



CLIMATE CHANGE DELIVERY PLAN



MEETING SCOTLAND'S STATUTORY CLIMATE CHANGE TARGETS

June 2009



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ISBN: 978-0-7559-8074-1

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Produced for the Scottish Government by RR Donnelley B60850 06/09

Published by the Scottish Government, June 2009

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Ministerial Foreword

The Climate Change (Scotland) Bill will introduce the most ambitious climate change legislation anywhere in the world. This Delivery Plan sets out how we will achieve the statutory emission targets which lie at the heart of the Bill. The action needed is huge and challenging but not impossible.

The Plan sets out what we need to do now, and in the medium and long term, to achieve our ambitious emissions reduction targets. It is a precursor to the more detailed statutory Report on Proposals and Policies to be produced in 2010, which will set out how we will meet our annual targets out to 2022. The Scottish Government is already planning the next steps: a new approach to managing carbon, drawing on how we manage our financial budgets; strengthening governance arrangements and accountability; working together to ensure carbon is taken properly into account in the decisions we make; and improving the evidence base and our knowledge of what works best.

We need to work together to transform Scotland's economy so that economic growth and emissions reductions happen together. All sectors of the economy must share in the effort. Scotland already has a thriving renewables sector, and we have a tremendous opportunity to be a world leader in green technologies such as marine energy and carbon capture and storage. We will also see a massive expansion of jobs in energy efficiency products and services. We all, as individuals,

also need to play our part, by factoring climate change into our decisions about how we travel, how we make our homes more energy efficient, what we buy and where it comes from, and how we dispose of what we no longer need.

Scotland's share of global emissions is small and the action Scotland takes needs to be part of a global effort to reduce emissions. Our most important contribution at a global level will be to demonstrate strong leadership, through setting ambitious statutory targets, and more significantly, showing that the pathway to a successful low carbon economy is achievable. Wherever possible we will take opportunities to influence others in the international community to follow our lead.

At the same time, we as a nation need to prepare for the changes we will see to our climate and landscape. By planning and preparing for change now, Scotland will be better placed to take advantage of any opportunities and to build its resilience to the negative consequences of a changing climate. Scotland's Climate Change Adaptation Framework, to be published later this year, will provide leadership and catalyse action.

As this Delivery Plan makes clear, transformational change is necessary. The Scottish Government is focused on making it happen.



John Swinney
Cabinet Secretary for Finance and Sustainable Growth



Stewart Stevenson
Minister for Transport, Infrastructure and Climate Change





CHAPTER 1: INTRODUCTION CHALLENGES AND OPPORTUNITIES

1.1

Climate change is one of the greatest challenges to life, across the world. It threatens human life through its impacts not just on ambient temperature, but also on the natural resources essential to life including fresh water supplies and our ability to produce food. It also increases the risks from disease, flooding and sea level rise. The world has to address this challenge urgently, and Scotland must be sufficiently enlightened to take a global lead in reducing its emissions.

1.2

Scotland faces other increasing pressures on the environment too, such as constantly rising levels of consumption and ever greater competition for natural resources such as fossil fuels, timber, water and land, all of which are already under pressure. That position cannot continue; as a nation Scotland needs to reduce its environmental impact on both a local and global scale.

1.3

Scotland aims to become a leading nation in developing a sustainable way of life, reducing the impact its people have on the local and global environment. The choices made will be critical to shaping a modern, successful and sustainable Scotland and to maintaining a quality of life which retains and attracts talented people and investment.

1.4

First and foremost, Scotland must play its part in the global effort to reduce greenhouse gas emissions. The Climate Change (Scotland) Bill commits Scotland to reduce its emissions by at least 80% from 1990 levels by 2050; with an interim emissions reduction target of at least 34% by 2020, increasing to 42% if the EU increases its 2020 target to 30% in the event of a global deal on climate change. The Bill is unprecedented in its ambition and will set the framework for future governments in Scotland to achieve ambitious targets that will challenge all parts of society. The Scottish Government's Purpose¹ also has sustainability at its core. Its Sustainability Purpose Targets are: to reduce emissions over the period to 2011; and to reduce emissions by 80 percent by 2050.

¹ To focus government and public services on creating a more successful country, with opportunities for all of Scotland to flourish, through increasing sustainable economic growth. Government Economic Strategy at <http://www.scotland.gov.uk/Publications/2007/11/12115041/0>

1.5

This document sets out the Scottish Government's Delivery Plan, identifying the high level measures to meet the interim statutory targets for 2020 and the work to be done over the next decade to prepare for the more radical changes needed by 2030 if the emissions reduction target for 2050 is to be achieved.

1.6

The drive to reduce the impact of climate change will have other positive advantages for Scotland. It will create economic opportunities in renewable energies, from world-leading technology export and manufacturing opportunities in marine energy and deep-water offshore wind-power, to rural jobs in biomass and renewable heat. With a quarter of Europe's tidal and offshore wind resource, coupled with high skills levels and innovative businesses, Scotland has the potential to become the green energy capital of Europe, and a world leader in offshore renewable energy technology and carbon capture and storage. Improving efficiency in business use of energy, water and other natural resources can also reduce costs and promote the competitiveness Scotland needs, to be a successful nation in the 21st century.

1.7

Legislation alone won't deliver the targets. It needs to be translated into real changes in everyday actions: by businesses; the public sector; voluntary and community groups; and individuals. Better public understanding is essential if people are to be motivated to act. The Scottish Government, its agencies and its non-government partners will need to work together to explain what's needed and to incentivise action. Alongside that, action is needed to reduce the emissions from transport, housing, business, land management and other sources. The whole nation must become better informed consumers. The public sector is a substantial purchaser in its own right and can encourage the development of greener goods and services. It can demonstrate its commitment by ensuring that the whole of the public sector in Scotland pays full and appropriate regard to the environmental consequences of the goods and services it buys and provides. Scotland's schools, colleges and universities must also work alongside the business sector to increase public awareness and to research and develop innovative solutions and technologies.



1.8

This Delivery Plan doesn't come from a standing start. The Scottish Government is already acting to tackle climate change. For example:

- The Climate Change (Scotland) Bill will place Scotland's commitment to reduce its emissions levels on a statutory footing
- Policy options and public spending decisions are already contributing to reducing emissions and to the action needed to help mitigate climate change
- Funding farmers and others to reduce climate change emissions from land management practices and to manage Scotland's rural environment more effectively
- The Scottish Government and its enterprise agencies are working closely with the Crown Estate on its leasing round for wave and tidal power in the Pentland Firth strategic area. This initiative, and others like it, is aimed at developing hundreds of megawatts in Scottish waters by 2020, helping to make Scotland the world leader in wave and tidal power.
- The Scottish Government has tripled the previous level of funding for community renewables and microgeneration
- Pursuing a zero waste policy that will reduce greenhouse gas emissions, especially of methane (a potent greenhouse gas)
- The Climate Challenge Fund is inspiring community-based action in all parts of Scotland to tackle climate change; making over £25 million available directly to communities to pursue their own ideas
- The Scottish Government will shortly publish a guide to improve sustainable procurement, for example urging all public bodies in Scotland to specify fresh, locally available, seasonal produce
- Investments in Smarter Measures and public transport, in partnership with local authorities, are addressing transport emissions and encouraging more walking and cycling.

1.9

But Scotland now needs a better co-ordinated approach, a national Delivery Plan showing all the actions that can be delivered over the next decade and beyond, to achieve the targets Parliament will lay down for Scotland in the Climate Change (Scotland) Bill.

THE CLIMATE CHANGE (SCOTLAND) BILL

1.10

The Climate Change (Scotland) Bill, introduced into the Scottish Parliament in December 2008, requires Scotland's greenhouse gas emissions, including its share of those from international aviation and shipping, to be at least 80% lower in 2050 compared with 1990 levels. An interim target will require emissions to be at least 34% below 1990 levels by 2020; and 42% by 2020 if the EU decides to increase its 2020 emission reduction target to 30% below 1990 levels, following a global deal on climate change.

1.11

The Bill also requires the Scottish Government to act:

- to reduce greenhouse gas emissions year on year, every year from 2010 to 2050
- to increase the rate of reduction from 2020 onwards to at least 3% per year
- to specify more detailed annual targets in 2010, for each year to 2022.

DELIVERY PLAN

1.12

Greenhouse gas emissions arise from almost every activity we undertake. The main source is the use of fossil fuels to generate electricity, heat buildings and provide transport. Other significant sources of emissions are the result of chemical or biological processes, for example in the production of cement; emissions associated with the growing of crops and the rearing of livestock; decomposition of waste; and from soil processes.

1.13

Reducing emissions requires one or more of the following abatement options:

- Reduce energy use through both decreasing demand and increasing the efficiency with which energy is used
- Reduce the use of fossil fuels and produce more low carbon energy

- Reduce consumption, particularly of products which emit greenhouse gases as part of their: manufacture, e.g. cement; production, e.g. meat; or decomposition, e.g. waste
- Sequester carbon geologically and in soils and vegetation, e.g. trees.

1.14

This Delivery Plan identifies:

- The key sectors for abatement
- The high level measures required in each sector to deliver the interim, 2020 targets in both a 34% and 42% Scottish target
- The four transformational outcomes required by 2030 to put Scotland on the right track to meet its 2050 target
- Milestones and actions; and barriers and risks around implementation
- Where the policy levers sit, e.g. at EU, UK or Scottish Government levels.

1.15

The Delivery Plan is structured as follows:

- Chapter 2 provides an overview of the key sectors for abatement, highlighting the importance of the "traded sector" and the sectoral contributions required from key areas within the non-traded sector to meet the 34% and 42% targets in 2020. A table summarising the key measures, milestones and actions across all the sectors is produced at the end of this chapter
- Chapters 3-7 cover each of the main sectors in more detail:
 - Electricity Demand and Supply
 - Heat Demand and Supply (including small scale electricity generation)
 - Transport
 - Rural Land Use (agriculture, forestry and other land management)
 - Waste.



The key messages for each sector are set out at the beginning of each chapter. A summary of the high level measures required to deliver the 34% and 42% interim targets and the relevant transformational outcomes are produced at the end of each chapter.

- A final, Next Steps chapter sets out what the Scottish Government will do over the next 12 months, at the end of which, as required by the Climate Change (Scotland) Bill, the Government will produce a Report on Proposals and Policies, setting out in more detail the measures to be delivered to meet Scotland's annual emissions reduction targets up to 2022.

1.16

In drawing up a Delivery Plan for emissions reduction, it's important to be clear about:

- Who controls the policy levers, including the distinction between the traded and non-traded sectors
- How emissions (and reductions) are measured for the purpose of the Climate Change (Scotland) Bill and the Delivery Plan
- The information used in the analysis for the Delivery Plan
- How costs, benefits and cost effectiveness are considered in the Delivery Plan.

WHO CONTROLS THE POLICY LEVERS?

1.17

Scotland cannot deliver its challenging targets by acting alone. Scotland is supported, and constrained, by levels of ambition and policy levers held at UK and EU levels. For example:

- The emissions reduction targets for the EU Emissions Trading Scheme, the largest carbon trading scheme in the world (see Chapter 2), are set at EU level
- The main responsibilities for energy policy and regulation are reserved to Westminster but the UK Government relies in turn on decisions that Scotland takes in permitting new sources of electricity generation

- Vehicle Excise Duty, Fuel Duty, driving licensing and speed limits on motorways are all reserved to Westminster but powers around pricing, Smarter Measures and transport infrastructure are generally devolved
- Agriculture and forestry policy and delivery are both devolved but work within an EU framework
- Landfill Tax is a reserved matter.

1.18

The UN Framework Convention on Climate Change (UNFCCC) is the basis on which international agreement on climate change is negotiated. The meeting in Copenhagen in December 2009 aims to deliver a successor to the UNFCCC Kyoto Protocol. A new international agreement would help Scotland make deep emissions reductions. The European Union has committed to increasing its 2020 emissions reduction target from 20% to 30% (from 1990 levels) in the event of a new global deal being reached. This would ensure that EU policy levers deliver deeper emissions reductions, making radical changes more attainable in Scotland. It would also reduce some of the economic challenges of an uneven playing field that may arise if Scotland aims far beyond the actions of its neighbours in the EU.

HOW EMISSIONS ARE MEASURED

1.19

The most accurate way of measuring Scotland's carbon footprint would be to look at the emissions associated with its consumption of goods and services. As a country that exports goods and services, such as electricity and food and drink, but imports many manufactured goods, Scotland's emissions profile using a consumption measurement would be rather different from an approach based on current production-based measurements. But while a consumption-based approach to measurement might be preferable, data are not yet sufficiently available or robust to use the consumption-based approach consistently. Thus, greenhouse gas emissions targets in Scottish, UK, EU and other international legislation are based on the emissions that arise from the production of goods and services within a country.

1.20

The Government is, however, committed to monitoring Scotland's progress on a consumption basis as well. This is reflected in the Climate Change (Scotland) Bill and the National Outcomes and Indicators supporting the delivery of the Government's Purpose. The Bill requires the Government to report on Scottish consumption of goods and services each year.

1.21

The National Performance Framework sets a National Outcome to reduce the local and global environmental impact of Scotland's consumption and production with a National Indicator to reduce Scotland's overall ecological footprint. This footprint gives an overall measure of the global impact of our everyday choices and offers an estimate of the land and sea area needed to provide all the energy, water, transport, food and materials that Scotland consumes. Part of this work will produce a measure of Scotland's *carbon footprint*.

1.22

Scotland's greenhouse gas emissions inventory (the Inventory)² details annual emissions from all emission producing activities in Scotland, using widely applicable standards. It is published approximately five months after the UK's national inventory. It provides the basis for the net Scottish emissions account.

1.23

The net Scottish emissions account lies at the heart of the Climate Change (Scotland) Bill. Achievement of the emissions targets set by the Bill will be measured against the level of this net account rather than against Scotland's actual emissions. The net Scottish emissions account has two main features:

- Net Scottish emissions, which are the emissions of greenhouse gases attributable to Scotland, as reduced by any "removals" of those gases by sinks such as forestry; and
- The net effect of any carbon units bought to offset any emissions or sold to emitters outside Scotland.

The way in which carbon units may be credited to or debited from the net Scottish emissions account will be detailed in statutory regulations. However, the underlying principle in the Bill is that Scottish Ministers should be able to take account of the annual balance of carbon units used.

² <http://www.naei.org.uk/reports.php?list=GHG>



THE INFORMATION USED IN THE ANALYSIS FOR THE DELIVERY PLAN

1.24

This Delivery Plan is informed by the best available evidence, drawing on the expert analysis of the UK Committee on Climate Change coupled with Scottish Government internal analysis.

1.25

Key information resources for this analysis are:

- Scotland's greenhouse gas emissions Inventory
- Technical models that estimate marginal costs and abatement of emission-reducing activities
- Energy and land use system models, which consider future supply and demand scenarios and their associated emissions/sequestration
- Expert assessment of the practical constraints to reducing emissions.

1.26

The Committee on Climate Change³ has advised the UK Government to commit to reducing greenhouse gas emissions by 34% by 2020 relative to 1990 levels, and by 42% once a global deal to reduce emissions is achieved. The Committee also identified indicative potential to reduce emissions in Scotland to contribute to the delivery of a UK 34% target.

1.27

The process of analysis for the Delivery Plan has thrown up the relative paucity of data and effective carbon assessment for certain policy areas at sub-UK level. A great deal of work is underway across the Scottish Government and by the Committee on Climate Change to remedy these weaknesses including work on carbon assessment. Given the imperative of early progress, action has to be taken now based on best available information, recognising that the Plan will need to be revised in time.

³ The CCC's First Report: Building a low-carbon economy - the UK's contribution to tackling climate change was published on 1st December 2008 <http://www.theccc.org.uk/reports/>

1.28

Taking the emissions inventory for agricultural land use as an example, at present it meets international standards for reporting emissions, but it is not fit for the purpose of capturing year-on-year changes in land use management policies and practice. This issue is being addressed at present at both UK and Scottish levels, but will not be solved in the short term.

1.29

Governments worldwide have a poor record of predicting the emission outcomes of their policies and programmes with accuracy. In part, this reflects the difficulty of predicting wider economic indicators, as well as problems of forecasting future energy prices. Governments use energy and land use models to project emissions from human activities into the future. UK models typically project out to 2020. The Scottish Government recently published its energy projections to 2020⁴. While these are useful as a guide to future emissions and abatement potential from different sectors, the projections are dependent on a series of assumptions, such as future levels of economic or population growth or average household warmth. Beyond 2020, the uncertainties within the assumptions make projecting emissions particularly difficult.

1.30

To deliver deep cuts in emissions, it is important to see beyond one particular year's emissions figures, which might be influenced by a range of random events, and focus on the underlying structural causes of emissions. For this plan, therefore, the key focus is on the necessary measures, milestones and actions, along with the barriers and risks around implementation, as they are seen today. This Plan and the more detailed, statutory Report on Proposals and Policies to be published in 2010 will be revised and refined over time as further evidence and advice becomes available.

⁴ Scottish Energy Study, Volume 5 (November 2008)

ECONOMIC COSTS, BENEFITS, AND COST-EFFECTIVENESS

1.31

According to Sir Nicholas Stern's Review⁵, the costs of stabilising greenhouse gas concentrations in the atmosphere at or below 550ppm CO₂e, to avoid an increase in global temperature of 2-3°C (less than the temperature increase of 5% from unabated climate change) are 1% (+/-3%) of global GDP⁶. Failure to take action would, in his view, lead to climate change impacts that would reduce global GDP by between 5% and 20%.

