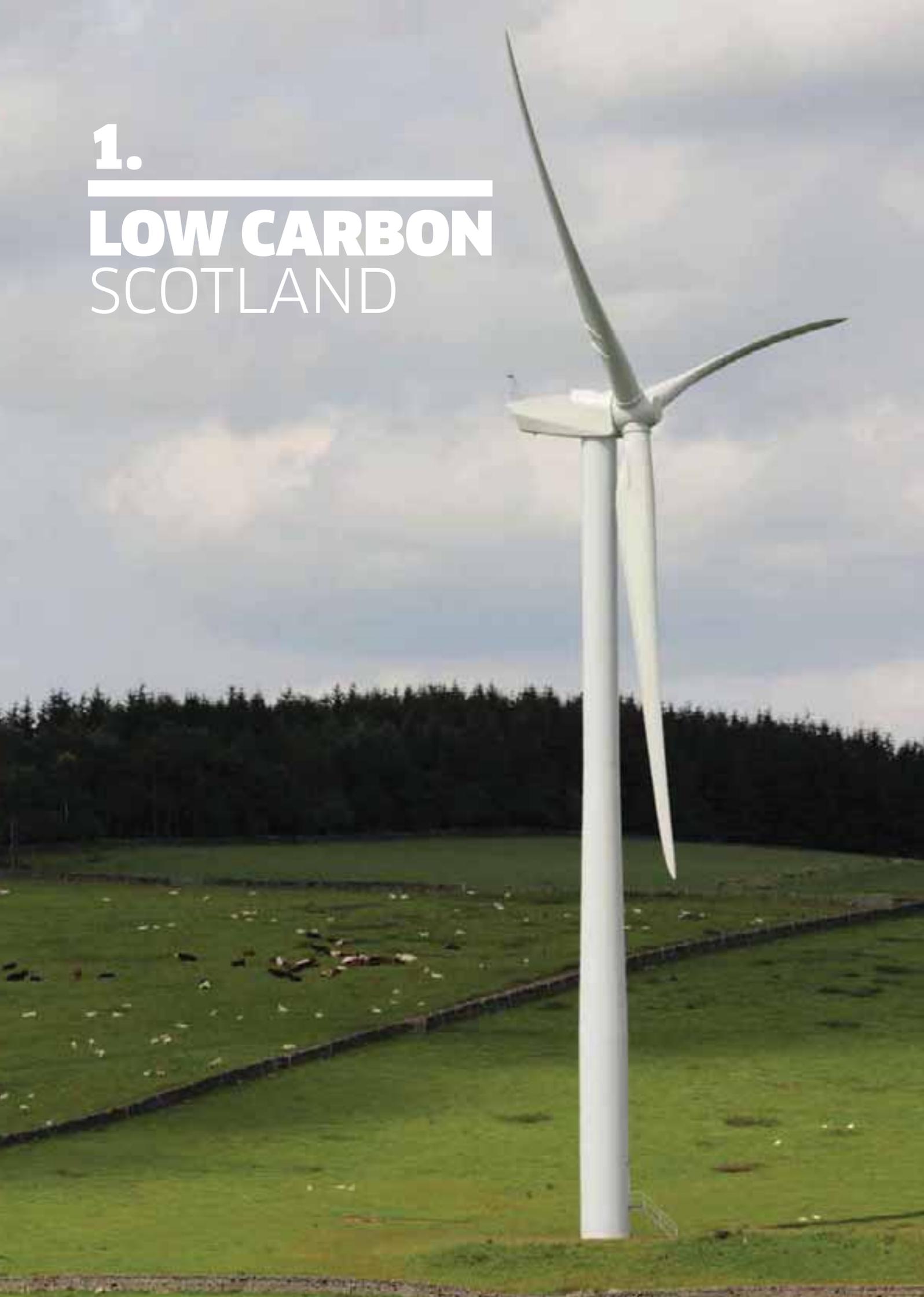


1.

