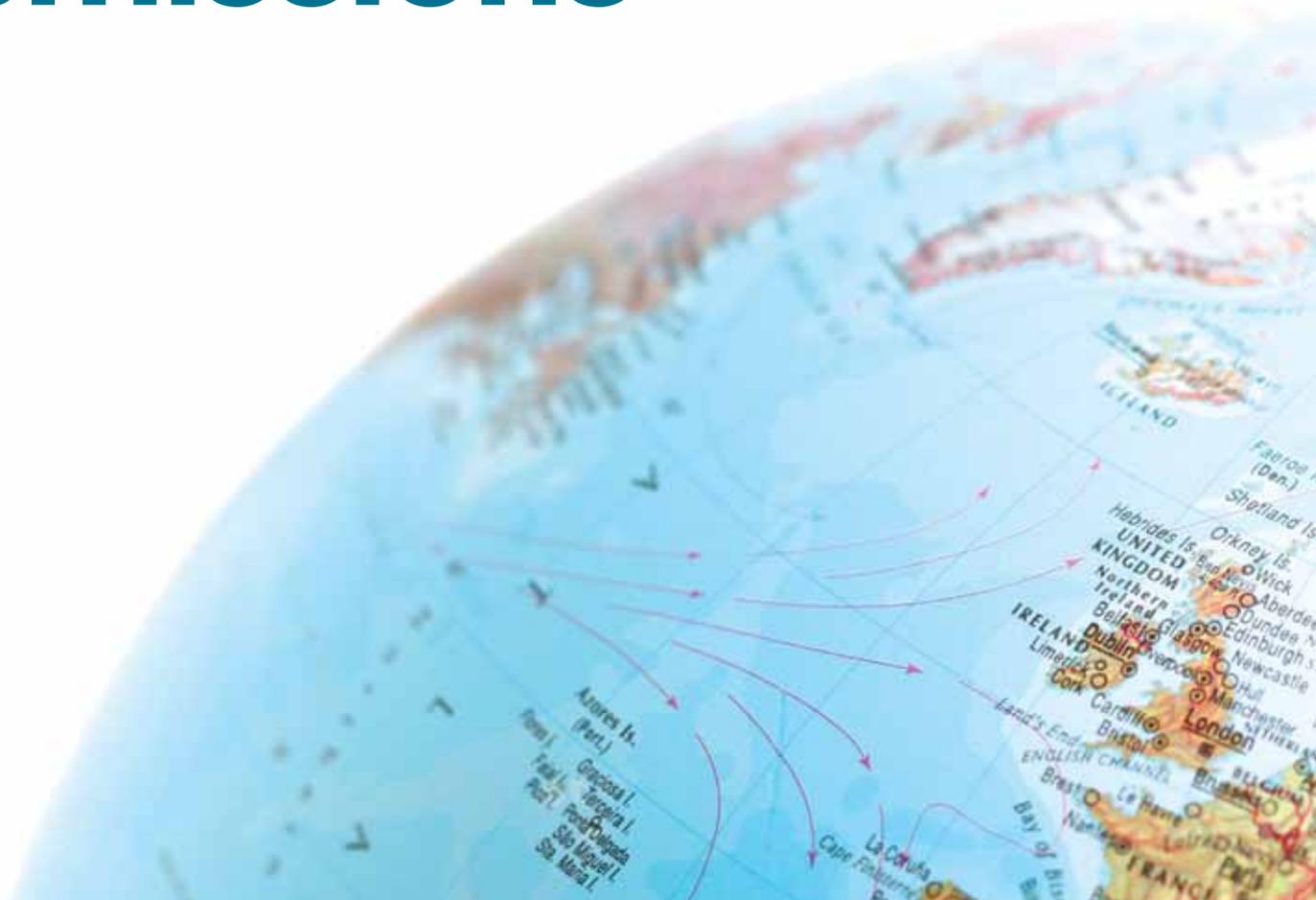


Reducing Scottish greenhouse gas emissions



Prepared for the Auditor General for Scotland
December 2011



Auditor General for Scotland

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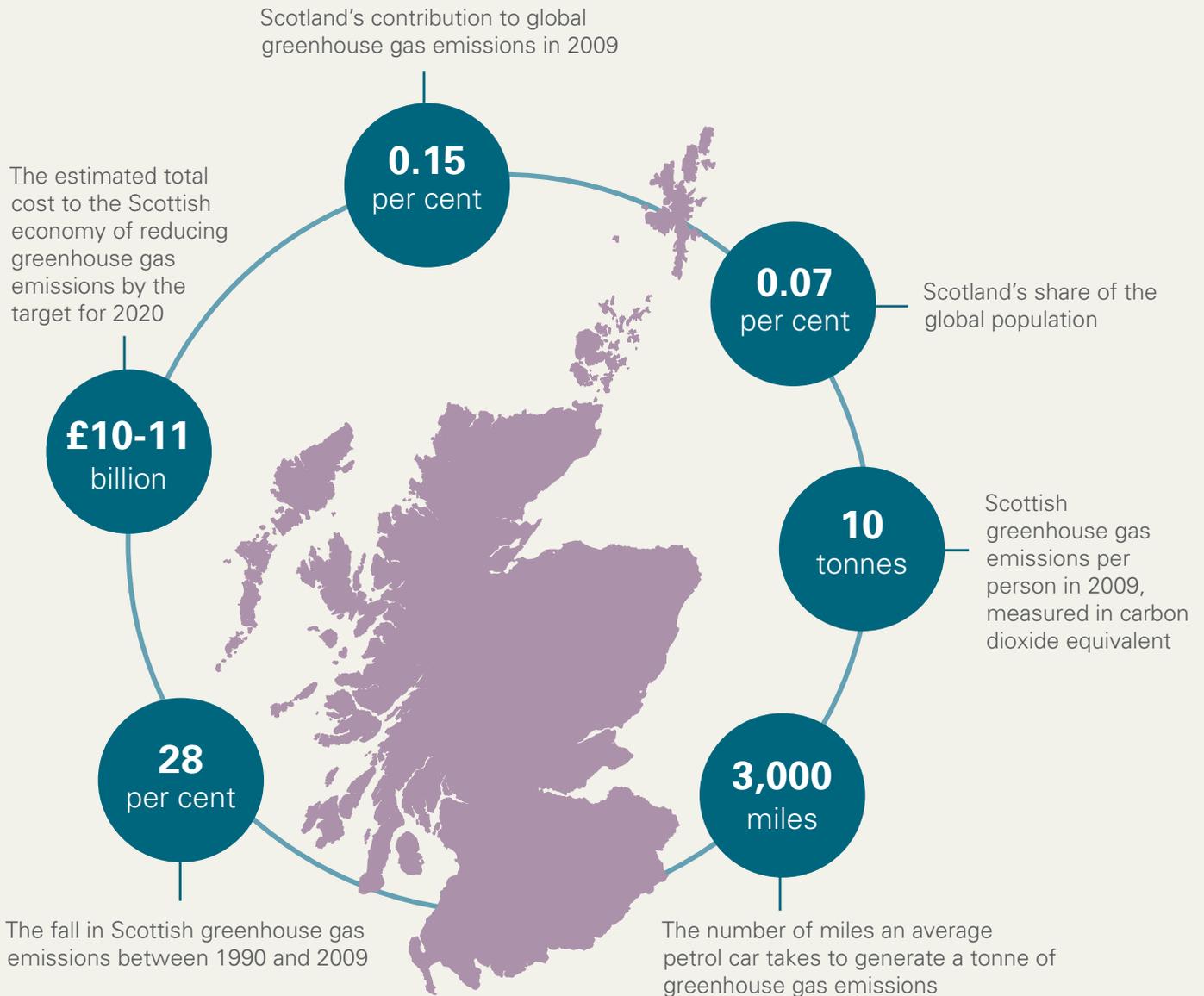
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Key facts



