



The Scottish  
Government  
Riaghaltas na h-Alba



# **LOW CARBON SCOTLAND**

## MEETING THE EMISSIONS REDUCTION TARGETS 2013-2027

THE SECOND REPORT ON  
PROPOSALS AND POLICIES



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REDUCTION TARGETS  
2013-2027

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PROPOSALS AND POLICIES

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## Ministerial Foreword



**Richard Lochhead**  
Cabinet Secretary for Rural  
Affairs and Environment



**Paul Wheelhouse**  
Minister for Environment and  
Climate Change

In 2009, the Scottish Parliament unanimously passed the most ambitious climate change legislation anywhere in the world. Four years later, our legislation and its framework of statutory annual targets remain the most ambitious in the world.

Whilst there is an increasing global focus upon dealing with the lingering effects of the global economic downturn, that in no way diminishes the clear threat that climate change poses to the people of Scotland, our quality of life and our environment, if average global temperature rises cannot be kept to 2°C or less.

It is imperative that we act, both locally and globally, to reduce greenhouse gas emissions, by moving to a low carbon economy. It is now vital to address the very real economic and social impacts of climate change on present and future generations and our environment.

Investing in a low carbon economy supports sustainable growth in Scotland by helping households and businesses save money through energy and resource efficiency and by securing new jobs and investment, and it also supports our long-term energy security. Recognising the importance of this investment, the Scottish Government has made the transition to a low carbon economy one of our strategic priorities in our Government Economic Strategy.

Our ambitious climate change legislation means that our Parliament has set very challenging targets and these have been made tougher still by substantial changes in the way in which Scotland's emissions are calculated.

These changes have been identified as a factor in missing the annual target for 2010 and such a change was the decisive factor in missing the target in 2011. The fact that the 2011 target was missed is disappointing, given that in 2011 we witnessed the largest ever recorded year on year decrease in unadjusted greenhouse gas emissions (at 9.9%) and significant progress was made across a number of sectors.

Our 2011 emissions figures also need to be seen in the context of the continuing downward trend in Scotland's emissions, which have now fallen by 25.7% since 1990. For comparison, this means that Scotland's greenhouse gas emissions have decreased in size by an amount greater than the total emissions in 2011 of our near neighbour, Northern Ireland. This progress means that Scotland continues to be a climate change leader in Europe, having reduced emissions faster than any member state in the EU-15. We can be proud of what we have achieved together, even if we recognise that more needs to be done.

Over the next decade, we will complete the 'easy wins'. The 2020s and beyond will establish the transformational changes necessary for a truly low carbon future. By 2030, Scotland's electricity supply will be largely decarbonised and we will have made significant progress decarbonising the sources of heat that we use and the vehicles that we travel in. Scotland will have seen a step-change in the provision of energy efficient homes. As a society, we will walk and cycle more, we will create even less waste and we will be smarter still about what we do with it. We will also be making the most of the many opportunities afforded through good stewardship of Scotland's ecosystems, deploying best practice in agriculture, while continuing to improve the ability of our peatland and woodland to lock in carbon.

The people of Scotland are building on strong foundations. In 2012, a record year, almost 39% of Scotland's electricity needs were generated by renewable sources. In housing, two-thirds of cavity walls have already been insulated and annual loft insulation rates more than doubled between 2008-09 and 2011-12. Large organisations are taking action to save money by cutting energy and resource use, with coordinated efforts such as the development of an energy efficient national street lighting programme, using LED technology.

Emissions from new vehicles have fallen by a quarter in the last decade and will reduce by a third more in the next. Recycling rates have increased from 5% to over 40% since 1999, the amount of waste that goes to landfill is down 58% in that period and waste management emissions fell 68% between 1990 and 2011. Finally, farmers are finding new ways to cut their use of nitrogen fertilisers, while the potential to lock carbon into Scotland's

peatland is beginning to be properly understood and the decline in woodland creation is being reversed.

This report shows where the next steps can be taken. It has been subject to rigorous review by Parliament's committees and our stakeholders. We would like to thank all of those who took part in this process, including members of all political parties, stakeholders, delivery partners and members of the public. The feedback on the draft has been helpful and we have adopted many of the recommendations in this final version.

The package of proposals and policies outlined in this report has the capacity to deliver emissions cuts well in excess of the amount that the independent expert Committee on Climate Change (CCC) suggested was possible and despite constraints arising from Scotland's block grant. Scotland's targets to 2020 were set to achieve a 42% reduction in emissions that the CCC advised could be hit in circumstances where the EU adopted an equivalent 30% target. Although progress towards a stronger EU 2020 target has stalled, this report shows that Scottish proposals and policies can deliver the 42% reduction even without a larger contribution from the EU. We believe these measures represent a credible approach to cutting emissions while also safeguarding and contributing to Scotland's economic recovery and ensuring that the actions we expect of individuals, families, businesses and other organisations are proportionate and fair.

The challenge that we have set ourselves is not an easy one. It would have been far easier to set targets that ignored climate science or showed little ambition, so that they would be straightforward to meet. Scotland does not lack ambition and as a nation we can take pride in that.

Scotland can be proud of the progress that we have already made. However, we can go further and that is why we have set ambitious new targets specifically to decarbonise the production of electricity and heat.

The low carbon transition is well underway but, despite obvious progress, we remain in the early stages of our journey. We must maintain momentum if we are to avoid facing the increased costs that would arise later if the global community fails to act. To achieve this, we need the continued support of our partners in the private and public sectors, the involvement of the thousands of members and activists within the environmental NGO movement and, most importantly, the participation of individuals and families across Scotland.

We recognise the responsibility of the Scottish Government to lead this effort: to help households and businesses save money on their bills; to make the big choices on policy and secure the investment that will give

Scotland a competitive advantage in important industries and markets; and, ultimately, to ensure we seize the opportunities that a low carbon future offers both to Scotland's economy and society as a whole.

**Richard Lochhead**  
Cabinet Secretary for Rural  
Affairs and Environment

Handwritten signature of Richard Lochhead in black ink.

**Paul Wheelhouse**  
Minister for Environment and  
Climate Change

Handwritten signature of Paul Wheelhouse in black ink.

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# EXECUTIVE SUMMARY

## Executive Summary

1. Climate change is one of the greatest global threats we face. Addressing it is vital but, in doing so, it also presents one of our society's greatest opportunities. We believe that the transition to a low carbon society is an essential investment for the people of Scotland, our environment, and for future generations. It is also an important contribution that Scotland can make as a good global citizen to a global challenge. Simply put, a low carbon Scotland is a better Scotland.
2. This is the Scottish Government's second report on proposals and policies (RPP2) for meeting its climate change targets. It sets out how Scotland can deliver its statutory annual targets for reductions in greenhouse gas emissions for the period 2013–2027 set through the Climate Change (Scotland) Act 2009.
3. The Climate Change (Scotland) Act is the most ambitious piece of climate change legislation anywhere in the world and remains an inspiration to many. The Act sets a world leading target of at least 42% emissions reductions by 2020, compared to the equivalent UK target of 34%. And, unlike the UK Act, Scotland's framework includes annual targets. Unlike the position in Wales, our targets also cover our whole economy and not just those areas where legislative power is devolved. To our knowledge, the Scottish Government is the only government that is held to account by its legislature in each and every year.

## Our role in the world and how we compare with other countries

4. Current global pledges for emissions cuts will not be enough to limit global warming to 2°C, so raising worldwide ambition remains a high priority for the Scottish Government and this has been a focus of our international engagement. We have played an active role as part of UK efforts for higher EU ambition on climate change targets for 2020 and beyond. In so doing, we have argued that levels of emissions reduction across the EU are already deeper than expected, and that the costs of moving beyond 20% are now lower, and the benefits now higher, than had been anticipated.
5. Scotland is at the top of the European league table for emissions reductions. Based on 2011 data, between 1990 and 2011 direct emissions in Scotland fell by 29.6%. This is the largest reduction among the EU-15 Member States, and higher than the EU-27 Member State average of 17.1%, when emissions from international aviation

and shipping and land use, land use change and forestry sectors are factored in.

6. We are leading the way to a low carbon society. By 2011, Scotland's emissions, including international shipping and aviation, had fallen 25.7% from 1990, over half way to meeting the 42% 2020 target set in the Climate Change (Scotland) Act. However, we know that the challenge remains an ambitious one and we need to continue looking for new opportunities to accelerate our society's transition to a low carbon future.

## Our vision

7. Our vision is for 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. To date, the carbon intensity of electricity generation has fallen from 347 gCO<sub>2</sub>/kWh in 2010 to 289 gCO<sub>2</sub>/kWh in 2011 and we are on track to a further 83% reduction in carbon intensity by 2030. We are also looking forward to a largely decarbonised heat sector 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.
8. We are aiming for 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 further modal shift towards public transport and active travel, and significant decarbonisation of rail services.
9. By 2030 there will be a step-change in provision of energy efficient homes to 2030 through retrofit of existing housing and improved building regulations for new build homes. We will also have made 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.
10. We have already made significant progress in reducing greenhouse gas emissions from the waste management sector. By 2025 at least 70% of all Scotland's waste will be recycled and by 2050, waste as we know it now will have been effectively designed out of our economy.

11. By 2027 land managers will have further optimised the productive use of natural resources, producing food and delivering public goods, such as protecting the natural environment and reducing greenhouse gas emissions. We will also have enhanced natural carbon capture through an expansion of our woodland and significantly more conservation of our peatlands.

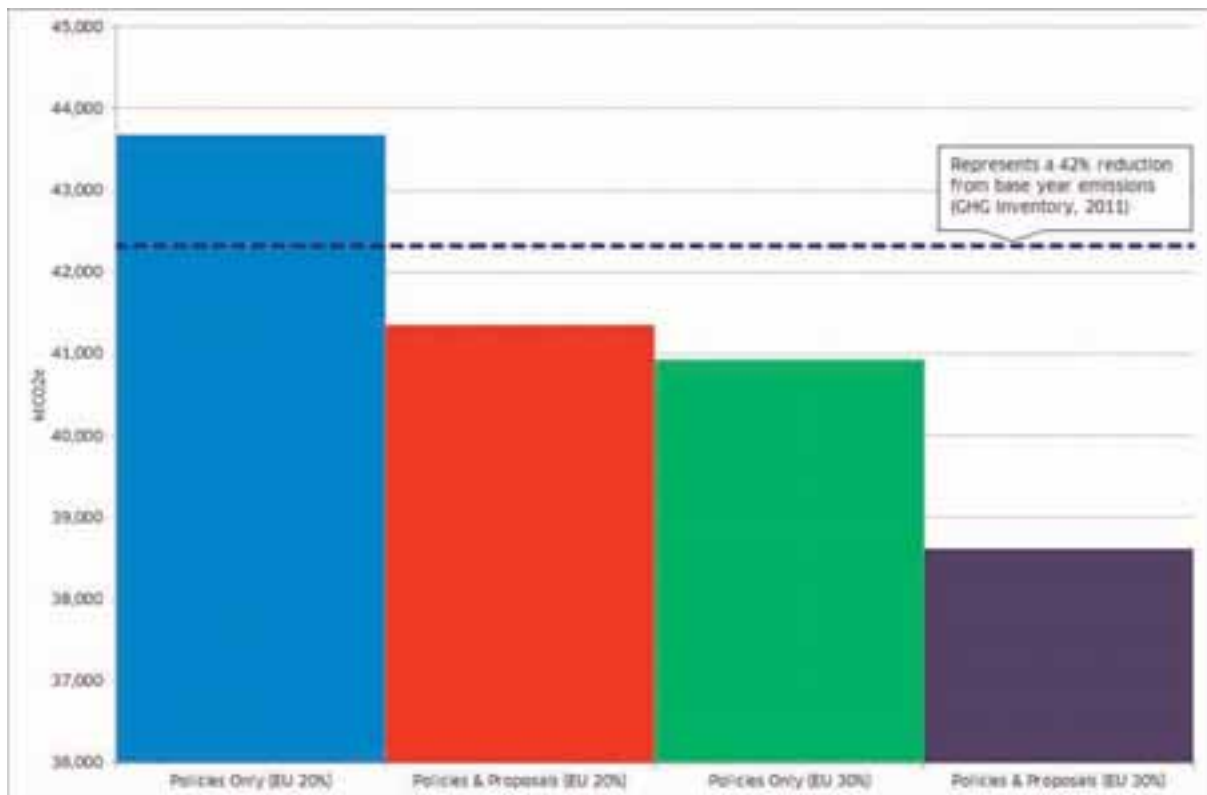
## Our approach

12. We want to ensure our approach to reducing greenhouse gas emissions both includes and benefits the people of Scotland. To this end, we have a set of guiding principles to help us, i.e. that our approach should be: sustainable; cost effective; inclusive; fair; transparent and deploy diverse technologies.
13. Participation is paramount. We are grateful to all the people and organisations that contributed to RPP2-related consultation events and processes, to those who submitted comments and or gave evidence as part of the Parliamentary scrutiny period in early 2013, and to those who continue to support us in delivery of the world's most ambitious climate change targets.
14. Scotland's targets from 2013–2027 are expressed in tonnes of carbon dioxide equivalent (CO<sub>2</sub>e). The baseline for the targets is continually under review and, when the Scottish Greenhouse Gas Inventory is published annually, Scotland's 1990/1995 baseline is updated.
15. Importantly, the total quantity of emissions that needs to be abated to meet the annual targets can vary depending on the baseline. For example, when the targets were set based on 2008 data, the absolute 2020 target was a 42% reduction against the 1990-1995 base year. Based on the 2011 data, with a revised figure for the base year, the required effort has increased to 44.2%. Put another way, the revisions of the data have resulted in emissions in the 1990 baseline, and in almost every year since the annual targets were set, being revised up by more than 2 MtCO<sub>2</sub>e. This has increased our challenge significantly.
16. In addition, the EU 2020 climate change target for 2020 remains at 20%. When the Scottish Parliament was considering the Climate Change (Scotland) Bill in 2009, the expectation among those scrutinising the Bill was that the EU would strengthen its 2020 target to require a 30% reduction in greenhouse gas emissions.

17. The number of emissions allowances in the EU Emissions Trading Scheme would be reduced as a consequence and this would provide a greater incentive for accelerated action on emissions from large emitters in Scotland such as electricity generation and heavy industry. However, stalling international climate change negotiations have so far limited further progress in Europe and constrained the contribution that the so-called 'traded sector' is making to cutting emissions in Scotland.
18. Despite the good progress in reducing Scotland's greenhouse gas emissions, challenges such as the continued baseline revisions described above, exacerbated by the historically cold weather in 2010, contributed to Scotland missing the emissions targets that had been set for 2010 and 2011.
19. Clearly, the outturn in relation to both targets has been disappointing, but we should not lose sight of the clear progress that has been achieved in comparison with benchmark countries across the EU-15 and the fact that, in percentage terms, emissions in Scotland had fallen by 25.7% by 2011, in comparison with a projected 23.9% for that year. The Scottish Government remains focussed on the downward trajectory in emissions and is committed to delivering the low carbon transition required to meet our international responsibilities, to ensure the sustainability of our economy and society and to maximise the impact of domestic effort. We also aim, where possible, to over-achieve against future annual targets to recover the difference by which the earlier targets were missed.
20. A full year-by-year breakdown of the estimated emissions impact of our policies and proposals in four scenarios is contained in the annexes. A 'policy' is a course of action which has already been wholly or largely decided upon. A 'proposal' is a suggested course of action, the details of which might change as this course of action is explored further. Each sector in this report, aside from Energy, contains both policies and proposals for reducing emissions. The two EU scenarios we set out envisage the EU maintaining a 20% climate change target for 2020 (the status quo); and the EU moving to higher ambition, with a target for 2020 of 30% emissions reductions (our policy position):
  - **If we implement our policies only and the EU stays at 20%, we project that Scottish emissions will have fallen by 40.1% in 2020 and by 47.0% in 2027.**
  - **If we implement both our policies and proposals and the EU stays at 20%, we project that Scottish emissions will have fallen by 43.3% in 2020 and by 57.8% in 2027.**

- If we implement our policies only and the EU moves to 30%, we project that Scottish emissions will have fallen by 43.9% in 2020 and by 47.0% in 2027.
- If we implement both our policies and proposals and the EU moves to 30%, we project that Scottish emissions will have fallen by 47.1% in 2020 and by 57.8% in 2027.

### Net Emissions in the Four Scenarios Compared to a 42% Reduction in Emissions in 2020



21. The policies and proposals in this report create **benefits and costs** for government, business and households. Scottish Government funding for climate change activities is less than the costs outlined in this document because the costs (and benefits) are to society as a whole, rather than to the Scottish Government alone. We estimate the costs of implementing the measures to be, on average, £1.6 billion per annum (or 1% of GDP) while the average benefits are estimated to amount to £1.2 billion (2011 prices) per annum.

22. There are a number of important **additional benefits** that are not included in these figures – for example co-benefits including job creation, health improvement, local air quality improvement and biodiversity protection and enhancement. In addition, the cost figures



do not include transformational investments in the electricity sector or where estimates for some proposals are not available at this stage.

23. As the wide range of policies and proposals in this report show, the Scottish Government cannot and should not meet the climate change targets alone. Local government has a pivotal role, alongside businesses, third sector organisations, communities, families and individuals. We are working in partnership, building capacity and facilitating Scotland-wide action to make the low carbon transition a reality.

## Understanding and achieving transformation

24. We know that transformation to a low carbon Scotland will be challenging. It will involve more than just focusing on particular sectors. For this reason, we have identified five cross-cutting themes that apply to all six sectors in this report.
25. The first theme is understanding external factors that are driving the pace of change. This includes an exploration of **different futures** – not as predictions – but in recognition that we need to understand different forward operating environments that might come to pass. These help us understand the need to be adaptive and flexible as we move forward in the transition.
26. The second theme is the transition to the **low carbon economy**. Based on the new strategic priority in our updated 2011 *Government Economic Strategy*, and our earlier *Low Carbon Economic Strategy for Scotland*, we emphasise the central importance of low carbon activity to Scotland's future economic success. There is a sound economic basis for our actions. Scotland's abundant natural resources are the basis for a revolution in renewable energy supported by energy infrastructure and skills in our oil and gas industries.
27. Our support for the low carbon economy is provided through six channels: long term legal and institutional certainty; expanding renewable energy production; improvements in energy and resource efficiency in households and industry; transition of transport to a lower carbon basis; expansion of renewable sources of heat; and sustainable land use.

28. The third theme outlines the wide range of **funding and financing** options available for climate change mitigation measures. Our principles for funding and financing climate change are: cost effectiveness; consideration of whole life cycle costs; preventative spend or ‘spend to save’; efficiency; and maximising wider economic benefits. Funding and financing mechanisms are available for large public and private organisations as well as households and small businesses. They range, for example, from the Green Investment Bank and the Green Deal, through to traditional capital finance and tax incremental financing.
29. The fourth theme addresses the critical role that **understanding and influencing behaviour** has in the majority of policies and proposals in this report. Our *Low Carbon Scotland: Behaviours Framework* sets out our strategic framework to encourage low carbon behaviours amongst Scotland’s businesses and households. This includes ten, evidence-based, household behaviours that are key to reducing greenhouse gas emissions: installing a more energy efficient energy system; keeping the heat in; better heating management; saving electricity; walking, cycling, using public transport and or car sharing; avoiding food waste; eating a healthy diet in season where we live; and reducing and reusing, in addition to the efforts we already make on recycling.
30. The ISM approach shows that **individual, social and material** contexts influence behaviours. Our use of the ISM tool, based on theory and evidence, combined with ten insights for effectively influencing behaviours, will also help us and others build stronger policies and programmes to meet the challenge of changing the way we live, work and travel.
31. The final of the five cross-cutting themes is the critical role of the **planning system**, which is used to make decisions about the future development and use of land in our towns, cities and countryside. Our *National Planning Framework, Scottish Planning Policy*, planning advice, and strategic and local development plans all play important roles in supporting the transition to a low carbon future.

## The Energy sector

32. Energy supply in Scotland emitted 16.93 MtCO<sub>2</sub>e in 2011, or 33% of Scotland's total. Emissions in this sector are dominated by installations in the EU Emissions Trading Scheme and are therefore in the traded sector.
33. Our energy emissions, largely from electricity generation, are addressed through our new ambitious target to decarbonise electricity alongside reducing our demand for energy. Our decarbonisation target is a carbon intensity of 50 gCO<sub>2</sub>/kWh by 2030. This is in line with the Committee on Climate Change's recommendations for the UK Government.
34. Our policy for electricity generation is set out in our *Electricity Generation Policy Statement*. This states that Scotland's electricity generation mix should deliver: a secure source of electricity supply; at an affordable cost to consumers; which can be largely decarbonised by 2030; and which achieves the greatest possible economic advantage to Scotland, including opportunities for community ownership and community benefits.
35. Progressing our thematic energy aims and targets is critical to achieving our decarbonisation target to: meet at least 30% overall energy demand from renewables by 2020; reduce final energy demand in Scotland by 12% by 2020 covering all fuels and sectors; deliver the equivalent of at least 100% of gross electricity consumption from renewables by 2020 with an interim target of the equivalent of 50% of gross electricity consumption from renewables by 2015; enable local and community ownership of at least 500 MW of renewable energy by 2020; demonstrate carbon capture and storage at commercial scale in Scotland by 2020, with full retrofit across conventional power stations thereafter by 2025-30; and to seek transmission system upgrades and increased interconnection capable of supporting the projected growth in renewable capacity.
36. The way in which energy markets and energy generation, transmission and supply is regulated is vital to our decarbonisation plans. This is why we retain a profound interest in the UK's Electricity Market Reform proposals. We are working closely with our UK counterparts on the UK Energy Bill.

37. We are making excellent progress across our energy targets. For example, provisional data for 2012 showed that almost **39% of Scotland's electricity** came from renewables.
38. In the longer term, we are confident that investing now in a low carbon future is an economically viable and necessary thing to do. As electricity generating assets reach the end of their operational life, they will need to be replaced with a diverse mix of generating technologies. Alternative and innovative methods of generation will replace traditional technologies' reliance on carbon intensive fuels. Our aim is to ensure that these costs are as low as possible, and affordable to consumers. The Committee on Climate Change highlights that, if gas prices were to continue to rise, reliance on fossil fuels could result in the average annual gas bill being as much as £600 higher in 2050 than it might be in a low carbon system.

### The Homes and Communities sector

39. **The residential sector in Scotland emitted 6.58 MtCO<sub>2</sub>e in 2011, or 12.8% of Scotland's total. These reported emissions are almost exclusively from our use of gas for heating and cooking.**
40. Our *Sustainable Housing Strategy* sets out our vision for warm, high quality, low carbon homes and a housing sector that helps to establish a low carbon economy for Scotland. The Strategy aims to: make sure no-one in Scotland has to live in fuel poverty, as far as practicable, by 2016; deliver a step-change in provision of energy efficient homes to 2030 through retrofit of existing housing and improved building regulations for new build homes; make a full contribution to the Climate Change (Scotland) Act targets; and enable the refurbishment and house building sectors to contribute to and benefit from Scotland's low carbon economy.
41. Emissions in this sector are addressed through fabric improvement and heating efficiency; building standards; the decarbonisation of heat; and information measures such as smart meters. Our policies include smart meters (UK); domestic building energy standards new build properties (2010 – Scottish); Renewable Heat Incentive (UK); Energy Company Obligation and Green Deal (UK); Home Energy Efficiency Programmes Scotland (Scottish); and the Warm Homes Fund (Scottish).

42. Our Scottish proposals in this sector include: domestic building energy standards new build properties (2014); regulation of private and social housing; continuation of Home Energy Efficiency Programmes Scotland; low carbon heat (domestic); and additional technical abatement through improvements to carbon efficiency of the housing stock.
43. Our enabling measures support this activity. For example, we have invested in the network of Energy Saving Scotland Advice Centres which provide free advice to, amongst others, householders and communities. Our Climate Challenge Fund has also made more than 500 awards to over 400 communities since 2008, with many projects supporting energy efficiency at a local level, as well as cycling and allotment activities.
44. We are making excellent progress. For example, since 2008, loft and cavity wall insulation has been professionally installed in over 540,000 homes through the Carbon Emissions Reduction Target scheme assisted by Scottish Government programmes.
45. There are significant benefits stemming from our approach. For example, consumers could save an estimated £2.4 billion on their energy bills between 2013 and 2027 as a result of energy efficiency measures in existing homes.

### The Business, Industry and Public sectors

46. **The business, industry and public sectors in Scotland emitted 9.98 MtCO<sub>2</sub>e in 2011, or 19.5 % of Scotland's total. These reported emissions are largely from buildings, some industrial processes and include some traded emissions.**
47. Emissions in this sector, sometimes known as the 'non-domestic' sector, are addressed through energy and resource efficiency measures, the decarbonisation of electricity, and the decarbonisation of heat. Our policies in this sector include smart meters (UK); Carbon Reduction Commitment energy efficiency scheme (UK/Scottish); buildings energy standards - new build properties (2010 Scottish); Green Deal (UK); EU products policy (EU); and the non-domestic Renewable Heat Incentive (UK).

48. Our Scottish proposals include: non-domestic buildings new-build energy standards (2014); assessment of energy performance and emissions regulations (non-domestic buildings); public sector additional potential; and non-domestic low carbon heat.
49. Important enabling measures in this sector include our new Resource Efficient Scotland 'one stop shop' advice and support programme. This service provides important support to businesses, third sector and public sector organisations to cut carbon and reduce overheads.
50. We are making excellent progress in this sector. For example, we estimate that the potential lifetime savings of our investment in the Carbon Trust programme, now replaced by Resource Efficient Scotland, could be up to £920 million and 10.2 MtCO<sub>2e</sub>.
51. There are significant benefits stemming from our approach. A recent UK study estimated that around 2.3% of GDP could be saved from straightforward resource efficiency measures. In 2010, this would have meant £2.9 billion savings to the Scottish economy.

## The Transport sector

52. **The transport sector in Scotland produced 12.96 MtCO<sub>2e</sub> in 2011, or 25.3 % of Scotland's total in 2011. These emissions include international aviation and shipping.**
53. We are addressing transport emissions through four packages: decarbonising vehicles; road network efficiencies; sustainable communities including modal shift to walking, cycling and public transport; and business engagement around sustainable transport.
54. Our decarbonising vehicles package includes: EU legislation on vehicle emissions standards and biofuels; and Scottish proposals that involve: fleet conversion to electric vehicles in the public sector, supporting electric vehicle charging infrastructure, the E-cosse Partnership, our Green Bus Fund and supporting hydrogen bus projects.
55. Our road network efficiencies package complements our work on promoting low carbon vehicles through congestion management and efficient driving. Intelligent Transport Systems in this package include variable speed limits and ramp metering and are complemented by deployment of average speed cameras.

56. Our sustainable communities package aims to help people understand their options and use more carbon friendly modes of travel, for example travel planning, walking and cycling, and the use of car clubs. The Climate Challenge Fund complements this work, through provision of funding opportunities for communities to progress local cycling projects. Improvements in integrated public transport, such as smart ticketing and park-and-ride facilities, and bus quality contracts and statutory bus partnerships are important aspects of this approach.
57. Our business engagement on sustainable transport package contains a range of measures including the provision of support for workplace travel planning and advice to encourage fleet efficiency improvements, including fuel efficient driver training.
58. A further proposal considers lower emission potential in transport – reflecting current uncertainties in traffic growth, and possible future scope to manage reductions in use of the road network in favour of public transport and active travel.
59. Important enabling measures in the transport sector include our significant investment in public transport as well as opportunities to reduce travel through the implementation of our *Digital Strategy*. For example, in 2012 we announced a £5 billion package of funding and investment in Scotland’s railways between 2014 and 2019.
60. Highlights of our progress to date include: supporting the purchase of around 270 public sector low carbon vehicles and the installation of approximately 300 charging points; the purchase of more than 90 low carbon buses through the Green Bus Fund; and the opening of Scotland’s first cycling/rail hub at Stirling railway station.
61. There are significant financial benefits stemming from our approach. In addition to these, most of the measures will bring other important benefits such as improved health, improved air quality, less congestion and noise pollution and enhanced biodiversity. The decarbonisation agenda also offers Scottish companies opportunities in the global market for low carbon vehicles and vessels. A growth in cycling could also mean an increase in jobs in local bicycle shops, supply chains and tourism outlets.

## The Waste and Resource Efficiency sector

62. The waste sector in Scotland produced 2.17 MtCO<sub>2</sub>e in 2011, or 4.2 % of Scotland's total.
63. When organic materials break down in landfill sites they produce potent greenhouse gases - mainly methane, which is approximately 25 times more potent than carbon dioxide. Over 92% of territorial emissions in the waste sector arise from landfill.
64. Our *Zero Waste Plan* (2010) sets out our vision for a zero waste society in which waste is a valuable resource, landfill is phased out, and increasing amounts of materials are reused or recycled, leaving only limited amounts to be treated. Targets relating to the proportion of household waste subsequently recycled, composted and or prepared for re-use are: 40% by 2010, 50% by 2013, 60% by 2020 and 70% by 2025 respectively; recycling 70% of all waste (including commercial and industrial waste) by 2025; and reducing the proportion of total waste sent to landfill to a maximum of 5% of all waste by 2025.
65. Emissions in this sector are addressed through the EU's Waste Framework and Landfill directives, the UK Landfill Tax while Scottish policies are contained within the *Zero Waste Plan*. The key policy is a ban on biodegradable municipal waste going to landfill from 2021. This ban was introduced by the Waste (Scotland) regulation 2012.
66. Our proposal for further abatement is to examine opportunities to capture methane emitted from closed or inactive landfill sites.
67. We are making excellent progress. 28% of households now receive a food waste collection service from their local authority and we expect this proportion to increase to 46% by the end of 2013. In 2012-13, £850,000 was invested through local authorities, land owners and facilities managers to install new recycling facilities in some of Scotland's busiest public places.
68. There are also other important benefits stemming from our approach. The overall cost of managing the implementation of the *Zero Waste Plan*, and the Waste (Scotland) Regulations 2012, will be significantly lower than the current cost of dealing with Scotland's waste. The net saving is of the order of £17 million per annum, rising to over £21 million per annum by 2025.



## The Rural Land Use sector

69. The rural land use sector in Scotland produced a net total of 2.66 MtCO<sub>2</sub>e in 2011, or 5.2 % of Scotland's total in 2011. These figures include carbon sinks from forestry.
70. Rural land use covers agriculture and related land use, peatland restoration and forestry. Emissions in these sectors come from livestock, agricultural soils, animal wastes and certain land use changes. Importantly, some biological processes also have the capacity to absorb CO<sub>2</sub>.
71. Rural land use emissions and sequestration are addressed through a combination of improved agricultural practice, woodland creation and management, and peatland restoration.
72. Our Scottish policies to address these emissions are: Farming For a Better Climate; and an increase in our afforestation rate, planting 100,000 trees over ten years.
73. Our Scottish proposals are: 90% uptake of fertiliser efficiency measures; developments in agricultural technology post-2020; accelerated restoration of degraded peatland, targeting up to 21,000 hectares a year; the Wood First timber construction programme; and additional technical potential from peatland and woodland.
74. Progress through the Farming For a Better Climate programme and focus farms is well underway with around 2,000 farmers participating in events. Between 2009-10 and 2010-11, new woodland creation rose from 2,700 hectares to 5,100 hectares annually while in 2011-12, 9,000 hectares of new woodland were created.
75. Farming For a Better Climate is estimated to save farm businesses around £240 million (undiscounted over the period to 2027). Improvements to water and air quality, as well as biodiversity and longer-term sustainability will also be achieved, while restored peatland has many benefits for our ecosystems, including improved biodiversity and natural flood management.
76. Investment (largely private sector) in new cross-laminated timber production facilities using Scottish timber could offer significant market development and business opportunities.

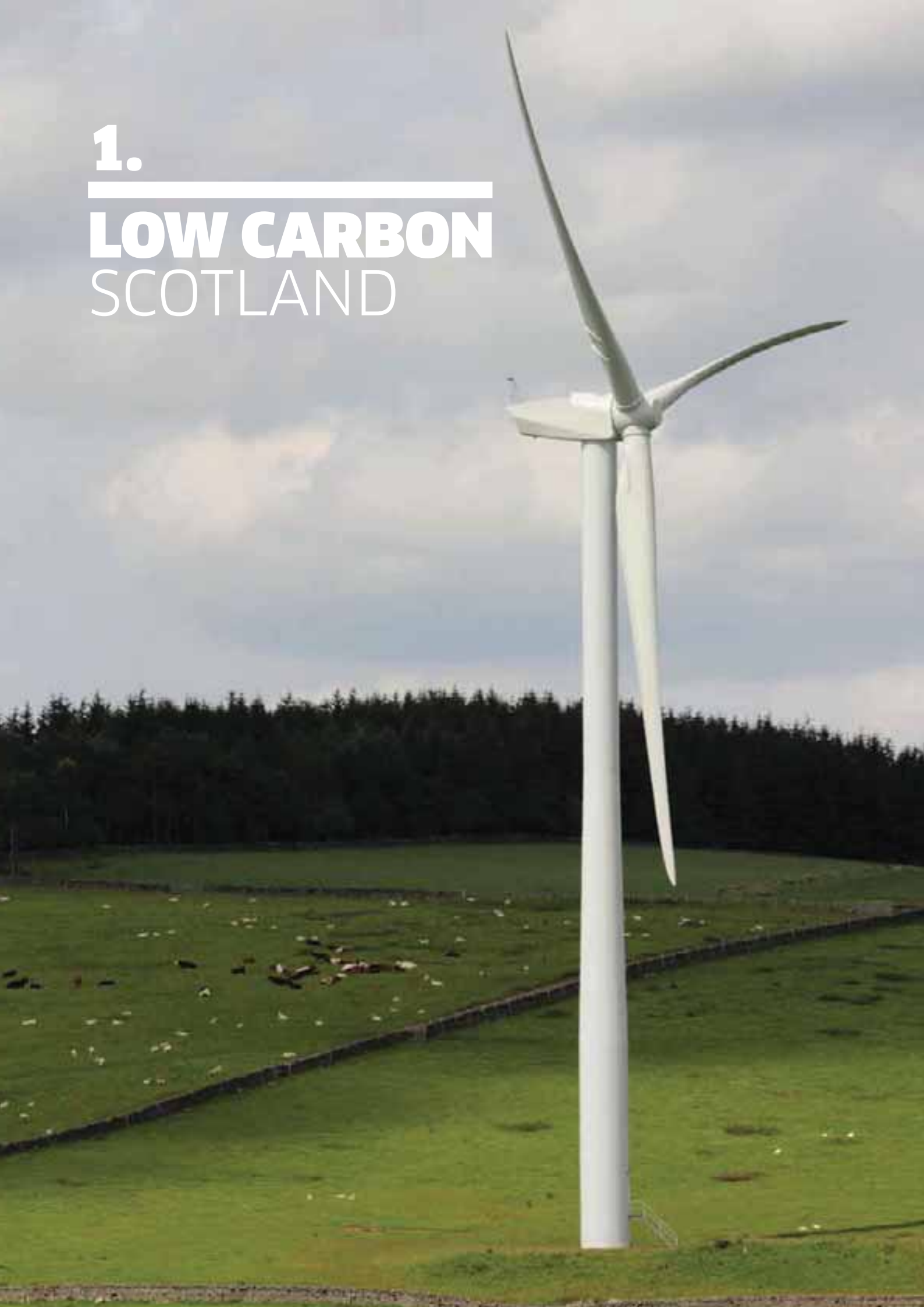
## The Scottish Government's Low Carbon Management System

77. The Climate Change Delivery Board has responsibility for monitoring Scottish Government progress on climate change mitigation and adaptation. In terms of mitigation, its purpose is to ensure delivery of the programme of policies and proposals in this report, and subsequent RPPs, to meet our statutory greenhouse gas emission reductions targets. The Board includes two non-executive members.
78. We are continuing to develop robust accountability and monitoring mechanisms to help us track progress. We publish details of the Board's meeting agendas, notes and our Carbon Reduction Activity Reports.
79. Strong and visible leadership is important in driving forward the climate change agenda. We are therefore setting up a Public Sector Climate Leaders Forum to be chaired by the Minister for Environment. The Convention of Scottish Local Authorities will also play a key role and membership will include leaders from across the public sector.
80. Since the publication of RPP1, a number of independent reports have been published. These include a report by Audit Scotland in 2011 and two statutory progress reports by the Committee on Climate Change. The Scottish Government is required to publish RPPs after setting batches of annual emissions reductions targets. The next batch, for 2028-2032, must be set by October 2016.

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**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.<sup>1</sup> 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 (CO<sub>2</sub>) emissions and, consequently, atmospheric CO<sub>2</sub> 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).<sup>2, 3</sup> 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.<sup>4</sup>

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<sup>1</sup> 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>

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

<sup>3</sup> 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 CO<sub>2</sub> 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.

<sup>4</sup> 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.<sup>5</sup> 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 CO<sub>2</sub> 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.

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<sup>5</sup> 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*.<sup>6</sup> 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;

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<sup>6</sup> Climate Change Delivery Plan: Meeting Scotland’s Statutory Climate Change Targets, 2009: [www.scotland.gov.uk/Publications/2009/06/18103720/0](http://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%<sup>7</sup> 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.

<sup>7</sup> 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,<sup>8</sup> 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*

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<sup>8</sup> 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*.<sup>9</sup> 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.<sup>10</sup> **2012** is currently ranked the 9th warmest year on record.<sup>11</sup>

**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.<sup>12</sup>

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.<sup>13</sup>

<sup>9</sup> European Commission, Green Paper, A 2030 framework for climate and energy policies: [http://ec.europa.eu/energy/green\\_paper\\_2030\\_en.htm](http://ec.europa.eu/energy/green_paper_2030_en.htm)

<sup>10</sup> World Meteorological Organization. Annual Statement, March 2012: [www.wmo.int/pages/mediacentre/press\\_releases/pr\\_943\\_en.html](http://www.wmo.int/pages/mediacentre/press_releases/pr_943_en.html)

<sup>11</sup> Met Office. December 2012: [www.metoffice.gov.uk/news/releases/archive/2012/2013-global-forecast](http://www.metoffice.gov.uk/news/releases/archive/2012/2013-global-forecast)

<sup>12</sup> Ibid.

<sup>13</sup> Met Office. January 2013: [www.metoffice.gov.uk/research/climate/seasonal-to-decadal/long-range/decadal-fc](http://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,<sup>14</sup> 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

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<sup>14</sup> The Stern Review: [http://webarchive.nationalarchives.gov.uk/+http://www.hm-treasury.gov.uk/sternreview\\_index.htm](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%.<sup>15</sup> 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.

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<sup>15</sup> 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 countries<sup>16</sup>**

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%

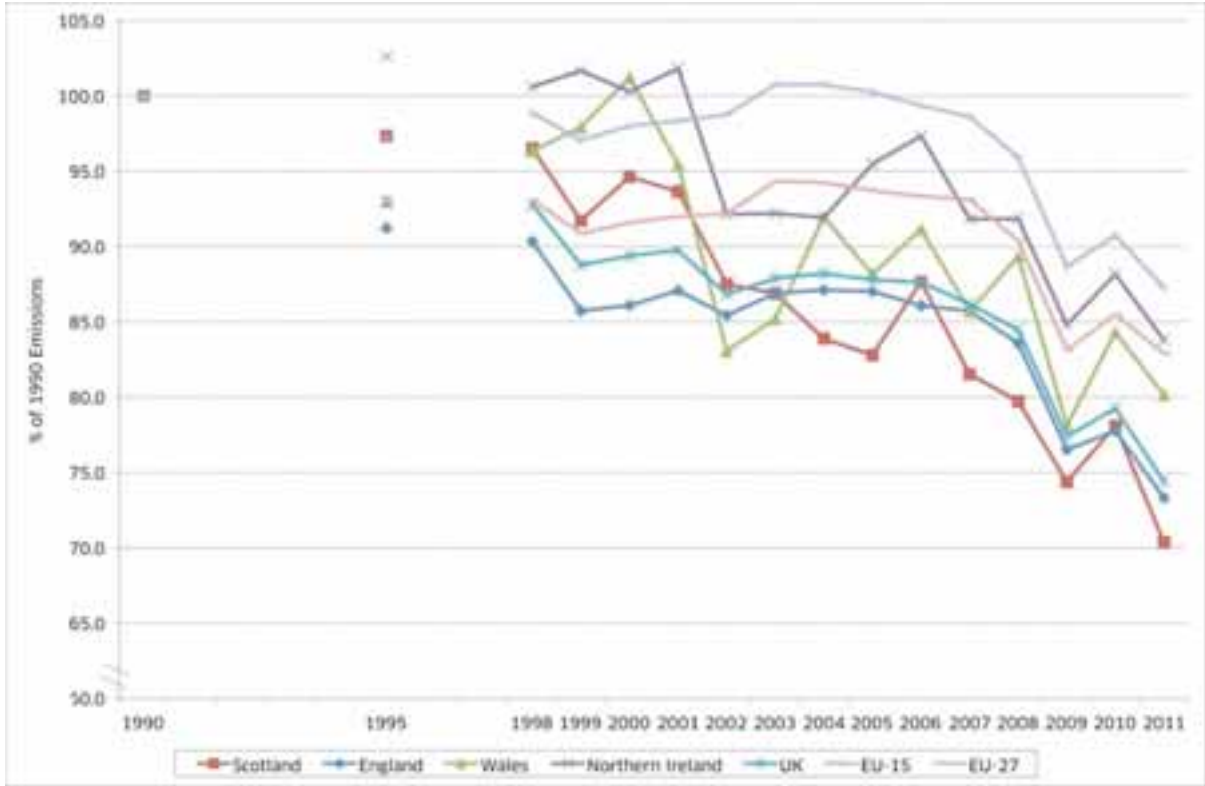
<b>SCOTLAND</b>	<b>-29.6%</b>
England	-26.7%
Wales	-19.8%
Northern Ireland	-16.2%
<b>United Kingdom</b>	<b>-25.6%</b>

<sup>16</sup> 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](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*.<sup>17</sup> 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

<sup>17</sup> 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.<sup>18</sup> 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.<sup>19</sup>

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.

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<sup>18</sup> Sniffer. An online handbook of climate trends across Scotland: [www.climatehandbook.adaptationscotland.org.uk/index.html](http://www.climatehandbook.adaptationscotland.org.uk/index.html)

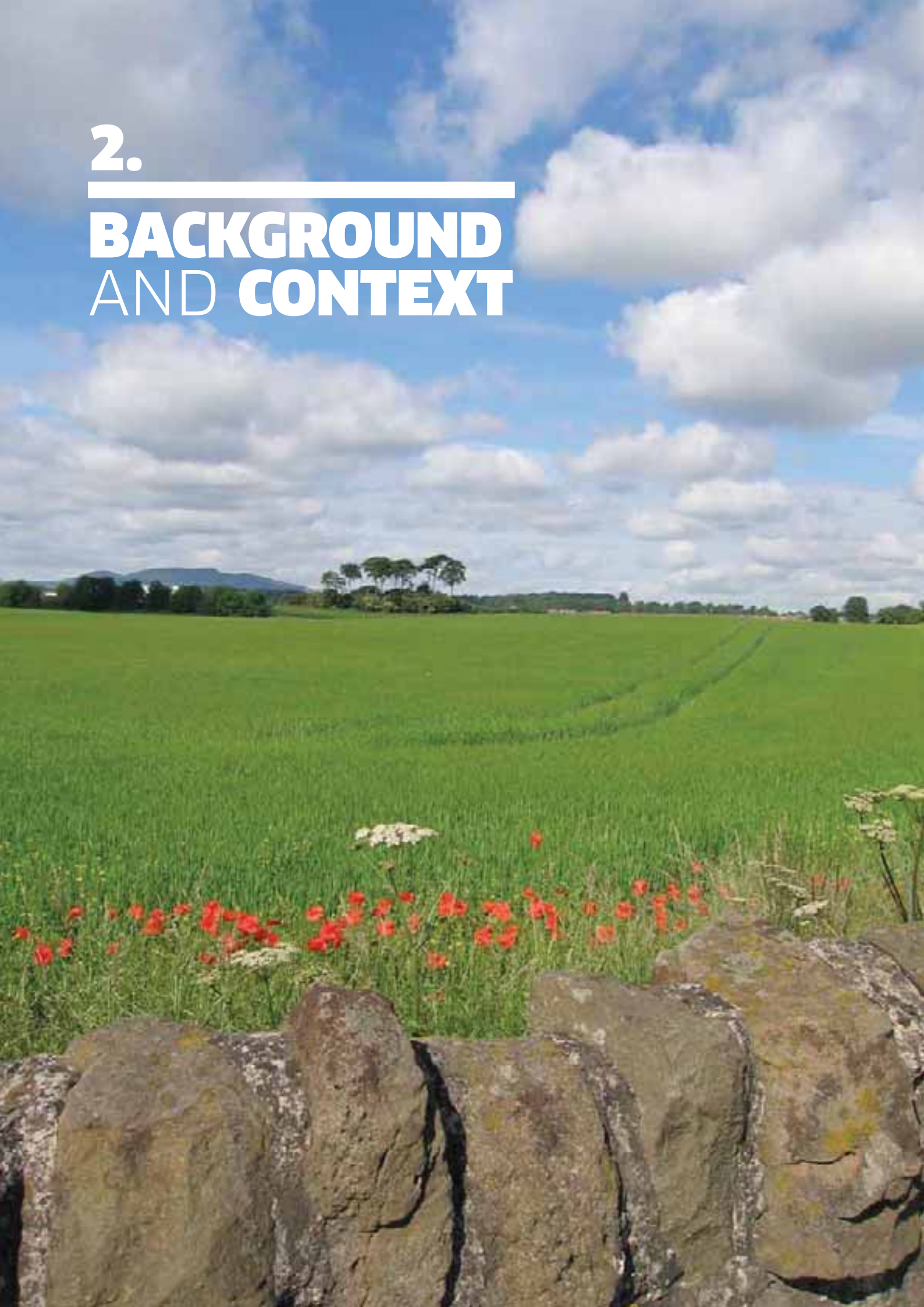
<sup>19</sup> UK Climate Projections: <http://ukclimateprojections.defra.gov.uk/21708>



**2.**

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**BACKGROUND  
AND CONTEXT**



## 2. Background and context

### 2.1 A whole Government approach

2.1.1 Tackling climate change in respect of leadership, policy, regulatory frameworks and project delivery is the responsibility of every part of the Scottish Government, its agencies, and local government. We are setting long term consistent and stable policy frameworks, working to ensure we understand how these relate to and impact on different parts of the Scottish economy and society.

2.1.2 We are working to maximise synergies, ensuring that all major policy initiatives take into account climate change impacts. We are taking action on our own estates, as well as maximising investment opportunities for low carbon activity through our procurement processes. The Public Bodies Climate Change Duties<sup>20</sup> in the Climate Change (Scotland) Act provide the statutory underpinning for action by public bodies relating to a number of these aspects and our agencies are accountable to the Scottish Ministers for their performance.

#### Scotland's Procurement Reform Bill

Scotland's Procurement Reform Bill<sup>21</sup> will establish a national legislative framework for sustainable public procurement that supports sustainable economic growth by delivering community benefits, supporting innovation, and considering environmental requirements. The Bill will also promote public procurement processes and systems that are transparent, streamlined, standardised, proportionate, fair and business friendly.

### 2.2 Our guiding principles

2.2.1 We are determined to tackle climate change in a way that both benefits and includes the people of Scotland. To do this, we have a number of principles to guide our approach. Each of these is set out below.

2.2.2 **Sustainable.** Sustainable development is integral to the Scottish Government's purpose. As we develop and implement emission reduction policies we will follow the five broad principles of sustainability:

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<sup>20</sup> The Public Bodies Climate Change Duties: [www.scotland.gov.uk/Publications/2011/02/04093254/1](http://www.scotland.gov.uk/Publications/2011/02/04093254/1)

<sup>21</sup> Procurement Reform Bill:

<http://www.scotland.gov.uk/Topics/Government/Procurement/policy/ProcurementReform>

- living within environmental limits;
- a strong, healthy and just society;
- a sustainable economy;
- promotion of good governance; and
- responsible use of sound science.

### The Agenda for Cities

As set out in the Agenda for Cities,<sup>22</sup> Scottish cities recognise the importance of sustainability and are keen to make the transition to a low carbon economy in a way which maximises economic benefits. As part of a range of measures, the Scottish Cities Alliance is considering carrying out “Mini Stern” reviews for each city that identify bespoke as well as collaborative opportunities for investment.

**2.2.3 Cost effective.** Where there are choices within and between policies, we will choose the most cost effective options, minimising costs to businesses, public organisations and households. This approach is explained in more detail in the funding and financing section later in this report.

**2.2.4 Portfolio of diverse technologies.** While we intend to choose the most cost effective mix of technologies and approaches in any sector, the reality is that, in many cases, we do not yet know how technologies will develop, or how their costs will change or what other disruptive technologies might emerge. We aim, where reasonable and practical, to encourage a portfolio of technologies and create competitive market conditions in which the most sustainable and cost effective succeed over time.

**2.2.5 Inclusive.** We will continue to work for and with the people of Scotland. We will consult, we will listen, and we will continue to learn from households, communities, non-government organisations, public sector partners, and businesses and industry as we adapt to new ways of doing things. The transition to a low carbon Scotland will involve all of us working together and we are grateful for the engagement by the stakeholder community in the preparation of this RPP2.<sup>23</sup>

<sup>22</sup> Scottish Cities Alliance: <http://scottishcities.wordpress.com/>

<sup>23</sup> For example, many people made significant effort to participate in two RPP2 workshops held in Edinburgh in May and September 2012. At the second workshop, the Director General of Enterprise, Environment and Digital committed to having an annual event to continue this engagement. Individual sectors have also continued to engage and consult with stakeholders on aspects of this RPP2.

**2.2.6 Fair.** Changing the way we do things, alongside our adoption of new technologies, will involve costs and benefits for many people. We will ensure that costs and benefits are distributed fairly, and pay special attention to the least well off in our communities, as well as minimising any unnecessary burdens on businesses and the third sector. Equalities impact assessments and individual business and regulatory impact assessments are part of the formal processes for implementing this principle and they will be undertaken for specific interventions where required, for example as proposals are converted to policies.

**2.2.7 Transparent.** The transition to a low carbon Scotland will involve some disruption and significant change although these are required to avoid even greater disruption and damaging change likely if global temperature rises exceed 2 °C. We will ensure that where possible, our assumptions, our data, and our decision making processes are clear and accessible as we work through the transition. The Technical Appendix at the end of this report provides the main assumptions behind the data used.

## **2.3 The Climate Change (Scotland) Act 2009 - statutory duties**

**2.3.1** The Climate Change (Scotland) Act 2009 ('the Act') sets targets to reduce Scotland's emissions of the basket of six Kyoto Protocol greenhouse gases<sup>24</sup> by at least 42% by 2020 and 80% by 2050, compared to the 1990/1995 baseline. As well as domestic emissions, Scotland's share of emissions from international aviation and shipping are included in the targets, unlike the UK Government which has deferred a decision on including aviation and shipping in its own targets until 2016.

**2.3.2** The Act requires the Scottish Ministers to set annual targets for emissions at least 12 years in advance. In October 2010, the Scottish Parliament passed legislation setting the first batch of annual targets, for the years 2010 to 2022. One year later, the Scottish Parliament passed subsequent legislation setting the second batch of annual targets, for the years 2023 to 2027.<sup>25</sup> Details of the targets are at section 2.4 below.

**2.3.3** The Act requires that, as soon as reasonably practicable after setting a batch of annual targets, Ministers publish a report setting out proposals and policies for meeting those targets. This RPP2 lays out how Scotland can deliver annual targets for reductions in emissions from 2013 to 2027. It

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<sup>24</sup> The basket of Kyoto Protocol greenhouse gases comprises carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O), for which the baseline is 1990; and hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF<sub>6</sub>), for which the baseline is 1995.

<sup>25</sup> Secondary legislation made under the Climate Change (Scotland) Act 2009:

[www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/climatechangeact/secondarylegislation](http://www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/climatechangeact/secondarylegislation)

sets the strategic direction towards further reductions in emissions of 80% in 2050. The trajectory towards 80% will likely result in a target of around 60% in 2030. Currently no 2030 target has been set for EU emissions, and Scotland will push the EU to demonstrate high ambition for 2030.

2.3.4 The Act requires that the report details progress on implementation of previous Reports on Proposals and Policies, in this case Low Carbon Scotland: Meeting the Emissions Reduction Targets 2010-2022 (RPP1).<sup>26</sup> published in 2011. Information has been included in the sectoral chapters of this report summarising progress to date.

## 2.4 The greenhouse gas emissions reduction targets 2013–2027

2.4.1 The annual targets, set out in Table 2.1 below, are expressed in tonnes of carbon dioxide equivalent (CO<sub>2</sub>e). Percentages have been adjusted to use the most up to date understanding of the revised 1990 baseline, taken from the latest 2011 Greenhouse Gas Inventory. Scotland's targets use the level of emissions in 1990 (for carbon dioxide, methane and nitrous oxide) and 1995 (for fluorine-based gases) as the baseline from which reductions are calculated.

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<sup>26</sup> The Scottish Government, RPP1, [www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/lowcarbon/rpp](http://www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/lowcarbon/rpp)

**Table 2.1: Greenhouse gas emissions reduction targets**

Target Year	Statutory annual greenhouse gas emissions targets expressed in tonnes of CO <sub>2</sub> equivalent (tCO <sub>2</sub> e)	% emissions reduction required year on year to achieve annual target <sup>27</sup>	% reduction against 1990 baseline when targets were set (70,201 ktCO <sub>2</sub> e in 2008 GHG Inventory) <sup>28</sup>	% reduction against 1990 baseline using latest data (72,974 ktCO <sub>2</sub> e in 2011 GHG Inventory) <sup>29</sup>
2010	53,652,000	N/A	-23.57%	-26.48%
2011	53,404,000	-0.46%	-23.93%	-26.82%
2012	53,226,000	-0.33%	-24.18%	-27.06%
2013	47,976,000	-9.86%	-31.66%	-34.26%
2014	46,958,000	-2.12%	-33.11%	-35.65%
2015	45,928,000	-2.19%	-34.58%	-37.06%
2016	44,933,000	-2.17%	-35.99%	-38.43%
2017	43,946,000	-2.20%	-37.40%	-39.78%
2018	42,966,000	-2.23%	-38.80%	-41.12%
2019	41,976,000	-2.30%	-40.21%	-42.48%
2020	40,717,000	-3.00%	-42.00%	-44.20%
2021	39,495,000	-3.00%	-43.74%	-45.88%
2022	38,310,000	-3.00%	-45.43%	-47.50%
2023	37,161,000	-3.00%	-47.06%	-49.08%
2024	35,787,000	-3.70%	-49.02%	-50.96%
2025	34,117,000	-4.70%	-51.40%	-53.25%
2026	32,446,000	-4.90%	-53.78%	-55.54%
2027	30,777,000	-5.10%	-56.16%	-57.82%

<sup>27</sup> The large drop in 2013 reflects Phase III of the EU ETS coming into effect, with a corresponding reduction in the available number of emissions allowances.

<sup>28</sup> The percentage reductions shown for 2010 and 2011 give the precise figures required by those annual targets against the two versions of the 1990 baseline: from the 2008 and 2011 Greenhouse Gas Inventories. They do not show the reported outturn figures for those years. That information is set out in section 2.7.

<sup>29</sup> As discussed in this section of the document, any methodological updates to the Greenhouse Gas Inventory are backdated to 1990 wherever possible. This means that the total estimated level of Scottish emissions in 1990 can change in each edition of the Inventory. Adjusting to include a Scottish share of emissions from international aviation and shipping, the 2008 Inventory estimate for 1990 was 70,201 KtCO<sub>2</sub>e. In the 2011 Inventory the estimate for 1990 was revised upwards to 72,974 KtCO<sub>2</sub>e.

## 2.5 The baseline for the targets has been continually revised

*The annual targets are set in absolute terms, i.e. a defined quantity of emissions not as a proportion of a baseline, and this has implications for the measurement and assessment of progress. In considering the targets and assessing performance over time it is critical that users of this document recognise the fact that the methodology is under continual review. These revisions have resulted in a very significant increase in the level of baseline emissions in each year and this has made the absolute targets (measured in tonnes) become far more demanding. The implications of this are assessed in the following sections.*

2.5.1 The methodology that underpins the Scottish Greenhouse Gas Inventory is under continual review in order to improve its accuracy. Each amendment to the Inventory is calculated back to 1990 to ensure consistency. This means that when the Inventory is published each year, Scotland's 1990/1995 baseline is updated and so are emissions for all other years in the intervening period.

2.5.2 The effect of this is that the total quantity of emissions that need to be abated to meet the annual targets can vary depending on the baseline. This is a crucial point and is discussed in more detail in section 2.6 below.

2.5.3 This RPP2 uses the figures from the latest 2011 Greenhouse Gas Inventory to illustrate progress since 1990, and when discussing emissions in 2010 and 2011 in relation to the targets that were set for those years. However, the 2011 Inventory became available too late to incorporate into the Business-as-Usual projection that is used to estimate what future emissions would be in the absence of further policy intervention.

2.5.4 This final RPP2 therefore continues to use the projection developed for the draft of this report (published in January 2013) which incorporates an estimate for 2011 emissions based on previously available UK-level data.<sup>30</sup>

## 2.6 Data revisions have increased the challenge

2.6.1 The Scottish Government believes it is important to keep improving the information we use to measure our progress in reducing emissions. This is a fast developing field and changes to the methodology used in the official Greenhouse Gas Inventory can have a significant effect on both the

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<sup>30</sup> See section 2.8 of the main RPP2 and section 3 of the Technical Appendix for more information about the Business-as-Usual Projection.

level of emissions that are reported each year and the level of emissions that are projected as likely to occur in the future without further intervention, the 'Business-as-Usual' (BAU) profile, which is discussed later in this chapter).

2.6.2 The annual targets for 2010 to 2027 were set using the baseline from the 2008 Greenhouse Gas Inventory, which at the time estimated 1990 emissions to have been 70.201 MtCO<sub>2</sub>e.

2.6.3 However, the annual targets set under the Climate Change (Scotland) Act are expressed as absolute quantities of emissions that must not be exceeded in each year in question. So, for example, the 2020 target was set at 40.717 MtCO<sub>2</sub>e. Using the 1990 baseline from the 2008 Inventory, this equated to a 42% reduction, which was in line with the requirement in the Act for the level of the 2020 interim target.

2.6.4 However, revisions made to the Inventory methodology in the three editions since the 2008 Inventory have significantly changed matters. More complete and up-to-date data, together with an evolving understanding of how to analyse that information, has resulted in the emissions in the 1990 baseline and almost every year since being revised up by more than 2 MtCO<sub>2</sub>e since the annual targets were set. In the 2011 Inventory, the 1990 base year had itself been revised upward to 72.974 MtCO<sub>2</sub>e, which is 2.7 MtCO<sub>2</sub>e higher than estimated in the 2008 Inventory.

2.6.5 This means that the emissions reductions required to meet each of the fixed annual targets, when compared with a baseline which has increased by more than 2 MtCO<sub>2</sub>e, is now significantly greater than was envisaged when the targets were set. So, for example, as Table 2.1 above shows, to reach the **2020 annual target (40.717 MtCO<sub>2</sub>e) now equates to a 44.2% reduction in emissions** (from 72.974 MtCO<sub>2</sub>e rather than 70.20 MtCO<sub>2</sub>e).

2.6.6 This is due to a particular characteristic of the Climate Change (Scotland) Act 2009 which restricts the ability to vary the annual targets to reflect baseline revisions. If the same percentage reductions were applied to the current baseline (GHG Inventory, 2011) and the targets were revised accordingly an equivalent 2020 target would be adjusted upwards to around 42.325 MtCO<sub>2</sub>e. This is 1.6 Mt higher than its current level.

2.6.7 The following section provides a more detailed description of the impacts of the baseline revisions on the 2010 and 2011 targets.



## 2.7 The 2010 and 2011 greenhouse gas emissions reduction targets

### The 2010 Greenhouse Gas Inventory

2.7.1 The first annual target under the Climate Change (Scotland) Act was set for 2010 and required that the net Scottish emissions account (NSEA) (comprising net emissions and the effect of the EU ETS for that year) not exceed 53.65 MtCO<sub>2</sub>e. The Greenhouse Gas Emissions Inventory for 2010 was published in July 2012 and, together with data on the operation of the EU ETS in Scotland, it showed that the net Scottish emissions account for 2010 was 54.71 MtCO<sub>2</sub>e, exceeding the annual emissions target for 2010 by 1.06 MtCO<sub>2</sub>e. However, these figures have subsequently been revised again, as described in the paragraphs below discussing the 2011 Inventory.

2.7.2 Two major factors contributed to missing the 2010 target: an increase in emissions from residential heating attributable to the extreme cold weather experienced at the start and end of 2010; and revisions to historical data. Both of these points were endorsed by the Committee on Climate Change.<sup>31</sup>

2.7.3 The average temperature for the six months January-March and October-December 2010 was the coldest since 1919. Scotland is not alone in experiencing the impact of this cold weather. In its recent progress report for our counterparts in the Welsh Government, the CCC noted that increased demand for energy during the winter months was a major contributory factor to the emissions covered by the Welsh climate change target increasing by 6% between 2009 and 2010.<sup>32</sup>

### The 2011 Greenhouse Gas Inventory

2.7.4 The Greenhouse Gas Emissions Inventory for 2011 was published in June 2013.<sup>33</sup> It incorporated a further significant set of updates to the methodology used to estimate Scotland's emissions. The main revision concerns the way in which "business and industrial" emissions are calculated. This follows greater scrutiny of EU ETS data for evidence of use of off-gases from petrochemical production processes being used in boilers on specific industrial sites in England and Scotland.

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<sup>31</sup> Committee on Climate Change, Reducing emissions in Scotland - 2013 progress report: [www.theccc.org.uk/publication/reducing-emissions-in-scotland-2013-progress-report](http://www.theccc.org.uk/publication/reducing-emissions-in-scotland-2013-progress-report)

<sup>32</sup> Committee on Climate Change, Welsh Progress Report 2013: <http://www.theccc.org.uk/news-stories/ccc-reports-on-progress-made-on-wales-climate-change-strategy/>

<sup>33</sup> Scottish Greenhouse Gas Emissions Inventory 2011 <http://www.scotland.gov.uk/News/Releases/2013/06/greenhousegasemissions07062013>

2.7.5 Reclassifying these combustion processes brings the Inventory in line with what sites are reporting under the EU ETS but it also identifies emissions that were not factored into the calculations to set Scotland's climate change targets in the first place.

2.7.6 The result of the methodology change in the 2011 Inventory has been to add approximately a further 0.7 MtCO<sub>2e</sub> (1.0%) to the 1990 Base Year emissions and 1.2 MtCO<sub>2e</sub> (2.1%) to emissions in 2010. This level of "additional" emissions is also therefore factored into the figures for 2011, which were reported for the first time and compounds previous revisions to baseline figures.

2.7.7 The 2011 Inventory showed that Scotland's unadjusted emissions in 2011 fell sharply from 2010, down 9.9% to 51.3 MtCO<sub>2e</sub>. This was due largely to a large fall (-18.4%) in direct emissions from energy generation, influenced by a significant reduction in output from Cockerzie power station; and from residential heating, which fell back after the spike in 2010.

2.7.8 The statutory annual target for 2011 set by Parliament and based on the 2008 Inventory data, requires that greenhouse gas emissions do not exceed 53.40 MtCO<sub>2e</sub>. Scotland's unadjusted emissions were 2.1 MtCO<sub>2e</sub> lower than the target. However, once the figures are adjusted to reflect the operation of the EU ETS in Scotland, the net Scottish emissions account for 2011 was 54.25 MtCO<sub>2e</sub>, exceeding the annual emissions target for 2011 by 0.85 MtCO<sub>2e</sub>.

2.7.9 However, it is worth noting that, if the same percentage reduction (23.93% as shown in Table 2.1) was applied to the current baseline (GHG Inventory, 2011) and the target was revised accordingly, it would be 55.513 MtCO<sub>2e</sub>. On this basis, the revised 2011 target would have been met with 1.26 MtCO<sub>2e</sub> to spare.

2.7.10 Another consequence of the data revisions is to increase the extent to which the 2010 emissions target was missed, with the 2011 Inventory reporting an excess of 2.27 MtCO<sub>2e</sub> in 2010. However, if a revised target had been calculated for 2010, (as per the method outlined in the previous paragraph) this would have been in the region of 55.771 MtCO<sub>2e</sub>. On this basis, excess emissions in 2010 would have been just 0.124 MtCO<sub>2e</sub>.

2.7.11 More information about the 2011 annual target and emissions that year is contained in our formal report on the Scottish Greenhouse Gas Emissions Annual Target 2011, published together with this RPP2.<sup>34</sup>

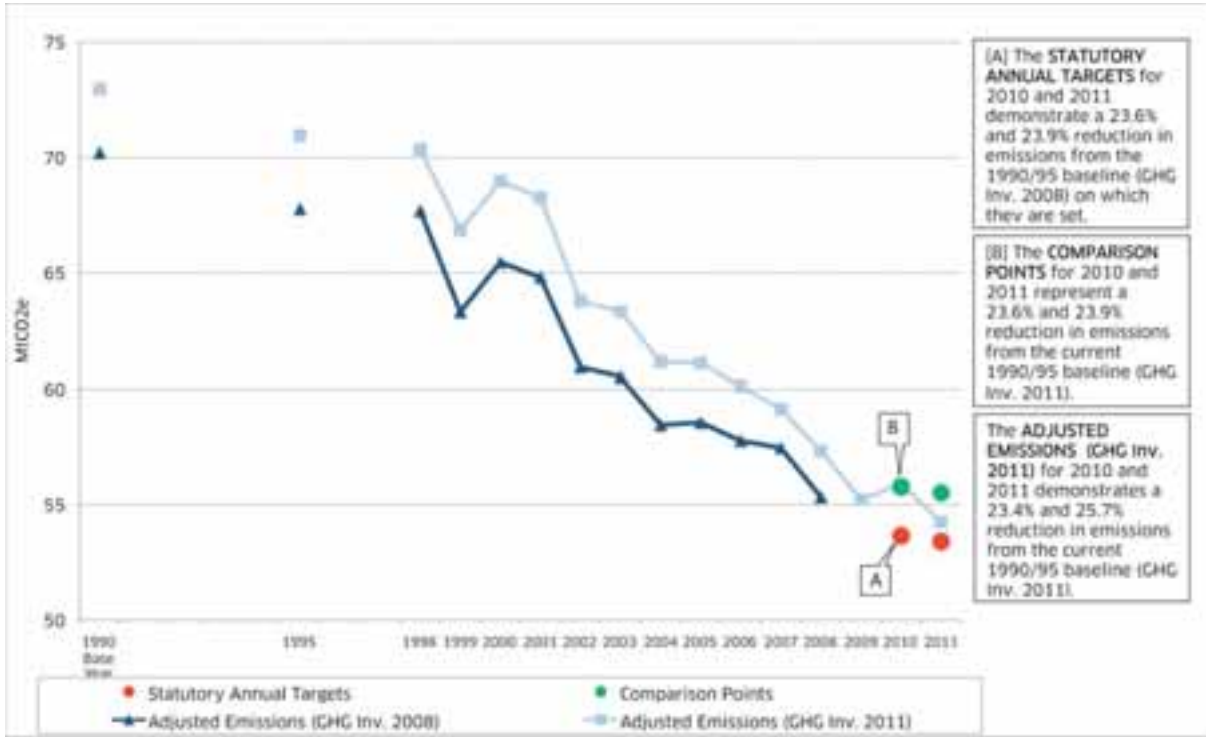
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<sup>34</sup> The Scottish Government, Scottish greenhouse gas emissions annual target: [www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/climatechangeact/reporting](http://www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/climatechangeact/reporting)

2.7.12 Missing the fixed, absolute 2010 and 2011 emissions targets is disappointing. Critically, however, annual fluctuations and the long term trend show that emissions are reducing in Scotland and doing so at a faster rate of decline than has been sought originally.

2.7.13 Chart 2.1 illustrates that trend as well as the significant impact that revisions to the methodology have had on the emissions baseline in comparison to the 2008 figures that were used to set the annual targets. It also includes the annual targets set for 2010 and 2011 and shows a set of hypothetical targets based on the same percentage reductions from 1990 but using the baseline as it is now understood in the 2011 Inventory.

**Chart 2.1: Adjusted Emissions Inventory Comparison Tracking Progress to Targets**



2.7.14 As Table 2.1 sets out, the annual targets require an emissions reduction between 2010 and 2011 of 0.218 MtCO<sub>2</sub>e (0.46%). **The net Scottish emissions account for 2011 is 1.64 MtCO<sub>2</sub>e lower than 2010, a reduction of 2.9%.**

2.7.15 Similar progress can be seen in comparison to the 1990 base year. Table 2.2 below shows that the annual targets for 2010 and 2011 envisaged emissions reductions of 23.6% and 23.9% respectively against the baseline as it was understood when the targets were set (using the 2008 Inventory). As already noted in this report, methodological changes in the last three editions of the Inventory have added more than 2 MtCO<sub>2e</sub> to almost every year from 1990 onwards. Despite this, however, the net Scottish emissions account for those years, based on the 2011 Scottish inventory, is respectively 23.4% and 25.7% lower than the base year. The percentage reduction in emissions envisaged when the targets were set and the corresponding reduction that was actually achieved in those years is highlighted in the table: yellow for 2010 and green for 2011.

**Table 2.2: Comparison of the 2010 and 2011 Annual Targets against the original and updated baselines.**

		2008 Baseline (ktCO <sub>2e</sub> )	2011 Baseline (ktCO <sub>2e</sub> )
	<b>1990 base year emissions</b>	70,201	72,974
2010	Annual Target	53,652	
	<i>% reduction from 1990</i>	-23.6%	-26.5%
	Reported Emissions	55,893	
	<i>% reduction from 1990</i>	-20.4%	-23.4%
2011	Annual Target	53,404	
	<i>% reduction from 1990</i>	-23.9%	-26.8%
	Reported Emissions	54,252	
	<i>% reduction from 1990</i>	-22.7%	-25.7%

2.7.16 So, even with the extreme cold weather in 2010, the overall emissions reduction achieved from the baseline in percentage terms was only 0.2% less than envisaged when the annual targets were set. **In 2011, the reduction from the baseline was 1.8% greater than was envisaged originally.**

### Compensating for excess emissions

2.7.17 Revisions to the methodology for calculating the Greenhouse Gas Inventory for Scotland have changed significantly the basis upon which the annual emissions targets were set. This is a matter that the Scottish Government will keep under review.

2.7.18 Overcoming these methodological issues is a challenge. But a far more important challenge is that of cutting Scotland's emissions and making

the transition to a truly low carbon economy. The Scottish Government remains committed to this task.

2.7.19 In accordance with section 36 of the Climate Change (Scotland) Act 2009, this RPP2 sets out how the Scottish Government plans to compensate for missing the 2010 and 2011 emissions targets.

2.7.20 It is our aim, where possible, to overachieve against future annual targets to recover the difference by which the earlier targets were missed. As is discussed elsewhere in this report, there are circumstances, in particular a stronger EU climate target, which would help achieve this aim more quickly. We believe that, given it is set to overachieve against its 20% target, the EU can and will improve its current position and we will continue to press for this. In a scenario where the EU adopts a 30% target for 2020, the net emissions abatement potential of the package of proposals and policies set out in this report could cut emissions over the period to 2027 by over 18 MtCO<sub>2e</sub> more than the cumulative requirements of the targets. Even without any further contribution from the EU, the measures in this report could deliver over 4 Mt more than the cumulative requirement of the targets.

#### **Committee on Climate Change Progress Report**

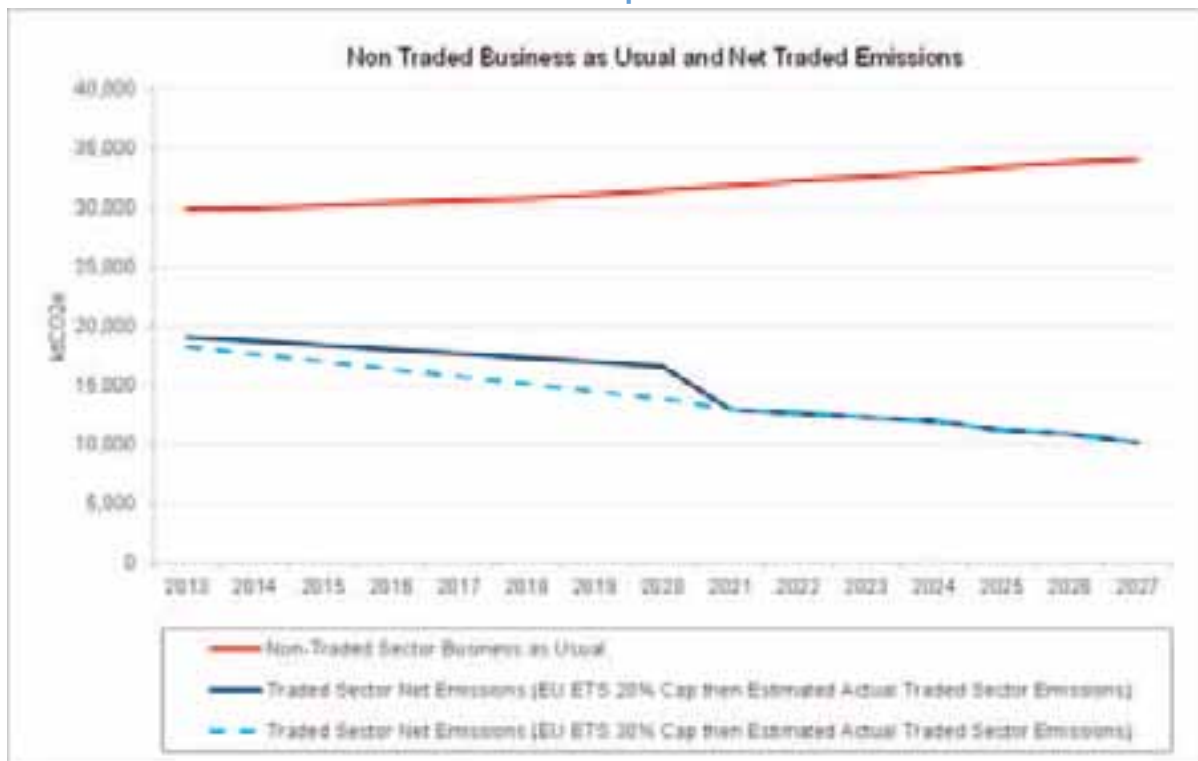
The CCC published its second report, on the progress and activities of the Scottish Government towards meeting Scottish climate change targets in March 2013.<sup>35</sup> This is an annual statutory requirement and one of the main mechanisms by which Scottish Ministers are held publically to account for their climate change duties. The report focuses on the implementation of RPP1. David Kennedy, Chief Executive said: “*Scotland has made good progress in delivering on emission reduction measures to date. This lays the foundations for meeting ambitious Scottish emissions targets and building a low carbon economy in Scotland with the benefits that this will bring.*”

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<sup>35</sup> Committee on Climate Change, Reducing emissions in Scotland – 2013 progress report: [www.theccc.org.uk/publication/reducing-emissions-in-scotland-2013-progress-report](http://www.theccc.org.uk/publication/reducing-emissions-in-scotland-2013-progress-report)

## 2.8 Estimating emissions reduction: business-as-usual profile

Chart 2.2: Business-as-Usual emissions profile



2.8.1 To quantify the effect of policies and proposals in reducing emissions, and thus the contributions to the reduction targets, we need to consider what would happen to future emissions in the absence of such interventions. The ‘Business-as-Usual’ (BAU) emissions profile provides an estimate of future annual emissions out to 2027 under assumptions on factors such as economic growth, fuel prices, and projected growth in both the population and number of households. The emissions reduction (abatement) from policies and proposals is then subtracted from the BAU to calculate what future emissions are likely to be with policies and proposals in place.

