energy-efficiency-policy/ActionPlan (accessed 01/07/2016)

[69] The Scottish Government (2011) 2020 Routemap for Renewable Energy in Scotland [online] Available at: http://www.gov.scot/Publications/2011/08/04110353/0 (accessed 27/06/2016)

[70] Scottish Government (2013) Draft Sectoral Marine Plans for Offshore Renewable Energy in Scottish Waters [online] Available at: http://www.gov.scot/Publications/2013/07/8702 (accessed 29/11/2016)

generation; and the Community Energy Policy Statement[71] which outlined a commitment to deliver local benefits from renewable energy development.

4.3.4 Local Authorities have already begun to lead the improvement of the energy efficiency in homes, businesses and public buildings with the aim to make Scotland's buildings near zero carbon by 2050. Scotland's Energy efficiency Programme (SEEP) will further build upon and integrate existing domestic energy efficiency programmes, bringing together support from the Scottish Government's Low Carbon Infrastructure Transition Programme (LCITP)[72], with the Home Energy Efficiency Programme Scotland (HEEPS): Area Based Scheme[73].

4.3.5 The plans, programmes and strategies relevant to both the draft Plan and draft Strategy are discussed further in Section 5. The draft Strategy aims to build on these by providing an overarching and consistent way forward to achieve these common ambitions.

4.4 Draft Scottish Energy Strategy: The future of energy in Scotland (the draft Strategy)

4.4.1 The draft Strategy draws together existing Scottish energy policies and new ambitions within a single overarching Strategy, and sets a long term vision for the energy system in Scotland. It lays the foundation for a cohesive, comprehensive and 'whole-systems' approach to realising Scotland's energy ambitions into the future.

4.4.2 The draft Strategy describes Scotland's current energy system and its policy context, and highlights drivers of change and the changing nature of energy systems worldwide. It explores the need for a stable and managed energy transition, for adaptation to the effects of climate change and for ensuring resilience and security of supply into the future. Many of the policies and proposals set out in the draft Strategy are reflected in the draft Plan, particularly in relation to the Electricity Supply sector and others which focus on sector decarbonisation and improving energy efficiency at point of use.

4.4.3 Policies and ambitions are set out in three main sections in the draft Strategy, each discussing an important component of Scotland's evolving energy sector:

i. **Meeting our energy supply needs**: presents the Scottish Government's vision on the role and contribution of both new and existing energy technologies in Scotland's future energy mix. A range of technologies are featured including the use of traditional fuel sources such as oil, gas

[71] The Scottish Government (2015) Community Energy Policy Statement [online] Available at: http://www.gov.scot/Topics/Business-Industry/Energy/CEPS2015 (accessed 06/09/2016)

[72] The Scottish Government (2016) Low Carbon Infrastructure Transition Programme [online] Available at: http://www.gov.scot/Topics/Business-Industry/Energy/Action/lowcarbon/LCITP (accessed 16/01/2017)

[73] The Scottish Government (2016) Home Energy and Fuel Poverty [online] Available at: https://beta.gov.scot/policies/home-energy-and-fuel-poverty/energy-efficiency-home-improvements/ (accessed 16/01/2017)

and coal; renewable and low carbon electricity and heat generation; new or lower carbon energy sources including bioenergy and hydrogen; and energy storage and increased system efficiency and flexibility.

ii. **Transforming Scotland's Energy Use**: presents the key ambitions of reducing energy demand and improving the efficiency of resources through support for greater flexibility for consumers and producers, and the introduction of viable, lower carbon alternatives in sectors such as transport. Energy supply and consumption are considered as equal priorities and an integrated approach for managing power, transport and heat is proposed.

iii. **Smart local energy systems**: builds upon the overarching theme of reducing overall energy demand and supports the decentralisation of energy networks. It supports and encourages local energy economies and community ownership of energy assets and considers how energy supply can be better and more flexibly managed and monitored.

5 Context of the draft Plan and draft Strategy

5.1 Environmental Objectives

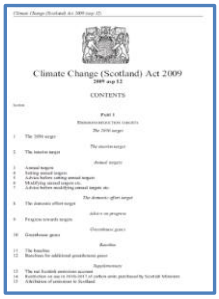
5.1.1 A wide range of environmental protection and improvement objectives are set out within existing legislation, policies, plans, programmes and strategies set at the EU, UK and Scottish levels.

5.1.2 The following sections of this report provide an overview of the overarching objectives and policy context considered most relevant to the preparation of the draft Plan and draft Strategy. This wider policy context also demonstrates the close links between the development of the two, including their common ambitions and drivers.

5.2 Relationship with other Plans, Programmes and Strategies and Environmental Objectives

5.2.1 The policy context for the preparation of the draft Plan and draft Strategy is illustrated in Figure 5.1.

5.2.2 As set out in Section 3, the Climate Change (Scotland) Act 2009 (the '2009 Act')[74] sets the statutory framework for GHG emissions reductions in Scotland, with targets for reductions by 80% in 2050, with an interim 2020 target of 42%. These targets are more ambitious than those for the UK as a whole, and the EU.


Climate Change (Scotland) Act 2009

CONTENTS

5.2.3 The Climate Change Delivery Plan[75], developed in 2009, set out the high level measures required in each sector to meet Scotland's statutory climate change targets, looking up to 2020 and beyond. This was taken forward following development of the 2009 Act through the development of the RPP series of reports. RPP[76] and RPP2[77] collated the range of policies and proposals developed over a range of sectors from 2010 to 2027 aimed at reducing GHG emissions to meet the targets set by the 2009 Act. These included ambitions to decarbonise energy supplies, transport, and reduce energy use.

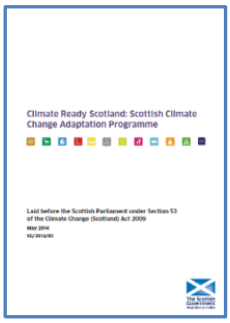
[74] The Scottish Government (2012) Climate Change (Scotland) Act 2009 [online] Available at: http://www.gov.scot/Topics/Environment/climatechange/scotlands-action/climatechangeact (accessed 01/12/2016)

[75] The Scottish Government (2009) Climate Change Delivery Plan: Meeting Scotland's Statutory Climate Change Targets [online] Available at: http://www.gov.scot/Resource/Doc/276273/0082934.pdf (accessed 01/12/2016)

[76] The Scottish Government (2013) Low Carbon Scotland - Meeting the Emissions Reduction Targets 2010-2022 [online] Available at: http://www.gov.scot/Topics/Environment/climatechange/scotlands-action/lowcarbon/rpp (01/12/2016)

[77] The Scottish Government (2013) Low Carbon Scotland – Meeting our Emissions Reduction Targets 2013-2027 [online] Available at: http://www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/lowcarbon/meetingthetargets (accessed 01/12/2016)

5.2.4 The Committee on Climate Change provides independent, expert advice to Scottish and UK Governments about all aspects of climate change. In July 2016, the Committee provided advice to Scottish Ministers on setting annual emission reduction targets for the years 2028 – 2032[78]. The development of the third report in the RPP series, the draft Plan, will take forward these ambitions by extending the time horizon. It will also explore further opportunities for reducing Scotland's GHG emissions between now and 2032.



5.2.5 Section 53 of the 2009 Act placed a duty on Ministers to produce an adaptation programme to address the risks identified for Scotland in the 2012 UK Climate Change Risk Assessment[79]. The Scottish Climate Change Adaptation Programme (the 'Programme') was published in 2014[80], outlining Scottish Ministers' objectives for adaptation. The Programme includes a series of policies and proposals aimed at mainstreaming climate change adaptation across sectors, to help reduce climate change risks. It was structured around three themes: adaptation in the natural environment, buildings and infrastructure networks and a climate ready society.

5.2.6 The recently published 2017 UK Climate Change Risk Assessment[81] set out priorities for the next five years. The impacts identified for Scotland are expected to be addressed by the second iteration of the Programme which is due in 2019[82].

5.2.7 Scotland's Economic Strategy[83] forms the foundations for all wider Scottish Government policy. In addition to setting goals for sustainable economic growth, it sets out ambitions for investment in Scotland's infrastructure, and aims to prioritise investment to ensure that we protect and nurture our natural resources whilst making the transition to a more resource efficient and lower carbon economy.

[78] Scottish Government (2016) CCC updated advice on Climate Change (Scotland) Act [online] Available at: http://www.gov.scot/Topics/Environment/climatechange/legislation/CCC-updated-advice (accessed 06/12/2016)

[79] Defra (2012) UK climate change risk assessment: Government Report [online] Available at: https://www.gov.uk/government/publications/uk-climate-change-risk-assessment-government-report (accessed 01/12/2016)

[80] The Scottish Government (2014) Climate Ready Scotland Scottish Climate Change Adaptation Programme [online] Available at: http://www.scotland.gov.uk/Publications/2014/05/4669 (accessed 01/12/2016)

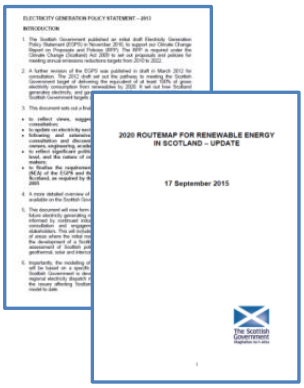
[81] Committee on Climate Change (2016) UK Climate Change Risk Assessment 2017 [online] Available at: https://www.theccc.org.uk/uk-climate-change-risk-assessment-2017/ (accessed 29/09/2016)

[82] Committee on Climate Change (2016) Scottish Climate Change Adaption Programme: An independent assessment [online] Available at: https://www.theccc.org.uk/wp-content/uploads/2016/09/Scottish-Climate-Change-Adaptation-Programme-An-independent-assessment-CCC-September-2016.pdf (accessed 24/10/2016)

[83] The Scottish Government (2015) Scotland's Economic Strategy Summary [online] Available at: http://www.gov.scot/Resource/0047/00473597.pdf (accessed 01/12/2016)

5.2.8 The Infrastructure Investment Plan 2015[84] sets out priorities for investment and a long term strategy for the development of public infrastructure in Scotland. It outlines why and how the Scottish Government invests, and what it intends to invest in up to 2035 by sector. The Investment Plan reflects upon the clear strategic direction for our infrastructure investment decisions set out in the Programme for Government and Scotland's Economic Strategy. Four guiding principles assist with decisions and the prioritisation of projects: delivering sustainable economic growth through increasing competitiveness and tackling inequality; managing the transition to a more resource efficient, lower carbon economy; supporting delivery of efficient and high quality public services; and supporting employment and opportunity across Scotland.

5.2.9 The Investment Plan reiterates Scotland's commitment to overarching objectives of decarbonisation of electricity generation and the heat sector by 2030 and 2050 respectively. It discusses investment in energy efficiency in the domestic and business context, increased renewable energy generation, promotion of community and local energy projects through the development of the Community Energy Policy Statement[85] in September 2015. It builds on Scotland's commitment to meeting targets of achieving 100% of energy demand and 11% of heat demand from renewables by 2020, and reducing end use energy consumption by 12% over the same period. These targets take forward commitments for the promotion of renewable energy generation at the European level, principally in the Directive on Electricity Production from Renewable Energy Sources (2001/77/EC)[86]. The Directive also formed an important part of a package of measures needed to comply with commitments made by the EU under the Kyoto Protocol on the reduction of GHG emissions[87].



5.2.10 The 2013 revision of the Electricity Generation Policy Statement[88] set the pathway for the Scottish Government to deliver the equivalent of at least 100% of gross electricity consumption from renewables by 2020. The Statement explored how Scotland generates its electricity and contained an overview of the changes

[84] The Scottish Government (2015) Infrastructure Investment Plan 2015, December 2015 [online] Available at: http://www.gov.scot/Publications/2015/12/5962/2 (accessed 01/12/2016)

[85] The Scottish Government (2015) Scottish Government Community Energy Policy Statement, September 2015 [online] Available at: http://www.gov.scot/Topics/Business-Industry/Energy/CEPS2015 (accessed 01/12/2016)

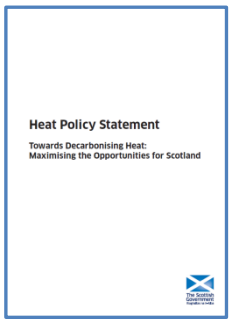
[86] Council Directive 2001/77/EC of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market [online] Available at: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32001L0077&from=EN (accessed 01/12/2016)

[87] EU (2001) Renewable energy: the promotion of electricity from renewable energy sources [online] Available at: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:l27035 (accessed 01/12/2016)

[88] The Scottish Government (2013) Electricity Generation Policy Statement [online] Available at: http://www.gov.scot/Topics/Business-Industry/Energy/EGPS2012/EGPS2013 (accessed 01/12/2016)

needed to ensure that the targets set by the Scottish Government are met, within a low carbon electricity generating mix.

5.2.11 The 2013 revision was developed alongside the second annual update to the 2020 Routemap for Renewable Energy in Scotland. The 2015 update of the Routemap[89] provided a progress report on developments within the renewables sector alongside updates on progress in meeting current targets and ambitions. This annual reporting mechanism established through the Routemap helped to identify the need for further collective actions in meeting these targets, to ensure Scotland fulfils its renewable energy potential.



5.2.12 The Heat Policy Statement: Towards Decarbonising Heat – Maximising the Opportunities for Scotland[90] set out the Scottish Government's future policy direction for addressing the three key aspects of the heat system: how it is used (heat demand and its reduction), how it is distributed and stored (heat networks and heat storage) and where it comes from (heat generation). It discussed how low carbon heat can reach more householders, businesses and communities, and presented a framework for investment in the future of heat in Scotland. It also considered how the amount of energy used in providing heat can be reduced, how sources of heat can be diversified, how security in heat supply may be increased, opportunities in having greater local control, and the potential to reduce pressure on household energy bills.

5.2.13 The Community Energy Policy Statement[91] explains the Scottish Government's commitment for local benefits from renewable energy development. It was developed to explore opportunities for community groups owning renewable energy projects such as including wind, hydro, and solar amongst others, and the potential for working with commercial developers on more innovative projects. The Statement also provided detail on the existing support schemes provided by the Scottish Government, including the Community and Renewable Energy Scheme, Renewable Energy Investment Fund and Local Energy Investment Fund.

5.2.14 National Planning Framework (NPF3)[92] was published alongside Scottish Planning Policy (SPP)[93] in June 2014. They focus on Scotland as: a

[89] The Scottish Government (2015) 2020 Routemap For Renewable Energy in Scotland - Update 2015 [online] Available at: http://www.gov.scot/Topics/Business-Industry/Energy/RoutemapUpdate2015 (accessed 01/12/2016)

[90] The Scottish Government (2015) The Heat Policy Statement: Towards Decarbonising Heat: Maximising the Opportunities for Scotland [online] Available at: http://www.gov.scot/Publications/2015/06/6679 (accessed 01/12/2016)

[91] The Scottish Government (2015) Scottish Government: Community Energy Policy Statement, Final Version published September 2015 [online] Available at: http://www.gov.scot/Resource/0048/00485122.pdf (accessed 01/12/2016)

[92] Scottish Government (2014) National Planning Framework 3: A Plan for Scotland: Ambition, Opportunity, Place and Scottish Planning Policy [online] Available at: http://www.scotland.gov.uk/Topics/Built-Environment/planning/NPF3-SPP-Review/NPF3 (accessed 26/10/2015)

successful, sustainable place; a low carbon place; a natural, resilient place; and a connected place

5.2.15 NPF3 brought together plans and strategies in economic development, regeneration, energy, environment, climate change, transport and digital infrastructure, to provide a coherent vision of how Scotland should evolve over the next 20 to 30 years. NPF3 is clear that planning must facilitate the transition to a low carbon economy, and should help to deliver the aims of the Scottish Government's low carbon ambitions and the RPP programme. In particular, it notes that the energy sector accounts for a significant share of Scotland's GHG emissions, and highlighted the potential for opportunities in this sector, and others, to contribute towards these aims. The importance of strengthening infrastructure, such as the electricity transmission grid, is also noted alongside the overarching need to protect the natural environment and ensure that natural assets are used sustainably.

5.2.16 SPP sets out the national planning policies for Scotland which reflect Scottish Ministers' priorities for operation of the planning system, and the development and use of land. It also sets out policy principles for supporting low carbon transition that are consistent with national objectives and targets, supporting the development of a diverse range of energy generation options including the expansion of renewables, and reduction in GHG emissions and energy consumption. SPP further notes the role of planning in protecting and making efficient use of Scotland's existing resources and environmental assets.

5.2.17 The Conserve and Save: Energy Efficiency Action Plan[94] set out a range of supporting actions for the Scottish Government's commitment to reduce total final energy consumption by 12% by 2020. It was largely focused on reducing the amount of energy needed to heat and cool our homes, our workplaces and the energy consumed in industrial processes; principally by encouraging behavioural change and low carbon practices.

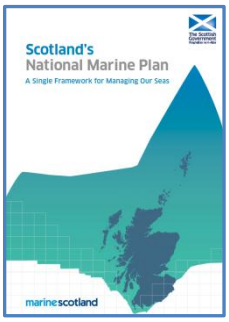
5.2.18 Marine planning is relevant to both the draft Strategy and the aims of the draft Plan. The National Marine Plan[95] and the draft Sectoral Plans for Offshore

[93] Scottish Government (2014) Scottish Planning Policy [online] Available at: http://www.gov.scot/Publications/2014/06/5823 (accessed 01/12/2016)

[94] The Scottish Government (2010) Conserve and Save, The Energy Efficiency Action Plan for Scotland October 2010 [online] Available at: http://www.gov.scot/Resource/Doc/326979/0105437.pdf (accessed 01/12/2016)

[95] The Scottish Government (2015) Scotland's National Marine Plan [online] Available at: http://www.gov.scot/Publications/2015/03/6517 (accessed 01/12/2016)

Renewable Energy in Scottish Waters[96] include provisions relating to energy development in Scottish territorial waters (out to 12 nautical miles). The Sectoral Plans in particular set out opportunities for offshore renewables development, identifying the role that this could play in contributing to Scotland's energy mix, and in helping low carbon transition and reducing GHG emissions across a range of sectors. The Plans aim balance this development with the needs of other coastal and marine users, including that of the natural environment.



5.2.19 The Energy Act 2008[97] designated the Scottish Ministers as the competent authority under the EU Directive on the Geological Storage of Carbon Dioxide in Scotland. The Directive was transposed through the introduction of secondary legislation including the Energy Act 2008 (Storage of Carbon Dioxide) (Scotland) Regulations 2011[98], the Storage of Carbon Dioxide (Licensing etc.) (Scotland) Regulations 2011[99] and the Environmental Liability (Scotland) Amendment Regulations 2011[100].

5.2.20 The UK participates in international action to tackle climate change. At the UK level, the Climate Change Act 2008 sets the statutory framework for GHG emissions reductions in the UK. A range of initiatives are also in place at the international level, focused primarily at reducing GHG emissions, improving energy efficiency, increasing the generation of renewable energy, and a series of associated commitments. For example, these include the EU Emissions Trading Scheme[101], Renewable Energy Directive,[102] Energy Efficiency Directive,[103] and binding targets decreasing emissions from road transport and the level of emissions allowed from new cars and vans[104]. In 2013, the EU

[96] The Scottish Government (2013) Planning Scotland's Seas: Draft Sectoral Marine Plans for Offshore Renewable Energy in Scottish Waters: Consultation Paper [online] Available at: http://www.gov.scot/Publications/2013/07/8702 (accessed 01/12/2016)

[97] UK Parliament (2008) Energy Act 2008 [online] Available at: http://www.legislation.gov.uk/ukpga/2008/32/contents (accessed 01/12/2016)

[98] Scottish Parliament (2011) The Energy Act 2008 (Storage of Carbon Dioxide) (Scotland) Regulations 2011 [online] Available at: http://www.legislation.gov.uk/ssi/2011/224/contents/made (accessed 01/12/2016)

[99] Scottish Parliament (2011) The Storage of Carbon Dioxide (Licensing etc.) (Scotland) Regulations 2011 [online] Available at: http://www.legislation.gov.uk/ssi/2011/24/contents/made (accessed 01/12/2016)

[100] Scottish Parliament (2011) The Environmental Liability (Scotland) Amendment Regulations 2011 [online] Available at: http://www.legislation.gov.uk/ssi/2011/116/contents/made (accessed 01/12/2016)

[101] European Commission (2016) The EU Emissions Trading System (EU ETS) [online] Available at: http://ec.europa.eu/clima/policies/ets_en (accessed 01/12/2016)

[102] Council Directive 2009/28/EC of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC [online] Available at: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0028&from=EN (accessed 01/12/2016)

[103] Council Directive 2012/27/EU of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EChttp://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32012L0027&from=EN (accessed 01/12/2016)

[104] European Commission (2016) Road transport: Reducing CO2 emissions from vehicles[online] Available at: http://ec.europa.eu/clima/policies/transport/vehicles_en (accessed 06/12/2016)

adopted a climate change adaptation strategy which encouraged both Member States and cities to produce comprehensive adaptation strategies[105]. In 2014, a climate and energy framework for 2030 was agreed[106].

5.2.21 In November 2016 the Paris Agreement came into force[107] after being adopted by 195 countries. The Agreement is the first ever universal, legally binding global climate deal and it sets out to limit global warming to well below 2°C[108]. A number of other agreements were reached on key issues such as mitigation through reducing emissions, adaptation and loss and damage[109]. The Paris Agreement provides certainty about the global low-carbon future in the same way that the 2009 Act provided certainty for Scotland's low carbon future[110]. The Agreement provides a clear international context for Scotland's action on climate change[111].

[105] Committee on Climate Change (undated) Climate Change Legislation in the EU [online] Available at: https://www.theccc.org.uk/tackling-climate-change/the-legal-landscape/european-union-legislation/ (accessed 01/12/2016)

[106] EC (2014) Climate Action, 2030 Climate and Energy Framework [online] Available at: http://ec.europa.eu/clima/policies/strategies/2030/index_en.htm (accessed 01/12/2016)

[107] UNFCC (2016) The Paris Agreement [online] Available at: http://unfccc.int/paris_agreement/items/9485.php (accessed 11/11/2016)

[108] European Commission (2016) Climate Action Paris Agreement [online] Available at: http://ec.europa.eu/clima/policies/international/negotiations/paris/index_en.htm (accessed 18/10/2016)

[109] ibid

[110] Scottish Government (2016) Climate Ready Scotland: Scottish Climate Change Adaptation Programme Second Annual Progress Report 2016 Annex A [online] Available at: http://www.gov.scot/Publications/2016/05/7046/4 (accessed 18/10/2016)

[111] ibid

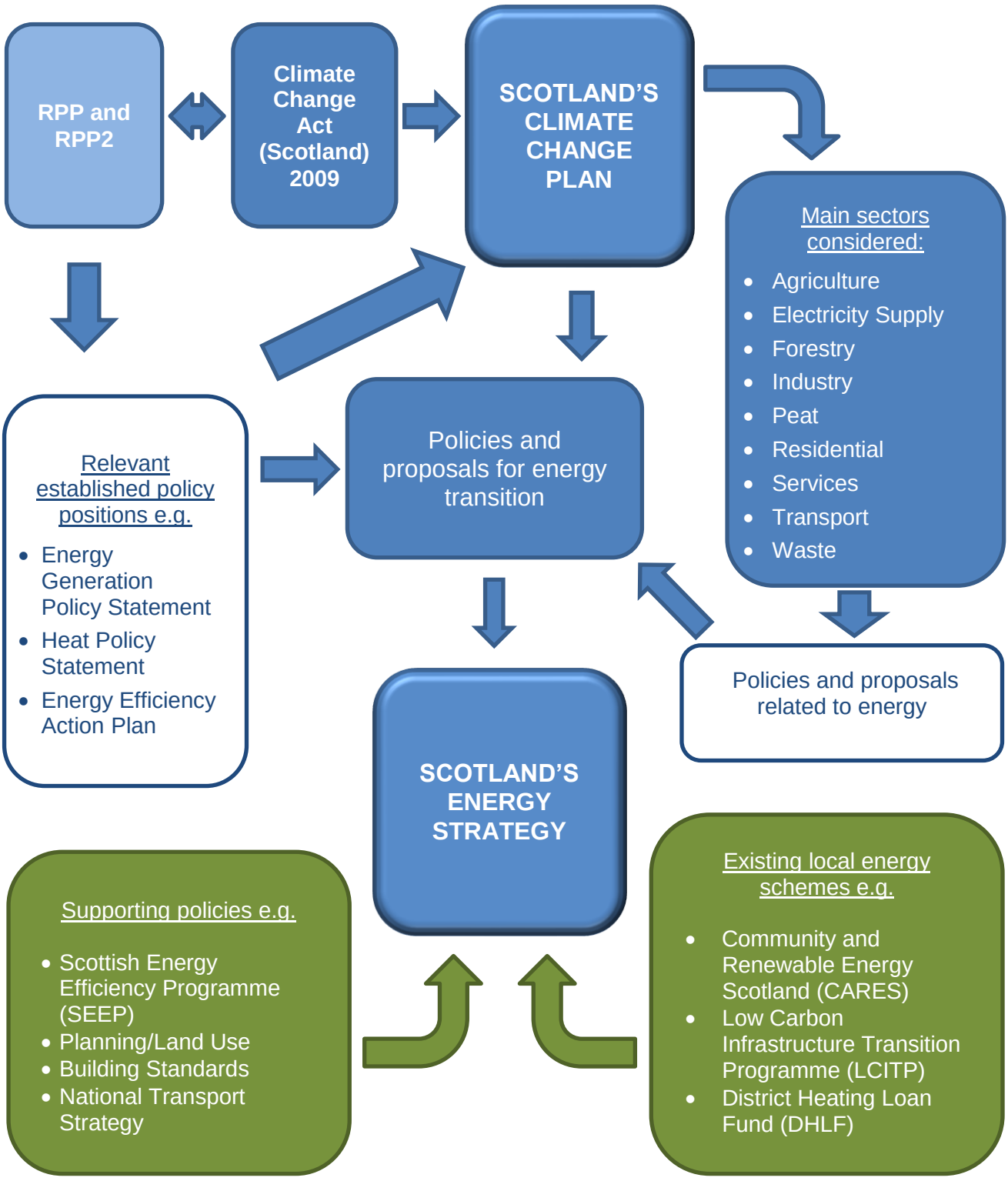


Figure 5.1 Relevant Policy Context for the draft Plan and draft Strategy

6 Findings of the Assessment

6.1 Introduction

6.1.1 As discussed in Section 2, the assessment of the draft Plan and draft Strategy involved three-stages. A detailed assessment of the individual policies and proposals set out in the draft Plan (Appendix C) and the draft Strategy (Appendix D) (Stage 1) was initially undertaken. Individual policy development milestones set out in the draft Plan were also assessed.

6.1.2 The combined environmental effects were then considered for the nine sectors included in the draft Plan and for the three policy groupings set out in the draft Strategy. The findings of this assessment stage are set out in the Summary Tables presented in the following sections of this Report (Stage 2). These tables also include a brief outline of the relevant policy context and key potential opportunities and constraints that have been identified.

6.1.3 To illustrate the key findings in the Summary Tables, a summary box and arrows have been used to show the significant impacts associated with each sector/policy grouping. The following key has been used:

Effects are positive overall for that environmental topic

Effects are mixed overall for that environmental topic

Effects are negative overall for that environmental topic

6.1.4 The accompanying narrative provides an over-arching and strategic analysis of the likely significant environmental impacts of the draft Plan and draft Strategy and their constituent parts. This includes the potential for cumulative and in-combination effects. (Stage 3).

AGRICULTURE

Objectives of the Policies and Proposals

Encouraging farm management measures including soil testing, nitrogen use efficiency, manure management and animal health practices. This will be supported by advice for farmers, carbon auditing and the development of tailored support schemes.

Promoting agroforestry practices.

Shifting the focus of farming and land use to sustainability and protecting ecosystem services.

Opportunities:

Opportunity to reduce GHG emissions from the agricultural sector through changing and improving managing farming practices.

Improved farm management, greater sustainability of the sector and opportunity to future-proof the industry.

Further implementation of agroforestry practices.

Environmental Context:

The Scottish Rural Development Programme 2014 - 2020 delivers Pillar 2 of the EU Common Agricultural Policy. It is aimed at protecting and improving the environment and addressing the impact of climate change on the sector.

The Second Land Use Strategy (2016) set out activities for the next 5 years based around themes such as agriculture and the Scottish Rural Development Programme, amongst others.

Farming For A Better Climate set out five key action areas to help farmers tackle climate change and improve their business.

Constraints:

Potential short term cost implications for farmers in implementing changes, although longer term savings could also be expected as costs should be recuperated over time.

Effective communication will be required to demonstrate benefits in the sector.

'Buy in' will be required to realise benefits.

Uncertainty in delivery of specific environmental benefits as a consequence of these policies and the proposal.

Summary of Findings

There is potential for positive environmental effects from the policies and proposals in the draft Plan relating to the agricultural sector. In particular, there are opportunities to contribute to GHG emission reductions though changing farming practices, more efficient use of resources, and encouraging a change in the way land is used and managed to provide greater carbon reduction/sequestration benefits (**climatic factors and material assets**). There is also likely to be additional benefits through greater use of farm waste as source of renewable energy (**climatic factors**).

Overall Significant Impacts

↑ Climatic Factors, Soil, Water, Biodiversity, Flora and Fauna, and Material assets

The majority of the policies and proposals present an opportunity to improve the conditions of the natural environment and promote less intensive farming practices, for example, by reducing the use of chemical fertilisers and increasing natural and organic fertilisers. If managed properly, this could help to minimise diffuse pollution and nutrient leaching from agricultural lands, with associated benefits for groundwater and surface water quality soil structure, fertility and crop production (**water, soil and material assets**). Additionally, these benefits would be realised by local habitats and species, particularly bird, aquatic and pollinating species (**biodiversity**). The creation or enhancement of new habitats through woodland creation and peatland restoration could have positive effects (**biodiversity, water and landscape**).

There are also potential benefits for rural landscapes by improving the health and appearance of farmland through better management practices and woodland creation (**landscape**), although the scale and nature of any such benefit would likely be site and region specific.

The significance of the effects will depend on the uptake of management practises on the ground. The provision of governmental advice, guidance and subsidies will play a key role in this process.

Key Findings:

- The policies and proposals are likely to have overall positive effects in contributing to meeting GHG emissions reduction targets. The extent of these benefits will depend on the level of take up of the measures.
- Positive effects are also likely for the natural environment including soil, water and biodiversity.
- Controls on species planted and movement of equipment would help to manage the risk of the spread of non-native/invasive species in agroforestry operations

ELECTRICITY SUPPLY

Objectives of the Policies and Proposals

Supporting renewables and the development of new technologies through financial means, including support for increased development of community schemes.

Facilitate an environment which will encourage investment into CCS projects and the development of a CCS demonstrator in Scotland.

Promote the development of energy storage (including pumped hydro-storage) schemes and flexible systems.

Opportunities:

A decarbonised and decentralised electricity sector.

Increased take-up of new technologies, including UK support for CCS.

Increased flexibility in the system through enhanced energy storage, and the development of community schemes.

Environmental Context:

A range of directives and policies are in place, notably the EU Directive on Electricity Production from Renewable Energy Sources. The 2013 revision of the Electricity Generation Policy Statement and the Renewables Routemap set the pathway for the delivery of at least 100% of gross electricity consumption from renewables by 2020. Others, such as the National Marine Plan and Sectoral Plans for Renewables include provisions relating to energy development in Scottish territorial waters.

The Community Energy Policy Statement is also aimed at increasing local renewable energy generation and promotion of community and local energy projects.

The NPF3 states that planning must facilitate the transition to a low carbon economy, and should deliver the aims of Scotland's low carbon ambitions and the RPP programme.

Constraints:

Cost implications in the development of new technologies and roll-out of CCS.

The UK Government position and market forces are likely to be the primary influences on the development and implementation of new technologies.

Uncertainty on the future of UK Government subsidies.

Summary of Findings

Overall Significant Impacts

Climatic factors, Air quality, Population and human health, Material assets

There is potential for broadly positive environmental effects. In particular, the Plan could contribute to further reductions in GHG emissions (**climatic factors**) by aiding the decarbonisation of electricity generation. Policies aimed at encouraging further investment in renewables and facilitating the progression of new technologies such as electricity storage and CCS are identified as likely to be beneficial (**climatic factors**). There is potential for further benefits in improving security of supply through flexibility and storage projects, local and community owned renewable electricity generation (**material assets and population and human health**) and adaptation of the electricity sector to the predicted effects of climate change (**material assets**).

Alongside the potential for overall reductions in GHG emissions, other potential benefits were identified (**soil, air, water, biodiversity, population and human health, cultural heritage and landscape).** However, demonstrating a commitment to pursue additional GHG emission reductions is expected to be beneficial, particularly the potential implementation of CCS technologies in combination with the continued use of fossil fuels within Scotland's varied energy mix. With the support of complementary proposals the assessment identified the clear potential for positive effects in terms of both climatic factors and material assets (**climatic factors and material assets**).

There is potential for adverse effects associated with some policies and proposals, particularly those leading to development at a local scale. For example, the development of renewables could result in environmental effects, including impacts to biodiversity, soil, water and air quality from construction activities and siting of developments, with the potential for both temporary and long-term effects (**biodiversity, soil, water and air quality**). Other potential long term effects could arise from changes in setting for cultural heritage and landscape (**cultural heritage and landscape**). However, the significance of any such impacts would likely depend on factors such as the type, size and scale of development/infrastructure works and the location and setting. More specific environmental effects will be considered through the planning process, marine licensing, Environmental Impact Assessment (EIA) and Habitats regulations Appraisal (HRA) and, in many instances, could be managed through the use of appropriate construction management measures such as Environmental Management Plans.

Key Findings:

- Other benefits could include improved energy security, and greater flexibility in managing demand and supply.
- There is potential for adverse effects arising from the construction of infrastructure for additional low carbon energy sources. However, any such effects will be considered as appropriate under relevant assessment and regulatory regimes.

FORESTRY

Objectives of the Policies and Proposals

Reducing carbon emissions by increasing the amount of forested area in Scotland.

Increasing accessible woodland space which can be used for recreational purposes and enhancing urban areas.

Promoting a shift from high-energy building materials to renewable timber products.

Increasing production of well-managed timber to underpin a sustainable forest products industry, with associated benefits for rural populations.

Delivering ecosystem services by contributing to natural flood management, soil stability and increasing biodiversity.

Opportunities:

Opportunity to grow Scottish timber market, particularly in relation to the supply of Scottish engineered timber.

Development of workforce through addressing skills shortages and gaps around the use of Scottish timber in the construction industry.

New habitat creation.

Environmental Context:

The Scottish Forestry Strategy and its Implementation (2015-18) sets out a vision and actions for taking forestry forward in Scotland. It sets out aims for integration with other land uses and businesses, improving the wellbeing of communities, protecting the environment and promoting sustainability.

The Land Use Strategy 2016 – 2021 acknowledges forestry's role as a key multipurpose land use in Scotland.

The 2020 Challenge for Scotland's Biodiversity seeks to protect biodiversity whilst utilising nature and its many processes and functions to improve prosperity and welfare.

Constraints:

Cost of woodland creation.

Land availability and conflicting demands for land use.

Timescale for approval of forestry projects.

Timely access to support.

Uncertainty in investment markets may affect private sector planting.

Summary of Findings

Overall Significant Impacts

↑ Climatic Factors, Population and Human Health, Soil, Water, Biodiversity, Flora and Fauna, Cultural heritage

↕ Landscape, Material Assets

Carbon sequestration from increased woodland and forest planting and the use of sustainable Scottish timber in construction in preference to other higher carbon intensive materials or imported timbers from overseas are likely to have positive effects (**climatic factors**).

Woodland creation, delivered in accordance with the UK Forestry Standard and associated guidelines, could have positive effects such as habitat creation, natural flood management and soil stabilisation (**soil, water and biodiversity**). Managing forests according to the Standard could help to mitigate the potential negative effects of soil erosion and a risk of decline in water quality, especially during the operations associated with timber harvesting. Positive effects may also arise through an increase in forested areas for recreational purposes such as walking and cycling, however, this is only likely to be accessible during the growing phase (**population and human health**). Positive effects from improved land management could occur, depending on its previous use, and the creation of new ecosystems (**biodiversity and landscape**). Additional benefits may also be derived from the increased use of renewable natural timber resources rather than non-renewable carbon-intensive construction materials, with associated benefits through reduced landfill activity and GHG emissions (**material assets and climatic factors**).

The effects of land use change on the wider environment and communities could be mixed, depending on the scale and nature of changes. For example, poorly designed and established woodlands or forests could affect the scenic and local biodiversity value of the area which could lead to negative visual impacts (**biodiversity and landscape**). Demand for land from other land uses could also generate some pressure (**material assets**).

It is considered that the identified potential negative impacts could be mitigated by adhering to relevant forestry standards and guidelines, by adopting good practice and the development and revision of Local Authority Forest and Woodland Strategies. Further consideration of potential environmental effects is likely to be undertaken at a project level, where woodland creation proposals must meet the requirements of statutory processes for assessing impact on designated habitats or the wider environment; for example, EIA.

Key Findings:

- While the policies and proposals are likely to contribute to meeting GHG emissions reduction targets, the significance of their effects will depend on the level of buy-in of stakeholders.
- Woodland creation has the potential for positive effects overall, particularly in terms of habitat creation, soil stabilisation and flood management, and for population and human health.
- Potential negative impacts could be mitigated at the project level by adhering to relevant forestry standards and guidelines, adopting good practice and through via existing mechanisms such as the planning process, EIA and HRA.

INDUSTRY

Objectives of the Policies and Proposals

Transitioned decarbonisation of Scottish industry with a focus on the use of existing EU, UK and Scottish schemes; such as the EU Emissions Trading Scheme (EU ETS), Climate Change Levy and Climate Change Agreements.

Promoting energy efficiency audits for industry to identify opportunities for savings, and provision of support and access to finance. This may include mandatory implementation of audit findings if within devolved competence, and demonstrated to be cost effective, improve productivity and save money for industry.

Supporting investment in energy efficiency via Scotland's Energy efficiency programme (SEEP) and existing financial and incentive schemes.

Changing how waste is viewed by industry and increasing the use of waste in production.

Opportunities:

Investment in new and future-proofed industry.

A change in thinking amongst industry and the identification of opportunities to increase productivity, save money and employ greater control over resource security.

To increase use of waste in production and reduce the consumption of natural resources.

Environmental Context:

Scotland's Economic Strategy sets overarching aims for increasing sustainable economic growth for Scottish industry, supported by a range of sector-specific policies and strategies.

National policy such as NPF3 set out principles for increasing the sustainable use of Scotland's natural resources.

Others, such as the Infrastructure Investment Plan 2015 and Conserve and Save: The Energy Efficiency Action Plan for Scotland sets out wide ranging programmes targeting activity on energy efficiency in the business sector.

Constraints:

Initial cost implications for businesses.

Current economic uncertainty.

Uncertainty in delivery of specific environmental benefits as a consequence of these policies and the proposal.

'Buy in' will be voluntary and will be dependent on communication and education.

Summary of Findings

Overall Significant Impacts

↑ Climatic Factors, Air quality, Material Assets

A wide range of measures, including the continuation of existing tax, discount and emissions trading schemes could contribute to GHG emission reductions (**climatic factors**). Other schemes aim to encourage the uptake of low carbon heat technologies, district heating networks and the installation of energy efficiency measures in Scotland could reduce the demand for electricity and heat from fossil fuel sources (**climatic factors**). Sequestering carbon emissions from the demonstration of CCS technology is also likely to have significant positive effects by reducing GHG emissions. This could also improve local air quality depending on the specific type of technology used (**climatic factors and air**).

Greater uptake of energy efficiency measures within industry could reduce demand and thereby reduce pressure on existing supply and distribution networks (**material assets**). Low carbon renewable heating technologies and networks could improve our heating infrastructure and contribute to enhancing security of supply. There is also an opportunity to reduce pressure on existing waste management networks through adoption of the principles of the circular economy and the use of recycled goods in manufacturing processes. This could reduce reliance on finite or virgin natural resources and limit carbon generation from the processing and transportation of such materials (**material assets, climatic factors**). However, the extent of the benefits realised will be influenced by buy-in from businesses and industry.

There is potential for localised adverse impacts on some topic areas as a consequence of construction and infrastructure improvement works from the installation of new heating networks, CCS infrastructure and energy efficiency measures, but these are expected to be temporary **(population and human health, soil, water, air and biodiversity)**. Longer term impacts can arise from certain technologies, such as those that impact on the fabric of building (**landscape and cultural heritage**). Factors such as the location and scale of the proposed works will influence the significance of the identified impacts. These are likely to be experienced at a local scale and be given consideration at a project level under existing consenting mechanisms. In some cases, impacts may also be managed through the use of appropriate construction management measures, such as Environmental Management Plans.

Key Findings:

- The policies and proposals are likely to contribute to meeting GHG emissions reduction targets and increase resource security.
- The realisation of any benefits is likely to be influenced by communicating potential benefits and opportunities to the sector, and achieving the buy-in of industry is an opportunity to introduce long-term thinking into infrastructure development.
- The potential for technologies such as CCS to help industry reduce climate change impacts, and aid the continued use of oil and gas as an energy source as industry transitions to low carbon energy sources.
- Many of the potential adverse effects are related to potential infrastructure development, and will be considered as appropriate under existing mechanisms such as the planning or consenting process, EIA and HRA, amongst others.

PEAT

Objective of the Policies

Restoring 10,000 hectares of peatland in 2017/18, rising to 20,000 hectares per annum thereafter

Opportunities:

Creation of new peatland habitats.

Improving landscapes that have been degraded.

Increasing the size of Scotland's carbon sink.

The development of local knowledge and skills to support restoration projects.

Environmental Context:

Scotland's Land Use Strategy (2016) identifies the key role of peatlands and the services that these natural assets provide. It sets out how pilot projects for peatland restoration could deliver multiple benefits, including contributing to climate change ambitions.

Scotland's National Peatland Plan seeks to quantify and promote the benefits of peatland restoration, protection and management. The Draft Peatland and Energy Policy Statement aims to maximise GHG emissions abatement, and presents an overview of policies and plans in relation to peatland and energy flowing from this overarching aim.

SPP identifies carbon-rich soils as nationally important environmental interests, and states that developments should aim to minimise the release of Carbon dioxide (CO_2) from these soils.

Constraints:

Cost implications in restoration of peatland areas.

Potential trade off with other land uses.

Summary of Findings

Largely positive environmental effects are expected from this sector; most notably a reduction in CO_2 emissions and the enhancement of the carbon sink potential of those areas (**climatic factors**). Further benefits are expected in relation to soil function and stability, water quality and reducing flood risk, maintaining ecosystem functions, supporting and restoring natural biodiversity (**soil, water and biodiversity**). Peatlands have an important influence on landscape and are of cultural value and so there is also potential to enhance landscape value and access to the outdoors (**landscape, cultural heritage and population and human health**).

There is potential for positive effects associated with land use change as a result of improving land management and restoring degraded land (**material assets**).

Overall Significant Impacts

Climatic factors, Population and human health, Soil, Water, Biodiversity, flora and fauna, Cultural heritage, Landscape, Material Assets

Key Findings:

- The policies are likely to increase Scotland's natural carbon sink and contribute to meeting GHG emissions reduction targets.
- The restoration of degraded peatland areas could have associated environmental benefits particularly over the long-term.

RESIDENTIAL

Objectives of the Policies and Proposals

Developing heat market regulations and a series of proposals aimed at supporting area-based delivery of energy efficiency measures; including development of Local Heat and Energy Efficiency Strategies, consideration of zoning for installation of new low carbon heat technologies, and a requirement under some circumstances for residential buildings to connect to heat networks.

Co-ordinating and integrating delivery of the Home Energy Efficiency Programme Scotland (HEEPS), its replacement, SEEP, and Warmer Homes Scotland.

Setting energy efficiency standards for the private rented sector, standards and/or incentives for owner occupied properties, and reviewing standards for social housing as part of SEEP.

Promoting low carbon heating options and heat networks through a suite of existing and proposed funding, loans and investment measures; notably a Scottish Energy Company Obligation.

Opportunities:

More energy efficient housing stock and increased generation of heat through local heat networks.

Decarbonisation of heat generation in the sector.

Development of local heat and energy efficiency plans targeting actions towards those with greatest need.

Environmental Context:

National policy such as NPF3 sets out ambitions to reduce energy demand and increase renewable electricity and heat generation across Scotland. Others, such as Scotland's Sustainable Housing Strategy, the Infrastructure Investment Plan 2015 commitment to a national infrastructure priority for energy efficiency (via SEEP), and Conserve and Save: The Energy Efficiency Action Plan for Scotland take these ambitions forward through a wide ranging programme targeting behaviour changes, delivering warm, high quality, affordable, low carbon homes, and a housing sector that helps to establish a successful low carbon economy.

The fuel poverty policy seeks to improve human health by improving energy efficiency and improving housing stock. These are closely linked to wider national health and wellbeing policies.

Constraints:

Potential short term cost implications for home owners and social housing providers, although longer term savings could also be expected.

Upfront cost implications for development of heat networks.

'Buy in' will be required.

Detail on proposed Scottish funding and incentive schemes is still to be determined.

Summary of Findings

Overall Significant Impacts

Climatic factors, Air quality, Population and human health, Material assets

Largely positive effects are expected from this sector. In particular, improving energy efficiency at the point of use and aiding the decarbonisation of energy supply to Scottish households will help to reduce emissions (**climatic factors**). Reducing energy demand is also likely to improve air quality, particularly by reducing demand for energy generated from traditional and finite sources (**air quality**), with associated benefits for human health (**population and human health**).Improving the energy efficiency of domestic properties could reduce domestic energy consumption, and aid in the development of more efficient and energy secure housing stock. The SEEP programme is the primary vehicle set out in the draft Plan for the residential sector, and will be an integral component of wider Scottish Government ambitions to improve health and wellbeing (**population and human health**).

The assessment also identified the potential for largely localised impacts associated with some policies and proposals, particularly those focused on the promoting the development of district heating systems and heat networks. Direct impacts from development works can include temporary or long-term impacts on a number of environmental receptors **(soil, air, water, biodiversity, population and human health**). Additionally, the operation of some technologies can have negative impacts. For example, whilst biomass is subject to regulation and standards, it is not carbon neutral and the biomass combustion process can result in the emission of air pollutants that are potentially harmful to human health (**population and human health, air quality**). Care is needed to ensure that the production of feedstocks can avoid or mitigate the potential for adverse effects on environmental receptors (**biodiversity, landscape, soil and water quality**).

Energy efficiency measures can have some adverse effects, most notably, where works may be undertaken to roof cavities which can have implications for bats (**biodiversity**). Some efficiency measures could affect cultural heritage features directly or through visual impacts on their setting and landscape (**landscape and cultural heritage**). However, these would be largely localised and their significance would depend on factors such as the size and scale of the proposed works, in conjunction with the location and setting. The potential for environmental effects would be considered as appropriate under existing mechanisms, such as the planning process, EIA and HRA. In many instances, impacts can be managed or mitigated by appropriate design and construction management measures such as the co-ordination of works to minimise disruption and the implementation of Environmental Management Plans.

As with other sectors considered in the draft Plan, these policies and proposals could help to reduce pressure on existing energy networks and progressively improve infrastructure. Greater uptake of new low carbon technologies, particularly local generation, could reduce pressure/demand on other energy resources and improve energy efficiencies across the sector (**material assets**). The resilience of Scotland's energy supply to the predicted impacts of climate change is likely to become increasingly important. Greater diversity in technologies and how they feed into the energy system should help to future proof supply. However, there will be the need for further and upgraded infrastructure to ensure that Scotland can achieve maximum benefit from the policies and proposals, and achieve an efficient, flexible and diverse energy mix (**material assets**).

In many instances, any identified benefits and/or adverse impacts, and their significance at the local and national levels, is likely to be influenced by the successful promotion and uptake of the policies and proposals.

Key Findings:

- The policies and proposals are likely to reduce energy demand and contribute to meeting GHG emissions reduction targets.
- There is an opportunity to improve energy efficiency and Scotland's housing stock, and introduce long-term thinking into infrastructure development.
- Many of the potential adverse effects are related to the need for infrastructure development, and are likely to be considerations under existing mechanisms such as the planning or consenting process, EIA and HRA, amongst others.

SERVICES

Objectives of the Policies and Proposals

Developing heat market regulations and supporting area-based delivery of energy efficiency measures, including Local Heat and Energy Efficiency Strategies.

Co-ordinating and integrating delivery of SEEP across domestic and non-domestic buildings.

Regulating energy efficiency improvements in the non-domestic sector and review of existing non-domestic standards as part of SEEP.

Facilitating the decarbonisation of business and the public sector, and support for energy efficiency through a suite of existing and proposed funding, loans and investment measures.

Opportunities:

Investment in more energy efficient non-domestic building stock.

Co-ordinated approach to delivery of SEEP across domestic and non-domestic sectors.

Development of district heat networks targeted at areas in need, and requiring public buildings to connect to heat networks.

Environmental Context:

National policy such as the NPF3 set out ambitions to reduce energy demand and increase renewable electricity and heat generation across Scotland.

Others, such as the Infrastructure Investment Plan 2015 commitment to a national infrastructure priority for energy efficiency (via SEEP), and Conserve and Save: The Energy Efficiency Action Plan for Scotland takes these ambitions forward through wide ranging programmes targeting activity on behaviour change, household, business and public sector energy efficiency, resource efficiency and investment in infrastructure in a low carbon economy.

Constraints:

Renewable Heat Incentive (RHI) and associated supportive Scottish schemes ends in early 2020s.

Requires local authority involvement through implementation at the local level, and in development of Local Heat and Energy Efficiency Strategies.

'Buy in' is needed to realise benefits.

Significant upgrades and investment may be necessary to improve efficiency in older buildings.

Summary of Findings

Overall Significant Impacts

↑ Climatic factors, Air quality, Population and human health, Material assets

Largely positive environmental effects are expected from this sector, most notably a reduction in GHG emissions (**climatic factors**) by contributing to the decarbonisation of energy supply and improving efficiency of how energy, in particular heat, is used in both domestic and non-domestic buildings. Many of the policies and proposals will complement one-another and, in some cases wider Scottish ambitions, including improving health. A raft of financial measures as well as large scale, innovative low carbon energy generation and energy demand reduction projects will also support the shift away from traditional and finite energy supplies. Many of the proposals seeking the delivery of lower carbon energy could improve air quality, with positive effects for human health and wellbeing (**air quality and population and human health**). For example, improving the energy efficiency of domestic properties could reduce domestic energy consumption, and help to develop more efficient and energy secure housing stock (**population and human health**).

Largely localised impacts could also arise from some of the policies and proposals, particularly those requiring development of new or upgraded infrastructure **(material assets).** For example, using low carbon technologies in district heating networks could lead to environmental impacts if new or upgraded infrastructure is needed **(material assets)**. This could include largely temporary effects from construction activities **(soil, air, water, biodiversity, population and human health)** that will require management and mitigation.

The implementation of energy efficiency measures could also have some adverse effects, most notably, where works may be undertaken to roof cavities which can have implications for bats (**biodiversity**). Impacts on the setting for cultural heritage and landscape features **(cultural heritage and landscape)** could arise, depending on the siting and construction of developments. However, these effects would be largely localised and temporary. Further, the potential for environmental effects would be considered under existing mechanisms, such as the planning process, EIA and HRA, as appropriate. In many instances, the impacts can be managed through appropriate design and construction management measures such as the co-ordination of works to minimise disruption and the implementation of Environmental Management Plans.

The opportunity to reduce pressure on existing energy networks and infrastructure was also noted in the assessment. Greater uptake of new low carbon technologies, particularly through local generation, could reduce pressure/demand on other energy resources and improve energy efficiencies across the sector. The resilience of Scotland's energy supply to the predicted impacts of climate change is likely to become increasingly important and greater diversity in technologies should aid in future proofing supply and distribution. This presents an opportunity to enhance Scotland's energy security and future-proof energy supply in the face of predicted future pressures (**material assets**).

Any identified benefits and/or adverse impacts, and their significance at the local and national levels, will be influenced by successful uptake and the promotion of the policies and proposals.

Key Findings:

- Many of the policies complement one-another, with the potential for overall benefits in reducing energy demand and GHG emissions in particular. However, the significance of effects will depend on the level of buy-in from business stakeholders.
- A co-ordinated, area-based approach to improving energy efficiency and decarbonising heat supply in non-domestic buildings would be beneficial.
- Many of the potential adverse effects are related to the need for infrastructure development and would be assessed as appropriate through existing mechanisms such as the planning or consenting process.

TRANSPORT

Objectives of the Policies and Proposals

Decarbonising the transport sector with a particular focus on road, but also rail, shipping and aviation.

Improving transport network efficiencies by technological means and by reducing travel events where possible.

Facilitating the increasing take-up of low carbon technologies and the progressive replacement of older, higher carbon technologies (e.g. vehicles, ferries).

Promoting and actively facilitating a modal shift towards low carbon travel (from road to rail, from motorised to active travel).

Changing how we travel and how freight is delivered, whilst seeking to maximise secondary benefits such as improving air quality in urban areas and improving health and wellbeing.

Opportunities:

Infrastructure investment – new and future-proofed infrastructure and low carbon transport alternatives.

Facilitate future-growth and identify new opportunities.

Potential to drive change in how freight is delivered and transported.

Environmental Context:

The National Transport Strategy sets the long term vision for Scotland's transport policies. It identifies a series of strategic outcomes, including improving journey times and connections, tackling congestion and improving integration: and reducing emissions to tackle climate change, air quality, and health improvement.

The NPF3 explored Scotland's overarching ambitions for connectivity and accessibility, ambitions to change how we travel and ensuring infrastructure is in place to facilitate decarbonisation of the sector.

Constraints:

Legislation will be needed to progress several proposals (e.g. Low Emissions Zones).

Take-up of electric vehicles (EVs) is dependent on consumer buy-in.

Financial incentives may be required to facilitate change in freight movements.

Achieving buy-in for active travel and low carbon alternatives.

Summary of Findings

Overall Significant Impacts

Climatic factors, Air quality, Population and human health.

Material Assets

Largely positive environmental effects are expected from this sector, most notably the potential to further reduce GHG emissions by promoting and enabling changes in how goods, services and people use transport in Scotland (**climatic factors**). Policies and proposals focused on increasing take-up of low carbon vehicles, reducing travel journeys and the decarbonisation of freight transport through electrification, could have particular benefits.

Many proposals also present an opportunity to improve air quality, particularly in urban areas and locations with identified air quality issues, such as Air Quality Management Areas. The replacement of existing cars, heavy goods vehicles (HGVs) and buses with lower emission vehicles, and low emissions zones in urban areas, would benefit air quality with associated benefits for human health **(air quality, population and human health).** Many of the policies and proposals are complementary. For example, the operation of low emission zones, promotion of low emissions vehicles, and support for the establishment of freight consolidation centres outside urban centres, could collectively change how freight is managed and address air quality issues that affect many of Scotland's urban centres. However, having appropriate infrastructure in place to enable this transition will be vital in achieving these benefits and can help to avoid the creation or exacerbation of existing issues at these locations. For example, increased congestion and air quality issues (**material assets**).

Policies and proposals requiring development of new or upgraded infrastructure and development could have localised impacts **(material assets).** For example, freight distribution centres, recharging facilities and hydrogen processing plants could lead to development and associated local environmental impacts. Direct impacts from development works can include temporary or long-term impacts through disturbance **(population and human health)** and impacts on biodiversity, soil, water and air quality from construction activities **(soil, air, water, biodiversity, population and human health).** The siting and construction of developments could also have effects on the setting of cultural heritage and landscape assets **(cultural heritage and landscape)**. However, the significance of any such impacts will depend on factors such as the size and scale of the proposed developments, their location and setting. Environmental effects will be considered under existing mechanisms, such as the planning process, EIA and HRA, as appropriate. In many instances, the identified impacts may also be managed through the use of appropriate construction management measures such as Environmental Management Plans.

There is potential for pressures on existing energy infrastructure arising from the policies and proposals. Greater uptake of new technologies, such as increased use of electric and electric-hybrid vehicles, is likely to increase pressure/demand for these energy resources. Any increased demand could place pressure on existing networks if upgrades are not made to facilitate transition towards decarbonisation of the sector (**material assets**).

In many instances, any identified benefits and/or adverse impacts, and their significance at the local and national levels, is likely to be influenced by successful uptake and the promotion of the policies and proposals amongst the transport sector and wider industry.

Key Findings:

- While the policies and proposals are likely to contribute to meeting GHG emissions reduction targets, the significance of effects will depend on the level of buy-in from stakeholders and the wider transport sector.
- Infrastructure development could result in largely localised and temporary adverse effects. Any such development will be assessed as appropriate under existing mechanisms such as the planning or consenting process, EIA and HRA.

WASTE

Objectives of the Policies and Proposals

Reducing waste and delivering on recycling and landfill diversion targets for 2025.

Capturing and flaring of landfill gas on closed sites.

