



National Audit Office

REPORT BY THE  
COMPTROLLER AND  
AUDITOR GENERAL

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Department of Energy and Climate Change

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# The government's long-term plans to deliver secure, low carbon and affordable electricity

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National Audit Office

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Department of Energy and Climate Change

# The government's long-term plans to deliver secure, low carbon and affordable electricity

Report by the Comptroller and Auditor General

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Amyas Morse  
Comptroller and Auditor General  
National Audit Office

25 June 2012

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This report can be found on the National Audit Office website at [www.nao.org.uk/electricity-landscape-2012](http://www.nao.org.uk/electricity-landscape-2012)

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## Key facts

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**21%**

of existing generating capacity scheduled to close by 2020

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**146m**

tonnes of carbon emissions were created by the electricity sector in 2011

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**£110bn**

the Department's estimate of the investment in electricity infrastructure needed up to 2020

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- 27 per cent** of the UK's total greenhouse gas emissions in 2011 came from electricity generation
- 90 gigawatts** total generating capacity of the electricity system in Great Britain as at December 2010
- 30 gigawatts** new generating capacity potentially required by 2020, to provide new low carbon sources of generation, replace closing power stations and to meet new demand
- £75 billion** the Department's estimate of the investment required in new generating capacity by 2020
- £35 billion** Ofgem estimate of the investment required in the networks that connect sources of electricity generation to end users
- £100** projected annual saving in 2020 in the average household's annual electricity bill from government interventions to support energy and climate change policy
- £302,000** projected increase in electricity bills for medium-sized businesses in 2020 resulting from government interventions to support energy and climate change policy

# Introduction

**1** Electricity is a critical national resource on which the economy and civil society depend. The Department of Energy and Climate Change (the Department) has overall responsibility within government for the delivery of UK climate change commitments. It is also responsible for energy policy and within this for the electricity sector in Great Britain. The policy and regulatory framework for electricity in Great Britain has created a market that for many years has provided a secure and reliable supply. The Department is facing several major new challenges in achieving the government's long-term energy security, affordability and climate change goals. For electricity this means:

- **Security of supply** Twenty-one per cent (19 gigawatts) of existing generating capacity is scheduled to close during the next decade. A major new programme of infrastructure construction will need to be financed and delivered to avoid an increased risk of power cuts.
- **Carbon emissions** Electricity generation created 146 million tonnes of carbon dioxide and 27 per cent of the UK's greenhouse gas emissions in 2011.<sup>1</sup> This could potentially increase as a result of greater use of electric vehicles and heating. The Department has therefore identified that electricity needs to be largely decarbonised during the 2030s to achieve the long-term statutory target to reduce UK greenhouse gas emissions. The Department estimates that around £110 billion investment is required in low carbon generation and network infrastructure by 2020.
- **Affordability** Electricity prices are likely to rise, owing to forecast increases in fossil fuel prices and wholesale electricity costs, government policies and the investment in infrastructure that is required. The impact of price rises on consumers will depend on the extent to which they improve their energy efficiency.

<sup>1</sup> Provisional estimate published in March 2012.

2 To address these challenges, successive governments have made interventions in the electricity market. The current government has proposed further measures which would represent major reforms to the electricity market and carry significant delivery risks. This memorandum for the Committee of Public Accounts describes the challenges the Department is seeking to address, its strategy and policy delivery for Great Britain. It does not address the measures taken by the devolved governments.<sup>2</sup> It does not provide a conclusion on the value for money of the government's interventions, which the National Audit Office may review and report to Parliament in future studies. This memorandum provides context for future National Audit Office work and for future scrutiny by the Committee and covers:

- risks to delivering secure, low carbon and affordable electricity (Part One);
- the 'pathways' the Department has developed to illustrate how generating technologies could develop up to 2050, and the options, uncertainties, trade-offs and costs involved (Part Two);
- interventions in the electricity market and the reforms that the Department has identified as necessary to secure new investment in low carbon technology (Part Three); and
- the Department's management of its complex portfolio of interventions in the electricity market (Part Four).

2 Audit Scotland reported in December 2011 on Reducing Scottish greenhouse gas emissions, available at [http://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)



# Part One

## The risks to delivering secure, low carbon and affordable electricity

**1.1** Delivering secure, low carbon and affordable electricity is a strategic policy priority for the Department. In this part of the memorandum we introduce:

- the Department's existing approach and future risks to security;
- the government's policy to reduce greenhouse gas emissions by at least 80 per cent compared to 1990 levels by 2050; and
- the Department's definition of affordability.

### Security

**1.2** The security of electricity supplies depends, in the short term, on having sufficient fuel and generating capacity and balancing supply with demand to avoid power interruptions. The longer-term resilience of supplies depends on the market building, maintaining and operating sufficient new generating and network infrastructure.

**1.3** The Department sets policy for the electricity sector in Great Britain. Ofgem regulates the electricity market and in fulfilling its statutory duties seeks to promote competition between electricity suppliers and between electricity generators. Increased demand should lead to wholesale price rises that incentivise generators to build new capacity. Generators take commercial decisions on when to invest and in which type of power plant. Private sector companies manage the network infrastructure that distributes electricity to consumers and Ofgem uses regulatory interventions to ensure these companies invest efficiently and in a timely way in the network (**Figure 1** overleaf).<sup>3</sup>

<sup>3</sup> Further information on the existing market is set out in National Audit Office's (July 2010), *The Electricity Generating Landscape in Great Britain*, available at [http://www.nao.org.uk/publications/1011/electricity\\_generating.aspx](http://www.nao.org.uk/publications/1011/electricity_generating.aspx)

**Figure 1**  
The electricity market in Great Britain

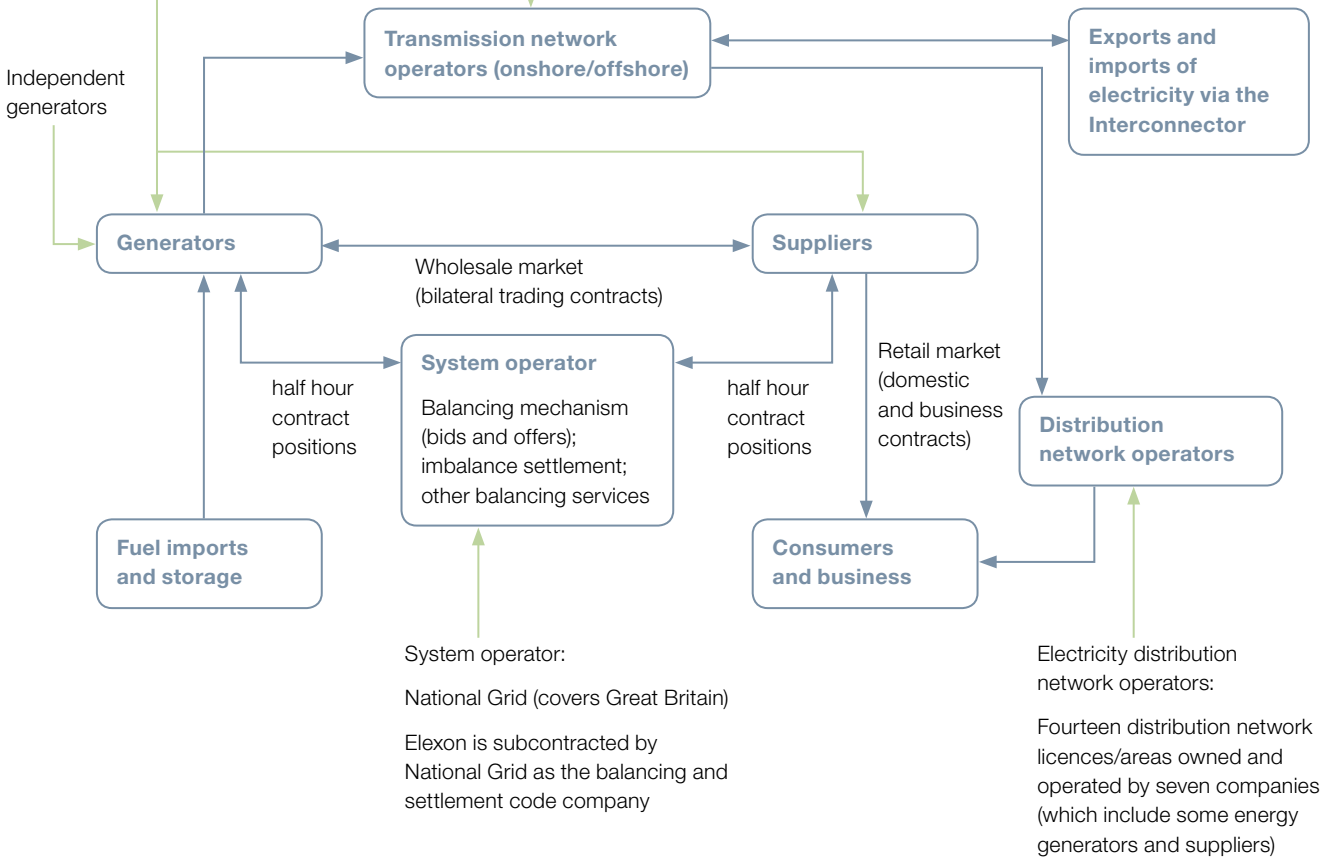
The electricity market comprises generators, suppliers and the companies that operate the network and balance the system

Energy generation and supply (the 'big six'):

- EDF (French)
- E.ON (German)
- RWE (German)
- Iberdrola (Spanish)
- Centrica (UK)
- Scottish and Southern (UK)

Electricity transmission high voltage networks:

- National Grid (England and Wales)
- Scottish and Southern (North Scotland)
- Scottish Power (South Scotland)
- Northern Ireland Electricity
- Offshore transmission operators (emerging market)