**LOW CARBON
SCOTLAND**



1. Low Carbon Scotland

The framework of policies and proposals described in this document sets out how Scotland can meet its emissions reduction targets. It also provides the essential building blocks towards making Scotland a low carbon society – which will bring significant economic and social benefits. In this way Scotland can make its contribution to addressing the worldwide challenge of climate change.

1.1 Low Carbon Scotland is a better Scotland

1.1.1 The purpose of the Scottish Government is to focus Government and public services on creating a more successful country, with opportunities for all of Scotland to flourish, through increasing sustainable growth.¹ Making the transition to a low carbon Scotland, through the achievement of our ambitious climate change targets, will place Scotland in an advantageous position within the global economy. Importantly, we will support global efforts to prevent the damaging effects of climate change and, in doing so, provide numerous benefits to communities and businesses across Scotland while also supporting the environment through reducing the loss of biodiversity, the incidence of non-native animal and plant diseases and of invasive non-native species.

1.1.2 The urgency to reduce greenhouse gas emissions globally is accelerating. Despite increasing awareness and political acceptance of the problem, carbon dioxide (CO₂) emissions and, consequently, atmospheric CO₂ concentrations continue to rise (in May 2013, the concentration measured at the Mauna Loa Observatory in Hawaii reached 400 parts per million compared to 280 parts per million in pre-industrial times).^{2, 3} Due to higher greenhouse gas concentrations in the atmosphere global mean temperature has increased and is now about 0.8 °C above pre-industrial levels.⁴

¹ Information on our purpose targets and performance indicators, including those relating to sustainability, can be found at <http://www.scotland.gov.uk/About/Performance/scotPerforms/glanceperformance>

² <http://www.esrl.noaa.gov/gmd/ccgg/trends/weekly.html>, accessed on 3 June 2013

³ Etheridge, D. M., L. P. Steele, R. L. Langenfelds, R. J. Francey, J.-M. Barnola, and V. I. Morgan, (1996), Natural and anthropogenic changes in atmospheric CO₂ over the last 1000 years from air in Antarctic ice and firn (<http://onlinelibrary.wiley.com/doi/10.1029/95JD03410/abstract>), J. Geophys. Res., 101(D2), 4115–4128, doi:10.1029/95JD03410.

⁴ Potsdam Institute for Climate Impact Research and Climate Analytics for the World Bank, Turn Down the Heat (<http://climatechange.worldbank.org/content/climate-change-report-warns-dramatically-warmer-world-century>), p.XIV

1.1.3 The World Bank reported in 2012 that present emission trends put the world plausibly on a path toward 4°C warming within the century.⁵ This could lead to a sea-level rise of 0.5 to 1.0 metre (possibly more); an increase of about 150 % in acidity of the ocean, making climate change the greatest threat to biodiversity (surpassing the threat of outright habitat destruction); and increase extremes of rainfall and drought that, apart from their direct costs, could substantially undermine food security globally and lead to mass movements of population seeking access to secure supplies of water and or food.

1.1.4 The longer action is delayed, the higher annual emission reductions need to be thereafter in order to keep CO₂ concentrations in the atmosphere below a dangerous level (such as the 800 ppm by 2100 used in the World Bank analysis).

1.1.5 Climate change is seen as one of the greatest global threats we face. It will undoubtedly impact upon quality of life and economic performance in Scotland and is additionally recognised as a UK national security threat. However, addressing it is also one of Scotland's greatest opportunities to benefit our economy, our environment, and the wellbeing of our people. That is why we have put tackling climate change at the heart of our ambition for the people of Scotland.

1.1.6 A low carbon Scotland will capitalise on both our natural resources and the talents and skills of our people. It will make better use of our precious natural resources both at home and abroad. It will reduce the amount of energy people need to use in their homes, schools, workplaces, and public buildings and, in doing so, help to reduce levels of fuel poverty. It will improve our public spaces and improve public health by reducing traffic pollution, increasing active travel and increasing woodland cover, particularly in and around urban areas. Tree planting, peatland restoration and increasingly sustainable land use will also benefit our biodiversity.