Developing a post-2025 framework for further waste reduction, management and circular economy policies and indicators.

Opportunities:

Reducing the amount of waste lost to landfill.

Promoting the re-use of waste materials, infusion of this into the design and manufacturing process, and industry seeing waste as a resource.

Reduction in consumption of natural resources from improved utilisation of waste, and potential for reduction in GHG emissions, particularly in the industrial sector.

Opportunity for businesses to take greater control and better manage resource inputs and waste outputs.

Environmental Context:

Making Things Last: A Circular Economy Strategy for Scotland sets out Scotland's ambitions for changing how waste is seen in our economy. It seeks to reduce waste lost from the economy, and retain the value of materials through repair, reuse, recycling and remanufacturing through a range of policies and proposals.

The Strategy builds on the progress made on the zero waste and resource efficiency agenda set out in Scotland's Zero Waste Plan and Safeguarding Scotland's Resources.

Constraints:

Likely cost implications for business and industry in the short-term.

Uncertainty in delivery of specific environmental benefits as a consequence of these policies and the proposal.

The level of 'buy in' will influence the extent of benefits.

Summary of Findings

This sector could have largely positive environmental effects particularly through improving waste management, reducing pressure on existing landfill infrastructure, and contributing to a reduction in GHG emissions (**climatic factors and material assets**). The policy on delivery of current waste targets and regulation and the proposal for a post-2025 circular economy framework could result in more efficient use of resources, particularly primary/virgin and finite materials, and encourage the repair, reuse and remanufacturing of goods **(material assets)**. Further reductions in energy use and associated GHG emissions could arise as remanufacturing goods requires fewer resources than manufacturing from new **(climatic factors)**.

Overall Significant Impacts

↑ Climatic Factors, Material Assets

↕ Soil

Methane is one of the main GHG emissions produced at landfill sites. The policy to continue to roll out a programme of landfill gas capture is expected to reduce or limit the release of this potent gas to the atmosphere **(climatic factors)**.

Localised impacts could arise from changes in how waste is managed, including policies that may require the development of new recycling and waste management facilities **(biodiversity, soil, water, air quality, population/human health, and landscape and cultural heritage)**. These can occur from the construction, operation and siting of waste infrastructure developments, with construction impacts being largely temporary. However, these identified impacts will be experienced at a local scale and would be assessed at a project level under existing mechanisms such as the planning process, Scottish Environment Protection Agency (SEPA) regulation, EIA and HRA. In some cases, impacts may also be managed through the use of appropriate construction management measures, such as Environmental Management Plans.

Key Findings:

- Improving how waste is utilised in our economy is likely to reduce pressure on waste infrastructure, reduce natural resource consumption, and contribute to a reduction in GHG emissions.
- The significance of these benefits will depend on the level of stakeholder buy-in.
- There is an opportunity to further increase long-term thinking in how waste materials are seen and utilised, particularly in the manufacturing sector.
- Many of the potential adverse effects are related to the need for infrastructure development and would be assessed as appropriate under existing mechanisms such as the planning or consenting process, EIA and HRA.

6.2 Draft Climate Change Plan – Summary of Likely Environmental Impacts

Primary Environmental Effects

6.2.1 The policies and proposals set out in the draft Plan are likely to reduce GHG emissions and have positive impacts on climate change objectives. Many of the policies and proposals relate to energy, including those focused on improving the energy efficiency of domestic and industrial buildings, decarbonisation of transport, and greater generation and use of low carbon and renewable electricity and heat. These policies and proposals are expected to have significant benefits for climatic factors given their contribution Scotland's GHG emissions[112]. The effects of these policies and proposals have also been considered in the assessment of the draft Strategy.

6.2.2 A number of policies and proposals in the draft Plan also relate to the transport sector, including those seeking to decarbonise the sector through increased electrification. While addressing a range of transport modes, the focus on road transport in particular could deliver significant benefits as cars alone account for nearly half of transports share of total GHG emission in 2014[113].

6.2.3 Some policies and proposals provide a significant opportunity to generate cross-cutting benefits across sectors. For example, the co-ordination and integration of SEEP across both domestic properties and non-domestic buildings will help to transform the energy system through investment in buildings and new low carbon heat infrastructure. Investment, regulations and incentives through SEEP should help to reduce demand for energy and improve energy productivity. This could lead to a significant reduction in GHG emissions across the services, residential and industry sectors.

6.2.4 Some policies and proposals also complement those within other sectors. For example, measures to improve industrial energy efficiency are likely to support, and be supported by, policies and proposals for the waste sector. This includes the adoption of circular economy principles in industry and promoting greater use of waste as a resource in order to reduce the amount of waste being sent to landfill in Scotland. Additionally, key Scottish industries, such as the food and drink industry and the broader bio economy, could play greater roles in energy recovery. For example, by increasing the use of biological wastes in

[112] Scottish Government (2014) Scottish Greenhouse Gas Emissions 2014, An official Statistics Publication for Scotland [online] Available at: http://www.gov.scot/Publications/2016/06/2307 (accessed 18/10/2016)

[113] Committee on Climate Change (2016) Reducing Emissions in Scotland 2016 Progress Report [online] Available at: https://www.theccc.org.uk/publication/reducing-emissions-in-scotland-2016-progress-report/ (accessed 26/10/2016)

processes such as anaerobic digestion to produce biogas, a source of renewable fuel and heat[114].

6.2.5 The capture and use of waste heat emitted from heat intensive industries is also likely to have significant benefits. Heat is integral to many industrial processes and so the benefits from employing technologies and systems that recover excess heat from industrial processes[115] could be significant. Additionally, recovered heat could be used within the same or nearby buildings for water and space heating, further reducing energy demand and any associated GHG emissions.

6.2.6 Agriculture and related land uses make up the third largest emission sector after energy supply and transport[116]. The management and use of land has a fundamental contribution to make to meeting Scotland's obligations in meeting the GHG emissions targets and adapting to the predicted impacts of climate change[117]. Policies and proposals that relate to peatland and the agriculture and forestry sectors could have significant environmental benefits by supporting adaptation as well as emissions reductions, through improved carbon sequestration. Given the importance of their role as a carbon sink, the restoration of peatland could have a particularly beneficial impact.

Secondary Environmental Effects

6.2.7 A number of potentially significant secondary impacts have been identified as likely to arise from the policies and proposals in the draft Plan. These include potential positive effects on air quality and population and human health across a number of sectors. For example, the displacement or reduction of energy generated from traditional energy sources, and the provision of warmer, more energy efficient and energy secure housing stock. Targeted action, such as the approach likely to be adopted by the implementation of SEEP, could provide further significant health benefits by concentrating funding and efficiency efforts towards the vulnerable and fuel poor[118].

6.2.8 Additionally, air quality and population and human health benefits are likely through the policies and proposals proposed for the transport sector. For

[114] Scottish Government (2016) Making Things Last – A Circular Economy Strategy for Scotland [online] Available at: http://www.gov.scot/Publications/2016/02/1761 (accessed 26/10/2016)

[115] The Scottish Government (2014) SEA Environmental Report on the Draft Heat Generation Policy Statement: Towards Decarbonising Heat: Maximising the Opportunities for Scotland [online] Available at: http://www.gov.scot/Publications/2014/03/7673 (Accessed 26/11/2016)

[116] Committee on Climate Change (2016) Reducing Emissions in Scotland 2016 Progress Report [online] Available at: https://www.theccc.org.uk/publication/reducing-emissions-in-scotland-2016-progress-report/ (accessed 26/10/2016)

[117] Scottish Government (2016) The SEA of Getting the best form our land: A Land Use Strategy for Scotland 2016-2021 [online] Available at: http://www.gov.scot/Resource/0049/00492155.pdf (accessed 24/11/2016)

[118] The Scottish Parliament (2015) SPICe Briefing Good for Climate, good for health [online] Available at: http://www.parliament.scot/ResearchBriefingsAndFactsheets/S4/SB_15-40_Good_for_climate_good_for_health.pdf (accessed 24/01/2017)

example, reducing pollution through the decarbonisation of transport could improve local air quality, while taking part in more sustainable forms of travel, such as walking and cycling, could have physical and mental health benefits for individuals. These benefits would be most significant where there are existing problems; for example, in areas that do not currently meet their air quality objectives as a result of traffic emissions[119]. There are also opportunities to build on existing research to better understand how to engage a wider range of people in active travel[120].

6.2.9 Infrastructure, including electric vehicle charging points, energy storage and grid interconnections will be required to facilitate many of the policies and proposals in the draft Plan. While these could have both negative and positive impacts, their significance will depend largely on factors such as the scale of uptake of new technologies, and their siting and design.

6.2.10 Development of certain renewable energy technologies, such as on and offshore wind renewables, are seen by many as a pressure on both visual amenity and the character of many rural landscapes. Technologies such as these are designed to mitigate climate change but careful management may be required to ensure that no negative effects arise as a result of their implementation[121].

[119] Air Quality in Scotland (undated) Air quality management areas [online] Available at: http://www.scottishairquality.co.uk/laqm/aqma (accessed 11/10/16)

[120] Aether (undated) Evidence Review of the Potential Wider Impacts of Climate Change Mitigation Options: Transport Sector, Report to the Scottish Government, page 39

[121] SNH (2016) How will Scotland's landscapes be affected by climate change?, Researching the effects of climate change on Scotland's landscapes [online] Available at: http://www.snh.gov.uk/protecting-scotlands-nature/looking-after-landscapes/landscape-policy-and-guidance/climate-change-landscape/ (accessed 21/10/2016)

Meeting our Energy Supply Needs

Objectives

Continuing to support recovery of North Sea oil and gas as part of a managed transition to a low carbon economy.

Supporting the commercialisation of Carbon Capture and Storage (CCS).

Exploring the potential role of new or lower carbon energy sources that can displace more carbon intensive fuels.

Increasing the supply of renewable energy.

Increasing the flexibility, efficiency, and resilience of the energy system as a whole.

Opportunities:

A modern, decarbonised and decentralised energy sector.

Encouraging innovation and take-up of new technologies, including hydrogen and CCS.

Infrastructure investment – new and future-proofed infrastructure and low carbon energy alternatives.

Increased flexibility and efficiency in the system through enhanced energy storage and the development of smart energy systems.

Environmental Context:

The 2013 revision of the Electricity Generation Policy Statement and the Renewables Routemap set the pathway for the delivery of at least 100% of gross electricity consumption from renewables by 2020. The National Marine Plan and Sectoral Plans for Renewables include provisions relating to energy development in Scottish territorial waters.

The Community Energy Policy Statement was also aimed at increasing renewable energy generation and promotion of community and local energy projects.

The NPF3 stated that planning must facilitate the transition to a low carbon economy, and should deliver the aims of Scotland's low carbon ambitions and the RPP programme.

Constraints:

The UK Government position and market forces are likely to be the primary influences on the development and implementation of new technologies.

Cost implications in the development of new technologies and roll-out of CCS.

Government subsidies not devolved to Scotland.

Grid capacity to accommodate future expansion

Summary of Findings

Energy generation and supply has the potential for environmental effects, from existing and historically important sources, and new and emerging technologies. The likelihood, type and significance of environmental effects of these technologies can vary. A shift towards low carbon energy generation could contribute significantly to meeting Scotland's GHG emissions targets (**climatic factors**). In turn, reducing impacts of climate change on the environment and reducing atmospheric pollution, could bring wider benefits to a number of environmental topics including **air, water, biodiversity, soil, cultural heritage and landscape and population and human health**. Given the continuing role for oil and gas as part of a managed transition, technologies such as CCS which could help to reduce some of the adverse environmental impacts of this sector on **air, climatic factors, population and human health**.

Overall Significant Impacts

↑ Climatic factors, Population and human health, Air quality, Material assets

↓ Soil

The transition to new energy sources and systems could present challenges to current energy networks and infrastructure. For example, shifting to hydrogen gas as a source of heat could accelerate planned upgrades to the gas grid. This could be coupled with a need for consumers to replace domestic appliances to ensure that they are suitable for use with hydrogen gas, with likely impacts on **population, human health and material assets**. While increased use of biofuels and electric vehicles in transport is likely to reduce energy demand from traditional supplies, this could have other implications. For example, consideration would need to be given to the production of biofuel feedstocks and the generation of additional electricity to meet growing demand from electric vehicles (**material assets**).

Sharing of good practice could result in further decentralisation of energy supply, and provide greater system flexibility and security of supply (with positive **population** and **human health** effects). Further decentralisation of energy generation could reduce existing pressures on network infrastructure, improve resilience of the sector to future change, and enable the network to be progressively upgraded and expanded as required, to ensure security of supply into the future. Enabling small-scale and community energy producers to feed power into the national grid could lead to benefits for **climatic factors** and **material assets**. Systems and technologies such as Active Network Management, and other smart technology, alongside energy storage should offer greater system flexibility, helping to manage fluctuations in energy demand, reducing pressure on current networks and infrastructure. Greater capacity for energy storage in particular should offer greater flexibility in how energy is used and the type of energy technologies that can be utilised. In some instances, there may be implications arising from the development of the necessary infrastructure required to facilitate changes in demand (**material assets**). For example, this is likely to become increasingly important in managing likely increases in electricity demand from further growth in electric vehicle use, and ensuring its delivery to consumers when it is needed.

All energy technologies have the potential for some adverse environmental effects arising from both construction and operation. For example, the implementation of offshore wind and marine renewable technologies could have direct and indirect impacts from the siting and operation of infrastructure in Scotland's coastal and marine environments; impacting on **air, soil, water, biodiversity, cultural heritage, landscape/seascape and population and human health**. Similarly, the use of hydrogen gas as an energy source could help to reduce GHG emissions if used with CCS technologies, but the development of the required infrastructure may have environmental effects on **human health, air, soil, water, biodiversity, cultural heritage and landscape**. Technological advancement presents further opportunities to improve efficiencies in energy generation over the short to long-term. Whilst the deployment of technologies such as repowering with new, more efficient wind turbines and implementation of CCS are likely to present new challenges, the use of existing infrastructure and connections (**material assets and landscape**) could also help to reduce the likelihood of negative effects, particularly during the construction phase.

However, many of the environmental effects identified for the different technologies require further consideration through planning and associated consenting regimes. Many could be avoided or at least mitigated through appropriate siting, design, and site management practices during the construction phase.

Key Findings:

- The policies and proposals are likely to contribute to meeting GHG emissions reduction targets and increase resource security.
- Technologies such as CCS could help to reduce GHG emissions.
- There is potential for adverse effects arising from the construction of infrastructure for additional low carbon energy sources. However, the potential for any such impacts will be considered as appropriate under relevant assessment and regulatory regimes.

Transforming Scotland's Energy Use

Objectives

Addressing the need to reduce demand and increase efficiency.

Getting the best deal for energy consumers, harnessing smart technology in the home.

Shifting patterns of transport use, adopting new technologies to support low carbon mobility services.

The manufacturing and industrial sectors delivering enhanced competitiveness and improved energy efficiency.

Opportunities:

Active consumer engagement leading to better management of energy consumption.

Creation of a Scottish market and supply chain for energy efficiency services and technologies.

Investment in more energy efficient domestic and non-domestic building stock could result in warmer, more comfortable living and working environments with wider health and social benefits.

Reducing the cost of energy, thereby reducing inequality and fuel poverty.

Decarbonisation of the transport sector, leading to improvements in air quality.

Environmental Context:

Scotland's Economic Strategy sets out overarching aims for increased sustainable economic growth for industry, supported by a range of sector-specific policies and strategies.

The Infrastructure Investment Plan 2015 and Conserve and Save: The Energy Efficiency Action Plan for Scotland sets out wide ranging programmes targeting activity on behaviour change, household, business and public sector energy efficiency and investment in infrastructure in a low carbon economy.

Scotland's Transport Strategy included high level objective seeking efficient and sustainable transport, minimising emissions and consumption of resources and energy.

National policy such as the NPF3 also reflect ambitions to reduce energy demand across Scotland, and aims to change how we travel and ensure infrastructure is in place to facilitate decarbonisation of the sector.

Constraints:

Requires a significant shift in societal attitudes and the way we live our lives

Collaboration will be required between business, industry and public sector.

Initial cost implications for businesses.

Requires significant investment in infrastructure, particularly in relation to alternative transport fuels.

Summary of Findings

Overall Significant Impacts

Climatic factors, Population and human health, Air quality, Material assets

The assessment broadly identified positive environmental effects from this group of ambitions and priorities, especially against **climatic factors and material assets**. In particular, reducing overall energy demand from domestic and industrial sectors and improving the management of the resources that supply energy are likely to be beneficial. The importance of optimising Scotland's energy resources and reducing pressures on network and distribution infrastructure were also identified, alongside ensuring the sectoral resilience to the challenges of climate change for energy generation and supply.

There is the potential for the sector to make a significant contribution to climatic factors by reducing GHG emissions, through a successful transition to low carbon energy use and improving energy efficiency. Benefits for **human health and population** are also expected from improved air quality associated with a reduction in the emissions generated by the use of fossil fuels, active and low carbon travel options. Improving the energy efficiency of Scottish homes is also likely to reduce energy demand, and could provide more energy efficient, cost effective and warmer housing stock, and help people who are susceptible to health concerns associated with poor **air quality**, leading to benefits for **population and human health**.

Technologies that will provide consumers with greater information on their energy consumption could also benefit **population and human health**. This could help consumers and communities to become more active in the energy market and take greater control over their energy use, helping to reduce demand. These benefits could have the greatest effect in more vulnerable sections of the population. The use of innovative technologies such as smart meters and improving the flexibility of the system to cater for variations in energy demand, and further decentralising energy production, could reduce pressure on existing supply and distribution networks and improve longer term resilience to climate change impacts (**material assets**).

Policies that lead to infrastructure and construction works (**material assets**) could lead to direct and indirect, temporary and long-term impacts on a number or environmental receptors, including **soil, air, water, biodiversity, population and human health**. The significance of these would however depend on where and how construction occurred. Retrofitting works, such as the implementation of efficiency technologies in existing building stock, could also affect the visual appearance of a building or impact on its setting and impact on landscape and cultural heritage. The addition of infrastructure on roofs and works undertaken in roof cavities can have implications for fauna, such as bats (**biodiversity, flora and fauna**). Changing fuels and the use of alternative energy sources could increase demand for these sources, which in turn will require that infrastructure is in place to facilitate an increase in demand (**material assets**).

These identified impacts are likely to be largely localised and in many cases temporary. Their significance would depend on factors such as the size and scale of the proposed works, the presence of biodiversity such as bats, and the type and status of the building in conjunction with its location and setting. Effects will be considered under existing mechanisms, such as consenting processes, including licences for the management of bats and/or undertaking EIA and/or HRA. In many instances, impacts would be managed as appropriate through the use of appropriate design and construction management measures; for example, co-ordination of works to minimise disruption and the implementation of Environmental Management Plans at the project level.

In many instances, the national and local significance of impacts will be influenced by successful uptake and the promotion of the ambitions and priorities that the draft Strategy sets out.

Key Findings:

- The policies and proposals are likely to contribute to meeting GHG emissions reduction targets by improving energy efficiency, reducing energy demand and shifting patterns of transport use.
- There is an opportunity to improve Scotland's housing stock, helping to reduce inequality and fuel poverty.
- Many of the potential adverse effects are related to infrastructure development, and are likely to be considered under existing mechanisms such as the planning or consenting process, EIA and HRA, amongst others.

Delivering Smart, Local Energy Systems

Objectives

To encourage the development of new low carbon energy and heat projects at a local / community level

Collaboration between stakeholders from the public and private sectors and from local communities to enable the effective delivery of decentralised energy provision and local electricity and heat solutions.

Opportunities:

Decarbonisation and decentralisation of heat and electricity generation.

Empowerment of local communities through ownership of energy schemes could bring reduced energy costs.

Addressing barriers that some communities face in areas of constrained electricity networks.

Environmental Context:

2013 revision of the Electricity Generation Policy Statement and the Renewables Routemap set the pathway for the delivery of at least 100% of gross electricity consumption from renewables by 2020.

The Community Energy Policy Statement was also aimed at increasing renewable energy generation and promotion of community and local energy projects.

Constraints:

Uncertainty on the future of UK Government subsidies.

Upfront cost implications for development of community energy schemes.

Potential grid capacity issues.

Collaboration between a variety of stakeholders is essential to success.

Summary of Findings

The assessment identified the potential for positive environmental effects from this group of ambitions and priorities. Mirroring those set out under the heading of Scotland's Energy use, this group is focused on reducing demand for energy and ensuring that networks and markets are capable of facilitating the continued evolution in how energy in Scotland is supplied. It also seeks to increase the volume of local and community renewable energy generation projects.

Overall Significant Impacts

Climatic factors, Population and human health, Air quality, Material assets

Empowering communities to participate in generating energy at a local level will better engage consumers with how energy is used and produced. This could present an opportunity to future-proof Scotland's energy supply and enhance resilience against future pressures (**material assets**).

The assessment identified the potential for a significant reduction in GHG emissions and improved air quality, primarily associated with reducing the amount of energy generated from traditional resources, with benefits to climatic factors and air quality. However, this would depend on the energy requirements of specific areas. There could be particular benefits for **population and human health** arising from an improvement in air quality. The introduction of greater system flexibility and resilience, and increased community involvement in energy generation, could help to enhance the security and resilience of supply. In turn, this should help reduce energy demand through increased efficiency of use. This may be beneficial to sections of the population (**population and human health**).

Largely localised direct and cumulative impacts could arise from the increased development of smaller energy schemes and networks, including on **landscape / townscape and cultural heritage**. There are also likely to be short-term impacts on a range of environmental receptors from construction works and site operations if not appropriately managed (**population and human health, air, soil, biodiversity and water**). The significance of any such impacts will depend on the nature, scale and distribution of these works. The potential for adverse effects could be further managed through existing mechanisms such as planning, appropriate design controls, and the implementation of appropriate on-site construction management.

Key Findings:

- The measures are likely to contribute to meeting GHG emissions reduction targets and increasing resource security through decentralising energy generation and increasing the provision of renewable and low carbon energy sources.
- This presents an opportunity for a co-ordinated, area-based approach to the implementation of new heat and energy networks and targeted action for energy efficiency on an area based approach.
- Scheme/infrastructure development could have potential adverse effects that would be considered and addressed under existing mechanisms such as the planning process.

6.3 Draft Energy Strategy - Summary of Likely Environmental Impacts

Primary environmental effects

6.3.1 It is expected that the draft Strategy will lead to a number of significant positive effects. In particular, significant benefits in reducing GHG emissions and increasing adaptation to climate change are expected.

6.3.2 The 'whole systems' approach to energy generation and use set out in the draft Strategy provides an opportunity to maximise benefits that may not be realised by a piecemeal incremental approach. This integrated approach builds on current strengths and has been informed by the development of the draft Climate Change Plan.

6.3.3 Improving the energy efficiency of Scotland's homes and buildings in the commercial, public and industrial sectors was recognised as a National Infrastructure Priority in 2015[122]. Many of the benefits of the draft Strategy and the integrated 'whole systems' approach are best demonstrated through the inclusion of SEEP. The programme of energy efficiency measures builds on previous action, expanding it to consider both domestic and non-domestic (industrial and commercial use) buildings. This is of particular relevance given that together, domestic and non-domestic use accounted for around half of energy consumption in 2013[123]. As such, the renewed focus given to energy efficiency in the draft Strategy through measures such as this and a proposal to set a new 2030 energy efficiency target should be help to reduce GHG emissions across these key areas.

6.3.4 As heat represents over half of all energy use in Scotland, heat efficiency measures will play a significant role in the reduction of energy use. Heat is integral to many industrial processes and there is potential for significant carbon savings from employing technologies and systems that recover excess heat from industrial processes[124]. As such, support in the draft Strategy for schemes such as the District Heating Loan Fund (DHLF), Low Carbon Infrastructure Transition Programme (LCITP) and potential new Local Heat and Energy Efficiency Strategies which, alongside SEEP, could play significant roles in both reducing consumption and facilitating the uptake of local low carbon energy production. The LCITP and the Community and Renewable Energy Scheme (CARES) should also help to promote the increased uptake of energy storage

[122] The Scottish Government (2015) Infrastructure Investment Plan 2015 [online] Available at: http://www.gov.scot/Resource/0049/00491180.pdf (accessed 07/12/2016)

[123] Scottish Government (2016) Energy in Scotland 2016 [online] Available at: http://www.gov.scot/Resource/0050/00501041.pdf (accessed 26/11/2016)

[124] The Scottish Government (2014) SEA Environmental Report on the Draft Heat Generation Policy Statement: Towards Decarbonising Heat: Maximising the Opportunities for Scotland [online] Available at: http://www.gov.scot/Publications/2014/03/7673 (Accessed 26/11/2016)

solutions and smart grids that are likely to play an increasingly important role in facilitating local and community energy generation.

6.3.5 Emphasis on smart networks and smart meters will offer important opportunities for consumers to better manage their energy use and inform their choice of supply. It could also help to incorporate energy storage within community and local energy generation projects to optimise local energy systems[125]. The delivery of smart local energy focused on local needs should therefore help to optimise demand and increase energy efficiency across the network, and so secondary environmental benefits could be expected. Support given by the draft Strategy to increase flexibility, efficiency and resilience of the energy sector as a whole should be beneficial to achieving this. Manifesto commitments, such as exploring the role of a Government Owned Energy Company and the creation of a Scottish Green Energy Bond are expected to provide further support for renewable energy projects, which in turn could lead to wider environmental effects.

6.3.6 Greater diversity and flexibility in the mix of energy technologies will be required over the long-term to meet the challenges of decarbonising Scotland's energy sector. The policies and proposals set out in the draft Strategy will influence this in a number of ways. For example, the proposal for setting an ambitious new "all energy" target for the equivalent of 50% of Scotland's heat, transport and electricity consumption to be supplied from renewable sources by 2030. This has the potential to influence the uptake of renewable technologies, some of which could impact on a range of environmental receptors during construction, and in some instances, during operational phases. For example, the siting and operation of renewable projects in the marine environment can have a range of negative effects on biodiversity and fauna and landscape/seascape, amongst others. Potential negative impacts can also arise through the displacement of other users of the marine environment.

6.3.7 Whilst providing continuing support for existing energy sources, the draft Strategy also provides an opportunity to explore the potential deployment of new emerging energy sources and technologies. Some of these have the potential to make a significant contribution to reducing GHG emissions. For example, CCS can capture up to 90% of the CO_2 emissions produced from the use of fossil fuels in electricity generation and industrial processes[126]. The use of CCS could enable traditional energy supplies to continue to play an important role in a diverse and balanced energy mix. Hydrogen also has the potential to play an increasingly important role as a clean, reliable, quiet and efficient source of high quality energy[127]. By supporting and exploring opportunities for

[125] DECC (2012) Electricity System – assessment of future challenges – summary [online] Available at: https://www.gov.uk/government/publications/electricity-system-assessment-of-future-challenges (accessed 29/11/2016)

[126] Carbon Capture and Storage Association (2016) What is CSS? [online] Available at: http://www.ccsassociation.org/what-is-ccs/ (accessed 27/10/2016)

[127] Environmental and Energy Study Institute (undated) Hydrogen Fuel Cells [online] Available at: http://www.eesi.org/topics/hydrogen-fuel-cells/description (accessed 27/10/2016)

new energy sources and technologies such as these, including through demonstration projects, the draft Strategy has the potential to aid their future deployment and use, with likely reductions in GHG emissions.

6.3.8 However, consideration will need to be given to any infrastructure requirements that may be required to facilitate the deployment of new technologies, and to the mitigation of any negative environmental effects that may arise through their operation. For example, there are a number of negative environmental effects that can arise from the use of CCS, the largest risk being from potential leakages of CO_2 during operation and post-closure phases[128].

Secondary Impacts

6.3.9 As discussed above, new low carbon development and projects will have some level of infrastructure requirements, whether for large-scale deployment or for local generation. In some instances, existing infrastructure may be reused, such as the potential to use oil and gas pipelines for CCS. New infrastructure is also likely to be required to facilitate the decarbonisation of heat and transport sectors, including recharging infrastructure for the electric and plug in hybrid vehicles market[129]. While the draft Strategy seeks to integrate these infrastructure requirements where possible, there is potential for environmental impacts associated with many such works that will require careful planning and management through applicable consenting regimes.

6.3.10 The decarbonisation of energy generation and use, such as the electrification of transport, has the potential to have positive effects for air quality and, in turn, human health. Alongside this, the implementation of action supporting energy efficiency measures and the uptake of low carbon heat technologies could deliver positive effects for human health, particularly if targeted at the vulnerable. Additionally, the use of smarter networks, more active consumer engagement and increased uptake new technologies such as smart meters could have benefits for consumers in providing greater control and flexibility in energy use, which could result in greater energy efficiencies and associated reductions in GHG emissions.

[128] Environment Agency (2011) Scoping the environmental impacts of carbon capture, transport and storage [online] Available at: http://uk.practicallaw.com/6-507-4993?source=relatedcontent (accessed 27/10/2016)

[129] Transport Scotland (2013) Switched On Scotland: A Roadmap to Widespread Adoption of Plug in Vehicles [online] Available at: http://www.transport.gov.scot/report/j272736-06.htm (accessed 28/10/2016)

6.4 Summary of the Assessment Findings for draft Plan and draft Strategy

Introduction

6.4.1 The following paragraphs set out the potential cumulative and in-combination effects likely to arise from the draft Plan and draft Strategy. The findings presented in this section have been informed by the previous stages of the assessment process.

Question 1: How will the draft Plan and draft Strategy contribute to meeting Scotland's climate change commitments?

6.4.2 The policies and proposals set out in the draft Plan and draft Strategy are expected to make a significant contribution to Scotland's commitment to GHG reduction targets. Scotland's ambitious climate change targets cannot be met by one sector alone - effort is required across all sectors.

6.4.3 Many of the policies and proposals set out in the draft Plan and draft Strategy build on existing measures aimed at reducing GHG emissions. Individually, the extent to which the policies and proposals contribute to these targets varies. However, by developing them collectively and in-combination, their effects will be optimised. For example, measures aimed at promoting energy efficiency within residential and business sectors will be complemented by those that provide information or financial mechanisms to facilitate their uptake.

6.4.4 The majority of policies and proposals covering the energy system focus on the decarbonisation of energy supply, the increased uptake of renewable and low carbon technologies, and improving energy efficiency. Reducing overall energy demand, improving the efficiency of energy generation, and increasing low carbon generation, could make a significant contribution to meeting the climate change targets.

6.4.5 Land management can also play a fundamental role in reducing GHG emissions. Policies and proposals, such as those that relate to peat and the forestry and agricultural sectors, will help to reduce emissions and support adaptation.

6.4.6 The continued development of renewable and low carbon technologies will support decarbonisation of the energy sector, complemented by energy storage and new and emerging technologies, such as hydrogen and CCS. These technologies will continue to be supported by the oil and gas sector in the first instance, but will, over time, play a fundamental role in in the creation of a largely decarbonised, resilient and flexible energy system. A broad mix of

technologies will be required to enable the stable and managed transition to decarbonisation.

6.4.7 The policies and proposals set out in the draft Plan and draft Strategy also support wider Scottish Government objectives. For example, some seek to improve health by encouraging active travel and providing for warmer, more energy efficient housing stock. Measures related to land use, such as climate friendly farming, peatland restoration and the creation of woodlands should help to reduce GHG emissions and sequestrate carbon, they are also likely to have additional benefits; for example, for biodiversity, flora and fauna.

Question 2: How will the draft Plan and draft Strategy contribute to climate change adaptation?

6.4.8 The energy sector faces major challenges from climate change and it is reported that without strong mitigation policies, the global average temperature is likely to rise above the internationally agreed 2°C target[130]. To deal with these challenges the energy sector must be more resilient and make efforts to adapt to climate change[131].

6.4.9 Progressive increases in temperature, growth in the number and severity of extreme weather events and changing precipitation patterns will affect energy production and delivery[132]. Flooding and coastal change risks to infrastructure are two of the key areas of inter-related climate change risks identified for the UK[133]. Ensuring appropriate, resilient infrastructure is in place will play a key role in ensuring security of supply and decarbonising our energy systems.

6.4.10 Support for local and community owned low carbon technologies could have benefits by displacing energy generated from traditional sources, reducing demand and pressure on existing networks, ensuring greater flexibility and

[130] University of Cambridge, World Energy Council (2014) Climate Change: Implications for the Energy Sector, Key Findings from the Intergovernmental Panel on Climate Change Fifth Assessment Report [online] Available at: http://www.cisl.cam.ac.uk/business-action/low-carbon-transformation/ipcc-climate-science-business-briefings/pdfs/briefings/IPCC_AR5__Implications_for_Energy__Briefing__WEB_EN.pdf (accessed 22/11/2016)

[131] International energy Agency (2015) Making the energy sector more resilient to climate change [online] Available at: https://www.iea.org/publications/freepublications/publication/making-the-energy-sector-more-resilient-to-climate-change.html (accessed 22/11/2016).

[132] University of Cambridge, World Energy Council (2014) Climate Change: Implications for the Energy Sector, Key Findings from the Intergovernmental Panel on Climate Change Fifth Assessment Report [online] Available at: http://www.cisl.cam.ac.uk/business-action/low-carbon-transformation/ipcc-climate-science-business-briefings/pdfs/briefings/IPCC_AR5__Implications_for_Energy__Briefing__WEB_EN.pdf (accessed 22/11/2016)

[133] Committee on Climate Change (2016) UK Climate Change Risk Assessment 2017 [online] Available at: https://www.theccc.org.uk/uk-climate-change-risk-assessment-2017/ (accessed 29/09/16)

improving security of supply. Energy storage could play a similar role, generating similar benefits.

6.4.11 Ensuring the energy system can respond to projected increases in demand over the longer term will be challenging, particularly for electricity. Policies and proposals setting out the establishment of smart grids, active network management and demand side response will be important. These measures can be used to provide a smarter energy system, introduce greater system flexibility and help balance energy demand and supply; all of which are expected to be important in order to meet the future challenges to energy supply and transmission.

6.4.12 Active network management can also help identify network losses, stabilise the system and detect faults[134]. It has been reported that up to 65% of future climate related losses can be averted using cost effective adaptation measures/adaptive practices[135].

6.4.13 Whilst not focused specifically on climate change adaption, many of the policies and proposals could support this. For example, improvements in the energy efficiency of housing stock, reducing energy demand and consumption and improving the resilience of energy infrastructure. Other proposals and policies relating to land use, such as woodland creation, climate friendly farming and restoration of peatlands will also provide opportunities for adaptation. For example, the use of trees in riparian areas can assist as natural flood management measures. Conversely, land use may also be influenced by the impacts of climate change through predicted changes in growing seasons and the increased risk of introduction and spread of invasive, non-native species and diseases.

Question 3: Are the policies and proposals set out in the draft Plan and draft Strategy likely to improve air quality and population and human health?

6.4.14 Many of the policies and proposals set out in the draft Plan and draft Strategy are likely to have significant benefits for air quality in Scotland, with further benefits for population and human health. Air pollution often originates from the same activities that contribute to climate change, notably transport and energy generation and poor air quality can have implications for population and human

[134] Scottish and Southern Electricity Networks (undated) What is Active Network Management [online] Available at: https://www.ninessmartgrid.co.uk/our-trials/active-network-management/what-is-active-network-management/ (accessed 31/10/2016)

[135] International energy Agency (2015) Making the energy sector more resilient to climate change [online] Available at: https://www.iea.org/publications/freepublications/publication/making-the-energy-sector-more-resilient-to-climate-change.html (accessed 22/11/2016).

health. Reducing emissions from these sources is therefore likely to improve air quality at a local and national level.

6.4.15 Transport emissions are the primary cause of air pollution in Scotland and have resulted in a number of urban locations being designated as Air Quality Management Areas. Policies and proposals related to the decarbonisation of the transport sector will therefore make a significant contribution to improving air quality in Scotland. In turn, this is likely to lead to positive benefits for human health. Additionally, measures aimed at encouraging a shift from vehicle use to active travel, such as walking and cycling, are likely to have additional health benefits by increasing physical activity and helping to improve mental wellbeing. The benefits of these policies and proposals are likely to be of greater significance where air quality problems already exist and further reduce adverse effects on human health, particularly in urban areas.

6.4.16 The overarching theme of energy efficiency is central to the draft Plan and draft Strategy, and is an integral component of many of the policies and proposals they set out. This should be beneficial for population and human health, and could be particularly significant for vulnerable members of society with existing health complications such as respiratory issues. Further benefits are also likely through increasing energy efficiency in housing stock, and making buildings more resilient to the predicted effects of climate change.

6.4.17 Policies and proposals promoting the decentralisation of energy and increased uptake of heat and electricity generation at local level are likely to have overall benefits for population and human health. Network reliability may be improved by the increased use of energy storage schemes and from upgrading energy infrastructure. The delivery of smart local energy solutions and smart networks should also increase flexibility for energy customers, increase awareness of consumption and increase customers' ability to reduce their energy bills through demand side response.

6.4.18 Technologies such as CCS could help to contribute to significant reductions in air pollution; particularly if utilised on a commercial scale. While this could have positive effects for human health, any air quality and health benefits will be influenced by the specific CCS utilised and the industries for which this technology is used.

6.4.19 Construction activities arising from infrastructure and improvements to building fabric could result in short-term negative effects. These are most likely to be related to nuisance such as dust, noise, vibration or visual impact, and are likely to be localised and temporary. In many instances, adverse impacts may be mitigated through a combination of appropriate siting and design, local consultation and engagement and on-site management measures.

Question 4: What are the likely implications of the draft Plan and draft Strategy in terms of infrastructure?

6.4.20 Infrastructure is likely to play an important role in delivering the many of the policies and proposals set out in the draft Plan. More specifically, the overarching ambition of many of the policies and proposals in the draft Strategy is to improve energy efficiency at the point of use and to reduce overall energy demand. If widely implemented, this should reduce pressure on existing energy infrastructure and help to optimise the use of energy resources. There will be a need for greater flexibility and appropriate infrastructure to facilitate a transition to a decarbonised energy sector.

6.4.21 The demand for electricity is expected to rise significantly as a result of the electrification of transport and heat, together with the increased penetration of decentralised and distributed generation[136]. This will pose new challenges for distribution networks[137]. Additionally, policies and proposals set out in the draft Strategy are likely to influence the uptake of energy technologies; for example, through the proposed introduction of a new "all energy" renewables target by 2030.

6.4.22 The emergence of new energy technologies and expansion of existing ones will come with some level of infrastructure requirements, whether for large-scale or local generation, and these requirements will differ depending on technology. Requirements may also be greater for relatively new energy technologies. For example, apart from a number of small-scale operations, there is presently little infrastructure in place to support greater use of hydrogen. This will be particularly relevant as the large-scale production of hydrogen for use in fuel cells and as a heating fuel is expected to require the implementation of CCS to minimise the emission of GHG in this process. In some instances, existing infrastructure may be reused, such as the potential use of existing oil and gas infrastructure for CCS. Additionally, repowering of existing wind farms could have benefits through the use of existing infrastructure, such as roads and grid connections.

6.4.23 Consideration will need to be given to the infrastructure requirements likely to be needed to facilitate many of the ambitions of the draft Plan and draft Strategy. This will likely be of particular relevance where new technologies and energy sources are explored, and potentially begin to play an increasingly

[136] DECC (2012) Electricity System – assessment of future challenges – summary [online] Available at: https://www.gov.uk/government/publications/electricity-system-assessment-of-future-challenges (accessed 29/11/2016)

[137] DECC (2012) Electricity System – assessment of future challenges – summary [online] Available at: https://www.gov.uk/government/publications/electricity-system-assessment-of-future-challenges (accessed 29/11/2016)

important role as part of Scotland's energy mix. Beyond the energy sector, consideration will need to be given to the potential for environmental effects arising from any infrastructure requirements needed to deliver policies and proposals. For example, the development of freight consolidation centres could lead to localised environmental impacts.

6.4.24 Smart grids, active network management, energy storage and demand-side response are expected to play an increasingly important role in improving system flexibility, and should help to manage fluctuations in energy production and demand. Together, these should help to optimise the use of existing infrastructure and resources, and potentially reduce network stress. This in turn will help to minimise the environmental effects arising from new infrastructure.

6.4.25 Looking beyond the energy sector, many other policies and proposals will likely benefit existing infrastructure. For example, ambitions to reduce travel journeys by car, shift road freight to rail, and to improve traffic management could significantly reduce pressure on Scotland's road infrastructure. The continued implementation of circular economy principles should reduce landfill waste and reduce the need for landfill infrastructure. Additionally, the implementation of targeted programmes such as SEEP will help to improve both domestic and non-domestic building stock, with overall benefits for Scotland's built environment.

Question 5: Are the policies and proposals set out in the draft Plan and draft Strategy likely to have indirect or secondary environmental effects?

6.4.26 The assessment identified the potential for a range of indirect environmental effects to arise from the implementation of policies and proposals in the draft Plan and draft Strategy. A number of these relate to the potential for negative impacts that can arise as a result of construction and development work, and the presence of infrastructure. These have the potential to be either short term or long term impacts and can affect a number of environmental receptors, such as soil, water, air and biodiversity. Other impacts from construction works include noise and vibration disturbance of nearby biodiversity and people, visual impacts and air quality effects. In some instances, negative impacts can arise through operational activities, such as the potential for noise disturbance arising from heat pumps[138]. The presence of new or replacement of existing infrastructure could also have environmental effects. For example, the repowering of wind turbines with larger, more efficient turbines could increase collision risk for some bird species.

[138] The Scottish Government (2014) SEA Environmental Report on the Draft Heat Generation Policy Statement: Towards Decarbonising Heat: Maximising the Opportunities for Scotland [online] Available at: http://www.gov.scot/Publications/2014/03/7673 (Accessed 26/10/2016)

6.4.27 Visual effects can arise from the uptake of technologies at both national and local scale including through changes in land use. In some instances the effects can be mixed, for example, forest and woodland planting. The significance of impact will also be influenced by factors such as the scale of change. For example, onshore and offshore wind or marine renewables can have large visual envelopes and thus potential to impact on landscape and seascape.

6.4.28 The installation of energy efficiency measures on existing domestic and non-domestic building stock could also have adverse effects. For example, where this involves work to the fabric of buildings there is potential for impacts on buildings of historic and cultural significance. In some circumstances, this could also have visual, landscape and/or townscape effects. Specific works, such as those on roofs or in roof cavities, may also have the potential for negative effects on biodiversity.

6.4.29 Secondary benefits are also likely to arise on a range of environmental topics through the predicted reduction in GHG emissions. Climate change has been identified as a primary pressure on many environmental receptors including soil, water and biodiversity. As such, it is likely that the implementation of the draft Plan and draft Strategy will help to reduce the pressures of a changing climate.

Question 6: How can these potential effects be effectively managed, mitigated or enhanced?

6.4.30 The draft Plan and draft Strategy set out a series of climate change mitigation measures. The ambitions, policies and proposals aim to meet Scotland's climate change commitments whilst improving energy security and delivering on a wider range of policy objectives. They are also likely to have beneficial impacts for adapting to and improving resilience to the predicted effects of climate change. Reducing demand for energy is a key component of both, and if widely implemented, should help to manage Scotland's energy systems more effectively, and reduce the need for additional energy and associated infrastructure.

6.4.31 While there will be clear benefits, the potential for adverse environmental effects were also noted. In particular, adverse effects could arise from the development of new, or the upgrade of existing, infrastructure.

6.4.32 Potential environmental effects associated with the large scale application of some technologies will be addressed as appropriate at a project level. For example, infrastructure for offshore renewables and CCS, repowering of onshore and offshore wind renewables, the construction and operation of transport infrastructure, and the installation of domestic heat pumps, will be

considered where required under existing mechanisms such as the energy consents and planning, marine licensing, EIA and HRA. The development of more specific plans, programmes and strategies with infrastructure implications will also require consideration under the Environmental Assessment (Scotland) Act 2005, if they are likely to have significant environmental effects.

6.4.33 The potential for negative impacts on some aspects of the built environment was also noted. In particular, specific impacts will arise from retrofitting older buildings to improve energy efficiency, including undertaking works in roof spaces and attics. Existing mechanisms such as the planning process, EIA, HRA, and regulations relating to the management of protected species, will manage the potential for environmental effects prior to works commencing. An area based co-ordinated approach such as that promoted by SEEP, will also help to mitigate this potential impact through the consideration of cumulative impacts. This will be particularly relevant in areas that are designated for their cultural heritage.

6.4.34 The potential for adverse impacts from the construction and operation of new energy developments will be further managed through the use of appropriate design and construction management measures at the project level. This should include, where appropriate, Environmental Management Plans. Existing regulatory regimes should ensure that any development projects will be subject to appropriate controls, minimising the potential impacts of activities and infrastructure.

6.4.35 The assessment also identified a need for consideration to be given to the sources of heat used in district heating systems, and that some technologies can have negative implications at both the point of use and in the supply chain. For example, care should be taken in ensuring that the production of feed stocks for biomass is able to meet demand, and that the sourcing and management of any feedstocks used is undertaken sustainably.

Question 7: How have alternatives to the draft plan and draft Strategy been considered in this assessment and what potential environmental effects have been identified?

Climate Change Plan and Reasonable Alternatives

6.4.36 There is much common ground between the policies and proposals set out in the draft Plan and those put forward by the Committee on Climate Change. It is therefore unsurprising that if implemented, the High Ambition Scenario[139] would be expected to deliver primarily positive environmental effects, including similar overall reductions in Scottish GHG emissions to those set out in the draft Plan[140].

6.4.37 When looking at some sectors in isolation, the Committee's High Ambition Scenario could result in further reductions in GHG emissions over a shorter timeframe. For example, the recommendation for higher rate of tree planting (to 16,000 hectares per year compared to 15,000 hectares set out in the draft Plan) would accelerate improvements in Scotland's carbon sequestration potential. Similarly, having stronger levers than those currently in place in the agriculture sector could help to achieve further reductions in GHG emissions in a shorter timeframe, and accelerate any associated environmental benefits; for soil as one example.

6.4.38 Benefits for air quality, population and human health would be likely from this High Ambition alternative, including particularly through measures such as the accelerated take-up of ultra-low emissions vehicles on urban roads (65% of new purchases by 2030) compared to those set out in the draft Plan. These measures, and others, could help to build on existing measures and secure accelerated reductions in GHG emissions.

6.4.39 However, the adoption of the Committee's High Ambition Scenario could also have the potential for adverse environmental effects. In particular, environmental impacts associated with infrastructure requirements in taking forward certain aspects of the scenario in a shorter timeframe would be greater. For example, greater take up of new ultra-low emissions vehicles will increase electricity demand, and could necessitate the need for new and upgraded

[139] Committee on Climate Change (2016) Scotland's emissions targets 2028 – 2032, The high ambition pathway towards a low-carbon economy, March 2016 [online] Available at: https://documents.theccc.org.uk/wp-content/uploads/2016/03/Scottish-Emissions-Targets-2028-2032.pdf (06/12/2016)

[140] The overall reductions under the Committee's High Ambition Scenario are slightly less ambitious than those under the draft Plan. This is because the draft Plan is required to meet the legislated targets out to 2032, which in turn fulfil the requirements of the 2009 Act. As described in Section 2, these statutory requirements lead to slightly deeper emission reductions than does the Committee's modelling scenario.

infrastructure over a shorter timeframe than that predicted in the draft Plan, and potentially realising adverse environmental effects in the shorter term.

Energy Strategy and Reasonable Alternatives

Renewable Energy Target

6.4.40 As set out in Table 6.1, a target of the equivalent of 50% of Scotland's energy requirements to be met by renewable sources by 2030 is considered in the draft Strategy. This level of renewable energy is in line with TIMES modelling prepared for the Climate Change Plan, and as such, the likely environmental effects are similar to those predicted for the draft Plan.

6.4.41 This target builds upon the commitments set out under existing targets including 30% of total energy consumption generated from renewables by 2020. This new target could place additional focus and commitment to the growing role of renewable energy in the decarbonisation of Scotland's future energy mix beyond 2020. As a result, it should lead to wider and potentially further enhancement of significant positive environmental effects compared to the 'business as usual' alternative.

6.4.42 Whether this target was developed or not, additional electricity will be needed to meet a projected future increase in demand, particularly from policies and proposals seeking to increase the uptake of electric vehicles in the short-medium term. It is clear new energy technologies are likely to continue to emerge and take on roles in a more diversified, lower carbon energy system, alongside further programmes aimed at improving energy efficiency and reducing demand. It is also clear that further growth in the renewables sector is likely, either through new developments or through repowering of existing generation.

6.4.43 However, there are limitations and constraints in taking forward new or emerging technologies in the short to medium-term. Some of those discussed in the draft Strategy are still in their infancy and they, along with the necessary infrastructure, are expected to be developed over a longer timescale. For example, hydrogen powered vehicles are unlikely to attain a significant market share in the short-to-medium term. The potential environmental effects of the growth and emergence of these have already been discussed.

6.4.44 Without this new target, it is expected that the overarching ambition would continue to be on the progressive decarbonisation of Scotland's energy system. The focus would continue to be towards reducing GHG emissions from the current energy system and the development of new low carbon energy technologies, including the continued growth of renewables and technologies such as CCS that could help to reduce emissions in some industries.

Table 6.1 Key differences

Set ambitious target of 50% of Scotland's energy needs from renewable sources by 2030	Business as usual: No new targets set
• The new target will build upon the 2020 targets, particularly that relating to renewable energy.	• Existing targets for reducing demand, renewable energy (heat and electricity) and climate change commitments remain the focus of the sector.
• The current focus on decarbonisation of Scotland's energy system will expand, with added focus and commitment on renewable energy as an important means of decarbonising the sector.	• Growing role of, and emergence of new, lower carbon energy solutions in Scotland's.
• Opportunity for enhancement of significant positive effects through this added focus of renewables.	• Opportunity for significant positive effects through decarbonisation of Scotland's energy system.
• There is greater incentive for the uptake of renewable energy generation, and particularly the emergence of new renewable energy technologies within in Scotland's energy mix: – This would include further incentive for development of energy storage solutions to capture energy generated from renewable sources for later use (e.g. pumped storage, hydrogen fuel cells powered by renewable electricity, battery storage). – Potential for greater diversification of new energy generation technologies could reduce pressure on established renewables developments (e.g. onshore and offshore wind).	• Evolution in how energy is generated and used is likely to continue as new technologies emerge: – This would include the continued growth of the role of renewable energy generation in Scotland's energy mix. – The progressive emergence of new renewable technologies and the need for associated infrastructure.

6.4.45 The development of a new, ambitious target for renewable energy would expand this focus and influence how these ambitions could be achieved. It should result in greater deployment of low carbon energy from renewable sources to complement the existing role of oil and gas, and further support the current trajectory of renewable energy production. There is the potential for significant growth in the renewable energy sector, particularly in the emergence of new technologies, which could increase diversification of the energy system as a whole and also its renewable component.

6.4.46 Increased deployment of new and innovative renewable technologies could support electricity system flexibility and undertake a role in balancing supply and demand. For example, smart technology and storage will improve system efficiency, with the potential to further reduce GHG emissions. Opportunities to utilise renewable energy when demand is low; for example, in the production of hydrogen fuel cells or for pumped storage would also be utilised. However, consideration would have to be given to ensuring that appropriate transmission and distribution infrastructure are in place to facilitate projected growth in energy demand and to allow new generation to connect to the electricity grid.

6.4.47 As discussed throughout this assessment, the development of additional energy generation, transmission and distribution infrastructure, renewable or otherwise, has the potential for environmental effects. In particular, the potential for impacts to soil, water, air, biodiversity, landscape and cultural heritage have been identified. The increased or accelerated uptake of certain technologies has the potential for adverse environmental effects, and in some cases, could contribute to adverse cumulative or in-combination environmental effects.

6.4.48 At this stage, it would not be possible to predict with any degree of certainty where these impacts may arise spatially given the strategic nature of the draft Strategy. The environmental effects of significant new energy generation projects are likely to be assessed through EIA and/or HRA in the consenting process. In addition Strategic plans and programmes that set further and more specific ambitions for parts of the energy sector would have to be considered for their own SEA requirements under terms of the 2005 Act. These systems provide an opportunity to discuss environmental effects with greater spatial specificity.

Consideration of Underground Coal Gasification

6.4.49 In considering possible energy technologies, the SEA also discussed the potential role of Underground Coal Gasification (UCG). A technology that could be employed to exploit difficult to reach fossil fuel resources.

6.4.50 UCG is an industrial process which converts coal located in difficult to reach underground seams into synthesis gas for utilisation to supplement current natural gas supplies. On 8 October 2015, the Scottish Government put in place a moratorium on UCG (separate to the moratorium on onshore unconventional oil and gas) to allow the necessary time for full and careful consideration of the potential impacts of this new technology.

6.4.51 UCG removes the need to mine for coal and could present an alternative means of contributing to Scotland's energy mix in the future. However, it is clear that implementation of UCG would have the potential for significant negative environmental impacts across a number of receptors. Evidence collected during this process reported a number of environmental impacts, in addition to public health concerns, likely to arise if UCG were to be implemented in Scotland.

6.4.52 Controlled and uncontrolled releases to air and water, as well as waste materials removed from the combustion site, drilling materials and treated materials at the surface, and products and wastes from syngas plant operation were identified as all requiring careful consideration. Potential implications to population and human health, including emissions to surface water and potential contamination risks and health risks from exposure to combustion emissions. Risks to groundwater were also identified, highlighting the significance of local hydrological conditions[141].

6.4.53 Recently published research indicated that "there is uncertainty associated with the GHG emissions as a result of uncertainties over syngas composition and combustion efficiency". "The most likely option for power generation from UCG syngas is based on co-firing with natural gas within a combined cycle gas turbine as this is currently the most economic and carbon efficient option. "It is estimated that the UCG syngas component would result in emissions that are between 40% and 100% higher than the natural gas fed component in a combined feed power station. If simple post combustion CCS is used, then the emissions comparisons quoted above remain valid as a percentage range". While other processes such as undertaking pre-combustion CCS could help to reduce these emissions significantly, economic viability would reduce as more processes are added. For example, "the amount of power, raw materials and disposal routes for the CO_2 capture and storage become significant"[142].

6.4.54 In light of the potential risks and likelihood of environmental effects identified, the SEA supports the policy position that UCG will not be taken forward in Scotland.

6.4.55 For note: Unconventional oil and gas (hydraulic fracturing and coal bed methane) are not within the scope of this SEA. The Scottish Government placed a moratorium on onshore unconventional oil and gas on 28 January 2015 while evidence of the potential impacts and public views are gathered and considered. The Scottish Government have compiled a comprehensive evidence-base, including a report by an Independent Expert Scientific Panel, and a series of research projects exploring certain issues in more detail. The Scottish Government are committed to undertaking a full public consultation on unconventional oil and gas. The Scottish Government are also committed to undertaking all relevant statutory assessments in coming to a final position on unconventional oil and gas, including undertaking a SEA.

[141] Campbell Gemmell (2016) Independent Review of Underground Coal Gasification – Report [online] Available at : http://www.gov.scot/Publications/2016/10/2704/downloads#res507473 (accessed 25/10/2016)

[142] Atkins (2015) Underground Coal Gasification - Evidence Statement of Global Warming Potential, Prepared for DECC, 28 November 2015 [online] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/575940/Underground_Coal_Gasification___Evidence_Statement_of_Global_Warming_Potential.pdf (accessed 06/01/2017)

7 Proposals for Monitoring

7.1.1 The importance of monitoring is set out in both the draft Plan and draft Strategy, particularly in ensuring the effective implementation and communication of progress. The proposed development of a monitoring framework as set out in the draft Plan and planned publication of an Annual Energy Statement outlined in the draft Strategy should provide opportunities to monitor progress. These could also help in identifying opportunities to adapt Scottish policy and actions in relation to climate change and the energy system to meet changing needs and circumstances.

7.1.2 A wide range of existing programmes in place at the national and local level aim to monitor environmental status and assess performance against established environmental indicators; many of which could likely help to inform the proposals for monitoring set out in the draft Plan and draft Strategy. The Key Scottish Environment Statistics 2016 Report provides information on a wide range of environmental topics and indicators, including indicators for GHG emissions and climate, air quality, land use, water, waste and biodiversity. It also includes key datasets on the state of the environment in Scotland, with an emphasis on the trends over time where possible[143].

7.1.3 As noted previously, recommendations on the setting of annual targets and annual monitoring and reporting of Scotland's overall GHG emission abatement is undertaken by the Committee on Climate Change[144]. This process involves reporting emissions trends and performance against these targets at both the sectoral and national levels.

7.1.4 The Water Framework Directive[145] sets the statutory obligation for monitoring of water quality by member states, and monitoring of Scotland's rivers, canals, freshwater lochs, estuaries and coastal and offshore waters is undertaken by SEPA and reported annually[146]. Monitoring as part of the Water Framework Directive includes a biodiversity element, through the requirement to consider the ecological quality of water in this monitoring programme.