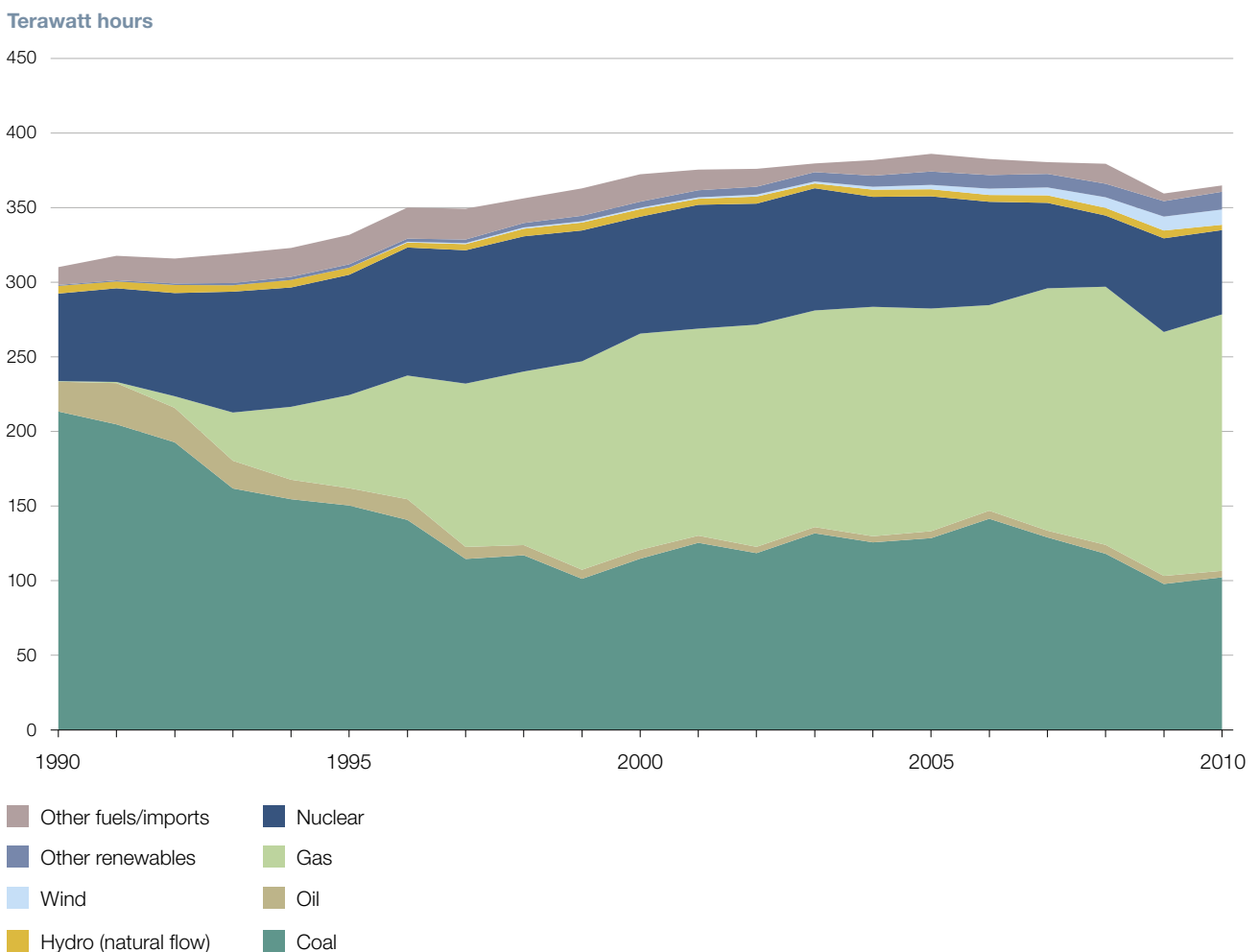


Source: National Audit Office

**1.4** Gas and coal-fired power stations supply most of Britain's electricity (**Figure 2**). However, 19 gigawatts, or 21 per cent of the 90 gigawatts of existing generating capacity, are scheduled to close over the next decade. This includes eight of Britain's nine nuclear power stations, which are due to reach the end of their operating lives between 2014 and 2023. It also includes some 12 gigawatts of fossil-fuel power stations, of which 8 gigawatts are coal-fired, which will have to close by the end of 2015. This is because these stations have opted out of the EU Large Combustion Plant Directive, which established limits on emissions of sulphur dioxide, nitrogen oxides and dust. The Department's central estimate is that there will be 92 gigawatts of electricity generating capacity in Great Britain in 2020. Taking account of scheduled and additional closures of power stations, for example for commercial reasons, the Department estimates that 30 gigawatts of new capacity will be needed by 2020.

**Figure 2**  
Trends in electricity source by fuel type, 1990 to 2010

Over the last two decades, most electricity has been produced using coal and gas



Source: Department of Energy and Climate Change, Energy in Brief 2011

## Carbon emissions

**1.5** As well as securing reliable electricity, the Department must meet EU targets to supply 15 per cent of energy from renewable sources by 2020 and an indicative national energy savings target of 9 per cent of final inland energy consumption by 2016 compared to the average during 2001-05. The Department also has a target to reduce greenhouse gas emissions in line with the UK's international commitment. The target, which was established by the Climate Change Act 2008, is to reduce greenhouse gas emissions by 34 per cent from 1990 levels by 2020 and by at least 80 per cent compared to 1990 levels by 2050. Under the Act, interim targets have been established through 'carbon budgets', which cap greenhouse gas emissions over five-year periods, currently up to 2027. The rate of decarbonisation established through the carbon budgets is informed by the advice of the Committee on Climate Change as provided for under the Act.

**1.6** Other countries are also acting to reduce greenhouse gas emissions. The EU has a target to reduce greenhouse gas emissions to 20 per cent below 1990 levels by 2020 and aims to reduce greenhouse gas emissions by between 80 per cent and 95 per cent by 2050 compared to 1990 levels. Germany has set itself a target to reduce greenhouse gas emissions by 40 per cent by 2020 and 80 per cent by 2050 compared to 1990 levels. France's targets are 20 per cent by 2020 and 75 per cent by 2050.

**1.7** By 2011, UK carbon dioxide emissions<sup>4</sup> from electricity generation had reduced from the 1990 baseline by 28 per cent.<sup>5</sup> This was largely due to a switch within the electricity sector from coal-fired to gas-fired power stations and an increase in the percentage of electricity supplied from renewable sources to 9.5 per cent.<sup>6</sup> However, coal and gas-fired power stations are still the main source of electricity supplies. Around 75 per cent of all new generating capacity built in the last two decades has been provided by gas-fired power stations.

**1.8** To meet the government's greenhouse gas emission reduction targets to 2050 the Department considers electricity generation needs to be largely decarbonised by the 2030s. The Department has concluded that existing measures do not attach a high enough market price to carbon to incentivise decarbonisation and so further measures are required.

**1.9** Large-scale electricity infrastructure takes many years to plan, design and build and therefore requires early action to ensure timely investment. Power stations typically have a lifespan of between 30 and 60 years. Choices made in the next few years about replacing existing electricity infrastructure will therefore have long-term implications for emissions from electricity generation and maintaining secure and affordable supplies.

<sup>4</sup> Carbon dioxide is the main greenhouse gas.

<sup>5</sup> Provisional estimate published in March 2012.

<sup>6</sup> Department of Energy and Climate Change, Energy Trends, March 2012. The latest available statistics for 2010 show that 3.3 per cent of all energy consumption came from renewable sources.

## Affordability

**1.10** The Department's approach to affordability is to provide for secure and low carbon electricity at the least cost to bill payers, the exchequer and the economy. It also has a legal obligation to tackle fuel poverty and so must take into account how costs are distributed across different parts of society and the economy.

**1.11** The Department has estimated that £110 billion of investment in the electricity sector will be required up to 2020. Of this figure, £75 billion is for generating capacity and £35 billion for investing in the network.<sup>7</sup> During the 2020s, industry will need to invest a similar level to deliver secure electricity supplies and reduce greenhouse gas emissions further. These costs will ultimately be passed on to domestic consumers and business. There will also be some costs to the exchequer through direct support for the development and demonstration of low carbon technologies. The estimated costs to the economy of meeting government policy objectives for electricity are set out in published impact assessments for individual policy measures.

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## Issues for discussion

This part of the report has described the scale of the challenge associated with meeting the government's three policy objectives for electricity. Key issues for discussion include:

- options for achieving the Department's long-term policy goals for electricity, which we examine in Part Two;
  - existing and proposed government interventions in electricity markets and the cost implications, which we examine in Part Three; and
  - the Department's management of delivery, which we examine in Part Four.
- 

<sup>7</sup> Estimates from the Department of Energy and Climate Change's modelling and Ofgem's Project Discovery.

## Part Two

### Pathways to 2050

**2.1** The Department has concluded that to deliver the policy to reduce UK greenhouse gas emissions by at least 80 per cent by 2050 against 1990 levels it is necessary to largely decarbonise electricity supplies. There are several ways in which this could be met. Each option involves constraints, trade-offs, uncertainties and costs. In this part of the report, we examine:

- the illustrative pathways that the Department has developed to inform debate on how the 2050 target could be met;
- implications for the electricity sector;
- uncertainties involved in decarbonising electricity; and
- the possible economic costs of meeting the 2050 target.

#### **The Department's energy pathways modelling identifies a range of ways in which electricity could be decarbonised**

**2.2** It is not possible to predict what the electricity sector will look like in 2050 or how technology will develop. The Department has, however, modelled a series of illustrative 'pathways' for the energy system to inform debate about how the 2050 target for reducing greenhouse gas emissions could be met. It has also published an online 'calculator' for people to model technology options and identify their implications for greenhouse gas emissions and costs. The Department is updating the calculator to include the latest data sources and assumptions.<sup>8</sup>

**2.3** The Department's analysis identified numerous possible pathways to 2050 for electricity supplies. **Figure 3** shows four pathways that achieve the 2050 target and are based on the target to supply 15 per cent of renewable energy by 2020 being met. It also shows how they compare with the position in 2011 and a scenario where policies to tackle climate change are not pursued. The Department estimates that if policies to tackle climate change are not pursued and electricity generation continues to be dominated by fossil fuel plants, total UK greenhouse gas emissions could be 19 per cent higher in 2050 than in 2010 and more than four times the target level of 160 million tonnes.<sup>9</sup>

<sup>8</sup> For further information on the online calculator visit: [http://www.decc.gov.uk/en/content/cms/tackling/2050/calculator\\_on/calculator\\_on.aspx](http://www.decc.gov.uk/en/content/cms/tackling/2050/calculator_on/calculator_on.aspx)

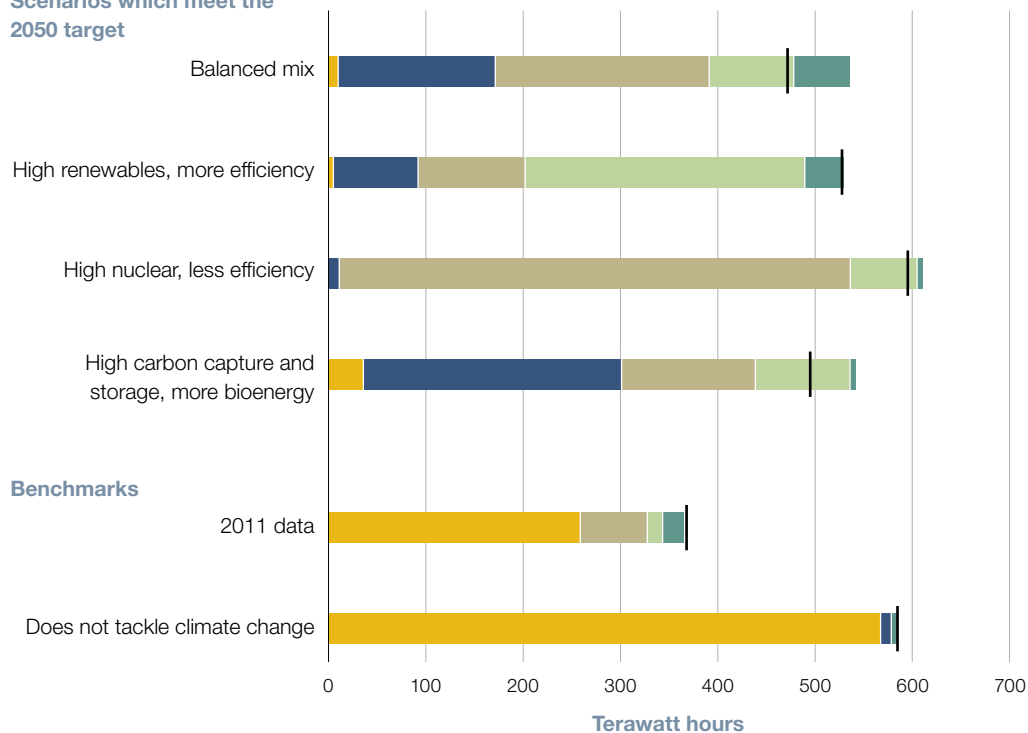
<sup>9</sup> The 2010 figure is based on the UK National Inventory Report 1990-2010, April 2012, and includes UK international aviation and shipping emissions.