1.1.7 A low carbon Scotland will also provide us with greater resilience to volatile energy and commodity prices. It will reduce our dependence on fossil fuels subject to geo-political forces outside our control. Simply put, a low carbon Scotland is a better Scotland. We regard it as an investment in our economy, our environment and it is essential for the benefit of future generations.

⁵ The World Bank. November 2012: <http://climatechange.worldbank.org/>

1.1.8 However, making the transition will not always be straightforward and there remain areas of uncertainty as we look further into the future. Some aspects will undoubtedly be challenging as we embrace new ways of doing things and work with new, more sustainable technologies.

1.2 Low Carbon Scotland – our vision

The specific proposals and policies detailed in this report aim to achieve step-changes in the way we use energy and resources. These fundamental transformations form the basis of our vision for a low carbon Scotland.

1.2.1 The term ‘low carbon Scotland’ is common in the policy world but what will meeting our climate change targets mean in terms of outcomes? In 2009, the Scottish Government published Scotland’s *Climate Change Delivery Plan*.⁶ It includes four transformational outcomes necessary to meet our target of an 80% greenhouse gas emission reduction by 2050. Those outcomes highlight the sectors that are responsible for significant greenhouse gas emissions in Scotland - electricity production, heat, transport and land use.

1.2.2 Four years on, we feel it is time to widen the transformational outcomes with further detail:

- **A largely decarbonised electricity generation sector by 2030**, using renewable sources for electricity generation with other electricity generation from fossil-fuelled plants utilising carbon capture and storage;
- **A largely decarbonised heat sector by 2050 with significant progress by 2030** through a combination of reduced demand and energy efficiency, together with a massive increase in the use of renewable or low carbon heating;
- **Almost complete decarbonisation of road transport by 2050, with significant progress by 2030** through wholesale adoption of electric cars and vans, as well as significant shift towards public transport and active travel, and significant decarbonisation of rail;
- A step-change in provision of **energy efficient homes to 2030** through retrofit of existing housing and improved building regulations for new build homes;

⁶ Climate Change Delivery Plan: Meeting Scotland’s Statutory Climate Change Targets, 2009: www.scotland.gov.uk/Publications/2009/06/18103720/0

- Significant progress in transforming energy use in industry, business and the public sectors by 2027, through energy efficiency, the use of low carbon electricity and our ambition in Scotland **for a largely decarbonised heat sector by 2050, with significant progress by 2030;**
- **At least 70%** of all waste recycled by **2025**, and by **2050** waste as we know will have been effectively designed out of our economy;
- Further optimised the **productive use of natural resources by 2027**, producing food and delivering public goods, such as protecting the natural environment and reducing greenhouse gas emissions; and
- by **2027**, enhanced **natural carbon capture** through our expanded woodlands and significantly more conservation of our peatland.

Laying the foundations

We are already laying the foundations for low carbon transformation across sectors of the economy and society. Scotland's net emissions have fallen 25.7%⁷ from 1990 levels. We are, therefore, more than halfway towards achieving our Climate Change (Scotland) Act target of at least 42% emission reduction by 2020.

Our ambitions for renewable electricity are also paying off. Renewable capacity increased by 15.2% between 2011 and 2012, continuing the recent excellent progress in this sector. 2012 renewable sources produced almost 39% of Scotland's total electricity consumption, well on the way to our new 2015 target: for the equivalent of 50% of Scotland's electricity demand to be met by renewable sources.

The Scottish Parliament's Energy, Enterprise and Tourism Committee recently concluded that our target for 2020 to generate the equivalent of 100% of Scotland's electricity demand from renewables is achievable.

⁷ This figure has been adjusted for trading in the EU ETS. Unadjusted emissions have fallen by 29.6% since 1990.

1.3 Scotland's place in the world

The challenges of climate change are global. Concerted international action is necessary to address them. Scotland is determined to play its full part in that international effort.

1.3.1 As current global pledges for emissions cuts are not enough to limit global warming to 2°C, raising worldwide ambition remains a high priority for the Scottish Government. Scotland aims to be a model for the international community in tackling climate change. Our ambitious statutory domestic climate change targets, with a requirement to meet annual targets, remain highly unusual in comparison to commitments made by other countries. We are playing a full part in supporting UK efforts on climate change by demonstrating to the international community the growth, investment and job opportunities of the low carbon economy, and championing climate justice.