Background

Greenhouse gases are linked to climate change

1. Greenhouse gases in the atmosphere trap energy and keep the earth's surface warmer than it would otherwise be. It is very likely that greenhouse gases emitted by human activities, such as burning fossil fuels, are changing the earth's climate.¹

2. To reduce the long-term environmental, social and economic risks posed by climate change, governments, businesses and individuals across the world are taking action to reduce greenhouse gas emissions. An influential review of the economics of climate change estimated that the global cost of taking early action to address climate change is significantly less than the long-term cost of taking no action.²

3. Emissions of the different greenhouse gases are measured in tonnes of carbon dioxide equivalent (CO₂e). A tonne of CO₂e occupies the volume of around six double-decker buses and is generated by, for example, driving a typical petrol car for about 3,000 miles or every household in Clackmannanshire boiling a kettle once.

4. In 2009, Scotland produced emissions totalling 52.0 million tonnes of CO₂e (MtCO₂e), equivalent to 8.6 per cent of the UK's emissions and 0.15 per cent of global emissions.³ Scotland has just 0.07 per cent of the global population but produces roughly twice the global average level of emissions for each person – about ten tonnes of CO₂e a year.

Exhibit 1

Targets for reducing emissions against a 1990 baseline

The Scottish target for 2020 is more demanding than the UK and EU targets.

	Scotland	UK	EU
Percentage reduction by 2020	42	34	20
Percentage reduction by 2050	80	80	No target

Source: Audit Scotland

Scotland has passed ambitious and demanding legislation on climate change

5. The Scottish Parliament unanimously passed the Climate Change (Scotland) Act 2009 to set ambitious targets for reducing Scottish greenhouse gas emissions over the next four decades. The Scottish Government wished to set a strong example to other countries seeking to manage climate change.⁴ The Act states that emissions must decrease over three timescales:

- every year – with annual targets set by the Scottish Parliament
- by at least 42 per cent by 2020 compared to their 1990 level
- by at least 80 per cent by 2050 compared to their 1990 level.

6. The Scottish Government's proposal in the bill it introduced to the Scottish Parliament was that a 50 per cent reduction should be achieved by 2030. Following scrutiny of the bill, the Scottish Parliament agreed a 42 per cent target for 2020, which requires more rapid reductions in emissions.

7. The Scottish 2020 target is more ambitious than corresponding UK and European Union (EU) targets and the EU has not set a target for 2050 (Exhibit 1). The requirement to reduce emissions every year is more challenging than for the rest of the UK where, although reported annually, emissions are managed over five-year periods. Emissions from international air travel and shipping arriving in Scotland are included in the Scottish targets but currently not in the UK's. This will make progress in reducing Scottish emissions more demanding and potentially less controllable than for the UK overall.

8. In 2010, the Scottish Government proposed annual emissions targets to the Scottish Parliament for the period up to and including 2022. The Scottish Parliament rejected these initial proposals and set more demanding annual targets.⁵ In September 2011, the Scottish Government proposed annual targets for 2023–27, which the Scottish Parliament approved unchanged.⁶ If the 2027 target is met, Scottish emissions will be more than 57 per cent lower than in 1990 and at least 40 per cent below their 2009 level.

1 *Synthesis Report, The Fourth Assessment Report: Climate Change 2007*, Intergovernmental Panel on Climate Change, 2007. The Panel defines 'very likely' as more than 90 per cent certain.

2 *Stern Review on the Economics of Climate Change*, HM Treasury, October 2006.

3 *Scottish Greenhouse Gas Emissions 2009*, Scottish Government, September 2011.

4 *Climate Change (Scotland) Bill: Explanatory Notes*, Scottish Government, December 2008.

5 *The Climate Change (Annual Targets) (Scotland) Order 2010*, October 2010.

6 *The Climate Change (Annual Targets) (Scotland) Order 2011*, October 2011.

9. The emissions targets set in the Act are reflected in the Scottish Government's *National Performance Framework*.⁷ The Scottish Government will report to the Scottish Parliament every year about progress on reducing emissions. If targets are not met, Scottish ministers have to explain to the Scottish Parliament how they plan to meet the shortfall in emissions reductions.

Reducing emissions is one of many competing priorities at a time when public spending is falling

10. Strong leadership and commitment are needed to make spending decisions that will reduce emissions over future decades. However, public sector finances are under intense pressure and face numerous competing priorities.⁸ The Scottish Government's revenue budget will decrease by 9.2 per cent between 2010/11 and 2014/15 in real terms and its capital budget will decrease by 36.7 per cent over the same period.⁹ The Scottish Government estimates that it may take until 2025/26 before public sector spending returns to 2010/11 levels.¹⁰ In this context, the Scottish Government will need to consider its priorities for investment in capital projects to support emissions reductions.

11. The Scottish Government believes that having ambitious targets for reducing emissions and moving to a low-carbon economy represent an important economic opportunity for Scotland, for example through the promotion of renewable energy.¹¹ The Scottish Government's spending review for the next three years

identifies moving to a low-carbon economy as one of its six strategic priorities.¹² It considers that: 'the transition to a low-carbon economy is an investment – not simply a public cost – and that this investment will help drive growth in the Scottish economy and provide a more sustainable future'.¹³

12. In 2011, the Royal Society of Edinburgh suggested that reducing emissions could provide Scotland with:

- economic advantages
- a more secure supply of energy through alternatives to fossil fuels
- more sustainable use of resources.

However, it noted that there must be greater engagement between individuals, society, the public sector and the private sector to achieve a low-carbon Scotland.¹⁴

About this audit

13. The audit assessed progress in reducing Scottish emissions since 1990 and evaluated the Scottish Government's approach to reducing emissions. We gathered a range of qualitative and quantitative evidence, and drew on the Scottish Government's forecasts of emissions to 2020, and the corresponding costs to Scotland.

