



The Scottish
Government

CLIMATE CHANGE

CONSULTATION ON PROPOSALS FOR
A SCOTTISH CLIMATE CHANGE BILL



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A SCOTTISH CLIMATE CHANGE BILL



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01 | MINISTERIAL FOREWORD



Climate change will change the world we live in. As a society we are at the cusp choosing which world we will pass to our children: a greener, sustainable economy, or a world where mass deaths from droughts, famines and storms and the extinction of species is the norm.

Scotland can play a leading role internationally in taking action on climate change. The Scottish Government's vision is to build a Greener Scotland for our children, setting an example to the rest of the world of how a developed nation can become greener sustainably. That is why we are proposing to build a long-term framework for this and successive administrations in Scotland to ensure that we reduce our emissions by 80% by 2050. Bringing forward a Climate Change Bill is a key commitment for our Government. This will be Scotland's main contribution to the global effort required to ensure that climate change is minimised for future generations.

We know that reaching this target and making sustained reductions over the coming years will be difficult. But we also know that the people of Scotland always rise to a challenge and will tackle it with the passion and ingenuity which, as history shows, we always have done when our nation is faced with a challenge. This Government has pledged to govern in the Scottish national interest and taking action on climate change is clearly in our national interest.

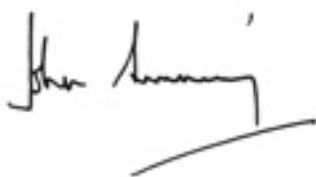
The Scottish Government has one clear purpose: to focus the Government and public services on creating a more successful country, with opportunities for all of Scotland to flourish, through increasing sustainable economic growth. This is why the Government Economic Strategy¹ introduces strategic targets which combine raising our GDP growth rate and reducing our emissions – reducing our emissions is a central part of increasing sustainable economic growth.

¹ Government Economic Strategy, available from: <http://www.scotland.gov.uk/Publications/2007/11/12115041/0>

The proposals we are setting out are designed to build a clear and credible framework to guide Scotland to a low-carbon economy. Businesses will have the certainty they need to invest in our immense green potential. That investment will bring new jobs and new growth. We can become a world leader in marine energy, and we can build the greener, sustainable economy that we want to pass on to our children.

The proposed Scottish Climate Change Bill is the key measure supporting this Government's commitment to tackling climate change. We are already taking action to reduce our emissions. We have tripled the funding for community renewables and microgeneration and we are providing funding to rural communities to help reduce emissions from land management practices. We will continue to take regular and sustained action to reduce our emissions but meeting our ambitious climate change targets will require greater action by all parts of Scottish society.

We are confident that Government, business and all of the people of Scotland are ready to rise to the challenge of climate change. The proposed Scottish Climate Change Bill will provide the long-term framework we need to do that. We need to get this framework right – it will provide the basis for action in Scotland on climate change for the next 40 years. This is why we have been talking to organisations from across Scotland to ask what needs to be included. We welcome your views on these proposals to make sure that we build a strong legal framework and, through that, to make sure that we build the right world for future Scots to enjoy.



John Swinney
Cabinet Secretary for Finance and Sustainable Growth



Stewart Stevenson
Minister for Transport, Infrastructure and Climate Change

02 INTRODUCTION

- 2.1** Climate change is one of the most serious threats facing Scotland and the world. The most severe consequences include famine, drought and the extinction of species. Further action by all nations is needed urgently in order to avoid the most severe climate change. On 12 December 2007, at the United Nations Climate Change Conference in Bali, Indonesia, UN Secretary General Ban Ki-moon stated that 'the time for equivocation is over. The science is clear. Climate change is happening. The impact is real. The time to act is now.'²
- 2.2** Climate change will have a profound affect on the everyday lives of the people of Scotland – both young and old in every village, town and city, on mainland and island. This is not the first time that climate change has affected the people of Scotland – indeed, the climate has always changed over the centuries, affecting our food supply, our travel and our homes. But the scale of climate change occurring at present is unprecedented – some parts of Scotland have seen winter average temperatures increase by up to 2°C – and, for the first time, this is being caused mainly by human activities. Action in Scotland is required now by Government, businesses and individuals.
- 2.3** The debate has clearly shifted over the last few years, from whether climate change is happening to what is causing it and what we need to do about it. Across Scottish society there is a growing awareness that people need to 'do their bit' and many are putting these good intentions into practice by making changes to their lifestyles to help reduce their energy consumption. There are worthwhile programmes and initiatives across organisations in the public, private and third (voluntary and community) sectors to make their operations 'greener'. The current and previous Scottish administrations have placed issues of sustainability and climate change at the heart of many of their policies. However, as the scientific understanding of climate change has developed, it has become clear that even greater efforts need to be made to reduce greenhouse gas emissions to a level below that which will lead to dangerous global warming.
- 2.4** The aim of the proposed Scottish Climate Change Bill will be to establish a framework to drive these greater efforts in Scotland. The Bill will create mandatory climate change targets to reduce Scotland's emissions and will create new legislative means to do so. This will provide business and society with a clear signal from Government of its seriousness in tackling this issue and will provide Scotland with the certainty it needs to make the right choices now. The Bill will signal to the international community Scotland's serious intent to contribute to the global effort to mitigate climate change and provide a strong example to other countries showing what can be done.

² UN Secretary-General Ban Ki-moon, *Address to the High-Level Segment of the UN Climate Change Conference*, Bali, Indonesia, 12 December 2007. Full speech available from: http://www.un.org/apps/news/infocus/sgspeeches/statments_full.asp?statID=161



- 2.5** Scotland has much to be proud about in its past. Our explorers, entrepreneurs and scientists have made a contribution to the modern world far out of proportion to our size. However, since the Industrial Revolution, our industries and lifestyles have also been contributing to climate change far out of proportion to our size. While we continue to benefit from this past, its legacy is threatening both Scotland and the world. This provides a moral imperative for Scotland to take action.
- 2.6** While our past actions as a society in Scotland provide a good reason for us to take action as a nation, it is important to focus on what needs to be done now. Through global action it is still possible to prevent the most extreme impacts of climate change. Scotland continues to emit greenhouse gases at a rate disproportionate to our size and our consumption patterns are unsustainable. Whilst every nation needs to take action to mitigate the most severe climate change, Scotland has an opportunity to provide international leadership on this issue and demonstrate our commitment to fulfilling our climate change responsibilities.
- 2.7** Acting now to mitigate climate change will cost the countries of the world less than waiting to deal with its effects in the future if we do nothing. Tackling climate change can also bring clear and tangible benefits to Scotland itself, bringing new jobs, cost savings and improved local environments that can generate sustainable economic growth. Taking action now will help make Scotland a wealthier and fairer, as well as greener, society. Reducing our emissions is a strategic target in the Government Economic Strategy and features significantly in the Spending Review.³
- 2.8** This consultation paper is intended to both inform and spark debate. The proposed Scottish Climate Change Bill is intended to provide a long-term framework for future action in Scotland on climate change. The Bill will not provide the solutions to all of the climate change issues we will face for the next 40 and more years but it will drive policies forward by making the Scottish Government responsible for achieving ambitious targets.
- 2.9** This consultation sets out the Scottish Government's thinking on the proposals for a Scottish Climate Change Bill and asks for your views on some of the options for the Bill. The Scottish Government is looking for responses to this consultation from every sector in Scotland – Government does not have all the answers to these questions! It is important for all of Scotland to work together in reaching credible solutions to the difficult problem of climate change. The Government will listen to your views and consider them when making our final decisions.

³ Scottish Budget Spending Review 2007, available from: <http://www.scotland.gov.uk/Publications/2007/11/13092240/0>

- 2.10** The Government will also be continuing to collect evidence alongside this consultation to ensure that the proposed Bill takes account of both what is needed and what is possible. The Bill's primary purpose is to establish a framework of credible measures.
- 2.11** The consultation will close in mid-April 2008. The next step is for the Government to consider the responses and publish a summary and analysis in the summer. The Government will then decide what is to be included in the Bill, and instruct lawyers to draft the Bill (this process will take a number of months). The Government aims to have the Bill ready for introduction to the Scottish Parliament before the end of 2008.
- 2.12** Thank you in advance for your responses and please do not hesitate to contact the Scottish Government if you have any questions about this consultation.

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03 WHY HAVE A BILL?

- 3.1** There are four key reasons why the Scottish Government is bringing forward legislation to create mandatory climate change targets:
- to drive decisions in government and business;
 - to create and enable new means of reducing emissions and adapting to climate change;
 - to play our part in global action on climate change; and
 - to provide a strong example to other countries showing what can be done.

Driving decisions in government and business

- 3.2** It can be difficult for government to give sufficient attention to climate change when there are daily issues whose impacts will be felt much sooner: crime on our streets, schools delivering the needed skills for our children, and hospitals providing care for our sick. The full effects of our emissions now will not be felt for 40 years or more, so it may seem a less urgent priority. However, delaying global action is likely to enhance the onset of dangerous climate change.
- 3.3** Setting a statutory target to reduce emissions will mean that the Scottish Government will need to think about climate change whenever it makes decisions. Statutory targets will drive government to take the more difficult, sometimes less popular, options that either reduce emissions directly or encourage individuals or businesses to reduce emissions. The Scottish Government has already made clear through the Government Economic Strategy that tackling climate change will become part and parcel of the way Government and the wider public sector behaves, not an optional extra.
- 3.4** The UK Climate Change Bill (discussed in more detail in paragraphs 4.51 and 4.52) will provide statutory targets at the UK level. But Scotland can, and should, go further. Scotland's emissions, and the potential to reduce emissions in Scotland, are different from the rest of the UK. We have massive potential in renewable energy, particularly in marine and wind energy. Studies have estimated Scotland's potential renewable resource to be around 60 GigaWatts. This is equivalent to around 75% of the existing electricity generating capacity across the UK.⁴ The majority of the UK's forest area is in Scotland and we potentially have the space to increase its extent further, which would add to its ability to absorb CO₂.

⁴ Scotland's Renewable Resource 2001, executive summary available from:
<http://www.scotland.gov.uk/Publications/2003/09/18270/27258>



- 3.5** There are also factors particular to Scotland which may make reducing emissions more difficult for us than in other parts of the UK. For example, we have a particularly high proportion of carbon-rich organic soils and a far greater proportion of our greenhouse gas emissions comes from our land use and agriculture. The Scottish Government has fewer policy levers available to achieve emissions reductions than the UK Government. Of the current carbon savings being made (set out in *Changing Our Ways, Scotland's Climate Change Programme*⁵), approximately two-thirds come from devolved measures and one third from reserved measures. There may be limitations in the potential for devolved policies to achieve large savings. For example, emissions from power generation represent the majority of Scotland's net emissions and reserved energy policy may act against progress towards savings from devolved measures. 'Hard' policy measures such as taxation and regulation of product standards may have more potential than softer, devolved measures.
- 3.6** The Scottish Government is proposing a Scottish target that takes account of our individual situation and drives our Scottish policies.
- 3.7** But tackling climate change is not only about changing the way Government does its own business. It is also about changing everyone's habits and behaviours. We will need new technologies to reduce emissions whilst striving to increase prosperity in Scotland for all. Much of the investment needed to deliver these technologies will come from the private sector and will need to be developed over the longer term. To make a real difference, Government needs to give the strongest possible incentive to invest in and develop new technologies – this is a key purpose of setting emissions targets into law. Businesses need to be certain that a change in Government will not change the level of support given to reducing emissions. Statutory targets will provide that certainty: they will apply regardless of who is in power at a national or a local level.

Enabling more action to reduce emissions or adapt to climate change

- 3.8** The proposed Bill also provides an opportunity to create or modify primary legislation to enable specific measures that will reduce emissions or help Scotland to adapt to the changing climate. The measures that the Scottish Government is considering are discussed in Section 8. Many of these will be consulted upon separately.

⁵ *Changing Our Ways, Scotland's Climate Change Programme*, available from: <http://www.scotland.gov.uk/Publications/2006/03/30091039/0>

Play our part in global action on climate change

- 3.9** The Intergovernmental Panel on Climate Change (IPCC) tells us that the impact of climate change – the extinction of species, damage in our cities and high death tolls from severe weather events, and a dramatic reduction in the production of food in parts of the world – will be difficult to mitigate but not impossible. The Scottish Government is committed to playing its part to help avoid such disasters.
- 3.10** There are those who argue that as Scotland emits only 0.15% of the world's greenhouse gases, we should not burden ourselves with a specific Scottish target to reduce emissions and we should instead wait for larger countries to take action. The Scottish Government believes that this is an irresponsible position: we led the industrial revolution and we have a moral obligation to lead the revolution to a new greener, cleaner, sustainable economy.

International leadership

- 3.11** Climate change is a global challenge. The Scottish Government and Scottish Parliament are already working in partnership with the rest of the UK on the UK Climate Change Bill to show international leadership on climate change. It is hoped that this will help to achieve an international agreement on climate change. The Scottish Climate Change Bill confirms the importance the Scottish Government attaches to tackling climate change and acts as a further demonstration of the leadership we want to provide to the rest of the world.
- 3.12** The challenge of climate change presents us with real opportunities – we could become Europe's biggest exporter of renewable energy if we take advantage of the potential we have for wind and marine energy. And if Scotland can become an exemplar we could help to accelerate global action – groups elsewhere pressing for change could point to Scotland to show how the transition to a low carbon economy and sustainable economic growth can work.

04 CLIMATE CHANGE CONTEXT AND BACKGROUND

- 4.1** The following section offers some basic information on the broad issues related to climate change to help give the context for your response. If you would like further information, contact details are provided in Section 10. Each section in the consultation paper will provide further information on the specific topics covered and questions asked. A partial Regulatory Impact Assessment and draft Environmental Report provide additional information and are available from the climate change pages of the Scottish Government's website: <http://www.scotland.gov.uk/climatechangebill>. You are encouraged to read these documents to help inform your response.

The science of climate change: how it occurs

- 4.2** Climate change is not a simple scientific issue. The mechanisms which operate in the Earth's atmosphere are complex. This section offers a basic explanation of some of the fundamental facts.
- 4.3** Radiation from the sun is necessary to sustain all life on Earth. A proportion of this radiation passes through the atmosphere and warms the atmosphere and surface of the Earth. The short wavelength (visible) radiation that penetrates the atmosphere is absorbed by the surface which is heated. The energy is then re-irradiated at longer wavelengths as infra-red radiation. The out-going infra-red radiation is absorbed by greenhouse gases in the atmosphere and re-irradiated in all directions, some back towards the surface. The result is to trap part of thermal energy re-irradiated by Earth's surface in the lower atmosphere which heats up. The higher the concentration of a greenhouse gas in the atmosphere, the greater the proportion of longer-wave radiation that is trapped and so the greater the warming. This process naturally keeps the Earth's surface warmer than would be the case otherwise – an average surface temperature of +15°C as opposed to an average of -18°C without it. However, human-induced greenhouse gas emissions enhance this effect to create warming greater than that which would occur naturally.
- 4.4** The main greenhouse gases are water vapour and carbon dioxide (CO₂). Other important greenhouse gases include methane (CH₄), nitrous oxide (N₂O), chlorofluorocarbons (CFCs); and certain fluorine-containing gases (HFCs, PFCs; SF₆). Excluding water vapour, the concentration of these gases in the atmosphere has been increasing since the beginning of the industrial era. This increase is largely due to human activities. As an example, carbon dioxide concentrations in the atmosphere have increased from a range of 275 to 285 parts per million (ppm) in the pre-industrial age (AD1000-1750) to 375ppm in 2005 and the rate at which this concentration is increasing is accelerating. Both carbon dioxide and methane are well above their normal range for at least the last 650,000 years.⁶



The concept of carbon dioxide equivalent (CO₂e)

- 4.5** Different greenhouse gases, whether naturally occurring or related to human activities, have differing chemical properties and make different contributions to climate change. A scientific methodology has been developed to enable quantitative comparisons between the different gases.
- 4.6** This approach captures both the ability of the gas to absorb radiation and its residence time in the atmosphere and enables us to determine the global warming potential (GWP) of each gas. The calculations to establish the GWP of a gas are based on its affect on the atmosphere over a 100 year period. A 100 year period was chosen as the basis for the UN Framework Convention on Climate Change to reflect the long time scale for addressing climate change. Carbon dioxide has a GWP of 1 and can be used as a benchmark against which the global warming effect of other greenhouse gases can be measured.

Table 1

Greenhouse Gas	Global Warming Potential (GWP)
Carbon dioxide (CO ₂)	1
Methane (CH ₄)	21
Nitrous oxide (N ₂ O)	310
Hexafluorocarbons	140 – 11,700
Perfluorocarbons	6,500 – 9,200
Sulphur hexafluoride (SF ₆)	23,900

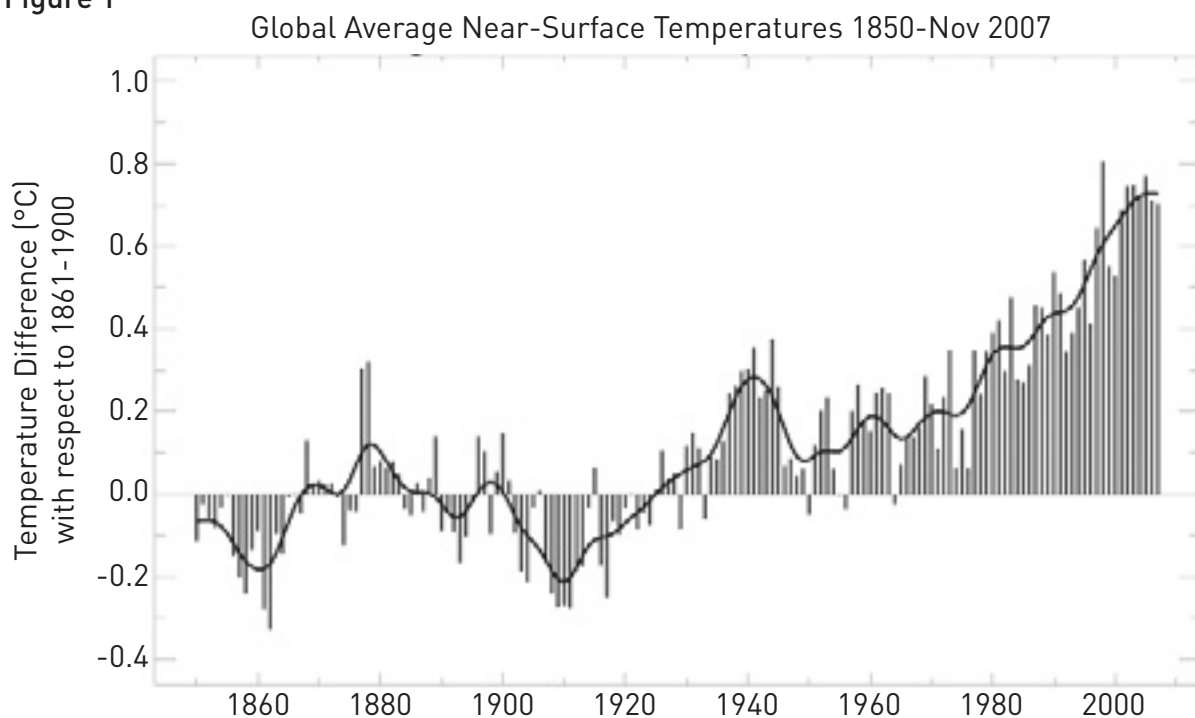
- 4.7** This measure of other greenhouse gases is usually expressed in the form 'carbon dioxide equivalent' (CO₂e). For example, 1 tonne of methane (CH₄) emitted into the atmosphere has 21 times the warming impact over 100 years compared to 1 tonne of carbon dioxide; or 1 tonne CH₄ = 21 tonnes CO₂e.