7.1.5 Changes to national levels of biodiversity are also monitored, with a focus on the status of valued and designated biodiversity features, for example, Special Areas of Conservation and Special Protected Areas[147]. Additionally, the

[143] The Scottish Government (2016) Key Scottish Environment Statistics 2016 [online] Available at: http://www.gov.scot/Publications/2016/10/7565 (accessed 01/12/2016)

[144] Committee on Climate Change (2016) Carbon Budgets and Targets [online] Available at|: https://www.theccc.org.uk/tackling-climate-change/reducing-carbon-emissions/carbon-budgets-and-targets/ (accessed 30/11/2016)

[145] EU water Framework Directive, Directive 2000/60/EC [online] Available at: http://ec.europa.eu/environment/water/water-framework/index_en.html (accessed 01/12/2016)

[146] Scotland's Environment (2016) Water [online] Available at: http://www.environment.scotland.gov.uk/get-informed/water/ (accessed 30/11/2016)

[147] SNH (2015) Site Condition Monitoring [online] Available at: http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/site-condition-monitoring/ (accessed 30/11/2016)

monitoring and reporting of air quality currently takes place at 95 sites located in urban areas throughout Scotland[148], and key performance indicators from the development of the Cleaner Air for Scotland: The Road to a Healthier Future[149] are also monitored. Many of these programmes will also help to identify effects arising from the broad range of policies and proposals that have been covered in this assessment.

7.1.6 Existing monitoring is likely to be complemented by monitoring for specific policies and proposals at the sectoral level. For example:

- The Energy in Scotland series reports on changes to Scotland's energy mix, and provides information on how energy is both generated and consumed[150].
- Growth in new woodland and forestry are routinely monitored, and performance is reported against annual planting targets[151].
- Scotland's performance against the waste hierarchy is reported annually, and improvements in reducing landfill waste and increasing utilisation of waste are regularly monitored and reported[152].

7.1.7 It is also likely that as new policies and proposals are brought forward, further monitoring proposals may be developed to review progress of their implementation.

[148] Scottish Air Quality (2016) Air Quality in Scotland, :Latest pollution map [online] Available at: http://www.scottishairquality.co.uk/ (accessed 30/11/2016)

[149] The Scottish Government (2015) Cleaner Air for Scotland: The Road to a Healthier Future [online] Available at: http://www.gov.scot/Resource/0048/00488493.pdf (accessed 15/12/2016)

[150] The Scottish Government (2016) Energy in Scotland 2016 [online] Available at: http://www.gov.scot/Resource/0050/00501041.pdf (accessed 30/11/2016)

[151] Forestry Commission Scotland (2016) FCS review of the year 2015-16 [online] Available at: http://scotland.forestry.gov.uk/supporting/management/annual-review (accessed 30/11/2016)

[152] Zero Waste Scotland (2016) Research and Evidence [online] Available at: http://www.zerowastescotland.org.uk/research-evidence (accessed 30/11/2016)

8 Assessment Conclusions and Recommendations

8.1.1 The following paragraphs set out the conclusions and recommendations identified in the SEA of the draft Plan and draft Strategy.

8.1.2 The draft Plan and draft Strategy are likely to lead to significant GHG emissions reductions and the SEA supported the cross-sectoral and 'whole systems' approach adopted by the draft Plan and draft Strategy. In particular, support was given to the renewed focus given to energy efficiency measures across sectors where opportunities for significant reductions in GHG emissions exist.

8.1.3 Policies and proposals in the draft Plan and draft Strategy could also contribute to adaptation to climate change and build resilience. The SEA supports these and recommends that action should be taken to maximise benefits where possible.

8.1.4 Significant benefits in terms of air quality and population and human health were identified; in particular, through policies and proposals related to the transport sector and built environment. In a number of instances, these benefits could be maximised by the implementation of targeted action; for example, targeting opportunities to improve air quality in areas of known concern and improving energy efficiency where fuel poverty is greatest. The SEA supports the approach set out in the draft Plan and draft Strategy, and recommends that opportunities to maximise the benefits of policies and proposals continue to be explored.

8.1.5 The SEA also supported the importance of the transition to low carbon energy and identified the opportunity for diversification and decentralisation of Scotland's energy mix to contribute to reducing GHG emissions. It was also noted that a key aspect in achieving this will be developing a broad mix of technologies and energy sources advocated by the draft Strategy. The SEA considered the findings of recent reports on Underground Coal Gasification (UCG)[153,154]; a technology that could be employed to exploit difficult to reach fossil fuel resources. The potential for these activities to have significant adverse environmental effects if implemented in Scotland has been identified. In light of the potential risks and likelihood of environmental effects identified, the SEA supports the policy position that UCG will not be taken forward in Scotland.

[153] Campbell Gemmell (2016) Independent Review of Underground Coal Gasification – Report [online] Available at : http://www.gov.scot/Publications/2016/10/2704/downloads#res507473 (accessed 25/10/2016)

[154] Atkins (2015) Underground Coal Gasification - Evidence Statement of Global Warming Potential, Prepared for DECC, 28 November 2015 [online] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/575940/Underground_Coal_Gasification___Evidence_Statement_of_Global_Warming_Potential.pdf (accessed 06/01/2017)

8.1.6 The SEA identified that consideration will need to be given to ensure that appropriate infrastructure is in place to facilitate many of the ambitions of the draft Plan and draft Strategy. This will be of particular relevance where new technologies and energy sources are developed, and as these begin to play an increasingly important role as part of Scotland's energy mix. The SEA supports the reuse infrastructure where practicable, such as the use of oil and gas infrastructure in CCS and reuse of infrastructure for repowering of wind renewable energy. Additionally, the SEA also supports action in the draft Strategy that seeks to integrate infrastructure requirements when considering the planning of Scotland's electricity network and recommends this approach be applied to maximise benefits of re-use or co-location where possible.

8.1.7 Potential impacts on topic areas such as cultural heritage, biodiversity, landscape and soil were considered likely to arise from many of the policies and proposals. However, it is expected that many such effects would be largely mitigated at a lower tier through existing mechanisms and actions such as appropriate siting of developments and construction management. In some instances, impacts could be considered further at the national level; for example, the likelihood of increased uptake of some renewable energy technologies.

8.1.8 The SEA identified the importance of robust monitoring to ascertain the environmental effect(s) of the policies and proposals set out in both the draft Plan and draft Strategy, and identify opportunities to adapt Scottish policy where needed. It supports the proposed development of the monitoring framework set out in the draft Plan and the planned publication of an Annual Energy Statement outlined in the draft Strategy.

9 Next Steps

9.1 Notes for Respondents

9.1.1 Public views and comments are invited on the draft Climate Change Plan, draft Scottish Energy Strategy and this Environmental Report.

9.1.2 In preparing their responses, respondents should note that there are **different deadlines** for providing comments on this Environmental Report relating to the draft Plan and draft Strategy.

9.1.3 Should a respondent wish to make a joint response on the Environmental Report for both the draft Plan and draft Strategy, they should do so by the **earlier deadline** to both addresses provided below to ensure that these comments can be collated and taken on board in the finalisation of the Plan and Strategy. To ensure that they are attributed correctly, we also ask that respondents clearly indicate those comments that relate to the draft Plan and draft Strategy in their responses.

9.2 Providing comments on this Environmental Report relating to the Draft Climate Change Plan

9.2.1 The draft Plan has been laid in Parliament and is subject to 60 days of parliamentary scrutiny. Calls for evidence will be issued by Parliamentary committees to assist with the scrutiny period.

9.2.2 Whilst not a Scottish Government consultation, respondents are welcome to copy any submissions they make to parliament in the calls for evidence on the draft Plan, and/or can provide direct responses to the Scottish Government on the draft Plan during this period if they wish.

9.2.3 This Environmental Report is now open for consultation. Respondents are asked to submit responses on the Environmental Report in relation to the draft Plan directly to the Scottish Government by **20th March 2017** to the address provided below:

Draft Climate Change Plan

The Scottish Government
Area 3-J (South)
Victoria Quay
Edinburgh
EH6 6QQ
Email: climate.change@gov.scot.

9.3 Providing comments on this Environmental Report relating to the Draft Scottish Energy Strategy

9.3.1 The Scottish Government is running a separate process for the draft Scottish Energy Strategy. The draft Strategy is open for consultation and responses relating to it should be submitted directly to the Scottish Government during the consultation period.

9.3.2 Respondents are also asked to submit responses on this Environmental Report relating to the draft Strategy directly to the Scottish Government by **30th May 2017** to the address provided below.

Energy Strategy Consultation

Energy and Climate Change Directorate
The Scottish Government
4th Floor, 5 Atlantic Quay
150 Broomielaw
Glasgow
G2 8LU
Email: energystrategy@gov.scot.

9.4 Suggested Questions for Responses on this Environmental Report

9.4.1 Respondents may find the following questions helpful to provide a focus for their responses on this Environmental Report. Please note that responses do not need to be confined to these questions, and more general comments on this Environmental Report, the draft Plan and/or draft Strategy are also invited.

Questions:

1. What are your views on the accuracy and scope of the information used to describe the SEA environmental baseline set out in the Environmental Report? (Please give details of additional relevant sources)
2. What are your views on the predicted environmental effects as set out in the Environmental Report?
3. What are your views on the findings of the SEA, and the proposals for mitigation and monitoring of the environmental effects set out in the Environmental Report?

9.5 Analysis and Use of Responses

9.5.1 Following the conclusion of the Parliamentary scrutiny period for the draft Plan and the consultations on the draft Strategy and this Environmental Report, the responses received will be collated, analysed and reported. Key messages from respondents, including those of the various stakeholder groups, will be highlighted and the relevant findings of the analysis will be taken into account in the finalisation of the Plan and the Strategy.

9.5.2 Thereafter, it is anticipated that post-adoption SEA Statements will be prepared and published for the Plan and Strategy. These Statements will reflect on the findings of the assessment and consultation, and will explain how the issues raised have been considered and addressed in the preparation of the finalised documents.

Appendix A

Relevant Environmental Protection Objectives and Environmental Baseline Information

1 Overview of Environmental Protection Objectives

1.1 A number of environmental protection objectives are detailed within existing legislation, policies, strategies and plans. In addition to forming the context for the draft Plan and the draft Strategy these also form the context for this Strategic Environmental Assessment (SEA).

1.2 For each environmental topic area scoped into the assessment, an overview of relevant existing environmental protection objectives has been developed. This information is set out in the following sections of this Appendix.

2 Developing the Environmental Baseline

2.1 Schedule 3 of the Environmental Assessment (Scotland) Act 2005 (the 2005 Act) requires that the following be identified when undertaking an SEA:

- Relevant aspects of the current state of the environment and its likely evolution without implementation of the plan or programme.
- Environmental characteristics of areas likely to be affected.
- Relevant existing environmental problems.
- Relevant environmental protection objectives at the international, European or national level.

2.2 The environmental baseline information considered relevant for the draft Plan and draft Strategy are presented in the following sections of this Appendix. A summary of the key and relevant information relating to the draft Plan and draft Strategy is also presented in Sections 3 and 4 of the main body of this report.

3 Climatic Factors

Overview of Environmental Protection Objectives

3.1 Scotland's ambition on tackling climate change is set out in the Climate Change (Scotland) Act 2009 ("the 2009 Act")[155]. Through this legislation, Scotland contributes to international (EU and UN) efforts on climate change mitigation and adaptation. The 2009 Act creates the statutory framework for greenhouse gas (GHG) emissions reduction in Scotland, and set targets for reduction in emissions of the seven Kyoto Protocol GHG[156] by 80% by 2050, with an interim 2020 target of 42%, compared to the 1990/1995 baseline level.

3.2 The 2009 Act also requires that annual GHG emissions targets are set, by Order, for each year in the period 2010 – 2050. Following the initial phase of target-setting, the annual targets are set in five year batches, at least twelve years in advance. The third and most recent batch of annual targets, covering the years 2028 – 2032, was agreed by the Scottish Parliament in October 2016.

3.3 The Scottish Climate Change Adaptation Programme (the Adaptation Programme)[157] addresses the impacts identified for Scotland in the UK Climate Change Risk Assessment (CCRA)[158]. The Adaptation Programme sets out Scottish Ministers' objectives in relation to adaptation to climate change, their proposals and policies for meeting these objectives, and the period within which these proposals and policies will be introduced. The Programme also sets out the arrangements for wider engagement in meeting these objectives. The recently published 2017 UK CCRA[159] sets out priorities for the next five years. The impacts identified for Scotland are expected to be addressed by the second iteration of the Adaptation Programme which is due in 2019[160].

3.4 At the Paris climate conference (COP 21) in December 2015, 195 countries adopted the first ever universal, legally binding global climate deal. The Paris Agreement is a bridge between today's policies and climate-neutrality before

[155] The Scottish Government (2012) Climate Change (Scotland) Act 2009 [online] Available at: http://www.gov.scot/Topics/Environment/climatechange/scotlands-action/climatechangeact (accessed 26/10/2016)

[156] 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) and Sulphur hexafluoride (SF_6), for which the baseline is 1995. Nitrogen triflouride (NF_3) has subsequently been added.

[157] Scottish Government (2014) Climate Ready Scotland Scottish Climate Change Adaptation Programme [online] Available at: http://www.gov.scot/Publications/2014/05/4669 (accessed 18/10/2016)

[158] UK Government (2012) UK Climate Change Risk Assessment [online] Available at: https://www.gov.uk/government/publications/uk-climate-change-risk-assessment-government-report (accessed 18/10/2016)

[159] Committee on Climate Change (2016) UK Climate Change Risk Assessment 2017 [online] Available at: https://www.theccc.org.uk/uk-climate-change-risk-assessment-2017/ (accessed 29/09/2016)

[160] Committee on Climate Change (2016) Scottish Climate Change Adaption Programme: An independent assessment [online] Available at: https://www.theccc.org.uk/wp-content/uploads/2016/09/Scottish-Climate-Change-Adaptation-Programme-An-independent-assessment-CCC-September-2016.pdf (accessed 24/10/2016)

the end of the century. The agreement sets out a global action plan to put the world on track to avoid dangerous climate change by limiting global warming to well below 2°C[161]. The deal also says countries should aim for the even more ambitious target of 1.5°C[162]. A number of other agreements were reached on key issues such as mitigation through reducing emissions, adaptation and loss and damage[163]. The Agreement entered into force on 4 November 2016[164].

3.5 The EU Emissions Trading System (EU ETS) is a key component of the EU's policy to combat climate change. In operation since 2005, it aims to reduce GHG emission from energy intensive industries, with emissions from within Europe aviation added in 2012. The EU ETS operates in 31 countries (all 28 EU countries plus Iceland, Liechtenstein and Norway) and covers 45% of the EU's emissions[165]. The EU ETS has emission reduction targets for 2020 of 20% on 2005 levels for industrial emissions. To achieve this, the system works on a "cap and trade" principle, requiring participants to obtain allowances to cover their annual emissions; the availability of which reduces annually. The allowances are issued through a combination of auction and free allocation, and participants can trade them on a secondary market; creating a market price for carbon.

Current Environmental Baseline

3.6 Over the last 50 years, it has become increasingly apparent that the world's climate is changing at an unprecedented rate. Evidence of an increase in average global temperatures and an increase in GHG in the atmosphere has led to the conclusion that human activities, including the use of carbon based fuels, is the main reason for this increase[166]. Other effects, such as air pollution, also often originate from the combustion of fossil fuels.

3.7 The extent of the effects of climate change will vary by location, but there is significant evidence supporting the belief that significant changes in precipitation, snowfall, seasonality, cloud cover, humidity, wind speeds, soil moisture, rising sea levels and extreme weather may occur[167]. Higher

[161] European Commission (2016) Climate Action Paris Agreement [online] Available at: http://ec.europa.eu/clima/policies/international/negotiations/paris/index_en.htm (accessed 18/10/2016)

[162] Energy & Climate Intelligence Unit (2016) The UK Climate Change Summit, What does the Paris Agreement mean for the UK? [online] Available at: http://eciu.net/reports/2016/what-does-the-paris-agreement-mean-for-the-uk (accessed 18/10/2016)

[163] European Commission (2016) Climate Action Paris Agreement [online] Available at: http://ec.europa.eu/clima/policies/international/negotiations/paris/index_en.htm (accessed 18/10/2016)

[164] UNFCC (2016) The Paris Agreement [online] Available at: http://unfccc.int/paris_agreement/items/9485.php (accessed 11/11/2016)

[165] European Commission (2016) Climate Action [online] Available at: http://ec.europa.eu/clima/policies/ets/index_en.htm (accessed 13/10/2016)

[166] Scotland's Environment (undated) Climate change [online] Available at: http://www.environment.scotland.gov.uk/our_environment/air_and_climate/climate_change.aspx (accessed 18/10/2016)

[167] IPCC (2014) Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

temperatures and changes in rainfall patterns have been exhibited since 1961. For example, some parts of north-west Scotland have become up to 45% drier in summer, while increases in as much as 60% of winter rainfall have been observed in northern and western regions[168]. Over this same period, average temperatures in all regions have risen every season and it is predicted under a high emissions scenario, summer and winter temperatures in 2080 may be 4.3°C and 3.1°C higher, respectively[169].

3.8 It is predicted that the greatest direct climate change-related threats for the UK are large increases in flood risk, exposure to high temperatures and heat waves, shortages in the public water supply and for agriculture, energy production and industry, substantial risks to UK wildlife and natural ecosystems risks to domestic and international food production and trade[170]. New and emerging pests and diseases, and invasive non-native species affecting people, plants and animals has also been noted as a research priority[171].

3.9 Climate change is considered to be one of the most serious environmental threats to sustainable development, with adverse impacts expected on human health, food security, economic activity, natural resources and physical infrastructure[172]. Adaptation to the effects of climate change is now acknowledged as being necessary to respond effectively and equitably to the impacts of climate change.

3.10 In 2014, Scotland's emissions of the seven GHG were estimated to be 46.7 million tonnes of carbon dioxide equivalent ($MtCO_2e$)[173]. This is 8.6% lower than the 2013 figure of 51.1 $MtCO_2e$, a 4.4 $MtCO_2e$ decrease[174]. A fall in energy supply emissions (e.g. power stations) and a reduction in residential emissions (i.e. space heating of homes) were identified as the two main contributors to the reduction between 2013 and 2014[175]. A 39.5% reduction in estimated GHG emissions was also exhibited between 1990 and 2014; a decrease of 30.5 $MtCO_2e$[176]. Decreases in emissions from energy supply and

[168] Scotland's Environment (2016) Scotland's Climate Trends Handbook. Available at: http://www.environment.scotland.gov.uk/climate_trends_handbook/index.html (accessed 18/10/2016)

[169] UKCP09 (20151) Temperature [online] Available at: http://ukclimateprojections.metoffice.gov.uk/21678 (accessed 18/10/2018)

[170] Committee on Climate Change (2016) UK Climate Change Risk Assessment 2017. Available at: https://www.theccc.org.uk/uk-climate-change-risk-assessment-2017/ (accessed 29/09/2016)

[171] ibid

[172] ICAO (undated) Climate change adaptation [online] Available at: http://www.icao.int/environmental-protection/Pages/adaptation.aspx (accessed 30/11/2015)

[173] Scottish Government (2014) Scottish Greenhouse Gas Emissions 2014, An official Statistics Publication for Scotland [online] Available at: http://www.gov.scot/Publications/2016/06/2307 (accessed 20/07/2016)

[174] ibid

[175] ibid

[176] Scottish Government (2014) Scottish Greenhouse Gas Emissions 2014, An official Statistics Publication for Scotland [online] Available at: http://www.gov.scot/Publications/2016/06/2307 (accessed 18/10/2016)

waste management (i.e. landfill) were reported as the two main contributors to this reduction[177].

3.11 The main contributors to Scotland's GHG emissions in 2014 were the energy supply sector (30%), transport (including international aviation and shipping) (28%), agriculture and related land uses (23%), business and industrial process (19%) and residential (13%)[178]. Relatively minor totals were reported for public sector buildings, development and waste management. Forestry was a net carbon sink and contributed to reducing emissions by approximately 18% in 2014[179].

3.12 Around three-quarters (73.7%)[180] of Scotland's GHG emissions produced in 2014 arose from Carbon Dioxide (CO_2). During 2014, CO_2 made up the largest component of emissions from each sector with the exception of agriculture, where methane from livestock and Nitrous oxide from soils made large contributions, and waste management, where methane from landfills was the main source[181].

3.13 Climate change has been identified as a primary pressure on many of the SEA topic areas (i.e. soil, water, biodiversity, cultural heritage and the historic environment). These pressures and predicted impacts from a changing climate have been discussed further under the relevant SEA topics in this Report.

4 Population and Human Health

Overview of Environmental Protection Objectives

4.1 Many existing environmental protection objectives are relevant to population and human health, either directly or indirectly. For example, the Air Quality Standards (Scotland) Regulations 2010[182], the Air Quality (Scotland) Regulations 2000, the Air Quality (Scotland) Amendment Regulations 2002 and the Air Quality (Scotland) Amendment Regulations 2016[183] help set out current objectives and requirements for air quality with clear relevance for human health. Protection is also afforded through existing legislation against noise and vibration nuisance at the both the European level through the Environmental

[177] Scottish Government (2014) Scottish Greenhouse Gas Emissions 2014, An official Statistics Publication for Scotland [online] Available at: http://www.gov.scot/Publications/2016/06/2307 (accessed 18/10/2016)

[178] ibid

[179] ibid

[180] ibid

[181] ibid

[182] The Air Quality Standards (Scotland) Regulations 2010 [online] Available at: http://www.legislation.gov.uk/ssi/2010/204/pdfs/ssi_20100204_en.pdf (accessed 20/10/2016)

[183] The Air Quality (Scotland) Amendment Regulations 2016 [online] Available at: http://www.legislation.gov.uk/sdsi/2016/9780111030837/contents (accessed 07/10/2016)

Noise Directive (2002/49/EC)[184] and the national level through regulations such as the Environmental Noise (Scotland) Regulations 2006[185].

4.2 The Pollution Prevention and Control (Scotland) Regulations 2012[186] (PPC Regulations) also seek to provide protection for human health. The PPC Regulations introduce a consistent and integrated approach to environmental protection to ensure that industrial activities that may have a significant impact on the environment are strictly regulated. The regulations were designed to eliminate or minimise emissions to air, water and land and extended pollution controls to previously unregulated sectors.

Current Environmental Baseline

4.3 The estimated population of Scotland in 2015 was 5.37 million, the highest ever and an increase of over 25,000 from the previous year[187]. Projections forecast that the population will continue to rise to around 5.7 million in 2039[188].

4.4 Almost 70% of Scotland's people live in urban areas in settlements of more than 10,000 people, covering just 2% of Scotland's land area[189]. Most of the population and industry is concentrated in highly urbanised areas in the Central Belt and on the East Coast, and primarily in four key city regions (Aberdeen, Dundee, Edinburgh, and Glasgow) and a number of smaller cities and towns (i.e. Ayr, Inverness, Perth and Stirling). Around 12.4% of the population live in small towns of less than 10,000 people; of this, around 70% of these towns are located within a 30 minute drive of large urban settlements, with the other 30% located more remotely[190].

4.5 Air quality is important for both short and long-term human health, and poor air quality can have impacts on people with existing health issues. In general, healthy people may not suffer from any serious health effects from exposure to

[184] Environmental Noise Directive 2002/49/EC [online] Available at: http://ec.europa.eu/environment/noise/directive_en.htm (accessed 20/10/2016)

[185] Environmental Noise (Scotland) Regulations 2006 [online] Available at: http://www.legislation.gov.uk/ssi/2006/465/made (accessed 20/10/2016)

[186] The Pollution and Prevention Control (Scotland) Regulations 2012 [online] Available at: http://www.gov.scot/Topics/Environment/waste-and-pollution/Pollution-1/Industrial-Pollution/PPC (accessed 20/10/2016)

[187] National Records of Scotland (2015) Population estimates by administrative area, Scotland, mid-2015 and corrected population estimates for mid-2012, mid-2013 and mid-2014 [online] Available at: http://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/population/population-estimates/mid-year-population-estimates/mid-2015-and-corrected-mid-2012-to-mid-2014 (accessed 07/10/2016)

[188] National records of Scotland (2015) Projected Population of Scotland (2014-based) – National Population Projects by Sex and Age, with UK and European Comparisons, [online] Available at: http://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/population/population-projections/population-projections-scotland/2014-based (accessed 07/10/2016)

[189] Scotland's Environment (undated) Cities, towns and greenspace [online] Available at: http://www.environment.scotland.gov.uk/get-informed/people-and-the-environment/cities-towns-and-greenspace/ (accessed 26/10/2016)

[190] ibid

the levels of pollution commonly experienced in urban environments. However, continual exposure can cause harm over the long term, and those with pre-existing health conditions such as heart disease, lung conditions and asthma can be adversely impacted by daily exposure to air pollutants[191]. Research has shown that air pollution reduces average life expectancy and often leads to premature deaths[192]. Activities that generate air pollutants have been considered under the topic of Air Quality.

4.6 The Scottish Index of Multiple Deprivation ranks small areas (data zones)[193] in Scotland from the most deprived to the least deprived. It analyses data from a number of indicators across the domains of income, employment, health, education, skills and training, housing, geographic access and crime. Key findings from the 2016 Index show that 14 areas have been consistently among the 5% most deprived in Scotland since the 2004 Index. Of these, half were in located in Glasgow City with a further four located in Inverclyde, Renfrewshire, North Lanarkshire and East Ayrshire. Eleven council areas now have a larger share of the 20% most deprived data zones in Scotland compared to four years ago, with the largest increases observed in West Dunbartonshire, Midlothian, North Ayrshire and South Ayrshire[194].

4.7 In 2014, the estimated rate of fuel poverty remained similar to the previous year at approximately 35% or around 845,000 fuel poor households[195]. Levels of fuel poverty are broadly determined by three factors: fuel prices, household income and the energy efficiency of housing stock. Numerous studies and research has been conducted into the complex issue of fuel poverty and human health. Presently, analysis of Scottish fuel poverty data fails to show a clear and direct link between fuel poverty and diminished health[196]. In October 2016, the Independent Scottish Fuel Poverty Strategic Working Group made four high-level recommendations including that a new community-based approach to tackling fuel poverty be developed, and that the definition of fuel poverty be reviewed to ensure help is targeted at those who need it most[197].

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[191] Scotland's Environment (undated) Air Quality [online] Available at: http://www.environment.scotland.gov.uk/our_environment/air_and_climate/air_quality.aspx (accessed 18/10/2016)

[192] House of Commons Environmental Audit Committee (2010) 'Air Quality, Fifth Report of Session 2009 – 10 Volume 1, http://www.publications.parliament.uk/pa/cm200910/cmselect/cmenvaud/229/229i.pdf (Accessed on 20/10/2016)

[193] Datazones have roughly the same population; however the boundaries of datazones are kept constant although the populations may change over time. http://www.scotland.gov.uk/Topics/Statistics/SIMD/FAQs

[194] SIMD 2016 Results (2016) Introducing the Scottish Index of Multiple Deprivation 2016 [online] Available at: http://www.gov.scot/Resource/0050/00504809.pdf (accessed 26/10/2016)

[195] Scottish Government (2016) High Level Summary of Statistics Trend - Fuel Poverty [online] Available at: http://www.gov.scot/Topics/Statistics/Browse/Housing-Regeneration/TrendFuelPoverty (accessed 17/10/2016)

[196] The Scottish Government (2012) Fuel Poverty Evidence Review, Defining, Measuring and Analysing Fuel Poverty in Scotland [online] Available at: http://www.scotland.gov.uk/Resource/0039/00398798.pdf (accessed 5/02/2014)

[197] Scottish Government (2016) Tackling fuel poverty [online] Available at: https://beta.gov.scot/news/tackling-fuel-poverty/ (accessed 24/10/2016)

4.8 There has been a small reduction in car traffic over the past five years, whilst the distance cycled is estimated to have increased[198]. Approximately 34% of all car journeys in Scotland are reported to be less than two miles in length and could be potentially covered by bicycle or on foot[199]. In addition to helping to reduce GHG emissions, active travel such as cycling or walking, can provide access to the outdoors with additional benefits for physical and mental health and well-being, including reducing obesity and stress.

4.9 Flooding can have significant environmental impacts and also affect people, communities and businesses. When floods occur, they disrupt day-to-day lives and their impacts can be long lasting, and climate change is expected to increase the risk of flooding in coming years[200].

4.10 The potential risks and benefits of climate change on population and health will not be evenly spread. Pockets of dense urban development, for example, will be more at risk of surface water flooding and summer heat stress. In addition, the effects to human health from climate change may have the greatest impact on vulnerable people. The negative health effects are likely to be disproportionately severe in areas of high deprivation because of the ability of individuals and communities to prepare, respond and recover[201].

5 Air

Overview of Environmental Protection Objectives

5.1 Scotland's air quality environmental protection objectives are largely derived from the EC Air Quality Directive (2008/50/EC) and the 4th Air Quality Daughter Directive (2004/107/EC)[202], via the Air Quality Standards (Scotland) Regulations 2010[203] which transposes these Directives into the Scottish context. There are also domestic objectives as part of the Local Air Quality Management system set under the Environment Act 1995 and associated regulations[204]. These objectives are largely aimed at reducing air emissions that are potentially harmful to human health and the environment, and together

[198] Transport Scotland (2014) Transport and Travel in Scotland 2013 [online] Available at: http://www.transport.gov.scot/system/files/documents/statistics/j333840.pdf (accessed 18/10/2016)

[199] Transport Scotland (undated) Cycling and walking, the benefits [online] Available at: http://www.transport.gov.scot/environment/cycling/cycling-and-walking (accessed 18/10/2016)

[200] Committee on Climate Change (2016) UK Climate Change Risk Assessment 2017. Available at: https://www.theccc.org.uk/uk-climate-change-risk-assessment-2017/ (accessed 29/09/2016)

[201] Scottish Parliament (2012) SPICe Briefing: Climate Change and Health in Scotland [online] Available at: http://www.parliament.scot/ResearchBriefingsAndFactsheets/S4/SB_12-26rev.pdf (accessed 24/10/2016)

[202] EC (2015) Air Quality – Existing Legislation [online] Available at: http://ec.europa.eu/environment/air/quality/legislation/existing_leg.htm (accessed 20/10/2016)

[203] The Air Quality Standards (Scotland) Regulations 2010 [online] Available at: http://www.legislation.gov.uk/ssi/2010/204/pdfs/ssi_20100204_en.pdf (accessed 20/10/2016)

[204] Scottish Government (2016) Local Air Quality Management policy guidance [online] Available at: http://www.gov.scot/Publications/2016/03/9717 (accessed 20/10/2016

they set out the requirement for monitoring with a particular focus on areas where air pollution is concentrated.

5.2 Scotland's PPC Regulations (2012)[205] allow for the regulation and monitoring of certain industrial activities in Scotland that can generate airborne pollution. Together with the Air Quality Standards (Scotland) Regulations 2010[206], the PPC Regulations enable regulators to monitor, manage and, ultimately, improve Scottish air quality. It also sets a requirement for monitoring of air quality with a particular focus on areas where air pollution is concentrated and seeks to identify the sources.

Current Environmental Baseline

5.3 As discussed in 'Population and Human Health', air pollution can result in adverse impacts on both human health and can significantly affect many aspects of quality of life. Air pollution can also cause adverse effects in the wider environment. For example, it can add nutrients to water bodies and soils and contribute to acidification, both of which can impact on plant and animal life, and can also damage the fabric of buildings and monuments[207].

5.4 The quality of the air around us is affected by the pollutants released into the atmosphere through human activities, such as transport and industry (including agriculture), as well as from natural sources. The pollutants generally considered as being of most importance in relation to human health and the environment includes Sulphur Dioxide ($SO_{2)}$, Nitrogen dioxide (NO_2) and particulate emissions. Ammonia is also produced in many agricultural activities, including in emissions from livestock farming, manure handling and the use of nitrogen fertilisers[208].

5.5 Air quality in Scotland has improved considerably over the last few decades. Between 1990 and 2014 there were decreases of 75% for Carbon monoxide (CO), 69% for Nitrogen oxides (NO_x), 65% for non-methane volatile organic compounds , 46% for fine particulate matter (PM_{10}) and 90% for SO_2[209,210].

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[205] Scottish Parliament, The Pollution Prevention and Control (Scotland) Regulations 2012, Coming into force 7th January 2013 [online] Available at: http://www.legislation.gov.uk/sdsi/2012/9780111018408/pdfs/sdsi_9780111018408_en.pdf (accessed 20/10/2016)

[206] The Air Quality Standards (Scotland) Regulations 2010, SSI 2010 No. 204 [online] Available at: http://www.legislation.gov.uk/ssi/2010/204/contents/made (accessed 11/10/2016)

[207] Scotland's Environment (undated) Air Quality: Why does the quality of our air matter? [online] Available at: http://www.environment.scotland.gov.uk/our_environment/air_and_climate/air_quality.aspx (accessed 11/10/2016)

[208] Scotland's Environment (undated) Air Quality [online] Available at: http://www.environment.scotland.gov.uk/our_environment/air_and_climate/air_quality.aspx (accessed 20/10/2016)

[209] Scottish Government (2015) Air Quality - Air Pollutant Emissions, High Level summary of Statistics Trend [online] Available at: http://www.scotland.gov.uk/Topics/Statistics/Browse/Environment/trendairpollutants (accessed 20/10/2016)

However, air pollution is still estimated to reduce the life expectancy of every person in the UK by an average of 7–8 months[211] and there are some towns and cities where air quality has been identified as a concern[212].

5.6 Section 83(1) of the Environmental Act 1995[213] sets out a requirement that where air quality objectives are not being met or are unlikely to be met within the relevant period, Local Authorities designate an Air Quality Management Areas (AQMAs). In Scotland, 38 AQMAs have currently been declared, with 14 of Scotland's 32 Local Authorities having declared at least one. The majority of these are declared in urban areas as a result of NO_x alone or in combination with PM_{10} levels, and primarily as a result of traffic emissions[214].

5.7 Air pollution often originates from the same activities that contribute to climate change; notably transport and energy generation. Transport is the most significant source contributing to poor air quality in urban areas[215]. While measures such as using alternative fuels sources and encouraging active travel can help improve air quality in addition to reducing GHG emissions, some measures aimed at reducing the impacts of climate change can also have a negative impact on air quality. For example, while emissions from well operated and well maintained modern biomass boilers are generally lower than the coal equivalent, the burning of biomass feedstock does emit air pollutants such as particulates[216].

6 Soil

Overview of Environmental Protection Objectives

6.1 The importance of soil as a resource is recognised internationally through the European Commission's Thematic Strategy for Soil Protection[217]. Nationally, the protection of prime quality agricultural land and peatlands is set out in the

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[210] National Atmospheric Emissions Inventory (2016) https://uk-air.defra.gov.uk/assets/documents/reports/cat07/1609130909_Devolved_Administrations_Air_Quality_Pollutant_Inventories_1990-2014_Issue1.1.pdf (accessed 20/10/2016)

[211] Scottish Government (2015) Air Quality - Air Pollutant Emissions, High Level summary of Statistics Trend [online] Available at: http://www.scotland.gov.uk/Topics/Statistics/Browse/Environment/trendairpollutants (accessed 20/10/2016)

[212] Scotland's Environment (undated) Air [online] Available at: http://www.environment.scotland.gov.uk/get-informed/air/ (accessed 11/10/2016)

[213] Environmental Act 1995 – Section 83(1) [online] available: http://www.legislation.gov.uk/ukpga/1995/25/section/83

[214] Air Quality in Scotland (undated) Air quality management areas [online] Available at: http://www.scottishairquality.co.uk/laqm/aqma (accessed 09/12/2016)

[215] Air Quality in Scotland (undated) Local air quality management [online] Available at: http://www.scottishairquality.co.uk/laqm.php?a=l&la_id=i (accessed 20/10/2016)

[216] ibid

[217] European Commission (2015) Soil, The Soil Thematic Strategy [online] Available at: http://ec.europa.eu/environment/soil/three_en.htm (accessed 17/08/2015)

Scottish Soil Framework[218], Scotland's National Peatland Plan[219] and the Scottish Government's Draft Peatland and Energy Policy Statement[220]

6.2 Geological sites receive protection through the designation of geological Sites of Special Scientific Interest at the national level and at the international recognition through establishment of a network of Geoparks[221].

Current Environmental Baseline

6.3 Soil is a non-renewable resource and is fundamentally one of Scotland's most important assets[222]. It supports a wide range of natural processes and underpins much of our natural environment, and through this important role, helps to provide a wide range of environmental, economic and societal benefits. For example, soil provides the basis for food, controls and regulates environmental interactions such as regulating water flow and quality and provides a platform for buildings and roads[223]. There is an intrinsic relationship between soil health and other environmental topics; biodiversity, water and air quality in particular. For example, soil erosion is one of the main contributors to diffuse water pollution[224].

6.4 Soils play a significant role in terms of storing carbon and therefore help to regulate GHG emissions. It is estimated that Scotland's soils contain 3,200 million tonnes of carbon, making up over 50% of the UK's soil carbon[225].

6.5 Peatlands are of particular importance for mitigating climate change by acting as carbon 'sinks'. These important areas store carbon in peat deposits and continually sequester new carbon in peat-forming vegetation. They are particularly abundant in Scotland, occupying around 23% of the land area[226], and extend over large areas of the Scottish uplands and extensively in the north and west of the country in areas with gentle slopes and poor drainage. As with all soils, peats are at risk from land use change and the effects of climate

[218] The Scottish Government (2009) The Scottish Soil Framework [online] Available at: http://www.gov.scot/Publications/2009/05/20145602/0 (accessed 12/02/2016)

[219] SNH (2015) Scotland's National Peatland Plan, Working for our Future [online] Available at: http://www.snh.gov.uk/docs/A1697542.pdf (accessed 16/09/2015)

[220] The Scottish Government (2017) Draft Peatland and Energy Policy Statement [online] Available at: http://www.gov.scot/Resource/0050/00502389.pdf (accessed 17/01/2017)

[221] SNH (2015) Geoparks [online] Available at: http://www.snh.gov.uk/enjoying-the-outdoors/what-can-i-see/geology-rocks/geoparks/ (accessed 29/06/2016)

[222] Scottish Government (2006) Scotland's Soil Resource Current State and Threats [online] Available at: http://www.scotland.gov.uk/publications/2006/09/21115639/7 (accessed 22/10/2015)

[223] Scottish Government (2009) Scottish Soil Framework [online] Available at: http://www.scotland.gov.uk/Publications/2009/05/20145602/0 (accessed 17/09/2015)

[224] SEPA (undated) Soil [online] Available at: http://www.sepa.org.uk/environment/land/soil/#effect (accessed 23/02/2016)

[225] Scottish Government (2016) Scotland's Soil – Soil Organic Matter [online] Available at: http://www.soils-scotland.gov.uk/context/organic (accessed 11/10/2016)

[226] Dobbie, K.E., Bruneau, P.M.C and Towers, W. (eds) (2011) The State of Scotland's Soil. Natural Scotland, http://www.soils-scotland.gov.uk/documents/15130508_SOSreport.pdf (accessed 09/12/2016)

change, and their loss or degradation (and the associated loss of carbon) has the potential to be a significant contributor to Scotland's GHG emissions[227].

6.6 While Scotland's soils are considered to generally be in good health, there are a range of pressures on them. Climate change and loss of organic matter pose the most significant threat to Scottish soils, with both likely to affect soil function, including loss of soil carbon. The loss of valued soils in particular has the potential for national impacts which will be difficult to reverse. In the case of GHG emissions, impacts are expected to be felt globally[228]. As such, the management and use of these resources can affect the amount of CO_2 that is held or released[229].

6.7 Changes in land use and land management practices are also a key pressure on soil, including activities such as the cultivation of soils for agriculture and forestry and expansion of, agriculture and forestry[230]. At present, there is uncertainty and a lack of quantitative information on threats to soil functions and ecosystem services, particularly relating to the extent of soil sealing, changes in soil biodiversity and compaction of soils[231].

7 Water

Overview of Environmental Protection Objectives

7.1 Objectives relating to the condition of all water bodies are set through the Water Framework Directive[232], which governs objectives for rivers, lochs, transitional waters, coastal waters and groundwater resources. The Water Framework Directive sets out the requirement for an assessment of both chemical and ecological status, alongside the requirement to consider the status of biodiversity as an indicator in determining water quality.

[227] Scottish Government (2016) Scotland's Soils – Impacts [online] Available at: http://www.soils-scotland.gov.uk/about/impact (accessed 11/10/2016)

[228] Scottish Government (2009) Scottish Soil Framework [online] Available at: http://www.scotland.gov.uk/Publications/2009/05/20145602/0 (accessed 26/10/2015)

[229] Soil Association (2015) Low Carbon Farming Technical Information Soil and Grassland Management [online] Available at: http://www.soilassociation.org/innovativefarming/lowcarbonfarming/technicalinformation (accessed 21/08/2015)

[230] Scotland's Environment (2014) Soil [online] Available at; http://www.environment.scotland.gov.uk/get-informed/land/soils/ (accessed 26/10/2015

[231] EC (2016) JRC Technical Report, Soil Threats in Europe, Status, methods, drivers and effects on ecosystem services [online] Available at: http://esdac.jrc.ec.europa.eu/public_path/shared_folder/doc_pub/EUR27607.pdf (accessed 26/10/2016)

[232] European Commission (2000) The Water Framework Directive [online] Available at: http://eur-lex.europa.eu/resource.html?uri=cellar:5c835afb-2ec6-4577-bdf8-756d3d694eeb.0004.02/DOC_1&format=PDF (accessed 11/10/2016)

7.2 These objectives are set in the Scottish context in a range of water, coastal and marine policies. Scotland's two River Basin Management Plans [233] aim to improve the overall condition of water bodies. The protection of Scotland's water resources has also been translated through the establishment of legislation and regulations such as the Water Environment and Water Services (Scotland) Act 2003[234] and the Water Environment (Controlled Activities) (Scotland) Regulations 2011[235] . These complement the role of others such as the Pollution Prevention and Control (Scotland) Regulations 2012[236] , developed to specifically control pollution relating to industry discharges.

7.3 The Flood Risk Management (Scotland) Act 2009[237] provides for the management of flood risk, and translates the EU Floods Directive[238] into the national context.

Current Environmental Baseline

7.4 Scotland's water provides a wide range of benefits, supporting our health and prosperity, such as the provision of drinking water and a resource for use in agriculture and industry. These water resources also support a rich diversity of habitats and species, attract tourism, promote recreation and provide for the sustainable growth of the economy[239].

7.5 In recent decades, significant improvements to water quality in many rivers, canals and estuaries have been observed alongside significant reductions in pollution. However, rivers across Scotland's central belt and east coast in particular, require additional work to achieve Scotland's overarching target of all water bodies achieving 'good or better' for overall status[240].

7.6 Scotland's groundwater is a valuable asset for many, particularly rural communities where it provides most of the private drinking water (73%)[241]. Around 80% of Scotland's groundwater is in good condition, although there are

[233] SEPA (2016) River Basin Management Planning, The Current Plans [online] Available at: https://www.sepa.org.uk/environment/water/river-basin-management-planning/ (accessed 11/10/2016)

[234] Water Environment and Water Services (Scotland) Act (2003) [online] Available at: http://www.legislation.gov.uk/asp/2003/3/contents (accessed 17/08/2015)

[235] Water Environment (Controlled Activities) (Scotland) Regulations (2011) [online] Available at: http://www.legislation.gov.uk/ssi/2011/209/contents/made (accessed 17/08/2015)

[236] The Pollution Prevention and Control (Scotland) Regulations (2012) [online] Available at: http://www.legislation.gov.uk/ssi/2012/360/contents/made (accessed 21/06/2016)

[237] The Flood Risk Management (Scotland) Act 2009 [online] Available at: http://www.legislation.gov.uk/asp/2009/6/contents (accessed 12/02/2016)

[238] European Commission, Directive 2007/60/EC of 23 October 2007 on the Assessment and Management of Flood Risks [online] Available at: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32007L0060&from=EN (accessed 21/06/2016)

[239] Scotland's Environment (undated) Water [online] Available at: http://www.environment.scotland.gov.uk/get-informed/water/ (accessed 15/09/2016)

[240] ibid

[241] Scotland's Environment (undated) Groundwater [online] Available at: http://www.environment.scotland.gov.uk/media/54815/Water-Groundwater.pdf (accessed 20/10/2016)

particular regions with widespread problems; for example, in the Central Belt[242]. Agriculture and the legacy of industrial activity are the main causes of regional-scale groundwater problems, whereas inadequate construction of private water supplies and inappropriate management of wastes can create localised problems[243].

7.7 Flooding can have significant and long-lasting impacts on people, communities and businesses. Climate change is expected to increase the risk of flooding in coming years, associated primarily with changing rainfall patterns and extreme weather events. Flood Risk Management Strategies[244] co-ordinate action to tackle flooding in Scotland, setting out the national direction for flood risk management, helping to target investment and coordinate action across public bodies. Flood maps have also been produced which help to show where areas are likely to be at risk of flooding from rivers, seas and surface water[245].

7.8 Key pressures on the surface water environment include urbanisation, an increase in invasive non-native species, intensive agriculture/aquaculture and climate change. Diffuse pollution remains a concern for water quality, particularly in relation to agriculture, forestry, and urban development[246,247]. Significant quantities of water are also extracted for electricity generation and agriculture[248].

7.9 The predicted effects of climate change such as increased temperatures and changes to rainfall patterns could affect flows in rivers and impact on water resource availability[249]. A changing climate is also expected to have ecological impacts, such as warmer sea temperatures and an increasing risk of non-native species to become established and spread in water environments[250].

[242] Scotland's Environment (2014) Groundwater [online] Available at: http://www.environment.scotland.gov.uk/get-interactive/data/groundwater/ (accessed 09/12/2016)

[243] Scotland's Environment (undated) Groundwater [online] Available at: http://www.environment.scotland.gov.uk/media/54815/Water-Groundwater.pdf (accessed 20/10/2016)

[244] SEPA (undated) Flood Risk Management Strategies [online] Available at: http://apps.sepa.org.uk/FRMStrategies/ (accessed 20/10/2016)

[245] SEPA (undated) Flood maps [online] Available at: http://www.sepa.org.uk/environment/water/flooding/flood-maps/ (accessed 20/10/2016)

[246] SEPA (2015) The river basin management plan for the Scotland river basin district: 2015–2027 [online] Available at: https://www.sepa.org.uk/media/163445/the-river-basin-management-plan-for-the-scotland-river-basin-district-2015-2027.pdf (accessed 24/10/2016)

[247] ibid

[248] Scotland's Environment (2016)Scotland's Water [online] Available at: http://www.environment.scotland.gov.uk/get-informed/water/ (accessed 24/10/2016)

[249] Scottish Government (2016) Scotland's Environment – Scotland's Water [online] Available at: http://www.environment.scotland.gov.uk/get-informed/water/ (accessed 24/10/2016)

[250] SEPA (2015) The river basin management plan for the Scotland river basin district: 2015–2027 [online] Available at: https://www.sepa.org.uk/media/163445/the-river-basin-management-plan-for-the-scotland-river-basin-district-2015-2027.pdf (accessed 24/10/2016)

8 Biodiversity, Flora and Fauna

Overview of Environmental Protection Objectives

8.1 Environmental protection objectives for biodiversity, flora and fauna are largely aimed at protecting habitats and species from damage and disturbance; principally through the identification and conservation of areas of particular value. The policies define a hierarchy of protection and include a range of international conventions, including the development of the Aichi Targets for 2020[251] and the Convention on Biological Diversity[252].

8.2 At European level, the Natura 2000 network of sites affords protection to key natural assets under the European Commission (EC) Habitats and Birds Directives[253,254]; both of which have been transposed into UK and Scottish regulations. The Natura 2000 network is made up of Special Areas of Conservation (SAC) and Special Protection Areas (SPA). The majority of SPAs and SACs are also underpinned by Site of Special Scientific Interest (SSSI) legislation[255].

8.3 The designation of European protected species and identification of species and habitats as being the most threatened and requiring conservation action in the UK also demonstrates the prioritisation of conservation ambitions at European and national levels. The 2020 Challenge for Scotland's Biodiversity[256] is Scotland's response to the 20 Aichi Targets set by the United Nations Convention on Biological Diversity, and the European Union's Biodiversity Strategy for 2020. The 2020 Challenge supplements the 2004 Scottish Biodiversity Strategy[257] and focuses on the importance of healthy ecosystems and an outcome that "Scotland's ecosystems are restored to good ecological health so that they provide robust ecosystem services and build on our natural capital".

[251] Convention on Biological Diversity (2011) Aichi Biodiversity Targets [online] Available at: https://www.cbd.int/sp/targets/default.shtml (accessed 14/11/2016)

[252] Convention on Biological Diversity (1993) Text of the CBD [online] Available at: https://www.cbd.int/convention/text/ (accessed 14/11/2016)

[253] European Commission, The Habitats Directive [online] Available at: http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm (accessed 14/11/2016)

[254] European Commission, The Birds Directive [online] Available at: http://ec.europa.eu/environment/nature/legislation/birdsdirective/index_en.htm (accessed 14/11/2016)

[255] Scottish Government (2016) Natura 2000 [online] Available at: http://www.gov.scot/Topics/Environment/Wildlife-Habitats/protectedareas/NATURA (accessed 11/11/2016)

[256] Scottish Government (2013) 2020 Challenge for Scotland's Biodiversity – A Strategy for the conservation and enhancement of biodiversity in Scotland [online] Available at: http://www.scotland.gov.uk/Publications/2013/06/5538 (accessed 26/10/2015)

[257] Scottish Government (2004) Scottish Biodiversity Strategy – It's in your hands [online] Available at: http://www.scotland.gov.uk/Publications/2004/05/19366/37239 (accessed 26/10/2015)

8.4 Beyond site and species designations there are also longer term aspirations for enhancing biodiversity, improving landscape-scale ecological networks and addressing the impacts of climate change on the natural environment.

Current Environmental Baseline

8.5 Biodiversity plays a key role in both the functioning of ecosystems and in supporting our lives by providing crucial resources such as fresh air, clean water and food[258]. It is commonly used as a measure of the health of ecosystems, and provides the ecosystems services that are the basis of life including the regulation of air and water, soil formation, nutrient cycling, flood regulation and pollination, amongst many others[259]. Biodiversity, flora and fauna is also closely linked with other environmental topics, particularly soil and water, which also help to support an incredible diversity of life across Scotland and in its surrounding waters.

8.6 As of 2016, Scotland's protected areas included 239 SACs, 153 SPAs, 51 Ramsar sites and 2 Biosphere reserves, amongst other internationally designated sites. There are further national level designations such as 1,425 SSSIs, 30 Marine Protected Areas and 2 National Parks[260].

8.7 The UK Biodiversity Action Plan identified 39 priority habitats and 197 priority species either occurring, or known to have occurred until recently, in Scotland[261]. By March 2016, 80.4 % of natural features on nationally protected nature sites were reported as being in a "favourable" condition; a marginal increase from 79.3% reported in 2015[262].

8.8 Areas of biodiversity value are not only contained within this network of designated sites. Many undesignated areas of Scotland also contain a wide range of habitats and species that have important functions and roles. For example, urban greenspace such as public and private gardens, parks, woodlands, recreational grounds, green corridors, allotments and community growing spaces can provide habitats and ecosystems which are valuable to wildlife[263].

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[258] SNH (2012) Safeguarding Biodiversity [online] Available at: http://www.snh.gov.uk/protecting-scotlands-nature/safeguarding-biodiversity/ (accessed 26/10/2016)

[259] Mackey E.C. and Mudge G.P. (2010) Scotland's Wildlife: An assessment of biodiversity in 2010, Scottish Natural Heritage, Inverness [online] Available at: http://www.snh.gov.uk/docs/B811968.pdf (accessed 26/10/2016)

[260] SNH (2016) International Designations [online] Available at: http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/international-designations/ (accessed 04/10/2016)

[261] Scottish Government (2014) High Level Summary Statistics – Biodiversity – BAP Species and Habitats, available at: http://www.gov.scot/Topics/Statistics/Browse/Environment/TrendBAP (accessed 20/10/2016)

[262] Scottish Government (2016) Scotland Performs – National Indicator – Protected Nature Sites [online] Available at: http://www.gov.scot/About/Performance/scotPerforms/indicator/naturesites (accessed 20/10/2016)

[263] SNH (2013) Urban greenspace and gardens [online] Available at: http://www.snh.gov.uk/about-scotlands-nature/habitats-and-ecosystems/greenspaces-and-gardens/ (accessed 26/10/2016)

8.9 While there are a wide range of pressures on biodiversity, climate change in particular has the potential to greatly impact on biodiversity on a global scale[264]. The establishment and spread of invasive non-native species are also a known pressure on local biodiversity, and one that is expected to be exacerbated by a changing climate[265]. Indirect impacts may also arise through climate change adaptation and the action taken in sectors such as agriculture, forestry, planning, water and coastal management in the face of a changing climate[266].

8.10 Habitat change, due mainly to increased and more intensive land management, urban development, pollution, nutrient enrichment, and over exploitation of natural resources are other known pressures.

9 Cultural Heritage and the Historic Environment

Overview of Environmental Protection Objectives

9.1 Existing cultural heritage objectives are set out in legislation including the Historic Environment (Amendment) Scotland Act (2011)[267], Ancient Monuments and Archaeological Areas Act 1979 (as amended) [268] and Planning (Listed Buildings and Conservation Areas) (Scotland) Act (1997)[269]. These objectives are focused primarily on the protection of valued sites and features, including townscapes (i.e. places, buildings and open spaces), buildings, archaeological sites, battlefields, wrecks and landscapes that have been recognised at the international, national and local levels through a hierarchy of designations.

9.2 Policies such as National Planning Framework (NPF3)[270] and Scottish Planning Policy (SPP)[271] aim to improve the quality of our settlements and built environment with a national level focus. These are complemented by the Historic Environment Strategy for Scotland (2014)[272] and the Historic

[264] Convention on Biological Diversity (undated) Climate Change and Biodiversity – Introduction [online] Available at: http://www.cbd.int/climate/intro.shtml (accessed 26/10/2016)

[265] Biodiversity Scotland (2013) Key pressures on biodiversity [online] Available at: http://www.biodiversityscotland.gov.uk/biodiversity/pressures/ (accessed 26/10/2016)

[266] MONARCH (undated), Modelling Natural Resource Reponses to Climate Change, A synthesis for biodiversity conservation [online] Available at: http://www.academia.edu/27987626/MONARCH_Modelling_Natural_Resource_Responses_to_Climate_Change_a_synthesis_for_biodiversity_conservation (accessed 26/10/2016)

[267] The Historic Environment (Amendment) Scotland Act 2011 [online] Available at: http://www.legislation.gov.uk/asp/2011/3/contents/enacted (accessed 26/10/2016)

[268] Ancient Monuments and Archaeological Areas Act 1979 (as amended) [online] Available at: http://www.legislation.gov.uk/ukpga/1979/46/pdfs/ukpga_19790046_en.pdf (accessed 21/10/2016)

[269] Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997 [online] Available at: http://www.legislation.gov.uk/ukpga/1997/9/contents (accessed 26/10/2016)

[270] The Scottish Government (2014) National Planning Framework 3 [online] Available at: http://www.gov.scot/Publications/2014/06/3539/0 (accessed 26/10/2016)

[271] The Scottish Government (2014) Scottish Planning Policy [online] Available at: http://www.gov.scot/Publications/2014/06/5823 (accessed 26/10/2016)

[272] Historic Environment Scotland (2014) Our Place in Time: The Historic Environment Strategy for Scotland [online] Available at: http://www.gov.scot/Resource/0044/00445046.pdf (accessed 26/10/2016)

Environment Scotland (HES) Policy Statement[273] which provide an overarching framework for historic environment policy in Scotland. Together, they emphasise the importance of preserving recognised sites, avoiding negative impacts on them and their wider setting, and contributing to their enhancement where appropriate. These key objectives also extend to taking into accounting of, and avoiding damage to or loss of, currently unknown archaeology.

Current Environmental Baseline

9.3 Scotland's many and varied historical sites are unique and irreplaceable. These sites and features are regarded as making a valuable contribution to our quality of life, cultural identity, education and economy. While these assets are distributed widely throughout Scotland, there are clusters of sites in and around our settlements and also around our coastlines.

9.4 Some parts of Scotland's historic environment are protected through a process of designation. The process aims to identify parts of the historic environment for their significance and enhance their protection. Designated assets currently include world heritage sites, listed buildings, scheduled monuments conservation areas and historic marine protected areas[274].

9.5 Information on the condition of the historic environment is largely collated at a local level, making it difficult to assess changes and trends as a whole. Data collected through regular inspection regimes for many historic sites shows that the condition of A-listed buildings (nationally or internationally important) is stable[275]. The condition of scheduled monuments is also generally stable, with some 85% of monuments visited in 2013 reported as being in an optimal or satisfactory condition. However, older buildings (built pre-1919) are more likely than newer properties to have a need for basic and extensive repair[276].

9.6 Inappropriate development is a key pressure on the historic environment and cultural heritage, both directly in terms of damage to known and unknown features, and the potential for impacts to setting. Other known pressures include changing land use and land management, tourism/visitors, pollution and climate change.