14. In summary, we:

- analysed published data on greenhouse gas emissions, including financial information produced by the Scottish Government
- reviewed relevant documents and guidance
- interviewed Scottish Government staff and representatives from other organisations including the Committee on Climate Change, Scottish Environment Protection Agency (SEPA), the 2020 Climate Group, and non-governmental bodies.^{15, 16}

15. Appendix 1 of this report sets out our audit methodology. Appendix 2 lists the members of our project advisory group. This report is complemented by an [online annex](#) which provides supporting detail.¹⁷

7 *National Performance Framework* (online guide), Scottish Government. The National Performance Framework provides information on the Scottish Government's performance against a range of outcomes and indicators.

8 *Scotland's public finances: addressing the challenges*, Audit Scotland, August 2011.

9 *Scottish Spending Review 2011 and Draft Budget 2012/13*, Scottish Government, September 2011.

10 *Ibid.*

11 *The Government Economic Strategy*, Scottish Government, September 2011.

12 *Scottish Spending Review 2011 and Draft Budget 2012/13*, Scottish Government, September 2011.

13 *Ibid.*

14 *Facing up to Climate Change: breaking the barriers to a low-carbon Scotland*, Royal Society of Edinburgh, March 2011.

15 The Committee on Climate Change was established under the Climate Change Act 2008. It provides the UK Government and the three devolved administrations with independent advice.

16 The 2020 Climate Group considers how Scotland's business, voluntary and public sectors can work together to manage climate change.

17 www.audit-scotland.gov.uk/work/central_national.php

Key messages

1 Scottish emissions have reduced by more than a quarter since 1990. They must continue to fall at a similar rate between 2009 and 2020 to meet statutory targets.

Scottish emissions fell by more than a quarter between 1990 and 2009

16. Scottish emissions fell by 28 per cent between 1990 and 2009, from 71.8 to 52.0 million tonnes of carbon dioxide equivalent (MtCO₂e).¹⁸ This represents an average reduction of 1.5 per cent each year.¹⁹ Ten per cent of this overall fall occurred during 2009, when emissions fell by 2.1 MtCO₂e. This may be linked to reduced economic activity associated with the recession.

17. After the production and supply of energy, transport is the second largest source of Scottish emissions (Exhibit 2).²⁰ With the exception of transport, emissions from all Scottish sources of greenhouse gases decreased between 1990 and 2009 (Exhibit 3). Emissions from transport rose by 3.7 per cent.

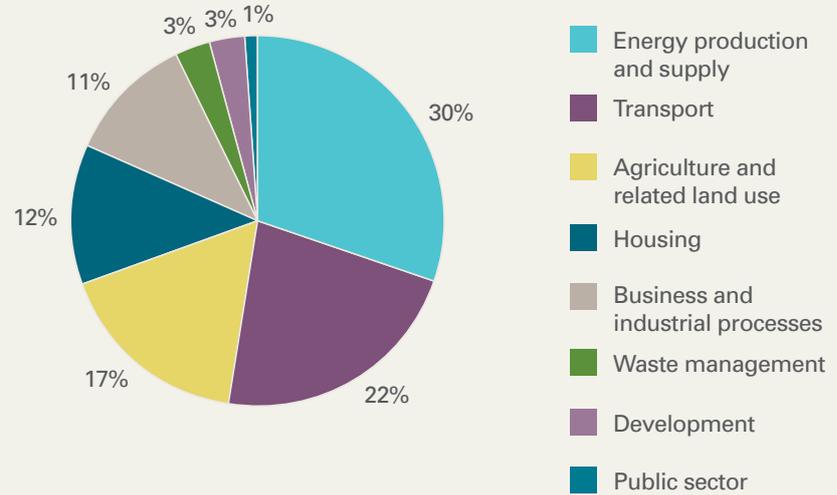
To meet the 2020 target, emissions need to reduce at the same rate as that achieved between 1990 and 2009

18. To meet the Scottish target of reducing emissions by 42 per cent by 2020, net Scottish emissions must decrease from 52.0 MtCO₂e in 2009 to 40.7 MtCO₂e by the end of 2020, an overall fall of 11.3 MtCO₂e (22 per cent). This represents an average reduction of 1.03 MtCO₂e each year. This is comparable to the annual reduction of 1.04 MtCO₂e achieved between 1990 and 2009. However, some of the reductions that have already been achieved cannot be repeated; for example, the closure of the Ravenscraig steelworks in 1992 significantly reduced Scottish emissions.²¹

Exhibit 2

Sources of Scottish emissions in 2009

Just over half of Scottish emissions came from the production and supply of energy and transport.

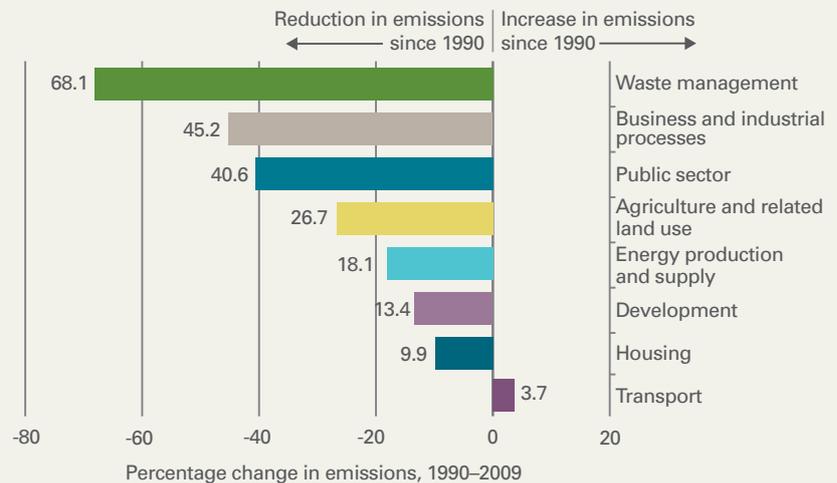


Source: Scottish Government

Exhibit 3

Changes in Scottish emissions between 1990 and 2009

Emissions from all sources fell between 1990 and 2009, with the exception of transport.



Notes:

1. The 3.7 per cent overall increase in emissions from transport was the net effect of a 144 per cent rise in emissions from international air travel, a 1.7 per cent increase in emissions from road and rail transport, and a 14 per cent decrease in shipping emissions.

2. Trees absorb emissions. This offsets emissions from the sources shown above. In 2009, trees absorbed 10.0 MtCO₂e compared to 8.3 MtCO₂e in 1990.

Source: Scottish Government

18 When reporting progress in reducing emissions, trading through the EU Emissions Trading Scheme (EU ETS) can be taken into account. The figures quoted have been adjusted to take account of trading in the EU ETS.

19 *Scottish Greenhouse Gas Emissions 2009*, Scottish Government, September 2011.

20 *Ibid.*

21 *Ibid.*

2 The Scottish Government's plans to reduce emissions require action by the EU, the public sector, the private sector and the general public. Around a third of planned emissions reductions are expected to come from policies solely under the Scottish Government's control.