1.32

The economic costs of transformational change to Scotland's economy and society to meet our climate change targets are not high relative to total economic output over the next 40 years.

1.33

The overall cost estimate is the aggregation of a range of costs and benefits, as well as distributional impacts across society. There will be a substantial financial cost for both the public and private sectors through the cost of carbon being incorporated into the price of goods and services and the cost of investing in new low carbon infrastructure. Many of such activities, particularly efficiency projects, are "net positive", meaning that, though they might require an upfront investment, the activity eventually both reduces emissions and saves money.

1.34

The Delivery Plan does not set out in detail how particular measures will be delivered or resourced. This will be done in the more detailed, statutory Report on Proposals and Policies to be published by the Scottish Government in summer 2010, which will set out how the annual emissions reduction targets to 2022 will be delivered. Work on costs will clearly also feature in the continuing work on the carbon assessment of the Scottish Government budget for 2010-11.

⁵ The Stern Review: The Economics of Climate Change (October 2006) <http://www.occ.gov.uk/activities/stern.htm>

⁶ World Bank estimates suggest that 1% of global GDP equates to around \$650 billion, taking into account both exchange rates and also the purchasing power of each world currency against the dollar, in 2007.



Carbon Pricing

1.35

To influence behaviour and investment decisions, investors and consumers must believe that a significant carbon price will be a factor into the future. This is particularly important to ensure appropriate investments in long-lived capital stock such as power stations, buildings and industrial plant. The price of carbon is largely outside Scottish influence.

Technology Policy

1.36

The development and deployment of a wide range of low-carbon technologies is essential in achieving the deep cuts in emissions that are needed. While the private sector will be the driver of change, closer collaboration between government and industry will help overcome risk and stimulate the development of a broad portfolio of low carbon technologies and reduce costs.

Behaviour Change

1.37

Even where measures to reduce emissions are cost-effective, there may be barriers preventing action. These can include a lack of reliable information, transaction costs, and behavioural and organisational inertia. Regulatory measures can play a powerful role in cutting through these barriers, and by providing clarity and certainty. Minimum standards can be a cost-effective way to improve performance, particularly where price signals may be too muted to have a significant impact. Information policies, including labelling and the sharing of best practice, can help consumers and businesses make sound decisions, and stimulate competitive markets for low-carbon goods and services. Financing measures can also help overcome upfront investment cost constraints when delivering energy efficiency improvements in particular.

1.38

The Scottish Government published the Scottish Environmental Attitudes and Behaviours Survey⁷ in March 2009, and its findings will be crucial to work going forward on behavioural change. This major survey of 3,000 adults found that:

- People were more likely to see the environment as a global problem than as an important issue facing Scotland
- When questioned further, most acknowledged climate change was an urgent problem, but around a third did not believe their own behaviour contributed to climate change; and
- When asked what they could do to reduce climate change, most described relatively 'easy' actions such as recycling as opposed to actions which demand more of a sacrifice.

1.39

The survey suggests that public attitudes need to be improved, and there is clearly work for the Scottish Government to do on this. However, attitude change is not sufficient, it is behavioural change which is key. Across all groups surveyed, including the greenest groups, participation in some forms of green behaviour were very low: for example, 44% of those who live a mile from work and own a car drive there. This suggests that in order to foster real improvements efforts must be focussed on understanding and enabling behaviour change.

1.40

On the benefits side, those nations leading such investment to shift the world to a low carbon economy might, Stern suggested, benefit from a share of a global market for low carbon technologies worth at least \$500 billion per annum by 2050.

1.41

With the right policy environment and appropriately targeted incentives and investment by the public and private sector Scotland's business sectors can benefit from an early move to a low carbon world by:

- Taking opportunities to strengthen the Scottish supply chain for low carbon investments, especially in renewable and low carbon energy and distributed energy systems

- Improved productivity and competitiveness through energy efficiency products and distributed energy services to communities and businesses
- Technology developments created by strong Scottish research and development work that can help build strong world-leading energy businesses that develop both domestic and export markets
- An improved skills base to deliver the exponential change in output from the non-fossil fuel energy sector that will be required to place energy at the centre of Scotland's future prosperity
- Cost savings through energy efficiency improvements that free up resources and increase demand for goods and services.

NATIONAL CONVERSATION

1.42

Choosing Scotland's Future inspired a National Conversation on the type of government which best equips Scotland for the future. The ultimate aim of the National Conversation⁸ is to allow the people of Scotland to make an informed decision about their future in a referendum on independence in 2010.

1.43

The current economic crisis has clearly demonstrated many weaknesses in the existing constitutional system. Scotland has very limited scope to adjust taxation or increase expenditure to provide a fiscal stimulus. The Scottish Government cannot borrow money to fund public works, or make changes to benefits, pensions or tax credits to meet Scottish needs. Instead, Scotland is dependent on the decisions made by the United Kingdom Government at Westminster.

1.44

Choices are also limited on issues such as climate change, investment in renewable energy, and in how Scotland's voice is heard in Europe and internationally. The issues which may impact on the Scottish Government's ability to meet its statutory climate change targets are considered below in each of the sectoral chapters of the Delivery Plan.

⁷ <http://www.scotland.gov.uk/Topics/Research/by-topic/environment/social-research/SESEN/workprogramme/Themes>

⁸ <http://www.scotland.gov.uk/Topics/a-national-conversation>





CHAPTER 2: OVERVIEW OF SECTORS FOR ABATEMENT

2.1

Reducing emissions by at least 80% from 1990 levels, over the next 40 years will require a radical change in the way in which society uses its energy and land. Some sectors will find it more difficult to reduce emissions by this extent without unacceptable changes in Scotland's social fabric or significant changes to consumer behaviour; that may mean other sectors will need to go further.

2.2

This chapter sets out the emissions reductions required across all sectors to meet the 34% and 42% targets in 2020 and the four transformational outcomes which need to be substantially delivered by 2030 to put Scotland on the correct pathway to the 2050 target. Underpinning these transformational outcomes is the need to give primacy to cost effective demand reduction and energy efficiency across all sectors.

2.3

The four transformational outcomes which the Scottish Government is working towards are:

- **A largely de-carbonised electricity generation sector by 2030**, primarily using renewable sources for electricity generation with other electricity generation from fossil fuelled plants utilising carbon capture and storage⁹
- **A largely de-carbonised heat sector by 2050 with significant progress by 2030** through a combination of reduced demand and energy efficiency, together with a massive increase in the use of renewable or low carbon heating
- **Almost complete decarbonisation of road transport by 2050 with significant progress by 2030** through wholesale adoption of electric cars and vans, and significant decarbonisation of rail by 2050

- **A comprehensive approach to ensure that carbon (including the cost of carbon) is fully factored into strategic and local decisions about rural land use** through: appropriate protection for Scotland's carbon rich soils; minimising emissions from agricultural and other land use businesses; encouraging the sequestration of carbon, for example, through woodland planting; and the use of natural resources to generate renewable energy.

Delivery of these transformational outcomes will be considered further in the sectoral chapters on Electricity Demand and Supply; Heat Demand and Supply; Transport; and Rural Land Use.

2.4

Evidence suggests that society can reduce demand and de-carbonise its energy supply, especially in countries like Scotland with rich natural resources and a highly skilled workforce. The challenge is for Scotland to do this and, at the same time, maximise the economic opportunities available in the pursuit of a global, low carbon economy.

2.5

Delivering the Scottish Government's 10 Energy Pledges¹⁰ will be a key driver in meeting Scotland's 2020 targets and achieving the transformational outcomes in the electricity, heat and transport sectors. The 10 pledges are:

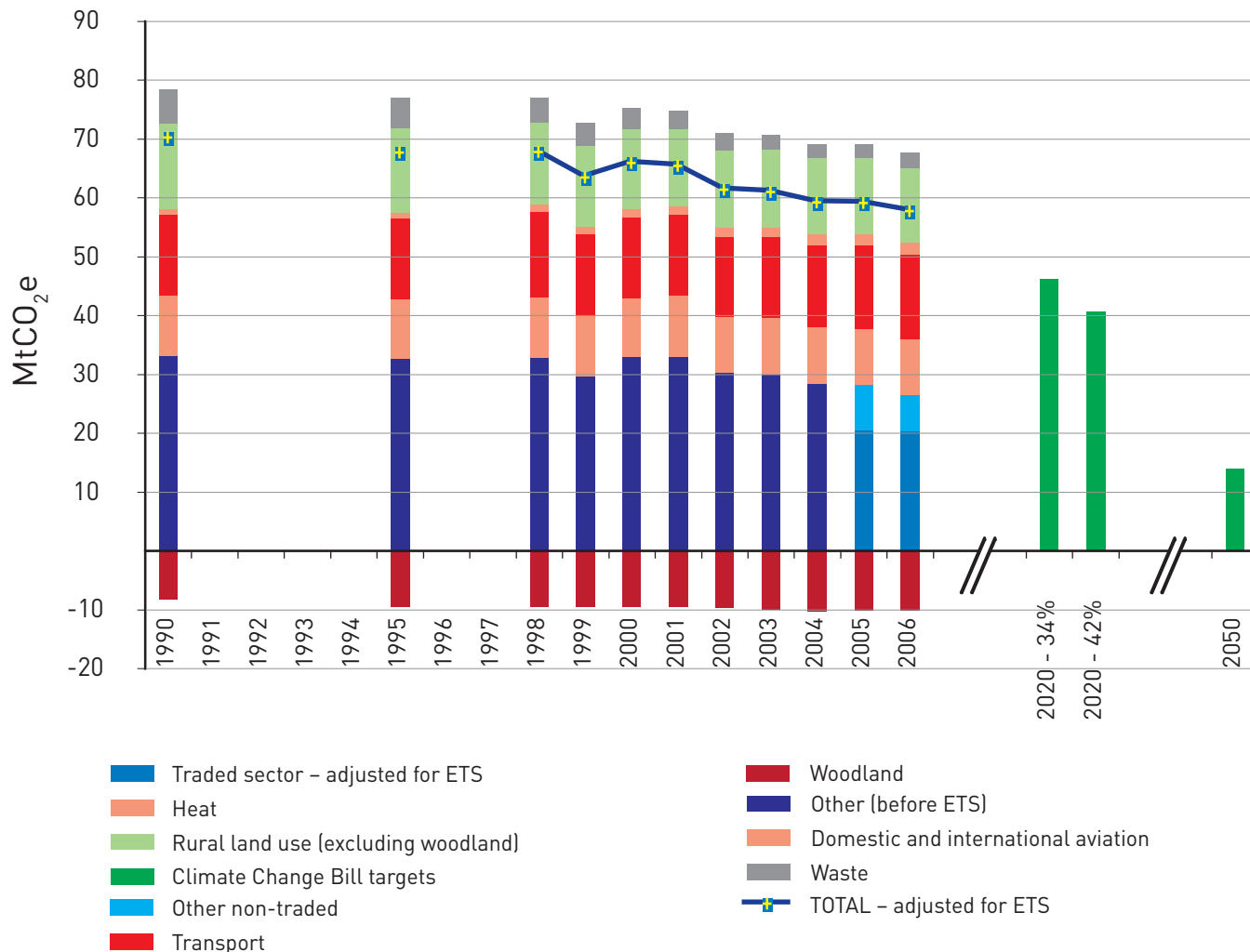
⁹ Carbon capture and storage refers to the suite of technologies that capture greenhouse gases from fossil fuels and store them in geological formations for the long term.

¹⁰ The Energy Pledges can be found in full at <http://www.scotland.gov.uk/Resource/Doc/917/0081161.pdf>



- **PLEDGE 1:** We will support and accelerate the implementation of renewable energy, through our Renewable Energy Action Plan, in a way which promotes large scale, community based, decentralised and sustainable generation.
- **PLEDGE 2:** We will aim to build a commercially viable, diverse renewable heat industry in Scotland to deliver benefits to the wider public, through the implementation of our Renewable Heat Action Plan.
- **PLEDGE 3:** We will work with the oil and gas sector to maintain its competitiveness, facilitate the transfer of skills and knowledge to other sectors and utilise Scottish-based skills in world markets.
- **PLEDGE 4:** We will enhance our capability to undertake energy and environmental foresight, and develop our preparedness to anticipate and respond to threats and take advantage of opportunities.
- **PLEDGE 5:** We will support development and implementation of clean fossil fuel technologies in Scotland, through collaboration with academia, industry and other interested parties.
- **PLEDGE 6:** We will support the development of sub-sea grids, alongside improvements in the onshore grids, and press the UK Government for fairer charging structures.
- **PLEDGE 7:** We will implement measures to improve Scotland's energy use through the Energy Efficiency Action Plan, which is a key part of the Scottish Government's Climate Change Bill.
- **PLEDGE 8:** We will develop and deliver more sustainable transport to improve efficiency and reduce transport emissions in the longer term.
- **PLEDGE 9:** We will promote the development, uptake and use of electric and other low carbon vehicles, in addition to using improvements in vehicle engineering which are already available.
- **PLEDGE 10:** We will work to develop international partnerships through the Saltire Prize and the Scottish European Green Energy Centre to make Scotland a leader in the development and deployment of green energy.

FIGURE 1: SCOTTISH NET GREENHOUSE GAS EMISSIONS, 1990, 2006, AND 2020 AND 2050 TARGETS^{1,2}



¹ Traded sector here does not include estimates of 2007 and 2008 additions to coverage.

² Domestic and international aviation emissions are computed without an adjustment for radiative forcing – this is in line with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.



2.6

The statutory planning system also has an important role in climate change mitigation through its influence over the location and scale of new development. Development plans, which are prepared by local authorities and the national park authorities, indicate where development should happen and where it should not and provide the basis for decisions about individual applications for planning permission.

SCOTLAND'S EMISSIONS

2.7

Figure 1 shows Scotland's emissions from 1990 to 2006, the most recent year for which information is available. The reduction in net emissions reflects the outcome of competing actions: the reduction in carbon dioxide emissions from the closure of the Ravenscraig steelworks; from the increased sequestration from forests planted in previous decades; and from more energy efficient households has been largely offset by rising emissions from road transport and power generation activities.

2.8

Methane emissions have reduced substantially, because of better management of landfill emissions and reduced livestock numbers. Nitrous oxide emissions have fallen sharply because of the relocation of Scotland's only nitric acid plant in the 1990s to Dublin and, as a result of changing agricultural practices. Overall, Scotland's greenhouse gas emissions have reduced by 18% between 1990 and 2006 (including international aviation and shipping, and after adjustment for the EU Emissions Trading Scheme (see below)).

2.9

The remainder of this chapter describes the importance of the traded and non-traded sectors and sets out the emissions reductions required from the key sectors to meet Scotland's 2020 targets.

THE TRADED AND NON-TRADED SECTORS

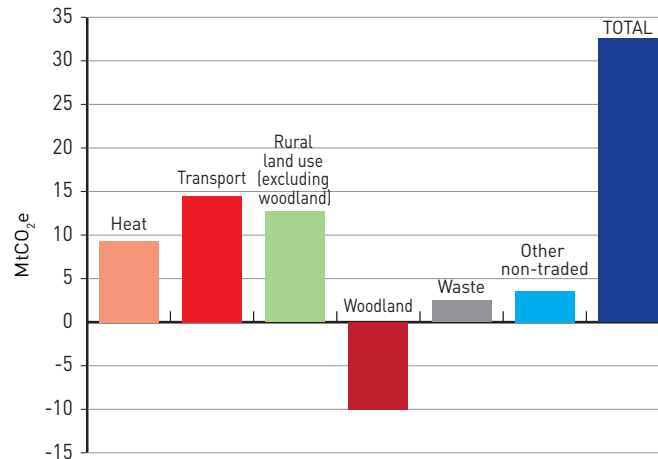
2.10

Scotland's major power stations and energy intensive industrial installations, covering around 40% of Scotland's greenhouse gas emissions, fall within the scope of the EU Emissions Trading Scheme, the world's primary carbon trading market, and often described as the "traded sector".

2.11

The non-traded sector consists of all the other sectors: heating domestic and non-domestic buildings; transport excluding aviation; rural land use including agriculture, forestry and other land use; and waste. Emissions in the key parts of the non-traded sector for 2006 are set out in Figure 2.

FIGURE 2: NON-TRADED SCOTTISH GREENHOUSE GAS EMISSIONS BY SECTOR, 2006



2.12

Emissions from the traded sector in Scotland, including aviation, which will be included in the EU Emissions Trading Scheme from 2012, equate to approximately 29 MtCO₂, which includes about 19 MtCO₂ from the production of the public supply of electricity.

2.13

The EU Emissions Trading Scheme is expected to deliver about two thirds of all emissions reductions in Europe to 2020. The emissions reduction trajectory for the traded sector is set at EU level. This carbon market is designed to uncover emissions reductions where they can be achieved at least cost. In this Plan, we apply the trajectory estimated by the Department of Energy and Climate Change for Scotland, although the portion of emissions that will be assigned to Scotland's emissions account is yet to be agreed formally. The EU Emissions Trading Scheme has developed in three phases: Phase 1 from 2005-2007; Phase 2 from 2008-2012; and Phase 3 from 2013-2020. The reduction in allocated emissions to Scotland over these three phases, from 2005 to 2020, is set out in Figure 3, and takes the form of roughly constant emissions to 2012 followed by annual reductions of around 2% from 2013 to 2020. Figure 4 shows the difference between actual (end of year) Scottish emissions and allocated emissions in the traded sector between 2005 and 2007.