⁶ IPCC, 2007: Summary for Policymakers. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Available from: <http://www.ipcc.ch/ipccreports/ar4-wg1.htm>

Global impacts of climate change

4.8 Climate change is already occurring and the consensus of scientific opinion is that it is being driven by the emissions resulting from human activities. Average global temperatures are 0.76°C higher than the second half of the last century and the rate of warming is increasing. Eleven of the 12 warmest years since 1850 occurred between 1995 and 2006.⁷ Global average sea levels are rising, with the rate of rising accelerating, and glacier sizes and snow cover have reduced on average in both hemispheres.

Figure 1



Met Office, Hadley Centre

4.9 The Intergovernmental Panel on Climate Change (IPCC) was established by the World Meteorological Organization and the United Nations Environment Programme in 1988. The IPCC assesses a wide range of information collected from existing literature to produce a credible basis for climate change science which policy makers across the world can rely on to be independent, wide-ranging and robust. It provides a wealth of information on the causes of climate change, how climate change is affecting the world and how it will affect the world over the years to come.

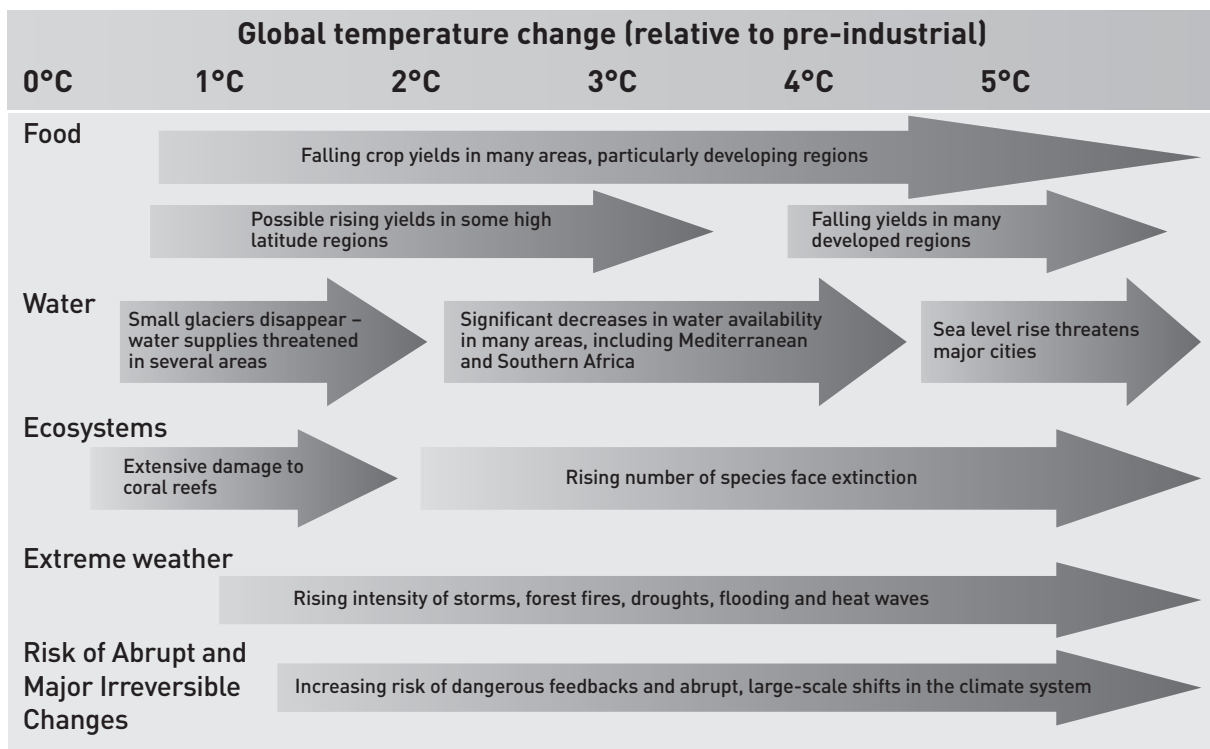
⁷ Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.



4.10 The IPCC has drawn on a large number of simulations and direct observations to cover a range of possible futures. It is likely that average global temperature will continue to increase by about 0.2°C per decade for the next two decades, assuming most likely emissions trends.

4.11 The wide range of possible temperature increases make it difficult to estimate the future impact on the global environment and on people. However, the IPCC has presented the likely result of various temperature increases.

Figure 2



The Stern Review on the Economics of Climate

4.12 This information demonstrates that as the average global temperature increases, the threat of more severe climate change consequences increases. This information also demonstrates that the effect will not be felt uniformly across the world but will begin to affect (indeed is already affecting) many regions in the developing world least capable of dealing with the effects of climate change.

- 4.13** Climate change is a real global threat. The independent Stern Review, which was published in 2006, is the most comprehensive review ever carried out on the economics of climate change.⁸ Stern states that if the world fails to stabilise emissions in a relatively short space of time, it ‘could create risks of major disruption to economic and social activity, later in this century and in the next, on a scale similar to those associated with the Great Wars and the economic depression of the first half of the 20th century’.
- 4.14** The most recent review of research presented by the Intergovernmental Panel on Climate Change indicates that world greenhouse gas emissions need to be reduced to between 50 and 85% below year 2000 levels in order to stabilise atmospheric concentrations of greenhouse gases and most likely limit warming to between 2.0 and 2.4 °C.⁹

Table 2

CO ₂ -eq Concentration (ppm)	Global mean temperature increase above pre-industrial at equilibrium, using “best estimate” climate sensitivity (°C)	Peaking year for CO ₂ emissions	Change in global CO ₂ emissions in 2050 (% of 2000 emissions)
445 – 490	2.0 – 2.4	2000 – 2015	-85 to -50
490 – 535	2.4 – 2.8	2000 – 2020	-60 to -30
535 – 590	2.8 – 3.2	2010 – 2030	-30 to +5
590 – 710	3.2 – 4.0	2020 – 2060	+10 to +60
710 – 855	4.0 – 4.9	2050 – 2080	+25 to +85
855 – 1130	4.9 – 6.1	2060 – 2090	+90 to +140

This is an extract. For the complete table, please see IPCC Fourth Assessment Report.

- 4.15** It should be noted that, in updating the scientific evidence of the causes of climate change, that the baseline the IPCC’s conclusions differs from the 1990 baseline for carbon dioxide emissions used in the Kyoto Protocol. However, for the time being, the Kyoto Protocol remains the basis for international action on reducing emissions.

⁸ Stern Review on the Economics of Climate Change, available from: www.hm-treasury.gov.uk/Independent_Reviews/stern_review_economics_climate_change/sternreview_index.cfm

⁹ Climate change 2007: Synthesis Report (Summary for Policymakers), IPCC, available from: http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf



4.16 Further information is also available from the Intergovernmental Panel on Climate Change. Contact details are provided in Section 10. The Met Office Hadley Centre for Climate Change has published information on the science of the Earth's climate in a variety of formats on its website: <http://www.metoffice.gov.uk/research/hadleycentre/>.

Likely impacts of climate change in Scotland

4.17 Met Office data published in the Key Scottish Environment Statistics 2007¹⁰ shows that average annual temperatures in Scotland over the first years of this century were 0.8°C warmer than in the 1960s. Further information on climate trends in Scotland is available from the Scotland and Northern Ireland Forum for Environmental Research.¹¹

4.18 The UK Climate Impacts Programme (UKCIP) has formulated scenarios to look at possible future climate change, dependent on predicted future global greenhouse gas emissions. This research provides Scotland with the best available information on predicted changes in Scottish climate over the next century and indicates possible:

- increases in the annual average temperature;
- increases in 24-hour maximum temperatures;
- increases in the length of the growing season; and
- wetter winters.

4.19 UKCIP is funded by the Department for Environment, Food and Rural Affairs on behalf of the UK Government, Scottish Government, Welsh Assembly Government and Northern Ireland Executive. In addition to research, UKCIP provides tools and datasets to support organisations and the public in understanding and adapting to the unavoidable changes in climate.

4.20 Revised versions of UK climate change scenarios will be available in October 2008. Further information can be obtained from the UK Climate Impacts Programme. Contact details are provided in Section 10.

¹⁰ Key Scottish Environment Statistics 2007, Global Atmosphere, Annual Mean Temperature: 1914-2006, available from: <http://www.scotland.gov.uk/Publications/2007/08/20165714/8>

¹¹ Patterns of climate change across Scotland: technical report, available from: http://www.sniffer.org.uk/exe/download.asp?sniffer_outputs/CC03.pdf

Adapting to the impacts of climate change

- 4.21** Climate scenarios predict that over the next century Scotland is likely to see changes in seasonal rainfall patterns, with wetter winters and autumns, and warmer temperatures throughout the year. While many climate changes will impact on Scotland, an increase in the number of extreme rainfall or storm events is expected to have the most significant implications. The destructive potential of such events has already been demonstrated by the 2002 Glasgow floods and 2005 Western Isles storm, with severe consequences for individuals, the natural environment, major infrastructure and the economy.
- 4.22** Climate change presents major challenges for Scotland's land-using industries. The role of the town and country planning system in mitigation and adapting to climate change is already addressed in Scottish Planning Policies including those on flooding, renewable energy and housing. It will also be addressed in the second National Planning Framework. Agriculture and forestry will need to adapt to safeguard sustainability, adjust land management practices to changing climate and intensifying weather extremes, and prepare to exploit any opportunities presented by climate change. Impacts of climate change felt in other regions of the world may hold social and economic implications for Scotland through changes in trade and consumption patterns.
- 4.23** A well planned and coordinated adaptation response will minimise the negative impacts and highlight potential opportunities of a changing climate. While a comprehensive response will require adaptation to be integrated at all levels of government, the Scottish Government is uniquely placed to influence many of the policy areas central to a strong adaptation response in Scotland. Through government and government agencies' use of procurement and investment decisions as well as the provision of guidance and regulation we will direct adaptation in areas such as planning, health, flood risk management, transport, forestry, building standards, agriculture and nature conservation. The Scottish Government is currently developing a Scottish adaptation strategy to identify priority adaptation action required in Scotland and to clarify roles and responsibilities in achieving this action. Initial consultation on the Scottish Adaptation Strategy will be conducted in Spring 2008.
- 4.24** The Scottish Government, along with the Scottish Environment Protection Agency, funds the Scottish Climate Change Impacts Partnership. The Partnership was established to increase the resilience of Scottish organisations and infrastructure to meet the challenges and opportunities presented by the impacts of climate change. The Partnership's website – www.sccip.org.uk – was recently launched and offers free access to high quality data on climate trends and their impacts in Scotland. Contact details are provide in Section 10.



- 4.25** The UK Climate Change Bill contains several provisions regarding adaptation to the impacts of climate change in the UK. Clauses would require the Secretary of State to lay before Parliament regular reports assessing the risks to the UK of the current and predicted impacts of climate change as well as setting out the UK Government's programme for action on adaptation. The Secretary of State is also to be given a power to direct relevant authorities performing public functions to similarly prepare reports assessing the risks associated with the impacts of climate change on the exercise of their functions, setting out their proposals for addressing those risks and outlining their progress. The Secretary of State's powers in relation to the programme of action and the power to direct relevant authorities performing public functions will relate to England and reserved matters only. Wales is taking similar powers through the UK Climate Change Bill, as is Northern Ireland in relation to a programme of action.
- 4.26** The Scottish Government recognises the need for countries to work together to address the global issues created by climate change. It is actively cooperating with the UK Government and other devolved administrations, however as the Scottish Government is able to address such matters within devolved competence, we do not require the UK Climate Change Bill to establish such legislative requirements to take effect in Scotland. Measures to address adaptation in Scotland will be primarily addressed through the Scottish Adaptation Strategy and any legislative requirements could be included in the Scottish Climate Change Bill.

Emissions trends in Scotland

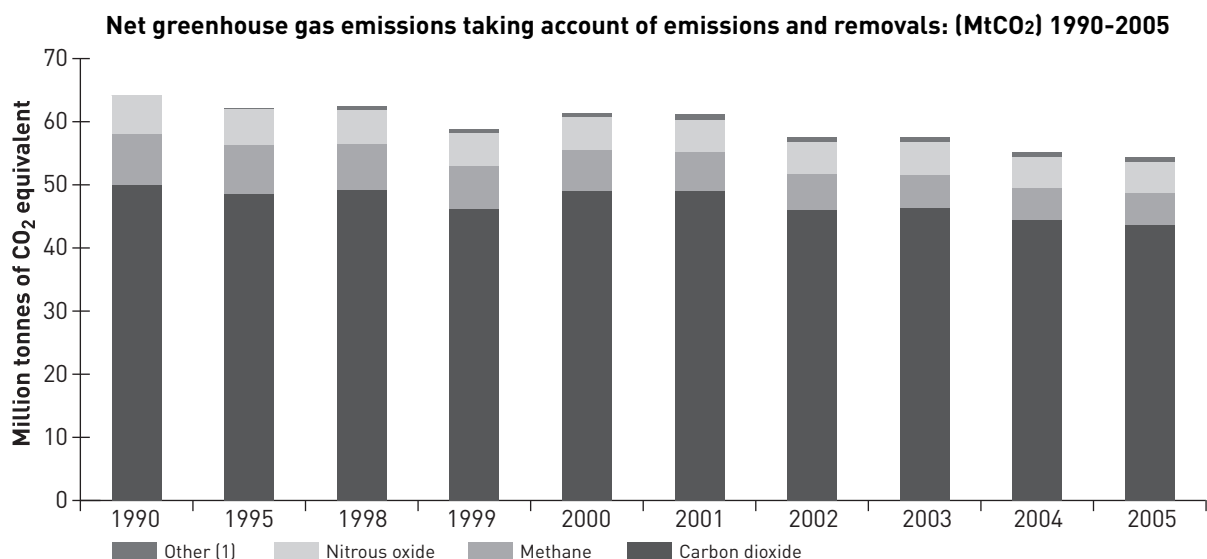
- 4.27** Scotland's emissions are reported in the Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland.¹² In measuring Scotland's emissions of greenhouse gases, a net figure is used which takes into account the amount of CO₂e which is taken out of the atmosphere by land use and forestry. Scotland's net emissions of CO₂e greenhouse gases in 2005 were over 54 million tonnes. This is approximately 0.2% of world CO₂ emissions and 0.15% of all greenhouse gas emissions due to human activities. The Scottish Government recognises that this is virtually insignificant as a proportion of world emissions – if Scotland were to eliminate all of its emissions, the effect on global climate change would be negligible. However, Scotland only has around 0.08% of the world's population – so we produce a much greater than average amount of emissions in proportion to our population. In addition to emissions which come from Scotland, consumption in Scotland has the effect of causing emissions to be released in other countries which produce products for the people of Scotland. Given the long-lived nature of greenhouse gases in the atmosphere it is also important to take account of past emissions. Levels of greenhouse

¹² Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2005 is available from: http://www.airquality.co.uk/archive/reports/cat07/0709180907_DA_GHGI_report_2005.pdf.

gases in the atmosphere have been rising since the beginning of the industrial age in the 18th century. Industrialised countries such as Scotland have contributed the vast majority of greenhouse gases caused by man currently in the atmosphere.

4.28 CO₂ accounts for roughly 80% of Scotland’s greenhouse gas emissions. The chart below shows net emissions of both carbon dioxide and all greenhouse gas emissions between 1990 and 2005 in Scotland, as recorded in the Greenhouse Gas Inventories.

Figure 3



(1) Hydrofluorocarbons, perfluorocarbons and sulphur

4.29 Emissions trends show that there has been a decrease in total emissions between 1990 and 2005. Greenhouse gas emissions have been falling at a faster rate than CO₂ alone. Between 1990 and 2005, CO₂ fell by 12.5%, predominantly due to economic restructuring and afforestation, and non-CO₂ gases fell by 25.3%, predominantly from a decrease in CH₄ (methane) emissions from landfill and N₂O (nitrous oxide) emissions from fertilisers, as well as a decrease in deep mine emissions. The overall reduction of all greenhouse gases in that period was 15.4%.

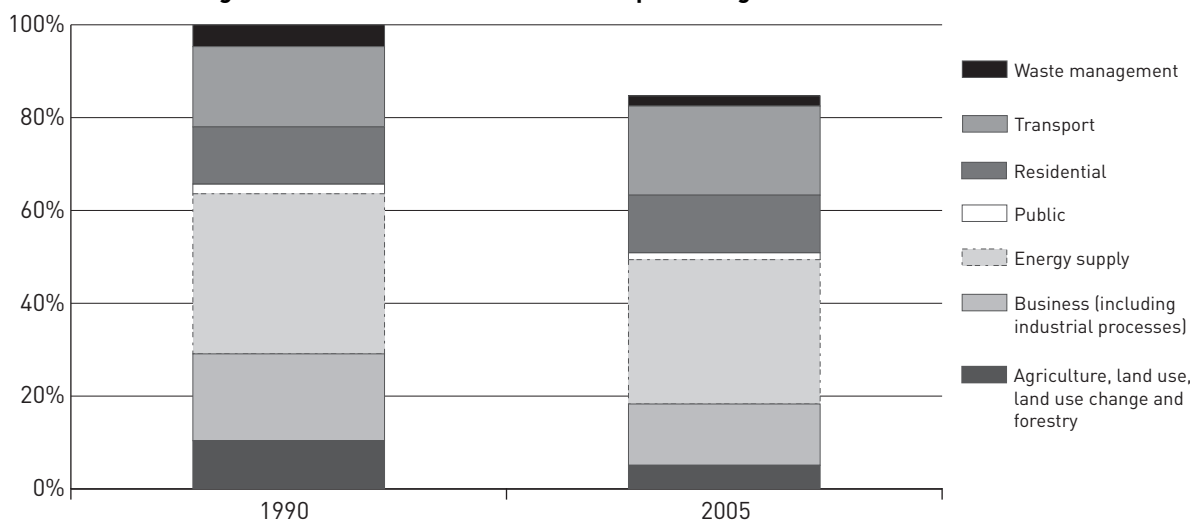
4.30 Though the general trend is that greenhouse gas emissions have been falling, total emissions levels have fluctuated year on year, with the largest annual percentage increase being 4.5% between 1999 and 2000 and the largest annual decrease 5.7% between 1998 and 1999. These annual fluctuations are largely due to changes in emissions from energy generation, which are influenced by factors outwith the control of Scottish Ministers such as changes in the relative price of fossil fuels and weather conditions.