9.7 It is projected that Scotland will become warmer and wetter as a result of climate change, resulting in the increased weathering of stone, rotting timbers and corrosion of metals. Reducing GHG emissions associated with the upkeep

[273] Historic Environment Scotland Policy Statement [online] Available at: https://www.historicenvironment.scot/advice-and-support/planning-and-guidance/legislation-and-guidance/historic-environment-scotland-policy-statement/ (accessed 21/10/2016)

[274] Scotland's Environment (2015) Historic Environment [online] Available at: http://www.environment.scotland.gov.uk/get-informed/people-and-the-environment/historic-environment/ (accessed 14/11/2016)

[275] ibid

[276] Historic Environment Scotland (2014) Summary of Scotland's Historic Environment Audit 2014 [online] Available at: https://www.historicenvironment.scot/media/2385/shea-2014-summary.pdf (accessed 26/10/2016)

of buildings whilst maintaining their cultural significance can also present challenges. For example, improving energy efficiency by preventing heat loss in some older buildings can result in condensation and fungus growth due to reducing the air flow in the building. This can potentially have damaging effects on the fabric of buildings and the health of those using it[277].

10 Landscape

Overview of Environmental Protection Objectives

10.1 Environmental protection objectives reflect the importance of all landscapes and also the need to help to improve those that have become degraded. The EC Landscape Convention[278] lays the foundation for these objectives.

10.2 The establishment of key national programmes including the National Scenic Areas Programme[279] demonstrate a continuing commitment to protect the special qualities of nationally important landscapes and seascapes. The protection and enhancement of Scotland's landscapes are set out at the national level in SPP and are also referenced in relation to several national developments and under a natural, resilient place in NPF3.

10.3 SNH has undertaken research on areas which are viewed as wild land[280]. This is based on four attributes: perceived naturalness of land cover; ruggedness of the terrain; remoteness from public roads or ferries; and lack of buildings, roads, pylons and modern artefacts. Areas with stronger wild land characteristics are more commonly found in the north and west, particularly areas of higher ground, although additional areas of wild land are present in other areas of Scotland[281].

Current Environmental Baseline

10.4 Rich in diversity, Scotland's landscapes are internationally renowned. Scotland's distinctive landscapes are a significant part of the country's natural and cultural heritage, and make a significant contribution to both the country's economic performance and the well-being of its people. Scotland's landscapes

[277] Historic Environment Scotland (2014) Summary of Scotland's Historic Environment Audit 2014 [online] Available at: https://www.historicenvironment.scot/media/2385/shea-2014-summary.pdf (accessed 26/10/2016)

[278] Council of Europe (2015) European Landscape Convention, ETS No. 176 [online] Available at: http://www.coe.int/en/web/conventions/full-list/-/conventions/treaty/176 (accessed 26/10/2016)

[279] SNH (2015) National Scenic Areas [online] Available at: http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/national-designations/nsa/ (accessed 11/10/2016)

[280] SNH (2012) Wild Land [online] Available at: http://www.snh.gov.uk/protecting-scotlands-nature/looking-after-landscapes/landscape-policy-and-guidance/wild-land/ (accessed 11/10/2016)

[281] SNH (2016) Mapping Scotland's wildness and wild land [online] Available at: http://www.snh.gov.uk/protecting-scotlands-nature/looking-after-landscapes/landscape-policy-and-guidance/wild-land/mapping/ (accessed 26/10/2016)

play a key role in attracting tourism, affording opportunities for business and providing the setting for outdoor recreation.

10.5 There are currently two National Parks (Loch Lomond and The Trossachs and the Cairngorms) and 40 National Scenic Areas in Scotland. Over 13% of Scotland's land area has been classified as a National Scenic Area[282]. Designations such as Local Landscape Areas, Special Landscape Areas, Regional Scenic Areas and Areas of Great Landscape Value have also been established at a regional and local level by many local authorities. These areas of important nature or landscape value have been designated locally for conservation purposes and protection from inappropriate development[283].

10.6 Scotland's landscapes are constantly changing and evolving in response to both natural processes and the changing demands of society. Changes in landscape tend to occur over long periods of time, and gradual change as a result of housing development and changes in farming and forestry practice can be difficult to determine[284]. The expansion of many towns and cities and associated infrastructure, such as roads and railways, is also seen as a pressure in changing the landscape settings in those areas[285].

10.7 Climate change is expected to lead to extensive landscape change across Scotland and is viewed as an increasing pressure on landscape, not only as a result of direct effects but also as a result of secondary impacts[286]. Direct impacts are likely as a result of changing temperatures and patterns of precipitation, weather events and sea level change[287]. Other commitments to adapting to the predicted effects of climate change, for example, the development of renewable energy (such as wind farms and hydro schemes) is seen by many as a pressure on both visual amenity and the character of many rural landscapes. The construction of new transport infrastructure and working towards a national target for increasing forest cover in Scotland also has the potential to affect our landscapes and seascapes.

10.8 The greatest changes are likely to be seen in areas of highest population, such as lowland and coastal areas. Mitigation and adaptation measures are

[282] SNH (2016) National Scenic Areas, [online] Available at: http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/national-designations/nsa/ (accessed 11/10/2016)

[283] SNH (2016) Local Designations, [online] Available at: http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/local-designations/ (accessed 11/10/2016)

[284] Scotland's Environment (2016) Landscape [online] Available at: http://www.environment.scotland.gov.uk/get-informed/land/landscape/ (accessed 12/10/2016)

[285] ibid

[286] SNH (2016) How will Scotland's landscapes be affected by climate change?, Researching the effects of climate change on Scotland's landscapes [online] Available at: http://www.snh.gov.uk/protecting-scotlands-nature/looking-after-landscapes/landscape-policy-and-guidance/climate-change-landscape/ (accessed 21/10/2016)

[287] SNH (2012) An assessment of the impacts of climate change on Scottish landscapes and their contribution to quality of life [online] Available at: http://www.snh.gov.uk/publications-data-and-research/publications/search-the-catalogue/publication-detail/?id=1868 (accessed 14/11/2016)

expected to have a greater influence on both Scotland's landscapes and the quality of life than that of the direct effects of climate change[288].

11 Material Assets

Overview of Environmental Protection Objectives

11.1 While existing policies relating to energy, waste, transportation and land use are wide-ranging, they largely share the aims of contributing to core planning objectives and supporting sustainable development, reducing GHG emissions, and making the best use of Scotland's resources and existing infrastructure.

11.2 There is a wealth of existing protection objectives and policy at the national and international levels relating to these broad topic areas. These include existing and forthcoming energy policy and climate change commitments in addition to current objectives and commitments set out in relevant policies. For example, Scotland's Land Use Strategy 2016 – 2021[289], NPF3[290] and SPP[291], Scotland's National Transport Strategy[292] and Making Things Last: A Circular Economy Strategy for Scotland[293].

Current Environmental Baseline

11.3 Waste management, transportation and efficiency in energy generation and land use form key aspects of the draft Plan and draft Strategy, and have the potential for environmental impacts. Environmental baseline information relevant to each of these sectors is presented in the following sections.

Energy

11.4 While overall electricity generation in Scotland decreased in 2014, Scotland continued to be a net exporter of electricity in exporting around 24% of the total

[288] SNH (2016) How will Scotland's landscapes be affected by climate change?, Researching the effects of climate change on Scotland's landscapes [online] Available at: http://www.snh.gov.uk/protecting-scotlands-nature/looking-after-landscapes/landscape-policy-and-guidance/climate-change-landscape/ (accessed 21/10/2016)

[289] Scottish Government (2016) Land Use Strategy 2016 – 2021 [online] Available at: http://www.gov.scot/Topics/Environment/Countryside/Landusestrategy (accessed 25/10/2016)

[290] Scottish Government (2014) National Planning Framework 3 [online] Available at: http://www.gov.scot/Publications/2014/06/3539/0 (accessed 25/10/2016)

[291] Scottish Government (2016) Scottish Planning Policy [online] Available at: http://www.gov.scot/Publications/2014/06/5823 (accessed 25/10/2016)

[292] Scottish Government (2016) National Transport Strategy [online] Available at: http://www.transport.gov.scot/system/files/documents/reports/Transport%20Scotland%20-%20National%20Transport%20Strategy%20-%20January%202016%20-%20final%20online.pdf (accessed 25/10/2016)

[293] Scottish Government (2016) Making Things Last: A Circular Economy Strategy for Scotland [online] Available at: http://www.gov.scot/Resource/0049/00494471.pdf (accessed 21/10/2016)

generated in 2014. However, this represented a decrease from 2013 where around 28% of all electricity generated was exported[294].

11.5 For the first time, renewables were the largest source of electricity generated in Scotland in 2014 (38%); contributing more than both nuclear (33%) and fossil fuels (28%)[295] which have both seen an overall decline in generation since 2000. Almost 19,000 Gigawatt Hours (GWh) of renewable electricity was generated in Scotland in 2014; almost a five-fold increase from 2000 when almost 5,000 GWh was generated[296]. In addition, the target of 500 Megawatt (MW) of community and locally owned renewable energy by 2020 has already been met[297]. The two largest renewable technology generators are presently wind and hydro, although a range of other alternative technologies are in the research or planning stages (e.g. wave and tidal energy).

11.6 Scotland consumed approximately 142 Terawatt Hours (TWh) of energy in 2014[298]. Industry and commercial sector was the main energy consumer accounting for 42% of demand, followed by the domestic sector and transport which accounted for 28% and 31%, respectively[299]. In 2014, final energy consumption in Scotland was around 15.2% lower than the 2005-2007 baseline[300].

11.7 Although the demand for heat in Scotland has fallen by 20% since 2005, heat is still estimated to account for over half of Scotland's total energy use (54%)[301]. Of this portion, around 41% was consumed domestically and 59% consumed in the industrial and commercial sectors[302]. In 2014, the primary heating fuel use for domestic purposes was mains gas (78%) followed by electricity (13%)[303]. However, estimates published by UK Department of Energy and Climate Change (DECC), now the Department for Business, Energy and Industrial Strategy, indicate that electricity, generated from renewable and non-renewable sources, used for heat now accounts for a larger proportion of all heat demand in the industrial (25%) and commercial sectors (19%)[304].

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[294] Scottish Government (2016) Energy in Scotland 2016 [online] Available at: http://www.gov.scot/Resource/0050/00501041.pdf (accessed 13/10/2016)

[295] ibid

[296] Scottish Government (2014) Scottish Greenhouse Gas Emissions 2014, An official Statistics Publication for Scotland [online] Available at: http://www.gov.scot/Publications/2016/06/2307 (accessed 18/10/2016)

[297] ibid

[298] Scottish Government (2016) Energy Statistics for Scotland - September 2016 [online] Available at: http://www.gov.scot/Resource/0050/00507078.pdf (accessed 13/01/17)

[299] The Scottish Government (2016) Energy Statistics Database, December 2016 [online] Available at: http://www.gov.scot/Topics/Statistics/Browse/Business/Energy/Database (accessed 13/01/17)

[300] Scottish Government (2016) Energy Statistics for Scotland – September 2016 [online] Available at: http://www.gov.scot/Resource/0050/00507078.pdf (accessed 26/10/2016)

[301] Scottish Government (2016) Energy in Scotland 2016 [online] Available at: http://www.gov.scot/Resource/0050/00501041.pdf (accessed 12/10/2016)

[302] ibid

[303] ibid

[304] ibid

Waste

11.8 Over 10 million tonnes of waste was generated in Scotland in 2014; a decrease of around 11% from the previous year and reflecting similar reductions in previous years[305]. The amount of waste generated in Scotland can vary by between 10 – 20% year on year[306]. This variation can be largely attributed to variations in the amount of construction and demolition waste generated; a waste stream that is particularly sensitive to the number of large infrastructure projects that are undertaken from year to year. However, when excluding construction and demolition waste, waste generation has fallen steadily each year since 2011[307].

11.9 The largest proportions of waste produced in 2014 consisted of soils (29.8%), household waste (21.9%) and mineral waste from construction and demolition (13.7%)[308]. Of this, around 5.57 million tonnes was recycled, reused or composted[309]. The remaining waste comprised 4.16 million tonnes disposed via incineration or landfill, and 0.47 million tonnes recovered through incineration/co-incineration processes[310].

11.10 There has been a progressive reduction in landfilled waste volumes since 2005 (over 42%)[311]. However, following significant reductions seen between 2005 and 2010, coinciding with the publication and implementation of Scotland's Zero Waste Plan, there has been increased variation in recycled volumes in recent years. In 2014, around half of recycled wastes were classed as soils and mineral wastes from construction and demolition, with the remainder consisting of vegetal, paper and cardboard, wood, metallic, sludge and other wastes[312]. There has been a steady increase in waste recovered through energy generation at co-incineration or incineration facilities.

11.11 The reduction in waste generation and increase in recycling may be partly due to implementation of a range of policies and targeted measures. These changes in waste management can be attributed, at least in part, to action taken at the nation and local levels. For example, a reduction in frequency of residual waste collections by local authorities, the implementation of source segregated recycling services to the commercial and public sector as required under the Waste Scotland Regulations (2012), and a new legislative duty of

[305] SEPA (2014) Waste from all sources – Summary data 2014 [online] Available at: http://www.sepa.org.uk/media/219149/wfas-2014-commentary-final-v141.pdf (accessed 13/10/2016)
[306] ibid
[307] ibid
[308] ibid
[309] ibid
[310] ibid
[311] ibid
[312] ibid

care that requires all waste producers (excluding householders) to segregate material for recycling[313].

11.12 A key driver in waste management has been achieving the aim of 'moving up' the waste hierarchy, and promoting the long-term benefits of waste prevention, minimisation and reuse in preference to disposal options. Much of Scotland's policy approach to waste management was set out in the Zero Waste Plan[314], Safeguarding Scotland's Resources: Blueprint for a More Resource Efficient and Circular Economy[315] and Making Things Last: A Circular Economy Strategy for Scotland[316].

Transport

11.13 The total volume of traffic on Scotland's roads in 2014 was 44.8 billion vehicle kilometres, the highest recorded level, and car journeys accounted for around 80% of these journeys. Some 2.8 million vehicles were licensed in Scotland in 2014, making this the highest ever number. A total of 84% of these were cars. In 2014, commuting remained the main reason for road travel[317].

11.14 The total number of new motor vehicles registrations in 2014 (262,000) was around 9% more than the previous year, and 2% more than 2004. Of these, 48% were petrol-propelled and 51% diesel-propelled, with the remainder electric or hybrid-electric vehicles[318].

11.15 In terms of the movement of freight, road travel accounted for the largest share of tonne kilometres travelled in 2012; prior to this, most freight was moved by coastwise shipping. It is estimated that in 2014, over 123 million tonnes of goods were lifted within Scotland by UK heavy goods vehicles (HGVs) and transported to destinations within Scotland[319]. Almost 14 million tonnes of goods were delivered from Scotland to destinations elsewhere in the UK, and over 18 million tonnes brought into Scotland from elsewhere in the UK[320].

[313] SEPA (2014) Waste from all sources – Summary data 2014 [online] Available at: http://www.sepa.org.uk/media/219149/wfas-2014-commentary-final-v141.pdf (accessed 13/10/2016)

[314] Scottish Government (2010) Scotland's Zero Waste Plan. Available at: http://www.gov.scot/Publications/2010/06/08092645/0

[315] Scottish Government (2010) Safeguarding Scotland's Resources: Blueprint for a More Resource Efficient and Circular Economy [online] Available at http://www.gov.scot/Resource/0043/00435308.pdf (accessed 21/10/2016)

[316] Scottish Government (2016) Making Things Last: A Circular Economy Strategy for Scotland [online] Available at: http://www.gov.scot/Resource/0049/00494471.pdf (accessed 21/10/2016)

[317] Transport Scotland (2016) Scottish Transport Statistics No. 34 2015 Edition, Road Transport Vehicles [online] Available at: http://www.transport.gov.scot/report/j415388-04.htm (accessed 13/10/2016)

[318] ibid

[319] Transport Scotland (20165) Scottish Transport Statistics No. 34 2015 Edition, Road Freight [online] Available at: http://www.transport.gov.scot/report/j415388-06.htm (accessed 13/10/2016)

[320] ibid

Around 55% of road freight journeys were over distances of less than 50 kilometres, with half of that carried a distance of less than 25 kilometres[321].

11.16 Scotland's marine areas and coastal waters are utilised by a wide range of vessels and service a variety of industries. Ports and harbours are located all around the Scottish coastline. These broadly range from single jetties that accommodate recreational vessels and fishing vessels; small ports and harbours that facilitate lifeline ferry services as well as recreational and fishing vessels[322]. Larger ports such as Cairnryan support ferry services between Scotland and Northern Ireland, and the Forth, Clyde and Sullom Voe ports accounted for the highest tonnages of freight traffic in Scotland in 2014[323].

11.17 There were approximately 24.1 million air terminal passengers at Scottish airports in 2014, an increase of 3.6%, or 1 million people from 2013[324]. Passenger numbers have increased by 39% between 2001 and 2007 before falling in 2010; since then, they have continued to rise by 15%[325]. Over the past ten years, the number of air passengers per head of population has been higher for Scotland than for the UK [326].

11.18 Transport emissions, including Scotland's share of international aviation and shipping, accounted for 28% (13 $MtCO_2e$) of Scotland's total emissions in 2014[327]. Road transport is by far the largest source of these emissions. In 2014, cars alone accounted for nearly half of Scotland's transport sector emissions (44%) alongside HGVs (17%) and vans (12%). International aviation and shipping emissions contributed around 18% of total transport emissions[328].

11.19 After a sequence of almost continual increases in transport emissions between 2000 and 2007 where emissions reached a peak of 14.8 $MtCO_2e$, emissions have fallen year on year, and in 2015, remained below the 1990 base year level of 13.2 $MtCO_2e$[329]. Overall, car emissions are just 2% lower than in 1990, both reflecting improvements in car efficiency alongside an increase in vehicle

[321] Transport Scotland (2016) Scottish Transport Statistics No. 34 2015 Edition, Road Freight [online] Available at: http://www.transport.gov.scot/report/j415388-06.htm (accessed 13/10/2016)

[322] Transport Scotland (2016) Scottish Transport Statistics No. 34 2015 Edition Water Transport [online] Available at: http://www.transport.gov.scot/report/j415388-12.htm (accessed 26/10/2016)

[323] ibid

[324] Transport Scotland (2016) Scottish Transport Statistics No 34 2015 Edition, Air Transport [online] Available at: http://www.transport.gov.scot/report/j415388-11.htm (accessed 26/10/2016)

[325] ibid

[326] ibid

[327] Committee on Climate Change (2016) Reducing Emissions in Scotland 2016 Progress Report [online] Available at: https://www.theccc.org.uk/publication/reducing-emissions-in-scotland-2016-progress-report/ (accessed 26/10/2016)

[328] ibid

[329] Transport Scotland (2015) Carbon Account for Transport No.7: 2015 Edition [online] Available at: http://www.transport.gov.scot/report/j408446-00.htm (accessed 14/10/2016)

kilometres over this period. The UK DECC estimates that petrol and diesel consumption has been falling since 2007[330].

11.20 Newly registered cars are becoming more efficient, with average CO_2 emissions for new car registrations falling by 25% over the last 10 years[331]. While the uptake of ultra-low carbon vehicles more than quadrupled between 2011 and 2015, this currently represents a very small proportion of new car registrations[332].

11.21 In 2014, aviation and shipping sector emissions decreased by 3% from the previous year, broadly in line with an average annual fall of 4% since 2009. Emissions are 11% lower than 1990 levels[333].

Forestry

11.22 In 2016, Scotland's woodland and forest cover is estimated at 1.4 million hectares (18% of the land area), with just one fifth of this being native woodland; the remainder is dominated by introduced species[334,335]. Of this, around 9% is the national forest estate managed on behalf of Scottish Ministers by Forestry Enterprise Scotland which is part of Forestry Commission Scotland[336]. The remainder of Scotland's woodland area is owned and managed by other interests including individuals, businesses, charities, community groups and local authorities, amongst others[337].

11.23 Around 6,000 hectares of new woodland were created in the UK in 2015-2016, mostly with broadleaved species[338]. The Scottish Forestry Strategy sets out plans to increase woodland cover to 25% by 2050[339]. While Scotland's forests and woodlands occupy just 18% of our land surface, they support a

[330] Transport Scotland (2015) Carbon Account for Transport No.7: 2015 Edition [online] Available at: http://www.transport.gov.scot/report/j408446-00.htm (accessed 14/10/2016)

[331] Transport Scotland (2015) Scottish Transport Statistics No. 34, Environment and Emissions [online] Available at: http://www.transport.gov.scot/report/j415388-16.htm (accessed 14/11/2016)

[332] ibid

[333] Committee on Climate Change (2016) Reducing Emissions in Scotland 2016 Progress Report. Available at: https://www.theccc.org.uk/publication/reducing-emissions-in-scotland-2016-progress-report/ (accessed 25/10/2016)

[334] Scotland's Environment (2015) Woodlands and forests [online] Available at: http://www.environment.scotland.gov.uk/get-informed/land/woodlands-and-forests/ (accessed 12/10/2016)

[335] Forestry Commission (2016) Forestry Statistics [online] Available at: http://www.forestry.gov.uk/forestry/infd-7aqdgc (accessed 12/10/2016)

[336] Forestry Commission Scotland (undated) More about Forestry Commission Scotland [online] Available at: http://scotland.forestry.gov.uk/images/corporate/pdf/about-fcs-brochure.pdf (accessed 12/10/2016)

[337] Scottish Government (2006) The Scottish Forestry Strategy [online] Available at: http://www.forestry.gov.uk/sfs (accessed 12/10/2016)

[338] Forestry Commission (2016) Forestry Statistics and Forestry Facts and Figures [online] Available at: http://www.forestry.gov.uk/forestry/infd-7aqdgc (accessed 12/10/2016)

[339] Forestry Commission Scotland (2006) The Scottish Forestry Strategy [online] Available at: http://www.forestry.gov.uk/sfs (accessed 26/10/2016)

disproportionately high share of our biodiversity[340]. Scotland's mature native woodlands support a rich variety of species, and some native woodlands and the plants and animals that live there are unique to Scotland and are at the limits of their worldwide distribution. Some areas of native woodland are legally protected as SSSIs or SACs, and as of March 2015, around 68% of designated woodland features were in favourable or recovering condition. This represented an increase from 59% in 2005[341].

11.24 Most Scottish woodlands are dominated by non-native species. This is a result of the planting of conifer species for softwood timber, as well as historical planting of sycamore, beech and other hardwoods[342]. Some 9.1 million cubic metres of overbark standing timber was harvested from Scottish forests in 2014, representing a 6% increase from the previous year[343]. Wood fuel for biomass heating is a growing use of forestry resources[344]. With the exception of a drop in harvesting in 2008/2009, the quantity of timber harvested has increased relatively steadily over the past 35 years and is around seven times the level of the late 1970s[345].

11.25 Woodlands and forests contain substantial carbon in the soil and vegetation, and are hugely important for carbon, water and energy cycles. In the UK, the amount of carbon held in woodlands and forests is estimated at around 880 million tonnes of carbon[346]. In addition, harvesting trees for wood fuel or power generation instead of fossil fuels can result in a net emissions reduction, provided the rate of growth of replacement trees is sufficient to absorb the CO_2 released during fuel production and consumption[347].

11.26 Scotland is a net sink of GHG from land use, land use change and forestry activities. The size of this sink increased by 166% between 1990 and 2014,

[340] Forestry Commission (2016) Biodiversity [online] Available at: http://scotland.forestry.gov.uk/supporting/strategy-policy-guidance/biodiversity (accessed 12/10/2016)

[341] Scotland's Environment (2015) Woodlands and forests [online] Available at: http://www.environment.scotland.gov.uk/get-informed/land/woodlands-and-forests/ (accessed 12/10/2016)

[342] Scotland's Environment (2015) Woodlands and forests [online] Available at: http://www.environment.scotland.gov.uk/get-informed/land/woodlands-and-forests/ (accessed 12/10/2016)

[343] Scottish Government (2015) Forestry – Timber Harvested [online] Available at: http://www.scotland.gov.uk/Topics/Statistics/Browse/Agriculture-Fisheries/TrendTimberHarvested (accessed 12/10/2016)

[344] Forestry Commission Scotland (2015) Woodfuel Demand & Usage. Available at: http://scotland.forestry.gov.uk/images/corporate/pdf/woodfuel-demand-and-usage-in-scotland_2015.pdf (accessed 26/10/2016)

[345] Scottish Government (2015) Forestry – Timber Harvested [online] Available at: http://www.scotland.gov.uk/Topics/Statistics/Browse/Agriculture-Fisheries/TrendTimberHarvested (accessed 12/10/2016)

[346] Forestry Commission (undated) Forestry and climate change mitigation [online] Available at: http://www.forestry.gov.uk/website/forestresearch.nsf/ByUnique/INFD-62HCJH (accessed 12/10/2016)

[347] ibid

attributed largely to an increase in forest carbon stocks and a reduction in the conversion of grassland and forests to cropland and settlements[348].

Agriculture

11.27 Agriculture is the dominant land use in Scotland, with agricultural holdings covering 5.6 million hectares, equating to around 71% of total land area[349]. Over half of this is used for rough grazing, around a quarter taken up by grassland, and smaller portions are used for crops or fallowing (11%), woodland (9%) and other land such as yards, buildings and ponds (3%)[350]. Additionally, around 0.6 million hectares of land is used for the common grazing of livestock[351].

11.28 While the proportion of farmland used for crops and fallow remained generally stable between 2005 and 2015, increases in grassland, woodland and other land areas were observed over the same period [352]. In particular, the area of woodland in agricultural holdings more than doubled over this period [353]. A decrease in livestock production (i.e. sheep, cattle, poultry and pigs) has also been observed since 2005; and alongside an increase in woodland area, these changes have likely contributed to the observed decrease in rough grazing land since 2008[354].

11.29 Agricultural land use has a strong influence on the landscape and environment. For example, Scottish farmland also sustains important habitats for biodiversity including unimproved grassland, cultivated fields, walls and hedges, watercourses, wetlands, moorland and upland grassland. Changes in land use can have an impact on wildlife habitats and water pollution (e.g. via diffuse pollution). Agriculture also accounts for around 19% of the total GHG emissions in the UK, contributing predominantly Nitrous oxide (N_2O) and methane gases, with smaller amounts of CO_2[355].

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[348] Salisbury et al. (2016) Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990 – 2014 [online] Available at: https://uk-air.defra.gov.uk/assets/documents/reports/cat07/1606140853_DA_GHGI_1990-2014_Report_v1.pdf (accessed 26/10/2016)

[349] Scottish government (undated) Agricultural Land Use in Scotland [online] Available at: http://www.gov.scot/Topics/Statistics/Browse/Agriculture-Fisheries/agritopics/LandUseAll (accessed 12/10/2016)

[350] Scottish Government (undated) Results from the June 2015 Scottish Agricultural Census [online] Available at: http://www.gov.scot/Publications/2015/10/6201/320268 (accessed 12/10/2016)

[351] ibid

[352] ibid

[353] ibid

[354] ibid

[355] Salisbury et al. (2016) Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990 – 2014 [online] Available at: https://uk-air.defra.gov.uk/assets/documents/reports/cat07/1606140853_DA_GHGI_1990-2014_Report_v1.pdf (accessed 26/10/2016)

11.30 Intensive land management is one of the main challenges to farmland wildlife[356]. A shift towards intensification of lowland farmland for food production, for people as well as livestock, has resulted in a change in biodiversity which could have major implications for food production[357]. Increased field sizes and use of agricultural chemicals has led to a potentially serious decline in pollinators such as bees which are essential for crop production[358]. This can affect crop volumes and therefore impact on the ability to meet the demand for food[359]. Soil erosion by water or wind is a natural process that can be exacerbated by poor land management[360]. In turn, soil erosion can result in the loss of fertile top soil, can damage soil function and adversely affect food production[361].

11.31 Climate change is expected to raise further challenges for the agriculture sector. Further changes in temperature and rainfall are expected to change the patterns of Scotland's agricultural land-uses, and could lead to increased pressure on the land[362]. Farming has an important role to play in increasing the resilience of biodiversity and assisting adaptation through the management of existing habitats and enhancing connectivity between areas through habitat networks[363]. Conversely, increased connectivity may also result in quicker spread of diseases and pests, including invasive non-native species.

11.32 Climate change impacts may also result in longer growing seasons which could placing further pressure on water quality (e.g. diffuse pollutants)[364].

12 Evolution of the Baseline in the Absence of the Plan

12.1 While the draft Plan and draft Strategy set out a range of policies and proposals to meet Scotland's climate change commitments, the progression of many of these would likely continue in the absence of the development of the two documents. For example, the Scottish Government's ambitions for the transition to low carbon energy and increasing energy security are focal points of

[356] Scotland's Environment (undated) Farmland [online] Available at: http://www.environment.scotland.gov.uk/get-informed/land/farmland/ (accessed 12/10/2016)

[357] ibid

[358] ibid

[359] ibid

[360] Scotland's Soils (undated) Soils [online] Available at: http://www.environment.scotland.gov.uk/get-informed/land/soils/ (accessed 12/10/2016)

[361] Scotland's Soils (undated) Extent of soil erosion and landslides [online] Available at: http://www.soils-scotland.gov.uk/context/erosion (accessed 26/10/2016)

[362] SNH (2012) Farming and Climate Change [online] Available at: http://www.snh.gov.uk/land-and-sea/managing-the-land/farming-crofting/farming-wildlife/farming-and-climate-change/ (accessed 12/10/2016)

[363] SNH (2009) Natural Heritage Futures Update, Farming [online] Available at: http://www.snh.gov.uk/docs/A306272.pdf (accessed 26/10/2016)

[364] Scotland's Environment (undated) Crops and Livestock [online] Available at: http://www.environment.scotland.gov.uk/get-informed/land/crops-and-livestock/ (accessed 22/10/2016)

established policies such as the Electricity Generation Policy Statement[365] and Renewable Routemap[366].

12.2 The Heat Policy Statement: Towards Decarbonising Heat: Maximising the Opportunities for Scotland[367] sets out the Scottish Government approach for reducing heat consumption, diversifying heat sources, increasing security of supply, and working towards greater local control of heat. Others, such as Home Energy Efficiency Programme Scotland (HEEPS), Warmer Homes Scotland and Scottish Energy Efficiency Programme (SEEP) are more focused on reducing demand, and together they address heat and power consumption through a variety of means (e.g. improved building efficiency, consumer education, and demand-side response). Improved human health from reductions in air pollution and fuel poverty are key considerations of policies such as Cleaner Air for Scotland – The Road to a Healthier Future[368] and the recent work of the Scottish Fuel Poverty Working Group[369].

12.3 Without the draft Plan and draft Strategy, the implementation of these policies and proposals would still be taken forward at the sectoral level, and Scotland's ambitions for a shift away from traditional, finite fuels towards lower carbon energy, and continued reduction in electricity and heat consumption would likely continue. However, this approach would lack the overarching cross-sectoral approach provided by the development of the draft Plan and draft Strategy, and their development provides an opportunity to apply greater focus on these issues and a vehicle to drive these actions forward. In particular, the draft Plan and draft Strategy could help to highlight the importance that a 'whole-systems approach' is taken in considering energy generation and use as equal priorities, and promote more efficient utilisation Scotland's resources.

Many of the environmental trends identified in the collation of the environmental baseline are independent of the draft Plan and Strategy. For example, Scotland's population is expected to continue to rise and age in the coming years[370]. Due to the carbon already released into the atmosphere, the predicted effects of climate change are expected to continue. Effects such as more frequent and extreme weather events, and changing rainfall patterns are

[365] The Scottish Government (2013) Electricity Generation Policy Statement – 2013 [online] Available at: http://www.gov.scot/Topics/Business-Industry/Energy/EGPSMain (accessed 06/12/2016)

[366] The Scottish Government (2015) 2020 Routemap for Renewable Energy in Scotland – Update, 17 September 2015 [online] Available at: http://www.gov.scot/Resource/0048/00485407.pdf (accessed 05/12/2016)

[367] The Scottish Government (2015) The Heat Policy Statement: Towards Decarbonising Heat: Maximising the Opportunities for Scotland [online] Available at: http://www.gov.scot/Publications/2015/06/6679 (accessed 06/12/2016)

[368] The Scottish Government (2015) Cleaner Air for Scotland – The Road to a Healthier Future [online] Available at: http://www.gov.scot/Resource/0048/00488493.pdf (accessed 06/12/2016)

[369] The Scottish Government (2016) A Scotland without fuel poverty is a fairer Scotland: Four steps to achieving sustainable, affordable and attainable warmth and energy use for all [online] Available at: http://www.gov.scot/Publications/2016/10/2273 (accessed 06/12/2016)

[370] The Scottish Government (2015) Summary: Age Demographics [online] Available at: http://www.gov.scot/Topics/People/Equality/Equalities/DataGrid/Age/AgePopMig (accessed 05/12/2016)

also likely to place additional pressures on infrastructure and both the supply and demand of energy. Climate change in particular is also expected to continue to place increasing pressure on the natural and historic environments, with pressures identified on global biodiversity from continuing trends in global warming, rising sea temperatures, increased salinity in Scotland's marine waters, and increased coastal erosion, amongst many others.

Appendix B

Background Information on Energy Technologies and Scotland's Energy Sector

1 Introduction

1.1 This appendix provides a broad overview of Scotland's energy sector and discusses a range of energy generation technologies in a Scottish or UK context. It provides a baseline on which the draft Strategy can be assessed and acts as a supplement to the environmental baseline in Appendix A.

2 Energy Infrastructure

2.1 Good electricity grid connection is essential to the social and economic wellbeing of communities in every part of Scotland. As Scotland's energy mix changes over the next few years, the electricity transmission network (grid) that supports the balance between energy generation and demand will change significantly.

2.2 New infrastructure may be required to facilitate a transition to new or large scale uptake of technologies. For example, it is considered in "Switched on Scotland: A Roadmap to Widespread Adoption of Plug in Vehicles" [371] sets out a vision that by 2050, Scottish towns, cities and communities will be free from the damaging effects of petrol and diesel fuelled vehicles. It further stated that this will require a long term transformation that extends to 2050 and set out a number of goals to achieve this, including recharging infrastructure to meet the changing needs of the electric and plug in hybrid electric vehicles market[372].

2.3 Many areas in Scotland are also off the gas grid, including the majority of the islands and more remote parts of rural Scotland[373]. In Scotland, 87% of Renewable Heat Initiative accreditations are from domestic properties off the gas grid[374], involving technologies such as air source heat pumps (91% of those installed are in locations off the gas grid), biomass (89%), ground source heat pumps (88%) and solar thermal (61%)[375].

2.4 Considerable opportunities for the re-use of energy infrastructure have also been identified. The reuse of equipment from wind turbines and

[371] Transport Scotland (2013) Switched On Scotland: A Roadmap to Widespread Adoption of Plug in Vehicles [online] Available at: http://www.transport.gov.scot/report/j272736-06.htm (accessed 28/10/2016)

[372] ibid

[373] Scottish Government (2016) Energy in Scotland 2016 [online] Available at: http://www.gov.scot/Resource/0050/00501041.pdf (accessed 26/10/2016)

[374] ibid

[375] ibid

decommissioned oil and gas platforms is one of four key priorities areas for action within “Making Things Last: A Circular Economy Strategy for Scotland”[376]. There may also be opportunities to extend the lifespan of infrastructure; for example, through repowering of existing windfarms.

2.5 Infrastructure will play a key role in ensuring security of supply and decarbonising our energy systems in the most cost effective, affordable way[377]. There will be significant challenges ahead in delivering these objectives to ensure our energy system can respond to increases in peak demand over the longer term (driven largely by the extent to which heating and transport are electrified) and make best use of more low carbon generation on the system[378]. The implementation of active network management[379] alongside smart solutions technologies such as demand side response, storage and smart networks[380], are expected to play key roles in the future. Together, these could help achieve greater flexibility in the energy system[381]. In turn, a more flexible system could help to reduce the overall need for power generation, improve monitoring of consumption and losses, allow generation to be “turned off” when it exceeds demand, and defer or avoid the need for additional investment in reinforcing energy networks[382].

Heat Distribution Systems

2.6 How heat is delivered to the final end user varies depending primarily on the source. This can range from a connection to the gas grid, to a district heating network to a single heating solution, such as a wood burning stove. The infrastructure for heat storage and distribution is different to that of oil and gas as heat cannot be transported efficiently over large distances.

2.7 A district heating system comprises a network of insulated pipes that are used to deliver heat in the form of hot water or steam, from point of generation to an end user. Heat networks can also be supplied by a range of sources, for example, biomass or bio-gas fuelled boilers, geothermal hot water, combined heat and power plants and excess heat (or waste heat). District heating schemes also have the potential to reduce greenhouse gas emissions (GHG)

[376] Scottish Government (2016) Making Things Last A Circular Economy Strategy for Scotland [online] Available at: http://www.gov.scot/Resource/0049/00494471.pdf (accessed 28/10/2016)

[377] DECC (2015) Toward a Smart Energy System [online] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/486362/Towards_a_smart_energy_system.pdf (accessed 31/10/2016)

[378] ibid

[379] Scottish and Southern Electricity Networks (undated) What is Active Network Management [online] Available at: https://www.ninessmartgrid.co.uk/our-trials/active-network-management/what-is-active-network-management/ (accessed 31/10/2016)

[380] DECC (2015) Toward a Smart Energy System [online] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/486362/Towards_a_smart_energy_system.pdf (accessed 31/10/2016)

[381] ibid

[382] ibid

emissions. For example, a large scale network in Aberdeen developed to supply gas fired combined heat and power reported a reduction of 45% carbon emissions from the buildings serviced[383] and a reduction in fuel costs[384].

Combined heat and power

2.8 Combined heat and power (CHP) is a highly effective process that captures and utilises the heat that is a by-product of the electricity generation process. By generating heat and power simultaneously, CHP can reduce carbon emissions by up to 30% compared to the separate means of conventional heat and power generation via a boiler and power station[385].

2.9 The majority of modern CHP engines tend to be designed to use bio-gas, natural gas or biomass as their fuel. As such, while CHP is a low carbon technology, Carbon dioxide (CO_2) emissions are still released[386]. The exhaust gases and the pollutants that these schemes can generate can have implications for the environment and human health, depending on the design and technology used. In some circumstances there could also be potential for visual impacts from large-scale CHP and the construction of the thermal store[387,388].

3 Energy Storage

3.1 Energy storage is likely to be an increasingly important part of the transition to deliver clean, affordable and secure supplies of energy[389]. In particular, there is a need to understand the potential for storage integration across the whole energy system[390]. Better use of energy storage can help Scotland manage peak energy demands and the intermittency of renewables, meet targets and

[383] Scottish Government (2013) District Heating Action Plan; Response to the Expert on District Heating [online] Available at: http://www.scotland.gov.uk/Publications/2013/06/7473 (accessed 19/09/2013)

[384] ibid

[385] Gov.UK (2013) About CHP [online] Available at: https://www.gov.uk/guidance/combined-heat-and-power (accessed 28/10/2016)

[386] Local Government Association (2012) Benefits and potential impacts for combined heat and power [online] Available at: http://www.local.gov.uk/climate-change/-/journal_content/56/10180/3510705/ARTICLE (accessed 28/10/2016)

[387] The Scottish Government (2014) SEA Environmental Report on the Draft Heat Generation Policy Statement: Towards Decarbonising Heat: Maximising the Opportunities for Scotland [online] Available at: http://www.gov.scot/Publications/2014/03/7673/2 (accessed 25/10/2016)

[388] Local Government Association (2012) Benefits and potential impacts for combined heat and power [online] Available at: http://www.local.gov.uk/climate-change/-/journal_content/56/10180/3510705/ARTICLE (accessed 28/10/2016)

[389] ClimateXchange (2014) Energy Storage in Scotland, summary of report on thermal and electrical energy storage [online] Available at: http://www.climatexchange.org.uk/files/6114/5218/2211/Summary_energy_storage.pdf (accessed 27/10/2016)

[390] ibid

extend infrastructure life[391]. Energy storage can come in many forms, from large scale hydro pumped storage to electric vehicles.

3.2 Battery storage devices can be used in a wide variety of applications including balancing supply and demand from the grid. They can operate across a range of scales, from large systems which connect to the grid to small scale domestic batteries and electric vehicles. Hydrogen can also be stored and re-converted to electricity using fuel cells or used as fuel for transport or in the gas distribution system. Hydrogen fuel cells are considered a clean, reliable, quiet and efficient source of high quality electric power[392]. The two main applications for hydrogen fuel cells are in stationary power sources and hydrogen fuel cell vehicles[393]. Fuel cells allow owners to operate independently from the power grid, which is important for those that cannot afford power supply disruptions[394].

3.3 Presently there is little infrastructure in place to support the use of this technology and substantial investment would be needed to convert from natural gas to hydrogen. Whilst there are likely benefits in terms of climatic factors through the use of fuel cells, the Strategic Environmental Assessment (SEA) undertaken for the Scottish Government's Heat Policy Statement noted the potential for impacts such as land take and visual and cultural heritage effects amongst others; particularly if deployed on a large scale[395].

3.4 Pumped hydro storage is discussed under Electricity Production (Section 5 of this Appendix).

4 Fossil fuels

4.1 In Scotland, electricity generation from fossil fuels as a whole decreased from 31.9% of total in 2013 to 27.7% in 2014 compared to an increase in generation from renewables from 32% to 38% over the same period[396]. This is thought to be partly due to the increase in capacity of renewable technologies and the Scottish Government's commitment to achieving the 100% renewable electricity

[391] ClimateXchange (2014) Energy Storage in Scotland, summary of report on thermal and electrical energy storage [online] Available at: http://www.climatexchange.org.uk/files/6114/5218/2211/Summary_energy_storage.pdf (accessed 27/10/2016)

[392] Environmental and Energy Study Institute (undated) Hydrogen Fuel Cells [online] Available at: http://www.eesi.org/topics/hydrogen-fuel-cells/description (accessed 27/10/2016)

[393] ibid

[394] ibid

[395] The Scottish Government (2014) SEA Environmental Report on the Draft Heat Generation Policy Statement: Towards Decarbonising Heat: Maximising the Opportunities for Scotland [online] Available at: http://www.gov.scot/Publications/2014/03/7673 (Accessed 26/10/2016)

[396] Scottish Government (2016) Energy in Scotland 2016 [online] Available at: http://www.gov.scot/Resource/0050/00501041.pdf (accessed 26/10/2016)

target[397]. However, this reflects an overall decrease observed in electricity generation from coal (by 38%), gas by (by 69%) and oil (by 69%) since 2000[398].

Oil and Gas

4.2 Oil and natural gas are fossil fuels which are extracted from wells drilled into reserves deep below the ground (onshore) and sea bed (offshore). Scotland is estimated to be the largest oil producer and second largest gas producer in the EU[399]. In 2015-2016, oil and gas fields in Scotland accounted for 96% of UK crude oil and natural gas liquids production, and 60% of UK natural gas production[400]. Estimates for the first quarter of 2016 indicate that oil and gas production remains at its highest level in four years[401].

4.3 Conventional oil and gas operations can place pressures on the environment through all stages of operation. These pressures will differ depending on whether the activities are undertaken onshore or offshore, but they broadly include the potential for disturbance and damage to species and habitats from these operations, and the risk of release of oil or chemicals to the environment, amongst others[402]. Additionally, the final consumption of the fossil fuels generated by all of these activities produces GHG emissions which are known to contribute to climate change.

4.4 Underground coal gasification (UCG) is an industrial process which converts coal in difficult to reach underground seams into synthesis gas, and is a type of unconventional technology[403]. The Scottish Government put in place a moratorium on UCG in October 2015 in order to gather and consider evidence on the technology[404]. Subsequent evidence collected during this process reported a number of environmental impacts, in addition to public health concerns, likely to arise through the implementation of UCG.

4.5 Impacts identified included releases to air and water, as well as waste materials removed from the combustion site, drilling materials and treated materials at the surface, and products and wastes from syngas plant operation all require

[397] Scottish Government (2016) Energy in Scotland 2016 [online] Available at: http://www.gov.scot/Resource/0050/00501041.pdf

[398] ibid

[399] ibid

[400] Scottish Government (2016) Oil and Gas Production Statistics 2015-16 [online] Available at: http://www.gov.scot/Resource/0050/00505657.pdf (accessed 19/10/2016)

[401] ibid

[402] OSPAR Commission (2009) Assessment of impacts of offshore oil and gas activities in the North-East Atlantic. Available at http://qsr2010.ospar.org/media/assessments/p00453_OA3-BA5_ASSESSMENT.pdf (accessed 20/10/2016)

[403] GSTC (undated) Underground Coal Gasification [online] Available at: http://www.gasification-syngas.org/technology/underground-coal-gasification/ (accessed 20/10/2016)

[404] Scottish Government (2016) Underground coal gasification blocked [online news article] Available at: http://www.gov.scot/Topics/Business-Industry/Energy/onshoreoilandgas (accessed 19/10/2016)

consideration[405]. Risks to groundwater have also been identified, highlighting the significance of local hydrological conditions[406]. It was also recommended that an appropriate environmental impact assessment (EIA) would reasonably be expected to address and consider the impacts of UCG on a broad range of environmental receptors. These included geology, water use, freshwater (and marine in the Scottish context) ecology, biodiversity and climatic factors and consider these at testing, construction, operational and decommissioning phases of development[407].

4.6 Coal has historically played a very important role in meeting Scotland's needs for electricity. In 2014, coal accounted for 20.6% of total electricity generation[408] with over 2.5 million tonnes of coal (nearly 22% of total UK production) mined in Scotland in that year[409]. Longannet power station, Scotland's last remaining coal-fired power station, ceased operations in early 2016[410], significantly reducing demand for the resource in Scotland beyond a small market demand for use in domestic heating. There are a number of environmental impacts that can arise from abandoned coal mines, including landscape, biodiversity and water quality implications, amongst others.

5 Electricity Production

Thermal Electricity Generation

5.1 A thermal power station uses a source of heat energy which is then converted into mechanical energy to drive an electrical generator. A number of different fuel sources can be used in this process including coal, gas, oil, waste and nuclear power.

5.2 Overall there has been a decrease in the amount of fossil fuels used to generate electricity. However, since the closure of Longannet power station in early 2016[411], Scotland now only has around 1,180 Megawatts (MW) of installed fossil fuel capacity from the gas fired Peterhead power station[412]. Fossil fuel thermal generating stations generate GHG emissions, and as such, put pressure on wider actions seeking to reduce emissions. They can also

[405] Campbell Gemmell (2016) Independent Review of Underground Coal Gasification – Report [online] Available at : http://www.gov.scot/Publications/2016/10/2704/downloads#res507473 (accessed 25/10/2016)

[406] ibid

[407] ibid

[408] Scottish Government (2016) Energy in Scotland 2016 [online] Available at: http://www.gov.scot/Resource/0050/00501041.pdf (accessed 21/10/2016)

[409] ibid

[410] Macalister, Terry (24 March 2016) Longannet power station closes ending coal power use in Scotland, The Guardian [online] Available at: https://www.theguardian.com/environment/2016/mar/24/longannet-power-station-closes-coal-power-scotland (accessed 08/12/2016)

[411] ibid

[412] SSE (2014) Peterhead [online] Available at: http://sse.com/whatwedo/ourprojectsandassets/thermal/peterhead/ (accessed 29/11/2016)

place pressure on water resources in terms of consumption, discharges and temperature changes, and their locations in predominantly coastal areas can impact on marine and coastal biodiversity, amongst others.

5.3 Nuclear power accounted for 33% of total electricity output in 2014, a small decrease from 35% in 2014[413]. Scotland's two remaining nuclear power stations are located at Hunterston B in Ayrshire and Torness in East Lothian. The estimated end of generation for the two plants is 2023 and 2030 respectively[414,415]. The Scottish Government does not support the development of new nuclear stations; however, it is acknowledged that in the short term, existing stations help security of supply. While the continued operation and eventual decommissioning of the two plants has the potential to result in a range of environmental effects, activities at these sites are closely regulated.

Renewable electricity

Overview

5.4 Renewable energy can be defined as utilising are sources of power that quickly replenish themselves, unlike fossil fuel sources which are finite. Sources of renewable energy broadly include wind (onshore and offshore), hydro, wave, tidal, biomass, solar and geothermal. As well as a source of electricity, energy from renewable sources can also be used for heating and transport.

5.5 The Scottish Government is committed to an overall renewable energy target of 30% by 2020[416]. To achieve this overall energy target, individual targets were established for renewable electricity, heat and transport:

- Electricity: Renewable electricity generation to be the equivalent of 100% of gross electricity consumption by 2020.
- Heat: 11% of non-electrical heat demand to be met from renewable sources by 2020.
- Transport: 10% share of biofuels in transport and diesel consumption by 2020.
- Energy Consumption: 12% reduction in total final energy consumption by 2020.
- Community Renewable Energy Target: 500 MW of community and locally-owned renewable energy by 2020.

[413] Scottish Government (2016) Energy in Scotland 2016 [online] Available at: http://www.gov.scot/Resource/0050/00501041.pdf (accessed 21/10/2016)

[414] EDF Energy (2016) Hunterston B Power Station [online] Available at: https://www.edfenergy.com/energy/power-stations/hunterston-b (accessed 01/11/2016)

[415] EDF Energy (2016) Torness Power Station [online] Available at: https://www.edfenergy.com/energy/power-stations/torness (accessed 01/11/2016)

[416] Scottish Government (2016) Energy in Scotland 2016 [online] Available at: http://www.gov.scot/Resource/0050/00501041.pdf (accessed 21/10/2016)

5.6 In 2013, around 13.1% of total Scottish energy consumption came from renewable sources, up from 11.3% in 2012. In 2014, renewables were the single largest contributor to electricity generation in Scotland for the first time[417].

Wind (offshore and onshore)

5.7 In 2015, the generation of electricity from wind power in Scotland was at a record high level of 14,136 Gigawatt hours (GWh); nearly 7 times that generated in 2006[418]. Since 2010, wind has generated more electricity in Scotland than any other type of renewable energy source[419].

5.8 In terms of the proportion of pre-operational renewable projects in Scotland (i.e. in the planning or construction phases), 63% of the capacity is accounted for by onshore wind and 31% is accounted for by offshore wind; suggesting that wind power will continue to dominate the renewable energy sector in the coming years[420]. The development and operation of onshore and offshore wind systems can have a range of environmental impacts, many of which are likely to be dependent on design and locational factors. In general terms, these can include the potential for impacts on biodiversity and fauna, particularly birds, impacts on marine and/or terrestrial habitats, impacts on other coastal marine users (e.g. displacement, increased collision risk) and effects on landscape and visual amenity, amongst others[421].

Solar technologies

5.9 Light from the sun can be used to produce electricity through the use of technologies such as photovoltaic (PV) cells arranged in panels. These technologies can range from small, kilowatt-sized solar panels installed on the walls or roof of domestic households to feed electricity directly into the building, to larger arrays which function as solar power plants to feed power directly into the electricity grid[422]. Radiation from the sun can also be used to supply heat directly to buildings through the placement of thermal panels. This heat can be used to heat water or provide input into a central heating system[423].

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[417] Scottish Government (2016) Energy in Scotland 2016 [online] Available at: http://www.gov.scot/Resource/0050/00501041.pdf (accessed 21/10/2016)

[418] Scottish Government (undated) Energy in Scotland – Get the Facts [online] Available at: http://www.gov.scot/Topics/Business-Industry/Energy/Facts (accessed 18/10/2016)

[419] Scottish Government (2016) Energy in Scotland 2016 [online] Available at: http://www.gov.scot/Resource/0050/00501041.pdf (accessed 25/10/2016)

[420] ibid

[421] Scottish Government (2013) Planning Scotland's Seas: Draft Sectoral Marine Plans for Offshore Renewable Energy in Scottish Waters- Strategic Environmental Assessment: Environmental Report [online] Available at: http://www.gov.scot/Publications/2013/07/2403 (accessed 01/11/2016)

[422] The Renewable Energy Centre (undated) Power from the Sun (Photovoltaics) [online] Available at: http://www.therenewableenergycentre.co.uk/power-from-the-sun-(photovoltaics)/ (accessed 18/10/2016)

[423] ibid

5.10 Generation from solar PV sources has increased rapidly in the UK in recent years. Forecasts made four years ago estimated around 1.5 Gigawatt (GW) of installed capacity by 2015[424]; the current estimated installed capacity in the UK in 2016 is around 10 GW[425]. This increase has almost entirely been confined to small scale domestic or community developments, and there are already 87 Solar PV community energy schemes operational in Scotland, under the feed-in tariff, accounting for a total of 1.6 MW of capacity[426]. Edinburgh College's "solar meadow" consisting of over 2,500 PV panels is one notable exception[427]. However, several large-scale commercial solar PV projects are currently in the planning or pre-construction phases in Scotland, with the potential to further contribute to Scotland's growing solar energy production sector.

5.11 The continued uptake of solar PV and thermal panels on domestic or community developments has the potential for environmental effects. For example, there is the potential for cumulative visual effects, and effects on landscape and cultural heritage, particularly in conservation areas[428]. There is also the potential for other effects, such as implications for species such as bats where roof spaces are affected during installation[429].

Marine technologies

5.12 The term marine power broadly encompasses energy generation from wave and tidal currents. In general terms, wave energy converters harness the motion of waves generated by wind and swell and tidal current energy devices harness the kinetic energy from natural tidal cycles around Scotland's coastlines.

5.13 Scotland has around 25% of Europe's tidal stream potential, equivalent to approximately 10 GW of energy potential, and 10% of wave resource with a potential of around 15 GW[430]. The Pentland Firth and Orkney Waters is one of

[424] UK Government (2016) Third Progress Report on the Promotion and Use of Energy from Renewable Sources for the United Kingdom [online] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/493857/3RD_UK_PROGRESS_REPORT_ON_RENEWABLE_ENERGY.pdf (accessed 18/10/2016)

[425] Department for Business, Industry, Energy & Industrial Strategy (2016) Energy Trends September 2016 [online] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/559574/Energy_Trends_September_2016.pdf (accessed 18/10/2016)

[426] Solar Trade Association (2016) STA Scotland: key facts and statistics [online] Available at: http://www.solar-trade.org.uk/wp-content/uploads/2016/03/Key-facts-and-statistics-Solar-in-Scotland-v8.pdf (accessed 08/12/2016)

[427] Edinburgh college (2016) Midlothian [online] Available at: http://www.edinburghcollege.ac.uk/Welcome/Our-Campuses/Midlothian (accessed 01/11/2016)

[428] The Scottish Government (2014) SEA Environmental Report on the Draft Heat Generation Policy Statement: Towards Decarbonising Heat: Maximising the Opportunities for Scotland [online] Available at: http://www.gov.scot/Publications/2014/03/7673/2 (accessed 25/10/2016)

[429] ibid

[430] Hi Energy (2016) Marine Energy Factsheet [online] Available at: http://www.hi-energy.org.uk/Downloads/Factsheets/FACTSHEET_April%20MARINE%20ENERGY_web.pdf (accessed 18/10/2016)

the most active tidal areas in the world and is the site of the world's first commercial scale leasing round for marine energy. There has been a period of significant research and growth exhibited within the marine renewables sectors in recent years; in particular, an increasing focus on technology development.

5.14 The installation and operation of wave and tidal technology devices has the potential to result in a number of adverse environmental impacts. For example, these can include presenting a collision risk for marine fauna and other coastal/marine users (e.g. vessels) during installation and operation, displacement of other marine users, disturbance of marine fauna including impacts on sea bird foraging and breeding, and the potential for adverse effects on landscape, seascape and the setting of cultural heritage assets, amongst others[431].

Hydroelectric (including pumped storage)

5.15 Hydroelectric power is generated from the kinetic energy of falling or fast flowing water turning a turbine to produce electricity. Hydroelectric power can be generated on a small scale, with micro and 'run-of-river' schemes, to those on a larger scale involving dams impounding a head of water in a reservoir to be released according to the demand for electricity. Pumped storage is another type of hydroelectric scheme which can be used to generate electricity during periods of high demand. In such schemes, water is typically pumped from a lower reservoir to an upper reservoir for release back to the lower reservoir through a turbine[432,433].

5.16 In 2015, hydropower produced around 27% of all renewable energy generated in Scotland[434]. This also accounted for around 93% of UK hydro output[435]. It is considered that there is still potential remaining to introduce new hydro schemes and expand or improve the efficiency of existing facilities in Scotland. For example, two large-scale new pumped storage schemes are being planned for the Great Glen area of the central Highlands[436].