1.3.2 At the UN Framework Convention on Climate Change (UNFCCC) summit in Doha in December 2012, the EU and some other countries agreed to a second commitment period to the Kyoto Protocol to run for eight years from 2013 to 2020. For this second period, the EU has taken on an emissions reduction commitment in line with its domestic target of cutting emissions by 20% of 1990 levels by 2020, but has left the door open to stepping up this reduction to 30%, if the conditions are right.

1.3.3 The targets of all countries participating in the second period will be revisited by 2014 with a view to considering raising ambition. However, the countries taking part in the second Kyoto period only account for around 14% of world emissions and by 2020 this will have fallen to around 10%. This underscores the need for the future climate regime to involve action by all countries. The second period forms part of the transition to the global agreement taking effect in 2020.

1.3.4 The Scottish Government has played an active role as part of UK efforts to lobby for higher EU ambition on climate change targets for 2020 and beyond, arguing that the levels of emissions reduction across the EU are already deeper than expected,⁸ with the EU on course to substantially outperform its 2020 target of 20% lower emissions, and that the costs are now lower, and the benefits now higher, of moving beyond 20%.

1.3.5 We are pleased that the European Commission has now launched a debate on its April 2013 green paper *'A 2030 framework for climate and*

⁸ Connie Hedegaard, the European Commissioner for Climate Action has stated that the EU is on track to deliver up to a 27% reduction by 2020.

energy policies.⁹ The paper recognises that many investors in low carbon technologies are already taking decisions on investments beyond 2020, and that clarity on EU climate and energy targets for 2030 would ensure greater certainty. The paper also acknowledges that in order to secure a global, legally-binding climate agreement in the UNFCCC in Paris in 2015 (the deadline set at the Durban Conference of the Parties in 2011), the EU will need to have a clear offer of post-2020 climate and energy policy, to complement the 2014 review of the second Kyoto period pre-2020 targets.

1.3.6 The Scottish Government is working closely with the UK Government to influence this debate, arguing for clear and ambitious greenhouse gas reduction targets for 2030 that are at least consistent with the EU's Low Carbon Roadmap 2050 (which envisaged a 40% reduction by 2030), coupled with substantial reform to strengthen the EU Emissions Trading Scheme, and measures to further incentivise low carbon energy sources such as renewables and carbon capture and storage beyond 2020. The Scottish Government supports UK efforts to press for an ambitious EU emissions reduction by 2030, and that the EU should lead efforts to secure an ambitious global legally-binding climate agreement by 2015.

The world is getting warmer

The decade **2001-2010** was the warmest since records began in 1850, with global land and sea surface temperatures estimated at 0.46 °C above the long-term average (1961-1990) of 14.0 °C. Nine of these years were among the ten warmest on record.¹⁰ **2012** is currently ranked the 9th warmest year on record.¹¹

2013 is expected to see global average temperatures between 0.43°C and 0.71°C warmer than the long-term average, with a best estimate of around 0.57°C, according to the Met Office annual global temperature forecast.¹²

Global average temperatures are expected to remain between 0.28°C and 0.59°C (90% confidence range) above the long-term (1971-2000) average during the period **2013-2017**, with values most likely to be about 0.43°C higher than average.¹³

⁹ European Commission, Green Paper, A 2030 framework for climate and energy policies: http://ec.europa.eu/energy/green_paper_2030_en.htm

¹⁰ World Meteorological Organization. Annual Statement, March 2012: www.wmo.int/pages/mediacentre/press_releases/pr_943_en.html

¹¹ Met Office. December 2012: www.metoffice.gov.uk/news/releases/archive/2012/2013-global-forecast

¹² Ibid.

