

# 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.

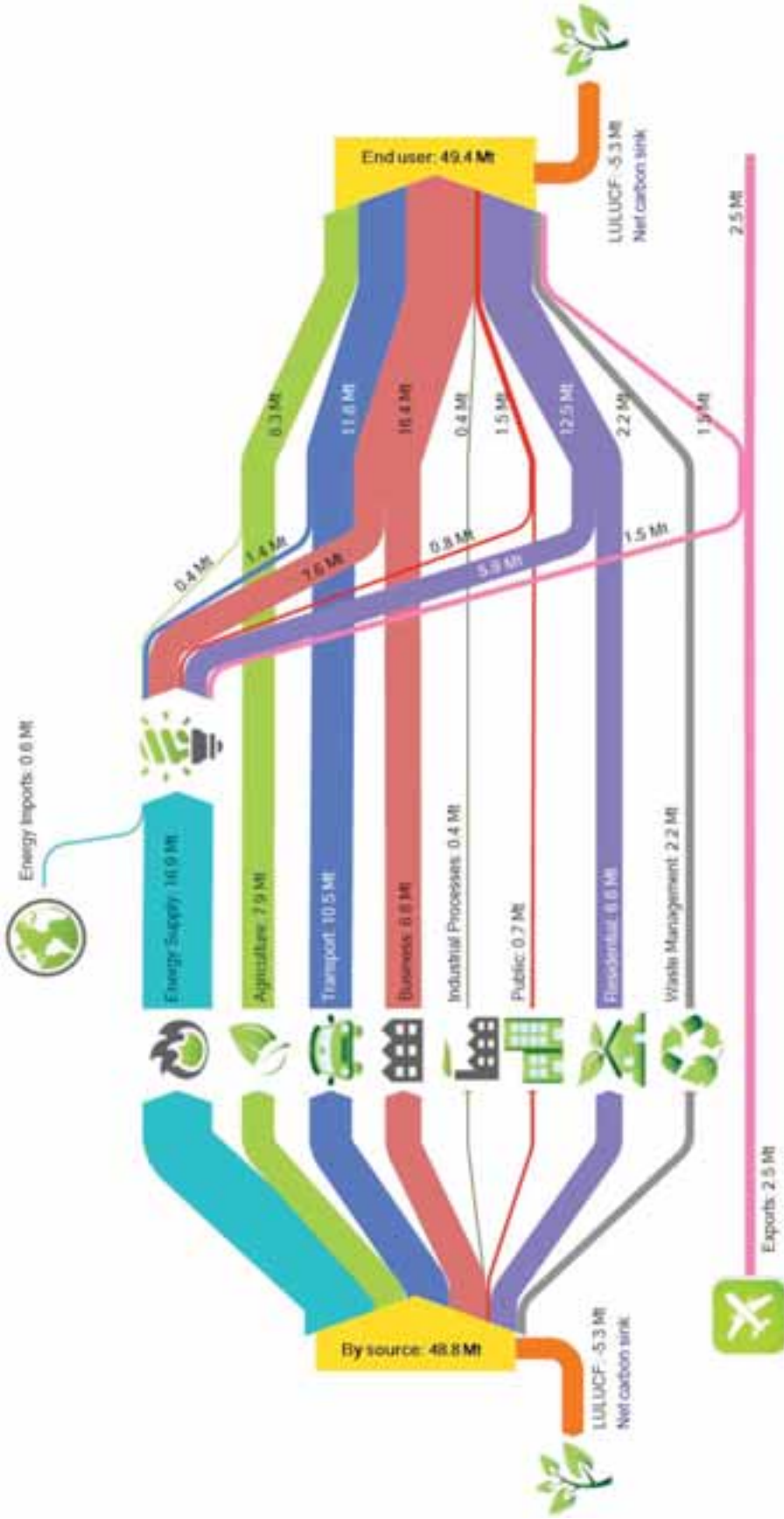
4.3.2 Emissions in the energy supply sector are dominated by installations within the EU ETS, with 94% of energy supply sector emissions in 2011 covered by these EU wide arrangements. As noted earlier in this document (section 2.10), this sector and the other emissions-intensive industries in the ETS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