[431] Scottish Government (2013) Planning Scotland's Seas: Draft Sectoral Marine Plans for Offshore Renewable Energy in Scottish Waters- Strategic Environmental Assessment: Environmental Report [online] Available at: http://www.gov.scot/Publications/2013/07/2403 (accessed 01/11/2016)

[432] EDF Energy (undated) Hydro [online] Available at: https://www.edfenergy.com/future-energy/energy-mix/hydro (accessed 18/10/2016)

[433] The Renewable Energy Centre (undated) Hydroelectric Power [online] Available at: http://www.therenewableenergycentre.co.uk/hydroelectric-power/ (accessed 18/10/2016)

[434] Scottish Government (2016) Energy in Scotland 2016 – Key Facts http://www.gov.scot/Resource/0049/00494813.pdf (accessed 18/10/2016)

[435] Scottish Government (2016) Energy in Scotland 2016 [online] Available at: http://www.gov.scot/Resource/0050/00501041.pdf (accessed 18/10/2016)

[436] Hi Energy (undated) Hydro Energy [online] http://www.hi-energy.org.uk/Renewables/Hydro-Energy.htm (accessed 18/10/2016)

5.17 The impacts from hydroelectric schemes on Scotland's nature and landscape can occur over a wide area[437]. For example, effects of particular concern include sediment transportation, effects on water quality and quantity, morphological changes and impacts on species; particularly on migratory fish, oceanic bryophytes and fresh water pearl mussels[438]. There is also the potential for visual and landscape effects, and implications for recreational users[439].

6 Carbon Capture and Storage

6.1 Carbon Capture and Storage (CCS) involves the capture of CO_2 at source, its extraction from flue gases and then its compression into a dense liquid state. This liquid can then be transported and subsequently injected into geological formations deep underground for permanent storage below the earth surface. There are broadly three geological storage options for CO_2; depleted oil and gas reservoirs, deep saline aquifers and constructed salt caverns[440].

6.2 It is estimated that CCS can capture up to 90% of the CO_2 emissions produced from the use of fossil fuels in electricity production and industrial processes[441]. Furthermore, the use of CCS in combination with renewable biomass is one of the few carbon abatement technologies that can be used in a "carbon negative" mode and could actually take carbon out of the atmosphere[442].

6.3 The largest risk stemming from CCS operation is the potential for leakages of CO_2 during operation and post-closure phases[443]. There is also the potential for other environmental effects such as the loss of aquatic habitats and species from the physical footprint of the infrastructure required, and impacts on surface water and groundwater hydrology, amongst others[444]. The SEA of the Heat Policy Statement considered CCS and noted that there is uncertainty regarding

[437] SNH (2016) Hydro [online] Available at: http://www.snh.gov.uk/planning-and-development/renewable-energy/hydro/ (accessed 18/10/2016)

[438] ibid

[439] ibid

[440] DECC (2015) UK Offshore Energy Strategic Environmental Assessment (UK OESEA3) [online] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/534335/OESEA3_Scoping_Document.pdf (accessed 26/10/2016)

[441] Carbon Capture and Storage Association (2016) What is CSS? [online] Available at: http://www.ccsassociation.org/what-is-ccs/ (accessed 27/10/2016)

[442] ibid

[443] Environment Agency (2011) Scoping the environmental impacts of carbon capture, transport and storage [online] Available at: http://uk.practicallaw.com/6-507-4993?source=relatedcontent (accessed 27/10/2016)

[444] Environment Agency (2011) Scoping the environmental impacts of carbon capture, transport and storage [online] Available at: http://uk.practicallaw.com/6-507-4993?source=relatedcontent (accessed 27/10/2016)

the potential effects of CCS technology, and recommended that these be addressed at an appropriate level[445].

6.4 CO2 utilisation (CCU) could be used alongside or in place of CCS and involves the manufacturing of products such as chemicals, fuels and building materials from waste CO_2 generated from energy production or industrial processes[446]. CCU is for the most part still in a phase of research and development. An increase in funding will be required if CCU technology is to be developed further in the UK[447].

7 Low Carbon Heat

Overview

7.1 There are a range of low carbon renewable technologies that can produce or harness heat. These can include biomass, heat pumps (e.g. ground source, air source and/or water source), solar heating, geothermal heating and heat from waste biomass and anaerobic digestion.

7.2 In 2015, Scotland generated an estimated 5.3 – 5.6% of its non-electrical heat demand from renewable sources; an increase from the 3.8% generated in 2014 and continuing the year-on-year increases seen since 2008/09. The increase in 2015 also equated to the largest annual increase in renewable heat output since measurement began in 2008/09, an increase of over 1,100 GWh in the single year. In 2015, over two-thirds of renewable heat came from large installations, despite contributing less than half of total renewable capacity. However, the capacity of large (>1 MW capacity), small to medium (>45 kilowatt and <1 MW capacity) and micro (<45 kilowatt capacity) installations all increased by between 44 – 51% in 2015[448].

7.3 In 2015, the majority of renewable heat output and capacity came from biomass primary combustion (53%) and biomass combined heat and power (36%). Heat pumps, energy from waste and solar thermal collectively contributed around 12% of output[449].

[445] The Scottish Government (2014) SEA Environmental Report on the Draft Heat Generation Policy Statement: Towards Decarbonising Heat: Maximising the Opportunities for Scotland [online] Available at: http://www.gov.scot/Publications/2014/03/7673/2 (accessed 25/10/2016)

[446] Centre for Low Carbon Futures (2011) Carbon Capture and Utilisation in the green economy [online] Available at: http://co2chem.co.uk/wp-content/uploads/2012/06/CCU%20in%20the%20green%20economy%20report.pdf (accessed 16/01/2017)

[447] ibid

[448] Energy Savings Trust (2016) Renewable Heat in Scotland 2015 [online] Available at: http://www.energysavingtrust.org.uk/sites/default/files/reports/161006_Renewable%20Heat%20in%20Scotland%202015_FINAL.pdf (accessed 20/10/2016)

[449] ibid

Biomass

7.4 Biomass is the generic term for any organic material that can be used to produce heat, electricity or transport fuel. Examples of biomass material or feedstocks include wood energy crops (e.g. coppiced willow), agricultural residues (e.g. cereal straw, manures) and waste (e.g. landfill gas, municipal solid waste, waste vegetable oils).

7.5 Biomass combustion can result in the emission of air pollutants that are potentially harmful to human health, especially particulate matter. In Scotland, biomass installations are subject to additional controls if located within Air Quality Management Areas. Further, a number of planning regulations, energy consents and guidance are in place for wood fuel installations in Scotland[450].

7.6 If care is not taken in the production of feedstocks for biomass, there is the also the potential for adverse effects on biodiversity, landscapes, soil and water quality. Scottish Natural Heritage (SNH) guidance advises that feedstocks should be developed in such a way to ensure they are produced according to sustainable management practises and that bioenergy in Scotland should not create additional pressures on ecosystems overseas[451].

7.7 Biomass is further considered under the topic of Bioenergy (Section 8 of this Appendix).

Heat Pumps

7.8 A heat pump uses natural resources as the surrounding air, ground and water to produce heating (space and water) or cooling energy[452]. They can range in size from small installations in single houses to large installations servicing district heating systems to supply whole communities.

7.9 In 2015, heat pumps provided just 8% of the capacity and 6% of the output of renewable heat in Scotland. However, heat pumps saw a significant proportional increase between 2014 – 2015 with capacity increasing by almost 50%[453].

7.10 Previous SEAs undertaken by the Scottish Government have reported that unqualified Permitted Development rights for ground, water and air source heat pumps could have implications for soil, water, archaeology, and cumulative

[450] Forestry Commission (undated) Using woodfuel, air quality regulations and guidance [online] Available at: http://www.usewoodfuel.co.uk/using-woodfuel/regulations-and-guidance/air-quality-regulations-and-guidance.aspx (accessed 26/10/2016)

[451] SNH (2009) Bioenergy and the natural heritage SNH's approach [online] Available at: http://www.snh.org.uk/pdfs/publications/corporate/bioenergynaturalheritage.pdf (accessed 14/11/2013)

[452] Heat pumps need to have a coefficient of performance of at least 3 (i.e. generate three units of heat for every unit of electricity it uses) to be classified as renewable heat.

[453] Energy Savings Trust (2016) Renewable Heat in Scotland 2015 [online] Available at: http://www.energysavingtrust.org.uk/sites/default/files/reports/161006_Renewable%20Heat%20in%20Scotland%202015_FINAL.pdf (accessed 20/10/2016)

visual and cultural heritage effects[454]. The potential for noise disturbance was identified as a notable concern, particularly where noise increases in non-domestic properties can impact on neighbouring residential areas[455].

Energy from Waste

7.11 Heat energy can also be produced from the treatment of organic biodegradable waste other than wood; for example, through anaerobic digestion, the capture of landfill gases and biomass primary combustion. These processes generally involve the production or capture of methane gas, and use of this gas to produce heat.

7.12 The development of Scotland's Zero Waste Plan[456] in 2010 sought to reduce waste and emphasise the importance of the waste hierarchy. The Plan acknowledged that energy from waste has an important role to play in meeting renewable energy targets. The publication of "Making Things Last – A Circular Economy Strategy for Scotland"[457] set out a raft of actions focused on promoting a circular economy. Building on the work of the Zero Waste Plan and "Safeguarding Scotland's Resources: Blueprint for a More Resource Efficient and Circular Economy"[458], the Strategy seeks to ensure that maximum value is retained in goods at all stages of their lifecycle. In a circular economy model, energy recovered from waste or landfill, such as landfill gas, is considered "leakage" from the economy. The Strategy sets out Scotland's ambition to have energy from waste infrastructure that effectively manages this "leakage" without creating demand for materials that could otherwise be kept in higher value use.

7.13 Like all other combustion plants burning solid or liquid fuels, the incineration process produces emissions, including acid gases, particulates and heavy metals, and ash residues. Existing energy from waste plants are subject to regulation by the Scottish Environment Protection Agency (SEPA)[459].

8 Bioenergy

8.1 Bioenergy is broadly defined as renewable energy made available from materials derived from organic sources. These organic sources are termed

[454] The Scottish Government (2014) SEA Environmental Report on the Draft Heat Generation Policy Statement: Towards Decarbonising Heat: Maximising the Opportunities for Scotland [online] Available at: http://www.gov.scot/Publications/2014/03/7673 (Accessed 26/10/2016)

[455] ibid

[456] The Scottish Government (2010) Scotland's Zero Waste Plan [online] Available at: http://www.scotland.gov.uk/Resource/Doc/314168/0099749.pdf (accessed 14/11/2013)

[457] Scottish Government (2016) Making Things Last – A Circular Economy Strategy for Scotland [online] Available at: http://www.gov.scot/Publications/2016/02/1761 (accessed 26/10/2016)

[458] Scottish Government (2013) Safeguarding Scotland's Resources: Blueprint for a More Resource Efficient and Circular Economy [online] Available at: http://www.gov.scot/Resource/0043/00435308.pdf (accessed 01/11/2016)

[459] SEPA (undated) Energy from Waste [online] Available at: https://www.sepa.org.uk/regulations/waste/energy-from-waste/ (accessed 26/10/2016)

biomass, and they include wood, agricultural crops, herbaceous and woody energy crops, municipal organic wastes and animal waste products[460]. Biomass is also discussed in Low Carbon Heat (Section 7 of this Appendix).

8.2 Implementing bioenergy technologies can offer many environmental benefits. For example, it can help to divert waste materials away from landfill, reducing the generation of sequestered gases (e.g. from landfill) that would otherwise be released to the atmosphere; this has the potential for a positive effects on climatic factors. Similarly, the use of biofuels in transport will help reduce the carbon footprint of petrol and diesel fuelled vehicles, whilst helping to improve local air quality[461].

8.3 As noted in Section 7 of this Appendix, negative effects can arise from the production of bioenergy feedstocks; notably the potential for impacts to biodiversity, soil and landscapes, amongst others. There is also a risk of potential loss of biodiversity and land use displacement effects overseas as it is thought that many UK operators will need to import much of their feedstock[462,463].

8.4 Energy from biomass is released through its combustion and this can be harnessed to generate heat and electricity[464]. There are a wide range of technologies for generating bioenergy, ranging from small solid wood heating installations for individual buildings, to biogas digesters for power generation and large-scale biomass gasification plants for heat and power[465]. In Scotland, over 1,800 GWh of renewable electricity was generated from biomass sources in 2015, almost doubling the 2008 figure of 993 GWh[466]. As noted in Section 7 above, biomass primary combustion and biomass CHP accounted for 89% of renewable heat output in 2015[467] and contributed 138 MW of energy from locally owned and community renewables[468].

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[460] IEA (undated) Bioenergy [online] Available at: https://www.iea.org/topics/renewables/subtopics/bioenergy/ (accessed 20/10/2016)

[461] Transport Scotland (undated) Low Carbon Vehicles – Biofuels and other alternative fuels [online] Available at: http://www.transport.gov.scot/environment/low-carbon-vehicles (accessed 20/10/2016)

[462] Local Government Association (2016) Benefits and potential impacts of biomass [online] Available at: http://www.local.gov.uk/climate-change/-/journal_content/56/10180/3510894/ARTICLE (accessed 20/10/2016)

[463] SNH (2013) Position Statement – Bioenergy and the Natural Heritage, August 2013 [online] Available at: http://www.snh.gov.uk/docs/A1208854.pdf (accessed 20/10/2016)

[464] HI Energy (undated) Biomass Energy [online] Available at: http://www.hi-energy.org.uk/Renewables/Biomass-Energy.htm (accessed 20/10/2016)

[465] IEA (undated) Bioenergy [online] Available at: https://www.iea.org/topics/renewables/subtopics/bioenergy/ (accessed 20/10/2016)

[466] Scottish Government (2016) Energy Statistics Summary - September 2016 [online] Available at: http://www.gov.scot/Resource/0050/00507078.pdf (accessed 20/10/2016)

[467] Scottish Renewables (undated) Renewables in Numbers [online] Available at: https://www.scottishrenewables.com/sectors/renewables-in-numbers/ (accessed 20/10/2016)

[468] Scottish Government (2016) Energy in Scotland 2016 [online] Available at: http://www.gov.scot/Resource/0050/00501041.pdf (accessed 20/10/2016)

8.5 Biofuels in liquid form (such as those derived from used cooking oil or animal tallow) can also be used as a transport fuel. These are generally blended into standard fuel in small percentages. The main fuels currently used in Scotland are bio-ethanol (used with petrol) and bio-diesel (used with diesel)[469]. In 2014, 1,768 million litres of liquid biofuels were consumed in transport in the UK, a rise of 11.5% compared to the 2013 total[470]. This is around 14 times higher than the volume consumed in 2005[471].

8.6 Landfilling of biodegradable waste is a significant source of GHG; in particular, methane. To address this, processes such as anaerobic digestion (AD) is likely to be used increasingly in Scotland to treat materials such as food wastes from households, business and the food processing sector. AD involves the breakdown of organic matter in the absence of oxygen to produce a methane-rich biogas. This gas can be combusted to generate electricity and heat. Biogas from the AD of waste can be used in CHP engines and can be converted to biomethane for injection into the gas grid. "Making Things Last – A Circular Economy Strategy for Scotland"[472] highlights the food and drink sector and the broader bio economy as one of four priority areas for action in Scotland. The Strategy also identified opportunities to promote the more efficient use of biological waste.

9 New Fuels (Hydrogen and Green Gas)

9.1 Hydrogen, like electricity, is not an energy source in its own right, and requires an energy source to produce it. It is therefore only as "environmentally friendly" as the primary energy used to produce it[473].

9.2 Hydrogen can be produced using a variety of process technologies (e.g. electrolysis), and can be utilised in three main ways: through standard combustion, in gas turbines and stored and re-converted to electricity using fuel cells[474]. Hydrogen could also potentially replace natural gas in the existing gas distribution grid to provide heat to homes[475].

[469] Transport Scotland (undated) Low Carbon Vehicles – Biofuels and other alternative fuels [online] Available at: http://www.transport.gov.scot/environment/low-carbon-vehicles (accessed 20/10/2016)

[470] Scottish Government (2016) Energy in Scotland 2016 [online] Available at: http://www.gov.scot/Resource/0050/00501041.pdf (accessed 20/10/2016)

[471] ibid

[472] Scottish Government (2016) Making Things Last – A Circular Economy Strategy for Scotland [online] Available at: http://www.gov.scot/Publications/2016/02/1761 (accessed 26/10/2016)

[473] Scottish Executive (2006) Hydrogen and Fuel Cell Opportunities for Scotland [online] Available at: http://www.gov.scot/Resource/Doc/146634/0038379.pdf (accessed 20/10/2016)

[474] Scottish Executive (2006) Hydrogen and Fuel Cell Opportunities for Scotland [online] Available at: http://www.gov.scot/Resource/Doc/146634/0038379.pdf (accessed 20/10/2016)

[475] Committee on Climate Change (2016) Next steps for UK heat policy, October 2016 [online] Available at: https://www.theccc.org.uk/wp-content/uploads/2016/10/Next-steps-for-UK-heat-policy-Committee-on-Climate-Change-October-2016.pdf (accessed 20/10/2016)

9.3 While hydrogen technology is still in its relative infancy, a number of major hydrogen demonstration projects are underway in Scotland[476]; notably the Hebridean Hydrogen Park[477] and the development of a hydrogen transport hub in Aberdeen[478]. The world's first community owned renewable hydrogen production plant demonstration project was developed in 2005 on the island of Unst[479]. It is estimated that a UK wide conversion to hydrogen will reduce heat emissions by a minimum of 73% as well as supporting ambitions for the decarbonisation of transport and localised electrical generation[480].

9.4 Green Gas (or biomethane) is created by from biodegradable material and can be used in the same way as traditional fossil fuel gas in both cooking and heating. Biomethane is typically created through AD to produce biogas which is then converted to biomethane. The main difference between biomethane and fossil fuel methane is that biomethane is virtually carbon neutral[481]. The Renewable Heat Initiative is the UK's financial support programme for renewable heat, and it pays those that generate and use renewable energy to heat their buildings. Biomethane injected in to the gas grid has accounted for around 3% (27 GWh) of the total heat generated under the non-domestic Renewable Heat Initiative scheme since it was introduced in 2011[482].

10 Geothermal

10.1 Deep geothermal operations broadly involve tapping into the heat source naturally stored below the earth's surface.

10.2 Geothermal heat in Scotland can be utilised from three main sources: abandoned mine waters, hot sedimentary aquifers, and hot dry rocks / petro thermal sources[483]. Heated water can be abstracted from these sources and used to provide space heating, hot water and in some cases, electricity.

[476] Scottish Government (2016) Energy in Scotland 2016 [online] Available at: http://www.gov.scot/Resource/0050/00501041.pdf (accessed 20/10/2016)

[477] HI Energy (undated) Hydrogen Fuel Cells [online] Available at: http://www.hi-energy.org.uk/Renewables/Hydrogen-Fuel-Cells.htm (accessed 26/10/2016)

[478] Aberdeen City Council (2015) UK's largest hydrogen production and bus refuelling station opens in Aberdeen [online] Available at: http://www.aberdeencity.gov.uk/CouncilNews/ci_cns/pr_hydrogenfuel_110315.asp (accessed 21/10/2016)

[479] HI Energy (undated) Hydrogen Fuel Cells [online] Available at: http://www.hi-energy.org.uk/Renewables/Hydrogen-Fuel-Cells.htm (accessed 26/10/2016)

[480] Northern Gas Network (2016) News archives July 2016 Watch our H21 Leeds City Gate Film [online] Available at: http://www.northerngasnetworks.co.uk/2016/07/watch-our-h21-leeds-city-gate-film/ (accessed 27/10/2016)

[481] Ecotricity (undated) What is green gas [online] Available at: https://www.ecotricity.co.uk/our-green-energy/our-green-gas/what-is-green-gas (accessed 26/10/2016)

[482] Scottish Government (2016) Energy in Scotland 2016 [online] Available at: http://www.gov.scot/Resource/0050/00501041.pdf (accessed 20/10/2016)

[483] Scottish Government (undated) Geothermal [online] Available at: http://www.gov.scot/Topics/Business-Industry/Energy/Energy-sources/19185/GeothermalEnergy (accessed 21/10/2016)

Following the extraction of the heat, in some scenarios (hot dry rocks and hot wet rocks) the water can be re-injected at the site, to maintain the level of the groundwater that is available for future abstraction[484].

10.3 While recent geothermal energy activity in Scotland has been modest, small-scale schemes such as that in Shettleston (Glasgow) and Lumphinnans (Fife) have used mine waters to generate heat for the local community[485]. A study into the potential for deep geothermal energy in Scotland identified that the old mine workings in the Central Belt offer the best immediate prospect as a source of renewable geothermal heat[486]. It also stated that mine waters alone could theoretically provide the equivalent of approximately one third of Scotland's heat demand[487].

10.4 Geothermal energy is generally well suited to producing renewable heat and has the advantage over other renewable energy technologies of being capable of supporting baseload power generation without being reliant on weather conditions. However, there is the potential for negative impacts associated with these operations. For example, short-term impacts from drilling operations may be a particular issue in urban areas and at locations close to dwellings (e.g. visual and landscape impacts, disturbance). However, the potential for impacts such as these would likely depend on factors such as the location, scale and nature of the works.

10.5 Deep geothermal operations can also involve the use and transport of geothermal fluid which has the potential to spill or leak and could affect water quality and the health of aquatic life. There is also the potential for similar risks associated with using old mine workings for their geothermal potential.

[484] Scottish Government (2016) Energy in Scotland 2016 [online] Available at: http://www.gov.scot/Resource/0050/00501041.pdf (accessed 20/10/2016)

[485] AECOM (2013) Study into the Potential for Deep Geothermal Energy in Scotland [online] Available at: http://www.gov.scot/Resource/0043/00437977.pdf (accessed 21/10/2016)

[486] ibid

[487] ibid

Appendix C

Assessment Tables for the Draft Climate Change Plan

This Appendix contains the assessment tables developed for each of the nine sectors considered in the draft Plan (Agriculture, Electricity, Industry, Peat, Residential, Services, Transport and Waste). These tables set out the potential for positive and negative impacts across a range of environmental receptors for each proposed policy, policy development milestone, and proposal.

The environmental effects are presented in two formats within the tables:

i. **A narrative describing the potential for environmental environment effects** – the 'Likely Environmental Effects' narrative sections broadly discuss the likely primary environmental impacts associated with the policy or proposal, whilst also identifying the potential for secondary or indirect impacts.

ii. **Colour-coded gradings assigned to the individual environmental topic areas scoped into the assessment** – the gradings reflect the likely primary impacts associated with the implementation of the policy/proposal against each environmental topic.

In many instances, existing mitigation measures have been identified to address the potential for adverse secondary impacts. For example, negative effects associated with construction activities and the development of infrastructure should be may be mitigated through a combination of appropriate design, existing mechanisms (e.g. the planning system, EIA, and on-site environmental management measures).

While this narrative also discusses the potential for secondary or indirect impacts, these effects have only been reflected in the gradings where it is considered that no mitigation is currently in place, and where these impacts are likely to be significant. This approach has been taken to enable the reader to readily identify the primary significant impacts associated with each policy and proposal.

The tables also outline any assumptions made in undertaking the assessment and where relevant, refer to previous SEA work that informed the assessment.

The gradings used are:

+	Potential for positive environmental effects
-	Potential for negative environmental effects
+/-	Potential for mixed environmental effects
0	Potential for environmental effects has not been identified

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
Agriculture	**Policies and policy development milestones**										
	Information and advice on climate change mitigation Policy contributes to policy outcome 1	+	0	0	0	0	0	0	0	+	This policy seeks to expand the advice and guidance currently provided to the sector. This includes the further development of practical tools to enable farmers to make informed decisions regarding the management of land, with an overall aim of mitigating GHG emissions. This is likely to have a number of secondary benefits on other topics such soil, water and biodiversity through measures that promote the better use of nitrogen fertilisers and lead to improved carbon sequestration.
											Assumptions & Links with Other SEA Work *Assumptions:* • The provision of advice and guidance and practical tools will lead to informed and positive decision making on the ground. *Previous SEA work:* • Getting the Best From Our Land: A Land Use Strategy for Scotland 2016-2021.
	Establish an agri-tech group Policy contributes to policy outcome 1	+	0	0	0	0	0	0	0	+	The policy sets out to deliver and disseminate information on agriculture and the role of the sector in producing GHG emissions, including sharing information on advances in technology. The provision of information on optimising crop yields and reducing emissions intensity should also have a benefit through possible reductions in the use of nitrogen fertilisers. These have the potential to lead to a reduction in GHG emission with secondary benefits for other associated topics through improved land management particularly relating to soil, water and biodiversity.
											Assumptions & Links with Other SEA Work *Assumptions:* • Education and information provision should lead to informed decision making on the ground. • This policy is likely to include measures that seek to better manage the application of nitrogen fertilisers. • The policy is closely linked to other policies and proposals that seek to reduce GHG emissions from nitrogen fertilisers. *Previous SEA work:* • Getting the Best From Our Land: A Land Use Strategy for Scotland 2016-2021.
	Recruit Climate Change Young Farmers Group Policy contributes to policy outcome 1	+	0	0	0	0	0	0	0	+	This policy supports others that seek to build on the current provision of advice to the agricultural sector and expands on this through the proposed recruitment of Climate Change Young Farmers Champions. The overall aim of this policy is to reduce GHG emissions through education and encouragement of low carbon farming methods. This has the potential to lead to reduced emissions and associated benefits on other topics, such as soil, water and biodiversity, through improved land management.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
											Assumptions & Links with Other SEA Work *Assumptions:* • The provision of advice and guidance and practical tools will lead to informed and positive decision making on the ground. *Previous SEA work:* • Getting the Best From Our Land: A Land Use Strategy for Scotland 2016-2021.
	Carbon audits Policy development milestone contributes to policy outcome 1	+	0	0	0	0	0	0	0	+	Carbon audits can identify the type, extent and source of emissions from farmed land and identify opportunities where GHG emissions can be reduced. The promotion of carbon audits should therefore have a beneficial effect through reducing GHG emissions and helping to encourage the uptake of low carbon farming methods. **Assumptions & Links with Other SEA Work** *Assumptions:* • The policy will lead to the increased uptake of carbon audits. • This policy development milestone is closely linked to the development of a low carbon package for tenant farmers.
	Develop a low carbon package for tenant farmers Policy development milestone contributes to policy outcome 1	+	0	0	0	0	0	0	0	+	The policy seeks to explore and consider how best to target action promoting the benefits of low carbon farming, with a focus on helping tenant farmers. Low carbon farming methods can lead to a number of benefits, such as reduced GHG emissions and improved soil, livestock and manure management practices. **Assumptions & Links with Other SEA Work** *Assumptions:* • The development of a low carbon package will help to encourage informed decision making on the ground regarding land management. • The policy development milestone is closely linked to other policies and proposals that relate to the provision and dissemination of information on the benefits of cost effective climate change mitigation measures and support the promotion of carbon audits. *Previous SEA work:* • Getting the Best From Our Land: A Land Use Strategy for Scotland 2016-2021.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	Precision farming and nitrogen use efficiency Policy contributes to outcome 2	+	0	0	+	+	+	0	0	+	The policy seeks to demonstrate the benefits of precision farming and the efficient use of nitrogen. There is the potential for this policy to lead to significant reduction in GHG emissions as fertiliser applications to grassland are reported to be the largest single source of nitrous oxide emissions[1]. Additionally, further benefits may be likely across a range of topics, such as soil, water and biodiversity, through the reduced or improved application of fertilisers. **Assumptions & Links with Other SEA Work** *Assumptions:* • The provision of advice and guidance will lead to informed decision making on the ground.
	Develop a science based target for reducing emissions from nitrogen fertilisers Policy supports policy outcome 2	+	0	0	+	+	+	0	0	+	The policy supports others that consider how best to support and promote the optimal use of nitrogen fertiliser and improve land management practices. As discussed previously, the application of fertilisers can lead to significant releases of GHG emissions. The setting of a target to reduce these emissions therefore has the potential for significant benefits once implemented. A number of associated benefits are also considered likely, in particular for soil if the policy is complimented by action that supports good soil management. **Assumptions & Links with Other SEA Work** *Assumptions:* • The policy will lead to the development a target being developed. • The policy is closely linked to soil testing. • The policy will be supported by advice and guidance on good soil management.
	Soil testing Policy contributes to outcome 2	+	0	0	+	+	+	0	0	+	The policy is likely to lead to improved farm management practises, in particular, the management and application of nitrogen fertiliser. This has the potential to lead to significant benefits through reduced GHG emissions as fertiliser applications to grassland are reported to be the largest single source of nitrous oxide emissions[2]. The effective management of nutrients, in particular nitrogen, is critically important in delivering lower carbon emissions from farming. As such, positive impacts are expected for climatic factors. The policy could also lead to long term benefits for soil health particularly if soil management advice and guidance is also promoted. In addition to benefits for climatic factors and soil, it is also anticipated that there could be further benefits for other topics such as water and biodiversity.

[1] Rees R.M, Topp CFE, Bell M, Reid G, Audsley R, Eory V, McLeod M, Wall E, Moran D, Moxely AP, (2015) Reducing the emissions from the agriculture and land use sector, Evidence presented to the Committee on Climate Change 22 January 2015 [online] Available at: https://www.theccc.org.uk/wp-content/uploads/2015/01/SRUC.pdf (accessed 02/11/2016)

[2] ibid

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
											<u>Assumptions & Links with Other SEA Work</u> *<u>Assumptions:</u>* • There will be increased uptake of soil testing through the compulsory nature of this policy • The policy is likely to include the provision of guidance and advice on soil management.
	Publish emissions intensity figures for beef, lamb and milk Policy contributes to outcome 3	+	0	0	0	0	0	0	0	+	Livestock play a key role in the amount of GHG emissions arising from the agriculture sector, in particular methane emissions and as such, the proposal is likely to lead to benefits for climatic factors. This could lead to further benefits on a range of topics depending on the measures introduced to reduce emissions, for example, reduced use of nitrogen fertilisers will have additional benefits for soil, water and biodiversity. **<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • The proposal will lead to the development of a metric and established target to facilitate a reduction in carbon emissions in food production. • The proposal is closely linked to other policies that consider the reduction of emissions from dairy and red meat production by improving efficiencies, such as the establishment of an emissions target and livestock health measures. • This proposal is also likely to be closely linked with others that aim to improve the use and management of fertilisers or seek to promote and market low carbon farming.
	Work with Quality Meat Scotland and livestock producers to encourage emissions intensity of livestock through genotyping, improving fertility, reducing mortality and improving farm management practices. Policy contributes to outcome 3	+	0	0	0	0	0	0	0	+	Breeding programmes and reducing the replacement rates of stocks are likely to lead to benefits primarily through reducing GHG emissions from livestock. The amount of methane emitted per unit of feed intake varies between animals due primarily to heritable differences in the production of methane in the rumen; however, there is the potential to reduce methane from ruminants by 10-20% through animal breeding[3]. Additionally, good animal health and reproductive performance will also be beneficial through reducing the replacement rate and improving the fertility of herds as this likely to reduce the associated methane emissions through carrying less young stock as a proportion of the herd[4]. **<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • The policy is closely linked to others that seek to reduce the intensity of emissions from livestock such as the establishment of an emissions target and livestock health measures. • The benefits of using livestock breeding to reduce GHG emissions may not be realised in the short term.

[3] GOV.UK (2014) Farming Advice Services Reducing emissions of greenhouse gases from agriculture [online] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/343281/GHG_Mitig_FINAL_270214.pdf (accessed 21/12/2016)
[4] ibid

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	Establish target for reduction in the intensity of emissions for beef, sheep and dairy sectors Policy development milestone contributes to policy outcome 3	+	0	0	0	0	0	0	0	+	The primary benefit of this proposal is likely to be potential reductions in GHG emissions. The establishment of a target alongside the development of metric to measure emissions should lead to continued long term improvements through the ability to measure and monitor progress annually. Further secondary benefits, such as those associated with low carbon farming methods, may also be realised if these measures are implemented to reduce emissions. For example, a reduction in the use or improved application of nitrogen fertilisers will have additional benefits for soil, water and biodiversity. **Assumptions & Links with Other SEA Work** • The establishment of a metric will be used to monitor and record annual progress in meeting the established target.
	Consult in 2017 to determine the nature of livestock health measures that the sector will adopt from 2018 Policy development milestone contributes to policy outcome 3	+	0	0	0	0	0	0	0	+	Livestock rearing is one of the largest contributors to agricultural GHG emissions, particularly through methane enteric emissions from cattle. This policy has the potential to improve the efficiency; quality and sustainability of animal herds and in doing, so reduce GHG emissions. **Assumptions & Links with Other SEA Work** *Previous SEA work:* • RPP2.
	Determine the potential feasibility of self-financing large scale – this includes the feasibility of co-operatively owned and managed anaerobic digesters. Policy development milestone contributes to policy outcome 4	+	0	0	+	+	+	0	0	+	The development milestone set out to determine feasibility of using anaerobic digestion to convert animal waste into electricity and heat. If taken forward, the primary benefit of this is likely to be reduced GHG emissions through the provision of a renewable source of energy displacing that provided by traditional fuel sources. Further GHG reductions are also considered likely through the reduced collection and storage of animal wastes and use of digestate as a fertiliser, reducing the need for nitrogen fertilisers. The policy also seeks to improve the use and storage of manure and slurry. The likely benefits of this include reduced GHG emissions with further associated benefits for soil, water and biodiversity considered likely. There may also be positive impacts on human health through improved storage practices leading to better management of nuisance effects such as odours. **Assumptions & Links with Other SEA Work** *Assumptions:* • Consideration will be given to the end of use products that arise through the process of anaerobic digestion, such as digestate and the potential for this to be used as a natural fertiliser. • These policies are closely linked to those that seek to reduce emissions from the use and storage of manure and slurry.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	Increased planting of trees and hedgerows Policy contributes to policy outcome 5	+	0	0	+	+	+	0	0	+	The policy sets out to explore how to optimise carbon sequestration through increased planting of trees and hedgerows. This has the potential to improve how land is utilised, as in some instances, the integration of trees on livestock farms can improve productivity of crops and enable crop diversity. The policy has the potential for increased carbon sequestration, particularly if trees or shrubs are planted on appropriate agricultural land providing an opportunity to reduce GHG emissions. There could also be a number of associated benefits for other topic areas, for example, improved soil function and stability. Benefits for biodiversity, flora and fauna are also considered likely through providing valuable habitats and connectivity between different habitats. Possible changes to rural landscapes as a result of the policy have been identified, although this is considered likely to be overall positive; particularly through any improvements to the health, diversity and appearance of agricultural areas that may arise through adopting these management practices. In addition, hedges are an integral part of Scotland's landscape and culture[5]. However, the nature of any of the identified benefits would be influenced by a number of factors and would be site and region specific. Whilst there is some concern that tree belts can act as a reservoir and source of crop pests, research has shown that increasing elements of non-crop habitat reduces the overall risk of pests[6]. **<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • Woodland/forestry planting will meet the requirements of the UK Forestry Standard which defines the requirements for the sustainable management of forests in the UK. • This proposal is closely linked to payment for carbon sequestration. *<u>Previous SEA work:</u>* This policy was previously considered in the SEA work taken forward for: • RPP2. • Getting the Best From Our Land: A Land Use Strategy for Scotland 2016-2021.
	Proposals										
	Marketing Scheme: Introduce a Low Carbon Farming marketing scheme Proposal contributes to outcome 1	+	0	0	+	+	+	0	0	+	The proposal seeks to explore the use market tools to incentivise and promote Scotland as a producer of low carbon foods. Market incentives and greater market demand for products produced via low carbon farming practices should lead to increased uptake of low carbon farming methods and sustainability practices being undertaken to meet this standard. For example, the consideration of carbon audits. The policy has the potential to lead to a number of benefits, such as reduced GHG emissions from improved nitrogen efficiencies, consideration of the length of grazing season and improved genetic and breading.

[5] SNH (2015) Field Margins and hedgerows [online] Available at: http://www.snh.gov.uk/about-scotlands-nature/habitats-and-ecosystems/farmland-and-croftland/hedgerows-and-field-margins/ (accessed 18/01/2018)
[6] Woodland Trust (2012) Benefits of trees on livestock farms – the evidence of integrating trees [online] Available at: https://www.woodlandtrust.org.uk/publications/2012/08/benefits-of-tree-on-livestock-farms/ (accessed 21/12/2016)

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
											Assumptions & Links with Other SEA Work *Assumptions:* • The proposal will lead to the creation of a marketing scheme. • Market demand will be generated leading to increased uptake of low carbon farming methods in addition to the adoption of farming methods that achieve greater sustainability in the sector.
	Minimum leguminous crops in rotation Proposal contributes to policy outcome 2	+	0	0	+	+	+	0	0	+	Crop rotation farming is recognised as an effective means of improving soil fertility[7] through the ability of legume crops to fix atmospheric nitrogen, returning this to the soil. However, the success of this process depends on the crop used. The anticipated benefits of this proposal include the reduced use of artificial fertilisers with associated benefits for climatic factors and improved soil health. There may also be further benefits for biodiversity through the reduced risk of insect pests and diseases that can arise from the application of crop rotation farming methods[8]. **Assumptions & Links with Other SEA Work** *Assumptions:* • The proposal will lead to measures being implemented to support the use of legumes in farming practice.
	Plant varieties with improved nitrogen use efficiency Proposal contributes to policy outcome 2	+	0	0	+	+	+	0	0	+	The proposal is aimed at Improving the efficiency of crops in the uptake of nitrogen, whilst maintaining yields. If implemented, this proposal is likely to lead to reduced fertilizer use, with associated benefits of reduced GHG emissions. Additionally, other secondary benefits are anticipated on a range of other topics; in particular, soil, water and biodiversity through improved soil health. **Assumptions & Links with Other SEA Work** *Assumptions:* • New breeding goals and the development of breeding programmes will be established prior to improved nitrogen varieties being introduced.
	Livestock feed additives to reduce methane Proposal contributes to policy outcome 3	+	0	0	0	0	0	0	0	+	The primary benefits considered likely to arise from this proposal are reduced GHG emissions and through greater livestock efficiencies. Methane emissions from ruminants are responsible for approximately 50% of the GHG emissions associated with agriculture in Scotland[9]. Feed additives inhibit the micro-organisms that produce methane in the rumen and subsequently reduce emissions and these can be categorised into three broad areas: synthetic chemicals, natural compounds such as tannins and fats and oils. Research has shown that the potential reduction in methane emissions can range from 11-21%, where reductions were expressed per unit field intake[10].

[7] DEFRA (2011) Crop Rotation Integrated Crop Management (CPA) [online] Available at: http://adlib.everysite.co.uk/adlib/defra/content.aspx?id=000IL3890W.17USY7NEWZ4R1 (accessed 20/12/2016)
[8] ibid
[9] ClimateXchange (2016) Nutritional strategies to reduce enteric methane emissions [online] Available at: http://www.climatexchange.org.uk/files/3814/7826/5108/Nutritional_strategies_to_reduce_enteric_methane_emissions.pdf (accessed 20/12/2016)
[10] ibid

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
											There can be implications arising from GHG emissions associated with the production and transport of feeds, however these are considered to be small in nature[11] . **Assumptions & Links with Other SEA Work** *Assumptions:* • Delivery mechanisms will be introduced to increase uptake of additives. • Consideration will be given to the land use implications that may arise from the creation of additives.
	Inclusion of livestock grazing in rotation on current arable land Proposal contributes to policy outcome 4	+	0	0	+	+	+	0	0	+	A number of benefits are likely to arise from this proposal to consider rotation farming between livestock grazing and arable land. In the first instance, this should lead to a reduced need for nitrogen fertilizers through alternating between crop production and harvesting activities and livestock grazing. In turn, this is likely to have a beneficial impact on a number of topics, in particular, climatic factors, soil, water and biodiversity. Additionally, soil and biodiversity are also likely to benefit from reduced intensification of growing and harvesting crops which can negatively impact on soil structure and can also lead to reduced biodiversity. **Assumptions & Links with Other SEA Work** *Assumptions:* • The proposal is closely linked to those that seek to reduce emissions from the use of nitrogen fertilisers, for example, support for soil testing and increased use of legumes in crops. *Previous SEA work:* • Getting the Best From Our Land: A Land Use Strategy for Scotland 2016-2021.
	Establishment of manure/ slurry exchange Proposal contributes to policy outcome 4	+	0	0	+	+	+	0	0	+	This proposal is likely to lead to a reduced need for nitrogen fertilisers through ensuring that there are stocks of natural resources in place where most needed. This is has the potential to lead to a number of benefits, primarily reduced GHG emissions, with secondary benefits on other topics such as soil, water and biodiversity. Appropriate storage conditions will be required as part of the exchange process in order to reduce further emissions of GHG and reduce the risk of leaks to water courses. **Assumptions & Links with Other SEA Work** *Assumptions:* • The proposal will led to the establishment of a manure/slurry exchange scheme. • This proposal is closely linked to other policies that consider the storage of farm waste and aim to reduce GHG emissions from the use of chemical fertilisers.

[11] ClimateXchange (2016) Nutritional strategies to reduce enteric methane emissions [online] Available at: http://www.climatexchange.org.uk/files/3814/7826/5108/Nutritional_strategies_to_reduce_enteric_methane_emissions.pdf (accessed 20/12/2016)

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	Minimise emissions from slurry storage Proposal contributes to policy outcome 4	+	0	0	+	+	+	0	0	+	This policy is aimed at determining how to encourage greater management of slurry storage facilities through encouraging these be covered. As slurry breaks down, this can lead to the release of GHG emissions, in particular, methane and ammonia. Whilst ammonia is not a GHG, it reacts in the atmosphere to create nitrous oxides which are considered about 300 times more powerful than carbon dioxide as a GHG[12]. Fitting above ground slurry pits with a rigid cover can reduce ammonia emissions by around 80%, whilst floating covers (e.g. plastic, straw or bark) have been shown to reduce ammonia emissions by around 50%[13]. This proposal is therefore likely to have potential for positive effects on climatic factors through preventing avoidable releases of methane and ammonia by covering slurry pits. There is also potential for positive effects through better management of a renewable resource which can reduce the requirement for chemical fertilisers, potentially leading to further GHG reductions. Positive impacts have also been identified on human health through the better management of manures which could reduce nuisance effects such as odours. **<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • Slurry will be used as a natural fertiliser, displacing or reducing the use of nitrogen fertilisers. • This measure is closely linked to those that consider the use of slurry and animal by- products to provide renewable energy, for example, through anaerobic digestion.
	Payment for carbon sequestration Proposal contributes to policy outcome 5	+	0	0	+	+	+	0	0	+	The proposal has the potential to improve how land is used and provides an opportunity to influence land management decisions via financial mechanisms to provide benefits such as greater carbon sequestration and reduced GHG emissions. In the first instance, this is likely to lead to positive effects for climatic factors, in particular, through action focused on soils including peat. A number of secondary benefits are also likely to arise across a range of other topic areas including biodiversity, flora and fauna, through the creation of habitats and improved connectivity, for example, the creation or enhancement of woodlands and hedgerows. **<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • The proposal will lead to a payment scheme being established. • The proposal considers aspects such as the restoration of peat and woodland creation. *<u>Previous SEA work:</u>* • Getting the Best From Our Land: A Land Use Strategy for Scotland 2016-2021.

[12] GOV.UK (2014) Farming Advice Services Reducing emissions of greenhouse gases from agriculture [online] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/343281/GHG_Mitig_FINAL_270214.pdf (accessed 21/12/2016)
[13] AHDB (2010) Greenhouse Gas Factsheet 5 – Ammonia emissions [online] Available at: https://dairy.ahdb.org.uk/resources-library/technical-information/climate-change/ammonia-emissions/#.WFpKxVJDTcs (accessed 21/12/2016)

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	Woodland/forestry cover targets for agricultural land Proposal contributes to policy outcome 5	+	0	0	+	+	+	+	+	+	This policy is aimed at the using areas of appropriate agricultural land for woodland creation, in line with ambitious woodland creation targets set out by Scottish Government. Primary benefits from this are likely to be positive effects on climatic factors from increased carbon sequestration. Secondary benefits are also considered likely on a range of topics as sustainably managed forest and woodlands can have beneficial impacts on soil, water and biodiversity. Additionally, depending on the species grown, there may also be benefits for cultural heritage. Potential land use conflicts can arise however, and this is recognised in the Scottish Forestry Strategy. However, it is anticipated that effective stakeholder engagement and the consideration of land capability information will be used to inform the decision making process of implementing this proposal. **Assumptions & Links with Other SEA Work** *Assumptions:* • Woodland/forestry planting will meet the requirements of the UK Forestry Standard which defines the requirements for the sustainable management of forests in the UK. • This policy is closely linked the policies and proposals regarding the implementation of targets set out for forestry in the draft Climate Change Plan. • Stakeholder engagement and consideration of the Land Capability for Agriculture classification and local Forestry and Woodland Strategies will be taken into account as the proposal develops. *Previous SEA work:* • Getting the Best From Our Land: A Land Use Strategy for Scotland 2016-2021.
Summary of Overall Effects	There is potential for positive environmental effects from the policies and proposals in the draft Plan relating to the agricultural sector. In particular, there are opportunities to contribute to GHG emission reductions though changing farming practices, more efficient use of resources, and encouraging a change in the way land is used and managed to provide greater carbon reduction/sequestration benefits (**climatic factors and material assets).** There is also likely to be additional benefits through greater use of farm wastes as a source of renewable energy **(climatic factors).** The majority of the policies and proposals present an opportunity to improve the conditions of the natural environment and promote less intensive farming practices, for example, by reducing the use of chemical fertilisers and increasing natural and organic fertilisers. If managed properly, this could help to minimise diffuse pollution and nutrient leaching from agricultural land, with associated benefits for groundwater and surface water quality soil structure, fertility and crop production (**water, soil and material assets**). Additionally, these benefits would be realised by local habitats and species, particularly bird, aquatic and pollinating species (**biodiversity**). The creation or enhancement of new habitats through woodland creation and peatland restoration could have positive effects (**biodiversity, water and landscape**). There are also potential benefits for rural landscapes by improving the health and appearance of farmland through better management practices and woodland and hedgerow creation (**cultural heritage and landscape**), although the scale and nature of any such benefit would likely be site and region specific. More effective management of animal stocks and animal wastes could have positive effects through a reduction in nuisance odours from agricultural land (**population and human health).** The significance of the effects will depend on the uptake of management practices on the ground. The provision of governmental advice, guidance and subsidies will play a key role in this process.										

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
Electricity	**Policies and Development Milestones**										
	Support the future development of a wide range of renewable technologies through addressing current and future challenges, including market and wider policy barriers Policy contributes to policy outcome 1	+	+	+	0	0	+/-	-	-	+	Encouraging further investment in the renewables sector through delivering a viable route to market for a wide range of renewable technologies, and long-term funding through schemes such as the Renewable Energy Investment Fund, Community and Renewable Energy Scheme, and Low Carbon Infrastructure Transition Programme is likely to aid the continued development of renewable technologies (both commercial and local/community projects). This could aid a broad shift towards the decarbonisation of energy supply in Scotland, with an increase in local or community ownership. Positive effects for climatic factors are likely through a reduction in GHG emissions from the sector by reducing reliance on carbon-intensive sources of electricity. Benefits for air quality and in association population and human health are also likely from aiding the shift from traditional non-renewable supplies. There is also the potential for the policy to enhance community involvement with associated positive effects through implementation of community energy projects. If widely implemented, there is the opportunity to reduce the reliance on carbon intensive energy generation, and provide benefits in terms of climate change adaptation. However, the implementation of some low carbon and renewable technologies can lead to negative impacts and there may be additional infrastructure requirements. This can include adverse impacts on biodiversity, soil and water from construction, operation and decommissioning of renewable devices, and adverse effects on landscape and cultural heritage assets through the siting of some technologies. There is also potential for cumulative effects associated with the installation of multiple developments, for example, the installation and operation of onshore and offshore wind and marine renewable arrays. The results provided reflect the potential for significant impacts. There may also be short term pressure on existing infrastructure whilst construction activities are on-going. In some instances, this may lead to the displacement of other land or marine users. Some technologies can however lead to positive effects on some topic areas in some instances. For example, the presence of submerged infrastructure in the marine environment can also have positive effects for biodiversity by providing new habitats for some species (reef effects). The likely location of some new infrastructure on brownfield sites and previously developed land could help to reduce the potential for some environmental impacts. However, it is considered that many of these impacts may be localised and these activities will be subject to existing mechanisms such as marine licensing, EIA and consenting conditions prior to work being undertaken. The promotion of low carbon and renewable energy will play be a key role in enhancing the security of energy supply as the impacts of a changing climate and the challenges are likely to become increasingly important. However, it is noted that the realisation of any of the identified impacts and further growth in the sector would rely on the achieving the buy-in of stakeholders in facilitating this transition.
											<u>Assumptions & Links with Other SEA Work</u> *<u>Assumptions:</u>* • The policy will promote further renewable energy development and the replacement of energy generated from traditional, finite sources. • Seeks to promote the development of new technologies (e.g. wave and tidal, etc.) and increase take-up of community and locally owned schemes. • Increased wave and offshore wind technology development is promoted, and this would help to grow the proportion of energy generated by these technologies in Scotland's energy mix.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
											• The policy sets out support for low carbon energy developments in the relevant consenting processes. *Previous SEA work:* Renewable electricity policy was previously considered in the SEA work taken forward for: • 2020 Routemap for Renewable Energy in Scotland. • Electricity Generation Policy Statement. • The Heat Policy Statement: Towards Decarbonising Heat: Maximising the Opportunities for Scotland. • The potential for environmental effects associated with wave renewable development was discussed in the SEA undertaken for the Draft Sectoral Marine Plans for Offshore Renewable Energy in Scottish Waters. • Support in the renewable energy consenting process has been discussed previously in several SEAs, such as Scotland's National Marine Plan and the Pentland Firth and Orkney Waters Marine Spatial Plan.
	Promoting greater flexibility in the electricity sector, including efficient network management, demand side response and electricity storage Policy contributes to policy outcome 1	+	+	+	0	0	0	0	0	+	This policy and policy milestones aim to promote the uptake of energy storage and smart technologies in Scotland to provide a flexible and responsive energy system which can effectively manage fluctuations in electricity demand. Electricity storage is available in many forms, from large scale hydro pumped storage schemes to domestic and battery storage. The promotion of these technologies through feasibility and funding measures could contribute to the growth of this technology sector and help facilitate its implementation in Scotland. The primary benefit of storage, both at a large-scale and through local and community projects, is in greater system flexibility and the ability to manage variations in demand as they occur. For example, it can help the network to manage the intermittency of renewables, and pumped hydro storage can be used to generate electricity during periods of high consumption. The use of storage in the energy network can also allow owners to operate independently from the power grid. If widely implemented, there is the potential for improvements in the balance of supply and demand from the grid and a reduction in pressure on network infrastructure. This is also likely to be beneficial in improving reliability and security of supply, and should aid in improving the resilience of the sector to the predicted pressures from climate change. However, hydrogen fuel cells could lead to increased demand for electricity where hydrogen would be generated via electricity intensive electrolysis. Improved efficiency in the supply and use of energy is likely to provide benefits for climatic factors in particular. There is the potential for an overall reduction in GHG emissions and improved air quality, particularly if associated with a reduction in reliance on traditional fuel sources. Greater system flexibility and reliability is likely to be positive for consumers, and could result in benefits for population and human health. However, there is potential for adverse localised impacts associated with the construction and development of the infrastructure required to implement certain storage technologies such as fuel cells or pumped hydro storage, particularly if deployed on a large scale. This could include impacts through land take and visual and cultural heritage effects from the siting of infrastructure, as well impacts on soil, air, water and biodiversity from construction activities. Local level consideration would need to be given to the potential implications that may arise through the siting, construction and development of required infrastructure. Locating new infrastructure on brownfield sites and previously developed land where possible could help to reduce the potential for some environmental impacts.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
											<u>Assumptions & Links with Other SEA Work</u> *<u>Assumptions:</u>* • The policy seeks to promote and facilitate the use of successful storage technology in Scotland, including pumped hydro and battery. • While at this stage it only relates to promotional and feasibility programmes, it is likely to have the potential to lead to implementation on the ground. • Energy storage can be used in conjunction with demand side response and smart technologies. *<u>Previous SEA work:</u>* • Electricity storage, smart energy technologies and demand side response were discussed in the SEA for the Electricity Generation Policy Statement.
	Encouraging the demonstration and commercialisation of Carbon Capture and Storage (CCS) in Scotland Policy contributes to policy outcome 2	+	0	0	0	0	0	0	0	+/-	Exploring the feasibility of CCS has the potential to directly inform the future role of this technology in Scotland's energy sector. A successful CCS demonstrator pilot project could help set a pathway towards implementation of a CCS decarbonisation system. However, is it noted that the provision of feasibility funding short of enabling a pilot project is unlikely to directly result in environmental effects. The potential for benefits in terms of climatic factors has been identified though the potential role of the technology in reducing GHG emissions. This also has the potential for benefits for material assets, particularly as CCS schemes in Scotland have the potential to repurpose over 400km of existing legacy oil and gas pipelines. This could reduce the requirement for new pipeline networks, with likely benefits for material assets and the avoidance of significant negative impacts for other environmental topic areas. CCS technology can make use of existing infrastructure from the oil and gas industry to process liquid outcomes associated with CCS. There is also the potential for the captured Carbon dioxide (CO_2) to be utilised in other sectors. For example, CO2 Utilisation (CCU) is an emerging technology which manufactures carbon dioxide into commercially viable products such as chemicals, polymers, building materials and fuels[1] .If this process was progressed the use of waste products in this way is considered likely to have a positive effect on material assets. Should CCS be implemented in the future, particularly if used in combination with industry and the continued use of fossil fuels in Scotland's energy mix, there is the potential for both positive and negative environmental effects on a range of topic areas. For example, there may be impacts associated with construction works, the upgrading of existing infrastructure and the installation of new infrastructure necessary to facilitate CCS operations. However, it is considered that these impacts may be localised and these activities will be subject to existing mechanisms such as marine licensing, EIA and consenting conditions at the project level prior to work being undertaken. Any future policy direction would also be required to consider implications of the Environmental Assessment (Scotland) Act 2005.

[1] University of Sheffield (undated) UK Centre for Carbon Dioxide Utilization [online] Available at: https://www.sheffield.ac.uk/cduuk (accessed 12/01/2017)

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
											<u>Assumptions & Links with Other SEA Work</u> *<u>Assumptions:</u>* • Contributing to UK policy formulation and consideration of the practical application of CCS at this stage, but with the likelihood, if feasible, to be supported by the Scottish Government and implemented in the future. • A future decision of the implementation of CCS would need to be considered under the requirements of the 2005 Act, and would likely be subject to existing mechanisms (e.g. planning, marine licensing, etc.). *<u>Previous SEA work:</u>* • CCS was discussed in the Electricity Generation Policy Statement SEA.
	Proposals										
	The Energy Strategy consultation will explore proposals that increase the level of renewable electricity generation, including new targets, additional measures to support onshore wind, and exploring the role for a government-owned energy company and Scottish renewable energy bond. **The Scottish Energy Strategy consultation will explore proposals that increase the level of low and zero carbon electricity generation and facilitates increased flexibility in the electricity system.** Proposals contributes to policy outcomes 1 and 2	+	+	+	0	0	0	0	0	+	The Energy Strategy contains various policies and priorities that relate to the electricity sector. These include: policies and proposals aimed at increasing provision of energy from low carbon and renewable sources; diversification of energy technologies in Scotland's energy mix; the continued development of new fuels and technologies such as CCS and energy storage; and increased local and community owned generation. Overall it was assessed that these measures are likely to have broadly positive effects on climatic factors by reducing GHG emissions, with associated benefits for air quality and population and human health. Benefits were also expected for material assets as the decentralisation of energy generation could reduce existing pressures on network infrastructure, improve system flexibility and resilience of the sector to future change, and enable the network to be progressively upgraded and expanded as required to ensure security and reliability of supply into the future. The potential for both positive and negative environmental effects on a range of topic areas was also identified; particularly impacts associated with construction works, the upgrading of existing infrastructure and the installation of new infrastructure that would be necessary to facilitate these ambitions. However, in many instances, it is considered that such impacts may be localised and these activities will be subject to existing mechanisms such as marine licensing, EIA and consenting conditions at the project level prior to work being undertaken. They have not been reflected in the gradings to the left, on this basis. A more detailed consideration of the environmental effects of the polices and priorities presented in the Energy Strategy can be found in the assessment tables in Appendix D of the Environmental Report.