¹³ Met Office. January 2013: www.metoffice.gov.uk/research/climate/seasonal-to-decadal/long-range/decadal-fc

1.3.7 Along with the UK Government, we are disappointed that the EU Environment Council has not yet been able to reach political agreement on higher emissions reductions pre-2020, consistent with the cost-benefit analysis undertaken by the European Commission in the Low Carbon Roadmap 2050. If a global deal is to be reached, we believe the EU must demonstrate continued leadership in attempting to encourage other parties to the negotiations to show similar ambition. We are pleased, though, that the European Commission is continuing to develop proposals for further emissions reduction by 2020, through reform of the EU ETS in its 'back-loading' proposal.

1.3.8 The Scottish Government continues to support a unilateral move by the EU to a 30% emissions reduction for 2020 – we believe that this is feasible and cost-effective and that it will generate further economic recovery for the EU through job creation in the low carbon economy.

The economics of climate change

As Lord Stern showed in his Report on the Economics of Climate Change,¹⁴ the cost of failing to act to reduce greenhouse gas emissions will ultimately far outweigh the cost of taking the necessary steps to stabilise our climate.

Stern estimated that without action, the overall costs of climate change will be equivalent to losing at least 5% of global gross domestic product (GDP) each year, now and forever. Including a wider range of risks and impacts could increase this to 20% of GDP or more. Costs include those related to losses from declining agricultural production, heat waves, droughts, flooding events, extreme precipitation, biodiversity loss, disease spread, and soil erosion.

Conversely, the study estimated that stabilising greenhouse gases to avoid a temperature increase in excess of 2°C by 2050 would cost the global community roughly 1% of GDP by 2050. In 2008, Stern increased the estimate for the annual cost of achieving stabilisation between 500 and 550 ppm to 2% of GDP to account for faster than expected climate change.

1.3.9 Beyond Europe, and in line with our new role in the world, we have been strengthening our support for developing countries. We are championing climate justice, a key issue for human rights in the 21st century that is rising up the UN agenda. We launched our Climate Justice Fund in June 2012 and announced the first awards for five projects prior to

¹⁴ The Stern Review: http://webarchive.nationalarchives.gov.uk/http://www.hm-treasury.gov.uk/sternreview_index.htm

the Doha UNFCCC conference. Scotland has also been invited by the UN Secretary-General Ban Ki-moon to work with the UN's 'Sustainable Energy for All' initiative and we have announced a partnership with United Nations Development Programme (UNDP) to develop a renewable energy toolkit for use in developing nation economies.

1.3.10 Our International Development Fund has funded a range of projects - from renewable energy projects in Malawi to climate change projects in other Sub-Saharan African countries. At the 2012 Rio+20 Earth Summit, the Scottish Government announced a partnership with the Government of Malawi to help prepare a Renewable Energy and Climate Strategy for the country.

1.3.11 At Doha, Scotland committed to host an international conference on climate justice. This will be held in Edinburgh on 9 October 2013. In addition, we have a Memorandum of Understanding with the Inter-American Development Bank to share Scottish expertise on clean energy. We are collaborating with the Global Carbon Capture and Storage Institute, and we are working with South Africa on the feasibility of a carbon capture and storage pilot. Our Saltire Commonwealth Fellowships support the exchange of knowledge on climate change policy and technology between Scotland and Commonwealth countries.

1.4 How Scotland compares to other countries

Scotland has made significant progress in reducing its emissions compared with other countries. This is a success story and a real momentum has been established. This document demonstrates how continuing policies and new proposals can continue and accelerate that downward pressure. Scotland wishes to encourage other countries to match its trajectory and will seek additional powers to ensure that it can play its full role on the world stage.

1.4.1 Scotland is at the top of the EU-15 league table for emissions reductions. Between 1990 and 2011, emissions in Scotland fell by 29.6%.¹⁵ This is the largest reduction among the EU-15 Member States, and higher than the EU-27 Member States average of 17.1 %, when emissions from international aviation and shipping and land use, land use change and forestry sectors are factored in. To put this into perspective, since 1990, Scotland's emissions have fallen by more than the equivalent of Northern Ireland's total emissions in 2011.

¹⁵ Unadjusted for EU-ETS.