### Figure 3

Sources of electricity supply in different 2050 scenarios in terawatt hours

Four scenarios illustrate possible balanced and technology specific options. The Department has not identified a preferred approach

#### Scenarios which meet the 2050 target



- Hydroelectric, tidal, wave and solar
- Wind
- Nuclear
- Carbon capture and storage
- Unabated coal, gas and biomass
- Generation net of imports/exports

#### NOTES

- 1 Three of the pathways envisage electricity exports at times of excess supply.
- 2 Pathways have different levels of energy efficiency and electrification of heating and transport, resulting in different total demand.
- 3 2011 data are provisional estimates.

Source: National Audit Office analysis of 2050 Calculator and Energy Trends (2012)

**2.4** The Department has identified specific advantages and trade-offs for each low carbon pathway in Figure 3:

- The 'balanced mix'<sup>10</sup> scenario supports the security objective by providing a diverse range of supplies. In the Department's assessment this is the least cost scenario.
- The high renewables with more energy efficiency scenario could provide security by reducing reliance on imported fuels. It would be a viable pathway if significant innovation reduced the cost of renewable technologies. It would, however, require some combination of additional backup generating capacity, such as gas-fired power stations, storage capacity and electricity from interconnections to other countries (**Figure 4**).
- The high nuclear scenario with less energy efficiency would be an alternative, particularly if there were no innovation bringing down the cost of renewable technologies and carbon capture and storage, and if there were low take-up of energy efficiency measures. However, nuclear power stations cannot cost-effectively respond quickly to variations in demand and so gas-fired back up capacity, storage capacity or interconnection to other countries would be required. The Department does not expect the first new nuclear power station to be available until 2019 at the earliest.
- The commercial carbon capture and storage<sup>11</sup> with more bioenergy and medium energy efficiency scenario supports security of supplies by providing a more balanced mix than the high nuclear scenario. This scenario would be viable if low-cost fossil fuel and bioenergy were available, for example due to shale gas production. Biomass production for use in electricity generation with carbon capture and storage also absorbs carbon emissions. It is unlikely that commercial-scale carbon capture and storage for electricity generation will be possible until the 2020s, and only if the technology is proven to work commercially at scale.

**2.5** Different scenarios involve different trade-offs. The Department has chosen not to set specific capacity targets for individual technologies as it believes that diversity and competition between technologies will deliver the most cost-effective solutions. However, using modelling commissioned from the consultants Redpoint Energy, the Department has estimated that by 2030, nuclear power stations could contribute up to 20 gigawatts of electricity generating capacity. Fossil fuel generation, with carbon capture and storage, could contribute up to 10 gigawatts and renewable sources could contribute up to 50 gigawatts, depending on costs and build rates.

<sup>10</sup> This refers to the core MARKAL scenario in the Carbon Plan.

<sup>11</sup> Carbon capture and storage is a three-part process that involves capturing the carbon dioxide produced from burning fossil fuels, transporting it to a storage site, and permanently storing it under pressure, usually underground.

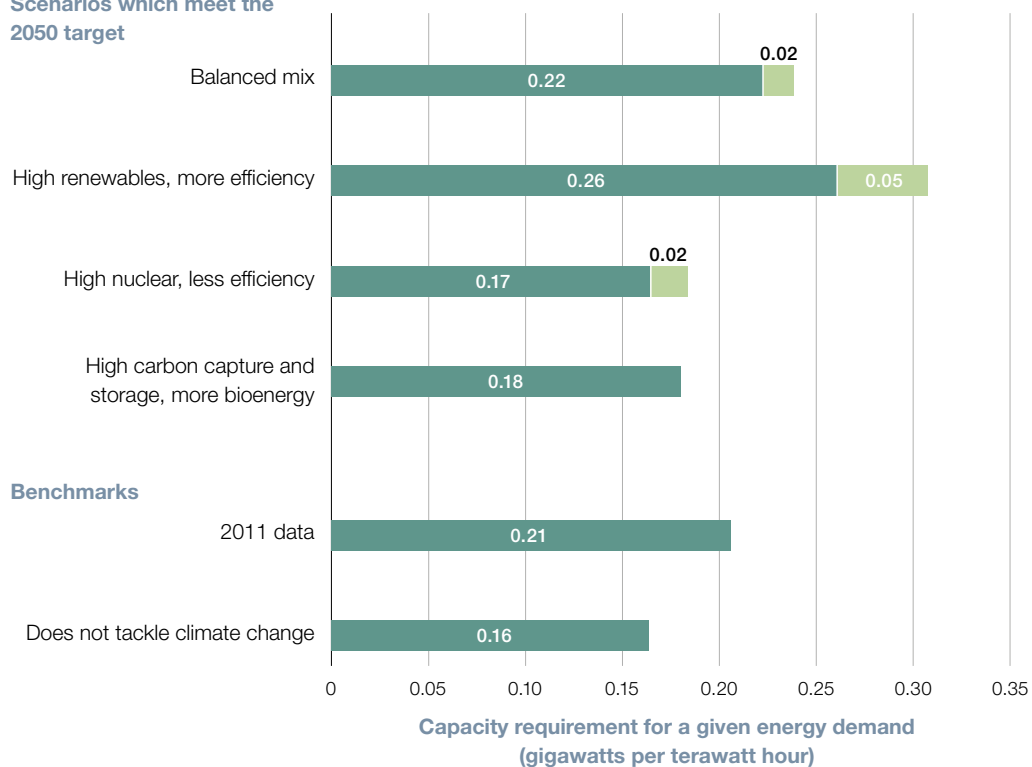


### Figure 4

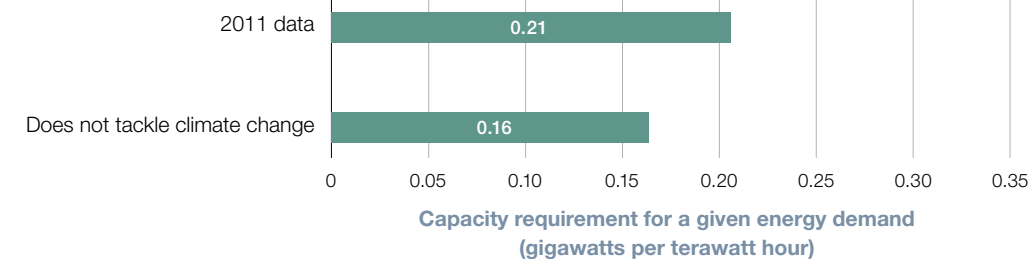
The need for backup capacity varies across pathways

The high renewables with more efficiency scenario requires the most capacity overall, including backup capacity

#### Scenarios which meet the 2050 target



#### Benchmarks



- Usual variability
- Backup under stress test

#### NOTE

1 The backup capacity in these scenarios is based on stress tests of what would be required if there were five consecutive cold and almost windless days, with gas turbines providing the backup.

Source: Department of Energy and Climate Change 2050 pathways calculator

## The Department's pathways analysis identifies key steps towards achieving the 2050 greenhouse gas emissions reduction target

**2.6** The Department's pathways analysis suggests that certain actions must happen to meet the 2050 greenhouse gas emissions reduction target:

- **The supply of electricity must increase significantly.** Heating and transport will need to be largely electrified to meet the 2050 target. The pathways developed by the Department assume that, even with increased energy efficiency, demand for electricity increases by between 27 per cent and 60 per cent between 2010 and 2050 (**Figure 5**).
- **The electricity sector must be largely decarbonised during the 2030s.** Carbon dioxide emissions from electricity generation are currently in excess of 500 grams per kilowatt hour. In its modelling, the Department has used illustrative decarbonisation benchmarks of 100 grams and 50 grams per kilowatt hour in 2030, but these are not targets. The Committee on Climate Change has concluded that achieving a carbon intensity of electricity generation of around 50 grams per kilowatt hour by 2030 is likely to be more cost effective.<sup>12</sup> The Department is considering what could be required by 2030 and how best to achieve this, including whether and how further targets may be necessary. In developing its approach, the Department aims to address the need for flexibility in how carbon budgets are met so as to minimise the economic cost.
- **Networks will need to become bigger and more sophisticated.** Networks will have to carry more and increasingly variable electricity supplies due to an increase in intermittent renewable electricity and increased electrification of heating and transport.
- **The use of biomass and biofuels<sup>13</sup> will need to increase to reach the 2050 target.** This is particularly important for sectors such as aviation where electrification is impractical. Some pathways illustrate biomass being used to produce electricity with carbon capture and storage.
- **There will be an ongoing need for fossil fuels to supply electricity.** Their precise role in the longer term will depend on factors such as developing carbon capture and storage.

<sup>12</sup> Committee on Climate Change, *The fourth carbon budget – reducing emissions through the 2020s*, December 2010.

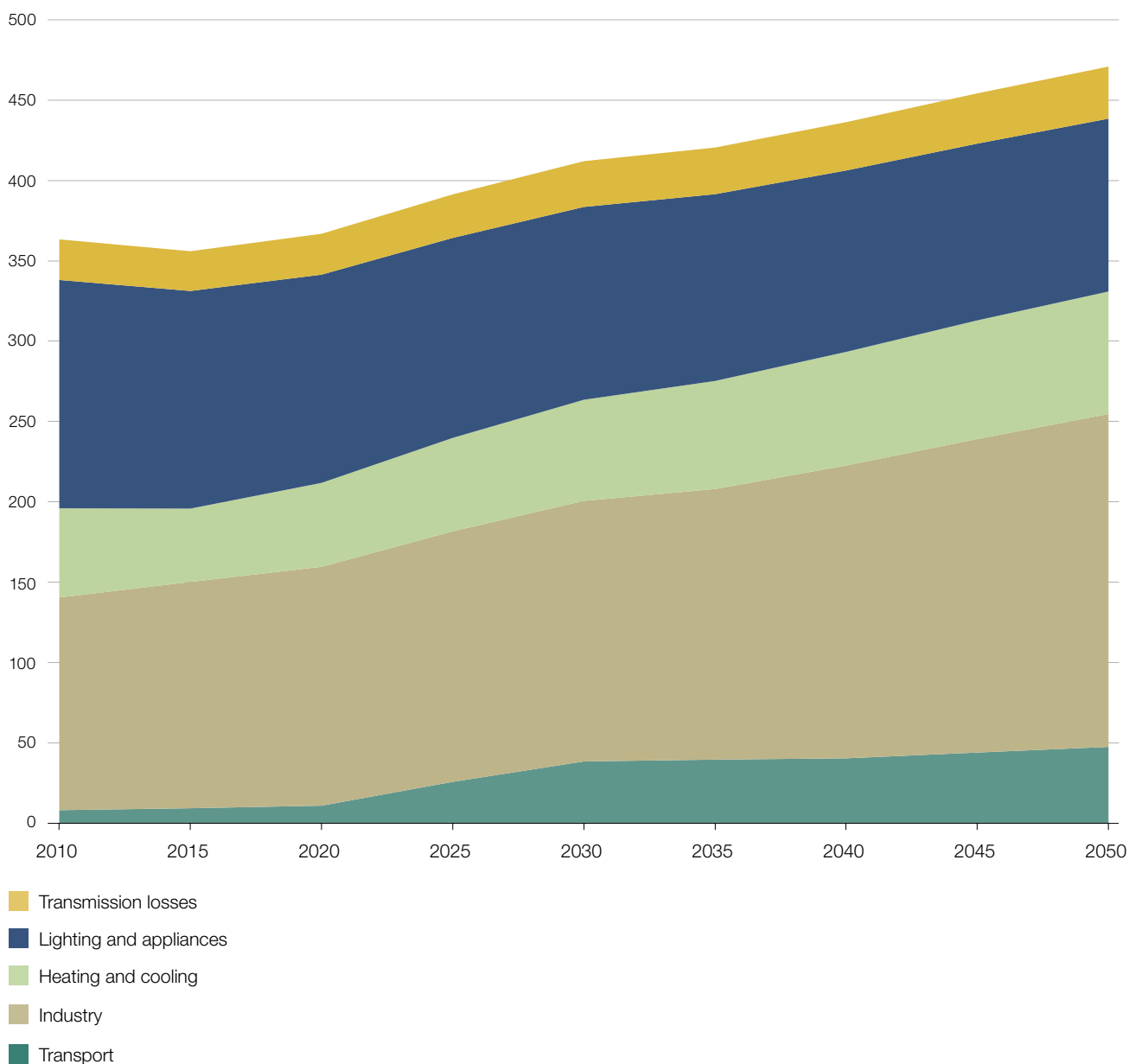
<sup>13</sup> Derived from living or recently living organisms.