2.14

Accounting for emissions reductions in the traded sector is more complicated than simply examining the end of year emissions themselves. The crucial point about the EU Emissions Trading Scheme is that emissions are allowed to go up or down in Scotland as long as overall emissions in the EU scheme are capped and reducing. To account for this situation, emissions are allocated to countries through their industry allowance allocations or through the allocation of auctioning rights. This means that the net Scottish emissions account will show the emissions plus/minus carbon units from the traded sector on a fixed downward trajectory to 2020, regardless of end-of-year emissions.



FIGURE 3: SCOTLAND'S TRADED SECTOR ALLOCATION, 2005 TO 2020¹¹

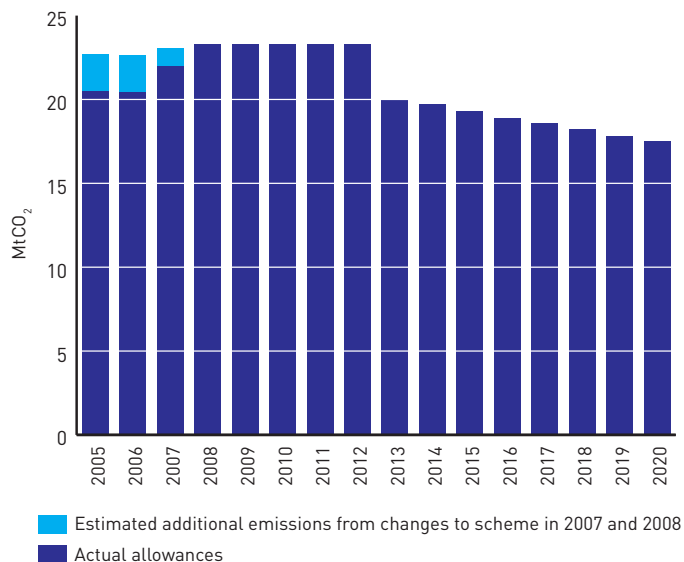
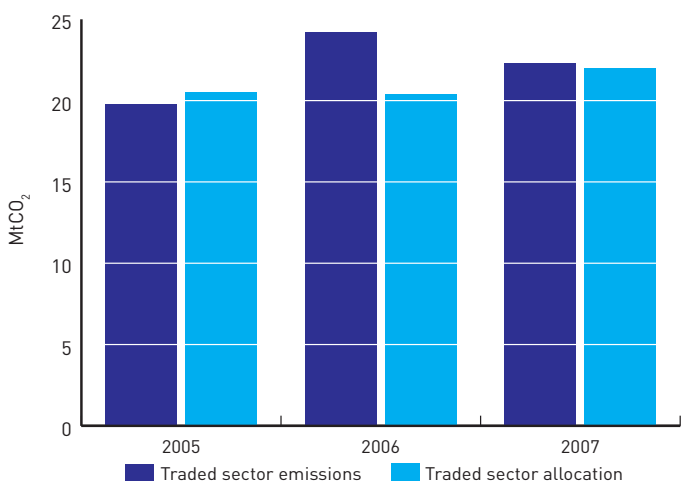


FIGURE 4: SCOTTISH TRADED SECTOR ACTUAL EMISSIONS AND ALLOCATION, 2005 TO 2007



¹¹ Allocation from 2008 to 2020 is an estimate and may change depending on how the UK's new entrant reserve is allocated.

2.15

The impact of the traded sector in contributing to the delivery of Scotland's 2020 targets and transformational outcomes is considered in more detail in Chapter 3: Electricity Demand and Supply.

2.16

A key forthcoming policy lever which operates across both the traded and non-traded sector is the Carbon Reduction Commitment. The Carbon Reduction Commitment is a mandatory emissions trading scheme being implemented jointly by the UK Government and Devolved Administrations. It begins in April 2010 and will regulate emissions from large, non-energy-intensive commercial and public sector organisations which are not already covered by the EU Emissions Trading Scheme or Climate Change Agreements. These include supermarkets, hotel chains, banks, local authorities and government departments. The Carbon Reduction Commitment is designed to generate a shift in awareness of energy use in large organisations and to drive changes in behaviour and infrastructure. After a three year introductory phase, an annually-decreasing emissions cap will be set, the level of which will be decided following advice from the Committee on Climate Change.

2.17

Other key policy levers which straddle the traded and non-traded sectors, although with greater emphasis on reducing heat demand, are the suite of UK supplier obligations which aim to mobilise and support a radical shift in our use of energy in our homes. The Carbon Emissions Reduction Target is a statutory obligation on energy suppliers to achieve carbon targets by encouraging households to take up energy efficiency and low carbon measures. The UK Government's proposed Community Energy Saving Programme would place an obligation on energy suppliers and electricity generators to meet a carbon reduction target by offering energy efficiency measures to domestic consumers using a 'whole house approach'. Although the Carbon Emissions Reduction Target (and the Community Energy Saving Programme) is reserved, it impacts on and interacts with devolved policies such as Scottish Government fuel poverty, climate change, renewables and energy efficiency initiatives.

MEETING SCOTLAND'S 2020 TARGETS

2.18

The Committee on Climate Change's First Report¹² laid out measures for meeting a 34% UK target in the absence of a new global agreement, and additional measures for meeting a 42% target without purchasing extra carbon credits. The 34% measures selected were those with a marginal abatement cost of less than the forecast price of carbon in 2020, £40/tCO₂e, or those with a higher cost that were considered important stepping stones on the way to 2050. The additional measures for 42% were further feasible, but more radical, options.

2.19

To achieve Scotland's interim targets in 2020, significant cuts in emissions are required in both the traded and non-traded sectors. On the basis of advice from the Committee on Climate Change and internal analysis within the Scottish Government, the relative effort required by each of these sectors is likely to be as set out in Figure 5 and Figure 6.

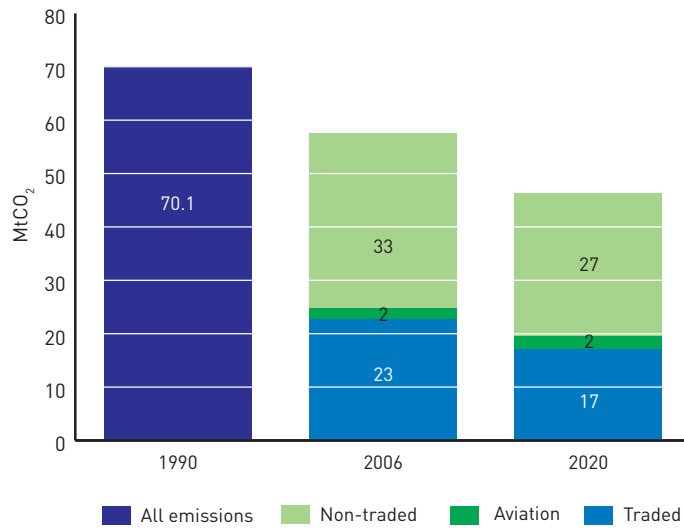
2.20

The Emissions Trading Scheme ensures that the anticipated emissions reductions are achieved from the traded sector to 2020. In the event of a global deal, the EU will set the Emissions Trading Scheme on a steeper trajectory, thereby providing additional support for Scotland's 42% interim target. The carbon savings from the traded sector for the 34% and 42% targets are set out in Figure 5 and Figure 6. Under agreements at EU level, half of the additional emissions reductions to meet the 42% target must come from abatement measures within the EU traded sector. The option is available for the other half to come from the purchase of international carbon units by participating installations in the EU Emissions Trading Scheme.

¹² Available from: <http://www.theccc.org.uk/reports/>



FIGURE 5: CONTRIBUTIONS FROM THE TRADED¹³ AND NON-TRADED SECTORS TO MEET THE 34% TARGET IN 2020



2.21

Significant, and proportionately higher, reductions will also have to be made in the non-traded sector. To meet the different targets the non-traded sector needs to deliver an annual reduction in 2020 (against 2006 levels) of:

- About 6 MtCO₂e for the 34% target; and
- About 8 MtCO₂e for the 42% target.

2.22

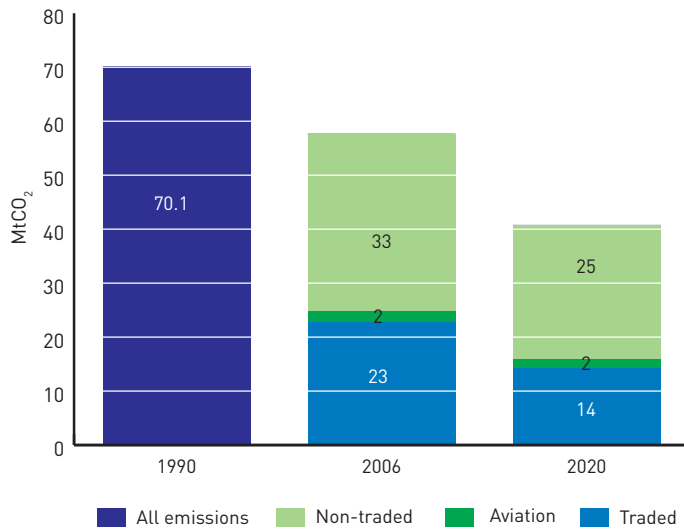
Table 1 shows the key sectors for abatement to 2020 and the emissions reductions necessary. The analysis supporting this Plan suggests that meeting the statutory 2020 target will depend on all potential cost-effective emissions reductions being delivered in full.

SUMMARY OF MILESTONES AND ACTIONS TO 2020, 2030 AND 2050

2.23

Table 2 outlines the key milestones and actions, across all sectors, associated with the delivery of the 2020 targets and the transformational outcomes to meet the ultimate goal of reducing emissions by at least 80% by 2050. The following chapters consider each of the key sectors: Electricity Demand and Supply; Heat Demand and Supply; Transport; Rural Land Use; and Waste, in more detail.

FIGURE 6: CONTRIBUTIONS FROM THE TRADED¹³ AND NON-TRADED SECTORS TO MEET THE 42% TARGET IN 2020



¹³ The traded sector figure for 2006 includes estimated emissions from sites that joined the scheme in 2007 and 2008. Traded sector in 2020 excludes the extra coverage that will be added in 2013.



TABLE 1: NET EMISSIONS IN 1990 AND 2006, AND NECESSARY EMISSIONS REDUCTIONS IN 2020, BY SECTOR

	1990 emissions MtCO ₂ e	2006 emissions MtCO ₂ e	2020 emissions – 34% Scottish target		2020 emissions – 42% Scottish target			
			MtCO ₂ e	% change against ... 1990	% change against ... 2006	MtCO ₂ e	% change against ... 1990	% change against ... 2006
Traded sector allocation¹		22.8	17.5	–	–23%	14.2	–	–38%
Phase 1 traded sector	20.4							
Not traded in 2006 but traded in Phase II	2.4							
Aviation – domestic and international	1.1	2.0	1.8	+69%	–9%	1.8	+69%	–9%
Other, non-traded²		3.8	4.3	–	+13%	4.3	–	+13%
Other, before ETS introduced	33.2							
Heat	10.2	9.3	5.4	–47%	–42%	5.0	–51%	–46%
Domestic Buildings	7.8	7.3						
Non-domestic Buildings	2.4	2.1						
Transport	13.7	14.5	11.2	–18%	–23%	10.0	–27%	–32%
Road	9.2	10.5						
Rail	0.2	0.3						
Off-road	1.6	1.6						
Shipping – domestic and international	2.6	2.2						
Waste	5.7	2.5	1.6	–73%	–39%	1.5	–73%	–39%
Rural land use (excluding woodland)	14.5	12.7	12.0	–17%	–8%	11.4	–21%	–10%
Agricultural and other land use – net sources ³	16.9	15.7						
Agricultural and other land use – net sinks	–2.4	–2.9						
Woodland	–8.2	–10.1	–7.4	*	*	–7.7	*	*
TOTAL (after adjustment for EU ETS)	70.1	57.6	46.3	–34%	–20%	40.5	–42%	–30%

¹ The traded sector expanded its coverage in 2007 and in 2008, and the size of this extra coverage has been estimated and included in the 2006 total. Coverage will change again in 2013 but these changes have not been considered here.

² “Other, non-traded” comprises emissions that are currently not included in the EU ETS, but do not fit within the categories of “Heat”, “Transport”, etc. These are mainly from non-energy-intensive industry and products emitting non-CO₂ greenhouse gases.

³ Includes emissions from land converted to settlements, some of which may be in urban areas.

* Percentage has been omitted to avoid confusion when looking at changes in negative numbers.



TABLE 2: MILESTONES AND ACTIONS TO DELIVER THE CLIMATE CHANGE (SCOTLAND) BILL TARGETS

SECTOR		2020	2030	2050
ELECTRICITY	Milestone	More than 50% of electricity from renewable sources	De-carbonised electricity generation from renewables and fossil fuel plant with CCS	EU North Sea grid in place
	Actions	Substantial investment in marine and tidal energy and infrastructure; and in grid connections for offshore wind		
	Milestone Actions	Fully operational commercial CCS plant Publish CCS route map; win EU/UK CCS pilot plant project(s); CCS levy to fund commercialisation; demonstration plant by 2015		
	Milestone Actions	All homes have “smart” meters UK Government committed to deliver smart meters by 2020		
HEAT	Milestone Actions	11% of heat from renewable sources Renewable Heat Incentive delivers cost-effective low-carbon heat Maximise the use of all biomass resources for heating	Significant progress towards de-carbonised heat Move towards all off-gas grid properties using low carbon heat – communities have access to mature local biomass market Work towards replacing remaining natural gas grid with biogas and local heat networks	Largely de-carbonised heat supply
	Milestone Actions	All suitable cavity walls and lofts insulated where possible Home Insulation Scheme and Energy Assistance Package drive high take-up of insulation Develop low carbon building standards for 2016/7		
	Milestone Actions	Commercial and public sector uses energy efficiently Carbon Reduction Commitment in place from 2010		
TRANSPORT	Milestone Actions	EU delivers $\leq 95\text{g/km}$ target for new cars EU regulations forthcoming for new car and van efficiencies	Wholesale adoption of electric cars and vans Develop biofuels for use in HGVs, aviation and shipping	Transport largely de-carbonised
	Milestone Actions	Battery charging infrastructure network in cities/towns Plan and develop battery charging infrastructure		
RURAL LAND USE	Milestone Actions	Woodland planting rate raised to 10-15 kha/year; use of existing woodfuel resource maximised Develop new funding models	Additional woodfuel capacity from woodland expansion	Forest cover approaching 25% of Scotland
	Milestone Actions	All cost-effective land management measures have high adoption rates Support, advice and appropriate incentives for land managers		
WASTE	Milestone Actions	Land filling no more than 5% of municipal waste (2025) More waste streams banned from landfill Halt growth in municipal waste Monitor progress on anaerobic digestion Further measures to minimise waste, increase re-use and recycling Research project commissioned in 2009 on landfill bans	Further materials banned from landfill	Near zero emissions from landfill





CHAPTER 3: ELECTRICITY DEMAND AND SUPPLY

KEY MESSAGES

- The traded sector has to deliver emissions reductions in 2020 of about 5 MtCO₂e (34% Scottish target) or about 9 MtCO₂e (42% Scottish target) against 2006 levels
- Primacy is given to cost effective demand reduction including more efficient use of electricity
- It is essential to deliver Transformational Outcome 1:
A largely de-carbonised electricity generation sector by 2030, primarily using renewable sources for electricity generation with other electricity generation from fossil fuelled plants utilising carbon capture and storage
- As gas and oil use is largely phased out, there will be an increased demand for electricity from the heat and transport sectors
- Scotland has huge natural and comparative advantages and could become a world leader in the development of both renewable electricity and carbon capture and storage
- The delivery of the relevant Energy Pledges is essential (see Chapter 2)

BACKGROUND

3.1

Electricity use by homes and businesses is primarily for lighting, information technology and white goods and, for those premises off the gas grid, heating.

3.2

Greenhouse gas emissions in 2006 from large scale production of electricity were equivalent to over 30% of total Scottish emissions. These emissions were largely from Scotland's three thermal power stations: Longannet (coal), Peterhead (gas/oil) and Cogenzie (coal). Cogenzie is currently scheduled to close by 2015 at the latest under European legislation, while the other power stations are currently expected to continue generating electricity beyond 2020. Actual greenhouse gas emissions fluctuate significantly year on year for various reasons including fuel price fluctuations, demand from consumers, changing weather patterns, and rising levels of renewable electricity.

3.3

Emissions from power stations fall within the traded sector. Renewable sources of electricity have zero net emissions. Scottish emissions from this sector, as recorded in the net Scottish emissions account (see Chapter 2) follow the trajectory set for the EU traded sector, regardless of total electricity production or the amount of renewable electricity.

3.4

Energy policy is formally reserved to the UK Government and the bulk of powers affecting energy regulation are exercised by the UK Department of Energy and Climate Change. However, the Scottish Government does have powers over: the planning and consenting of electricity generating stations and overhead transmission lines; the promotion of renewable energy including the operation of the Renewable Obligation; and the promotion of energy efficiency.

3.5

Among the key infrastructure projects which the second National Planning Framework designates as national developments are electricity grid reinforcements necessary to realise the potential of Scotland's renewable energy resources and baseload electricity generation projects which will enable Scotland to play a lead role in the development of carbon capture and storage technology.

MEETING SCOTLAND'S 2020 TARGETS

3.6

As set out in **Table 1** in Chapter 2, the traded sector has to deliver emissions reductions in 2020 from 2006 levels of about 5 MtCO₂e (34% Scottish target) or about 9 MtCO₂e (42% Scottish target).

3.7

This level of savings has already been set at an EU level through the Emissions Trading Scheme. To meet the 34% Scottish target, the allocated emissions for Scotland's traded sector will decline by around 23% by 2020 (see **Table 1**). To meet a 42% Scottish target, allocated emissions will have to decline by around 38%.