2.8.2 For the purposes of this report, a BAU emissions profile has been developed for the **non-traded** sector, against which the abatement from policies and proposals is deducted. The **traded sector** is presented as a **net-emissions profile**. (Further information on these sectors is in section 2.10 below).

2.8.3 Emissions in the traded sector are calculated on the basis of two scenarios to 2020, which merge into the same scenario thereafter:

- **Under the ETS 20% scenario for the period to 2020**, we use the existing trajectory for the ETS based on Scotland's share of the EU wide reduction in emissions of 20% by 2020 on the 2005 baseline used by the ETS. This is the current legislative requirement, and forms the basis for measuring Scotland's "traded" sector emissions on an annual basis.
- **Under the ETS 30% scenario for the period to 2020**, we use the trajectory for the ETS based on Scotland's share of the EU wide reduction in emissions of 30% by 2020 on the 2005 baseline. **This trajectory was described in full in RPP1 and remains our policy objective.**
- Specific details regarding the EU ETS for the period beyond 2020 have not yet been established. Rather than base our calculation on a Scottish share of a nominal ETS trajectory, after 2020 the traded sector is presented in this report as 'net emissions' based on estimates of direct future electricity generation emissions in Scotland and from the CCC target advice that identifies abatement from other non-electricity generation installations within the traded sector.

## 2.9 The Committee on Climate Change target advice

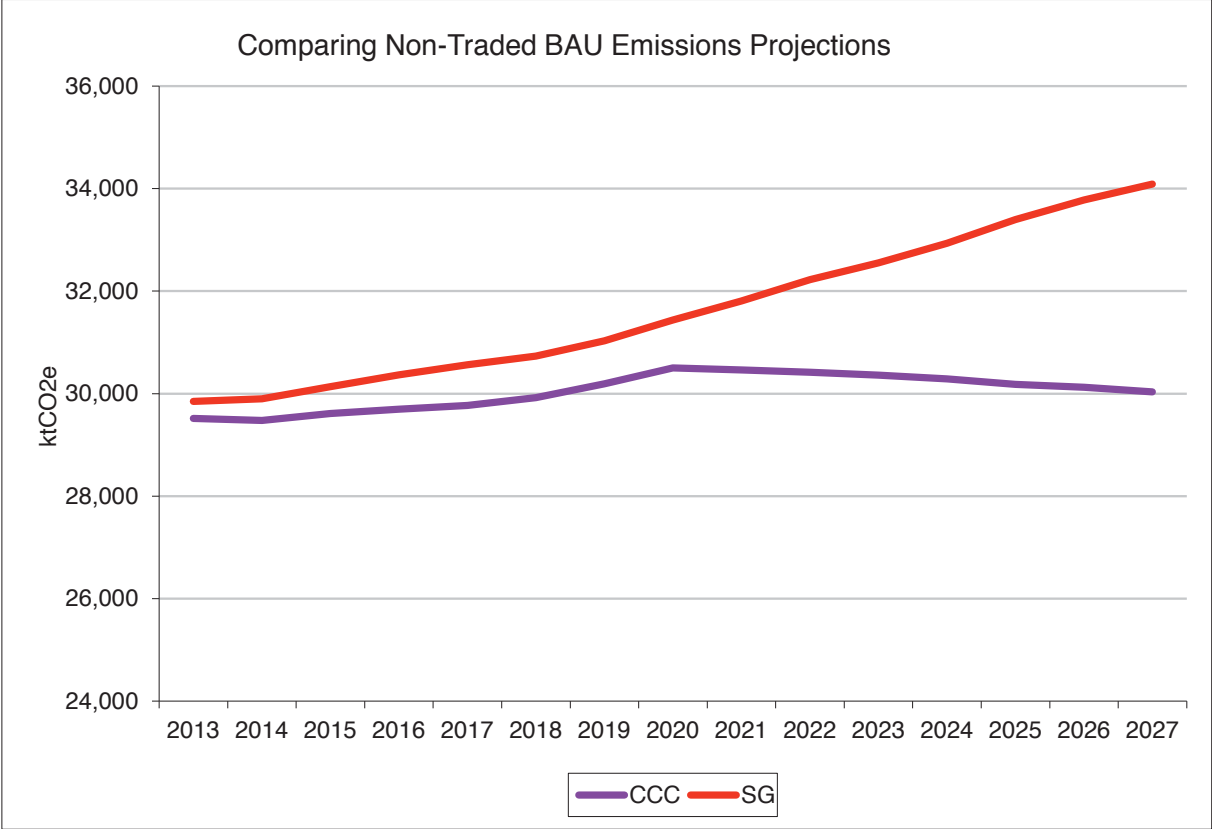
2.9.1 The BAU is important not only for understanding the effects of our policies and proposals, but also, critically, for how the reduction targets were set. The CCC provides independent expert advice to government about all aspects of climate change. The 2023-2027 annual emission reduction targets were informed by advice published by the CCC in 2011.<sup>36</sup>

2.9.2 The CCC used the 2008 Greenhouse Gas Emissions Inventory when it was developing its advice on the 2010-2022 and 2023-2027 targets. Whilst this RPP2 draws in part on the CCC's advice, since its publication, new emissions data and projections have become available which provide more up to date insights into future Scottish emissions and the abatement required to meet annual targets.

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<sup>36</sup> The Committee on Climate Change advice to the Scottish Ministers:  
<http://www.scotland.gov.uk/Topics/Environment/climatechange/what-is/expertadvice/advisorybody>

**Chart 2.3: Non-traded sector BAU projection used by the CCC**



2.9.3 Chart 2.3 shows the non-traded sector BAU projection used by the CCC in its target advice to the Scottish Government in 2011 and the higher, more up to date, emissions profile that is used in this report. Importantly, the amount of abatement that this RPP2 indicates is required to meet the annual targets is much greater than that needed according to the CCC advice. In 2027, this difference amounts to some 4.1 MtCO<sub>2</sub>e. Scotland therefore needs to outperform the emissions abatement the CCC suggested would be necessary in order to meet the targets.



## Measuring our progress

Achievement of Scotland's targets is measured against the level of the Net Scottish Emissions Account (NSEA). This accounts for the greenhouse gas emissions from sources in Scotland, Scotland's share of emissions from international aviation and international shipping, the effect of any relevant emissions sequestration (e.g. "carbon sinks" such as woodland) and the effect of the sale and purchase of relevant emissions allowances.

Scotland's emissions are disaggregated from UK data and are reported annually in the Greenhouse Gas Emissions Inventory for England, Scotland, Wales and Northern Ireland.<sup>37</sup> Regulations set down in detail how the NSEA will be calculated from the disaggregated Inventory.<sup>38</sup>

## 2.10 Explaining the traded and non-traded sectors

2.10.1 The official source of greenhouse gas emissions data that is used by the Scottish Government is the disaggregated Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland, which is part of the National Atmospheric Emissions Inventory (NAEI). The Inventory compiles estimates of emissions to the atmosphere from UK sources and is used as the basis for setting the Scottish annual climate change targets and for assessing progress against the targets.

2.10.2 The advent of the EU ETS in 2005 meant that emissions were split into those accounted for in the '**non-traded**' sector and those in the '**traded**' sector. The non-traded sector includes greenhouse gas emissions captured in the Inventory in Scotland that do not fall under the EU ETS. They can be disaggregated into the following sources of emissions: residential, non-traded business, industry and public sector, transport, agriculture and related land use, forestry, waste sector, and development (land use). **Traded sector** emissions include emissions from the generation of electricity, energy intensive business and industrial processes such as production of steel and iron, and energy intensive parts of the public sector such as large hospitals.<sup>39</sup> The trading scheme exists so that organisations have to pay for the CO<sub>2</sub> they emit and so acts as an incentive for them to reduce their

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<sup>37</sup> Greenhouse Gas Emissions Inventory for England, Scotland, Wales and Northern Ireland: 1990-2008: [www.naei.org.uk/report\\_link.php?report\\_id=620](http://www.naei.org.uk/report_link.php?report_id=620)

<sup>38</sup> The Carbon Accounting Scheme (Scotland) Regulations 2010, SSI 2010 no. 216: [www.opsi.gov.uk/legislation/scotland/ssi2010/ssi\\_20100216\\_en\\_1](http://www.opsi.gov.uk/legislation/scotland/ssi2010/ssi_20100216_en_1)

<sup>39</sup> As part of an EU wide process to develop the EU ETS in phase 3 (2013-2020), official submission of public sector 'opt-outs' have been made to the European Commissions for consideration. These are due to be resolved later in the year and as such have not been incorporated into this document.

emissions. The EU ETS entered its third phase in 2013 and aims by 2020 to reduce EU wide emissions by 20% compared to emissions in 2005.

### The role of the EU ETS and the traded sector

2.10.3 The EU ETS is implemented at the Member State level and Scotland participates in it as part of the UK. The cap and trade nature of the scheme is designed so that emissions reductions take place in the most cost effective manner, thus encouraging operators to invest in low emission technologies and techniques, such as more energy efficient equipment or less emission intensive energy sources.

2.10.4 The scheme is focused on large, energy intensive installations as well as all emissions from flights arriving at and flying from European airports from the start of 2012. As part of on-going international negotiations the European Commission has implemented a 'stop the clock' proposal on flights into and out of Europe. Section 7.4 provides further details. Industry participants include cement and glass manufacturing as well as some distilleries. In Scotland there are 110 operators from a variety of sectors, which emitted approximately 20 MtCO<sub>2</sub>e in 2011.

2.10.5 Most operators receive a set number of free EU Allowances (EUA), with each EUA covering one tonne of CO<sub>2</sub>, and must trade or buy at auction any additional EUAs they require. As there are a set number of total EUAs within the market, the overall environmental targets are maintained.

2.10.6 The current EUA price is lower than had been expected, due mostly to the global economic downturn, and this has resulted in a smaller incentive to reduce emissions. Scottish Government officials are working closely with the UK Department of Energy and Climate Change (DECC) to engage with the European Commission on potential structural reforms that could create a more effective EUA price.

2.10.7 The Commission has recently proposed to address this in the short term by adjusting the timing in which allowances are introduced to the market (through a process of 'back-loading'). This would alter the auctioning timetable and reduce the numbers of allowances auctioned in the early part of Phase III (2013-2020), and re-introduce them near the end of the Phase (in 2019-2020). In April 2013, the European Parliament voted against the 'back-loading' proposal by a small margin. However, it was not rejected outright and the issue has been returned to the Commission for further discussion.

2.10.8 The Commission's recent Carbon Market Report<sup>40</sup> provides an outline of six measures that would lead to longer-term structural reform:

- an EU 30% greenhouse gas reduction target for 2020;
- the permanent cancellation of allowances;
- a change to the annual linear reduction factor;
- the inclusion of extra sectors;
- a review of inclusion of international project credits; and
- the establishment of price management mechanisms.

2.10.9 The Scottish Government has welcomed publication of the report as part of our push for the EU to raise its 2020 greenhouse gas emission reduction target to 30%, which would be consistent with our own domestic target of 42%. We continue to support the UK's efforts to secure substantial structural reform and strengthening of the ETS, both in the on-going 'back-loading' negotiations, and as part of the debate on longer-term EU targets.

## 2.11 The emissions abatement trajectory

2.11.1 A full year by year breakdown of the estimated emissions impact of proposals and policies in four scenarios is shown in Annexes B and C.

### The Four Scenarios

#### **Policies only and EU at 20%**

This scenario assumes that the EU does not increase its 2020 climate change target from 20% to 30%, nor does it take any alternative additional action such as back-loading or cancelling allowances in the EU ETS. In these circumstances, if no further proposals were turned into policies, based on the package of active policies set out in this report, we **project that Scottish emissions will have fallen by 40.1% in 2020 and 47.0% by 2027.**

#### **Policies and proposals and EU at 20%**

This scenario also assumes that the EU 2020 target remains at 20%, with no equivalent additional European action taking its place. In these circumstances, if the package of proposals in this report were turned into policies, we **project that Scottish emissions will have fallen by 43.3% in 2020 and 57.8% by 2027.**

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<sup>40</sup> European Commission, The state of the European carbon market in 2012:  
[http://ec.europa.eu/clima/news/articles/news\\_2012111401\\_en.htm](http://ec.europa.eu/clima/news/articles/news_2012111401_en.htm)

### **Policies only and EU at 30%**

This scenario assumes that the EU does strengthen its 2020 climate change target from 20% to 30%, with a consequential tightening of the EU ETS. In these circumstances, if no further proposals were actioned based on the package of existing policies set out in this report, we **project that Scottish emissions will have fallen by 43.9% in 2020 and 47.0% by 2027.**

### **Policies and proposals and EU at 30%**

This scenario also assumes that the EU 2020 target is strengthened to 30%, with a consequential tightening of the EU ETS. In these circumstances, if the package of proposals in this report were turned into policies, we **project that Scottish emissions will have fallen by 47.1% in 2020 and 57.8% by 2027.**

2.11.2 When the Climate Change (Scotland) Bill was being debated in the Scottish Parliament in 2008 it was widely acknowledged that an increased contribution from the EU ETS, stemming from an increase in the EU 2020 emissions target from 20% to 30%, was important for meeting the extended level of ambition represented by the Scottish 42% target set for 2020.

2.11.3 This view was endorsed by the CCC in its analysis on setting targets for 2010-2022. In that advice, the CCC stated:

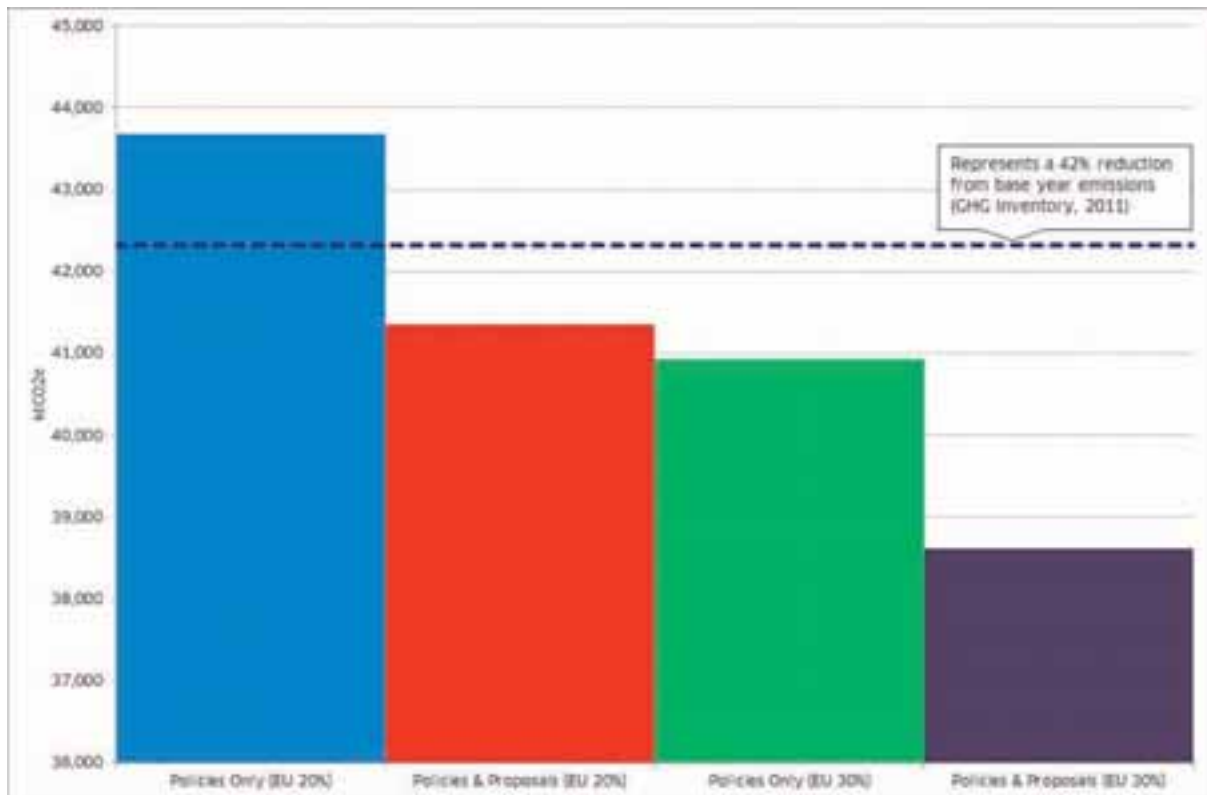
*“Our conclusion is that the 42% target is achievable through domestic effort in a context where there is a new global deal to reduce emissions which triggers the EU’s target to reduce emissions by 30% in 2020 relative to 1990.”<sup>41</sup> “*

2.11.4 These scenarios, illustrated in Chart 2.4, show both the importance of the contribution that stronger EU action could make, plus the **significant size of the emissions cuts that Scotland can achieve based just on the policies that are already in place.**

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<sup>41</sup> Committee on Climate Change, Scotland's path to a low carbon economy: <http://downloads.theccc.org.uk/Scottish%20report/CCC-Scottish-Report-web-version.pdf>

Chart 2.4: Net Emissions in the Four Scenarios Compared to a 42% Reduction in Emissions in 2020 from 1990 Baseline



2.11.5 The economic downturn and disappointing progress at international climate change negotiations in recent years have made a move to 30% by the EU more difficult to achieve consensus around. While we have set out policies and proposals to further enhance domestic effort, our policy remains that the EU should move to 30% as this is what is required as part of a global effort to avoid dangerous climate change. The Scottish Government supports the UK and other progressive Member States in their efforts to persuade the EU to increase its 2020 emissions reduction target above 20% unilaterally. We will review this position during the production of RPP3.

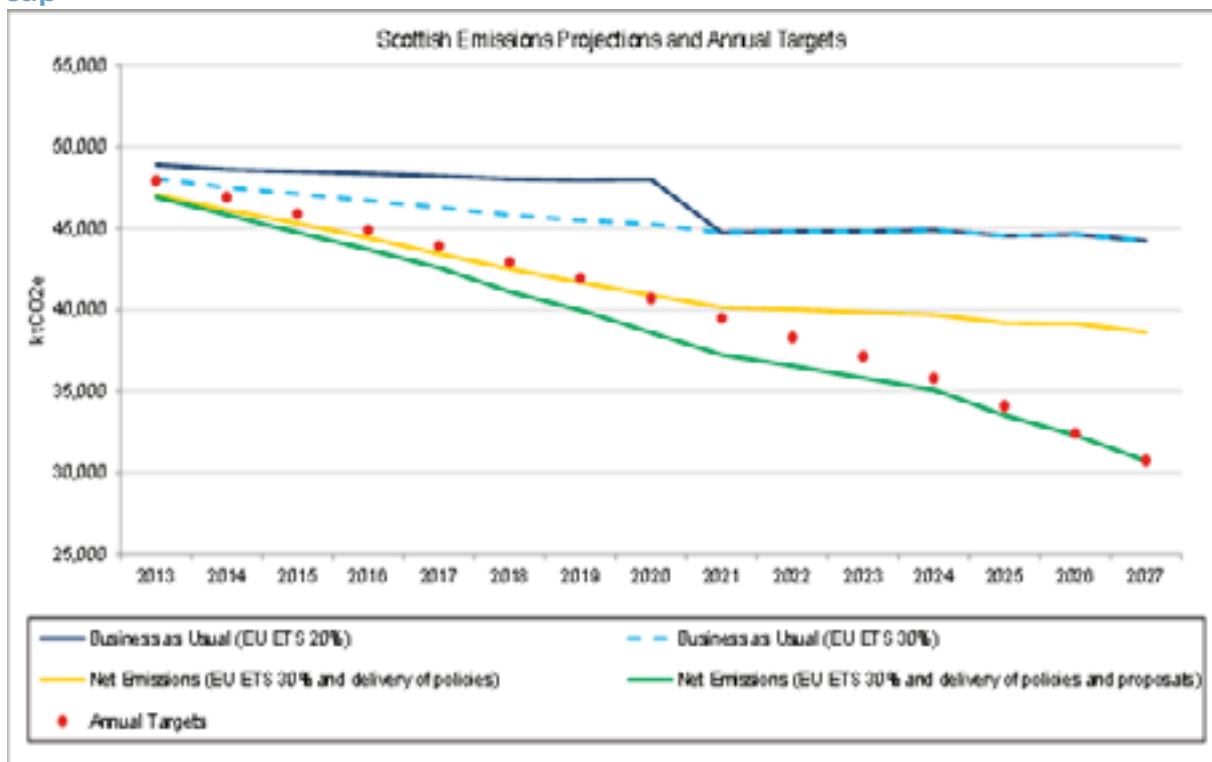
2.11.6 Analysis of the emissions reduction package set out in RPP2 shows that:

- Our policies and proposals give us **significantly more abatement** than the CCC suggested is both an appropriate global contribution from Scotland and in line with our potential.
- By the mid-2020s, despite the lack of progress in strengthening the EU 2020 emissions target, the amount of our planned non-traded abatement is approximately **2 MtCO<sub>2e</sub>** a year greater than the Climate Change Committee recommendation.

- If we were to continue using the **original projections** used by the CCC when it gave the Scottish Government advice on the level to set the annual targets, all of the annual emissions targets would be met, even if the EU retains a 20% emissions cap rather than moving to a 30% one.
- However, **our latest data and analytical models give us a higher non-traded BAU projection than the CCC used.** It is appropriate to seek to use the most up-to-date data, but the result is to raise projected Scottish BAU emissions significantly. **In 2027, this amounts to 4.1 MtCO<sub>2</sub>e more than the CCC BAU** (see Chart 2.1). This makes the targets set under the Climate Change (Scotland) Act more difficult to achieve.

2.11.7 Annexes B and C present information on the extent to which projections suggest we will either under or overshoot the annual targets in each year on the assumption of either a 20% or 30% EU emissions cap. Chart 2.5 below illustrates how this is achieved with a 30% cap. The BAU projection line is shown at the top of the chart; our policies are then subtracted to give net emissions after the delivery of policies; finally our proposals are subtracted to give net emissions after delivery of policies and proposals.

**Chart 2.5: Projected emissions and annual targets with EU 30% emissions cap**



2.11.8 There is a high level of uncertainty associated with estimating emissions projections out to 2027, both in terms of estimating a BAU

emissions profile and the emissions abatement potential from policies and proposals. There is also uncertainty when estimating the future financial costs and benefits of policies and proposals. In both cases, a range of assumptions has been made to enable credible projections out to 2027 to be made, whilst acknowledging that the future uncertainty is significant. The Technical Appendix provides fuller details of these uncertainties and assumptions.

2.11.9 While we have set out policies and proposals to further enhance domestic effort, as stated previously, our policy remains that the EU should move to 30% as this is what is required as part of a global effort to avoid dangerous climate change. The Scottish Government supports the UK and other progressive member states such as Denmark and Germany in their efforts to persuade the EU to increase its 2020 emissions reduction target above 20% unilaterally. We will review this position during the production of RPP3 and in the light of decisions taken by the EU during 2014 on future EU climate and energy targets for 2030.

## 2.12 The domestic effort target

2.12.1 The Act places a duty on Scottish Ministers to ensure that reductions in net Scottish emissions of greenhouse gases account for at least 80% of the reduction in the net Scottish emissions account (NSEA) in any target year. The domestic effort target limits the quantity of carbon units (i.e. tradable emissions allowances) that Scottish Ministers may use to reduce the NSEA in any target year. The exception is carbon units surrendered by participants in the EU ETS which are accounted for in line with international practice.

2.12.2 While it remains an option for consideration, in line with previous commitments, we have no proposals or policies to purchase carbon units in this RPP2, which covers the period to 2027. Our focus is on measures that seek to reduce our emissions at source and for the long term. We intend, therefore, that the measures in this RPP2 will be consistent with meeting the domestic effort target in each target year even though this makes the tasks against which the Scottish Government will be judged even tougher, although it is clear that many stakeholders are aware of the impact of Inventory revisions and their implications.

## 2.13 Definitions: policies, proposals and enabling measures

2.13.1 A **policy** is a course of action which has been wholly or largely decided upon. In many cases policies will have committed funding and or legislation and timescales. Some policies are not owned by the Scottish Government (for example some European Directives or UK legislation).

Many major policies (stemming from the EU) currently 'end' in 2020. Where this occurs we have made assumptions about how these might continue. These assumptions can be found in the relevant sections of the document.

2.13.2 A **proposal** is a suggested course of action, the details of which might change as this course of action is explored further. Some proposals are set to become firm policies once development work is completed and/or financial resources allow. Other proposals could be considered more as propositions and these will be evaluated and developed if and when required to meet the targets. Wherever possible, the contribution of proposals to the achievement of the annual targets, and their costs, have been quantified. There are inevitable uncertainties in aspects of these estimates, particularly as we move towards longer time horizons.

2.13.3 A **supporting and enabling measure** is a measure which may not directly lead to a significant reduction in emissions, but which works mainly towards removing barriers or maximising the success of other policies.

2.13.4 These definitions are provided as guidance. Inevitably some measures will not fall neatly into a specific category. The schedule of work to develop and implement each policy and proposal in this document will start from the position that the policy or proposal presently occupies in relevant government programmes.

2.13.5 Meeting the annual targets obviously requires different types of actions. Some of these will be strategic, involving small numbers of major sites (such as the development of carbon capture and storage) whereas others will involve relatively small changes that are population wide (for example, retrofitting energy efficiency measures in homes across Scotland, or modal shift in transport use). In some cases, the action needed will be ground breaking and the result forecast, but not known for certain.

2.13.6 We are taking a non-site specific approach to identifying policies and proposals. For example, while we commit to decarbonising heat supply, we do not identify specific future district heating schemes except by way of illustration.

## 2.14 How we deal with costs and benefits

2.14.1 Costs and benefits can be considered both in the short and longer term. This document has been prepared during the 2012-2015 budget period. One of the three priorities of the 2013-14 budget is to accelerate economic recovery, create jobs and secure new opportunities through the low carbon economy.



2.14.2 We provided the Scottish Parliament with a summary paper outlining our proposed expenditure on climate change related activity for 2013-14 and 2014-15.<sup>42</sup> Scottish Government funding for climate change activities is less than the costs outlined in this document because the costs are to society as a whole, rather than to the Government alone. In addition our current spending plans only go out to the financial year 2014-15.

2.14.3 The measures in this report create costs and benefits for government, business and private households. We estimate the costs of implementing these measures to be on average £1.6 billion per annum (or 1% of GDP) while the average benefits are estimated to amount to £1.2 billion (in 2011 prices) per annum. The estimated benefits are partial and primarily reflect the increased energy efficiency resulting from the investment in climate change policies and proposals. In particular they do not include the benefits associated with reduced global warming. The Stern Report estimated these benefits at a global level to be between 5% and 20% of GDP. Neither do the figures include important co-benefits such as job creation, health improvement, local air quality and biodiversity.

2.14.4 The cost figures do not include transformational investments in the electricity sector. In addition, there are some proposals for which cost estimates are not available at this stage.

2.14.5 The proposals outlined in the RPP2 are in many cases at the start of the policy development process. As such, a full and detailed appraisal of the costs and benefits of proposals and their distribution between government, business and households has not been undertaken yet. This will be done at an individual proposal level as and when these proposals are converted to policies.

## 2.15 Consumption-based emissions

2.15.1 Consumption-based emissions are all emissions attributable to the goods and services we consume in Scotland (as opposed to the domestic emissions on which our targets are based). The Climate Change (Scotland) Act requires that Scottish Ministers report, in so far as is reasonably practicable, the emissions of greenhouse gases (whether in Scotland or elsewhere) which are produced by or otherwise associated with **the consumption of goods and services** in Scotland. These reports must be laid before the Scottish Parliament in respect of each year in the period 2010-2050. The reports can be accessed on the Scottish Government's website.<sup>43</sup>

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<sup>42</sup> The Scottish Government, Draft Budget 2013-14, Details of funding for climate change mitigation measures: [www.scotland.gov.uk/Resource/0040/00408239.pdf](http://www.scotland.gov.uk/Resource/0040/00408239.pdf)

<sup>43</sup> Scottish Consumption-based emission reports: [www.scotland.gov.uk/Topics/Statistics/Browse/Environment/ExpStats](http://www.scotland.gov.uk/Topics/Statistics/Browse/Environment/ExpStats)

2.15.2 Consumption-based emissions reporting is a complex and evolving field and we are working to determine the most suitable methodology on which to base our reports. In 2009 we made available a time series (1992-2006) of the Scottish greenhouse gas footprint, including consumption estimates, which reflect this developing work.<sup>44</sup> Subsequently, in May 2012 we published experimental data on Scotland's greenhouse gas footprint for 2009.<sup>45</sup>

2.15.3 This RPP2 focuses on policies and proposals to reduce emissions as measured against the annual targets by the NSEA. While the impact of the proposals and policies on Scotland's wider international emissions footprint has not been quantified here, the measures have been developed with the wider emissions impacts in mind. Wider, global emissions impacts can be quantified using 'consumption-based' emissions estimates. We plan to report on consumption based emissions for 2010 in 2013. Thereafter the intention is to report every three to four years to bring the time series up to date

2.15.4 We have purposely avoided developing policies or proposals in this report that would result in a transfer of emissions to other countries rather than a genuine reduction. For example, decreasing the numbers of Scottish livestock would be unlikely to affect the amount of meat consumed in Scotland, and would therefore result in meat being imported with emissions overseas.

## 2.16 Working with our partners

2.16.1 It must be emphasised that the Scottish Government cannot meet Scotland's climate change targets alone. The wider public sector in Scotland has a pivotal role too, alongside businesses, third sector organisations, communities, families, and individuals. In particular, Scottish local authorities have a position of influence both as organisations that deliver services and employ large workforces.

2.16.2 **Local authorities** have demonstrated leadership on climate change with the signing of their Climate Change Declaration<sup>46</sup> and by pursuing local outcomes related to climate change through Community Planning Partnerships. Local government has a key role in fulfilling the statutory obligations of the Act, as well as providing leadership to wider civil society.

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<sup>44</sup> Production of a Time Series of Scotland's Ecological and Greenhouse Gas Footprints: [www.scotland.gov.uk/Publications/2009/10/28101012/0](http://www.scotland.gov.uk/Publications/2009/10/28101012/0)

<sup>45</sup> Greenhouse Gas Footprint 2009: [www.scotland.gov.uk/Topics/Statistics/Browse/Environment/ExpStats](http://www.scotland.gov.uk/Topics/Statistics/Browse/Environment/ExpStats)

<sup>46</sup> Scotland's Climate Change Declaration: <http://www.keepsotlandbeautiful.org/sustainability-climate-change/sustainable-scotland-network/climate-change/scotlands-climate-change-declaration/>

Local government will have an important role in our new **Public Sector Leaders Forum** (see section 10.2.1 for details).

2.16.3 **Scotland's 2020 Climate Group** was established by Ian Marchant, Chief Executive of SSE, in 2009.<sup>47</sup> It considers how Scotland's business, voluntary and public sectors can work together to help achieve Scotland's emissions reduction targets. The group is independent of Government and seeks input and guidance from the Scottish Government where appropriate. The Group published 12 priority actions for 2012 and has developed 13 priorities for 2013.<sup>48</sup>

### Scotland's Climate Change Declaration

All of Scotland's 32 local authorities have signed up to Scotland's Climate Change Declaration. Acknowledging the reality and importance of climate change, they commit to: mitigating their impact on climate change through reducing greenhouse gas emissions; taking steps to adapt to the unavoidable impacts of a changing climate; and working in partnership with their communities to respond to climate change.

The Declaration recognises that Scottish local authorities play a key role in their collective response to the challenge of climate change, and publicly demonstrates their commitment to action. Signatories do not need to have taken action on climate change to sign the Declaration, but by signing they are expected to play their part. Signatories also agree to issue an annual statement, detailing the progress of their climate change response.

The process is driven by the Sustainable Scotland Network (SSN), with support from the Scottish Government, and we will continue to work with SSN, COSLA and individual local authorities to ensure the success of the initiative, aligning it with related reporting requirements in the broader public sector.

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<sup>47</sup> Scotland's 2020 Climate Group: [www.2020climategroup.org.uk/](http://www.2020climategroup.org.uk/)

<sup>48</sup> Scotland's 2020 Climate Group: [www.2020climategroup.org.uk/about-2020/13-for-2013/](http://www.2020climategroup.org.uk/about-2020/13-for-2013/)

2.16.4 The third sector has a central role too. Non-government organisations rally support and activity across Scotland, and in many cases act as delivery partners. There are also numerous community-based initiatives throughout Scotland demonstrating how low carbon living might be achieved - from renewable energy generation to local food production and organic markets. The Scottish Government's Climate Challenge Fund (see paragraph 5.6.4) provides grants to community groups wishing to reduce their carbon emissions and tackle climate change.

## 2.17 How we got here – timeline summary

Date	Milestone
June 2009	Scottish Government's Climate Change Delivery Plan published.
June 2009	Climate Change (Scotland) Act 2009.
February 2010	CCC advice to the Scottish Government on the 2020 interim target and annual emissions targets 2010 – 2022.
May 2010	The Climate Change (Limit on Carbon Units) (Scotland) Order 2010, setting carbon unit limits 2010 – 2012.
May 2010	The Climate Change (International Aviation and Shipping) (Scotland) Order 2010.
May 2010	The Carbon Accounting Scheme (Scotland) Regulations 2010.
October 2010	The Climate Change Annual Targets (Scotland) Order 2010, setting annual emissions reduction targets 2010 – 2022.
November 2010	Scottish Government's Draft First Report on Proposals and Policies (RPP1) laid in the Scottish Parliament.
March 2011	Scottish Government's First Report on Proposals and Policies (RPP1) published.
July 2011	CCC advice to Scottish Ministers on the second batch of annual targets 2023 – 2027 received.
August 2011	CCC advice to Scottish Ministers on setting carbon unit limits 2013 – 2017 received.
October 2011	Scottish Government's Climate Change Annual Targets (Scotland) Order 2011 setting the annual emissions targets 2023 – 2027.
December 2011	The Climate Change (Limit on Carbon Units) (Scotland) Order 2011, setting carbon unit limits 2013 – 2017.
January 2012	CCC's first annual progress report, Reducing emissions in Scotland, published.
July 2012	Scottish Government published Net Scottish Emissions Account for 2010. Data revisions to Inventory and emissions baseline recorded.
October 2012	Scottish Government's First Annual Report, The Scottish Greenhouse Gas Emissions Annual Target 2010, published.
January 2013	Scottish Government's draft Second Report on Proposals and Policies (RPP2) laid in the Scottish Parliament.
March 2013	CCC's second annual progress report, Reducing emissions in Scotland 2013, published.
June 2013	Scottish Government published Net Scottish Emissions Account for 2011. Further data revisions to Inventory and emissions baseline recorded.
June 2013	Scottish Government's Second Report on Proposals and Policies (RPP2) published.
June 2013	Scottish Government's Second Annual Report, The Scottish Greenhouse Gas Emissions Annual Target 2011, published.

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**UNDERSTANDING  
AND ACHIEVING  
TRANSFORMATION**



## 3. Understanding and achieving transformation

### 3.1 Five cross-cutting themes of transformation

3.1.1 We know that the transformation to a low carbon Scotland will be challenging – and it will involve more than just focussing on particular sectors. This section of the report outlines our strategic approach to five cross-cutting themes:

- A strategic assessment of external factors that are driving the pace of change;
- Embedding achievement of the targets in the transition to a low carbon economy;
- Ensuring we collectively have access to a range of funding and financing mechanisms;
- Understanding the role of behaviour and decision making in achieving the targets and influencing accordingly; and
- Recognising the long term role of our planning system.

### 3.2 Strategic assessment: understanding external drivers

3.2.1 There are a number of external drivers that are forcing the pace of change in energy and climate change issues. While there may be little we can do to directly influence them given current limitations of Scotland's powers and ability to speak within key fora, it is important that we understand them and build future uncertainties into our long term planning.

3.2.2 The energy world is set to undergo profound change over the next 20 years as economies large and small - developed and developing - seek to make the transition to a low carbon world. As an open export-dependent economy, Scotland is reliant on access to international markets and flows of trade and investment across the globe. We will not be immune to global change. A number of factors are driving the pace of that change.

- Role of emerging economies in shaping future energy demand:** In the period to 2030 industrialisation, urbanisation and rising living standards in China, India and the Middle East will increase global energy demand by over one-third. China's demand will rise by 60% while India's will more than double. By 2030, 60% of the world's population will live in cities, with China adding 276 million and India 218 million urban dwellers.<sup>49</sup>

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<sup>49</sup>IEA World Energy Outlook 2012: [www.worldenergyoutlook.org/](http://www.worldenergyoutlook.org/)

- ii. Meantime, the number of people considered to be in the 'global middle class' is expected to grow as a percentage of overall population – further increasing pressure on per-capita consumption of resources.
- iii. **A shifting global energy landscape:** The next 20 years will witness significant shifts in the global energy map, with implications for energy markets and trade. By 2035, the United States of America may be virtually self-sufficient in energy due to increased unconventional hydrocarbons, increased bio-energy, and improved fuel efficiency in transport. As North American energy exports increase, 90% of Middle Eastern oil exports will go to Asia.<sup>50</sup> Changing patterns of energy production, balance of trade flows and import/export dependencies may redefine global economic and geopolitical balances.
- iv. **Policy choices and priorities:** Policy makers face critical choices in reconciling energy, environmental and economic objectives. Global fossil fuel subsidies are still growing to \$523 billion in 2011, up 30% from 2010. By comparison, global renewable energy subsidies amounted to only \$8 billion in 2011. Cumulative investment required in new energy supply is estimated to total \$37 trillion over 2012-2035. In the face of growing global energy demands, public policy will increasingly seek to reduce energy demand where possible – but energy efficiency dividends currently remain largely untapped, mostly due to non-technical barriers.<sup>51</sup>
- v. **Forward Operating Environments:** As we look further ahead, beyond 2025, the degree of uncertainty increases to the point where projections alone are not sufficient. Therefore, considering alternative futures can offer one way to assess potential forward operating environments for Scotland. Scotland's future energy and climate change prospects are especially interconnected with, and heavily influenced by:
  - Economic growth *-or-* stagnation across the world which will significantly impact investor confidence, access to capital, opportunities for industrial and commercial collaboration, levels of energy demand and supply; and

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<sup>50</sup> Ibid.

<sup>51</sup> Ibid.



- Weak *-or-* strong climate change mitigation policy implementation at home and overseas which will shape the competitive landscape for Scottish industry and exports, determine the fortunes of our energy technologies and energy services, and define the scope of our reductions in greenhouse gas emissions.

3.2.3 As part of the background work to this report, we explored a range of different futures, **not as predictions**, but rather in recognition of the potential for alternative and plausible operating environments ahead that we need to understand, including:

- A world where economic growth returns to pre-crisis levels and most governments invest in robust carbon reduction policies. However, behaviour change lags behind investment;
- A world of economic recovery, but where most debt-ridden governments prioritise growth near term to ensure security long term – all at the expense of investment in the low carbon transition;
- A world where indebted countries experience a decade of stagnation. But low carbon policies are not abandoned, but shifted towards low cost measures, especially to a focus on energy efficiency; and
- A world experiencing a decade of stagnation where the low carbon agenda is overshadowed by resource protectionism, minimising import dependencies, and prioritising a return of domestic growth.

3.2.4 The long term future requires our immediate attention. Policies over the next five years will shape the investments for the next ten years, which will largely define the global energy picture out to 2050. Strategic investments in infrastructure will commit us ahead for decades, battles for global standards may render otherwise promising emerging technologies redundant, and new energy solutions may create new resource dependencies.

3.2.5 Consequently, we are developing policies and proposals in an adaptive way, one which sets a clear direction and yet is sensitive to the fast changing operating context in which we compete. This RPP2 attempts to balance the need for a long term credible plan to meet our emission targets with the need to remain flexible to change.

3.2.6 Our policies and proposals should be able to flex in different futures. We expect our proposed transformational *outcomes* to remain largely steady, but our interventions, some technologies, our business models and our priorities may change as different ‘futures’ come to pass.

### 3.3 The transition to a low carbon economy

3.3.1 In our updated Government Economic Strategy published in 2011, we established a new strategic priority, the 'Transition to a Low Carbon Economy' emphasising the central importance of low carbon to Scotland's future economic success. The earlier Low Carbon Economic Strategy<sup>52</sup> for Scotland set out our approach in detail. It represents a bold vision for a fundamental restructuring in the domestic economy – moving it to a low carbon basis in advance of a similar restructuring across the global economy.

3.3.2 Over the coming decades, consumer behaviour, business models, products, services and technologies will all adapt to a reduced reliance on carbon – this is the basis of an unprecedented economic opportunity for Scotland. The transformational changes required in our domestic economy are an investment to drive long-term growth and provide sustainable export markets for Scottish products and services.

3.3.3 There is a sound economic basis for our actions. Scotland's abundant natural resources are the basis for a revolution in renewable energy, supported by the energy infrastructure and skills in our oil and gas industry. Our future success in developing innovative low carbon technologies is dependent on Scotland's industrial and engineering excellence – and the outstanding performance of Scotland's research institutions. And our successful services sector is the platform for an exportable services market in waste, resource efficiency and energy demand management.

3.3.4 Our support for the low carbon economy is provided through six channels:

**Long term legal and institutional certainty.** Business certainty and investment are prerequisites for a successful transition. Scotland's world-leading statutory climate change targets and the accompanying actions in this report are the credible basis for long-term business certainty on Scotland's low carbon commitment.

**Expanding renewable energy production.** The supply of clean electricity from renewable sources will reduce the major sectoral contributor of greenhouse gases - power generation - and represents the major economic opportunity for Scotland to capitalise on its rich natural resources. Our commitment to supply 100% of energy demand from renewable sources by 2020 will ensure that the indirect emissions of

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<sup>52</sup> The Scottish Government: [www.scotland.gov.uk/Publications/2010/11/15085756/0](http://www.scotland.gov.uk/Publications/2010/11/15085756/0)

other sectors of the economy are also addressed. Indeed, by making such a significant contribution to meeting our targets, renewable energy can relieve pressure on other areas of Scottish society.

**Improvements in energy and resource efficiency in households and industry.** The major opportunity outside renewable energy is in the emergence of new markets for services and products to improve the energy efficiency of the residential and industrial sectors, reducing fuel poverty in households and improving productivity and resource efficiency for business. The opportunities here are immense and span the construction, manufacturing and services industries.

**Transition of transport to a lower carbon basis.** Transport is a significant source of Scottish greenhouse gas emissions. Scotland has key competitive strengths to exploit in new and emerging transport technologies, for example, hybrid buses and ferries, and fuel cells and batteries (in line with our clean electricity story).

**Expansion of renewable sources of heat.** We can support the provision of private and public infrastructure to supply heat from renewable sources. This is a growing market opportunity for Scottish energy suppliers and construction businesses and a platform for the provision of a range of innovative new technologies.

**Sustainable land use.** Sustainable land use is the bedrock of any credible plan for a low carbon transition. We recognise the centrality of responsible stewardship of our natural resources to the future growth of the economy and to protect Scotland's resource base to benefit future generations.

3.3.5 Our commitments in the Low Carbon Economic Strategy support this RPP2. Work is already underway to take forward these commitments to:

- ensure our policies support low carbon investment - focusing on the development of financial models and products that promote and de-risk low carbon technology investments. These include the **Renewable Energy Investment Fund (REIF)**<sup>53</sup>, a multi-million pound fund to stimulate greater levels of private finance investment in green power and renewable district heating projects;

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<sup>53</sup> Renewable Energy Investment Fund:  
[www.scottish-enterprise.com/news/2012/10/renewable-energy-investment-fund-open-for-business.aspx](http://www.scottish-enterprise.com/news/2012/10/renewable-energy-investment-fund-open-for-business.aspx)

- press the UK Government and the EU on path-dependent policy areas such as the **UK Electricity Market Reform**<sup>54</sup> and the **EU energy and climate change targets and scenarios**, as well as ensuring that we maximise the economic and investment opportunities for Scotland from the UK Green Investment Bank (GIB)<sup>55</sup> and the UK Government's 'Green Deal' package<sup>56</sup> for householders and businesses;
- further develop our international profile to secure investment and promote our low carbon exporters;
- assist organisations to be 'programme and project ready' as investors increasingly turn to Scotland looking for opportunities;
- work with a range of public, third sector organisations and investors to enable innovative funding models that reduce emissions and dependency on fossil fuel, and also provide revenues to communities, households and investors; and
- refresh the Climate Challenge Fund with a focus on reaching 'disadvantaged' and 'hard to reach' communities, to ensure that climate justice is delivered to those most vulnerable to the detrimental impacts of climate change, and deliver Manifesto commitments to allow revenue raising and engage young people in climate change action.<sup>57</sup>

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<sup>54</sup> DECC. UK Electricity Market Reform:

[www.decc.gov.uk/en/content/cms/meeting\\_energy/markets/electricity/electricity.aspx](http://www.decc.gov.uk/en/content/cms/meeting_energy/markets/electricity/electricity.aspx)

<sup>55</sup> BIS. UK Green Investment Bank: [www.bis.gov.uk/greeninvestmentbank](http://www.bis.gov.uk/greeninvestmentbank)

<sup>56</sup> DECC. Green Deal: [www.decc.gov.uk/en/content/cms/tackling/green\\_deal/green\\_deal.aspx](http://www.decc.gov.uk/en/content/cms/tackling/green_deal/green_deal.aspx)

<sup>57</sup> Scottish Government, Extending the Challenge:

[www.scotland.gov.uk/News/Releases/2012/11/climatechallenge27112012](http://www.scotland.gov.uk/News/Releases/2012/11/climatechallenge27112012)

## Energy Efficiency Potential

The energy efficiency sector in the UK accounts for about 136,000 jobs and had sales of £17.6 billion in 2010-11. UK sales have grown by over 4% per year since 2007-08, and are projected to grow by around 5% per year between 2010-11 and 2014-15. However, we believe there is more potential in the market.

The UK Energy Efficiency Strategy<sup>58</sup> estimates that through socially cost-effective investment in energy efficiency we could be saving 196 TWh in 2020, equivalent to 22 power stations. Were all this potential to be realised, final energy consumption in 2020 could be 11% lower than the Business-as-Usual baseline. This potential can be found across the UK economy: realising this could have significant benefits for businesses and households in Scotland.

The promotion of energy efficiency is devolved and Scotland has established its own target to reduce final energy consumption by 12% in absolute terms against a baseline averaged over the years 2005 to 2007 by 2020.

## 3.4 Funding and financing the climate change targets

*A range of funding routes exists and is being added to which will support the continuing development of policies and proposals.*

3.4.1 This report covers a period which extends beyond the Budget for 2013-14 and which will encompass future sessions of the Scottish Parliament. Budget provisions for 2013-14 and plans for 2014-15 relevant to RPP1 and the delivery of the policies and proposals in this report have been provided to Scottish Parliament committees and the Scottish Parliamentary Information Centre. We have also published it on our website.<sup>59</sup>

3.4.2 A major consideration in meeting both medium and long term climate change targets across sectors is how interventions and activities might be funded and financed. This section considers this at a practical level – drawing closely on mechanisms outlined in our Infrastructure Investment Plan 2011.<sup>60</sup> Funding mechanisms which result in direct emissions abatement are detailed further in their respective sectoral chapters.

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<sup>58</sup> DECC, Energy Efficiency Strategy: The Energy Efficiency Opportunity in the UK:

<https://www.gov.uk/government/publications/energy-efficiency-opportunities-in-the-uk>

<sup>59</sup> The Scottish Government, Draft Budget 2013-14, Details of funding for climate change mitigation measures: [www.scotland.gov.uk/Topics/Environment/climatechange/climatechange/fundingdocument](http://www.scotland.gov.uk/Topics/Environment/climatechange/climatechange/fundingdocument)

<sup>60</sup> The Scottish Government, Infrastructure Investment Plan: [www.scotland.gov.uk/Topics/Government/Finance/18232/IIP](http://www.scotland.gov.uk/Topics/Government/Finance/18232/IIP)

3.4.3 Taking action on climate change, specifically in reducing energy consumption, can result in direct cost savings. This is important not only for businesses tackling their bottom lines, but also for the public sector in reducing costs to release funding for other priorities and in making savings for tax payers. Key principles that underline our approach to funding and financing activities to support the climate change targets are:

- cost effectiveness;
- consideration of whole life cycle costs;
- preventative spend and 'spend to save';
- efficiency; and
- maximising wider economic benefits.

3.4.4 Governments will always have to prioritise limited funding and make tough decisions. However, when choosing to allocate funding to greenhouse gas abatement measures, there are choices. How these choices are made will depend on the type of policy or project under consideration.

3.4.5 Policies and projects require different types of funding, depending on their nature, timing and context. Capital funding is the most common method of financing public sector infrastructure projects. Many interventions involving behaviour change require revenue funding. And as the influencing behaviour section later in this chapter illustrates, supporting infrastructure may also be necessary, and so both capital and revenue funding are required in some cases.

#### **Fuel Efficient Driving**

Fuel efficient driving (sometimes known as eco-driving) advice and training is currently provided on our behalf by the Energy Saving Trust. Fuel efficient driving can significantly reduce fuel consumption and emissions. In the coming years, we will continue to promote driver training, to public sector organisations, businesses and individuals as well as promoting telematics applications to bed-in the new driving behaviours.

The business case for more efficient driving is considerable. Fuel savings of up to 10% means the costs of training and telematics are recoverable within a short period. By the end of the decade we would expect to see a mature commercial approach to training provision as is already the case for the freight transport sector.

3.4.6 Significant elements of this RPP2 are capital intensive. Many lower carbon goods, for example electric vehicles or new energy efficient buildings, often have higher up front capital costs but lower long term

running costs than their higher carbon counterparts. In many cases this requires us to think differently about how we fund and finance low carbon infrastructure and services.

3.4.7 A critical requirement of making the transition to a low carbon economy and society, therefore, is for organisations and businesses to be able to draw on a range of funding, financing and investment mechanisms at local, national and international levels. The Scottish Government's role is to create, support and or draw attention to these mechanisms, as well as helping build capacity in other organisations to draw down on opportunities - for example with European funding.

3.4.8 As the Scottish Government is currently facing a severe fall in the level of traditional capital funding available, a 25.1% real-terms reduction between 2010-11 and 2014-15, alternative financing models, such as the Non Profit Distributing (NPD), Regulatory Asset Base (RAB), Tax Incremental Financing (TIF) and the National Housing Trust (NHT) are being taken forward to maximise our infrastructure investment programme.

## The Scottish Low Carbon Investment Conference

The Scottish Low Carbon Investment Conference has taken place in Edinburgh each year since 2010. The conference is a leading international forum for emerging renewable energy and other low carbon innovation. Senior politicians, financiers and industry chiefs, as well as developers, practitioners, academics and policy makers from around the world, gather to debate and explore the global transition to low carbon economies and examine the role of the key sectors in scaling up investment.

Scotland, with its heritage of expertise in finance and technology and abundance of natural resources, is uniquely placed to make a significant contribution to the innovation needed in both fields to progress the global shift to low carbon. The role of government is recognised as key amongst the support architecture for green growth. The Scottish Government has committed to working with all stakeholders to ensure public sector intervention is targeted at the right areas to engender investor confidence and deliver a strong low carbon market. The conference is, therefore, an important forum for reaffirming that commitment and developing new and existing relationships.

A central theme of the conference objectives is that progress will be better achieved if the key sectors work together. The challenges are not isolated but common to the global economy. Energy security and climate change, the need to shift from finite resources to a sustainable footing for our energy needs, the technological hurdles that entails, and the need to find new investment instruments to support the low carbon sector, provide ample questions for the conference to consider.

3.4.9 We are thus increasingly turning to innovative ways of funding investments, using the Scottish Government's own funding to unlock other funding streams. The following non-exhaustive list illustrates the types of opportunities that may be available in the future for emission abating infrastructure, services, research and development, and business support.

3.4.10 The **Green Investment Bank (GIB)** is headquartered in Edinburgh.<sup>61</sup> Over the Spending Review period to 2015, it will invest £3 billion focused on:

- offshore wind;
- commercial and industrial waste processing and recycling;
- energy from waste generation;

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<sup>61</sup> BIS. Green Investment Bank: [www.bis.gov.uk/greeninvestmentbank](http://www.bis.gov.uk/greeninvestmentbank)



- non domestic energy efficiency; and
- supporting the Green Deal.

3.4.11 GIB has invested £635 million in eleven projects in its first five months of operation unlocking an additional £1.7 billion of private sector investment. The investments will save more than 2.5 MtCO<sub>2</sub>e per year, the equivalent of taking around one million cars off the road, and generate enough renewable electricity to power 2.3 million UK homes.

3.4.12 The Scottish Government in collaboration with Scottish Enterprise and Scottish Futures Trust has identified a portfolio of low carbon projects in excess of £4 billion that might be appropriate for investment by GIB or other funds such as Scotland's Renewable Energy Investment Fund. About £500 million of these projects are under active consideration by the GIB.

3.4.13 The GIB is now looking to secure involvement in a range of projects in Scotland and is keen to join forces in unlocking projects across its key sectors as well as those of a larger more strategic nature. The Scottish Government has agreed to work with the GIB, and other potential investors, to bring forward a national programme of LED street lighting and to explore opportunities across the public sector estate for similar energy efficiency interventions. Scottish Government will make available up to £2 million in 2013-14, to support local authorities to undertake street lighting condition surveys, in order to accelerate this investment.

3.4.14 The **Green Deal** is a new UK-wide finance mechanism funded by private capital. It will enable households and occupants of other buildings to have energy efficiency improvements installed at no upfront capital cost and to pay for them, over a period of years, through a charge on their electricity bill. More detail on the Green Deal can be found in section 5.4.

3.4.15 **Traditional capital finance** is the most common method of financing public sector infrastructure projects. Development and construction costs are paid from capital budgets at the time of building the asset. In general it ensures lowest cost of finance for a project. Examples of capital-funded infrastructure include cycling infrastructure, renewable projects, energy assistance within the housing sector, and estate maintenance.

3.4.16 The Scottish Government uses **capital and revenue grants** to good effect, often leveraging or matching significant funding from the private sector or other areas such as Lottery funding. Examples of grants include those used in our Green Bus Fund.<sup>62</sup>

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<sup>62</sup> Transport Scotland. Scottish Green Bus Fund:  
[www.transportscotland.gov.uk/public-transport/Buses/Bus-Fund](http://www.transportscotland.gov.uk/public-transport/Buses/Bus-Fund)

3.4.17 The Scottish Government does not yet have flexibility to borrow under the current public finance framework. The limited **capital borrowing** powers enabled by the Scotland Act mean that for the purposes of capital investment, the Scottish Government will, from 2015-2016, be able to borrow up to 10% (approximately £250 million) of the capital budget each year with a cumulative limit of £2.2 billion. Capital borrowing will be one way of funding low carbon infrastructure.

3.4.18 Local authorities have powers to borrow under the **prudential borrowing regime**. In 2010-11, around £1.1 billion of capital spend was supported by LA borrowing. Local authorities are using this funding arrangement for activities that include emission abatement as well as saving money. Fife Council, for example, has a rolling programme to replace its inefficient street lighting with a more efficient system. The payback period is relatively short and Fife is not only reducing its emissions but also reducing its liabilities under the Carbon Reduction Commitment (CRC) scheme.

3.4.19 The **Regulatory Asset Base (RAB)** is a well-used method of funding infrastructure within the rail industry. Transport Scotland works directly with the Office of Rail Regulation and Network Rail to agree on major new investment. Projects are financed by borrowing undertaken by Network Rail. The Scottish Government then makes regular contractual repayments to Network Rail. Examples of rail infrastructure being financed in this way are the Edinburgh Glasgow Improvement Programme and Borders Railway.

3.4.20 **Tax Incremental Financing (TIF)** is used to fund public sector infrastructure needed to unlock regeneration in an area, and which might otherwise be unaffordable to local authorities. TIF allows local authorities to keep locally generated, incremental non-domestic rate revenue (NDR) from economic activity that has arisen as a direct result of their investment in “unlocking” infrastructure. The captured revenue is then used to repay the local authority’s debt raised to finance the infrastructure investment.

3.4.21 The Scottish Government uses **loan funds** to facilitate investment by others, where the market is failing to provide businesses and communities with access to finance. For example, the Energy Saving Trust has Scottish Government funding for a **District Heating Loan Fund**, helping communities to replace traditional heating with low carbon and renewable heat.

## Tax Incremental Financing

One of the six TIF pilot projects under development is from Fife Council. The project involves a £17 million investment in infrastructure to improve vehicle and marine access to Energy Park Fife, remediate the site and enhance delivery of a Levenmouth Low Carbon Investment Park. An estimated 1000 new jobs will be created.

3.4.22 Access to finance is often cited as a barrier to energy efficiency or renewables uptake. The Energy Saving Scotland **Small Business Loans Scheme** provides loans of up to £100,000 through the Energy Saving Trust for the installation of technologies that reduce energy consumption and improve resource efficiency in SMEs (small and medium sized enterprises). The loans are interest free for energy efficiency measures.

3.4.23 Our **Central Energy Efficiency Fund (CEEF)** provides funding for local government, NHS Scotland and Scottish Water to reduce energy consumption and carbon emissions.<sup>63</sup> Projects must pay back within seven years for energy efficiency or ten years for renewable measures. Savings are repaid into the fund up to the original loan amount. Further savings may be used for frontline services or more carbon reducing measures.

3.4.24 Our **Salix Finance loans scheme** provides a public sector revolving loans fund for publically funded autonomous institutions such as universities and colleges to implement energy efficiency measures.<sup>64</sup> This fund will be opened up to the wider public sector in 2013-14.

3.4.25 The **Scottish Futures Trust (SFT)**, a company established by the Scottish Government, has responsibility to deliver value for money across all public infrastructure investment.<sup>65</sup> SFT works closely with public sector bodies to deliver infrastructure investment, including Scotland's Schools for the Future, the Non Profit Distributing programme, Asset Management and the Scotland-wide Hub programme.

3.4.26 SFT's indicative analysis shows that an investment of c.£300 million in low carbon measures across the Scottish Public Sector estate could lead to potential cost reductions in the region of c.£1.1 billion before financing costs and £900 million after financing costs.

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<sup>63</sup> Central Energy Efficiency Fund: [www.energy-efficiency.org/ceef/CCC\\_FirstPage.jsp](http://www.energy-efficiency.org/ceef/CCC_FirstPage.jsp)

<sup>64</sup> Salix Finance: [www.salixfinance.co.uk/](http://www.salixfinance.co.uk/)

<sup>65</sup> Scottish Futures Trust: [www.scottishfuturestrust.org.uk](http://www.scottishfuturestrust.org.uk)

3.4.27 The Trust has initiated a Low Carbon Workstream to develop commercial delivery structures to aggregate projects and establish national energy efficiency programmes. Through this, SFT aims to realise investment potential and attract private finance as well as reduce costs for all authorities and the wider public sector. This will be achieved, for example, through developing public sector approaches to energy performance contracting, especially those which may be capable of being funded from the Government's revenue budgets. This work will initially focus on pilots involving an NHS Health Services Scotland office building and Glasgow City Council's primary school estate.

#### **Street lighting**

SFT, supported by Scottish Government, COSLA, the Cities Alliance, the Society of Chief Officers of Transportation and Resource Efficient Scotland, is managing the development of a national street lighting programme. The Trust is helping local authorities to assess the potential financial and carbon savings that could be captured, while the financial and commercial options is being developed in conjunction with the GIB. The Scottish Government will make up to £2 million available in 2013-14 to accelerate this programme and encourage local authorities to undertake street lighting condition surveys.

3.4.28 **Non Profit Distributing** (NPD) involves a partnership with a private sector provider, who finances, constructs and maintains an asset. The public sector then pays an annual charge over a 25-30 year period to the private sector from the revenue budget once the asset has been built.

3.4.29 The Scottish Government supports the use of NPD to deliver revenue-financed investment. NPD seeks to transfer risk and exert private sector discipline during the construction phase of a project and throughout its lifetime, but without the excessive profits associated with past Private Finance Initiative (PFI) projects.

3.4.30 In 2010, the Scottish Government announced a pipeline of NPD projects with a value of £2.5 billion across public services in transport, education and health. This is one of the largest investment programmes of its kind in Europe. High-quality sustainable design is supported by SFT at all stages of procurement and through to delivery.

3.4.31 **Hub**<sup>66</sup> is a Scotland-wide initiative delivering new community infrastructure that is expected to be valued at more than £2 billion over the next ten years. It brings together community planning partners, including health boards, local authorities, police, and fire and rescue services, and private sector development partners, to deliver sustainable community infrastructure collaboratively.

#### City of Glasgow College

Environmental sustainability is a key feature of the City of Glasgow College's technical requirements for its New Campus *Non Profit Distributing* Project. The College is looking for a design that meets certain minimum sustainability targets, including in relation to BREEAM<sup>67</sup> and Energy Performance Certificate ratings,<sup>68</sup> carbon emissions and low or zero carbon technologies. The College will use a low carbon assessment tool to review and evaluate all aspects of bidders' sustainability proposals.

3.4.32 The **Scottish Investment Bank (SIB)**<sup>69</sup> supports the development of Scotland's private sector SME funding market to ensure both early stage and established businesses with growth and export potential have adequate access to growth capital. SIB operates a suite of investment funds. The three equity funds adopt a co-investment and shared risk intervention model to encourage more private investors to invest in early stage Scottish companies with high growth potential. SIB is also the lead investor in the privately managed Scottish Loan Fund which operates on a fully commercial basis and is aimed at established companies.

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<sup>66</sup> Scottish Futures Trust. Scotland-wide hub initiative: [www.scottishfuturestrust.org.uk/our-work/hub/](http://www.scottishfuturestrust.org.uk/our-work/hub/)

<sup>67</sup> BREEAM: [www.breeam.org/about.jsp?id=66](http://www.breeam.org/about.jsp?id=66)

<sup>68</sup> Energy Performance Certificates:

[www.scotland.gov.uk/Topics/Built-Environment/Housing/BuyingSelling/Home-Report/epcs](http://www.scotland.gov.uk/Topics/Built-Environment/Housing/BuyingSelling/Home-Report/epcs)

<sup>69</sup> Scottish Investment Bank:

[www.scottish-enterprise.com/fund-your-business/scottish-investment-bank.aspx](http://www.scottish-enterprise.com/fund-your-business/scottish-investment-bank.aspx)

### **Haddington Infant School and St Mary's Primary School<sup>70</sup>**

The new, joint school building benefits from natural lighting and includes a 'breathing wall' construction for good indoor air quality, solar-thermal water preheating and photovoltaic panels, while smart lighting controls are used to enhance energy efficiency. The joint facility was designed to achieve an Energy Performance Certificate A rating and delivers lower energy bills against each set of guidance from the Chartered Institution of Building Services Engineers<sup>71</sup> and the Carbon Trust.<sup>72</sup>

The school grounds are a resource for ecology teaching and recycling as well as recreation.

**3.4.33 Scottish Enterprise has a range of innovation and research and development grants.** These are available to businesses of all sizes for research and development, co-investment and technological innovations. Scottish Enterprise provides guidance<sup>73</sup> on the most appropriate grant for businesses and supports them throughout the application process.

### **Low Carbon Funding Landscape Navigator**

The UK Government launched a low carbon funding landscape navigator in 2012 to help providers of and applicants for low carbon funding link up more easily. Available on the Low Carbon Funding Landscape Navigator website,<sup>74</sup> the navigator has been developed by the Energy Generation & Supply Knowledge Transfer Network with support from DECC. Users can search for funding opportunities and get help in finding partners to build collaborations for specific calls. Both public and private funders can add and manage their own funding opportunities.

The navigator is a resource for the entire low carbon energy R&D community. It will be particularly valuable to smaller technology companies who struggle to keep up to speed with the myriad of support mechanisms.

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<sup>70</sup> Scottish Government News Release: [www.scotland.gov.uk/News/Releases/2011/11/08113629](http://www.scotland.gov.uk/News/Releases/2011/11/08113629)

<sup>71</sup> The Chartered Institution of Building Services Engineers Technical Guidance: [www.cibseknowledgeportal.co.uk/cibse-guides](http://www.cibseknowledgeportal.co.uk/cibse-guides)

<sup>72</sup> The Carbon Trust Scotland: [www.carbontrust.com/client-services/scotland](http://www.carbontrust.com/client-services/scotland)

<sup>73</sup> Scottish Enterprise. Fund Your Business guidance: [www.scottish-enterprise.com/fund-your-business.aspx](http://www.scottish-enterprise.com/fund-your-business.aspx)

<sup>74</sup> Knowledge Transfer Network. Low Carbon Funding Landscape Navigator: [www.lowcarbonfunding.org.uk](http://www.lowcarbonfunding.org.uk)

3.4.34 **European Structural Funds.** In the 2007-2013 programming period we have supported projects through targeted low carbon themed application calls. This has added valuable extra resources to individual projects. RPP2 related projects have included energy efficiency in social housing in Orkney. However, continuing this approach would mean that we miss an opportunity to combine Structural Funds with rural and fisheries funding streams in order to leverage additional resources from the private sector and centrally managed funds (e.g. Connecting Europe. Horizon 2020).

3.4.35 We want to identify low carbon as a priority from the outset of the new programme and to allocate a significant funding envelope. This strategic approach will help us to establish a combination of grant and financial engineering instruments that match our ambitions.

3.4.36 To support the delivery of regeneration projects in Scotland, we developed the £50 million **Scottish Partnership for Regeneration in Urban Centres (SPRUCE)**<sup>75</sup> using money from the EU JESSICA investment loan fund. This includes up to £15 million for energy efficiency retrofit projects in eligible local authority areas. Schemes that pilot or demonstrate new or innovative approaches to energy efficiency retrofit measures, including the retrofit of existing social housing stock, are eligible to submit a bid for this element.

3.4.37 Launched in 1992, the **LIFE programme** is one of the spearheads of EU environmental funding. The European Commission has proposed to boost funding for environmental and climate projects through a new LIFE programme in the 2014-2020 period.<sup>76</sup> If this regulation is adopted by the Member States and the European Parliament, the overall budget would be raised to €3.2 billion, of which €800 million would be allocated to a new climate sub-programme which will focus on reducing greenhouse gas emissions; increasing resilience to climate change; and increasing awareness, communication, and exchange of information on climate actions.

3.4.38 Grants to finance projects will remain the main type of intervention of the LIFE programme. They will support public authorities, the private sector (including SMEs), NGOs and other non-profit organisations, in testing small-scale low carbon and adaptation technologies, with new approaches and methodologies. Specific local and regional climate mitigation or adaptation strategies or action plans will also be financed. The sub-programme will support capacity building as well as awareness-raising actions.

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<sup>75</sup> The Scottish Partnership for Regeneration in Urban Centres: [www.ambergreenspruce.co.uk/](http://www.ambergreenspruce.co.uk/)

<sup>76</sup> European Commission, LIFE Programme: <http://ec.europa.eu/environment/life/about/beyond2013.htm>

## Tayeco Ltd

Based in South Queensferry, Tayeco Ltd has received more than £900,000 from SIB's Scottish Co-investment Fund.<sup>77</sup> The company has developed *Ewgeco*<sup>78</sup> - the world's first real-time energy monitor for homes and business. *Ewgeco* provides users with a better understanding of their energy consumption patterns and encourages behavioural changes through precise and instant information on electricity, water and gas at any point in time.

3.4.39 Finally, the Scottish delegation was given useful advice on securing international finance in meetings at **UNFCCC Doha** with the financial and business sector, including the **European Investment Bank** and **Global Scots** in Qatar. Many European cities have accessed European Investment Bank funding for green initiatives, particularly in transport. A wide range of green projects could be eligible for loan funding as long as they represent a bankable proposition in terms of returns; the Scottish Government and some large Scottish local authorities would be big enough to act as guarantors (or alternatively a pool of smaller local authorities).

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<sup>77</sup> Scottish Co-investment Fund:

[www.scottish-enterprise.com/fund-your-business/scottish-investment-bank/sib-equity-funding/scif.aspx](http://www.scottish-enterprise.com/fund-your-business/scottish-investment-bank/sib-equity-funding/scif.aspx)

<sup>78</sup> EWGECO: [www.ewgeco.com/blog/energy-display-pioneer-embarks-on-non-domestic-expansion-drive/](http://www.ewgeco.com/blog/energy-display-pioneer-embarks-on-non-domestic-expansion-drive/)



## 3.5 Understanding and influencing behaviour

*The Government recognises that behavioural factors are of critical importance in ensuring the success of most of the policies and proposals in this report. It published the Low Carbon Behaviours Framework in March 2013 which sets out our strategic approach to encourage low carbon lifestyles amongst Scotland's individuals and households.*

3.5.1 This section of the document addresses the critical role that understanding and influencing behaviour has in the majority of the policies and proposals in this report and in meeting our climate change targets.

3.5.2 The Low Carbon Scotland: Behaviours Framework,<sup>79</sup> published in March 2013, sets out our strategic approach to encourage low carbon lifestyles amongst Scotland's individuals and households. The Framework draws on the latest behaviour change research and builds on the work achieved through our earlier Low Carbon Scotland: Public Engagement Strategy published in 2010. The Individual, Social and Material (ISM) approach, combined with ten insights for effectively influencing behaviours, will help the government and others to build stronger policies and programmes to meet the challenge of changing the way we live, work and travel.

### The Scottish context

3.5.3 The way we use electricity and heat our homes and other buildings, the ways we travel, the products we purchase and transport from home and abroad, and the way we run our businesses and organisations, have emissions consequences. These stem from the choices we make, the fuels and technologies that we use and the way in which we use them, i.e. our behaviours.

3.5.4 Reducing emissions is challenging, and as Scotland's population and number of households increases, this challenge becomes greater still. Scotland's population<sup>80</sup> has seen a continuous increase in recent years, partly because there have been more births than deaths, but mainly because more people have moved to Scotland than have left. In 2011, migration was largely responsible for an increase in our population of 0.6% over the previous year. At 5,295,000, the population is now the highest ever recorded and it is projected to further increase to 5,760,000 by 2035.<sup>81</sup>

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<sup>79</sup> The Scottish Government, Low Carbon Scotland Behaviours Framework: <http://www.scotland.gov.uk/Publications/2013/03/8172>

<sup>80</sup> Scotland's Census, 2011: [www.scotlandscensus.gov.uk/en/](http://www.scotlandscensus.gov.uk/en/)

<sup>81</sup> Scotland's greenhouse gas emission reduction targets do not change with changing demographics.

3.5.5 The Scottish Government is working hard to increase sustainable economic growth by promoting Scotland as a positive place to live, work, learn and remain. Should the trend in population increase continue, Scotland will be on track to exceed the population growth target established in our Government Economic Strategy. We have a large established migrant community and welcome the contribution new Scots are making to our economy and to society. However, all things being equal, population increases will mean still greater energy demands, and higher emissions from transport and waste. This makes Scotland's climate change targets more ambitious to achieve and means that we need to engage everyone in Scotland in the transition to a low carbon lifestyle.

3.5.6 There is no magic bullet for changing the way we produce and use energy, or manage our land. But clearly, policy and engagement programmes have key roles to play in influencing how society organises itself and what choices we are able to make. New and carefully planned infrastructure, innovative services and technologies, effective communications, and community and business engagement can do more to help us live more sustainably as a society, particularly where these are joined up and consistent.

### The Low Carbon Scotland Behaviours Framework

3.5.7 Our Low Carbon Behaviours Framework sets out the key behaviours we need to encourage to meet Scotland's climate change targets, our evidence-based approach, the actions we will take, and how we will measure progress. The Framework recognises that changing behaviours is more likely to be successful when we consider the multiple factors across **individual, social and material (ISM)** contexts that influence them.

### Ten key household behaviours

3.5.8 We need to be clear about which individual and household behaviours are key to tackling climate change. In 2010, Scottish Government research identified where household actions would make the biggest impact on reducing energy demand. Those **ten key behaviours** are intended to inform our analysis and understanding of what Government and others can do to enable, encourage and exemplify change. Furthermore, the key behaviour areas are relevant to many of the policies and proposals contained within this report. They are outlined in the table below. Further information can be found on the Influencing Behaviours website.<sup>82</sup>

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<sup>82</sup> Climate Change Behaviours Research Programme - Update Report: [www.scotland.gov.uk/Topics/Research/by-topic/environment/social-research/Behaviour-Change-Research/CCBRPupdatereport](http://www.scotland.gov.uk/Topics/Research/by-topic/environment/social-research/Behaviour-Change-Research/CCBRPupdatereport)

**Table 3.1. Ten Key Household Behaviours**

Home Energy	Installing a more efficient energy system
	Keeping the heat in (draught proofing & insulation)
	Better heating management
	Saving electricity
Travel	Walking, cycling, using public transport and or car sharing instead of (solo) driving
	Using a low carbon vehicle, fuel efficient driving
	Using alternatives to flying where practical
Food	Avoiding food waste
	Eating a healthy diet high in fruit and vegetables, in season, where we live
Consumption	Reducing and reusing, in addition to the efforts we already make on recycling

3.5.9 There are strong links between the policies and proposals in this report and the ten key behaviours. For example, Chapter 5 outlines the policies and proposals that will help us to install more efficient energy systems and better manage heat. Chapter 7 describes how we propose to help people make more carbon-friendly travel choices, whilst the waste and resource efficiency chapter outlines steps that will help households reduce and reuse and expand on the existing recycling efforts of many households.