The Scottish Government is relying on a combination of existing and proposed new policies to meet emissions targets

19. The Scottish Government's *Climate Change Delivery Plan* identified four 'transformational outcomes' that it considered needed to happen.²²

- By 2030, greatly reduced emissions from the generation of electricity, by using renewable energy, and fossil fuels combined with carbon capture and storage (CCS) technology.²³
- By 2050, greatly reduced emissions from the heating and cooling of buildings, by reducing demand, improving energy efficiency and making greater use of renewable or low-carbon heating.
- By 2050, virtually no emissions from road transport, with significant progress made by 2030 through using electric vehicles.
- Better use of land to reduce emissions from agriculture, protect carbon in soils and increase tree planting (no timeline was set).

20. In early 2011, following scrutiny by the Scottish Parliament, the Scottish Government published plans to reduce emissions every year up to 2022.²⁴ These shorter-term, more detailed plans require action across a range of policy areas and will be

challenging to deliver. The Scottish Government recognises that there are considerable uncertainties surrounding the projected reductions in emissions and that it therefore may need to adapt its plans.

21. Appendix 3 summarises all 35 existing and proposed new policies to reduce emissions and provides information on the estimated emissions reductions and costs associated with each policy. The Scottish Government's plans assume the continuation of 17 existing policies, including:

- improving the energy efficiency of homes
- increasing the energy efficiency of large public and private sector organisations
- implementing EU regulations on vehicle emissions.

22. The Scottish Government has also identified 18 proposed new policies to help meet the emissions targets. These policies include:

- reducing energy use by introducing tougher construction standards for new buildings
- reducing cars' emissions by teaching people to drive efficiently and enforcing speed limits
- increasing the rate of tree planting by 50 per cent, to boost absorption of emissions.

The Scottish Government's plans rely on action by the European Union

23. Currently, the planned emissions reductions depend on the Scottish Government's assumption that the EU's target for reducing emissions by 2020 will increase from 20 to 30 per cent. The higher target of 30 per cent

would tighten the limits on emissions regulated by the EU Emissions Trading System (EU ETS). This system regulates industries that produce large amounts of emissions, such as the energy generation and petrochemicals industries. Responsibility for liaison with the EU over the EU ETS lies with the UK Government. SEPA is responsible for regulating almost 100 Scottish installations covered by the EU ETS.²⁵

24. If the EU's target remains at 20 per cent, the Scottish Government may fall just short of meeting Scotland's 2020 target of a 42 per cent reduction in emissions ([Exhibit 4, overleaf](#)). If the EU's 2020 target rose to 30 per cent soon, the Scottish Government could potentially:

- meet Scotland's 2020 target by just continuing all existing policies
- exceed Scotland's 2020 target by continuing all existing policies and implementing all its proposed new policies.

25. However, in July 2011, the European Parliament voted against increasing the EU's 2020 target.²⁶ In September 2011, the Scottish Parliament's Rural Affairs, Climate Change and Environment Committee heard evidence that the EU is unlikely to increase its target to 30 per cent in the near future.²⁷ This increases the risk that the Scottish Government will not be able to meet the Scottish 2020 target. If the EU does not increase its 2020 target, the Scottish Government will need to consider:

- extending the scope of its existing and proposed new policies
- introducing new policies that it has previously ruled out, such as a road pricing scheme and charges for workplace parking

²² *Climate Change Delivery Plan*, Scottish Government, June 2009.

²³ This process captures carbon dioxide from power stations and other industrial sources, and transports it to sites where it can be stored, for example in old oil and gas fields.

²⁴ *Low Carbon Scotland: meeting the emissions reduction targets 2010-2022: the report on policies and proposals*, Scottish Government, March 2011.

²⁵ *The EU ETS – how does the system work* (online guide), Scottish Environment Protection Agency.

²⁶ *Reference INI/2011/2012*, European Parliament, July 2011.

²⁷ Rural Affairs, Climate Change and Environment Committee, Scottish Parliament, 21 September 2011.

- purchasing emissions trading credits.^{28, 29, 30}

Around a third of the planned emissions reductions are within the Scottish Government’s sole control

26. Across the Scottish Government’s 35 existing policies and proposed new policies, around a third (32 per cent) of the planned reductions in emissions are in areas where the Scottish Government has sole control. Of the remaining reductions, 44 per cent are in policy areas solely under EU control, and 24 per cent are under various combinations of EU, UK and Scottish Government control (Exhibit 5).

27. The Act requires the Scottish Government to reduce emissions caused by Scotland’s share of emissions from international aviation and international shipping, which jointly account for six per cent of all Scottish emissions. It is difficult for the Scottish Government to establish plans for these areas because progress will depend on international agreements about aviation and shipping, over which Scotland may have limited influence.³¹

Over half of planned emissions reductions come from energy and transport

28. Most potential emissions reductions (83 per cent) come from four areas:

- energy (28 per cent)
- transport (27 per cent)
- business and the public sector (14 per cent)
- housing (14 per cent) (Exhibit 6).

29. All of the potential emissions reductions from the production and supply of energy are dependent

Exhibit 4

Impact of the European Union target

If the EU’s target stays at 20 per cent, the Scottish Government may fall just short of the 2020 target of a 42 per cent reduction in emissions without additional policies being brought forward.

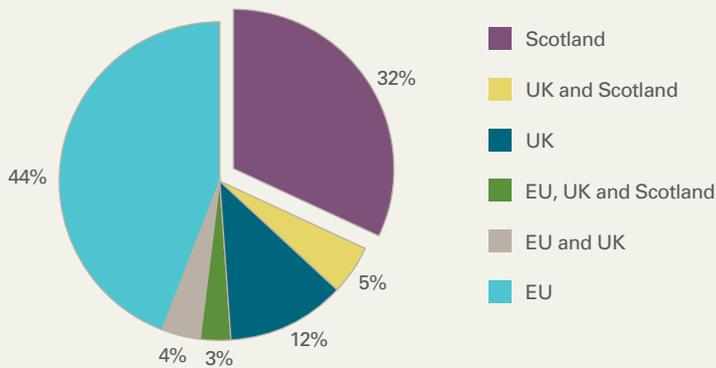
	EU target for 2020	
	20 per cent	30 per cent
Percentage reduction by just continuing all existing policies	38	42
Percentage reduction by also implementing all proposed policies	41	45

Source: Audit Scotland

Exhibit 5

Control of reductions of greenhouse gas emissions

Around a third of planned reductions are within the Scottish Government’s sole control.