3.8

Measures in the electricity sector which contribute to the meeting of the EU Emissions Trading Scheme cap to 2020 include:

- Demand reduction and management, and changing behaviour
- Promotion of renewable electricity, including micro- and small-scale production
- Efficiency standards in electrical products and appliances.

3.9

The measures and the actions relevant to the traded sector are summarised in **Table 3** at the end of this chapter. They are considered more fully below as each of the main delivery mechanisms is considered.



TRANSFORMATIONAL OUTCOME 1: DE-CARBONISING ELECTRICITY GENERATION

3.10

The primary transformational outcome for the traded sector is:

A largely de-carbonised electricity generation sector by 2030, primarily using renewable sources for electricity generation with other electricity generation from fossil-fuelled plants utilising carbon capture and storage.

3.11

This transformational outcome is the key to putting Scotland on the path towards a low carbon economy. The traded sector, on the basis of the present EU Emissions Trading Scheme provisions, is not designed to achieve this outcome. Additional interventions at UK and Scottish level are required over and above the current trajectory defined for the EU traded sector.

3.12

The measures needed to deliver the transformational outcome at reasonable economic cost are:

- Reduction in overall electricity demand and increase in energy efficiency of products and appliances
- Increase in renewable sources of electricity, including large-, small- and micro-scale developments
- Decrease in carbon intensity of any remaining thermal generation, through the use of carbon capture and storage.

These measures and the actions required to deliver them are summarised in **Table 3** at the end of this chapter. They are considered more fully below.

THE MAIN DELIVERY MECHANISMS

3.13

The main delivery mechanisms to de-carbonise the electricity generation sector by 2030 are:

- Managing demand/changing behaviour
- Renewable electricity
- Micro- and small-scale production of electricity; and
- Large-scale electricity generation.

Managing demand/changing behaviour

3.14

The inclusion of electricity production in the traded sector means that reducing electricity use does not have any material impact on the emissions trajectory recorded in the net Scottish emissions account, since the emission reduction trajectory is set regardless of levels of electricity consumption. However, reducing wasteful use of energy improves social and individual welfare and is a critical step towards a low carbon economy. It can also result in significant financial savings for the public sector and commercial organisations. Given the expected increase in demand for electricity from transport and heating energy requirements, more efficient use of electricity will be needed to moderate overall increase in demand. A key challenge for society is to ensure organisations and individuals take up the potential benefits associated with using energy efficiently. In late summer 2009, the Scottish Government will consult on the Energy Efficiency Action Plan which will cover both electricity and heat use, and will:

- Oversee the strategic direction of the Government's energy efficiency policies
- Set out indicative energy savings needed from different sectors to contribute to greenhouse gas reductions
- Set out key activities in each sector and identify key gaps in activity that need to be tackled. Activities include:
 - Replacing fuel poverty programmes with the Energy Assistance Package
 - Efforts to ensure Scotland retains a fair share of GB-wide domestic efficiency measures, funded through the GB-wide Carbon Emissions Reduction Target scheme
 - Bring forward further details for the first stage of an area based home insulation scheme.

3.15

A range of policies deliver financial and information support for more efficient use of electricity: including European appliance standards and labelling; new buildings standards; and actions undertaken under the UK supplier obligations to improve electrical energy efficiency in existing homes (see Chapter 2). The impact of individual behaviour is also critical in reducing electricity demand.

3.16

Evidence suggests that one of the barriers to householders taking action is that neither they, nor their suppliers, have sufficient knowledge about consumption levels within their house. To address this all households need smart meters to provide real time information on electricity consumption to the householder and supplier. The UK Government is committed to fitting smart gas and electricity meters to all homes by 2020¹⁴.

3.17

More effective understanding of household and business electricity consumption can lead to more sophisticated approaches to demand management, such as the use of dynamic pricing (where the price is set by demand levels through the day). This will enable load balancing across the electricity grid to cope more effectively with intermittent renewable sources of electricity, as well as increasing supplies of electricity into distribution networks from communities and businesses.

3.18

Businesses already have multiple economic instruments applied to their electricity use to encourage demand reduction, including: the Climate Change Levy (or associated Agreements); the price feed-through from the EU Emissions Trading Scheme; and for large electricity consumers the forthcoming Carbon Reduction Commitment. There are no immediate gaps in this policy framework, though the rate of emissions reductions does yet not match the targets set out in the Climate Change (Scotland) Bill.

¹⁴ The UK Government is presently consulting on the roll out of smart meters. The consultation asks about the proposal to have a stand alone display unit, and the kind of data provided by, and accessibility of, the displays.



Renewable Electricity

3.19

Scotland's renewable electricity policy framework, which is based on the Renewables Obligation on suppliers to source an increasing level of renewable electricity, is designed to deliver targets of 31% gross electricity demand from renewable sources by 2011 and at least 50% by 2020. This equates to 8.4 GW of installed renewables capacity by 2020; current activity suggests that these targets will be met comfortably. Scotland is estimated to have up to 60 GW of raw renewable electricity resources, which could make Scotland a major exporter of renewable electricity to the rest of UK and further afield. Delivering the onshore and offshore grid connections that will connect, transport and export this renewable energy potential is challenging. There are significant regulatory, financial, logistic and environmental considerations to address, which will involve balancing a range of policy considerations and views and making difficult decisions about developing Scotland's future grid network.

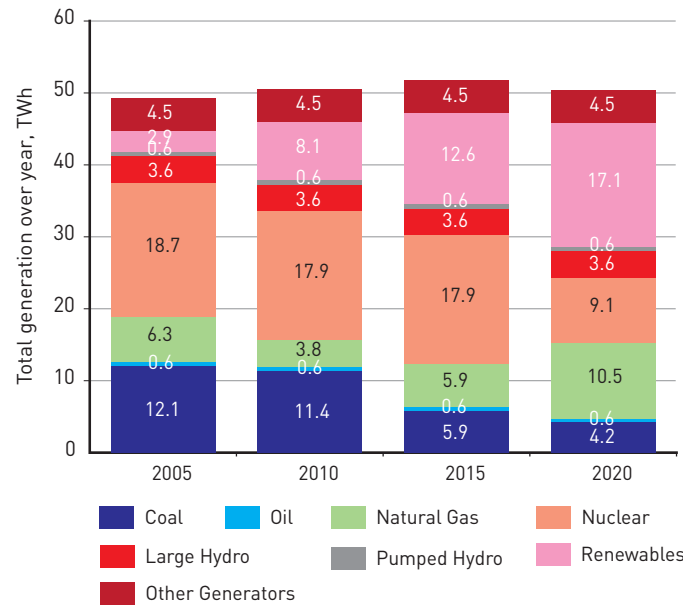
3.20

The requirement on the UK to meet EU renewable energy targets by 2020, equating to 15% of all energy use (including transport and heat) from renewable sources, will lead to strong demand from elsewhere in the UK for Scottish renewable electricity. Figure 7, taken from Volume 5 of the Scottish Energy Study¹⁵, sets out the electricity generation mix in 2005 and projections for 2010, 2015 and 2020.

3.21

The renewable electricity targets can be met without significant grid investment beyond that currently approved by Ofgem. But additional grid reinforcement, which is currently being planned, will accommodate over 11 GW of Scottish renewables generation by 2020 and over 25 GW by 2030. A new Scottish Renewables Action Plan will be published for consultation in summer 2009.

FIGURE 7: PROJECTED SCOTTISH ELECTRICITY GENERATION MIX TO 2020 (FROM SCOTTISH ENERGY STUDY VOLUME 5, 2008)



3.22

While renewable electricity can deliver the majority of Scotland's needs by 2030, intermittent renewable sources of electricity require back-up or grid balancing generation. There is an important pipeline of fossil-fuel technology projects, which are flexible systems to provide back-up to renewable generation and where necessary provide support. The National Planning Framework identifies potential sites for clean fossil fuel development and the range of onshore grid reinforcement that will be needed to deliver Scotland's renewable energy future, as well as highlighting the importance of sub-sea grid. The Scottish Government will shortly publish a roadmap for developing carbon capture and storage to support the outcome of the decarbonisation of electricity production by 2030. In addition, more sophisticated ("smart") grid balancing approaches are being developed, using dynamic demand management and distributed two way charging (for example from using electric vehicles plugged into the grid), ultra-capacitors, and hydrogen fuel cells.

Micro- and small-scale production of electricity.

3.23

Low carbon energy production by households or communities blurs the distinction between the electricity and heat sectors at local levels. Measures with abatement potential and milestones from these activities are reported in the heat sector chapter. This will include activities associated with any potential feed-in tariff for electricity.

Large-scale electricity generation

3.24

Both the Scottish and UK Governments are working to promote the deployment of carbon capture and storage demonstrators at fossil fuel power stations and will be consulting this summer on appropriate financial incentives. This approach seeks to bridge the technology innovation gap that currently exists between demonstration and full-scale operational carbon capture and storage plant.

3.25

Carbon capture and storage technologies have been demonstrated in isolation and on a small scale around the world. Full-scale demonstrators are expected to be built by 2013-2015, assuming appropriate financial support is available. Since new fossil-fuelled power stations have operational lives to well beyond 2030, it is necessary to impose guarantees that these power stations will be fitted with carbon capture technologies before 2030. The Scottish Government is currently considering which mechanisms might be put in place through its consenting powers to ensure that carbon capture and storage technology is installed at new and existing baseload stations as soon as possible.

¹⁵ <http://www.scotland.gov.uk/Publications/2008/11/14093227/0>



3.26

Over the next two decades, decommissioning activities currently planned will remove the current large-scale nuclear power stations in Scotland. Some level of new thermal power is therefore necessary to complement the rising renewable capacity. Scotland has the local technical expertise and the physical geology to be a world leader in carbon capture and storage technologies. This will bring substantial economic opportunities and benefits. However, the economic and environmental benefits will only be realised if both pilot and full-scale technologies operate in Scotland. It is likely that both nuclear and carbon capture storage technologies will be required in the UK and elsewhere. Given the competition for scarce industry skills globally, it makes sense for Scotland to focus on its current industry strengths, and its geological assets, to develop carbon capture and storage technologies, and thereby support the ongoing use of fossil-fuelled power stations, rather than nuclear.

3.27

The First Minister outlined actions for developing carbon capture and storage technologies on 1 May 2009, including:

- Proposals for UK and EU carbon capture and storage demonstration projects
- Research funding
- A Scottish consortium of Government, business and academics exploring the practicalities and costs of delivering carbon capture and storage in Scotland.

3.28

The Scottish Government will bring forward a carbon capture and storage route map later in 2009 which will set out the work necessary to ensure that all fossil-fuel generation operates with carbon capture and storage technology by 2030.

BARRIERS AND RISKS

3.29

The need for additional intervention during the next two decades to de-carbonise the sector by 2030 carries two key risks:

- The costs associated with bringing online additional renewables and delivering carbon capture and storage
- The possibility of failure of one of the key technologies, such as carbon capture and storage, or the failure of more effective demand management from the use of smart meters.

3.30

The actions needed to minimise these risks will be covered in the renewable energy and energy efficiency action plans and the carbon capture and storage route map.

NATIONAL CONVERSATION

3.31

A key issue for the Scottish Government is the lack of legislative powers in Scotland with the main responsibilities for energy policy and regulation reserved to Westminster. Scotland is emerging as a key player in energy policy at both UK and EU levels and having greater regulatory powers would ensure that electricity policy and regulations would be better aligned to ensure delivery of our statutory climate change targets and maximising Scotland's economic potential in renewable energy and carbon capture and storage.



TABLE 3: : DELIVERY PLAN FOR THE TRADED SECTOR AND ELECTRICITY DEMAND AND SUPPLY (for Aviation see Transport)

Measure	Required measures (34% Scottish target, 42% Scottish target or Transformational measure)	Action		
		Progress	What more do we need to do?	
ELECTRICITY AND REFINERIES (21.2 MtCO₂e in 2006)				
EU Emissions Trading Scheme	34% Scottish target	EU ETS is main policy lever for delivering traded sector reductions.	Current cap will deliver around 5 MtCO ₂ reduction in Scottish emissions between 2006 and 2020.	
	42% Scottish target	EU ETS cap will decrease faster if EU commits to a 30% reduction in emissions by 2020	Depends on outcome of Copenhagen negotiations in December 2009 – EU will commit to 30% if a global deal on emissions is agreed.	
Demand reduction and energy efficiency	T 2020	Behaviour change to reduce wasted electricity.	Energy Efficiency Action Plan being developed (end 2009 – see Energy Pledge 7). “Smart” meters for all households by 2020.	May require further marketing to incentivise action.
	T 2020	Increased energy efficiency of appliances.	Domestic efficiency measures funded by the UK-wide Carbon Emissions Reduction Target scheme. European appliance standards and labelling.	
Renewable energy	T 2020	50% of gross Scottish electricity consumption to come from renewable sources by 2020	On pathway to meet target. Will be largely delivered through hydro and onshore wind. Currently total capacity of renewables schemes either operating or with planning permission is 5.5 GW. Around another 3 GW of installed renewables capacity needed.	Significant investment in infrastructure and grid connections for off-shore wind required – see Energy Pledge 6. Regular dialogue to put pressure on UK Government and regulators to look more strategically at improving the grid. Ensure Green Energy Centre drives co-operative research and development into key green technologies across Europe and brings together the best of energy research institutes from across Scotland.
			Saltire Prize and establishment of Scottish European Green Energy Centre – see Energy Pledge 10.	
	T 2030	Delivery of significant wave and tidal energy	Renewables Action Plan (autumn 2009 – see Energy Pledge 1) will identify actions and resources required to deliver. Potential economic opportunity.	Substantial investment in marine and tidal energy and infrastructure – see Energy Pledge 6. FREDS Marine Energy Group has commissioned a study looking at the investment needed in infrastructure and supply chain for marine energy – findings will enable SG, SE, HIE and SDI to take strategic decisions on where investment should be focused.
Carbon Capture and Storage	T 2015 2020 2030	Working Scottish demonstration plant Fully operational, commercial CCS plant All remaining fossil fuel plants use CCS	See Energy Pledge 5 – Three UK sites entered for UK and EU competition. Thermal Guidance on carbon capture ready/CCS in preparation. Scottish report on CCS opportunities has been published. CCS route map forthcoming.	Ensure demonstration plant is delivered to “prove” CCS by working with the UK gov and other stakeholders to move into demonstration and then operational phases of CCS.
INDUSTRY (8.4 MTCO₂E IN 2006)				
Energy efficiency and Combined Heat and Power	34% Scottish target	Nearly all energy efficiency savings that have net costs less than £40/tCO ₂ plus some CHP	Carbon Reduction Commitment	Work with UK Government to ensure that the CRC cap is sufficiently tight to deliver real emissions reductions. Make funds available to ensure that all public sector buildings are brought up to standards required, rather than pay “fines”.





CHAPTER 4: HEAT DEMAND AND SUPPLY (and small-scale electricity production)

KEY MESSAGES

- Emissions from housing and non-domestic buildings have to be reduced in 2020 by 3.9 MtCO₂e (34% Scottish target) or by 4.3 MtCO₂e (42% Scottish target) against 2006 levels.
- Improved energy efficiency and reduction in energy demand through behavioural change will be crucial to deliver progress in the short term.
- It is essential to deliver Transformational Outcome 2:
A largely de-carbonised heat sector by 2050 with significant progress by 2030 through a combination of reduced demand and energy efficiency, together with a massive increase in the use of renewable or low-carbon heating.
- In the long term it will be necessary to replace the natural gas grid network with low carbon alternatives, in some cases operating through local heat networks.
- It will be essential for there to be a step change in the levels of renewable and low-carbon heat to 2020.
- There will be a need to mitigate the cost impacts of investment in carbon reduction on fuel poverty.
- The delivery of the relevant Energy Pledges is essential (see Chapter 2).

BACKGROUND

4.1

In Scotland, heat energy demand produces emissions of about 9 MtCO₂e (excluding emissions from electricity), which works out at 1.8 tonnes of CO₂e per person each year. In homes and businesses, this heat demand arises predominantly from water and space heating.

4.2

Reducing emissions related to heat energy is crucial to the reductions required in the non-traded sector to 2020 and beyond. It requires this sector to be “de-carbonised” by 2050 with significant progress towards that by 2030.

4.3

Energy policy in the heat sector is largely devolved. However, a number of the key delivery mechanisms, including supplier obligations such as the Carbon Emissions Reduction Target and the Community Energy Savings Programme (see Chapter 2) and the forthcoming Renewable Heat Incentive, operate on either a GB or UK basis.

4.4

Analysis suggests that there are many low or zero cost opportunities to reduce emissions rapidly in the short and medium term. For example, the up-front costs of measures such as loft and cavity wall insulation are quickly paid back through reduced fuel bills. However, other measures, such as solid wall insulation are much more expensive and disruptive with longer term pay back. There are some real challenges in the longer term, particularly in replacing the heating provision derived from the natural gas grid network and household boilers.

4.5

One of the challenges of delivering renewable heat energy is the difficulty in transporting it. Typically in the UK heat is generated on individual premises, though in other European countries local and district heat networks are common. While some forms of renewable heat generation are suitable at the individual household level, others work most effectively at community scales. To capture the benefit of such technologies therefore also requires cultural changes within local communities and businesses. The planning system has an important role in facilitating more decentralised patterns of energy generation and supply. The National Planning Framework requires local authorities to take account of the potential for developing heat networks when preparing development plans and considering major development proposals.