### Figure 5

#### The Department's modelling of electricity demand to 2050

The chart shows growth in electricity use over the next 40 years, based on the 'balanced mix' scenario. Increased demand is largely due to the electrification of heating, industry and transport

#### Annual electricity use (terawatt hours)



Source: Department of Energy and Climate Change, 2050 pathways calculator

## Pathways analysis features many inherent uncertainties

**2.7** Modelling possible pathways for the electricity sector is difficult as it rests on uncertain assumptions about many interrelated factors. The Department recognises the uncertainties. Analysing a range of pathways using different models means that it is not relying on one approach. It also regularly tests key assumptions and its approach against those used by other bodies, such as the International Energy Agency and the Committee on Climate Change.

**2.8** Key uncertainties in the Department's modelling include:

- future demand;
- future developments in low carbon technologies; and
- the international context.

### Future demand and the capacity required

**2.9** Deciding on which new electricity infrastructure to build must allow for future trends in demand. The Department estimates that energy efficiency measures will need to reduce energy demand by between 30 per cent and 50 per cent per person. Overall, the Department's scenarios suggest that electricity demand could potentially increase by up to 60 per cent based on assumptions about future economic and population growth. This depends on how users respond to future increases in electricity prices, the impact of energy efficiency measures and the take-up of new technologies such as electric cars and heat pumps. Each of these assumptions is subject to considerable uncertainty and could reduce or increase the need for new generating capacity.

### Future technology developments

**2.10** Some potential pathways depend on developing low carbon generation and storage technologies further. For example, carbon capture and storage depends on a technology that has not yet been proven to work on a commercial-scale power station. The high nuclear scenario is based on the industry successfully building and operating new reactors at a very fast pace. The high renewables scenario would require developing existing and emerging renewable energy technologies and electricity storage technologies further as an alternative to backup generating capacity.

### The international context

**2.11** The direction that other countries take will affect the availability and price of fuel, the supply chains for key technologies and future technological development. The UK will need to respond to global companies' shifting priorities. For example, as at April 2012 there were 60 new nuclear power stations under construction worldwide and a further 150 planned. Increasing demand could put pressure on available resources for UK investment. There are a relatively small number of global companies that have the skills, capacity and

finance to build and operate new nuclear power stations.<sup>14</sup> RWE and E.ON announced in March 2012 that they had decided not to proceed with plans to build 6 gigawatts of nuclear generating capacity in Britain by 2025. This shows how individual companies can impact on potential pathways. The impact on international prices of any increases in fuel availability, for example through shale gas, will also be important.

## The cost of meeting the 2050 target

**2.12** Cost modelling commissioned by the Department indicates that on the basis of 'levelised costs' – a measure of the total cost of building and operating an electricity generating plant over its lifetime per megawatt hour of electricity it produces – nuclear power is potentially the cheapest (see **Figure 6** overleaf). There is a high degree of uncertainty within these estimates, which use assumptions about technology development costs and fuel inputs. Technology costs for carbon capture and storage and the new generation of nuclear reactors are particularly uncertain.

**2.13** Providing a comprehensive estimate of the cost of the pathways to 2050 is very challenging. Using the 2050 calculator, the Department has estimated that over the period to 2050, the total annual average cost per person of a substantially decarbonised energy system would range between £4,671 and £5,262 (in 2010 prices) across the four scenarios. This compares to a current energy system cost of £3,700.<sup>15</sup> The Department estimates that the equivalent cost if the UK does not tackle climate change will be £4,695. These figures include capital, operating, fuel and financing costs for the entire energy system, but exclude carbon prices and the economic impacts of climate change. They include many factors beyond electricity generation, such as modes of transport, heating fuels, insulation and industrial processes. These are indicative long-term projections of economic costs rather than assessments of the impact on bills. The Department uses other models to estimate the impact on electricity bills up to 2030, which we report on in Part Three.

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## Issues for discussion

This part of the report has described the Department's modelling of pathways to 2050 and the implications for the electricity sector to provide context for the government's interventions in electricity markets, which we examine in Part Three. Key issues for discussion include:

- the scale of the challenge;
  - pathways to 2050: scenarios or plans?
  - uncertainties and contingency; and
  - the economic cost of meeting the government's objectives.
- 

<sup>14</sup> National Audit Office, *The nuclear energy landscape in Great Britain*, April 2012.

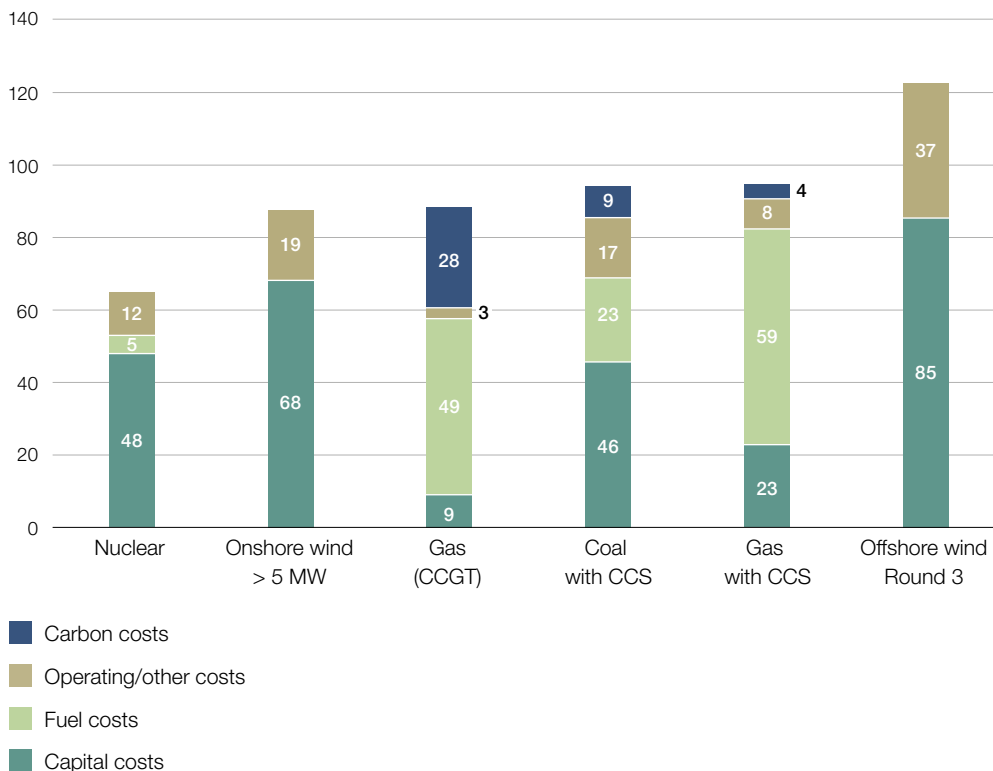
<sup>15</sup> Figures are from the June 2012 version of the calculator, available here: <http://2050-calculator-tool.decc.gov.uk>

**Figure 6**

Estimated levelised costs from 2011 for different technologies based on projects starting in 2017

The Department's analysis suggests that large-scale offshore wind farms are the most expensive technology, and nuclear power stations are the least expensive, but this is based on uncertain assumptions

£ per megawatt hour



**NOTES**

- 1 CCS is carbon capture and storage. Gas is combined cycle gas turbine (CCGT).
- 2 These cost estimates are mid-points of cost ranges and are for 'nth of a kind projects' starting in 2017 using a 10 per cent discount rate for all technologies.
- 3 The cost for nuclear power stations includes the cost of decommissioning.

Source: Parsons Brinckerhoff, Arup and Ernst and Young, available at [http://www.decc.gov.uk/en/content/cms/about/ec\\_social\\_res/analytic\\_projs/gen\\_costs/gen\\_costs.aspx](http://www.decc.gov.uk/en/content/cms/about/ec_social_res/analytic_projs/gen_costs/gen_costs.aspx)

## Part Three

### The government's interventions in the electricity market

**3.1** The government seeks to influence the electricity markets in Great Britain to reduce greenhouse gas emissions and maintain secure and affordable electricity supplies. Successive governments have introduced a range of policy instruments that impact on generators, the operators of the transmission and distribution networks that carry electricity from generators to end users, electricity suppliers and their customers. In this part of the report, we describe:

- government interventions;
- the Department's assessment of why further action is needed;
- the government's plans to reform the electricity market and invest in new and replacement networks, and the risks that must be managed; and
- the costs to consumers of the government's interventions.

#### Existing interventions in electricity markets

**3.2** Successive governments' measures incentivise security of supply, support energy efficiency investment, add the cost of carbon emissions to the cost of generation using fossil fuels, and encourage investment in generating renewable and low carbon electricity. The Department estimates the cost-effectiveness of individual policies in published impact assessments. These include quantifiable costs and benefits but exclude some impacts, for example, cost reduction as a result of support for innovation. The estimates in **Figure 7** overleaf show the relative cost-effectiveness of individual measures but are not directly comparable owing to the different assumptions and timescales used.