Source: Scottish Government

on changes at the EU level (see paragraph 23). The Scottish Government expects transport-related emissions to make the second largest contribution (27 per cent) to the planned reductions (Exhibit 6). Reducing emissions from transport poses particular challenges:

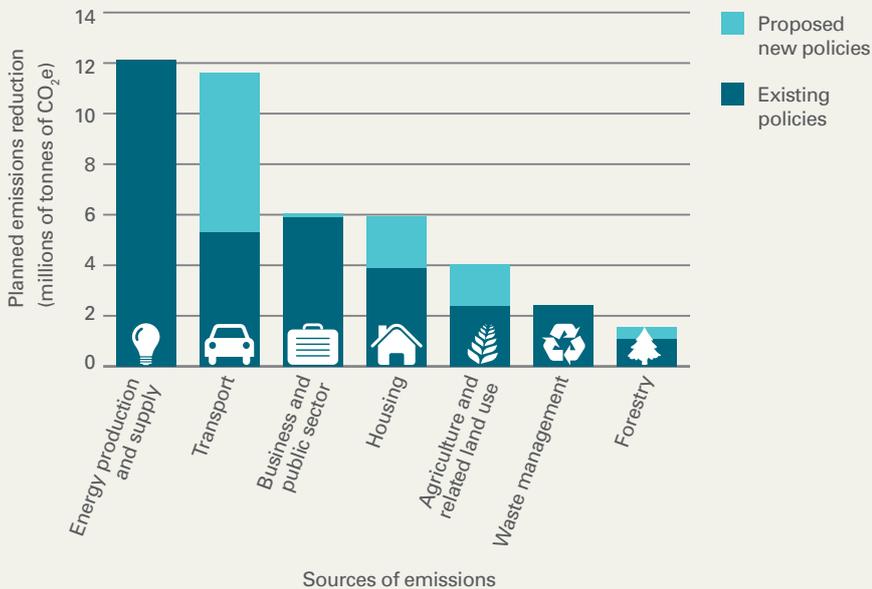
- Transport depends more than any other source of emissions on proposed new policies to achieve emissions reductions (13 in total). All of these fall under the Scottish Government’s control. These proposed new policies could collectively deliver

28 *Scotland’s Path to a Low Carbon Economy*, Committee on Climate Change, February 2010.
 29 *Advice to the Scottish Government on emission targets for 2023-2027 and credit use in 2013-2017*, Committee on Climate Change, July 2011.
 30 An emissions trading credit is a generic term for a tradeable certificate or permit that represents the right to emit one tonne of carbon dioxide equivalent. The Act allows the Scottish Government to buy emissions trading credits after 2013, which would effectively allow it to offset Scottish emissions. The Act limits the extent to which emissions trading credits can be used.
 31 *Aviation in the EU Emissions Trading System* (online guide), Department of Energy and Climate Change. Aviation is to fall within the EU ETS from 2013.

Exhibit 6

Planned emissions reductions by 2020

Success in reducing emissions depends on progress in the energy and transport sectors.



Source: Scottish Government

over half of all potential transport-related emissions reductions and 14 per cent of all Scottish emissions reductions by 2020. The Scottish Government recognises the scale of this challenge and acknowledges that: “None of the measures has been rolled out at this level of intensity previously”.³²

- Transport emissions increased between 1990 and 2009. Reversing this trend will require changes to the attitudes and behaviour of the general public to issues such as car use and public transport.
- Although representing only small proportions of the overall potential emissions reductions, there are optimistic assumptions contained within the plans to reduce transport emissions, for example:

- there will be a tenfold increase in the proportion of journeys made by bicycle³³
- there will be 100 per cent compliance with the 70 miles per hour speed limit on Scottish motorways.³⁴

30. The Scottish Government has started to implement two new transport policies:

- training for drivers of lorries and freight vans
- promoting travel by low-carbon buses and taxis. The Scottish Green Bus Fund provided £4.4 million in 2010/11, which has enabled the introduction of 48 new buses.³⁵

31. A third proposed new policy, to reduce emissions from ferries, was also expected to be implemented in 2011. The Scottish Government is considering the environmental impact of ferries as part of its ongoing review of ferry services, which will result in a long-term plan to 2022.³⁶

32. Plans to reduce emissions from housing, and business and the public sector are much less dependent on taking new measures than transport (Exhibit 6). Less than a fifth of the planned emissions reductions from these two areas are expected to come from taking new measures.

Meeting the 2020 target depends on the timely and successful implementation of new policies

33. Ten of the 18 proposed new policies will start in 2013 or later, with eight policies expected to take effect from 2014 (Exhibit 7, overleaf). In part, this timing reflects the need to reduce emissions every year, the technical aspects of the policies, and factors outside the Scottish Government’s control, such as timing of reform of the Common Agricultural Policy, which mean proposed new policies cannot be brought forward.

34. After 2014, there will be only six years for existing or proposed new policies to contribute to meeting the 2020 target to reduce emissions by 42 per cent. If the implementation of proposed new policies is abandoned or delayed, or some policies do not achieve their full potential, there will only be a short period in which to take corrective action by 2020.

Changing public attitudes and behaviours will be essential if emissions targets are to be met

35. Not all of the public sees climate change as a high priority. In a recent UK survey, 40 per cent of people considered that the seriousness of

³² *Low Carbon Scotland: meeting the emissions reduction targets 2010-2022: the report on policies and proposals*, Scottish Government, March 2011.

³³ *Cycling Action Plan for Scotland*, Scottish Government, June 2010.

³⁴ *Low Carbon Scotland: meeting the emissions reduction targets 2010-2022: the report on policies and proposals*, Scottish Government, March 2011.

³⁵ *Scottish Green Bus Fund* (online), Transport Scotland.

³⁶ *Scottish Ferries Review* (online), Scottish Government.

Exhibit 7

Planned introduction of proposed new policies

Most of the 18 proposed new policies are to be implemented after 2012.



Source: Scottish Government

3 We estimate the total cost of meeting the Scottish 2020 target will be around £10-11 billion. Half this cost is expected to achieve three-quarters of the required emissions reductions. The Scottish Government has not established how much of the total cost will fall on the public sector.

We estimate that meeting the emissions reductions targets will cost £10-11 billion

38. During parliamentary scrutiny of the Climate Change (Scotland) Act 2009, the Scottish Government estimated in 2008 that the total cost to Scotland of delivering an 80 per cent reduction in emissions by 2050 would be in the region of between one and two per cent of Gross Domestic Product (GDP) in 2050.⁴¹ Similarly, in July 2011, the Committee on Climate Change advised the Scottish Government that meeting emissions targets would cost Scotland about one per cent of GDP each year.⁴² In 2010, Scotland's GDP was around £116 billion.⁴³

39. The Scottish Government subsequently suggested that it would cost £11-12 billion by the end of 2020 to meet the Scottish targets.⁴⁴ Using the Scottish Government's data and applying HM Treasury's discount rate of 3.5 per cent for all existing policies and proposed new policies, we estimate it will cost Scotland (including the public sector, the private sector and individuals) around £9.6-10.7 billion at current prices to meet the emissions targets up to 2020.⁴⁵ There are considerable uncertainties associated with estimating the costs of reducing emissions, as the Scottish Government has acknowledged.

climate change is exaggerated.³⁷

In a European Commission survey, respondents saw tackling climate change as the responsibility mainly of national governments, the EU and business. Only 21 per cent of respondents considered that they had a personal responsibility.³⁸

36. It will be challenging for the Scottish Government to change public attitudes and behaviours, given the long timescales involved in reducing emissions and the lack of immediately obvious benefits compared to more immediate financial priorities. The Scottish Government recognises the public has an important role and is undertaking a research programme to better understand how to influence public behaviour to reduce emissions.³⁹

37. As required by the Climate Change (Scotland) Act 2009, the

Scottish Government has produced a *Public Engagement Strategy* to coordinate its approach to informing and influencing the public about climate change.⁴⁰ It sets out principles for public engagement and 61 actions, including actions for the Scottish Government and other public bodies, as well as organisations beyond the public sector such as private sector and non-governmental organisations. The Scottish Government developed the *Public Engagement Strategy* independently of its plans for reducing emissions and there is limited connection between them. There are also separate engagement and communications activities in policy sectors, such as in energy, transport and agriculture. The Scottish Government has committed to reporting progress against the actions in the *Public Engagement Strategy*, but as yet there is no system in place for it to do so.