### The ISM approach

3.5.10 Our approach to addressing the individual, social and material (ISM) contexts for behaviours is outlined in the User Guide to the ISM tool published on 5 June 2013.<sup>83</sup>

3.5.11 The tool is based on theory and evidence which shows that three different contexts – the individual, social and material – influence people’s behaviours. One of the key principles of the ISM approach is that developing a package of interventions that targets all the three contexts is more likely to be successful in bringing about significant and long lasting change, as the example on recycling in the box below shows. The ISM tool has been developed as a practical aid for thinking through how best to influence people’s behaviours.

<sup>83</sup> The Scottish Government: Influencing Behaviours - Moving Beyond the Individual - A User Guide to the ISM Tool : [www.scotland.gov.uk/Publications/2013/06/8511](http://www.scotland.gov.uk/Publications/2013/06/8511)

3.5.12 At **individual** level there is a need to influence a number of factors, including values and attitudes, which help drive our choices and behaviours. The **social** context in which we operate is also very important - how other people behave and what they consider to be appropriate and desirable behaviour strongly influences how each of us acts. Finally, the **material** context - infrastructure and technologies, legislative and policy frameworks - can either work to promote or constrain low carbon choices and behaviours. This is why they feature strongly in this report.

#### Recycling and the ISM approach

Across the last 20 years, kerbside recycling has become an 'everyday' behaviour for many households across the country. What caused this change in behaviour across society to occur? ISM points to multiple actions by diverse actors covering a range of factors:

**Individual:** Lots of messaging working on people's attitudes and emotions was provided about the importance and benefits of recycling and 'doing your bit'. Recycling was made easier by the introduction of a wide range of collections infrastructure, including kerbside collections, and providing clear and simple 'how to' information, thereby highlighting the ease and lowering the 'costs' of participation.

**Social:** Kerbside collection boxes sent out strong visual signals about who was (and wasn't) recycling, thus working on the power of social norms. Recycling was also promoted within people's workplaces, schools and colleges - from where some people take their new behaviours home. Consistent branding e.g. 'Waste Aware Scotland' and 'Recycle for Scotland' was also used to create a sense of collective national action.

**Material:** The introduction of EU directives on waste management and associated regulation in the UK (e.g. landfill tax), incentivised local authorities to provide collections infrastructure for household recycling. More recently, changes in the scheduling of recycling kerbside collections relative to other household rubbish (e.g. weekly for recycling, fortnightly for residual waste) further incentivised people to take practical action to manage their different waste, and sent out further signals to householders about the need to recycle.

Future plans, such as expansion of 'Recycling on the Go' - which will provide additional recycling facilities for separating plastic, paper, and other materials on the streets of our towns and cities - will further reinforce recycling as a normal and every-day activity.

3.5.13 A programme of work to familiarise government officials and delivery partners with the ISM tool is commencing. Use of the tool will help strengthen the behavioural aspects of policies and proposals to deliver the greatest change. The work will include ISM workshops with Scottish Government policy teams to look at all of the factors which influence people's behaviours, as well as capacity building workshops with delivery organisations. Further workshops on using ISM will be offered to stakeholders and community groups within the low carbon behaviours field. An update report highlighting progress on these initial workshops will be published on the Scottish Government website later in 2013.

### Ten insights for effective behaviour change

3.5.14 Whilst ISM offers a useful tool for thinking through all of the contexts that influence people's behaviours, research also offers other important **insights** on how to most effectively influence people's behaviours. This section sets out ten insights about influencing behaviours and decision making which should be regarded as underpinning principles for policy development that remain relevant over time. Again, these apply to the majority of policies and proposals in this report and so we do not necessarily reference them again in the sectoral chapters. While they are written in the context of policy development and implementation for the Scottish Government, they are important for **all organisations and groups** considering how to best influence behaviour. They are evidence based, drawn from the Scottish Government's Climate Change Behaviours Research Programme (CCBRP).

3.5.15 Working with our partners, we will need to:

1. Show leadership
2. Be consistent
3. Build common cause
4. Make change as easy as possible
5. Ensure change is targeted and tailored
6. Use a packaged approach
7. Intervene at 'moments of change'
8. Think about 'use' when rolling out new products and technology
9. Build sustainability into everyday life
10. Robustly monitor and evaluate interventions

3.5.16 **Insight 1: Show leadership.** We know that the public expects the Scottish Government to show leadership on climate change. Evidence suggests that there is a public appetite for action, even if this means using legislation to drive change forward.<sup>84</sup> At the same time, public, private and third sector organisations have crucial roles to play in promoting positive values and influencing behaviours.

3.5.17 It is important that the Scottish Government both leads the way, and is seen to lead the way, from the setting of clear, stable and long term policy frameworks that drive ambitious emissions reductions, through to transformational management of its own activities and estate. A formal example of this leadership is our new Public Sector Leaders Forum, chaired by the Minister for Environment and Climate Change (see section 10.2 for details). Of course, transformation will not be achieved by the Scottish Government alone and, in many cases, it will be more appropriate for others to take the lead.

3.5.18 **Insight 2: Consistency of message and of action is key.** Evidence suggests that the Scottish Government and its partners need to be seen to be consistently low carbon if the public are to take action themselves. Policies that appear to contradict key messages undermine public belief in the seriousness of the Scottish Government's resolve, and the fairness of the measures introduced. In order to address this issue in the short to medium term, the Minister for Environment and Climate Change will hold a series of local discussions with different stakeholder groups to discuss issues around low carbon behaviours.

3.5.19 **Insight 3:** Any engagement work must approach tackling climate change as a **genuinely joint endeavour, with a strong values-based approach.** Engagement work needs to avoid telling people what *they* should do: instead, the focus needs to be on building common cause – acting together, moving towards the same goal. This will be important in winning hearts and minds, particularly as many of the choices leading up to 2027 could be, or appear to be, difficult. Genuine engagement with individuals, families, communities, businesses, and interest groups will be essential in both generating options and later buy-in to major policy decisions and implementation plans.

3.5.20 **Insight 4: Change needs to be as easy as possible.** Even change that should be straightforward – having an energy efficiency measure installed, for example – can be challenging and difficult for some people. This can deter people from making simple changes in the first place or from

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<sup>84</sup> Tipping or Turning point. Social Marketing and Climate Change, 2007.  
[www.ipsos-mori.com/researchpublications/publications/publication.aspx?oItemId=1174](http://www.ipsos-mori.com/researchpublications/publications/publication.aspx?oItemId=1174)

following up on changes they have already made. Making sure that any lower carbon action or choice is as hassle-free as possible, throughout the process, should be key to any intervention planning.

### Cool Biz, Japan

Cool Biz was a Japanese Ministry of Environment initiative that began in 2005 to reduce energy use in government buildings. Air conditioning settings were changed throughout the summer months, so that buildings would not be cooled below 28°C. To make this more comfortable for workers, a new dress code was implemented, which Government Ministers also followed, moving away from traditional business suits towards lighter clothing. The programme was a success, with the Ministry estimating a reduction of 1.14 MtCO<sub>2</sub>e in 2006. With further energy reductions needed following the 2011 earthquake and tsunami, Super Cool Biz has now been launched with an even more flexible dress code and other measures to conserve energy in government offices. Simple interventions like this demonstrate leading by example and consistency of message or action, and also have the potential to reduce energy costs and carbon emissions significantly.<sup>85</sup>

**3.5.21 Insight 5: Personalised information** and individualised feedback can be key drivers. Giving people personalised information about their energy use, what their travel options are, or how efficiently they are driving is a good way to enable them to take action themselves.<sup>86</sup> For example, most people are unaware of how much energy they use, what tariff they are on, and how they can reduce their personal carbon footprint. Making actual energy usage more visible (feedback) improves customer understanding and helps individuals take action as a result.

**3.5.22** For maximum impact, information needs to be personalised, continuous and visually appealing. In the same way, finding out how our energy use compares with others in our neighbourhoods provides real-life feedback that can be an important driver of energy reductions.

**3.5.23 Insight 6: Make change packaged.** A packaged approach is often the most efficient way of delivering significant change. This is very much in line with ISM, i.e. by creating a package of interventions to address the

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<sup>85</sup> Southerton, D. et al (2011) International Review of Behaviour Change Initiatives. The Scottish Government: Edinburgh. [www.scotland.gov.uk/Publications/2011/02/01104638/0](http://www.scotland.gov.uk/Publications/2011/02/01104638/0)

<sup>86</sup> Changing Household Energy Behaviours: Key Findings from a Review of Applied Research. The Scottish Government. Edinburgh. [www.scotland.gov.uk/Topics/Research/by-topic/environment/social-research/Behaviour-Change-Research/domesticenergy](http://www.scotland.gov.uk/Topics/Research/by-topic/environment/social-research/Behaviour-Change-Research/domesticenergy)

three different contexts which influence people's behaviours, substantive change is more likely to be achieved.

3.5.24 Personalised approaches are even more successful when they are offered as part of a package of interventions. This might mean targeting one behavioural issue with multiple approaches. Or it might mean tackling a range of issues at once. A concrete example of the latter is the 'whole house approach' to home energy auditing that identifies multiple energy efficiency issues in one visit and 'sorts' them with a follow-up package. Studies suggest this can lead to significant energy reductions compared to baseline levels and control groups, with effects seen over a number of years.

#### **Durham, Canada**

The Durham region in Canada introduced a social marketing campaign to reduce residential water use, particularly from watering gardens and lawns. Two approaches were used. One group received a "passive" information campaign that aimed to raise awareness of the problem, while the other received a community-based package of interventions to affect behaviour change. The latter included face-to-face visits, external reminder signs, pledges to water in specific circumstances only, and provision of water gauges to test when lawns actually needed water. The results were revealing. The first approach resulted in increased lawn watering while the second led to a 54% reduction in water consumption. The initiative cost Durham \$80,000 to deliver but saved it \$945,000 by not having to invest in a new water processing plant.<sup>87</sup>

3.5.25 **Insight 7: Intervene at moments of change.** Major life or work events offer opportunities to deliver significant shifts in lifestyles or work culture. For individuals and households, these 'moments' might be buying a new property, moving to a new area, getting a new job, or having a first child. Or there could be other 'trigger points', such as getting a new kitchen or bathroom, that provide opportunities to do other improvement work to the home.

3.5.26 For businesses or other organisations, the change might be an office relocation or reorganisation, or bringing in a major new technology or product. These moments of change offer, essentially, a new context in which to reflect on life or work arrangements. Targeting moments of change is at present an underused strategy in terms of interventions,

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<sup>87</sup> Southerton, D. et al (2011) *International Review of Behaviour Change Initiatives*. The Scottish Government: Edinburgh. [www.scotland.gov.uk/Publications/2011/02/01104638/0](http://www.scotland.gov.uk/Publications/2011/02/01104638/0)



particularly with households, but one that offers genuine potential. Travel planning is one area where some work has been done on this. And retailers are particularly sharp on maximising these kinds of opportunities.

3.5.27 **Insight 8:** Technological advances will be key to living more sustainably in future, but **how people respond to and use new products and services must be carefully considered**. This is a key factor within the ISM approach. Any technological innovation must take behavioural implications into account if it is to maximise the potential benefit. For example, by 2019 every household in Scotland should have a smart meter. However, smart meters can deliver variable savings depending on how they are used, so to maximise these savings, the quality of the information and support given at the point of installation and the opportunity to obtain subsequent advice is crucial. Service providers will need the appropriate skills to be able to advise households appropriately. Energy-saving light bulbs are a good example of a new technology that has not yet led to significant energy savings, because of how they are used (see box on page 88).

#### **EAE**

EAE is a leaflet distribution company based outside Edinburgh with other locations north of Aberdeen and ten 'home bases' in rural and remote areas of Scotland. The company aims to be carbon neutral by 2015.<sup>88</sup> For EAE, relocating to new premises provided an opportunity for the leaflet distribution company to review its activities. Investments included the installation of showers to encourage people to cycle to work and the construction of the company's own wind turbine - a very visual symbol of the company's commitment to sustainability. Since its relocation, the company continues to identify new areas in which it can reduce its carbon emissions.

3.5.28 **Insight 9:** Build sustainability into everyday life. The more that sustainable behaviours are built into the fabric of everyday life, the more likely it is that people will behave sustainably. People don't 'behave' in isolation: we develop preferences, habits and lifestyles over time, and in wider contexts. So, while a series of sensible interventions targeting individuals might bring about some limited change, 'individual-based action' won't on its own bring about a low carbon society. Broader, longer-lasting, societal change requires a more ambitious approach.

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<sup>88</sup> Cox, A. et al. (2012) *The Impact of Workplace Initiatives on Low Carbon Behaviours: Case Study Report*. The Scottish Government. [www.scotland.gov.uk/Publications/2012/03/2237](http://www.scotland.gov.uk/Publications/2012/03/2237)

3.5.29 This means influencing individuals where possible, but also focusing on building social norms – in other words, what’s seen as normal and everyday behaviour - and providing infrastructure that is easy to use and services that offer genuine help and support. Recycling is a good example of a sustainable behaviour that is built into everyday life. Ideally, every intervention would involve consideration of how it can work on individual, social, and material (i.e. infrastructure) levels.

#### **Climate Challenge Fund**

The Climate Challenge Fund empowers communities to come up with their own projects for reducing emissions. Since its launch in 2008, the Scottish Government has awarded over **£46.9 million** to Scottish communities through the Fund with **563 individual awards** made to **408 different communities** across Scotland to encourage local communities to reduce their carbon footprints. By 2015 we will have made available a total resource of **£68.6 million** since the Fund was established in 2008.

A refresh exercise, announced in November 2012, introduced changes to help attract applications from a wider variety of community groups from disadvantaged areas, and young people, including the introduction of **development grants**. Other changes will facilitate improved peer support and encourage innovation including the ability for groups to bring forward project proposals which include revenue raising.

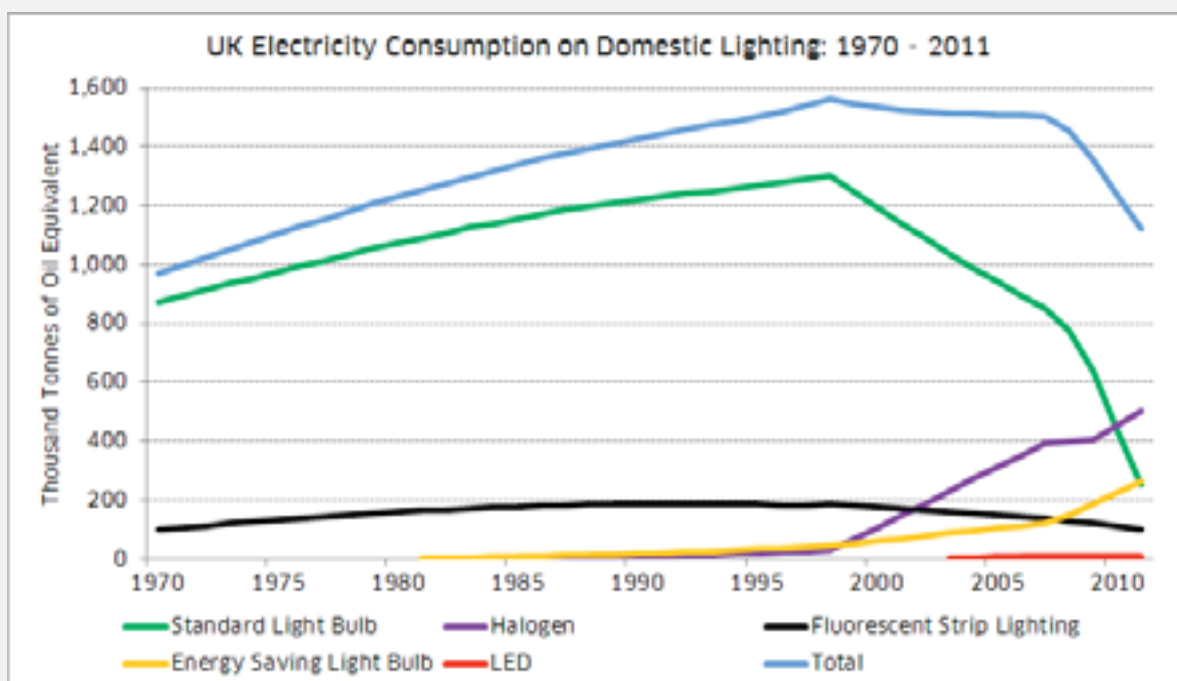
3.5.30 **Insight 10: Monitor and evaluate interventions.** Without robust monitoring and evaluation, it is difficult to know whether interventions have been successful, or how they could be improved. Even hard measures, like insulation programmes, can benefit from evaluation: of course, simply installing insulation will, for most, reduce their overall energy consumption. But households may react to lower bills by being less concerned to monitor their energy use. Or they may not make the energy savings they could have made, just because they haven’t had tailored advice. Or they may simply feel dissatisfied because of the service they received, which could put them off future programmes. Every programme taken forward with carbon implications would benefit from robust monitoring and evaluation to maximise savings and to learn lessons for the future.

3.5.31 In summary, our successful long term strategy to influence behaviours around climate change will work **beyond the individual**, to look at broader social and material contexts, and about how new products are actually used in practice. It will be based on leadership and values-based engagement, especially about the difficult choices ahead. We will work to

make change as easy as it can be, and personalise and tailor interventions where it makes sense to do so.

## Light-bulbs

A reduction in sales of standard bulbs and the promotion of new energy efficient alternatives has led to total energy consumption from lighting beginning to decline (see top line in the chart below). However, the total savings are less than expected bearing in mind the energy savings made from fewer standard bulbs (compare the top two lines in the chart). These savings have been partly offset by increasing energy consumption from other types of bulb.



In the case of lighting, while purchasing behaviours may have been changed (success), environmental impacts have not been significantly reduced (failure). Emerging tastes for ambient low-lighting have resulted in many more light bulbs per room in European countries than in the past. So, for example, one standard bulb may be replaced by multiple bulbs, which may individually be more energy efficient but the total amount of energy consumed for lighting may not ultimately be very different.

In short, behavioural outcomes may not be achieved simply by introducing sustainable substitute products. How these products are used by people in real life contexts needs to be carefully considered and influenced.<sup>89</sup>

<sup>89</sup> Southerton, D. et al (2011) *International Review of Behaviour Change Initiatives*. The Scottish Government: Edinburgh. <http://www.scotland.gov.uk/Publications/2011/02/01104638/0>

3.5.32 We will monitor and evaluate our programmes and learn lessons from the wider evidence base, including the work of others. In this way, we can be clear about the impact of the programmes and where and how improvements might be made. And, finally, we will continue to recognise that the people of Scotland are at the heart of our climate change ambitions. While the transformation to a low carbon economy will involve significant technological change, our success will depend on the decisions and behaviours of each of us.

## 3.6 The role of the planning system

3.6.1 The planning system is used to make decisions about the future development and use of land in our towns, cities and countryside. It considers where development should happen, where it should not and how development affects its surroundings. The system balances competing demands to make sure that land is used and developed in the long-term public interest.

3.6.2 The planning system has an important role in promoting sustainable development and can help us adapt to climate change and mitigate its effects. Planning will support emissions reduction in sectors such as energy, transport, heat, and waste and is often a critical enabling measure.

3.6.3 The National Planning Framework, Scottish Planning Policy, planning advice, and strategic and local development plans all play their parts in supporting the transition to a low carbon future. Planning authorities review their development plans on a five year cycle. Development plans prepared after the publication of this second Report on Policies and Proposals are expected to include policies which will support the transformational change required to meet our climate change targets. In the context of public bodies duty obligations, avoiding further levels of assessment will help to maintain planning performance. Activities within the planning system include:

- The transition to a low carbon economy has been identified as a key theme for the third National Planning Framework (NPF3);
- The Spatial Planning Assessment for Climate Emissions (SPACE) tool will ensure that the implications for greenhouse gas emissions of alternative spatial planning options are factored into decision-making;
- The expansion of renewable energy generating capacity is strongly supported by national planning policy;

- Sustainable and active travel are promoted by Scottish Planning Policy and the National Planning Framework;
- We are supporting planning authority work on heat mapping to inform future strategic and local policy on the development of heat networks; and
- Scottish Planning Policy provides clear guidance on development and flood risk, and a replacement Planning Advice Note on Flooding, Water and Drainage will be published in 2013.

3.6.4 We will consider how national planning policy can further assist in delivering emissions reduction in support of our annual targets. The reduction of emissions will continue to be a major consideration in the planning system's promotion of sustainable places. Public consultations on National Planning Framework 3 and Scottish Planning Policy will help to inform those key planning policies.

#### **The role of the Scottish Government**

The Scottish Government can help to foster low carbon initiatives in areas as diverse as the development of carbon capture and storage and the expansion of renewables, renewable heat and district heating by maintaining a supportive planning system. The current Second National Planning Framework (NPF2) sets out a spatial strategy for Scotland's development to 2030 taking forward the spatial aspects of the Scottish Government's policy commitments on climate change, sustainable economic growth and renewable energy. The Scottish Government is presently consulting on the third National Planning Framework<sup>90</sup> and a revised Scottish Planning Policy.

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<sup>90</sup> The Scottish Government, National Planning Framework 2: Action Programme:  
<http://www.scotland.gov.uk/Topics/Built-Environment/planning/National-Planning-Policy/npf/NPF3>

# 4.

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# ENERGY



## 4. Energy

The way we produce and use energy is central to tackling climate change and creating a low carbon economy.

### 4.1 Our ambitions for decarbonising Scotland's energy supply

4.1.1 Our aim is to achieve secure, affordable and low carbon energy supplies for the long term by both **reducing our demand** for energy and **decarbonising** the means by which that energy is produced. We will also develop our role as a supplier of low carbon energy to our neighbours.

4.1.2 The first Report on Policies and Proposals (RPP1) indicated that Scotland aims to reduce the demand for energy and decarbonise its energy supply in order to provide secure and low carbon energy supply for the long term. It outlined that dramatic progress had already been made in harnessing Scotland's vast potential for renewable electricity generation. The case for change remains as strong as ever, and the progress being made has continued over the last two years.

4.1.3 Our 2020 energy targets set out our aim to make significant progress toward decarbonisation by 2020 (in line with those of the EU):

- meet at least 30% overall energy demand from renewables by 2020;
- reduce total final energy demand in Scotland by 12% by 2020, covering all fuels and sectors;
- source 11% of heat demand and 10% of transport fuels from renewables by 2020;
- delivering the equivalent of at least 100% of gross electricity consumption from renewables by 2020 with an interim target of the equivalent of 50% of gross electricity consumption from renewables by 2015;
- enable local and community ownership of at least 500 MW of renewable energy by 2020;
- demonstrate carbon capture and storage (CCS) at commercial scale in Scotland by 2020 with full retrofit across conventional power stations thereafter by 2025-30; and
- seek transmission system upgrades and increased interconnection capable of supporting the projected growth in renewable capacity.

4.1.4 Emissions from energy cut across several sectors of the Scottish economy, i.e. transport fuels, space heating and industrial processes, not just the energy supply sector itself. In this section we focus primarily on decarbonising Scotland's electricity supply.

## 4.2 Our ambitions for decarbonising Scotland's electricity supply

4.2.1 Our policy on electricity generation was set out in the draft Electricity Generation Policy Statement (EGPS), published in March 2012.<sup>91</sup> The Statement said that Scotland's generation mix should deliver:

- a secure source of electricity supply;
- at an affordable cost to consumers;
- which can be largely decarbonised by 2030; and
- which achieves the greatest possible economic benefit and competitive advantage for Scotland including opportunities for community ownership and community benefits.

4.2.2 Renewable energy comes from natural resources such as sunlight, rain, wind, tides and waves. These resources are renewable because they are naturally replenished. Deploying **renewables in Scotland** will: enhance security of supply by broadening the base of our electricity generating mix; minimise consumer exposure to future reliance on volatile and rising fossil fuel prices; and deliver obvious economic benefits to Scotland. The development of more renewables will also lead to decarbonisation of the supply to the electricity grid and provide greater scope for the deployment of **electrified heating and transportation** systems in the future.

4.2.3 Our ambitions for renewables and the delivery of clean electricity in Scotland go beyond our current 2020 targets. We have therefore set a **2030 decarbonisation target**, to achieve a carbon intensity of 50 gCO<sub>2</sub>/kWh of electricity generation in Scotland. This is in line with the Committee on Climate Change's recommendations for the UK Government. The CCC has also provided advice to us on the downward path of emissions from the electricity industry from 2010 through to 2030.<sup>92</sup>

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<sup>91</sup> Draft Electricity Generation Policy Statement:  
[www.scotland.gov.uk/Topics/Business-Industry/Energy/EGPS2012](http://www.scotland.gov.uk/Topics/Business-Industry/Energy/EGPS2012)

<sup>92</sup> The Committee on Climate Change advice to the Scottish Government:  
[www.scotland.gov.uk/Topics/Environment/climatechange/what-is/expertadvice/advisorybody](http://www.scotland.gov.uk/Topics/Environment/climatechange/what-is/expertadvice/advisorybody)



4.2.4 The targets are challenging but we are confident that we will be able to achieve them. We are making good progress, with renewable generation in Scotland hitting a record high of 36.3% of gross consumption in 2011, well above our 31% interim target for that year (see chart 4.2). Provisional figures for 2012 show a further increase to almost 39% of gross consumption.

4.2.5 Delivery of the 100% renewable electricity target will play a crucial role in the delivery of the long-term 2030 decarbonisation target. The modelling for RPP2 shows that successful delivery of the 100% target plus the progressive deployment of CCS through the 2020s means that our new 2030 electricity decarbonisation target could actually be hit a little earlier, perhaps closer to 2027. (See box 'Our central scenario beyond 2020' on page 99.)

4.2.6 Scotland's electricity mix and associated CO<sub>2</sub>e emissions are influenced by a small number of power plants. Decisions which will be made concerning the closure of existing plant and development of new capacity in Scotland over the next few years will determine whether we will be able to achieve our ambition. The majority of electricity used in Scotland is still generated by plant which was commissioned around 20 years ago, and a sizeable minority by plants over 30 years old. Long-lived generation assets and market decisions on their future operation or replacement will play a significant role in our future fuel mix.

4.2.7 Our decarbonisation target is non-statutory, but will be used to guide our policy approach and will set the context for planning decisions under Section 36 of the Electricity Act 1989 going forward.<sup>93</sup> We need to remain flexible on how best to deliver our target in the light of progress in the world climate change talks, integration of the EU energy market, UK Electricity Market Reform, developments in grid technology and storage, progress in cost reduction of renewables and CCS, and progress in energy efficiency and demand side management.

4.2.8 At this stage, we, like the rest of the UK and our EU neighbours, have not set **electricity targets** beyond 2020 in terms of **specific fuel mixes**. The UK Government has committed to amending the current Draft Energy Bill to take powers to set a decarbonisation target range for 2030 in secondary legislation, and Scottish Ministers will have a role in setting or amending the future target. A decision to exercise this power will be taken once the CCC has provided advice in 2016 on the UK Government's 5th Carbon Budget which covers the corresponding period.

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<sup>93</sup> The Scottish Government: [www.scotland.gov.uk/Topics/Business-Industry/Energy/Infrastructure/Energy-Consents/Guidance](http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Infrastructure/Energy-Consents/Guidance)

## Progress towards decarbonisation of electricity supply

Our aim is to ensure that we have a largely decarbonised electricity system by 2030. Our 2030 decarbonisation target will be to achieve a carbon intensity of 50 gCO<sub>2</sub>/kWh of electricity generation in Scotland.

The Climate Change (Scotland) Act requires a report to the Scottish Parliament on the Carbon Intensity of the Electricity Supply System in Scotland. The carbon intensity of the grid (including estimates of emissions from backup and balancing services) was officially reported to be 347 gCO<sub>2</sub>/kWh in 2010 but is estimated to have fallen to 289 gCO<sub>2</sub>/kWh in 2011 using the same methodology.<sup>94</sup> We propose to use the same indicator to measure progress toward our decarbonisation target. The target therefore represents an 83% reduction in carbon intensity between 2011 and 2030.

## 4.3 Where we are now

4.3.1 Scotland accounts for only around 9% of the UK's total energy consumption, but is rich in energy resources and produces an increasing diversity of energy supply. The energy supply sector covers the production of energy, and in particular the generation of electricity, either in power stations or in large industrial process (like refining). Energy supply in Scotland produced 16.9 MtCO<sub>2</sub>e in 2011, which equated to 33% of Scotland's total in 2011.

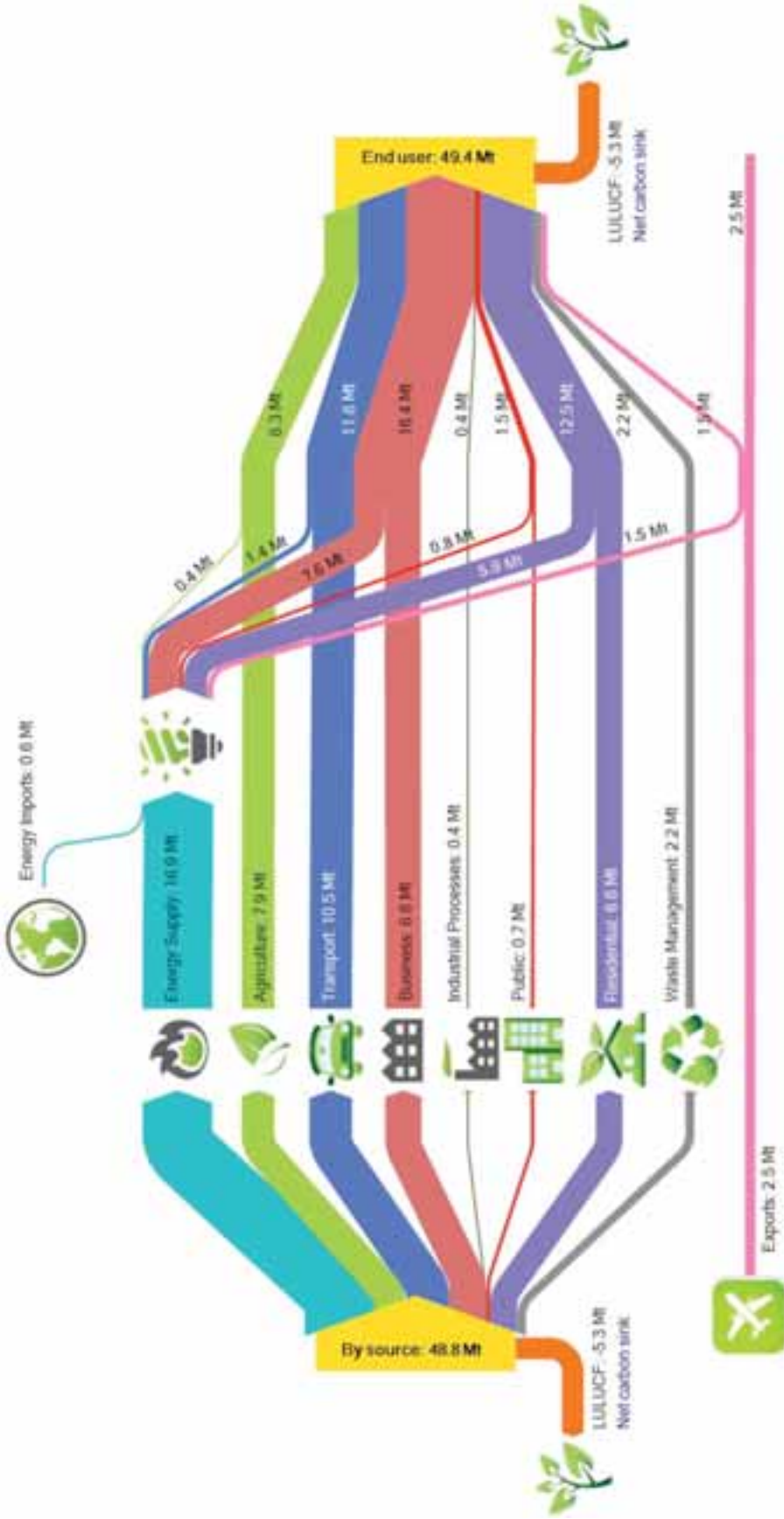
4.3.2 Emissions in the energy supply sector are dominated by installations within the EU ETS, with 94% of energy supply sector emissions in 2011 covered by these EU wide arrangements. As noted earlier in this document (section 2.10), this sector and the other emissions-intensive industries in the ETS are referred to as the 'traded sector'.

4.3.3 Energy supply includes emissions from power generation, refineries, coalmines, solid fuel transformation, oil and gas extraction and processing, and other energy industries. Overall, there has been a slight downward trend in energy supply emissions since the 1990s. This reflects the long lived nature of the coal generation assets, and their greater use toward the end of their working lives due an increased ability to export power to England and Wales.

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<sup>94</sup> The Scottish Government, Report on the Scottish Greenhouse Gas Emissions Annual Target 2010: [www.scotland.gov.uk/resource/0040/00405463.pdf](http://www.scotland.gov.uk/resource/0040/00405463.pdf)

Figure 4.1: Sankey diagram showing by source and end user<sup>95</sup> GHG emission transfers for Scotland in 2011 (Mt CO<sub>2</sub>e)<sup>96 97</sup>



<sup>95</sup> The pink line from 'Energy Supply' to 'End User' represents emissions from energy supply in the production of fuels used in international aviation and shipping.

<sup>96</sup> 'Exports' equates to emissions from international aviation and shipping.

<sup>97</sup> Energy imports (0.6 Mt) represents emissions relating to energy imports/exports. Scotland is a net exporter of electricity but the emissions in the diagram arise due to the use of UK emission efficiencies for electricity production. Scotland produces less GHG emissions per unit of electricity than the UK average.

4.3.4 The energy supply sector produces electricity for use in other sectors and to understand the mitigation potential of a sector it is useful to look at the emissions caused by its total energy use and not only at its direct emissions. The Sankey diagram (figure 4.1) above illustrates the difference between emission estimates by ‘producers’ (‘by source’ reporting – left-hand side of the diagram) and by ‘consumers’, (‘end user’ reporting – right hand side of the diagram). Going from left to right in the diagram, emissions by the energy supply source sector are attributed to the users of electricity in different sectors of the GHG inventory and added to their source emissions to calculate end-user emissions. Emissions from the Land Use Change, Industrial Process and Waste Management sectors are unchanged since no energy emissions are allocated to these sectors.

4.3.5 The main source of emissions in Scotland within this sector is electricity generation at power stations, which accounts for 71.8% of energy supply emissions in 2011 (12.1 MtCO<sub>2e</sub>); refinery emissions account for a further 13.5% (2.3 MtCO<sub>2e</sub>) of the Energy Supply sector emissions in 2011.

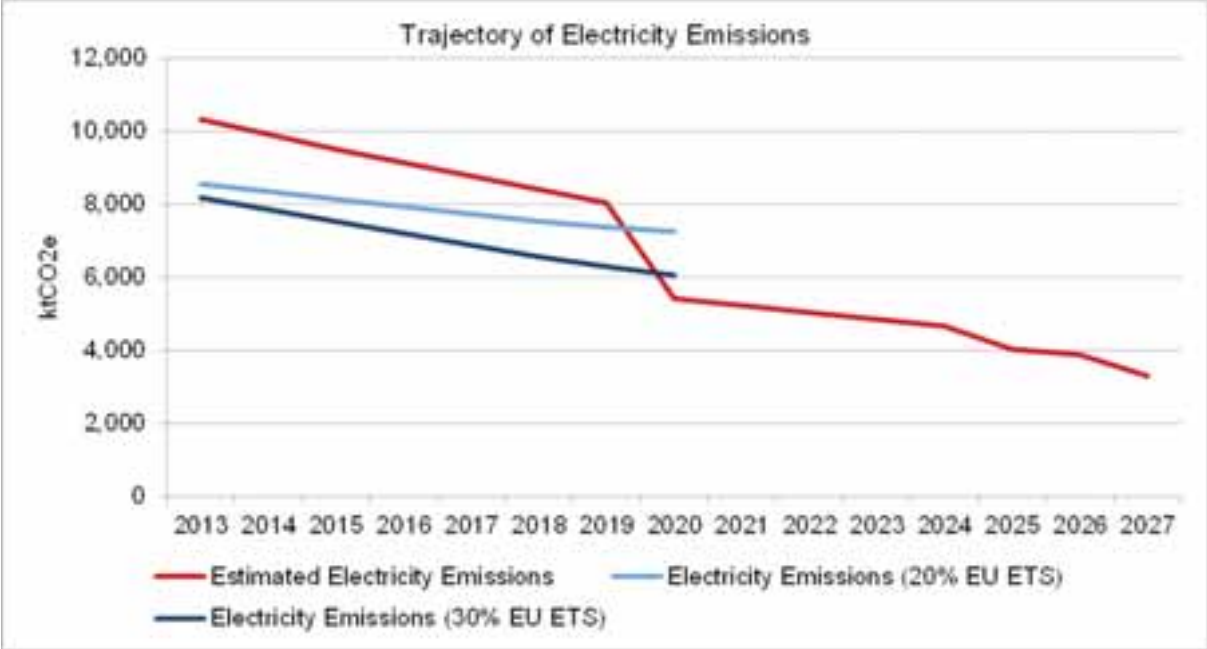
4.3.6 RPP1 outlined that the Net Scottish Emissions Account (NSEA) will track the trajectory of EU ETS emissions rather than Scottish territorial emissions from power generation. This means that a large proportion of Scotland’s emissions are assumed to fall on a pre-determined trajectory, irrespective of actual emissions. In RPP1, therefore, electricity generation policies were considered as ‘enabling policies’, which, although not affecting the NSEA, were vital for the achievement of Scotland’s long term goals. For example, the decarbonisation of the electricity sector is a vital component of decarbonising other parts of the Scottish economy such as transport, which will become increasingly reliant on electricity.

4.3.7 In this RPP2, we outline the progress towards our 2020 targets, and the role that the ETS will play in reducing emissions. Beyond 2020, there is scope for significant further reductions in emissions but there is significant uncertainty over long term policies at UK and EU level. As stated in section 2.10, from 2021 to 2027 the traded sector is presented as ‘**net emissions**’ resulting from estimates of future actual **electricity generation** emissions in Scotland and from the CCC target advice that identifies abatement from **non-electricity generation traded industry**.

4.3.8 Our estimate of electricity emissions beyond 2020 is realistic but ultimately projections of future emissions from the electricity generation sector are highly uncertain. A number of complex and competing factors govern generators’ hourly dispatch decisions, including relative fossil fuel prices, demand, system constraints and wind speed. Future market and investment decisions relating to the building, extension and closure of generating plant are also subject to this uncertainty.

4.3.9 The chart below presents emissions from a plausible generation scenario to 2027, making credible assumptions about thermal plant build and closure dates, average annual running times and the deployment of CCS at demonstration and or at scale. This scenario is designed to give an indication of emissions from the sector by varying the amount of coal, gas and CCS on the system (see box on page 99 for further detail), and compares the profile against the current estimated proportion of emissions from electricity generation in the EU ETS 20% and 30% profiles.

**Chart 4.1: Trajectory of electricity emissions under RPP2**

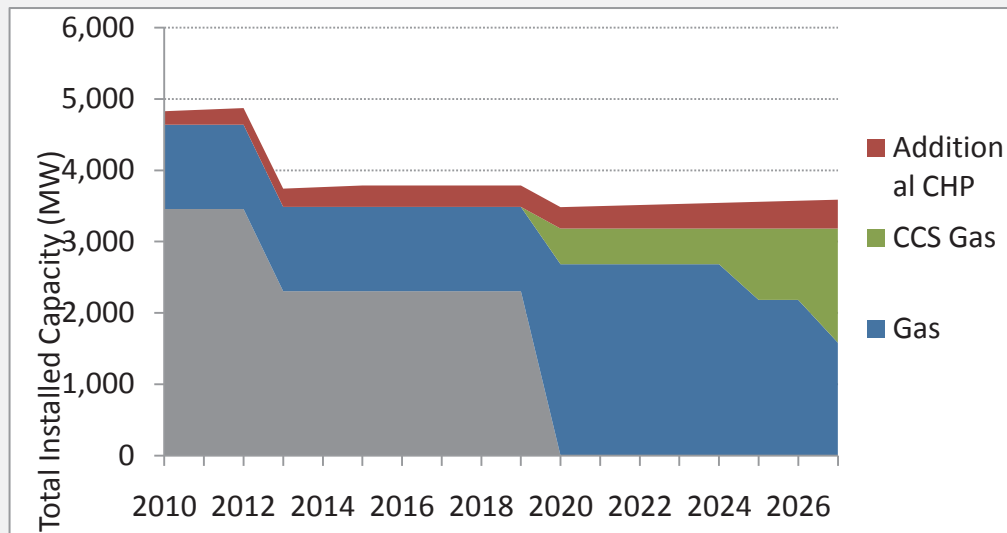


4.3.10 Overall our assessment is that, by 2020, emissions from Scotland’s electricity sector will be substantially lower than today and be broadly in line with the pathway of emissions under the ETS 30% scenario.

4.3.11 Where the supporting narrative below refers to specific plant, this is intended to provide context to the assumptions. The analysis here does not indicate any preference for particular plant, and the equivalent levels of gas, coal and CCS capacity could be delivered by a number of different combinations of generating plant.

## Our central scenario beyond 2020

This chart sets out the total installed coal and gas capacity of the central scenario. The use of unabated gas plant capacity is, in part, to provide peaking plant services; this reflects the fact that the economics of CCS are unlikely to support peaking plant generation in the first instance.



**To 2020:** the scenario assumed that Cockerhills coal fired power station closed in 2013, with Longannet coal fired station closing in 2020, consistent with industry information and the requirements of EU Directives. Peterhead gas fired power station continues to generate. 2 GW of new gas capacity is assumed to come online in 2020, to coincide with the closure of Longannet. It is assumed that 500 MW of CCS demonstration plant is operational by 2020.

**To 2027:** a further 500 MW of CCS is added in 2024-25 building on the experience of the earlier CCS demonstrators. By 2027, a further 600 MW of gas plant adopts CCS, resulting in a total of 1,600 MW of CCS gas plant by 2027, with a further 1,600 MW unabated.

Using the emissions and an aggregate generation figure (consistent with that adopted for the Draft Electricity Generation Policy Statement), this scenario would suggest a **2030 carbon intensity figure below the CCC recommended 50 gCO<sub>2</sub>/kWh.**

With our greater ambition for renewables, especially offshore beyond 2020 and a possible ongoing role for existing nuclear generation, it is plausible that this figure could be even lower with any exported generation also helping the UK Government deliver on its own climate change ambitions and or with increased domestic demand for electricity for use in transport and heat sectors.

4.3.12 The central generation scenario above will benefit from the future role for (non-pumped) electricity storage at scale and increased interconnection. While still in development, there are numerous electricity storage solutions across the globe. Synergies between storage and intermittent renewables can significantly reduce the need for flexible, typically unabated fossil fuel, generation capacity leading to savings for consumers as well as emissions reductions. The Committee acknowledged the importance of the Scottish Government in supporting electricity storage solutions. We are working with the Institute of Mechanical Engineers in Scotland to critically assess the viability and efficacy of these storage options including their potential application across Scotland. Successful delivery of storage solutions in Scotland will help us achieve the targets, and could lead to lower levels of emissions than those set out here.

4.3.13 There are numerous ways the electricity mix could evolve in the years to come and it is important not to be too prescriptive about what the actual mix might look like by 2020. The analysis presented here is consistent with that adopted for the draft EGPS, which includes a need for a minimum of 2.5 GW of upgraded thermal capacity, with any minor variations reflecting the many uncertainties associated with the future.

4.3.14 The analysis is also being enhanced to provide a more comprehensive scenario-based view. We are investing to improve our modelling capability by creating a Scottish specific electricity dynamic dispatch model to allow for more accurate modelling of this nature in the future. This enhanced modelling capacity will not only allow us to provide more sensitivity testing of key variables, but also allow us to better predict net Scottish emissions from the electricity sector. We anticipate the model to be in operation in 2013.

4.3.15 Over the coming months and years, we will continue to develop and enhance our understanding of the complex interaction of policies and investment decisions that will impact upon the electricity sector. We will publish the final Electricity Generation Policy Statement (EGPS) in the summer of 2013, but it will be in subsequent EGPS publications where more detailed analysis, including analysis of 2030 and beyond, will become available.

## 4.4 Decarbonisation policies - our approach

4.4.1 As described elsewhere in this chapter, decarbonisation will be achieved through a range of policies and be dependent upon a number of factors, some of which are beyond the control of the Scottish Government. The policies and proposals identified in this report alongside the Draft EGPS would suggest that the carbon intensity of the grid in Scotland will fall at least in line with the levels outlined by the CCC.

4.4.2 The Draft EGPS examined the way in which Scotland generates electricity and considers the changes required to meet our targets. It looks at the sources from which that electricity is produced, the amount of electricity which we use to meet our own needs, and the technological and infrastructural advances and requirements which Scotland will require over the coming decade and beyond. These are set out in more detail below.

4.4.3 Alongside a substantial further growth in renewables, Scotland will maintain and build new power stations run on traditional fossil fuels. This thermal generation will form our base-load generation capacity and flexible element of our energy supplies. Our aim is that Scotland's thermal generation will be decarbonised over time through the increased application of CCS. CCS has the potential to substantially reduce emissions from fossil fuel power stations and will be a vital element of a decarbonised power sector by 2030. Section 4.7 provides further detail on CCS.

### Scotland's Targets for Renewable Electricity

We are aiming for an output equivalent to 100% of Scotland's demand for electricity to be met from renewables by 2020. But this does **not** mean that Scotland will be 100% dependent on renewables generation; renewables will form a vital part of a wider electricity mix, supported by continuing need for a minimum of 2.5 GW of upgraded clean thermal baseload. The electricity generation mix that we see as likely and necessary for Scotland is set out in our revised Draft Electricity Generation Policy Statement.

4.4.4 The deployment of renewable electricity and CCS in Scotland will not only help to enhance security of supply, minimise consumer exposure to volatile and rising fossil fuel prices and deliver obvious economic benefits to Scotland. It will also lead to decarbonisation of Scotland's electricity supply and provide greater scope for the deployment of electrified heating and transportation systems.



## Draft Electricity Generation Policy Statement

The Draft EGPS was published in March 2012 for consultation along with an accompanying Environmental Statement. Our aim is to achieve a secure, affordable and sustainable supply of electricity, including:

- **Energy demand reduction** – detailed in our Energy Efficiency Action Plan, towards our target of a 12% reduction in total final energy consumption by 2020;
- **Renewable energy sources** – our Renewables Routemap outlines the importance of renewable sources, including our targets that 50% of Scotland’s gross electricity consumption be provided by renewables by 2015 and 100% by 2020, and our target for at least 500 MW of renewable energy (electricity and heat) to be in local and community ownership by 2020;
- **Carbon Capture and Storage (CCS)** – our policy is that renewable generation should operate alongside upgraded and more efficient thermal stations, and that there should be a particularly strong role for CCS, where Scotland has the natural advantages and resources which could enable it to become a world leader, with the central North Sea thought to be capable of storing as much as 100 MtCO<sub>2e</sub> per year up to 2030 and 500 MtCO<sub>2e</sub> per year beyond 2030.
- **Nuclear** – we are opposed to any new build of nuclear power stations in Scotland. The existing stations will be phased out in Scotland over time, with no new nuclear build taking place in Scotland. We have, however, consistently stated that, subject to the relevant safety cases being approved by the Office for Nuclear Regulation, we do not see that this precludes extending the operating life of Scotland’s existing nuclear stations to help maintain security of supply over the next decade while the transition to renewables and cleaner thermal generation takes place. As such, we did not oppose the life extension of Hunterston B Nuclear Power Station to 2023 announced by EDF Energy in December 2012.
- **Bioenergy** – our policy is that biomass should be used in the most efficient and beneficial applications at a scale that is appropriate to make the best use of finite bioenergy supplies, i.e. in heat-only or Combined Heat and Power (CHP) applications and off gas-grid solutions. In this way, biomass can make an appropriate contribution to meeting the Scottish Government’s target of 11% of heat demand to be sourced from renewables by 2020.

- **Role of electricity storage** – we support the development of electricity storage solutions, which, while financially and technologically challenging, can help address the variability of certain forms of renewable generation.
- **Transmission and distribution** – we recognise the need for extensive new onshore and offshore grid development and reinforcement in Scotland and strengthened connections within and across the UK. The Scottish Government works closely with UK Government, Ofgem and Transmission System Owners to plan and deliver the grid upgrades needed to deliver Scotland’s future grid. As a result of this work, Ofgem is fast-tracking up to £7 billion worth of grid upgrades in Scotland to boost capacity and better connect and transport Scotland’s electricity. We also continue to press for changes to the regulatory regime to accelerate deployment of our onshore and offshore resources – in particular an equitable outcome on charging.
- **Interconnection** - beyond the GB system and in Europe we are pushing the importance of developing more and better interconnection from Scotland to other parts of the UK, the Nordic countries and Europe. This includes working to deliver cross-border offshore grid connections in the seas between Scotland and Ireland, as set out in the Irish Scottish Links on Energy Study (ISLES). It includes supporting projects of interconnection to Norway and Europe and working with EU partners on developing a North Sea electricity transmission grid.

4.4.5 Within the context of an integrated GB market for electricity, Scotland has its own policies and support measures aimed at influencing electricity demand and supply. Our policies will deliver substantial reductions in emissions and a substantial increase in low carbon electricity **exports** from Scotland by 2020, while maintaining security of supply within Scotland.

4.4.6 Those exports will **increase substantially** in the 2020s as Scottish-based renewable energy and low carbon electricity generators secure their position as the most competitive producers of low carbon electricity in an increasingly integrated European market.

## 4.5 Energy demand reduction

4.5.1 Our ability to reduce total final energy demand in Scotland by 12% by 2020 is critical to meeting our other targets in a cost-effective way. Electricity use is likely to rise in the long term as more is used for transport and heat.

Energy efficiency is the simplest and most cost-effective way to reduce emissions whilst seeking to maximise the efficiency of our renewable energy resources. It complements our other energy-related strengths, and applies across housing, business, and transport to help us create a more sustainable Scotland. Energy efficiency measures relevant to particular sectors are detailed in the corresponding sectoral chapters in this document.

4.5.2 We published the Energy Efficiency Action Plan (EEAP) in 2010 and progress reports in 2011 and 2012. We have recently completed a formal review of the plan which includes the 2013 progress report.<sup>98</sup> The EEAP established a target to reduce total final energy demand in Scotland by 12% by 2020 from a 2005-7 baseline, covering all fuels and sectors. The data for 2010 showed a 1.2% increase in consumption compared to 2009 due in part to the economic recovery from the previous year and a particularly cold winter. However consumption in 2010 was still 6.2% lower than the 2005-2007 baseline against which the 12% Energy Efficiency Target is measured. This shows that we are on track to meet that target

## 4.6 The role of renewable electricity

4.6.1 In October 2012, we published an update to our 2020 Routemap for Renewable Energy in Scotland, summarising progress made over the past year, as well as considering what still needs to be done and the ways in which we are approaching these tasks.<sup>99</sup>

4.6.2 With DECC statistics showing Scotland met the equivalent of 36.3% of its electricity demand from renewables in 2011 and provisional figures for 2012 suggesting this rose to almost 39% in 2012, the update sets a new and more ambitious target of the equivalent of 50% of Scotland's electricity demand met from green power by 2015 - an achievable target based on the sector's rapid progress. This target will keep Scotland on the delivery path to meet the equivalent of 100% of Scotland's electricity demand from renewable sources by 2020.

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<sup>98</sup> Scottish Government, Energy Efficiency Action Plan - Formal Review and Annual Report 2013: [www.scotland.gov.uk/Publications/2013/05/2162](http://www.scotland.gov.uk/Publications/2013/05/2162)

<sup>99</sup> The Scottish Government, 2020 Routemap for Renewable Energy: [www.scotland.gov.uk/Resource/0040/00406958.pdf](http://www.scotland.gov.uk/Resource/0040/00406958.pdf)

Chart 4.2: Electricity generation from renewables in Scotland



We are on track to meet our renewable electricity targets. Electricity generation from renewables was at a record high in 2011, and figures published in December 2012 confirmed that we exceeded our interim target for the equivalent of 31% of electricity demand to be generated from renewables by the end of 2011.<sup>100</sup>

The provisional renewable electricity generation figure for Scotland during 2012 is 14,646 GWh – up 6.7% on 2011, the previous record year for renewables.<sup>101</sup>

Provisional figures for 2012 show that the equivalent of around 39% of Scotland’s electricity needs were met by renewable sources (using 2011 gross consumption as a proxy for 2012).<sup>102</sup>

4.6.3 The Scottish Government’s support for renewable electricity is delivering huge savings in greenhouse gas emissions across the UK. DECC estimated that Scottish renewable generation displaced 8.3 MtCO<sub>2</sub>e across the UK electricity grid in 2011. These savings will increase further in line with our renewables deployment, highlighting the role that renewables can play in combating climate change.

<sup>100</sup> Scottish Government: [www.scotland.gov.uk/Topics/Statistics/Browse/Business/TrenRenEnergy](http://www.scotland.gov.uk/Topics/Statistics/Browse/Business/TrenRenEnergy)

<sup>101</sup> Scottish Government: [www.scotland.gov.uk/Resource/0041/00417390.pdf](http://www.scotland.gov.uk/Resource/0041/00417390.pdf)

<sup>102</sup> Scottish Government: [www.scotland.gov.uk/News/Releases/2013/03/Energy-figures-28032013](http://www.scotland.gov.uk/News/Releases/2013/03/Energy-figures-28032013)

4.6.4 Scotland's seas will play a huge role in this expansion beyond 2020. We are already investigating, through the marine planning process, the potential for additional sites for offshore wind, wave and tidal energy. These could provide the capability to more than double capacity and production from these sources, with at least an extra 10 GW of potential supply for domestic use or export.

4.6.5 In terms of validation of this progress, the Scottish Government has welcomed the recent central finding by the Economy, Energy and Tourism Committee that our renewable energy target for electricity generation is achievable, subject to a number of issues being addressed.<sup>103</sup>

4.6.6 Our **Renewables Obligation (Scotland)**<sup>104</sup> is an obligation on electricity suppliers to source an increasing proportion of electricity from renewable sources, which works alongside the other UK Renewables Obligations

4.6.7 The Scottish Government continues to work with the UK Government on the proposals to reform the Electricity Market in the UK Energy Bill. These are discussed later in this chapter. We also have a range of funding programmes and initiatives such as the National Renewables Infrastructure Fund, our Community and Renewable Energy Scheme and funds for to support the development of offshore wind and the commercialisation of marine renewables. More details of these can be found in the Funding and Financing section earlier in the document.

4.6.8 The Scottish Government is committed to innovation and research, aimed at driving the development and deployment of renewable generation. Innovations include the Saltire Prize,<sup>105</sup> the Scottish European Green Energy Centre (SEGEC),<sup>106</sup> the European Marine Energy Centre (EMEC),<sup>107</sup> and the revised approach to low carbon innovation set out in our Low Carbon Economic Strategy.<sup>108</sup>

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<sup>103</sup> The Scottish Parliament: [www.scottish.parliament.uk/S4\\_EconomyEnergyandTourismCommittee/eeR12-07.pdf](http://www.scottish.parliament.uk/S4_EconomyEnergyandTourismCommittee/eeR12-07.pdf)

<sup>104</sup> Renewables Obligation Scotland: [www.scotland.gov.uk/Topics/Business-Industry/Energy/Obligation-12-13](http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Obligation-12-13)

<sup>105</sup> Saltire Prize: [www.saltireprize.com/](http://www.saltireprize.com/)

<sup>106</sup> The Scottish European Green Energy Centre: [www.segec.org.uk/](http://www.segec.org.uk/)

<sup>107</sup> The European Marine Energy Centre: [www.emec.org.uk/](http://www.emec.org.uk/)

<sup>108</sup> The Scottish Government: [www.scotland.gov.uk/Publications/2010/11/15085756/0](http://www.scotland.gov.uk/Publications/2010/11/15085756/0)

## 4.7 The role of carbon capture and storage

4.7.1 Our ambition is for Scotland to lead the UK and EU in the development of Carbon Capture and Storage (CCS), and to maximise our comparative economic advantage through demonstrating this technology. CCS should be economically and technically proven by 2020 and progressively fitted to all coal and gas thermal plants in Scotland by 2030 to ensure full decarbonisation of the electricity supply.

### Carbon Capture and Storage

Two Carbon Capture and Storage (CCS) projects are putting Scotland at the forefront of CCS development and deployment: the CCGT station at Peterhead; and the Captain Clean Energy Project at Grangemouth Port.

In March 2013, DECC announced that the Peterhead CCS Project had been awarded preferred bidder status in the CCS Commercialisation Programme Competition, while the Captain Clean Energy Project would remain as a reserve bidder. DECC is negotiating terms for a Front End Engineering Design (FEED) study with Shell/SSE, which should be concluded by summer 2013. The Captain Clean Energy Project could still be considered for FEED funding if negotiations with one of the two preferred bidders fail. However, it is hoped that the project could continue through the alternative support mechanisms (Contract for Difference) proposed in the Electricity Market Reform process.

**Peterhead:** a 340 MW post-combustion capture retrofitted to part of an existing 1,180 MW Combined Cycle Gas Turbine power station at Peterhead. This project is led by Shell and SSE.

**Grangemouth-Captain Clean Energy Project:** a proposal for a new 570 MW, fully-abated coal Integrated Gasification Combined Cycle (pre-combustion) project in Grangemouth, with storage in offshore depleted gas fields. This project is led by Summit Power, involving Petrofac (CO<sub>2</sub> Deepstore) National Grid and Siemens.

4.7.2 Scotland is well-placed to take a lead on CCS and to capitalise on its position as the EU's largest potential offshore CO<sub>2</sub> store. Our CCS Roadmap, published in 2010, and the more recent Scottish Enterprise report '*Central North Sea CO<sub>2</sub> Storage Hub - Enabling CCS deployment in the UK and Europe*' highlight that Scotland has considerable advantages in CO<sub>2</sub>

storage.<sup>109, 110</sup> We have the knowledge and expertise in our universities and industry, the infrastructure in the North Sea, and the strong leadership within Government necessary to make this happen.

4.7.3 The Scottish Government has participated in the CCS Cost Reduction Taskforce (a short-life, industry led joint taskforce established by DECC). In its final report in May 2013, the taskforce highlighted the clear potential of CCS to be cost competitive compared with other forms of low carbon power generation, and deliver electricity at a levelised cost approaching £100 per MW hour by the early 2020s, and significantly below £100 per MW hour soon thereafter.<sup>111</sup> In order to achieve this, action will be required in all parts of the CCS chain, particularly with regards to CO<sub>2</sub> storage.

## 4.8 Oil and gas

4.8.1 The oil and gas industry will play an essential role in the development of a low carbon economy in Scotland. At present, direct emissions from the sector do not form part of Scotland's emissions inventory, but the Scottish Government is committed to continued membership of the EU ETS as the best way to ensure the industry recognises and manages the wider carbon costs of its activity.

4.8.2 The oil and gas sector is Scotland's largest by value. Gross Value Added for the Extraction of Oil and Gas in Scotland was around £22 billion in 2012.<sup>112</sup> The skills, infrastructure and resources of the sector must therefore become the basis of a successful transition to a low carbon economy. The central long-term task is the cross-sector transfer of skills and infrastructure. Scotland's unparalleled knowledge of deep water engineering, for example, will support the nascent offshore wind and marine renewable energy industry. Analysis by Scottish Enterprise has shown that the use of the oil and gas supply chain has the potential to bring substantial cost efficiencies, reducing the cost of offshore wind installation and operation by 20%. CCS technology also rests on the maintenance of key infrastructure in the North Sea, bringing the potential to store immense volumes of carbon undersea.

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<sup>109</sup> The Scottish Government: [www.scotland.gov.uk/Topics/Business-Industry/Energy/Infrastructure/Energy-Consents/Thermal-Guidance/CCS-roadmap](http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Infrastructure/Energy-Consents/Thermal-Guidance/CCS-roadmap)

<sup>110</sup> Scottish Enterprise: [www.scottish-enterprise.presscentre.com/Media-library/Central-North-Sea-CCS-Storage-Hub-report-3dd.aspx](http://www.scottish-enterprise.presscentre.com/Media-library/Central-North-Sea-CCS-Storage-Hub-report-3dd.aspx)

<sup>111</sup> The Department for Energy and Climate Change: [www.gov.uk/government/policy-advisory-groups/ccs-cost-reduction-task-force](http://www.gov.uk/government/policy-advisory-groups/ccs-cost-reduction-task-force)

<sup>112</sup> The Scottish Government (2013) - Scottish National Accounts Project: <http://scotland.gov.uk/Topics/Statistics/Browse/Economy/SNAP>

4.8.3 More widely, the value chain that supports offshore extraction is the same valuable, interlinked set of industries that will ultimately support the commercial exploitation of low carbon goods, products and services. The Scottish Government has implemented a range of measures, most notably, the recent Renewable Energy Investment Fund, to encourage investment in this cross-sectoral transition.

## 4.9 Grid infrastructure and consents for renewable generation

4.9.1 We are supporting initiatives to **enhance grid interconnections** between Scotland and the rest of the UK and to Europe: the Scottish Government is working as part of the North Seas Countries Offshore Grid Initiative, focusing on the European priority of developing the Northern Seas Grid Infrastructure; and working with the Irish and Northern Irish Governments to promote grid interconnections cross border trade of renewable energy in the Irish Sea and Atlantic.

4.9.2 Our section 36 guidance sets out policy and process for the application to Scottish Ministers for consent of renewable generation, as well as the Scottish Government's role and responsibility for determining applications for improvements to the electricity grid.<sup>113</sup> Individual planning authorities can influence the development of renewables through their responses to Ministers' consultation, through the local development plan policy and through their own role in determining development proposals. The Scottish Government has developed an on-line resource to support planning authorities in considering the development of wind energy in their areas.

4.9.3 In the case of onshore wind, spatial frameworks prepared by planning authorities help to steer wind farms over 20 MW (and under if considered appropriate) to the best locations. Policy criteria set out in the development plan for deciding applications provides a clear indication of the potential for wind farms of all scales. The Scottish Government has developed on-line renewables planning advice to support planning authorities in preparing spatial frameworks and for considering the development of wind energy in their areas.<sup>114</sup>

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<sup>113</sup> The Scottish Government: [www.scotland.gov.uk/Topics/Business-Industry/Energy/Infrastructure/Energy-Consents/Guidance](http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Infrastructure/Energy-Consents/Guidance)

<sup>114</sup> The Scottish Government: [www.scotland.gov.uk/Topics/Built-Environment/planning/National-Planning-Policy/themes/renewables](http://www.scotland.gov.uk/Topics/Built-Environment/planning/National-Planning-Policy/themes/renewables)



## 4.10 Energy market – powers and regulation

4.10.1 The way in which energy markets and energy generation, transmission and supply are regulated is vital to our decarbonisation plans. This applies to the market incentives for different kinds of renewable energy production, as well as for developing connections to the UK and Europe for the export of energy and ensuring security of Scotland's future energy supply.

4.10.2 Scotland's renewables targets, and their reliance on being able to support, develop and export (across the UK and Europe) energy from a wide range of technologies, require a framework which is stable, and which supports the production of renewable energy in a sensible and sustainable way. This is why we retain a profound interest in the progress of the UK's Electricity Market Reform (EMR) proposals, and in changes to the relationship between governments and the UK energy regulator Ofgem contained in the UK Energy Bill.<sup>115</sup>

4.10.3 The Energy Bill was introduced to the UK Parliament in November 2012 and the Scottish Government is working closely with UK counterparts on the detail. The EMR contains proposals for fundamental reform of the electricity market, built around four mechanisms:

- a **Carbon Price Floor**, to tax fossil fuel electricity generation in relation to the amount of CO<sub>2</sub> emitted, thereby improving the relative economics of low carbon generation;
- a system of long-term contracts, known as a '**Feed-in-Tariff with Contract-for-Difference**' (FiT CfD), to provide a high level of certainty on revenue streams for low carbon generators, thereby encouraging investment in such generation. This would replace the current Renewables Obligation (RO);
- a **Capacity Mechanism** to help ensure security of supply by providing payments to ensure availability of sufficient generation capacity; and
- an **Emissions Performance Standard**, to limit the permitted CO<sub>2</sub> emissions from fossil fuel-powered electricity stations.

4.10.4 We welcome these reforms and the UK Energy Bill and intend to work with the grain of the GB energy market now and into the future. But we are clear that the EMR must build on Scotland's strengths and successes

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<sup>115</sup> DECC, Maintaining UK Energy Security: [www.gov.uk/government/policies/maintaining-uk-energy-security--2/supporting-pages/electricity-market-reform](http://www.gov.uk/government/policies/maintaining-uk-energy-security--2/supporting-pages/electricity-market-reform)

and not undermine them in any way. It is in the interests of both Scotland and the UK to protect the strong industry and investor confidence and growth we are delivering across the Scottish Energy Sector, renewables in particular, and in thermal generation and carbon capture and storage technologies.<sup>116</sup>

4.10.5 We are committed to this work and to working with our UK counterparts. Our commitment echoes the wishes of the Scottish Parliament which, in May 2013 voted in favour of a motion which welcomed;

*“the continuing commitment of the Scottish Government to work within an integrated UK market framework; ...the importance of the electricity market reform proposals in maintaining investor confidence in Scotland in both renewable and carbon capture and storage technologies and supports the Scottish Government’s working to secure the best possible outcome for Scotland’s electricity supply industry and consumers; ...welcomes the role of the Scottish Government in the Energy Bill, including setting the level of the UK decarbonisation target range.”<sup>117</sup>*

4.10.6 To help deliver this commitment, we have agreed to take forward a **joint concordat** with the UK Government to set out the roles and responsibilities under EMR and to embed the principles of good working practices in an enduring framework. This will be published in summer 2013.

4.10.7 Given the complex interface between reserved and devolved areas of competence affected by electricity market reform, Scottish Ministers will have a statutory consultation role in relation to the following aspects of the Energy Bill:

- design and delivery of the **Contracts for Difference** scheme;
- transition to a **fixed Renewable Obligation Certificate (ROC)** from 2027;
- making of regulations in relation to the interpretation of the **Emissions Performance Standard**, its application to additional cases or modifications and in the event the EPS is suspended;
- setting the level of the **UK decarbonisation target range** in secondary legislation; and
- development of **Ofgem’s Strategy and Policy Statement**.

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<sup>116</sup> For more information on the Scottish Government position on EMR, please see our website at [www.scotland.gov.uk/Topics/Business-Industry/Energy/Infrastructure/Grid-Connections/EMR-consultation-UK](http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Infrastructure/Grid-Connections/EMR-consultation-UK)

<sup>117</sup> The Scottish Parliament: [www.scottish.parliament.uk/parliamentarybusiness/28862.aspx?r=8147](http://www.scottish.parliament.uk/parliamentarybusiness/28862.aspx?r=8147)

4.10.8 The Emissions Performance Standard (EPS) and its application in Scotland give rise to a Legislative Consent Motion (LCM) in the Scottish Parliament. This has been considered by the Economy, Energy and Tourism Committee which has agreed to recommend that Parliament approve the LCM.<sup>118</sup>

4.10.9 While the EPS is a useful tool in strengthening the incentives for CCS on any new coal-fired plant, we are clear that the EPS on its own will not deliver the Scottish Government's 2030 decarbonisation target and should be seen in the context of wider policies and powers including our policy on thermal generation with Carbon Capture and Storage and planning powers.

## 4.11 Costs and benefits of a low carbon energy mix

4.11.1 A continuing supply of electricity is essential for our economy and society. It will however require significant investment. As electricity generating assets reach the end of their operational life, they will need to be replaced with a diverse mix of generating technologies. Alternative and innovative methods of generation will replace traditional technologies reliant on carbon intensive fossil fuels. Our aim is to ensure that these costs are as low as possible, and affordable to consumers.

4.11.2 Energy price rises experienced in the previous decade have been largely driven by the rising international price for gas. Ofgem's Project Discovery report points out that the next decade could be characterised by far greater price hikes and volatility if energy supplies are more reliant on fossil fuels than low carbon sources.<sup>119</sup> Policies to decarbonise the electricity generation sector are key to breaking the link between electricity prices and uncertain fossil fuel prices.

4.11.3 Analysis by the Committee on Climate Change<sup>120</sup> shows that energy bills have increased significantly in recent years. This is mainly due to increases in the international price of gas and investment in electricity and gas networks (contributing 62% and 16% respectively of the increase in household energy bills since 2004). The impacts are smaller for support for low carbon technologies and support for energy efficiency improvement (less than 10% each of the increase in household bills since 2004).

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<sup>118</sup> For a copy of the Economy, Energy and Tourism Report on the Legislative Consent Memorandum on the Energy Bill see:

[www.scottish.parliament.uk/S4\\_EconomyEnergyandTourismCommittee/Reports/eeR-12-07w.pdf](http://www.scottish.parliament.uk/S4_EconomyEnergyandTourismCommittee/Reports/eeR-12-07w.pdf)

<sup>119</sup> Ofgem, Project Discovery: [www.ofgem.gov.uk/Markets/WhlMkts/monitoring-energy-security/Discovery/Pages/ProjectDiscovery.aspx](http://www.ofgem.gov.uk/Markets/WhlMkts/monitoring-energy-security/Discovery/Pages/ProjectDiscovery.aspx)

<sup>120</sup> Committee on Climate Change, Energy prices and bills – impacts of meeting carbon budgets: [www.theccc.org.uk/publication/energy-prices-and-bills-impacts-of-meeting-carbon-budgets/](http://www.theccc.org.uk/publication/energy-prices-and-bills-impacts-of-meeting-carbon-budgets/)

4.11.4 The CCC estimates that by 2020, support for low carbon power generation will increase energy bills by around £100, while wholesale gas prices would add £130 under DECC's central scenario. Additionally, increasing network costs will add £55, with smart meters and VAT adding around £5 and £20 respectively. This would be £1,340 in 2020. However, energy efficiency policies and gas boiler replacement have the potential to reduce bills by £145; resulting in a total annual domestic energy bill of around £1,195.

4.11.5 DECC has also produced estimates of the impact of energy and climate change policies on average household energy bills in 2020.<sup>121</sup> This analysis shows that by 2020 the average household's energy bill could be £166 (11%) lower because of the net effect of the energy and climate change policies that have been established.

#### **The value of investment in a low carbon electricity system**

In the longer term, the Scottish Government is confident that investing now in a low carbon future is an economically viable and necessary thing to do. Beyond 2020, low carbon support mechanisms will continue to have a small impact on bills but this will offer greater certainty and reduce exposure to the risks of very high electricity prices under a system dominated by unabated gas generation. The CCC report highlights that if gas prices were to continue to rise, reliance on fossil fuels could mean that the average annual bill in a gas-based system could be as much as £600 higher in 2050 than in a low carbon system.

4.11.6 Beyond electricity, the CCC's advice on the UK Government's fourth Carbon Budget also highlights the importance of a decarbonised electricity supply in order to deliver challenges in heat and transport to meet our ambitious 2050 climate change targets.

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<sup>121</sup>Policy impacts on prices and bills: [www.gov.uk/policy-impacts-on-prices-and-bills](http://www.gov.uk/policy-impacts-on-prices-and-bills)

## Energy: highlights of progress

- Electricity generation from renewables was 36.3% in 2011, exceeding the interim target for the equivalent of 31% of electricity demand to be generated from renewables by the end that year. The progress continues, with renewable generation rising to almost 39% in 2012.
- Scottish Ministers have consented 54 renewable projects since May 2007 - more than double the number for the previous four years.
- The £103 million Renewable Energy Investment Fund<sup>122</sup> was opened for business in October 2012 and will leverage further private finance into green energy projects.
- The £35 million Prototyping for Offshore Wind Energy Renewables Scotland (POWERS) fund will support production of full-scale prototypes of next generation offshore wind turbines.
- The £18 million Marine Renewables Commercialisation Fund will accelerate the deployment of wave and tidal stream arrays in Scottish waters.
- Since May 2007, over 800 grants for community renewables, worth over £16 million were allocated under Community and Renewable Energy Scheme (CARES)
- On 25 April 2013, the Scottish Government announced a new £15 million fund to support innovative foundations for offshore wind in depth of greater than 30 metres. The Scottish Innovation Foundation Technologies Fund, delivered by Scottish Enterprise and Highlands & Islands Enterprise, will be available in two calls, the first of which was in April-May 2013 and the second will be made in Spring 2014.<sup>123</sup>
- The Scottish Government welcomes the reforms to the Electricity Market in the UK Energy Bill and has agreed to take forward a joint concordat with the UK Government to set out the roles and responsibilities under the operation of the Electricity Market Reform.