**Figure 7**

## The main interventions to reduce greenhouse gas emissions from electricity production

This chart shows the cost-effectiveness of interventions, where available, as measured by the cost per tonne of carbon dioxide emissions avoided

Scheme	Date introduced	Aim	Description	Cost per tonne of carbon dioxide emissions avoided (£) <sup>1</sup>	Delivery against other objectives
CRC Energy Efficiency Scheme	April 2010	Improved efficiency	Requires large organisations that are not energy intensive to report on and buy allowances for emissions of carbon dioxide. The government is currently consulting on simplifying the scheme and has committed to replace it with an environmental tax if it cannot produce significant savings.	-455	Reduced import dependency
Carbon Emission Reduction Target	April 2008	Improved efficiency	Requires licensed electricity and gas suppliers with a certain number of domestic customers (either individually or as part of a group of companies) to meet a carbon emissions reduction obligation, for example by installing insulation. This scheme is to be succeeded by the Energy Company Obligation.	-841 (this figure relates to the extension to the Scheme)	Reduced import dependency Reduced fuel poverty Increased innovation
Smart metering programme	Roll-out scheduled to start 2014	Improved efficiency	This programme requires suppliers to install smart electricity and gas meters in all UK households and smaller non-domestic premises by 2019. The meters provide detailed information on usage and prices and can support a wider range of tariffs. The Department estimates that it will help consumers reduce their electricity demand by 2.8 per cent.	-285 (domestic) -505 (non-domestic)	Reduced import dependency
Eco Design and Energy Labelling Directives	October 2009 and May 2010	Improved efficiency	Set minimum performance standards for the efficiency of a wide range of household and non-domestic products. The Department estimates that the first tranche of these measures will deliver annual savings of seven million tonnes of carbon dioxide by 2020 and cut consumer electricity bills by £850 million. A second tranche is being finalised at EU level.	Not available <sup>2</sup>	Reduced import dependency



**Figure 7** *continued*

The main interventions to reduce greenhouse gas emissions from electricity production

Scheme	Date introduced	Aim	Description	Cost per tonne of carbon dioxide emissions avoided (£) <sup>1</sup>	Delivery against other objectives
Green Deal and Energy Company Obligation	Starts October 2012	Improved efficiency	Enables private firms to offer consumers energy efficiency improvements to their homes, community spaces and businesses at no upfront cost, and recoup payments by charging instalments on the energy bill. Alongside the Green Deal, the Energy Company Obligation will set targets for energy companies that will make provision for support to low income and harder-to-treat homes.	-155	Reduced import dependency Reduced fuel poverty Increased innovation
EU Emissions Trading System	April 2005	Charging for carbon emissions	Requires large-scale industry to cap carbon dioxide emissions. Participants must purchase sufficient allowances to emit carbon dioxide to cover their verified emissions. A fixed number of allowances are issued.	Not applicable	Not applicable
Climate Change Levy and Climate Change Agreements	April 2001	Charging for carbon emissions	A tax on using energy in industry, commerce and the public sector, with exemptions for renewable energy and combined heat and power. Climate Change Agreements allow eligible energy intensive businesses to receive up to a 65 per cent discount from the levy, rising to 90 per cent for electricity in 2013, for meeting energy efficiency or carbon-saving targets.	Not available	Not applicable
Renewables Obligation	April 2002	Support for renewables	Obliges suppliers to supply an increasing proportion of electricity from renewable sources. The scheme is due to close to new applications from 2017 but will continue for existing participants until 2037.	Not available	Reduced import dependency Increased innovation
Feed-in tariffs	April 2010	Support for renewables	The scheme provides a fixed tariff for low carbon generators based on the amount of electricity they generate and further payments for any energy they do not use and 'export' to the electricity grid.	80	Reduced import dependency Increased innovation

**NOTES**

- 1 Includes the value of carbon emissions reductions due to reduced consumption of energy other than electricity.
- 2 The lead Department for this policy is the Department for Environment, Food and Rural Affairs.
- 3 Lifetime cost-effectiveness indicators are not directly comparable, as they have been calculated at different times, for different time periods, and involve different assumptions.

Source: Department of Energy and Climate Change

### Further interventions could reduce demand for electricity

**3.3** The Department considers that it may need to take further action to reduce demand for electricity. Using electricity more efficiently and avoiding waste reduces demand and the need to invest in new generating capacity. However, there are barriers to action. They include inertia, the 'hassle factor' and the up-front cost of investing in energy efficiency, as well as uncertainties about future prices and the financial benefits of investing in efficiency measures. This is particularly so for households and businesses whose electricity costs represent a small proportion of their spending. There is a further barrier for those in rented property, where landlords may not invest in energy efficiency as their tenants pay the electricity bills.<sup>16</sup>

**3.4** There are several measures that aim to overcome barriers to investing in energy efficiency and behaviour change. Consumers will be given better information on electricity consumption through the programme to install smart meters by 2019. The Department will also charge large organisations for their carbon emissions through the CRC Energy Efficiency Scheme.<sup>17</sup> Support for investing in energy efficiency will be provided through the Energy Company Obligation and the Green Deal will help consumers finance energy efficiency improvements. Introducing minimum performance standards for a range of consumer and industrial products under the Eco Design and Energy Labelling Directives is also designed to improve efficiency.

**3.5** The Department considers that it is on track to meet the UK's indicative domestic energy efficiency target but it could potentially do more to incentivise reductions in demand for electricity. The International Energy Agency has also concluded that potential for higher energy efficiency exists, particularly in the building sector.<sup>18</sup> As part of its market reform programme, the Department initiated the Electricity Demand Reduction Programme in 2011 to assess the scope for further initiatives to deliver permanent reductions in electricity demand. The Department aims to complete this work by summer 2012. It will also need to identify what is needed to implement the forthcoming EU Energy Efficiency Directive, which is due to come into force at the end of 2012.

### Existing measures will not deliver the required investment in new generating capacity

**3.6** The Department considers that existing measures will not deliver the required investment in new generating capacity. It estimates that to meet future demand for electricity, the private sector will need to invest £110 billion up to 2020 in new generating capacity and in the networks that link capacity to end users, with further significant investment in the 2020s. However, investors face a number of risks and uncertainties, as outlined below.

<sup>16</sup> Comptroller and Auditor General, *Programmes to reduce household energy consumption*, Session 2007-08, HC 1164, National Audit Office, November 2008.

<sup>17</sup> For further information, see National Audit Office, *The CRC energy efficiency scheme*, March 2012, available at: <http://www.parliament.uk/documents/TSO-PDF/committee-reports/crcenergy.pdf>

<sup>18</sup> International Energy Agency, *United Kingdom in-depth review 2012*, May 2012.

## Investing in low carbon technologies involves significant construction risk

**3.7** Nuclear power stations have high capital costs and long build times. For example, construction of the new power station that is being built in France using the same type of reactor that EDF intends to build in Britain started in 2005 and is not scheduled to finish until 2016, four years later than planned. This project is also around 80 per cent over budget.<sup>19</sup> The technical viability of carbon capture and storage for large-scale electricity generation is unproven and the Department has launched a new programme to support the development of the technology. There are significant construction risks involved in building offshore wind turbines.

## Availability of finance

**3.8** New nuclear power stations and large-scale offshore wind farms are costly to build. For example, research commissioned by the Department suggests that it costs around £10 billion to build a new nuclear power station with two 1.6 gigawatt reactors. New offshore wind projects could each cost more than £1 billion. Utility companies may not be able to provide all of the finance or take all the construction risk themselves. The cost of finance has increased and its availability reduced as a result of the credit crisis. For example, the cost of bank finance has increased by between 20 per cent and 33 per cent and banks now tend to lend relatively small amounts for short terms. To help improve the availability of funding, the government is currently establishing a Green Investment Bank. The government is also examining how private finance for major infrastructure projects could be facilitated. As part of this work it has supported the establishment of a new Pension Infrastructure Platform owned and run by UK pension funds. These arrangements are at an early stage. The government is also working with industry to significantly reduce the costs of offshore wind technologies, for example, through the Cost Reduction Task Force.

## Regulatory and policy uncertainties and risks

**3.9** There is a risk for investors that changes in policies or health and safety or environmental regulations will reduce the commercial viability of proposed projects. For example, the government is intending to significantly increase the cap on nuclear operators' liabilities in the event of a nuclear accident. For carbon capture and storage, the 2009 EU Directive on the geological storage of carbon dioxide makes operators of storage sites liable for ensuring that stored carbon dioxide is completely and permanently contained. The Directive requires the relevant regulator to step in if the operator fails to meet its obligations and enables it to require operators to provide financial security against the potential liability. The scale and nature of this financial security is yet to be decided.

<sup>19</sup> National Audit Office, *The nuclear energy landscape in Great Britain*, April 2012, available at: [http://www.nao.org.uk/publications/1012/nuclear\\_energy\\_landscape.aspx](http://www.nao.org.uk/publications/1012/nuclear_energy_landscape.aspx)

## Public acceptance

**3.10** Public attitudes to the construction of new electricity generating and grid infrastructure will have an important influence on the outcome of planning applications.

## Types of existing support

**3.11** Existing measures, principally the Renewables Obligation, create incentives to invest in generating renewable electricity, in support of the 2020 renewable energy target. They also create disincentives to invest in higher carbon electricity generation (for example through the EU Emissions Trading System).

**3.12** The Renewables Obligation requires electricity suppliers to obtain an increasing amount of electricity from renewable sources. The Department has sought to achieve value through this scheme by introducing different rates of subsidy for individual renewable technologies and reviewing rates in the light of changing costs. It plans to introduce revised rates from April 2013. The Department uses data from public consultations, industry contacts, independent market analysis and the Department's own internal commercial monitoring. The data are used to inform the cost ranges and incentive levels for each technology (**Figure 8**). Reductions in technology costs could result in investors receiving excessive returns that exceed what the scheme is intended to provide. This happened in the small-scale Feed-in Tariffs scheme. The scheme requires energy suppliers to pay low carbon generators a fixed tariff based on how much electricity they generate. The Department reviewed the rates earlier than planned, as technology costs fell faster than it had assumed, and brought some uncertainty to the market.<sup>20</sup> The Department has sought to reduce this uncertainty for the future by including a clear and predictable cost control mechanism into the revised arrangements introduced in May 2012, which automatically reduces tariffs as deployment rises.

**3.13** The Committee of Public Accounts has previously highlighted the need for technology innovation to achieve the 2050 target.<sup>21</sup> The Department has supported developing technology through innovation funding for renewable energy. It has also supported the demonstration of carbon capture and storage. However, the competition for the first demonstration project, which was launched in 2007, was cancelled by the Department in 2011 on the grounds of protecting value for money and because the project could not be funded within the £1 billion capital budget agreed at the 2010 spending review.<sup>22</sup>

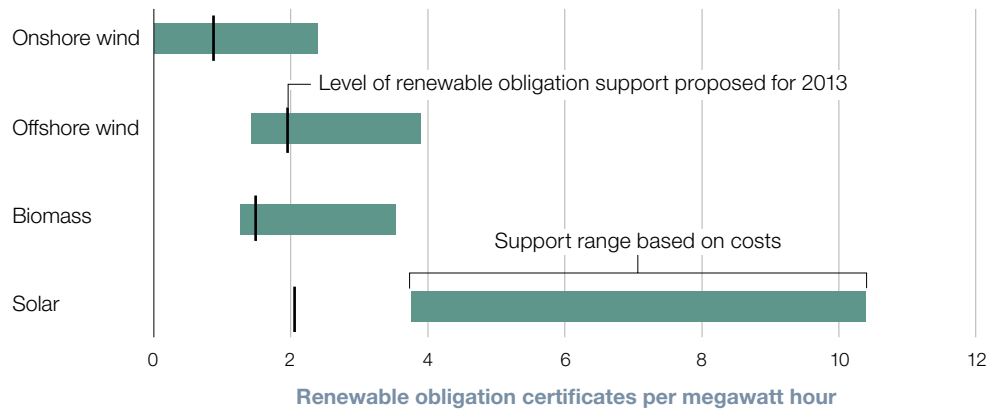
20 National Audit Office, *The modelling used to set Feed-in Tariffs for solar photovoltaics*, November 2011, Available at: [http://www.nao.org.uk/publications/1012/fits\\_briefing.aspx](http://www.nao.org.uk/publications/1012/fits_briefing.aspx)

21 HC Committee of Public Accounts, *Funding the development of renewable energy technologies*, Seventh Report of Session 2010–11, HC 538, November 2011.

22 Comptroller and Auditor General, *Carbon capture and storage: lessons from the competition for the first UK demonstration*, Session 2010–2012, HC 1829, National Audit Office, March 2012.

**Figure 8**  
Ranges in costs for some technologies

The Department sets the support rate against the range in costs for each technology



Source: National Audit Office

**3.14** The government has also encouraged the European Union to introduce a more stringent cap on greenhouse gas emissions under the EU Emissions Trading System to provide the long-term carbon price signal required to incentivise investment in low carbon electricity. The EU has not reached an agreement on this issue. In the meantime UK participants in the system could achieve greater reductions in emissions than required under the EU Emissions Trading System due to domestic policies. If this happens, it could reduce the price of EU allowances and therefore slow progress towards reducing carbon dioxide emissions across the EU.