4.6

Commercial buildings, including shops, hotels and offices, are responsible for a significant proportion of Scotland’s carbon emissions. Improving the energy efficiency of commercial buildings, both existing and new, therefore needs action alongside improvements to domestic properties. Changes to existing properties can include improving thermal performance through replacement of windows and reducing energy use through more effective insulation and more efficient lighting and heating systems. In addition to refurbishment options, the replacement of obsolete commercial buildings provides important opportunities for improving energy performance.

4.7

Energy intensive businesses have a strong profit motive to use energy efficiently and multiple costs imposed by government through economic instruments (taxation, emissions trading schemes) encourage them to use energy more effectively. However, this is not the case for many non energy intensive or smaller businesses. The Carbon Reduction Commitment will provide larger commercial businesses and public sector organisations with an additional incentive to reduce heating demand or use lower carbon heat and the planning system and building standards have a role in facilitating improved energy efficiency in refurbished and new commercial properties.

4.8



Actions that reduce greenhouse gas emissions from heating needs are:

- Reduction in energy demand, either by improving boiler efficiency or improving insulation, fabric or controls in buildings
- Changes in lifestyle, resulting in lower demand for heating/cooling
- Use of lower carbon sources to generate heat energy including waste industrial heat and other forms of combined heat and power.

4.9

A distinction can be drawn between households and businesses connected to the natural gas grid network and the 30-35% that remain off-gas grid. The latter group are obvious candidates for earlier decarbonisation, on cost effectiveness grounds, since they are likely to be using relatively carbon intensive, expensive fuels such as heating oil or solid fuels. The former already use a low carbon fuel, natural gas, for their heating needs, with relatively low costs; unless prices spike, and in the absence of other incentives, we might expect these to be the last to convert to low carbon fuels.

4.10

Existing low-carbon technologies can reduce dependence on imported fuels and reduce the ongoing costs of meeting heating needs. Examples include:

- Ground, air & water source heat pumps (essentially reverse refrigerators)
- Dedicated biomass boilers
- Solar thermal water heating
- Biogas in place of natural gas in some instances.

MEETING SCOTLAND'S 2020 TARGETS

4.11

As set out in **Table 1**, emissions from housing and non-domestic buildings have to be reduced in 2020 by 3.9 MtCO₂e (34% Scottish target) or 4.3 MtCO₂e (42% Scottish target) from 2006 levels. Around three-quarters of savings for the 34% Scottish target could be delivered from housing.

4.12

Measures in the Heat sector which will contribute to the delivery of the 34% Scottish target in 2020 include:

- All current energy efficiency measures to deliver expected savings
- Additional measures to encourage industrial and business energy efficiency and productivity which cost less than £40/tCO₂e
- A step change in insulation of domestic buildings, including the insulation of all suitable cavity walls in Scotland and enhancement of all loft insulation where it is practical to do so
- Delivering the proposed 11% renewable heat target by 2020 through the forthcoming Renewable Heat Incentive
- Introduction of increasingly tight building regulations, leading to low-carbon requirements for all new houses from 2017.

4.13

Emerging results from new Scottish Government analytical tools based on Scottish data indicate that the scale of the challenge (both in terms of size of savings from identified measures and their cost) for reducing domestic emissions in Scotland to contribute to the delivery of either the 34% or 42% target may be greater than that envisaged by the Committee on Climate Change. Work is ongoing to refine our understanding of the carbon impacts of the key energy efficiency measures required and to ascertain their cost-effectiveness in comparison to other measures.

4.14

The measures and actions required to deliver the 2020 targets are summarised in **Table 4** at the end of this chapter and are considered more fully below.

TRANSFORMATIONAL OUTCOME 2: DE-CARBONISING THE HEAT SECTOR

4.15

The transformational outcome for the heat sector is:

A largely de-carbonised heat sector by 2050 with significant progress by 2030 through a combination of reduced demand and energy efficiency, together with a massive increase in the use of renewable or low-carbon heating.

4.16

Ultimately, meeting Scotland's 2050 target will require heating in Scotland to be almost zero carbon by that time. All cost-effective energy efficiency measures will need to have been undertaken, including some that are not cost effective at current world energy prices. Achieving this outcome will require the replacement of the natural gas network with low-carbon heat. Significant progress on low carbon heat needs to be made by 2030 and, as with the 2020 target, priority areas might include the use of heat pumps, biomass and solar water heating in off-grid households and businesses and local heat networks in new housing developments.

4.17

It is important to start to lay the groundwork now to de-carbonise the heat sector by 2050. That will mean incentivising individuals and businesses to install heating technologies that might currently cost more than £40/tCO₂e, but which are a stepping stone to the wider use of low-carbon heat sources.



THE MAIN DELIVERY MECHANISMS

4.18

The main delivery mechanisms to achieve the 2020 targets and de-carbonise the heat sector in the longer term are:

- Managing demand/changing behaviour
- Energy efficiency; and
- Low carbon heat.

Managing demand/changing behaviour

4.19

For a start, greater efforts will be made to encourage behavioural change - actions such as turning down the home heating thermostat, or washing clothes in cooler water. In Scotland, the potential emissions reductions associated with such behavioural change is nearly 0.3 MtCO₂e by 2020. UK households have on average increased the temperatures in their house from 13°C (1970) to 18°C (2006), although the energy consequences of this have been partially offset by rising ambient air temperatures.

4.20

Delivery of changes in behaviour cannot be achieved by the Government alone. The Energy Saving Scotland advice network is one source of help. A broader coalition of civil society and local communities, in part encouraged by the Climate Challenge Fund¹⁶, will need to make such behavioural adjustments socially acceptable.

4.21

Social norms do not, at present, encourage effective management of heat energy in homes or offices, though an increasing number of businesses will be subject to schemes such as the forthcoming Carbon Reduction Commitment.

ENERGY EFFICIENCY

4.22

More effective energy management and installation of efficiency measures have the potential to reduce greenhouse gas emissions most rapidly and at zero or near zero net cost. Non-domestic potential is predominantly associated with more effective energy management and the use of efficient heating and cooling equipment, lighting and controls. Domestic potential is predominantly associated with more effective insulation in housing, with some additional savings coming from early replacement of inefficient boilers.

4.23

Emissions reductions from energy management in the non-domestic sector will result from technical improvements in energy use by businesses. The realistic potential for these emissions reductions is estimated to be 0.4 MtCO₂e by 2020 in Scotland. A key driver for these savings will be the Carbon Reduction Commitment which will cap and reduce emissions from larger commercial businesses and the public sector in the UK through until 2020, either through the increased use of low carbon fuels or the more efficient use of heat and electrical energy in buildings. To deliver these savings, it is assumed that the carbon price will be around £40/tCO₂e in 2020 and act as a sufficient incentive for behaviour change in this sector.

4.24

In the domestic sector, achieving the heat sector's contribution to the 34% Scottish target will depend to a significant extent on existing policy tools, such as the Carbon Emissions Reduction Target and on the successful delivery of the proposals outlined in recent consultations by the UK Government, in particular the scope and ambition of future supplier obligations such as the Community Energy Saving Programme and the Renewable Heat Incentive. These programmes act as a bridge from current policies focusing on low cost basic insulation measures towards more expensive whole-house approaches which deliver large reductions in emissions. The Scottish Government is bringing forward an ambitious area based Home Insulation Scheme to increase the uptake of energy efficiency measures such as loft and cavity wall insulation.

4.25

Enhanced insulation will include much greater provision of insulation in cavity walls and lofts, plus a step change in the number of homes receiving more expensive measures such as solid wall insulation. However, the constraints on delivering all these technical measures are likely to be associated with:

- Adapting the existing skills and accreditation of existing installers to manage new technologies;
- Individual behavioural barriers, hindering the installation of more intrusive technologies and measures, such as solid wall insulation;
- The readiness of the UK Government to increase the obligations placed on energy companies to the level needed to ensure that potentially intrusive measures such as solid wall insulation are installed on a significant scale.

4.26

A key element of the strategy to reduce wasteful use of heat energy is through more effective building standards. These have already driven steep reductions in energy demand, and emissions, from households, estimated at over 60% between houses built in 1990 and houses built today. Further tightening of these standards are expected over the next eight years, with the outcome that by 2020 all new houses built in Scotland will be low carbon. This is expected to deliver relative emissions reductions of nearly 0.2 MtCO₂e by 2020 compared with not introducing these new standards.

¹⁶ <http://www.scotland.gov.uk/Topics/SustainableDevelopment/funding/ClimateChallengeFund>



Low carbon heat

4.27

Achieving the Scottish Government's target of 11% renewable heat (which includes low carbon heat such as heat pumps) to 2020 will be critical to achieving the statutory targets set in the Climate Change (Scotland) Bill. We need to exploit the most cost effective opportunities to develop renewable heat in areas such as off-gas-grid domestic properties and the small business sector, and in the use of local heat networks in new housing developments. The UK Government's proposed Renewable Heat Incentive will provide financial incentives to encourage this. With an estimated 80% of installed boilers needing to be replaced by 2020, Scotland has a huge opportunity to influence the future direction of the heat market. The forthcoming Renewable Heat Action Plan due later in 2009 will develop these issues further.

4.28

Industrial requirements for heat are largely captured within the scope of the EU Emissions Trading Scheme. Their emissions reductions will be driven by the overall EU "traded sector" trajectory for reducing emissions and facilitated by the energy efficiency measures being directed at this sector. However, waste heat from these industrial processes is not currently used effectively. Opportunities to use this heat resource need to be identified, quantified and costed in Scotland, and the proposed Energy Efficiency Action Plan will consider this aspect.

4.29

Changing social attitudes to low carbon heat technologies is more challenging. The conditions need to be created in which the choice by a householder or small business to invest in a low carbon heating source, such as solar thermal, ground or air source heat pumps, or biomass boilers, is no more unusual than purchasing a new gas or oil boiler. This requires a clear framework in which suppliers can meet demand, installers are properly trained and accredited, householders know the cost implications and benefits of the low carbon heat source, and consideration is given to the air quality implications of the installation of biomass boilers, particularly in urban areas where there may already be air quality concerns.

4.30

The Renewable Heat Action plan will seek to provide the overarching framework; providing a focus on the actions needed, and by when, to deliver the necessary changes.

Barriers and Risks

4.31

The main risks to delivery of the emissions reductions identified are:

- Failure of UK Government supplier obligation policies to deliver sufficient savings in existing domestic households
- Insufficient carbon price to incentivise efficiency measures and energy management in businesses before 2020
- Missing opportunities associated with mapping and delivering waste industrial heat and community scale combined heat and power to business and domestic sectors
- Missing opportunities and removing barriers to the development of local heat networks in appropriate locations
- Failing to overcome household resistance to using non-conventional low carbon technologies, such as heat pumps, solar thermal and biomass boilers
- Failure to overcome "rebound effect" where positive behavioural change to more energy efficient practices lasts for only a short time
- Failure to deliver low carbon housing through enhanced building regulations or failure to enforce new building standards
- Failure to overcome tension between the goals of reducing emissions and tackling fuel poverty. Increasing energy prices to pay for emission reducing investment will tend to increase fuel poverty and have a disproportionate effect on those least able to afford it.

These risks will be addressed by the forthcoming energy efficiency and renewable heat action plans as well as ongoing work on Building Standards.

NATIONAL CONVERSATION

4.32

A key issue for the Scottish Government is the lack of legislative powers in Scotland with the main responsibilities for energy policy and regulation reserved to Westminster. Having greater regulatory powers would ensure that energy policy and regulations would be better aligned to ensure delivery of Scotland's statutory climate change targets and maximising Scotland's economic potential in renewable energy.

4.33

Regarding energy efficiency, the Scottish Government has recently called upon the UK Government to:

- legislate for a pro-rata level of energy efficiency supplier obligation activity in Scotland;
- give powers to the Scottish Government to enable it to direct and co-ordinate this activity through a co-ordinating body of its choice;
- recognise the variation in Scotland's climate and housing types;
- provide greater level of incentive for loft top-up.

4.34

This should help to guarantee that new energy efficiency investment includes Scotland's rural and island communities and ensure the accurate, disaggregated and regular reporting of energy efficiency related activity in Scotland.

4.35

This will also allow the Scottish Government to use and build upon the mechanisms that it has put in place (Energy Saving Scotland advice network) that deliver the Energy Assistance Package and Home Insulation Scheme to more effectively deliver any future energy efficiency obligation schemes.



TABLE 4: : DELIVERY PLAN FOR THE HEAT SECTOR – DOMESTIC BUILDINGS

Measure	Required measures (34% Scottish target, 42% Scottish target or Transformational measure)	Action		
		Progress	What more do we need to do?	
DOMESTIC BUILDINGS (7.3 MtCO₂e in 2006)				
Insulation and heat efficiency	34% Scottish target	High uptake of low cost insulation measures (loft and cavity wall), plus 10% of potential for solid wall insulation. Some replacement of inefficient boilers.	Home Insulation Scheme and Energy Assistance Package will assist in driving take-up of measures under the UK Government CERT scheme. Community Energy Saving Programme will increase level of solid wall insulation.	Continue to develop current Scottish Government schemes. Seek to ensure appropriate design of future UK Government supplier obligations.
	42% Scottish target	As above, but 40% solid wall insulation.	Not in current policy framework.	Significant expansion of whole house approach of the kind to be piloted under CESP.
Behaviour	34% Scottish target	Turning down thermostats by 1 degree. Switching off lights/appliances.	Energy Efficiency Action Plan being developed (end 2009 – see Energy Pledge 7). Energy efficiency advice to consumers through Energy Saving Scotland advice network.	Further marketing to incentivise action, followed, if necessary, by dynamic pricing.
Renewable heat	34% Scottish target	11% renewable heat target.	Renewable Heat Action Plan (in 2009 – see Energy Pledge 2). Renewable Heat Incentive (planned for April 2011).	
	T 2020	New housing connected to heat networks, heated by biomass or using low carbon heat, including renewables.	Will not be achieved under current policy framework. New building regulations will reduce demand for heat in new buildings – may limit feasibility of heat networks.	National Planning Framework requires local authorities to take account of the potential for new heat networks in development plans.
	2030	All off-grid properties using low carbon heat, including renewables.		
	2050	De-carbonised heat supply.	District heating will have high infrastructure costs.	
Low carbon new housing	34% Scottish target	Low carbon building regulations. All new homes low carbon by 2016/17 with cost-effective delivery of residual energy needs.	Proposed 2010 building standards would deliver around 70% reduction on 1990 levels. Levels recommended in Sullivan report for 2013 could produce up to 80% reductions compared with 1990. Net zero carbon homes by 2016/17 if practical.	Agree future standards for very low carbon buildings, and start now to ensure that every publicly funded home constructed anticipates those standards.
		Energy Performance Certificates.	EPCs already required for new builds and sale/let.	



TABLE 5: : DELIVERY PLAN FOR THE HEAT SECTOR – NON-DOMESTIC BUILDINGS

Measure	Required measures (34% Scottish target, 42% Scottish target or Transformational measure)	Action		
		Progress	What more do we need to do?	
NON-DOMESTIC BUILDINGS (2.1 MtCO₂e in 2006)				
Insulation and heat efficiency	34% Scottish target	Nearly all energy efficiency/ management savings costing less than £40/tCO ₂ . Small amounts of microgeneration/ CHP.	<p>Carbon Reduction Commitment.</p> <p>Energy efficiency advice to SMEs. Small business loans. Carbon Trust advice and support to large and energy-intensive businesses.</p> <p>Climate Change (Scotland) Bill proposes mandatory assessment of energy performance in existing non-domestic buildings.</p> <p>EPCs already required for sale/rental and public buildings.</p>	Mandatory upgrading of existing non-domestic buildings likely to be needed.
	42% Scottish target	As above, but more microgeneration/ CHP.	Current policy framework not sufficient to deliver. Scottish Business Rates Exemption for microgeneration.	More compulsion to achieve higher savings?
Renewable heat	34% Scottish target	11% renewable heat target.	<p>Renewable Heat Action Plan (in 2009 – see Energy Pledge 2).</p> <p>Scottish Biomass Heat Scheme (£3.3m 2009-10 and 2010-11).</p> <p>Renewable Heat Incentive (planned for April 2011).</p>	Extend Scottish Biomass Heat Scheme until Renewable Heat Incentive is fully operational.
Low carbon new buildings	34% Scottish target	All new non-domestic buildings very low carbon by 2016/17 with cost-effective delivery of residual energy needs.	<p>Proposed 2010 building standards would deliver around 70% reduction on 1990 levels. Levels recommended in Sullivan report for 2013 could produce 80% reductions.</p> <p>EPCs already required for new buildings.</p>	Agree future standards for very low carbon buildings, and anticipate those standards in all publicly supported buildings procured from 2010.



CLIMATE CHANGE DELIVERY PLAN

CHAPTER 4: HEAT DEMAND AND SUPPLY (and small-scale electricity production)





CHAPTER 5: TRANSPORT SECTOR

KEY MESSAGES

- Transport emissions in Scotland (excluding aviation) were 14.5 MtCO₂e in 2006. Emissions need to be reduced in 2020 by 3.3 MtCO₂e (34% Scottish target) or by 4.6 MtCO₂e (42% Scottish target) against 2006 levels.
- It is essential to deliver Transformational Outcome 3:
Almost complete decarbonisation of road transport by 2050 with significant progress by 2030 through wholesale adoption of electric cars and vans, and significant decarbonisation of rail by 2050.
- There is a need for additional planning and demand management measures through to 2020 to reduce the need for travel and the carbon intensity of travel; and to maximise active travel (e.g. walking and cycling).
- Improved vehicle technologies, primarily the shift to hybrid and electric vehicles, will provide substantial emissions reductions.
- An electric charging infrastructure to support the use of plug-in hybrid and electric vehicles across Scotland will need to be planned and developed.
- Action in the traded sector will be needed to offset any growth in emissions from aviation (which will be included in the EU Emissions Trading Scheme from 2012).
- A number of key policy levers for the transport sector sit at the UK or EU level. Scotland has powers over measures such as:
 - infrastructure and local speed limits
 - Smarter Measures including adoption of more fuel efficient “eco-“ driving;
 - demand management measures including road space reallocation
 - prioritising integrated public transport and maximising active travel
 - influencing the location of new development through the planning system.
- Emissions from transport can be expected to decrease significantly but only in the medium term.
- The delivery of the relevant Energy Pledges is essential (see Chapter 2).