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<sup>122</sup> Renewable Energy Investment Fund: [www.scottish-enterprise.com/news/2012/10/renewable-energy-investment-fund-open-for-business.aspx](http://www.scottish-enterprise.com/news/2012/10/renewable-energy-investment-fund-open-for-business.aspx)

<sup>123</sup> The Scottish Innovation Foundation Technologies Fund <http://www.scottish-enterprise.com/your-sector/energy/energy-how-we-can-help/energy-funding/innovative-foundations-fund.aspx>

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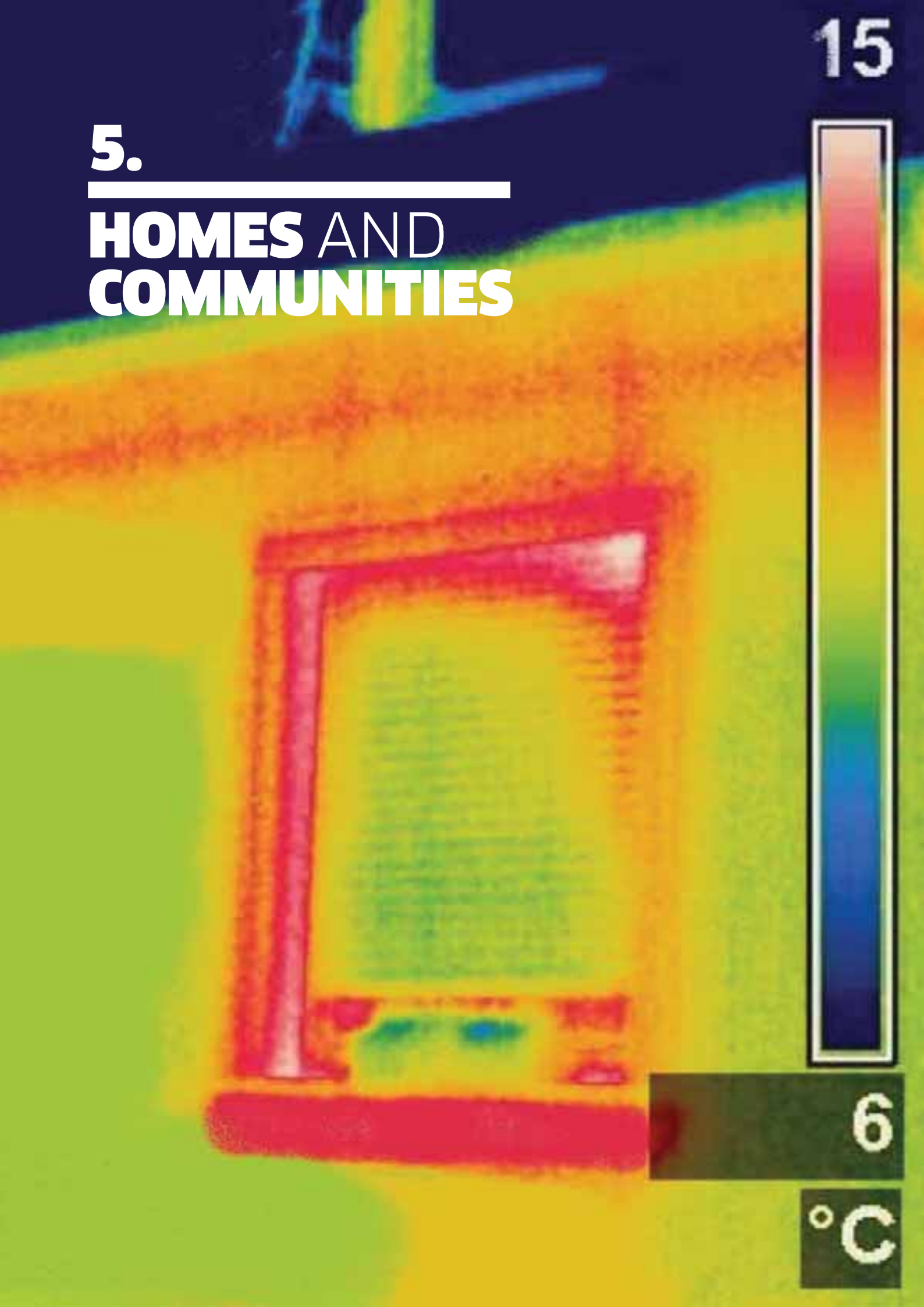
**HOMES AND COMMUNITIES**

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## 5. Homes and Communities

### 5.1 Introduction

5.1.1 Our homes are where we spend much of our lives and choose to relax with our families and friends. We want to make them comfortable, warm and welcoming but, in a time of rising energy costs, this can be expensive. And the way we use energy in our homes and appliances also results in significant greenhouse gas emissions.

### 5.2 Our ambition for homes and communities

5.2.1 Our **Sustainable Housing Strategy (SHS)** sets out our vision for warm, high quality, affordable, low carbon homes and a housing sector that helps to establish a low carbon economy across Scotland. The strategy aims to:

- make sure no-one in Scotland has to live in fuel poverty, as far as practicable, by 2016;
- deliver a step-change in provision of energy efficient homes to 2030 through retrofit of existing housing and improved building regulations for new build homes;
- make a full contribution to the Climate Change (Scotland) Act targets; and
- enable the refurbishment and house building sectors to contribute to and benefit from Scotland's low carbon economy and to drive Scotland's future economic prosperity.

5.2.2 The strategy recognises that, alongside programmes to support the retrofit of Scotland's existing housing stock and a role for standards, there is also a need to transform the market for sustainable housing. We need to address the fact that while energy efficient homes should be warmer and cheaper to run, this is not currently reflected in more favourable lending terms or higher property values. The Sustainable Housing Strategy is based on many of the proposals and policies outlined in this chapter and sets out the action we will take to achieve the kind of change we want to see.

5.2.3 We are also aiming for a largely decarbonised heat sector by 2050 with significant progress towards it by 2030. This could be achieved through a combination of reduced demand and energy efficiency, together with a massive increase in the use of renewable or low carbon heating. We will explain how we intend to achieve this in our Heat Generation Policy Statement, due for publication later in 2013.

5.2.4 We also set the following milestones for 2020:

- every home to have loft and cavity wall insulation, where this is cost-effective and technically feasible, plus simple measures such as draught-proofing and pipe lagging;
- every home heated with gas central heating to have a highly efficient boiler with appropriate controls; and
- at least 100,000 homes to have adopted some form of individual or community renewable heat technology for space and or water heating.

## 5.3 Where we are now

5.3.1 In mid-2011, there were around 2.37 million households in Scotland, occupying 85% of the housing stock we expect to be in place by 2050. Household projections suggest over half a million additional homes will be needed to meet expected demand to 2035.<sup>124</sup> A fifth of our homes are now over 90 years old and a third more than 67 years old. Detached houses, with generally higher emissions than other domestic properties (tenements have the lowest), have dominated the new build market since the early 1980s.

5.3.2 Over three-quarters of the energy we use in our homes is from gas-fired boilers for space and hot water heating. For accounting purposes, emissions from domestic electricity use are part of the 'traded sector'. Therefore, reported emissions from homes arise almost exclusively from our use of gas for heating and cooking. In 2011, the residential sector produced 6.6 MtCO<sub>2</sub>e of greenhouse gas emissions, which was 13% of Scotland's total that year.<sup>125</sup>

5.3.3 Indeed, in 2011, direct (non-electricity) residential emissions were 21% lower than in 2010, and 19% lower than in 1990 - even though the housing stock has increased by more than 371,000 homes since then.<sup>126</sup> Emissions in this sector are volatile as they depend heavily on weather conditions. Although there has been a general downwards trend since 2000, 2010 was one of the coldest winters on record. Household energy costs rose by 76% in real terms between 2000 and 2010 - and may be expected to rise further. Better demand management can bring down energy bills and save money.

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<sup>124</sup> General Register Office for Scotland (2012). Household Projections for Scotland 2010-based.

<sup>125</sup> Scottish Greenhouse Gas Emissions 2011: [www.scotland.gov.uk/Publications/2013/06/1558](http://www.scotland.gov.uk/Publications/2013/06/1558)

<sup>126</sup> There were 2,124,000 dwellings in December 1990 and 2,495,000 in March 2011, the latest figure available.



5.3.4 In March 2013, our independent adviser, the CCC, published its second progress report on Scotland. The Committee commented that we had made steady improvements in the insulation of homes with annual loft insulation rates more than doubling from 40,000 in 2008-09 to 104,000 in 2011-12.<sup>127</sup> More recent data shows that nearly 142,000 lofts were professionally installed in the first three quarters of 2012-13.<sup>128</sup>

5.3.5 This has contributed to the good progress we are making towards our insulation and other 2020 milestones. The Scottish House Condition Survey (SHCS) estimates that by 2011 around 86% of lofts had at least 100 millimetres insulation and 45% had 200 millimetres or more while two-thirds (66%) of cavity walls had been insulated.<sup>129</sup> The SHCS also shows that 125,000 homes reported having gas central heating installed or upgraded in 2011, which indicates that we should be on track for our milestone on efficient gas central heating.

5.3.6 On renewable heat, the Energy Saving Trust estimates 10,800 micro-heat technologies had been installed by 2012. Space and or water heating can also be provided by renewable electricity such as solar PV and the SHCS estimates that, in 2011, around 20,000 homes used some form of renewable heat. Provisional estimates from EST are that around 2,000 homes are connected to renewable district heating out of around 6,000 homes connected to community heating schemes.

5.3.7 The CCC also noted that, although Scotland had missed its annual target for 2010, this could be attributed to an exceptionally cold winter which increased energy demand for heating, particularly in homes. The Committee suggested that in a normal year for temperature the target would have been achieved. It also concluded that underlying progress had generally been good. But there is still remaining potential on loft and cavity wall insulation and a large challenge on solid wall insulation.

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<sup>127</sup> Committee on Climate Change, Reducing emissions in Scotland – 2013 progress report: [www.theccc.org.uk/publication/reducing-emissions-in-scotland-2013-progress-report/](http://www.theccc.org.uk/publication/reducing-emissions-in-scotland-2013-progress-report/)

<sup>128</sup> Energy Saving Trust, CERT Reports: [www.energysavingtrust.org.uk/Organisations/Government-and-local-programmes/Free-resources-for-local-authorities/Homes-Energy-Efficiency-Database/CERT-reports-from-HEED](http://www.energysavingtrust.org.uk/Organisations/Government-and-local-programmes/Free-resources-for-local-authorities/Homes-Energy-Efficiency-Database/CERT-reports-from-HEED)

<sup>129</sup> The Scottish Government, Housing and Regeneration Statistics: <http://www.scotland.gov.uk/Topics/Statistics/Browse/Housing-Regeneration>

## 5.4 Decarbonisation policies and proposals

5.4.1 This section outlines policies and proposals that are driving the decarbonisation of our homes. They include UK and Scottish measures that will increase energy efficiency, provide consumers with improved information on energy use, and facilitate the decarbonisation of heat. The Scottish proposals are being developed or are under consideration by Scottish Ministers.

5.4.2 Table 5.1 shows how the policies and proposals outlined in RPP1 have developed since then and identifies how proposals have changed into policies within RPP2. Table 5.2 summarises the policies and proposals for this sector, highlighting the abatement potential projected to 2020 and 2027, start dates and whether responsibility lies at Scottish or UK level.

5.4.3 Overall, estimated emissions from the homes and communities sector in 2020 are projected to be 5,106 ktCO<sub>2</sub>e once the impact of policies and proposals have been factored in. This is 37% lower than the current figure for 1990 baseline emissions from housing, 8,146 ktCO<sub>2</sub>e.

### Fabric improvement and heating efficiency policies

5.4.4 In April 2013, the Scottish Government launched our national retrofit programme, the Home Energy Efficiency Programmes for Scotland (HEEPS).<sup>130</sup> HEEPS will refurbish or refit Scotland's existing homes to make them more energy efficient. This will save people money on their fuel bills and reduce emissions while providing opportunities for businesses as we develop our low carbon economy. Building on the success of previous schemes, the core of the programme will be area-based strategies, aimed initially at fuel poor areas. National schemes are in place to provide support to vulnerable households outwith the targeted areas.

5.4.5 Local authorities will play a key strategic role in identifying fuel poor areas, and stock that requires upgrading, and develop projects to tackle this. Scottish Government funding of **£79 million** is available in 2013-14 to bring together a range of funding streams and lever maximum investment by the energy companies into Scotland.

5.4.6 We launched our **Warm Homes Fund**<sup>131</sup> in late 2012, to invest £50 million in green energy projects to further help heat homes across the country. The Fund provides grants and loans to install renewable energy

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<sup>131</sup> Warm Homes Fund:

[www.energysavingtrust.org.uk/scotland/Take-action/Get-business-funding/Warm-Homes-Fund](http://www.energysavingtrust.org.uk/scotland/Take-action/Get-business-funding/Warm-Homes-Fund)

measures such as biomass, hydro schemes, wind turbines and solar water heating. Councils and housing associations applying to the fund will be expected to use any income generated from their schemes to improve the energy efficiency of their existing housing. The fund will attract further finance from public and private sources.

### Warm Homes Fund

Pilot schemes in Glasgow and the West Highlands will be the first to benefit from the Warm Homes Fund. West Whitlawburn Housing Cooperative in Glasgow and West Highland Housing Association in Oban will both receive assistance for biomass heating schemes, helping more than 550 households to heat their homes more cost effectively.

5.4.7 Installing energy efficiency measures has traditionally required up-front payment – with the costs being recovered over time. We need to ensure that householders have access to finance for energy efficiency measures. The **Green Deal**<sup>132</sup> is a GB wide policy that enables householders and other occupants of buildings to install energy efficiency improvements without up-front capital costs. Instead, they will pay for them over a period of years through a charge on their electricity bills. At the heart of the Green Deal financial mechanism is the ‘Golden Rule’ that estimated savings on bills should always equal, or exceed, the cost of the improvements undertaken.

5.4.8 While householders will have access to finance, energy companies also have obligations. **The Energy Company Obligation (ECO)**<sup>133</sup> is a UK Government policy designed to replace both the Carbon Emission Reduction Target (CERT)<sup>134</sup> and the Community Energy Saving Programme (CESP).<sup>135</sup> The ECO requires energy supply companies to deliver energy efficiency measures to homes, with a twin focus on reducing heating costs for vulnerable consumer groups and saving carbon in hard to treat homes.

5.4.9 We have worked closely with the DECC on the development of ECO and have helped to secure important changes compared with the original proposals, including support for a wider range of measures and a stronger focus on delivery in rural areas. HEEPS will seek to leverage investment

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<sup>132</sup> DECC. Green Deal:

[www.decc.gov.uk/en/content/cms/tackling/green\\_deal/green\\_deal.aspx](http://www.decc.gov.uk/en/content/cms/tackling/green_deal/green_deal.aspx)

<sup>133</sup> DECC. Energy Company Obligation:

[www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/48086/1732-extra-help-where-it-is-needed-a-new-energy-compan.pdf](http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48086/1732-extra-help-where-it-is-needed-a-new-energy-compan.pdf)

<sup>134</sup> DECC. Community Energy saving Programme

[www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/48210/3342-evaluation-of-the-community-energy-saving-programm.pdf](http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48210/3342-evaluation-of-the-community-energy-saving-programm.pdf)

<sup>135</sup> DECC. Community Energy saving Programme:

[www.decc.gov.uk/en/content/cms/funding/funding\\_ops/cesp/cesp.aspx](http://www.decc.gov.uk/en/content/cms/funding/funding_ops/cesp/cesp.aspx)

from energy companies under ECO to create a combined fund of around £200 million per annum to invest in energy efficiency measures. Nearly £50 million has already been allocated to local authorities to develop area-based schemes to tackle fuel poverty. Those local authorities are leveraging significant amounts of energy company funding that suggest that our £200 million target is achievable.

5.4.10 The **ECO carbon savings obligations** are designed to ensure that support is available for measures such as solid wall insulation and hard to treat cavities, as well as providing targeted support for people in low income and rural areas. The **ECO home heating cost reduction obligation** will support vulnerable, low-income households who live in the private sector and are entitled to defined benefits. We have developed Memoranda of Understanding with several energy companies for our national Affordable Warmth Scheme.

5.4.11 In Scotland, we will work to ensure that Green Deal finance providers are able to support households across Scotland. We will also work with the UK Government to ensure that Scotland-specific issues are fully recognised in the delivery of both schemes. Working through the Sector Skills Councils, the Scottish Qualifications Authority and Certification bodies we will ensure that there are sufficient qualified assessors and certified installers available to install the energy efficiency improvements in our homes. We are also developing an electronic register of buildings to support the delivery of the Green Deal and ECO.

5.4.12 Our **Green Homes Cashback scheme**<sup>136</sup> is aimed at increasing the activity around installations of energy efficiency measures and also creating confidence in the Green Deal Assessor market. This is a £20 million programme which will be delivered during 2012-13 and 2013-14. In 2013 - 14 it will provide up to £1,200 Cashback per household. Our **Private Sector landlord cashback**<sup>137</sup> will also contribute to the replacement of inefficient appliances and boilers. These schemes are run on our behalf by the Energy Saving Trust.

5.4.13 In addition to improving the fabric of our existing housing stock, **new homes** need to be built to very low carbon standards. Housing built to 2010 standards emits 70% less carbon dioxide than housing built to the standards that existed in 1990. A review of **Scottish domestic energy standards for 2014** is currently nearing completion.

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<sup>136</sup> **Green Homes Cashback Scheme:**  
[www.energysavingtrust.org.uk/scotland/Take-action/Find-a-grant/Green-Homes-Cashback-Scheme](http://www.energysavingtrust.org.uk/scotland/Take-action/Find-a-grant/Green-Homes-Cashback-Scheme)

<sup>137</sup> Energy Saving Trust, Private Sector Landlord Cashback:  
[www.energysavingtrust.org.uk/scotland/Organisations/Innovation/Free-resources-for-housing-professionals/Private-Sector-Landlords](http://www.energysavingtrust.org.uk/scotland/Organisations/Innovation/Free-resources-for-housing-professionals/Private-Sector-Landlords)

## Promoting innovation in new-build homes

More than 330 new affordable homes will be built through the Greener Homes Innovation Scheme promoting greener methods of construction in the house building industry and enabling families to save up to £1,000 per year on running costs. Our Greener Homes Prospectus<sup>138</sup> showcases examples and case studies of the kind of work that can be done to improve energy efficiency in homes.

### Smart meters

5.4.14 Whilst much can be achieved through funding incentives, support and regulation, good information is also a critical factor in driving down energy use. We support the UK Government's plan to install **smart meters** for gas and electricity in every home by 2020. A smart meter, together with an individual display unit provides real-time information about energy use and costs, encouraging better household energy management. The roll-out across the UK, by energy suppliers, will take place between 2014 and 2019, although suppliers estimate that five million meters will have been installed prior to the official go-live date.

### Fabric improvement and heating efficiency proposals

5.4.15 Ambitious work is already underway through the policies and programmes described above. However, we recognise more will need to be done and the following proposals are currently under consideration or in development.

5.4.16 We aim to continue our Home Energy Efficiency Programmes for Scotland to **cover the whole of Scotland**. This could involve a continuation of effort on hard to treat properties such as tenements, combining energy efficiency measures with tackling disrepair.

5.4.17 Regulation may need to play a part in improving energy efficiency. In the SHS consultation, we sought views on if, how, and when to set **minimum standards of energy efficiency for private sector housing**. Feedback from the consultation has informed a stakeholder working group that is considering the issues and is developing draft regulations for consultation.

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<sup>138</sup>The Scottish Government [www.scotland.gov.uk/Topics/Built-Environment/Housing/sustainable/largescale/GreenerHomesProspectus](http://www.scotland.gov.uk/Topics/Built-Environment/Housing/sustainable/largescale/GreenerHomesProspectus)

5.4.18 Responses to the SHS consultation supported a lead-in time between consulting on draft regulations and the application of any standards to allow time for householders and landlords to prepare for the changes. Scottish Ministers have previously stated that we would not look to set **minimum standards before 2015**. Our current thinking at this stage assumes a minimum standard for all private sector housing to be introduced in 2018 (the same timescale being considered for the private rented sector in England and Wales). However, this timetable is one of the issues to be considered by the stakeholder working group.

5.4.19 We also need to consider social housing standards. Social landlords are already required to meet the **Scottish Housing Quality Standard by 2015**, and this includes an energy efficiency element. We propose to introduce a **new energy efficiency standard for social housing in 2013** setting initial targets to be met by 2020. This will further improve the energy efficiency of social housing, reducing energy consumption and fuel poverty and driving down emissions.<sup>139</sup>

#### **New techniques and technologies**

Scotland's Housing Expo held in Inverness in 2010 showcased master planning, passive energy techniques and new building technology in low carbon building design. The homes were designed to tight cost limits, some with predicted annual heating costs of less than £100.

5.4.20 **New build domestic energy standards 2014.** As part of the review of building regulation energy standards in response to the recommendations of the Sullivan Report,<sup>140</sup> we are consulting on the potential to cut new-build emissions by around 45% compared to 2007 standards. In practice this will mean there will generally be less air-infiltration, improved fabric insulation, better heating controls, heating systems of greater efficiency and, for some building types, greater use of low carbon technologies such as micro-generation and innovative measures such as wastewater heat recovery to deliver emissions reductions.

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<sup>139</sup> The Scottish Government [www.scotland.gov.uk/Topics/Built-Environment/Building/Building-standards/publications/sullivan](http://www.scotland.gov.uk/Topics/Built-Environment/Building/Building-standards/publications/sullivan)

<sup>140</sup> A Low Carbon Building Standards Strategy For Scotland, 'The Sullivan Report': [www.scotland.gov.uk/Resource/Doc/217736/0092637.pdf](http://www.scotland.gov.uk/Resource/Doc/217736/0092637.pdf)

## Further abatement potential in housing

5.4.21 We consider that there may be some further abatement potential (around 0.65 MtCO<sub>2</sub>e by 2027) through improvements to the carbon efficiency of housing beyond those estimated for the identified policies and proposals. However, we have not put forward a fully-fledged proposal at this stage as further work is required to analyse and consider a range of options. We intend to produce a detailed proposal on how we may realise this potential in RPP3.

5.4.22 Further analysis and consultation are needed before bringing forward a more detailed proposal. In the meantime we will also need to assess the impact of action to encourage market transformational change. And, as options, costs and technical solutions develop in the future years, more efficient and cost-effective approaches may emerge. Our analysis indicates that this additional carbon abatement is potentially available from the housing stock in Scotland, if it is needed to meet our emission targets. However, if more cost effective options emerge in other sectors, then it may be preferable for some or all of this abatement to be delivered from other parts of the economy.

5.4.23 At this stage, the estimated abatement has been modelled in a similar way to our other housing proposals. We used DEMScot, a model designed for us for this purpose by a partnership led by Cambridge Architectural Research Ltd. The full model, along with user manuals, is available on the Scottish Government website.<sup>141</sup>

5.4.24 The model is based on a building stock database abstracted from the Scottish House Condition Survey. Using specified building physics parameters, and taking account of Scottish weather, DEMScot models the total energy use of a home, including space and water heating, cooking, lighting and appliances.

5.4.25 DEMScot allows us to model 19 different upgrades to houses where such upgrades are technically feasible. The Scottish House Condition Survey was used to supply the starting house conditions, and then the type and number of upgrades were estimated in turn for 'business as usual', policies, and proposals (excluding technical potential). The model then provides an estimate of how many upgrades to the existing housing stock are still technically feasible.

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<sup>141</sup> The Scottish Government, Housing Market Context Materials: [www.scotland.gov.uk/Topics/Built-Environment/Housing/supply-demand/chma/marketcontextmaterials](http://www.scotland.gov.uk/Topics/Built-Environment/Housing/supply-demand/chma/marketcontextmaterials)

5.4.26 These remaining technically feasible upgrades were the basis of modelling the further potential. They include measures such as solid wall insulation, loft and floor insulation and a range of other upgrades which also form part of our current policies and proposals. The difference is that there is a greater proportion of higher cost upgrades in the further potential, since our policies and proposals typically start with the most cost-effective measures.

5.4.27 Many of the upgrades in the further potential would be in the owner-occupied and private rented sectors, where energy efficiency policies have not advanced as much as in the social sector. The optimum blend of regulation and incentives that should be used in the private sector is an area that is currently being investigated and developed in Scotland and the rest of the UK. We need to consider all the options for realising this additional potential.

## 5.5 Decarbonising heat policies

5.5.1 The Scottish Government's current policies and action on low carbon and renewable heat are set out in our Renewable Heat Action Plan,<sup>142</sup> in the 2020 Routemap for Renewable Energy in Scotland<sup>143</sup> and in the Scottish Government's draft Outline Heat Vision<sup>144</sup> which was published in January 2013 alongside the draft of this RPP2.

5.5.2 Specific policies on district heating have now been published in the District Heating Action Plan.<sup>145</sup> This sets out how we are taking forward recommendations from the Expert Commission on District Heating, which reported in November 2012.<sup>146</sup>

5.5.3 The RHI,<sup>147</sup> a UK Government policy, was introduced in 2011 to incentivise the use of heat produced from renewable non-fossil fuel sources, such as wood fuel or heat pumps. RHI is key to us meeting our Scottish target of **11% of heat demand from renewables by 2020**, and will play a significant role in decarbonising the heat sector by 2030. We have

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<sup>142</sup> Renewable Heat Action Plan: [www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/19185/Heat/RHUpdate11](http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/19185/Heat/RHUpdate11)

<sup>143</sup> Update to 2020 Routemap for Renewable Energy: [www.scotland.gov.uk/Topics/Business-Industry/Energy/UpdateRenewableRoutemap](http://www.scotland.gov.uk/Topics/Business-Industry/Energy/UpdateRenewableRoutemap)

<sup>144</sup> Outline Heat Vision: <http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/19185/Heat/DraftHeatDeployment>

<sup>145</sup> District Heating Action Plan: <http://www.scotland.gov.uk/Publications/2013/06/7473>

<sup>146</sup> Expert Commission on District Heating: <http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/19185/Heat/ExpertCommission>

<sup>147</sup> UK Renewable Heat Incentive: <https://www.gov.uk/government/policies/increasing-the-use-of-low-carbon-technologies/supporting-pages/renewable-heat-incentive-rhi>



developed a range of supporting actions to increase deployment of renewable heat technologies in Scotland.

5.5.4 The RHI is being implemented in phases. Phase one focuses on the industrial and commercial sectors. Including the grant scheme for domestic users, the RHI is worth about **£90 million** to Scotland over four years, with the sector expected to create up to 1,350 new jobs during this period.

5.5.5 The UK Government consulted on proposals for a RHI for the domestic sector in autumn 2012, with proposals for its introduction in summer 2013. However, the UK Government later announced that the scheme would be delayed until Spring 2014. In the interim, the UK Government has extended the support for installations of renewable heat technologies in the household sector through the Renewable Heat Premium Payment scheme<sup>148</sup>.

5.5.6 The UK Government will publish further information on the domestic RHI, including tariff rates, over summer 2013. Due to delays, no cost information has been included. However, it is likely that up-front costs for the installation of renewable heat generation will be met by property owners, with the incentive guaranteeing them a reasonable return on investment.

5.5.7 Consistent with DECC updated emissions projections, estimates of the contribution of domestic RHI to abatement have been revised downwards since RPP1 was published in 2011.

5.5.8 The **District Heating Loan Fund**<sup>149</sup> offers loans to support both low carbon and renewable technology solutions to a range of infrastructural issues and the costs of developing district heating networks. We have allocated at least £5 million to the scheme over this spending review period. It is open to local authorities, registered social landlords, SMEs and energy services companies in Scotland.

5.5.9 In June 2012 we announced a £5 million boost to the budget for **Home Renewables Loans**,<sup>150</sup> and an increase in the maximum loan available for renewable heat installation to £10,000. The loans are providing support to individual householders to install renewable technologies in their homes through the Energy Saving Trust, which has seen a sharp rise in the levels

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<sup>148</sup> DECC. Renewable Heat Premium Payment scheme

[www.decc.gov.uk/en/content/cms/meeting\\_energy/renewable\\_ener/premium\\_pay/rhpp\\_voucher/rhpp\\_voucher.aspx](http://www.decc.gov.uk/en/content/cms/meeting_energy/renewable_ener/premium_pay/rhpp_voucher/rhpp_voucher.aspx)

<sup>149</sup> District Heating Loan Fund:

[www.energysavingtrust.org.uk/scotland/Take-action/Get-business-funding/District-heating-loan-fund2](http://www.energysavingtrust.org.uk/scotland/Take-action/Get-business-funding/District-heating-loan-fund2)

<sup>150</sup> Home Renewables Loans:

[www.energysavingtrust.org.uk/scotland/Take-action/Find-a-grant/Home-renewables-loan-scheme](http://www.energysavingtrust.org.uk/scotland/Take-action/Find-a-grant/Home-renewables-loan-scheme)

of interest since the announcement. The loans were scheduled to close in 2013 when launch of the domestic RHI was proposed. However, following the announcement of the delay in the RHI until Spring 2014, we are reviewing support for household renewables across all available measures, for example, the Green Deal.

### Use of Biomass

The Scottish Government policy is to promote the use of biomass plants for heat or for combined heat and power, with new plants relatively small in scale. This is to optimise local supply, serve localised heat markets and maximise efficient use of a limited fuel source.

Wood fuel use for energy production has more than tripled in the last five years. We are currently reviewing the blend of support available for biomass to establish a more appropriate balance between the support available, policy priorities and competing needs for the resource.

5.5.10 Heat mapping is fundamental in the development of our ambitions to decarbonise heat. Heat maps help identify and define future renewable heat opportunities in an area, particularly heat networks. Pilot heat maps have already been completed in Highland, Fife and Perth and Kinross and we are rolling out the heat mapping programme to all local authorities in Scotland with the aim of creating a pan-Scotland heat map by March 2014.

5.5.11 Heat mapping will help to identify opportunities for investment in heat infrastructure to support delivery of the Scottish Government's programmes, such as expenditure under the REIF,<sup>151</sup> the Warm Homes Fund, the District Heating Loan Scheme<sup>152</sup> and implementation of the District Heating Action Plan<sup>153</sup> as well as ensuring increased uptake of the RHI in Scotland.

### Decarbonising heat proposal

5.5.12 While we are taking forward significant activity on decarbonising heat in Scotland, we recognise the need for a more strategic approach for significant decarbonisation of heat by 2030.

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<sup>151</sup> Renewable Energy Investment Fund: [www.scottish-enterprise.com/fund-your-business/scottish-investment-bank/renewable-energy-investment-fund.aspx](http://www.scottish-enterprise.com/fund-your-business/scottish-investment-bank/renewable-energy-investment-fund.aspx)

<sup>152</sup> District Heating Loans Scheme: [www.energysavingtrust.org.uk/scotland/Take-action/Get-business-funding/District-heating-loan-fund2](http://www.energysavingtrust.org.uk/scotland/Take-action/Get-business-funding/District-heating-loan-fund2)

<sup>153</sup> District heating Action Plan: [www.scotland.gov.uk/Publications/2013/06/7473](http://www.scotland.gov.uk/Publications/2013/06/7473)

5.5.13 Our new ambitious proposal for decarbonising heat, expressed in a new vision, hierarchy and Heat Generation Policy Statement, will include both the domestic and non-domestic sectors. As the majority of the emissions abatement is likely to fall in the non-domestic sector, details are at paragraph 6.5.10 in the next chapter. Given the significant policy work still required in this area, the final abatement split between the Homes and Communities Sector and the Business, Industry and Public Sector may change.

## 5.6 Supporting and enabling measures

5.6.1 The proposals and policies in RPP1 were supported by a number of enabling measures. All of these enabling measures are still in place and we have included some new ones in this second report. These enabling measures do not necessarily abate carbon by themselves but they help to support the kind of change in behaviour and perception that are needed to transform the market and maximise the success of the other policies.

5.6.2 Access to information is vital to help people make low carbon decisions from transport through to energy efficiency in the home. We have invested in the network of **Home Energy Scotland Advice Centres** to provide free advice and support across a range of energy efficiency matters to householders, businesses, communities, and local authorities and housing associations.<sup>154</sup> This service will also provide the impartial remote advice service for Green Deal.

5.6.3 Important information is also available to existing and prospective property owners through **Energy Performance Certificates (EPCs)**.<sup>155</sup> They are required on completion of construction and at the point of sale or rental and provide energy efficiency information, allowing comparisons to be made. EPCs are accompanied with advice on ways in which energy efficiency of the building concerned could be improved in a cost-effective manner.

5.6.4 Information and support is also vital for community action. Communities working together can often achieve more than households and individuals acting alone. Our **Climate Challenge Fund**<sup>156</sup> supports local communities in developing their own solutions for reducing greenhouse gas emissions. Since 2008, over 400 communities have undertaken projects

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<sup>154</sup>Home Energy Scotland Advice Centres:

[www.changeworks.org.uk/householders/essacs-landing-page/408/#householder](http://www.changeworks.org.uk/householders/essacs-landing-page/408/#householder)

<sup>155</sup> Energy Performance Certificates:

[www.scotland.gov.uk/Topics/Built-Environment/Housing/BuyingSelling/Home-Report/epcs](http://www.scotland.gov.uk/Topics/Built-Environment/Housing/BuyingSelling/Home-Report/epcs)

<sup>156</sup>Climate Challenge Fund:

[www.scotland.gov.uk/Topics/Environment/climatechange/howyoucanhelp/communities/ClimateChallengeFund](http://www.scotland.gov.uk/Topics/Environment/climatechange/howyoucanhelp/communities/ClimateChallengeFund)

from energy efficiency and insulation projects to active travel and sustainable food production.

5.6.5 The fund empowers communities to deliver projects that are relevant to them and which leave a positive and sustainable legacy for the future. The fund supports communities to generate an income from their low carbon activity, where this can be achieved within State Aid rules, and the income is reinvested in further project activity which is consistent with a low carbon future.

5.6.6 The Junior Climate Challenge Fund operates alongside the main fund and supports projects which are designed, developed and delivered by young people (under 18s) whose future actions are crucial to the delivery of our climate change targets. The young people are engaged throughout, with funding decisions made by a youth panel.

5.6.7 The Scottish Government and COSLA produced joint guidance on local authority coverage of climate change in their local housing strategies (LHS). Following publication of the supplementary guidance in 2011, we continue to work closely with local authorities to support their work on integrating climate change with their other housing policies through the LHS process. Consideration of climate change requirements forms part of the LHS peer review process. Since the supplementary guidance was issued, 25 local housing strategies have been peer reviewed with a further six underway. All have demonstrated a more strategic approach to climate change activities for housing.

5.6.8 Private landlords can access Energy Saving Scotland Small Business Loans to install energy efficiency measures.<sup>157</sup> The Landlords' Energy Saving Allowance (LESA) allows landlords to claim a tax allowance of up to £1,500 on energy efficiency measures.<sup>158</sup>

5.6.9 Many people in Scotland live in historic and traditionally built houses and tenements which can be difficult to treat. While it is considered challenging to make these buildings more energy efficient thermal upgrades are possible and extensive research has taken place in this area by Historic Scotland. Following a series of refurbishment pilots, Historic Scotland has developed technical guidance<sup>159</sup> on how to improve pre-1919 dwellings and this was published in September 2012.

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<sup>157</sup> Small business loans: [www.energysavingtrust.org.uk/scotland/Organisations/Innovation/In-depth-energy-advice/Small-business-loans](http://www.energysavingtrust.org.uk/scotland/Organisations/Innovation/In-depth-energy-advice/Small-business-loans)

<sup>158</sup> Landlords' Energy saving Allowance: <http://www.energysavingtrust.org.uk/scotland/content/view/full/30143>

<sup>159</sup> Historic Scotland: [www.historic-scotland.gov.uk/technicalpapers](http://www.historic-scotland.gov.uk/technicalpapers)

5.6.10 The measures developed are suitable for listed buildings of all types. Examples of properties that have been improved are reported in the Historic Scotland Refurbishment Case Study Series. Later building types often perform worse than traditional ones, and Historic Scotland is a partner on a BRE led project<sup>160</sup> to develop refurbishment options on a “four in a block” house type dating from 1930 at the Ravenscraig Innovation Park. Building on this research and guidance Historic Scotland will work with the Sector Skills Councils to develop training at trade level for the delivery of appropriate measures in older buildings.

### **Traditional buildings**

Traditional buildings should not be seen as inevitably “hard to treat” buildings, although they may need a distinct approach to adaptation. Historic Scotland has carried out a number of refurbishment pilots to test the effectiveness of different interventions in traditional buildings and to develop cost effective improvements in thermal performance that respect their fabric and the appearance. A refurbishment of four ‘B’ Listed properties belonging to Castle Rock Edinvar Housing Association were successfully upgraded with wall and glazing improvements, winning the Carbon Trust Low Carbon Building Refurbishment Award in March 2012.

## **5.7 Costs and benefits**

5.7.1 The cost of implementing our policies and proposals for energy efficiency in existing homes is estimated at £5.1 billion over the period from 2013 to 2027. Much of these costs will be met by consumers and landlords, through either the ECO or self-financed measures (including through the Green Deal mechanism). There will also be significant targeted financial support and other action from the Scottish Government to facilitate uptake.

5.7.2 We have already made good progress in delivering the most cost-effective energy efficiency measures, such as loft and standard cavity wall insulation. As we progress towards our 2027 and 2050 targets, the focus will increasingly shift to more expensive measures that have longer pay-back periods.

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<sup>160</sup> BRE: [www.bre.co.uk/](http://www.bre.co.uk/)

5.7.3 The benefits of new build domestic energy standards include lower energy use and bills for households and support for more widespread use of energy-efficient construction practices and technologies, and the development of the low carbon economy. However, it should be noted that, in the majority of cases, fuel prices would have to increase in excess of RPI for the current additional capital cost of building to the proposed standards to be recouped during the lifetime of a new home.

5.7.4 There are significant benefits alongside these costs. Consumers would save an estimated £2.4 billion on their energy bills between 2013 and 2027 as a result of energy efficiency measures in existing homes compared to the “BAU” scenario. Savings from the measures installed would also continue beyond 2027 at an estimated £289 million a year. These estimates are based on current energy prices, and the trend is for these to increase. This means the savings may be underestimated.

5.7.5 These estimated benefits do not include the benefits associated with preventing harmful climate change as well as addressing the ill-health related to fuel poverty. A large body of research shows that improvements in housing conditions can lead to improved physical and mental health. Particularly important in the context of energy efficiency policies is that some of the greatest risks to health from housing are related to cold and damp (including moulds and fungus), which affect and exacerbate respiratory conditions.

5.7.6 We aim to make Scotland the most attractive place in Great Britain for energy companies to invest in energy efficiency. Decarbonising homes has the potential to create many **jobs** through upgrading existing homes, installing domestic renewable technologies and developing export markets. This will require new **skills**, for example, in modern methods of construction, and multi-skilling to enable retro-fit. It will also require the retention of specialist traditional skills for older and historic buildings. We will only be able to take advantage of these economic opportunities with a skilled and adaptable workforce.

5.7.7 Input-output analysis suggests that for every £100 million spent on energy-efficiency measures, approximately 1,300 full-time jobs are supported across the Scottish economy. We will continue to encourage industry to recognise the important role of **training** in preparing for these growth opportunities. There may be a need for new recruits, including currently under-represented groups, and returners affected by the recent economic downturn. Our **National Training Programmes** have at least 500 places in energy and low carbon industries. The introduction of the Green Deal will also result in training requirements for Green Deal assessors and potentially an element of up-skilling for installers.

5.7.8 We aim to ensure **continuity for installers**, particularly in the insulation industry. There will be new employment opportunities for installers, particularly with solid wall or hard to treat wall insulation, an industry so far relatively undeveloped in Scotland. The Green Deal will provide opportunities for SMEs as well as large businesses.

5.7.9 **Driving down costs** of energy efficiency measures will be particularly important in encouraging uptake. **Social landlords** are well placed to act as pioneers because of their ability to plan and manage major improvement programmes and offer economies of scale. This may be important in driving down costs of more expensive types of wall insulation and developing new approaches that can then be applied in the complex owner-occupier market.

5.7.10 The Scottish Government invested almost £150 million in fuel poverty and energy efficiency programmes between 2009-10 and 2011-12 to help households reduce their fuel bills. And we will be spending around £250 million over the current spending review period on energy efficiency to make homes warmer, to cut fuel poverty and to create jobs. We have increased this spending in a time of tight fiscal constraint, as part of our commitment to meeting our fuel poverty and climate change targets and because of the wider health, social and economic benefits it can bring to the people of Scotland. We estimate that this three-year investment will lead to a net gain in household income of about £700 million and a saving of 3 MtCO<sub>2</sub>e.

5.7.11 Over and above this investment, district heating schemes are reducing heating costs for an increasing number of households. Aberdeen Heat and Power's district heating scheme<sup>161</sup> has reduced running costs from £14 a week before the combined heat and power scheme installed to around £8.50 a week currently, and has reduced carbon emissions by about 45%. Similar benefits are being delivered to 1,500 households by Cube Housing Association's Wyndford Estate district heating scheme, installed and managed by Scottish and Southern Energy (SSE) Heat Networks.<sup>162</sup> Additional funding of £1 million from the Scottish Government is enabling over 235 private homeowners to benefit from connections to the scheme.

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<sup>161</sup> Aberdeen Heat and Power: [www.aberdeenheatandpower.co.uk/](http://www.aberdeenheatandpower.co.uk/)

<sup>162</sup> Cube Housing: [www.cubehousing.co.uk/WhatsNew/November\\_2012.asp](http://www.cubehousing.co.uk/WhatsNew/November_2012.asp)

**Table 5.1: Highlights of progress since publication of RPP1**

Homes and Communities	Summary
<p><b>Policies</b></p> <p>Smart meters installed in every home by 2020 to encourage better household energy management.</p>	<p>This initiative is led by the UK Government due to policies regarding the UK electricity market being reserved to Westminster. Latest estimates from DECC are that suppliers have installed approximately 1.25 million smart meters across Great Britain during the Foundation stage of the programme. Separate Scottish figures are not currently available. DECC announced in May 2013 that the planned mass roll-out of smart-meters had been delayed until autumn 2015 in order to allow time to finalise the technical specifications for the meters. In light of this, the main Scottish energy suppliers have delayed intensive installation activity. However, Scottish Power has installed 30,000 smart meters in a pilot programme, of which more than 50% were in Scotland. The Scottish Government bases its figures on the latest DECC projections and it is not believed that the delay to the main roll-out of the programme will significantly impact overall emissions abatement.</p>
<p>Domestic energy efficiency policies to install cavity wall, loft insulation and other energy efficiency measures.</p>	<p>Since 2008, loft and cavity wall insulation has been installed in over 540,000 homes in Scotland through the CERT scheme assisted by the Scottish Government funded home insulation programmes. This has supported progress towards our 2020 milestone on insulation, while our Boiler Scrappage Scheme has contributed towards our milestone on efficient gas central heating.</p> <p>The UK Government obligations on energy companies to deliver energy efficiency measures for domestic consumers outlined in RPP1 changed from the beginning of 2013. The new Energy Company Obligation (ECO) replaces the Carbon Emission Reduction Target (CERT) and the Community Energy Saving Programme (CESP).</p> <p>The ECO requires energy supply companies to provide homes with energy efficiency measures. It has a twin focus on reducing heating costs for vulnerable consumer groups and saving carbon in hard to treat homes, particularly through solid wall insulation.</p>



	<p>This is complemented by the Green Deal which is a new GB-wide policy that enables householders and other occupants of buildings to install energy efficiency improvements without up-front capital costs. Instead, they will pay for them over a period of years through a charge on their electricity bills.</p> <p>Since RPP1, we have also introduced a new Warm Homes Fund to provide grants and loans for community renewable energy schemes. Alongside these policies, the Scottish Government Green Homes Cashback scheme, will operate until March 2014 to incentivise the installation of a wide range of energy efficiency measures.</p> <p>The proposal in RPP1 to develop new fuel poverty and insulation programmes was implemented when the Scottish Government introduced a new national retrofit programme, the Home Energy Efficiency Programmes for Scotland (HEEPS) in April 2013. This ambitious programme supersedes the Energy Assistance Package, Universal Home Insulation and Boiler Scrappage Schemes. The new programmes, supported by £79 million in 2013-14, include both area-based and national schemes, giving priority to people and areas at most risk of fuel poverty. The area-based programmes will support a range of measures with a focus on hard-to-treat homes.</p>
<p>New build domestic energy standards for 2007 and 2010 - progressive improvement in building standards to reduce emissions from housing.</p>	<p>Standards introduced in 2010 set emissions targets for new homes which are 30% lower than those within the previous 2007 standards. These standards apply to building warrant applications made from October 2010. An increasing proportion of new homes being completed are now to these standards.</p>
<p>Renewable Heat Incentive (RHI): payments to home owners who install and obtain heat from renewable sources.</p>	<p>The RHI is a UK Government scheme and Phase 1 for non-domestic renewable heat installations was launched in November 2011. Phase 2 of the RHI will include payments to householders for renewable heat generated by domestic installations. The UK Government consulted on the domestic RHI in autumn 2012.</p> <p>Prior to implementation of the domestic RHI, the UK Government has run two phases of the Renewable Heat Premium Payment (RHPP), which provides a limited up-front payment towards the capital costs of an installation. In 2011-12, under Phase 1 of the RHPP, 662 households in Scotland were paid vouchers worth around 13.5% of the total value of vouchers paid, and a similar proportion during Phase 2 in 2012-13. As implementation of the domestic RHI has now been delayed until spring 2014, the UK Government has announced an extension to the RHPP and in May 2013, made a further announcement of an increase in the value of the vouchers.</p>

Proposals	
Fuel poverty and insulation programmes.	<p>The fuel poverty and insulation programmes outlined as proposals in RPP1 are being delivered as policies in RPP2 through ECO, Green Deal and the Home Energy Efficiency Programmes for Scotland. We have designed HEEPS to draw in the maximum additional funding from the ECO into Scotland and the Green Homes Cashback scheme will support uptake of measures through the Green Deal scheme.</p> <p>While HEEPS is now an active policy, our modelling has presented HEEPS as a proposal from 2018, reflecting the fact that decisions on the scale and nature of future phases of HEEPS will be a matter for future administrations.</p>
Regulation of energy efficiency in existing housing and reducing emissions from social housing.	<p>RPP1 included the setting of energy efficiency standards for both social and private housing as an enabling and supporting measure. Since then, there has been extensive investigation and development, work with stakeholders and a consultation process, leading to these measures being upgraded into proposals for RPP2.</p>
New build domestic energy standards for 2013.	<p>The 2013 review of energy standards in building regulations proposed in RPP1 is nearing completion. Consultation on proposed standards for 2014, which propose a further 21% reduction in emissions over 2010 standards (45% reduction on 2007 standards) took place between January and April 2013. In support of this review, work is also underway to improve compliance and as-built performance, both within building regulations and in the wider industry process of procurement, design and construction.</p>

**Table 5.2: Summary of Homes and Communities policies and proposals**

Homes & Communities	EU, UK or Scottish	Maximum abatement potential (KtCO <sub>2e</sub> ) in 2020	Maximum Abatement potential (KtCO <sub>2e</sub> ) in 2027	Earliest start date
<b>Policies</b>				
<b>Smart Meters</b> The UK Government is committed to installing "smart" meters for gas and electricity in every home by 2020. This type of meter, when accompanied by an individual display unit, can display real-time information about energy use and costs, encouraging better household energy management.	UK	88	95	Preliminary installations have been undertaken by some suppliers during the Foundation Stage pending full roll-out
<b>Domestic Building Energy Standards (2010) - New Build Properties</b> Homes built to current building regulations have emissions in the region of 70% lower than those built to standards applicable in 1990, following improvement in 2002, 2007 and 2010. Improvements introduced in 2010 resulted in new homes with emissions 30% lower than those built to 2007 standards.	Scottish	76	142	2010
<b>Renewable Heat Incentive (Domestic)</b> Payments to those who install and obtain heat from renewable sources. Householders have had access to the Renewable Heat Premium Payment grant scheme since 2011, but it is planned to introduce the domestic RHI alongside the non-domestic sector in Spring 2014.	UK	78	80	2014

<p><b>Energy Company Obligation and Green Deal</b></p> <p>The ECO requires energy supply companies to provide energy efficiency measures to homes, with a twin focus on reducing heating costs for vulnerable consumer groups and saving carbon in hard to treat homes. The Green Deal works alongside the ECO and enables households throughout Great Britain to install energy efficiency improvements without up-front capital costs.</p>	<p>UK</p>	<p>104</p>	<p>132</p>	<p>2013</p>
<p><b>Home Energy Efficiency Programmes Scotland</b></p> <p>Area-based and national schemes to refurbish Scotland's older homes and make them more energy efficient, tackle fuel poverty and reduce emissions, while providing opportunities for businesses in the low carbon economy. These Scottish Government schemes aim to draw in maximum extra funding from the ECO.</p>	<p>Scottish</p>	<p>207</p>	<p>207</p>	<p>2013</p>
<p><b>Warm Homes Fund</b></p> <p>This fund provides grants and loans to install renewable energy measures such as biomass, hydro schemes, wind turbines and solar water heating. Councils and housing associations applying to the fund will be expected to use any income generated from their schemes to improve the energy efficiency of their existing housing.</p>	<p>Scottish</p>	<p>23</p>	<p>22</p>	<p>2013</p>
<p><b>District Heating Loan Fund</b></p> <p>The District Heating Loan Fund provides low interest loans for both low carbon and renewable technology to help organisations implement district heating projects that will benefit local communities.</p>	<p>Scottish</p>	<p>36</p>	<p>36</p>	<p>2011</p>

Proposals	EU, UK or Scottish?	Maximum abatement potential (KtCO <sub>2</sub> e) in 2020	Maximum Abatement potential (KtCO <sub>2</sub> e) in 2027	Earliest start date
<p><b>Domestic Buildings Energy Standards (2014) New Build Properties</b></p> <p>A consultation launched in January 2013 proposes a further 21% reduction in current emissions in new homes from 2014. This equates to a 45% reduction in emission compared to the 2007 building standards.</p>	Scottish	22	55	2014
<p><b>Regulation of Private and Social Housing</b></p> <p>As well as introducing a new Energy Efficiency Standard for Social Housing, we are working with stakeholders to develop draft minimum standards for the energy efficiency of private housing for consultation.</p>	Scottish	63	152	2014
<p><b>Continuation of Home Energy Efficiency Programmes Scotland</b></p> <p>We propose to continue the programmes beyond the current spending review period, to cover the whole of Scotland. This will continue to improve the energy efficiency of Scotland's homes, particularly those that are harder to treat.</p>	Scottish	33	167	2018
<p><b>Low Carbon Heat (Domestic)</b></p> <p>The Scottish Government has published a "Draft Outline Heat Vision" and "Draft Heat Deployment Options Guidance". They bring together policy on heat across government to show how they contribute to our Economic Strategy objective to make the transition to a low carbon economy. We will develop a new Heat Generation Policy Statement in 2013. This will set out future supply scenarios, building upon the success of the Electricity Generation Policy Statement.</p>	Scottish	99	609	2013

<p><b>Additional technical potential through improvements to carbon efficiency of the housing stock</b></p> <p>Our modelling suggests there is an additional technical abatement potential of approximately 0.65 Mt CO<sub>2e</sub> in 2027 through improvements to the carbon efficiency of the housing stock. There are inherent uncertainties in predicting technologies and costs more than a decade into the future and further analysis is needed. We intend to include a proposal on how we may realise this potential in the next RPP.</p>	<p>Scottish</p>	<p>210</p>	<p>650</p>	<p>2018</p>
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# **BUSINESS, INDUSTRY AND THE PUBLIC SECTOR**



## 6. Business, Industry and the Public Sector

### 6.1 Introduction

6.1.1 This chapter addresses emissions from business, industry and the public sector. This sector is sometimes referred to as the ‘non-domestic’ sector. It focuses on emissions from buildings and some industrial processes. Emissions from transport, waste, etc. are dealt with in other relevant chapters in this report.

### 6.2 Our ambitions for business, industry and the public sector

- Our Energy Efficiency Action Plan includes a Scotland-wide target to reduce energy consumption by at least 12%.<sup>163</sup> This establishes a minimum level of ambition for all sectors, including the public sector.
- By 2027, we will have witnessed a complete transformation in the way Scottish public bodies work and in how their estates are managed. This will be achieved through implementing and exceeding existing carbon management plans, adopting sustainable procurement processes and through supporting governance arrangements.
- By 2027, we will have made significant progress in transforming energy use in industry and business through resource efficiency measures and low carbon technologies such as CCS and fuel switching.
- By 2050, direct emissions from the sector will be almost zero through reducing the sector’s energy demand, the use of low carbon electricity sources, and our ambition for a largely decarbonised heat sector by 2050, with significant progress by 2030.

### 6.3 Where we are now

6.3.1 The ‘public sector’ includes the Scottish Government and its executive agencies (such as Transport Scotland and Scottish Enterprise), 32 local authorities, and bodies such as the National Health Service trusts. The Climate Change (Scotland) Act 2009 contains a list of bodies subject to Public Bodies Duties.<sup>164</sup>

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<sup>163</sup> Conserve and Save: Energy Efficiency Action Plan: [www.scotland.gov.uk/Publications/2010/10/07142301/0](http://www.scotland.gov.uk/Publications/2010/10/07142301/0)

<sup>164</sup> Guidance to support public bodies in exercising their duties under the Climate Change (Scotland) Act 2009: [www.scotland.gov.uk/Publications/2012/01/05153413/1](http://www.scotland.gov.uk/Publications/2012/01/05153413/1)



6.3.2 Scotland has nearly **310,000 private sector enterprises** extending from construction and manufacturing companies to service providers and retail organisations.<sup>165</sup> 2,230 large enterprises account for two-thirds of turnover while SMEs account for 99.3% of enterprises and 53.6% of employment. Industry in Scotland is varied and complex, covering very different modes of production, material demands, ownership and products.

6.3.3 In 2011, greenhouse gas emissions from business and industrial processes totalled 9.2 MtCO<sub>2</sub>e, or 18% of the Scottish total. This includes some emissions that are covered by the EU ETS. Emissions from the public sector account for 0.8 MtCO<sub>2</sub>e, or 1.5% of the total.<sup>166</sup>

### **Sustainability and Utilities Procurement**

In 2009, Scottish Procurement launched a national electricity supply contract with Scottish Power and Scottish and Southern Energy. The contract, which ran until March 2013, was available to the whole of the public sector in Scotland and was almost universally adopted.

The contract provided enough green electricity to cover the entire requirement. Two terawatt hours (2 TWhrs) were provided by Whitelee onshore wind farm (Europe's largest). Green electricity provided by Scottish Power (the larger of the two contracts) does not attract any premium. Users of the contract had access to Automatic Meter Reading (AMR) technology at very competitive prices, which enabled them to manage their carbon footprints. AMRs, along with smart building programmes, significantly improve the quality of data available. This helps building managers baseline building performance and helps direct work to reduce energy costs, consumption and carbon footprints. Over 6000 AMRs were installed.

In April 2013, a replacement contract went live with EDF Energy. It builds on the success of the previous contract, incorporating more than 28,000 supply points using 2.8 TWhrs of electricity and facilitating improvements in environmental performance through access to energy reduction technologies and energy management advice from the appointed supplier. The new contract also gives access to 100% Levy Exemption Certificate backed electricity from renewable sources.

<sup>165</sup> Businesses in Scotland: [www.scotland.gov.uk/Topics/Statistics/Browse/Business/TrendBusinesses](http://www.scotland.gov.uk/Topics/Statistics/Browse/Business/TrendBusinesses)

<sup>166</sup> Scottish Greenhouse Gas Emissions 2011: [www.scotland.gov.uk/Publications/2013/06/1558](http://www.scotland.gov.uk/Publications/2013/06/1558)

## 6.4 Decarbonisation policies

6.4.1 A number of policies already contribute to the sector's decarbonisation. Some stem from the EU, some are UK Government policies while others are policies of the Scottish Government. Together, they incentivise energy efficiency through financing and or regulation, improve the quality of information to energy consumers, and support the decarbonisation of heat sources.

6.4.2 The EU ETS is implemented at the Member State level, using a cap and trade mechanism to put a price on carbon to promote reductions of greenhouse gas emissions in a cost effective or economically efficient manner.<sup>167</sup> With effect from January 2013, the scheme is focused on large, energy-intensive installations as well as European aviation operators. Industry participants include cement and glass manufacturing enterprises as well as some distilleries. Most operators receive a set number of free EU Allowances (EUA), with each EUA covering one tonne of CO<sub>2</sub>, and must trade or buy any additional EUAs they require at auction. As there is a set number of total EUAs within the market the overall environmental targets are maintained. The allocation of free allowances will be phased-out over time and more auctioning is being introduced.

6.4.3 The current EUA price is lower than expected, due mostly to the recession, and this has resulted in a smaller incentive to reduce emissions. As mentioned elsewhere in this document, officials of the Scottish Government are working closely with the UK Government to engage with the European Commission on potential structural reforms that could create a more effective EUA price.

6.4.4 At this point in time, it is unclear how the ETS will develop after the current phase III ends in 2020. Therefore, for the purposes of this report, we are not applying to projected abatement figures any emissions savings generated by the carbon price mechanism of the ETS beyond 2020 but only emission reductions from the complementary policies detailed in this section.

6.4.5 **The Carbon Reduction Commitment (CRC) Energy Efficiency Scheme**<sup>168</sup> is a UK-wide policy designed to incentivise investment in energy efficiency. In Scotland, there are 132 full participants in the scheme, which together emitted around 4.1 MtCO<sub>2</sub>e in 2011-12.

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<sup>167</sup> EU Emissions Trading System: [http://ec.europa.eu/clima/policies/ets/index\\_en.htm](http://ec.europa.eu/clima/policies/ets/index_en.htm)

<sup>168</sup> Carbon Reduction Commitment Energy Efficiency Scheme: [www.decc.gov.uk/en/content/cms/emissions/crc\\_efficiency/crc\\_efficiency.aspx](http://www.decc.gov.uk/en/content/cms/emissions/crc_efficiency/crc_efficiency.aspx)

## Energy Efficiency Policies

### EU Energy Efficiency Directive<sup>169</sup>

In 2012, the European Union passed a new Directive on Energy Efficiency on efficiency targets, efficiency in energy use (public bodies, obligation schemes, audits, billing), efficiency in energy supply (heating and cooling, transformation, transmission and distribution) and energy services. This Directive is due to be implemented by June 2014 and is expected to contribute approximately 17% to the energy efficiency target set for 2020 against a business-as-usual baseline.

A key article (Article 5) requires central government to lead by example by renovating 3% of its own estate each year, and to encourage the rest of the public sector to follow. As existing building stock is crucial to achieving energy efficiency and greenhouse gas emission reduction targets, and represents the biggest potential sector for energy savings, the rate of building renovation needs to be increased.

The Scottish Government aims to work closely with UK counterparts to ensure that the Directive is effectively implemented to the required timescales.

6.4.6 The CRC Scheme requires large non-energy intensive organisations to measure and report their carbon dioxide emissions and purchase allowances issued by the UK Administrator for each tonne of carbon dioxide they emit.<sup>170</sup> The Scheme targets the emissions of large businesses and public sector bodies that are not covered by the EU ETS or Climate Change Agreements. Following consultation during 2012, the Government published a number of simplifications to the scheme which will reduce the burden on participants. The scheme will be reviewed again by the UK and Scottish Governments in 2016.

6.4.7 Estimates of the contribution of carbon reduction commitments for 2020 have been revised down since publication of RPP1 and consistent with DECC's updated emissions projections.

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<sup>169</sup> EU Energy Efficiency Directive 2012/27/EU: [http://ec.europa.eu/energy/efficiency/eed/eed\\_en.htm](http://ec.europa.eu/energy/efficiency/eed/eed_en.htm)

<sup>170</sup> With the agreement of Scottish Ministers, the Environment Agency operates as UK Administrator for the purpose of allowance sales.

6.4.8 Access to funding is a critical aspect of achieving energy efficiency. **The Non-Domestic Green Deal is a GB wide policy.**<sup>171</sup> From early 2013, non-domestic property owners and occupiers will be able to apply for energy efficiency measures funded through private finance with costs recouped from charges on energy bills. The amount of finance will be based around a 'golden rule' whereby the repayments on the meter will be equal to, or less than, the savings identified during the assessment. On that basis, the total amount available will vary from building to building and measure to measure. When properties are bought and sold or rented, the charge for finance will be transferred to the new bill payer. Current estimates are that Green Deal investment could amount to £14 billion across the UK over the next decade, and Scotland is well placed to secure a proportionate share of this investment.

#### **The Climate Change Levy**<sup>172</sup>

The **Climate Change Levy** is a UK Government tax on the use of electricity, gas and solid fuels in the non-domestic sector. Revenue raised through the levy is recycled back to organisations through a reduction in employers' national insurance contributions and support for energy efficiency and low carbon technologies. All non-domestic (public and private) organisations pay this in full unless they have entered into a Climate Change Agreement or have a renewable energy supply.

The voluntary **UK Climate Change Agreements** enable eligible energy-intensive businesses to receive up to 90% discounts from the Climate Change Levy in return for meeting energy efficiency or carbon saving targets.<sup>173</sup> Around 376 facilities in Scotland have Climate Change Agreements.

6.4.9 To support Green Deal implementation, we have worked on the development of a Green Deal assessor qualification in Scotland with Asset Skills, the employer-led skills body for facilities management, housing and property, and the Scottish Qualifications Authority (SQA), the national accreditation and awarding body. £1 million has been allocated by DECC for the training of up to 1,000 Green Deal assessors across Great Britain. We are also working with Skills Development Scotland to assess demand and determine what follow-up action we should take.

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<sup>171</sup> DECC. Non-Domestic Green Deal:

[www.decc.gov.uk/en/content/cms/tackling/green\\_deal/gd\\_customer/gd\\_nondomcust/gd\\_nondomcust.aspx](http://www.decc.gov.uk/en/content/cms/tackling/green_deal/gd_customer/gd_nondomcust/gd_nondomcust.aspx)

<sup>172</sup> DECC. Climate Change Levy:

[www.decc.gov.uk/en/content/cms/emissions/ccas/cc\\_levy/cc\\_levy.aspx](http://www.decc.gov.uk/en/content/cms/emissions/ccas/cc_levy/cc_levy.aspx)

<sup>173</sup> DECC. Climate Change Agreements:

[www.decc.gov.uk/en/content/cms/emissions/ccas/ccas.aspx](http://www.decc.gov.uk/en/content/cms/emissions/ccas/ccas.aspx)

### **Energy Efficiency Small Business Loans Scheme: Kinloch Anderson**

Kinloch Anderson, an Edinburgh highland kilt manufacturer, was referred to its local Home Energy Scotland advice centre through the company's business manager at Scottish Enterprise.<sup>174</sup> An energy consultant visited the company's premises to outline ways in which the firm could improve its energy efficiency and how a loan could assist.

Consequently, the company installed a new steam press and ironing system. The ironing press is in constant use. Kinloch Anderson's Chief Executive, Nick Bannerman, said: "In terms of energy costs the move is saving us around £3,500 per annum. It has also increased our operating efficiency by allowing us to get more work done in a shorter space of time. The small business loans scheme has really been of great benefit to us."

6.4.10 A £1.5 million training fund for installers across the UK who wish to operate under the Green Deal was also made available. We are working with Construction Skills, the UK Sector Skills Council for the construction industry, to ensure that Scottish installers are offered a share of this.

### **National Health Service Scotland CEEF Projects**

NHS Greater Glasgow and Clyde is investing £200,000 to replace an inefficient refrigeration plant at Glasgow Royal Infirmary with the latest high efficiency plant. This resulted in a payback period of three years and an annual saving of £72,000 and 0.39 ktCO<sub>2</sub>e.

NHS Fife spent £11,000 to improve the management of its heating and air-conditioning plant at the Queen Margaret Hospital. This resulted in a payback period of 6 months, annual savings of £23,000 and an emissions reduction of 0.177 ktCO<sub>2</sub>e per year.

6.4.11 The UK has set up the Green Investment Bank, the world's first investment bank solely dedicated to greening the economy.<sup>175</sup> Large-scale non-domestic energy efficiency projects will form one of the three initial priorities of the bank. Other sources of finance include the Central Energy Efficiency Fund and the Energy Saving Small Business Loan Scheme, also detailed in Section 3.4 of this report.

<sup>174</sup> Home Energy Scotland Advice Centres: [www.changeorg.org.uk/householders/essacs-landing-page/408/#householder](http://www.changeorg.org.uk/householders/essacs-landing-page/408/#householder)

<sup>175</sup> BIS. Green Investment Bank: [www.bis.gov.uk/greeninvestmentbank](http://www.bis.gov.uk/greeninvestmentbank)

6.4.12 The policies above largely relate to the use of existing buildings. However, we need to take action with new buildings too. Most recently, **new-build energy standards for non-domestic buildings** were applied in **2010** as a Scottish policy. Non-domestic buildings built to these standards have emissions 30% lower than those built to 2007 standards. In practice this means that there is; less air-infiltration, improved fabric insulation (with less thermal-bridging), better heating and lighting controls, heating and cooling systems of greater efficiency and, for some buildings, limited use of low carbon technologies (such as micro-generation) to reach the emissions reduction standard.

### Decarbonising heat policies

6.4.13 As noted in Chapter 5, the RHI is a UK Government policy to encourage public sector bodies, businesses and communities to reduce emissions by using heat from renewable sources such as wood fuel or heat pumps. Under RHI, up-front costs for the installation of renewable heat generation are met by installation owners with the incentive scheme guaranteeing them a reasonable return on investment. Phase 1 focuses on the industrial and commercial sectors.

6.4.14 We recognise that Government has a role in supporting the construction of combined heat and power plants and heat networks. We have made a number of clear policy statements including through our 2020 Routemap for Renewable Energy in Scotland. We have introduced a range of funding support for heat networks, including the district heating loan scheme<sup>176</sup> and the Renewable Energy Investment Fund<sup>177</sup> and we also continue to make the case to the UK Government that the RHI should include an uplift for district heating.

6.4.15 Estimates of the contribution of non-domestic RHI to abatement have been revised downwards since RPP1 was published and are consistent with DECC updated emissions projections.

6.4.16 Our Expert Commission on District Heating<sup>178</sup> reported in 2012, and we have now published a District Heating Action Plan<sup>179</sup> setting out how we are taking forward these recommendations. We are already providing support through the **district heating loan scheme** to overcome the barriers

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<sup>176</sup> The Scottish Government, District Heating loan scheme: [www.scotland.gov.uk/News/Releases/2012/10/districtheating1102012](http://www.scotland.gov.uk/News/Releases/2012/10/districtheating1102012)

<sup>177</sup> Renewable Energy Investment Fund: [www.scottish-enterprise.com/news/2012/10/renewable-energy-investment-fund-open-for-business.aspx](http://www.scottish-enterprise.com/news/2012/10/renewable-energy-investment-fund-open-for-business.aspx)

<sup>178</sup> Expert Commission on District Heating: [www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/19185/Heat/ExpertCommission](http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/19185/Heat/ExpertCommission)

<sup>179</sup> The Scottish Government, District Heating Action Plan: [www.scotland.gov.uk/Topics/Business-Industry/Energy/resources/Publications/DHAP](http://www.scotland.gov.uk/Topics/Business-Industry/Energy/resources/Publications/DHAP)

and challenges facing developers. The scheme is open to local authorities, registered social landlords, SMEs and energy service companies. We have allocated £5 million over the current spending review period.

6.4.17 The **Action Plan** sets out how a roadmap for accelerating the uptake of renewable heat. This will support implementation of Article 14 of the Energy Directive on the promotion of efficiency in heating and cooling, which will require electricity generators and industrial applications, above a certain scale, to consider the costs and benefits of supplying heat to district heating networks.

6.4.18 As noted in the previous Homes and Communities chapter, heat mapping<sup>180</sup> is critical to heat decarbonisation in this sector too, and we are rolling it out to all local authorities in Scotland, to support our Action Plan.

6.4.19 As the majority of industrial emissions arise from generating heat from fossil fuels for manufacturing processes, changing to lower carbon fuels such as sustainable biomass and biogas represent one of the most important means for transformation.

6.4.20 The type of fuel switching will differ between sectors. For lower temperature processes, for example those involved in the food and drink industry, a range of options may be available. These include using biomass boilers to generate steam or 'process integration' for exploiting heat already used in higher temperature processes. Higher temperature processes often present a greater challenge and may need innovative solutions such as sustainable biomass to replace coke, or a shift towards the electrification of processes. Fuel switching will develop gradually, depending on the needs of each sub sector of industry in Scotland, and in particular, the temperature of the heat required.

6.4.21 For some industrial processes, greenhouse gas emissions are an intrinsic part of the chemistry and can only be mitigated through innovative options such as carbon capture and storage. In the longer term, the deployment of sustainable biomass and further carbon, capture and storage should be able to address remaining combustion and the carbon dioxide component of process emissions.

6.4.22 Process emissions will also need to be tackled. Fluorinated gases (F-gases) are part of the Scottish Government's climate change targets. In 2011, the latest year for which Scottish figures are available, F-gases made up 2.5% (c1.3 MtCO<sub>2</sub>e) of total Scottish greenhouse gas emissions. This has

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<sup>180</sup> The Highland Council, Heat Mapping in Highland Region:  
[www.highland.gov.uk/yourenvironment/planning/energyplanning/renewableenergy/HighlandHeatMappingProject](http://www.highland.gov.uk/yourenvironment/planning/energyplanning/renewableenergy/HighlandHeatMappingProject)

increased from 0.32% in the 1995 base year, primarily due to the take up of Hydrofluorocarbons to replace phased-out ozone-depleting substances. F-gases also make up 2.5% of UK greenhouse gas emissions (including international aviation and shipping).<sup>181</sup>

6.4.23 EU Regulations put in place offences and penalties covering infringements in relation to leakages; leakage checking and leak detection systems; placing on the market prohibitions; and qualifications for personnel working on equipment. Sectors affected by these regulations are stationary refrigeration, air-conditioning and heat pumps; stationary fire protection; and high voltage switchgear in electrical transmission networks. The Regulations also provided enforcement powers for SEPA. The EU Regulations were implemented in the UK by the Fluorinated Greenhouse Gases Regulations 2009.<sup>182</sup>

6.4.24 We have been working with SEPA and the UK Government to develop a regulatory framework for F-Gases in Scotland and have recently finished a comprehensive review of industry to provide a framework for this regulation. At the end of 2012, the EU Commission put forward a proposal to replace the existing regulation with the aim of significantly reducing emissions of these gases. The EU hopes to spur the development of more climate-friendly options and to stimulate new global action to reduce gas emissions. The Scottish Government is working with the UK Government on the proposal and a stakeholder meeting took place in early 2013 to discuss the way forward.

### Smart Meters and products policies

6.4.25 Understanding an organisation's energy use is critical to reducing it. The UK Government policy of introducing **smart electricity and gas meters** will provide organisations with more accurate information supporting efficient use of energy, and cost savings. Smart meters will be rolled out to over 200,000 non-domestic small users in Scotland by 2019. The cost is expected to fall principally on the non-domestic energy consumer through higher energy bills from their energy supplier.

6.4.26 Estimates of the contribution of smart metering to abatement in 2020 have been revised down slightly since RPP1 and are consistent with DECC updated emissions projections.

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<sup>181</sup> The Fluorinated Greenhouse Gases Regulations 2009:

[www.legislation.gov.uk/ukxi/2009/261/pdfs/ukxi\\_20090261\\_en.pdf](http://www.legislation.gov.uk/ukxi/2009/261/pdfs/ukxi_20090261_en.pdf)

<sup>182</sup> [www.legislation.gov.uk/ukxi/2009/261/pdfs/ukxi\\_20090261\\_en.pdf](http://www.legislation.gov.uk/ukxi/2009/261/pdfs/ukxi_20090261_en.pdf)



6.4.27 An important way of reducing the energy we use is through the design of more energy efficient products. **EU Products policy** is addressed through the Eco-design Framework Directive which allows minimum environmental performance standards for products to be set across the EU.<sup>183</sup> The standards are set through regulation or voluntary agreements. The regulations aim to improve the environmental performance of products by reducing the impact of a product's life-cycle on the environment.

#### **BT's Energy Saving Campaign**

BT ran a staff engagement pilot in its London headquarters of around 3,000 employees to reduce energy use by 10%. BT engaged staff by: recruiting energy champions from across all levels of the business to raise awareness of the campaign to reduce energy waste by reporting faults, conducting energy audits and encouraging networking to share ideas; and Identifying areas of the business where significant savings could be made. Importantly it engaged with staff members who had the influence to implement changes within these areas.

In the three months of the pilot, energy consumption was reduced by 17%, equating to cost savings of around £200,000. BT has now rolled out the initiative to 25 of its other buildings, four of which are in Scotland. This has led to annual savings of over £800,000 for the company. As one manager put it:

*"It's our corporate social responsibility; companies should be leading by example. People can be involved by just being energy efficient. In that sense, everyone can be an energy champion".*

6.4.28 One of the effects of this kind of regulation is to reduce the electricity consumption of many products. This also tends to reduce the amount of heat emitted from these products because much of the electricity that inefficient products consume is wasted through heat production. As lighting and appliances become more energy efficient, heating and cooling systems compensate for this reduction in heat.

6.4.29 The effect in terms of emissions accounting is to increase emissions from heat very slightly but to reduce emissions from electricity generation by a greater amount. The heat element of these emissions is shown directly in the breakdown of abatement provided in this report. The savings from reduced electricity consumption are incorporated into the modelling used to estimate emissions from the traded sector.

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<sup>183</sup> European Commission: <http://ec.europa.eu/enterprise/policies/sustainable-business/documents/eco-design/legislation/framework-directive/>

6.4.30 Likewise, the **Energy Labelling Framework Directive**<sup>184</sup> sets energy labelling requirements for products across the EU. It requires that a standard label showing energy efficiency, and other sustainability aspects, such as water consumption, is displayed on products where they are sold. The UK Government leads on compliance with both Directives.

## 6.5 Decarbonisation proposals

The following Scottish proposals are being developed or are under consideration by Scottish Ministers.

**6.5.1 Non-domestic buildings new-build energy standards 2014 – Scottish Proposal.** Our review of standards in response to the Sullivan Report considered the potential to cut new-build non-domestic building emissions by up to 75% compared to 2007 standards. We have now reached the consultation stage. The supporting costing research (as recommended by Sullivan) indicates that costs of a 75% improvement will not generally payback through reduced energy bills. We have now consulted on a proposed 60% improvement that will often payback within the projected lifespan of the buildings and offers a cost benefit at a national level. A consultation report will be issued later in 2013.

6.5.2 The proposals for a 60% reduction in emissions involves moving to aggregate emissions based approach. This means that whilst not all buildings will deliver the same level of reduction, the overall reduction in emissions will be 60%. In practice there will generally be less air-infiltration; improved fabric insulation (unless this causes overheating issues); better heating and lighting controls; heating and cooling systems of greater efficiency; and for some building types, greater use of low carbon technologies (such as micro-generation) to reach the emissions reduction standard. In support of the review of energy standards, work is also underway to improve compliance and as-built performance both within building regulations and in the wider industry process of procurement, design and construction.

**6.5.3 Non-domestic buildings: assessment of energy performance and emissions regulations – Scottish proposal.** Buildings account for over 40% of greenhouse gas emissions in the UK and less than 1% of the existing stock is replaced by new buildings each year. Therefore, we are currently developing regulations under Section 63 of the Climate Change (Scotland) Act for the assessment of the energy performance and emissions of existing non-domestic buildings, and for owners to improve the energy performance of their buildings and to reduce emissions.

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<sup>184</sup> Ibid.

6.5.4 Under the regulations being developed, owners (and occupiers) of large buildings will need to physically improving their buildings. If they are not in a position to carry out such work, they must make arrangement for measuring and reporting the operational energy use on a year on year basis.

6.5.5 Initially, the proposal would be implemented broadly in line with our consultation, covering buildings over 1000 square metres.<sup>185</sup> The proposal would be reviewed within 10 years and the scope could be widened by possibly requiring the building improvements be carried out, without recourse to operational ratings. Alternatively, they could go further by including all buildings over 250 square metres and increasing the assessment frequency. However, no investigation into the practicalities of widening the scope of the proposal has been developed at this stage.

6.5.6 We recognise the important role of the public sector in Scottish civic life as a provider of services, as a major employer and procurer of goods and services and through the influence it exerts on our lives in carrying out its functions. There is a clear expectation that our public bodies should lead by example and we therefore propose to **ramp up emission reductions in the public sector**.