1.4.2 Under the Kyoto Protocol, EU Member States (then the EU-15) agreed to collectively reduce their greenhouse gas emissions to 8% below 1990 levels over the period 2008-2012, with Member States taking on differentiated targets in recognition of their national circumstances. Ten of the remaining twelve EU member states, (the EU-12), committed to individual targets under the Protocol. Of the EU-12, eight Member States have a target to reduce their emissions by 8%, while Hungary and Poland have targets of 6%, and Cyprus and Malta have no target. For the purpose of enabling the closest possible comparison with Scotland, the figures shown in Table 1.1 below are calculated on a different basis to those targets.

Table 1.1: How Scotland compares to other countries¹⁶

Member State	Change 1990-2011	Member State	Change 1990-2011
Austria	18.0%	Bulgaria	-38.9%
Belgium	-6.4%	Cyprus	54.5%
Denmark	-26.3%	Czech Republic	-34.4%
Finland	-22.5%	Estonia	-46.3%
France	-15.3%	Hungary	-35.3%
Germany	-22.4%	Latvia	n/a
Greece	9.3%	Lithuania	-74.0%
Ireland	4.7%	Malta	213.0%
Italy	-7.8%	Poland	-14.3%
Luxembourg	-4.5%	Romania	-54.8%
Netherlands	1.0%	Slovakia	-38.7%
Portugal	-4.1%	Slovenia	6.8%
Spain	29.2%		
Sweden	-12.0%		
United Kingdom	-25.6%		
Average EU - 15	-12.7%	Average EU - 27	-17.1%

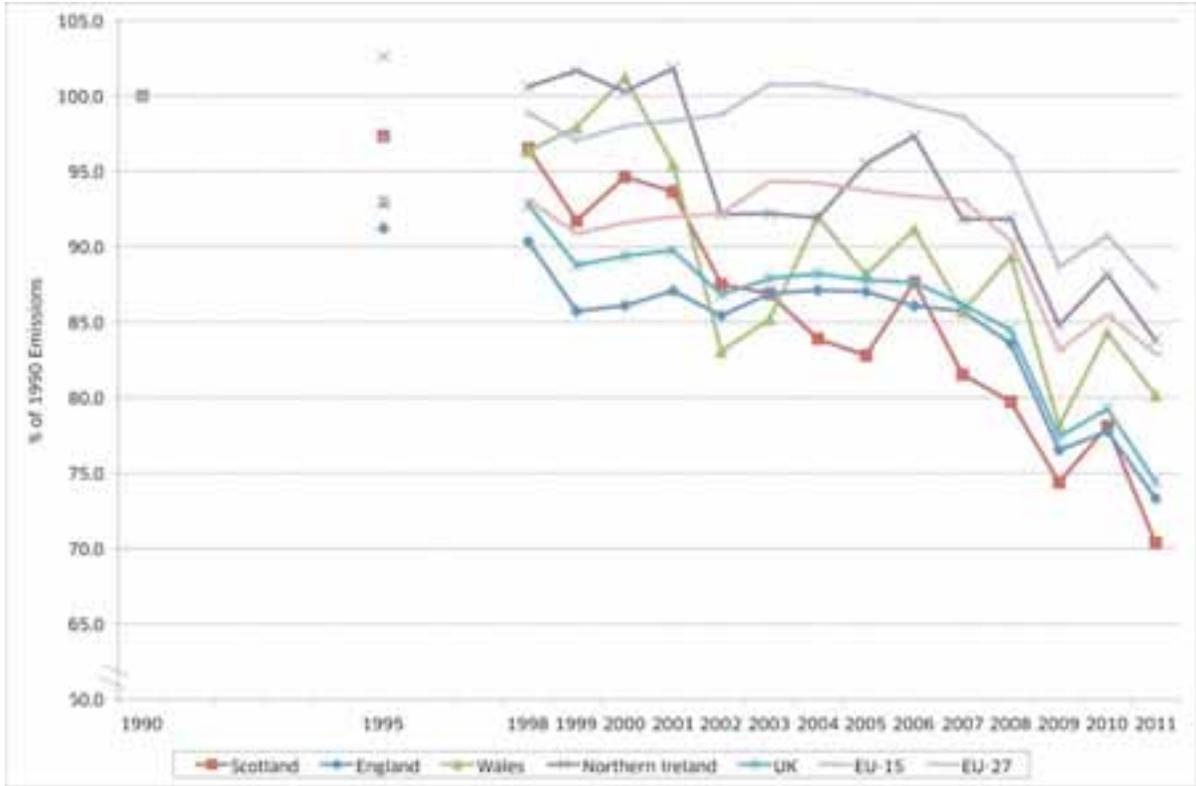
SCOTLAND	-29.6%
England	-26.7%
Wales	-19.8%
Northern Ireland	-16.2%
United Kingdom	-25.6%