4.31 The chart below shows the sectors in the Greenhouse Gas Inventories for Scotland which produce the emissions and how these vary between 1990 and 2005. The energy supply sector is the dominant source of greenhouse gas emissions: it represented 37% of all greenhouse gas emissions in 2005 but 39% on average over the period covered by the Greenhouse Gas Inventories (1990 to 2005).

Figure 4

Greenhouse gas emissions in 1990 and 2005 as a percentage of 1990 emissions



Future emissions trends

4.32 We cannot be sure what future greenhouse gas emissions in Scotland will be; the forecasting of greenhouse gas emissions is an extremely complex task, with projections being made within an ever-changing policy, regulatory and economic landscape. Projections depend on a number of assumptions, including:

- Fossil fuel prices
- Fuel mix (whether gas or coal is favoured)
- Population growth
- Economic growth
- Success of programmes and policies designed to reduce emissions

4.33 There are a number of existing studies which have modelled future CO₂¹³ and non-CO₂¹⁴ greenhouse gas emissions in Scotland but none of these presents an up to date picture of future greenhouse gas emission trends in Scotland. The Scottish

¹³ Energy and Carbon Dioxide Emissions Projections for Scotland, 1990-2020 in Chapter 4 Section A of the **Scottish Economic Report January 2002**, available from: <http://194.247.95.101/Resource/Doc/158582/0043007.pdf>

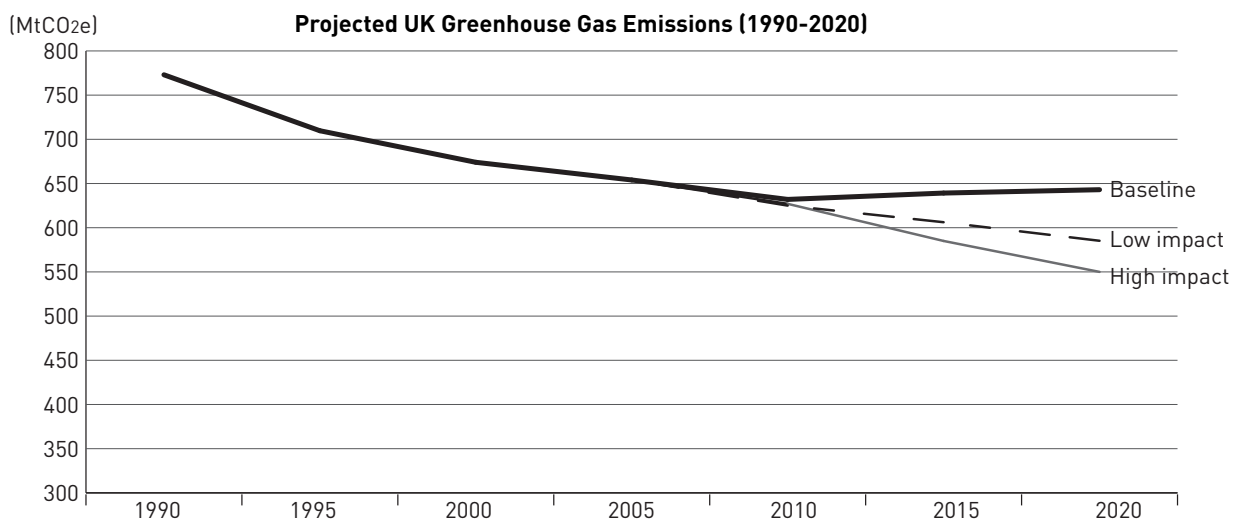
¹⁴ **Projections of Non-CO₂ Greenhouse Gas Emissions for the UK and Constituent Countries – Final Report**, WS Atkins Consultants. Available from: <http://products.ihc.com/Ohsis-SEO/98347.html> (online subscription required).

Energy Study,¹⁵ considered, among other things, how Scotland’s energy use could change in the medium term to 2020, using projections of demand and supply informed by different scenarios that will influence energy use in the future. The final volume of the Study – Volume 5 – covering energy projections, is currently being further updated and we expect to publish findings in the first half of 2008.

4.34 Updated UK emission projections produced for the UK Government’s Energy White Paper¹⁶ show that baseline UK greenhouse gas emissions are likely to fall in the short term (i.e. to 2010) but rise thereafter, see chart below.

4.35 As well as economic and social factors, future emissions trends will depend on the impact of new measures introduced to abate emissions. Given a range of measures identified in the Energy White Paper, two scenarios of high and low impact of these measures are also shown on the chart.

Figure 5



Source: Updated Energy and Carbon Emissions, Energy White Paper, 2007

4.36 This analysis shows that though progress has been made in reducing emissions, the road ahead is particularly challenging. Emissions post-2010 are unlikely to fall further without additional measures and might instead increase.

¹⁵ Scottish Energy Study. Summary Report available from: <http://www.scotland.gov.uk/Publications/2006/01/19092557/0>; Volume 1 available from <http://www.scotland.gov.uk/Publications/2006/01/19092748/0>; and Volume 2 available from <http://www.scotland.gov.uk/Publications/2006/01/19093058/0>

¹⁶ Meeting the Energy Challenge: A White Paper on Energy, available from: <http://www.berr.gov.uk/energy/whitepaper/page39534.html>



4.37 Using the UK figures is useful to illustrate possible future trends but these trends may not accurately reflect future Scottish emissions. There are factors that influence emissions projections which may have a different effect in Scotland than for the UK as a whole, these include:

- Differing rates of economic and population growth.
- Land use change and forestry.
- Electricity generation – Scotland currently has a much higher proportion of nuclear and renewable generation but this is offset to some extent by significant electricity exports to England and Northern Ireland (i.e. Scotland produces more electricity than it consumes so emissions are higher).
- Transport demand – the distances each vehicle travels have grown faster in Scotland than in the rest of the UK, leading to a faster growth rate of emissions from transport.

The economics of climate change

4.38 Tackling climate change and reducing our greenhouse gas emissions is a difficult task and will require wholesale changes in technology and to our lifestyles. Even though it will cost money to change our society to a low-carbon economy, there will be new business opportunities and savings from energy efficiencies. It is therefore appropriate that we assess the benefits and drawbacks of mitigating climate change in the world and in Scotland.

4.39 The UK has taken a leading role in studying the economics of climate change. The UK Government commissioned Sir Nicholas Stern to produce his review of the economics of climate change. The report assessed:

- The global economic impacts of moving to a low-carbon global economy, focusing on the medium to long-term perspective, and drawing implications for the timescales for action, and the choice of policies and institutions.
- The potential of different approaches for adaptation to changes in the climate.
- Specific lessons for the UK, in the context of its existing climate change goals.

4.40 The review looked primarily at the global economy and reached a clear conclusion: the benefits of strong and early action far outweigh the economic costs of not acting. The review found that if the world does nothing to mitigate climate change, the impacts could cost the world the equivalent of 5% of global GDP each year. Furthermore, it also found that if a wider range of risks and impacts are included, for example increased risk of disease and the possibility of irreversible environmental impacts, not taking action could cost the world the equivalent of 20% of global GDP each year or even more.¹⁷

¹⁷ The Stern Review on the Economics of Climate Change

4.41 On the other hand, the Stern Review estimated that the long-run costs of action to stabilise global concentrations of CO₂e at 550 parts per million (ppm) are expected to be around 1% of global GDP by 2050, within a range of +/- 3%. Analysis accompanying the UK Energy White Paper indicates that the long-term costs of achieving a 60% CO₂ target in the UK are around 0.7% of GDP by 2050; ranging between 0.3% of GDP by 2050 depending on the future price of fossil fuels and 1.5% of GDP if low carbon technologies are not available. Further analysis undertaken for the Impact Assessment of the UK Climate Change Bill has examined the potential impact of an 80% CO₂ target. This analysis estimates the costs to be between 1.1% and 2.6% of GDP in 2050. This is within the range calculated by the Stern Review and these figures give a clear message: taking early action to reduce emissions may have some costs but these are far outweighed by the costs that climate change will cause if no action is taken.

4.42 The Stern Review identifies four main ways of tackling emissions reductions:

- Reduce demand for emission-intensive goods.
- Improve energy efficiency.
- Switch to lower-carbon technologies for power, heat and transport.
- Reduce non-fossil fuel emissions, particularly in land use and agriculture.

The mixture of abatement opportunities are likely to vary across countries and sectors over time, for example, some technologies will not become commercially viable until several decades from now.

4.43 There is a role for government in establishing a policy framework which is conducive to reducing emissions. The Stern Review identifies three areas of market failure where government can act to provide the right incentives for businesses and individuals to act. These are:

- Set a price for carbon. The damage costs imposed on the world by greenhouse gas emissions are an 'externality' that needs to be reflected in the prices of goods.
- Technology policy. Uncertainty and knowledge spill-overs mean that carbon pricing alone will not be enough to induce low carbon technology at the pace and scale needed.
- Removing other barriers to behaviour change. Imperfections such as information asymmetry and capital constraints mean that abatement will not be fully implemented if relying on carbon pricing alone.



4.44 The economic case for action is clear. The Scottish Government believes that taking early action will have additional benefits to the Scottish economy. Enshrining targets in legislation should increase certainty for firms investing in Scotland when coupled with the implementation of credible policies which clearly demonstrate capacity to deliver these objectives. This clear signal could help Scottish firms to gain an early advantage, potentially becoming European and global market leaders. Our natural resources in renewable energy are also immense, some of the best in the world, and our position in Europe means that we can take advantage of this economically while also playing our part in the global fight against climate change.

International context

4.45 Cutting Scottish emissions will only help to avoid the most dangerous aspects of climate change if other countries with high levels of emissions are prepared to take action. If not, drastic cuts in emissions in Scotland (or the UK) will have an insignificant impact on climate change. The Scottish Government therefore supports the UK Government making climate change a strategic priority in discussions with international partners.

4.46 The international community has already begun a coordinated response to the challenge. The current international agreement to reduce greenhouse gas emissions is the Kyoto Protocol in which a number of industrialised countries aim to reduce their emissions of greenhouse gases by, on average, 5.2% below 1990 levels by 2008-2012. An international agreement is needed to set commitments beyond 2012 and negotiations have begun.

4.47 The Scottish Government was represented, as part of the UK delegation, at the third meeting of the Parties to the Kyoto Protocol in Bali in December 2007. The conference achieved an historic breakthrough in agreeing a roadmap to achieve a global deal by the end of 2009. The roadmap recognises that deep cuts in global emissions are needed. The conference agreed to address the four 'building blocks' of mitigation, adaptation, technology and financing. Agreements were also reached on addressing deforestation, work to accelerate investment in technology, and a fund to support adaptation in developing countries.

4.48 The EU has committed to reducing its collective greenhouse gas emissions by 8% in order to contribute to the Kyoto Protocol target of 5.2% overall. The UK share of the EU collective target was 12.5%. The key plank for achieving the EU target is the EU Emissions Trading Scheme (EU ETS) which began in January 2005 and is the largest emissions trading scheme in the world (see textbox on page 42 for further details). The scheme is mandatory for large emitters, covers almost 50% of Scottish CO₂ emissions and is designed to ensure that emissions reductions are made where they are most cost-effective.

- 4.49** Further developments have been taking place at a European level. At the Spring European Council on 8 and 9 March 2007, EU Heads of Government agreed an ambitious unilateral binding target to reduce Europe's greenhouse gas emissions by at least 20% by 2020 (compared to 1990 levels) and to increase this commitment to a 30% reduction if an international agreement is reached.
- 4.50** The Scottish Government monitors international and EU developments and works with the UK Government to agree a UK position on relevant international climate change issues. The Scottish Government plays an active role in the States and Regions' climate change initiative that brings together smaller countries, regions and states with a view to playing their part in combating dangerous climate change.¹⁸

UK context

- 4.51** The UK Government published its consultation on a draft Climate Change Bill in March 2007, with a headline target of reducing the UK's carbon dioxide emissions by 60% by 2050. The Bill, which was introduced into the UK Parliament in November 2007, includes setting targets in statute and setting a limit on the total amount that can be emitted by the UK over a five-year period (carbon budgeting). It also seeks to establish an independent committee to advise on the level of those carbon budgets, create enabling powers and reporting requirements.¹⁹ Following the Scottish Parliament's agreement in December 2007 to a Legislative Consent Motion, many of the provisions of the UK Bill, on enactment, will extend to Scotland.
- 4.52** Given the global challenge of climate change, it is right that the Scottish Government should work in partnership with the rest of the UK to show international leadership. The UK Bill provides a framework for shared action and has been drafted in terms which recognise the role of the Scottish Government as a partner in the pursuit of the UK emissions reduction target. It does not specify the measures to be used in Scotland to achieve the targets. The Scottish Climate Change Bill will offer an opportunity to put in place a statutory framework, additional to the UK one, for a distinctive Scottish target and to introduce any relevant devolved policy measures which require primary legislation. Actions taken under devolved Scottish powers to meet the Scottish target will help towards meeting the UK target as well. Similarly, there are areas such as energy generation for which power has not been devolved but where UK Government climate change action could help Scotland meet the Scottish target.

¹⁸ The Climate Group brought together representatives of smaller countries, regions and states at the United Nations Framework Convention on Climate Change Conference of the Parties 12 in Nairobi in 2006, where they agreed to work together through a Climate Alliance. Further information is available on the Climate Group website at www.theclimategroup.org.

¹⁹ The consultation was conducted solely on the basis of the UK Government with Devolved Administrations engaged at a later date. Further information available is from: <http://www.defra.gov.uk/environment/climatechange/uk/legislation/index.htm>



4.53 As part of the UK Energy White Paper published in May 2007, a proposal for a UK-wide Carbon Reduction Commitment (CRC) was announced. It will target emissions from energy use by most large commercial and public sector organisations (including supermarkets, hotel chains, government departments and large local authorities). The scheme is likely to be introduced in 2010. A second joint consultation was launched in June 2007 by the Department for Environment, Food and Rural Affairs (DEFRA), the Scottish Government and the other devolved administrations on a range of options for achieving the required emissions savings (the consultation closed on 9 October 2007). Two Scottish stakeholder seminars were held (in January and August 2007) to discuss options and scheme implementation. Scottish Ministers will decide how the scheme will be implemented in Scotland following analysis of the consultation responses.

Scottish context

4.54 Changing Our Ways, Scotland's Climate Change Programme,²⁰ set out Scotland's response to the urgent social, economic and environmental challenge of climate change. It quantified for the first time Scotland's equitable contribution to UK climate change commitments in carbon terms, setting a Scottish share and target. The first annual report on progress was published in March 2007.²¹ A new programme will be required to deliver the more ambitious target set out in this consultation.

4.55 The proposed Bill will sit above Scotland's Climate Change Programme and will set the high level statutory framework for climate change policies in Scotland. The Government Economic Strategy²² has emissions reduction as one of its targets, providing a key yardstick by which our commitment to sustainable economic growth will be judged. In addition to specific spending proposals linked to emission reduction measures, the Scottish Government's Budget Spending Review²³ makes a strategic commitment to introduce a system of cross-compliance, making it clear that all public spending decisions must take account of, and contribute to, the action needed to meet our emissions targets. Some of the measures included in the Spending Review which are expected to lead to a reduction in emissions in Scotland include:

- Funding initiatives by farmers and other stakeholders in the rural community to reduce climate change emissions from land management practices and to manage our rural environment more effectively, through the £1.6 billion Rural Development Programme.

²⁰ Changing Our Ways, Scotland's Climate Change Programme, available from: <http://www.scotland.gov.uk/Publications/2006/03/30091039/0>

²¹ Scotland's Climate Change Programme: Annual Report 2007, available from: <http://www.scotland.gov.uk/Publications/2007/03/08105454/0>

²² Government Economic Strategy, available from: <http://www.scotland.gov.uk/Publications/2007/11/12115041/0>

²³ Scottish Budget Spending Review 2007, available from: <http://www.scotland.gov.uk/Publications/2007/11/13092240/0>

- Launching the first-ever Saltire Prize with a £2 million annual fund to recognise innovation and a £10 million horizon prize – with the first challenge in 2008 focusing on renewable energy.
 - Tripling the funding for community renewables and microgeneration to reach £13.5 million a year by 2010-11.
 - Addressing the environmental impacts of transport through a package of funded measures that promote more sustainable travel.
 - Ensuring that the Forestry Commission is able to invest £15 million a year in new woodlands in a move towards increasing forest cover to 25%.
- 4.56** The Scottish Government has also just set a new, demanding renewables target: 50% of electricity generated in Scotland by 2020 (as a proportion of whole demand – i.e. Scottish consumption including transmission and distribution losses and own use by generators) should come from renewable sources, with an interim target of 31% by 2011.
- 4.57** The way we use agricultural, afforested and other undeveloped land has a major impact on net greenhouse gas emissions. Scotland has huge amounts of carbon locked up in, peatlands, organo-mineral soils, and vegetation, including forests. Maintaining the overall level of these carbon stocks is an important priority, particularly as climate change itself might make them more vulnerable to oxidation, thereby adding to emissions. Land use changes like deforestation and conversion of grassland to arable all result in CO₂ emissions. Livestock and use of fertilisers are sources of methane and nitrous oxides. On the other hand, woodland creation and conversion of arable to grassland create carbon sinks, with CO₂ being locked up in biomass and soils. Given Scotland's significant land resource, emissions reduction from, and carbon sequestration through, land use will remain a key part of our climate change strategy.
- 4.58** The historic built environment can also contribute to emissions reduction and the reduction of environmental impact through informed and sustainable management of historic and traditional buildings. In general, refurbishment of an existing structure uses less material, and produces lower greenhouse gas emissions, than creating a structure from scratch. Preliminary work carried out by the Building Research Establishment on life cycle analysis of historic buildings using eco-points of materials (including greenhouse gas emissions, life cycles, toxicity of materials, etc.) has shown that a building constructed of new materials will have used a larger quantity of CO₂ relative to an equivalent building made from traditional materials.
- 4.59** The Scottish Government has also committed to introducing a Flooding Bill to allow a modernised and sustainable approach to flood risk management with streamlined decision making. It will introduce new measures to reform the current legislation, the Flood Prevention (Scotland) Act 1961, transpose the EC Directive on the Assessment and Management of Flood Risks and make provision for a portfolio of responses for managing flood risk.