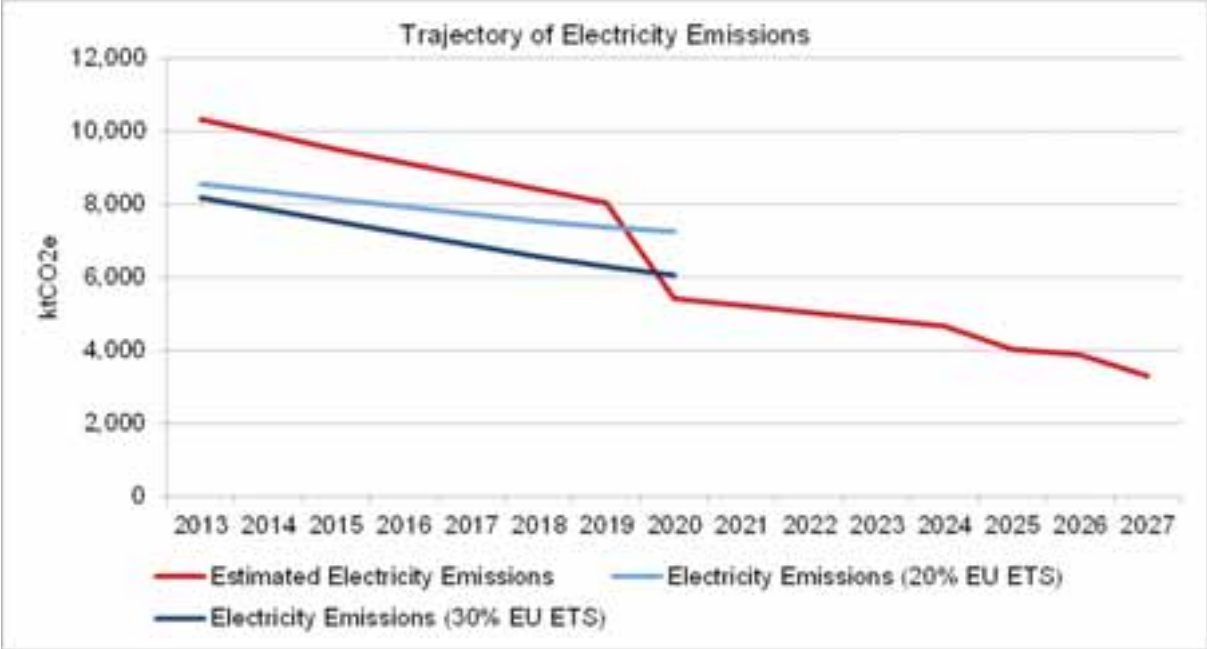
4.3.6 RPP1 outlined that the Net Scottish Emissions Account (NSEA) will track the trajectory of EU ETS emissions rather than Scottish territorial emissions from power generation. This means that a large proportion of Scotland's emissions are assumed to fall on a pre-determined trajectory, irrespective 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



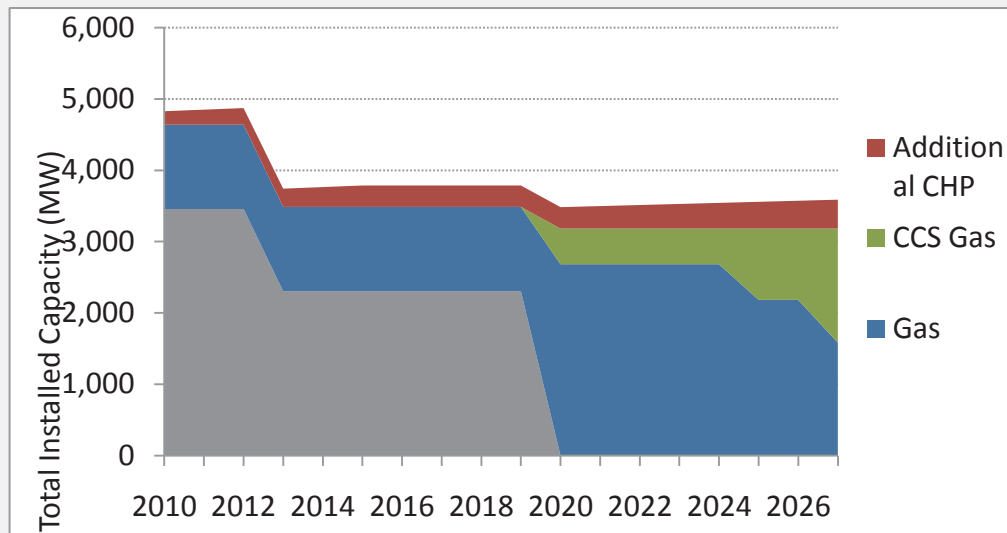
4.3.10 Overall our assessment is that, by 2020, emissions from Scotland’s electricity sector will be substantially lower than today and be broadly in line with the pathway of emissions under the ETS 30% scenario.

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 1600 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>