6.5.7 We know, through research undertaken on our behalf by the Carbon Trust that public bodies in Scotland could do more to reduce emissions from their own estates.<sup>186</sup> Initially this would involve accelerating actions in existing Carbon Management Plans, and later move to more ambitious activity. The Carbon Trust research was designed to identify what additional abatement in the public sector might be feasibly delivered between now and 2027-30. The report estimates that with an accelerated programme of implementation, there is the potential to reduce emissions across the public sector by 29% or 291 ktCO<sub>2</sub>e by 2020. The report identified that over 30% of this abatement would be delivered by measures already identified, and it is estimated that there is additional potential to reduce emissions by 285 ktCO<sub>2</sub>e by 2027.

6.5.8 These are non-traded building emissions and are significantly greater than current activity in public bodies' Carbon Management Plans (CMPs). Achieving the full abatement potential will require a significant uplift of activity in the existing carbon management plans across the entire public sector. Actions are likely to include: behavioural change at organisational and individual levels; making our estate more energy efficient; and using renewable energy sources.

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<sup>185</sup>The Scottish Government, Building Standards Consultation:[www.scotland.gov.uk/Topics/Built-Environment/Building/Building-standards/publications/pubconsult/S63SGR](http://www.scotland.gov.uk/Topics/Built-Environment/Building/Building-standards/publications/pubconsult/S63SGR)

<sup>186</sup> Potential Carbon Abatement from the Scottish Public Sector: [www.scotland.gov.uk/Publications/2012/12/3885](http://www.scotland.gov.uk/Publications/2012/12/3885)

### **The National Library of Scotland**

The National Library of Scotland (NLS) has implemented a Carbon Management Plan which has reduced emissions and produced significant savings in running costs. The plan comprised 15 individual projects covering a range of actions from investment in building services equipment, to awareness raising and changes to operating procedures. Carbon management at the NLS has reduced carbon emissions by 0.62 KtCO<sub>2</sub>e and saved £75,000 on energy bills per year.

6.5.9 To develop this **proposal into a clear plan of action** we will, by October 2013, consider, review and conclude the following:

- Our governance and leadership arrangements, including consulting key stakeholders over summer 2013 on our proposals for revised structures;
- Whether to set a target or set of targets for Scottish public bodies linked to mandatory reporting of emissions in the context of the Public Bodies Duty set out in the Climate Change (Scotland) Act;
- What more might be done through our procurement activities;
- Funding and financing options, working with the Scottish Futures Trust; and
- The skills and expertise within our public bodies for both accelerating emission reductions and carbon accounting.

## Decarbonising heat

### Decarbonising heat proposal

Heat makes up around half of our energy demand, and is a significant source of carbon emissions across households, industry and the public sector. Therefore, heat has a key role to play in a low carbon economy for Scotland. RPP1 set out our ambition that by 2050, Scotland will have a largely decarbonised heat sector with significant progress made by 2030. For 2027, this means total estimated abatement of **3 MtCO<sub>2e</sub>** from the domestic and non-domestic sectors.

A number of policies are helping to deliver this aim including: the Renewable Heat Action Plan; Energy Efficiency Action Plan; Micro-generation Strategy, Sustainable Housing Strategy; and decarbonising heat policies for business and industry. We published the District Heating Action Plan in May 2013.

In RPP2, we recognise the need to take a holistic approach to our policy and proposals to decarbonise heat. We therefore published an **Outline Heat Vision**, alongside RPP2, to bring together policy and a renewed focus to heat, both low carbon and renewable, stretching across all sectors - domestic, non-domestic, industrial and commercial - to put us on course to fully realise the potential for decarbonising heat in Scotland.

The heat vision looks at heat in the wider context of available energy resources. It sets out our statutory and regulatory responsibilities and highlights policy drivers. It also provides clarity on our overarching principles of keeping demand to a minimum, most efficient use of energy and recovering as much “waste” heat as practically possible, at least cost to consumers, for future heat deployment.

To provide further clarity on the Scottish Government’s views on the generation of heat within Scotland we will publish a **Draft Heat Generation Policy Statement (HGPS)** for consultation in 2013. The HGPS will look in more detail at possible generation scenarios, including their impact on the renewable heat target and associated greenhouse gas emissions. We will also set out a stakeholder engagement plan to inform development of the scenarios. When published, this document and our Electricity Generation Policy Statement will provide a comprehensive energy policy view and, along with our developed Heat Vision, set out the framework for the transition to decarbonising heat in Scotland.

6.5.10 Our ambition for heat is that by 2050, Scotland will have a largely decarbonised heat sector with significant progress by 2030. For 2027, this means total estimated abatement of 3 MtCO<sub>2</sub>e from the domestic and non-domestic sectors. Although this heat proposal is in the business, industry and public sector chapter, it includes domestic heating too.

### Heat Deployment

6.5.11 The **Heat Vision** sets out a draft deployment options matrix which takes a pragmatic approach to deployment of low carbon heat technologies. For example, we expect that to 2020 dense urban areas will be more suited to district heating, with the initial infrastructure likely to be non-renewable in areas on the gas grid. However, the ultimate aim is to encourage the most low carbon solution for all buildings in the area and in the medium to long term, we would expect a shift to renewables and a significant reduction in heat demand in buildings.

6.5.12 Factors such as building density, available fuel sources and heat demand profiles will provide the context for optimising the deployment of low carbon heat technologies. These include energy efficiency, district heating with different energy sources, electricity and site specific solutions including micro-generation across domestic, industrial, commercial and public sectors.

### Renewable Heat

6.5.13 The promotion of renewable heat is a devolved matter. Scottish Ministers' additional devolved powers, over matters such as energy efficiency, consumer information and heat mapping at a local authority level, will complement and add weight to measures being introduced across the UK. These measures include the RHI, Green Deal, ECO and other measures set out in the UK Government's heat policy document, *Meeting the Challenge: The Future of Heating*, published in March 2013.<sup>187</sup>

6.5.14 Our 11% renewable heat target as it is currently defined requires approximately 6,400 GWh of energy to be sourced from renewables by 2020. Assuming conservatively that this could be achieved by displacing gas, the target could reduce emissions in Scotland by over 1 MtCO<sub>2</sub>e in 2020. We are currently reviewing our target, and have set out proposals in the

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<sup>187</sup> DECC, Meeting the Challenge: The Future of Heating:

[www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/190149/16\\_04-DECC-The\\_Future\\_of\\_Heating\\_Accessible-10.pdf](http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/190149/16_04-DECC-The_Future_of_Heating_Accessible-10.pdf)

**Renewable Heat Report**<sup>188</sup> which will significantly increase our ambitions for renewable heat.

## District Heating

6.5.15 Increasing the deployment of district heating will play a key role in decarbonising the heat sector, particularly in major urban areas. As mentioned in the previous chapter, in 2012, the **Expert Commission on District Heating** made recommendations to the Scottish Government on accelerating the uptake of district heating.<sup>189</sup> We have now published a **District Heating Action Plan** setting out how we are taking forward these recommendations.<sup>190</sup>

6.5.16 Large-scale heat networks create an integrated heat supply, across homes and communities, business and industry and the public sector. Key actions in the District Heating Action Plan include setting up the Heat Network Partnership for Scotland, to bring together the Scottish Government support across these sectors to create a coordinated programme to scale up the delivery of district heating. We are supporting local authorities to roll out the Heat Mapping Programme for Scotland. This will assist strategic planning for heat and identify opportunities for the development of heat networks. The development of the Heat Generation Policy Statement will allow the Scottish Government to consider targets for district heating, particularly for public sector buildings.

## 6.6 Supporting and enabling measures

6.6.1 Clear accessible information is critical for organisations wanting to improve their energy efficiency and reduce waste. We have integrated our non-domestic energy and material resource efficiency services and in April 2013 launched the new **Resource Efficient Scotland** advice and support programme.<sup>191</sup> It will provide valuable support to businesses, third sector and public sector organisations to reduce overheads through improved energy, material resource and water efficiency, and reducing waste.

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<sup>188</sup> The Scottish Government, Heat: [www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/19185/Heat](http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/19185/Heat)

<sup>189</sup> The Scottish Government: [www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/19185/Heat/ExpertCommission](http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/19185/Heat/ExpertCommission)

<sup>190</sup> The Scottish Government, District Heating Action Plan: [www.scotland.gov.uk/Topics/Business-Industry/Energy/resources/Publications/DHAP](http://www.scotland.gov.uk/Topics/Business-Industry/Energy/resources/Publications/DHAP)

<sup>191</sup> The Scottish Government, Resource Efficient Scotland: [www.scotland.gov.uk/Topics/Business-Industry/Energy/Action/energy-efficiency-policy/ResourceEfficientScotland](http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Action/energy-efficiency-policy/ResourceEfficientScotland); [www.resourceefficientscotland.com](http://www.resourceefficientscotland.com)

6.6.2 The **Resource Efficient Scotland** programme is an integration of services previously delivered through the Carbon Trust, the Energy Saving Trust and Zero Waste Scotland into one streamlined and holistic programme. Resource Efficient Scotland will help cut carbon across businesses, third sector and public sector organisations and reduce overheads through improved energy, material resource and water efficiency. Taking simple steps to use energy, water and raw materials more efficiently could save Scottish organisations up to £2.9 billion annually.

6.6.3 The programme has three components:

- A Scotland-wide integrated Advice and Support service. This ‘one-stop-shop’ single service delivers practical technical advice and support to all business and public sector organisations on waste/material resource use, energy and water efficiency. It focuses on the implementation of resource efficiency measures, including advice around finance and how to access it;
- a suite of sector-focused activities tailored to meet the specific needs of business and public sector across Scotland in order to deliver resource efficiency savings. Sectors where there is significant efficiency saving potential have been identified. Resource Efficient Scotland will focus its efforts in the first instance on Construction and the Built Environment, Food & Drink, Hospitality and the Public Sector. More sectors will be included as the programme evolves; and
- an Integrated Business and Public Sector Intelligence strand which supports the whole programme activity, including monitoring and evaluation, leading to the continual development and improvement of the programme.

6.6.4 As outlined in the Government Economic Strategy, we established the **Scottish Energy and Resource Efficiency Service (SERES)**.<sup>192</sup> This virtual **partnership** brings together existing business support and advice programmes delivered by a range of bodies. The service makes it easier for businesses to access energy and resource efficiency advice from any entry point, for example Business Gateway, through joint marketing, events and cross-referral. SMEs, in particular, benefit from this holistic advice and support.

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<sup>192</sup> The Scottish Government, Scottish Energy and Resource Efficiency Service: [www.scotland.gov.uk/Topics/Economy/EconomicStrategy/SERES](http://www.scotland.gov.uk/Topics/Economy/EconomicStrategy/SERES)



6.6.5 For SMEs, the introduction of the GB-wide Green Deal programme is anticipated to offer a new source of funding for energy efficiency measures. In addition, Green Deal itself will be an important contribution in our transition to a low carbon Scotland and could present huge opportunities for Scottish industry, particularly SMEs. The Scottish Government will shortly be launching a scheme to support SMEs through the training and certification processes necessary to become Green Deal approved, including signposting to any financial assistance that may be available.

6.6.6 As noted previously in Chapter 5, **Energy Performance Certificates (EPCs)** are an important source of information. They provide existing and prospective building owners with energy efficiency information and allow comparisons to be made. They are also accompanied with advice on ways in which efficiency could be improved in a cost-effective manner.

### Scottish Water<sup>193</sup>

Scottish Water<sup>194</sup> is part of our critical infrastructure network and provides Scotland-wide water and sewerage services. In public ownership, it reports to Ministers and the Scottish Parliament on its performance. It is subject to the duties on public bodies under the Climate Change (Scotland) Act 2009. The provision of water and sewerage services is energy intensive, and this is a key area for Scottish Water to focus on: reducing its energy demand; making efficient use of that energy; and using its assets for the generation of renewable energy.

Scottish Water operates within a regulatory framework in which Scottish Ministers, set the objectives for the industry to be delivered at least cost to customers. Its activities are broadly separated into core and non-core activities. Core activities are the provision of water and sewerage services to customers in Scotland, and non-core activities are work that Scottish Water undertakes separately from this, such as developing its presence internationally and pursuing other commercial opportunities. Scottish Water submits Business Plans to Ministers for approval covering its core and non-core proposals.

Scottish Water has a considerable asset base which can be used for **renewables projects**, and has technological expertise which can provide a consultancy service to other countries. Its assets have the potential to generate considerably more renewable energy than it requires, and could be used to meet some of Scotland's electricity demand. Scottish Water can act as a landlord allowing other sectors to make use of its land and other assets to generate renewable energy.

<sup>193</sup> Further information about Scottish Water and its subsidiaries is available from: [www.scottishwater.co.uk](http://www.scottishwater.co.uk)

<sup>194</sup> Further information about the water industry in Scotland, including the regulatory framework, see: <http://www.scotland.gov.uk/Topics/Business-Industry/waterindustryscot>

The Scottish Parliament recently passed the **Water Resources (Scotland) Act 2013**, which places a duty on Ministers to take reasonable steps to develop the value of Scotland's water resources. The Scottish Government recognises the monetary and non-monetary value of Scotland's abundant water resources, and the importance of the water sector to Scotland. The Act also tasks Scottish Water with engaging in any activity that it considers will assist in the development of the value of Scotland's water resources. In particular, it sets out that Scottish Water must take reasonable steps to promote the use of its assets for the generation of renewable energy.

**Business Stream**, a subsidiary of Scottish Water, is a provider of water and sewerage services to the non-domestic market. It advises its customers on how to reduce their bills by being more **efficient** in their use of water. This includes: measuring water use; advising on water efficiency measures; benchmarking usage against other businesses in the same sector; and a leakage detection and repair service. So far, it has helped save Scottish businesses more than £35 million in water charges. Business Stream is one of a number of providers who serve the non-domestic market and compete for business.<sup>195</sup>

For Scottish Water, reducing the level of **leakage** from its network is a priority. It has a target to reduce leakage from its water distribution network to the Long Run Economic Level of Leakage as calculated using the current industry standard. Annual reduction milestones are agreed between Scottish Water, SEPA and the Water Industry Commission for Scotland.

## 6.7 Costs and benefits

6.7.1 While these policies, supporting measures, and proposals will drive emission reductions they will also bring a range of other benefits. A recent UK study estimated that around 2.3% of GDP could be saved from straightforward resource efficiency measures, using raw materials more efficiently and generating less waste.<sup>196</sup> In 2010, that would have meant £2.9 billion savings to the Scottish economy – over half of the savings can be made within businesses (£1.5 billion) raising profitability directly.

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<sup>195</sup> Further information about the non-domestic market in Scotland and the benefits retail competition have brought for businesses is available from the Water Industry Commission for Scotland: [www.watercommission.co.uk/](http://www.watercommission.co.uk/)

<sup>196</sup> Meeting the UK climate change challenge: The contribution of resource efficiency: [www.wrap.org.uk/sites/files/wrap/Final%20Report%20EVA128\\_SEI%20\(1\)%20JB%20SC%20JB3.pdf](http://www.wrap.org.uk/sites/files/wrap/Final%20Report%20EVA128_SEI%20(1)%20JB%20SC%20JB3.pdf)

6.7.2 Taking up remaining opportunities for energy, material and process efficiency will reduce manufacturing costs and boost the competitiveness of industry in Scotland. Low carbon manufacturing, using inputs such as sustainable biomass and future supplies of decarbonised electricity may increasingly be demanded by both UK and export markets.

6.7.3 Moving to low carbon technologies in other sectors of the economy will also create new markets for the goods, such as niche low carbon vehicles, produced in Scotland. We also depend on industry to manufacture some components in Scotland – products which need to become ever more energy efficient and low carbon over the coming decades.

6.7.4 The proposals and policies described will require investment from the public sector, business and other sources. Annex A and the Technical Appendix provide further information about these costs.

**Table 6.1: Highlights of progress since publication of RPP1**

Business, Industry and Public Sector	Summary
<p><b>Policies</b></p> <p><b>Smart Metering and Better Billing</b></p>	<p>This initiative is led by the UK Government due to policies regarding the UK electricity market being reserved to Westminster. Latest estimates from DECC are that suppliers have installed approximately 1.25 million smart meters across Great Britain during the Foundation stage of the programme. Separate Scottish figures are not currently available. DECC announced in May 2013 that the planned mass roll-out of smart-meters had been delayed until autumn 2015 in order to allow time to finalise the technical specifications for the meters. In light of this, the main Scottish energy suppliers have delayed intensive installation activity. However, Scottish Power has installed 30,000 smart meters in a pilot programme, of which more than 50% were in Scotland. The Scottish Government bases its figures on the latest DECC projections and it is not believed that the delay to the main roll-out of the programme will significantly impact overall emissions abatement.</p>
<p><b><u>Energy Intensive Business Package</u></b></p> <p><b>Climate Change Levy and Climate Change Agreements</b></p> <p>The Climate Change Levy is a UK tax on energy use in industry, commerce and the public sector, used to support energy efficiency and renewables. The voluntary UK Climate Change Agreements enable eligible energy intensive businesses to receive a 90% discount on the Climate Change Levy for electricity use in return for meeting energy efficiency or carbon saving targets.</p>	<p>UK Government announced in the 2013 Budget that it will introduce exemptions from the Climate Change Levy for energy used in metallurgical and mineralogical processes from 1 April 2014.</p> <p>Alongside this, a new simplified Climate Change Agreements scheme launched 1 April 2013 and shall provide an extension to the Climate Change Levy rebate for energy intensive industries until 2023 in return for meeting energy efficiency improvement targets. The Environment Agency has taken over administration of the new scheme, providing a simplified and streamlined approach to administration for both Government and Industry. Around 376 facilities in Scotland now have Climate Change Agreements.</p> <p>On 1 April 2013, the rebate increased from 65% to 90%.</p>

**Carbon Trust and Energy Saving Trust Programmes and successor programmes to encourage businesses and the public sector to reduce energy consumption (including loans to SMEs)**

**Carbon Trust and Energy Saving Trust Programmes**

**Carbon Trust Programme** (grant funding ceased 31 March 2013 and activity was replaced by Resource Efficient Scotland.)

The Scottish Government invested over £23 million between 2007-08 to 2012-13 into the Carbon Trust for non-domestic advice and support. The Carbon Trust worked with Scottish businesses with an energy spend of over £30,000 p.a. and also with the public sector to reduce energy use, carbon emissions and to implement energy efficiency measures. Through the Carbon Trust 150 large public sector organisations have Carbon Management Plans in place.

It is estimated that the potential lifetime savings of the Carbon Trust programme could be up to £920 million and 10.2 MtCO<sub>2e</sub>.

**Energy Saving Trust Programme** (grant funding ceased 31 March 2013 and activity was replaced by Resource Efficient Scotland.)

Around £3 million was invested from 2007 into the Energy Saving Trust (EST) programme for non-domestic advice. Between 2007 and 2011, EST worked with over 2,500 organisations.

It is estimated that the potential lifetime savings of the EST programme could be up to £43.6 million and 219 KtCO<sub>2e</sub>.

**Resource Efficient Scotland**

On 1 April 2013, a new, single Resource Efficient Scotland programme integrating energy and resource efficiency services, delivered previously through Carbon Trust, Energy Saving Trust and Zero Waste Scotland, was launched. The Scottish Government is investing £7 million annually to establish the programme. The new programme provides support to businesses, third sector and public sector organisations to reduce overheads through improved energy, material resource and water efficiency, and in doing so it will help cut carbon across public and private sectors organisations.

### **Scottish Futures Trust (SFT) Low Carbon Workstream**

SFT's indicative analysis shows that an investment of c.£300 million in low carbon measures across the Scottish Public Sector estate could lead to potential cost reductions in the region of c.£1.1 billion before financing costs or £900 million after financing costs.

The Scottish Government is supporting the Scottish Futures Trust to establish a Low Carbon Workstream to develop commercial delivery structures; to aggregate projects and establish national programmes of energy efficiency projects; to realise investment potential, attract in private finance such as the Green Investment Bank, as well as reduce costs for all authorities and the wider public sector. Initial areas of focus are street lighting, non-domestic retrofit, micro generation and district heating.

### **Scottish Government funding and finance**

The Scottish Government supports a number of schemes that provide funding and finance to help private and public sector organisations to invest in measures to improve their energy and resource efficiency and reduce emissions. A breakdown is provided in Table 6.2 'Scottish Government funding and finance schemes' below.

### **Green Deal & Supporting Policy (UK policy)**

In January 2013, the UK Government launched its GB wide Green Deal initiative which intends to reduce carbon emissions cost effectively by revolutionising the energy efficiency of British properties. Within the initiative is a new innovative financial mechanism that eliminates the need to pay the upfront capital cost of energy efficiency measures and is repaid through savings made on fuel bills.

Green Deal itself could present huge opportunities for Scottish SMEs who can get involved in the provision and delivery of Green Deal.

The Scottish Government will shortly be launching a scheme to support SMEs through the training and certification processes necessary to become Green Deal approved including signposting to financial assistance.

<p><b>CRC Energy Efficiency Scheme</b></p>	<p>The Scottish Government has worked closely with the Devolved and UK governments to successfully implement the CRC simplification package. This will reduce the administrative burden of the scheme on Scottish participants with minimal reductions in emissions coverage. So far Scottish participants' emissions have dropped from 4.5 MtCO<sub>2</sub> in 2010-11 to 4.1 MtCO<sub>2</sub> in 2011-12, a change of 0.4 MtCO<sub>2</sub> or approximately 9%, although it is too early to say how much of this reduction can be attributed to the CRC.</p> <p>Based on the estimated energy savings set out in the DECC impact assessment, and consistent with the method used to attribute emissions reductions to Scotland, it is estimated that by the end of 2012 energy savings totalled 120 GWh (16 GWh Electricity and 104 GWh Gas). To put that in context, total Scottish final energy consumption in 2010 in the Industrial and Commercial Sector was 66,217 GWh. By 2020, energy savings in Scotland are estimated to be 779 GWh (135 GWh Electricity and 644 GWh Gas.)</p>
<p><b>New Build non-domestic energy standards for 2007 and 2010</b></p>	<p>Non-domestic buildings built to 2007 standards have emissions 23-28% lower than those built to 2002 standards. Non-domestic buildings built to 2010 standards have emissions 30% lower than those built to 2007 standards. An increasing proportion of new buildings being completed are now to these standards.</p> <p>The impact of this policy has been assessed in terms of emissions abatement. The abatement was identified as approximately 14-16 ktCO<sub>2</sub> annually. As abatement is cumulative from each year's build, this would give an annual abatement of 133 ktCO<sub>2</sub> in 2020 and 253 ktCO<sub>2</sub> in 2027.</p>
<p><b>Renewable Heat</b></p>	<p>The <b>Scottish Biomass Heat Scheme</b>, funded by the Scottish Government and Forestry Commission Scotland ran from 2009 to 2011. £2.7 million was paid to 44 projects including hotels, farms, and estates, a brewery and a timber processing plant. The funding also enabled the growth of woodfuel supply chains and Energy Services Companies (ESCOs) to design, build and supply small-scale biomass district heating schemes.</p> <p>The <b>Renewable Heat Incentive (RHI)</b> for non-domestic installations was launched by the UK Government in November 2011. Ofgem's RHI Register shows that to date 259 projects in Scotland, totalling 61 MW thermal, mainly biomass, have been registered to date.<sup>197</sup> These installations have generated 50 GW hours of heat, with payment made of £1.7 million, about 16% of the total paid to date under the RHI.</p>

<sup>197</sup> Ofgem Renewable Heat Incentive (RHI) Register: <https://rhi.ofgem.gov.uk/Default.aspx>

<p><b>Energy Performance of Buildings Directive 2010/31/EU</b></p>	<p>This EU Directive requires the production of Energy Performance Certificates on construction, sale or rental of buildings and that large buildings frequently visited by the public display their energy performance certificate. It also requires giving of advice on cost-effective energy efficiency measures and inspections of air conditioning systems. There is no abatement directly attributed to this Directive within RPP2.</p>
<p><b>Proposals</b></p>	
<p><b>New-build non domestic energy standards for 2013.</b></p>	<p>The review of energy standards in building regulations proposed in RPP1 is nearing completion. Between January and April 2013, the Scottish Government consulted on new standards for 2014, which propose a further 43% reduction in emissions over 2010 standards (60% reduction on 2007 standards) took place. An announcement on standards is anticipated before autumn 2013.</p> <p>In support of this review, work is also underway to improve compliance and as-built performance, both within building regulations and in the wider industry process of procurement, design and construction.</p>



**Table 6.2: Scottish Government funding and finance schemes**

Project	Description	Amount invested by SG (£m)	Estimated savings (lifetime)	
			(£m)	KtCO <sub>2</sub> e
Central Energy Efficiency Fund (CEEF)	<p>Launched in 2004, CEEF continues to provide a ring-fenced source of funding for public sector organisations for energy efficiency and renewable measures.</p> <p>CEEF has supported over 95 projects in Scotland's NHS with emissions reductions of around 167 KtCO<sub>2</sub>e and revenue savings of over £5.3 million. Scottish Water reported lifetime savings of over 770 ktCO<sub>2</sub>e and of over £90 million.</p>	20*	95.3	940
Salix Finance loans fund	<p>Since 2008, Salix Finance has managed a £4 million revolving loans fund on behalf of the Scottish Government to fund low carbon investment projects in Scottish Further and Higher Education establishments. In October 2012, the Scottish Government invested another £1 million to this scheme as part of the Green Investment Package bringing the total invested to £5 million.</p>	5	42	231
Green Investment Package	<p>We have committed £10.3 million between 2012-13 and 2013-14 to enhance public sector loans funds and energy efficiency projects.</p>	10.3	-	20.6**
Small Business Loans Scheme	<p>Administered by the Energy Saving Trust on our behalf, loans of £1,000 - £100,000 are available to SMEs to install renewable energy technologies or measures that reduce energy consumption.</p>	11.4	18.5	57

\* Money invested prior to 2007-08

\*\* Estimated cumulative annual savings over period 2012-2014

**Table 6.3: Summary of Business, Industry and Public Sector policies and proposals**

<b>Business, Industry &amp; Public Sector</b>	<b>EU, UK or Scottish</b>	<b>Annual Abatement (KtCO<sub>2</sub>e) in 2020</b>	<b>Annual Abatement (KtCO<sub>2</sub>e) in 2027</b>	<b>Earliest start date</b>
<b>Policies</b>				
<b>Smart Meters</b> Roll-out of "smart" meters to small and medium-size businesses to encourage better energy management.	UK	53	46	Preliminary installations have been undertaken by some suppliers during the Foundation Stage pending full roll-out
<b>CRC Energy Efficiency Scheme</b> UK-wide policy designed to incentivise investment in energy efficiency. The Scheme requires large non-energy intensive organisations to measure and report their carbon dioxide emissions and purchase allowances issued by the UK Administrator <sup>198</sup> for each tonne of carbon dioxide they emit.	UK/Scottish	130	154	2010
<b>Buildings Energy Standards (2010) - New Build Properties</b> Non-domestic buildings built to 2007 standards have emissions 23-28% lower than those built to 2002 standards. Non-domestic buildings built to 2010 standards have emissions 30% lower than those built to 2007 standards.	Scottish	57	101	2010

<sup>198</sup> With the agreement of Scottish Ministers, the Environment Agency operates as UK Administrator for the purpose of allowance sales.

<p><b>Green Deal &amp; Supporting Policy</b></p> <p>The Non-Domestic Green Deal is a GB wide policy. From early 2013 non-domestic property owners and occupiers can apply for energy efficiency measures funded through private finance with costs recouped from charges on energy bills.</p>	UK	92	24	2013
<p><b>EU Products Policy</b></p> <p>EU Products policy is addressed through the Eco-design Framework Directive. An important element of this is improving the energy efficiency of products. This reduces electricity consumption and heat output. The emissions savings from using less electricity are factored into the RPP2 calculations in the energy sector. The reduced heat output is shown here, reflected in a slight increase in emissions resulting from compensatory use of space heating. The overall effect, however, is to reduce total emissions.</p>	EU	-11	-8	On-going
<p><b>Renewable Heat Incentive (RHI - Non Domestic)</b></p> <p>This is a UK policy providing a tariff payment for heat generated by renewable technologies including biomass, heat pumps, geothermal, solar thermal, biogas and biomethane. Payments are made for the metered heat produced by an installation over 20 years.</p>	UK	896	914	2011
<b>Proposals</b>				
<p><b>Non-domestic buildings new-build energy standards for 2014</b></p> <p>Review of non-domestic building standards with the proposal to improve them further to achieve emissions reductions of 60% compared to 2007 standards.</p>	Scottish	25	60	2014

<p><b>Assessment of Energy Performance and Emissions Regulations (Non Domestic Buildings)</b></p> <p>Buildings account for over 40% of greenhouse gas emissions in the UK. However, as less than 1% of the existing stock is replaced by new buildings each year, regulations are to be introduced under Section 63 of the Climate Change (Scotland) Act for the assessment of the energy performance and emissions of existing non-domestic buildings and for owners to improve the energy performance of their buildings and to reduce emissions.</p>	<p>Scottish</p>	<p>42</p>	<p>142</p>	<p>2013</p>
<p><b>Public Sector (additional potential)</b></p> <p>Research by the Carbon Trust suggests potential to increase public sector emissions reductions. The Scottish Government is currently reviewing how this potential could be realised, with a view of publishing an action plan for delivering more in partnership with other public organisations. Working with the Scottish Futures Trust, Resource Efficient Scotland, COSLA and NHS Health Facilities Scotland we plan to bring forward a nationwide programme of energy efficiency projects across the public sector estate including; greener street lighting and non-domestic building retrofit with the potential to attract investment from the private sector such as the Green Investment Bank. Indicative analysis indicates that an investment of £300 million could lead to potential cost reductions in the region of £900 million. The Scottish Government has made up to £2 million available in 2013/14, to encourage local authorities to undertake street lighting condition surveys as an early action.</p>	<p>Scottish</p>	<p>239</p>	<p>285</p>	<p>2013</p>
<p><b>Low Carbon Heat (Non Domestic)</b></p> <p>The Scottish Government has published a “Draft Outline Heat Vision” and “Draft Heat Deployment Options Guidance”. They bring together policy on heat across government to show how they contribute to our Economic Strategy objective to make the transition to a low carbon economy. We will develop a new Heat Generation Policy Statement in 2013. This will set out future supply scenarios, building upon the success of the Electricity Generation Policy Statement.</p>	<p>Scottish</p>	<p>101</p>	<p>1,334</p>	<p>2013</p>

**7.**

**TRANSPORT**



## 7. Transport

### 7.1 Introduction

7.1.1 Transport emissions, including international aviation and shipping, make up just under a quarter of Scotland's total emissions, and more than two thirds of these emissions come from road transport.

7.1.2 Over the past few decades, there has been a large rise in the distance we travel, mostly through car travel. Around 84% of the 2.7 million vehicles in Scotland in 2010 were cars, 9% were light goods vehicles, 3% were motorcycles, while heavy goods vehicles accounted for about 1%. Active travel, that is walking and cycling, accounts for less than 3% of the total distance travelled each year by Scottish residents.

### 7.2 Our ambitions for decarbonising transport

7.2.1 Our ambition is for almost complete decarbonisation of road transport by 2050. In RPP1, we set milestones to 2020:

- a mature market for low carbon cars resulting in achievement of an average efficiency for new cars of less than 95 gCO<sub>2</sub>e/km;
- an electric vehicle (EV) charging infrastructure in place in Scottish cities;
- personalised travel planning advice provided to all households;
- effective travel plans in workplaces with more than 30 employees; and
- at least 10% of all journeys made by bicycle.

7.2.2 Achievement of our ambitions for decarbonising transport will deliver additional benefits beyond emissions reductions such as: an improvement in air quality due to a reduction in vehicle emissions; less congestion due to the adoption of smarter travel measures, which will promote increased business efficiency; and an improvement in physical and mental well-being due to the increased physical activity in active travel.

7.2.3 We aim to see significant progress in the decarbonisation of road transport by 2030 through wholesale adoption of electric cars and vans, and conversion to hybrid or alternatively-fuelled HGVs and buses – as well as significant steps to decarbonise rail and maritime transport. We are also

aiming for significant modal shift from the private car to public transport and active travel.

7.2.4 Given sufficient progress to 2020, EV uptake could accelerate in the 2020s. Key drivers will be the continued installation of charging facilities, increases in vehicle range, and reductions in cost. By 2030, potentially 60% of new vehicles (over 30% of car and van fleet) will be plug-in hybrid (PIH) or battery EV and hydrogen fuel cells.<sup>199</sup>

## 7.3 Where we are now

7.3.1 In 2011, transport emissions amounted to 13 MtCO<sub>2</sub>e or 25.3% of total Scottish emissions, and the majority (9.3 MtCO<sub>2</sub>e) were from road transport.<sup>200, 201</sup>

7.3.2 Overall, transport emissions (including international aviation and shipping) have increased 0.1% since 1990. In 2011, emissions from domestic transport were 0.2% lower than 1990, at 10.47 MtCO<sub>2</sub>e, while emissions from international aviation and shipping in 2011 were 2.49 MtCO<sub>2</sub>e, up slightly from 2.45 MtCO<sub>2</sub>e in 1990 (aviation emissions rose significantly while shipping emissions fell).

7.3.3 However, emissions in 2011 were slightly lower than in 2010 - giving four consecutive years of reductions. In 2011, road traffic distances fell a further 0.2% compared to 2010, attributable mainly to a fall in HGV kilometres. The intermittent recovery from the economic recession clearly continues to play a significant part in the recent reduction in reported transport emissions. However, the current Business as Usual projection for transport emissions suggests that transport emissions will increase by 11% from 13.5 MtCO<sub>2</sub>e to 14.8 MtCO<sub>2</sub>e between 2013 and 2027.

7.3.4 Emissions from cars currently account for 5.2 MtCO<sub>2</sub>e, or around 55% of land-based transport emissions. Average vehicle emissions per kilometre are falling steadily as a consequence of improved engine efficiencies and currently stand at stand at 159 gCO<sub>2</sub>e/km. However, these gains have been offset by increased car travel.<sup>202</sup> In 2011, the Society of Motor Manufacturers and Traders calculated that average new car emissions in the

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<sup>199</sup> Based on the current fleet size (2.3 million) and new car sales of 168,000, these percentages equate to new sales of 100,000 cars and a low carbon car fleet of around 710,000.

<sup>200</sup> Scottish Greenhouse Gas Emissions 2011: [www.scotland.gov.uk/Publications/2013/06/1558](http://www.scotland.gov.uk/Publications/2013/06/1558)

<sup>201</sup> The transport estimate includes emissions from international aviation and shipping, but the aggregate Scottish emissions estimate used here does not take account of the EU ETS.

<sup>202</sup> This is an internal calculation using Scottish Transport Statistics figure for vehicle kilometres and Scottish emissions data from the National Atmospheric Emissions Inventory (NAEI).

UK fell to 138 gCO<sub>2</sub>e/km, down from 190 gCO<sub>2</sub>e/km in 1997 and a fall of 27% over the period.<sup>203</sup>

## 7.4 Four packages for decarbonisation

7.4.1 Our transport contribution is set out below as four packages of activity:

- decarbonising vehicles;
- road network efficiencies;
- sustainable communities; and
- business engagement around sustainable transport.

7.4.2 Policies and proposals covering Scotland's transport emissions are anticipated to reduce emissions by **4.0 MtCO<sub>2</sub>e** in 2027 from a Business as Usual scenario of 14.5 MtCO<sub>2</sub>e.

### Package 1 - Policies and proposals to decarbonise vehicles

#### Policies

7.4.3 **EU Directives** make significant contributions to emissions reductions. The EU Directive on carbon dioxide from cars requires new car fleet average emissions to be 130 gCO<sub>2</sub>e/km by 2015, with a target of 95 gCO<sub>2</sub>e/km by 2020. For vans, the respective figures are 175 gCO<sub>2</sub>e/km by 2017 and 147 gCO<sub>2</sub>e/km by 2020.<sup>204</sup>

7.4.4 We support the UK Government's efforts to press the European Commission for **higher vehicle emissions standards beyond 2020** to deliver further improvements in conventional vehicle efficiency and to provide certainty on future markets for ultra-low carbon vehicles. The UK Government considers a range of emissions of between 50 gCO<sub>2</sub>e/km and 70 gCO<sub>2</sub>e/km in 2030 to be plausible for new cars and, for new vans, a range of between 75 gCO<sub>2</sub>e/km and 105 gCO<sub>2</sub>e/km.

7.4.5 The **EU biofuels target** is implemented through the **UK Renewable Transport Fuel Obligation (RTFO)**.<sup>205</sup> Currently, it seems unlikely that biofuels will make up more than 10% of transport fuel by volume by 2020. Biofuels could, though, have a role in market segments where there is

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<sup>203</sup> SMMT. Average new car CO<sub>2</sub> emissions: [www.smmt.co.uk/co2report/#](http://www.smmt.co.uk/co2report/#)

<sup>204</sup> Reducing CO<sub>2</sub> emissions from vehicles: [http://ec.europa.eu/clima/policies/transport/vehicles/index\\_en.htm](http://ec.europa.eu/clima/policies/transport/vehicles/index_en.htm)

<sup>205</sup> EC Renewable Transport Fuel Obligation: <https://www.gov.uk/renewable-transport-fuels-obligation>



limited scope for emissions cuts through electrification, for example in relation to conventional cars and vans, buses and coaches, and HGVs (HGV diesel already meets the RTFO).

## Proposals

7.4.6 The Scottish interventions below are treated as proposals for emissions accounting purposes. This is because, while in most cases they are already being taken forward, they are not yet being implemented at the intensity required for the abatement figures in this document.

7.4.7 The CCC suggests that by 2020, at least 5% of the car fleet should be electric vehicles (16% of new car sales) in order to provide the ‘critical mass’ for subsequent roll-out. This would amount to 120,000 vehicles with new car sales of around 27,000.<sup>206</sup>

7.4.8 Our work in the coming years will focus on decarbonising vehicles, particularly through fleet conversion to **EVs** in the public sector, as well as **supporting electric vehicle infrastructure**. Industry will have a key technology development role to play in increasing battery ranges and reducing their costs (costs can currently be prohibitive for some buyers), while manufacturers are expected to develop alternative ownership models for consumers.

7.4.9 We are now in our third year of funding the installation of EV charging facilities and participating in the UK Government’s Office of Low Emission Vehicles’ (OLEV) **Plugged-in Places** initiative.<sup>207</sup> The programme will see the installation of a high powered interoperable network of charging facilities across Scotland’s seven cities and primary road network together with commercial workplace and home charging facilities.

7.4.10 During 2013, we are aiming for a network of over 500 double-outlet charging posts, of which over 300 will be publically available across Scotland. This, ultimately commercial, network is to be known as ‘Charge Place’ Scotland.<sup>208</sup> Our **Low Carbon Vehicle Procurement Programme** has enabled the purchase of some 270 low carbon vehicles as well as supporting the change of public attitudes towards these vehicles by increasing their visibility.<sup>209</sup> We have invested over £8 million in these programmes over the past three years.

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<sup>206</sup> Assuming new car sales and fleet size on a par with 2011 figures. In practice, new car sales and fleet size are likely to be marginally above the 2011 level so absolute sales are likely to be higher.

<sup>207</sup> Plugged in Places: [www.gov.uk/government/publications/plugged-in-places](http://www.gov.uk/government/publications/plugged-in-places)

<sup>208</sup> Charge Place Scotland: [www.greenerscotland.org/greener-travel/electric-vehicles/chargeplace-scotland](http://www.greenerscotland.org/greener-travel/electric-vehicles/chargeplace-scotland)

<sup>209</sup> Low Carbon Vehicle Procurement Programme: [www.transportscotland.gov.uk/road/sustainability/low-carbon-vehicles](http://www.transportscotland.gov.uk/road/sustainability/low-carbon-vehicles)

7.4.11 We are reliant on the development programmes of various vehicle manufacturers who, in European terms, are only releasing low carbon vehicles for sale from spring 2013 onwards. This should result in greater opportunities for society to purchase vehicles. Our 'Charge Place' charging infrastructure will be ready for use and undergoing further roll-out across all of Scotland.

### **Electric vehicles and the grid**

There are a number of important reasons to manage and influence electric vehicle recharging behaviours. Firstly, it enables the greatest carbon reduction benefits, as recharging at times of low overall demand makes it more likely that renewable energy sources will provide most of the electricity. In contrast peak surges in demand are currently met by switching on high-carbon coal or gas generators.

Managed recharging can also support increased electricity generation from wind turbines and other renewable sources. The recharging of plug-in cars can be matched to the fluctuating levels of generation from renewable sources, helping to balance energy systems and charge with green electricity that might not otherwise be used.

Smart and controlled recharging will also limit the requisite need for grid reinforcement, and avoid overloading local networks at times of peak demand. Moreover, plug-in vehicles could ultimately reduce peak generation requirements. In the short to medium-term, this is most likely to be in the form of vehicle-to-home applications, with surplus capacity in plug-in vehicle batteries used to run domestic appliances. However, in the longer-term, vehicle-to-grid applications may enable plug-in vehicles to export electricity back to the grid, although this is expected to be some way off.

The central measure to regulate or incentivise recharging at specific times will be new consumer energy packages and tariffs which promote recharging at the most optimal electricity price for the day. This will help reduce the operating costs of plug-in vehicles and may also enable large fleets to agree terms with energy providers where there is a mutual benefit in specific tariffs. In addition to advancing plug-in vehicle adoption, new ways of supplying electricity and associated product offerings could represent an entrepreneurial opportunity for Scottish companies.

7.4.12 As other technologies emerge and become credible, we will promote them. For example, we have identified projects at key locations

that involve LNG (liquid natural gas), inductive charging technology for fleet vehicles, and hydrogen to help tackle emissions from HGVs and public service vehicles.

7.4.13 The **E-cosse Partnership**, initiated by Transport Scotland and WWF Scotland, is a collaboration involving industry, government and other key stakeholders to advance the adoption of EVs in Scotland. Its approach acknowledges that, whilst government can put in place relevant policy frameworks, stakeholder support is essential. For example, and as already noted, industry has a critical role through technology development on batteries and their costs, while manufacturers are expected to develop alternative EV ownership or leasing models for consumers.

7.4.14 Through the work of the E-cosse partnership, we'll be publishing an **Electric Vehicle Roadmap for Scotland** later in 2013. This will set out the actions we, and partners, will take to achieve our ambition of EVs becoming an increasingly mainstream option for drivers. Other elements of E-cosse comprise:

- its Strategic Board, a forum of leaders from government, industry and other stakeholders. Chaired by the Minister for Transport and Veterans and co-chaired by Gordon McGregor, Energy and Environment Director at Scottish Power, it first met in October 2012; and
- Readiness initiatives, which will establish a portfolio of projects to advance EV adoption and implement the recommendations of the roadmap.

## Buses

7.4.15 Buses account for 6% of Scotland's surface transport emissions. Our **Scottish Green Bus Fund**, launched in 2010, is helping our bus industry invest in the latest emission reducing technology and demonstrates our commitment to its future.<sup>210</sup> Our support targets the price difference between a LCV bus and its diesel equivalent. Our aims are to improve air quality, accessibility and encourage modal shift.

7.4.16 A market penetration of 50% **low carbon buses** by 2027 is thought to be achievable, provided the technology improvements continue to remove the price differential between LCVs and diesel vehicles. Towards the end of this period, LCVs are expected to become cost competitive with

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<sup>210</sup> Scottish Green Bus Fund: [www.transportscotland.gov.uk/public-transport/Buses/Bus-Fund](http://www.transportscotland.gov.uk/public-transport/Buses/Bus-Fund)

diesel vehicles. This transformation is an important opportunity for the Scottish bus manufacturing sector, led by Alexander Dennis of Falkirk.

7.4.17 Following a revision in the **Bus Service Operators Grant** methodology, grants to operators to support the network and keep fares down are based on distance rather than fuel consumption.<sup>211</sup> This increases incentives for fuel efficiency and thus rewards environmentally efficient operations, as well as supporting the extent of the bus network. LCVs receive double the standard rate. Further, local authority actions around permitted vehicle types in air quality zones could further encourage low carbon transformation.<sup>212</sup>

7.4.18 We are supporting hydrogen pilot projects and, as outlined below, will continue to seek further opportunities in this area.

### Hydrogen Buses

The Aberdeen Hydrogen project, led by Aberdeen City Council and SSE, will see ten hydrogen buses operate on routes within central Aberdeen. This will be the largest fleet of hydrogen buses in Europe. They should be on First and Stagecoach bus routes by 2014 and will be refuelled at Scotland's first large hydrogen refuelling station, which will also be able to fuel hydrogen powered cars.

In the second phase of the project, SSE will develop a whole hydrogen system, which will harness wind energy to produce and store hydrogen, which can then be used to fuel vehicles and other uses such as generating electricity at times of peak demand.

The Scottish Government and Scottish Enterprise have each committed up to £1.65 million to support the project, which has a total budget of £22.5 million. The project has also received funding from the European Commission, the UK Technology Strategy Board and NESTRANS. Other partners include Aberdeen Renewable Energy Group, Ballard, BOC/Linde, Element Energy, Scotia Gas Networks and Van Hool.

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<sup>211</sup> Transport Scotland, Bus Service Operators Grant: [www.transportscotland.gov.uk/public-transport/Buses/bus-service-operators-grant](http://www.transportscotland.gov.uk/public-transport/Buses/bus-service-operators-grant)

<sup>212</sup> The Scottish Government, Air Quality: [www.scotland.gov.uk/Topics/Environment/waste-and-pollution/Pollution-1/16215](http://www.scotland.gov.uk/Topics/Environment/waste-and-pollution/Pollution-1/16215)

## Maritime transport

7.4.19 While emissions from ferries are relatively small, it is important to drive them down. Subject to capital availability, our **Ferries Plan** published in 2012, sets out a major programme of vessel investment, including fuel efficiency improvements, from 2015.<sup>213</sup> We are considering the scope for more efficient powering of vessels while they in port through **connection to shore-side power sources**, and the use of port sites for renewable power generation.

7.4.20 We are also working with operators and the port sector on the environmental impact of maritime transport. This work includes emissions reduction from improved vessel design, **hybrid diesel-electric engines** (especially for ferries) and use of other alternative fuels, and **improved fleet management**. Improvements to the efficiency of the subsidised fleet as a whole are dependent upon the pace of vessel replacement.

7.4.21 Over the period 2027-2050, we expect many new low-emission ferries to be introduced. We are currently providing over £20 million to our asset-owning company, Caledonian Maritime Assets Ltd (CMAL), for the construction of two hybrid ferries, which will be equipped with both conventional diesel engines and batteries, which will be charged overnight from the grid.<sup>214</sup>

7.4.22 **Liquid Natural Gas** may also contribute to maritime emissions abatement, with potential usage for one or perhaps two generations of vessels as part of the transition to the low carbon ferries.

7.4.23 We also support efforts for an international agreement on carbon emissions from shipping.

## Aviation

7.4.24 The EU is responsible for the main policy lever for addressing **aviation** emissions, through the EU ETS, under which emissions from both domestic and international aviation are capped. In 2012, emissions were capped at 97% of average annual emissions from 2004–2006, and from 2013–2020 they will be capped at 95%.

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<sup>213</sup> Transport Scotland, Ferries Plan: [www.transportscotland.gov.uk/strategy-and-research/publications-and-consultations/j254579-00.htm](http://www.transportscotland.gov.uk/strategy-and-research/publications-and-consultations/j254579-00.htm)

<sup>214</sup> Caledonian Maritime Assets Ltd: [www.cmassets.co.uk/en/home.html](http://www.cmassets.co.uk/en/home.html)

7.4.25 In support of an agreed international position on aviation emissions, the European Commission has instigated a 'stop the clock' proposal, the effect of which will be the exclusion, from the EU ETS, of flights into and out of Europe until September 2013. If sufficient progress is made as part of these international negotiations, this will continue post September. The International Civil Aviation Organisation is taking forward these negotiations while Scotland is feeding into the discussions through the UK's negotiators. European aviation emissions will continue to be included in the scheme for domestic flights and flights to and from European nations.

7.4.26 We endorse the on-going aviation **Clean Sky** partnership between the European Commission and industry which, with a grant budget of some €1.6 billion, will speed up technological advance.<sup>215</sup> Since June 2011, biofuels have been used on a number of commercial flights and have potential to deliver a step-change in the environmental performance of aviation.

### Package 2 - Road network efficiencies

7.4.27 We will complement our work on promoting LCVs with Scottish road network efficiency initiatives, such as congestion management and efficient driving.

7.4.28 Our **Intelligent Transport Systems (ITS)** and the further deployment of **average speed cameras on trunk roads** (on sections of the network where they are likely to have an impact) will encourage driving at more efficient speeds.<sup>216</sup> The most efficient driving speed for cars varies but, in general, efficiency tends to decrease at speeds above 50 mph. ITS tools include variable speed limits, variable message signs, ramp metering and targeted use of the hard shoulder as an additional 'managed lane' for priority vehicles. Smoother traffic flows can also result in a reduced emissions and fuel consumption.

### Package 3 - Sustainable communities

7.4.29 The **sustainable communities** package aims to help people understand their options and use more carbon friendly modes of travel through travel planning, walking and cycling, and the use of car clubs.

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<sup>215</sup> Clean Sky partnership: [www.cleansky.eu/](http://www.cleansky.eu/)

<sup>216</sup> Transport Scotland. Intelligent Transport Systems : [www.transportscotland.gov.uk/road/technology/intelligent-transport-systems](http://www.transportscotland.gov.uk/road/technology/intelligent-transport-systems)

7.4.30 By the 2020s, the concept of a sustainable community should be more of a reality than it is today, particularly given on-going work with local authorities, regional transport partnerships and other partners to develop approaches to providing and promoting sustainable transport options. The proportion of people commuting to work each day could be lower as a consequence of both digital technologies and low carbon behaviours and values.

7.4.31 We, with partners, will continue to develop community-based travel planning strategies in light of the learning from the joint £15 million *Smarter Choices Smarter Places (SCSP)* sustainable transport demonstration programme, as well as from other similar initiatives. The SCSP ran in seven local areas between 2008 and 2012.<sup>217</sup> There is a significant role for local authorities in delivering both behaviour change and infrastructural improvements (e.g., traffic calming and local road re-design). In addition, advice on travel choices (including vehicles type) is available from the network of Energy Saving Scotland Advice Centres.<sup>218</sup>

#### Smarter Choices Smarter Places (SCSP)

The SCSP work identified the importance of residents receiving common messages from multiple sources and often from people or agencies they trust. Effective two-way communication, and action on feedback from the community, ensures an appropriate balance between investment in supply and demand for travel, e.g. through travel planning work.

Involvement by local people and businesses in the delivery of programmes similar to those delivered in the SCSP areas is also essential for their sustainability. This is often achieved through building community support, to enable programmes to be responsive to local opportunities as they arise.

The findings from the programme's evaluation are being used to inform and determine the characteristics of future programmes to be led and supported by the Scottish Government and designed to promote modal shifts to public and active travel.

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<sup>217</sup> Transport Scotland. Smarter Choices Smarter Places: [www.transportscotland.gov.uk/roads/sustainable-transport/funding-for-projects/smarter-choices-smarter-places](http://www.transportscotland.gov.uk/roads/sustainable-transport/funding-for-projects/smarter-choices-smarter-places)

<sup>218</sup> Changeworks, Energy Saving Scotland Advice Centres: <http://www.changeworks.org.uk/householders/essacs-landing-page/408/#householder>

7.4.32 Improvements in integrated public transport, such as smart ticketing, and park-and-ride facilities, will support further modal shift to bus<sup>219</sup> and rail<sup>220</sup> and away from private car usage, particularly where complemented by local travel planning. Local authorities have key roles in establishing **Bus Quality Contracts** and **statutory bus partnerships** as on-going measures to attract new passengers by improved bus service delivery. We are working with the Bus Stakeholder Group to identify and tackle any barriers to wider take up of bus quality contracts and partnerships. **Integrated ticketing** and **smartcards** also have potential to increase public transport use, especially as connectivity steadily improves.

7.4.33 In addition, work by bus operators and local authorities on interactive information boards within bus stops, with real time information on services, will develop confidence in public transport. Hand-held devices such as smart phones, with access to similar information, offer the potential to limit time spent waiting for buses at stops – seen as one of the major costs of using public transport.

7.4.34 Our **Cycling Action Plan** sets out our plans for achieving our vision that by 2020, 10% of all journeys in Scotland will be taken by bike. This has been undergoing a recent re-refresh exercise with stakeholders to ensure it is as up-to-date and as effective as possible in the wake of delivery experience. A new version was published in June 2013.<sup>221</sup>

7.4.35 Our active travel policy beyond 2020 will continue work to substitute cycling and walking for car journeys of up to 5 miles, with on-going work with stakeholders to deliver further infrastructure improvements and promote active travel for shorter journeys. Scottish Ministers' intention to develop a **National Walking Strategy** was announced in May 2012 and work is underway with stakeholders.<sup>222</sup>

7.4.36 We will also continue to work with partners to develop a Scotland-wide network of **car clubs**<sup>223</sup> across Scotland. Around a dozen have been developed to date and more are in development as communities recognise the potential cost-savings and convenience from car sharing over car ownership. Car club vehicles are generally at the lower end of the emissions range for conventional vehicles, so car club journeys compare favourably in terms of average emissions. On average, Scottish car club vehicles are 29% more fuel efficient than the average car in the UK.

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<sup>219</sup> Transport Scotland. Bus Policy: [www.transportscotland.gov.uk/public-transport/Buses/Policy](http://www.transportscotland.gov.uk/public-transport/Buses/Policy)

<sup>220</sup> Transport Scotland. Rail Policy: [www.transportscotland.gov.uk/rail](http://www.transportscotland.gov.uk/rail)

<sup>221</sup> Transport Scotland, Cycling Action Plan for Scotland:  
[www.transportscotland.gov.uk/news/cycling-action-plan-scotland-relaunch](http://www.transportscotland.gov.uk/news/cycling-action-plan-scotland-relaunch).

<sup>222</sup> National Walking Strategy:  
[www.scotland.gov.uk/News/Releases/2012/05/walkingstrategy17052012](http://www.scotland.gov.uk/News/Releases/2012/05/walkingstrategy17052012)

<sup>223</sup> Car Clubs in Scotland: [www.carplus.org.uk/our-work/car-clubs-in-scotland/](http://www.carplus.org.uk/our-work/car-clubs-in-scotland/)



7.4.37 Car clubs also offer an opportunity to pilot the use of EVs in communities and this will be developed in the coming years. Car clubs should become self-sustaining over time given their financial attractiveness to members.

#### Package 4 - Business engagement on sustainable transport

7.4.38 Businesses and organisations are significant generators of travel, with 10% of average annual travel accounted for by business activity.<sup>224</sup> Travel is a significant cost to businesses. This package of Scottish interventions includes the on-going roll-out of **fuel efficient driving**, **workplace travel planning** and **freight efficiencies**.<sup>225, 226</sup>

7.4.39 Through the “ChooseAnotherWay” website hosted by Energy Saving Trust on behalf of Transport Scotland, we are supporting workplace travel-planning to identify alternatives to travel (through the use of technology) and lower-carbon alternatives, including promotion of alternatives to travel (smarter working).<sup>227</sup> We are also researching the impacts of the **Worksmart** initiative and similar projects being undertaken by local authorities and other organisations to reduce work-related travel and lever significant financial benefits as well as carbon abatement, with a view to encouraging further behavioural change work.<sup>228</sup>

#### ChooseAnotherWay

The chooseanotherway.com website is a resource for organisations in Scotland wanting to reduce the costs and environmental impacts associated with how we work and travel. It is hosted by the Energy Saving Trust on our behalf, and was developed in partnership with the 2020 Climate Group.

Mobility and the way we travel to the workplace, to meet clients, to transport goods and as part of daily operations can be a significant cost, source of emissions and area of corporate and occupational risk for organisations. The approaches provided will help businesses and organisations identify cost effective strategies for tackling travel-related issues, unlock benefits and achieve greater business efficiency and resilience. The website also provides knowledge-sharing opportunities through a series of webinars.

<sup>224</sup> This excluding commuting which accounts for a further 20% of annual individual travel.

<sup>225</sup> Fuel Efficient Driving:

[www.energysavingtrust.org.uk/scotland/Travel/Driving/Fuel-Efficient-Driver-training](http://www.energysavingtrust.org.uk/scotland/Travel/Driving/Fuel-Efficient-Driver-training)

<sup>226</sup> Workplace Travel Planning: [www.chooseanotherway.com/](http://www.chooseanotherway.com/)

<sup>227</sup> Choose Another Way: [www.chooseanotherway.com/index.php](http://www.chooseanotherway.com/index.php)

<sup>228</sup> Worksmart initiative: [www.flexibility.co.uk/cases/Aberdeenshire-Council-Worksmart.htm](http://www.flexibility.co.uk/cases/Aberdeenshire-Council-Worksmart.htm)

7.4.40 We are encouraging **fleet efficiency** improvements through promoting fuel-efficient driving practices (for cars, vans and HGVs), the application of vehicle telematics, by signposting opportunities for fleet conversion through green fleet reviews, and work to help organisations identify the opportunities for reducing grey fleet costs.

7.4.41 Telematics combine IT and communications networks to enable hauliers and fleet managers to monitor vehicle location, fuel efficiency, driver technique and traffic conditions. They enable congestion avoidance, improve driving practices and reduce mileage.

7.4.42 We will continue to work with the haulage sector on alternatives to road haulage (freight modal shift to rail and water) and to encourage more efficient freight vehicle usage (fuel efficient driving practices for HGVs and vans, fuels, encouraging load sharing and consolidation etc).<sup>229, 230</sup>

### Lower emission potential in Transport

7.4.43 In preparing RPP2, we have taken a practical ‘bottom-up’ approach, i.e. we have identified and considered individual measures, estimated their potential emissions reductions impacts, and built up a package of proposals and policies.

7.4.44 However, when considering emissions abatement potential over a long time-frame, such as the climate change targets out to 2027, there is also a need to draw on elements of ‘top-down’ modelling. In these cases, modelling work suggests areas of long-term emissions abatement potential in certain sectors but with a greater level of uncertainty about the means of delivery than for other policies and proposals in this report. For this reason, in this report we refer to these measures as ‘technical potential’ proposals.

7.4.45 In the case of transport, a range of models used to predict transport emissions suggests that there may be an additional technical emissions abatement potential of perhaps as much as 0.75 MtCO<sub>2</sub>e by 2027. This potential reflects uncertainties in projections of traffic growth, and the scope to manage reductions in use of the road network in favour of public transport and active travel.

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<sup>229</sup> Transport Scotland. Freight Grants:  
[www.transportscotland.gov.uk/road/policy/freight/Freight-Grants](http://www.transportscotland.gov.uk/road/policy/freight/Freight-Grants)

<sup>230</sup> Transport Scotland:  
[www.transportscotland.gov.uk/road/policy/freight](http://www.transportscotland.gov.uk/road/policy/freight)

7.4.46 These estimates are necessarily very preliminary and so remain ‘technical’ for the time being due to the uncertainties surrounding a number of central factors. The baseline forecast that far ahead relies on a number of variables that are currently relatively volatile, e.g. fuel prices, and traffic growth, the rate at which new technologies evolve and are adopted, and the current situation will have consequences for projections of road network use and travel modes. This baseline is then affected by the scale, speed, timing and success of the currently identified policies and proposals which adds further uncertainties.

7.4.47 The emissions abatement from these transport technical potential proposals has been factored in to the RPP2 calculations for the years 2025 - 2027. The profile of the estimated emissions abatement potential simply reflects the limitations of currently available data. In reality, any emissions savings are likely to build more gradually, over a longer period of time. As such, the most appropriate approach to this potential is to undertake more robust analysis and appraisal before reporting in more detail. This analysis is likely to be undertaken in a number of phases over the period out to the context of RPP3 with the first of these assessments, looking at current trends in travel patterns and modes in Scotland (“Car, rail and bus travel trends in Scotland, 1995 to 2010”), due for release in the very near future. Work to develop and refine these proposals will continue and it is our intention to set out more information in RPP3 about how this emissions abatement might be realised.

## 7.5 Supporting and enabling measures

7.5.1 **Scottish Planning Policy** influences the location, density and form of development to make access by public transport and active travel easier and reduce travel demand. It can also influence the accessibility of infrastructure for mobile phone technology, Wi-Fi and broadband.

7.5.2 Communities will benefit from the impacts of our **Digital Strategy** allowing more opportunities for dispersed tele-working from home and community facilities, potentially reducing commuting and associated traffic and public transport congestion.<sup>231</sup> Business and leisure travel emissions and costs should fall as more services, including shopping and public services, are accessed digitally.

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<sup>231</sup> Scotland’s Digital Future: A Strategy for Scotland: [www.scotland.gov.uk/Publications/2009/08/26141950/0](http://www.scotland.gov.uk/Publications/2009/08/26141950/0)

7.5.3 We are implementing a wide range of **infrastructure investment plans**, geared to support sustainable economic growth in Scotland, which will encourage modal shift to public transport and active travel. We are committed to Fastlink in Glasgow, supporting the Glasgow Subway modernisation and Borders Rail, and supporting the Edinburgh trams, as well as work linked to the Forth Replacement Crossing around Park & Ride and dedicated busways.

7.5.4 In 2012-13, we are investing over £1 billion in public transport and other sustainable transport options to maintain the network and encourage people out of their cars. In June 2012, we announced a £5 billion package of funding and investment in Scotland's railways between 2014 and 2019, including a commitment to further electrification of the rail network.

7.5.5 Although Scotland does not feature in the UK Department for Transport's plans for high speed rail, Scottish Ministers have agreed a programme of joint working with the UK Government for high speed rail between the North of England and Scotland.<sup>232</sup> These plans will be presented during 2015. Scotland's inclusion adds to the economic case for high speed rail in the UK. It will also encourage modal shift from the UK's busiest domestic aviation market, between Scotland's central belt and London. A three hour journey time would potentially capture two-thirds of the overall Scotland to London travel market, and deliver reductions in carbon emissions from modal shift from air to train.

7.5.6 The Scottish Government is focused on delivering emissions reductions across the whole country. Transport Scotland has joined with SEPA to form the Scottish Transport Emissions Partnership (STEP).<sup>233</sup> This group will develop a strategic approach to practical actions that can help manage poor air quality in Scotland. STEP aims to seek and share technical ideas and solutions to both address existing Air Quality Management Areas (AQMAS) and prevent further AQMAS from being declared.

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<sup>232</sup> Department for Transport. High Speed Rail: <http://highspeedrail.dft.gov.uk/>

<sup>233</sup> Scottish Transport Emissions Partnership:

[www.scottishairquality.co.uk/documents/reports/4\\_Scottish\\_AQD\\_and\\_Website\\_Annual\\_Seminar\\_18\\_March\\_2013\\_STEP\\_Presentation.pdf](http://www.scottishairquality.co.uk/documents/reports/4_Scottish_AQD_and_Website_Annual_Seminar_18_March_2013_STEP_Presentation.pdf)

## 7.6 Costs and benefits

7.6.1 The costs of the interventions described above are largely derived from the MTCCI report on which our RPP1 analysis was founded.<sup>234</sup> We have built on the work using updates from additional publications, including the CCC's Fourth Carbon Budget report.<sup>235</sup>

7.6.2 A significant proportion of the up-front funding required to implement many of these policies is likely to fall to the public sector, particularly through funding cost-gaps to stimulate the uptake of new technologies in the early years, or to support behavioural change work through the delivery of public-good type infrastructure (i.e., from which revenue streams cannot readily be generated in practice) such as cycle paths, or ITS for major roads.

7.6.3 Over time, individuals and businesses will be encouraged to invest in low carbon transport themselves through movements in relative prices for higher carbon alternatives. Proactive investment by the supply chain would also be sought to pump-prime the commercial transitions envisaged as the LCV agenda takes off. However, in general, the measures described here should bring financial benefits greater than their costs. Fuel efficient driving will bring fuel-cost savings for households and businesses, as well as a strong possibility of fewer traffic accidents. Modal shift to active travel should also provide financial savings to individuals. Car club membership can reduce the requirement for car ownership, while offering households and organisations access to lower cost car usage.

7.6.4 On top of the financial benefits, most of the policies and proposals will bring additional benefits such as improved health, improved air quality, less congestion and noise pollution, and enhanced biodiversity. Overall, the cumulative effect of our four packages will be to deliver a transport infrastructure that reduces greenhouse gases and other emissions, reducing the volume of substances in the outdoor air that are harmful to health and the natural environment.

7.6.5 The decarbonisation agenda offers a real opportunity to re-focus Scotland's expertise in high value manufacturing into a new, dynamic and rapidly growing **global market for low carbon vehicles and vessels**. Although Scotland has no major car manufacturing industry, Scottish companies have capability in niche vehicle manufacturing and are bringing

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<sup>234</sup> Mitigating Transport's Climate Change Impacts:  
[www.scotland.gov.uk/Publications/2009/08/26141950/0](http://www.scotland.gov.uk/Publications/2009/08/26141950/0)

<sup>235</sup> Committee on Climate Change. Fourth Carbon Budget:  
[www.theccc.org.uk/publication/the-fourth-carbon-budget-reducing-emissions-through-the-2020s-2/](http://www.theccc.org.uk/publication/the-fourth-carbon-budget-reducing-emissions-through-the-2020s-2/)

prototypes to market. These companies include Allied Vehicles Ltd (EVs),<sup>236</sup> Axeon (lithium-ion batteries)<sup>237</sup> and Alexander Dennis Ltd (hybrid buses).<sup>238</sup> The uptake of EVs will also support opportunities related to large scale transition to renewable energy generation. In addition, the £20 million contract for new hybrid ferries has been awarded to the Ferguson Group.<sup>239</sup>

7.6.6 Taking account of forecast costs for petrol and diesel, and the relative fuel efficiencies of conventional and electric cars, EVs should, over time, become significantly cheaper to run than conventional vehicles. Potentially, this could stimulate increased vehicle usage, thus congestion, which would need to be tackled through traffic management.

7.6.7 The provision of additional cycling and walking infrastructure can be labour-intensive relative to larger infrastructure projects, thus creating construction work for locally-based contractors. A growth in cycling could also mean an increase in jobs in bike shops, supply chains and leisure and tourism outlets, as well as in relation to cycle-training provision and promotion (though logically with a consequent negative impact on the vehicle sector). Increased participation in active travel, in addition to car and lift sharing, can also help alleviate transport poverty issues by widening the low-cost low carbon travel options available.

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<sup>236</sup> Allied Vehicles Ltd: [www.alliedelectric.co.uk](http://www.alliedelectric.co.uk)

<sup>237</sup> Axeon: [www.axeon.com](http://www.axeon.com)

<sup>238</sup> Alexander Dennis Ltd: [www.alexander-dennis.com/alexander-dennis-limited.php](http://www.alexander-dennis.com/alexander-dennis-limited.php)

<sup>239</sup> Ferguson Group: [www.fergusongroup.co.uk/shipbuilding/profile.aspx](http://www.fergusongroup.co.uk/shipbuilding/profile.aspx)

**Table 7.1: Highlights of progress since publication of RPP1**

Transport	Summary
<b>Policies</b>	
<p><b>EU Directives</b> The adoption of EU Directives relating to cars (2009) and vans (2011) established mandatory CO<sub>2</sub>e emissions reduction targets to improve the fuel economy of new vehicles by 2020. Phased emissions reductions targets are introduced from 2012 (cars) and 2014 (vans) respectively; The adoption of the EU Biofuels Directive (2009) increases the proportion of fuel used in transport that must be derived from renewable sources to a minimum of 10% by 2020.</p>	<p><b>Actions</b> Market-led adjustments to the supply of new vehicles in Scotland. Transposition of the European Biofuels Directive through the UK Renewables Transport Fuel Obligation.</p> <p><b>Outcomes</b> On-going transition to lower emission vehicles through steady replacement of the existing fleet; increasing penetration of biofuels into the transport fuel supply mix.</p>
<b>Proposals</b>	
<p><b>Eco-driving</b> Eco-driving delivers driving techniques leading to average fuel savings of 5-10%. This proposal is to encourage market demand for eco-driving training from car drivers and its delivery.</p>	<p><b>Actions</b> The Scottish Government has provided grant funding to the Energy Saving Trust (EST) to deliver training in fuel efficient driving techniques to businesses Scotland-wide.</p> <p><b>Outcomes</b> In 2012-13, around 3,000 drivers, including 1,000 high-mileage drivers, benefited from subsidised training. Support for fuel-efficient driver training will continue in 2013-14.</p>
<p><b>Speed limits</b> Stricter enforcement of the existing 70 mph limit on dual carriageways and motorways.</p>	<p><b>Actions</b> Actions taken forward under Intelligent Transport Systems (ITS).</p> <p><b>Outcomes</b> Outcomes listed under Intelligent Transport Systems (ITS).</p>

<p><b>Low carbon vehicles and infrastructure</b></p> <p>Measures to support the procurement of low carbon vehicles and their supportive infrastructure.</p>	<p><b>Actions</b></p> <p>Over the past two years, the Scottish Government has invested over £8 million in EVs and associated infrastructure in Scotland. The 'E-cosse' Partnership, a collaboration between government, industry, WWF Scotland and other key stakeholders has been established and will produce a roadmap in Summer 2013 setting out the process for advancing the wholesale adoption of EVs in Scotland. E-cosse aims to capitalise on the Scotland's potential to be an EV pioneer, maximizing the economic, environmental and social benefits of EVs as an integral part of a sustainable transport system and a smart energy grid.</p> <p>We have also supported innovative projects such as Aberdeen City Council's hydrogen fuel cell bus trial, which show the potential of other advanced low carbon vehicle technologies.</p> <p><b>Outcomes</b></p> <p>Our funding over the last two years has contributed to the purchase of around 270 public sector low carbon vehicles and the installation of approximately 300 charging points. We aim to install a further 200 charging points in this financial year in households, in workplaces and in publicly accessible locations</p>
<p><b>Freight efficiencies</b></p> <p>Measures aimed at improving freight efficiency through technological, purchasing and operational changes in the fleets of freight vans and HGVs.</p>	<p><b>Actions</b></p> <p>Subsidised fuel efficient driver training was initially provided by SG to establish commercial demand for this training. Freight Best Practice advice with supporting case studies is provided on the Transport Scotland website.<sup>240</sup> The advice includes a carbon toolkit developed with industry input.</p> <p><b>Outcomes</b></p> <p>Increased industry engagement with emissions reduction agenda. The Freight Transport Association has a Logistics Carbon Reduction Scheme, which aims to reduce emissions by 8% by 2015 through improved efficiency and some modal shift to rail, while the Road Haulage Association has produced guidance on carbon reduction measures.</p>

<sup>240</sup> Transport Scotland: [www.transportscotland.gov.uk/road/policy/freight/best-practice](http://www.transportscotland.gov.uk/road/policy/freight/best-practice)



<p><b>Van efficiencies</b></p>	<p><b>Actions</b> Actions taken forward under Freight Efficiencies.</p> <p><b>Outcomes</b> Outcomes taken forward under Freight Efficiencies.</p>
<p><b>Intelligent Transport Systems (ITS)</b> To use ITS to reduce the volume or increase the efficiency of traffic flows on the trunk road network.</p>	<p><b>Actions</b> Provision of variable speed limits, variable message signs, ramp metering, speed enforcement, and targeted use of the hard shoulder as an additional 'managed lane' for priority vehicles, as appropriate.</p> <p><b>Outcomes</b> Various components of ITS have been included as part of the M74 completion (£445 million) and M80 Stepps to Haggs (£320 million) major infrastructure projects. In December 2012 ITS was introduced on the M90 in Fife, with a dedicated bus lane and variable speed limits used during periods of congestion to smooth traffic flow, cut jams and make journey times more reliable. In February 2013 ITS was also introduced at junction 1A of the M9.</p>
<p><b>Maritime</b> To work with domestic ferry operators to achieve emissions reductions of up to 20%.</p>	<p><b>Actions</b> We are supporting the next generation of vessels, including lower-emissions hybrid technologies.</p> <p><b>Outcomes</b> We are funding the construction by Fergusons of Port Glasgow of two new hybrid ferries at a cost of £20 million.</p>
<p><b>Travel planning</b> Provide advice and information on sustainable transport options as an alternative to single-occupancy car journeys, tailored to individual circumstances</p>	<p><b>Actions</b> Personalised travel planning has been provided to 50,000 households through the Smarter Choices Smarter Places (SCSP) programme, under which supported a range of sustainable transport initiatives in the participating communities. Next steps will be developed with stakeholders in the wake of the SCSP evaluation.</p> <p><b>Outcomes</b> An evaluation of the programme was published in April 2013. The evaluation reported that the programme has encouraged more people in their areas to use active forms of travel. These changes have usually been more than in comparable areas without the same types of interventions.</p>

<p><b>Cycling and walking infrastructure</b></p> <p>The Cycling Action Plan (CAPS) for Scotland published in 2010 sets the framework for a tenfold increase in the proportion of journeys made by bicycle by 2020. This proposal also includes options to encourage people to walk shorter journeys more often. The proposal seeks to increase the proportion of journeys by active travel to 20%.</p>	<p><b>Actions</b></p> <p>On-going work to implement the CAPS, including promotion of cycling across schools, communities and workplaces, and investment in infrastructure improvements across Scotland (with SG support of more than £50 million over three years. A refresh of the Cycling Action Plan for Scotland has been undertaken with stakeholders to ensure it is as up-to-date and effective as possible going forward.</p> <p><b>Outcomes</b></p> <p>The latest (2011) figure for the number of trips undertaken on the National Cycle Network (NCN) is 44 million. The proportion of children receiving on-road 'Bikeability Scotland' cycle training has increased to 31.7% of the P6-7 cohort. We have urged local authorities to not only meet Cycling Scotland's target of 40% by 2015 but to exceed it. Local cyclist-awareness 'Give Me Cycle Space' campaigns aimed at drivers have been delivered in fifteen local authority areas covering over 130 schools since May 2012, with evaluation results suggesting a positive impact on cycling interest and participation. Scotland's first cycling/rail hub was opened at Stirling Railway station in May 2013, providing information and advice to cyclists.</p>
<p><b>Car clubs</b></p> <p>To create car clubs in towns with populations less than 25,000 to reduce the need for car ownership</p>	<p><b>Actions</b></p> <p>A number of communities are being financially supported to test the feasibility of establishing car clubs in their areas. Those locations which prove to be suitable for car club development are being given further support to establish a functioning car club operation, which should become self-financing within 2-3 years</p> <p><b>Outcomes</b></p> <p>Fourteen car clubs have so far received support from the Developing Car Clubs in Scotland programme, including in Aberdeen, Dundee and Dumfries which launched in 2012.</p>

<p><b>Buses and taxis</b></p> <p>Extension of the Green Bus Fund to encourage operators and local authorities to invest in new low carbon vehicle technology. Work with the bus operators through CPT and the Greener Journeys programme to encourage increased bus patronage. Funding for local authorities to encourage travel by public transport through innovative travel exchange points, information provision, and integrated travel.</p>	<p><b>Actions</b></p> <p>Through the Green Bus Fund, the Scottish Government has provided £7.7 million of grant funding to support the purchase of low carbon buses by a variety of bus operators across Scotland.</p> <p><b>Outcomes</b></p> <p>Since 2010 over 90 buses have been purchased through this scheme. Each new bus is expected to produce 30% less emissions and require 60% less fuel than a diesel bus, to deliver an average emissions reduction of around 21 tCO<sub>2</sub>e per year or 300 tCO<sub>2</sub>e over its life-cycle.</p>
<p><b>Freight modal shift-</b></p> <p>Provide further incentives to encourage modal shift of freight to rail or water as appropriate.</p>	<p><b>Actions</b></p> <p>We operate four freight grant schemes to encourage the transfer of freight from road to rail or water, where the road option is cheaper.</p> <p>We are developing a rail freight policy framework that aims to encourage increased modal shift to rail for freight, from less sustainable modes.</p> <p><b>Outcomes</b></p> <p>Freight mode shift grant funded projects have removed over 52 million lorry miles from Scotland's roads since 2007 by transferring freight from road to rail and water.</p>
<p><b>Community hubs</b></p> <p>To further reduce the need to travel through the provision of shared remote working facilities in settlements with populations less than 10,000.</p>	<p><b>Actions</b></p> <p>Emerging findings of activities undertaken since RPP1 indicated greater emissions abatement potential to be achieved through pursuit of other measures especially workplace travel planning and further investigation of smarter working approaches and possibilities.</p> <p><b>Outcomes</b></p> <p>On-going work around alternatives to travel with partners such as the 2020 Climate Group and public sector organisations.</p>

**Table 7.2: Summary of Transport policies and proposals**

Transport	EU, UK or Scottish	Annual Abatement (KtCO <sub>2</sub> e) 2020	Annual Abatement (KtCO <sub>2</sub> e) 2027	Earliest start date
<b>Policies</b>				
<b>Decarbonising Vehicles (EU Directives)</b>				
EU legislation on new vehicle emissions standards and on the proportion of transport fuel that must be comprised of biofuels.	EU	1,243	1,727	On-going
<b>Proposals</b>				
<b>Decarbonising Vehicles</b>				
Programme of measures designed to increase the adoption of electric vehicles, low carbon buses, hybrid ferries and encourage the use of biofuels across the transport sector.	Scottish	282	798	On-going but scalable
<b>Sustainable Communities</b>				
Promote sustainable and active transport through the provision of integrated public transport, travel planning to promote sustainable travel choices, developing the cycling and walking infrastructure and encouraging the expansion of car clubs to reduce car ownership.	Scottish	139	277	On-going but scalable
<b>Business Efficiencies</b>				
A range of measures centred around engaging with businesses including providing support for workplace travel-planning and advice to encourage fleet efficiency improvements including the provision of fuel efficient driver training.	Scottish	121	462	On-going but scalable

<p><b>Network Efficiencies</b></p> <p>For appropriate sections of the trunk road network, applying Intelligent Transport System (ITS) tools and the use of average speed cameras to promote fuel efficient driving.</p>	<p>Scottish</p>	<p>36</p>	<p>32</p>	<p>On-going but scalable</p>
<p><b>Lower Emission Potential in Transport</b></p> <p>Potential additional abatement reflecting current uncertainties in projections of traffic growth, and the possible future scope to manage reductions in use of the road network in favour of public transport and active travel</p>	<p>Scottish</p>	<p>0</p>	<p>750</p>	<p>2025</p>

**8.**

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**WASTE AND  
RESOURCE  
EFFICIENCY**



## 8. Waste and resource efficiency

### 8.1 Introduction

8.1.1 This chapter addresses greenhouse gas emissions arising from waste produced and landfilled in Scotland. When organic materials break down in landfill sites they produce potent greenhouse gases, mainly methane, which is approximately 25 times more potent than carbon dioxide. Over 92% of territorial emissions in the waste sector arise from landfill.