BACKGROUND

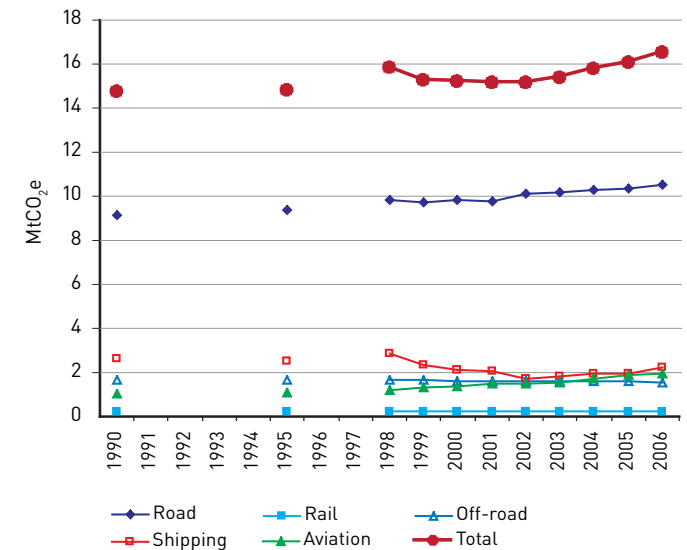
5.1

Emissions from the transport sector were 14.5 MtCO₂e in 2006, excluding aviation but including shipping and off-road (e.g. agricultural) vehicles. Recent years have seen rising demand in the transport sector with increasing greenhouse gas emissions.

5.2

Emissions by travel mode between 1990 and 2006 are set out in **Figure 8**. The largest component is road transport, with 10.5 MtCO₂e in 2006, up from 9.2 MtCO₂e in 1990. Scotland's aviation emissions¹⁷ totalled 2.0 MtCO₂e in 2006, almost double the emissions in 1990, and 3% of total net Scottish emissions. Some 43% of these emissions came from flights within the UK.

FIGURE 8: TRANSPORT EMISSIONS FROM 1990 TO 2006, BY MODE



¹⁷ Domestic and international aviation emissions are computed without an adjustment for radiative forcing – this is in line with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.



5.3

Current forecasts of transport demand suggest continued growth until 2020¹⁸. Forecasts also suggest an increase in UK aviation emissions of over 50% between 2005 and 2050¹⁹.

5.4

Emissions reductions in the transport sector can be achieved in a number of ways, including:

- Reduction in demand for travel; and/or
- Reduction in the carbon intensity within each mode of transport; and/or
- A shift from more carbon intensive to less carbon intensive modes of transport.

MEETING SCOTLAND'S 2020 TARGETS

5.5

As set out in **Table 1** in Chapter 2, emissions from transport (excluding aviation, for which see below) have to be reduced in 2020 by 3.3 MtCO_{2e} (34% Scottish target) or by 4.6 MtCO_{2e} (42% Scottish target) against 2006 levels.

5.6

Measures in the transport sector which will contribute to the delivery of the 34% Scottish target in 2020 include:

- Improvements in energy efficiency of petrol and diesel vehicles, and increasing uptake of hybrid and electric engines with supporting infrastructure
- Smarter Measures including reduced travel and modal shift to less carbon-intensive modes of transport, e.g. public transport and active travel (e.g. walking and cycling)
- Demand management including road space reallocation
- Changes to the pattern of development to reduce the need to travel

- Efficient driving: through improved driving behaviour, e.g. eco-driving, car sharing or lower speed limits
- Sustainable biofuels
- Improved energy efficiency of new ships.

5.7

Measures in the transport sector which will contribute to the delivery of the 42% Scottish target in 2020 will, in addition, include:

- More widespread uptake of improved vehicle efficiency in vans and HGVs
- More widespread adoption of eco-driving
- Speed limit reductions on motorways.

5.8

Public sector vehicle procurement policies will be key in leading by example in making the transfer from conventional to hybrid and electric cars and priming the demand for electric charging infrastructure.

5.9

Aviation emissions to 2020 will become part of the EU Emissions Trading Scheme. If aviation emissions continue to grow as predicted, the increase will be compensated by a reduction in emissions elsewhere in the EU traded sector (whose total emissions are capped).

5.10

The measures and actions required to deliver the 2020 targets are summarised in **Table 6** at the end of this chapter and are considered more fully below.

TRANSFORMATIONAL OUTCOME 3: DE-CARBONISING THE TRANSPORT SECTOR

5.11

The transformational outcome for the transport sector is: **Almost complete decarbonisation of road transport by 2050 with significant progress by 2030** through wholesale adoption of electric cars and vans, and significant decarbonisation of rail by 2050.

5.12

The increasing adoption of electric vehicles will in turn demand the planning and development of an electric charging infrastructure across Scotland. The move to electric cars together with other measures is expected to make a 50% reduction in road and rail transport emissions feasible by 2030. This will also have a significant positive impact on air quality. A Scottish Government consultation on low carbon vehicles will take place over summer 2009.

5.13

Other important measures may include the development of second and third generation biofuels or appropriate supplies of hydrogen fuels derived from low carbon sources. All transport measures are expected to make a 90% reduction in land transport emissions feasible by 2050.

5.14

There is also potential to reduce shipping emissions, but there are currently few incentives to do so. While the sector has made long term efficiency improvements and some technological advances, investment in shipping fleets inevitably takes time, with the result that early improvement in the emissions intensity of shipping will require additional interventions.

5.15

A key message is that emissions from transport can be expected to decrease significantly but only in the medium term. The measures and actions required to deliver the transformational outcome are summarised in **Table 6** at the end of this chapter and are considered more fully below.

¹⁸ Note that the CCC's reference projection for road transport in Scotland shows a decrease due to the methodology used. This is described in more detail in the Technical Annex accompanying this Plan.

¹⁹ Source: Committee on Climate Change.



MAIN DELIVERY MECHANISMS

5.16

The main delivery mechanisms to achieve the 2020 targets and to de-carbonise the road and rail sector by 2050 are:

- Road and rail transport: Technologies
- Road and rail transport: Alternative fuels
- Road and rail transport: Demand management and behaviour change
- Aviation; and
- Shipping.

Road and rail transport: Technologies

5.17

Major uptake of new car and van technologies is likely to be required to significantly reduce transport emissions: the power to deliver such change rests with the European Union. Improved road vehicle technologies, some pre, and others post, 2020 include:

- Non-engine measures such as improved aerodynamics, weight reduction, gear shift indicators and low rolling resistance tyres
- Improved engine efficiencies in conventional petrol and diesel vehicles
- Increased use of hybrid engine technologies in petrol and diesel vehicles, which capture and use the energy dissipated in deceleration and braking
- Adoption of plug-in hybrids (which switch between using electricity and petrol/diesel depending on the type of driving) and/or fully electric vehicles
- Much further in the future, hydrogen fuel cell technology, using hydrogen produced by renewable sources of energy.

5.18

Current rates of new technology uptake are not sufficient to force substantial emissions reductions from the road transport sector. New mandatory EU targets will require manufacturers to meet average carbon intensity targets for new cars sold of less than 95 gCO₂/km by 2020. The UK has further to go than other EU countries. In 2006, the UK's new cars had an average carbon intensity of 167 gCO₂/km, higher than EU average emissions of 160 gCO₂/km (largely because of a high proportion of large cars)²⁰.

5.19

This process of technology improvement will be driven by international and EU markets and emissions requirements; Scotland can play its part by facilitating and supporting these technology shifts through a number of mechanisms. A key milestone will be ensuring the necessary infrastructure and electricity generation capacity to charge electric and plug-in hybrid vehicles is available in Scotland.

5.20

The Committee on Climate Change has modelled potential UK uptake rates for new vehicle technology for both the 34% and 42% Scottish targets, compared with a “business as usual” scenario.

- Under business as usual, over 99% of new cars and 100% of new vans and HGVs use conventional or advanced petrol and diesel engines in 2020
- In a 34% Scottish target, only 3% of new cars use this type of engine, with around three-quarters using stop-start, micro hybrid or hybrid engines, and over 20% plug-in hybrid or fully electric
- In a 42% Scottish target, similar progress is needed in vans, with almost two-thirds stop-start, micro hybrid or hybrid engines, and more than 20% plug-in hybrid or fully electric.
- In both the 34% and 42% Scottish target, around half of new HGVs use stop-start or micro hybrid engines.

²⁰ Source: King Review.

5.21

The expected increase in the use of electricity for transport will need to be met by increased capacity of the grid. Full uptake of electric cars is estimated to require an additional 15% (or 5 TWh per year) of electrical energy relative to 2020 projections. However, charging vehicles outside the hours of peak electricity use, coupled with smart grids²¹, could help to mitigate against the intermittency of renewable energy sources.

5.22

Although emissions from diesel powered trains are relatively small (0.3 MtCO₂e in 2006) there is the potential to reduce emissions substantially through electrification. With the current electricity mix, electric trains produce around 30% fewer emissions than diesel engines per passenger-kilometre²². As the electricity sector de-carbonises, the gains from electrification will increase. Electrification of the rail network has been progressing for many years, The electrified network currently represents 49% of passenger journeys; under current Scottish Government action 64% of journeys will be on electric trains by 2020, with aspirations to deliver further electrification beyond 2020.

5.23

At the same time, developments in rolling stock technology will continue, with more efficient vehicles and technologies coming forward. There have recently been successful trials of hybrid diesel and battery powered trains which delivered an energy saving of approximately 20% per journey. If proven, these technologies will influence how the Scottish Government specifies future rolling stock.

²¹ A term describing a disparate set of goals associated with the modernisation of the electricity transmission and distribution networks.

²² Committee on Climate Change.



Road and rail transport: Alternative fuels

5.24

Heavy vehicles such as HGVs and buses require a higher intensity of energy than batteries can currently provide. Major reductions in carbon emissions cannot be achieved through new vehicle technologies alone; alternative fuels must play a key role.

5.25

Biofuels are one part of this solution, since sustainable sources of biofuels have low net carbon emissions. Technologies for converting many different types of biomass into fuels for internal combustion engines are well established. However, concerns about the overall impacts of existing biofuel production, including on food production, suggest that a cautious approach is appropriate. Following the Committee on Climate Change position, the Scottish Government assumes that biofuels will make up no more than 10% of transport fuel by volume (8% by energy) by 2020. Second and third generation biofuels may well play an important role in future, but require more research and analysis alongside decisions about the best use of land resources around the globe.

5.26

Hydrogen fuels, if produced from renewable sources, can offer an alternative to electricity as a fuel for all types of vehicles. Whilst already feasible for niche applications, hydrogen powered vehicles are not currently available on the mass market and are generally viewed as a longer term technology option. Challenges to the development of hydrogen vehicles and the prospect of them becoming commercially viable include:

- The difficulties of storing hydrogen in an energy dense form suitable for use in road vehicles
- The absence of a natural source of hydrogen means it has to be specifically produced, which is a relatively energy intensive and expensive process; and
- The requirement for a new supply infrastructure.

Road and rail transport: Demand management and behaviour change

5.27

Annual distances (vehicle-km) travelled by cars have increased almost constantly since 1975, when statistics were first available²³; this increase is expected to continue²⁴. In the short term, progress in reducing emissions will entail creating viable alternatives as a means of reducing the need for carbon intensive travel.

5.28

Demand management measures, many with concurrent benefits to health and wellbeing, include:

- Road space reallocation with priority to less carbon-intensive modes of transport, e.g. public transport and active travel
- Parking strategies which incentivise low carbon vehicles
- Choices about the location of new development to reduce the need to travel or to reduce the carbon intensity of travel
- Efficient driving: through. eco-driving or lower speed limits.

5.29

Current policies for addressing demand include the “Smarter Choices, Smarter Places” pilot of investment in infrastructure and sustainable travel initiatives in seven demonstration communities. The findings from this pilot will be transferable across locations in Scotland and, if successful, will help contribute to the Government’s long-term objectives.

5.30

In the medium to long term (2030 to 2050) the benefits of promoting increased levels of active travel are likely to be predominantly better health, reduced congestion and less time wasted in travelling. Increases in vehicle efficiency are expected to reduce the emissions reduction impact of these measures.

²³ Source: Main Transport Trends, Scottish Government (2008).

²⁴ Note that the CCC’s reference projection for road transport in Scotland shows a decrease due to the methodology used. This is described in more detail in the Technical Annex accompanying this Plan.

Aviation

5.31

Aviation will be included in the EU Emissions Trading Scheme from 2012. The number of allowances to the aviation industry will initially be capped at 97% of average emissions between 2004 and 2006, reducing to 95% from 2013.

5.32

Under this scheme, if emissions increase above the level of allowances agreed by EU Member States there must be compensatory emissions reductions in other parts of the traded sector. Scottish aviation emissions reported in the net Scottish emissions account are fixed by the number of allowances or auctioning rights allocated to Scotland through to 2020.

5.33

Opportunities to reduce actual emissions from aviation lie in the following broad areas: technological improvements, including to engines, aircraft design and fuel type; operational improvement, including the different routing of services or increased passenger loading of aircraft; and behavioural change, including modal shift by users to alternative forms of travel. The Scottish Government has little influence over these factors.

5.34

Research shows that the introduction of High Speed Rail services between city locations served by aviation links can achieve significant modal shift from air to rail. High Speed Rail achieves this particularly well at distances of around 400 to 450 miles, the distance between Scotland’s central belt and London. Currently, Britain’s busiest domestic air routes are from Edinburgh and Glasgow to London, which account for almost a half of Scotland’s total domestic aviation demand. High Speed Rail has the potential to significantly reduce domestic air travel between the central belt and England, but the investment would be largely in England.



Shipping

5.35

Scottish emissions from shipping are similar to those from its aviation activities, at just over 2 MtCO₂e in 2006. Just under half comes from domestic navigation, including from the oil, gas and fishing industries as well as ferries. However, historically, reported annual emissions have fluctuated over time. This may reflect the fact that there is currently uncertainty in the inventory figures, with a revision to shipping fuel use data having been identified as one of the top priorities in the development of an improvement programme for the Devolved Administrations' inventory data.

5.36

Shipping can be a very fuel efficient method of moving bulk freight, and is generally the most low carbon method currently available for long-distance movement of freight. However, though efficient compared to other modes, shipping does contribute to global carbon emissions, and movement of goods by ships continues to grow. For these reasons, while the shipping sector has not been a major focus of emissions reduction policy or technology development so far, there remains a strong case to consider technology options for reducing the carbon footprint of shipping over time.

5.37

Emissions reductions in shipping are possible through new technology, including improvements to current propulsion systems, methods to improve movement through the water, and a wide range of new and improved fuels. Furthermore, as shipping companies spend a large proportion of their operating costs on fuel, there is a significant incentive for them to invest in such measures to improve fuel economy. As the design life of vessels is 15-30 years, these improvements will only make reductions per tonne-kilometre possible over the medium to long term, but policy levers could accelerate earlier emissions reductions. Various policy levers are possible, though constrained by the international nature of shipping. Possible policy levers available include:

- Public sector investment in new vessels for subsidised lifeline ferry services
- Supporting the development of emissions reduction targets in shipping operations.

5.38

As with aviation, shipping is an international industry, so it is essential to develop an international approach for emissions reduction policy to be fully effective. The UK Government has already put a discussion paper to the International Maritime Organisation (IMO) on emissions trading and the possibilities of extending it to the shipping sector. The Scottish Government will continue to work with the UK Government, the IMO and other relevant international organisations to progress work.

5.39

By 2020, a 5-10% emissions reduction through technology measures and another 10% reduction through demand and fleet management could reduce shipping emissions by 0.4 MtCO₂e²⁵. By 2050 shipping emissions might be halved.

BARRIERS AND RISKS

5.40

The need for additional interventions during the next two decades to make significant progress towards de-carbonising the road transport sector by 2050 carries three key risks:

- The costs for the public and private sectors associated with a major shift from fossil fuels to electric and hybrid vehicles
- The possibility of failure of one or more of the key technologies in delivering expected emissions reductions and/or achieving market penetration
- Lack of public support and participation in both Smarter Measures and new vehicle technologies.

5.41

The actions needed to minimise these risks are being addressed for Smarter Measures in the Smarter Choices project being trialled across Scotland. Work is ongoing for new vehicle technologies with the first consultation due in summer 2009.

NATIONAL CONVERSATION

5.42

The majority of transport functions are already devolved to the Scottish Parliament. However, there are a number of areas where legislative powers and fiscal autonomy could contribute to meeting Scotland's statutory climate change targets. These include:

- Legislative powers to allow the Scottish Government to reduce emissions through setting lower national speed limits
- Fiscal autonomy to tailor fuel and vehicle excise duties to better take account of Scottish circumstances which could contribute to emissions reductions.

²⁵ Potential efficiency savings are cautious estimates based upon a 2007 report, 'Low carbon commercial shipping' produced by AEA Energy and Environment for the Department for Transport.