37 *Core Reputation Issues and Ideas*, Ipsos Mori, April 2011.

38 *Special Eurobarometer 365-EB75.2, Attitudes of European Citizens Towards the Environment*, European Commission, October 2011.

39 *Climate Change Behaviours Research Programme 2010-2012*, Scottish Government, 2011.

40 *Low Carbon Scotland: Public Engagement Strategy*, Scottish Government, December 2010.

41 *Climate Change (Scotland) Bill*, Scottish Government.

42 *Advice to the Scottish Government on emission targets for 2023-2027 and credit use in 2013-2017*, Committee on Climate Change, July 2011.

43 *Scottish National Accounts Project (trial publication)*, Table 7, Scottish Government, September 2011.

44 *Low Carbon Scotland: meeting the emissions reduction targets 2010-2022: the report on policies and proposals*, Scottish Government, March 2011.

45 *The Green Book: Appraisal and Evaluation in Central Government*, HM Treasury, July 2011. For projects lasting up to 30 years, HM Treasury recommends applying a discount rate of 3.5 per cent.

However, the scale of the expected total costs to Scotland is broadly in accordance with the advice to the Scottish Government by the Committee on Climate Change.⁴⁶

40. Two areas are expected to account for around three-quarters of the total costs of reducing emissions between 2011 and 2020:

- Housing: costing £4.5-4.8 billion at current prices, depending on the assumptions made. Almost half the costs are for a proposed new policy to improve buildings' insulation.
- Transport: costing around £3.1 billion at current prices, depending on the assumptions made. The estimated cost of the 13 proposed new transport policies is around 11 times the cost of continuing the two existing transport policies. Costly proposed policies include:
 - promoting the use of buses and taxis and measures to reduce their emissions, costing around £1.1 billion at current prices by 2020 to achieve a three per cent reduction in total emissions
 - improving the national cycling and walking infrastructure, costing around £1.0 billion at current prices by 2020 to achieve a one per cent reduction in total emissions.

41. The Scottish Government estimates that three policies will produce a financial saving:

- an existing policy that encourages reductions in farms' emissions

- a proposed new policy to be introduced following reform of the Common Agricultural Policy in 2013
- a policy to reduce the amount of waste sent to landfill, under the Scottish Government's existing *Zero Waste Plan*.⁴⁷

42. The Scottish Government expects the cost of meeting the emissions targets to vary from year to year, depending on the phasing of activity in each policy. We estimate that, according to the Scottish Government's own data, the total annual cost at current prices will peak at around £1.4-1.5 billion in 2012, then vary between £0.8-1.2 billion a year until 2020.

It is difficult to estimate the costs of reducing emissions

43. The Scottish Government has not identified how the costs of reducing greenhouse gas emissions will be spread across the public sector, the private sector, third sector and individuals. Where the Scottish Government has estimated the cost of policies to reduce emissions, its figures are associated with significant uncertainties, an issue that it recognises:

- They are based on assumptions and long-range forecasts about factors such as economic growth rates, fuel prices and the impact of policies on the public.
- Some costs depend on factors that remain to be decided outside Scotland, including the extent to which reform of the EU Common Agricultural Policy will prioritise emissions reductions.

- Scientific understanding of greenhouse gas emissions is continually developing. Emissions associated with land use are particularly uncertain, leading to uncertainty about costs.
- Future technological advances could make emissions reductions easier and cheaper to achieve than currently predicted. However, the pace and timing of technological development is unpredictable.

44. The Scottish Government has not estimated costs for some policies it is relying on to reduce emissions. For example:

- Costs for emissions reductions for the production and supply of energy are excluded as the Scottish Government expects major installations operating under the EU ETS to finance their own reductions.
- Because suitable data were not available, the Scottish Government has not estimated the costs of three policies which collectively account for four per cent of the total emissions reductions it expects by 2020:
 - An existing policy to help improve the energy efficiency of non-domestic buildings.
 - A proposed new policy to introduce higher energy standards for new non-domestic buildings from 2013.
 - A proposed new policy to introduce higher energy standards for domestic buildings from 2013.

There is wide variation in the cost-effectiveness of actions to reduce emissions

45. The Scottish Government has not sought to prioritise within its set of policies for reducing emissions on the basis of their cost-effectiveness (defined here as the level of emissions reduction that could be achieved for a given level of spending) because it is dependent on all of them for meeting the 2020 target.

46. The cost (at current prices) of individual policies for reducing emissions to 2020 varies from £6 million for training van drivers to drive more efficiently, up to £2 billion to improve the insulation of domestic properties. However, the cheapest actions may not be the easiest to implement or be the most effective at reducing emissions. Taking the example of the 13 proposed new policies to reduce transport emissions, the cost (at current prices) of reducing emissions by a tonne of CO₂e by 2020 varies by a factor of 130, between:

- £20 a tonne to enable greater e-working, tele-conferencing and video-conferencing in community hubs
- £2,615 a tonne to implement new intelligent transport systems that improve traffic flow.

Three-quarters of the required emissions reductions may be achievable for half of the total cost

47. Scottish emissions have fallen by 28 per cent since 1990. If the EU target for 2020 remains at 20 per cent, the Scottish Government considers that:

- emissions could be reduced by a further ten per cent to 38 per cent relative to 1990 by continuing its existing 17 policies. This could cost £4.3-5.4 billion at current prices

- emissions could be reduced by an additional three per cent to 41 per cent relative to 1990, by also implementing all of its 18 proposed new policies. This could cost an additional £5.3 billion at current prices.

There are wider benefits of reducing emissions

48. Many policies for reducing emissions potentially have wider non-financial benefits for society, the environment and the economy. For example, greater use of electric vehicles in urban areas could reduce emissions in city centres, improve air quality, and reduce the incidence of breathing difficulties. In turn, cleaner air may generate financial savings through reduced healthcare costs.^{48, 49} The Scottish Government has made limited progress in understanding and evaluating the financial and non-financial value of the wider benefits of reducing emissions. However, this is a highly complex topic.

4 The Scottish Government has difficulty in assessing its performance, due to delays in the availability of emissions data. It is already taking steps to improve its management of emissions reductions but needs to make further progress.