8.1.2 The chapter also discusses wider actions to help lower global greenhouse gas emissions through our work to reduce Scotland's dependency on primary resources.

### 8.2 Our ambitions for decarbonising waste

8.2.1 We published our **Zero Waste Plan** in 2010, setting out our vision for a zero waste society; a society where waste is a valuable resource, landfill is phased out, and increasing amounts of materials are reused or recycled, leaving only limited amounts to be treated.<sup>241</sup> This is complemented by actions to progressively design out avoidable waste from our economy.

8.2.2 The Zero Waste Plan sets waste management targets including:

- the proportion of household waste subsequently recycled, composted and or prepared for re-use. The targets are 40% by 2010, 50% by 2013, 60% by 2020 and 70% by 2025;
- recycling 70% of all waste (including commercial and industrial waste) by 2025; and
- reducing the proportion of total waste sent to landfill to a maximum of 5% of all waste by 2025.

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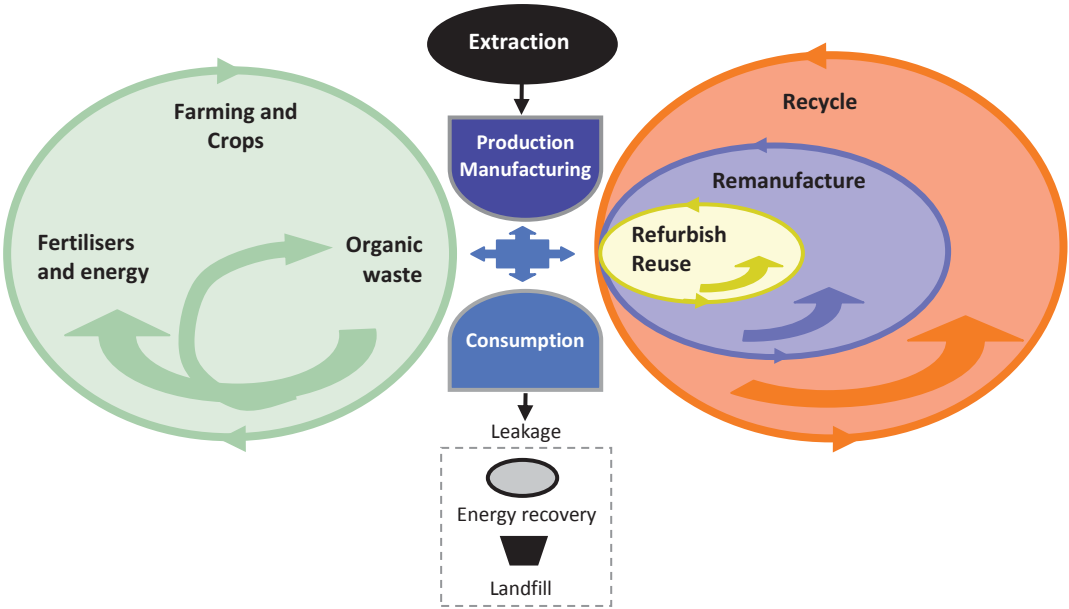
<sup>241</sup>Scottish Government, Zero Waste Plan: [www.scotland.gov.uk/Publications/2010/06/08092645/0](http://www.scotland.gov.uk/Publications/2010/06/08092645/0)

8.2.3 To deliver on the Zero Waste Plan’s commitment to develop a waste prevention programme, we have consulted on Safeguarding Scotland’s Resources – a programme for the sustainable use of our materials.<sup>242</sup> This proposes ambitious targets to cut Scotland’s total waste from households and businesses by 5% by 2015 and by 15% by 2025, through measures covering:

- working with key business sectors to cut waste and use energy and materials more efficiently – delivering environmental benefits and improving competitiveness;
- promoting reuse through improving supply as well as demand for reused items, including strengthening the reuse sector; and
- influencing behaviours, including through education and communications such as last year’s food waste prevention campaign.

8.2.4 By 2050, we aim to achieve full recycling of our waste; landfill will no longer be necessary, and waste as we know it will have been designed out of our economy and way of life. Scottish companies will not only be reprocessing recycled materials for new products, they will be at the forefront of changes to manufacturing and retail that will have transformed how goods and services are provided to the public (Figure 8.1).

Figure 8.1: Zero Waste - a more circular model of resource use



<sup>242</sup> Scottish Government, Safeguarding Scotland’s Resources: <http://www.scotland.gov.uk/Topics/Environment/waste-and-pollution/Waste-1/latest/ssrsea>



## 8.3 Where we are now

8.3.1 In 1999, Scotland produced 14.6 million tonnes of waste, with around 10.9 million tonnes going to landfill and less than 5% recycled. Today our recycling rate is over 40% and we have reduced the total amount of waste sent to landfill by 58% i.e. 6.3 million tonnes (2010-11).

8.3.2 In 1990, Scottish emissions from waste management were 6.7 MtCO<sub>2</sub>e. In 2011, waste contributed 2.2 MtCO<sub>2</sub>e or 4% of total Scottish emissions.<sup>243</sup> The combined effect of reduced waste to landfill and action to mitigate or capture landfill gases means waste management emissions have fallen by 67% since 1990.

## 8.4 Decarbonisation policies

8.4.1 **Landfill gas** is the main waste related contributor to our territorial greenhouse gas emissions. In 2012, the Scottish Parliament passed the **Waste (Scotland) Regulations 2012**.<sup>244</sup> These regulations introduced measures to transform how waste and recyclables are processed in Scotland. Specific measures introduced by the regulations include:

- a requirement for businesses to present dry recyclables (metals, plastics, paper, card and glass) and food waste for collection;
- a requirement on local authorities to provide householders with a collection service for dry recyclables and food waste;
- a ban on materials collected separately for recycling going to landfill or incineration; and
- introducing a ban on biodegradable municipal waste going to landfill by the end of 2020.

8.4.2 These regulations – coupled with waste prevention measures in our forthcoming Safeguarding Scotland's Resources programme - will progressively change both the **amount** and **composition** of waste going to landfill. The combined effect of these regulations will be to reduce annual emissions from landfill by 214 ktCO<sub>2</sub>e in 2027.

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<sup>243</sup> Scottish Greenhouse Gas Emissions 2011: [www.scotland.gov.uk/Publications/2013/06/1558](http://www.scotland.gov.uk/Publications/2013/06/1558)

<sup>244</sup> The Waste (Scotland) Regulations 2012: [www.legislation.gov.uk/ssi/2012/148/contents/made](http://www.legislation.gov.uk/ssi/2012/148/contents/made)

## Using waste to generate energy and reduce emissions

8.4.3 Waste has the potential to be a considerable source of energy. For instance, if all of the estimated two million tonnes of annual food waste in Scotland was used in anaerobic digestion, it could generate enough electricity to power a city the size of Dundee, while also producing fertilisers to meet 10% of our arable farming needs.

### Global pressures on resources

By 2050, we will share our planet with **two billion more citizens**. Furthermore, estimates indicate that three billion new wealthier consumers will enter the global market by 2030. Business and global economies may thrive on providing for these new demands, but they will place further strains on natural resources. Demographic and consumer trends are already heightening global competition for a range of resources. Prices of food, non-food agricultural items, metals, and energy are at a higher level than at any time in the past century. These trends are already affecting businesses.

In a recent survey<sup>245</sup> over 80% of chief executives of manufacturing companies said that raw materials shortage was a risk to their business in 2012. While we expect these pressures to lead businesses to look much harder at their processes to reduce reliance on materials, we are working to insulate our economy from such resource pressures and to take advantage of the economic opportunities they will bring.

## 8.5 Decarbonising proposal

8.5.1 We are examining opportunities for **capturing gas** from closed or inactive landfill sites. Methane capture can be economically viable and incentives, such as the **renewable obligation certificates**<sup>246</sup>, already provide financial support to landfill operators. However, once landfill sites close the capture rates are generally too small to make investment in gas capture infrastructure viable.

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<sup>245</sup> EEF: The Manufacturers' Organisation (2012) Executive Survey 2012.

<sup>246</sup> Renewables Obligations: [www.scotland.gov.uk/Topics/Business-Industry/Energy/Obligation-12-13](http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Obligation-12-13)

8.5.2 Through Zero Waste Scotland,<sup>247</sup> we are mapping out opportunities for enhanced gas capture across Scotland. The final report will provide the basis from which to make the future policy decisions required to achieve the abatement potential.

### Energy from waste

In 2010, the Sustainable Development Commission reported that energy from waste could contribute around 3% of Scotland's total heat and electricity demand.<sup>248</sup> The study focused on the use of combustion and anaerobic digestion with biogas capture and the main technologies that could contribute to these outputs. It emphasised that the greatest output could be achieved if thermal output is used for heat, as this would be more than 80% efficient. Thermal-only output could equate to around 6% of Scotland's existing heat demand.

These opportunities need to be set against the Scottish Government's policy of continually reducing Scotland's residual waste and minimising the need for residual waste treatment through increased rates of recycling and reuse, and waste prevention.

## 8.6 Supporting and enabling measures

8.6.1 The Zero Waste Plan is an economic strategy: it aims to maximise the value of all the material resources we use in our economy, helping to create new business opportunities as well as helping businesses and local authorities find savings in how they use materials and manage their waste.

8.6.2 At the heart of these changes is a shift toward a more circular model of resource use and economic growth that ultimately designs waste out of our economy (Figure 8.1). This isn't simply about using less and recycling more. It's about supporting new forms of manufacturing, redesigning products and packaging, reshaping supply chains and stimulating innovative new ways to transform recyclables into new, higher value materials. The opportunities stretch across all sectors, from the motor industry to the oil industry through to retail and farming.

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<sup>247</sup> Zero Waste Scotland: [www.zerowastescotland.org.uk](http://www.zerowastescotland.org.uk)

<sup>248</sup> Sustainable Development Commission. Energy from Waste Potential in Scotland, 2010: [www.scotland.gov.uk/Resource/Doc/311011/0098129.pdf](http://www.scotland.gov.uk/Resource/Doc/311011/0098129.pdf)

## Behaviour change

8.6.3 Section 3.5, earlier in this document, discusses the important role of understanding and influencing behaviour in meeting our climate change targets. The required shift in how materials are used in our economy needs a behavioural step-change on valuable items often discarded as waste. A key element of our national engagement is through our Greener Scotland campaign which aims to motivate collective action to help make Scotland a cleaner, greener place.<sup>249</sup> A recent focus of this campaign has been preventing food waste and future campaign work will focus on recycling Scotland's food waste.

### **Changeworks Recycling's Business Recycling Services - Our Dynamic Earth**

Changeworks Recycling carries out free and bespoke waste audits for all clients to enable them to engage with the waste they produce. An audit carried out for Dynamic Earth enabled it to focus in on a number of key waste reduction areas, and to understand how working practices could be changed to divert food waste from landfill.

To inspire staff, Changeworks arranged a visit to the Scottish Parliament to allow Our Dynamic Earth staff to see food waste recycling operations. This provided Dynamic Earth with the knowledge and techniques to embed new waste reduction techniques, resulting in a 300% increase in food waste recycling.

## Market development

8.6.4 Through Zero Waste Scotland and the enterprise agencies we are working to encourage investment in new forms of infrastructure to increase 'closed-loop' recycling of materials and to support increased reuse or repair of products. This includes:

- investing £6 million in Scotland's anaerobic digestion capacity;
- supporting the development of new plastics reprocessing infrastructure through loan and capital grant funds;
- developing the evidence base for reprocessing of materials including nappies, end of life vehicles and tyres; and
- providing funds to support innovation and investment in leading edge technologies.

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<sup>249</sup> Greener Scotland: [www.greenerScotland.org/](http://www.greenerScotland.org/)

## Resource efficiency

8.6.5 Using materials more efficiently and preventing waste is fundamental to addressing carbon impacts. Established in April 2013, the Resource Efficient Scotland programme provides a more accessible, integrated energy and resource efficiency service for business and public bodies.<sup>250</sup> This holistic approach to low carbon transition aims to help more organisations to reduce their emissions, save money and increase their competitiveness. The programme will focus on implementation to maximise the carbon and financial benefits of resource efficiency actions.

## Waste and global carbon emissions

8.6.6 In 2011, we introduced a world leading carbon tool for measuring benefits of recycling over landfill.<sup>251</sup> The tool not only looks at the avoided methane emissions from landfill, it assesses the “life-cycle” carbon emissions created from the production and consumption of materials. It calculates the carbon saved through recycling of the materials rather than using new, raw materials. The tool is currently being updated to allow us to examine the global carbon benefits of all actions taken in Scotland to recycle, reuse or prevent waste.

### Supporting innovation through public procurement

By creating new markets for sustainable products and services, public procurement can play a critical role in attracting investment in new infrastructure and the creation of new supply chains for sustainable products and services.

One example would be refurbished IT and telecommunication equipment. If sections of the public sector were committed to purchasing a fixed proportion of refurbished IT and telecommunication equipment, it could help stimulate investment in new or existing sophisticated refurbishment facilities to supply the new demand for these products in Scotland, creating new jobs and growth of an important manufacturing base. For the public sector, such investment could help create a stable supply chain of low carbon and resource efficient goods. The Scottish Government’s Procurement reform work includes a series of proposals on the smarter use of public procurement to encourage innovation and growth.

<sup>250</sup> See subsection 6.6 for further detail on Resource Efficient Scotland.

<sup>251</sup> Zero Waste Scotland, Carbon Metric: [www.zerowastescotland.org.uk/carbonmetric](http://www.zerowastescotland.org.uk/carbonmetric)

## 8.7 Costs and benefits

8.7.1 The overall cost of managing the implementation of the Zero Waste plan and the Waste (Scotland) Regulations 2012 will be significantly lower than the current cost of dealing with Scotland's waste. There is a net financial saving of the order of £17 million per year, with savings increasing to over £21 million by 2025. This amounts to a total saving of £173 million in net present value terms over the period 2013-2025.

8.7.2 Environmental benefits are estimated to be in the region of £1.4 billion (net present value) following full implementation of the Waste (Scotland) Regulations 2012. Most of these environmental benefits are attributed to reduced global carbon emissions.

8.7.3 A recent UK study estimated around 2.3% of GDP could be saved through straightforward resource efficiency measures, using raw materials more efficiently and generating less waste.<sup>252</sup> In 2010, that would have translated into potential savings to the Scottish economy of in excess of £2.9 billion. Around half of the savings (£1.54 billion) would be made within businesses. The research also looked at longer-term best practice savings that could be achievable by 2050, giving an additional savings potential of around 5% of GDP - more than £6.3 billion on current figures.

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<sup>252</sup> WRAP: Meeting the UK Climate Challenge: The contribution of resource efficiency:  
[www.wrap.org.uk/sites/files/wrap/Final%20Report%20EVA128\\_SEI%20\(1\)%20JB%20SC%20JB3.pdf](http://www.wrap.org.uk/sites/files/wrap/Final%20Report%20EVA128_SEI%20(1)%20JB%20SC%20JB3.pdf)

**Table 8.1: Highlights of progress since publication of RPP1**

Waste and Resource Efficiency	Summary
<p><b>Policies</b></p> <p>Zero Waste Plan - Waste prevention plan</p> <p>Zero Waste Plan - Information and awareness programmes</p> <p>Zero Waste Plan - Drive recycling towards 70% for all waste by 2025</p> <p>Zero Waste Plan - Separate collection of key materials</p> <p>Zero Waste Plan - Expand recycling on the go facilities</p> <p>Zero Waste Plan - Introduce progressive landfill bans</p>	<p>In 2011, we consulted on Safeguarding Scotland's Resources- a plan to reduce the occurrence of waste even before the need to treat or manage it.</p> <p>In 2012, we established Resource Efficient Scotland - making it easier for businesses and public organisations to cut waste and use materials and energy more efficiently, improving productivity.</p> <p>In 2011, we implemented high profile campaigns to influence behaviours to prevent waste and boost recycling</p> <p>The recycling and composting rate for household waste has increased from less than 5% in 1999 to over 40% in 2011.</p> <p>Since 2011, 665,500 properties or 28% of total households, now receive a food waste collection service from their local authority. We expect 1.1 million households (46% of total households) to have access to a food waste collection service by the end of 2013.</p> <p>Three-fold increase in food waste processing capacity since 2008 with infrastructure able to process over 300,000 tonnes now on stream.</p> <p>In 2012, we introduced the Waste (Scotland) Regulations 2012 that phased in requirements for collection of food waste and dry recyclables - creating a step-change in the availability and quality of recycling services available to homes and businesses across Scotland.</p> <p>£850,000 invested through local authorities, land owners, and facilities managers in 2012-13 to install new recycling facilities in some of Scotland's busiest public places. The initiative was backed by best practice guidance.</p> <p>In 2012, we legislated to ban any metal, plastic, glass, paper, card and food collected separately for recycling from going to incineration or landfill; and to ban biodegradable municipal waste going to landfill from January 2021.</p>

**Table 8.2: Summary of Waste and Resource Efficiency policies and proposals**

Waste and Resource Efficiency	EU, UK or Scottish measure	Maximum abatement potential (KtCO <sub>2</sub> e) in 2020	Maximum abatement potential (KtCO <sub>2</sub> e) in 2027	Earliest start date
<b>Policies</b>				
<b>Zero Waste Policies (pre May-2010)</b>				
Policies in place prior to the zero waste plan include:				
<p>Waste Framework Directive</p> <p>EU Framework for the management of waste lays down a number of provisions covering a variety of areas, including the definition of waste, the waste hierarchy, and re-use &amp; recycling targets.</p> <p>Landfill Directive</p> <p>This includes targets for reducing the amount of biodegradable municipal waste sent to landfill - of 75% of the 1995 baseline by 2010, 50% by 2013 and 35% by 2020.</p> <p>Landfill Tax</p> <p>A tax on active wastes in landfill rising on an £8 per year escalator rising to £80 per tonne by 2014-15.</p>	<p>EU</p> <p>EU</p> <p>UK</p>	<p>748</p>	<p>871</p>	<p>&lt;2010</p>
<p><b>Zero Waste Plan</b></p> <p>The Scottish waste policies in the RPP are all drawn from the Zero Waste Plan. The Zero Waste Plan is now the Scottish Government's overarching strategy for making the most efficient use of resources by minimising Scotland's demand on primary resources, and maximising the reuse, recycling and recovery of resources instead of treating them as waste.</p>	<p>Scottish</p>	<p>141</p>	<p>290</p>	<p>2010</p>



<p>For territorial carbon abatement, the key policy is a ban on biodegradable municipal waste going to landfill (from 1 January 2021), thus helping to substantially reduce harmful emissions of methane. This ban was introduced by the Waste (Scotland) regulation 2012.</p> <p>The regulations also place a requirement on businesses to present food waste for collection, and a requirement on local authorities to provide householders with a collection service for food waste. The abatement from this action is incorporated in the figures above.</p> <p>Accompanying policies that will contribute either assist in deliver these policies and or reduce carbon emissions outside of the UK include:</p> <ul style="list-style-type: none"> <li>• Working with food retailers and brands through the Courtauld Commitment to meet stretching targets to reduce packaging and food waste.</li> <li>• National campaigns to influence public behaviours to recycle more and waste less - supported by local roadshows in partnership with LAs and retailers.</li> <li>▪ Creation of the Resource Efficient Scotland programme is making it easier for businesses and public organisations to cut waste and use materials and energy more efficiently, improving productivity.</li> </ul>				
<b>Proposal</b>				
<b>Enhanced Capture of Landfill Gas</b>				
<p>The Scottish Government is examining opportunities to capture methane emitted from closed or inactive landfill sites.</p>	Scottish	163	140	2013

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# **RURAL LAND USE**



## 9. Rural land use

### 9.1 Introduction

9.1.1 In this chapter, the term 'rural land use' covers agriculture and related land use, peatland restoration and forestry. Emissions in these sectors come from livestock, agricultural soils, animal wastes and certain land use changes. Importantly, some biological processes also have the capacity to absorb carbon dioxide from the atmosphere and store carbon in soils and vegetation.

### 9.2 Our ambitions for rural land use

9.2.1 Our 2009 transformational outcome was to develop a comprehensive approach to ensure that carbon (including the cost of carbon) is fully factored into strategic and local decisions about rural land use through: appropriate protection for Scotland's carbon rich soils; minimising emissions from agricultural and other land use businesses; encouraging the sequestration of carbon, for example, through woodland planting; and the use of natural resources to generate renewable energy.

9.2.2 In RPP1 we set out process and outcome milestones for supporting emissions reduction:

- Completion in 2011 of research on behaviour change in agriculture and the development of indicators to measure progress in reducing agricultural emissions.
- Incorporation of wetland management data into the net Scottish emissions account to enable peatland restoration to be counted towards Scotland's climate change targets.
- Increase the rate of new woodland creation to an average of 10,000 hectares per year from 2015 onwards.

9.2.3 As we move towards 2027 and beyond, low carbon actions that might seem innovative now should be commonplace across the rural land use sector:

- By 2027 land managers will have further optimised the productive use of natural resources, producing food and delivering public goods, such as protecting the natural environment and reducing greenhouse gas emissions;

- With our partners, we are working to ensure that Scotland's peatlands will be managed in ways that conserve their substantial carbon stores and biodiversity. Where peatlands have been damaged, action will be taken to prevent further damage and where practicable to restore them to a favourable condition in which they are no longer a source of greenhouse gas emissions; and
- We will create 100,000 hectares of new woodland by 2022, equivalent to an average of 10,000 hectares per year, and agree targets for subsequent years by 2020.

### 9.3 Where we are now

9.3.1 Approximately 80% of Scotland is used for **agricultural** purposes.<sup>253</sup> In 2011, emissions from agriculture and related land use accounted for 20% of total Scottish emissions; that is 10.1 MtCO<sub>2e</sub>, a decrease of 4.2 MtCO<sub>2e</sub>, or 29.3%, from 1990.<sup>254</sup>

9.3.2 **Peatlands** cover about 20% of Scotland, some 1.7 million hectares, much of which have been drained or damaged in the past. They contain an estimated 1,600 million tonnes of carbon. It is estimated that 47,000 hectares of peatland have benefited from restoration measures since 1990, giving an annual saving that would amount to 0.02 MtCO<sub>2e</sub> by 2027.<sup>255</sup>

9.3.3 Scotland has some 1.4 million hectares of **woodland**, which equates to roughly 18% of total land area. Scotland's woodland sequestered a net total of 9.1 MtCO<sub>2e</sub> in 2011. Without this, total Scottish emissions would have been 18% higher. However, following a period of low historic rates of woodland planting, net carbon sequestration rates are currently reducing year on year due to the lower proportion of young trees in Scottish forests.<sup>256</sup>

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<sup>253</sup> The Scottish Government, Economic Report on Scottish Agriculture 2012, Table C2: [www.scotland.gov.uk/Publications/2012/06/6894/102](http://www.scotland.gov.uk/Publications/2012/06/6894/102)

<sup>254</sup> Scottish Greenhouse Gas Emissions 2011: [www.scotland.gov.uk/Publications/2013/06/1558](http://www.scotland.gov.uk/Publications/2013/06/1558)

<sup>255</sup> Once wetland management activities are incorporated into greenhouse gas emissions reporting.

<sup>256</sup> Ibid

## 9.4 Decarbonisation policies

9.4.1 Our approach to reducing emissions from the rural land use sector is guided by our Land Use Strategy, which sets out three objectives relating to the economy, environment and communities.<sup>257</sup> These support an integrated approach to managing the competing demands we place on our land resource. They seek to balance a productive land-based sector and a successful tourism and leisure industry, with the vital role that our land plays in maintaining Scotland’s rich biodiversity and in storing carbon.

### Agriculture

9.4.2 Emissions from the rural land use sector, particularly in agriculture, are dominated by methane and nitrous oxide rather than carbon dioxide, but the term “decarbonisation” is used in this report as general shorthand for reducing greenhouse gas emissions. The transition to low-emission agriculture is aided by a number of linked initiatives developed and supported by the Scottish Government, as well as by industry-led action:

- **research** provides innovative and sustainable solutions and advice on improving efficiency and reducing emissions from farming systems;
- **advisory initiatives** promote sustainable farm practices focusing on resource efficiency and advise on cross-cutting benefits of on-farm action; and
- **support mechanisms** like the Scotland Rural Development Programme (SRDP) aid uptake of sustainability measures in agriculture.

9.4.3 RPP1 described our ambition to influence farming and land management practices through a programme of best practice advice and demonstration. Our *Farming For A Better Climate (FFBC)* programme, delivered by Scotland’s Rural College (SRUC), is designed to encourage voluntary uptake of win-win actions in five key areas:<sup>258</sup>

- farm energy and fuel efficiency;
- renewable energy generation;
- locking carbon into soils and vegetation;
- optimised fertiliser and manure management; and
- optimised livestock management through improved breeding and feeding practices.

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<sup>257</sup>The Scottish Government, Land Use Strategy:

[www.scotland.gov.uk/Topics/Environment/Countryside/Landusestrategy](http://www.scotland.gov.uk/Topics/Environment/Countryside/Landusestrategy)

<sup>258</sup>SRUC, Farming For a Better Climate: [www.sruc.ac.uk/climatechange/farmingforabetterclimate/](http://www.sruc.ac.uk/climatechange/farmingforabetterclimate/)

9.4.4 Given the cost effectiveness of the measures in FFBC, we anticipate that better information provision will increase voluntary uptake by **around 50%** (from starting level) for most of the measures. Some of the livestock measures, particularly those relating to improved breeding practices, may experience lower uptake in the short term due to learning barriers that may make time to overcome.

9.4.5 Estimates of uptake have been taken from published work<sup>259</sup> on behavioural responses to incentives, taking into account issues such as acceptability and costs of implementation. We are developing a monitoring framework, and we intend to survey farmers in 2013 to measure progress towards meeting uptake targets. The information we gather will inform our decision on whether regulation is necessary to secure sufficient emission savings, as discussed further in our proposals outlined in section 9.5 below.

9.4.6 Advisory activities such as FFBC and Future Proofing Scotland's Farming<sup>260</sup> also promote the uptake of adaptation measures, which help to increase the resilience of agriculture to climate change.

9.4.7 It is important to understand the wide range of factors influencing farmer behaviours and decision making, because it will ultimately have an effect on greenhouse gas emission from farming activity. In liaison with stakeholders, the Scottish Government has therefore undertaken a comprehensive study on behavioural change in agriculture.<sup>261</sup> The research is being used to inform and refine the way advisory activities, like FFBC, are carried out.

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<sup>259</sup> ADAS, RMP/5142 Analysis of Policy Instruments for Reducing Greenhouse Gas Emissions from Agriculture, Forestry and Land Management: <http://archive.defra.gov.uk/foodfarm/landmanage/climate/documents/climate-ag-instruments.pdf>

<sup>260</sup> Soil Association, Futureproofing Scotland's Farming: [www.soilassociation.org/innovativefarming/futureproofingscotlandsfarming](http://www.soilassociation.org/innovativefarming/futureproofingscotlandsfarming)

<sup>261</sup> The Scottish Government: Agriculture and Climate Change: Evidence on Influencing Farmer Behaviours - Research Findings: [www.scotland.gov.uk/Publications/2012/10/8893](http://www.scotland.gov.uk/Publications/2012/10/8893)

## **Putting Farming For a Better Climate into practice**

FFBC provides best practice information, including practical tutorials and workshops on four 'climate change focus farms' to showcase steps under the FFBC key action areas. It allows visiting farmers to see how the individual measures are being implemented on the focus farm, what business benefits these bring and consider how these might work on their own farms. In addition to the focus farms, farmer meetings and events are held across Scotland on working farms to demonstrate steps other farmers are already taking to reduce emissions. Examples of measures taken on the climate change focus farms include:

### **Ross Paton, Organic Dairy Farmer, Nr Castle Douglas**

After benchmarking energy use in the dairy, Ross Paton identified a number of ways to reduce electricity use. One of the measures, retrofitting variable speed control on vacuum pumps in the dairy, could save around £5,500 over ten years based on current energy prices.

### **Robert and Jac Neill, Beef and Arable, Nr Jedburgh**

Linking GIS technology to soil sampling has allowed Robert and Jac Neill to accurately assess nutrient requirements across the farm. Precision fertiliser application will allow optimum use of nutrients and lead to improved efficiency and profitability through more uniform yields, whilst at the same time nitrous oxide emissions are reduced.

### **Neil and Linsey Butler, Mixed Dairy Farm, Nr Perth**

Improved use of clover in silage fields, tailoring application of manures based on soil analyses and topping up with nitrogen, associated savings in fuel use are just some of the measures Neil and Linsey are implementing. Savings could be in the region of £10,000 with no loss of production.

### **David Houstoun, Upland Beef and Sheep Farmer, Nr Blairgowrie**

Following analysis of pit silage, David was able to feed concentrates to his 1,042 ewes two weeks later than usual, and reduce the amount of feed for the remaining six weeks based on silage quality. This was a saving of just under £3,000 and nearly five tonnes of carbon with no loss of production from the farm.

## Peatland Restoration

9.4.8 When peatlands are drained or otherwise disturbed, they are liable to lose carbon through oxidation to form carbon dioxide. Where they are in good condition, or restoration has resulted in the re-growth of sphagnum moss, they can sequester carbon dioxide. In RPP1, we recognised that **peatlands should be conserved and where practicable restored**. The Land Use Strategy also recognised the potential importance of peatlands in climate change mitigation.<sup>262</sup>

9.4.9 While little new drainage of peatland has been carried out in Scotland in the past two decades, there has been some restoration work. Historical data about areas of restored peatland is limited, and projections of the emissions abatement potential of peatland may also be subject to revision in light of developing scientific knowledge and the outcomes of the IPCC process. Already it is clear that re-wetting of peatland that has been drained can prevent losses of carbon to the atmosphere.

9.4.10 It is our policy to incorporate the restoration work across Scottish peatlands in Scottish emissions accounting. There is already funding for peatland conservation measures, such as moorland management, and restoration, such as peat dams, in the Rural Priorities part of the Scottish Rural Development Programme. However the rate of restoration activity needs to be stepped up. We have announced funding of £1.7 million for peatland restoration from 2012 to 2015.

9.4.11 We intend to assess the effects of these measures with a view to developing an enhanced approach to peatland restoration, where possible and as described further in paragraphs 9.5.10-9.5.13 below.

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<sup>262</sup> The Scottish Government, Land Use Strategy:  
[www.scotland.gov.uk/Topics/Environment/Countryside/Landusestrategy](http://www.scotland.gov.uk/Topics/Environment/Countryside/Landusestrategy)



## Emissions accounting for peatlands

The effects of drainage or of restoration to avert such effects are not included in the current Scottish Greenhouse Gas Inventory unless land use change is involved. However, at the 2011 UN Climate Change Conference in Durban, agreement was reached on the principle of allowing countries to include the effects of wetland management (which includes peatland restoration) since 1990 within their greenhouse gas emissions reporting.

The Scottish Government hosted a meeting of the Intergovernmental Panel on Climate Change (IPCC) Technical Group in 2012. This was part of the IPCC's programme to develop Technical Guidelines for the inclusion of wetland management within national greenhouse gas inventories. Hosting the meeting provided Scottish organisations with opportunities to showcase examples of peatland restoration. The IPCC's Technical Guidelines are expected in mid-2013 and this internationally validated methodology for estimating carbon benefits will assist us in making informed decisions about further action on peatlands. The emissions estimates used in this draft RPP2 are the best available at this time and will be shared with the IPCC Technical Group to help inform their deliberations.

## Forestry

9.4.12 During the 1970s and 1980s there was a period of major forest expansion which declined in the 1990s and 2000s. As the average age of Scotland's forests has increased, the quantity of carbon dioxide that they are able to remove from the atmosphere has reduced. We are taking action to reverse this trend. As a result of improvements to the Scotland Rural Development Programme and activity on the national forest estate, new woodland creation nearly doubled between 2009-10 and 2010-11, from 2,700 hectares to 5,100 hectares. A further significant increase was achieved in 2011-12 with a rise to 9,000 hectares.

9.4.13 In RPP1 we committed to **boosting the rate of new woodland creation to 10,000 hectares per year** from 2015 onwards. Forestry Commission Scotland (FCS) is continuing to promote this policy and administer grant support. Forest Enterprise Scotland is delivering afforestation on the National Forest Estate. New forest carbon regulatory mechanisms such as the Woodland Carbon Code will be facilitated by FCS and governed in partnership with industry stakeholders.<sup>263</sup>

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<sup>263</sup> Forestry Commission, Woodland Carbon Code: <http://www.forestry.gov.uk/forestry/INFD-863FFL>

## 9.5 Decarbonisation proposals

9.5.1 The following Scottish proposals are being developed or are under consideration by Scottish Ministers.

### Agriculture

9.5.2 One of the areas with the greatest potential to cut greenhouse gas emissions in agriculture is to optimise the use of nitrogen-based fertilisers and manures. Excess fertiliser, and fertiliser applied at the wrong time using inappropriate application methods, leads to nitrogen leakage to the air as nitrous oxide, a greenhouse gas.

9.5.3 Our FFBC programme seeks to encourage best practice in nitrogen efficiency, emphasising the win-win nature, and the benefits to water and air quality of many of the steps that farmers and land managers can take.

9.5.4 Considerable emission reduction could be achieved if farms in Scotland would optimise their nitrogen usage. The proposal aims at achieving a 90% uptake of nitrogen efficiency measures identified as cost-effective, i.e. resulting in emission reduction without incurring costs at farm level. Discussions as part of the Agriculture and Climate Change Stakeholder Group reinforced the willingness of the agriculture industry to achieve a 90% uptake via a voluntary approach using farm advisory services. The Scottish Government will keep this voluntary framework under review and, depending on the progress that is achieved, will **consider whether measures to regulate nitrogen fertiliser use are also needed.**

9.5.5 Those farmers who adopt efficiency measures early will not be penalised by a regulatory approach. Rather, early adopters will benefit from greater farm business savings. Any action would of course also be sensitive to the level of emissions per unit of food produced. Cutting emissions in a way that could risk undermining Scotland's food-producing sector, at a time when global population and demand for food are growing, is not the way forward.

9.5.6 **Developments in technology** will influence farming practices in the time period to 2027. Some measures which seem costly and or impractical today could become widespread in the future. Although it is not possible to predict precisely, a judgement can be made of which measures may be implemented within the industry post-2020.

9.5.7 For example, a combination of an increased uptake of **livestock management measures** that ensure the maximum production from each animal, along with increased uptake of **anaerobic digestion** technology to transform animal waste into electricity and heat could contribute additional abatement in 2027.

9.5.8 Modern approaches to the use of forage legumes, such as white clover, red clover and lucerne, as well as grain legumes, have the potential to reduce emissions by lessening the amount of inorganic nitrogen needed. The development of **precision agricultural technology**, such as the use of GPS, may also influence farming practices. We estimate that these activities could contribute approximately 0.3 MtCO<sub>2</sub>e of additional abatement in 2027. These estimates are based on research carried out by SRUC, and are set out in detail in the Technical Appendix to this report.

9.5.9 However, we acknowledge that many of the factors that will influence this outcome, such as the pace of technological progress and the price of inputs such as oil and fertiliser, are largely outside the control of government. Given the number of variables, these measures are classed as proposals in this report. However, we will work with industry to consider how best opportunities such as these might be maximised.

### Peatland restoration

9.5.10 We want to maximise the ecosystem and emissions benefits that **restoring degraded peatland** can achieve. This is an area where the science is developing, and new evidence could lead to changes in the estimated benefits, as well as the associated financial costs of carrying out restoration work.

9.5.11 We are working with Scottish Natural Heritage (SNH) to develop a **Peatland Plan**. The Plan will encourage partnerships with private land interests as well as action based on land designated for protection or land that is owned or managed by public bodies or environmental NGOs.

9.5.12 Depending on the final methodology (see 'Emissions Accounting for Peatland' earlier in this chapter) and on-going work to assess the scope for projects in Scotland, it may be possible to achieve significantly greater levels of annual peatland restoration than at present. For example, if the restoration rate were increased to 21,000 hectares per annum, which would be technically feasible, abatement of 0.5 MtCO<sub>2</sub>e per year could be achieved by 2027.

9.5.13 With this technical potential in mind, the Scottish Government and SNH will be working with interested parties, represented in the Peatland Working Group (convened by the Moorland Forum). However, achieving substantial increases in the area of peatland restored will depend on collaboration with land managers. In this way, it should be possible to bring about substantial increases in the funding, both public and private, for peatland restoration. One development under consideration is a Peatland Carbon Code, which could reflect the success of the Woodland Carbon Code.

## Forestry

9.5.14 Since the publication of RPP1, Forestry Commission Scotland has continued to investigate the potential for emissions abatement by **increasing the amount of Scottish timber used in the construction and refurbishment of buildings**. The CCC has identified timber in construction as a cost effective carbon abatement technology and in its Bioenergy Review it published a carbon hierarchy which placed timber in construction at the top of that hierarchy.<sup>264</sup>

9.5.15 Timber has the lowest embodied energy of any mainstream building material and has the potential to deliver a wide range of benefits, from the substitution impacts of replacing more energy-intensive materials, to the market opportunities presented by increased demand for Scottish timber (which, in turn, would help to incentivise investment in woodland creation) and the future scope for production in Scotland of wood products for export.

9.5.16 Forestry Commission Scotland is working with the Scottish Innovation Gateway research programme aimed at developing and commercialising wood products, processes and systems utilising Scottish timber. Key projects include work on timber panel construction systems and exploring the potential for manufacturing cross laminated timber panels using Scottish softwood.

9.5.17 Achieving these kinds of outcomes over the long-term may require more than simply promoting the benefits of timber as a construction material. The potential role of planning, building standards, local authorities and building design will be considered, as must issues of competitiveness and the need to avoid perverse incentives that might encourage use of timber in inappropriate circumstances.

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<sup>264</sup> Committee on Climate Change, Bioenergy Review: [www.theccc.org.uk/publication/bioenergy-review](http://www.theccc.org.uk/publication/bioenergy-review)

9.5.18 In taking forward this work to promote the low carbon agenda and increased use of timber in construction, Forestry Commission Scotland will co-ordinate and co-fund the project, working in partnership with those identified above alongside others such as Scottish Enterprise and Wood for Good. As part of this project, work has already been commissioned to provide transparent, freely available carbon data for timber products used in construction to ensure that carbon values in buildings can be estimated more accurately.

9.5.19 Given the transformation required in both policy and practice, estimates for potential emission abatement from this proposal do not commence until 2022. However, as we develop this work we will accelerate progress wherever possible.

#### **Additional technical potential from peatland restoration and woodland creation**

9.5.20 Some of the work that we carried out to identify emissions abatement potential in the rural land use sector involved modelling variables associated with extending and restoring Scotland's natural carbon sinks and stores. Using this approach, our analysis suggests that an additional abatement potential of approximately 0.75 MtCO<sub>2</sub>e in 2027 could be realised through greater levels of peatland restoration and woodland creation than those currently envisaged in the policies and proposals already outlined in this chapter. Scotland's soils contain about 3,000 MtCO<sub>2</sub>e. The additional abatement potential is a small proportion of the total stock of soil carbon, but it represents a potential reduction of around 20% in the annual emissions from UK peatlands.

9.5.21 This abatement potential remains "technical" for the time being due to uncertainties that currently surround scaling up action beyond existing commitments. The availability of and ability to access suitable land is uppermost within these considerations, but so is the possible long-term effectiveness of peatland restoration. We believe we have used fairly conservative estimates for the impact of peatland restoration in RPP2 and the numbers could increase when the IPCC validates the international accounting methodology later in 2013.

9.5.22 As well as the potential from peatland, there may also be scope, albeit limited due to the lead in time, to achieve some additional abatement by further increasing the woodland creation rate in the 2020s, following a review of current commitments. In preparing the next RPP, further work will be taken forward to help define the place for, and scale of, future woodland creation potential through initiatives such as the third National

Planning Framework, Woodlands In and Around Towns, and the Land Use Strategy for Scotland Action Plan.

9.5.23 The emissions abatement from this land use technical potential proposal has been factored in to the RPP2 calculations for the years 2023, 2024, and 2025. This may appear rather “sudden”, but it simply reflects the limitations of currently available information and we cannot at this stage be precise in predicting technical advances or further land use changes. In reality, any emissions savings are likely to build more gradually over a longer period of time. Work to develop and refine these proposals will continue and it is our intention to set out more information in RPP3 about how this emissions abatement might be realised.

## 9.6 Supporting and enabling measures

9.6.1 Together with the other UK administrations, the Scottish Government is supporting research projects to improve the accuracy and resolution of the part of the **Greenhouse Gas Emissions Inventory** that estimates emissions from **agriculture, land use, land use change and forestry**.<sup>265</sup> The outcome of this work will be advanced greenhouse gas emission factors and farm practice data with which to calculate a more accurate emissions baseline and better forecast the outcomes of proposed policy measures. With an improved inventory and evidence base, the agriculture and other land use industries will be better equipped to assess progress, and focus emission reduction activity where it is needed and most effective.

9.6.2 We are also working with the other UK Administrations to reduce and eventually **phase out the use of peat in horticulture**. Three million cubic metres of peat are sold in the UK annually, most of it imported. Scotland’s share is estimated to be 10%. 500,000 cubic metres of peat were extracted in Scotland in 2009 (the output varies with the dryness of the summer), and the effects are counted as part of Scotland’s greenhouse gas emissions, amounting to 0.1 MtCO<sub>2</sub>e. If such peat were to be sourced from other countries, the quantity extracted would be recorded elsewhere; real improvement requires the marketing and distribution of alternatives to peat in horticulture. Sites from which peat has been extracted can be restored in many cases, but this may require work over several years.

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<sup>265</sup> Agricultural Greenhouse Gas Inventory Research Platform: [www.ghgplatform.org.uk/Home.aspx](http://www.ghgplatform.org.uk/Home.aspx)

9.6.3 In response to the Woodland Expansion Advisory Group's recommendations (see below) and building on improvements in planning guidance such as FCS's 'Right Tree in the Right Place' (2010), a series of regional and sub-regional **approaches to understanding woodland creation constraints and opportunities** are being piloted in partnership with local authorities and other public sector bodies.<sup>266</sup> Alongside this, there will be an enhanced role for Regional Forestry Forums in providing FCS and local authorities with advice. This will include opportunities for implementation of **Forestry and Woodland Strategies** as well as the implications of woodland creation for other land-based objectives.

9.6.4 In recent times, Scotland's trees have been faced with an increase in the instances of new pests and diseases. Advice from Forest Research indicates that climate change may create the conditions for even more pest and disease activity and these heightened threats require us to take a **strategic approach to forest and tree health given the importance of woodlands for carbon storage and to the commercial timber sector**. Action is being coordinated across the UK as part of the Forestry Commission's Biosecurity Strategy.<sup>267</sup> This aims to preserve the health and vitality of our forests, trees and woodlands by excluding, detecting and responding to existing and new pests, whether of native or exotic origin.

9.6.5 The **wood fuel market for renewable power and heat** has developed rapidly over the last five years largely because of support for biomass electricity and CHP plants under the Renewable Obligation (RO) Scotland. The RHI is now providing significant support for the installation of biomass heat (and CHP plants) in commercial, industrial and public buildings with a household RHI to follow in 2013.

9.6.6 We are providing additional impetus to the uptake of the RHI and encouraging better woodland management on the back of increased demand for wood fuel through regional wood fuel forums.

### Review of woodland creation rates

9.6.7 In RPP1 we proposed that it might be appropriate to increase new woodland planting rates towards 15,000 hectares per year. This was subject to a number of conditions. In response to Proposal 7 in the Land Use Strategy, the Woodland Expansion Advisory Group (WEAG), with members representing the interests of agriculture, forestry, communities and the environment, was established to provide the Cabinet Secretary for

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<sup>266</sup> Forestry Commission Scotland, The right tree in the right place: [www.forestry.gov.uk/pdf/fcfc129.pdf/\\$FILE/fcfc129.pdf](http://www.forestry.gov.uk/pdf/fcfc129.pdf/$FILE/fcfc129.pdf)

<sup>267</sup> Forestry Commission, Biosecurity Strategy: [www.forestry.gov.uk/forestry/infid-8gykba](http://www.forestry.gov.uk/forestry/infid-8gykba)

Rural Affairs and the Environment with advice identifying which types of land are best for tree planting in Scotland, in the context of other land-based objectives. The WEAG published its report in 2012.<sup>268</sup> It endorsed our policy of increasing the woodland creation rate to 10,000 hectares per year, recommending that the focus of activity should be on creating 100,000 hectares of new woodland between 2012 and 2022, equivalent to an average of 10,000 hectares per year over this 10 year period.

9.6.8 The WEAG also recommended that there should be a review, initiated no later than 2020, in order to set targets beyond 2022. We have accepted this recommendation as an important step in setting longer-term targets for woodland expansion, and ensuring an appropriate balance between alternative land uses. The need to achieve our ambitious greenhouse gas emission reductions targets should be a key factor in the review.

9.6.9 Pending this review, the estimates of emissions abatement presented in the RPP2 are based on a continuation of the current 10,000 hectare per year policy over the period 2022–2027 and do not include projections for either an increased rate of 15,000 hectares per year, nor any reduced rate.

## 9.7 Costs and benefits

### Agriculture and related land use

9.7.1 Improving efficiency of agriculture and related land use systems will yield financial benefits as well as supporting the transition to a low carbon economy. Due to the cost effective nature of those measures promoted by FFBC, the policy is estimated to result in overall reduction in costs to farm businesses of around £240 million (undiscounted over the period to 2027). These savings arise largely from productivity increases resulting from improved efficiency in input use.

9.7.2 A change to more efficient farm practices will not only reduce emissions, but will result in farm business savings and make businesses more resilient. In many cases, improvements to water and air quality, as well as biodiversity and longer-term sustainability will also have been achieved through farming which is more integrated with wider land management practices.

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<sup>268</sup> Forestry Commission Scotland, Woodland Expansion Advisory Group: [www.forestry.gov.uk/weag](http://www.forestry.gov.uk/weag)



9.7.3 With cost savings and emissions reductions, the overall cost effectiveness of FFBC works out on an undiscounted basis, at approximately £160 per tonne of saved emissions. Increasing the uptake of fertiliser efficiency measures as proposed will lead to further savings. The overall cost effectiveness of the proposal (undiscounted with no allowance for policy costs) is estimated to be around £90 per tonne of saved emissions.

9.7.4 The cost-benefit analysis covering agricultural policies is detailed in the Technical Annex. It is based on research undertaken by SRUC and was commissioned by the Committee on Climate Change. A European level assessment of the costs and benefits of nitrogen fertiliser use outlines the considerable adverse effects of nitrogen leakage.<sup>269</sup> The analysis highlights how the overall environmental costs of all nitrogen losses in Europe (estimated at €70–€320 billion per year at current rates) outweigh the direct economic benefits of nitrogen use in agriculture. The highest societal costs are associated with loss of air quality and water quality, linked to impacts on ecosystems and especially on human health.

9.7.5 Whilst this study used aggregate data for Europe only, it highlights the importance of tackling nitrogen as a key threat which cuts across several policy areas and environmental outcomes.

## Peatlands

9.7.6 The cost of an enhanced peatland (optimised current) restoration programme of 6,500 hectares a year is estimated at approximately £5 million a year, the larger part of which would be from public funds; if this was to be tripled to some 20,000 hectares a year, the cost would be around £15 million per year. There should be some private sector expenditure, for instance for projects part-funded through the SRDP.

9.7.7 Peatlands in good condition provide many ecosystem benefits. They include sites for wildlife and are valued for biodiversity. Blanket bog is protected under the Habitats Directive and is included in the UK Biodiversity Action Plan as Priority Habitat. Lowland raised bogs are less common in Scotland and many are greatly valued by their local communities, such as Langlands Moss (East Kilbride) and Blawhorn Moss, administered by Scottish Natural Heritage. Peatlands retain and filter water, thus providing benefits for both the flow and quality of water. They are valued for leisure activities, landscape and tourism.

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<sup>269</sup> European Science Foundation: European Nitrogen Assessment: [www.nine-esf.org/ENA](http://www.nine-esf.org/ENA)

### The Milton of Mathers Woodland Project

Forest Carbon<sup>270</sup> has developed a new woodland at Milton of Mathers near St Cyrus in Aberdeenshire on behalf of the arable farming landowner, Messrs JD Reid and Partners. The woodland creation and management is overseen by the Scottish Rural College.<sup>271</sup> The aims of the new woodland are to reduce pollution from the nearby farm and act as a buffer to the burns, improve farm conservation and provide a safe haven for animals as well as provide access for people to enjoy them. About 1,600 plants per hectare will be planted by the time the canopy closes. Over 70 years, the 17.4 hectare woodland will sequester 4.77 ktCO<sub>2</sub>e.

A combination of Scottish Government grant and private investment secured the project. The carbon capture resulting from the project is quality assured through independent verification under the Woodland Carbon Code; and details are included within the Forestry Commission's Registry of UK Woodland Carbon Projects.<sup>272</sup>

9.7.8 We estimate that the current programme of 10,000 hectares of new woodland creation per year could provide lifetime savings of around 4.8 MtCO<sub>2</sub>e by 2027. Further emissions savings will continue throughout the lifetime of the woodland. The cost of achieving this over the period 2013-2022 will be around £450 million and average around £57 million per year thereafter to 2027. Much of this will come from financial support through the SRDP, but there will also be additional planting on the national forest estate.

9.7.9 Opportunities for developing the market for timber construction materials lie primarily in the growing utilisation of cross-laminated timber (CLT) products. Currently, around 75% of new homes built in Scotland use timber frames CLT is a solid wood engineered product which extends timber's attractiveness to developers beyond building frames as it can be used as walls, floors and roofs. Investment (largely private sector) in new cross-laminated timber production facilities using Scottish timber could offer an opportunity for significant market development. In this case an investment in two new plants of around £40 million by 2022 and around a further £10 million by 2025 to expand production capacity, could potentially achieve cumulative emissions abatement of the order of 606 ktCO<sub>2</sub>e by 2027.

<sup>270</sup> Forest Carbon: [www.forestcarbon.co.uk/](http://www.forestcarbon.co.uk/)

<sup>271</sup> Scotland's Rural College: [www.sruc.ac.uk/](http://www.sruc.ac.uk/)

<sup>272</sup> Forestry Commission: [www.forestry.gov.uk/website/carbonregistry.nsf/byprojectid](http://www.forestry.gov.uk/website/carbonregistry.nsf/byprojectid)

## Blue Carbon

The term 'blue carbon' refers to the carbon sequestration benefits of marine ecosystems such as salt marshes, seagrass beds, maerl beds and kelp forests. The process acts as partial mitigation of anthropogenic carbon release. Due to their high productivity and high carbon sequestration capacity per unit area, recent estimates suggest that the standing stock of carbon in these ecosystems can be of a similar magnitude to many of the larger terrestrial green carbon sinks, such as forests and grasslands. However, blue carbon is a relatively new concept and our understanding of its potential is not yet well developed.

Saltmarshes, seagrass beds and kelp forests are potentially quantitatively important 'blue' carbon sinks in Scotland. Whereas Scottish saltmarsh habitats are relatively well identified and quantified in terms of their locations and areal coverage, further investigations are needed on standing stocks and areal coverage of seagrass beds and kelp forest communities in Scottish waters before a more reliable quantitative assessment can be made in terms of their total carbon sequestration potential. That said, current literature indicates that these habitats might be relatively abundant in Scottish waters compared to other coastal areas in UK and Europe.

### *Protection of Blue Carbon Ecosystems*

The degradation or damage of these systems can increase carbon release to the atmosphere and all three habitat types are suffering from degradation due to both human and natural activities, including climate change.

About 80% of Scottish saltmarshes and around 50-60% of known seagrass beds in Scottish waters are currently managed within protected or managed fisheries areas. The Marine Protected Area (MPA) network is also being developed in Scotland's seas, with 33 MPA proposals identified and reported to Parliament in December 2012. The proposals for inclusion in the MPA network include seagrass beds, maerl and kelp forests. Saltwater marsh habitat is also included in Special Protection Areas for seabirds designated under the EU Wilds Birds Directive.

The Scottish Government plans to consult on a draft National Marine Plan during Summer 2013. In accordance with the Marine (Scotland) Act, the Plan will include objectives and policies related to climate change mitigation and adaptation. It will propose that developments or activities should not result in the complete loss of or damage to natural carbon sinks.

In addition, the sectoral marine planning process will produce a revised offshore wind energy plan and wave and tidal energy plans during 2013. These will cover issues such as strategic cable installation and will highlight any potential for interaction with blue carbon resources.

### *Next Steps*

Our current state of knowledge and scientific understanding mean it is not possible for RPP2 to set out detailed policies and proposals on blue carbon. The evidence base on blue carbon is not yet mature enough to allow a credible estimate of its potential contribution to emissions reduction.

The Scottish Government is working with Scottish Natural Heritage to continue to develop our understanding of blue carbon. It is envisaged that this work will:

- a) increase understanding of the distribution of blue carbon habitats, their condition and potential contribution; and
- b) review and develop policies on blue carbon and consider proposals to capture their potential.

It is hoped that this will allow us to build a foundation from which it may be possible to develop policies and proposals for inclusion in the next RPP in order to contribute to the efforts necessary to meet Scotland's annual greenhouse emissions reduction targets.

**Table 9.1: Highlights of progress since publication of RPP1**

Rural Land Use	Summary
<b>Policies</b>	
Farming For a Better Climate (FFBC)	<p>This policy has continued in RPP2. The FFBC programme and Focus Farms are now well established, with regular on-farm advisory events well attended. Since inception of the programme in 2010, and estimated 2000 farmers have participated in FFBC and partner events. The FFBC webpage continues to be expanded and updated with relevant information, including case studies illustrating the greenhouse gas emission and business savings resulting from uptake of mitigation measures.</p> <p>The advice provided by the Scottish Government is being supported by complementary industry-led action, such as <i>Future Proofing Scotland's Farming</i>, an advisory initiative delivered by Soil Association Scotland with industry support from QMS, SAOS and NFUS<sup>273</sup> and <i>Scotland's Farming Innovation Network</i>.<sup>274</sup></p>
Support for anaerobic digestion through the SRDP	<p>This is now covered by RPP2 proposal '<i>Developments in technology</i>'. Although funding is still available through the SRDP, in practice this has largely been superseded by financially more attractive Feed-in-Tariffs, RHI and the Scottish Government's CARES loan scheme.</p>
Increase afforestation rate to 10,000 hectares per year	<p>As a result of improvements to the Scotland Rural Development Programme and activity on the national forest estate, new woodland creation nearly doubled between 2009-10 and 2010-11, from 2,700 hectares to 5,100 hectares. A further significant increase was achieved in 2011-12 with a rise to 9,000 hectares.</p>
<b>Proposals</b>	
Mandatory regime to secure 90%	RPP 1 set out a proposal to potentially drive 90% uptake of nitrogen efficiency measures through

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[www.soilassociation.org/innovativefarming/futurefarminginscotland/futureproofingscotlandsfarming](http://www.soilassociation.org/innovativefarming/futurefarminginscotland/futureproofingscotlandsfarming)

<sup>274</sup>

[www.soilassociation.org/innovativefarming/futurefarminginscotland/scotlandsfarminginnovationnetwork](http://www.soilassociation.org/innovativefarming/futurefarminginscotland/scotlandsfarminginnovationnetwork)

<p>uptake of nitrogen efficiency measures.</p>	<p>mechanisms under EU Common Agricultural Policy (CAP) cross-compliance if the current voluntary fails to deliver sufficient emission reductions. However, subsequent revisions to the CAP mean that post-2013, cross-compliance will not be suitable to enforce these measures.</p> <p>Consideration is now being given to how equivalent regulation might be implemented in Scotland, including what parameters might be set to “trigger” the implementation of regulation. This is a key focus of the Agriculture &amp; Climate Change Stakeholder Group’s current work programme.</p>
<p>Increase afforestation rate to 15,000 hectares per year</p>	<p>RPP1 set out a proposal to increase woodland planting rates to 15,000 hectares per year from 2015. This proposal was presented with the caveat that implementation would depend on whether this could be shown to be practicably achievable, in particular in relation to the availability of more privately owned land becoming available than has been the case in recent years.</p> <p>In response to questions that had been raised about balancing land use, the Woodland Expansion Advisory Group recommended in June 2012 that afforestation targets remain at the current 10,000 hectares per year level until 2022, with a review to be conducted by 2020. For the purpose of estimating emissions abatement in RPP2, our calculations focus on the 10,000 hectares per year policy and do not include projections for an increased rate of 15,000 hectares, nor any reduced rate.</p>

**Table 9.2: Summary of Rural Land Use policies and proposals**

Rural Land Use	EU, UK or Scottish	Maximum abatement potential (KtCO <sub>2e</sub> ) in 2020	Maximum Abatement potential (KtCO <sub>2e</sub> ) in 2027	Earliest start date
<b>Policies</b>				
<b>Farming For a Better Climate (FFBC)</b> Programme of best practice advice and demonstrations designed to encourage farmers to and land managers to adopt business efficiency measures that also reduce emissions. <b>Increase afforestation rate to 10,000 hectares per year</b> Commitment to increase planting rates to an average of 10,000 per year by 2015. Emissions abatement estimates assume that this rate is maintained from 2015 onwards.	Scottish	103	107	2010
	Scottish	310	687	2015
<b>Proposals</b>				
<b>90% Uptake of fertiliser efficiency measures</b> Transition from a voluntary approach to a mandatory regime designed to optimise the use of nitrogen fertilisers. To be introduced only if voluntary approach (policy - FFBC) does not result in sufficient uptake. <b>Developments in agricultural technology post 2020</b> Potential emissions abatement from a range of measures that are currently considered marginal and less than cost-effective in some circumstances. However, analysis suggests that these may become more feasible after 2020. The measures include anaerobic digestion, plant varieties with improved nitrogen use efficiency, improved livestock management and precision farming.	Scottish	260	260	2018
<b>Accelerated restoration of degraded peatland</b>	Scottish	177	515	2013

<p>Maximisation of the ecosystem and emissions benefits from restoring degraded peatland. Research has suggested that it may be technically feasible to restore up to 21,000 hectares of peatland per year. Work is currently underway to explore how to realise this technical potential subject to developing scientific understanding and international emissions accounting methodology.</p> <p><b>Wood First - Timber Construction Programme</b></p> <p>A package of measures designed to increase the amount of Scottish timber used in the construction and refurbishment of buildings, displacing higher-carbon materials.</p> <p><b>Additional technical potential from peatland and woodland</b></p> <p>Estimated long-term emissions abatement potential that Scottish Government analysis suggests might be technically feasible from increasing peatland restoration and woodland creation rates beyond the levels already set out in the policies and proposals above.</p>							
	Scottish	0	125	2022			
	Scottish	0	750	2025			



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**MONITORING  
PROGRESS  
AND IMPACTS**



## 10. Monitoring progress and impacts

### 10.1 The Scottish Government's Low Carbon Management System

10.1.1 The Climate Change Delivery Board<sup>275</sup>, previously known as the Emissions Reduction Programme Board, has responsibility for monitoring the Scottish Government's progress on both climate change mitigation and adaptation. In terms of mitigation, its purpose is to ensure delivery of the programme of policies and proposals in RPP2 and subsequent reports required to meet the statutory greenhouse gas emissions reductions targets.

10.1.2 The Board is chaired by the Director General for Enterprise, Environment and Digital. Members of the Board include the Directors in the Scottish Government responsible for the key sectors detailed in this document. Current membership is likely to expand following the recent inclusion of climate change adaptation to the Board's remit. To introduce greater scrutiny and challenge, and in response to the 2011 Audit Scotland review (see below), two non-executive members have joined the Board: James Curran, Chief Executive of the Scottish Environment Protection Agency; and Alan Thompson. In addition, we have had discussions with COSLA about their potential future membership of the Board.

10.1.3 Robust accountability and monitoring mechanisms are an essential aspect of our low carbon management system. Since the publication of RPP1, we have continued to develop these mechanisms to help us track progress. We will further develop them using a system of Check Point Reports and Exception Reports. Risk identification and management will be a significant part of the system.

10.1.4 An important aspect of this approach involves the use of milestones. While there are some milestones in RPP2, we recognise that more needs to be done. We are, therefore, developing milestones for RPP2 that will be used by the Board to measure progress against both policies and proposals. The nature of the milestones will vary. However, they will all signify the completion of a significant deliverable, for example a key decision, an element of new infrastructure, the development of legislation, or the securing of finance. The milestones will help the Board assess progress and, importantly, provide an early warning system to identify where delivery is not as originally envisaged.

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<sup>275</sup>The Scottish Government, Climate Change Delivery Board:  
[www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/EmissionReduction](http://www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/EmissionReduction)

10.1.5 To ensure transparency, and in response to the 2011 Audit Scotland review report, we publish information about the Board on our climate change webpages. This includes details of the Board's meeting agendas, its meeting notes, and the **Carbon Reduction Activity Reports**<sup>276</sup> (previously referred to as scorecards during their development phase).

## 10.2 Public Sector Climate Leaders Forum

10.2.1 We believe that the key to driving down climate change emissions is strong and visible leadership. This is particularly important in the Scottish public sector. To this end we propose to establish a Public Sector Climate Leaders Forum. This Forum will be chaired by the Minister for Environment and Climate Change, with COSLA's political leadership playing a key role. Membership will compose of leaders from across the public sector.

10.2.2 The remit of the Forum will include oversight of climate change governance for public bodies, oversight of progress on emission reductions delivery and implementation, and a strong relationship with SSN (Sustainable Scotland Network). The focus of the Forum in the first instance will include our RPP2 proposal to ramp up emission reductions in the public sector (see para 6.5.6) but it will also have a key role in encouraging the sharing of good practice through to identifying and overcoming barriers to progress. We will publish our proposals in October 2013.

## 10.3 Independent assessments

10.3.1 Since the publication of RPP1, a number of independent progress or review reports have been undertaken and published. In December 2011, Audit Scotland published a review report on the Scottish Government's progress in reducing greenhouse gas emissions.<sup>277</sup> As stated above we responded to the transparency recommendation in that report by appointing non-executive members to the Climate Change Delivery Board, and setting up a new web page<sup>278</sup> with information about the Board.

10.3.2 The CCC has also published two statutory annual reports assessing Scotland's progress in reducing greenhouse gas emissions. The first was

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<sup>276</sup> Scottish Government, Carbon Reduction Activity Reports:  
[www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/EmissionReduction/ActivityReports](http://www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/EmissionReduction/ActivityReports)

<sup>277</sup> Audit Scotland, Reducing Scotland's Greenhouse Gas Emissions:  
[www.audit-scotland.gov.uk/docs/central/2011/nr\\_111208\\_greenhouse\\_gases.pdf](http://www.audit-scotland.gov.uk/docs/central/2011/nr_111208_greenhouse_gases.pdf)

<sup>278</sup> The Scottish Government, Climate Change Delivery Board:  
[www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/EmissionReduction](http://www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/EmissionReduction)

published in January 2012<sup>279</sup>, and the second in March 2013<sup>280</sup>. We welcome the findings of both reports that Scotland has made good progress in delivering on emission reduction measures to date.

## 10.4 The Scottish Parliamentary scrutiny process

10.4.1 This document is the final version of the second report on proposals and policies for meeting annual targets that the Scottish Ministers must lay before the Scottish Parliament in accordance with the requirements in section 35 of the Climate Change (Scotland) Act 2009.

10.4.2 A draft version of the report was laid before the Scottish Parliament on 29 January 2013 and underwent a 60-day period for Parliamentary consideration. During this period, the following four Parliamentary subject committees took evidence on the draft report:

- Rural Affairs, Climate Change and Environment Committee
- Economy, Energy and Tourism Committee
- Infrastructure and Capital Investment Committee
- Local Government and Regeneration Committee

10.4.3 The reports of these committees were published on 22 March 2013 and are available from the Scottish Parliament Information Centre and on the Scottish Parliament's website.<sup>281 282 283 284</sup>

10.4.4 The Official Report of the Parliamentary debate on the draft RPP2, which took place on 26 March 2013, is also available on the Scottish Parliament website.<sup>285</sup>

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<sup>279</sup> Committee on Climate Change, 1<sup>st</sup> Scottish Progress Report:  
[http://downloads.theccc.org.uk.s3.amazonaws.com/1552\\_CCC\\_Scotland%20report.pdf](http://downloads.theccc.org.uk.s3.amazonaws.com/1552_CCC_Scotland%20report.pdf)

<sup>280</sup> Committee on Climate Change, 2<sup>nd</sup> Scottish Progress Report:  
[www.theccc.org.uk/wp-content/uploads/2013/03/1674\\_CCC\\_Scots-Report\\_bookmarked\\_2.pdf](http://www.theccc.org.uk/wp-content/uploads/2013/03/1674_CCC_Scots-Report_bookmarked_2.pdf)

<sup>281</sup> Scottish Parliament, Rural Affairs, Climate Change and Environment Committee Report on the Draft Second Report on Proposals and Policies (SP Paper 289, RACCE/S4/13/R2):  
[www.scottish.parliament.uk/parliamentarybusiness/CurrentCommittees/61495.aspx](http://www.scottish.parliament.uk/parliamentarybusiness/CurrentCommittees/61495.aspx)

<sup>282</sup> Scottish Parliament, Economy, Energy and Tourism Committee Report on the Draft Second Report on Proposals and Policies (SP Paper 288, EET/S4/13/R4):  
[www.scottish.parliament.uk/parliamentarybusiness/CurrentCommittees/61496.aspx](http://www.scottish.parliament.uk/parliamentarybusiness/CurrentCommittees/61496.aspx)

<sup>283</sup> Scottish Parliament, Infrastructure and Capital Investment Committee Report on the Draft Second Report on Proposals and Policies (SP Paper 291, ICI/S4/13/R3):  
[www.scottish.parliament.uk/parliamentarybusiness/CurrentCommittees/61494.aspx](http://www.scottish.parliament.uk/parliamentarybusiness/CurrentCommittees/61494.aspx)

<sup>284</sup> Scottish Parliament, Local Government and Regeneration Committee Report on the Draft Second Report on Proposals and Policies (SP Paper 292, LGR/S4/13/R6):  
[www.scottish.parliament.uk/parliamentarybusiness/CurrentCommittees/61493.aspx](http://www.scottish.parliament.uk/parliamentarybusiness/CurrentCommittees/61493.aspx)

<sup>285</sup> The Scottish Government, RPP Parliamentary Consideration:  
[www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/lowcarbon/meetingthetargets/parliamentaryconsideration](http://www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/lowcarbon/meetingthetargets/parliamentaryconsideration)

10.4.5 The Scottish Government also received direct representations on the draft RPP2. These have been published on the Scottish Government's website.<sup>286</sup>

10.4.6 The Scottish Ministers laid a written statement before the Scottish Parliament together with this final report, setting out details of the representations etc. made to them in respect of the draft report and indicating the changes that were made as a result of those representations.

## 10.5 Strategic environmental assessment

10.5.1 The Environmental Assessment (Scotland) Act 2005 sets out statutory requirements for the preparation and publication of Strategic Environmental Assessments (SEA) by public bodies. The purpose of SEA is to ensure that the likely significant environmental effects of Scottish plans, programmes and strategies are assessed and taken into account during their preparation.

10.5.2 The Environmental Report is the key medium for outlining the outputs of the Strategic Environmental Assessment process. The Environmental Report on the proposals and policies set out in the draft RPP2 details the results of the environmental assessment of these measures, identifying and evaluating the likely significant environmental effects of implementing them, as well as identifying the means to prevent or avoid significant adverse effects and enhance positive ones, while also considering reasonable alternatives where appropriate.<sup>287</sup>

10.5.3 The Environmental Report was available for comment during the 60-day period for Parliamentary consideration of the draft RPP2 detailed above.

10.5.4 The last output of the SEA process is the preparation and publication of an SEA Statement that will, in due course, set out how the findings of the SEA have been considered, and how views expressed during the consultation period were taken into account.

10.5.5 More information about the SEA of the proposals and policies set out in this report is available on the Scottish Government's website.

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<sup>286</sup> *ibid*

<sup>287</sup> Scottish Government, SEA Environmental Report for RPP2: [www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/lowcarbon/meetingthetargets/SEAEnvironmentalReport](http://www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/lowcarbon/meetingthetargets/SEAEnvironmentalReport)

## Annex A: Greenhouse Gas Business as Usual Projections and Emissions Abatement (ktCO<sub>2</sub>e) and Cost (£m) Estimates

<b>Business as Usual Projections</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>
Traded Sector Net Emissions (20% EU Target) <b>Includes Energy Supply</b>	19,099	18,749	18,399	18,048	17,698	17,348	16,986	16,618							
Traded Sector Net Emissions (30% EU Target) <b>Includes Energy Supply</b>	18,267	17,639	17,012	16,385	15,757	15,130	14,502	13,875	12,960	12,635	12,310	11,987	11,197	10,897	10,181
Non-Traded Sector Business As Usual	29,846	29,902	30,138	30,364	30,563	30,730	31,032	31,436	31,810	32,225	32,551	32,936	33,398	33,780	34,091
Total Business As Usual Projection (20% EU Target)	48,945	48,651	48,537	48,412	48,261	48,079	48,019	48,054	44,770	44,860	44,861	44,923	44,595	44,677	44,272
Total Business As Usual Projection 30% EU Target)	48,113	47,541	47,150	46,748	46,320	45,860	45,535	45,311	44,770	44,860	44,861	44,923	44,595	44,677	44,272

Up to 2020, the net Scottish emissions account will measure Scotland's share of EU ETS allowances. The overall number of allowances is assumed to be lower if the EU strengthens its 2020 target from 20% to 30%. Phase III of the EU ETS runs from 2013-2020. It is our proposal to review our emissions accounting methodology after Phase III and measure actual emissions from the traded sector.

Because of the change in methodology partway through the time series, this table differs from the other tables in this annex in that it presents an estimated scenario of *actual emissions* from the traded sector, which includes energy supply, rather than a projected Business as Usual baseline from which emissions abatement is deducted.