05 TARGETS

5.1 This section discusses how a statutory target should be designed. It covers a number of complex issues:

- The target could be based on either emissions produced in Scotland, or on emissions from goods and services consumed in Scotland.
- The target could be expressed as a particular percentage reduction by a particular year, or as the total amount of emissions from Scotland over a particular time period.
- Different gases could be included in the target.
- Different means of measuring the target could be used.
- Different means of accounting for emissions which are already regulated through the EU emissions trading scheme.
- International credits.
- Emissions from international aviation and shipping.
- The level of the target.
- Future amendments to the target.

5.2 There are close relationships between each of these issues. For example, the choice of base year affects the level of the target. An 80% reduction by 2050 from 1990 levels is the equivalent of 77% reduction from 2005. Including international credits would enable a higher target to be met at the same cost to Government and the economy. Choosing a CO₂ target rather than a target based on a basket of greenhouse gases may allow a higher target to be met for the same cost to Government and the economy. Therefore, when considering the issues discussed in this section it is important to bear in mind the linkages existing between them.

Targeting Scottish emissions

5.3 The conclusion of the IPCC Fourth Assessment Report²⁴ is that to avoid dangerous climate change, global warming must be limited to 2°C above pre-industrial levels. The EU supports this as an objective and is using it as the foundation for its climate change policy development and in international negotiations. The Scottish Government has very little influence over global indicators such as global temperature rise or global emissions concentrations. Therefore it would not be credible for a Scottish target to use such global measures. The Scottish Government therefore proposes that the targets are specified in terms of Scottish emissions.

²⁴ IPCC Fourth Assessment Report, available from: <http://www.ipcc.ch/ipccreports/ar4-syr.htm>



- 5.4** But what are Scottish emissions? Scottish emissions could be defined as the emissions from goods and services **produced** in Scotland (direct emissions), or emissions from goods and services **consumed** in Scotland (indirect emissions). Direct emissions are those emanating from activities in Scotland: such emissions form the basis for the Greenhouse Gas Inventories – and for existing international emission reduction agreements. But, as part of the global economy, most of the products Scotland consumes are produced outside Scotland. This external production activity also causes emissions, so-called indirect emissions. Such indirect emissions are not reflected in the Inventory.
- 5.5** A particular fraction of Scottish direct emissions worth mentioning in this context is that associated with the generation of electricity in Scotland which is subsequently exported outside Scotland (some 20% of the electricity generated in Scotland in 2006). In line with international practice, such emissions are recorded in Scotland's Inventory of emissions. Further discussion on the significance of this fraction in determining the Scottish target is set out in paragraph 5.28.
- 5.6** In addition to the emissions associated with the production and consumption of goods and services, we also need to consider the energy needed throughout the life of a product or service we consume. A new building may require less energy to heat than an old building, but renovating an old building may require far less energy and use materials that required far less energy to make (known as embodied energy) than building a new building.
- 5.7** There are ways under development to measure our overall impact on global emissions from our consumption. The most common of these is the carbon footprint. There are a number of definitions of carbon footprint but the one that is probably the most appropriate for Scotland is:

'The carbon footprint is a measure of the exclusive total amount of carbon dioxide emissions that is directly and indirectly caused by an activity or is accumulated over the life stages of a product.'²⁵

However, methodologies of this kind are not yet sophisticated enough to be used as the basis for a statutory target and so it is not proposed to pursue such an approach at this time.

²⁵ ISAUK Research Report 07-0, A Definition of 'Carbon Footprint', Thomas Wiedmann and Jan Minx, available from: http://www.isa-research.co.uk/docs/ISA-UK_Report_07-01_carbon_footprint.pdf

- 5.8** There is some evidence to suggest that currently there is little difference between measuring emissions associated with consumption and production. Analysis published by WWF reveals that 'Scotland's CO₂ emissions from production (11.49 tonnes per capita) and consumption (11.61 tonnes per capita) are very similar. On a per capita basis, its territorial emissions are higher than the UK average and its CO₂ emissions from consumption are lower. CO₂ emissions from household energy consumption in Scotland are higher than the UK average: 3 tonnes per capita compared with an average of 2.75 tonnes per capita. This may be partially due to Scotland's colder climate. Even though much of Scotland is rural, it emits only 1.3 tonnes per capita of CO₂ from transport, compared with the UK average of 1.7 tonnes per capita.'²⁶ The relationship between emissions as measured by consumption and production methods may change over time, depending on several factors, including the mix of methods used to generate electricity in Scotland and how much of that electricity is exported.
- 5.9** It is considered that the only workable option is to set a target based on the emissions that we produce in Scotland. However, what matters for climate change is global emissions, not just Scottish emissions, so this target should always be seen as a proxy for Scotland's impact on global emissions. Scottish policies should be designed to impact on the global emissions Scotland causes, not just those we produce. This may mean that Scottish climate change policies tackle our consumption patterns or encourage technology that may be used overseas. Such measures may not improve Scottish emissions figures, and so may not contribute towards our target, but they will help in the global fight against climate change. These supplementary measures could still be reported upon to Parliament.

How should the target be expressed: a point target or a cumulative target?

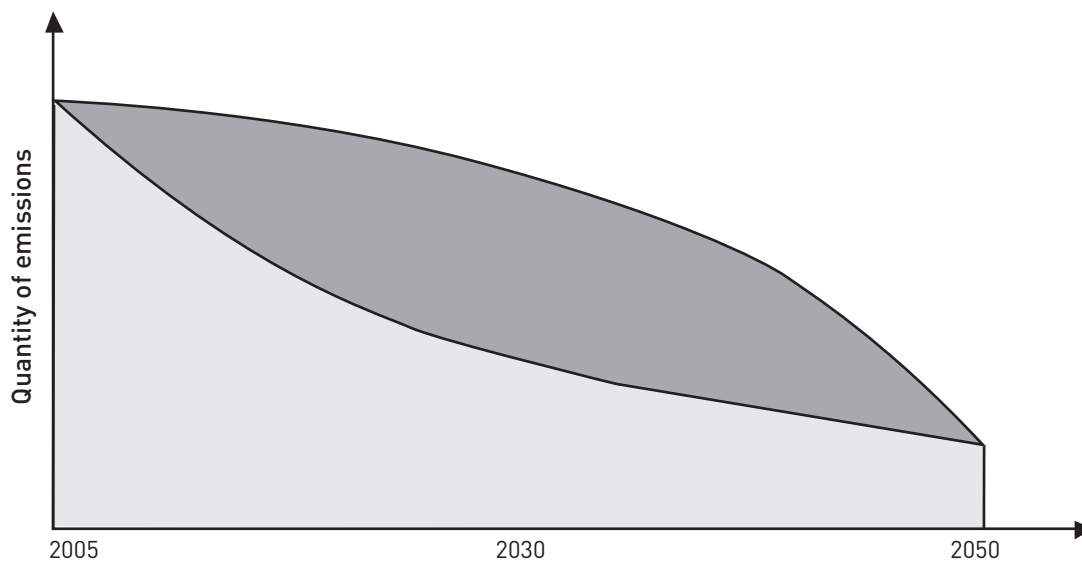
- 5.10** Most international agreements are phrased in terms of a point target: reducing emissions to a certain level by a certain year. Framing the Scottish target in a similar manner would facilitate comparisons of effort between countries.

²⁶ SEI, WWF and CURE (2006). *Counting Consumption – CO₂ emissions, material flows and Ecological Footprint of the UK by region and devolved country*, available from: <http://www.wwflearning.org.uk/data/files/ecological-budget-uk-report-348.pdf>



5.11 It is not just the particular level of greenhouse gas emissions in a single year which affects climate change; rather it is the total amount emitted over a number of years. The graph below shows two emissions reduction paths from the same starting level to the same point reduction – but with different trajectories (rates of progress). The areas under each trajectory – representing the total amount of emissions over the period – are quite different: the darker shaded area shows how delaying emissions reduction results in greater cumulative emissions. Therefore, the setting of a single point reduction target does not, by itself, determine the total emissions produced over a period.

Figure 6
Illustration of the affect on total emissions over time of different emissions reduction trajectories



5.12 It would be possible to construct a target for the total amount of emissions that could be released to 2050. Such a target, if met, would give greater certainty about the level of Scotland's contribution to the global effort to tackle climate change than a single point percentage reduction target.

- 5.13** However, a cumulative emissions target will be more challenging and more costly to meet due to the fact that the economy will take time to shift onto a low carbon path and many of the technologies expected to deliver savings are not yet commercially viable. Setting a certain amount of emissions will mean that greater emissions reductions will be required in the short run which may force the government to implement measures which are not cost-effective, increasing the overall cost of meeting the target.
- 5.14** The credibility of the target will be key to the Scottish Climate Change Bill's success in providing a framework for long-term investment and business decisions. A cumulative target would give less flexibility with which to meet some of the great uncertainties in tackling climate change. If it were widely perceived that the target would be missed, a cumulative target would lack credibility.
- 5.15** Given that Scotland's global impact is relatively minor, and that the uncertainties involved in tackling climate change are indeed great, the Scottish Government proposes to adopt a point target for 2050, rather than a cumulative target. However the Scottish Government recognises the advantages which a cumulative approach can bring, and therefore proposes to adopt a cumulative approach to interim emissions budgets (see Section 6).

Which gases should be targeted?

- 5.16** The purpose of a Scottish target is to reduce our impact on global climate change. The emissions of gases which are caused by human activities and cause climate change and are included in international agreements are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆) (see Section 4 for further information).
- 5.17** An individual target could be developed for each greenhouse gas but this would increase the cost of meeting the targets without bringing any additional benefits. Measures to reduce emissions of every gas would be needed. But a measure for one gas may be more expensive than another that produced the same reduction in carbon dioxide equivalent. If the cost of reducing emissions of a basket of greenhouse gases and individual targets for each gas that have the same overall impact on climate change are compared, the basket approach gives greater flexibility and therefore is likely to be less costly. This section therefore discusses two options: basing the target on carbon dioxide only, or basing the target on a basket of greenhouse gases (the carbon dioxide equivalent of the six greenhouse gases).



- 5.18** There are many ways of reducing Scotland's emissions of different gases and each measure will have a different cost associated with it. To inform policy development, more information is needed about the implications of pursuing particular options, including the associated costs and how these costs are distributed between the public and private sector. It may be impossible to stop some activities which produce greenhouse gas emissions or to eliminate some greenhouse gases altogether. If non-CO₂ gases prove difficult and/or very costly to abate, greater reductions in CO₂ will be needed to compensate. Therefore a target based on a basket of greenhouse gases may place additional costs on the economy as compared to a CO₂ only target.
- 5.19** The Scottish Government is currently undertaking research to assess the potential range of measures available to reduce greenhouse gas emissions in Scotland, including the impact of these measures, any barriers to implementation and the likely costs involved. The output of this research is planned to be published in Spring 2008.
- 5.20** The greatest proportion of Scotland's greenhouse gas emissions is carbon dioxide (80% of greenhouse gas emissions in 2005). This is mostly generated by burning fossil fuels (coal, gas and oil) for electricity or transport. Whilst the Kyoto Protocol targets are based on the basket of greenhouse gases, other climate change frameworks, such as the UK Climate Change Bill and the EU Emissions Trading Scheme, only target carbon dioxide (although the UK Bill does allow for other greenhouse gases to be targeted at a later date and other activities which emit non-CO₂ gases may be included in the EU ETS in later phases). This is because carbon dioxide is the gas in which the deepest cuts are needed – both within the UK and globally.
- 5.21** Within the UK, substantial progress has been made in reducing emissions from non-CO₂ gases. In 2005, UK non-CO₂ emissions had fallen 45% since 1990. In Scotland the reduction was 25%. UK emissions of non-CO₂ greenhouse gases are currently projected to fall to 50% of 1990 levels by 2050. The feasibility and cost of further non-CO₂ reduction is currently unknown, but in some sectors (e.g. methane from mines and HFCs in refrigeration), greater reductions in emissions may be very difficult and/or costly to achieve.²⁷
- 5.22** The data about how much of each gas Scotland produces is compiled in the Greenhouse Gas Inventories. Most of the elements of the inventory are estimates, rather than actual measurements, and there is a level of uncertainty associated with each figure (see Table 3). All statistics carry a degree of uncertainty but the recorded numbers are still a valid monitoring tool.

²⁷ Mechanisms for reducing methane and HFC emissions from four selected sectors, AEA Technology study for Defra, available from: <http://www.defra.gov.uk/environment/climatechange/uk/business/crc/pdf/aeat-reducing-emissions-report.pdf>

Table 3

Uncertainties ²⁸ around the inventory estimate (rounded)			
greenhouse gas			
	Scotland	UK	
CO ₂	± 6%	± 2%	
CH ₄	± 18%	± 21%	
N ₂ O	Lower ²⁹ Estimate Upper	3 kt 16 kt 68 kt	28 kt 128 kt 474 kt
HFC	± 19%	± 19%	
PFC	± 10%	± 10%	
SF ₆	± 20%	± 20%	
Total	± 20%	± 13%	

- 5.23** In general, the emission estimates for carbon dioxide are less uncertain than those for the other greenhouse gases because the data relating to CO₂ emissions is more robust. Most CO₂ emissions are the result of combustion and we have good estimates of the amount of fuel burnt and the associated emission factors.
- 5.24** Uncertainty relates to both the emissions factor and activity data used to estimate emissions associated with each activity. The relatively larger contribution made by land use, land use change and forestry makes the Scottish CO₂ estimate more uncertain than for the UK.
- 5.25** There are therefore a number of issues to consider when considering which gases should be included in the target: impact on global climate change, cost to the economy and credibility of the target.

- Q 1.** Should a Scottish target be based on carbon dioxide only or the basket of six greenhouse gases?
- Q 2.** Should the Bill contain provisions to alter which gases are included, for example if the reliability of data for a particular gas improves or if science changes in the future about which gases cause climate change?

28 Uncertainty is defined as ± 2 (standard deviation)/mean %, which closely approximates the 95% confidence interval.

29 The N₂O distribution is heavily skewed so that 2.5% (lower) and 97.5% (upper) confidence limits are quoted.



How should progress towards the target be measured?

- 5.26** To ensure that the Scottish Climate Change Bill provides the right incentives to reduce emissions, we must consider whether different means of measuring the target might better reflect the Scottish Government's ambition for Scotland to make its contribution to tackling climate change.
- 5.27** The Greenhouse Gas Inventories measure emissions produced in Scotland. They are published annually and comply with internationally recognised methodologies. They are the best source of data we have for Scottish emissions. However, they are not perfect: compiling the data involves a 20-month delay before publication; and, as explained in paragraph 5.22, there is a level of uncertainty around the figures. In the context of setting a target, it is also important to note that, as it stands, the Inventories are unlikely to show explicitly, the results of all progress made in reducing energy demand, improving energy efficiency and scaling up renewable electricity generation in Scotland – key planks of Scotland's emissions reduction agenda.
- 5.28** Generation, transmission and supply of electricity is undertaken on an integrated basis across the UK. Accordingly, electricity is able to be transmitted across the countries of the UK, as demonstrated most recently by the fact that some 20% of electricity generated in Scotland was exported to other parts of the UK in 2006. As mentioned earlier (paragraph 5.5), one of the principal implications for Scotland of exporting electricity is that the emissions associated with the generation of such electricity count against Scotland's emissions total rather than that of the country receiving the electricity. Another significant implication is that any reduction in demand from within Scotland for electricity from fossil fuel power stations – as a result of a reduction in energy demand (e.g. closure of industrial installations), improved energy efficiency or increased consumption of renewable electricity – increases the potential for such power stations to export electricity. In such circumstances, while Scotland may well be successful in its pursuit of improved energy efficiency and increased generation of renewable electricity, this success will not necessarily be reflected in Scotland's emissions Inventory. This said, Scotland's success in these areas will be reflected elsewhere in the UK due to the net affect on emissions at the UK-level of improved energy efficiency and increased supply of renewable electricity.
- 5.29** Energy efficiency measures are generally the least expensive means of reducing emissions and can often save money. However there are barriers to improving energy efficiency which need to be overcome: making use of and acting on clear and trusted information, disruption when improvement works are taking place, and

the initial financial investment (although most energy efficiency measures produce financial savings in a relatively short time). There is also evidence that when energy efficiency measures are installed, energy demand does not always decrease – householders may, for example, set their heating higher because it is now cheaper, or use the savings to buy energy intensive goods such as a dishwasher or plasma TV. The Bill must therefore provide a stronger incentive to reduce overall energy demand.

- 5.30** As mentioned above, increases in Scottish renewables capacity and generation do not necessarily affect the emissions counted in the Scottish inventory. Existing UK fossil-fuel powered stations will continue to dominate emissions until a combination of reductions in demand and renewables are capable of replacing generation capacity when it reaches the end of its productive life. The decision on when to close (or whether to build replacement) fossil fuel power stations, the type of fuel used (e.g. gas, oil or coal), and where in the UK to build them, is for electricity generators, though it is also influenced by legislation such as the Large Combustion Plants Directive and the EU Emissions Trading Scheme.
- 5.31** Yet providing the right incentives for each of these measures will be critical to decarbonising the Scottish economy. Increasing renewable capacity (both electricity and heat), improving energy efficiency and reducing energy demand can each have knock-on effects greater than the associated reduction in immediate emissions: greater renewables generation and reduced energy demand may mean we need fewer new fossil fuel (or nuclear) power stations in the UK, avoiding future emissions from construction and technological lock in. Improvements in energy efficiency would counter our need for the energy capacity we require currently because of inefficient generation, transmission and appliances and products.
- 5.32** Even though energy efficiency and renewable energy may not reduce the emissions Scotland produces, they do help to reduce emissions elsewhere and so should be encouraged. The Scottish Government wants to ensure that the Bill creates the right incentives to encourage energy efficiency and renewable energy by ensuring that the statutory target is framed in a way which allows progress made in these areas to be reflected. Measuring emissions from Scottish sources alone is unlikely to do this. Two options which may help to provide the appropriate incentives for renewable energy and energy efficiency are to base the target on an end-user inventory instead of the source inventory, or to have separate targets for energy demand and renewable electricity in addition to a target for the source inventory.