Management arrangements for reducing emissions were revised during 2011

49. At the start of 2011, a number of Scottish Government-led groups, with overlapping remits and memberships, were involved in overseeing various aspects of reducing emissions. Several of these groups included members from outside the Scottish Government. During 2011, the Scottish Government stopped operating most of these groups and established a single Emissions Reduction Programme Board with a remit to ensure that the Scottish

emissions reduction targets are met. The Programme Board:

- monitors and assesses progress against policies to reduce emissions, and agrees remedial actions if progress is insufficient
- provides a forum for discussing potential tensions between policy priorities, for example improving roads while reducing the number of miles travelled by car
- champions the mainstreaming of climate change across the Scottish Government.

50. The Programme Board is chaired by the Director-General of Enterprise and Environment and its membership covers the key areas within the Scottish Government involved with delivering emissions reductions. There are no members from outside the Scottish Government or non-executives, who could potentially contribute expertise and independent challenge.

51. The Scottish Government draws on the Committee on Climate Change (CCC) for advice on a range of issues, including specific advice on setting emissions reductions targets. In addition, the CCC plays an important role in holding the Scottish Government to account by providing independent scrutiny of its progress both in reducing greenhouse gas emissions and in managing Scotland's adaptation to climate change.

52. The Scottish Government is also supported by a number of Scottish groups including:

- The **2020 Climate Group** was established in 2009 by the chief executive of Scottish and Southern Electricity plc, who currently chairs the group. It considers how Scotland's business, voluntary and public sectors can work together to help achieve Scotland's emissions targets.⁵⁰
- The **Public Sector Climate Action Group**, established in 2010, is co-chaired by the Minister for Environment and Climate Change, and the Convention of Scottish Local Authorities (COSLA). The group aims to promote good practice across the public sector and find opportunities to work with the business sector. It maintains an overview of climate change work already under way, to ensure value for money and avoid duplication of effort.⁵¹
- The **Scottish Centre of Expertise on Climate Change**, established in 2011, is a virtual centre that draws on expertise from across Scotland, including several universities. It aims to deliver objective, independent evidence to support the Scottish Government in relation to its activities to reduce emissions, adapt to climate change and move to a low-carbon economy.⁵²

53. During 2011, the Scottish Government introduced new risk management arrangements across the organisation, and these also cover its work on reducing emissions. As these arrangements have been in place for less than a year, it is too soon to gauge their effectiveness. In relation to emissions reductions, they manage risk at three levels:

- The Scottish Government's Strategic Board, whose risk register includes the failure to mainstream climate change.
- The Emissions Reduction Programme Board, whose risk register identifies five risks:
 - external factors beyond Scottish Government control
 - decisions leading to increased emissions
 - behaviour change not happening
 - actions by other government/institutions (EU, UK etc) inconsistent with Scottish targets
 - internally, the Scottish Government not responding to the risks above, including the failure to mainstream climate change.
- Individual Scottish Government directorates, Forestry Commission Scotland and Transport Scotland – each has a separate risk register.

It takes almost two years to obtain data on Scottish emissions

54. It is difficult to assess the effectiveness of policies for reducing emissions due to the length of time it takes to obtain data on actual levels of emissions. For example, finalised data on Scottish emissions in 2009 were not available until September 2011. Contributing to the time lags are the large amounts of data that need to be collected and processed, and strict international reporting requirements. The Scottish Government is in discussion with the UK Department of Energy and Climate Change and the devolved administrations for Wales and Northern Ireland about ways to improve the timeliness of annual emissions data.

55. Since March 2011, the Scottish Government has been developing a system of scorecards which is intended to provide the Emissions Reduction Programme Board with more immediate management information about individual policy areas, and to indicate whether sufficient progress is being made. However, the system remains under development and is not yet well connected to the Scottish Government's *National Performance Framework*. The scorecards have not been made publicly available and this reduces the transparency of the Scottish Government's performance management arrangements for reducing emissions.

It is challenging to assess emissions associated with imported goods and services

56. The emissions reductions targets discussed in this report relate to emissions produced in Scotland. The Act also requires Scottish ministers to report to the Scottish Parliament on emissions linked with the consumption and use of goods and services for every year between 2010 and 2050, even if these have been produced overseas and imported into Scotland. This is a highly challenging field of work and there is no internationally agreed method for assessing consumption-related emissions. It will therefore be challenging for the Scottish Government to make significant early progress against this aspect of the Act.

57. In 2010, the Scottish Government estimated that imported emissions could account for the equivalent of 29 per cent of all Scottish emissions.⁵³ There is a risk that a rise in the level of imported emissions could outweigh the reduction of emissions generated within Scotland.

50 www.2020climategroup.org.uk

51 www.scotland.gov.uk/Topics/Environment/climatechange/howyoucanhelp/publicbodies/pscag

52 www.scotland.gov.uk/Topics/Research/About/EBAR/StrategicResearch/future-research-strategy/CoEClimateChange

53 *Scottish Government Carbon Assessment Project Phase 2 Report*, Scottish Government, April 2010.

Recommendations

The Scottish Government should:

- review the risks and mitigating actions associated with the EU maintaining its 2020 target at 20 per cent
- continue to refine its estimates of the costs of policies to reduce emissions
- align all its public engagement activities that seek to reduce emissions
- develop and communicate a better understanding of policies' wider non-financial and financial benefits
- improve the completeness and transparency of its performance management arrangements, by finalising its performance management scorecards and publishing them on a regular basis
- continue to work with the UK and the other devolved administrations to reduce the time taken to obtain data on actual Scottish emissions
- develop its understanding and reporting of emissions associated with the consumption of goods and services.

Appendix 1.

Audit methodology

To inform the audit, we:

- reviewed the terms of reference for relevant Scottish Government working groups and teams, and reviewed their meeting papers and supporting documents, including financial information
- reviewed key Scottish Government publications relating to climate change and greenhouse gas emissions and, in particular, analysed existing Scottish Government data on greenhouse gas emissions
- reviewed programme and project plans; progress reports; performance statistics; financial data; risk management information at corporate, programme and project levels; and improvement/action plans at programme and project levels
- reviewed and analysed material published by other bodies, including the Committee on Climate Change, Treasury and Department for Energy and Climate Change
- interviewed Scottish Government staff, including those directly involved in managing the climate change programme; those who manage contributory work that impacts on climate change in key sectors and workstreams; and those involved in the development of the methods, policies, proposals and projects underpinning them

- interviewed representatives from other key organisations including: Committee on Climate Change, Forestry Commission Scotland, Scottish Environment Protection Agency, Transport Scotland, and the 2020 Climate Group.

The audit did not consider:

- the Scottish Government's approach to adapting Scotland to the consequences of climate change, such as an increased risk of flooding
- renewable energy; we will conduct a performance audit on renewable energy during 2012/13
- the implementation of the climate change duties that apply to all public bodies. These duties only took effect in January 2011 and it is too early to assess performance against them. We are considering conducting a performance audit on climate change duties in 2013/14.

Appendix 2.

Project advisory group members

Audit Scotland would like to thank members of the project advisory group for their input and advice throughout the audit.