<b>Homes &amp; Communities</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	
<b>Business as Usual Emissions</b>	6,410	6,309	6,214	6,129	6,075	6,089	6,116	6,146	6,201	6,254	6,300	6,330	6,354	6,366	6,344	
<b>Policies (emissions abatement ktCO<sub>2</sub>e)</b>																
Smart Metering	7	17	33	49	66	80	86	88	89	90	91	92	94	94	95	
Domestic Buildings Energy Standards (2010) - New Build Properties	16	24	32	41	49	58	67	76	84	93	103	113	122	132	142	
Renewable Heat Incentive (Domestic)	11	19	27	35	46	57	68	78	79	79	79	80	80	80	80	
Energy Company Obligation (ECO) and Green Deal (GD)	13	24	33	42	52	62	89	104	114	132	132	132	132	132	132	
National Retrofit Programme: Scottish Government Fuel Poverty & Energy Efficiency Programmes	59	99	137	173	207	207	207	207	207	207	207	207	207	207	207	
Warm Homes Fund	7	12	17	21	25	24	23	23	23	22	22	22	22	22	22	
District Heating Loan Fund	24	36	36	36	36	36	36	36	36	36	36	36	36	36	36	
<b>Total Abatement from policies</b>	<b>138</b>	<b>231</b>	<b>315</b>	<b>397</b>	<b>481</b>	<b>524</b>	<b>576</b>	<b>612</b>	<b>631</b>	<b>659</b>	<b>670</b>	<b>682</b>	<b>692</b>	<b>703</b>	<b>713</b>	
<b>Proposals (emissions abatement ktCO<sub>2</sub>e)</b>																
Domestic Buildings Energy Standards (2014) - New Build Properties	0	0	1	4	8	13	17	22	26	31	35	40	45	50	55	
Regulation of Private and Social Housing	0	1	13	20	27	38	51	63	74	85	102	118	130	141	152	
National Retrofit Programme: Insulation and Heat Programme	0	0	0	0	0	22	27	33	43	49	71	91	117	143	167	
Low Carbon Heat (Domestic)	0	0	7	25	39	57	76	99	135	186	247	336	424	513	609	
Additional Technical Potential in Fabric and Energy Efficiency	0	0	0	0	0	72	142	210	278	343	407	470	531	591	650	
<b>Total abatement from Proposals</b>	<b>0</b>	<b>1</b>	<b>21</b>	<b>49</b>	<b>74</b>	<b>203</b>	<b>314</b>	<b>428</b>	<b>555</b>	<b>694</b>	<b>861</b>	<b>1,055</b>	<b>1,248</b>	<b>1,438</b>	<b>1,634</b>	
<b>Total abatement from Policies and Proposals</b>	<b>138</b>	<b>232</b>	<b>336</b>	<b>446</b>	<b>555</b>	<b>727</b>	<b>889</b>	<b>1,040</b>	<b>1,186</b>	<b>1,353</b>	<b>1,531</b>	<b>1,737</b>	<b>1,940</b>	<b>2,141</b>	<b>2,347</b>	
<b>Net Emissions after Policies and Proposals</b>	6,272	6,077	5,878	5,684	5,521	5,362	5,227	5,106	5,014	4,901	4,769	4,593	4,414	4,225	3,997	
<b>% Change against 1990</b>	-23%	-26%	-28%	-31%	-33%	-34%	-36%	-38%	-39%	-40%	-42%	-44%	-46%	-48%	-51%	
<b>Total cost of Policies</b>																
<b>Total cost of Policies</b>	405	415	392	413	418	306	305	303	300	297	155	153	150	148	146	
<b>Total cost of Proposals</b>																
<b>Total cost of Proposals</b>	0	102	133	167	162	291	290	294	304	301	438	435	431	427	424	
<b>Total cost of Policies and Proposals</b>																
<b>Total cost of Policies and Proposals</b>	405	517	524	580	580	597	595	598	604	598	593	588	581	576	571	

<b>Business, Industry &amp; Public Sector</b>	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	
<b>Business as Usual Emissions</b>	5,072	5,073	5,074	5,071	5,066	5,036	5,005	4,975	4,960	4,944	4,929	4,913	4,898	4,896	4,894	
<b>Policies (emissions abatement ktCO<sub>2e</sub>)</b>																
Smart Metering	2	8	19	30	42	49	52	53	52	51	50	49	48	47	46	
CRC Energy Efficiency Scheme	30	41	54	68	83	98	114	130	149	169	184	200	216	187	154	
Non Domestic Buildings Energy Standards (2010) - New Build Properties	13	19	25	32	38	44	51	57	63	70	76	82	89	95	101	
Green Deal & Supporting Policy	2	4	18	38	58	74	85	92	97	98	73	55	41	31	24	
EU Products Policy	-6	-10	-7	-8	-9	-10	-11	-11	-11	-10	-10	-9	-9	-8	-8	
Renewable Heat Incentive (Non Domestic)	106	171	256	375	532	641	768	896	869	849	877	893	902	909	914	
<b>Total Abatement from policies</b>	<b>147</b>	<b>233</b>	<b>365</b>	<b>535</b>	<b>743</b>	<b>896</b>	<b>1,060</b>	<b>1,217</b>	<b>1,220</b>	<b>1,227</b>	<b>1,250</b>	<b>1,270</b>	<b>1,288</b>	<b>1,260</b>	<b>1,231</b>	
<b>Proposals (emissions abatement ktCO<sub>2e</sub>)</b>																
Non Domestic Buildings Energy Standards (2014) - New Build Properties	0	0	2	5	10	15	20	25	30	35	40	45	50	55	60	
Assessment of Energy Performance and Emissions Regulations (Non Domestic Buildings)	0	6	12	18	24	30	36	42	56	70	85	99	113	128	142	
Public Sector	87	109	130	152	174	195	217	239	245	252	259	265	272	278	285	
Low Carbon Heat (Non Domestic)	16	74	112	116	81	95	90	101	269	459	602	777	960	1,145	1,334	
<b>Total abatement from proposals</b>	<b>103</b>	<b>189</b>	<b>256</b>	<b>290</b>	<b>289</b>	<b>335</b>	<b>363</b>	<b>406</b>	<b>600</b>	<b>816</b>	<b>985</b>	<b>1,186</b>	<b>1,395</b>	<b>1,606</b>	<b>1,821</b>	
<b>Total abatement from policies and proposals</b>	<b>250</b>	<b>422</b>	<b>621</b>	<b>826</b>	<b>1,032</b>	<b>1,232</b>	<b>1,423</b>	<b>1,623</b>	<b>1,820</b>	<b>2,043</b>	<b>2,235</b>	<b>2,456</b>	<b>2,682</b>	<b>2,866</b>	<b>3,051</b>	
<b>Net Emissions after Policies and Proposals</b>	4,822	4,652	4,453	4,246	4,034	3,804	3,582	3,352	3,139	2,901	2,694	2,457	2,216	2,030	1,843	
<b>% Change from 1990 (including 20% EU ETS)</b>	-36%	-37%	-39%	-40%	-42%	-43%	-45%	-46%	-57%	-58%	-60%	-61%	-64%	-65%	-68%	
<b>% Change from 1990 (including 30% EU ETS)<sup>288</sup></b>	-38%	-40%	-42%	-45%	-47%	-49%	-51%	-54%	-57%	-58%	-60%	-61%	-64%	-65%	-68%	
<b>Total cost of policies (£m)</b>																
<b>Total cost of policies (£m)</b>	141	164	171	184	198	204	198	216	198	181	168	150	139	124	131	
<b>Total cost of proposals (£m)</b>	24	72	91	95	81	80	75	76	157	173	188	198	207	206	232	
<b>Total cost of policies and proposals (£m)</b>	165	236	262	278	280	284	274	291	355	355	356	348	346	331	363	

<sup>288</sup> The percentage change shown for the Business, Industry and Public Sector includes emissions from the traded sector as it has not been possible to split emissions into 'traded' and 'non-traded' prior to the start of the EU Emissions Trading System in 2005.



<b>Transport</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>	
<b>Business as Usual Emissions</b>	13,236	13,256	13,289	13,420	13,527	13,622	13,720	13,822	13,906	13,992	14,083	14,176	14,253	14,374	14,494	
Policies (emissions abatement ktCO <sub>2e</sub> )																
Decarbonising Vehicles (EU Directives)	157	267	381	500	642	811	1,009	1,243	1,328	1,408	1,483	1,553	1,619	1,676	1,727	
<b>Total Abatement from policies</b>	<b>157</b>	<b>267</b>	<b>381</b>	<b>500</b>	<b>642</b>	<b>811</b>	<b>1,009</b>	<b>1,243</b>	<b>1,328</b>	<b>1,408</b>	<b>1,483</b>	<b>1,553</b>	<b>1,619</b>	<b>1,676</b>	<b>1,727</b>	
Proposals (emissions abatement ktCO <sub>2e</sub> )																
Decarbonising Vehicles	1	7	47	76	110	151	209	282	441	453	564	676	689	793	798	
Sustainable Communities	0	12	56	70	82	103	122	139	158	179	198	219	241	259	277	
Business Efficiencies	26	29	58	67	76	91	106	121	173	227	270	306	357	409	462	
Network Efficiencies	2	4	31	32	33	34	35	36	35	35	34	33	33	33	32	
Lower Emission Potential in Transport	0	0	0	0	0	0	0	0	0	0	0	0	250	500	750	
<b>Total abatement from proposals</b>	<b>29</b>	<b>53</b>	<b>192</b>	<b>245</b>	<b>301</b>	<b>379</b>	<b>473</b>	<b>579</b>	<b>808</b>	<b>894</b>	<b>1,065</b>	<b>1,235</b>	<b>1,569</b>	<b>1,994</b>	<b>2,320</b>	
<b>Total abatement from policies and proposals</b>	<b>186</b>	<b>320</b>	<b>574</b>	<b>745</b>	<b>943</b>	<b>1,190</b>	<b>1,482</b>	<b>1,822</b>	<b>2,135</b>	<b>2,301</b>	<b>2,548</b>	<b>2,788</b>	<b>3,188</b>	<b>3,671</b>	<b>4,046</b>	
<b>Net Emissions after Policies and Proposals</b>	13,050	12,937	12,715	12,675	12,584	12,433	12,239	12,000	11,770	11,691	11,534	11,388	11,065	10,703	10,448	
<b>% Change from 1990</b>	1%	0%	-2%	-2%	-3%	-4%	-5%	-7%	-9%	-10%	-11%	-12%	-15%	-17%	-19%	
<b>Total cost of policies (£m)</b>	<b>9</b>	<b>17</b>	<b>24</b>	<b>31</b>	<b>40</b>	<b>52</b>	<b>68</b>	<b>88</b>	<b>90</b>	<b>90</b>	<b>91</b>	<b>92</b>	<b>93</b>	<b>94</b>	<b>95</b>	
<b>Total cost of proposals (£m)</b>	<b>47</b>	<b>43</b>	<b>168</b>	<b>177</b>	<b>181</b>	<b>158</b>	<b>141</b>	<b>146</b>	<b>151</b>	<b>162</b>	<b>127</b>	<b>130</b>	<b>137</b>	<b>132</b>	<b>134</b>	
<b>Total cost of policies and proposals (£m)</b>	<b>55</b>	<b>59</b>	<b>192</b>	<b>208</b>	<b>222</b>	<b>210</b>	<b>209</b>	<b>233</b>	<b>241</b>	<b>252</b>	<b>218</b>	<b>222</b>	<b>230</b>	<b>226</b>	<b>229</b>	

<b>Waste and Resource Efficiency</b>	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
<b>Business as Usual Emissions</b>	2,121	2,105	2,088	2,073	2,059	2,044	2,029	2,014	2,003	1,992	1,981	1,969	1,958	1,958	1,958
<b>Policies (emissions abatement ktCO<sub>2</sub>e)</b>															
Zero Waste Policies (pre May-2010)	484	533	579	622	659	693	722	748	774	795	813	827	837	856	871
Zero Waste Plan	13	26	41	58	77	97	119	141	163	185	206	228	249	270	290
<b>Total Abatement from policies</b>	<b>497</b>	<b>559</b>	<b>620</b>	<b>680</b>	<b>737</b>	<b>790</b>	<b>841</b>	<b>889</b>	<b>937</b>	<b>980</b>	<b>1,019</b>	<b>1,055</b>	<b>1,086</b>	<b>1,126</b>	<b>1,161</b>
<b>Proposals (emissions abatement ktCO<sub>2</sub>e)</b>															
Enhanced Capture of Landfill Gas	22	44	67	90	112	133	154	163	161	158	155	151	148	144	140
<b>Total abatement from proposals</b>	<b>22</b>	<b>44</b>	<b>67</b>	<b>90</b>	<b>112</b>	<b>133</b>	<b>154</b>	<b>163</b>	<b>161</b>	<b>158</b>	<b>155</b>	<b>151</b>	<b>148</b>	<b>144</b>	<b>140</b>
<b>Total abatement from policies and proposals</b>	<b>519</b>	<b>603</b>	<b>687</b>	<b>769</b>	<b>848</b>	<b>924</b>	<b>995</b>	<b>1,052</b>	<b>1,098</b>	<b>1,138</b>	<b>1,174</b>	<b>1,206</b>	<b>1,234</b>	<b>1,270</b>	<b>1,302</b>
<b>Net Emissions after Policies and Proposals</b>	<b>1,602</b>	<b>1,502</b>	<b>1,401</b>	<b>1,304</b>	<b>1,210</b>	<b>1,120</b>	<b>1,034</b>	<b>963</b>	<b>906</b>	<b>854</b>	<b>806</b>	<b>763</b>	<b>724</b>	<b>689</b>	<b>656</b>
<b>% Change from 1990</b>	<b>-76%</b>	<b>-78%</b>	<b>-79%</b>	<b>-81%</b>	<b>-82%</b>	<b>-83%</b>	<b>-85%</b>	<b>-86%</b>	<b>-87%</b>	<b>-87%</b>	<b>-88%</b>	<b>-89%</b>	<b>-89%</b>	<b>-90%</b>	<b>-90%</b>
<b>Total cost of policies (£m)</b>	<b>172</b>	<b>161</b>	<b>163</b>	<b>163</b>	<b>163</b>	<b>164</b>	<b>162</b>	<b>163</b>	<b>164</b>	<b>165</b>	<b>164</b>	<b>165</b>	<b>165</b>	<b>165</b>	<b>165</b>
<b>Total cost of proposals (£m)</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Total cost of policies and proposals (£m)</b>	<b>173</b>	<b>162</b>	<b>164</b>	<b>164</b>	<b>164</b>	<b>165</b>	<b>163</b>	<b>164</b>	<b>164</b>	<b>165</b>	<b>164</b>	<b>165</b>	<b>165</b>	<b>165</b>	<b>165</b>

<b>Rural Land Use</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>	<b>2027</b>
<b>Business as Usual Emissions</b>	3,007	3,158	3,473	3,670	3,836	3,939	4,161	4,478	4,741	5,043	5,258	5,548	5,936	6,187	6,401
<b>Policies (emissions abatement ktCO<sub>2e</sub>)</b>															
Farming for a better climate	50	62	75	87	100	101	103	103	104	104	105	106	106	107	107
Increase afforestation rate to 10 kh per year	15	16	45	92	144	195	248	310	373	435	477	529	582	634	687
<b>Total Abatement from policies</b>	<b>65</b>	<b>78</b>	<b>120</b>	<b>179</b>	<b>244</b>	<b>296</b>	<b>351</b>	<b>413</b>	<b>477</b>	<b>539</b>	<b>582</b>	<b>635</b>	<b>688</b>	<b>741</b>	<b>794</b>
<b>Proposals (emissions abatement ktCO<sub>2e</sub>)</b>															
90% Uptake of Fertiliser Efficiency Measures	0	0	0	0	0	260	260	260	260	260	260	260	260	260	260
Developments in agricultural technology from 2020	0	0	0	0	0	0	0	310	310	310	310	310	310	310	310
Accelerated restoration of degraded peatland	0	9	25	47	73	104	139	177	218	263	309	358	410	462	515
Wood First - Timber Construction Programme	0	0	0	0	0	0	0	0	0	89	89	89	89	125	125
Additional technical potential from low carbon land use	0	0	0	0	0	0	0	0	0	0	0	0	250	500	750
<b>Total abatement from proposals</b>	<b>0</b>	<b>9</b>	<b>25</b>	<b>47</b>	<b>73</b>	<b>364</b>	<b>399</b>	<b>747</b>	<b>788</b>	<b>922</b>	<b>968</b>	<b>1,017</b>	<b>1,319</b>	<b>1,657</b>	<b>1,960</b>
<b>Total abatement from policies and proposals</b>	<b>65</b>	<b>87</b>	<b>145</b>	<b>226</b>	<b>317</b>	<b>660</b>	<b>749</b>	<b>1,160</b>	<b>1,265</b>	<b>1,461</b>	<b>1,550</b>	<b>1,652</b>	<b>2,007</b>	<b>2,397</b>	<b>2,754</b>
<b>Net Emissions after Policies and Proposals</b>	2,942	3,071	3,328	3,444	3,519	3,279	3,412	3,318	3,476	3,582	3,708	3,896	3,929	3,790	3,648
<b>% Change from 1990</b>	-63%	-61%	-58%	-56%	-55%	-58%	-57%	-58%	-56%	-54%	-53%	-50%	-50%	-52%	-54%
<b>Total cost of RLU policies (£m)</b>															
<b>Total cost of RLU proposals (£m)</b>	37	42	47	49	51	53	54	56	57	58	58	59	60	60	60
<b>Total cost of RLU policies and proposals (£m)</b>	55	59	63	64	67	69	70	377	378	419	379	380	389	379	379

## Annex B: Emissions targets and projections for policies and proposals (ktCO<sub>2e</sub>)

YEAR	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	
<i>Emissions targets</i>	47,976	46,958	45,928	44,933	43,946	42,966	41,976	40,717	39,495	38,310	37,161	35,787	34,117	32,446	30,777	
<i>% change from 1990 baseline</i>	-34.26%	-35.65%	-37.06%	-38.43%	-39.78%	-41.12%	-42.48%	-44.20%	-45.88%	-47.50%	-49.08%	-50.96%	-53.25%	-55.54%	-57.82%	
<b>Margin by which target hit (+ve) or missed (-ve)</b>																
Implementation of RPP2 Policies only (EU ETS 20%)	+35	-324	-809	-1,188	-1,469	-1,795	-2,207	-2,963	-683	-1,737	-2,696	-3,942	-5,105	-6,725	-7,868	
Implementation of RPP2 Policies & Proposals (EU ETS 20%)	+189	-29	-247	-468	-620	-381	-505	-641	+2,229	+1,746	+1,339	+702	+572	+114	+5	
Implementation of RPP2 Policies and move to EU ETS 30%	+867	+785	+578	+476	+472	+424	+277	-220	-683	-1,737	-2,696	-3,942	-5,105	-6,725	-7,868	
Implementation of RPP2 Policies & Proposals and move to EU ETS 30%	+1,021	+1,081	+1,140	+1,196	+1,321	+1,838	+1,979	+2,103	+2,229	+1,746	+1,339	+702	+572	+114	+5	

### Annex C: Annual reduction in projected Scottish emissions against 1990 Base Year (2011 GHG Inventory)

YEAR	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Implementation of RPP2 Policies only (EU ETS 20%)	-34.3%	-35.2%	-36.0%	-36.8%	-37.8%	-38.7%	-39.5%	-40.1%	-44.9%	-45.1%	-45.4%	-45.6%	-46.3%	-46.3%	-47.0%
Implementation of RPP2 Policies and Proposals (EU ETS 20%)	-34.5%	-35.6%	-36.7%	-37.8%	-38.9%	-40.6%	-41.8%	-43.3%	-48.9%	-49.9%	-50.9%	-51.9%	-54.0%	-55.7%	-57.8%
Implementation of RPP2 Policies only (EU ETS 30%)	-35.4%	-36.7%	-37.9%	-39.1%	-40.4%	-41.7%	-42.9%	-43.9%	-44.9%	-45.1%	-45.4%	-45.6%	-46.3%	-46.3%	-47.0%
Implementation of RPP2 Policies and Proposals (EU ETS 30%)	-35.7%	-37.1%	-38.6%	-40.1%	-41.6%	-43.6%	-45.2%	-47.1%	-48.9%	-49.9%	-50.9%	-51.9%	-54.0%	-55.7%	-57.8%

**Low Carbon Scotland:**

**Meeting our Emissions Reduction Targets  
2013-2027**

The Second Report on Proposals and Policies

**Technical Appendix**

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## 1. Introduction

### 1.1 Context

1.1.1 The purpose of this technical appendix is to present the methodological and technical detail underpinning the information presented in the main document of the Second Report on Policies and Proposals (RPP2).

1.1.2 Scotland's annual climate change targets are explicit in the rate of greenhouse gas (GHG) emissions reduction required each year and the target level of annual emissions that is permitted under the Climate Change (Scotland) Act 2009 over the period 2010 and 2027. The robustness of the evidence base that underpins the potential impacts of policies and proposals is key to ensuring that appropriate decisions can be made on the most effective means of meeting the targets.

1.1.3 This technical appendix provides information on historical GHG emissions in Scotland, the methodology used to estimate future business-as-usual (BAU) emissions projections and the emissions abatement potential from implementation of policies and proposals. It also provides the basis on which estimates of the required financial investments to deliver the policies and proposals have been derived.

1.1.4 This appendix has three parts:

- Part 1 presents the context in which the RPP2 is set, the statutory targets that are to be achieved and how progress against those targets is measured.
- Part 2 presents historical emissions data for Scotland and the methodology adopted to estimate a BAU future emissions projection for Scotland. It also explains the degree to which there are uncertainties associated with estimating future emission projections.
- Part 3 presents the methodologies adopted to estimate the emissions savings, investments and benefits identified for the policies and proposals within each sector.



## 2. Part 1: RPP2 and the Statutory Greenhouse Gas Emissions Targets

### 2.1 Background to RPP2

2.1.1 The RPP2 demonstrates how Scotland can reduce its GHG emissions and meet its climate change targets each year from 2013 to 2027. It builds on the work undertaken and presented in the first 2011 Report on Policies and Proposals - *Low Carbon Scotland: Meeting the Emissions Reduction Targets 2010-2022<sup>1</sup> (RPP1)* – which set out the Scottish Government’s approach to meeting its statutory annual GHG emissions targets from 2010 to 2022. RPP2 provides both an update to RPP1 for the period 2013 to 2022 and for the first time sets out a path for meeting the 2023 to 2027 annual targets. This fulfils the requirements of both Sections 35 and 36 of the Act.

### 2.2 Scotland’s Emissions Targets

2.2.1 The Climate Change (Scotland) Act 2009 creates a statutory framework for GHG emissions reductions in Scotland by setting an interim target of at least a 42 per cent reduction for 2020, and at least an 80 per cent reduction target for 2050 against a 1990/1995 baseline.<sup>2</sup>

2.2.2 The Committee on Climate Change (CCC) advised the Scottish Government on the level of emission reduction targets which included a minimum saving of 3% per annum over the 2023-27 period to put Scotland on a path to an emissions reduction of around 60% in 2030 relative to 1990 levels.<sup>3</sup> Table 1 below provides the annual emissions targets for Scotland. Achievement of Scotland's annual targets is measured against the level of the Net Scottish Emissions Account (NSEA). This is undertaken annually with the most recent 2013 publication presenting the 2011 emissions data against Scotland’s annual target.<sup>4</sup>

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<sup>1</sup> <http://www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/lowcarbon/rpp>

<sup>2</sup> Scotland’s targets use the level of emissions in 1990 (for carbon dioxide, methane and nitrous oxide) and 1995 (for fluorine-based gases) as the baseline from which reductions are calculated.

<sup>3</sup> <http://theccc.org.uk/topics/uk-and-regions/scotland/beyond-2020>

<sup>4</sup> <http://www.scotland.gov.uk/Publications/2013/06/1558/downloads#res-1>

## Technical Appendix

**Table 1: Annual Scottish Emissions Targets, 2010 - 2027 (ktCO<sub>2</sub>e)**

Year	Emissions Targets
2010	53,652
2011	53,404
2012	53,226
2013	47,976
2014	46,958
2015	45,928
2016	44,933
2017	43,946
2018	42,966
2019	41,976
2020	40,717
2021	39,495
2022	38,310
2023	37,161
2024	35,787
2025	34,117
2026	32,446
2027	30,777

## 3. Part 2: Historical Emissions Data and the Business-as-Usual Future Emissions Projections

### 3.1 Historical Emissions Data

3.1.1 The official source of GHG emissions data that is used by the Scottish Government is the National Atmospheric Emissions Inventory (NAEI).<sup>5</sup> The NAEI compiles estimates of emissions to the atmosphere from UK sources. This data is disaggregated to a regional level and the Scottish estimates are published annually with approximately an 18 month lag in the Greenhouse Gas Inventory.<sup>6</sup> The time series of data runs from 1990 with the latest Scottish GHG emissions estimates for 2011 published in June 2013. Data from the NAEI has been used as the basis for setting the Scottish annual GHG emissions targets and for assessing progress against the targets.

#### Traded and Non-Traded Emissions

3.1.2 The advent of the European Union Emissions Trading Scheme (EU ETS) in 2005 meant that emissions were split into those accounted in the 'Traded' sector and those in the 'Non-Traded' sector. Emissions in the traded sector (EU ETS) include GHG emissions from the generation of electricity, energy intensive business and industrial processes such as production of steel and iron, and energy intensive parts of the public sector such as large hospitals. In 2011, 98% of GHG emissions from the Energy Supply sector were estimated to be traded, alongside 49% of the business and industry sector's emissions and 21% of the public sector's emissions.

3.1.3 The non-traded sector emissions include all other GHG emissions captured in the NAEI in Scotland that are not in the traded sector. These are disaggregated into the following sources of emissions: residential, non-traded business, industry and public sector, transport, agriculture and related land use, forestry, waste sector, and development (land use).

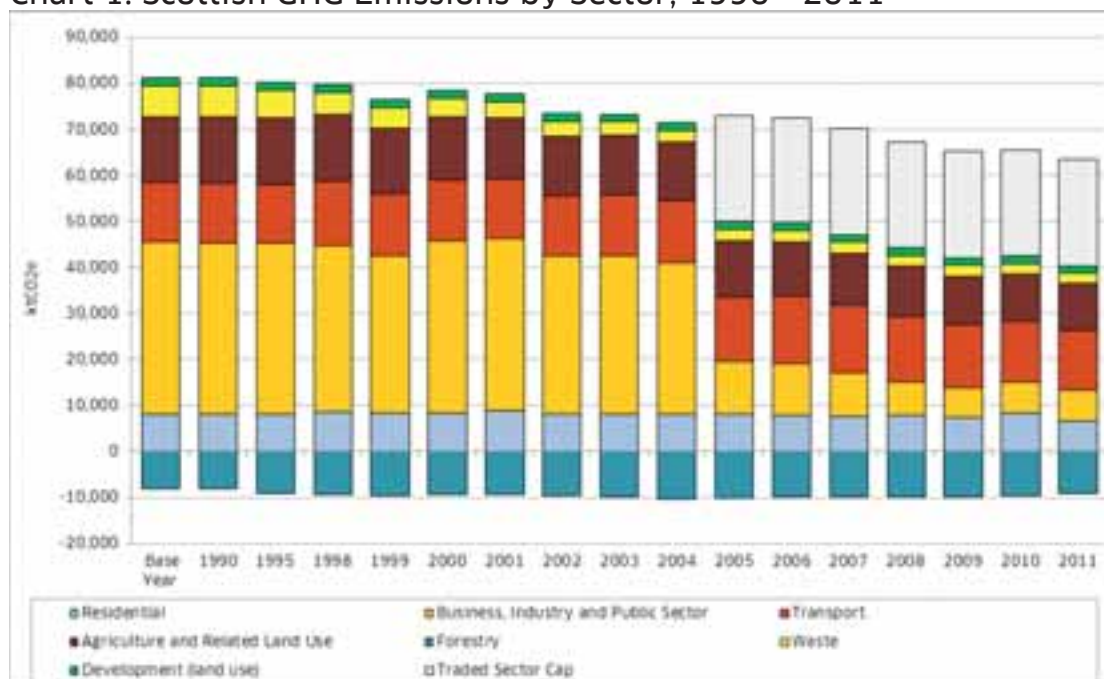
3.1.4 Chart 1 below shows historical Scottish emissions by sector. The start of the EU ETS can be seen in 2005 when more than half the emissions from the Business, Industry and Public Sector category moved into the Traded Sector.

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<sup>5</sup> <http://naei.defra.gov.uk/index.php>

<sup>6</sup> [http://naei.defra.gov.uk/reports/reports?report\\_id=756](http://naei.defra.gov.uk/reports/reports?report_id=756)

Chart 1: Scottish GHG Emissions by Sector, 1990 - 2011



Source: GHG Inventory (NAEI), 2013<sup>7</sup>

## 3.2 Future Emissions Projections

### Non-Traded Sector

3.2.1 The BAU GHG emissions projection for Scotland is the first step in establishing the scale of abatement that is required to meet future annual GHG emissions targets. The full process is to construct a BAU GHG emissions profile for Scotland then net off the abatement potential from the policies and proposals identified in order to meet the emissions targets that have been set. Details of the abatement potential from policies and proposals are set out in Part 3 of this appendix.

3.2.2 The BAU scenario is an estimate of what emissions in Scotland are most likely to be each year between 2013 and 2027 based on NAEI data and the on-going effects of policies implemented up to the 2006 UK and Scottish Climate Change Programmes.

3.2.3 The non-traded sector BAU emissions projections are estimated at a sectoral level as detailed above. The basis of the BAU projections is the 2010 'outturn' data from the NAEI. An estimate of 2011 Scottish sectoral emissions was calculated by applying the percentage change in emissions observed at a UK level between 2010

<sup>7</sup> Non-Traded sector estimate for Business, Industry and Public Sector post 2004 is based on 2011 EU ETS verified emissions.

and 2011.<sup>8</sup> From 2012 to 2027 BAU emissions were calculated for each sector, for CO<sub>2</sub> and non-CO<sub>2</sub> emissions, using a range of projection tools and sources. Details of these are set out below.

### Scenario Tool of Emissions Projections for Scotland (STEPS)

3.2.4 The STEPS model was commissioned by the CCC and developed by Cambridge Econometrics (CE). The model provides Scottish BAU CO<sub>2</sub> projections for the non-traded sector out to 2030.<sup>9</sup>

3.2.5 The STEPS model has been used to create CO<sub>2</sub> BAU projections from 2013 to 2027 for the Residential sector, non-traded Business, Industry and Public sector, and Transport (not including aviation).

3.2.6 To generate the most robust estimates possible for Scotland, the STEPS model is informed by two Scottish Government models: Domestic Emissions Model for Scotland (DEMScot), which is particularly geared for the Scottish residential sector, and the Transport Model for Scotland (TMfS), which inputs Scottish specific data on vehicle fleet mix and efficiency.

3.2.7 Aviation is the only mode of transport for which projected GHG emissions are not estimated by the STEPS model. From 2012, aviation CO<sub>2</sub> emissions are captured in the EU ETS. As such, for the purposes of modelling their impact on Scotland's GHG emissions, aviation BAU emissions have been assumed to follow the capped trading amount of 97% of the 2004 – 2006 average aviation emissions in 2012 falling to 95% of the same average from 2013 onwards.<sup>10</sup>

### Non-CO<sub>2</sub> Emissions Projections

3.2.8 The CCC commissioned AEA to provide non-CO<sub>2</sub> BAU projections for Scotland and the other countries within the UK.<sup>11</sup> This analysis provides projections for 2010, 2015, 2020 for all non-CO<sub>2</sub> emissions arising in Scotland. To derive the annual projection, the 5-yearly results have been linearly interpolated over the years to 2027.

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<sup>8</sup> 2011 Scottish data was not available at the time the analysis was undertaken.  
[http://www.decc.gov.uk/en/content/cms/statistics/climate\\_stats/gg\\_emissions/uk\\_emissions/uk\\_emissions.aspx](http://www.decc.gov.uk/en/content/cms/statistics/climate_stats/gg_emissions/uk_emissions/uk_emissions.aspx)

<sup>9</sup> <http://downloads.theccc.org.uk.s3.amazonaws.com/ScotlandLetter/STEPS%20update%20-%20final%20report%20-%20march%202011.pdf>

<sup>10</sup> [http://ec.europa.eu/clima/policies/transport/aviation/index\\_en.htm](http://ec.europa.eu/clima/policies/transport/aviation/index_en.htm)

<sup>11</sup> "Non-CO<sub>2</sub> Greenhouse Gas Projections for England, Scotland, Wales and Northern Ireland", October 2009, <http://www.naei.org.uk/reports.php>

3.2.9 The AEA projections are used to provide non-CO<sub>2</sub> projections for Residential, Business, Industry and Public Sector, the Agriculture Industry element of Agriculture and Related Land Use, Transport and Waste.

### **Land Use, Land Use Change and Forestry (LULUCF)**

3.2.10 The LULUCF<sup>12</sup> emissions projections are based on the work of the Centre for Ecology and Hydrology (CEH)<sup>13</sup> which produces a national inventory and projections of emissions by sources and removals of GHGs at a range of spatial scales. This feeds into the NAEI.

3.2.11 Its latest report provides projections to 2050 on carbon stock changes (resulting in net CO<sub>2</sub> emissions) and CO<sub>2</sub>, Carbon Monoxide (CH<sub>4</sub>) and Nitrous Oxide (N<sub>2</sub>O) emissions arising from LULUCF activities reported in the latest NAEI.<sup>14</sup> Following a request by the Scottish Government, the scenarios were modified to include continuing cropland-grassland turnover (crop-rotation). In RPP2 the CEH projections were used to provide CO<sub>2</sub> and non-CO<sub>2</sub> projections for Agriculture Related Land Use, Forestry and Development (land use).

### **Food and Agriculture Policy Research Institute (FAPRI)**

3.2.12 The FAPRI UK modelling system captures the dynamic interrelationships among the variables affecting supply and demand in the main agricultural sectors of England, Wales, Scotland and Northern Ireland.<sup>15</sup> The model consists of a system of equations covering the dairy, beef, sheep, pigs, poultry, wheat, barley, oats, rapeseed and bio-fuel sectors and generates annually-determined, 10-year baseline projections of all the major agricultural commodity prices, production levels and GHG emissions, against which policy scenarios can be compared.

3.2.13 In RPP2, FAPRI is used to generate non-CO<sub>2</sub> emission projections for the Scottish Agriculture sector.

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<sup>12</sup> The LULUCF sector is divided into six land use types for reporting of emissions/removals: 5A Forest Land, 5B Cropland, 5C Grassland, 5D Wetlands, 5E Settlements, 5F Other Land.

<sup>13</sup> [http://naei.defra.gov.uk/report\\_link.php?report\\_id=713](http://naei.defra.gov.uk/report_link.php?report_id=713)

<sup>14</sup> Emissions of greenhouse gases to the atmosphere are expressed as positive quantities, and removals of carbon dioxide as negative quantities. The net LULUCF emission is the balance of emissions and removals.

<sup>15</sup>

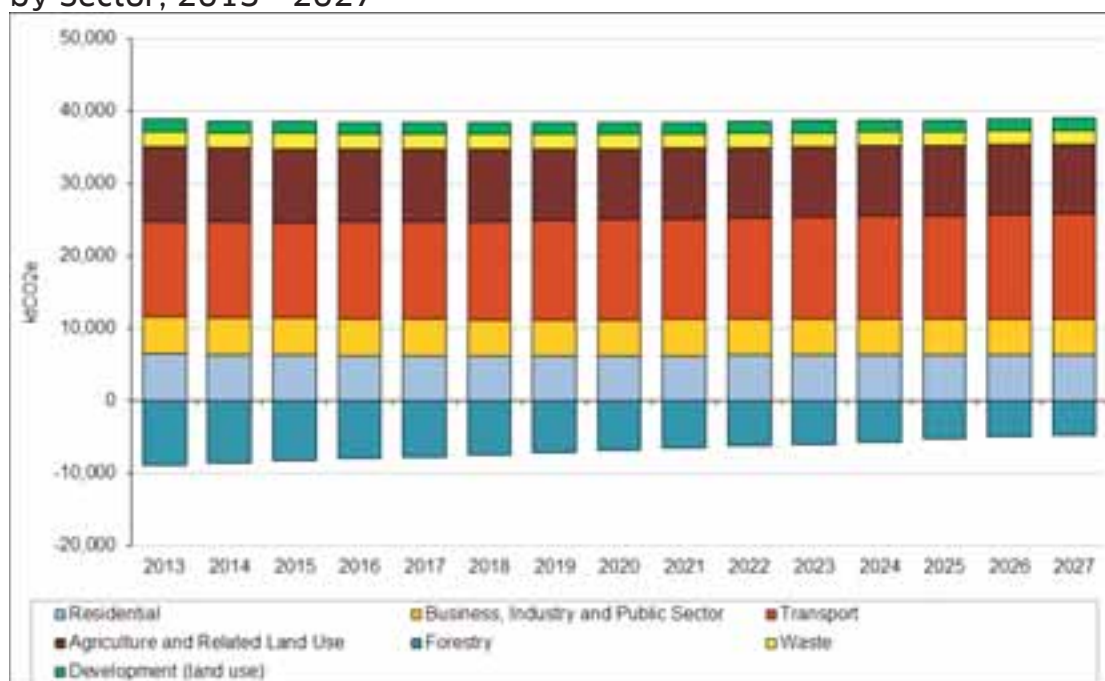
<http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=17569>

3.2.14 Table 2 presents a summary of the tools used to project non-traded BAU emissions in RPP2 and Chart 2 illustrates the non-traded BAU projections by sector.

Table 2: Summary of Sources used to Estimate Non-Traded Scottish Business-as-Usual Emissions

Sector	CO <sub>2</sub>	Non-CO <sub>2</sub>
Residential	STEPS	AEA
Business, Industry and Public Sector	STEPS	AEA
Transport	STEPS	AEA
Agriculture and Related Land Use	STEPS and LULUCF	FAPRI and LULUCF
Forestry	LULUCF	LULUCF
Waste	AEA	AEA
Development (land Use)	LULUCF	LULUCF

Chart 2: Non-Traded Scottish Business-as-Usual Emissions Projection by Sector, 2013 - 2027



Source: Scottish Government, 2012/13

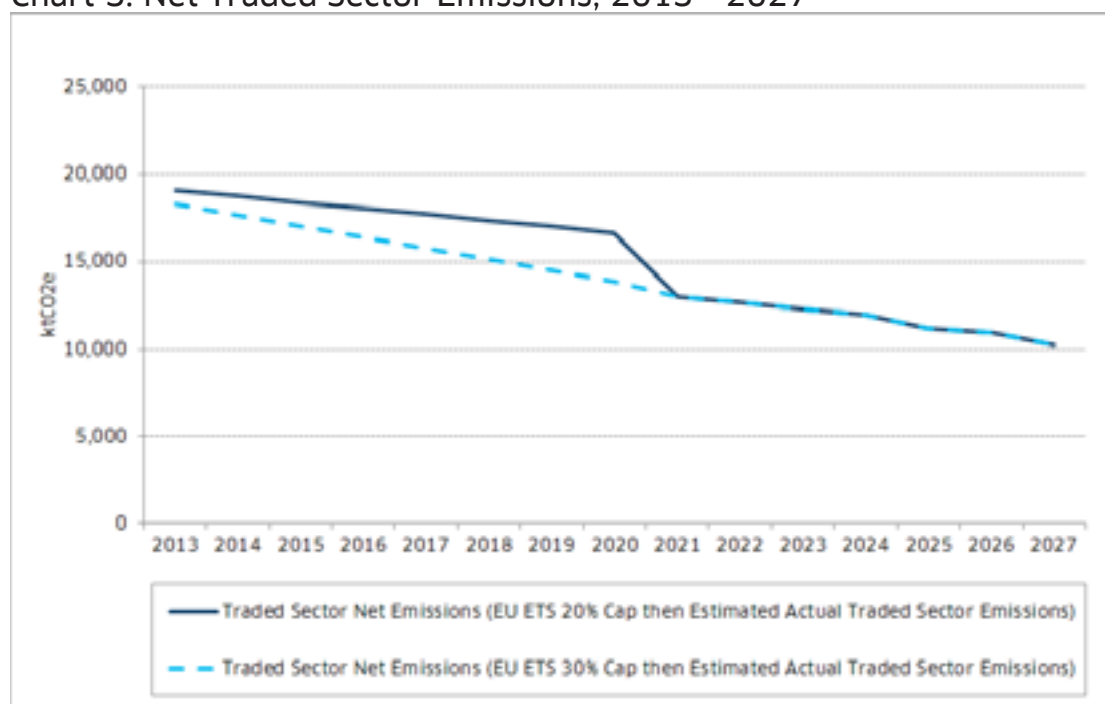
### The Traded Sector

3.2.15 Estimating a future emissions projection for the traded sector has been split into two parts. From 2013 to 2020, the traded sector is presented as per the EU ETS and Scotland's share of the trading scheme's declining permit allocation is used as the emissions profile for the traded sector. From 2021 to 2027, there are no details on the

nature of the EU ETS, and so an estimate of ‘net traded sector emissions’ has been presented. This is constructed from a projection of actual electricity generation emissions in Scotland in its transition to a sectoral emissions intensity of 50g/kWh in 2030 and from the CCC second target advice that identifies abatement from non-electricity generation traded industry (e.g. refineries). The traded sector emissions profile already builds in abatement, initially through the assumed price mechanism and permit supply in the EU ETS up to 2020, and thereafter as a result of progressing on to 50g/kWh. As such, no additional emissions abatement is deducted from the traded sector profile.

3.2.16 Chart 3 illustrates the traded sector emissions profile for Scotland.

Chart 3: Net Traded Sector Emissions, 2013 - 2027



Source: Scottish Government, 2012

### 3.3 Uncertainty of Emissions Projections

3.3.1 The BAU emissions projections for the traded and non-traded sectors have a significant level of uncertainty around them, which naturally increases the further into the future the projection stretches. The projections out to 2027 are based on a wide range of assumptions associated with issues such as future economic circumstances, energy consumption, land use changes, consumer behaviours and natural uptake of current policies. All assumptions made have been based on the most up to date emissions data



available at a Scottish level and our best understanding of future circumstances through the projection tools used. However, the research and data associated with GHG emissions and their sources are fast evolving, which can have a significant effect on the profile of BAU emissions projections as the updates are incorporated.<sup>16</sup>

3.3.2 This high level of uncertainty also feeds into the abatement potential of policies and proposals that are set out in Part 3. A range of assumptions have had to be made about the potential uptake of measures and the financial investments that could be required to achieve the abatement potential detailed. Some of the policies and proposals are very much dependent upon changes in consumer behaviour, which is a particular source of uncertainty. The next section makes clear the sector specific uncertainties that exist with the emission abatement and investment projections and the assumptions (and sources) that have been used to provide credible emissions profiles.

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<sup>16</sup> <http://www.scotland.gov.uk/Resource/0042/00424034.pdf> (pages 6 and 7)

## 4. Part 3: Sectoral Emissions Abatement, Financial Costs and Benefits

### 4.1 Energy and the Traded Sector

4.1.1 The Traded Sector consists of CO<sub>2</sub> emissions from the following categories in the NAEI: industry, commercial and the public sector; industrial process, power stations, refineries, and other energy supply. As set out above, the approach to providing an emissions projection for the traded sector from 2013 to 2020 is based on phase three of the EU ETS. The estimate of a 20% cap is based on an estimate of what Scotland's share of free allocation permits, auctioned permits and new entrants reserve will be in phase three. Whilst the 20% cap refers to a reduction of EU wide emissions of 20% by 2020 compared to a 2005 baseline, the Scottish share of that is estimated to represent a 25% reduction compared to 2005 traded emissions. To estimate the 30% reduction at an EU level, the Scottish share is assumed to be a 37.5% reduction against the 2005 traded emissions.

4.1.2 Post 2020, in the absence of an agreed EU ETS, the approach to estimating traded emissions has been to consider the abatement potential that is likely to occur from the different aspects of the traded sector. For emissions from the electricity generation sector (power stations), a Scottish Government estimate of future emissions from the sector has been used and for the non-electricity generation component of the traded sector (refineries, industry, commerce and public sector, and other energy supply), the methodology used by the CCC for the 2023 to 2027 target advice has been adopted.

#### Electricity Generation Sector

4.1.3 Projections of future emissions from the electricity generation sector are highly uncertain. A number of complex and competing factors govern generators hourly dispatch decisions, including relative fossil fuel prices, demand, system constraints and wind speed. Future investment decisions relating to the building, extension and closure of generating plant are also subject to this uncertainty.

4.1.4 The electricity sector generation scenario presents one plausible generation scenario to 2027, which make assumptions about thermal plant build and closure dates, average annual running times and the deployment of carbon capture & storage (CCS) at demonstration and/or at scale. This scenario is designed to give an indication of emissions from the sector by varying the amount of coal, gas and carbon capture & storage on the system. Emissions factors for

thermal generating assets were applied to the estimated output from stations in the scenario to provide an emissions trajectory to 2027.

4.1.5 The analysis presented here is broadly consistent with that adopted for the Electricity Generation Policy Statement<sup>17</sup> with any minor variations reflecting the many uncertainties associated with the future generation mix.

4.1.6 There are limitations to this approach. The model used does not allow for dynamic dispatch decisions to be well represented. Load factors for thermal plants will vary according to market wide conditions, whereas in this model thermal load factors remain fixed. There is also no reduction in efficiency as plants age, nor does the approach consider any emissions associated with grid balancing services provided by National Grid as system operator.

4.1.7 The model assumes that there are no changes to peak and aggregate demand over time. We have also modelled unabated gas plant capacity into each scenario, to act as peaking plant, largely because the economics of CCS suggest they will have to provide base-load services.

4.1.8 The scenario presented sees Combined Cycle Gas Turbine (CCGT) as the dominant CCS technology but we would not rule out a role for clean coal once the technology is technologically proven.

4.1.9 The generation scenario will benefit from the future role for [non-pumped] electricity storage at scale and increased interconnection. While still in their infancy, there are numerous electricity storage solutions currently under development across the globe. Synergies between storage and intermittent renewables can significantly reduce the need for flexible, typically unabated fossil fuel, generation capacity leading to savings for consumers as well as emissions reductions. We are working with the Institute of Mechanical Engineers in Scotland to critically assess the viability and efficacy of these storage options including their potential application across Scotland. Successful delivery of storage solutions in Scotland will help us achieve the targets, and could lead to lower levels of emissions than those set out here.

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<sup>17</sup> <http://www.scotland.gov.uk/Topics/Business-Industry/Energy/EGPS2012>

## Non-Electricity Generation

4.1.10 The net emissions that are projected for refineries, industry, commerce and public sector, and other energy supply is based on the projections used by the CCC when providing advice on the 2023 - 2027 targets.<sup>18</sup>

### 4.2 Homes and Communities

4.2.1 Different approaches to modelling abatement and costs are taken for the five policy groups – (1) fabric improvements and heating efficiency, (2) behaviour change, (3) renewable heat incentive, district heating, and other low carbon heat measures, (4) building standards, and (5) additional technical potential in fabric and energy efficiency.

#### Group 1: Fabric Improvements and Heating Efficiency

4.2.2 The fabric improvement policies are designed to drive an increase in the energy efficiency of the household sector, for example through installing insulation and improving the efficiency of heating systems in homes. This group of policies and proposals includes the Energy Company Obligation (ECO) and Green Deal; the Home Energy Efficiency Programmes for Scotland (HEEPS) and Warm Homes Fund; and proposals for regulation of private and social housing.

4.2.3 There is general consensus that homes need to be more energy efficient and also, in most cases, a general consensus on the required measures to achieve this. The challenge to the sector is the degree and speed of penetration of the energy efficiency measures required to be installed in homes by owners, landlords and residents. This will depend on the societal and infrastructure context as well as individual decisions responding to income, motivations, barriers and lifestyle choices.

4.2.4 Policies include those which operate at the GB level, such as the ECO and the Green Deal, complemented by Scottish Government policies such as the HEEPS and Warm Homes Fund. The ECO will concentrate on external and internal wall insulation and heating systems for lower income households, while the Green Deal is a market-based mechanism which aims to remove the up-front cost barrier of energy efficiency improvements.<sup>19</sup>

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<sup>18</sup> <http://www.theccc.org.uk/topics/uk-and-regions/scotland>

<sup>19</sup> [http://www.decc.gov.uk/en/content/cms/consultations/green\\_deal/green\\_deal.aspx](http://www.decc.gov.uk/en/content/cms/consultations/green_deal/green_deal.aspx)

4.2.5 Fabric improvement is modelled based on an estimated number of measures delivered by policies to homes per annum. The abatement is calculated through the DEMScot model. Modelling assumes Scottish Government programmes are funded up to 2017. Up to 2013, measures have been provided through the Universal Home Insulation Scheme, Boiler Scrappage scheme and Energy Assistance Package. From April 2013 these will be replaced by the HEEPS and Warm Homes Fund. Further modelling to fully account for the effect of these programmes will be undertaken once their development is finalised and data has started to be recorded.

4.2.6 The Climate Change (Scotland) Act provides for Ministers to consider regulating homes to improve energy efficiency. The Scottish Government has consulted on detailed proposals for a new Energy Efficiency Standard for Social Housing, which will build on the Scottish Housing Quality Standard. Alongside this, the consultation on the Sustainable Housing Strategy included consideration of if, how and when to regulate for minimum energy efficiency standards in privately owned and rented housing.

### **Methodology for Estimating Emissions Abatement Potential of Fabric Improvement and Heating Efficiency Measures**

4.2.7 The first step in calculating abatement potential was to estimate a baseline of measures. Current knowledge on the delivery of measures from existing policy programmes was taken as the basis to project forward. The baseline assumes that there is a natural uptake<sup>20</sup> of policy measures alongside measures installed as a result of past policies. The most important of these was CERT.<sup>21</sup> The measures due to the policies and proposals set out below were added to this baseline.

### **Green Deal and ECO (Domestic Buildings)**

4.2.8 Estimation of measures to be installed under ECO and Green Deal modelling has been informed by interim and final impact assessments published by DECC,<sup>22</sup> assuming that Scotland achieves a pro rata share (9%) of the programme. Measures included in the UK

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<sup>20</sup> This is where households install an energy efficiency measure without any policy inducement. For example boilers tend to have a life span of 8-10 years so it would be reasonable to expect households to replace their boilers after this period.

<sup>21</sup>

[http://webarchive.nationalarchives.gov.uk/20121217150421/www.decc.gov.uk/en/content/cms/funding/funding\\_ops/cert/cert.aspx](http://webarchive.nationalarchives.gov.uk/20121217150421/www.decc.gov.uk/en/content/cms/funding/funding_ops/cert/cert.aspx)

<sup>22</sup> <http://www.decc.gov.uk/assets/decc/11/consultation/green-deal/5533-final-stage-impact-assessment-for-the-green-deal-a.pdf>

<http://www.decc.gov.uk/assets/decc/11/consultation/green-deal/3603-green-deal-eco-ia.pdf>

Government impact assessments are external and/or internal wall insulation, cavity wall insulation and loft insulation. As noted by the UK Government, due to the innovative and market-based nature of the new Green Deal mechanism, it is difficult at this stage to model likely uptake with confidence. In three to five years' time there will be a much better sense of the additional abatement that Green Deal is bringing forward and the interaction with both ECO and Scottish Government programmes.

### **Scottish Government's Home Energy Efficiency Programmes for Scotland 2012-2017 and Warm Homes Fund**

4.2.9 It is assumed that the current pattern of delivery in terms of installed measures continues from 2012 until 2017. This will prioritise installation of loft and wall insulation along with draught-proofing and heating systems with a total spend of £60m-£65m per annum for five years (2012-2017). The HEEPS is expected to leverage significant investment from the ECO and other sources as demonstrated by pilot schemes. It is assumed that a separate fund of £50m over the period up to May 2016 will be targeted specifically at renewable heat measures and renewable energy projects through the Warm Homes Fund. The breakdown of measures to be delivered from this programme is not known at this stage. For modelling purposes, it is assumed that half of the money goes to communal heating and the remaining half is equally distributed between air source heat pumps, ground source heat pumps and biomass boilers - upgrading a total of 20,000 homes.

### **Private and Social Housing Regulation**

4.2.10 Only measures that are currently most cost effective for private households (i.e. loft insulation, cavity wall insulation, floor insulation and efficient boilers) have been included in the modelling. Modelling for social regulation has been informed by on-going work on formulating an Energy Efficiency Standard for Social Housing.<sup>23</sup>

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<sup>23</sup> For further information, see <http://www.scotland.gov.uk/Topics/Built-Environment/Housing/sustainable/standard>

## The Home Energy Efficiency Programmes for Scotland 2018-2027

4.2.11 The on-going structure and delivery of the HEEPS will depend on future spending decisions. For modelling purposes it is assumed that the programme will include continued support for insulation and heating efficiency measures for the period 2018 to 2027. These proposals are expected to be followed by a programme of solid wall insulation which will continue the ECO (or successor) programme and a further heating efficiency programme. Given that they will be building on a market where new technologies are likely, costs may be substantially lower and there may be a backdrop of regulation.

4.2.12 Once the above assumptions on the measures to be delivered in Scotland were made, the abatement potential of policies and proposals was modelled using the Cambridge Architectural Research DEMScot tool,<sup>24</sup> which uses a Scottish specific set of assumptions based on the housing stock and weather to calculate abatement.

4.2.13 The abatement from DEMScot was calibrated against the STEPS reference projection to ensure comparability. A sectoral rebound rate of 15% was assumed to take account of 'comfort taking' in the residential sector. The resultant energy demand was multiplied by emission factors to assess GHG emissions.

### The DEMScot Model and Estimation Uncertainty

4.2.14 The Domestic Energy Model for Scotland (DEMScot),<sup>25</sup> was developed in 2009 for the Scottish Government by a partnership led by Cambridge Architectural Research Ltd. It was designed to inform the Scottish Government about the carbon and financial impacts of improving the housing stock.

4.2.15 The modelling is based on a building stock database abstracted from the Scottish House Condition Survey, specified building physics parameters and Scottish weather variables. It models total energy use, including space and water heating, cooking, lighting and appliances.

4.2.16 DEMScot allows users to model 19 different upgrades to houses, where such upgrades are technically feasible. These upgrades

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<sup>24</sup> Scottish Government, 2009, Modelling Greenhouse Gas Emissions from Scottish Housing: Final Report, <http://www.scotland.gov.uk/Publications/2009/10/08143041/0>

<sup>25</sup> The DEMScot model along with relevant reports and manuals are available to download at: <http://www.scotland.gov.uk/Topics/Built-Environment/Housing/supply-demand/chma/marketcontextmaterials>

include a range of insulation measures, heating systems, and renewable technologies, and allows for behaviour change. The model shows the effect that implementing upgrades has on energy use and GHG emissions as well as the associated costs of installing upgrades and savings in energy costs. In 2010 DEMScot was extended to include maintenance costs of upgrades and to model price elasticity and rebound effects.

4.2.17 The following bullet points detail the key sources of uncertainties in the abatement potential and cost estimates:

- Estimates of the number of measures delivered under each programme are generally based on limited data of actual performance and assumptions on future uptake rates, combined with assumptions about distribution of UK-wide policies (such as the ECO and Green Deal). As experience with Scottish programmes develops further and data on UK programmes becomes available it should be possible to improve these estimates.
- The natural uptake of a measure is an estimate of what would happen without Government intervention. As with the overall BAU, there is uncertainty in making this estimate.
- Estimates of future abatement are modelled from the assumed application of specific measures to the housing stock in Scotland. The relationship of this abatement to the reference projection, where results are from an econometric model based on past trends of consumption, is complex because of the different methodologies involved.

#### **Methodology for Estimating Costs and Benefits of Fabric Improvement and Heating Efficiency Measures<sup>26</sup>**

4.2.18 Current policies running to 2027 are estimated to incur costs of approximately £2.1bn in total. Costs identified are additional to the costs of the policy contained in the BAU projection (of £5.4bn from 2010 to 2027).

4.2.19 The costs of proposals up to 2027 are estimated to be around £3.1bn. This is additional to the cost of the policy package in place and based on the capital and maintenance costs of the measures estimated to be delivered by the proposals over that period. The basis

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<sup>26</sup> Financial figures presented in 2011 prices unless otherwise stated.



of the cost data is from DEMScot but where available these figures have been updated with figures published in the ECO/Green Deal Impact Assessments. They do not take account of the reduced costs that may be gained from capital programmes leveraging economies of scale, or from reduced costs of technologies over time.

4.2.20 It is assumed that the total costs of these measures will fall on government, consumers and energy suppliers as described below.

4.2.21 Upgrades delivered through Green Deal will be paid for by the household through a charge on the meter. While the ECO places an obligation on energy suppliers to install energy efficiency measures in homes, energy customers effectively pay for the cost of their energy supplier's meeting its target through their fuel bills. It is estimated that in 2008 residential customers paying for both gas and electricity contributed an additional average of £38 to fund the CERT programme.<sup>27</sup>

4.2.22 The cost to the Scottish Government of investment in the HEEPS and Warm Homes fund over the period 2012 to 2017 is £375m.

4.2.23 Investment in energy efficiency measures in the home will also save money over the lifetime of the upgrade and in many cases is likely to pay back the initial investment through savings in fuel consumption. It is estimated that measures detailed in this section could produce savings in fuel bills of £2.4bn by 2027 with continued savings accumulating after this date. This is in keeping with the CCC's report Building a Low Carbon Economy, which presented a Marginal Abatement Cost Curve (MACC)<sup>28</sup> for the residential sector showing that most insulation measures and use of energy efficient appliances achieve savings over their lifetime.

4.2.24 These estimated benefits do not include the benefits associated with preventing harmful climate change as well as addressing the ill-health related to fuel poverty. A large body of research shows that improvements in housing conditions can lead to improved physical and mental health. For example, warm, dry homes can improve respiratory conditions.<sup>29</sup>

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<sup>27</sup> Ofgem, Household energy bills explained, (updated), Jan 2008 ([www.ofgem.gov.uk/Pages/MoreInformation.aspx?docid=73&refer=Media/FactSheets](http://www.ofgem.gov.uk/Pages/MoreInformation.aspx?docid=73&refer=Media/FactSheets)).

<sup>28</sup> Figure 6.10, <http://www.theccc.org.uk/reports/building-a-low-carbon-economy>

<sup>29</sup> See "A Select Review of Literature on the Relationship between Housing and Health", available at <http://www.scotland.gov.uk/Topics/Built-Environment/Housing/supply-demand/chma/marketcontextmaterials> under the Research category

Table 3: Abatement Potential and Costs of Fabric Improvement Policies and Proposals, 2013 - 2027

	Annual emissions abatement from policies (ktCO <sub>2</sub> e)	Annual total costs of policies (£m)	Annual emissions abatement from proposals (ktCO <sub>2</sub> e)	Annual total costs of proposals (£m)
2013	79	275	0	0
2014	136	275	1	79
2015	187	275	13	79
2016	236	275	20	79
2017	283	265	27	79
2018	293	140	60	204
2019	319	140	78	204
2020	334	140	96	204
2021	344	140	117	204
2022	361	140	134	204
2023	361	0	172	344
2024	361	0	209	344
2025	361	0	247	344
2026	361	0	284	344
2027	361	0	320	344

**Group 2: Behaviour Change - Smart Metering (Domestic Buildings)**

4.2.25 Behaviour change is led by UK policies and hence the modelling is based on estimates provided by the Department of Energy and Climate Change (DECC). A wide range of policies aim to stimulate behaviour change, so to avoid double counting the only abatement included in the modelling is from installation of smart meters.

4.2.26 Smart meters are able to display real-time information about energy use and costs, thereby encouraging better household energy management. The UK Government expects mass roll-out of smart meters to start in 2014 and be complete by 2019.

**Methodology for Estimating Emissions Abatement Potential, Costs and Benefits from Smart Metering**

4.2.27 In the absence of Scottish-specific data for this scheme, the abatement potential estimated as part of the DECC Updated Emission Projections (October 2011) at the UK level was apportioned to Scotland as a share of UK households. Scotland's share is 9% of total UK households. In 2027 this policy is expected to reduce emissions in Scotland by 95ktCO<sub>2</sub>e.

4.2.28 In the DECC impact assessment for smart meter roll-out for the domestic sector,<sup>30</sup> it's assumed that the total cost of rolling out this policy to 2030 is £10.85bn (PV, 2012), with associated benefits of £15.69bn. Costs include the capital cost associated with the installation of meters and their operation and maintenance, the cost of communication systems and the cost of disposal. Consumer benefits are largely from reduced energy consumption. Supplier benefits include avoided site visits and reduced inquiries and customer overheads.

4.2.29 The costs presented are cumulative to 2030. To remain consistent with the emissions savings that these actions are estimated to deliver, Scotland's proportional cost/benefit share is also based on the proportion of UK households in Scotland.

4.2.30 The smart meter rollout in the Scottish domestic sector is therefore estimated to cost approximately £1.13bn (undiscounted), with benefits totalling £1.58bn over the RPP2 period.

4.2.31 The cost of the smart meter roll out is expected to fall on the consumer through their energy bills from their energy supplier.

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<sup>30</sup> <http://www.decc.gov.uk/assets/decc/11/consultation/smart-metering-imp-prog/4907-smart-meter-rollout-non-domestic-ia-resp.pdf>

Table 4: Abatement Potential and Costs of Residential Smart Metering, 2013 - 2027

	Annual emissions abatement (ktCO <sub>2</sub> e)	Annual total costs (£m)
2013	7	9.5
2014	17	20.9
2015	33	40.9
2016	49	63.0
2017	66	80.4
2018	80	94.2
2019	86	95.3
2020	88	94.4
2021	89	91.9
2022	90	90.9
2023	91	89.8
2024	92	89.2
2025	94	88.4
2026	94	87.5
2027	95	86.4

**Group 3: Domestic Renewable Heat Incentive, District Heating Loans Fund Policies and other Low Carbon Heat Proposals**

**Renewable Heat Incentive (Domestic Buildings)**

4.2.32 The Renewable Heat Incentive (RHI) is a UK wide policy offering payments to those who install and obtain heat from renewable sources. This incentive payment is already available to renewable heat technologies in the non-domestic sector. The domestic scheme has been delayed until 2013, with the Renewable Heat Premium Payment providing short term support to renewable heat technologies in the domestic sector in the interim. DECC is currently consulting on cost control measures, and any changes in expected abatement and cost will be reflected in any updates.

**Methodology for Estimating Emissions Abatement Potential, Costs and Benefits of RHI Policy**

4.2.33 The abatement potential for the RHI was estimated at the UK level in DECC's Updated Emission Projections (October 2011) according to the 9% proportion of UK households in Scotland. In 2027 this policy could potentially reduce emissions in Scotland by 80ktCO<sub>2</sub>e. However, as this policy incentivises market demand through the opportunity to collect an output based tariff, the uptake

will be driven by a number of market, regional and environmental factors.

4.2.34 Due to the uncertainty surrounding the domestic RHI, no cost or benefit information has been included. However, under the RHI, it is likely that up-front costs for the installation of renewable heat generation will be met by property owners, with the incentive guaranteeing them a reasonable return on investment.

### **District Heating Loan Scheme**

4.2.35 The Scottish Government's district heating loan fund provides loans for both low carbon and renewable technologies to help organisations implement district heating projects to benefit local communities. Low interest loans of up to £400,000 per project will be made available to be repaid over a period of up to 10 years. The scheme is open to local authorities, registered social landlords, small and medium sized enterprises and energy services companies.

### **Methodology for Estimating Emissions Abatement Potential, Costs and Benefits of District Heating Loan scheme**

4.2.36 There are a number of factors which impact the abatement potential of a district heating network, including the mix of the housing stock and the density of the network. The abatement potential for the District Heating Loan Scheme applies estimates from Poyry's "The Potential and Costs of District Heating Networks"<sup>31</sup> to the number of homes currently connected, and the number estimated to connect, to district heating networks through the scheme.

4.2.37 To 2014, this proposal could potentially reduce annual emissions in Scotland by up to 50ktCO<sub>2</sub>e, across both the domestic and non-domestic sector.

### **Domestic Low Carbon Heat**

4.2.38 The proposal for decarbonising heat will include both the domestic and non-domestic sectors. As the majority of the emissions abatement is likely to fall in the non-domestic sector, the final abatement split between the Homes and Communities sector and the Business, Industry and Public Sectors may change.

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<http://webarchive.nationalarchives.gov.uk/20121205174605/http://decc.gov.uk/assets/decc/what%20we%20do/uk%20energy%20supply/energy%20mix/distributed%20energy%20heat/1467-potential-costs-district-heating-network.pdf>

## **Methodology for Estimating Emissions Abatement Potential, Costs and Benefits of Low Carbon Heat**

4.2.39 Estimates of the Scottish abatement potential for low carbon heat are derived from the detailed cost effectiveness model developed for the CCC. This model looks at the potential scenarios for low carbon heat technologies to replace fossil fuel use up to 2030. The model has drawn upon and extended the evidence base used for previous low carbon heat modelling in DECC, and includes technology assumptions and input data that have been extended to 2030. Additional technologies have been incorporated to reflect a wider range of possible future developments (e.g. synthetic biogas from the gasification of biomass, and heat pumps with heat storage that can shift electricity load profiles).

4.2.40 There are a number of credible scenarios for future low carbon heat generation, and this analysis represents one scenario. Estimates of abatement potential include all forms of low carbon heating. To avoid double counting, the abatement potential from policies which deliver low carbon heating (i.e. the Warm Homes Fund, the domestic Renewable Heat Incentive and the District Heating Loans Fund) has been subtracted from the overall abatement this proposal can potentially deliver.

4.2.41 The costs of the Low Carbon Heat proposal have been proportionately reduced from the costs produced by the CCC modelling, although the high level of uncertainty should be noted since the costs are not uniform across the proposal but will depend on the particular mix of measures.

4.2.42 In order to achieve our vision of decarbonising heat supply, we will develop a longer term strategy that looks at heat in the wider context of available energy resources, and demand. In this respect, we have developed a draft heat hierarchy of use and will publish a Heat Generation Policy Statement (HGPS) by the end of 2013, which will look in detail at possible generation scenarios. The HGPS will sit alongside the Electricity Generation Policy Statement providing a comprehensive energy policy view.

Table 5: Abatement Potential and Costs of Domestic Renewable Heat Incentive and District Heating Loan Scheme, 2013 - 2027

	Renewable Heat Incentive (Domestic) <sup>32</sup>	District Heating Loans Fund		Low Carbon Heat proposals	
	Annual emissions abatement (ktCO <sub>2</sub> e)	Annual emissions abatement (ktCO <sub>2</sub> e)	Annual total costs (£m)	Annual emissions abatement (ktCO <sub>2</sub> e)	Annual total costs (£m)
2013	11	24	41	0	0
2014	19	36	41	0	0
2015	27	36	0	7	10
2016	35	36	0	25	23
2017	46	36	0	39	19
2018	57	36	0	57	25
2019	68	36	0	76	25
2020	78	36	0	99	30
2021	79	36	0	135	42
2022	79	36	0	186	40
2023	79	36	0	247	38
2024	80	36	0	336	36
2025	80	36	0	424	33
2026	80	36	0	513	30
2027	80	36	0	609	28

#### Group 4: Domestic Building Standards

4.2.43 New energy standards for new homes came into force in October 2010. These revisions deliver an aggregate 30% reduction in CO<sub>2</sub> emissions from new dwellings when compared to those constructed to the 2007 building standards. This equates to a reduction of around 70% compared to the standards that existed in 1990. A further review of domestic energy building standards is underway and has investigated further improvements up to and including the 60% reduction on 2007 emissions recommended in the Sullivan Report.<sup>33</sup> A consultation containing proposals for the next set of energy standards based on a 45% reduction on 2007 emissions took place between January and April 2013.

<sup>32</sup> Costs for the RHI have not been included since insufficient detail is available to estimate these.

<sup>33</sup> <http://www.scotland.gov.uk/Resource/Doc/917/0098823.pdf>

## **Methodology for Estimating Emissions Abatement Potential, Costs and Benefits of New Building Standards**

4.2.44 By 2027, the cumulative abatement potential of the new building standards, already in force in 2010 and introduced beyond 2013, have been assessed as 1.5 MtCO<sub>2</sub>e. This is considered separately from the existing stock of housing but has a smaller abatement impact as the number of new buildings per annum currently accounts for less than 1% of the overall housing stock and also due to the previous 2007 standard already requiring new homes to be energy efficient, with relatively low emissions.

4.2.45 The analysis assumes that the BAU projections for the residential sector include the 2007 building standards. The 2010 building standards deliver a 30% reduction in CO<sub>2</sub> emissions from new dwellings when compared with BAU. The annual abatement figure is the sum of the emissions reduction from both the new housing built in the relevant year and from housing built each year since the 2010 base date. Consultation on the next set of energy standards proposes a 45% reduction on 2007 emissions from new dwellings, or approximately a 22% improvement on 2010 standards. Following consultation, Ministers will confirm both the level of improvement to be implemented and when new standards will be introduced. Projections are currently based upon the consultation proposal to introduce improved standards in 2014.

4.2.46 The abatement results from the non-traded sector only and assumes that 85% of total abatement from the building standards falls in the non-traded sector. The remaining 15% is assumed by the traded sector as a result of electricity demand reduction.

4.2.47 The abatement potential calculations include assumptions about the number of new dwellings built per annum and the CO<sub>2</sub> that they will release per year. It is assumed an annual build rate will drop from almost 17,000 units in 2010 to between 15-16,000 units and then rise gradually to approximately 19,000 units per annum by 2027. Assessment is based upon a notional fuel type mix applied to a range of typical example dwellings. It is assessed that the average dwelling built to 2007 standards will release approximately two tonnes of CO<sub>2</sub> annually. Emissions reported on in this policy area are those calculated, using the 2009 edition of the UK Standard Assessment Procedure, from a standardised assessment of 'regulated energy use' arising from fixed building services within new dwellings - emissions arising from heating/cooling, hot water, lighting, ventilation and auxiliary equipment (e.g. circulating pumps). Energy



used for domestic appliances and cooking fall out with the scope of building regulations

4.2.48 The emission savings from the new standards are phased in over three years to reflect the delay period between the introduction of new standards and the delivery of almost all new housing built to those standards.

4.2.49 In terms of the financial costs and benefits, analysis within the Regulatory Impact Assessment<sup>34</sup> for the 2010 changes to energy standards within building regulations identifies a mid-range additional cost to development of £129m per annum. The same assumptions about the annual build rate and rate of introduction of new standards as set above are used. The annual costs shown in the table below represent the cost of implementation of the new standards, before deduction of energy savings. Net present value is calculated using 2010 prices. The cumulative cost to development in application of the 2010 and proposed 2014 standards (to 2027) is assessed as £1.8 billion at current NPV. These are additional costs over and above the costs of the 2007 building standards in the baseline.

4.2.50 The costs should be assumed to be broadly indicative as they represent the most cost effective application of a limited range of improvement scenarios and may not represent the actual solutions adopted. Financial savings from reduced fuel consumption as a result of the 2010 and proposed 2014 standards is estimated at £960m.

4.2.51 The majority of the additional cost of the new building standards will be borne by those funding the housing development – businesses and consumers. The Scottish Government may also face higher costs through its funding of social housing. Savings from reduced energy costs will accrue to bill payers who will normally be the householders.

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<sup>34</sup> <http://www.scotland.gov.uk/Resource/Doc/917/0098823.pdf>

Table 6: Abatement Potential and Costs of Building Standards Policies and Proposals, 2013 - 2027

	2010 Standards		2014 Standards	
	Annual emissions abatement (ktCO <sub>2</sub> )	Annual total cost (£m)	Annual emissions abatement (ktCO <sub>2</sub> )	Annual total cost (£m)
2013	16	80	0	0
2014	24	78	0	23
2015	32	76	1	44
2016	41	75	4	65
2017	49	73	8	64
2018	58	72	13	62
2019	67	70	17	61
2020	76	69	22	60
2021	84	68	26	58
2022	93	66	31	57
2023	103	65	35	56
2024	112	64	40	55
2025	122	62	45	54
2026	132	61	50	53
2027	142	60	55	52

### Abatement Potential Compared to RPP1

4.2.52 Annual emissions abatement from domestic building standards differ from those reported under RPP1 due to the following factors. Overall abatement for the 2010 policy and 2014 proposal is now based upon an annual build rate more than 40% lower than originally anticipated. Revision of the 2014 proposal from a 60% reduction on 2007 emissions to 45% reduction reduces the abatement potential of this proposal by half (a 22% emissions reduction over 2010 policy compared to a 44% reduction).

### Group 5 - Additional Technical Potential in Fabric and Energy Efficiency

4.2.53 Our modelling suggests that there is also an additional technical abatement potential of approximately 0.65 Mt which could be achieved by 2027 through improvements to the carbon efficiency of the housing stock. We have not put forward a fully-fledged proposal at this stage as further work is required to analyse and consider a range of options. Many of these upgrades would be in the

owner-occupied and private rented sectors, where energy efficiency policies have not advanced as much as in the social sector, and for which the optimum blend of regulation and incentives is currently being investigated and developed in Scotland and the rest of the UK.

4.2.54 As we develop future policies, we will also need to assess the impact of action to encourage market transformational change. As options, costs and technical solutions develop in future years, more efficient and cost-effective approaches may emerge. In particular, if more cost-effective options emerge in other sectors then it may be preferable for some or all of this abatement to be delivered from other parts of the economy. But in the case that further abatement is required from the homes and communities sector, we intend to produce a detailed proposal in RPP3 of how we may realise some or all of this remaining technical potential.

4.2.55 At this stage the estimated additional abatement has been modelled in a similar way to our other housing proposals. Using DEMScot, we first modelled upgrades for the 'business as usual', as well as for the various policies and proposals. The model then provides an estimate of how many upgrades to the existing housing stock are still technically feasible. These upgrades include measures such as solid wall insulation, loft and floor insulation and a range of other upgrades which also form part of our current policies and proposals. The difference is that there is a greater proportion of higher cost upgrades in the further potential, since our policies and proposals typically start with the most cost-effective measures.

Table 7: Abatement from Additional Technical Potential in Fabric and Energy Efficiency, 2013 - 2027

	Annual emissions abatement (ktCO <sub>2</sub> e)
2013	0
2014	0
2015	0
2016	0
2017	0
2018	72
2019	142
2020	210
2021	278
2022	343
2023	407
2024	470
2025	531
2026	591
2027	650

### 4.3 Business, Industry and the Public Sector

#### Smart Metering (Non-Domestic Buildings)

4.3.1 Smart meters will be rolled out in non-domestic small and medium sized business buildings. Smart meters help customers understand in real-time their energy consumption patterns, promoting better energy management. This is a UK Government policy, with mass roll-out of smart meters expected to start in 2014 and to be complete by 2019.

#### Methodology for Estimating Emissions Abatement Potential, Costs and Benefits of Smart Metering

4.3.2 There is no Scottish specific data for this scheme. As such, the abatement potential estimated as part of the DECC Updated Emission Projections (Oct 2011) was apportioned to Scotland, according to the proportion of UK small and medium sized enterprises in Scotland, which is 7.1%. On this basis, this policy is expected to reduce annual emissions in Scotland by 46ktCO<sub>2</sub>e in 2027.

4.3.3 In the DECC Smart Meter roll-out for the non-domestic sector (GB) impact assessment,<sup>35</sup> DECC assumes the total cost of rolling out this policy to 2030 is £608m (PV, 2012), with associated benefits of £2.95bn. Costs include the capital cost associated with the installation of meters and their operation and maintenance, the cost of communication systems and the cost of disposal. Benefits include energy and carbon savings through efficient energy use, as well as process savings to the energy suppliers and network operators.