Summary of Overall Effects	
	There is potential for broadly positive environmental effects. In particular, the Plan could contribute to further reductions in GHG emissions (**climatic factors**) by aiding the decarbonisation of electricity generation. Policies aimed at encouraging further investment in renewables and facilitating the progression of new technologies such as electricity storage and CCS are identified as likely to be beneficial (**climatic factors**). There is potential for further benefits in improving security of supply through flexibility and storage projects, local and community owned renewable electricity generation (**material assets and population and human health**) and adaptation of the electricity sector to the predicted effects of climate change (**material assets**). Alongside the potential for overall reductions in GHG emissions, other potential benefits were identified (**soil, air, water, biodiversity, population and human health, cultural heritage and landscape).** However, demonstrating a commitment to pursue additional GHG emission reductions is expected to be beneficial, particularly the potential implementation of CCS technologies in combination with the continued use of fossil fuels within Scotland's varied energy mix. With the support of complementary proposals the assessment identified the clear potential for positive effects in terms of both climatic factors and material assets (**climatic factors and material assets**). There is potential for adverse effects associated with some policies and proposals, particularly those leading to development at a local scale. For example, the development of renewables could result in environmental effects, including impacts to biodiversity, soil, water and air quality from construction activities and siting of developments, with the potential for both temporary and long-term effects (**biodiversity, soil, water and air quality**). Other potential long term effects could arise from changes in setting for cultural heritage and landscape (**cultural heritage and landscape**). However, the significance of any such impacts would likely depend on factors such as the type, size and scale of development/infrastructure works and the location and setting. More specific environmental effects will be considered through the planning process, marine licensing, Environmental Impact Assessment (EIA) and Habitats regulations Appraisal (HRA) and, in many instances, could be managed through the use of appropriate construction management measures such as Environmental Management Plans.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
Forestry	**Policies and Policy Development Milestones**										
	Forestry Grants – Provision of funding via the Forestry Grant Scheme to support eligible land owners to establish appropriate woodlands Policy contributes to policy outcome 1	+	+	0	+	+	+	+	+/-	+/-	The provision of funding through the Forestry Grant Scheme aims to support land-owners to establish appropriate woodlands. It seeks to increase the rate of woodland creation in Scotland which is likely to have a positive effect on climactic factors by reducing GHG emissions through increased CO_2 sequestration. Sustainably managed forests can have associated beneficial effects on soil and water at the local level if managed appropriately. This will also be true for flora and fauna as Scotland's forests and woodlands support a disproportionately high share of our biodiversity. Depending on the species grown, there may also be benefits for cultural heritage. There is the potential for beneficial effects on human health and wellbeing through the increased provision of accessible woodland space which can be used for recreational purposes and can enhance the environmental quality of urban areas in particular. Forestry is a key asset in Scotland and our forests are some of the most productive in the UK, with the amount of timber harvested increasing steadily. This policy could further stimulate rural development and bring possible material asset benefits. The effects of land use change on the wider environment and communities could be mixed, depending on the scale and nature of changes. For example woodland creation can have significant positive or negative impacts on the landscape, biodiversity and patterns of recreational use. Potential negative impacts can be mitigated if woodland creation schemes are appropriately designed and delivered to meet the requirements of the UK Forestry Standard. Local forestry and woodland strategies also identify the appropriate location for woodlands to maximise the delivery of public benefits and minimise adverse environmental and landscape impacts. In addition, specific woodland creation proposals must meet the requirements of the statutory processes for assessing impact on designated habitats or the wider environment; for example, Environmental Impact Assessment.
											<u>Assumptions & Links with Other SEA Work</u> *<u>Assumptions:</u>* • Afforestation will meet the requirements of the UK Forestry Standard which defines the requirements for the sustainable management of forests in the UK. *<u>Previous SEA work:</u>* Woodland creation was previously considered in the SEA work undertaken for: • RPP2. • Getting the Best from Our Land: A Land Use Strategy for Scotland 2016-2021.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	Woodland Creation – Creation of new woodland on the National Forest Estate through a targeted woodland creation programme Policy contributes to policy outcome 1	+	+	0	+	+	+	+	+/-	+/-	The creation of new woodland on Scotland's National Forest Estate is likely to have a positive effect on climactic factors by reducing GHG emissions through increased CO_2 sequestration. If managed properly, sustainably managed woodlands and forests can have associated beneficial effects on soil and water at the local level, and for flora and fauna as Scotland's forests and woodlands support a disproportionately high share of our biodiversity. Depending on the species grown, there may also be benefits for cultural heritage, and there is also the potential for beneficial effects on human health and wellbeing through the increased provision of accessible woodland space which can be used for recreational purposes and used to enhance the environmental quality of urban areas. The effects of land use change on the wider environment and communities could be mixed, depending on the scale and nature of changes. For example woodland creation can have significant positive or negative impacts on the landscape, biodiversity and patterns of recreational use. Potential negative impacts can be mitigated if woodland creation schemes are appropriately designed and delivered to meet the requirements of the UK Forestry Standard. Local forestry and woodland strategies also identify the appropriate location for woodlands to maximise the delivery of public benefits and minimise adverse environmental and landscape impacts. In addition, specific woodland creation proposals must meet the requirements of the statutory processes for assessing impact on designated habitats or the wider environment; for example, Environmental Impact Assessment. **<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • Afforestation will meet the requirements of the UK Forestry Standard which defines the requirements for the sustainable management of forests in the UK and be independently certified against the UK Woodland Assurance Scheme. *<u>Previous SEA work:</u>* Woodland creation was previously considered in the SEA work undertaken for: • RPP2. • Getting the Best from Our Land: A Land Use Strategy for Scotland 2016-2021.
	Awareness Raising - work in partnership with representatives from land management organisations to deliver annual awareness raising programmes to encourage more woodland creation **Woodland Carbon Code - an annual programme of**	+	+	0	+	+	+	+	+/-	+/-	Increased awareness of the benefits of woodland creation amongst land owners and managers and promotion of the Woodland Carbon Code are likely to increase the creation of woodland in Scotland, and help to contribute towards the established afforestation targets. Promotion of the integration of farming and forestry enterprises could also optimise the use of farming land, with benefits for material assets. Increased woodland creation in Scotland is likely to have a positive effect overall on climactic factors by reducing GHG emissions through increased CO_2 sequestration. There is the potential for associated benefits for soil, water, biodiversity, flora and fauna, human health and cultural heritage, particularly if accessible for recreation purposes. The effects of land use change on the wider environment and communities could be mixed, depending on the scale and nature of changes. For example woodland creation can have significant positive or negative impacts on the landscape, biodiversity and patterns of recreational use. Potential negative impacts can be mitigated if woodland creation schemes are appropriately designed and delivered to meet the requirements of the UK Forestry Standard. Local forestry and woodland strategies also identify the appropriate location for woodlands to maximise the delivery of public benefits and minimise

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	promotion to encourage an increased level of investment in woodlands that are accredited under the Woodland Carbon Code Policies contribute to policy outcome 1										adverse environmental and landscape impacts. In addition, specific woodland creation proposals must meet the requirements of the statutory processes for assessing impact on designated habitats or the wider environment; for example, Environmental Impact Assessment. **<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • Afforestation will meet the requirements of the UK Forestry Standard which defines the requirements for the sustainable management of forests in the UK. *<u>Previous SEA work:</u>* Woodland creation was previously considered in the SEA work undertaken for: • RPP2. • Getting the Best from Our Land: A Land Use Strategy for Scotland 2016-2021.
	Woodland Standards – Review of the UK Forestry Standard to ensure that all new woodlands supported under the Forestry Grant Scheme are designed and established to meet recognised standards of sustainable forestry Policy contributes to policy outcome 1	+	+	0	+	+	+	+	+	+	A refresh of the UK Forestry Standard that will be focused on internationally recognised sustainable forest management principles is likely to deliver overall benefits for the natural environment. It should help in promoting the sustainable planting and management of new forests and woodlands, and could help to promote the opportunities and benefits of woodland creation to land owners and managers alike. A revision that considers the latest information and guidance for managing biodiversity, climate change, historic environment, landscape, people, soil and water issues could also be beneficial overall. A continued focus on the importance of balancing the environmental, economic and social benefits of forests, and the recognition that Scotland's forests serve a wide range of objectives, could also aid in managing potential adverse effects such as land use conflicts that may develop with the creation of new woodland. **<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • Afforestation will meet the requirements of the UK Forestry Standard which defines the requirements for the sustainable management of forests in the UK. *<u>Previous SEA work:</u>* Woodland creation was previously considered in the SEA work undertaken for: • RPP2. • Getting the Best from Our Land: A Land Use Strategy for Scotland 2016-2021.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	Forestry and Woodland Strategies – Support the development and revision of Local Forestry and Woodland Strategies Policy contributes to policy outcome 1	+	+	0	+	+	+	+	+	+	Forestry and Woodland Strategies are currently being developed or revised as Supplementary Planning Guidance by Scotland's Local Authorities. The inclusion of forest and woodland strategies as Supplementary Guidance to the Local Development Plan could help to identify opportunities for land owners and managers, and realise the potential for increased CO_2 sequestration. In providing a regional framework for forestry expansion and in identifying preferred areas for forestry, the Strategies can help to guide the creation of new woodlands to areas of particular benefit. With the buy-in of Local Authorities and land managers, this could help to enhance the delivery of positive impacts; for example, it could help to deliver benefits through reducing the risk of landscape effects, and improve wellbeing through helping to enhance the consideration of recreational use at an early stage. It could also present an opportunity to minimise and/or mitigate potential impacts to the natural environment and manage potential conflicts with alternative land uses. **<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • Afforestation will meet the requirements of the UK Forestry Standard which defines the requirements for the sustainable management of forests in the UK. *<u>Previous SEA work:</u>* Woodland creation was previously considered in the SEA work undertaken for: • RPP2. • Getting the Best from Our Land: A Land Use Strategy for Scotland 2016-2021.
	Implementation of the Timber Development Programme promoting the development of wood products for use in construction Policy contributes to policy outcome 2	+	0	0	0	0	0	0	+/-	+/-	The proposal sets out how wood products can be better utilised in the construction sector. A shift in using building materials obtained from renewable sources rather than non-renewable and more carbon intensive materials, such as steel or concrete, has the potential to reduce GHG emissions and have a positive impact on climatic factors. This will be particularly relevant if the timber is sourced from sustainably managed forests as there are likely to be a number of associated benefits, including positive effects on biodiversity, soil and water. Timber forests can help to control soil erosion and help create new, but temporary, habitats during growth periods. Effects on recreational users and landscape can also be positive during growth periods. Additional benefits may also be derived from reducing waste materials generated from the construction sector. Construction materials are one of the most of significant material flows, by weight, in Scotland. Reducing the amount currently being disposed of in landfill will therefore have further benefits through reducing the negative impacts associated with this waste disposal method. Increasing timber consumption is likely to encourage an increase in productive forest area in Scotland. However, if this is not sustainably managed, there could be negative impacts on soil stability, water quality and biodiversity during planting and harvesting. Adverse environmental effects should be managed by following good practice promoted in the UK Forestry Standard and associated Guidelines. As with other policies which affect land use, there is potential for both positive and negative effects relating to land use changes and the potential for conflict with other land uses.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
											Assumptions & Links with Other SEA Work *Assumptions:* • The majority of forests producing timber in Scotland are independently certified against internationally recognised principles and criteria for sustainable forest management. • The proposal is closely linked to the delivery of other proposals and policies for the Waste sector. *Previous SEA work:* This policy was previously assessed in the SEA work taken forward for: • RPP2. • Construction waste was considered in the SEA of Making Things Last: A Circular Economy Strategy for Scotland.
	Proposals										
	Deliver improvements to the Forestry Grant Scheme application process (2017) **Develop further targeted grant measures (2018 – 19)** Proposals contribute to policy outcome 1	+	+	0	+	+	+	+	+/-	+/-	Improving the application process for the Forestry Grant Scheme and the development of additional targeted grant measures in the coming years could further help land-owners and managers in establishing appropriate and sustainable woodlands. Increasing the rate of afforestation in Scotland is likely to have a positive effect on climactic factors by reducing GHG emissions through increased CO_2 sequestration. Sustainably managed forests can have associated beneficial effects on soil, water, biodiversity, flora and fauna, human health and wellbeing, and cultural heritage if created and managed appropriately. This policy could further stimulate rural development and bring possible material asset benefits. However, there is the potential for both positive and negative effects through land use change and conflict over potential alternative land use options, and for landscape depending on the scale and nature of changes. The effects of land use change on the wider environment and communities could be mixed, depending on the scale and nature of changes. For example woodland creation can have significant positive or negative impacts on the landscape, biodiversity and patterns of recreational use. Potential negative impacts can be mitigated if woodland creation schemes are appropriately designed and delivered to meet the requirements of the UK Forestry Standard. Local forestry and woodland strategies also identify the appropriate location for woodlands to maximise the delivery of public benefits and minimise adverse environmental and landscape impacts. In addition, specific woodland creation proposals must meet the requirements of the statutory processes for assessing impact on designated habitats or the wider environment (e.g. Environmental Impact Assessment). **Assumptions & Links with Other SEA Work** *Assumptions:* • The proposal is closely linked to the delivery of other proposals and policies contributing to Outcome 1. • Afforestation will meet the requirements of the UK Forestry Standard which defines the requirements for the sustainable management of forests in the UK. *Previous SEA work:* Woodland creation was previously considered in the SEA work undertaken for: • RPP2.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
											• Getting the Best from Our Land: A Land Use Strategy for Scotland 2016-2021.
	Identify additional investment opportunities for woodland creation schemes (2017 – 18) Proposal contributes to policy outcome 1	+	+	0	+	+	+	+	+/-	+/-	Identifying opportunities for further woodland creation is likely to have a positive effect on climactic factors by reducing GHG emissions through increased CO_2 sequestration. The creation of sustainably managed forests and woodlands can have beneficial effects on soil, water, biodiversity, flora and fauna, human health and wellbeing, and cultural heritage if managed appropriately. This policy could also stimulate rural development and bring possible material asset benefits, particularly for the forestry sector. However, there is the potential for both positive and negative effects through land use change and conflict over potential alternative land use options, and depending on the scale and nature of changes, visual impacts and effects on landscape. It is anticipated that Local Authority Forest and Woodland Strategies (supplementary planning guidance) should provide a regional framework for forestry expansion through identifying preferred areas where forestry can have a positive impact on the environment, landscape, economy and local community so potential impacts may be mitigated. **Assumptions & Links with Other SEA Work** *Assumptions:* • The proposal is closely linked to the delivery of other proposals and policies contributing to Outcome 1. • Afforestation will meet the requirements of the UK Forestry Standard which defines the requirements for the sustainable management of forests in the UK. *Previous SEA work:* Woodland creation was previously considered in the SEA work undertaken for: • RPP2. • Getting the Best from Our Land: A Land Use Strategy for Scotland 2016-2021.
	Review Forest Enterprise Scotland's woodland creation activity on the National Forest Estate (2019 – 20) Proposal contributes to policy outcome 1	+	+	0	+	+	+	+	+	+	The proposal seeks to review the woodland creation activity on the National Forest Estate. In itself, this review is unlikely to have significant environmental effects. However, if used to inform and support the delivery of other policies and proposals, and particularly help to inform future actions that seek to contribute to meeting Scotland's woodland creation ambitions, a wide range of benefits are likely. Identifying areas of success and opportunities for improvement should help to improve policies relating to the National Forest Estate, and help to hone in on those programmes that are seen to be of most benefit. This could ultimately help to optimise opportunities to improve CO_2 sequestration and deliver wider benefits for the natural environment. **Assumptions & Links with Other SEA Work** *Assumptions:* • The proposal is closely linked to the delivery of other proposals and policies contributing to Outcome 1. • Afforestation will meet the requirements of the UK Forestry Standard which defines the requirements for the sustainable management of forests in the UK.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
											Previous SEA work: Woodland creation was previously considered in the SEA work undertaken for: • RPP2. • Getting the Best from Our Land: A Land Use Strategy for Scotland 2016-2021.

Summary of Overall Effects

Carbon sequestration from increased woodland and forest planting and the use of sustainable Scottish timber in construction in preference to other higher carbon intensive materials or imported timbers from overseas are likely to have positive effects (**climatic factors**).

Woodland creation, delivered in accordance with the UK Forestry Standard and associated guidelines, could have positive effects such as habitat creation, natural flood management and soil stabilisation (**soil, water and biodiversity**). Managing forests according to the Standard could help to mitigate the potential negative effects of soil erosion and a risk of decline in water quality, especially during the operations associated with timber harvesting. Positive effects may also arise through an increase in forested areas for recreational purposes such as walking and cycling, however, this is only likely to be accessible during the growing phase (**population and human health**). Positive effects from improved land management could occur, depending on its previous use, and the creation of new ecosystems (**biodiversity and landscape**). Additional benefits may also be derived from the increased use of renewable natural timber resources rather than non-renewable carbon-intensive construction materials, with associated benefits through reduced landfill activity and GHG emissions (**material assets and climatic factors**).

The effects of land use change on the wider environment and communities could be mixed, depending on the scale and nature of changes. For example, poorly designed and established woodlands or forests could affect the scenic and local biodiversity value of the area which could lead to negative visual impacts (**biodiversity and landscape**). Demand for land from other land uses could also generate some pressure (**material assets**).

It is considered that the identified potential negative impacts could be mitigated by adhering to relevant forestry standards and guidelines, by adopting good practice and the development and revision of Local Authority Forest and Woodland Strategies. Further consideration of potential environmental effects is likely to be undertaken at a project level, where woodland creation proposals must meet the requirements of statutory processes for assessing impact on designated habitats or the wider environment; for example, Environmental Impact Assessment.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
Industry	**Policies, Policy Development Milestones and Proposals**										
	EU Emissions Trading Scheme (EU ETS) delivers 43% reduction on 2005 EU emissions levels by 2030 **Includes consideration of the EU ETS beyond 2030** Policy and policy development milestone contribute to policy outcome 1	+	0	+	0	0	0	0	0	0	The EU ETS puts a cap on the amount of GHGs that can be emitted by businesses and creates a market and price for carbon allowances, thereby providing an incentive for installations to reduce their carbon emissions as they can sell their surplus allowances. There is potential for continuing GHG emission reduction action by business and industry under the current phase of the ETS and from increased reductions in the next proposed phase (Phase IV) which is expected to implement a steeper emission reduction factor (from 1.74% p.a. in Phase III (2014-20) to 2.2% p.a. in Phase IV (2021-30)). As the EU contribution to the Paris Agreement is currently only set out to 2030, no figures for Phase V of the ETS (post-2030) are available. It is likely that there will be further tightening of the cap in a future Phase V to meet the EU's 2050 target of 80% emissions reduction. There is also the potential for further improvements in air quality associated with a reduction in energy demand from traditional and finite fossil fuel sources. **<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • The EU ETS continues into Phase IV and V, and the UK continues to be a member of the EU ETS, or linked to the EU ETS, post-Brexit, operating to the same overall cap agreed by the UK for its contribution to the EU 2030 GHG target (of -40% on 1990) within the Paris Agreement and the development of Phase V target. *<u>Previous SEA work:</u>* • This policy was previously assessed in the SEA work undertaken for the RPP2.
	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 sectors Policy contributes to policy outcome 1	+	0	+	0	0	0	0	0	0	Environmental tax and discount schemes such as the CCL and CCA incentivise a reduction in energy consumption and encourage greater efficiencies within energy-intensive industries. Further reductions in GHG emissions from this sector could therefore be realised if these schemes continue past 2023. There is also the potential for further improvements in air quality associated with a reduction in energy demand from traditional and finite fossil fuel sources. **<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • Climate Change Levy increases for gas in 2019, as announced by UK government, until it reaches parity with electricity in 2025, therefore leading to greater incentive to reduce industrial gas consumption. Climate Change Agreements remain available for sectors beyond 2023. *<u>Previous SEA work:</u>* • The principles of the levy and agreement were discussed in the SEA undertaken for the RPP2.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	Non-domestic Renewable Heat Incentive (ends 2020/21) and associated Scottish Government supportive programmes will continue to encourage the uptake of renewable heat technologies Policy contributes to policy outcome 1	+	0	+	0	0	0	0	0	+	The Renewable Heat Incentive (RHI) and associated programmes aim to incentivise the adoption of low renewable heat technologies within businesses by allowing users to be paid for generating and consuming their own heat to contribute towards the decarbonisation of Scotland's energy supplies. RHI was a component of RPP2. The implementation of technologies such as heat pumps, solar thermal panels and biomass boilers could help reduce reliance on fossil fuels and in doing so reduce GHG emissions and improve air quality. However, there is the potential for negative impacts in to arise from the siting, installation and operation of the different technologies, both short term and long term. For example, there may be temporary impacts from construction. Biodiversity implications may also arise if work is undertaken in roof cavities to install technologies which could lead to adverse impacts on bats. Other relevant considerations include possible negative implications that can arise from the uptake of some technologies. For example, whilst biomass boilers are subject to strict regulation and standards, they are not carbon neutral and the biomass combustion process can result in the emission of air pollutants that are potentially harmful to human health. If care is not taken in the production of feedstocks, there is the also the potential for adverse effects on biodiversity, landscapes, soil and water quality. The resilience of Scotland's energy supply to the predicated impacts of climate change is likely to become increasingly important; promotion of more diverse technologies and increased flexibility in relation to how these feed into the energy system as a whole should aid in future proofing supply. The implementation of efficient heat technologies advocated through the RHI could potentially contribute to enhancing security of supply and help to future-proof energy supply.
											<u>Assumptions & Links with Other SEA Work</u> *<u>Assumptions:</u>* • Policy considers both domestic and commercial/industry sectors. • While the RHI does not include district heating, it does include eligible heat technologies that provide heat to a heat network. *<u>Previous SEA work:</u>* • The RHI was discussed in the SEA undertaken for the RPP2.
	Our Manufacturing Action Plan: A Manufacturing Future for Scotland – industrial energy efficiency and decarbonisation workstream supports investment in energy efficiency and heat recovery.	+	0	+	0	0	0	0	0	+	Our Manufacturing Action Plan commits the Scottish Government and its partners to a programme of activity to support industrial energy efficiency and decarbonisation. It includes working with the UK Government and businesses, developing expert advice for energy intensive companies and facilitating cross-sector technology demonstrator projects to help Scotland's manufacturing sector through the transition to a more circular economy and the decarbonisation of production. With business and industry buy-in there is the potential for positive environmental effects, principally a reduction in GHG emissions and waste generation in the manufacturing sector. Introducing circular economy targets could encourage more efficient resource use and therefore reduce the requirement for waste disposal. The reuse, repair and remanufacturing of goods will extend the longevity of materials in circulation which could lead to a reduction in the requirement to manufacture goods from new, providing benefits for material assets by reducing reliance on finite or virgin materials. Secondary benefits for climatic factors are likely to be realised from the avoidance of carbon generation from the sourcing,

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	Policy contributes to policy outcomes 1 and proposal contributes to policy outcome 2										processing and transportation of such materials. The development of new incentives or regulatory mechanisms, and demonstration of successful technologies for industry has the potential to increase industry interest and investment in efficiency practices. This too has the potential for overall positive effects, particularly in terms of reducing GHG emissions and the development of infrastructure. If successful, the proposal could increase the use of carbon as a manufacturing feedstock through its sequestration by Carbon Capture and Storage (CCS) technology, as well as other technologies such as heat electrification and industrial biomass. There is the potential for significant GHG emissions reductions as a result of this, though CCS has still not been proven at a commercial scale. CCS could also provide an opportunity to upgrade infrastructure networks and provide resource security if carbon used as a manufacturing feedstock. There is potential for adverse impacts on most topic areas associated with infrastructure works required for the implementation of CCS technology. However, impacts are likely to be managed at a project level through current mechanisms, such as the planning process. Increased uptake of certain technologies can also have the potential for environmental effects. For example, whilst the implementation of biomass would be subject to regulation and standards, it is not carbon neutral and the biomass combustion process can result in the emission of air pollutants that are potentially harmful to human health. If care is not taken in the production of feed stocks to meet a potential increase in demand, there is the also the potential for adverse effects on biodiversity, landscapes, soil and water quality.
											<u>Assumptions & Links with Other SEA Work</u> *<u>Previous SEA work:</u>* The proposal has been discussed in the following SEA work: • Making Things Last: A Circular Economy Strategy for Scotland. • RPP2. • The Heat Policy Statement: Towards Decarbonising Heat: Maximising the Opportunities for Scotland. • The Electricity Generation Policy Statement.
	National Infrastructure Priority for Energy Efficiency - Scotland's Energy Efficiency Programme (SEEP) Policy development milestone contributes to policy outcome 1	+	0	+	0	0	0	0	0	+	The provision of support through measures such as regulation, advice and financial incentives for the development of energy efficiency and decarbonisation measures in industry is primarily aimed at reducing energy consumption within industry. If widely implemented, there is the potential for significant reductions in GHG emissions and an overall positive effect in terms of climatic factors. Increased uptake of fabric improvements such as loft and wall insulation, and decarbonisation of heat supply is likely to reduce energy requirements from traditional and finite sources. There is the potential for positive effects for climatic factors through a reduction in GHG emissions and improvement in air quality in particular. Greater energy efficiency has the potential to reduce pressure on existing supply and distribution networks, and improve energy efficiency across the sector. If widely adopted, it could potentially contribute to enhancing security of supply and help to future-proof energy supply. There is also the potential for impacts associated with the implementation of some efficiency measures; in particular those involving construction works and/or installation of infrastructure. There may also be the potential for impacts on bats from any work being undertaken in roof spaces, for example, and from installation of infrastructure to distribute recovered heat or the development of, and connection, to heat networks. However, it is considered that the negative impacts that have

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
											been identified will be largely localised and subject to consenting conditions prior to work being undertaken.
											<u>Assumptions & Links with Other SEA Work</u> *<u>Assumptions:</u>* • The proposal includes the energy efficiency of industrial processes and equipment as well as buildings. • Reduction in energy demand means less energy generated from non-renewable sources (e.g. fossil fuels). • This proposal is a continuation of previous and closely related financial levers/funding programmes. • It could increase uptake in the generation and use of low carbon energy in industry.
	Our Manufacturing Action Plan: A Manufacturing Future for Scotland - Energy Savings Opportunity Scheme (ESOS) audit pilot. Policy development milestone contributes to policy outcome 1	+	0	+	0	0	0	0	0	+	The Action Plan commits Scottish Enterprise and Highlands and Islands Enterprise to build on the existing pilot of follow up audits with roll-out of Scotland-wide programme of targeted advice to industry. This will include offering relevant investment support and access to finance through existing funds or new funds developed under SEEP. Further development could include consideration of the potential for mandatory implementation of ESOS audit findings, if this is within devolved competence. Action on the existing energy efficiency auditing of large enterprises under ESOS, and providing financial support to implement energy saving measures, has the potential to reduce energy requirements in the sector, thereby reducing GHG emissions. Additionally, audits are required to include all aspects of an organization's operations, potentially leading to further benefits. For example, these include potential changes to transport fleets to low emissions vehicles. Requiring the mandatory implementation of certain energy efficiency audit findings could further build on the effectiveness of the ESOS and have the potential to further reduce energy requirements within the industry sector. This proposal also offers an opportunity to alleviate pressure on existing energy networks with improved efficiencies, with benefits for material assets. There is also the potential for further improvements in air quality associated with reduced demand for energy generated from traditional and finite sources. However, there is also the potential for impacts associated with the implementation of some efficiency measures; in particular those involving construction works and/or installation of infrastructure. However, it is considered that the negative impacts that have been identified will be largely localised and subject to existing mechanisms such as planning and consenting conditions.

Summary of Overall Effects	
	A wide range of measures, including the continuation of existing tax, discount and emissions trading schemes could contribute to GHG emission reductions **(climatic factors)**. Other schemes aim to encourage the uptake of low carbon heat technologies, district heating networks and the installation of energy efficiency measures in Scotland, could reduce the demand for electricity and heat from fossil fuel sources **(climatic factors)**. Sequestering carbon emissions from the demonstration of CCS technology is also likely to have significant positive effects by reducing GHG emissions. This could also improve local air quality depending on the specific type of technology used **(climatic factors and air)**. Greater uptake of energy efficiency measures within industry could reduce demand and thereby reduce pressure on existing supply and distribution networks (**material assets**). Low carbon renewable heating technologies and networks could improve our heating infrastructure and contribute to enhancing security of supply. There is also an opportunity to reduce pressure on existing waste management networks through adoption of the principles of the circular economy and the use of recycled goods in manufacturing processes. This could reduce reliance on finite or virgin natural resources and limit carbon generation from the processing and transportation of such materials **(material assets, climatic factors)**. However, the extent of the benefits realised will be influenced by buy-in from businesses and industry. There is potential for localised adverse impacts on some topic areas as a consequence of construction and infrastructure improvement works from the installation of new heating networks, CCS infrastructure and energy efficiency measures, but these are expected to be temporary **(population and human health, soil, water, air and biodiversity)**. Longer term impacts can arise from certain technologies, such as those that impact on the fabric of building **(landscape and cultural heritage)**. Factors such as the location and scale of the proposed works will influence the significance of the identified impacts. These are likely to be experienced at a local scale and be given consideration at a project level under existing consenting mechanisms. In some cases, impacts may also be managed through the use of appropriate construction management measures, such as Environmental Management Plans.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
Peat	**Policies**										
	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 2018/19 **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** Policies contribute to policy outcome 1	+	+	0	+	+	+	+	+	+	These policies are aimed at increasing the rate of restoration of peatlands to their natural state and increasing awareness amongst landowners and managers. They build on measures outlined in previous plans. Peatland restoration has the potential to have a significant positive effect on climatic factors through increasing the CO_2 sequestration potential of these areas which could reduce the impact of carbon emissions. Positive effects are also expected for biodiversity, flora and fauna as peatlands support many important species, habitats and ecosystems which may have been lost through previous degradation. Soil and water quality are also likely to benefit as peatlands store and clean water as well as acting as important natural flood plains, soaking up excess water and regulating run-off. The ability of peatlands to filter water helps to reduce treatment costs for public supplies and also helps to sustain quality drinking water for private supplies, which may also lead to additional positive benefits for human health. Upland peatlands are popular for outdoor recreational activities such as hillwalking so additional population and human health benefits could be achieved through increasing the provision of accessible peatland. Enhancing community well-being is another possible related benefit through the development of local skills and knowledge in relation to the management of restoration schemes. There is the potential for positive impacts on landscape through restoring a sense of 'wilderness', particularly in areas that have been subject to significant peatland degradation. By restoring degraded peatland there are also likely to be benefits for land use through better land management. Additionally, upland peatlands are considered some of our most iconic landscapes and are culturally significant, so there are likely to be benefits for cultural heritage.
											Assumptions & Links with Other SEA Work *Previous SEA work:* This policy was previously assessed in the following SEA work: • RPP2. • Getting the Best From Our Land: A Land Use Strategy for Scotland 2016-2021. • The upcoming Energy and Peatlands Policy Statement.
Summary of Overall Effects	Largely positive environmental effects are expected from this sector; most notably a reduction in CO2 emissions and the enhancement of the carbon sink potential of those areas (**climatic factors**). Further benefits are expected in relation to soil function and stability, water quality and reducing flood risk, maintaining ecosystem functions, supporting and restoring natural biodiversity (**soil, water and biodiversity**). Peatlands have an important influence on landscape and are of cultural value and so there is also potential to enhance landscape value and access to the outdoors (**landscape, cultural heritage and population and human health**). There is potential for positive effects associated with land use change as a result of improving land management and restoring degraded land (**material assets**).										

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
Residential	**Policies and Policy Development Milestones**										
	Energy Company Obligation (ECO) Policy contributes to policy outcome 1	+	+	+	0	0	0	0	0	+	This is a UK-wide policy aimed at improving energy efficiency in homes to reduce greenhouse gas emissions. It includes sub-obligations which target vulnerable consumer groups. It aims to reduce the demand for heating and create carbon savings. A Scottish ECO policy is also being developed to take forward these ambitions (this is discussed under the proposals below). The policy is helping to improve energy efficiency and reduce GHG emissions, and it is assumed the Scottish ECO under development will have the same ambition. There is also the potential for improved air quality, particularly if coupled with a reduction in demand for energy produced from traditional and finite supplies. An increase in energy efficient buildings that are easier to heat could also have potential benefits in terms of health through reduced exposure to cold and damp properties and improved air quality. As such, there may be benefits for population and human health, particularly for vulnerable members of society with existing health complications such as respiratory issues. The retrofitting of buildings could potentially have a negative impact on buildings with historical or architectural value. There may also be an impact on biodiversity where particular species have nested in buildings where works are carried out. The realisation of any negative impacts will be largely felt at a localised level and will require further consideration, including giving due regard in any consenting processes. Improving energy efficiency across the sector has the potential to reduce pressure on existing supply and distribution networks and if widely adopted could potentially contribute to enhancing security of supply.
											<u>Assumptions & Links with Other SEA Work</u> *<u>Assumptions:</u>* • Measures which deliver the most cost effective carbon savings will be delivered, such as cavity wall insulation. • A Scottish ECO will be consulted upon and taken forward in due course and this will deliver measures similar to those under the current UK scheme. This is discussed further under the proposals below. *<u>Previous SEA work:</u>* • This policy has been considered in light of the SEA for Conserve and Save: Energy Efficiency Action Plan.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	Home Energy Efficiency Programmes for Scotland (HEEPS) Policy contributes to policy outcome 1	+	+	+	0	0	0	0	0	+	HEEPS and Warmer Homes Scotland are area-based programmes aimed at retrofitting existing housing stock in Scotland to make them more energy efficient. It involves the provision of grants to install energy efficiency and heating measures seeking to reduce carbon emissions and make homes easier and cheaper to heat, helping to tackle fuel poverty. Potential benefits are likely to include a reduction in GHG emissions and improved air quality. Associated benefits for human health may also occur, particularly for some sections of the population through making homes easier to heat and reducing exposure to cold, damp, and mouldy properties. There could be potential impacts for cultural heritage as a result of retrofitting buildings of historical or architectural value with energy efficiency measures. Consideration will also need to be given to any proposed works that disturb roof cavities as there may be biodiversity implications where loft installations are involved as there may be biodiversity interests to consider, such as bats. The realisation of any negative impacts identified will be largely at a localised level and will require further consideration, including due regard being given to consenting processes. Improving energy efficiency across the sector has the potential to reduce pressure on existing supply and distribution networks and if widely adopted could potentially contribute to enhancing security of supply. **<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • HEEPS and Warmer Homes Scotland are centred on the installation of insulation and heating systems, predominantly gas central heating. It does not include renewable energy measures such as micro-wind generation and solar (Photovoltaic cells). • The Scottish Energy Efficiency Programme (SEEP) will take forward the mix of measures in previous schemes, with increased deployment of low carbon heat (e.g. heat pumps).

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	SEEP Pilots - This includes Pilot Programmes to test innovative delivery mechanisms for energy efficiency and low carbon heat Policy contributes to policy outcomes 1 and 2	+	+	+	0	0	0	0	0	+	Undertaking a co-ordinated and integrated delivery of the SEEP programme through area-based delivery programmes, managing works and helping building owners secure funding/finance of energy efficiency and heat decarbonisation measures is likely to be integral to maximising the potential benefits of the programme. This will be achieved by offering advice and information, helping building owners and tenants access finance, and ultimately helping them to comply with future regulation. The delivery programmes will build on the evidence and lessons learned from existing programmes and from pilot projects. The proposal reinforces the important role that SEEP can play in both the domestic and non-domestic context. Taking a co-ordinated and integrated approach to energy efficiency through the delivery of this scheme is likely to lead to largely positive effects including reducing GHG emissions and improved air quality. Population and human health could also see a positive impact as more homes become easier to heat, and helping to reduce the number of properties that could currently be classified as cold, damp, and mouldy. Seeking to maximise benefits and reducing the need for heating and electricity could see less demand on current infrastructure and therefore reduction of pressure on the systems. This benefit could be enhanced with off-grid generation. If widely implemented, the approach has the potential to contribute to enhancing the security of supply and help to future-proof energy supply. Taking a coordinated approach to delivery, for example, through the development of Local Heat and Energy Efficiency Strategies and approaching delivery across an area or community, will consider cumulative impacts and avoid a piecemeal approach to addressing the longer-term impacts on landscape and cultural heritage; particularly if this could result in changes to a building's appearance in a conservation area. There is also the potential to consider cumulative impacts that could occur by taking a co-ordinated approach to delivery across an area.
											<u>Assumptions & Links with Other SEA Work</u> *<u>Assumptions:</u>* • The proposal is largely delivery-focused and seeks to maximise benefits produced through other proposals. • The delivery programme will be supported by SEEP regulations and SEEP financial mechanisms outlined in the preceding sections. • There is an in-built assumption that capacity to deliver integrated programmes exist, or can be developed, amongst delivery partners. This is currently being trialled via SEEP pilots. • The proposal will help to plan the implementation of energy efficiency measures more effectively. • The proposal presents an opportunity to target measures towards those in greater need in order to maximise benefits.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	Social landlords will meet the Energy Efficiency Standard for Social Housing in 2020 Policy contributes to policy outcome 1	+	+	+	0	0	0	0	0	+	The policy involves retrofitting existing social housing stock in Scotland to make homes more energy efficient. It could also include installation of micro renewables systems, such as solar PV panels, to meet targets. There is the potential for these measures to reduce energy demand and, as such, lead to a reduction in GHG emissions and improved air quality, particularly in instances where demand for energy generated from traditional and finite supplies is reduced. There is also the potential for human health benefits, particularly for some sectors of the population with health problems that could be exacerbated by cold, damp, and mouldy properties. Retrofitting existing housing stock could lead to a number of negative impacts, both temporary and long term in nature. This can include longer-term impacts on landscape and cultural heritage, particularly if these could result in changes to a building's appearance. Consideration would also need to be given to any proposed works that disturb roof cavities and have the potential for disturbance of fauna. The realisation of any negative impacts will be largely felt at a localised level and will require further consideration, including giving due regard to any consenting processes. Improving energy efficiency across the sector has the potential to reduce pressure on existing supply and distribution networks and if widely adopted could potentially contribute to enhancing security of supply. **<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • This policy relates to energy efficiency measures in buildings and includes heating systems. *<u>Previous SEA work:</u>* • This proposal was discussed in the SEA undertaken for the RPP2.
	Smart Meter roll out –UK Government commitments to ensure that every home and business in the country is offered a smart meter by 2020 Policy contributes to policy outcome 1	+	+	+	0	0	0	0	0	+	It is expected that smart meters are likely to encourage improved management of domestic energy consumption and enable more efficient use of energy resources. A reduction in energy consumption is likely to have positive effects on climatic factors from reduced GHG emissions. Associated benefits for air quality are also likely, particularly through a reduction in demand from conventional, finite fuel sources. Benefits are expected for population and human health through increased flexibility for domestic consumers in choice of energy suppliers and energy tariffs and by shifting usage during peak periods in response to financial incentives (which could potentially help fuel become more affordable for some) and improved reliability. For example, enabling two-way communication between consumers and utility providers is expected to have positive effects in providing real-time feedback on use. This could help providers to further improve energy systems in the future, identify and reduce system losses and increase security of supply. However, it is also noted that regulation and powers relating to energy tariffs are not devolved to Scotland. The provision of consumption data and increased control for consumers in managing energy costs through the introduction of smart meters is also anticipated. As a consequence, benefits are expected through an increase in the proportion of 'active consumers', improved energy efficiency and the potential for an overall reduction in energy demand. A reduction in energy demand is also likely to have benefits on material assets through reduced pressure on current energy and network infrastructure. Security of supply and system resilience should also be improved. As noted above, enabling two-way communication between consumers and utility providers could help forecast demand and improve energy systems in the future.

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											<u>Assumptions & Links with Other SEA Work</u> *<u>Previous SEA work:</u>* • Smart meters and demand side response were discussed in the SEA for the Electricity Generation Policy Statement. • Smart meters were discussed in the SEA for RPP2.
	Renewable Heat Incentive (RHI) and associated Scottish Government supportive programmes such as the Home Energy Scotland Renewables Loan (ends 2020/21) Policy contributes to policy outcome 2	+	+	+	0	0	0	0	0	+	The RHI and supporting programmes seek to increase uptake of renewable heat sources such as biomass boilers, solar water heating and certain heat pumps, and includes such technologies which provide heat to district heating. RHI was a component of the RPP2 The RHI is primarily focused on decarbonising heat supply and, as such, has the potential for benefits in reducing GHG emissions. Additionally, positive effects for air quality are considered likely, with associated benefits on human health as a result of a shift towards renewable heat technologies, displacing energy production from traditional and finite supplies. There is the potential for impacts associated with development, particularly in the construction and operation of infrastructure facilitated through the RHI scheme. For example, the potential for temporary impacts from the construction phase and longer-term impacts on landscape and cultural heritage have been identified, particularly if this could result in changes to a building's appearance. Biodiversity implications may also arise if work is undertaken in roof cavities to install technologies as this could lead to adverse impacts on species that may have nested there. Increased uptake of some technologies can also have the potential for environmental effects. For example, whilst technologies such as biomass boilers are subject to regulation and standards, they are not carbon neutral. The biomass combustion process can result in the emission of air pollutants that are potentially harmful to human health. If care is not taken in the production of feedstocks to meet a potential increase in demand, there is the also the potential for adverse effects on biodiversity, landscapes, soil and water quality. The resilience of Scotland's energy supply to the predicated impacts of climate change is likely to become increasingly important. The promotion of a greater diversity of technologies and increased flexibility in terms of how these feed into the energy system as a whole should help with this challenge. The wide implementation of efficient heat technologies advocated through the RHI could potentially contribute to enhancing security of supply and help to future-proof energy supply.
											<u>Assumptions & Links with Other SEA Work</u> *<u>Assumptions:</u>* • The policy looks at both domestic and commercial/industry sectors. • While the RHI does not include district heating, it does include eligible heat technologies that can provide heat to a heat network. *<u>Previous SEA work:</u>* • The RHI was considered in the SEA undertaken for the RPP2.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	District Heating Loan Fund and Heat Network Partnership Policy Policies contribute to policy outcome 2	+	+	+	-	0	0	-	-	+	Together, the fund and partnership seek to address the financial and technical barriers to improving energy efficiency within the public sector, businesses and communities. They involve promoting and facilitating the distribution of heat through the development of district heating networks and providing space and water heating through a new local network. There is the potential for significant reductions in GHG emissions and as such, an overall positive effect on climatic factors. Associated benefits for air quality are also likely from aiding a shift towards low carbon energy generation from traditional non-renewable sources. Population and human health could also be positively impacted through increased security of supply, particularly if coupled with other efficiency measures. The construction and operation of district heating infrastructure could have a range of environmental impacts; notably the potential for soil compaction from siting of infrastructure, and impacts to cultural heritage and landscape setting. Temporary impacts during the construction phase and longer-term impacts on air, water, population and human health and visual amenity have also been identified. It is likely that these effects will be localised in nature and will require further consideration, including being given due regard in any consenting processes. The efficient and localised use of energy through schemes such as district heating also has the potential to reduce pressure on wider supply and distribution networks and improve energy productivity across the sector. The promotion of low carbon and renewable energy will play a key role in enhancing the security of energy supply as the impacts of a changing climate and the challenges therein are likely to become increasingly important.
											Assumptions & Links with Other SEA Work *Assumptions:* • The two play key roles in directly promoting and facilitating the development of low carbon technologies and low carbon heat networks. *Previous SEA work:* • The fund was considered in the SEA undertaken for the RPP2.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	SEEP – Regulation and Standards Policy development milestone contributes to policy outcomes 1 and 2	+	+	+	-	0	0	-	-	+	The proposal aims to consult on the phased regulation of existing buildings and to look at financial incentives to improving the energy efficiency of Scotland's building stock and efficiency in the provision of heat. It will also consult on regulations for district heating development, and will inform future programme development. It is to be delivered as part of the wider approach to developing area-based delivery programmes for energy efficiency under SEEP and allows for the integration of energy demand reduction and heat decarbonisation where appropriate. Overall, there is the potential for significant reductions in GHG emissions and improved air quality associated with the shift towards energy supply through district low carbon and renewable heat displacing energy produced from traditional and finite supplies. Population and human health could also see a positive impact as homes become easier to heat and the number of properties that could be classified as cold, damp and mouldy is reduced. Consideration may however need to be given to the sources of heat used in district heating systems as some technologies can have negative implications, such as biomass. There may also be negative impacts on soils, landscape and cultural heritage from the construction and operation of heat networks, and from introduction of energy efficiency measures in buildings. These could be both temporary and long term but likely be localised in nature. The requirement for new or upgraded infrastructure to ensure supply to households is, however, likely to have positive effects on material assets. Increased uptake of low carbon and renewable heat technologies at the local level has the potential to reduce pressure on the wider heat network and could play an important part in enhancing security of supply. However, longer-term impacts on landscape and cultural heritage could occur, particularly if this could result in changes to a building's appearance. Consideration will also need to be given to any proposed works that disturb roof cavities. The realisation of the negative impacts identified will be largely at a local level and may require further consideration, including given due regard to any consenting processes. Consideration may need to be given to the sources used to generate the heat which is used in district heating systems as some technologies can have negative implications, such as biomass. There is also the potential for negative impacts on soils, landscape and cultural heritage from the establishment and operation of heat networks. These effects could be temporary or long term in nature, and are likely to be localised. The requirement for new or upgraded infrastructure to ensure supply to households is, however, likely to have positive effects on material assets. Increased uptake of low carbon and renewable heat technologies at the local level has the potential to reduce pressure on the wider heat network and could play an important part in enhancing security of supply.
											Assumptions & Links with Other SEA Work *Assumptions:* • The proposal will work in combination with other district heating measures (e.g. provision of funding) and have similar impacts. • The proposal takes forward the measures included in RPP2. *Previous SEA work:* • This proposal was discussed in the SEA undertaken for the RPP2.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	SEEP – Financial Incentives Policy development milestone contributes to policy outcomes 1 and 2	+	+	+	0	0	0	0	0	+	The financial facilities established under SEEP allow the cost of energy efficiency and low carbon heat measures to be spread-out over a period of time. These include retrofitting houses with insulation, new boilers, draught exclusion and low carbon heat. The development of financial loan and grant schemes are primarily aimed at reducing energy consumption for households and increasing deployment of low carbon heat. If widely implemented, there is the potential for significant reductions in GHG emissions and an overall positive effect in terms of climatic factors. Improved air quality and benefits for population and human health associated with a reduction in energy demand from traditional and finite sources is also considered likely. The installation of technologies and measures could lead to a number of negative impacts, both temporary and long term in nature. This includes longer-term impacts on landscape and cultural heritage, particularly for installations that may result in changes to a building's appearance. Consideration will also need to be given to any proposed works on roof cavities that could disturb fauna. The realisation of the negative impacts identified will be largely at a local level and will require further consideration, including given due regard to any consenting processes. Improving energy efficiency across the sector has the potential to reduce pressure on existing supply and distribution networks and if widely adopted could potentially contribute to enhancing security of supply. **<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • The proposal covers both domestic and non-domestic installations. • The aim of the programme is to broadly reduce the need for heat and electricity, and includes the deployment of low carbon heat. • Energy efficiency measures will likely be similar to the previous proposals in so far as retrofitting houses with insulation, new boilers, draught exclusion and micro-generation. • The proposal is a continuation and expansion of previous and closely related financial levers/funding programmes. *<u>Previous SEA work:</u>* • The proposal has been considered in the SEA of Conserve and Save: Energy Efficiency Action Plan.
	SEEP – Advice and Information Policy development milestone contributes to policy outcomes 1 and 2	+	+	+	0	0	0	0	0	+	The proposal seeks to expand the existing advice and support services for residential (Home Energy Scotland), business and public sectors (Resource Efficient Scotland) to provide support in improving the energy efficiency and decarbonising the heat supply of buildings. The proposal will continue to support the wider roll out of SEEP and the delivery of ambitions across the programme. Positive effects are likely to arise through the provision of additional support and commitment to implement efficiency measures. Overall, there is the potential for significant reductions in GHG emissions and improved air quality associated with a reduction in energy demand and the shift towards energy supply through district low carbon and renewable heat displacing energy produced from traditional and finite supplies. Potential benefits may arise for population and human health through ensuring that these measures are targeted towards areas of greatest need and benefit, leading to more energy efficient homes, commercial and public buildings. The requirement for new or upgraded infrastructure to ensure supply to households is, however, likely to have positive

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											effects on material assets. Increased uptake of low carbon and renewable heat technologies at the local level has the potential to reduce pressure on the wider heat network and could play an important part in enhancing security of supply. However, consideration may need to be given to the potential for negative implications associated with some measures and technologies. For example, there may be negative impacts on soils, landscape and cultural heritage from the construction and operation of heat networks, and from introduction of energy efficiency measures in buildings. These could be both temporary and long term but likely be localised in nature. Longer-term impacts on landscape and cultural heritage could occur, particularly if this could result in changes to a building's appearance. Consideration will also need to be given to any proposed works that disturb roof cavities. The realisation of the negative impacts identified will be largely at a local level and may require further consideration, including given due regard to any consenting processes. **<u>Assumptions & Links with Other SEA Work</u>** <u>*Assumptions:*</u> • This proposal is largely advice and information focused, seeking to maximise the benefits produced through other proposals. • It will support other ambitions of SEEP outlined in this table. • The proposal will help to promote the delivery and options in improving energy efficiency and in the delivery of efficient and effective low carbon energy options. The proposal presents an opportunity to target measures towards those in greater need in order to maximise benefits.
	SEEP – Delivery Programmes including development of a RouteRoad Map Policy development milestones contribute to policy outcomes 1 and 2	+	+	+	0	0	0	0	0	+	Undertaking a co-ordinated and integrated delivery of the SEEP programme through area-based delivery programmes, managing works and helping building owners secure funding/finance of energy efficiency and heat decarbonisation measures is likely to be integral to maximising the potential benefits of the programme. This will be achieved by offering advice and information, helping building owners and tenants access finance, and ultimately helping them to comply with future regulation. The delivery programmes will build on the evidence and lessons learned from existing programmes and from pilot projects, and feed into the development of a SEEP Route Map expected to be published in 2018. The proposal reinforces the important role that SEEP can play in both the domestic and non-domestic context. Taking a co-ordinated and integrated approach to energy efficiency through the delivery of this scheme is likely to lead to largely positive effects including reducing GHG emissions and improved air quality. Population and human health could also see a positive impact as more homes become easier to heat, and helping to reduce the number of properties that could currently be classified as cold, damp, and mouldy. Seeking to maximise benefits and reducing the need for heating and electricity could see less demand on current infrastructure and therefore reduction of pressure on the systems. This benefit could be enhanced with off-grid generation. If widely implemented, the approach has the potential to contribute to enhancing the security of supply and help to future-proof energy supply. Taking a coordinated approach to delivery, for example, through the development of Local Heat and Energy Efficiency Strategies Plans and approaching delivery across an area or community, will consider cumulative impacts and avoid a piecemeal approach to addressing the longer-term impacts on landscape and cultural heritage; particularly if this could result in changes to a building's appearance in a conservation area. There is also the potential to consider cumulative

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
											impacts that could occur by taking a co-ordinated approach to delivery across an area.
											Assumptions & Links with Other SEA Work *Assumptions:* • The proposal is largely delivery-focused and seeks to maximise benefits produced through other proposals. • The delivery programme will be supported by SEEP regulations and SEEP financial mechanisms outlined in the preceding sections. • There is an in-built assumption that capacity to deliver integrated programmes exist, or can be developed, amongst delivery partners. This is currently being trialled via SEEP pilots. • The proposal will help to plan the implementation of energy efficiency measures more effectively. • The proposal presents an opportunity to target measures towards those in greater need in order to maximise benefits.
	Proposals										
	Regulation – Review of energy standards within building regulations Proposal contributes to policy outcome 1	+	+	+	0	0	0	0	0	+	The intention to review and potentially develop more rigorous standards for domestic buildings would likely lead to increased energy efficiency in new buildings and where owners of existing buildings elect to undertake new building work. This is likely to contribute to further reductions in both energy demand and emissions in the residential sector. Positive effects for population and human health and air quality will also be likely where regulations result in a reduction in use of energy generated from traditional and finite sources. There is the potential for impacts associated with the construction and operation of infrastructure. This could include impacts on cultural heritage, particularly if this could result in changes to a building's appearance. There is also the potential for impacts on biodiversity where works may be undertaken on the fabric of buildings (e.g. implications for bats relating to roof works). However, any such effects are likely to be largely localised. Greater energy efficiency has the potential to reduce pressure on existing supply and distribution networks, potentially enhancing security of supply. Once determined, the scope of any review of building regulations will be subject to a full and separate SEA.
											Assumptions & Links with Other SEA Work *Assumptions:* • The proposal could result in the introduction of more stringent standards applicable to new dwellings and to work to existing domestic buildings.
	Develop and identify best approach to the long term decarbonisation of the heat supply, to commence after 2025 Proposal contributes to policy	+	+	+	0	0	0	0	0	+	Decarbonisation of heat supply is likely to be largely positive for climatic factors and should help to reduce GHG emissions generated in the energy sector. Benefits for air quality and population and human health are also likely from greater use of low carbon energy sources, and a reduction in energy generated through traditional, finite supplies such as fossil fuels. There will also be positive impacts through reducing the impacts of climate change on other related topics, such as biodiversity, water and soil. However, the development and operation of low carbon energy technologies, and the infrastructure required to facilitate this shift, can also lead to adverse or mixed environmental impacts. For example, negative impacts associated with the construction of or connection to district heat networks and any associated infrastructure can arise, including temporary

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	outcome 2										impacts during the construction phase and longer-term impacts on air, soil, water, visual amenity, landscape and cultural heritage. Additionally, negative impacts can also arise depending on the source of heat generation used in a district heating network which will require further consideration. The generation of electricity from renewable sources for use in heating is also likely to have environmental implications. While infrastructure and construction impacts are likely to be realised most at a local level, the scale and significance of these impacts will be subject to factors such as location, type and size of proposed developments and the technologies involved. The determination of the best approach in decarbonising the sector is likely to be important in ensuring that the potential benefits are both realised and maximised where possible. This should also assist in the consideration of potential environmental effects, and inform the management/mitigation of adverse effects. **<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • This proposal seeks to optimise decarbonisation of the heat sector. • The proposal will be included in a future Climate Change Plan and will set out an approach for decarbonising heat from 2025 onwards. • The proposal presents an opportunity to identify the optimal pathway towards decarbonisation of heat, and to identify and manage/mitigate the potential for adverse effects that may occur from a shift towards low carbon heat supply and use.
Summary of Overall Effects	Largely positive effects are expected from this sector. In particular, improving energy efficiency at the point of use and aiding the decarbonisation of energy supply to Scottish households will help to reduce emissions (**climatic factors**). Reducing energy demand is also likely to improve air quality, particularly by reducing demand for energy generated from traditional and finite sources (air quality), with associated benefits for human health (**population and human health**). Improving the energy efficiency of domestic properties could reduce domestic energy consumption, and aid in the development of more efficient and energy secure housing stock. The SEEP programme is the primary vehicle set out in the draft Plan for the residential sector, and will be an integral component of wider Scottish Government ambitions to improve health and wellbeing (**population and human health**). The assessment also identified the potential for largely localised impacts associated with some policies and proposals, particularly those focused on the promoting the development of district heating systems and heat networks. Direct impacts from development works can include temporary or long-term impacts on a number of environmental receptors (**soil, air, water, biodiversity, population and human health**). Additionally, the operation of some technologies can have negative impacts. For example, whilst biomass is subject to regulation and standards, it is not carbon neutral and the biomass combustion process can result in the emission of air pollutants that are potentially harmful to human health (**population and human health, air quality**). Care is needed to ensure that the production of feedstocks can avoid or mitigate the potential for adverse effects on environmental receptors (**biodiversity, landscape, soil and water quality**). Energy efficiency measures can have some adverse effects, most notably, where works may be undertaken to roof cavities which can have implications for bats (**biodiversity**). Some efficiency measures could affect cultural heritage features directly or through visual impacts on their setting and landscape (**landscape and cultural heritage**). However, these would be largely localised and their significance would depend on factors such as the size and scale of the proposed works, in conjunction with the location and setting. The potential for environmental effects would be considered as appropriate under existing mechanisms, such as the planning process, EIA and HRA. In many instances, impacts can be managed or mitigated by appropriate design and construction management measures such as the co-ordination of works to minimise disruption and the implementation of Environmental Management Plans. As with other sectors considered in the draft Plan, these policies and proposals could help to reduce pressure on existing energy networks and progressively improve infrastructure. Greater uptake of new low carbon technologies, particularly local generation, could reduce pressure/demand on other energy resources and improve energy efficiencies across the sector (**material assets**). The resilience of Scotland's energy supply to the predicted impacts of climate change is likely to become increasingly important. Greater diversity in technologies and how they feed into the energy system should help to future proof supply. However, there will be the need for further and upgraded infrastructure to ensure that Scotland can achieve maximum benefit from the policies and proposals, and achieve an efficient, flexible and diverse energy mix (**material assets**). In many instances, any identified benefits and/or adverse impacts, and their significance at the local and national levels, is likely to be influenced by the successful promotion and uptake of the policies and proposals.									

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Services	**Policies and Policy Development Milestones**										
	Low Carbon Infrastructure Transition Programme (LCITP) - includes support for investment in decarbonisation of business and the public sector through £76 million funding to 2018 Policy contributes to policy outcomes 1 and 2	+	+	+	0	0	0	0	0	+	LCITP comprises a raft 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 principal aim of the LCITP is to contribute to the Scottish Government's long-term target of reducing GHG emissions. As such, this policy is likely to have an overall positive effect in terms of climatic factors. Associated benefits for air quality are also considered likely through aiding a shift towards low carbon energy generation from traditional non-renewable supplies, such as fossil fuels. However, the scale and nature of any benefits will be influenced by the low carbon technologies applied and some may have negative impacts which will require further consideration. For example, there is the potential for negative impacts associated with the construction and operation of infrastructure that is promoted or facilitated through the Programme. However, it is likely that consideration will be given to these factors whilst applications are given due regard to set criteria within the programme. Increased uptake of low carbon energy technologies also has the potential to reduce pressure on existing energy networks and improve energy productivity across the sector. If widely implemented, the policies could potentially contribute to enhancing the security and resilience of supply and help future-proof Scotland's energy supply to the predicted effects of climate change through facilitating a broad mix of technologies. **<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • The programme directly supports and facilitates the development of large scale, innovative low carbon energy generation and energy demand reduction projects. • An increase in new low carbon energy generation combined with a more comprehensive approach to improving energy efficiency and reduction energy demand will reduce reliance on fossil fuels and increase the resilience of Scotland's energy systems. • LCITP has strict requirements for the low carbon technologies that are supported.