**3.15** In March 2010, the Department concluded that the existing electricity market framework and policies needed reforming to secure the investment needed beyond 2020 for secure and low carbon electricity. In its July 2011 White Paper, the Department set out proposals for electricity market reform. It estimated that without reform, greenhouse gas emissions will by 2027 exceed the legally binding Climate Change Act targets by 181 million tonnes. It also estimated that the margin between electricity supply and peak demand will fall from 10.5 per cent in 2010 to 6.8 per cent by 2018 and, when the wind is not blowing, -0.2 per cent. This could increase the risk of power cuts.

### Proposed market reforms are intended to increase low carbon generation

**3.16** The Department expects the proposed market reforms to increase low carbon generation up to 2030, but there are significant risks to delivery. The legislation for the first new measure, the carbon floor price, was enacted as part of the 2011 Budget and will be introduced from April 2013. The draft Energy Bill 2012 sets out the legislative framework for the other three measures, which are scheduled to come into effect in 2014. The measures are feed-in tariffs with contracts for difference to support low carbon technologies, a capacity mechanism and an emissions performance standard.

## Carbon price floor

**3.17** In the absence of agreement to change the EU Emissions Trading System, the government has introduced the carbon price floor to create investment certainty, while it continues to push the European Union to move to a higher emissions reduction target to ensure that all member states play their part to reduce emissions. The carbon price floor will impose a tax on fossil fuels being used to generate electricity from 2013. The tax will initially be set (in 2009 prices) at £16 per tonne of carbon dioxide and rise over time to £70 per tonne (in 2009 prices) by 2030. It will supplement the EU Emissions Trading System, in which as at May 2012 the carbon price was trading at just over €6 per tonne. The government intends to introduce measures worth £250 million over the spending review period for energy intensive industries. This will help to reduce the impacts on industries whose international competitiveness is most affected by the carbon price floor and the EU Emissions Trading System.

## Feed-in tariffs with contracts for difference

**3.18** Contracts will fix the price that low carbon generators receive from suppliers for the term of the contract. If wholesale prices for electricity fall below that 'strike price', suppliers will pay generators the difference. If they are above the strike price, generators will pay suppliers the difference (**Figure 9**). The costs will be passed on to consumers through their bills. The contracts for difference will replace the Renewables Obligation.

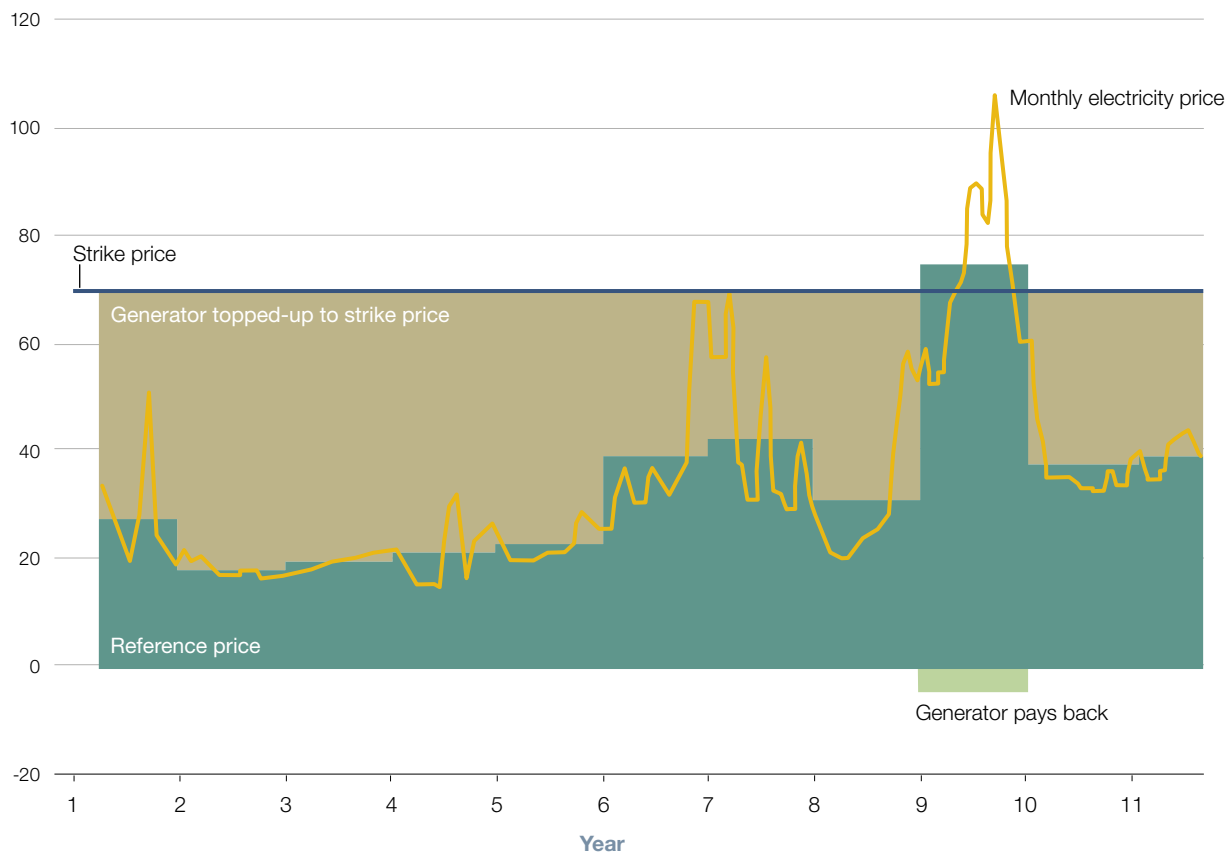
**3.19** The Department intends that individual strike prices for contracts for difference will initially be set on an administrative basis, for some technologies, or in the case of some larger projects negotiated on a case-by-case basis before moving to an auction-based system. It intends to move to an auction based system to allow competition to reveal the least expensive projects and reduce the costs of decarbonisation. The Department has yet to determine the volume of contracts, the strike price and other terms on which contracts will be negotiated. Setting the financial incentives within contracts for difference will require reliable information on costs and wholesale electricity prices for individual technologies, but this is hard to obtain as it is commercially sensitive. Setting the strike price too high would result in paying excessive subsidies to low carbon generators and bring forward more investment than required. However, if the price is set too low take-up rates would be insufficient. The Department expects that National Grid will administer the contracts and produce analysis for Ministers to allow them to set strike prices and other key contract parameters. The government will establish an independent panel of technical experts to assure the quality of this analysis and the analysis and proposed strike prices will then be subject to consultation.

**Figure 9**

A feed-in tariff with contract for difference

The market price generators receive for the electricity they produce will be topped up if it is below an agreed 'strike price', which is represented by the horizontal line

Electricity price £ per megawatt hour



**NOTE**

1 This is an illustrative example of a contract for difference using annual reference prices.

Source: Department of Energy and Climate Change

**3.20** To help reduce the risk of an investment gap before the first contracts are let in 2014, the Department is keeping the Renewables Obligation open to new applications until 2017. It has also established a 'final investment decision enabling project'. This project includes an option for the Secretary of State for Energy and Climate Change to issue investment instruments to low carbon developers before electricity market reform legislation is passed and before receiving decisions on state aid. The form of these instruments has still to be determined. Possible options include the Secretary of State for Energy and Climate Change giving prior agreement to the terms of contracts for difference that individual developers will subsequently receive if primary powers and state aid approval to award contracts are given. The aim is to provide sufficient certainty to allow final investment decisions from the end of 2012.

### Capacity mechanism

**3.21** The mechanism will involve auctioning for contracts to guarantee sufficient capacity when there is significantly more intermittent generation from onshore and offshore wind. It is not designed to replace the need for the system operator (National Grid) to ensure that it can meet its short-term operating needs for reserve capacity. The government has stated that it will only use this mechanism if it considers that additional capacity is needed.

**3.22** The capacity mechanism could be used to support investing in electricity storage technologies or to subsidise gas-fired stations to compensate them for operating significantly below their full capacity or to support demand management technology. Inaccurate forecasting would result in paying for too much or too little capacity.

### The emissions performance standard

**3.23** The emissions performance standard will from mid-2013 set a legal limit on carbon dioxide emissions from power stations of 450 grams per kilowatt hour. This will effectively rule out new investment in coal-fired power stations that do not use carbon capture and storage. It will not affect investment in gas-fired power stations and the government has confirmed that it will maintain the level of the emissions performance standard for power stations at 450 grams per kilowatt hour until 2045. The Committee on Climate Change has estimated that to reduce emissions from power stations to 50 grams per kilowatt hour by 2030, gas-fired power stations are needed to balance intermittent renewable generation but could generate at less than 10 per cent of their capacity (this is an average across all gas-fired power stations).

### Key milestones

**3.24** The timetable for the market reforms and investment is challenging. Key milestones in the Department's plans for decarbonising electricity by 2030 (**Figure 10** overleaf) include:

- securing investment decisions on the first new nuclear power station in 2013;
- awarding the first long-term contracts for difference in 2014 (subject to the necessary legislation by 2013 and receiving state aid approval);



- delivering early commercial carbon capture and storage projects from 2016; and
- supplying around 30 per cent of electricity from renewable sources by 2020.

**3.25** The Department has identified that its reforms may impact on the wider management of the electricity system. It is therefore reviewing the impact and timescales of future changes in generation and demand on the electricity system, and the potential for non-generation approaches, including interconnection, storage and demand side responses as part of the development of a smarter grid system. It intends to report in summer 2012 on how the electricity system will need to adapt in future.

### Cable networks need to be replaced, upgraded and expanded

**3.26** The networks that carry electricity around the country need replacement. They also need to be strengthened where new power stations are added to existing networks and upgraded to manage increased capacity and flows from many smaller renewable generators.