¹⁶ EEA Greenhouse Gas Emissions Data Viewer: : <http://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer>. Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland 1990-2011: http://naei.defra.gov.uk/reports/reports?report_id=756

Figures contain estimates for emissions from international aviation and shipping and emissions and removals from the Land Use, Land Use Change and Forestry (LULUCF) sector as reported under the United Nations Framework Convention on Climate Change. They do not include any adjustment for trading in the EU ETS. Latvia is a net source of emissions in 1990 and a net sink in 2011. Therefore, it is not appropriate to show a percentage change. Emissions resulting from offshore operations are not attributed to England, Scotland, Wales or Northern Ireland. They are included in the UK figures.

1.4.3 There is no official international data which compares Scotland’s emissions with other countries because Scotland is not an EU Member State in its own right. The comparisons in Table 1.1 and Chart 1.1 are made by the Scottish Government with Scottish figures including international aviation and shipping and emissions from the Land Use, Land Use Change and Forestry (LULUCF) sector as detailed in *Scottish Greenhouse Gas Emissions 2011*.¹⁷ They do not include any adjustment for the effect of the EU ETS.

Chart 1.1: Greenhouse gas emissions by country shown as a percentage of 1990



1.4.4 Chart 1.1 shows for each country, each year’s emissions as a percentage of 1990 emissions. This illustrates that Scotland has seen the largest percentage point decrease since 1990 of any of the countries of the UK, the UK itself, the EU-15 and EU-27 total reductions.

1.4.5 The level of ambition shown by many developed countries is inadequate, and where pledges have been made they often have a number of conditions attached. Many countries are setting a good example, with Mexico and South Africa among those with ambitious greenhouse gas emission reduction targets. Scotland’s targets are based on an assessment

¹⁷ Scottish Greenhouse Gas Emissions 2011: <http://www.scotland.gov.uk/News/Releases/2013/06/greenhousegasemissions07062013>

of what Scotland's contribution should be to the level of international action that is required to avoid catastrophic climate change across the globe. Other countries should follow our lead and commit to ambitious action.

"In Scotland, we are proud of the fact that the Scottish Parliament has unanimously passed the world's toughest climate change legislation requiring us to reduce greenhouse gas emissions by 42% by 2020..."

"Addressing climate change is not solely an environmental and moral imperative, however. The development of renewable energy is also a massive economic opportunity for Scotland."

First Minister, Renewable UK Annual Conference, October 2012.

1.5 Limited powers

Scotland is achieving much, but full powers to take our own decisions in areas such as energy and fiscal policy, and a direct voice in the UN and EU, would give Scotland greater freedom and more influence on issues that are fundamental to the low carbon transition. Scotland is a land powered by nature but Scotland's people will only be truly empowered by independence.

1.5.1 The approach to the proposals and policies in this document reflects the limitations in the powers currently available to Scotland. In a number of important areas, such as energy and agriculture, legislative competence is retained at UK or EU level. In respect of all international negotiations between member states, for example at the UNFCCC, the EU Environment Council, and Agriculture and Fisheries negotiations, Scotland does not have a direct voice.

1.5.2 The Scottish Government has a powerful vision of Scotland's future as an energy rich country. Full powers over energy policy will be a dramatic step forward in maximising the economic and environmental benefits of Scotland's energy resources. Scotland has abundant renewable energy resources. With 25% of EU offshore wind and tidal and 10% of EU wave energy potential, Scotland is already building on its North Sea expertise to rebuild our engineering and manufacturing industries and to become the green energy capital of Europe. With full powers and if we exploit our competitive advantages we can do even more. For example, by 2015-16, our low carbon industry could provide 10% of Scotland's economy and 5% of all jobs by 2020.