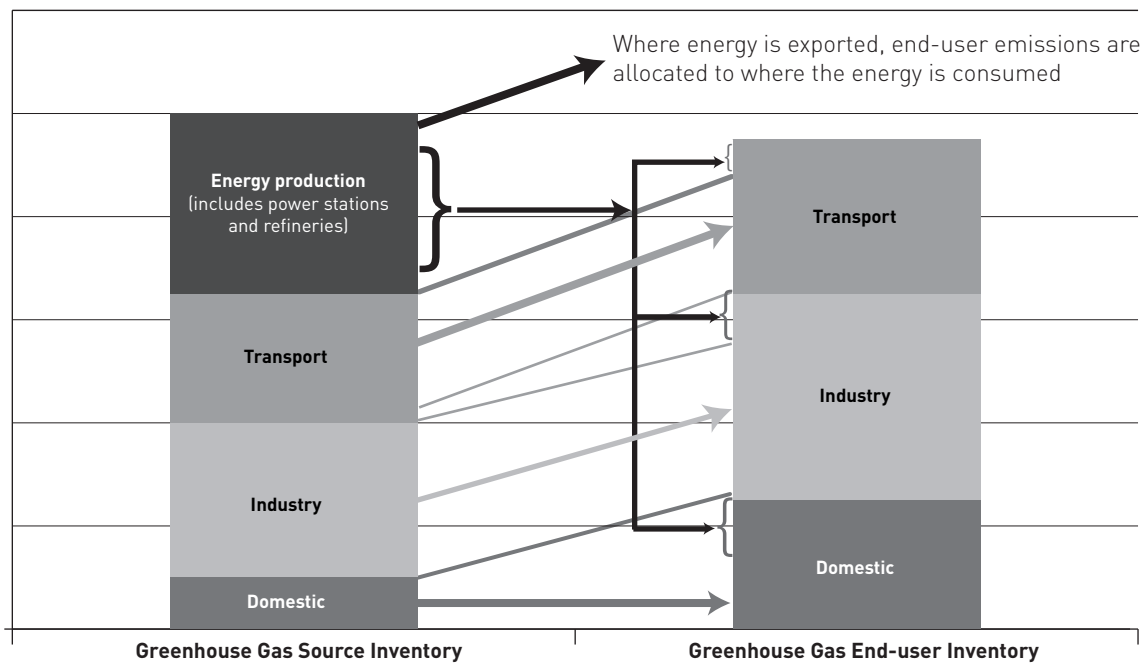
End-user inventory

5.33 To create an end-user inventory, the figure for emissions from our power stations and oil refineries in the standard inventory is replaced by a measure of the electricity and fuel consumed in Scotland. This would entail counting the electricity consumed in Scotland and translating it into an emissions equivalent by multiplying it by the average emissions factor for all electricity generated in Scotland (this is known as the “carbon factor”). This means that reductions in energy demand in Scotland would be reflected. It also means that an increase in renewable electricity generation would be reflected because such an increase would reduce the carbon factor. The end-user inventory would still count emissions from other products that are exported, such as whisky, food products, chemicals and office machinery.

Figure 7

Relationship between Greenhouse Gas Source Inventory (production-based) and End-user Inventory (consumption-based) – showing how emissions relating to energy production are reallocated to other sectors

(Note the information shown is purely indicative)



Separate targets

5.34 Another option would be to have a separate, mandatory target for each of energy demand and renewable electricity, where it is within the competence of the Scottish Parliament to set such a target (regulation of energy supply is reserved). Having separate statutory targets would mean that we would have less flexibility in how we reduce our emissions. Given that the regulation of energy supply is reserved to the UK Government, and therefore that the Scottish Government does not have access to all of the necessary policy and financial levers, there is a risk of falling short of statutory targets expressed in terms of energy efficiency or renewable electricity. Separate targets might provide the wrong incentive: money or effort may be spent on meeting a renewables target when the same amount of money or effort invested in supporting another type of measure may have resulted in a greater reduction in emissions. Separate targets may also be confusing: if emissions were not decreasing but targets for energy demand and renewables were being met, should Scotland be doing more or would we be on track?

Q 3. The Scottish Government wishes to ensure that the Bill gives sufficient incentives to invest in energy efficiency and renewable electricity. Should the targets be based on source emissions; an end-user inventory; or on individual targets for energy efficiency and renewable electricity? Do you have any other suggestions?

Q 4. Do you agree that the Bill should allow the means of measuring the target to be changed through secondary legislation to reflect international developments or unforeseen consequences of the Bill?

Interaction with EU Emissions Trading Scheme

5.35 The EU Emissions Trading Scheme (EU ETS) currently regulates just under 50% of Scottish CO₂ emissions. Trading schemes are, under particular conditions, the most economically efficient means of reducing emissions, because they allow emissions reductions to be made where they are least expensive. They also guarantee the level of emissions reductions (in a global context) because the total amount of emissions from installations included within the trading scheme is capped. In establishing over-arching national statutory targets through the Scottish Climate Change Bill, the Scottish Government does not want the Bill to undermine this important policy lever.



The EU Emissions Trading Scheme (EU ETS)

The EU ETS is one of the key policies introduced by the European Commission to help meet the EU's 8% greenhouse gas emissions reduction target under the Kyoto Protocol. The Scheme covers energy activities (e.g. boilers, electricity generation, Combined Heat and Power); production and processing of ferrous metals; mineral industries; pulp and paper industries.

The EU ETS uses a market-based mechanism to incentivise the reduction of greenhouse gas emissions in a cost-effective and economically efficient manner. The Scheme operates through the allocation and trade of greenhouse gas emissions allowances throughout the EU, where one allowance represents one tonne of CO₂ equivalent. In phases I and II of the scheme (2005–2007 and 2008–2012). An overall limit or 'cap' is set by each Member State on the total number of allowances to issue to installations in the Scheme, based on the member state's Kyoto and/or national emissions reduction target.

At the end of each year, the Scheme's participants (i.e. individual companies) are required to ensure they have sufficient allowances to account for their installation's actual emissions. They have the flexibility to buy allowances to meet their actual emissions, or to sell any surplus allowances generated by reducing their emissions below their allocation. The buying and selling of allowances takes place on an EU-wide market, and under the rules of the Scheme there is no restriction placed on where within the EU allowances are sourced, or how many may be purchased to cover actual emissions. All transfers are recorded in national registries.

The Linking Directive amends the EU ETS Directive and provides for the use of credits from the Kyoto Protocol's flexible mechanism for compliance purposes in the EU ETS. Use of these credits are required to be restricted up to the limit set out in each member state's national allocation plan.

5.36 In considering the relationship between the EU ETS and an over-arching statutory emissions reduction target for Scotland it is important to understand certain features of the trading regime. Although the EU ETS is largely a devolved measure, the allocation of allowances for individual installations is set through the mechanism of a National Allocation Plan for the UK as a whole and agreed by the European Commission. The UK-level cap for Phase II of the EU ETS was informed by the UK Government's domestic CO₂ emissions target to reduce emissions by 20% by 2010 – a target the previous Scottish administration committed to support. It is likely that future caps will be set by the European Commission,³⁰ informed by the EU's

³⁰ At the time of printing, the European Commission was due to make a public announcement on 23 January 2008 about future European Union Emissions Trading Scheme caps. Information about EU ETS is available from: <http://ec.europa.eu/environment/climat/emission.htm>

overarching emissions target of a reduction in greenhouse gas emissions of 20% by 2020 (30% if an international agreement is reached). Therefore the caps for individual installations covered by the EU ETS in Scotland may be set on the basis of a different target to that proposed to be set in the Scottish Climate Change Bill. Imposing further statutory controls on those installations covered by the EU ETS, in line with Scotland's emissions reduction target would be unlikely to generate any additional reductions globally (see paragraph 5.38) and may result in industry moving out of Scotland.

- 5.37** The other important feature to note about the EU ETS – as described in the box on page 46 – is the facility to buy additional allowances to cover emissions made beyond an installation's cap or to sell any surplus allowances generated as a result of an installation reducing its emissions below its allocation. This process of trading is an international one – within the EU-wide market and beyond into the wider international arena through the Kyoto Protocol's flexible mechanisms. Given the wider mechanisms at work, the EU ETS imposes certain, important, limitations on what can be achieved through national emission reduction targets, limitations that will have to be borne in mind when determining the form of target to be set through the Bill.
- 5.38** If the statutory target included actual emissions from installations covered by the EU ETS (rather than the allocations given to those installations), the benefits of the trading scheme would be redundant and result in higher costs for Scottish installations. Scottish installations are likely to have to make more emissions reductions to contribute to meeting the national target, even if the making of such reductions are more expensive than buying allowances. Such a situation would mean that the installations would be emitting below the EU ETS cap allocated to them, thereby enabling the installation operators to sell their excess allowances through the EU ETS market. Although Scottish emissions would fall, there would be no difference in overall emissions from the Scheme. An analogy would be to imagine a balloon filled with a fixed amount of air, representing the EU-wide emissions cap. Squeezing part of the balloon, i.e. the emissions in Scotland, simply leads to a bulge in another part of the balloon, i.e. the emissions in other countries.
- 5.39** The UK Government already uses a means of accounting which includes the effort made through EU ETS in its Energy White Paper 2007, the updated Energy Projections 2007, and the Greenhouse Gas Inventories. UK Climate Change Bill allows for effort made through the EU emissions trading scheme (buying allowances and credits).



Impacts of including EU ETS effort

5.40 Because the EU ETS currently regulates just under 50% of Scottish CO₂ emissions, taking account of the EU ETS in the Scottish target is important. There appear to be two options, both of which have serious disadvantages:

- Counting the allocations to installations rather than actual emissions from the traded sector. The disadvantages would be that there may be a substantial lack of Scottish control over the level of emissions made, and installations may not be given allocations in future years (they may be auctioned) so this approach may not be possible in future years.
- Excluding the traded sector from the target. The disadvantages would be that this would be likely to exclude more and more activity over time and diminish the importance of the Scottish target.

This section seeks your views and suggestions on how to address this significant, complex, and evolving problem.

5.41 Allowing for effort made through the EU Emissions Trading Scheme should smooth Scotland's emissions data. Power generation in particular can be very volatile. In the past, emissions from this sector have fluctuated by up to 12% but early, indicative, data shows that between 2005 and 2006 the rise in emissions from power stations is likely to be confirmed to be in the region of 35%. To take advantage of this smoothing, one option for factoring the emissions from installations covered by EU ETS in Scotland into a national emissions reduction target would be to count their annual allocation (set in advance), rather than their actual emissions.

5.42 The nature of the EU ETS means that the Scottish Government cannot directly control what emissions are released by installations within the EU ETS. The EU ETS is largely a devolved measure, but the cap has been set at the member state level (ie the UK level) and is likely to move to the EU level. Scottish emissions may rise because Scottish emitters choose to buy allowances, but nevertheless there would be an overall beneficial impact on global emissions because savings would have occurred elsewhere.

5.43 Although the EU ETS cap is currently set at the UK level, it takes into account competitiveness issues. If the cap is set so tightly for a competitive industry that production moves to another country, the economy suffers with no benefit in overall emissions: the bulge moves to another part of the balloon. Therefore the cap tends to be set at a "business as usual" level for sectors subject to international competition. This is likely to be insufficient to meet domestic emissions reductions targets. The non-traded sector would have to make a greater effort in reducing emissions to meet the target. This would mean that one of the key policy levers regulating a large proportion of our CO₂ emissions to meet the Scottish target is not set directly by Scottish Ministers, nor is it necessarily set consistently with Scottish or UK targets.

- 5.44** In the future, the influence of the EU ETS on national emissions is likely to become of greater significance. It is probable that over time, other sectors and gases not currently covered by the scheme will be included, such as aviation and possibly surface transport. This means that emissions from other areas of the economy will be removed from the direct control of Scottish Ministers.
- 5.45** Another feature of the EU ETS that could introduce more complication in the future is the intention for a greater proportion of allowances to be auctioned rather than allocated. Scotland is not allocated an allowance; rather it is proposed that each member state would be given a certain allocation to auction. Installations from any member state could bid for allowances auctioned in the UK. If a greater proportion of allowances are auctioned it may be difficult to establish what Scotland's share of the UK allowance is.
- 5.46** Given the way the EU ETS operates and acknowledging the important role trading has to play in bringing about emission reductions within the EU and globally – through an ever-increasing carbon market – it is important that the relationship between the EU ETS and national emission reduction targets is clear. On the face of it, the two regimes need to be considered separately. To do otherwise risks undermining the rationale behind the EU ETS – to encourage reductions through the most cost-effective means. But, excluding emissions from installations covered by the EU ETS from the scope of the proposed statutory emissions reduction target equally runs the risk of severely limiting the range of emission sources covered by such a target. This is an extremely difficult issue. The Scottish Government considers that maximising the emission sources covered by its planned 80% reduction target is imperative and, to this end, welcomes views on how best to take account of the EU ETS in the design of the target.

Q 5. Should the emissions reduction target take account of the abatement effort made by companies under emissions trading schemes? If so, how?

International credits

- 5.47** Emissions of greenhouse gases have the same effect wherever they occur in the world. Both the Kyoto Protocol and the EU Emissions Trading Scheme allow the purchase of carbon credits from overseas to count towards domestic targets. This allows emissions reductions to be made at a lower cost and provides a flow of low carbon investment funds for developing countries. A recent study by the UNFCCC Secretariat³¹ estimated that of the US \$200–\$210 billion necessary in 2030 to return global greenhouse gas emissions to current levels, almost half of this funding – around US \$100 billion – would need to go to developing countries if they were to meet their growing demands for energy in a sustainable way.

³¹ Dialogue on long-term cooperative action to address climate change by enhancing implementation of the Convention (Dialogue Working Paper 8), UNFCCC, available from: http://unfccc.int/cooperation_and_support/financial_mechanism/items/4053.php



The Kyoto Protocol and flexible mechanisms

The Kyoto Protocol provides countries that have adopted targets with a number of ways to meet them, through international emissions trading and 'flexible' mechanisms (explained below). Through these mechanisms the Protocol creates a system whereby emissions reductions may occur at the least cost location, the net effect being a reduction in global greenhouse gas emissions.

The Kyoto flexible mechanisms, the Clean Development Mechanism (CDM) and Joint Implementation (JI), allow for countries with a Kyoto target to participate in projects that abate emissions in another country. The credits generated (where each is worth one tonne of CO₂e abated) can then be used to meet the participating country's Kyoto target.

The CDM provides for countries with a Kyoto target ('Annex I' countries) to carry out projects in developing countries which do not have a reduction commitment ('non-Annex-I' countries). These projects reduce emissions and may have additional sustainable development benefits. The 2006 Department for International Development White Paper³² set out the UK Government's objectives regarding deployment of low-carbon technology in developing countries and CDM projects play an important role in this regard.

JI allows a country with a reduction target under Kyoto to purchase credits generated by a project to reduce emissions in another country covered by a Kyoto target.

5.48 Many countries with substantial emissions reductions targets expect to use international credits to help meet those targets. The Scottish Government proposes to allow international credits to be counted towards its targets. These would only be credits verified by international processes supporting the Kyoto Protocol – either clean development mechanism (CDM) or joint implementation credits (JI). Allowing international credits also helps to make a stringent target more credible. Even if new technologies and behavioural change are not having sufficient effect, the Scottish Government can ensure our targets are met by buying international credits. Any use of international credits would be in line with the international principle of 'supplementarity' established under the Kyoto Protocol. This means that the primary focus must be emissions from within Scotland, and that international credits should only be a minority of our emissions reductions. However, the Scottish Government does not propose to set a statutory limit on the amount of international credits that can be used. This would provide greater flexibility and lower costs to meeting the targets, and provides a mechanism to rectify any deviation from the emissions reduction pathway. The Scottish Government would propose to obtain independent advice on what the appropriate usage of international credits would be.

³² White Paper: Eliminating World Poverty: Making Governance Work for the Poor, available from: <http://www.dfid.gov.uk/wp2006/default.asp>

Q 6. Do you agree that international credits should be counted towards Scottish targets? Should there be limits on credits counted towards Scottish targets?

International aviation and shipping

- 5.49** Due principally to the international nature of the aviation industry, emissions from international aviation are not currently covered by international climate change agreements by the UK’s targets or those proposed for Scotland. Complications might include passengers taking more than one flight to reach their final destination, given the hub and spoke model of international aviation routes; and long haul flights where aeroplanes have to stop in a different country en route just to refuel. And, within a UK context, many of the policy measures which might be used to reduce international aviation emissions are reserved to the UK Parliament, so it would be difficult for Scottish Ministers to influence emission levels to the extent necessary.
- 5.50** Given aviation’s international nature, the Scottish Government supports the UK in believing that an international solution is needed. The Scottish Government has supported the UK Government’s efforts to press to include aviation in the EU Emissions Trading Scheme and is pleased that, at the EU Environment Council meeting in December 2007, it was agreed that this would happen during Phase II of the Scheme, in 2012. The current European Commission proposal would require airlines to pay for the growth of their emissions above 2004-06 levels with equivalent emissions reductions from other sectors.
- 5.51** International discussions on how best to deal with international shipping emissions are even less advanced than in the aviation sector. The Scottish Government’s view is that international shipping emissions (as with international aviation emissions) are best addressed at an international level. The Scottish Government also supports the UK Government’s pressure for international action for the maritime sector.
- 5.52** Domestic aviation and shipping are already included in the Greenhouse Gas Inventories statistics (i.e. emissions from planes and ships whose journeys start and finish within the territorial limits of the UK). As methods for apportioning aviation and shipping emissions within an international framework develop and are agreed internationally, it may become possible for these emissions to be satisfactorily included in Scotland’s reduction targets and there will be scope in the Bill to include these sectors in the legislative framework at a future date.



Level of the target

- 5.53** The level of the target could be set either on the basis of the science and supporting research that indicates by how much emissions need to be reduced to avoid dangerous climate change or, alternatively, by looking at what existing and new technologies and likely behavioural change are expected to achieve. The target must be set at a level which is sufficiently challenging to drive action and set an example to the rest of the world of the level of ambition required to avoid dangerous climate change. However, there must be a reasonable likelihood of achieving the target. If it is set so high that it cannot be achieved, businesses and firms will not believe that Government will do everything needed to meet the target and one of the primary reasons of having the mandatory target – constructing a credible, long-term framework for private sector investment – will be undermined. This is a delicate balance. The target needs to be more ambitious than what current technologies can deliver in order to help provide an incentive to develop new technologies, yet not so challenging as to be unachievable and therefore redundant.
- 5.54** The Scottish Government's preference is to reduce emissions by 80% by 2050. Opting for an ambitious target recognises that Scotland has a relatively affluent economy and great potential for generating energy from renewable sources. This is in line with the latest IPCC report which states that global emissions cuts of between 50% and 85% by 2050 will be required to minimise the chances of a global temperature rise in excess of 2°C – 2.4°C.
- 5.55** The Scottish Government proposes to use the same base dates as the Kyoto Protocol target for the baseline. This would be 1990 for carbon dioxide. If the target were to be based on the basket of greenhouse gases, this would be 1990 for carbon dioxide, nitrous oxide and methane, and 1995 for F gases (hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride).
- 5.56** The level of ambition will, of course, depend on many of the other issues discussed in this section. If any elements of flexibility are tightened, the target will become more difficult to achieve.
- 5.57** Meeting an 80% target – no matter how it is framed – will be extremely challenging. Many of the factors which influence emissions are outwith Scottish Ministers' control, such as temperature and relative fuel prices. Greenhouse gas emissions from certain sectors (such as methane from cattle and carbon dioxide from ploughing land) are very difficult to reduce without reducing the size of a particular sector or its productivity. Scotland has a relatively small energy intensive sector in which large efficiencies might be made. Section 4 of this consultation, the partial Regulatory Impact Assessment and the draft Environmental Report³³ give more information on what the impacts of meeting such a target might be.