4.3.4 These costs are cumulative to 2030. To remain consistent with the emissions savings that these actions are estimated to achieve, it is intended that Scotland’s proportional cost/benefit share should be based on the proportion of UK small and medium sized enterprises in Scotland. The smart meter rollout in the Scottish non-domestic sector is therefore estimated to cost approximately £54m (undiscounted), with benefits totalling £242m over the RPP2 period.

4.3.5 In terms of distribution of costs and benefits, DECC estimates that both the costs and benefits from the non-domestic smart metering programme are expected to fall principally on the consumer, in this case small and medium sized enterprises.

Table 8: Abatement Potential and Costs of Non-Domestic Smart Metering Programme, 2013-2027

	Annual emissions abatement (ktCO <sub>2</sub> e)	Annual total costs (£m)
2013	2	-0.3
2014	8	0.0
2015	19	1.5
2016	30	3.2
2017	42	4.8
2018	49	5.9
2019	52	5.8
2020	53	5.5
2021	52	5.2
2022	51	4.7
2023	50	4.3
2024	49	3.9
2025	48	3.5
2026	47	3.1
2027	46	2.7

<sup>35</sup> <http://www.decc.gov.uk/assets/decc/11/consultation/smart-metering-imp-prog/4907-smart-meter-rollout-non-domestic-ia-resp.pdf>

## Renewable Heat Incentive (Non-Domestic Buildings)

4.3.6 The Renewable Heat Incentive (RHI) is a UK wide policy that offers reduced tariffs to those who install and obtain heat from renewable sources.

### Methodology for Estimating Emissions Abatement Potential, Costs and Benefits of Non-Domestic RHI

4.3.7 The abatement potential estimated for Scotland was derived as part of the UK DECC Updated Emission Projections (Oct 2011) and apportioned to Scotland, according to the proportion of UK non-domestic consumption in Scotland, which is 10.1%. In 2027 this policy is expected to reduce annual emissions in Scotland by 914 ktCO<sub>2e</sub>.

4.3.8 In the DECC renewable heat impact assessment on the final proposals of renewable heat support for the non-domestic sector,<sup>36</sup> it is assumed that the cumulative lifetime cost of this policy is £14bn (PV, 2010), with associated benefits of £9.8bn. Benefits will include both traded and non-traded sector carbon costs, though the majority of installations will be outside the scope of the EU-ETS.

4.3.9 To remain consistent with the emissions savings that these actions are estimated to achieve, it is assumed that Scotland's proportional cost/benefit share is the proportion of UK non-domestic consumption in Scotland. The non-domestic RHI arising from Scottish installations is therefore estimated to cost approximately £1.34bn (undiscounted), with benefits totalling £705m over the RPP2 period.

4.3.10 In terms of distribution of costs and benefits, up-front installation and operating costs fall to the business and industrial asset owners. The RHI tariff compensates for the difference in the costs of a renewable system compared with a fossil fuel heat system, whilst paying a reasonable return to generators to compensate for the financial opportunity cost of this additional capital expenditure.

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<sup>36</sup> <http://www.decc.gov.uk/assets/decc/11/meeting-energy-demand/renewable-energy/3775-renewable-heat-incentive-impact-assessment-dec-20.pdf>

Table 9: Abatement Potential and Costs of Non-Domestic Renewable Heat Incentive, 2013-2027

	Annual emissions abatement (ktCO <sub>2</sub> e)	Annual total costs (£m)
2013	106	52
2014	171	82
2015	256	82
2016	375	90
2017	532	102
2018	641	102
2019	768	105
2020	896	122
2021	869	104
2022	849	91
2023	877	95
2024	893	88
2025	902	81
2026	909	69
2027	914	78

### Carbon Reduction Commitment (CRC) Energy Efficiency Scheme

4.3.11 The CRC is a mandatory UK-wide trading scheme covering large business and public sector organisations and designed to reduce emissions through incentivising increased energy efficiency. The policy covers organisations with at least one half hourly meter that use more than 6,000MWh/annum of equivalently metered electricity.

#### Methodology for Estimating Emissions Abatement Potential, Costs and Benefits of CRC

4.3.12 As part of the ongoing consultation process into streamlining the CRC scheme, DECC published an impact assessment setting out simplification options for this scheme,<sup>37</sup> which contained an estimate of the emissions savings and cost impacts of the policy under a BAU case. This has been apportioned to Scotland, according to the proportion of UK non-domestic consumption in Scotland, which is 10.1%. In 2027 this policy is expected to reduce annual emissions in Scotland by 154 ktCO<sub>2</sub>e.

4.3.13 The same DECC consultation document suggests that the BAU of the CRC scheme is approximately £801m to 2030 (PV, 2011), with

<sup>37</sup> <http://www.decc.gov.uk/assets/decc/11/consultation/CRC/4758-ia-simp-crc-energy-efficiency-scheme.pdf>

associated energy and non-traded carbon benefits estimated at approximately £5bn.

4.3.14 To remain consistent with the emissions savings that the CRC is estimated to achieve it is assumed that Scotland’s proportional cost/benefit share is the proportion of UK non-domestic consumption in Scotland. The CRC energy efficiency scheme is therefore estimated to cost approximately £98m (undiscounted), with benefits totalling £682m over the RPP2 period.

4.3.15 In terms of the distribution of costs and benefits, there is an administrative cost to organisations of complying and reporting within the CRC scheme. Subsequent simplifications to the scheme may reduce these costs. However, relative to a world without the CRC Scheme, organisations now have to pay for their emissions where previously they did not. The cost of emissions to firms has the potential to reduce the more firms act to reduce their emissions. The benefit of the CRC scheme is the cost of emissions avoided due to putting a price on the emissions externality.

Table 10: Abatement Potential and Costs of CRC Energy Efficiency Scheme, 2013-2027

	Annual emissions abatement (ktCO <sub>2</sub> e)	Annual total costs (£m)
2013	30	10.7
2014	41	4.7
2015	54	4.7
2016	68	4.9
2017	83	4.8
2018	98	11.3
2019	114	6.9
2020	130	6.1
2021	149	6.1
2022	169	5.3
2023	184	12.4
2024	200	5.8
2025	216	2.6
2026	187	2.6
2027	154	2.6

### New Non-Domestic Building Standards

4.3.16 Energy standards for new non-domestic buildings came into force in October 2010. These revisions deliver a 30% reduction in CO<sub>2</sub> emissions from new non-domestic buildings when compared to those



constructed to the 2007 building standards. This equates to a reduction of 65-70% compared to the standards that existed in 1990. A further review of non-domestic energy standards is underway and has investigated further improvements up to and including the 75% reduction on 2007 emissions recommended in the Sullivan Report<sup>38</sup>. A consultation containing proposals for the next set of energy standards based upon a 60% reduction on 2007 emissions took place between January and April 2013.

4.3.17 The cumulative abatement potential of the new building standards, already in force in 2010 and introduced beyond 2013, have been assessed as 1.2 MtCO<sub>2</sub> by 2027. This is considered separately from the existing stock of buildings but has a smaller abatement impact as the square metreage of new buildings per annum currently accounts for less than 1% of the existing public and commercial stock and also due to the previous 2007 standard already requiring new buildings to be energy efficient, with relatively low emissions.

#### **Methodology for Estimating Emissions Abatement Potential, Costs and Benefits from New Non-Domestic Building Standards**

4.3.18 The BAU projections for the non-domestic sector include the 2007 building standards. The 2010 building standards deliver a 30% reduction in CO<sub>2</sub> emissions from new dwellings when compared with BAU. The annual abatement figure is the sum of the emissions reduction from both the new buildings constructed in the relevant year and from those constructed each year since the 2010 base date. Consultation on the next set of energy standards proposes a 60% reduction on 2007 emissions from new dwellings, or approximately a 43% improvement on 2010 standards. Following consultation, Ministers will confirm both the level of improvement to be implemented and when new standards will be introduced. Until this is confirmed, the introduction of new standards is assumed for 2018, as a worst case, given obligations under the EU Directive on the Energy Performance of Buildings which must be met.

4.3.19 The abatement results from the non-traded sector only and assumes that 54.9% of total abatement from the building standards falls in the non-traded sector. The remaining 45.1% is assumed by the traded sector as a result of electricity demand reduction.

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<sup>38</sup> <http://www.scotland.gov.uk/Resource/Doc/217736/0092637.pdf>

4.3.20 The abatement potential calculations are based upon a broad assumption about the overall metreage of new buildings delivered per annum and the CO<sub>2</sub> that they will generate per year. There is very little information on the current annual build rate for commercial premises. Accordingly, an assumption of a constant annual build rate of 700,000m<sup>2</sup> is applied, extrapolated from recent UK statistics. Assessment is currently based upon a notional fuel type mix applied to a range of nine different example building types. Emissions reported on in this policy area are those calculated using the 2009 edition of the UK National Calculation Methodology, implemented through iSBEM v4.1a using carbon factors for fuels applicable in 2010.<sup>39</sup> This implements a standardised assessment of 'regulated energy use' arising from fixed building services within new buildings - emissions arising from heating/cooling, hot water, lighting, ventilation and auxiliary equipment (e.g. circulating pumps). Energy used for business equipment or industrial process fall out with the scope of building regulations.

4.3.21 The emission savings from the new standards are phased in over four years to reflect the delay period between the introduction of new standards and the delivery of almost all new buildings built to those standards.

4.3.22 Analysis within the Regulatory Impact Assessment<sup>40</sup> for the 2010 changes to energy standards within building regulations identifies a mid-range additional cost to development of £84.5m per annum. The same assumptions about the annual build rate and rate of introduction of new standards as set out in the paragraphs above have been used. The annual costs shown in the table below represent the cost of implementing current 2010 standard and proposed new standards, before deduction of energy savings. Net Present Value (NPV) is calculated using 2010 (policy) & 2012 (proposal) prices. The cumulative cost to development to 2027 is assessed as £1.3bn at current NPV. These are additional costs over and above the costs of the 2007 building standards in the baseline.

4.3.23 The costs should be assumed to be broadly indicative as they represent the most cost effective application of a limited range of improvement scenarios and may not represent the actual solutions subsequently adopted. Financial savings from reduced fuel consumption as a result of the 2010 standards and further improvements to standards, are assessed at £553 million.

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<sup>39</sup> Table 6, NCM Modelling Guide (Scotland) - <http://www.scotland.gov.uk/Resource/Doc/217736/0117285.pdf>

<sup>40</sup> <http://www.scotland.gov.uk/Resource/Doc/917/0098823.pdf>

4.3.24 The majority of the additional cost of the new building standards will be borne by those funding development – businesses and consumers. Savings due to reduced energy demand will benefit those owning or occupying buildings that are responsible for energy bills.

Table 11: Abatement Potential and Costs of Building Standards, 2013-2027

	Annual emissions abatement (ktCO <sub>2</sub> ) 2010 standards	Annual cost (£m) 2010 standards	Annual emissions abatement (ktCO <sub>2</sub> ) beyond 2013	Annual cost (£m) beyond 2013
2013	13	76		
2014	19	73	0	14
2015	25	71	2	26
2016	32	68	5	38
2017	38	66	10	37
2018	44	64	15	36
2019	51	61	20	34
2020	57	59	25	33
2021	63	57	30	32
2022	70	55	35	31
2023	76	53	40	30
2024	82	51	45	29
2025	89	50	50	28
2026	95	48	55	27
2027	101	46	60	26

### Abatement Potential Compared to RPP1

4.3.25 Annual emissions abatement from non-domestic building standards differ from those reported in RPP1 due to the following factors. Revision of the 2014 proposal from 75% reduction on 2007 emissions to 60% reduction reduces the impact of this proposal by one third (a 43% emissions reduction over 2010 policy compared to a 64.5% reduction).

### Green Deal (Non-Domestic Buildings)

4.3.26 The Green Deal is a UK energy efficiency measure which will be offered by the private sector to enable homeowners and businesses to implement energy efficiency improvements at little or

no upfront cost with payment recouped through customers' energy bills.

### **Methodology for Estimating Emissions Abatement Potential, Costs and Benefits of Green Deal**

4.3.27 The abatement potential for this scheme in Scotland was estimated using the UK final stage impact assessment for the Green Deal and Energy Company Obligation<sup>41</sup> (June 2012). Abatement was apportioned to Scotland based on the proportion of UK non-domestic consumption in Scotland, which is 10.1%. In 2027 this policy is expected to reduce annual emissions in Scotland by 24ktCO<sub>2</sub>e.

4.3.28 DECC's Green Deal impact assessment assumes that the cumulative lifetime cost of this policy is £17.3bn (PV, 2011), with associated benefits of £25.6bn. This is the total domestic and non-domestic cost. To remain consistent with the emissions savings that these actions are estimated to achieve it is assumed that Scotland's proportional cost/benefit share is the proportion of UK non-domestic consumption in Scotland. Non-domestic green deal in Scotland is therefore estimated to cost approximately £182m (undiscounted), with benefits totalling £373m over the RPP2 period.

4.3.29 In terms of distribution of costs and benefits, installation and financing costs will fall largely to those organisations benefiting from energy efficiency measures. There will also be costs to energy companies of administering the ECO scheme, though these are expected to be passed on to energy consumers.

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<sup>41</sup> [http://www.decc.gov.uk/en/content/cms/consultations/green\\_deal/green\\_deal.aspx](http://www.decc.gov.uk/en/content/cms/consultations/green_deal/green_deal.aspx)

Table 12: Abatement Potential and Costs of Green Deal & Supporting policies, 2013-2027

	Annual emissions abatement (ktCO <sub>2</sub> e)	Annual total costs (£m)
2013	2	3.2
2014	4	4.4
2015	18	12.6
2016	38	17.8
2017	58	20.9
2018	74	20.4
2019	85	19.8
2020	92	23.2
2021	97	25.4
2022	98	24.8
2023	73	3.0
2024	55	1.6
2025	41	1.6
2026	31	1.7
2027	24	1.7

### EU Products Policy

4.3.30 EU Products policy refers to an EU wide minimum energy efficiency standard that provides energy and emissions savings. Examples of items affected by these measures are non-domestic information & communication technology and commercial appliances.

#### Methodology for Estimating Emissions Abatement Potential, Costs and Benefits of EU Products Policy

4.3.31 To calculate an abatement potential in Scotland from this measure, the estimated UK abatement potential as part of the DECC Updated Emission projections (Oct 2011) was apportioned to Scotland based on the proportion of UK small and medium sized enterprises in Scotland of 7.1%. In 2027 this policy is expected to increase emissions in Scotland by 8ktCO<sub>2</sub>e. The increase in emissions results from the heat replacement effect. Appliances and lighting consume energy which is in part converted to heat. As appliances become more energy efficient, heating systems compensate for this reduction in heat. Emissions in the traded sector are estimated to fall as a result of reduced electricity demand.

4.3.32 DECC's Carbon Plan<sup>42</sup> (December 2011) assumes that the cumulative lifetime cost of tranche 1 of this policy is £3.9bn (PV, 2011), with associated benefits of £14.1bn. This is the total domestic and non-domestic cost. Annualised cost information for the non-domestic sector is not available.

4.3.33 In terms of distribution of costs and benefits, it is estimated that both the costs and benefits from these measures are expected to fall principally on the consumer, in this case small and medium sized enterprises.

Table 13: Additional Emissions Potential of EU Products Policy, 2013-2027

	Annual emissions (ktCO <sub>2</sub> e)
2013	6
2014	10
2015	7
2016	8
2017	9
2018	10
2019	11
2020	11
2021	11
2022	10
2023	10
2024	9
2025	9
2026	8
2027	8

### Public Sector Extended Ambition

4.3.34 Commissioned research has shown that the Scottish public sector could potentially achieve significant reductions in CO<sub>2</sub>e emissions.<sup>43</sup> The study used the Carbon Management Plans (CMP) of Scottish public sector bodies and the Carbon Trust's proprietary database of carbon reduction recommendations made to the public sector to assess the potential for emissions reductions across the public sector. Behaviour change, renewables, HVAC and building fabric are the areas offering the largest potential reduction in terms of total emissions.

<sup>42</sup> [http://www.decc.gov.uk/en/content/cms/emissions/carbon\\_budgets/carbon\\_budgets.aspx](http://www.decc.gov.uk/en/content/cms/emissions/carbon_budgets/carbon_budgets.aspx)

<sup>43</sup> <http://www.scotland.gov.uk/Publications/2012/12/3885>

4.3.35 Possible options for achieving the identified abatement potential from CMPs and other recommendations made by Carbon Trust to the public sector in Scotland are at an early stage of development. Options will need to tackle the barriers in areas of: senior leadership and performance management; engaging procurement functions; availability of financing; lack of skilled resources; and split incentives. These could include a significant expansion of the existing CMP across the public sector targeted at all local authorities, NHS, Higher and Further Education and others to maximise opportunities for decisive action, set targets for the public sector to reduce emissions and go further than BAU projections will deliver.

#### **Methodology for Estimating Emissions Abatement Potential, Costs and Benefits of Reducing Emissions in the Public Sector**

4.3.36 To calculate an abatement potential in Scotland from this measure, research was commissioned which identified a baseline for Scottish public sector emissions using public sector CMPs. An assessment has been made of the potential reduction in non-traded emissions from this baseline. It's assumed that abatement comes as a result of delivering previously identified but not implemented emissions reductions measures earlier, and extending the ambition out to 2030.

4.3.37 In 2027 this proposal is estimated to reduce emissions in Scotland by 285ktCO<sub>2</sub>e. Initial estimates suggest that this proposal could cost public sector bodies approximately £216m per annum in total by 2027.

Table 14: Abatement Potential and Costs of Public Sector Extended Ambition, 2013-2027

	Annual emissions abatement (ktCO <sub>2</sub> e)	Annual total costs (£m)
2013	87	16
2014	109	16
2015	130	16
2016	152	16
2017	174	16
2018	195	16
2019	217	16
2020	239	16
2021	245	16
2022	252	5
2023	259	5
2024	265	5
2025	272	5
2026	278	5
2027	285	5

### Non-Domestic Buildings: Assessment of Energy Performance and Regulations (AEPR)

4.3.38 Buildings account for over 40% of the GHG emissions in the UK but less than 1% of the existing stock is replaced by new buildings each year. Regulations would be introduced through Section 63 of the Climate Change (Scotland) Act for the assessment of the energy performance of existing non-domestic buildings and their emissions and for owners to improve the energy performance of their buildings and to reduce emissions.

4.3.39 Initially, the proposal would be implemented broadly in line with the consultation with assessments to be carried out every 10 years. Owners would then either have to implement building improvements or annually report the building's operational carbon and energy performance. The proposal would be reviewed within 10 years and the scope could be widened by requiring the building improvements be carried out or alternatively go further by also including all buildings down to 250 m<sup>2</sup> and increasing the assessment frequency to every five years.



## Methodology for Estimating Emissions Abatement Potential, Costs and Benefits of AEPR

4.3.40 The abatement potential and costs of this proposal are based on the 2008 consultation: Action on Climate Change Proposals for improving the Energy Performance of existing Non-Domestic Buildings.<sup>44</sup> This was carried out for section 50 of the Climate Change (Scotland) Bill (now Section 63 of the CCSA). Due to the early stage of development, the partial RIA contained 7 options.

4.3.41 For the years 2014 to 2020, abatement potential is based on a scenario in which it is assumed the proposal is implemented broadly in line with the consultation for the assessment. Post 2022, abatement potential has been estimated by taking the mid-point of two possible emission abatement scenarios:

- Scope of regulations widened by mandating the implementation of Assessments of the Carbon and Energy Performance of buildings recommendations and retaining assessment frequency at 10 years.
- Scope of regulations widened for mandatory improvements by reducing the eligible building size to 250 m<sup>2</sup> and reducing the assessment frequency to five years.

4.3.42 The costs of the proposal are based on the Partial Regulatory Impact Assessment (RIA) that was prepared for the 2008 consultation. The partial RIA contained costing's for seven options. This cost base has been maintained to allow comparison with earlier costings.

4.3.43 Benefits associated with each of the options described in the above consultation were calculated assuming that the policy commenced in 2009 and is delivered to 2020. Costs are assumed to be incurred by Government and building owners over those years. However savings arising from additional energy saving actions taken within that period are assumed to persist beyond the 2020 and these have been taken into account by assuming that energy savings will typically persist for 10 years.<sup>45</sup> All monetary costs and benefits have been discounted at 3.5% in order to calculate the Net Present Value (NPV) of each option.

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<sup>44</sup> <http://www.scotland.gov.uk/Publications/2008/08/15155233/0>

<sup>45</sup> <http://www.scotland.gov.uk/Publications/2008/08/15155233/11>

Table 15: Abatement Potential and Costs of Energy Performance Assessments of Non-Domestic Buildings, 2013-2027<sup>46</sup>

	Annual emissions abatement (ktCO <sub>2</sub> e)	Annual total costs (£m)
2013	0	0
2014	6	6
2015	12	13
2016	18	13
2017	24	13
2018	30	13
2019	36	13
2020	42	13
2021	56	88
2022	70	88
2023	85	88
2024	99	88
2025	113	88
2026	128	88
2027	142	88

### Low Carbon Heat

4.3.44 The proposal for decarbonising heat will include both the domestic and non-domestic sectors. As the majority of the emissions abatement is likely to fall in the non-domestic sector, the final abatement split between the Homes and Communities sector and the Business, Industry and Public Sectors may change.

### Methodology for Estimating Emissions Abatement Potential, Costs and Benefits of Low Carbon Heat

4.3.45 Estimates of the Scottish abatement potential for low carbon heat are derived from a detailed cost effectiveness model developed for the CCC. This model looks at the potential scenarios for low carbon heat technologies to replace fossil fuel use up to 2030. The model has drawn upon and extended the evidence base used for previous low carbon heat modelling in DECC, and includes technology assumptions and input data that have been extended to 2030. Additional technologies have been incorporated to reflect a wider range of possible future developments (e.g. synthetic biogas from the gasification of biomass, and heat pumps with heat storage that can shift electricity load profiles). There are a number of credible

<sup>46</sup> Further recent work carried out on existing non-domestic buildings indicates that emission abatement could be greater than that shown in the table.

scenarios for future low carbon heat generation, and this analysis represents one such scenario. In order to achieve our vision of decarbonising heat supply, we will develop a longer term strategy that looks at heat in the wider context of available energy resources, and demand. In this respect, we have developed a draft heat hierarchy of use and will publish a Heat Generation Policy Statement (HGPS) by the end of 2013, which will look in detail at possible generation scenarios. The HGPS will sit alongside the Electricity Generation Policy Statement providing a comprehensive energy policy view.

Table 16: Abatement Potential and Costs of Low Carbon Heat, 2013-2027

	Annual emissions abatement (ktCO <sub>2</sub> e)	Annual total costs (£m)
2013	16	8
2014	74	36
2015	112	36
2016	116	28
2017	81	16
2018	95	15
2019	90	12
2020	101	14
2021	269	32
2022	459	49
2023	602	65
2024	777	76
2025	960	86
2026	1,145	87
2027	1,334	113

## 4.4 Transport

4.4.1 Abatement estimates for transport have been informed by a number of published studies assessing the feasibility and likely form of policies aimed at reducing emissions from the sector. The majority of the analysis of the policy and proposals draws upon the published findings of the Atkins/Aberdeen study,<sup>47</sup> with further additional internal analysis bringing the findings into line with the latest available set of economic circumstances and information.

<sup>47</sup> <http://www.scotland.gov.uk/Publications/2009/08/26141950/0>

4.4.2 Cost information is presented as undiscounted annual total costs across all measures. Not all costs have been broken down across public/private sectors given that delivery mechanisms are not yet fully specified in every case but where the position is clearer, it has been explained in the relevant text.

### **Group 1: Decarbonising Vehicles**

4.4.3 This group of policies and proposals sets Scotland on the pathway to achieve the almost complete decarbonisation of road transport in Scotland by 2050. This will be achieved through a combination of a number of policies:

- Further improvement in conventional vehicle efficiency.
- The scaling up of electric vehicle (EVs) and plug-in hybrid (PIH) penetration.
- Scope for increased use of biofuels.
- Fuel efficient driving (cars).

### **Improvements in Conventional Vehicles and Fuel Efficiency**

4.4.4 Transport technologies and fuel have made some significant advances since the 1990s through greater efficiencies in use of fuel and lowering the emissions content of a unit of fuel. These improvements have been driven by two main factors: European regulations on emissions and by rising fuel prices increasing the demand for improved fuel economy in vehicles.

4.4.5 Since 1995 the average car emissions per kilometre has fallen by 18 % from 194 to 159 gCO<sub>2</sub>e/km today.<sup>48</sup> This level will fall further as the EU is in the middle of a process that will see emissions level from new cars reduced to 95gCO<sub>2</sub>e/km by 2020.

4.4.6 In 2012, 65% of each manufacturer's newly registered cars must on average comply with the target set by the legislation. This rises to 75% in 2013, 80% in 2014, and 100% from 2015 onwards. Our estimates assume that manufacturers will meet their targets by 2015 and then increase the annual rate of improvement from 2015 onwards in order to meet their 2020 targets.

4.4.7 Beyond 2020 available evidence suggests that an emissions range in cars of 50-70gCO<sub>2</sub>e/km is possible by 2030. For vans, which account for around 10% of all transport emissions and 15% of road

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<sup>48</sup> Own calculation for car fleet as a whole using total car emissions from NAEI and total car kilometres from Scottish Transport Statistics.

emissions, evidence suggests that an emissions range of 75-105gCO<sub>2</sub>e/km is possible, but over a longer timescale.

4.4.8 While conventionally fuelled vehicles remain dominant in the fleet and in the proportion of total driven kilometres, this policy can deliver significant emissions savings in Scotland. Thereafter, the importance and impact of further efficiencies in conventionally fuelled road travel in the late 2020s will reduce provided the electric and plug-in hybrid electric vehicle begins to penetrate deep into the car market by the late 2020s. Larger vans and heavy goods vehicles are though still likely to be dependent on conventional fuel out to 2030.

4.4.9 Costs from meeting the tighter standards are expected to be borne by firms initially through additional R&D and product development expenditure. It is anticipated that at least some of these costs will be passed on to consumers through the vehicle purchase price. The extent to which the fuel efficiency saving from the more efficient vehicle is captured by the consumer will depend on the competition within and maturity of the market.

### **Bio-Fuels**

4.4.10 The Renewables Transport Fuel Obligation introduced in the UK as a way to transpose the EU biofuels directive is a UK wide policy. No funding for this policy is required from the Scottish Government – DfT funds and supports the RTFO, with the function of the Renewable Fuels Agency now transferred to the Secretary of State for Transport.

4.4.11 An increased penetration of biofuels up to 8% of total liquid fuel consumption (by energy) is consistent with broader sustainability limits, as recommended by the Gallagher Review. There will be some cost implications in relation to infrastructure costs which will result from the introduction and use of bio-gasoline in remote and rural areas (for Scotland the Highlands and Islands region).

4.4.12 By volume, biofuels are on average more expensive than fossil fuels and also typically have lower energy content than fossil fuel. As such, a rise in biofuel use increases the number of litres of fuel required to travel a given distance and thus increases fuel costs. The cost of increasing the percentage of biofuels in petrol/diesel will eventually feed through to consumers in the form of relatively higher fuel prices which should cause motorists to marginally decrease their mileage relative to an outcome without the RTFO.

4.4.13 While biofuels will not provide the sole basis for transport decarbonisation in the 2020s, second generation biofuels could have a significant niche role to play in those parts of transport where there is limited scope for a move away from oil based fuels, notably with HGVs, buses and coaches.

### **Hybrid Buses**

4.4.14 The first two rounds of the Scottish Government's Green Bus Fund will lead to 71 new low carbon buses replacing conventional buses with the third round expected to increase the total beyond 90. Early adopters are seeing significant levels of fuel savings but as yet the additional up front purchase costs remain a barrier to solely market based purchasing, particularly when there is a divergence between social and private discount rates.

4.4.15 A continuation of Government support to assist the purchase of cleaner low carbon engine buses, coupled with a demonstration of a significant reduction in fuel costs and supply side economies of scale for producers, should lead to cost comparability over the medium term between the two types and see low carbon buses accounting for half of the Scottish bus fleet by 2027.

### **Low Carbon Vehicles**

4.4.16 Up to 2022 we expect to see a small but significant increase in the penetration of plug-in hybrid electric vehicles (PIHs) into Scotland, initially through the public sector and then through businesses. This roll-out will demonstrate demand for hybrids and help generate supply side economies of scale to kick-start the process of closing the price gap between the purchase price of normally aspirated and electric vehicles.

4.4.17 Under the Committee on Climate Change's assessment the likely impact in the transport sector from actions broadly in line with the statements and commitments made suggests that by 2020 plug-in hybrid cars could account for 16% of new cars and around 5% of the total fleet. This outcome is based on the assumption that the level of fuel duty remains at current or even higher levels and that electric battery costs fall in line with current expectations. For EVs to dominate fleet sales in the late 2020s the reduction in battery cost and increase in battery range are key.

4.4.18 Data on the profile of battery cost (past, present and future projections) is however very uncertain. What is clearer is the commitment of the industry in the three main markets (North America, Europe and Japan) to bring about significant reductions in battery costs by 2020. The working assumption in the CCC's 2009 report is that costs will fall to around £200 per kWh by 2020 and £130 per kWh by 2030. Taking account of forecast costs for petrol, electricity, battery development and the relative fuel efficiency of conventional and electric cars (EVs require far less energy than an equivalent conventional petrol car) then EVs will become significantly cheaper to run than conventional vehicles. Further, the CCC's assessment is that EVs and PIHs are cost effective relative to the projected carbon price in 2030.

4.4.19 Given these outcomes it will be possible for there to be a significant roll out of electric cars in the 2020s.<sup>49</sup> Under its central scenario the CCC estimates that by 2030 60% of new car sales (over 30% of fleet) will be PIH or EV.

4.4.20 While overcoming the cost differential and increasing battery range are key barriers to the mass uptake of electric vehicles, there are other important factors that need to be addressed:

- Domestic infrastructure for charging.
- Publicly available charging infrastructure.
- Capabilities for fast charging.
- Battery reliability and replacement - including a network of locations.
- Uncertainty surrounding being a first mover/adopter.
- General added 'hassle' factor.
- Incomplete understanding of personal/family mileage pattern or concern over inability to undertaking 'spur of the moment' or emergency long journeys.

4.4.21 Each of these factors will need to be addressed and solved by industry, individuals or Government (or a combination of them all) before battery electric vehicles can dominate Scottish car sales.

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<sup>49</sup> Research work [by Element Energy - [http://hmccc.s3.amazonaws.com/Element\\_Energy\\_EV\\_infrastructure\\_report\\_for\\_CCC\\_2009\\_final.pdf](http://hmccc.s3.amazonaws.com/Element_Energy_EV_infrastructure_report_for_CCC_2009_final.pdf)] indicates that 96% of car trips and 73% of total car distance travelled are covered by individuals travelling less than 160 kilometres a day - the range of current batteries.

## Fuel Efficient Driving

4.4.22 While not strictly a decarbonising measure this will reduce the level of emissions per kilometre travelled.

4.4.23 Commencing in 2012, it is assumed an on-going promotional and awareness raising campaign will eventually reach all driving licence holders. It is assumed that this campaign would result in 85% of the driving population undertaking face-to-face eco-driving training sessions by 2027 with a refresher update every five years.

4.4.24 The emissions abatement from this initiative is assumed to flow from reduced fuel consumption, the extent of which depends on fuel type and degree of adjustment in driving style. Average emissions rates of vehicles have also been adjusted over time to reflect the on-going improvement in new vehicle fuel efficiency, and a rebound effect has been included to account for the increase in demand resulting from a lowering of the cost per kilometre driven.

### Impact on Emissions from Decarbonising Vehicles Group

4.4.25 Together, these policies and proposals are expected to significantly reduce emissions over the period to 2027.

Table 17: Abatement Potential and Costs of Decarbonising Vehicles, 2013-2027

	Annual emissions abatement (ktCO <sub>2</sub> e)	Annual total costs (£m)
2013	157	25
2014	274	32
2015	429	39
2016	576	51
2017	752	61
2018	962	72
2019	1218	91
2020	1526	111
2021	1769	114
2022	1861	115
2023	2047	116
2024	2230	121
2025	2308	124
2026	2470	121
2027	2525	122



## **Group 2: Sustainable Communities**

4.4.26 Low carbon vehicles are not expected to reach a critical mass for commercial scale roll-out until the mid to late 2020s. Until then there is a need to encourage changes to individual and household travel behaviours and patterns. The sustainable communities' policy grouping looks to help people understand the options and plan in favour of more carbon friendly modes of travel where possible through travel planning, providing infrastructure to support increased cycling and walking and introducing car clubs in larger towns and cities. The proposals in this group include:

- Domestic and school travel planning.
- Investment in active travel infrastructure.
- Car clubs.

### **Travel Planning**

4.4.27 This proposal undertakes the widespread roll out of travel planning targeting the workplace, schools and households. It aims to identify travel options and particularly aims to encourage modal shift and reduce car use. A full roll out is expected to reduce urban car commuting trips, with a smaller reduction in rural car commuting trips. Business trips, school escort trips and leisure escort trips are also expected to decline.

4.4.28 The cost of delivering this programme and rolling out travel planning to all households and schools is expected to fall entirely on the public sector.

### **Cycling and Walking Infrastructure**

4.4.29 Active travel in the form of cycling and walking already plays a significant role in shorter journeys in Scotland, although there is potential to marginally increase its share, particularly on distances of between one and two miles where the proportion of car journeys increases dramatically compared to the position on the shortest trips. More generally this distance range also sees a dramatic fall in the number of active travel trips.

Table 18: Number of Trips taken by Scottish Residents 2009/10 by Mode and Distance

	< 1 mile	1-2 miles	2-5 miles	5-10 miles	10-25 miles	25-50 miles	> 50 miles	All length
Walk	151	53	12	1	-	-	-	216
Driver of car, van or lorry	21	63	131	82	77	19	7	399
Passenger in car, van or lorry	13	34	67	41	34	9	5	201
Other Private (e.g. bicycle, m/cycle)	2	4	7	3	3	1	1	21
Public Transport (e.g. bus, rail, taxi)	4	18	47	26	18	4	3	119
All Modes	191	171	263	153	131	32	16	957

4.4.30 Investment by Government and local authorities in the active travel infrastructure will include improvements to lighting, surfaces, crossings and signage for pedestrians. For cycling, investment will be in facilities such as cycle lanes and paths, advanced stop lines and cycle parking, as well as potential new initiatives to support the integration of active travel and public transport, and enhance access to bikes in urban areas.

4.4.31 For walking, it is assumed that the package of measures will increase the number of walking trips by 50% with a third of these trips replacing journeys by car by 2022. For cycling, it is assumed that the package of measures achieves an outcome of 10% of all journeys being made by bicycle, with 33% of those additional trips being switches from car journeys.

4.4.32 Investment in cycling and walking infrastructure is based on evidence of intensive cycle programmes in Europe which have involved expenditure in the order of £5 per person per year over a 10 to 15 year period. A further assumption made is that the investment will be front loaded to help change the current culture of very low cycle use and to further increase the number of walking trips.

### Car Clubs

4.4.33 The proposal is for a fully integrated national network of car clubs across Scotland to help reduce vehicle numbers and kilometres travelled by cars, and improve the fuel efficiency of the car fleet. Scheme funding would initially come from the taxpayer via Government expenditure to establish the schemes and purchase low carbon vehicles (LCVs). Membership would then provide an income stream to help pay for maintenance and replacement vehicles. Local authorities would have dual roles in supporting and funding the

provision of infrastructure (establishing designated locations for cars and a good coverage of exclusive parking bays) as well as potentially offering corporate membership for local businesses.

4.4.34 Households would gain from having access to a fuel efficient car without the up-front purchase costs and benefit from the opportunity to drive and experience the practicality of a new LCV. On the supply side car manufacturers will benefit from having a route to roll out and test newer LCVs or Ultra-LCVs.

4.4.35 It is assumed that the network of car clubs will be rolled out over a 10-year period so that by 2022 there is one in every town in Scotland with a population over 25,000.<sup>50</sup> It is further assumed that over time up to 10% of households in larger, more established cities and towns become members of a car club. Emissions from equivalent journeys switched to car clubs are assumed to be lower as car club cars are on average around 30% more fuel efficient than the average fleet.

#### **Impact on Emissions from Sustainable Communities' Group**

4.4.36 Together, these proposals are expected to have a significant impact on emissions over the period to 2027.

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<sup>50</sup> The latest projections estimate there are 29 such towns in Scotland currently, although this is likely to change out to 2022.

Table 19: Abatement Potential and Costs of Sustainable Communities Group, 2013-2027

	Annual emissions abatement (ktCO <sub>2</sub> e)	Annual total costs (£m)
2013	0	17
2014	12	13
2015	56	84
2016	70	84
2017	82	84
2018	103	85
2019	122	63
2020	139	63
2021	158	67
2022	179	72
2023	198	55
2024	219	53
2025	241	55
2026	259	56
2027	277	58

### Group 3: Business Engagement around Sustainable Transport

4.4.37 The business efficiencies proposals grouping covers behaviour change at the organisational level and encompasses:

- Freight modal shift.
- Fuel efficient driving for freight and van travel.
- Ferry investment.
- The productivity and financial benefits of mobile and flexible working from expanding digital and broadband technologies.
- Corporate travel plans supporting employees and visitors in reducing business travel emissions.

#### Freight - HGV Modal Shift

4.4.38 The aim of the proposal under Freight Modal Shift is to assist the redistribution of freight from road to rail and water where appropriate and to rationalise the movement of freight more generally. This is done through the direct payment of a grant to cover the cost differential between road and the nearest cost alternative.

4.4.39 The emissions abatement achieved from these measures flows from reduced vehicle kilometres travelled by road and reduced fuel consumption. A 5% modal shift from HGVs in 2022 has been assumed.

This is based on a moderately ambitious scenario; since 1997 Freight Facility Grants alone have removed approximately 33 million lorry miles per annum from roads in Scotland.

4.4.40 The expenditure is based on a continued expansion of current Freight Modal Shift Grants. Additional costs for the full roll out of load consolidation centres and to facilitate Freight Quality Partnerships across Scotland have been factored in.

#### **Fuel Efficient Driving - Freight and Van**

4.4.41 This proposal covers a range of measures to train drivers of HGVs and LGVs to drive in a more fuel-efficient manner.

4.4.42 While there are already on-line resources to help with fuel efficient driving, this policy aims to provide practical training for drivers of goods vehicles. It is assumed that it will cost around £400 to train each driver once, with a retraining event five years later adding to that cost. This policy assumes a 100% take up of Safe and Fuel Efficient Driving (SAFED) by HGV drivers between 2015 and 2002 and 30% take up by van users by 2027.

4.4.43 A combined implementation of the current policy activity and proposals is assumed to reduce emissions from HGVs by 5% in 2022. For vans it is assumed that an average efficiency improvement of 4% per vehicle can be achieved from the proposals.

#### **Maritime - Introduction of Hybrid Ferries**

4.4.44 This proposal will improve the fuel efficiency of engines within the ferry fleet through public procurement of new vessels that have both an improved more efficient diesel engine along with a battery to help with propulsion. The costs of purchasing the new ferries will fall to the Government and taxpayer as the services and fares are still controlled to some extent as a support service to the island communities. The first ferry is expected to be brought into service in 2013.

#### **Work Smart**

4.4.45 Mobile and flexible working involves a range of new, often technology assisted processes such as working from home, working from multiple offices and non-office mobile working. Shifting to this flexible way of working is expected to reduce both commuting and business travel as well as potentially rationalising the business estate.

Very little funding is required from the public sector beyond facilitating the exchange of information while both consumers and businesses should expect to see reduced travel costs. More generally, the level of congestion on roads at locations near to the organisations taking part is likely to be reduced. If the remote working includes the possibility of working at home employees are likely to see some increase on average in their heating bills through the winter offsetting some of the cost savings made by the change in working pattern.

4.4.46 We are currently undertaking a short study into the potential impacts of the work smart programme and the outcome and result of the study will be reported in due course.

#### **Impact on Emissions from Policies to Improve Business Transport**

4.4.47 Together, these proposals are expected to have a small but significant impact on emissions over the period to 2027.

Table 20: Abatement Potential and Costs of Business Transport Measures, 2013-2027

	Annual emissions abatement (ktCO <sub>2</sub> e)	Annual total costs (£m)
2013	26	3
2014	29	6
2015	58	22
2016	67	21
2017	76	21
2018	91	21
2019	106	22
2020	121	25
2021	173	25
2022	227	29
2023	270	28
2024	306	29
2025	357	32
2026	409	30
2027	462	30

## **Group 4: Network Efficiencies**

4.4.48 This group of proposals aims to improve traffic flows across the different transport networks and the connection between them. It consists of:

- Intelligent transport systems (ITS).
- Some enhancement of speed limit enforcement through further rolling out of average speed cameras on targeted sections of the trunk road network.

4.4.49 Deployment of these measures across the networks will require significant up front capital investment by the public sector. This expenditure will, though, increase the resilience of the network and improve journey times and reliability.

### **Intelligent Transport Systems**

4.4.50 Intelligent Transport Systems (ITS) will enhance the capacity and operation of the current trunk road network. Measures such as overhead gantries with the capability to vary messages and speed limits could be introduced on up to 170 kilometres of the most congested parts of the trunk road network to smooth traffic flow. Research suggests that the cost of implementing ITS could be in the order of £630,000 per kilometre. This cost covers both the capital costs of installation and maintenance of the system.

4.4.51 In addition, interactive information boards within bus stops, with real time information on services using it, will develop confidence in public transport, while hand held devices with access to similar information offer the potential to limit time spent waiting for buses at stops – seen as one of the major costs of using public transport. Such apps for technology could be developed by the private sector, although would be dependent upon the public investment in the vehicles and infrastructure to allow this to happen.

### **Speed limit Enforcement through Greater Deployment of Average Speed Cameras on the Trunk Road Network**

4.4.52 It is assumed that average speed cameras would be used to enforce the speed limit on the trunk road network.

4.4.53 Average speed camera installations cost around £40,000 per kilometre with an annual maintenance cost of £4,000 per km. It is important to note that the costs only cover the implementation and

maintenance of the infrastructure and do not include consequential costs incurred by bodies such as the police or the judicial system as a result of strict policy enforcement.

4.4.54 Emissions abatement and cost savings would be achieved through people adhering to the speed limit, lowering average speeds and decreasing fuel consumption. Air quality would see a marginal improvement and there are likely to be fewer road accidents as a result of lower average speeds. However, there would be a consequential reduction in fuel sales and revenue to the exchequer through fuel duty and VAT.

### Impact on Emissions from Network Efficiencies Group

4.4.55 Together, these proposals are expected to have a significant then declining impact on emissions over the period to 2027.

Table 21: Abatement Potential and Costs of Network Efficiencies Measures, 2013-2027

	Annual emissions abatement (ktCO <sub>2</sub> e)	Annual total costs (£m)
2013	2	10
2014	4	9
2015	31	47
2016	32	52
2017	33	56
2018	34	32
2019	35	33
2020	36	34
2021	35	35
2022	35	36
2023	34	19
2024	33	19
2025	33	19
2026	33	19
2027	32	19

### Potential Future Abatement from Transport

4.4.56 Current modelling and research suggests that the future projection of transport emissions could be reduced by up to 0.75 MtCO<sub>2</sub>e by 2027. At this stage the potential is highly uncertain due to volatility in a number of key factors including projecting traffic growth during the current economic uncertainties, fuel prices, the rate



of adoption of new technologies into the car fleet in particular and the possibility to manage reductions in the use of the road network in favour of public transport, active travel and through a greater impact from travel planning. These potential impacts have not yet been appraised in a way consistent with the above analysis but we aim to assess and appraise these impacts in future work.

Table 22: Potential Future Abatement from Transport, 2025-2027

	Annual emissions abatement (ktCO <sub>2</sub> e)
2025	250
2026	500
2027	750

### Uncertainties in Transport Emissions Analysis

4.4.57 Emissions in the sector are not recorded directly but instead calculated using information on aircraft movement, port movement data and local road traffic data. While this data is subject to some uncertainty and methodological change, particularly in the case of shipping, the fact that the sector’s emissions calculation is predominantly based on fuel consumption data means the resultant emissions calculation from the movement data is relatively straightforward.

4.4.58 Uncertainty also arises when estimating the impact of policy changes on emissions from transport. Calculating this impact requires the modelling of scenarios to estimate the way in which transport supply and demand are affected. These changes further rely on a wide range of assumptions and complex interactions concerning changed driver behaviour, changed car and trip purchase behaviour and modal switching.

4.4.59 There are further uncertainties surrounding the costs incurred during implementation. The costs will depend on what exactly is to be delivered, the extent, method and speed of implementation. Whether the costs fall on businesses, consumers, taxpayers, or a combination of all three depends on the precise way that the policy is delivered.

4.4.60 Where possible the assumptions on which estimated abatement and costs have been derived have been explicitly stated. Where drawn from available published evidence, this has been referenced.

## 4.5 Waste and Resource Efficiency

4.5.1 The abatement potential from Waste policies and proposals in RPP2 were calculated using the 2006 model developed by the Intergovernmental Panel on Climate Change (IPCC).<sup>51</sup> The model uses a first-order decay method, which approximates the steady decomposition of organic matter across a number of decades assuming constant conditions. This results in a declining output of waste products, including methane.

4.5.2 The assumptions within the IPCC model were deemed sufficient and representative of Scottish landfills relating to default location (Western Europe), climate (wet temperate), types of landfills, and other constants such as the lag time before anaerobic decay begins (six months).

4.5.3 The IPCC Waste Model:

- Provides default values for landfill conditions (Western Europe, wet temperate climate, rate of methane production per waste type, plus others).
- Allows customisation of input factors such as amount and composition of waste, amount landfilled, and amount of methane captured.
- Provides values for total methane emissions per year.

### Zero Waste Policy Measures – pre-2010

4.5.4 In the period before the Zero Waste Plan (ZWP) was introduced in Scotland, there was a policy framework which promoted waste efficiency and introduced targets for recycling (National Waste Plan for Scotland, 2003). These targets were refined in 2008 before being absorbed into the ZWP. It is therefore the case that much of the abatement being reported after 2013 is due to changes made before the introduction of the ZWP.<sup>52</sup>

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<sup>51</sup> <http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol5.html>

<sup>52</sup> These emissions are not captured in the BAU profile.

## Zero Waste Plan

4.5.5 The Zero Waste Plan (ZWP) is the Scottish Government's vision for a zero waste society. It was published in June 2010 and set out 22 actions to influence resource streams, economic opportunity, resource management and education and awareness; all relevant to the removal of barriers to the minimisation of landfill. This Plan works within the wider EU Waste Framework and Landfill Directives. A further update to the ZWP was published in 2011,<sup>53</sup> and this introduced a wider remit to include all waste types within the plan.

### Methodology for Estimating Emissions Abatement Potential, Costs and Benefits of the Zero Waste Plan

4.5.6 The main assumption with the Zero Waste Plan is that it broadly succeeds in its aims. The aims that relate to landfill, and how they are modelled, are detailed below:

- Maximum 5% waste sent to landfill by 2025: assumption that municipal waste achieves 10% landfilled by 2030, and industrial waste achieves 10% landfilled by 2025.
- Biodegradable waste banned from landfill in 2020: assumption that municipal waste contains only 5% food by 2020 and thereafter. Other bio-waste such as paper assumed to be more difficult to remove from waste stream, reduced to 10% by 2030.
- Waste prevention programme: assumption that there is a general reduction in the amount of waste per person arising. This is partially offset by a predicted increase in the population.

4.5.7 A more general assumption is that the wider pre-existing policy environment which promotes resource efficiency and waste sorting also encourages a reduction in waste arising and of recycling. Furthermore, landfill tax provides a strong financial incentive to find other ways to treat waste.

4.5.8 These assumptions in the model all interact, and their general outcomes are that there is less waste being landfilled, and less of that waste is biodegradable, resulting in lower methane emissions over the upcoming years and decades.

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<sup>53</sup> <http://www.scotland.gov.uk/Topics/Environment/waste-and-pollution/Waste-1/wastestrategy>

4.5.9 The Economic Assessment of the Zero Waste Plan for Scotland,<sup>54</sup> commissioned by Zero Waste Scotland, presents costs and benefits relative to a BAU profile for Scotland, and is used as the basis of the cost figures included in the RPP2.

4.5.10 The costs are summarized in the model in the following categories:

- Change in collection costs: It is more expensive to collect separated waste streams than waste from one residual bin.
- Change in material revenues: Increased recycling leads to increased revenues from sale of the resulting materials.
- Change in organic treatment fees: Increased use of e.g. anaerobic digestion facilities.
- Change in residual waste management costs: source separation of waste has financial benefits through selling inputs for other processes, and waste auditing and segregation allow businesses to identify precisely where their waste is produced and how it could be reduced. Reducing waste not only avoids any costs of waste treatment, but can also reduce costs through lower overall material consumption.
- Change in sorting fee: increased use of materials recovery facilities to sort residual waste as thoroughly as possible.
- Change in regulatory costs: additional costs incurred through monitoring application of stricter rules under the ZWP.

4.5.11 These costs will mainly fall to the bodies that deal with the waste as it comes through the system, the local authorities and/or their contractors who deal with household waste, and the commercial waste producers themselves. Whether any costs are passed on to households depends on how local authorities plan to fund their waste collections.

4.5.12 A lot of the modelling will depend on market conditions for the sales of recycled materials, as well as the costs of waste processing such as energy use and staffing.

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<sup>54</sup> Zero Waste Scotland/Eunomia Economic Assessment of the Zero Waste Plan For Scotland  
<http://www.zerowastescotland.org.uk/ZWPCostbenefit>

Table 23: Abatement Potential of Pre-2010 Waste Policy and Abatement Potential and Costs of the Zero Waste Plan, 2013-2027

	Annual emissions abatement from pre-2010 Waste Policy (ktCO <sub>2</sub> e)	Annual emissions abatement from ZWP (ktCO <sub>2</sub> e)	Annual total costs of ZWP (£m)
2013	484	13	172
2014	533	26	161
2015	579	41	163
2016	622	58	163
2017	659	77	163
2018	693	97	164
2019	722	119	162
2020	748	141	163
2021	774	163	164
2022	795	185	165
2023	813	206	164
2024	827	228	165
2025	837	249	165
2026	856	270	165
2027	871	290	165

### Enhanced Methane Capture from Landfill

4.5.13 This proposal is to capture extra methane emissions from landfill sites by focussing efforts on closed facilities, most of which will be emitting methane for many years to come. This would be above and beyond the responsibilities currently upon the bodies that own landfill sites.

### Methodology for Estimating Emissions Abatement Potential and Costs of Enhanced Methane Capture from Landfill

4.5.14 The amount of available methane for electricity generation from closed landfill sites was modelled, and an assumption was made of an increasing proportion of this gas being captured to 2020, the proportion captured remaining constant thereafter. As the amount of available methane generally declines over time, this source of abatement diminishes too.

4.5.15 The following assumptions are used:

- The available power generation capacity from landfill gas in Scotland for 2006 (70MW).<sup>55</sup>
- The emission profiles of a selection of closed landfill sites were modelled, assuming exponential decline of gas output from 100% at the date of closure.
- The proportion of total emissions from closed landfill sites increases steadily from a baseline of 25% in 2013 to over 50% in 2027.
- The amount of viable closed sites being used for landfill gas capture rises linearly from 0% in 2012 to 75% in 2020.

4.5.16 These factors combine to give a value for additional MW capacity captured each year which is then converted into mass of methane and ktCO<sub>2</sub> equivalent.

4.5.17 Cost information draws on 2010 advice from the US Environmental Protection Agency which assumes that the generation from closed landfill sites will be more expensive than active sites due to the smaller scale and dwindling supplies of extant gas.

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<sup>55</sup> The Power of Scotland: Cutting Carbon with Scotland's Renewable Energy

Table 24: Abatement Potential and Costs of Landfill Gas Capture, 2013-2027<sup>56</sup>

	Annual emissions abatement (ktCO <sub>2</sub> e)	Annual total costs (£m)
2013	22	1.0
2014	44	1.1
2015	67	1.2
2016	90	1.2
2017	112	1.3
2018	133	1.3
2019	154	1.4
2020	163	1.3
2021	161	0.3
2022	158	0.3
2023	155	0.3
2024	151	0.3
2025	148	0.3
2026	144	0.3
2027	140	0.3

## 4.6 Rural Land Use

4.6.1 Rural land use is made up of agriculture and related land use, peatland and forestry.

### Agriculture

4.6.2 Abatement and cost estimates for the policies assessed are based upon economic analysis undertaken by the Scottish Agricultural College (SAC)<sup>57</sup> which produced a revised marginal abatement cost curve (MACC) in conjunction with RESAS<sup>58</sup> in 2011. This was an update of work carried out in 2008<sup>59</sup> and 2010,<sup>60</sup> which derived MACCs for agriculture, related land use and forestry in the UK and constituent countries to assess the abatement potential and cost effectiveness of measures aimed at mitigating GHG emissions. The updated MACCs for Scotland reassessed the underlying assumptions which form the

<sup>56</sup> Does not include the change in environmental costs, or the effect of related measures enacted before the Zero Waste Plan came into effect.

<sup>57</sup> SAC is now known as Scotland's Rural College (SRUC)

<sup>58</sup> Scottish Government Rural and Environment Science and Analytical Services division

<sup>59</sup> SAC (2008) - UK Marginal Abatement Cost Curves for the Agriculture and Land Use, Land-Use Change and Forestry Sectors out to 2022, with Qualitative Analysis of Options to 2050. Report to the CCC: <http://hmccc.s3.amazonaws.com/pdfs/SAC-CCC:%20UK%20MACC%20for%20ALULUCF:%20Final%20Report%202008-11.pdf>

<sup>60</sup> SAC (2010) - Review and update of UK marginal abatement cost curves for agriculture. [http://downloads.theccc.org.uk/s3.amazonaws.com/0610/pr\\_supporting\\_research\\_SAC\\_agriculture.pdf](http://downloads.theccc.org.uk/s3.amazonaws.com/0610/pr_supporting_research_SAC_agriculture.pdf)

foundations of the model. This included: the Food and Agriculture Policy Research Institute (FAPRI) baseline; estimates of applicability and effectiveness; and the method for calculating interactions.

### **Applicability and Effectiveness Assumptions**

4.6.3 RPP1 was based on the original MACC that SAC produced in 2008. This was the first attempt at modelling abatement for UK agriculture, and hence there was a high degree of uncertainty over the final estimates. In 2010, SAC, in conjunction with ADAS Ltd, published an update to the 2008 model which demonstrated this uncertainty. The main issues identified were to do with the underlying assumptions of applicability (how many hectares/livestock the measure can be applied to) and effectiveness (how much CO<sub>2</sub> equivalent could be abated by adopting this measure per hectare/livestock unit).

4.6.4 Two versions of the MACC were produced within the 2010 MACC publication, one using more optimistic versions of the underlying assumptions, and one more pessimistic. The degree of uncertainty, and hence the difference between optimistic and pessimistic assumptions, varied for each measure. For some measures, there was less uncertainty, and a central assumption was agreed on by the expert group that helped to develop the 2010 MACC.<sup>61</sup> However, even where there was agreement on the underlying assumptions, there remains a large degree of uncertainty around how the measures interact with different field environments, which could lead to large fluctuations in effectiveness of the particular measure in practice.

4.6.5 These issues demonstrate the difficulty of estimating abatement potential from measures in this sector and the 'real world effects' that will influence the level of abatement delivered in practice. However, the MACC offers the best evidence on which to base our abatement estimates for this sector.

4.6.6 For each measure, in conjunction with the Agriculture and Climate Change Stakeholder Group<sup>62</sup> and using evidence provided in the MACC 2010 documentation, an appropriate level of abatement and effectiveness was agreed. The benefit of this process is to derive the most appropriate figures for the Scottish context, rather than the

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<sup>61</sup> For a list of members of expert group see Appendix A of 'SAC 2010 – Review and update of UK marginal abatement cost curves for agriculture'

<sup>62</sup> Membership of the stakeholder group is representative of the various industry and environmental stakeholder bodies in Scotland.



UK as a whole on which the underlying assumptions were originally based. Involving the stakeholder group at this early stage has ensured the industry is involved in forming estimates.

4.6.7 SAC incorporated the estimates into the MACC model to provide a maximum technical potential (MTP) for each measure. Final estimated abatement figures for each policy were calculated following the method used in ADAS (2009).<sup>63</sup> An “achievement” against the maximum technical potential (MTP)<sup>64</sup> for the mitigation options relevant to each policy was estimated based upon two assumptions:

- The “coverage” of the policy, in terms of the percentage of on-farm emissions relevant to the options targeted by the policy.
- The estimated uptake of each option under the policy in 2022.

4.6.8 Estimates of achievable uptake of each option are based upon: assumptions in ADAS (2009); the nature of each option (particularly cost and other barriers to uptake); and discussions with Scottish Government Agriculture and Climate Change Stakeholder Group.

Estimated abatement for mitigation option X under policy Y as a stand-alone policy	=	MTP of mitigation option X	x	% of emissions targeted by option X covered by policy Y	x	% of farmers adopting option X covered by policy Y
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### Policy Interactions

4.6.9 Repeating the calculation above for each mitigation option targeted by a given policy, produces estimated abatement on a stand-alone policy basis. However, potential for interaction has been identified between Farming for a Better Climate (FFBC) and the proposed 90% uptake of fertiliser efficiency measures. Where the policy and the proposal target the same mitigation measure, abatement realised by FFBC is likely to reduce the potential for abatement from the proposal. This has been accounted for so that abatement from FFBC and the proposal for 90% uptake of fertiliser measures can be added together without double counting.

<sup>63</sup> ADAS (2009) RMP/5142 Analysis of Policy Instruments for Reducing Greenhouse Gas Emissions from Agriculture, Forestry and Land Management. Report to DEFRA: <http://archive.defra.gov.uk/foodfarm/landmanage/climate/documents/climate-ag-instruments.pdf>

<sup>64</sup> Maximum technical potential refers to the level of abatement that would be achieved if all farmers who could technically implement a given measure did so fully.

4.6.10 For those measures targeted by both FFBC and the proposal, abatement is allocated from 2010-2017 to FFBC, according to the increasing linear profile of uptake described above. From 2018, uptake is expected to move to 90%, as a result of voluntary action or, if necessary, through a mandatory framework. Beyond 2018, the additional uptake up to 90% is realised through the proposal. Annual abatement from these measures under FFBC from 2018-2022 is held at the 2017 level, on the basis that uptake of these options is realised as a result of provisions under FFBC and that these provisions (and associated funding) are maintained.

4.6.11 For the mitigation options included in the proposal from 2018, abatement equals the expected level of 90% abatement for each option minus the level of abatement already achieved by FFBC.

Additional abatement under 90% uptake proposal	equals	Estimated achievement of 90% uptake as a stand-alone proposal	minus	Estimated achievement of MTP already achieved under FFBC to 2017 for these measures
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4.6.12 For those measures targeted by FFBC only, there are no policy interactions to consider and abatement continues along a linear trajectory to the 2022 level.

4.6.13 A similar process was used for interactions between FFBC measures, and measures outlined as 'additional proposals post 2020'.

## Measure Interactions

4.6.14 Accounting for policy interactions avoids double counting of abatement where two separate delivery vehicles operate at the same time. Measure interactions occur at the farm level where two measures will interact if they are implemented simultaneously. For example, the use of nitrogen fixing plants interacts with other fertiliser efficiency measures as it reduces the level of fertiliser that a farmer will need to apply and the resulting abatement potential.

## Policy Costs

4.6.15 Both private costs and costs to Government are estimated, in addition to total policy cost effectiveness in GHG mitigation.

4.6.16 Private costs (i.e. those incurred by farmers) account for changes in input costs (fertiliser, labour and machinery costs) and changes in yield arising from the application of mitigation measures. Most measures estimated to be cost-effective by SAC (2008) relate to changes in farm management practices requiring no upfront investment. For these measures, annual costs are calculated by multiplying annual abatement by cost effectiveness values given in SAC (2008).

4.6.17 Costs to Government generally arise from the administration of policies and the provision of direct support.

4.6.18 Policy cost effectiveness is total cumulative costs (private costs plus costs to Government) divided by total GHG abated by the policy over the assessment period (2010-2022). Cost-effectiveness estimates do not take account of wider environmental and societal benefits (e.g. changes in water quality) due to a lack of suitable data. All costs are in 2011 prices.

## Individual Policy Assessments

### Farming for a Better Climate

4.6.19 Farming for a Better Climate (FFBC)<sup>65</sup> is an on-going policy which targets five key areas of action for farmers to reduce GHG emissions from agricultural production. These relate primarily to mitigation options identified in the SAC MACC that improve the

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<sup>65</sup> See <http://www.sac.ac.uk/climatechange/farmingforabetterclimate/> for more details.

productivity of the farm business as well as reducing GHG emissions. The relevant measures are:<sup>66</sup>

- Improved timing of mineral fertiliser application.\*
- Improved timing of slurry and poultry manure application.\*
- Adding maize to silage.
- Full allowance on manure nitrogen supply.\*
- Plant varieties with improved nitrogen use efficiency.
- Avoiding nitrogen excess.\*
- Use composts and straw based manures in preference to slurry.\*
- Separate slurry applications from fertiliser applications by several days.\*
- Selecting beef cattle for breeding based on productivity.
- Selecting dairy cattle for breeding based on productivity.
- Selecting dairy cattle for breeding based on fertility.

4.6.20 It is assumed that FFBC targets 90% on-farm GHG emissions. This takes account of the concentration of GHG emissions among a relatively small number of large farms. FFBC is assumed to target 50% of farms comprising of the largest GHG emitters, which are estimated to account for around 90% total farm business GHG emissions.

4.6.21 FFBC is expected to reduce emissions by up to 107 ktCO<sub>2</sub>e per annum in 2027 relative to the baseline, and deliver cumulative savings of close to 1.5 MtCO<sub>2</sub>e between 2010 and 2027.

4.6.22 Due to the cost effective nature of those measures promoted by FFBC, the policy is estimated to result in savings to farm businesses of around £250 million (undiscounted over the period out to 2027). These savings arise largely from productivity increases resulting from improved efficiency in input use. With negative overall costs and emissions savings, the overall cost effectiveness of FFBC works out on an undiscounted basis, at around -£160 per tonne of saved emissions.

4.6.23 Costs to Government are estimated at around £0.25 million per annum or around £4.5m (undiscounted) between 2010 and 2027. These costs arise from knowledge provision and exchange services provided through the SAC, such as workshops and demonstration farms.

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<sup>66</sup> (\*) indicate measures targeted by both FFBC and proposed for inclusion in mandatory requirements.

Table 25: Abatement Potential and Costs of FFBC, 2013-2027

	Annual emissions abatement (ktCO <sub>2</sub> e)	Annual total costs (£m)
2013	50	0.3
2014	62	0.3
2015	75	0.3
2016	87	0.3
2017	100	0.3
2018	101	0.3
2019	103	0.3
2020	103	0.3
2021	104	0.3
2022	104	0.3
2023	105	0.3
2024	106	0.3
2025	106	0.3
2026	107	0.3
2027	107	0.3

### 90% Uptake of Fertiliser Efficiency Measures

4.6.24 The climate change-related actions proposed for inclusion in the 90% uptake of fertiliser efficiency measure from 2018 are a subset of those promoted by FFBC. Under this proposal, measures associated with the application of nitrogenous fertilisers were deemed to be most effective in terms of abatement potential and cost savings to farmers. They are:

- Improved timing of mineral fertiliser application.
- Improved timing of slurry and poultry manure application.
- Full allowance on manure nitrogen supply.
- Avoiding nitrogen excess.
- Use composts and straw based manures in preference to slurry.
- Separate slurry applications from fertiliser applications by several days.

4.6.25 GHG emissions abatement for each targeted mitigation option is calculated using the same method as for FFBC. It is estimated that for these mandatory measures, an 81% achievement of Maximum Technical Potential (MTP) can be achieved. This is based upon a 90% emissions coverage (as for FFBC), and an assumption that 90% of those farms adhere to requirements, i.e. uptake is 90% (based upon ADAS 2009).

4.6.26 Abatement allocated to the 90% uptake of fertiliser efficiency measure takes account of uptake already achieved from the same options under FFBC. The inclusion of the above options as mandatory requirements is estimated to result in additional achievement of 61% of MTP (81% minus abatement achieved by FFBC to 2017).

4.6.27 The additional 61% achievement of MTP equates to annual abatement of 260 ktCO<sub>2e</sub> from 2018, or 2.6 MtCO<sub>2e</sub> cumulatively between 2018 and 2027. As the measures are essentially extensions to FFBC they also result in lower overall costs to the private sector of around £240 million (undiscounted) over the period 2018-2027. Cost to Government of the requisite monitoring and enforcement regime is as yet unknown.

Table 26: Abatement Potential and Costs of 90% Uptake of Fertiliser Efficiency Measures, 2018-2027

	Annual emissions abatement (ktCO <sub>2e</sub> )	Annual total costs (£m)
2018	260	0.4
2019	260	0.4
2020	260	0.4
2021	260	0.4
2022	260	0.4
2023	260	0.4
2024	260	0.4
2025	260	0.4
2026	260	0.4
2027	260	0.4

4.6.28 The incorporation of 90% uptake of fertiliser efficiency measures is currently a proposal, and its introduction as a mandatory policy would be dependent on the degree to which the industry has taken forward these fertiliser efficiency measures on a voluntary basis.

## **Additional Proposals Post-2020**

4.6.29 It is very difficult to determine factors such as the rate of technological change and how this will affect farming practices in the time period to 2027. An additional uncertainty is the price of key inputs, such as oil. However, it is anticipated that farming methods will progress and it is more than likely that the price of oil based inputs (including fertiliser) will continue to rise due to resource constraints and population growth.

4.6.30 Some measures which seem impractical or unacceptable by the farming industry today could become widespread in the next decade. Although impossible to predict, a judgement can be made of which measures may be implemented post-2020. There is no commitment from the Government to deliver these 'possibilities' by 2027, however it is reasonable to expect that these measures will be more feasible by 2020 and that they will be taken up by the industry to some extent.

4.6.31 Further analysis was commissioned through the Centre of Expertise for Climate Change (ClimateXChange) to seek advice on additional measures that could offer abatement in the future. This work identified precision farming as a potentially cost effective measure, providing that the cost of technology falls to a pre-determined level.

4.6.32 It is also suggested here that other 'expensive' measures may become more viable by 2020. For example, anaerobic digestion, which is assumed will reduce in price sufficiently to make it viable for a small number of large and medium farms after 2020. Also, the use of biological fixation, which currently has a large yield cost, might experience a reduction in costs through introduction of new species and better understanding of effective implementation techniques on the farm.

4.6.33 Assumptions have also been made on how uptake for livestock management could change for measures that are in FFBC but currently have relatively low associated uptake estimates. Improved breeding for productivity (beef and dairy) and fertility (dairy) are likely to become more established in normal practice over time, and it is anticipated that the benefits of adding maize to silage will also become better understood and more widely implemented. For these reasons, beyond 2020, it is predicted that uptake will increase to around 50%.

4.6.34 The combination of precision farming, anaerobic digestion, biological fixation and increased uptake for livestock management measures could contribute to approximately 310 ktCO<sub>2</sub>e of additional abatement in 2027. The financial costs from these measures currently outweigh the financial benefits (costs of £305 million in 2027 against financial benefits of £51 million). The prices of key inputs and technology between now and the period 2020-27 will be the main determinant of the scale of adoption of these measures, and these factors are largely outside the control of policy makers.

Table 27: Abatement Potential and Costs of Additional Proposals Post 2020, 2020 - 2027

	Annual emissions abatement (ktCO <sub>2</sub> e)	Annual total costs (£m)
2020	310	305
2021	310	305
2022	310	305
2023	310	305
2024	310	305
2025	310	305
2026	310	305
2027	310	305

## Peatland

### Accelerated Restoration of Degraded Peatland

4.6.35 Since 1990, on average 1,000 hectares of peatland have been restored per year. Through better co-ordination of effort and increased funding this proposal increases restoration levels to up to 20,000 hectares per year. This could give an annual abatement by 2027 in the range 0.47 – 0.58 MtCO<sub>2</sub>e per annum, which would continue to increase as the peatlands recover.

4.6.36 The abatement consists of two elements. First, restoration prevents further degradation and oxidation of soil carbon. Secondly, as peatland recovers, it can again become a carbon sink as mosses (Sphagnum) absorb carbon in their growth which, over time, is accumulated in the peat layer. Counteracting the emission savings there is an initial spike in methane emissions caused by anaerobic digestion of re-wetted peat – this may offset the emissions savings by 10-20% in the early years. There is considerable uncertainty regarding these numbers.



4.6.37 Both the scope for emission reductions and the financial costs of peatland restoration are highly uncertain, since so much depends upon the level of intervention required, remoteness and terrain. We have assumed an average cost of £880 per hectare. The proposal is based on the assumption that different types of peatland are being treated simultaneously and costs decrease over time when the whole available area of some types of peatland has been restored. Emissions abatement is low for newly restored areas but increases as the peatland recovers.

Table 28: Abatement Potential and Costs of Accelerated Restoration of Degraded Peatland, 2013-2027

	Annual emissions abatement (ktCO <sub>2</sub> e)	Annual total costs (£m)
2013	0	19
2014	9	18
2015	25	17
2016	47	16
2017	73	16
2018	104	16
2019	139	16
2020	177	16
2021	218	16
2022	263	16
2023	309	16
2024	358	16
2025	410	13
2026	462	13
2027	515	13

## Forestry

### Increase Afforestation Rate to 10 khpa

#### Methodology for Estimating Emissions Abatement Potential and Costs of Increasing the Afforestation Rate

4.6.38 The Scottish Ministers have a target to increase woodland cover by 100,000ha in the period to 2020 (WEAG, 2012). This requires woodland planting rates to increase to an average of 10,000 hectares per year (ha/yr).

4.6.39 For comparison, the average new planting rate between 1998 and 2010 was just over 6,500 ha/yr (rates fell during this period), so current policy requires a significant increase in planting rates.

4.6.40 The increased planting rate will be backed by grant support to private land-owners and will also include further plantings on the National Forest Estate. There will also be stakeholder engagement to remove barriers and ensure that new woodlands are appropriately cited and designed.

4.6.41 Woodland expansion needs to be integrated with agricultural production and other land management objectives. On the basis of private returns, where emission from agricultural activity or the sequestration of carbon dioxide by trees are not valued and not part of the private decision making process, greater profits are usually derived from agricultural production. However, taking into account wider societal costs and benefits (from the emission of greenhouse gases and the sequestration of CO<sub>2</sub>) brings the returns from the two enterprises closer together, particularly on more marginal land where the returns from agricultural production are lower, and paying a grant to encourage the planting of woodland is one way of bringing the wider societal benefits into the private balance sheet.

4.6.42 Based on an assumed constant rate of planting of 10,000 ha per annum, this will lead to lifetime emissions savings of 4.8 MtCO<sub>2</sub>e by 2027 and impose costs of up to £60 million per annum in 2027.<sup>67</sup>

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<sup>67</sup> <http://www.forestry.gov.uk/scotland>

Table 29: Abatement Potential and Costs of Increasing the Annual Planting Rate to 10,000ha, 2013-2027

	Annual emissions abatement (ktCO <sub>2</sub> e)	Annual total costs (£m)
2013	15	36
2014	16	41
2015	45	47
2016	92	49
2017	144	51
2018	195	53
2019	248	54
2020	310	56
2021	373	57
2022	435	58
2023	477	58
2024	529	59
2025	582	60
2026	634	60
2027	687	60

### Wood First - Timber Construction Programme

4.6.43 Increasing the use of timber in construction will bring about carbon benefits through sequestration of the harvested wood products and the substitution impacts of replacing more energy intensive materials such as steel, brick and block, and concrete.

4.6.44 Planning authorities would require developers to adopt a Wood First approach i.e. to consider timber as the first choice building material for a development and only specify other, more carbon intensive materials if timber is unsuitable. This approach could build upon the recent local planning guidance on the use of home grown timber in construction which has been adopted by a number of local authorities in Scotland.

### Methodology for Estimating Emissions Abatement Potential and Costs of Wood First

4.6.45 The models used in Scotland are relatively crude in terms of estimating carbon savings from increased use of Scottish (home-grown) timber in construction. Work is ongoing to improve these models and their accuracy/sensitivity.

4.6.46 Much of the timber used in construction in Scotland comes from other parts of Europe, in part, for historical reasons. Because these timber products are harvested from forests abroad it is likely that the carbon savings from the use of harvested wood products such as construction timber will be accounted against the emissions inventory in the country in which the tree grew.

4.6.47 Likewise in relation to substitution benefits, where timber substitutes for e.g. steel or concrete, a saving will only show up in Scotland's emissions inventory if the concrete or steel was produced here and there was a saving because that steel or concrete was not now used.

4.6.48 This policy would bring real carbon savings globally from greater stored carbon and substitution of more carbon intensive construction products such as concrete and steel. But the allocation of the carbon savings in emissions inventories will be dependent on where the product was produced.

4.6.49 Timber in construction is a low cost carbon abatement technology. There is no cost penalty in construction costs for the use of timber frame for new housing. For cross-laminated timber (CLT), anecdotally, the total build costs are similar to traditional methods of construction, with the higher costs of CLT balanced by reduced construction times.

4.6.50 In terms of realising an increased use of timber in low carbon construction, alongside reviewing the role of planning, building standards and design, investment (largely private sector) in CLT production facilities using Scottish timber may offer an opportunity for significant market development. In this case an investment in two new plants of around £40 million by 2022 and around a further £10 million by 2025 to expand production capacity, could potentially achieve cumulative abatement of around 600 ktCO<sub>2</sub>e by 2027.

Table 30: Abatement Potential and Costs of the Timber Construction Programme, 2013-2027

	Annual emissions abatement (ktCO <sub>2</sub> e)	Annual total costs (£m)
2013	0	0
2014	0	0
2015	0	0
2016	0	0
2017	0	0
2018	0	0
2019	0	0
2020	0	0
2021	0	0
2022	89	40
2023	89	0
2024	89	0
2025	89	10
2026	125	0
2027	125	0

**Additional Technical Potential in Peatland Restoration and Woodland Creation**

4.6.51 Our sensitivity analysis suggests that there is an additional abatement potential of approximately 0.75 Mt by 2027 associated with a package of low carbon land use policies from measures such as peatland restoration and woodland creation (e.g. Woodlands In and Around Towns).

Table 31: Additional Technical Abatement Potential in Rural Land Use, 2025 - 2027

	Annual emissions abatement (ktCO <sub>2</sub> e)
2025	250
2026	500
2027	750





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