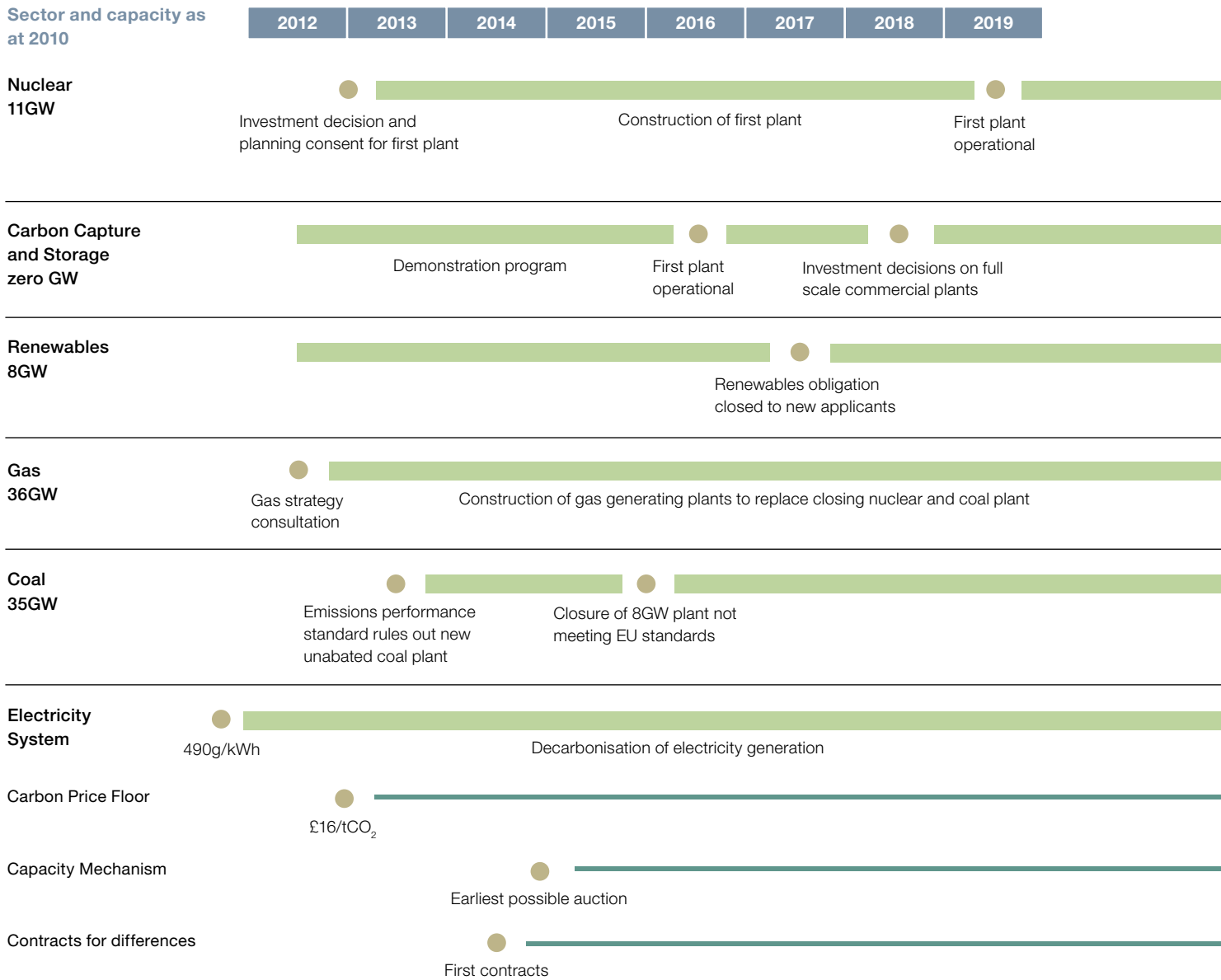
**3.27** The Department sets strategic policy objectives for electricity networks. Ofgem reviews and takes decisions on whether to approve network operators' investment cases, which are built on their assessment of future needs. There is no competition between network companies or statutory limits on spending. This means that Ofgem must ensure that investment in electricity networks is necessary and efficient. In April 2012, Ofgem published its 'fast-track' Final Proposals for the transmission price controls from 2013–21 of SP Transmission Ltd and Scottish Hydro Electric Transmission Ltd, which own the transmission networks in Scotland. These provided for investment of around £7.6 billion. Ofgem estimated this will increase the annual electricity bill of an average domestic customer by £2.80 by 2021. Ofgem is currently reviewing National Grid Electricity Transmission's proposals to invest £21.3 billion, which would equate to a £11 increase in the average annual electricity bill by 2021. Ofgem's final decision on National Grid Electricity Transmission's expenditure is due for publication in December 2012.

**3.28** Ofgem is also awarding licences to private companies to operate and manage offshore transmission networks. As at May 2012, four offshore transmission licences had been awarded, to Transmission Capital Partners and Blue Transmission (Macquarie and Barclays).

**3.29** Ofgem approved plans put forward by distribution network operators to invest £6.7 billion over 2010–2015 in their distribution networks. It also operates an Innovation Funding Initiative, which has an annual budget of £20 million and a £500 million Low Carbon Networks Fund that provides funding for innovative distribution network projects and trials during 2010–2015. To date, Ofgem has awarded £120 million through the Low Carbon Networks Fund competition on a range of projects that include developing smart grids technology.<sup>23</sup> The new regulatory regime that has been applied to investment in transmission will take effect for the distribution network from 2015.

23 Further information is available online at <http://www.ofgem.gov.uk/Networks/ElecDist/lcnf/Pages/lcnf.aspx>

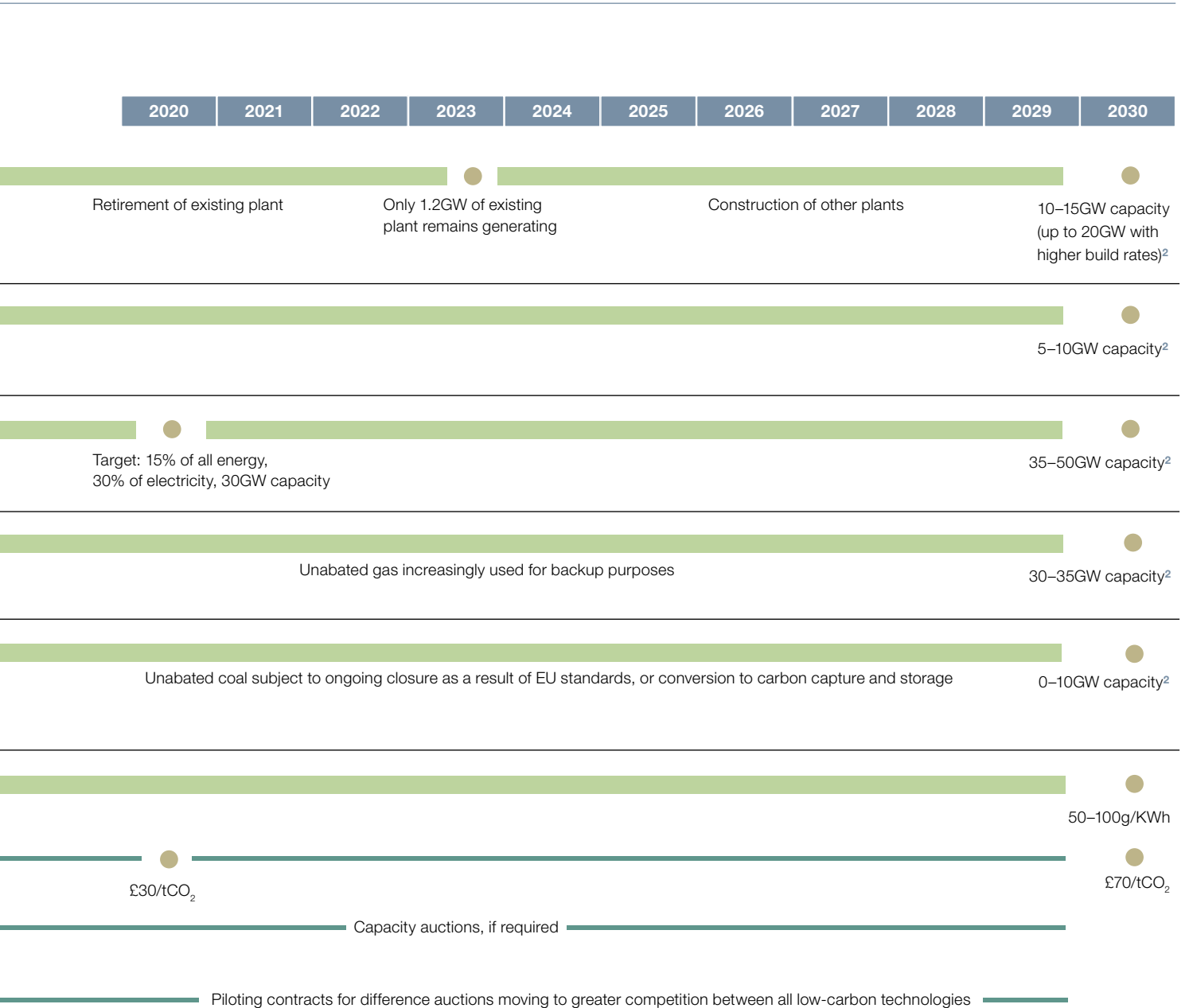
**Figure 10**  
Key milestones in decarbonising electricity by 2030



**NOTES**

- 1 Circular dots represent key milestones or targets.
- 2 Potential capacity for each technology in 2030 are illustrative figures supplied by the Department. They do not correlate to the amount of electricity generated by each technology because some technologies such as wind are intermittent and because unabated coal and gas would be used mainly for back-up generation.
- 3 The carbon intensity in 2030 is an illustrative benchmark (see paragraph 2.6).

Source: National Audit Office



The planning regime will influence progress towards decarbonising the electricity sector

**3.30** The National Infrastructure Directorate of the Planning Inspectorate reviews applications for projects over 50 megawatts in England and Wales, with the Secretary of State for Energy and Climate Change taking the final decision. Local planning authorities process applications for projects up to 50 megawatts. Of the 115 new power stations that started generating between 2005 and 2011, 85 (74 per cent) were less than 50 megawatts. However, more than 80 per cent of electricity supplies in Great Britain are provided by around 60 large power stations.

**3.31** In 2011, planning applications for around 8.1 gigawatts of renewable electricity projects, principally wind, and a 3.2 gigawatt nuclear power station at Hinkley Point were under consideration. Not all of these projects will proceed. The Department estimates that around 30 per cent of planning applications for renewable energy projects that have been submitted will not proceed. For gas-fired power stations that have received planning consent, uncertainty about their future revenues could undermine the investment case for constructing them.

### **The cost implications for consumers are uncertain**

**3.32** Projecting future energy prices and bills is very challenging. In addition to estimating the impact of policies, projections must also be made for wholesale fuel prices and consumption changes which cannot be known with any certainty. As a result all bill projections should be treated with caution.

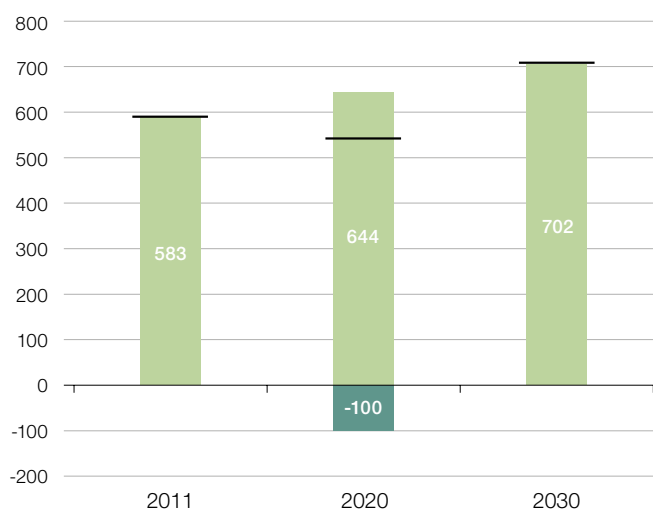
**3.33** Since 2009, the Department has published an annual assessment of the impact of its policies on both gas and electricity bills. The Department estimates that increases in fossil fuel prices, investment in new capacity, network costs and support for low carbon electricity will increase electricity prices. However, overall household electricity bills will fall by 8 per cent between 2011 and 2020. This is due to the offsetting effect of government policies to encourage increased energy efficiency, for example, through the use of more efficient boilers, lighting systems and appliances. The Department has also estimated that average UK household electricity bills in 2020 will be 16 per cent (£100) lower than they would otherwise be. By 2030, it considers that household bills might be £4 higher than they would be without its policies (**Figure 11**). The Department expects that bills for medium-sized businesses will be 25 per cent (£302,000) higher in 2020 than they would have been as a result of policies, but bills for these businesses generally make up a small proportion of their costs.