1.5.3 Accessing these vast resources of green energy will also help to provide stable energy prices for customers, by reducing dependence on fossil fuels, and volatility of wholesale gas and oil prices, and it will provide a major contribution to reducing our carbon emissions. Building on our existing track record of promoting energy efficiency effectively and creatively, full legislative and regulatory powers will enable a much greater focus on energy efficiency measures and tackling fuel poverty, by enabling approaches that are appropriate for Scottish customers.

1.5.4 As part of the current constitutional debate, the aim of the Scottish Government is to bring all fiscal and regulatory levers under its control in an independent Scotland with a view to delivering a sustainable, secure and affordable energy sector that supports investment, skills and wider economic development. Scotland is a land powered by nature but Scotland's people will only be truly empowered by independence.

1.5.5 Under current constitutional arrangements, however, decisions taken by the UK Government, for example in terms of fiscal policy, demonstrate that, without the same financial and economic powers as other nations, Scotland currently has limited flexibility when it comes to implementing measures to reduce emissions through, for example, vehicle and fuel duties. This means that more options need to be identified from existing powers, and there is, therefore, a need to consider more radical options than might be required if Scotland had a full complement of fiscal and policy responsibilities. In these circumstances, the Scottish Ministers will continue their policy of pursuing and influencing decisions at UK and EU levels, to encourage a greater level of ambition in accordance with existing practice.

1.6 Climate change adaptation

Changes are already being seen in Scotland's weather patterns. We need to prepare and respond to these changes as we work towards our vision of a low carbon Scotland.

1.6.1 As we work towards our vision of a low carbon Scotland, it is essential that we take into account the impacts of actual climate change in Scotland. Due to past and present global emissions, our climate will continue to change for at least the next 30 to 40 years. We cannot prevent this change, but we can be more resilient in the face of change to reduce its consequences for our economy, society and natural and built environment.

1.6.2 It is important that we plan our mitigation interventions in the context of Scotland's changing climate as the climate may have an impact on the siting of specific infrastructure; on performance of our agriculture

and forestry sectors with implications for land use strategy; on the uptake of particular measures; and on the effectiveness of measures.

1.6.3 Our first statutory Climate Change Adaptation Programme will seek to identify and address the key threats to Scotland from the changing climate and to maximise the opportunities it will present. In advance of the Programme, the non-statutory Adaptation Framework aims to build resilience and capacity to adapt to the changing climate.

1.6.4 As well as understanding Scotland's changing climate, we need to understand the interactions between potential mitigation actions and potential adaptation actions. We will take advantage of synergies already identified, for example woodland planting can provide natural flood defences, whilst also helping address the negative impacts of mitigation actions (for example where a mitigation intervention reduces resilience or vice versa).

We need to adapt to changing weather

Over the last few decades, Scotland's climate has become warmer, but also wetter, with an increase in both the amount of rainfall (especially in winter) and the occurrence of heavy downpours with consequentially greater levels of flood risk and soil erosion.¹⁸ A rise in temperature of a few degrees would create conditions unlike anything experienced in Scotland today. We may have fluctuating temperatures and more frequent and/or prolonged periods of high rainfall or drought, leading to more extreme weather events, like heat waves or heavy rainfall.¹⁹

Potential impacts from the changing climate in Scotland will affect communities, the economy and the environment. The threats are wide-ranging. Examples include: reduction in river flows and water availability during the summer; increased risks of pests and diseases to agriculture and forestry; increases in flooding through more intense precipitation events which would affect properties; infrastructure and people; changes in, or loss of, species and habitats; and increased disruption from extreme weather events.

¹⁸ Sniffer. An online handbook of climate trends across Scotland: www.climatehandbook.adaptationscotland.org.uk/index.html

¹⁹ UK Climate Projections: <http://ukclimateprojections.defra.gov.uk/21708>