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	Public Sector Energy Efficiency Procurement Framework / Project Support Unit – enables potentially £300m worth of investment across public sector estate Policy contributes to policy outcome 1	+	0	+	-	0	0	-	-	+	The proposal seeks to change how public buildings source and utilise energy, and demonstrate opportunities in connecting to low carbon energy sources via local heat networks. Investment in improving efficiency in the use and delivery of energy Scotland's public sector estates has the potential to result in a range of environmental effects. Notably, the potential for a reduction in energy consumption is likely to result in significant reductions in GHG emissions. There is also the potential for further improvements in air quality associated with a reduction in energy demand from traditional and finite sources. There is also the potential for impacts associated with the implementation of some efficiency measures, in particular those involving construction works and/or installation of infrastructure. This could include temporary impacts from the construction phase and longer-term impacts on landscape and cultural heritage, particularly if this results in changes to a building's appearance. There may also be the potential for impacts on biodiversity from any work being undertaken in roof spaces, for example, with possible implications for bats. However, it is considered that the negative impacts that have been identified will be largely localised and subject to consenting conditions prior to work being undertaken. The proposal is likely to increase take-up of heat networks by the public sector and further promote the generation and use of heat from low carbon sources at local level. The displacement of traditional and finite energy sources has the potential for positive effects for climatic factors through a reduction in GHG emissions and air quality. Negative impacts associated with the construction of or connection to district heat networks and any associated infrastructure can arise, including temporary impacts during the construction phase and longer-term impacts on air, soil, water, visual amenity, landscape and cultural heritage. Additionally, negative impacts can also arise depending on the source of heat generation used in a district heating network which will require further consideration. It is likely that the negative impacts identified would be localised in nature. Greater energy efficiency has the potential to reduce pressure on existing supply and distribution networks, and improve energy productivity across the sector. If widely implemented, this measure has the potential to contribute to enhancing the security of supply.
											<u>Assumptions & Links with Other SEA Work</u> *<u>Assumptions:</u>* • The policy is a mandatory requirement for Scotland's public sector. • It addresses improved efficiency in both the use of energy and its supply, including the potential for public buildings to connect to heat networks. • The proposal target a reduction in demand for existing energy sources for public buildings, primarily a reduction in fossil fuel use in heating.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	Non-domestic energy efficiency finance (Salix Loans (public sector), Small and Medium sized Enterprise (SME) Loans (business), District Heating Loan Fund) continues as part of development of SEEP Policy contributes to policy outcome 1	+	+	+	0	0	0	0	0	+	Together, this collection of policies and measures seek to address the financial and technical barriers to improving energy efficiency within the public sector, businesses and communities. Overall, they are aimed at reducing energy consumption and aiding decarbonisation of the energy sector. Overall, there is the potential for significant reductions in GHG emissions and, as such, an overall positive effect on climatic factors. Associated benefits for air quality are also likely from aiding a shift towards low carbon energy generation from traditional non-renewable supplies. Some low carbon technologies can also lead to negative impacts, however, and there may be additional infrastructure requirements. The construction and operation of infrastructure likely to be promoted or facilitated by these financial mechanisms, such as district heating systems, could also have a range of environmental impacts. These include temporary impacts during the construction phase and longer-term impacts on air, soil, water, visual amenity, landscape and cultural heritage. It is likely that the negative effects identified will however be localised in nature. Improving energy efficiency also has the potential to reduce pressure on supply and distribution networks and improve energy productivity across the sector. Moving towards a decarbonised energy sector will require the promotion of a diverse mix of technologies to provide suitable and flexible solutions to Scotland's energy requirements. The promotion of low carbon and renewable energy will play a key role in enhancing the security of energy supply as the impacts of a changing climate and the challenges are likely to become increasingly important. **Assumptions & Links with Other SEA Work** *Assumptions:* • The policies directly finance and enable businesses and the public sector to develop and implement energy efficiency measures. *Previous SEA work:* This policy was previously discussed in the following SEA work: • District heating funds was discussed in RPP2. • District heating was discussed in the SEA of The Heat Policy Statement: Towards Decarbonising Heat: Maximising the Opportunities for Scotland.
	District Heating Loan Fund and Heat Network Partnership Policy contributes to policy outcome 2	+	+	+	0	0	0	0	0	+	Together, the fund and partnership seek to address the financial and technical barriers to improving energy efficiency within the public sector, businesses and communities. They involve promoting and facilitating the distribution of heat through the development of district heating networks and providing space and water heating through a new local network. Increased uptake of low carbon heat technologies has the potential for overall benefits, particularly in reducing GHG emissions. Associated benefits for human health in relation to community and domestic initiatives are also considered likely, alongside the potential for improved air quality associated with the shift towards low carbon and renewable heat from traditional and finite supplies. District heating networks can be powered by a number of fuel sources and consideration may need to be given to possible negative implications that may arise, depending on fuel source use. There is also the potential for impacts associated with the construction of heat network infrastructure which could include temporary impacts during the construction phase and longer-term impacts on air, soil, water, visual amenity, landscape and cultural heritage. Infrastructure and construction impacts are likely to be realised most at a local level. The scale and

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											significance of impacts will also be subject to factors such as location and size of proposed developments, and should be given due regard in any consenting processes. If widely implemented, the proposal will help to diversify how heat is generated and could potentially contribute to enhancing the security of supply.
											<u>Assumptions & Links with Other SEA Work</u> <u>*Assumptions:*</u> • The two play key roles in directly promoting and facilitating the development of low carbon technologies and low carbon heat networks. <u>*Previous SEA work:*</u> • The fund was considered in the SEA undertaken for the RPP2.
	Non-domestic Renewable Heat Incentive (RHI) (ends 2020/21)and associated Scottish Government supportive programmes Policy contributes to policy outcome 2	+	+	+	0	0	0	0	0	+	The RHI and supporting programmes seek to increase uptake of renewable heat sources such as biomass boilers, solar water heating, certain heat pumps, and non-domestic schemes for geothermal and biogas/biomethane. RHI was a component of the RPP2. While the focus remains unchanged, the scheme is going through a "refocus" with an aim to improve it by focusing on long-term decarbonisation and offering better value for money. Reform measures are also likely to include consideration of supporting growth in supply chains and market challenges. The RHI is primarily focused on decarbonising heat supply, and as such, has the potential for benefits in reducing GHG emissions. Additionally, positive effects for air quality are considered likely, with associated benefits on human health as a result of a shift towards renewable heat technologies displacing energy production from traditional and finite supplies. There is the potential for impacts associated with the development, particularly in the construction and operation of infrastructure facilitated through the RHI scheme. For example, this could include temporary impacts from the construction phase and longer-term impacts on landscape and cultural heritage, particularly if this could result in changes to a building's appearance. Biodiversity implications may also arise if work is undertaken in roof cavities to install technologies and this could have adverse impacts on bats. Increased uptake of certain technologies can also have the potential for environmental effects. For example, whilst biomass boilers are subject to regulation and standards, they are not carbon neutral and the biomass combustion process can result in the emission of air pollutants that are potentially harmful to human health. If care is not taken in the production of feed stocks to meet a potential increase in demand, there is the also the potential for adverse effects on biodiversity, landscapes, soil and water quality. The resilience of Scotland's energy supply to the predicated impacts of climate change is likely to become increasingly important and promotion of a greater diversity and flexibility of technologies and how these feed into the energy system as a whole should aid in future proofing supply. The wide implementation of efficient heat technologies advocated through the RHI could potentially contribute to enhancing security of supply and help to future-proof energy supply.

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											<u>Assumptions & Links with Other SEA Work</u> *<u>Assumptions:</u>* • The policy considers both domestic and commercial/industry. • While the RHI does not include district heating, it does include eligible heat technologies that provide heat to a heat network. *<u>Previous SEA work:</u>* • The RHI was discussed in the SEA undertaken for the RPP2.
	All small and medium sized non-domestic premises to be offered a smart meter by 2020 Policy contributes to policy outcome 2	+	+	+	0	0	0	0	0	+	It is expected that smart meters are likely to encourage improved management of non-domestic energy consumption and enable more efficient use of energy resources. A reduction in energy consumption is likely to have positive effects on climatic factors from reduced GHG emissions. Associated benefits for air quality are also likely, particularly through a reduction in demand from conventional, finite fuel sources. Benefits are expected for population and human health through increased flexibility for consumers in choice of energy suppliers and energy tariffs and by shifting usage during peak periods in response to financial incentives (which could potentially help fuel become more affordable for some) and improved reliability. For example, enabling two-way communication between consumers and utility providers is expected to have positive effects in providing real-time feedback on use. This could help providers to further improve energy systems in the future, identify and reduce system losses and increase security of supply. However, it is also noted that regulation and powers relating to energy tariffs are not devolved to Scotland. The provision of consumption data for businesses and increased control for consumers in managing energy costs through the introduction of smart meters is also anticipated. As a consequence, benefits are expected through an increase in the proportion of 'active consumers', improved energy efficiency and the potential for an overall reduction in energy demand. A reduction in energy demand is also likely to have benefits on material assets through reduced pressure on current energy and network infrastructure. Security of supply and system resilience should also be improved. As noted above, enabling two-way communication between consumers and utility providers could help forecast demand and improve energy systems in the future.
											<u>Assumptions & Links with Other SEA Work</u> *<u>Previous SEA work:</u>* • Smart meters and demand side response were discussed in the SEA for the Electricity Generation Policy Statement. • Smart meters were discussed in the SEA for RPP2.

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	Scotland's Energy Efficiency Programme (SEEP) – Regulation and Standards Policy development milestone contributes to policy outcomes 1 and 2	+	+	+	-	0	0	-	-	+	The proposal aims to consult on the phased regulation of existing buildings and to look at financial incentives to improving the energy efficiency of Scotland's building stock and efficiency in the provision of heat. It will also consult on regulations for district heating development, and will inform future programme development. The proposal is being developed to work beside other financial and promotional measures, such as the District Heating Loan Fund and the Heat Network Partnership. Overall, there is the potential for significant reductions in GHG emissions and improved air quality associated with the shift towards energy supply through district low carbon and renewable heat displacing energy produced from traditional and finite supplies. Consideration may however need to be given to the sources of heat used in district heating systems as some technologies can have negative implications, such as biomass. There may also be negative impacts on soils, landscape and cultural heritage from the construction and operation of heat networks, and from introduction of energy efficiency measures in buildings. These could be both temporary and long term but likely be localised in nature. The requirement for new or upgraded infrastructure to ensure supply to households is, however, likely to have positive effects on material assets; particularly if an area-wide approach is taken. Increased uptake of low carbon and renewable heat technologies at the local level has the potential to reduce pressure on the wider heat network and could play an important part in enhancing security of supply. However, longer-term impacts on landscape and cultural heritage could occur, particularly if this could result in changes to a building's appearance. Consideration will also need to be given to any proposed works that disturb roof cavities. The realisation of the negative impacts identified will be largely at a local level and may require further consideration, including given due regard to any consenting processes. The requirement for new or upgraded infrastructure to ensure supply to households is, however, likely to have positive effects on material assets. Increased uptake of low carbon and renewable heat technologies at the local level has the potential to reduce pressure on the wider heat network and could play an important part in enhancing security of supply. **<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • The proposal will work in conjunction with other district heating measures (e.g. funding etc.). *<u>Previous SEA work:</u>* The proposal was discussed in the SEA undertaken for the RPP2.
	SEEP – Financial Incentives Policy development milestone contributes to policy outcomes 1 and 2	+	+	+	0	0	0	0	0	+	The development of a financial incentives such as loan and grant schemes for the promotion of energy efficiency and low carbon heating measures, is primarily aimed at stimulating the market for investment and reducing energy consumption by helping building owners and tenants to meet energy efficiency or heat standards set by regulation. If widely implemented, there is the potential for significant reductions in GHG emissions and an overall positive effect in terms of climatic factors. Improved air quality associated with a reduction in energy demand from traditional and finite supplies is considered likely, with secondary benefits expected for population and human health. The development and operation of a number of technologies supported by the programme is likely to lead to a number of negative impacts, both temporary and long term in nature. This includes longer-term impacts on landscape and cultural heritage, particularly if this could result in changes to a building's appearance. Consideration will also need to be given to

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											any proposed works that disturb roof cavities. The realisation of the negative impacts identified will be largely at a local level and may require further consideration, including given due regard to any consenting processes. Greater energy efficiency has the potential to reduce pressure on existing supply and distribution networks, and improve energy productivity across the sector. If widely implemented, this measure has the potential to contribute to enhancing the security of supply.
											<u>Assumptions & Links with Other SEA Work</u> *<u>Assumptions:</u>* • The proposal includes both domestic and non-domestic. • The proposal is limited to efficiency measures in buildings and low carbon energy generation, particularly heating. • A reduction in energy demand means less energy generated from non-renewable sources (e.g. fossil fuels). • This proposal is a continuation and expansion of previous and closely related financial levers/funding programmes.
	SEEP - Advice and Information Policy development milestone contributes to policy outcomes 1 and 2	+	+	+	0	0	0	0	0	+	The proposal seeks to build upon the existing advice and support services for residential (Home Energy Scotland), business and public sectors (Resource Efficient Scotland) to provide support in improving the energy efficiency and decarbonising the heat supply of buildings. The proposal will continue to support the wider roll out of SEEP and the delivery of ambitions across the programme. Positive effects are likely to arise through the provision of additional support and commitment to implement efficiency measures. Overall, there is the potential for significant reductions in GHG emissions and improved air quality associated with a reduction in energy demand and the shift towards energy supply through district low carbon and renewable heat displacing energy produced from traditional and finite supplies. Potential benefits may arise for population and human health through ensuring that these measures are targeted towards areas of greatest need and benefit, leading to more energy efficient homes, commercial and public buildings. The requirement for new or upgraded infrastructure to ensure supply to households is, however, likely to have positive effects on material assets. Increased uptake of low carbon and renewable heat technologies at the local level has the potential to reduce pressure on the wider heat network and could play an important part in enhancing security of supply. However, consideration may need to be given to the potential for negative implications associated with some measures and technologies. For example, there may be negative impacts on soils, landscape and cultural heritage from the construction and operation of heat networks, and from introduction of energy efficiency measures in buildings. These could be both temporary and long term but likely be localised in nature. Longer-term impacts on landscape and cultural heritage could occur, particularly if this could result in changes to a building's appearance. Consideration will also need to be given to any proposed works that disturb roof cavities. The realisation of the negative impacts identified will be largely at a local level and may require further consideration, including given due regard to any consenting processes.

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											<u>Assumptions & Links with Other SEA Work</u> *<u>Assumptions:</u>* • This proposal is largely advice and information focused, seeking to maximise the benefits produced through other proposals. • It will support other ambitions of SEEP outlined in this table. • The proposal will help to promote the delivery and options in improving energy efficiency and in the delivery of efficient and effective low carbon energy options. • The proposal presents an opportunity to target measures towards those in greater need in order to maximise benefits.
	SEEP – Delivery Programmes including development of a Route Map Policy development milestones contribute to policy outcomes 1 and 2	+	+	+	0	0	0	0	0	+	Undertaking a co-ordinated and integrated delivery of the SEEP programme through delivery programmes is likely to be integral to maximising the potential benefits of the programme, through offering advice, information, financial incentives and access to managed, trusted installers, to building owners and tenants. The delivery programmes will build on the evidence and lessons learned from existing programmes and from pilot projects, and feed into the development of a SEEP Route Map expected to be published in 2018. The proposal reinforces the important role that action in both the domestic and non-domestic context will play in delivering these benefits through the SEEP programme. It is likely that positive effects will arise through adopting a co-ordinated and integrated approach to energy efficiency, and through setting out the steps to be taken within the upcoming SEEP Route Map. Seeking to maximise benefits in both domestic and non-domestic sectors has the potential to significantly reduce pressure on existing energy networks and infrastructure. If widely implemented, the approach has the potential to contribute to enhancing the security of supply and help to future-proof energy supply. Positive effects are likely to arise through the provision of additional support and commitment to implement these measures nationally and on an area-wide scale, predominately through reduced GHG emissions. However, potential benefits may arise for population and human health through ensuring that these measures are targeted towards areas of greatest need and benefit, leading to more energy efficient homes, commercial and public buildings. Taking a coordinated approach to delivery, for example, through the development of Local Heat and Energy Efficiency Strategies and approaching delivery across an area or community, will consider cumulative impacts and avoid a piecemeal approach to addressing the longer-term impacts on landscape and cultural heritage; particularly if this could result in changes to a building's appearance. There is also the potential to consider cumulative impacts that could occur by taking a co-ordinated approach to delivery across an area.
											<u>Assumptions & Links with Other SEA Work</u> *<u>Assumptions:</u>* • This proposal is largely delivery focused, seeking to maximise the benefits produced through other proposals. • The delivery programme with be supported by SEEP regulations and SEEP financial mechanisms outlined in this table. • There is an in-built assumption that capacity to deliver integrated programmes exist, or can be developed, amongst delivery partners. This is currently being trialled via SEEP pilots.

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											• The proposal will help to plan the implementation of energy efficiency measures more effectively. • The proposal presents an opportunity to target measures towards those in greater need in order to maximise benefits.
	SEEP – Evidence and Evaluation Policy development milestone contributes to policy outcome 1 and 2	+	+	+	0	0	0	0	0	+	The proposal seeks to collate data and develop a better understanding of current performance of SEEP in relation to non-domestic buildings. It seeks to establish a baseline for non-domestic buildings' energy and emissions data against which progress under the Climate Change Plan can be measured, and development of a unified non-domestic building stock model to support further action in the future. In itself, the collation and use of evidence is unlikely to have significant environmental effects. However, if used to inform and support the delivery of the wider SEEP programme, a wide range of benefits are likely. For example, identifying areas of success and opportunities for improvement should help to improve SEEP and help to hone in on those programmes that are seen to be of most benefit. This should ultimately help to maximise opportunities to improve the efficient use and delivery of energy via SEEP. This should have overall benefits in improving energy efficiency in supply and use, and result in reduced GHG emissions, improved human health and air quality, in particular. This also presents an opportunity to best take forward the delivery of efficient building stock, and focus the delivery of low carbon heat to domestic and non-domestic users to best effect.
											Assumptions & Links with Other SEA Work *Assumptions:* • This proposal seeks to maximise the benefits produced through other proposals. • It will support the delivery of other ambitions of SEEP outlined in this table. • The proposal will help to promote the delivery and options in improving energy efficiency and in the delivery of efficient and effective low carbon energy options. • The proposal presents an opportunity to identify and target measures towards those in greater need in order to maximise benefits.
	Proposals										
	Regulation – Review of the Assessment of Energy Performance of Non-domestic Buildings (Regulations) 2016 Proposal contributes to policy outcome 1	+	0	+	0	0	0	0	0	+	The review and potential introduction of additional requirements relating to energy efficiency improvements beyond current provisions (applicable to non-domestic buildings >1,000 m² offered for sale or rental) has the potential to result in a range of environmental effects. Notably, the potential for a reduction in energy consumption is likely to result in significant reductions in GHG emissions. There is also the potential for further improvements in air quality associated with a reduction in energy demand from traditional and finite sources. There is the potential for impacts associated with the construction and operation of infrastructure. Review of these regulations will consider impacts on cultural heritage, particularly if this could result in changes to a building's appearance. There is also the potential for impacts on biodiversity where the level of improvement sought under regulations is likely to result in work to the fabric of buildings. (e.g. implications for bats relating to roof works). Greater energy efficiency has the potential to reduce pressure on existing supply and distribution networks, and improve

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											energy productivity across the sector. If widely implemented, this measure has the potential to contribute to enhancing the security of supply. Once determined, the scope of the review of regulations will be subject to a full and separate SEA.
											<u>Assumptions & Links with Other SEA Work</u> <u>*Assumptions:*</u> • Current policy is a mandatory requirement for non-domestic buildings over 1,000 m² in area. The proposal could result in the introduction of more stringent standards, applicable to a broader range of existing non-domestic buildings.
	Regulation – Review of energy standards within building regulations Proposal contributes to policy outcome 1	+	+	+	0	0	0	0	0	+	The intention to review and potentially develop more rigorous standards for non-domestic buildings would likely lead to increased energy efficiency in new buildings and where owners of existing buildings elect to undertake new building work. This is likely to contribute to further reductions in both energy demand and emissions in the public and commercial buildings sector. Positive effects for population and human health and air quality will also be likely where regulations result in a reduction in use of energy generated from traditional and finite sources. There is the potential for impacts associated with the construction and operation of infrastructure. Review of these regulations will continue to consider impacts on cultural heritage, particularly if this could result in changes to a building's appearance. There is also the potential for impacts on biodiversity where the works undertaken by building owners include improvements to the fabric of buildings (e.g. implications for bats relating to roof works). However, any such effects are likely to be largely localised. Greater energy efficiency has the potential to reduce pressure on existing supply and distribution networks, potentially enhancing security of supply. Once determined, the scope of any review of building regulations will be subject to a full and separate SEA.
											<u>Assumptions & Links with Other SEA Work</u> <u>*Assumptions:*</u> • The proposal could result in the introduction of more stringent standards applicable to new buildings and to work to existing non-domestic buildings.
	Develop and identify best approach to the long term decarbonisation of the heat supply, to commence after 2025 Proposal contributes to policy outcome 2	+	+	+	0	0	0	0	0	+	Decarbonisation of heat supply is likely to being largely positive for climatic factors and should help to reduce GHG emissions generated in the energy sector. Benefits for air quality and population and human health are also likely from greater use of low carbon energy sources, and a reduction in energy generated through traditional, finite supplies such as fossil fuels. There will also be positive impacts through reducing the impacts of climate change on other related topics, such as biodiversity, water and soil. However, the development and operation of low carbon energy technologies, and the infrastructure required to facilitate this shift, can also lead to adverse or mixed environmental impacts. For example, negative impacts associated with the construction of or connection to district heat networks and any associated infrastructure can arise, including temporary impacts during the construction phase and longer-term impacts on air, soil, water, visual amenity, landscape and cultural

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
											heritage. Additionally, negative impacts can also arise depending on the source of heat generation used in a district heating network which will require further consideration. The generation of electricity from renewable sources for use in heating is also likely to have environmental implications. While infrastructure and construction impacts are likely to be realised most at a local level, the scale and significance of these impacts will be subject to factors such as location, type and size of proposed developments and the technologies involved. The determination of the best approach in decarbonising the sector is likely to be important in ensuring that the potential benefits are both realised and maximised where possible. This should also assist in the consideration of potential environmental effects, and inform the management/mitigation of adverse effects. **<u>Assumptions & Links with Other SEA Work</u>** <u>*Assumptions:*</u> • This proposal seeks to optimise decarbonisation of the heat sector. • The proposal will be included in a future Climate Change Plan and will set out an approach for decarbonising heat from 2025 onwards. • The proposal presents an opportunity to identify the optimal pathway towards decarbonisation of heat, and to identify and manage/mitigate the potential for adverse effects that may occur from a shift towards low carbon heat supply and use.
Summary of Overall Effects	Largely positive environmental effects are expected from this sector, most notably a reduction in GHG emissions (**climatic factors**) by contributing to the decarbonisation of energy supply and improving efficiency of how energy, in particular heat, is used in both domestic and non-domestic buildings. Many of the policies and proposals will complement one-another and, in some cases wider Scottish ambitions, including improving health. A raft of financial measures as well as large scale, innovative low carbon energy generation and energy demand reduction projects will also support the shift away from traditional and finite energy supplies. Many of the proposals seeking the delivery of lower carbon energy could improve air quality, with positive effects for human health and wellbeing (**air quality and population and human health**). For example, improving the energy efficiency of domestic properties could reduce domestic energy consumption, and help to develop more efficient and energy secure housing stock (**population and human health**). Largely localised impacts could also arise from some of the policies and proposals, particularly those requiring development of new or upgraded infrastructure (material assets). For example, using low carbon technologies in district heating networks could lead to environmental impacts if new or upgraded infrastructure is needed (**material assets**). This could include largely temporary effects from construction activities (**soil, air, water, biodiversity, population and human health**) that will require management and mitigation. The implementation of energy efficiency measures could also have some adverse effects, most notably, where works may be undertaken to roof cavities which can have implications for bats (**biodiversity**). Impacts on the setting for cultural heritage and landscape features (**cultural heritage and landscape**) could arise, depending on the siting and construction of developments. However, these effects would be largely localised and temporary. Further, the potential for environmental effects would be considered under existing mechanisms, such as the planning process, EIA and HRA, as appropriate. In many instances, the impacts can be managed through appropriate design and construction management measures such as the co-ordination of works to minimise disruption and the implementation of Environmental Management Plans. The opportunity to reduce pressure on existing energy networks and infrastructure was also noted in the assessment. Greater uptake of new low carbon technologies, particularly through local generation, could reduce pressure/demand on other energy resources and improve energy efficiencies across the sector. The resilience of Scotland's energy supply to the predicted impacts of climate change is likely to become increasingly important and greater diversity in technologies should aid in future proofing supply and distribution. This presents an opportunity to enhance Scotland's energy security and future-proof energy supply in the face of predicted future pressures (**material assets**). Any identified benefits and/or adverse impacts, and their significance at the local and national levels, will be influenced by successful uptake and the promotion of the policies and proposals.									

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
Transport	**Policies and Policy Development Milestones**										
	With the EU and UK, negotiate stretching vehicle emissions standards for new cars (and vans) beyond 2020 (and 2021) Policy contributes to policy outcomes 1 and 2 **With the EU and UK, negotiate an emission standard for new Heavy Goods Vehicles (HGVs) from 2025** Policy contributes to policy outcome 3	+	+	+	0	0	0	0	0	0	These policies set out Scottish ambitions to negotiate with the EU and UK Governments to extend vehicle emission standards for new cars and vans, and to introduce new emissions standards for HGVs. Negotiating these changes can be considered as a positive approach, and if successful, has the potential to deliver a number of key benefits. For example, if emissions standards were to be extended and further standards introduced for new vehicles, there is the potential for significant reductions in GHG emissions in the transport sector. Improvements in air quality are likely to be seen in urban areas as a result of the proposal, particularly in areas designated due to poor air quality, and the potential for associated benefits for human health. **Assumptions & Links with Other SEA Work** *Assumptions:* • The SEA has assumed that this policy is limited to negotiating.
	With the UK, negotiate vehicle excise duty (VED) differentials between ultra-low emission vehicles (ULEVs) and diesel/petrol vehicles to support and encourage the uptake of ULEVs Policy contributes to policy outcome 1 and 2	+	+	+	0	0	0	0	0	+/-	In general terms, the changes to the reforms to VED that will take effect from 1 April 2017 seek to promote the purchase of new lower emission cars through an exemption from VED. Maintaining vehicle excise duty differentials represents a continuation of current policy. In general terms, the VED regime that will come into effect from April 2017 seeks to support growth of the ULEV sector, and has the potential to increase the number of low emissions vehicles on Scottish roads and gradually replace older, higher emissions vehicles. If taken-up by vehicle purchasers, this is likely to reduce GHG emissions, improve air quality and have benefits for human health, particularly in urban areas with known air quality issues (e.g. Air Quality Management Areas). Increased uptake of these vehicles also has the potential to increase electricity demand and pressure on existing electricity generation networks if upgrades are not made to facilitate transition towards decarbonisation. In particular, infrastructure such as the increased development of recharging points will be required to meet market demand. **Assumptions & Links with Other SEA Work** *Assumptions:* • The policy will maintain the current differentials, subject to the HM Revenues & Customs changes of 2015 to be implemented for new cars purchased from 1 April 2017. • The new VED proposals seek to make low emission (largely electric) vehicles more appealing to purchasers. • There are clear links with other policies and proposals seeking to increase Low Emission Vehicle (LEV) numbers on our roads and gradually replace higher emissions vehicles.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	With the UK, negotiate biofuels policies that will enable them to be used sustainably in the decarbonisation of the whole transport sector Policy contributes to policy outcomes 1 and 3	+	0	+	0	0	0	0	0	0	This policy sets out Scottish ambitions to work with the UK Governments to introduce more ambitious and binding biofuels targets. Working towards these changes can be considered as a positive approach, and if successful, has the potential to increase biofuel use in transport and increase biofuel production. If implemented, the greater use of biofuels in transport has the potential to lead to further reductions in GHG emissions in particular. Improvements in air quality are likely to be seen in urban areas, particularly in areas designated due to poor air quality, and there is the potential for associated benefits in human health. Increased demand for biofuels is likely to lead to increased biofuel production, which has the potential for a range of environmental effects. For example, pressure on land use and soils could occur due to the increased production of first generation biofuels (from bio-crops). Other effects on landscape (e.g. the creation of monocultures, changes in local setting and setting of cultural heritage features), water quality and biodiversity could occur (e.g. from production of biofuels in the marine environment). However, there is the potential for benefits in utilising second generation biofuels (from waste and by-products), particularly in terms of maximising the use of waste resources and also in terms of overall carbon abatement. While any potential impacts would likely be felt at the local level, implementing a sustainable approach and carefully managing biofuel production, including consideration of the potential for landscape impacts, is likely to mitigate the potential for any such effects. **Assumptions & Links with Other SEA Work** *Assumptions:* • It has been assumed that this policy is limited to working with the UK Government. • The net effect will be that biofuel production will be increased compared to that considered in RPP2 and the ratio of biofuel to petrol/diesel used in cars will be greater. *Previous SEA work:* • The use of biofuels was discussed in RPP2.
	Support fuel efficient driver training Policy contributes to policy outcome 1	+	0	+	0	0	0	0	0	0	The proposal involves the continuation of existing measures aimed at changing behaviours by using improving driver training as a means of reducing fuel consumption and overall emissions from transport. If widely utilised, this could lead to an overall reduction in fuel consumption and reduce demand for fuel. While the proposal will not reduce the number of travel journeys, there is the potential for reduced vehicle emissions and improved air quality through the education and promotion of fuel efficiency driving skills. **Assumptions & Links with Other SEA Work** *Assumptions:* • Proposal involves the continuation of support set out in RPP2. *Previous SEA work:* • The proposal was discussed in the SEA undertaken for the RPP2.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	With local authorities and others, evaluate the scope for incentivising more rapid uptake of electric and ultra-low emission cars and vans, as through public procurement policies and preferential local incentives (such as access management and parking policies) Policy development milestone contributes to policy outcome 1										If implemented, measures such as procurement policies and financial and convenience incentives are likely to increase the penetration of ULEVs in the public sector. This could encourage the progressive replacement of older fossil-fuelled public sector vehicle fleets (and the fleets of their partner/supplier organisations) with lower emission vehicles. However, it will be important to ensure that these vehicles are used efficiently to achieve benefits. If widely implemented, increased uptake in low emission vehicles in these sectors is likely to contribute towards reducing GHG emissions in the transport sector, with associated benefits in improving air quality. Improved air quality also has the potential to be beneficial for human health, particularly in urban areas where there are existing air quality issues such as Air Quality Management Areas. Increased uptake of low emissions vehicles, such as electric and electric-hybrid vehicles, has the potential to increase electricity demand and increase pressure on electricity generation networks. There will also be a requirement for infrastructure requirements, such as recharging points, to facilitate or meet demand. Consideration will need to be given to this and to ensure that the network is able to support this transition.
	Work with the UK government, local authorities and other public and third sector partners to identify annually a package of financial and convenience ultra-low emission vehicles (ULEVs) incentives, such as free parking, access to low emission zones and interaction with proposed workplace parking levies Policy development milestone contributes to policy outcome 2	+	+	+	0	0	0	0	0	+/-	**<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • Infrastructure works would be largely focused on those required to facilitate uptake of electric vehicles, such as charging points.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	With local authorities and others, evaluate the scope for urban-wide low emission zones with a specific focus on CO_2 emissions, as well as air pollution more generally Policy development milestone contributes to policy outcomes 1 and 3. As a proposal this contributes to policy outcome 4	+	+	+	0	0	0	0	0	+/-	The implementation of low emission zones is likely to change the behaviours of road transport users and changing how goods are distributed. For example, this could result an overall increase in the use of low emissions vehicles/heavy goods vehicles (HGVs) on Scottish roads, and increase public transport footfall and the use of services such as park and ride in and around in urban centres. These changes should lead to a reduction in GHG emissions. It is also considered that improvements in air quality are likely to arise from this measure, with additional benefits for population and human health. This will be particularly relevant in areas where current air quality problems exist due to air pollution from traffic. Consideration may need to be given to the location of the proposed sites, however, to ensure that increased traffic movement does not potentially lead to negative impacts out-with these zones through increased congestion, for example. The consideration of factors such as location and any existing air quality issues when identifying possible sites should help to mitigate any potential negative impacts. It will also be important that infrastructure, such as road and public transport networks and services (e.g. park and ride) are able to accommodate the implementation of this proposal. The potential for impacts directly related to freight consolidation centres is discussed further within the assessment of that proposal. **<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* There is a clear relationship between this proposal and the one that proposes the development of freight consolidation areas on the outskirts of low emissions zones.
	Enhance the capacity of the electric vehicle charging network (ChargePlace Scotland) - **Includes provide funding until at least August 2019 to support the on-going expansion of the publicly available network of electric vehicle (EV) charge points** **Includes providing funding to support the safe and convenient installation of domestic and workplace charge points** Policies contributes to policy outcome 2	+	+	+	0	0	0	0	0	+/-	This will involve the continued investment and expansion of electric charging/fuelling points across Scotland, including supporting the installation of domestic and workplace charge points and identifying solutions for households without off-street charging. Beyond the benefit of developing a national network of charging and fuelling points, improving this infrastructure is primarily likely to foster the take up of electric and alternatively-powered vehicles, and ultimately, help to facilitate the further decarbonisation of the road transport sector. An increase in the number of these vehicles on Scotland's roads, and the replacement of older petrol and diesel-fuelled vehicles is likely to result in a reduction in GHG emissions, improved air quality and benefits for human health, particularly in urban areas with known air quality issues (e.g. Air Quality Management Areas). Increased uptake of low emissions vehicles, particularly electric vehicles, has the potential to increase electricity demand and increase pressure on electricity generation networks if upgrades are not made to facilitate transition towards decarbonisation. Infrastructure development has the potential for secondary effects, particularly in relation to land take and areas out-with low emissions zones. For example, construction works can result in noise and visual disturbance, impacts to air, soil and water quality, amongst others. If inappropriately sited, infrastructure could impact on landscape and the setting of cultural heritage assets. However, it is likely that the identified impacts would be localised and potentially managed through existing mechanisms. **<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • This policy and assessment refers to LEVs including electric vehicles and hybrids.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	Provide interest-free loans through the Energy Savings Trust to enable the purchase of EVs by both consumers and businesses until at least March 2020 **Promote the benefits of EVs to individuals and fleet operators and increase awareness and confidence in the viability of EVs as an alternative to fossil-fuelled vehicles** Policies contribute to policy outcome 2	+	+	+	0	0	0	0	0	+/-	These policies seek to increase the use of low emission cars and vans for private and business use as a replacement to older and less efficient vehicles, and those with higher emissions. It intends to do this by offering financial support and incentives and through increasing awareness by promoting the benefits of EV ownership. It is expected that within the timescales being considered in the draft Plan, this is expected to focus primarily on electric vehicles. This proposal has the potential to lead to a reduction in GHG emissions with additional benefits for air quality. Further, improved air quality can be beneficial for human health, particularly in urban areas where air quality issues have been identified, such as Air Quality Management Areas. Increased uptake of low emissions vehicles such as electric and electric-hybrid vehicles has the potential to increase electricity demand and increase pressure on electricity generation networks. There will also be infrastructure requirements, such as recharging points, to facilitate or meet market demand. Consideration will need to be given to this and network requirements to enable this transition. **Assumptions & Links with Other SEA Work** *Assumptions:* • The proposal refers to electric and electric hybrid vehicles.
	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 Policy contributes to policy outcome 2	+	+	+	0	0	0	0	0	+/-	The proposal seeks to encourage local authorities to introduce incentives and to use their licensing powers to help reduce the emissions generated by vehicles used in the taxi and private hire sector. This will be through the progressive replacement of older fossil-fuelled taxi and private hire vehicle fleets with lower emission vehicles. It will be important to ensure that these vehicles are used efficiently, however. If widely implemented, increased uptake in low emission vehicles in these sectors is likely to contribute towards reducing GHG emissions in the transport sector, with associated benefits in improving air quality. Improved air quality also has the potential to be beneficial for human health, particularly in urban areas where there are existing air quality issues such as Air Quality Management Areas. Increased uptake of low emissions vehicles such as electric and electric-hybrid vehicles has the potential to increase electricity demand and increase pressure on electricity generation networks. There will also be a requirement for infrastructure requirements, such as recharging points, to facilitate or meet demand. Consideration will need to be given to this and network requirements to enable this transition. **Assumptions & Links with Other SEA Work** *Assumptions:* • Infrastructure works would be largely focused on those required to facilitate uptake of electric vehicles, such as charging points, rather than the development of hydrogen plants. *Previous SEA work:* • The proposal was discussed in the SEA undertaken for the RPP2.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	Deliver the Rail Freight Strategy Policy contributes to policy outcome 3	+	+	+	0	0	0	0	0	+/-	‘Delivering the Goods’ – Scotland’s Rail Freight Strategy sets a vision for a competitive, sustainable rail freight sector and providing a safer, greener, and more efficient way of transporting products and materials in Scotland. With the buy-in of stakeholders, the Strategy seeks to change in how freight is managed and transported. A shift from road to rail freight transport should lead to a reduction in GHG emissions. Improvements in air quality are likely to be seen in urban areas as a result of the proposal, particularly in areas designated due to poor air quality. While the policy has the potential to reduce pressure on the existing road network, there is the potential for increased pressure/demand on the rail freight network should the appropriate infrastructure not be in place to accommodate this transition. **<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • The Strategy was published in March 2016.
	Continue to support local authorities in delivering the ECO-Stars programme, reducing fuel consumption for HGVs, buses, coaches and vans Policy contributes to policy outcome 3	+	+	+	0	0	0	0	0	+	Fleet recognition schemes such as the ECO-Stars programme provide recognition for best operational practices and guidance for making improvements. It could encourage road transport fleet operators to improve fuel and operational efficiencies of their vehicles to reduce fuel consumption. While the policy will not necessarily reduce the number of travel journeys, there is the potential for reduced GHG and other vehicle emissions and improved air quality. This is also likely to have associated benefits for population and human health, particularly in areas designated as Air Quality Management Areas. If widely utilised, this policy could lead to an overall reduction in fuel consumption and reduce demand for fuel, which could have positive effects on material assets. **<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • This is a recognition and guidance scheme only and involves no direct financial incentive from the Scottish Government.
	Consult on Intelligent Transport Systems (ITS) Strategy by the end of March 2017 Policy development milestone contributes to policy outcome 3	+	0	+	0	0	0	0	0	+	This proposal involves exploring opportunities for the deployment of Intelligent Transport Systems (i.e. use of average speed cameras, variable message signs and speed limits, etc.) on trunk roads to encourage driving at more efficient speeds and improve traffic flows. While unlikely to reduce travel journeys, if implemented there is the potential to reduce vehicle emissions and reduce stress on road infrastructure networks as a result of improvements in traffic management; for example, through less congestion. Associated benefits on air quality are likely to arise (e.g. less idling) alongside the potential for a reduction in vehicle accidents. **<u>Assumptions & Links with Other SEA Work</u>** *<u>Previous SEA work:</u>* • The proposal was discussed in the SEA undertaken for the RPP2.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	Provide financial support for the purchase and operation of low carbon buses Policy contributes to policy outcome 4	+	+	+	0	0	0	0	0	+/-	This proposal is an extension of existing proposals involving the use of the Scottish Green Bus Fund to help the bus industry to invest in emission reducing technology (i.e. hybrid buses) and improve fuel and operational efficiencies. There is the potential for reductions in GHG emissions and improvements in air quality associated with the increased use of green buses and replacement of existing bus fleets. Improved air quality is also likely to arise and this has the potential to be beneficial for human health, particularly in urban areas where there are existing air quality issues such as Air Quality Management Areas. However, the continued development of green bus services has the potential for a range of secondary effects depending on the technologies that are being introduced. For example, the introduction of hydrogen buses such as those introduced in Aberdeen would require new infrastructure and new facilities, creating the potential for impacts to some topic areas during construction and operational periods (e.g. disturbance, impacts to soil, water and air quality). Greater uptake of electric bus systems is likely to increase pressure/demand for electricity and could place pressure on existing networks if upgrades are not made to facilitate transition towards decarbonisation. **<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • Involves the expansion of proposals included in the RPP2, including the use of the Scottish Green Bus Fund to help the bus industry to invest in emission reducing technology (i.e. hybrid buses) and the Bus Service Operators Grant with incentives for fuel and operational efficiencies. *<u>Previous SEA work:</u>* • Green bus services were discussed in the SEA undertaken for the RPP2.
	In the context of the current 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 Policy development milestone contributes to policy outcome 4	+	+	+	0	0	0	0	0	0	The successful implementation of climate change policies through the current review of the National Transport Strategy and Transport Bill would likely result in environmental benefits. However, without knowledge of the specific policies and proposals that will be put forward, this assessment can only provide a high-level assessment of the likely effects. The transport sector is one of the main contributors to Scotland's GHG emissions. As such, policies which have the potential to reduce GHG emissions are likely to have positive effects on climatic factors in particular. Road traffic is also a large contributor to air pollution, specifically in urban areas, and many locations in Scotland have been designated as Air Quality Management Areas due to air pollutants from traffic. The inclusion of policies made in relation to climate change has the potential to lead to improvements in air quality, and could deliver associated benefits for human health. **<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • Engagement on the National Transport Strategy begins in 2017. • The National Transport Strategy and Transport Bill would be required to consider implications of the Environmental Assessment (Scotland) Act 2005.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	Encourage and support Scottish port authorities and airports to adopt low emissions solutions Policy contributes to policy outcome 5	+	0	+	0	0	0	0	0	0	The proposal is largely aimed at improving efficiencies and reducing emissions generated by operations undertaken at both airports and ports. These could include cold ironing (the use of shore power by ships whilst in harbour) and measures to reduce emissions associated with airport ground operations and whilst planes are on the ground; for example, single engine taxiing, the use of ground power for planes at stand, and low emission ground vehicles where appropriate. There is the potential for these proposals to contribute to reducing GHG emissions and improving air quality. Improved air quality also has the potential to be beneficial for human health in urban areas located near to these facilities (e.g. Aberdeen Harbour); however, it is unclear if these benefits would be significant at the national level. **Assumptions & Links with Other SEA Work** *Assumptions:* • The measures are voluntary, however they also link to the aviation sector's other voluntary measures to promote sustainable aviation.
	Examine the scope for procuring hybrid and low carbon powertrains in the public sector marine fleet as part of the Scottish Government vessel replacement programme Policy contributes to policy outcome 6	+	0	+	0	0	0	0	0	+	This policy is aimed at gradually replacing the Scottish Government-owned ferry fleet with low-carbon variants. In doing so, this will lead the way for other ferry service providers in Scotland. The policy has the potential for GHG emissions reductions. There is also the potential for associated air quality improvements in port and harbour areas, and for material assets associated with the replacement of aging vessels with new ferries. **Assumptions & Links with Other SEA Work** *Assumptions:* • Specific types of ferries have not been discussed in any detail in the assessment. It has been considered that this would be detailed elsewhere as plans evolve.
	Electrification of the rail network in the High Level Output Statement for Control Period 6 (2019-2024) Policy development milestone contributes to policy outcome 7	+	+	+	0	0	0	0	0	+	The continued electrification of rail services has the potential to contribute to reducing GHG emissions through the replacement of diesel engines with electric engines. Associated works aimed at enhancing rail accessibility and connectivity through the wider rail improvement programme could help to encourage a modal shift from road to rail transport, and as a consequence, could also aid in reducing road-related GHG emissions. Rail electrification is also likely to have generally positive effects on air quality and has the potential to lead to human health benefits, particularly in urban areas such as Air Quality Management Areas where there are existing air quality issues. Other benefits are also likely, such as a reduced risk of fuel leaks/spills to soil and watercourses. However, the electrification programme also has the potential for adverse impacts, particularly at the local level in relation to infrastructure development and construction activities. For example, the improvement works can result in noise and visual disturbance, impacts to air, soil and water quality impacts during the construction works, impacts from spills/leaks, adverse effects on landscape and cultural heritage assets, and effects on biodiversity. It is likely that the negative impacts identified will be realised at a local level. Overall, increased electrification of Scotland's railways is likely to increase pressure/demand for electricity and could place pressure on existing networks if upgrades are not made to facilitate transition towards decarbonisation.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
											<u>Assumptions & Links with Other SEA Work</u> *<u>Assumptions:</u>* • This extends beyond the package for work proposed in the Edinburgh Glasgow improvements Programme and seeks to progress electrification of Scotland's wider rail network. • The policy also aims to investigate hybrid trains and other emerging technologies to determine suitability for application on Scotland's railways as a potential alternative to overhead wire electrification. *<u>Previous SEA work:</u>* • Rail electrification was discussed in the SEA undertaken for the Edinburgh Glasgow improvements Programme.
	Active travel: Maintain funding for infrastructure and behaviour change programmes until at least 2021 **Support the Smarter Choices Smarter Places programme to encourage travel behaviour change** Policies contribute to policy outcome 8	+ +	+ +	+ +	0 0	0 0	0 0	0 0	0 0	+ +	These policies seek to promote and facilitate active travel through investment in walking and cycling infrastructure and programmes targeting changing travel behaviours. The focus is primarily towards promoting short and local active travel and the use of paths and on-road provision, as well as the promotion of car sharing and public transport for longer journeys Increased uptake of active travel for shorter journeys is likely to be beneficial overall in reducing travel through other means, particularly in urban areas (e.g. car travel). This presents an opportunity to develop a cohesive multi-use transport network, with clear benefits in terms of material assets. There is also the potential for reduced pressure on existing transport modes, particularly the road network. Reducing single occupancy car use in longer journeys, through car clubs, for example, will also help to reduce pressure on the roads, If widely implemented and adopted, a reduction in GHG emissions is likely through reducing in travel journeys. Improvements in air quality are likely to be seen in urban areas as a result of the proposal, particularly in areas designated due to poor air quality. There are likely to be benefits for population and human health through improved connectivity of walking and cycling networks, and likely benefits in human health if active travel alternatives are widely taken up. **<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • These policies include measures such as the use of short, local links via paths and on-road provision, more and better bike parking and the development of a network of active travel hubs at public transport interchanges. • The Smarter Choices Smarter Places programme partners with COSLA and targets specific populations for travel change interventions through projects such as public awareness events, signage and mapping, supporting car clubs, and working with public transport operators.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	Proposals										
	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 Proposal contributes to policy outcomes 1 and 4 **Collaborate with a local authority to put in place a pilot low emission zone by 2018, examining the feasibility of low emission zones (LEZs) mitigating CO_2 emissions via the National Low Emission Framework** Proposal contributes to policy outcome 3	+	+	+	0	0	0	0	0	+/-	Modelling and piloting reductions in congestion and improvements in public transport could be explored further in association with the development of a pilot low emission zone. Overall, the implementation of low emission zones would likely to change the behaviours of road transport users and change how goods are distributed. For example, this could result an overall increase in the use of low emissions vehicles/heavy goods vehicles (HGVs) on Scottish roads, and increase public transport footfall and the use of services such as park and ride in and around in urban centres. These changes would likely lead to a reduction in GHG emissions. It is also considered that improvements in air quality are likely to arise from this measure, with additional benefits for population and human health. This will be particularly relevant in areas where current air quality problems exist. Consideration may need to be given to the location of the proposed sites, however, to ensure that increased traffic movement out-with these zones does not potentially lead to negative impacts through increased congestion, for example. The consideration of factors such as location and any existing air quality issues when identifying possible sites should help to mitigate any potential negative impacts. It will also be important that infrastructure, such as road and public transport networks and services (e.g. park and ride) are able to accommodate the implementation of this proposal. **<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • There is a relationship between these proposals and that below proposing the development of freight consolidation areas on the outskirts of low emissions zones.
	Building Standards: Includes considering draft proposals in the Energy Performance of Buildings Directive, relating to the provision of EV charge points / wiring in new residential and commercial developments **Includes investigating how such measures could potentially be trialled in Scotland and consider developing guidance on**	+	+	+	0	0	0	0	0	+/-	This group of proposals broadly aim to increase the overall provision of plug-in vehicle charging infrastructure in Scotland. These aims are to be achieved by measures such as the development of planning guidance for local authorities and the requirement, as laid out in legislation and policy, to consider the installation of cabling and charging points as part of new developments. The continued investment and expansion of electric charging/fuelling points across Scotland is likely to facilitate further decarbonisation of the road transport sector by fostering the take up of electric and alternatively-powered vehicles. An increase the number of these vehicles on Scotland's roads, and the replacement of older petrol and diesel-fuelled vehicles, is likely to result in a reduction in GHG emissions, improved air quality and benefits for human health, particularly in urban areas with known air quality issues (e.g. Air Quality Management Areas). Increased uptake of low emissions vehicles, particularly electric vehicles, has the potential to increase electricity demand and increase pressure on electricity generation networks if upgrades are not made to facilitate transition towards decarbonisation. Infrastructure development has the potential for secondary effects, particularly in relation to land take and areas out-with low emissions zones. For example, construction works can result in noise and visual disturbance, impacts to air, soil and water quality, amongst others. If inappropriately sited, infrastructure could impact on landscape and the setting of cultural heritage assets. However, it is likely that identified impacts would be localised and potentially managed through existing mechanisms.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	charge point provision to support planning authorities Proposals contribute to policy outcome 2										**<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • The proposed measures are currently voluntary and are aimed at increasing provision of vehicle charging infrastructure.
	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. Proposal contributes to policy outcome 2	+	+	+	-	0	0	0	0	+/-	Supporting the continued investigation into the adoption of cleaner alternative fuels is likely to lead to reducing the reliance on petrol and diesel transport fuels. This has the potential to reduce GHG emissions and contribute to the decarbonisation of the transport sector. In addition, it is likely to lead to improvements in air quality with further benefits for human health. Particular benefits are likely to be seen in urban areas with known air quality issues (e.g. Air Quality Management Areas) and by those susceptible to health concerns associated with poor air quality. It is also likely to increase energy security by reducing reliance on finite fossil fuels, with benefits for material assets. Whilst a greater proportion of ULEVs utilising alternative fuels (such as hydrogen and biofuels/biogas) could contribute to reducing the demand for oil and gas production, there is the potential for greater demand and pressure on other energy sources. For example, increased production of first generation biofuels (from bio-crops) has the potential to put pressure on land use, soils and landscape. However, benefits could be realised in utilising second generation biofuels (from waste and by-products), particularly in terms of maximising the use of waste resources and also in terms of overall carbon abatement. Consideration may also need to be given to the development and implementation of novel energy sources such as hydrogen as the development of hydrogen processing plants will likely result in land take and soil compaction. Construction of plants and infrastructure also has the potential for environmental effects such as noise and visual disturbance, impacts to air, soil and water quality, amongst others. If inappropriately sited, infrastructure could impact on landscape and the setting of cultural heritage assets. However, it is likely that any such impacts would be realised at a local level and managed through project level requirements.
											<u>Assumptions & Links with Other SEA Work</u> *<u>Assumptions:</u>* • Hydrogen will be produced from renewable sources. • Hydrogen-powered vehicles are unlikely to develop significantly within the timeframe of the draft Plan (by 2032).
	Work with Scottish Enterprise, the UK Government and other bodies to investigate the potential to undertake trials of connected and autonomous vehicles in Scotland	+	+	+	0	0	0	0	0	+	The proposal aims to use technology to transform our transport system by making it safer and more efficient through the use of automated and connected vehicles. This proposal is currently only concerned with the trailing of these systems but if they were to be implemented there is the potential for reduced vehicle emissions and improved air quality through more fuel efficient methods of driving (due to computer control and operation). If widely utilised, they would be unlikely to reduce the number of travel journeys but could lead to an overall reduction in fuel consumption and demand, with benefits for material assets. There are also likely to be benefits for population and human health through increased road/vehicle safety and a reduction in traffic accidents. However, buy-in will be key to the take-up of these systems and it may be hampered by negative public perception of ‘driverless cars’.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	Proposal contributes to policy outcome 2										**<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • Autonomous vehicles are unlikely to develop significantly within the timeframe of the draft Plan (by 2032).
	Work with Scotland Excel, COSLA and other partners 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 Proposal contributes to policy outcome 2	+	+	+	0	0	0	0	0	+/-	The proposal seeks to further engage public bodies with Scotland's climate change ambitions by reducing emissions generated by vehicles utilised in the public sector. This could result in the progressive replacement of vehicle fleets with lower emission vehicles. However, it will also be important to ensure that these vehicles are used efficiently to achieve benefits. If widely implemented, increased uptake in low emission vehicles in these sectors is likely to contribute towards reducing GHG emissions in the transport sector, with associated benefits in improving air quality. Improved air quality also has the potential to be beneficial for human health, particularly in urban areas where there are existing air quality issues such as Air Quality Management Areas. Increased uptake of low emissions vehicles such as electric and electric-hybrid vehicles has the potential to increase electricity demand and increase pressure on electricity generation networks. There will also be a requirement for infrastructure requirements, such as recharging points, to facilitate or meet demand. Consideration will need to be given to this and network requirements to enable this transition. **<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • Infrastructure works would be largely focused on those required to facilitate uptake of electric vehicles, such as charging points, rather than the development of hydrogen plants. *<u>Previous SEA work:</u>* • The proposal was discussed in the SEA undertaken for the RPP2.
	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 low emission zones); and to support market testing of local initiatives.	+	+/-	+/-	-	0	0	-	-	+/-	By exploring the feasibility of new freight logistics and infrastructure, this proposal aims to increase the efficiency and sustainability of freight movements in cities. One example of this is the potential for development of freight consolidation centres on the outskirts of low emission zones. The proposal, in combination with the establishment of low emission zones in urban areas, is likely to facilitate changes in how goods are received and delivered. If this is further combined with an increase in the use of low emission HGVs it should lead to a reduction in GHG emissions. Whilst improvements in air quality are likely to be seen in urban areas as a result of the proposal, particularly in areas designated due to poor air quality, the exacerbation of existing issues outside these zones could occur. For example, the creation of these centres could worsen existing traffic congestion or increase traffic movements in adjoining areas, leading to reduced air quality. The proposal also has the potential to reduce pressure on urban transport networks through changing freight movement. Conversely, adverse impacts effects could also arise through the physical establishment of new infrastructure. Negative impacts may include land take, leading to loss of habitats, impacts on biodiversity, air, water and soil. There is the potential for visual impacts which could affect landscape and cultural heritage, depending on site and setting. However, it is likely that the negative impacts identified through the implementation and construction of such infrastructure will be realised at a local level.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	Proposal contributes to policy outcome 3										**<u>Assumptions & Links with Other SEA Work</u>** *<u>Assumptions:</u>* • This proposal is linked with the creation of urban low emission zones and increased utilisation of LEVs in urban areas. • Planning approvals are likely to be required for the development of freight consolidation centres.

Summary of Overall Effects

Largely positive environmental effects are expected from this sector, most notably the potential to further reduce GHG emissions by promoting and enabling changes in how goods, services and people use transport in Scotland (**climatic factors**). Policies and proposals focused on increasing take-up of low carbon vehicles, reducing travel journeys and the decarbonisation of freight transport through electrification, could have particular benefits.

Many proposals also present an opportunity to improve air quality, particularly in urban areas and locations with identified air quality issues, such as Air Quality Management Areas. The replacement of existing cars, HGVs and buses with lower emission vehicles, and low emissions zones in urban areas, would benefit air quality with associated benefits for human health **(air quality, population and human health).** Many of the policies and proposals are complementary. For example, the operation of low emission zones, promotion of low emissions vehicles, and support for the establishment of freight consolidation centres outside urban centres, could collectively change how freight is managed and address air quality issues that affect many of Scotland's urban centres. However, having appropriate infrastructure in place to enable this transition will be vital in achieving these benefits and can help to avoid the creation or exacerbation of existing issues at these locations. For example, increased congestion and air quality issues (**material assets).**

Policies and proposals requiring development of new or upgraded infrastructure could have localised impacts **(material assets).** For example, freight distribution centres, recharging facilities and hydrogen processing plants could lead to development and associated local environmental impacts. Direct impacts from development works can include temporary or long-term impacts through disturbance **(population and human health)** and impacts on biodiversity, soil, water and air quality from construction activities **(soil, air, water, biodiversity, population and human health).** The siting and construction of developments could also have effects on the setting of cultural heritage and landscape assets **(cultural heritage and landscape)**. However, the significance of any such impacts will depend on factors such as the size and scale of the proposed developments, their location and setting. Environmental effects will be considered under existing mechanisms, such as the planning process, EIA and HRA, as appropriate. In many instances, the identified impacts may also be managed through the use of appropriate construction management measures such as Environmental Management Plans.