³³ Available from: <http://www.scotland.gov.uk/climatechangebill>

Amending the target

- 5.58** Considerable scientific uncertainty remains over the optimal stabilisation rate to avoid dangerous climate change. The Stern Review and the Royal Commission on Environmental Pollution³⁴ suggest reducing emissions to stabilise atmospheric concentrations to 550ppm by 2050. At this level, the Royal Commission estimates that UK CO₂ levels would have to fall by 60% by 2050 (around 440 – 500 ppm CO₂ only). The Stern Review states that stabilising CO₂e at or below 550 ppm would require global emissions to peak in the next 10-20 years, and then fall at a rate of at least 1-3% per year. By 2050, global emissions would need to be around 25% below current levels, and reductions of this kind would need to be made in the context of a world economy which could be three to four times larger than today.
- 5.59** Scotland's greenhouse gas emissions are only 0.15% of the world's emissions, and that proportion will fall as large developing countries continue to industrialise. Whilst it is important to lead by example, even eliminating all Scottish emissions would have a negligible affect on climate change. Climate change policies which focus solely on cutting Scottish emissions may have a perverse impact on emissions elsewhere. Tight regulations that force larger emitters to move from Scotland could damage the Scottish economy whilst having no effect on global emissions; they simply move the emissions to another part of the world. Indeed such action might even increase emissions if the goods produced elsewhere then need to be transported back to Scotland.
- 5.60** New international agreements are anticipated in the next few years. These may have an impact on some of the factors relevant to how we measure the Scottish target: for example, agreements on how to allocate emissions from international aviation and shipping, new trading schemes, changes to the international credit mechanisms, or changing the international approach from measuring source emissions to measuring consumption.
- 5.61** The Scottish Climate Change Bill could allow for the 2050 target to be changed in future through secondary legislation, which would be faster and require less Parliamentary scrutiny than creating a new Bill to change the target. This could be limited so that the target could only be revised on the basis of independent, expert advice if, for example, new technologies are developed or the science of climate change develops. It could be limited to only increasing the target to increase the certainty for business that investment in low carbon technologies is worthwhile.

Q 7. Should the Bill allow the level of the 2050 target to be changed through secondary legislation? If so, should this only be allowed on the basis of independent, expert advice, to reflect international developments or unforeseen consequences of the Bill? Should any changes to the target be limited to an increase in the target?

³⁴ 22nd Report of the Royal Commission On Environmental Pollution, available from: <http://www.rcep.org.uk/newenergy.htm>

06 SUPPORTING FRAMEWORK

Trajectory

6.1 A robust framework for emissions reductions needs interim targets as well as a long term target for two reasons. Firstly, the pathway taken to reduce emissions to a certain point matters because the atmospheric concentrations of greenhouse gases depend on the total amounts emitted over a long period of time (see paragraphs 4.6 and 5.11). Meeting specific annual emission targets is therefore less relevant than the total level of emissions over that period of time. The later cuts are made, the greater they must be to have the same effect, so they will be more expensive. Secondly, setting interim targets gives businesses better information and more certainty on which they can base their investment decisions. The Scottish Government therefore proposes that the Bill sets out a framework for interim targets towards the 2050 target. This should ensure regular, sustained action by all future governments in Scotland to tackle climate change.

Interim budgets

6.2 It is the total amount of greenhouse gases emitted over a particular time which causes climate change, rather than the amount of emissions in any single year. Whilst there are difficulties with taking a cumulative approach for the 2050 target (setting a target for the total quantity of emissions through to 2050), it is possible to set the desired trajectory, and thus limit cumulative emissions, by establishing a set of emissions budgets. An emissions budget period would last for a specific number of years and would allow for annual fluctuations in emissions to occur whilst limiting the overall amount of emissions during the budget period.

What is 'Emissions Budgeting'?

Akin to a financial budget, an 'Emissions Budget' refers to the aggregated quantity of emissions which are permitted during a specified time period – in this example, five years long. The first budget might cover the years 2008-12 and would be expressed as 'x million tonnes of CO₂e'.

The diagrams on page 52 provide an indicative illustration of how the first three budgets may work. **Figure 8** shows a trajectory whereby the level of emissions permitted by the budget is reduced over time. **Figure 9** presents the detail of how emissions within a five-year budget period may fluctuate, providing the aggregate for the five years does not exceed the limit set out in the budget. Thus a system of five-year budgets provides for increased year-on-year flexibility whilst still ensuring an emissions reduction trajectory results.



Figure 8

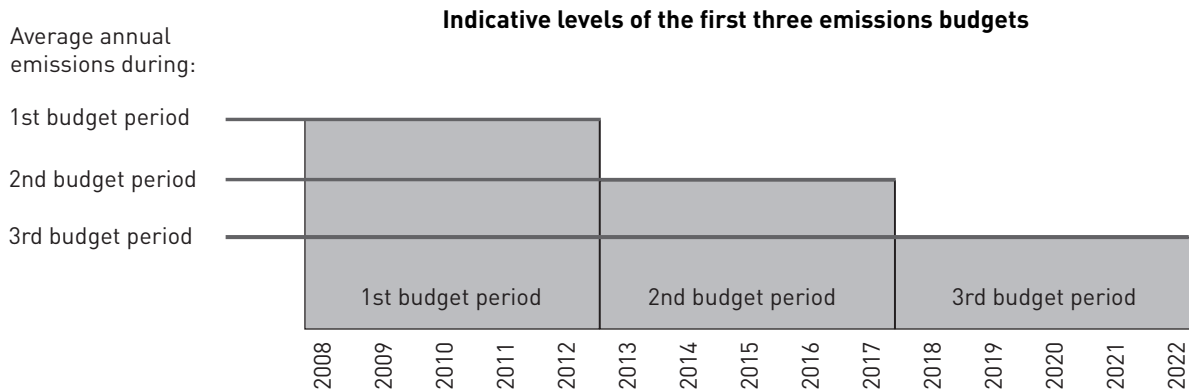
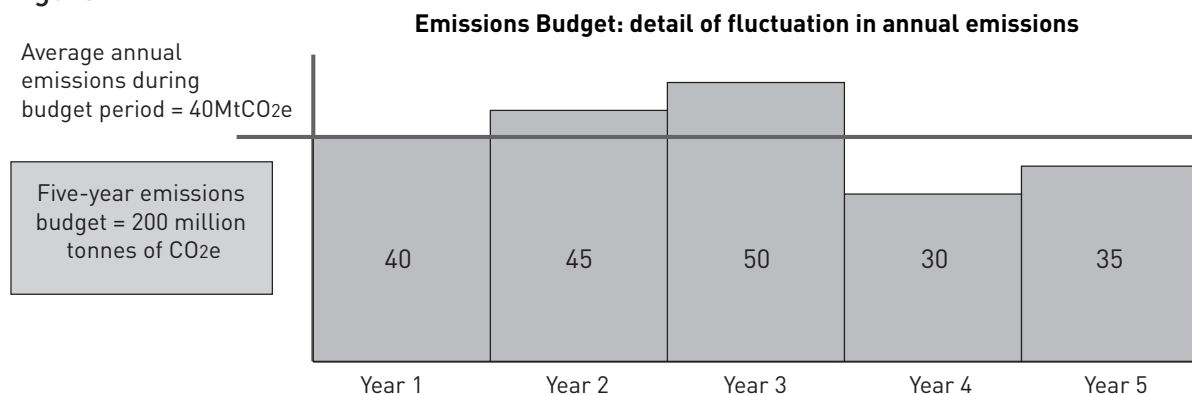


Figure 9



6.3 Emissions budgets will ensure scrutiny as reporting will require focus on the underlying emission trends and the impact of policies, rather than on short-term impacts of gas prices or a cold winter. Budgets would be set several periods ahead – this will allow both Government and industry to plan in advance, knowing what will be expected over the coming years so that proper investment in low carbon infrastructure can occur in the knowledge that there is an established framework in place that will value such investments. The Scottish Government therefore proposes to use emissions budgets as interim targets to ensure progress towards the 2050 target.

Level of budgets

6.4 The appropriate level at which these budgets are set will be a complex issue and it is important that the process by which they are set is transparent and robust.

6.5 The levels set must be challenging to provide a strong incentive for increased action. A number of factors would need to be considered, including but not limited to:

- Likely economic growth.

- Likely population growth.
- Likely technological progress.
- Social impacts, including impact on rural areas.
- Environmental impacts.
- Impacts on the economy and business competitiveness.
- International circumstances.
- Scientific knowledge about climate change.

6.6 The level set for the budgets should set the trajectory to the 2050 target whilst maximising benefits and minimising costs.

Q 8. What factors should be taken into account when setting the level of budgets?

Duration of budgets

- 6.7** The Scottish Government wishes to design a framework which gives strong incentives for early action: Stern's analysis shows that appropriate early action reduces long-term costs. One of the purposes of the Bill is to ensure that climate change action is not delayed in favour of short-term priorities.
- 6.8** The interim time periods need to be long enough to know whether emissions are on course and, if not, to design, implement, monitor and adapt policies to reduce emissions. It can take over a year to evaluate the effects of new policies and refine them so that they have the desired effect. Sometimes policies can have unintended consequences which may not become evident until analysis and statistics are published some years after the reporting period.
- 6.9** The availability of data to monitor whether targets have been met is a key issue, given the present 20-month lag for Scottish Greenhouse Gas Inventory emissions figures. Therefore any interim target of less than two years would not allow for corrective action (either policy changes, borrowing or buying credits) to be taken if there is a spike in emissions.
- 6.10** Buying credits would be one of the quickest means of making an adjustment, but this could only be done if funds were available. If the Government allocates contingent funds to cover purchase of credits, this could send a signal that Government expects to fail and would undermine the credibility of the framework. However if no provision was made, there would be no funds with which to buy credits. So it may be preferable if interim periods end just after Government budget cycles begin, to allow provision to be made if credits are needed.



- 6.11** Longer periods may also reduce the cost of policies to reduce emissions because the timing of policies could be adjusted to take advantage of revised information or the pace of technological development. Infrastructure lags will also be critical. We are locked into some high-carbon technologies because capital lifetime can be 40-50 years. Changes will likely only make economic sense at the end of the working life of major plants, such as electricity generators. Longer interim targets cope better with this lumpiness in the emissions trajectory.
- 6.12** Aligning budget periods with international and UK reporting timescales would increase transparency because international comparisons could be made, and would reduce bureaucracy because in-depth analysis will not need to be repeated in different timescales. In practical terms, the EU ETS caps about half of Scottish carbon dioxide emissions and it would be more difficult to assess progress if the interim budgets were not synchronised with phases of the EU ETS.
- 6.13** The Scottish Government is therefore minded to have multi-year budgets of at least three years. Multiples of two years fit with the financial budget cycle (the comprehensive spending review is every two years). However, there are a number of choices for the length of the budget period:
- Four years – fits with the Scottish Parliamentary cycle (However the data and policy time lags mean that the emissions for at least half of the period for which Governments will be held to account would have been the responsibility of the administration in power during the previous Parliament);
 - Five years – fits with the UK Climate Change Bill periods, current EU ETS phase and Kyoto period;
 - Six years – multiple of financial budget cycle but allows more time to adjust policies; or
 - Eight years – fits with possible future EU ETS phases (2012 onwards).

Q 9. How long should interim budget periods be?

Annual targets

- 6.14** The SNP manifesto proposed a 3% annual emissions reduction in order to meet an ambition of an 80% reduction by 2050 against a 1990 baseline. That ambition remains unchanged: to reach an 80% reduction by 2050 Scotland must, in fact, reduce its emissions by an average of more than 3% per year. Continuous progress on reducing emissions is essential. The Scottish Government believes that reporting an annual measure of progress within a multi-year budget process would be the best means of achieving this.

- 6.15** At a global level, emissions fluctuations in individual countries are smoothed out and annual targets can be meaningful. However for a small country like Scotland this is not the case. Significant annual variations in emissions can occur due to a variety of factors over which the Scottish Government may have no control (such as changes in relative fuel prices or temperature etc.) and these can disguise underlying trends. In 2006, for example, gas prices were relatively higher than coal prices, which led to a shift towards coal-fired electricity production. Published figures³⁵ for carbon dioxide emissions from Scottish sites in the EU Emissions Trading Scheme indicate an increase of some 1.2 Mt CO₂e between 2005 and 2006, principally from power stations. Scotland is more susceptible than the UK or EU to annual variations of this kind because our emissions are dominated by a few power stations: three power stations produce about 35% of Scotland's CO₂ emissions, so changes in production at those stations have a very significant impact on total emissions.
- 6.16** There is also little evidence that a smooth year-on-year reduction in emissions should be expected. In Scotland, though the general trend is that greenhouse gas emissions have been falling since 1990, total emissions levels have fluctuated year on year, with the largest annual percentage increase being 4.5% between 1999 and 2000 and the largest annual decrease 5.7% between 1998 and 1999. The Intergovernmental Panel on Climate Change does not project a smooth year-on-year fall in global emissions; it forecasts that global emissions will peak before falling more steeply. Significant changes are likely as major plants are replaced or new technologies such as carbon storage or clean coal technology are introduced. Investing in low-carbon energy will also take time as industry is diverted towards low-carbon technologies.
- 6.17** Annual fluctuations in emissions not only create a greater risk that mandatory annual targets would be missed, but in doing so they also threaten the credibility of the framework. Markets may not believe that a Government had sufficient policy capacity to respond to natural market variability effectively, or may believe that the Government would maintain an emissions policy that resulted in very high price spikes or that had strongly negative consequences for competitiveness. The precedents of the Exchange Rate Mechanism and Growth Pact illustrate the difficulties of maintaining fixed policies against market speculation or in the face of unexpected economic pressures.
- 6.18** The Scottish Government recognises that annual targets could help to encourage progress by governments – but does not think that mandatory annual targets would create a credible framework, due to the large fluctuations in Scotland's emissions. The Scottish Government believes that any mandatory targets must reflect the likely

³⁵ Emission Trading Scheme (EU ETS) Community Independent Transaction Log, more information available from: http://ec.europa.eu/environment/climat/emission/citl_en.htm



nature of Scotland’s emissions and potential for reductions in order to provide a strong, credible signal to business and industry. It believes this is possible by the adoption of statutory multi-year budgets and, to support these, a strong framework of annual reporting and scrutiny. Details of the reporting and scrutiny measures which will be introduced to ensure continuous progress in reducing emissions towards the 2050 target are discussed in Section 7.

How far in advance should emissions budgets be set?

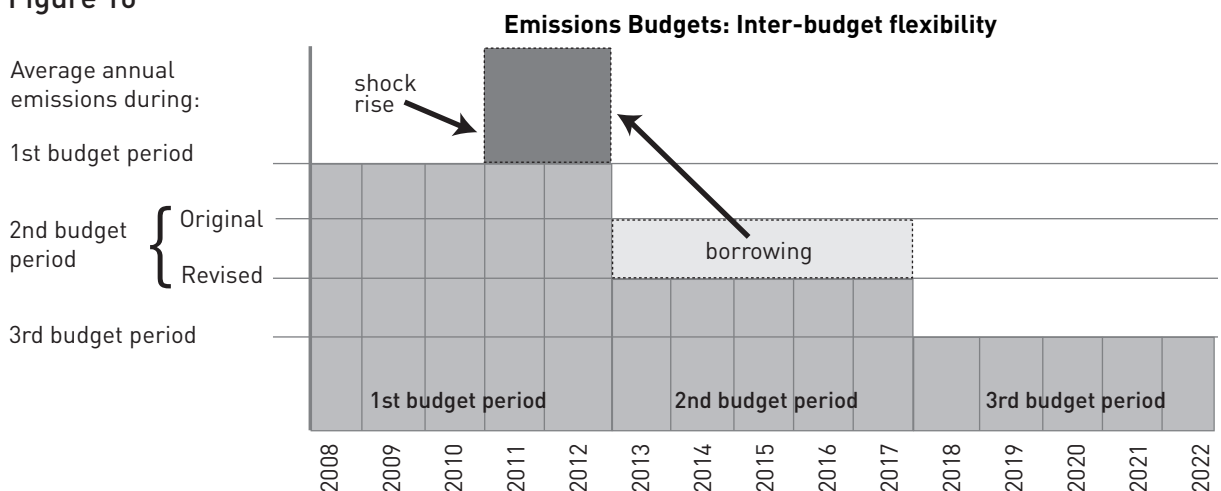
6.19 The rationale behind having longer term emissions budgets is to provide certainty for businesses and governments sufficient incentive to invest and innovate. Some technologies or changes in plant need a long lead in time and some behaviours take generations to change. The Scottish Government believes that emissions budgets should be set far enough in advance so that they can be taken account of when making most investment decisions that are likely to affect our emissions trajectory. The Government would welcome evidence about the lengths of lead-in time for most capital replacement to inform how far in advance budgets should be set.

Q 10. How many years in advance should emissions budget periods be set in order to provide sufficient time to develop infrastructure?

Banking and Borrowing

6.20 Another important issue exists around the ability of Governments to ‘bank’ or ‘borrow’ emission amounts over budget periods. Banking and borrowing would allow the Scottish Government to carry unused emissions rights over to later budget periods (banking) or allow it to bring forward emissions allocations from future budget periods (borrowing). This would provide a means of allowing for unexpected rises in emissions, instead of, or in addition to, the use of international credits (paragraph 5.47). The diagram below explains the concept of banking and borrowing:

Figure 10



- 6.21** Banking will incentivise Government to over-perform – to try to reduce emissions further than is necessary under the framework if it is cost-effective to do so. This could drive down the cost of reducing emissions in Scotland.
- 6.22** Borrowing, however, is a less certain issue. It will allow Government to correct unexpected spikes in emissions during the end of a budget period, especially as emissions data may not be available for up to 20 months. Allowing Government to correct this in the following budget period will ensure that the emissions framework remains workable and credible. However, allowing Government unlimited borrowing will reduce the certainty that both business and individuals need. The framework would lose credibility if unlimited borrowing were allowed. Therefore, finding the appropriate level of borrowing allowed is essential to the creation of a credible climate change framework in Scotland.

Q 11. What should be the limit (in terms of absolute quantity or as a percentage of the budget period) on the amount of emissions which the Government can borrow from a following budget period?

Mid-point targets

- 6.23** There is strong evidence that action over the next 10-15 years is critical if dangerous climate change is to be avoided. UK and European climate change objectives contain interim targets for emissions reductions by 2020. (26 – 32% CO₂ for UK, 20% greenhouse gas for EU or 30% if an international agreement is reached). Setting an interim target in the Bill would provide more information about the likely trajectory of emissions towards the 2050 target. However, there is a danger that setting an arbitrary figure which either became implausible, or lacked sufficient ambition, would damage the credibility of the Bill. The process of setting emissions budgets in advance, on the basis of expert advice, will provide clear information about the likely trajectory. The Scottish Government is therefore minded not to include an interim target, but will consider doing so if strong reasons – and, critically, a justifiable target level – can be brought forward.