TABLE 6: DELIVERY PLAN FOR THE TRANSPORT SECTOR

Measure	Required measures (34% Scottish target, 42% Scottish target or Transformational measure)		Action	
			Progress	What more do we need to do?
ROAD AND RAIL TRANSPORT (10.8 MtCO₂e in 2006)				
Vehicle efficiency	34% world	Average new car efficiency 95 gCO ₂ /km in 2020. Increased efficiency in vans and HGVs, through advanced technologies. Most buses and coaches Euro IV standard by 2020.	Regulation for average new car efficiencies expected to be agreed soon. Framework for new van efficiencies under discussion. Environmentally-focused bus service operators' grant scheme being considered. Not in current policy framework.	Mandatory EU objectives – but also need to reduce UK average emissions relative to rest of EU. On a UK level, VED and other measures to stimulate uptake.
	42% world T	More widespread uptake of engine technologies in vans and more non-engine efficiency measures for HGVs. Decarbonisation of cars and vans requires wholesale switch to electric vehicles during 2020s.	Nascent industry working group on sustainable transport. Also see Energy Pledges 8 and 9.	Planning and development of battery charging infrastructure.
Eco driving	34% world	Adopted by 10% of car and van drivers and all HGV drivers.	Energy Saving Trust provide advice on eco-driving. Eco-driving now part of driving theory test. Freight Best Practice programme encourages efficient HGV driving.	Eco-driving assessed as part of practical driving test – DfT-led. Frequent reminders needed.
	42% world	Adopted by 40% of car and van drivers and all HGV drivers.	Not in current policy framework.	
Smarter Choices	34% world	Achievement of DfT's "central case" estimate of savings through shift to sustainable, off-peak and active travel.	Smarter Choices, Smarter Places. 7 demonstration towns investing in infrastructure and various initiatives for sustainable travel. Evaluated in 2012.	LA-led national roll-out if pilot successful.
Demand management	34% world	Measures to encourage shift away from cars: e.g. pedestrianising roads.	Some measures in place or being piloted: park & ride; potential for bus hard shoulder running; integrated ticketing.	Further work/national roll out, supported by financial measures if necessary.
Biofuels	34% world	Renewable Transport Fuels Obligation, 8% (energy) by 2020, in line with CCC report.	Gallagher review recommends maximum of 4-6% by energy unless biofuels demonstrably sustainable.	Develop sustainable biofuels.
Speed limit	42% world	Speed limit reduction to 60mph on motorways.	No plans at present; in UK Government hands. Eco driving delivering 2% reduction in energy use.	National speed limits currently set by UK, but lower local speed expectations to be set by local government.
Rail efficiencies ¹	34% world	Emissions reduction resulting from planned electrification (see text). Efficiencies in both electric and diesel rail through the Sustainable Rail Programme ² .	Other abatement measures include further introduction of regenerative braking in electric trains. Increased savings with introduction of new rolling stock to 2020.	Continued delivery of the Sustainable Rail Programme.
SHIPPING (2.2 MtCO₂e in 2006)				
Efficiency	34% world	Improved energy efficiency of new vessels combined with demand and fleet management.	No action in hand.	Support IMO work on extending emissions trading into shipping sector.
	42% world	Faster improvements needed.	Not in current policy framework.	
AVIATION (2.0 MtCO₂e in 2006)				
EU Emissions Trading Scheme	34% world	Inclusion of aviation in EU Emissions Trading Scheme in order to drive reductions in demand/ increased rate of improvements in fleet efficiency/ improved operational efficiency.	Aviation to be included in the EU ETS from 2012.	Promote high speed rail link from England.

¹ Savings from electric trains are in the traded sector.

² The Sustainable Rail Programme is led by the Sustainable Development Steering Group (SDSG), comprising senior government representatives (DfT and Transport Scotland) and chief executives from the rail industry.







CHAPTER 6: RURAL LAND USE

KEY MESSAGES

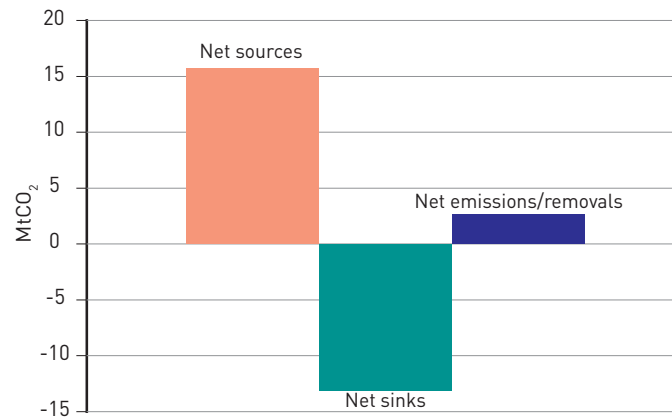
- Emissions from agriculture and agricultural land use have to be reduced in 2020 from 2006 levels by 0.7 MtCO₂e (34% Scottish target) or 1.3 MtCO₂e (42% Scottish target).
- Emissions from agriculture and agricultural related land use form a significant proportion of Scotland's greenhouse gas emissions although some of the emissions figures are very uncertain.
- The key milestone for forestry is to increase planting rates to 10,000 -15,000 hectares/yr by 2015 and to sustain that rate thereafter to maintain the levels of carbon sequestered annually in trees and soils; and to support the rapidly growing wood-fuel industry. There is likely to be a need for new models to finance the higher planting rates required.
- It is essential to deliver Transformational Outcome 4:
A comprehensive approach to ensure that carbon (including the cost of carbon) is fully factored into strategic and local decisions about rural land use through appropriate protection for Scotland's carbon rich soils; minimising emissions from agricultural and other land use businesses; encouraging the sequestration of carbon, for example through woodland planting; and the use of natural resources to generate renewable energy.
- A key challenge for this sector is to achieve these targets while working within the global context of increasing demand for food.
- Short term action will focus on improved advice and services to land managers and opportunities for grant aid through the Scotland Rural Development Programme.

BACKGROUND

6.1

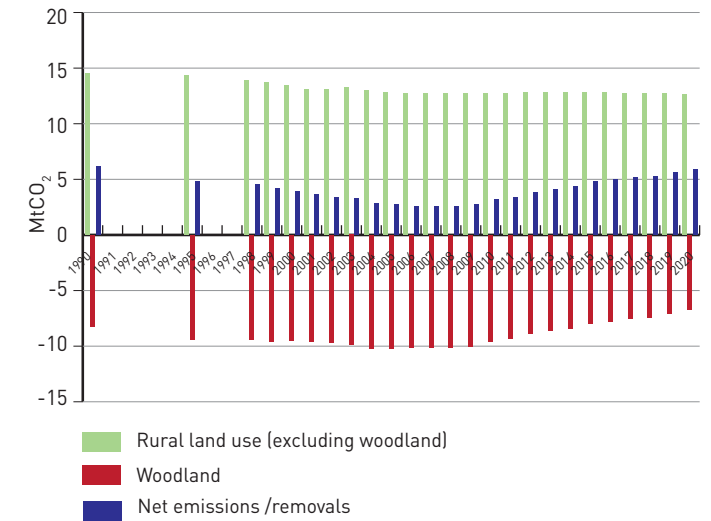
The land use sector gives rise to emissions from livestock, agricultural soils, from liquid and solid animal wastes, and from certain land use changes, for example, conversion of grassland to cropping. However, it is also a sector with the capacity to sequester carbon through the creation of woodlands and in soils. Allowing for the effect of sequestration, the net emissions from this sector were 2.6 MtCO₂e/yr in 2006. Figure 9 shows the net sources and net sinks²⁶ and the overall effect for 2006. Figure 10 sets out the historical emissions from these activities from 1990 to 2006 together with projections out to 2020.

FIGURE 9: RURAL LAND USE NET SOURCES, NET SINKS, AND OVERALL EMISSIONS, 2006



²⁶ Some of the Rural Land Use activities both emit and absorb carbon, so "net sources" means the sum of all activities that are net sources in the Inventory, and "net sinks" means the sum of all those that are net sinks

FIGURE 10: HISTORICAL AND PROJECTED EMISSIONS FROM THE RURAL LAND USE SECTOR, 1990 TO 2020



6.2

Rural land use activities are interrelated and interdependent. Land currently in agricultural use, for example, provides the bulk of the land for new woodland planting. A great deal of land in Scotland is used both for extensive grazing and sporting purposes. Much of Scotland's land has significant value for biodiversity and access to the outdoors and these public benefits may depend, in part, on agricultural and woodland management. Rural land management also provides a significant potential for the development of renewable energy for use by land based enterprises and rural communities. The Scottish Government recognised in 2008 that a lack of evidence was hindering decision-making by both government and stakeholders in relation to these choices and commissioned a Rural Land Use Study which is due to report in late 2009.



6.3

All rural land uses are heavily dependent on soils, topography and water. These are the natural resources which need to be managed to minimise emissions and maximise sequestration. Scottish soils are particularly important as a store of carbon, a fact recognised by the Scottish Government's recently published Scottish Soil Framework²⁷ which highlights protection and enhancement of soil organic matter and reduction of greenhouse gas emissions from soils as two key outcomes and priorities for action. Rural land use is also heavily dependent on the weather with the result that land management must both contribute to the reduction in global emissions and be in the forefront of adapting to anticipated changes in the climate.

6.4

The current estimates of emissions and sequestration from land use management as set out in the Inventory provide only, at best, a very rough guide for both policy and practical land use management. Some improved management practices which reduce emissions will not currently result in changes to the figures given in the Inventory. Others such as improvements in the use of energy on farms or the development of renewable sources of energy are not attributable to the land use sector but will appear elsewhere in the Inventory. There are also concerns about the accuracy of the significant emissions currently attributable to changes from cropping to grassland. Additionally, it should be noted that the carbon sequestered naturally in Scotland's peatlands is not accounted for in the Inventory and will not, therefore, be taken into account in the net Scottish emissions account.

6.5

None of these weaknesses with the current Inventory reduces the need for action to reduce emissions. They do place greater priority on identifying and addressing improvements over time and on considering supplementary means of demonstrating progress in the meantime.

MEETING SCOTLAND'S 2020 TARGETS

6.6

Projections to 2020 without additional interventions suggest that emissions from agriculture operations alone will rise slightly, to about 7.3 MtCO₂e/yr, driven largely by rising nitrous oxide (N₂O) emissions from fertiliser use more than offsetting the reduction in methane emissions from lower livestock numbers.

6.7

As set out in **Table 1** in Chapter 2, emissions from agriculture and land use have to be reduced in 2020 from 2006 levels by 0.7 MtCO₂e (34% Scottish target) or 1.3 MtCO₂e (42% Scottish target). Afforestation rates need to increase to 10,000 ha/yr by 2015 (34% Scottish target) or 15,000 ha/yr (42% Scottish target). Afforestation to 2020 will deliver some carbon benefits but the greatest levels of sequestration will be delivered in the period 2020 to 2050.

6.8

Measures in the rural land use sector which will contribute to the delivery of the 34% Scottish target in 2020 include:

- Measures to improve livestock productivity
- Improved manure and slurry management
- Development of anaerobic digestion
- Improved nutrient management systems
- Protecting high carbon soils
- Afforestation rates of 10,000 ha/yr.

6.9

Measures in the rural land use sector which will contribute to the delivery of the 42% Scottish target in 2020 will, in addition, focus on:

- Much higher uptake of many of the above measures
- Afforestation rates of 15,000 ha/yr.

6.10

The measures and actions required to deliver the 2020 targets are summarised in **Table 7** at the end of this chapter and are considered more fully below.

TRANSFORMATIONAL OUTCOME 4: A COMPREHENSIVE APPROACH TO CARBON IN RURAL LAND USE DECISIONS

6.11

The transformational outcome for the rural land use sector is:

A comprehensive approach to ensure that carbon (including the cost of carbon) is fully factored into strategic and local decisions about rural land use through appropriate protection for Scotland's carbon rich soils; minimising emissions from agricultural and other land use businesses; encouraging the sequestration of carbon, for example through woodland planting; and the use of natural resources to generate renewable energy.

6.12

The measures and actions required to deliver this transformational outcome are summarised in **Table 7** at the end of this chapter and are considered more fully below.

THE MAIN DELIVERY MECHANISMS

6.13

In the short term, advice and support for land managers will be crucial in ensuring awareness of the carbon implications of their actions and of best practice to help reduce emissions. Appropriate mechanisms include advisory services such as those provided by the Scottish Agricultural College and Government guidance on best practice.

6.14

The Scotland Rural Development Programme currently provides funding for a wide range of different land management activities. This Programme will need to give sufficient priority to those options which reduce emissions, strengthen sequestration and encourage the development of renewable energy. The broad potential rests in the shape of the Common Agricultural Policy beyond 2014 to be determined by the European Union. This might require new options, new ways of prioritising or setting payment levels, or new ways of attaching minimum conditions for receipt of payment.

²⁷ <http://www.scotland.gov.uk/Publications/2009/05/20145602/0>



6.15

Beyond 2020 there is likely to be further scope for reductions in emissions through the continued adoption of good practice together with the potential impact of technological and management innovations such as changes in animal genetics and feedstuffs. In addition, the scope for increased sequestration and the development of renewable energy sources should continue over this time horizon. Consumers may also be prepared to reduce the greenhouse gas emissions “embedded” in what they buy to consume.

Agriculture

6.16

Emissions from agricultural activities have a significant unavoidable component as they arise from natural biological processes. A relatively high proportion of the unavoidable component is associated with livestock production and thus presents a challenge to society’s current demand for products such as meat and dairy. The greatest impact on emissions within Scotland would be to decrease Scotland’s current production of meat and dairy products but it would be potentially self defeating to limit Scottish production if retailers simply stocked imported meat which might have higher greenhouse gas emissions per unit of product. The production of agricultural products is part of a globally traded system. For example, about 50% of lambs born in Scotland are exported to the rest of the UK for finishing. The Scottish Government is commissioning research on the carbon footprint of Scottish livestock products.

6.17

Avoidable emissions from agricultural activities are those that those can be reduced by changes in management practices such as changes in the timing and amounts of nitrogen fertiliser or application of slurry and manures in line with best practice. And farmers, along with other rural land managers, can help to increase the sequestration of carbon in the soil and vegetation, for example, by planting woodlands and by protecting high carbon soils. Analysis by the Scottish Government, based on original work by the Scottish Agricultural College for the Committee on Climate Change, suggests an emissions reduction potential of by 0.7 MtCO₂e (34% Scottish target) or 1.3 MtCO₂e (42% Scottish target) is possible by 2020 at reasonable cost, through a range of changes to nutrient, soil and livestock management.

6.18

There are also opportunities for reducing other emissions related to agricultural activities, such as off-road transport and energy use. The fact that these are not recorded in the agriculture or land use sections of the Inventory should not be a deterrent. Farmers can also take action to develop alternative sources of energy such anaerobic digestion using farm wastes. The full range of practical measures to reduce emissions is set out in the Scottish Government’s *Farming for a Better Climate*²⁸ programme.

Forestry

6.19

The potential for carbon savings in the forestry sector arises primarily²⁹ from increasing the forest area (afforestation) and from replacement of fossil fuels with sustainable sources of woodfuel (discussed in Chapter 4: Heat Demand and Supply). Product substitution, such as replacing concrete or steel with timber, also has significant potential and will be important in the assessment of a more holistic, consumption based approach but the benefits are not captured within the existing production-based emissions Inventory.

6.20

The significant increase in forest cover in Scotland from the 1950s to 1990s has sequestered a large volume of carbon dioxide. As these forests mature, the level of carbon sequestration will be balanced by emissions from decaying organic matter and harvesting of wood products. By 2020 and without additional plantings³⁰, projections suggest the net level of carbon sequestered from forestry will have fallen to 6.7 MtCO₂e/yr, compared with 10.1 MtCO₂e/yr in 2006, causing an increase in net Scottish emissions of over 3 MtCO₂e/yr by 2020.

²⁸ <http://www.scotland.gov.uk/Topics/Agriculture/Environment/climatechange/Advice>

²⁹ Including both analysis by AEA Technology (2008) and internal analysis by Forestry Commission Scotland.

6.21

Ministers have endorsed the Scottish Forestry Strategy target to increase woodland cover to 25% of Scottish land area (by the second half of the century). This will require additional planting levels of up to 15,000 ha/yr, compared with the current average rates of 4,000-5,000 ha/yr. Grant aid under the Scotland Rural Development Programme has not proved a sufficient incentive, and therefore Forestry Commission Scotland is considering alternative approaches to increase afforestation rates.

Semi-natural habitats

6.22

Semi-natural habitats make up around 50% of Scotland’s land-cover, with heathland and blanket bog as the predominant types. Such habitats support a range of biodiversity and contribute to the economy through extensive agriculture, game management and tourism, as well as locking carbon within soil and plant matter. Management of these areas can include controlled burning (muirburn) to improve productivity or biodiversity value. Although muirburn directly releases carbon dioxide from plant material, it can also be a valuable tool for reducing the risk of severe wildfires which can ignite peaty soils and woodlands, thereby releasing far greater volumes of greenhouse gases. Proposals to improve the regulation of muirburn and to encourage more widespread good practice are currently under consideration by the Scottish Government. More generally these habitats need to be managed in a manner that is consistent with climate change policy. As well as locking carbon in soils, improving habitats for wildlife can also help mitigate against the effects of a changing climate and help species adaptation.