There is potential for pressures on existing energy infrastructure arising from the policies and proposals. Greater uptake of new technologies, such as increased use of electric and electric-hybrid vehicles, is likely to increase pressure/demand for these energy resources. Any increased demand could place pressure on existing networks if upgrades are not made to facilitate transition towards decarbonisation of the sector (**material assets**).

In many instances, any identified benefits and/or adverse impacts, and their significance at the local and national levels, is likely to be influenced by successful uptake and the promotion of the policies and proposals amongst the transport sector and wider industry.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
Waste	**Policies and Policy Development Milestones**										
	Delivery of waste reduction, recycling and landfill diversion targets and regulation up to 2025 **Target to recycle 70% of all waste by 2025** **Target to reduce food waste by 33% by 2025** **Ending landfilling of biodegradable municipal waste by 2020 and reducing all waste sent to landfill to 5% by 2025** **Reduce waste and establish a more circular economy, where goods and materials are kept in use for longer** Policies contribute to policy outcome 1	+	0	0	+/-	0	0	0	0	+	This group of policies are aimed at changing the way waste is generated, managed and disposed of in Scotland. It seeks to implement principles of the waste hierarchy by promoting prevention, minimisation and recycling whilst discouraging disposal to landfill. The waste targets referred to are backed up by regulations and other policy interventions. For example, the Waste (Scotland) Regulations 2012 include a ban on biodegradable municipal waste going to landfill from 2021 and all businesses and public sector organisations are required to sort wastes for recycling. Reductions in GHG emissions are likely to be realised by diverting waste from landfill and the promotion of longer-lived products, reuse and recycling which could help to reduce the energy requirements needed to process, transport and import new goods. There is potential for further positive effects on material assets by improving how waste is managed, reducing pressure on existing landfill infrastructure, and in meeting Scotland's waste reduction targets. Additionally, extending the longevity of materials in circulation through the establishment of a more circular economy could lead to a reduction in the need to manufacture goods from new, providing further benefits as a result of reduced energy use in the manufacturing sector. However, it is noted that mixed secondary impacts on a number environmental topics may arise as a result of the policy. For example, whilst there may be a reduced need for landfill operations, leading to associated benefits for all of the topic areas, there could be requirements for additional recycling and waste management facilities which could have negative impacts on soil from land take. Further negative impacts may also arise from the construction and operation of such facilities through nuisance impacts such as noise, vibration and odour. The significance of the identified impacts will be dependent on the scale, nature and location of developments and likely to be experienced at a local level. Potential impacts are likely to be mitigated by existing mechanisms such as the planning system, SEPA regulation and on-site management measures. **<u>Assumptions & Links with Other SEA Work</u>** *<u>Previous SEA work:</u>* Improving the utilisation of waste and reducing landfill waste were discussed in the following SEAs: • RPP2. • Scotland's Zero Waste Plan. • Safeguarding Scotland's Resources – Blueprint for a More Resource Efficient And Circular Economy. • Making Things Last: A Circular Economy Strategy for Scotland.

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	Landfill gas capture on closed sites (12 sites to be supported by 2022) Policy and policy development milestone contributes to policy outcome 2	+	0	0	0	0	0	0	0	0	This policy builds on a commitment made in RPP2 to capture landfill gas from closed landfill sites which would otherwise be released uncontrolled to atmosphere, and to flare it to reduce GHG emissions. Twelve suitable sites have been identified by SEPA to be supported by 2022. Low calorific flaring of landfill gas could therefore have positive effects on climatic factors through reducing GHG emissions, specifically methane. Whilst utilising the gas for power generation is likely to be a more favourable option environmentally and economically, it is noted that this may not be suitable on sites with low gas flow rates. Many constituents of landfill gas are hazardous. SEPA Guidance on Landfill Gas Flaring[1] notes that during combustion there is a risk of the formation of gaseous pollutants which could have negative impacts on air quality, human health and flora and fauna. However, it is considered that the uncontrolled migration of landfill gas presents more significant negative effects on human health and the environment than flaring. Flaring avoids the release of potent methane into the atmosphere, which has a much larger global warming potential than CO_2, and so, offers a more significant overall benefit in terms of climate change. There may be nuisance impacts from flaring activities at a local level such as noise, heat and odour which could affect population/human health and local wildlife. There is also potential for landscape and visual impacts associated with these activities[2]. However, the design and siting of flares will be managed at a project level through the planning process which should help to mitigate any effects. Other impacts could be managed by following the relevant SEPA Guidance, and from the requirement for site owners/managers to undertake emissions monitoring and environmental assessment of existing and proposed flares.
											<u>Assumptions & Links with Other SEA Work</u> *<u>Previous SEA work:</u>* The capture of landfill gas was discussed in the following SEAs: • RPP2. • Making Things Last: A Circular Economy Strategy for Scotland.
	Proposals										
	Post-2025 framework for further waste reduction, management and circular economy policies and indicators Policies contribute to policy outcome 1	+	0	0	+/-	0	0	0	0	+	In a circular economy, waste materials are seen as resources and the re-use, repair, refurbishment, recycling and remanufacture of existing products are planned and enhanced. With the buy-in of industry, public sector bodies and individuals there is the potential for positive environmental effects, principally a reduction in waste and in GHG emissions. A future circular economy framework has the potential for positive effects on material assets as it could encourage more efficient resource use and therefore reduce the amount of waste sent to landfill. There may be mixed environmental effects at local level, associated principally with likely changes to waste management infrastructure including the development of new waste management facilities and the expansion of existing facilities. However, it is noted that there are current existing mechanisms in place to identify and mitigate any potential environmental impacts associated with these.

[1] SEPA and the Environmental Agency (2002) Guidance on Landfill Gas Flaring [online]. Available at: https://www.sepa.org.uk/media/28988/guidance-on-landfill-gas-flaring.pdf (accessed 16/11/16)
[2] ibid

	Policies and Proposals	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
											Assumptions & Links with Other SEA Work *Previous SEA work:* • Making Things Last: A Circular Economy Strategy for Scotland.
Summary of Overall Effects	This sector could have largely positive environmental effects particularly through improving waste management, reducing pressure on existing landfill infrastructure, and contributing to a reduction in GHG emissions (**climatic factors and material assets**). The policy on delivery of current waste targets and regulation and the proposal for a post-2025 circular economy framework could result in more efficient use of resources, particularly primary/virgin and finite materials, and encourage the repair, reuse and remanufacturing of goods (**material assets**). Further reductions in energy use and associated GHG emissions could arise as remanufacturing goods requires fewer resources than manufacturing from new (**climatic factors**). Methane is one of the main GHG emissions produced at landfill sites. The policy to continue to roll out a programme of landfill gas capture is expected to reduce or limit the release of this potent gas to the atmosphere (**climatic factors**). Localised impacts could arise from changes in how waste is managed, including policies that may require the development of new recycling and waste management facilities (**biodiversity, soil, water, air quality, population/human health, and landscape and cultural heritage**). These can occur from the construction, operation and siting of waste infrastructure developments, with construction impacts being largely temporary. However, these identified impacts will be experienced at a local scale and would be assessed at a project level under existing mechanisms such as the planning process, Scottish Environment Protection Agency (SEPA) regulation, EIA and HRA. In some cases, impacts may also be managed through the use of appropriate construction management measures, such as Environmental Management Plans.									

Appendix D

Assessment Tables for the Draft Energy Strategy

This Appendix contains the assessment tables developed for the three policy groupings set out in the draft Strategy (Meeting Our Energy Supply Needs; Transforming Scotland's Energy Use; and Delivering Smart, Local Energy Systems). These tables set out the potential for positive and negative impacts across a range of environmental receptors for each proposed policy and proposal.

The environmental effects are presented in two formats within the tables:

i. **A narrative describing the potential for environmental environment effects** – the 'Likely Environmental Effects' narrative sections broadly discuss the likely primary environmental impacts associated with the policy or proposal, whilst also identifying the potential for secondary or indirect impacts.

ii. **Colour-coded gradings assigned to the individual environmental topic areas scoped into the assessment** – the gradings reflect the likely primary impacts associated with the implementation of the policy/proposal against each environmental topic.

In many instances, existing mitigation measures have been identified to address the potential for adverse secondary impacts. For example, negative effects associated with construction activities and the development of infrastructure should be may be mitigated through a combination of appropriate design, existing mechanisms (e.g. the planning system, EIA, and on-site environmental management measures).

While this narrative also discusses the potential for secondary or indirect impacts, these effects have only been reflected in the gradings where it is considered that no mitigation is currently in place, and where these impacts are likely to be significant. This approach has been taken to enable the reader to readily identify the primary significant impacts associated with each policy and proposal.

The tables also outline any assumptions made in undertaking the assessment and where relevant, refer to previous SEA work that informed the assessment.

The gradings used are:

+	Potential for positive environmental effects
-	Potential for negative environmental effects
+/-	Potential for mixed environmental effects
0	Potential for environmental effects has not been identified

	Priorities and Policies	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
Meeting Our Energy Supply Needs	**Continuing to support the recovery of North Sea oil and gas as a highly regulated source of hydrocarbon fuels**										
	Offshore and Onshore Oil and Gas **Underground Coal Gasification (UCG)** **Unconventional Oil and Gas** **Liquid Natural Gas, Compressed Natural Gas and Liquid Petroleum Gas**	-	+/-	-	-	-	-	-	-	+/-	Scotland's oil and gas sector will continue to play an essential role in Scotland's energy mix during the transition to a decarbonised energy system, in line with the ambitious emissions reduction targets set through Scotland's Climate Change Act. The oil and gas sector remains of paramount importance for its economic and social benefits, in particular what to date has been affordable and secure supply of energy. The environmental impacts associated with offshore and onshore oil and gas operations are well understood and documented. Operations can have both direct and indirect impacts on the marine or terrestrial environment at each stage of the process. For example, extraction and transportation operations could result in the loss of habitats through the development and installation of oil and gas infrastructure, whereas use of these resources has resulted in GHG emissions. The significance of such impacts are dependent on a number of factors, including technology, infrastructure requirements, location, scale and distribution of developments. Whilst Liquid Natural Gas, Compressed Natural Gas and Liquid Petroleum Gas are considered to be cleaner fuels in relation to GHG emissions and air quality, the impacts related to their extraction would be similar to other oil and gas operations. On 8 October 2015 the Scottish Government put in place a moratorium on underground coal gasification (UCG) (separate to the moratorium on onshore unconventional oil and gas) to allow the necessary time for full and careful consideration of the potential impacts of this new technology. Evidence collected during this process reported a number of environmental impacts, in addition to public health concerns, likely to arise if UCG were to be implemented in Scotland. Releases to air and water, as well as waste materials removed from the combustion site, drilling materials and treated materials at the surface, and products and wastes from syngas plant operation were identified as all requiring consideration. Risks to groundwater were also identified, highlighting the significance of local hydrological conditions[1]. Recently published research[2] also indicated that "there is uncertainty associated with the GHG emissions as a result of uncertainties over syngas composition and combustion efficiency". "The most likely option for power generation from UCG syngas is based on co-firing with natural gas within a combined cycle gas turbine as this is currently the most economic and carbon efficient option. It is estimated that the UCG syngas component would result in emissions that are between 40% and 100% higher than the natural gas fed component in a combined feed power station. If simple post combustion CCS is used, then the emissions comparisons quoted above remain valid as a percentage range". While other processes such as undertaking pre-combustion Carbon Capture and Storage (CCS) could help to reduce these emissions significantly, economic feasibility will also reduce as more processes are added. For example, "the amount of power, raw materials and disposal routes for the CO_2 capture and storage become significant". Unconventional oil and gas (hydraulic fracturing and coal bed methane) are not within the scope of this SEA. The Scottish Government placed a moratorium on onshore unconventional oil and gas on 28 January 2015 while evidence of the potential impacts and public views are gathered and considered. The Scottish Government has compiled a comprehensive evidence-base, including a report by an Independent Expert Scientific Panel, and a series of research projects exploring certain issues in more detail. The Scottish Government are committed to undertaking a full public consultation on unconventional oil and gas. The Scottish Government are also committed to undertaking all relevant statutory assessments in coming to a final position on unconventional oil and gas, including undertaking a SEA.

[1] Campbell Gemmell (2016) Independent Review of Underground Coal Gasification – Report [online] Available at : http://www.gov.scot/Publications/2016/10/2704/downloads#res507473 (accessed 16/11/2016)

[2] Atkins (2015) Underground Coal Gasification - Evidence Statement of Global Warming Potential, Prepared for DECC, 28 November 2015 [online] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/575940/Underground_Coal_Gasification___Evidence_Statement_of_Global_Warming_Potential.pdf (accessed 06/01/2017)

	Priorities and Policies	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
											<u>Assumptions & Links with Other SEA Work</u> *<u>Assumptions</u>* • This ambition is concerned primarily with offshore North Sea oil and gas reserves. However, onshore oil and gas, UCG, unconventional oil and gas, and liquid/compressed natural gas and petroleum are also discussed within the draft Energy Strategy. These have been included as part of the assessment of offshore oil and gas to avoid repetition as the environmental impacts are similar.
	Exploring the potential role of new or lower carbon energy sources										
	Hydrogen	+	+	+	-	0	0	0	0	+	The shift to decarbonise Scotland's energy supply through the development of novel fuels, such as hydrogen, has potential for positive environmental effects, providing it is produced sustainably. Hydrogen production can result in carbon emissions, for example if produced using methane, or expensive if developed using electrolysis. However, hydrogen is naturally abundant and is an efficient fuel source which produces no toxic emissions or CO_2 at point of use. Hydrogen generation that utilises Carbon Capture and Storage (CCS) would avoid negative effects on climatic factors through reducing emissions. Domestic hydrogen use would displace the use of natural gas that has carbon emissions at final end use. Other potential benefits include improved air quality and human health, for example uptake of vehicles utilising hydrogen cell technology, alongside electric vehicles, would displacing the use of petrol and diesel, reducing air pollutants and associated respiratory effects. The large scale development of hydrogen technologies would require the construction of processing plants and fuel cells. There may be opportunities, where appropriate and available, for siting these on brownfield land and existing industrial areas to minimise their environmental impact. Consideration would have to be given at the project level as to whether previously developed land would be suitable for this use, as capacity and impacts would vary between sites. A large scale switch from natural gas to hydrogen would require upgrades to the gas network, using new polyurethane pipes, and new supporting infrastructure may be required, such as new boilers, hobs and ovens in the domestic context. The production and fitting of these will be associated with some level of environmental impact; for example, digging up of roads and disposal of existing infrastructure. There is an opportunity to avoid additional impacts through the co-ordinated management of future replacement programmes and conversion activities. There is the potential for a range of impacts associated with connecting off-grid properties and new connections. However, any such impacts are likely to be localised and will be subject to consideration prior to consent and construction.
											<u>Assumptions & Links with Other SEA Work</u> *<u>Assumptions:</u>* • Plans will be effectively communicated to consumers and gas providers to minimise the disruption that may occur from conversion activities and the replacement of domestic boilers/ovens/hobs/etc. *<u>Previous SEA work:</u>* Hydrogen fuel cells were discussed in the SEA work taken forward for: • Electricity Generation Policy Statement • The Heat Policy Statement: Towards Decarbonising Heat: Maximising the Opportunities for Scotland.

	Priorities and Policies	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	Supporting the demonstration and commercialisation of Carbon Capture and Storage and CO_2 Utilisation										
	Carbon Capture and Storage (CCS) and CO_2 Utilisation (CCU)	+	+	+	0	0	0	0	0	+/-	The implementation of CCS could contribute to significant reductions in GHG emissions, particularly if utilised with carbon-intensive industries and energy generation from fossil fuels where CCS can capture up to 90% of the CO2 emissions produced[3]. CCS could have positive effects on air quality and human health, although this is likely to be influenced by the specific CCS use and the industries to which it relates. CCS technology can make use of existing infrastructure from the oil and gas industry to process the liquid outcomes associated with carbon capture. There is also the potential for captured carbon to be utilised in other sectors. This process, known as Carbon Capture and Utilisation (CCU) is an emerging technology which manufactures carbon dioxide into commercially viable products such as chemicals, polymers, building materials and fuels. If this was progressed further, the use of waste products in this way is considered likely to have a positive effect on material assets. Should CCS be implemented more widely in the future, as a means of limiting the release of CO_2 from industrial processes, there is potential for some negative environmental effects over a range of environmental topics. For example negative effects are likely to be associated with the upgrading or conversion of existing infrastructure, and the installation of new infrastructure, necessary to facilitate CCS. In some circumstances new infrastructure could have adverse effects on local visual amenity, landscape or cultural heritage. The significance of this would be influenced by factors such as size and location of any development. The transportation of CO_2, other than by pipeline, could present the potential for wider environmental impacts. For example from new infrastructure in ports and harbours for transportation by ship, or additional lorries on Scottish roads collecting and depositing CCS liquid outcomes at processing sites. The potential for leakage of CO_2 during the operation and post-closure phases can also have adverse environmental effects; for example, environmental issues to soil, water and flora through acidification from small leakages, and impacts on biodiversity and human health from large leakages[4]. Notwithstanding these potential negative environmental effects, the development of CCS and any associated infrastructure would be subject to existing mechanisms such as planning, marine licensing, Environmental Impact Assessment (EIA) and potential Habitats Regulations Appraisal (HRA), prior to consent being granted . Any future public plans and programmes relating to CCS would also have to be considered in relation to the requirements of the Environmental Assessment (Scotland) Act 2005. This assessment has focused on the impacts likely to arise directly from the policy proposals. Some effects, such as those arising from activities such as storage and transportation, are expected to be neutral at this stage and would be considered through future assessment work.

[3] Carbon Capture and Storage Association (2016) What is CSS? [online] Available at: http://www.ccsassociation.org/what-is-ccs/ (accessed 19/01/2017)
[4] Environment Agency (2011) Scoping the environmental impacts of carbon capture, transport and storage [online] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/297115/geho0811bucq-e-e.pdf (accessed 19/01/2017)

	Priorities and Policies	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
											Assumptions & Links with Other SEA Work *Assumptions:* • CCS is not an energy generation technology but rather a technology that could aid in reducing climatic impacts of fossil fuel-intensive industry and energy generation. • CCS is likely to have a role to play in the continued use of oil and gas resources in industry and in the bioenergy and emerging hydrogen-fuel sector. *Previous SEA work:* CCS was discussed in the SEA work taken forward for: • Electricity Generation Policy Statement. • The Heat Policy Statement: Towards Decarbonising Heat: Maximising the Opportunities for Scotland.
	Increasing the generation of renewable energy										
	Electricity Onshore and Offshore Wind Marine (Wave and Tidal) Hydro Solar	+	+/-	+	-	-	+/-	-	-	+	The draft Energy Strategy proposes the introduction of an ambitious target of 50% of Scotland's energy consumption to be met by renewable energy sources by 2030. Support for decarbonisation of Scotland's energy production through the continued development of renewables is expected to generate a wide range of environmental effects. A continued shift towards low carbon energy from more traditional, finite sources such as oil and gas will help to reduce GHG emissions generated in the energy sector and support overall improvements for air quality, and thus population and human health. This in turn could help to reduce the impacts of climate change on other aspects of the environment, such as biodiversity, water and soil. However, the development and operation of renewable energy technologies, and the infrastructure required to facilitate this shift, could have more mixed and adverse environmental impacts. As identified in previous environmental assessments, the development and operation of onshore wind, and offshore wind and marine renewables technologies, could have environmental effects including on air, soil, water, biodiversity, cultural heritage and landscape. For example, the presence of infrastructure in the marine environment can also benefit certain marine species which can the submerged infrastructure as an artificial reef, whereas, negative effects could include navigational hazards for certain marine species or the displacement of foraging sea birds. Repowering of existing wind farm sites has the potential for both positive and negative environmental effects. As advances are made in the efficiency of wind device technology, the deployment of fewer new devices on existing sites may still increase yields, and reduce some effects. However, the installation of larger turbines on existing sites could also present new environmental effects, such as additional bird strike risk or increasing the visual envelope for landscape impacts. The use of existing infrastructure and grid connections may reduce or limit the significance of adverse environmental effects when compared to a previously undeveloped site. As current mechanisms such as EIA and HRA would continue to be used to assess repowering proposals on a case by case basis, it is expected that these types of potential environmental effects would be effectively considered and managed at the project level. Increased development of solar power has the potential for some negative environmental effects. For example, building and roofing works for the installation of photovoltaic panels could impact on certain species, such as bats or result in effects on cultural heritage and visual amenity. Although bats are a European protected species and cannot be disturbed at certain times within the year, a loss of suitable nesting sites would have a detrimental effect. Existing mechanisms including protection

	Priorities and Policies	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
											legislation is in place to help avoid and manage the potential for adverse environmental effects. The development and operation of hydro power schemes and pumped storage systems can have negative impacts, particularly from the construction and siting of infrastructure. However, the significance of these effects would depend on a range of factors such as the siting and scale of developments. Operating 'closed loop' pumped storage systems, where no natural inflows of water are involved, could help to avoid environmental impacts during the operational phase. Existing mechanisms such as Controlled Activity Regulations (CAR) are in place to help manage and mitigate potential adverse environmental effects. Overall, the promotion of local and national low carbon and renewable energy projects has the potential to play a key role in enhancing Scotland's security of energy supply. This is likely to become increasingly important as climate change continues to present a key challenge for energy production and transmission.
											Assumptions & Links with Other SEA Work *Assumptions:* • Policy will express support for renewable energy as key part of Scotland's energy mix, and that this is likely to become increasingly important in the future. • Renewable energy will continue to reduce demand for energy from traditional, more finite sources (e.g. oil and gas). *Previous SEA work:* Renewable electricity was discussed in the SEA work taken forward for: • Electricity Generation Policy Statement • Draft Sectoral Marine Plans for Offshore Renewable Energy in Scottish Waters.

	Priorities and Policies	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	Heat Renewable Heat Electric Heating District Heating	+	+	+	0	0	0	0	0	+/-	Promoting a transition from an oil and gas based system towards greater generation and use of renewable and low carbon heat will help to reduce GHG emissions from the energy sector and will have associated benefits for air quality and population and human health. However, increased generation and use of low carbon heat from renewable sources and technologies such as biomass boilers, solar water heating, some types of heat pumps, and the use of some of these technologies in district heating schemes could also have some negative environmental effects. Impacts are likely to be associated with the development of district heating infrastructure, the placement of solar panels on roofs and use of heat pump technologies in the domestic and non-domestic context. The potential environmental effects include temporary impacts from construction works and longer-term impacts on landscape and cultural heritage, particularly if any work undertaken involves changes to a buildings appearance or setting. This is likely to be of particular importance in areas of high conservation value. Negative effects on biodiversity, specifically on bats, may also arise if work is undertaken in roof cavities to install technologies. The operation of some technologies, such as air source heat pumps can also lead to elevated noise levels. However, the significance of these impacts would be influenced by a number of factors, such as the level of uptake, siting and setting of devices. Any such impacts would be largely localised and would be addressed through appropriate consenting regimes. If widely implemented, increased adoption of these technologies is likely to reduce demand for heat from traditional supplies. New or upgraded infrastructure may be required to ensure security of supply to households, leading to benefits on material assets. Consideration may need to be given to implications on existing networks as changes in how heat and electricity are generated may place additional pressure on networks and infrastructure. Diversification of technologies, further decentralisation of energy supplies and increased energy security could also lead to benefits for population and human health. However, there may also be negative impacts from some heat technologies, such as biomass combustion which can impact on air quality, with further implications for population and human health and biodiversity, flora and fauna. To avoid repetition, these impacts have been set out under ‘bioenergy’.
											Assumptions & Links with Other SEA Work *Assumptions:* • Includes electric heating from local renewables (e.g. solar panels, heat pumps) and from renewable energy. Forms part of the wider decarbonisation ambitions to reduce demand from traditional, finite sources. • The development of district heating schemes is likely to be taken forward as part of housing development schemes and as such, within agreed zones. *Previous SEA work:* Hydrogen fuel cells were discussed in the SEA work taken forward for: • Electricity Generation Policy Statement • The Heat Policy Statement: Towards Decarbonising Heat: Maximising the Opportunities for Scotland.

	Priorities and Policies	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	Bioenergy Biomass Biomethane Biofuels	+	+	+	0	0	0	0	0	+	The continued use of bioenergy to provide heat and transport fuel is likely to help reduce GHG emissions, and provide benefits for air quality with associated positive effects on population and human health. The capture and utilisation of biogas (particularly biomethane produced in the anaerobic digestion process), which would otherwise be released uncontrolled to atmosphere, could also have positive effects on climatic factors by reducing GHG emissions. In environmental terms, using gas for power generation is also likely to be a more favourable option than low calorific flaring, although the process of methane capture may not be suitable on sites with low gas flow rates. Impacts could arise from the development of the infrastructure required to facilitate these activities. However, the design and siting of such infrastructure will be managed at a project level through the planning process which should help to mitigate any effects. The increased uptake of biomass and production of biofuels also has the potential for negative environmental effects. Whilst biomass boilers are subject to regulation and standards, they are not carbon neutral and the biomass combustion process can result in the emission of air pollutants that are potentially harmful to human health. Impacts on biodiversity, landscapes, soil and water quality may also occur in the production of biofuel feedstock if this is not managed sustainably. Whilst there is uncertainty on the likely scale and significance of biofuel feedstock development in Scotland, consideration would need to be given to the potential for impacts from large-scale production in particular. SNH Guidance on the sustainable management of biofuel feedstock production is currently in place, and while the assessment has identified the potential for adverse effects, it has been assumed that feedstock production will be undertaken sustainably. Use of second generation biofuels from waste and by-products could have positive impacts, particularly in terms of maximising the use of waste resources as well as overall carbon abatement. Growth in the use of technologies that use waste products would need to be considered alongside current Scottish Government policy on waste management, such as the waste hierarchy and circular economy principles. If widely implemented, bioenergy technologies are likely to contribute to reducing demand for heat from traditional supplies, reducing pressure on network infrastructure and making it more readily available for other fuels such as hydrogen. There could also be a positive impact on material assets as infrastructure may be reused or converted, for example for hydrogen, or new or upgraded infrastructure would likely be required to ensure supply to households and increased security of energy supply.
											<u>Assumptions & Links with Other SEA Work</u> *<u>Assumptions:</u>* • Forms part of wider decarbonisation ambitions to reduce demand from traditional, finite sources. Biomass and biofuel feedstocks will be developed in such a way to ensure they are produced according to sustainable management practices and that bioenergy in Scotland will not create additional pressures on ecosystems overseas.

	Priorities and Policies	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	Increasing the flexibility, efficiency and resilience of the energy systems as a whole										
	Energy storage and increased flexibility and efficiency in the energy system (e.g. Active Network Management).	+	+	+	-	0	0	0	0	+	The draft Strategy aims to increase the adoption of energy storage technologies in Scotland to help shift the focus towards effectively managing fluctuations in energy demand. Together, the use of systems and technologies such as Active Network Management, demand side response, and other smart technology, coupled with energy storage, can play a key role in achieving greater flexibility and efficiency in Scotland's energy system. Active Network Management in particular could provide a means for increasing amounts of renewable energy to connect to distribution network, and providing flexibility in distribution to help to meet predicted increases in electricity demand. Energy storage technology is available in many forms, from large scale hydro pumped storage schemes to hydrogen fuel cells in vehicles. Electric vehicles, another form of energy storage, are expected to become more common. Both at a large-scale and through smaller-localised schemes, energy storage can support system flexibility and help to manage variations in supply and demand as they occur. For example, it can help the network to manage the intermittency of energy generation by renewables, whilst pumped hydro storage can be used to generate electricity during periods of high consumption. Greater storage of energy can allow consumers to use energy differently, and in the case of fuel cells and battery storage, can allow them to operate independently from the power grid. If widely implemented, this could improve the balance of supply and demand from the grid and reduce pressure on network infrastructure. This can also improve reliability and security of supply, as well as the resilience of the sector to the predicted pressures from climate change. Potential benefits also include a reduced need to significantly reinforce existing energy networks. Improved efficiency in the supply and use of energy should help to help reduce GHG emissions as a result of reduced demand for generation, and can improve air quality, especially where this reduces reliance on oil and gas. Greater system flexibility and reliability is likely to be positive for consumers, and could result in benefits for population and human health. There is also potential for adverse impacts associated with the construction and development of the infrastructure required to implement certain storage technologies such as fuel cells or pumped hydro storage, particularly if deployed on a large scale. Changes in land use and visual and cultural heritage effects could arise from the siting of infrastructure, as well impacts on soil, air, water and biodiversity from construction activities. Local level consideration would need to be given to the potential implications that may arise through the siting, construction and development of required infrastructure.

	Priorities and Policies	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
											Assumptions & Links with Other SEA Work *Assumptions:* • A variety of energy storage technologies are being promoted as part of the Strategy, including battery storage (including electric vehicles), hydrogen fuel cells and pumped hydro storage. • This section of the draft Strategy does not include Solar Thermal Storage or CCS, and as such, these technologies have not been assessed here. • Energy storage can be used in conjunction with demand side response, smart technologies and active network management – these are also of relevance under the discussion on "Delivering smart, local, energy systems". *Previous SEA work:* Electricity storage was discussed in the SEA work taken forward for: • Electricity Generation Policy Statement.

Summary of Overall Effects

Energy generation and supply has the potential for environmental effects, from existing and historically important sources, and new and emerging technologies. The likelihood, type and significance of environmental effects of these technologies can vary. A shift towards low carbon energy generation could contribute significantly to meeting Scotland's GHG emissions targets (**climatic factors**). In turn, reducing impacts of climate change on the environment and reducing atmospheric pollution, could bring wider benefits to a number of environmental topics including **air, water, biodiversity, soil, cultural heritage and landscape and population and human health**. Given the continuing role for oil and gas as part of a managed transition, technologies such as CCS which could help to reduce some of the adverse environmental impacts of this sector on **air, climatic factors, population and human health**.

The transition to new energy sources and systems could present challenges to current energy networks and infrastructure. For example, shifting to hydrogen gas as a source of heat could accelerate planned upgrades to the gas grid. This could be coupled with a need for consumers to replace domestic appliances to ensure that they are suitable for use with hydrogen gas, with likely impacts on **population, human health and material assets**. While increased use of biofuels and electric vehicles in transport is likely to reduce energy demand from traditional supplies, this could have other implications. For example, consideration would need to be given to the production of biofuel feedstocks and the generation of additional electricity to meet growing demand from electric vehicles (**material assets**).

Sharing of good practice could result in further decentralisation of energy supply, and provide greater system flexibility and security of supply (with positive **population** and **human health** effects). Further decentralisation of energy generation could reduce existing pressures on network infrastructure, improve resilience of the sector to future change, and enable the network to be progressively upgraded and expanded as required, to ensure security of supply into the future. Enabling small-scale and community energy producers to feed power into the national grid could lead to benefits for **climatic factors** and **material assets**. Systems and technologies such as Active Network Management, and other smart technologies, alongside energy storage should offer greater system flexibility, helping to manage fluctuations in energy demand, reducing pressure on current networks and infrastructure. Greater capacity for energy storage in particular should offer greater flexibility in how energy is used and the type of energy technologies that can be utilised. In some instances, there may be implications arising from the development of the necessary infrastructure required to facilitate changes in demand (**material assets**). For example, this is likely to become increasingly important in managing likely increases in electricity demand from further growth in electric vehicle use, and ensuring its delivery to consumers when it is needed.

All energy technologies have the potential for some adverse environmental effects arising from both construction and operation. For example, the implementation of offshore wind and marine renewable technologies could have direct and indirect impacts from the siting and operation of infrastructure in Scotland's coastal and marine environments; impacting on **air, soil, water, biodiversity, cultural heritage, landscape/seascape and population and human health**. Similarly, the use of hydrogen gas as an energy source could help to reduce GHG emissions if used with CCS technologies, but the development of the required infrastructure may have environmental effects on **human health, air, soil, water, biodiversity, cultural heritage and landscape**. Technological advancement presents further opportunities to improve efficiencies in energy generation over the short to long-term. Whilst the deployment of technologies such as repowering with new, more efficient wind turbines and implementation of CCS are likely to present new challenges, the use of existing infrastructure and connections (**material assets and landscape**) could also help to reduce the likelihood of negative effects, particularly during the construction phase.

However, many of the environmental effects identified for the different technologies require further consideration through planning and associated consenting regimes. Many could be avoided or at least mitigated through appropriate siting, design, and site management practices during the construction phase.

	Priorities and Policies	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
Transforming Scotland's Energy Use	**Addressing the need to reduce demand and increase energy efficiency through the development of Scotland's Energy Efficiency Programme**	+	+	+	0	0	0	0	0	+	The implementation of Scotland's Energy Efficiency Programme (SEEP), to build on the success of the Home Energy Efficiency Programme (HEEPS), and the introduction of energy efficiency standards for building stock are likely to improve the energy efficiency of Scotland's domestic and non-domestic buildings. If widely adopted, these actions will reduce energy demand and GHG emissions. There is also the potential for positive impacts on air quality from a reduction in energy production, particularly where this leads to reduced demand for energy generated from traditional finite sources. Measures which help to reduce energy consumption could benefit population and human health. The provision of warmer, more energy efficient housing stock is also likely to particularly benefit people who are vulnerable to health problems that could be exacerbated by cold, damp, and mouldy properties. Reducing heat and electricity demand could help to reduce pressure on existing energy systems and networks, potentially extending the lifespan of current grid infrastructure and eliminating the need for new or upgraded infrastructure in the short term. This may be enhanced through the implementation of other actions, such as greater off-grid energy generation. This is also likely to enhance the resilience of the sector, particularly in light of the predicted effects of climate change. Together, these could also provide an opportunity to prioritise heat measures and ensure that suitable infrastructure is in place to accommodate future energy needs to facilitate decarbonisation measures. The implementation of some energy efficiency improvements can have adverse environmental effects. For example, the construction of grid connection infrastructure could have impacts on soil, biodiversity and air quality, amongst others. Retrofitting work involving changes in a building's appearance could have impacts on landscape and cultural heritage. Consideration would also need to be given to proposed works that involve disturbing roof cavities as a result of the potential to disturb bats; such impacts would be localised, and as bats are a European protected species and as such afforded strict protection through a consenting process. Construction works also have the potential for adverse effects such as short-term noise disturbance at a local level. Any adverse impacts will be largely localised and often temporary and will be considered under relevant consenting processes.
											<u>Assumptions & Links with Other SEA Work</u> *<u>Assumptions:</u>* • This includes efficiency measures to reduce demand (such as SEEP which will soon expand on HEEPS to include non-domestic buildings).

	Priorities and Policies	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	Helping energy consumers to manage their bills, harnessing smart technology in the home and supporting new business models in the retail energy market	+	+	+	0	0	0	0	0	+	This group of priorities aim to help reduce fuel costs for consumers and communities by offering access to better fuel tariffs and increasing the variety and proportion of non-traditional energy suppliers. They also seek to promote energy efficiency amongst consumers by encouraging users to take control of their energy usage and supply. It does this by promoting measures such as the provision of real-time information on consumption and spending, digitising the energy distribution networks, enabling better management and monitoring of supply, and responding to variations in demand of the grid. Changing the role of producer and consumer and fostering change in consumer behaviours could significantly affect how energy is managed in Scotland. Gas and electricity smart meters are likely to encourage improved management of domestic energy consumption and enable more efficient use of energy resources. A reduction in energy consumption is likely to reduce GHG emissions. Associated benefits for air quality are also likely, particularly through a reduction in demand from conventional, finite fuel sources. Particular benefits could be seen by those impacted by fuel poverty or with underlying health issues that could be exacerbated by cold, damp and mouldy properties. Benefits are expected for population and human health through increased flexibility for consumers in choice of energy suppliers and energy tariffs, and by shifting usage during peak periods in response to financial incentives, which could potentially help fuel become more affordable for some, and improved reliability. For example, enabling two-way communication between consumers and utility providers is expected to have positive effects in providing real-time feedback on usage. This could help providers to further improve energy systems in the future, identify and reduce system losses, and increase security of supply. It should however be noted that regulation of energy tariffs is not devolved to Scotland. The provision of consumption data for households and businesses, and increased control for consumers in managing energy costs through the introduction of smart meters is also anticipated. As a consequence, benefits for population and human health are expected through an increase in the proportion of 'active consumers', improved energy efficiency and the potential for an overall reduction in energy demand. A reduction in energy demand is likely to have benefits on material assets through reduced pressure on current energy and network infrastructure. Security of supply and system resilience should also be improved as a result. As noted above, enabling two-way communication between consumers and utility providers could help better forecast demand and improve energy systems in the future.
											<u>Assumptions & Links with Other SEA Work</u> *<u>Assumptions:</u>* • Regulation and powers relating to energy tariffs are not devolved to Scotland and Ofgem remains the regulator. Some Scottish organisations can offer different tariffs but we have assumed that tariffs will 'evolve' further towards increasing flexibility for consumers. *<u>Previous SEA work:</u>* • Smart meters and demand side response were discussed in the SEA for the Electricity Generation Policy Statement. • Smart meters were discussed in the SEA for RPP2.

	Priorities and Policies	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	Supporting the introduction of viable, lower carbon alternatives across all modes of transport	+	+	+	0	0	0	0	0	+	Increasing the efficiency of petrol and diesel-fuelled vehicles and supporting the widespread adoption of ultra-low emission vehicles on Scotland's roads is likely to help reduce GHG emissions and lead to improvements in air quality, with subsequent benefits for human health. Particular benefits are likely to be seen in urban areas with existing air quality issues (e.g. AQMAs) and by those with underlying health issues, exacerbated by poor air quality. Whilst a greater proportion of ultra-low emissions vehicles using alternative fuels such as hydrogen, biofuels/biogas and electricity should help to reduce the demand on more traditional sources, there is the potential for this increase demand on alternative energy sources which in turn will have environmental effects. For example, as discussed earlier under Bioenergy, greater use of bio-fuel in the transport sector has the potential to put pressure on land use, soils and landscape through the production of bio-fuel crops. Greater uptake of electric and electric-hybrid vehicles would require appropriate infrastructure to be in place and an increase in electricity generation, transmission and distribution to meet this demand. The electrification of transport is considered likely to pose a significant challenge in ensuring the energy system can respond to increases in peak demand over the long term[5]. Upgrading of existing and development of new infrastructure, such as charging points and hydrogen processing plants, would be required to facilitate an increase in the uptake of hydrogen. This has the potential for some, very localised and temporary, environmental effects. For example, construction works can result in noise and visual disturbance, impacts to air, soil and water quality, amongst others. If inappropriately sited, infrastructure could even impact on landscape and the setting of cultural heritage assets. However, such impacts would managed through project level requirements and consenting process. Increased uptake of active travel is also likely to have a number of benefits arising from reduced travel journeys and pressure on existing transport infrastructure, primarily roads. This would reduce GHG emissions, lead to improved air quality and have associated benefits for population and human health. There may also be additional benefits for population and human health through increased physical activity, mental health and well-being.
											<u>Assumptions & Links with Other SEA Work</u> *<u>Assumptions:</u>* • Promotion of ultra-low emissions vehicles and all associated infrastructure is included in this. • It is likely that the uptake of ultra-low emissions vehicles would primarily consist of electric vehicles in the short to medium term, with hydrogen-powered vehicles likely to develop over the long term.
	Manufacturing and industrial sector delivering enhanced competitiveness and improved energy efficiency	+	0	+	0	0	0	0	0	+	Given its significant energy use, greater energy efficiency in the industrial sector could help to reduce pressure on existing generation and supply networks. If energy efficiency measures are fully implemented within the Scottish industry sector, there is potential for significant reductions in GHG emissions and an overall positive effect in terms of climatic factors. Additionally, if coupled with a reduction in energy demand from traditional and finite sources such as oil and gas, there is also the potential for associated positive effects on air quality. Where possible the use of CCS in electricity generation and carbon-intensive industries could intensify that benefit and help to deliver substantial GHG emissions reductions in the sector. The Strategy promotes measures to facilitate a reduction in energy demand and this could enhance security of supply, improve resilience and help overall ambitions to future-proof Scotland's energy sector. Decarbonisation of Scottish

[5] DECC (2015) Toward a Smart Energy System [online] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/486362/Towards_a_smart_energy_system.pdf (accessed 31/10/2016)

	Priorities and Policies	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
											industry through greater use of alternative energy sources and fuels, such as district heating or use of waste heat, more efficient use of energy in processes, as well as the use of circular economy principles in manufacturing, should work together to reduce energy demand. In some instances where industry can use waste materials and waste heat resources, businesses may improve their security of energy and resource supply, and demonstrate benefits for others in the industrial sector. However, there is also the potential for negative environmental impacts associated with the implementation of some efficiency measures and the utilisation of alternative energy sources. For example, negative impacts could to arise from construction works and/or installation of infrastructure. Changing fuels would increase demand on other alternative energy sources - consideration would be necessary to ensure that these fuel sources are sufficient, that they can be sustainably managed, and appropriate infrastructure is in place to facilitate an increase in demand. Potential negative impacts would largely be localised and would be subject to existing consenting processes, such as planning and building warrants, prior to work being undertaken.
											<u>Assumptions & Links with Other SEA Work</u> *<u>Assumptions:</u>* • Linked to the use of measures such as CCS for those industries that are energy and fossil fuel intensive, and alternative energy sources that would require CCS to be low carbon (e.g. hydrogen).
Summary of Overall Effects	The assessment broadly identified positive environmental effects from this group of ambitions and priorities, especially against **climatic factors and material assets**. In particular, reducing overall energy demand from domestic and industrial sectors and improving the management of the resources that supply energy are likely to be beneficial. The importance of optimising Scotland's energy resources and reducing pressures on network and distribution infrastructure were also identified, alongside ensuring the sectoral resilience to the challenges of climate change for energy generation and supply. There is the potential for the sector to make a significant contribution to climatic factors by reducing GHG emissions, through a successful transition to low carbon energy use and improving energy efficiency. Benefits for **human health and population** are also expected from improved air quality associated with a reduction in the emissions generated by the use of fossil fuels, active and low carbon travel options. Improving the energy efficiency of Scottish homes is also likely to reduce energy demand, and could provide more energy efficient, cost effective and warmer housing stock, and help people who are susceptible to health concerns associated with poor **air quality**, leading to benefits for **population and human health**. Technologies that will provide consumers with greater information on their energy consumption could also benefit **population and human health**. This could help consumers and communities to become more active in the energy market and take greater control over their energy use, helping to reduce demand. These benefits could have the greatest effect in more vulnerable sections of the population. The use of innovative technologies such as smart meters and improving the flexibility of the system to cater for variations in energy demand, and further decentralising energy production, could reduce pressure on existing supply and distribution networks and improve longer term resilience to climate change impacts (**material assets**). Policies that lead to infrastructure and construction works (**material assets**) could lead to direct and indirect, temporary and long-term impacts on a number or environmental receptors, including **soil, air, water, biodiversity, population and human health**. The significance of these would however depend on where and how construction occurred. Retrofitting works, such as the implementation of efficiency technologies in existing building stock, could also affect the visual appearance of a building or impact on its setting and impact on landscape and cultural heritage. The addition of infrastructure on roofs and works undertaken in roof cavities can have implications for fauna, such as bats (**biodiversity, flora and fauna**). Changing fuels and the use of alternative energy sources could increase demand for these sources, which in turn will require that infrastructure is in place to facilitate an increase in demand (**material assets**). These identified impacts are likely to be largely localised and in many cases temporary. Their significance would depend on factors such as the size and scale of the proposed works, the presence of biodiversity such as bats, and the type and status of the building in conjunction with its location and setting. Effects will be considered under existing mechanisms, such as consenting processes, including licences for the management of bats and/or undertaking EIA and/or HRA. In many instances, impacts would be managed as appropriate through the use of appropriate design and construction management measures; for example, co-ordination of works to minimise disruption and the implementation of Environmental Management Plans at the project level. In many instances, the national and local significance of impacts will be influenced by successful uptake and the promotion of the ambitions and priorities that the draft Strategy sets out.										

	Priorities and Policies	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
Delivering Smart, Local Energy Systems	**Directly supporting the demonstration and growth of new innovative projects within low carbon, local energy systems**	+	+	+	0	0	0	0	0	+	This ambition encourages the continued development of new low carbon energy generation and storage technologies and demonstrator schemes, at a local and community level. Encouraging further community and local energy ownership through funding and support schemes is likely to lead to an increase in the development of low carbon electricity and heat generation projects. If widely implemented, further decentralisation of energy generation will significantly reduce Scotland's reliance on more traditional energy sources, reducing GHG emissions and improving air quality. Reducing pressure on traditional supplies is likely to have positive impacts for material assets, particularly through a reduction in pressure on existing networks. The measures could also provide an opportunity to future-proof supply against new challenges; by enabling smaller energy production developments to connect to and supply energy to the network. Progress to date regarding the uptake of community and locally owned renewable energy has been significant with the 2020 target of 500 MW being exceeded five years early[6]. Further expansion of community and locally owned energy can play a key role in raising awareness of climate change, improved acceptance of the need for renewable energy[7] and provide a long term income with local control over finances[8]. Additional wider community benefits that may arise include increased autonomy, empowerment and resilience and a strengthened sense of place[9]. Cumulative negative impacts could arise over time from the increased implementation of smaller community and locally owned schemes; for example, impacts on landscape / townscape and the historic environment. However, any impacts are likely to depend on factors such as the technology deployed, the scale and distribution of developments, and their location. Community involvement in the development of these schemes may also help to identify opportunities for the development of appropriate measures to avoid or mitigate potential adverse impacts. There may also be some short-term impacts from construction works in addition to the longer term implications from operations. These are likely to be considered and managed through effective spatial planning and appropriate design controls prior to development.
											Assumptions & Links with Other SEA Work *Assumptions:* • This would result in greater take-up of community-developed or owned energy generation projects. • Appropriate network upgrades would be undertaken to enable this and facilitate feed in to the national grid. *Previous SEA work:* • Community ownership of renewable energy schemes is discussed in the SEA of the Electricity Generation Policy Statement. • Community and locally-owned renewable energy is also discussed in the SEA of the Heat Policy Statement: Towards Decarbonising Heat: Maximising the Opportunities for Scotland.

[6] Committee on Climate Change (2016) Reducing Emissions in Scotland 2016 Progress Report [online] Available at: https://www.theccc.org.uk/publication/reducing-emissions-in-scotland-2016-progress-report/ (accessed 26/10/2016)
[7] ibid
[8] Shared Assets (2012) Social and Economic Benefits of Community Energy Schemes [online] Available at: http://www.ukcec.org/sites/default/files/files/NT%20report_%20Social%20and%20Economic%20Benefits%20of%20Community%20Energy.pdf (accessed 29/11/2016)
[9] ibid

	Priorities and Policies	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
	Partnership between communities, the private and public sectors to develop future energy systems which are proportionate to local needs	+	+	+	0	0	0	0	0	+	This ambition acknowledges that a co-ordinated approach could help to implement and manage the decentralisation of energy provision and the effective local planning of energy efficiency and heat. This is to be achieved through strategic approaches including potential new Local Heat and Energy Efficiency Strategies, that makes use of heat mapping and area-based heat, and energy efficiency programmes (as part of SEEP). It will involve collaboration from stakeholders from the public and private sectors as well as from local communities. Encouraging the decentralisation of heat networks and providing more efficient use of heat is likely to contribute to a reduction in GHG emissions from reduced energy demand. The promotion of district heating should result in a reduction in the use of heat from more traditional sources, although this would vary depending on the energy requirements of specific areas. Although the fuel source for district heating may not actually be low carbon itself, it could still result in a net reduction in GHG emissions through efficiencies of use. For example, benefits may be achieved in off-grid locations by supplying heat to a community by district heating rather than through individuals separately heating their homes, or in a city by more efficient use of waste heat and distribution of heat to communities. The ability of district heating networks to deliver heat recovered from sources which would otherwise be lost, such as unused industrial heat is acknowledged. Reducing pressure on existing supplies and grid networks is likely to have positive impacts on material assets, as does the opportunity to better plan and implement new grid infrastructure. Likely efficiencies in the use and delivery of energy would have further beneficial effects on climatic factors. Locally-focused projects have the potential to help foster buy-in of consumers and help to change behaviours in energy use. It is also likely to provide societal benefits such as improved wellbeing through empowerment and resilience, and building a stronger sense of community and a strengthened sense of place[10]. Energy may become more affordable for homes and businesses and the ability to sell any excess generated could contribute to reducing fuel poverty, with positive effects for local populations. Over the longer term there is the potential for some cumulative negative impacts from the increased installation of heat networks. This has the potential to affect landscape/townscape and the historic environment in particular. The scale of these impacts would be dependent on the nature, scale and distribution of developments. Early consideration of planning implications and appropriate design is likely to help mitigate this, and community involvement has the potential to alleviate perceptions of such impacts. There are also likely to be some short-term impacts from construction works on soils, air, biodiversity and water but these may be managed through appropriate site management controls, such as Environmental Management Plans.
											<u>Assumptions & Links with Other SEA Work</u> *<u>Previous SEA work:</u>* • District heating is discussed in the SEA of the Heat Policy Statement: Towards Decarbonising Heat: Maximising the Opportunities for Scotland. • Community ownership of renewable energy schemes is discussed in the SEA of the Electricity Generation Policy Statement. • Community and locally-owned renewable energy is also discussed in the SEA of the Heat Policy Statement: Towards Decarbonising Heat: Maximising the Opportunities for Scotland.

[10] Shared Assets (2012) Social and Economic Benefits of Community Energy Schemes [online] Available at: http://www.ukcec.org/sites/default/files/files/NT%20report_%20Social%20and%20Economic%20Benefits%20of%20Community%20Energy.pdf (accessed 29/11/2016)

	Priorities and Policies	Climatic Factors / Emissions Reduction	Population and Human Health	Air	Soil	Water	Biodiversity, Flora and Fauna	Cultural heritage	Landscape	Material Assets (Waste, Energy, Transport and Land Use)	Likely Environmental Effects
Summary of Overall Effects	The assessment identified the potential for positive environmental effects from this group of ambitions and priorities. Mirroring those set out under the heading of Scotland's Energy use, this group is focused on reducing demand for energy and ensuring that networks and markets are capable of facilitating the continued evolution in how energy in Scotland is supplied. It also seeks to increase uptake of local and community renewable energy generation projects. Empowering communities to participate in generating energy at a local level will better engage consumers with how energy is used and produced. This could present an opportunity to future-proof Scotland's energy supply and enhance resilience against future pressures (**material assets**). The assessment identified the potential for a significant reduction in GHG emissions and improved air quality, primarily associated with reducing the amount of energy generated from traditional resources, with benefits to climatic factors and air quality. However, this would depend on the energy requirements of specific areas. There could be particular benefits for **population and human health** arising from an improvement in air quality. The introduction of greater system flexibility and resilience, and increased community involvement in energy generation, could help to enhance the security and resilience of supply. In turn, this should help reduce energy demand through increased efficiency of use. This may be beneficial to sections of the population (**population and human health**). Largely localised direct and cumulative impacts could arise from the increased development of smaller energy schemes and networks, including on **landscape / townscape and cultural heritage**. There are also likely to be short-term impacts on a range of environmental receptors from construction works and site operations if not appropriately managed (**population and human health, air, soil, biodiversity and water**). The significance of any such impacts will depend on the nature, scale and distribution of these works. The potential for adverse effects could be further managed through existing mechanisms such as planning, appropriate design controls, and the implementation of appropriate on-site construction management.										

Appendix E: Abbreviations

AD	Anaerobic Digestion
AQMA	Air Quality Management Area
CAR	Controlled Activity Regulations
CARES	Community and Renewable Energy Scheme
CCA	Climate Change Agreement
CCRA	UK Climate Change Risk Assessment
CCL	Climate Change Levy
CCS	Carbon Capture and Storage
CCU	CO2 Utilisation
CH_4	Methane
CHP	Combined Heat and Power
CO	Carbon Monoxide
CO2	Carbon Dioxide
COP 21	Paris Climate Conference
COSLA	Council of Scottish Local Authorities
DECC	Department of Energy and Climate Change (now Department for Business, Energy & Industrial Strategy)
DHLF	District Heating Loan Fund
EC	European Commission
ECO	Energy Company Obligation
EIA	Environmental Impact Assessment
ESOS	Energy Savings Opportunity Scheme
EU ETS	Emissions Trading Scheme
EU	European Union
EV	Electric Vehicle
GHG	Greenhouse Gas
GW	Gigawatt
GWh	Gigawatt Hours
HFC	Hydrofluorocarbons
HGVs	Heavy Goods Vehicles
HEEPS	Home Energy Efficiency Programme Scotland
HES	Historic Environment Scotland
HRA	Habitats Regulations Appraisal
ITS	Intelligent Transport System
LCITP	Low Carbon Infrastructure Transition Programme
LEV	Low Emissions Vehicle
LEZ	Low Emission Zone
$MtCO_2e$	Carbon dioxide equivalent

MW	Megawatt
N_2O	Nitrous oxide
NF_3	Nitrogen triflouride
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides
NPF3	National Planning Framework 3
PFC	Perfluorocarbons
PM_{10}	Particulate Matter of Diameter Less Than or Equal to 10 microns (mm)
PPC	Pollution Prevention and Control
PV	Photovoltaic
REIF	Renewable Energy Investment Fund
RHI	Renewable Heat Initiative
RPP	Low Carbon Scotland: Meeting our Emissions Reduction Targets 2010 – 2022: Report on Proposals and Policies
RPP2	Low Carbon Scotland: Meeting our Emissions Reduction Targets 2013 – 2027: The Second Report on Proposals and Policies
SAC	Special Area(s) of Conservation
SEA	Strategic Environmental Assessment
SEPA	Scottish Environment Protection Agency
SEEP	Scotland's Energy Efficiency Programme
SF_6	Sulphur hexafluoride
SIMD	Scottish Index of Multiple Deprivation
SME	Small and Medium Sized Enterprise Loans
SNH	Scottish Natural Heritage
SO_2	Sulphur dioxide
SPA	Special Protection Area
SPP	Scottish Planning Policy
SSSI	Site(s) of Special Scientific Interest
TWh	Terawatt Hour
The 2005 Act	The Environmental Assessment (Scotland) Act 2005
The 2009 Act	Climate Change (Scotland) Act 2009
UCG	Underground Coal Gasification
UK	United Kingdom
ULEV	Ultra-low Emissions Vehicles
VED	Vehicle Excise Duty

Appendix F: Compliance Checklist

Environmental Report Requirements	Section(s) of This Report
Relevant Sections of the Environmental Assessment Act	
14 (2) The report shall identify, describe and evaluate the likely significant effects on the environment of implementing—	
(a) the proposals in the plan or programme; and	Section 6 Appendices C and D
(b) reasonable alternatives to the plan or programme.	Section 6
14 (3) The report shall include such of the information specified in schedule 3 as may reasonably be required.	
Information referred to in schedule 3	
1. An outline of the contents and main objectives of the plan or programme, and of its relationship (if any) with other qualifying plans and programmes.	Sections 3 – 5
2. The relevant aspects of the current state of the environment … … and the likely evolution thereof without implementation of the plan or programme.	Sections 3 – 4 Appendix A
3. The environmental characteristics of areas likely to be significantly affected.	Appendix A
4. Any existing environmental problems which are relevant to the plan or programme including, in particular, those relating to any areas of a particular environmental importance, such as areas designated pursuant to Council Directive 79/409/EEC on the conservation of wild birds and Council Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna (as last amended by Council Directive 97/62/EC).	Sections 3 – 4 Appendices A and B
5. The environmental protection objectives, established at international, Community or Member State level, which are relevant to the marine spatial plan or programme … … and the way those objectives and any environmental considerations have been taken into account during its preparation.	Sections 3 – 4 Appendix A
6. The likely significant effects on the environment, including— (a) on issues such as— (i) biodiversity and natural heritage; (ii) population; (iii) human health;	Section 6 – 8 Appendices C and D

Environmental Report Requirements	Section(s) of This Report
(iv) fauna; (v) flora; (vi) soil; (vii) water; (viii) air; (ix) climatic factors; (x) material assets; (xi) cultural heritage and historic environment, including architectural and archaeological heritage; (xii) landscape; (xiii) the inter-relationship between the issues referred to in heads (i) to (xii). (b) short, medium and long-term effects. (c) permanent and temporary effects. (d) positive and negative effects. (e) secondary, cumulative and synergistic effects.	
7. The measures envisaged to prevent, reduce and as fully as possible offset any significant adverse effects on the environment of implementing the marine spatial plan or programme.	Section 6
8. An outline of the reasons for selecting the alternatives dealt with, and a description of how the assessment was undertaken including any difficulties (such as technical deficiencies or lack of expertise) encountered in compiling the required information.	Sections 2 and 6
9. A description of the measures envisaged concerning monitoring in accordance with section 19.	Section 7
10. A non-technical summary of the information provided under paragraphs 1 to 9.	See accompanying Non-Technical Summary

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