Q 12. Should the Bill include an interim point target? If so, what year (or years) should it be for (2020, 2025, 2030, etc.)? How should the level be chosen?

07 REPORTING AND SCRUTINY FRAMEWORK

- 7.1** The Scottish Government believes that its commitment to reducing Scotland's emissions should be underpinned by a regular and comprehensive reporting and scrutiny regime. Strong reporting requirements will strengthen accountability for achieving emissions reductions and ensure that important information is published regularly and consistently so that the public, businesses and other stakeholders can have added confidence that targets and budgets will be met.

Annual report on emissions

- 7.2** The Scottish Government proposes that the Scottish Ministers report annually to the Scottish Parliament stating:
- The net Scottish emissions for each gas (the total Scottish emissions in the last available year for each greenhouse gas and Scottish removals – e.g. emissions absorbed through carbon sinks);
 - identification of the methods used to calculate those amounts; and
 - whether any of the amounts are an increase or decrease compared to the previous year.
- 7.3** Scottish emissions information is already published as part of the Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland. However, the proposals in the Scottish Climate Change Bill would build on these arrangements by making it a statutory requirement for the Scottish Ministers to report to the Scottish Parliament. The complete mix of matters to be reported on will also be informed by decisions taken on other issues covered by this consultation paper.

Longer-term reporting cycle

- 7.4** In addition to the annual report on emissions, the Scottish Ministers could also be required to report to the Scottish Parliament at least once in every emissions budget period providing:
- Proposals and policies that the Government has for meeting future emissions reduction targets and budgets;
 - The emissions credited or debited from the Scottish emissions budget for the reporting period; and
 - The Government's objectives in relation to adaptation to climate change and its proposals and policies for meeting those objectives (including time-scales for introduction).
- 7.5** Such reports would only be required once in every budget period because the effects of certain measures to reduce emissions, and the developing effects of climate change itself, only become apparent over periods longer than one year.



Other possible reporting requirements

7.6 There is a range of other issues related to climate change on which the Bill could require the Scottish Government to report. An example of this is a requirement to report on what effect specific policies will have on emissions internationally so that it is clear if a policy is simply shifting Scotland's emissions to another country. Another possible option might be a full reporting of policies which includes not just their possible effect on Scotland's emissions but also on the 'embedded' emissions such as the energy required to produce or transport products, even if these emissions occur outside Scotland.

7.7 Other possible options include:

- Forecast emissions;
- An assessment of the impacts and risks of current emission levels;
- An assessment of the effectiveness (measured or projected) of current and/or planned policies;
- A measure of the energy efficiency of domestic and non-domestic buildings in the public and private sectors;
- The capacity of Scotland's renewable energy sector;
- Emissions produced by the 'Scottish element' of international aviation and shipping; and
- A measure of energy/carbon consumption in Scotland such as carbon footprint.

Q 13. Should the Scottish Ministers be required to report on any other issues related to climate change in addition to the requirements already set out. If so, what and how often?

Accountability for meeting targets

7.8 If one or more of the targets or budgets set by the Scottish Ministers are not met, the Scottish Ministers will be required to report to the Scottish Parliament setting out a plan of how they intend to get back on track. The Scottish Government believes that this requirement, coupled with a robust reporting framework will ensure that the Scottish Ministers are fully and publicly accountable for their work to mitigate and adapt to the effects of climate change.

Q 14. Is a process of Parliamentary scrutiny the appropriate way of holding the Scottish Government to account if targets or budgets are not met?

Handling new and existing functions

7.9 The proposed Scottish Climate Change Bill will introduce a new framework for Scotland in tackling climate change. This framework will require new functions

to be carried out, including the setting of emissions budgets and monitoring and reporting on progress and action. This is in addition to existing functions already carried out which are related to climate change such as scrutinising the Scottish Government and the provision and gathering of information and research.

7.10 While some functions clearly lie with Government, there are some functions which could be taken on by other organisations. If the Scottish Climate Change Bill puts targets into statute, the Scottish Government will require advice on how to set budgets for the coming years and how this burden should be shared across the economy. Emissions levels will need to be monitored in a credible and transparent manner in order to demonstrate that targets and budgets are being met. Additional scrutiny may be required of the Scottish Government and the effectiveness of its policies to reduce emissions. Finally, there may be a need to have a centralised point for providing or gathering climate change research in Scotland which can be relied upon by a wide range of public sector bodies.

7.11 This consultation paper is seeking views on which organisation(s) should carry out the following functions:

- A primary source of independent advice to the Scottish Government for setting emissions targets or budgets;
- Monitoring the progress of the Scottish Government on reducing emissions; and
- Additional scrutiny and reporting on the Scottish Government and the effectiveness of its policies in reducing emissions.

Independent advice and scrutiny

The Committee on Climate Change

7.12 The UK Climate Change Bill introduced in the UK Parliament in November 2007 will create a new public body, the Committee on Climate Change. One of the Committee's functions will be to report to the UK and Scottish Parliaments, and to the other devolved legislatures, each year setting out its views on the progress being made towards meeting the targets and budgets set under the UK climate change legislation. It will also be required to report during the second year after the end of each carbon budget period setting out its views on the way in which budgets have or have not been met and the action taken by government, business or society at large to reduce net emissions of greenhouse gases. The UK Secretary of State will have to lay a response to each of these reports before the UK Parliament and is required to consult with the Scottish Government before doing so. This will provide a mechanism for Scottish Ministers to ensure that information about Scotland's ongoing efforts to reduce emissions is reflected in the response.



- 7.13** The Committee on Climate Change will also provide advice to the UK Government and the three devolved administrations. These include advice on:
- the level of each five year carbon budget set by the UK Government, consistent with the optimal trajectory towards the statutory 2050 and 2020 limits established by the UK Bill;
 - how much effort should be made in the UK and overseas; and
 - how much effort should be made by the part of the economy covered by cap and trade schemes, and by the rest of the economy.
- 7.14** The membership of the Committee will consist of experts from fields such as climate change, technology, business competitiveness, economic analysis and energy production. Further information on the Committee on Climate Change can be found at: <http://www.defra.gov.uk/environment/climatechange/uk/legislation/committee/index.htm>.
- 7.15** The UK Climate Change Bill allows for the Committee on Climate Change to provide similar advice to the Scottish Government. It may, however, be difficult for Scotland to confer new functions on the UK Committee so the Scottish Government may wish to receive advice from another organisation and can do so if it so chooses – it is not bound to using the Committee on Climate Change.
- 7.16** The Scottish Climate Change Bill could be used to create a separate Scottish Committee on Climate Change to carry out such functions as necessary in order to ensure that the Scottish Government receives advice which is best suited for the needs of Scotland. However, the Bill could also allow for an existing Scottish public body to carry out this function though the high-quality expertise required to provide advice on reducing emissions while protecting the economy is not currently held by any one public body in Scotland.
- 7.17** There may also be a role for other organisations to scrutinise formally the climate change proposals and policies of the Scottish Government, including the evaluation of projects or programmes.

Advice to the Scottish Government for setting emissions targets or budgets

- 7.18** The Scottish Government is minded to utilise the UK Committee on Climate Change in the short-term and evaluate within three years the effectiveness of the Committee's advice for Scotland and its unique circumstances. The Scottish Government is also minded to include provisions in the Bill to create a new Scottish Committee on Climate Change if the evaluation concludes that the advice of the UK Committee does not fully meet Scottish needs.

Q 15. What should be the primary source of advice to the Scottish Government for setting emissions targets or budgets and why? Options include: the proposed UK Committee on Climate Change, a new Scottish Committee on Climate Change, an existing public body in Scotland, or the Scottish Government itself.

Q 16. If it were to be an existing Scottish public body, which public body is most suited to carrying out this task and why?

Monitoring the progress of the Scottish Government on reducing emissions

7.19 The Scottish Government is minded to utilise the UK Committee on Climate Change to monitor the progress of the Scottish Government on reducing emissions in the short-term and evaluate the effectiveness of the UK Committee within three years time. The Scottish Government is also minded to include provisions in the Bill to create a new Scottish Committee on Climate Change if the evaluation deems the UK Committee to not fully meet Scottish needs.

Q 17. Which organisation should be tasked with monitoring the progress of the Scottish Government on reducing emissions and why? Options include: the proposed UK Committee on Climate Change, a new Scottish Committee on Climate Change, an existing public body in Scotland, or the Scottish Government itself.

Q 18. If it were to be an existing Scottish public body, which public body is most suited to carrying out this task and why?

Additional scrutiny and reporting on the Scottish Government and the effectiveness of its policies in reducing emissions

Q 19. Should additional independent mechanisms for scrutinising the effectiveness of the Scottish Government's policies in reducing emissions be created by the Bill (in addition to any scrutiny already provided by the Scottish Parliament)?

Q 20. If so, which organisation is best placed to carry out this function and why? Options include a new Scottish Committee on Climate Change or an existing public body in Scotland.

Q 21. If it were to be an existing Scottish public body, which public body is most suited to carrying out this task and why?

Other functions relating to climate change

Q 22. Are there any other functions related to climate change, existing or new, which should be carried out at arm's length from the Scottish Government and why?

08 SUPPORTING MEASURES

- 8.1** The small changes that each of us make are important. Walking, cycling and taking public transport rather than the car when we can, switching off electrical equipment when we are not using it, reusing items that are not broken but which we might otherwise have thrown away – all these little things, and many others, may seem insignificant on their own but they soon add up to make a real difference. Many of the steps we can take save money as well as energy. Some measures may cost a little more to set up, such as installing or improving insulation, but more than pay for themselves over time through the energy saved. Every aspect of our behaviour is important. In January 2008, the Scottish Government launched a campaign promoting ‘Ten Steps to a Greener Scotland’. Everybody in the country can sign up to one or more pledges to help make a positive difference. More information about the Ten Steps is available online at: <http://www.itsourfuture.co.uk/ourfuture/202.40.43.html>
- 8.2** We all have a role to play in making environmentally sustainable behaviour the norm rather than something we do only occasionally. However, the Scottish Government recognises that there are some measures that could be included in the Scottish Climate Change Bill which could contribute to this effort by enabling or requiring more action to be taken in specific areas and ensuring that such action is carried out in a responsible and sustainable fashion, balancing the immediate and local impacts with the aim of reducing emissions and meeting the 2050 target.

Energy efficiency and microgeneration

- 8.3** The Scottish Government is committed to improving energy efficiency and promoting microgeneration where effective and appropriate for the circumstances as it believes they can play an important role in reducing harmful carbon emissions, tackling fuel poverty and maintaining a secure energy supply. Following the recent consultation on the draft Energy Efficiency and Microgeneration Strategy,³⁶ the Scottish Government is currently developing a plan that will translate those key objectives into action.
- 8.4** Cleaner ways of generating energy are fundamental to reducing the emissions which cause climate change. However, at least as important is using energy from current and future sources more efficiently so we require less of it in the first place. The Stern Review states that:

‘Studies by the International Energy Agency show that, by 2050, energy efficiency has the potential to be the biggest single source of emissions savings in the energy sector. This would have both environmental and economic benefits: energy-efficiency measures cut waste and often save money.’³⁷

³⁶ Energy Efficiency and Microgeneration: Achieving a Low Carbon Future: A Strategy for Scotland - draft for consultation, available from: <http://www.scotland.gov.uk/Publications/2007/03/09144516/0>

³⁷ Stern Review on the Economics of Climate Change, available from: www.hm-treasury.gov.uk/Independent_Reviews/stern_review_economics_climate_change/sternreview_index.cfm



- 8.5** Stern goes on to state that global CO₂e reductions from greater energy efficiency could be between 31% and 53% of the total achievable by 2050.
- 8.6** It is crucial that individuals make the small changes needed to the way they consume energy if we are to achieve the potential emissions reductions that are possible. Energy efficiency will help to reduce carbon dioxide emissions, but will not on its own be enough to meet an 80% reduction target. In order to move to a low carbon economy, more clean energy must be created. Microgeneration, in appropriate circumstances, can also help to make a contribution to tackling climate change. It can provide a sustainable source of low carbon energy and help to reduce carbon dioxide emissions from homes, small commercial buildings, and community buildings such as leisure centres and schools. Creating our own energy through microgeneration can bring about a better sense of responsibility, can engage others and can raise awareness of the individual action we all can take in tackling climate change.
- 8.7** The responsibility for making a change falls to us all. However, there may be options open to the Scottish Government to put in place requirements for minimum energy efficiency standards to be met in certain circumstances within the public and private sectors in Scotland. The Scottish Climate Change Bill could be used to do this.

Combined heat and power

- 8.8** Scotland has made significant progress towards meeting our ambitious targets of 31% of electricity generated in Scotland coming from renewable sources by 2011 and 50% by 2020. This makes a key contribution in the move to a low carbon energy supply. We also recognise that how we use energy to heat our homes and businesses will have to change as part of that shift. We are already seeing the development of renewable heat sources such as biomass, and the microgeneration of heat. There is also potential to target waste heat from large scale energy generation or industrial processes through Combined Heat and Power and district heating schemes, as happens in other parts of the EU. The Scottish Government will consider how reduction of the carbon emissions associated with the generation of heat might contribute to our climate change targets, and whether measures might be necessary in the Bill.

Reducing carbon emissions from buildings

- 8.9** The buildings in which we live, work and spend our leisure time are significant users of energy and producers of carbon dioxide emissions. This means that reducing emissions from buildings through improvements to energy efficiency will be key to achieving our targets. Currently, when new building work is carried out, energy standards in the Scottish building regulations apply. Scotland already leads the UK with these standards. A range of measures is already in place to encourage and incentivise the owners of existing buildings to improve their energy efficiency, including advice and in some cases, grants.

- 8.10** Planning policy already sets a target for on-site low and zero carbon equipment to reduce CO₂ emissions by 15% below the standards in Scottish building regulations and consideration is being given to extending permitted development rights so that more microgeneration equipment can be installed on existing buildings without applying for planning permission.
- 8.11** The Scottish Government is currently considering the Low Carbon Building Standards Strategy for Scotland report which recommends measures to make new and existing buildings in Scotland more energy efficient.³⁸ As new buildings only represent 1% of the building stock each year, the Government is also considering the role for standards for existing non-domestic buildings and housing stock and it is the intention to consult separately on new policy proposals. The Scottish Climate Change Bill could, if necessary, provide an appropriate vehicle for these policies if it is determined that new legislation is required.

Waste reduction and recycling

- 8.12** Just as generating and using energy more efficiently reduces CO₂ emissions, so does producing and consuming products more efficiently. Scotland currently produces an estimated 22 million tonnes of waste each year of which 2.9 million tonnes is collected from households and the rest results directly from commercial and industrial operations (including construction and agriculture). Waste minimisation, including reuse of potentially waste materials, and increased recycling can help to reduce greenhouse gas emissions. By contrast, landfilling of bio-degradable wastes leads to the production of methane and other greenhouse gases.
- 8.13** Valuable progress has been made at increasing recycling of municipal waste, but there is much more that needs to be done to reduce emissions in this area. The Scottish Government has recently made a statement on the future direction of waste policy and it will be taking this forward through a wide ranging review of the National Waste Plan and it also intends to consult separately on possible legislative measures that might be included in the Scottish Climate Change Bill.

Carbon storage

- 8.14** Carbon storage has the potential to reduce CO₂ emissions from power stations by up to 90%. Longannet, Cockenzie and Peterhead power stations typically produce 35% of Scotland's total carbon emissions. Carbon storage can therefore play a key role in meeting climate change targets. The legacy of infrastructure and known geology

³⁸ A Low Carbon Building Standards Strategy For Scotland, available from:
http://www.sbsa.gov.uk/pdfs/Low_Carbon_Building_Standards_Strategy_For_Scotland.pdf
The Scottish Government's initial response to this Strategy is available at:
<http://www.scotland.gov.uk/News/Releases/2007/12/12124702>



from oil and gas production places Scotland in strong position to exploit opportunities to reduce carbon emissions – through capturing carbon dioxide and storing it in depleted oil and gas fields and deep saline aquifers. The Scottish Government is working with Scottish and Southern Energy, Scottish Power, oil companies, and universities on a study that will identify the most economic, safe and technically feasible infrastructure to transport and store CO₂ in Scotland. Other studies estimate that geological structures beneath the North Sea could store somewhere between 60 and several hundred years of carbon emissions from the UK. Carbon storage in depleted oil and gas fields can also enhance oil and gas production, thus contributing to UK energy security. This could offer the opportunity for a new industry in the North Sea – prolonging the life of the existing infrastructure and utilising the world class skills base in the offshore industry.

- 8.15** The Scottish Government recognises the need to act quickly to create a framework that can regulate carbon storage in Scotland, giving certainty to the energy industry, and to ensure that we have all of the necessary levers to support this new technology in meeting our 80% target. We are discussing with the UK Government cooperation with the UK Energy Bill, but have not ruled out separate legislation for Scottish territorial waters.

Public sector

- 8.16** The public sector has a key role to play in reducing emissions in Scotland due to its size, the policies it is responsible for setting and delivering and its leadership position in Scotland. In 2005, the public sector accounted for 23.4% of the Scottish workforce, employing 577,300 people. 55.6% of this total was in local government (including fire and police services), 25.7% in the NHS and 2.1% in non-departmental public bodies. Legislative competence in relation to regulating these sectors is largely devolved to the Scottish Parliament (although aspects of these sectors remain reserved matters).
- 8.17** It is intended that the planned Single Outcome Agreements with local authorities will be based on national outcomes, under a common framework, in order to reflect the major contribution that local government will make to all of the Government's Strategic Objectives and the successful delivery of the national outcomes. This includes their contribution to the delivery of the high level sustainability target of reducing emissions over the period to 2011 and by 80% by 2050.
- 8.18** Using the public sector to reduce emissions can continue to be done through voluntary measures such as the Scottish Climate Change Declaration³⁹ to which all local authorities in Scotland have committed. However, as it becomes more difficult to reduce emissions, some organisations may be reluctant to take action.

³⁹ Scottish Climate Change Declaration, available from: <http://www.sustainable-scotland.net/climatechange/>

Officers responsible for implementing changes to reduce emissions may face some organisational resistance to reducing emissions as it is seen as 'not their job'. The proposed Bill could, through the inclusion of specific enabling powers, serve as a vehicle to introduce various measures at a later date if it is deemed necessary. It is preferable, however, that voluntary commitments are carried through in the first instance as these may prove sufficient.

- 8.19** Various duties are placed on the public sector in Scotland including: a duty on public bodies to promote disability equality, the duty of local authorities to assess watercourses, various duties of care (e.g. environment, child protection), and a duty of Best Value. One potential measure to reduce emissions could be to place a duty of some sort on certain parts of the public sector such as local authorities or large public bodies. This consultation does not propose to define exactly what a duty would be if the Bill was to contain enabling powers to introduce one at a later date. However, it could include a requirement to evaluate projects or policies to determine emissions, a duty to reduce corporate emissions, a duty to meet specific targets, a duty to make a clear and equitable contribution to national climate change targets, a duty to consider climate change in policies and decisions or a duty to take account of emissions in procurement contracts. Any such proposal would be likely to require further consultation when secondary legislation was brought forward.