³⁰ The planting rate under a “business as usual” scenario is assumed to be the “mid” rate of 4,000 ha/yr from the the CEH Inventory and Projections of UK Emissions by Sources and Removals by Sinks due to Land Use, Land Use Change and Forestry, available from: <http://www.edinburgh.ceh.ac.uk/ukcarbon/reports.htm>



Soils

6.23

Scottish soils are very rich in carbon; they store over 3,000 million tonnes of carbon, equivalent to over 180 years of annual Scottish greenhouse gas emissions. As a result, the management of this carbon store is extremely important. Of particular importance are Scottish peatlands, which make up the majority of Scottish soil carbon and over 50% of all UK soil carbon. Well managed soils will lead to further accumulations of carbon. Poorly managed carbon rich soils, for example, those subject to overgrazing, drainage, inappropriate ploughing and burning can lead to substantial emissions from this stock of carbon. The changing climate may also affect this stock of carbon but to a lesser extent.

6.24

The immediate need is to ensure appropriate protection for those peatlands and high carbon soils. There are a variety of targets relating to the protection of peatland within UK Habitat Action Plans. These cover management and condition of sites and will contribute to protecting peatlands. Other, short term actions, which are beginning to be addressed, include improving our understanding and measurement of the implications of different land use activities on Scotland's soil carbon. In particular, a better understanding is required of activities that might enhance the ability of soil to sequester carbon and reverse damage that has already taken place, for example, to areas of peatland.

A comprehensive approach to carbon in rural land use decisions

6.25

The opportunities for further reductions in greenhouse gas emissions in the rural land use sector up to 2050 will depend very largely on the balance required between the services required from Scotland's land. Determining the appropriate mix of land use, and within that the appropriate mix of farming, will lead to the transformational outcome for this overarching sector. This can be achieved by ensuring that carbon is properly factored into decisions about optimising the productivity of Scotland's natural resources.

6.26

This will require appropriate protection for Scotland's carbon rich soils, minimising, as far as possible, emissions from agriculture and other land use activities, and maximising the sequestration of carbon and the use of natural resources to generate renewable energy.

6.27

Economic instruments, such as emissions trading schemes or taxation, could contribute to the reduction in emissions within the rural land use management sector. However, there are issues around the difficulty of measuring emissions and the level of transaction costs given the number of businesses involved. Further work on the use of economic instruments in the rural sector may be required.

6.28

In the absence of applicable economic instruments, there is a greater need to increase alignment of payment and incentive systems for land use activities to provide clearer opportunities for land managers, particularly in the face of volatile farm commodity prices. Any changes of this nature would need to be consistent with the Common Agricultural Policy and other EU legislation.

6.29

The transformational outcome will require that both new and existing delivery mechanisms value carbon effectively and factor in carbon implications alongside the other objectives of rural land use including food and energy security, biodiversity and environmental heritage. A coherent framework is critically important and this will be a feature of the Rural Land Use Summit to be held later in 2009. It is also timely that the Climate Change (Scotland) Bill includes a commitment to develop a Land Use Strategy by March 2011. This strategy will build on the evidence gathered in the Rural Land Use Study which was launched in early autumn 2008 and the outputs from the Land Use Summit.

BARRIERS AND RISKS

6.30

The main risks to delivering the potential level of emissions reduction in the rural land sector are:

- The ability of increased advisory and communication activity, coupled with existing incentive structures, to realise the level of reductions required in avoidable emissions from the agriculture sector. There is a risk for the 34% Scottish target for 2020 and a more significant risk for a 42% target
- The development and implementation of new models in the forestry sector to realise the increased rate of afforestation
- Any lack of progress in improving the uncertainties in the Inventory and a means of monitoring the effectiveness of current efforts, leading to delays in action on the ground.

NATIONAL CONVERSATION

6.31

Scottish policy on agriculture, forestry and rural development has to work within the framework of the EU Common Agricultural Policy and therefore the ability of Scotland to negotiate in the EU is likely to increase Scotland's influence over the overarching policy and delivery framework.

6.32

Taxation has a fundamental influence on land use decisions. Greater flexibility to define a fiscal regime for Scotland would help align taxation regimes with Scotland's economic and environmental priorities.



TABLE 7: DELIVERY PLAN FOR THE RURAL LAND USE

Measure	Required measures (34% Scottish target, 42% Scottish target or Transformational measure)	Action		
		Progress	What more do we need to do?	
RURAL LAND USE (15.7 MtCO₂e from net sources and -13.1 MtCO₂e from net sinks in 2006)				
Livestock	34% Scottish target	Adopted by 45% of land managers: Improved storage of manures and slurries; genetic improvement and better management systems to improve animal productivity and fertility; action to improve animal health.	Supported scientific work on genetics and health. Advisory campaigns on animal health.	Tailor incentives in new Scotland Rural Development Programme.
	42% Scottish target	Further development of anaerobic digestion (AD) to treat on-farm and other bio-wastes. Same measures, but around 90% adoption.	Work on AD being taken forward. Now receives double Renewables Obligation Certificates.	Link with community green waste schemes. Regulation probably required to meet this level – e.g. along the lines of Cross Compliance applied to CAP payments.
Crops	34% Scottish target	Adopted by 45% of land managers: Minimising the release of emissions by applying nutrients at the optimum rate, timing nutrient applications in line with best practice, using manure, composts and slurries in preference to fertilisers; and choosing plant varieties which use nitrogen more efficiently.	Guidance and advice available, funding available for slurry management through SRDP. Considering establishment of advisory programme.	Shape incentives to incentivise desired outcome.
	42% Scottish target	Same measures, but around 90% adoption.		
Land and soil management	34% Scottish target	Protecting peatland and moorland; protecting and creating other semi-natural habitats; managing wetlands and flood plains; creating and managing farm woodlands; and reduced tillage.	Guidance and advice available. Considering establishment of advisory programme. Current emissions and the likely impact of these measures is uncertain.	New incentives or regulation if better understanding of issue does not lead to sufficient action.
Woodland creation	34% Scottish target	Planting rate of around 10 kha/year.	Planting currently only 4 kha/year.	Further intervention required to boost planting rates.
	42% Scottish target	Planting rate of 15 kha/year.	Work ongoing to develop funding streams through carbon offsetting and other funding models.	New funding models required.



CHAPTER 7: WASTE

KEY MESSAGES

- Emissions from waste have to be reduced in 2020 by 1.0 MtCO₂e against 2006 levels.
- Targets for reducing waste sent to landfill are set in part by EU legislation.
- Scotland has met the EU 2010 target on biodegradable municipal waste: subsequent targets will be challenging.
- Scotland has existing detailed targets on municipal waste prevention and recycling.
- More work is required to obtain better data on the amount of commercial waste and its composition.

BACKGROUND

7.1

In the absence of further interventions, emissions from waste are expected to reduce by at least 10%, from about 2.5 MtCO₂e in 2006 to about 2.2 MtCO₂e in 2020.

7.2

Key waste policies are driven in part by EU targets on reducing the amount of biodegradable municipal waste sent to landfill.

7.3

The UK Government Landfill Tax is a key driver for reducing the amount of waste sent to landfill. Other key drivers include funding, voluntary agreements with industry and producer responsibility legislation.

MEETING SCOTLAND'S 2020 AND 2050 TARGETS

7.4

Reducing the amount of commercial waste sent to landfill will be achieved through the Landfill Tax, producer responsibility legislation, voluntary agreements with industry and the provision of advice on resource efficiency and waste prevention.

7.5

Continued reductions in the amount of household waste sent to landfill will be achieved through more waste prevention work (eg on food waste); through more recycling and through infrastructure to treat residual waste. The use of anaerobic digestion to reduce food waste to landfill provides one opportunity which needs to be developed further in Scotland.

7.6

The UK Committee on Climate Change suggested provisional figures of a 0.7 MtCO₂e saving from the waste sector in Scotland by 2020. These figures were calculated before it was announced as part of the UK Government Budget that the standard rate of Landfill Tax would continue to increase up to 2013. So, a higher saving is a clear possibility.

THE MAIN DELIVERY MECHANISMS

7.7

Reducing landfill requires one or more of a range of measures including: fiscal, e.g. landfill tax; awareness, e.g. ensuring that businesses and householders have good information on recycling services; ensuring that energy is produced from waste efficiently; and using public procurement to drive waste management outcomes, e.g. using recycled material.

7.8

Work is ongoing to explore the practicalities of landfill bans; the project reports later in autumn 2009.

7.9

Provisions in the waste chapter of the Climate Change (Scotland) Bill could promote waste prevention and re-use, as well as improving separate collection of waste and thus making recycling easier. All of these would improve use of resources and reduce Scotland's carbon impacts.

7.10

Table 2 in Chapter 2 sets out the milestones, challenges, and actions in the short, medium and long term in this sector and Table 8 below identifies the measures needed to meet the targets in 2020.

NATIONAL CONVERSATION

7.11

Targets for reducing waste sent to landfill are set in part by EU legislation. The ability of Scotland to negotiate in the EU is likely to increase Scotland's influence over the overarching policy and delivery framework.

7.12

Taxation has a fundamental influence on waste decisions. Greater flexibility to define a fiscal regime for Scotland would help align taxation regimes with Scotland's economic and environmental priorities – for example, landfill tax and the aggregates levy are currently set at UK level.

7.13

Other areas where additional powers for Scotland could help to contribute to meeting climate change targets are the regulations covering excess packaging, to enable a more aggressive focus on packaging reduction, and the regulation of waste exports.



TABLE 8: DELIVERY PLAN FOR THE WASTE SECTOR

Measure	Required measures (34% Scottish target, 42% Scottish target or Transformational measure)	Action		
		Progress	What more do we need to do?	
WASTE (2.5 MtCO₂e in 2006)				
Reducing emissions from municipal waste	34% Scottish target	60% of municipal waste to be recycled/composted by 2020.	New National Waste Management Plan in 2010.	Ban biodegradable waste to landfill.
		<p>Minimise biodegradable waste sent to landfill in line with EU Landfill Directive targets in 2010, 2013 and 2020.</p> <p>Up to 25% can be used for Energy from Waste in high efficiency plants.</p> <p>Anaerobic digestion for biodegradable waste.</p>	<p>Municipal recycling rates increasing but pace of increase is slowing down.</p> <p>More landfill gas being captured – and amount of waste sent to landfill falling.</p> <p>2010 target on reducing the amount of biodegradable municipal waste sent to landfill has been met. However, 2013 target is very challenging.</p> <p>Carbon savings in Scotland and elsewhere identified from life cycle analysis</p> <p>Aim to stop growth in municipal waste by 2010: latest figures show waste growth is stabilising.</p> <p>AD to treat food waste is coming forward – now receives double Renewables Obligation Certificates – although close attention is needed on progress in this area.</p>	<p>Further progress on minimising waste, increasing re-use and recycling.</p> <p>Pay close attention to progress.</p>
Reducing emissions from commercial and industrial waste	34% Scottish target	Reduce biodegradable waste going to landfill.	UK landfill tax escalator drives reductions in landfill – has been extended to 2013.	Ban more waste from landfill: UK landfill ban project reports in September.
		<p>Anaerobic digestion for biodegradable waste (see above).</p> <p>Reuse or recycle 70% of Construction and Demolition waste by 2020: new target in EU Waste Framework Directive, which we are already close to meeting.</p>	<p>Producer responsibility obligation in a number of these areas.</p> <p>Voluntary agreements on waste with a number of industry sectors are in place or planned.</p> <p>Government supports advice to business on resource efficiency and waste prevention.</p>	<p>Further progress on minimising waste, increasing re-use and recycling.</p>







CHAPTER 8: NEXT STEPS

The legislative process

8.1

The Climate Change (Scotland) Bill, once enacted, will place a duty on Scottish Ministers to set annual targets for the maximum amount of the net Scottish emissions account, with those for the first period (2010-2022) having to be set by 1 June 2010. Before finalising these targets, Scottish Ministers are obliged to request advice from the relevant body which will be the Committee on Climate Change.

8.2

This Delivery Plan is necessarily at a high level and as such provides limited detail of abatement measures and how they will be delivered in practice. The Plan is a precursor to the first Report on Proposals and Policies which, under the provisions of the Bill, Scottish Ministers are obliged to lay before the Scottish Parliament, expected to be in summer 2010.

Strengthened governance arrangements

8.3

Given the statutory imperative of delivering the emissions reductions, new governance arrangements have been adopted in the Scottish Government to support the development work over the coming year and to ensure delivery of the final package of measures contained in the Report on Proposals and Policies. The Director General for the Environment has been appointed as the Government's climate change "champion" to oversee the delivery process with a new Climate Change Delivery Board established. The Board is supported by a Climate Change Operational Group which co-ordinates the work of 13 workstreams covering the key sectors and several cross-cutting areas. This reflects the wide-ranging nature of the abatement measures and the range of policy areas involved in tackling climate change.

8.4

The workstreams on the key sectors will be responsible for generating the next level of detail for the Report on Proposals and Policies. The Delivery Plan makes clear that transformational outcomes around energy, transport and land use must be delivered to put Scotland on the pathway to meeting its 2050 target. Delivering the 10 Energy Pledges will make a vital contribution. The Pledges form a coherent approach to energy issues, focussing on both short- and longer-term opportunities for Scotland to benefit from competitive advantage in the move towards a low-carbon economy, thereby contributing to economic recovery and growth and to addressing climate change.

8.5

Some of the measures in the Delivery Plan are existing or in train. These will be reviewed to ensure they will deliver the emissions reductions expected of them. Where the measures are new they will be worked up in more detail, including a timeline for their delivery in line with the milestones defined in the Delivery Plan. This will be supported by work to provide a more detailed assessment of abatement potential across all the key sectors, building a more distinct Scottish dimension to the analysis contained in the First Report of the Committee on Climate Change. The outcome of this work will be contained in the Report on Proposals and Policies.

8.6

The Government's proposals for future work will be reviewed in light of the final Climate Change (Scotland) Bill expected to be agreed in June.



New system of carbon management and assessment

8.7

One of the cross-cutting workstreams is responsible for the development of a new system of carbon management within the Scottish Government. Carbon is to become an integral part of the policy-making and budgetary processes. This will be a fundamental change of approach across government with carbon being treated in a similar way to finance and is a clear signal of the importance the Government attaches to addressing climate change. The development of an effective and workable means of carbon management, and its establishment, is required in time for the Bill's monitoring requirements coming into effect.

8.8

The Government's commitment to publish a carbon assessment of the Budget for 2010-11 (in September 2009) is a concrete expression of its intentions in this area. This assessment is supported by work currently underway to develop a High Level Assessment methodology to assess the carbon impact of the Government's expenditure. This is combined with an Individual Level Assessment which will develop a methodology to assess the potential emissions impact of a policy and then integrate this work into the overarching assessment of individual policies and programmes. Together, these carbon assessment tools will enable the Government to understand better the implications of its budgetary and policy choices and thereby facilitate the ongoing reduction in emissions associated with its decisions. The findings from the first phase of work to develop both of these assessment methodologies will be available during the second half of 2009.

Economic opportunities and costs

8.9

Early action in moving Scotland down the low carbon pathway is seen as providing Scotland with significant economic opportunities across all the key sectors. Existing work underway in this area will be enhanced to ensure that the economic potential is understood and realised. In the joint Communiqué agreed in May by the Scottish Government and the Scottish Trades Union Council it was agreed that Government analysts will undertake a scoping exercise of what research there is on the impact of climate change on employment at national and regional level. Further work is also required on the costs of policies in the Delivery Plan, the distribution of these costs, and ancillary impacts in terms of, for example, fuel poverty.

Improving the means of measuring progress

8.10

It is important that the impact of Scotland's abatement effort can be measured. The net Scottish emissions account will provide the basis for measuring progress against targets. As defined in the Climate Change (Scotland) Bill, this will be net emissions, based on Scotland's greenhouse gas emissions Inventory, with adjustments for credits and debits. The Inventory has its shortcomings, as discussed at various points in this Delivery Plan. Work is ongoing, with the UK Government and other Devolved Administrations, to improve the content of the Inventory, the current focus being on the energy and land use sectors, where the aim is to increase the resolution of the basic data upon which estimates of emissions are based. While some improvements can be made in the short term it is inevitable that others will take place over a longer time-scale. Other means of demonstrating progress which is not captured in the Inventory will need to be explored and could form part of a wider commentary on overall performance.

8.11

Importantly, options to improve the inventory compilation process at both a UK and Scotland level are being explored with a view to speeding up the reporting process.

Wider engagement and behaviour change

8.12

Delivering the scale of emissions reductions in the Delivery Plan will require real changes from all in Scottish society: government and the public sector, business, voluntary and community groups and individuals. An engagement strategy is being prepared to ensure we approach this in an effective and co-ordinated way.

8.13

The Scottish Environmental Attitudes and Behaviours Survey (SEABS) has offered an important insight into how people in Scotland think and behave on green issues. However, there is a need to deepen this understanding in order to influence attitudes and enable change. The next steps to this will involve:

- Commissioning in-depth qualitative follow up research into key aspects of SEABS that require further investigation; this is likely to consist of a suite of studies focusing on understanding behaviour change
- Developing further work on enabling behaviour change, ensuring that policy development is taken forward with a clear understanding of attitudes and behaviours
- Making SEABS findings more widely accessible to academic/analytical study.

8.14

Finally, it must be remembered that one of the key aims of the Scottish Government – in bringing forward the Climate Change (Scotland) Bill to set ambitious and challenging targets, and in producing this Delivery Plan to show how these targets can be delivered – is to demonstrate strong leadership to others and to use this to influence the international community. The engagement strategy will need to consider how the Scottish Government will galvanise support and action from others in the global effort to tackle climate change.



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ISBN: 978-0-7559-8074-1

This document is also available on the Scottish Government website:
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