Member	Organisation
Prof James Curran	Director of Science and Strategy, Scottish Environment Protection Agency
Jill Goldsmith	Director of Energy, Climate Change and Sustainability Value for Money Studies, National Audit Office
Gabriella Pieraccini	Climate Change Targets and Legislation Team, Scottish Government
Dr David Reay	Senior Lecturer in Carbon Management, University of Edinburgh
Martin Valenti	Business Manager, 2020 Climate Group

Note: Members of the project advisory group sat in an advisory capacity only. The content and conclusions of this report are the sole responsibility of Audit Scotland.

Appendix 3.

Existing and proposed new policies to reduce emissions

There are 17 existing policies (●) and 18 proposed new policies (○). For proposed new policies, the date in square brackets is the planned year of implementation. We have converted the estimated cost up to the end of 2020 into current prices using a discount rate of 3.5 per cent. A cost figure in brackets represents a saving. n/a = not available (see paragraph 44).



EU control



UK Government control



Scottish Government control

Policy	Control over policy	Emissions reduction (MtCO ₂ e)	Per cent of total emissions reduction	Estimated cost (£ million)
Energy (EU ETS)				
● Increase in EU target for 2020 target from 20 to 30 per cent.		12.144	27.8	n/a
Transport				
● Mandatory car emissions targets – by 2012, maximum average emissions from new cars will be 130g of CO ₂ per kilometre. By 2015, maximum average emissions from new cars will be 95g of CO ₂ per kilometre.		2.927	6.7	26
● Biofuels target – the Renewable Energy and Fuel Quality Directives will increase the amount of bio-fuel used in the transport sector.		2.398	5.5	235
○ Buses and taxis – improvements to the infrastructure for road public transport and incentives to promote the use of low-carbon buses and taxis. [2011]		1.351	3.1	1,141
○ Travel planning – targeting workplaces, schools and households to reduce travel, particularly car use. [2014]		1.002	2.3	89
○ Heavy Goods Vehicle (HGV) efficiency improvements – range of measures to train drivers of HGVs to drive in a more fuel-efficient manner. [2011]		0.978	2.2	35
○ Freight modal shift – grants to encourage the movement of freight from road to rail and water. [2012]		0.526	1.2	129
○ Cycling and walking infrastructure – improvements including better surfaces, quality cycle routes and lanes, provision for cycles on public transport and cycle rental schemes in cities. [2014]		0.495	1.1	1,010
○ Eco-driving – campaign to raise awareness of fuel-efficient driving techniques. By 2027, 85 per cent of drivers will have undertaken free, face-to-face, eco-driving training sessions. [2014]		0.418	1.0	26
○ Community hubs – reducing the need for travel by promotion of e-working, tele-conferencing and video-conferencing. [2014]		0.400	0.9	8
○ Low-carbon vehicles – infrastructure, procurement and provision. [2012]		0.284	0.6	105
○ Maritime transport – improvements to the fuel efficiency of ferry engines and technical improvements to the ferry fleet. [2011]		0.275	0.6	17

Policy	Control over policy	Emissions reduction (MtCO ₂ e)	Per cent of total emissions reduction	Estimated cost (£ million)
○ Car clubs – a network of car clubs, with ten per cent of households in all towns larger than 25,000 being members of a car club by 2022. [2013]		0.215	0.5	41
○ Speed limit enforcement at 70mph – lower average speeds will reduce fuel consumption and emissions. [2014]		0.169	0.4	38
○ Van efficiency improvements – range of measures to train drivers to drive in a more fuel-efficient manner. [2012]		0.101	0.2	6
○ Intelligent transport systems – improvements in traffic flow including the use of hard shoulders and variable speed limits. [2012]		0.076	0.2	199
Business and the public sector				
● Renewable heat incentive – payments to those who install and obtain heat from renewable sources.		3.306	7.6	387-878
● Energy-intensive business packages – a range of policy measures including the extension to Climate Change Agreements, Energy Performance of Building Directive, industrial smart metering and advice and loans from the Carbon Trust.		1.296	3.0	n/a
				
				
● Carbon Reduction Commitment Energy Efficiency Scheme – a UK-wide scheme to increase energy efficiency in large organisations across the public and private sectors.		0.745	1.7	29
● Smart metering – smart meters will be installed in non-domestic small and medium-sized business buildings to improve energy management.		0.324	0.7	23
● New non-domestic buildings energy standards for 2010 – these came into force in October 2010 and should deliver around a 30 per cent reduction in CO ₂ emissions compared with 2007 standards.		0.227	0.5	527
○ New non-domestic buildings energy standards for 2013 – non-domestic building standards will be reviewed for 2013 with the aim of achieving a 75 per cent reduction in emissions compared with 2007. [2014]		0.158	0.4	n/a
Housing				
● Domestic building energy efficiency – a range of policies to increase household energy efficiency, eg by installing better insulation and heating systems.		1.635	3.7	873
● Renewable Heat Incentive – payments to those who install and obtain heat from renewable sources.		1.179	2.7	224-499

Policy	Control over policy	Emissions reduction (MtCO ₂ e)	Per cent of total emissions reduction	Estimated cost (£ million)
● New domestic energy standards for 2010 – these came into force in October 2010. These should deliver around a 30 per cent reduction in CO ₂ emissions compared with 2007 standards.		0.640	1.5	969
● Smart meters – smart meters for gas and electricity to be installed in every home by 2020, to encourage better domestic energy management.		0.433	1.0	417-496
○ Fuel poverty and insulation programmes – a range of programmes to deliver energy efficiency measures in homes from 2013. [2013]		1.717	3.9	1,998
○ New-build domestic energy standards 2013 – standards will be reviewed for 2013 with the aim of achieving a 60 per cent reduction in emissions compared with 2007. [2014]		0.319	0.7	n/a
Agriculture and related land use				
● Farming for a Better Climate – encouraging farmers to use energy and fuels efficiently, developing renewable energy, protecting carbon in the soil, optimising livestock management and waste storage.		2.295	5.2	(290)
● Scottish Rural Development Programme – funding for anaerobic digestion equipment on farms to process livestock manure and slurry. Anaerobic digestion produces a biogas which can be used to generate electricity and heat.		0.109	0.2	2
○ Single farm payment scheme – to be introduced following the review of the EU Common Agricultural Policy in 2013. It comprises measures to optimise the application of fertiliser and manure. [2018]		1.620	3.7	(121)
Waste				
● Zero waste policies (pre-May 2010)	 	1.661	3.8	681
● Zero Waste Plan		0.766	1.8	(132)-104
Forestry				
● Increase afforestation rate to 10,000 hectares per year – supporting the target to increase woodland cover to 25 per cent of Scotland.		1.074	2.5	375
○ Increase afforestation rate to 15,000 hectares per year – supporting the target to increase woodland cover to 25 per cent of Scotland. [2012]		0.482	1.1	534
Total		43.745	100	9,601 – 10,683

Reducing Scottish greenhouse gas emissions

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