Q 23. Should the Bill contain enabling powers to introduce a duty on certain parts of the public sector (i.e. local authorities and large public bodies) to take specified actions on climate change or other specified environmental issues? Why?

Q 24. What should such a duty (or duties) include?

- 8.20** The Bill could also introduce statutory guidance for certain parts of the public sector. Again, it is preferred if voluntary commitments are carried through in the first instance as these may prove sufficient. It would only be necessary to enact provisions for statutory guidance in the Bill if insufficient action was being taken on a voluntary basis.

Q 25. Should the Bill contain enabling powers to introduce statutory guidance for certain public sector bodies (i.e. local authorities and large public bodies) on specified climate change or other environmental measures? Why? Are there gaps in any existing guidance?

Q 26. What should this guidance include?



8.21 Another possible measure which could be introduced is a reporting mechanism for certain parts of the public sector on action being taken to reduce emissions or, in addition, to adapt to climate change. Again, this may not be necessary or this could be introduced as a voluntary measure. However, the Bill could include provisions to include such a requirement at a later date if these do not prove sufficient.

Q 27. Should the Bill contain enabling powers to create a requirement for certain public sector bodies (i.e. local authorities and large public bodies) to make regular reports on specific measures they are taking to tackle climate change (whether mitigation or adaptation) or other environmental issues? Why? What should be included in such reports?

8.22 The Local Government in Scotland Act 2003 placed a statutory duty of Best Value upon local authorities in the discharge of their functions and statutory guidance was introduced in 2004. In 2002, a non-statutory duty of Best Value was placed on certain other public service organisations. Best Value guidance includes sustainable development as a key characteristic of Best Value and through this organisations should 'consider social, economic and environmental impacts of activities and decisions in the short and long term'. However, this may not be a clear enough signal that public service organisations should embed climate change considerations in their policies and seek to reduce their own corporate emissions. Best Value may be an appropriate vehicle for driving forward change in the public sector as it would not be prescriptive as to how emissions reductions took place and has a successful existing scrutiny process in place.

Q 28. As a potential non-legislative measure, should current Best Value guidance be amended to take specific account of climate change mitigation and adaptation? If so, how should Best Value guidance be amended?

8.23 The UK Government is currently seeking evidence and views on how the public sector can fulfil an exemplary role in the context of energy efficiency. The Energy End Use and Energy Services Directive (Directive 2006/32/EC) is intended to promote the cost effective improvement of energy end-use efficiency and to develop a market for energy services. The consultation document can be found at: <http://www.defra.gov.uk/environment/climatechange/uk/energy/energyservices/index.htm>.

Once this consultation has closed, the Scottish Government will consider what action it will take in the context of the proposed Scottish Climate Change Bill.

- 8.24** Government, particularly local government, may want at some stage to introduce variable charging in order to incentivise action on climate change by individuals or by business. This would mean higher charges for less climate change friendly options, products or behaviours. For example, Woking Council charges different rates for parking, depending on the emissions of each vehicle. The Bill could have provisions for enabling powers to introduce variable charging on specific issues at a later date to the extent such powers are within the legislative competence of the Scottish Parliament. Details of any scheme would be consulted upon separately and would need to be approved by the Scottish Parliament.
- 8.25** Alternatively, there may be charging regimes which currently create perverse incentives (i.e. it is more beneficial not to take action that would reduce emissions) which are enshrined in statute but which might be usefully altered or repealed.

Q 29. Are there any amendments to existing legislation or any enabling powers needed to allow for variable charging (for example by local authorities) to incentivise action or eliminate perverse incentives?

Trading schemes

- 8.26** Trading schemes are designed to create a market price for emissions in order to drive reductions. These schemes have two main advantages: emissions are reduced at least cost, and there is certainty about the quantity of targeted gases which are allowed to be emitted. In cap and trade schemes, an emissions cap is imposed on all participants and individual companies can reduce their own emissions, or trade with another participant who can reduce their emissions more cheaply. In obligation schemes, participants are given an obligation to supply a specific percentage of their output in a particular low carbon manner (for example, fuel or electricity from renewable sources). They can then choose whether to meet this obligation or trade with others who can meet the obligation more cheaply.
- 8.27** The UK Climate Change Bill will allow the Scottish Government to establish new trading schemes for Scotland, or to be part of new trading schemes with any or all of the other countries within the UK. However, there may be additional measures needed to complement these powers. The Scottish Government may therefore propose measures to create or adapt domestic trading schemes in the Scottish Climate Change Bill.



Adaptation

8.28 Even if international action is taken to reduce emissions, some degree of change remains unavoidable as the impacts of climate change over the next 30 to 40 years have been determined by past and present emissions. Greenhouse gases are active in the atmosphere for many years after they are emitted. CO₂, for example, has an active life of approximately 100 years. We cannot prevent the effects of climate change that are already in the system but we can adapt. We know that the emissions over the past decades will cause our climate to change in the coming decades. Section 4 provides further details on the likely changes in climate for Scotland as well as what Government is doing to adapt to these changes.

Q 30. Are there any provisions to help Scotland adapt to the impacts of climate change which should be included in the Scottish Climate Change Bill?

Strategic environmental assessment

8.29 The Environmental Assessment (Scotland) Act 2005 ensures that all public plans, programmes and strategies (includes policies) that are likely to result in significant environmental effects, are properly assessed for their impact on the environment. The Act lists 'climatic factors' as one of the environmental issues which can trigger the need for a Strategic Environmental Assessment, although it does not specify that climatic factors include the emission of greenhouse gases. Those public plans, programmes and strategies that are likely to result in significant environmental effects against climatic factors must outline within a mandatory public consultation, measures envisaged to prevent, reduce and as fully as possible offset any significant adverse effects.

Q 31. Should provisions within the Environmental Assessment (Scotland) Act 2005, be amended in order to provide clearer links with emissions reduction? If so, how should this be done?

Equality impact assessment

8.30 An Equality Impact Assessment will be carried out during the final policy development of the proposed Bill. This will be based on existing research which has been conducted across the Scottish Government. While the Bill will primarily introduce a broad framework with mechanisms within which future climate change mitigation and adaptation policies will fit, the broad framework will undoubtedly have an effect on Scotland, particularly its economy. We would like your views on the potential equalities implications of the Bill.

Q 32. What are the equalities implications of the measures in the proposals for the Scottish Climate Change Bill?

Other measures

8.31 There is a wide range of legislation which impacts upon the ability of Government, the public sector, the private sector and the third sector to take action to mitigate climate change but which it has not been possible to cover specifically in this consultation. However, the Scottish Government would like to receive your views on relevant issues which have not been addressed elsewhere in this document.

Q 33. Is there any existing legislation within the competence of the Scottish Parliament (devolved) which needs to be amended so that appropriate action on climate change can be taken by sectors in society?

09 | SUMMARY OF QUESTIONS

TARGETS

1. Should a Scottish target be based on carbon dioxide only or the basket of six greenhouse gases?
2. Should the Bill contain provisions to alter which gases are included, for example if the reliability of data for a particular gas improves or if science changes in the future about which gases cause climate change?
3. The Scottish Government wishes to ensure that the Bill gives sufficient incentives to invest in energy efficiency and renewable electricity. Should the targets be based on source emissions; an end-user inventory; or on individual targets for energy efficiency and renewable electricity? Do you have any other suggestions?
4. Do you agree that the Bill should allow the means of measuring the target to be changed through secondary legislation to reflect international developments or unforeseen consequences of the Bill?
5. Should the emissions reduction target take account of the abatement effort made by companies under emissions trading schemes? If so, how?
6. Do you agree that international credits should be counted towards Scottish targets? Should there be limits on credits counted towards Scottish targets?
7. Should the Bill allow the level of the 2050 target to be changed through secondary legislation? If so, should this only be allowed on the basis of independent, expert advice, to reflect international developments or unforeseen consequences of the Bill? Should any changes to the target be limited to an increase in the target?

SUPPORTING FRAMEWORK

8. What factors should be taken into account when setting the level of budgets?
9. How long should interim budget periods be?
10. How many years in advance should emissions budget periods be set in order to provide sufficient time to develop infrastructure?
11. What should be the limit (in terms of absolute quantity or as a percentage of the budget period) on the amount of emissions which the Government can borrow from a following budget period?
12. Should the Bill include an interim point target? If so, what year (or years) should it be for (2020, 2025, 2030, etc.)? How should the level be chosen?



REPORTING SCRUTINY AND FRAMEWORK

13. Should the Scottish Ministers be required to report on any other issues related to climate change in addition to the requirements already set out. If so, what and how often?
14. Is a process of Parliamentary scrutiny the appropriate way of holding the Scottish Government to account if targets or budgets are not met?
15. What should be the primary source of advice to the Scottish Government for setting emissions targets or budgets and why? Options include: the proposed UK Committee on Climate Change, a new Scottish Committee on Climate Change, an existing public body in Scotland, or the Scottish Government itself.
16. If it were to be an existing Scottish public body, which public body is most suited to carrying out this task and why?
17. Which organisation should be tasked with monitoring the progress of the Scottish Government on reducing emissions and why? Options include: the proposed UK Committee on Climate Change, a new Scottish Committee on Climate Change, an existing public body in Scotland, or the Scottish Government itself.
18. If it were to be an existing Scottish public body, which public body is most suited to carrying out this task and why?
19. Should additional independent mechanisms for scrutinising the effectiveness of the Scottish Government's policies in reducing emissions be created by the Bill (in addition to any scrutiny already provided by the Scottish Parliament)?
20. If so, which organisation is best placed to carry out this function and why? Options include a new Scottish Committee on Climate Change or an existing public body in Scotland.
21. If it were to be an existing Scottish public body, which public body is most suited to carrying out this task and why?
22. Are there any other functions related to climate change, existing or new, which should be carried out at arm's length from the Scottish Government and why?

SUPPORTING MEASURES

23. Should the Bill contain enabling powers to introduce a duty on certain parts of the public sector (i.e. local authorities and large public bodies) to take specified actions on climate change or other specified environmental issues? Why?
24. What should such a duty (or duties) include?

25. Should the Bill contain enabling powers to introduce statutory guidance for certain public sector bodies (i.e. local authorities and large public bodies) on specified climate change or other environmental measures? Why? Are there gaps in any existing guidance?
26. What should this guidance include?
27. Should the Bill contain enabling powers to create a requirement for certain public sector bodies (i.e. local authorities and large public bodies) to make regular reports on specific measures they are taking to tackle climate change (whether mitigation or adaptation) or other environmental issues? Why? What should be included in such reports?
28. As a potential non-legislative measure, should current Best Value guidance be amended to take specific account of climate change mitigation and adaptation? If so, how should Best Value guidance be amended?
29. Are there any amendments to existing legislation or any enabling powers needed to allow for variable charging (for example by local authorities) to incentivise action or eliminate perverse incentives?
30. Are there any provisions to help Scotland adapt to the impacts of climate change which should be included in the Scottish Climate Change Bill?
31. Should provisions within the Environmental Assessment (Scotland) Act 2005, be amended in order to provide clearer links with emissions reduction? If so, how should this be done?
32. What are the equalities implications of the measures in the proposals for the Scottish Climate Change Bill?
33. Is there any existing legislation within the competence of the Scottish Parliament (devolved) which needs to be amended so that appropriate action on climate change can be taken by sectors in society?

10 SOURCES OF FURTHER INFORMATION

Climate Change Website for Schoolchildren (Learning & Teaching Scotland)

Website: <http://www.ltscotland.org.uk/climatechange>

Department for Business, Enterprise and Regulatory Reform (Energy)

1 Victoria Street

London SW1H 0ET

Telephone: 020 7215 5000

Fax: 020 7215 0105

E-mail: enquiries@berr.gsi.gov.uk

Website: <http://www.dti.gov.uk/energy>

Department for Environment, Food and Rural Affairs

Nobel House

17 Smith Square

London

SW1P 3JR

Telephone: 08459 33 55 77

E-mail: helpline@defra.gsi.gov.uk

Website: <http://www.defra.gov.uk>

European Commission – Environment Directorate-General

B – 1049 Brussels

Belgium

Telephone: 00 800 6 7 8 9 10 11

Website: http://ec.europa.eu/dgs/environment/index_en.htm

European Environment Agency

Kongens Nytorv 6

DK-1050 Copenhagen K

Denmark

Telephone: +45 33 36 71 00

Fax: +45 33 36 71 99

<http://www.eea.europa.eu>



Intergovernmental Panel on Climate Change

Telephone: +41-22-730-8208/84

E-mail: IPCC-Sec@wmo.int

Website: <http://www.ipcc.ch>

Met Office Hadley Centre

FitzRoy Road

Exeter

Devon

EX1 3PB

Telephone: 0870 900 0100

Fax: 0870 900 5050

E-mail: enquiries@metoffice.gov.uk

Website: <http://www.metoffice.gov.uk/research/hadleycentre>

Office of Climate Change

Nobel House

Smith Square

London

SW1P 3JR

E-mail: enquiries@occ.gsi.gov.uk

Website: <http://www.occ.gov.uk>

Scottish Climate Change Impacts Partnership

Telephone: 0131 524 9749

E-mail: marion@sniffer.org.uk

Website: <http://www.sccip.org.uk>

UK Climate Impacts Programme

Oxford University Centre for the Environment

Dyson Perrins Building

South Parks Road

Oxford

OX1 3QY

Telephone: 01865 285717

Fax: 01865 285710

Email: enquiries@ukcip.org.uk

Website: <http://www.ukcip.org.uk>

11

GLOSSARY AND ABBREVIATIONS FOR USEFUL TERMS

Carbon capture

Carbon capture is a process consisting of the separation of CO₂ from industrial and energy-related sources, transport to a storage location and long-term isolation from the atmosphere.

Carbon dioxide (CO₂)

A chemical compound which exists as a gas in the Earth's atmosphere. It is produced by all animals, plants, fungi and micro-organisms during respiration and is used by plants during photosynthesis. Carbon dioxide is also an important greenhouse gas.

Carbon Reduction Commitment (CRC)

The Carbon Reduction Commitment is a scheme, announced in the UK Government's Energy White Paper 2007 which will apply mandatory emissions trading to cut carbon emissions from large commercial and public sector organisations (including supermarkets, hotel chains, government departments, large local authority buildings) by 1.1 MtC/year by 2020.

Chlorofluorocarbons (CFCs)

Chlorofluorocarbons are chemical compounds formerly used widely in industry for purposes such as refrigeration and aerosol propellant. They have a depleting effect on the ozone layer which protects the surface of the Earth from dangerous levels of ultraviolet radiation. Because of this, their use is being phased out under the terms of the Montreal Protocol, which entered into force in 1989. They are also a powerful greenhouse gas.

Combined Heat and Power (CHP)

Combined Heat and Power is the simultaneous generation of usable heat and power (usually electricity) in a single process.

Department for Business, Enterprise and Regulatory Reform (BERR)

BERR is a UK Government Department tasked to help ensure business success in the UK and to act as the voice for business across the UK Government. Regulation of energy production and supply also falls within its remit.

Department for Environment, Food and Rural Affairs (DEFRA)

DEFRA is a UK Government Department with the aim to enable everyone in the UK to live within our environmental means. This includes tackling climate change and securing a healthy, resilient, productive and diverse natural environment.



Emissions Trading Scheme (ETS)

Emissions Trading Schemes are schemes which aim to reduce emissions of carbon dioxide and combat the threat of climate change. This is generally done through putting a price on carbon that businesses use, thus creating a market for carbon, encouraging organisation to emit less so they do not have to purchase credits or even make money by selling surplus credits earned by reducing emissions.

GigaWatt (GW)

A GigaWatt is equal to one billion watts.

Greenhouse gases

Greenhouse gases are components of the atmosphere which trap part of the sun's thermal energy re-irradiated by the Earth's surface. The higher the concentration of a greenhouse gas in the atmosphere, the greater the proportion of thermal radiation that is trapped and so the greater the warming.

Gross Domestic Product (GDP)

GDP is a way of measuring the size of an economy. It is defined as the total market value of all final goods and services produced within a country in a given period of time.

Hydrofluorocarbons (HFCs)

Hydrofluorocarbons are chemical compounds used in industry for purposes such as refrigeration and aerosol propellant. They are greenhouse gases but, unlike like Chlorofluorocarbons, HFCs have no known effects on the ozone layer.

Intergovernmental Panel on Climate Change (IPCC)

The IPCC is a scientific intergovernmental body set up by the World Meteorological Organization and the United Nations Environment Programme to provide decision-makers and others interested in climate change with an objective source of information about climate change. The IPCC does not conduct any research nor does it monitor climate related data or parameters. Its role is to assess on a comprehensive, objective, open and transparent basis the latest scientific, technical and socio-economic literature produced worldwide.

MegaWatt (MW)

A MegaWatt is equal to one million Watts.

Methane (CH₄)

Methane is a chemical compound which is the principal component of natural gas and is a greenhouse gas.

Nitrous oxide (N₂O)

Nitrous oxide is a chemical compound which can be used in medical anaesthetics, aerosol propellants and to increase the power of internal combustion engines. It is a greenhouse gas.

Parts per million (ppm)

Ppm denotes relative proportions in measured quantities: one part per 1,000,000 parts.

Perfluorocarbons (PFCs)

Perfluorocarbons are chemical compounds used in a wide range of medical applications such as eye surgery and ultrasound imaging. They are extremely potent greenhouse gases.

Scotland and Northern Ireland Forum for Environmental Research (SNIFFER)

SNIFFER identifies and manages environmental research on behalf of its members – the Scottish Environment Protection Agency, Environment and Heritage Service, the Scottish Government, Scottish Natural Heritage and the Forestry Commission – and other stakeholders.

Scottish Climate Change Impacts Partnership (SCCIP)

SCCIP is an initiative that brings together stakeholders in Scotland to collectively address and prepare for the impacts of climate change.

Strategic Environmental Assessment (SEA)

SEA is a systematic assessment (required by the Environmental Assessment (Scotland) Act 2005) of the environmental affects of strategic land use related plans, programs and strategies.

Sulphur hexafluoride (SF₆)

Sulphur hexafluoride is a chemical compound used in the electrical industry as a non-conducting insulating gas and in medical applications such as eye surgery and ultrasound imaging. It is also a greenhouse gas.

UK Climate Impacts Programme (UKCIP)

UKCIP is funded by the Department for Environment, Food and Rural Affairs on behalf of the UK Government, Scottish Government, Welsh Assembly Government and Northern Ireland Executive. In addition to research, UKCIP provides tools and datasets to support organisations and the public in understanding and adapting to the unavoidable changes in climate.

Watt

The standard unit of Power. Power is the rate at which energy is transmitted for a given unit of time.



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