**Figure 11**  
The effect of policies in electricity bills

The Department estimates that by 2020, its policies will reduce household electricity bills by £100 compared to business as usual but increase bills for medium-sized businesses by £302,000

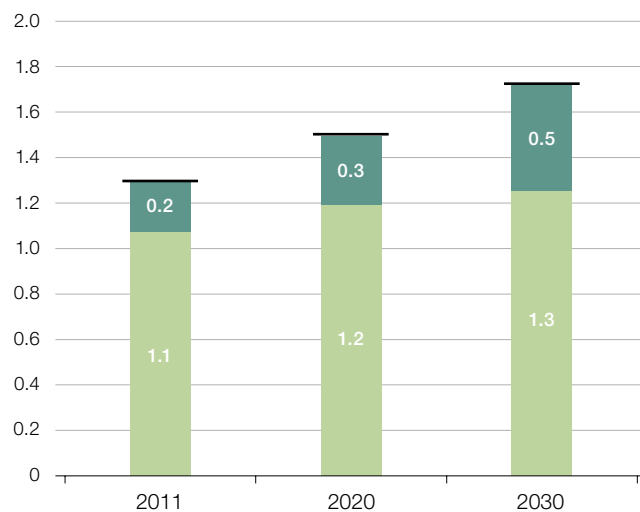
Composition of consumer bills

**Average annual household electricity bills (£)**



Composition of bills for medium-sized business

**Average medium-sized business electricity bills (£m)**



■ Projected impact of policies   ■ Bill without policies   — Net cost after policy effects

**NOTE**

1 Estimated average annual electricity bills, real 2010 prices.

Source: Department of Energy and Climate Change

**3.34** The Committee on Climate Change also published an assessment of the impact of policies on household energy bills, in December 2011. It suggested that, relative to 2010, electricity bills for a typical dual fuel household in 2020 would increase by £180, of which £100 is due to additional support for low carbon electricity generation and £10 for further energy efficiency improvements. Successful take-up of energy efficiency measures would reduce total electricity bills by £115. The Committee and the Department both used similar assumptions in their analyses, but the Committee's figures are for dual fuel households and the estimates are not directly comparable. For example, the Department's focus was on what bills would be in the absence of policies whereas the Committee examined how bills are expected to change over time and included a narrower set of policies.

**3.35** The estimates of impacts on bills are subject to significant uncertainties, including future prices of fossil fuels, particularly gas. The Department's central projection is for an 11 per cent increase in wholesale gas prices between 2011 and 2020. That assumption could be affected by, for example, discoveries of new gas reserves or increased use of hydraulic fracturing ('fracking') to extract gas from shale, a type of sedimentary rock. It could also be affected if higher oil prices resulted in an increase in gas prices.

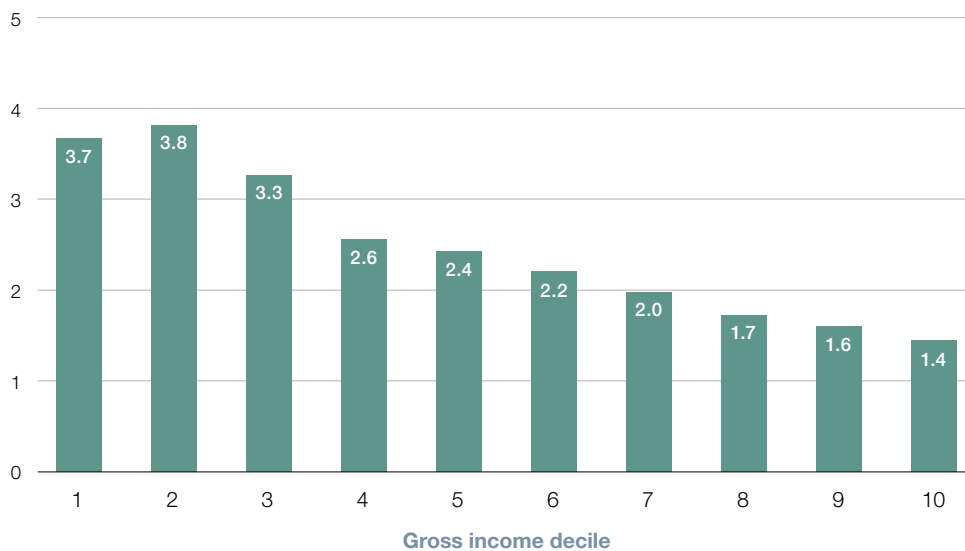
**3.36** The Department's analysis shows that different assumptions about future fossil fuel prices could result in very different savings in average household bills in 2020. Consumers would benefit directly from lower fossil fuel prices as the overall price of electricity would be lower. However, if lower fossil fuel prices caused the wholesale price of electricity to fall, payments to generators through the proposed contracts for difference would increase. The Department's estimates of the impact on bills under different fossil fuel price assumptions range from a 6 per cent to 20 per cent reduction for households and an 18 per cent to 41 per cent increase for medium-sized businesses compared to what their bills would have been in the absence of policies.

**3.37** Policies will have different impacts on different types of household. Households that take advantage of support offered to improve the energy efficiency of their homes could be expected to benefit from policy changes. The Department assumed for the purpose of its estimates that around 65 per cent of households will not take up the support on offer and will generally lose out. Electrically heated households would also bear a greater burden than those heated by gas. Poor households, who tend to spend more on electricity as a proportion of their income than richer ones (**Figure 12**), are also likely to be disproportionately affected by changes in electricity prices. The government expects that by targeting interventions including the Energy Company Obligation, at lower income groups, poorer households will benefit relatively more from climate change interventions in 2020.

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**Figure 12**

Spending on electricity: electricity accounts for a greater proportion of total spending among lower income households

**Percentage of household expenditure on electricity**

Source: *Living Costs and Food Survey, National Statistics*

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**Issues for discussion**

This part of the report has described the portfolio of measures that the Department has established or plans to introduce to support its objectives to deliver low carbon, secure and affordable electricity. Its proposals for electricity market reform will introduce new forms of support for all low carbon technologies. However, the scale of investment required is considerable and there are significant technical and commercial risks. We examine how the Department has organised itself to deliver its portfolio of interventions in the electricity market in Part Four. Key issues for discussion include:

- demand;
  - incentivising low carbon generation;
  - ensuring sufficient capacity is available;
  - key milestones; and
  - costs and who pays.
-

## Part Four

### Managing delivery

**4.1** Parts One to Three set out the nature of the challenge that the Department faces, its programmes to encourage behaviour change by companies and individuals and how it is acting to encourage investment from national and international businesses. The Major Projects Authority considers the Department is responsible for one of the most challenging delivery portfolios across Whitehall. In this part we examine:

- how far the Department is following good portfolio management principles;
- its approach to working with delivery partners;
- its risk management and cost control; and
- its skills to deliver.

#### **The Department is seeking to manage its work as a portfolio of interdependent projects and programmes**

**4.2** The objective to deliver low carbon, secure and affordable electricity supplies is a key part of the Department's overall business plan objectives for the energy system. The policies, projects and programmes that contribute to this objective are managed within the Department's two main delivery groups (**Figure 13**). The International Climate Change and Energy Efficiency Group manage demand-side programmes, such as the smart metering programme. The Energy Markets and Infrastructure Group manage programmes addressing electricity supply issues, such as electricity market reform.

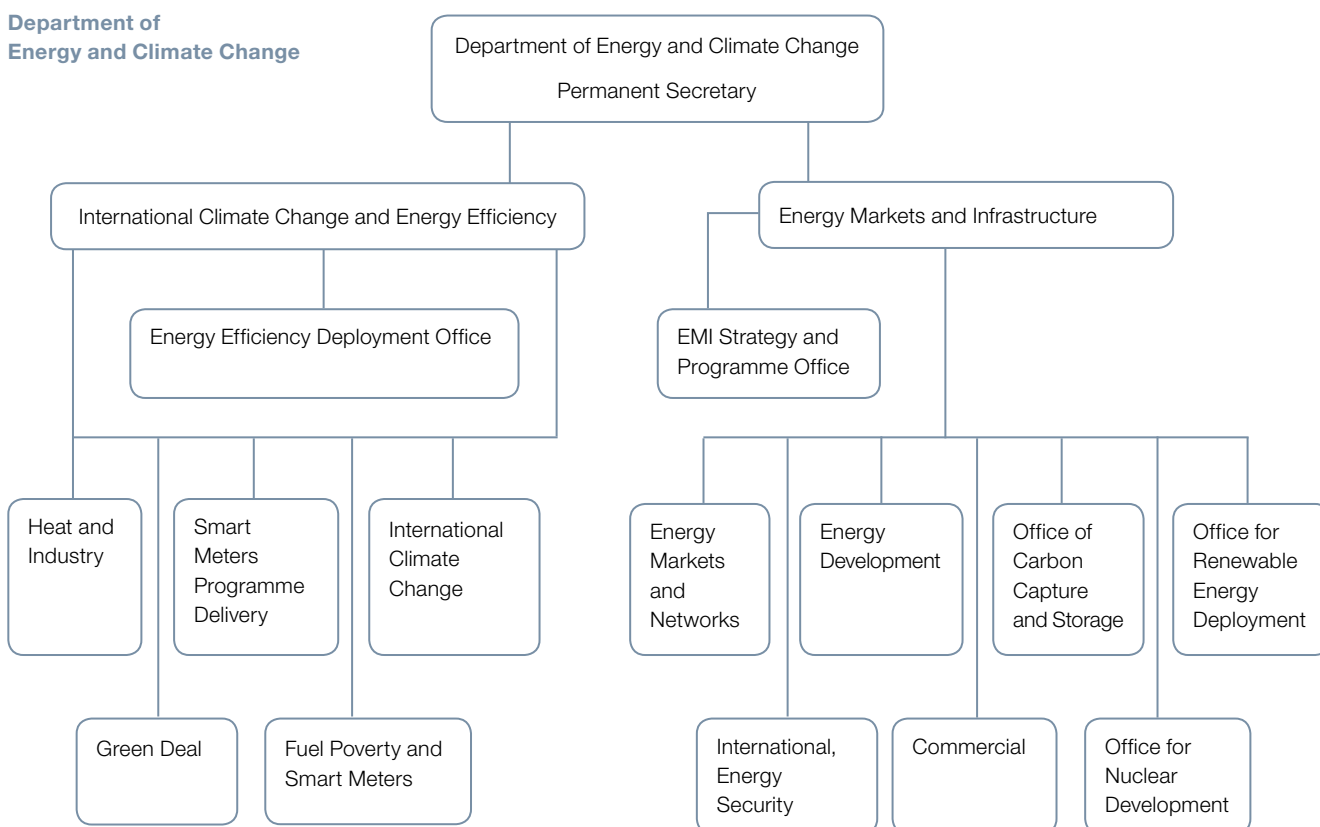
**4.3** To deliver linked projects and programmes the Department must understand the risks and interdependencies between them and use good portfolio management (**Figure 14** on page 40). The Departmental board, chaired by the Secretary of State, oversees whether the Department is meeting its business plan priorities to provide secure, low carbon and affordable energy. In addition, the Department has executive committees, including the approvals committee, which reviews business cases and major investment decisions. The Department's group structure enables the most closely linked programmes to be planned and managed together. But the Department recognises that there is a need for more focus on interdependencies and to assess the relative priority of projects or consider cumulative risks across the portfolio. The Department therefore intends to introduce a portfolio management system across its business by December 2012.



**Figure 13**

Departmental responsibilities for managing electricity demand and supply

The diagram shows the Departmental teams with policy responsibilities for managing electricity demand or supply



**NOTE**

1 The Strategy and Evidence Group and Chief Operating Officer's Group, both of which report to the Permanent Secretary, are not shown.

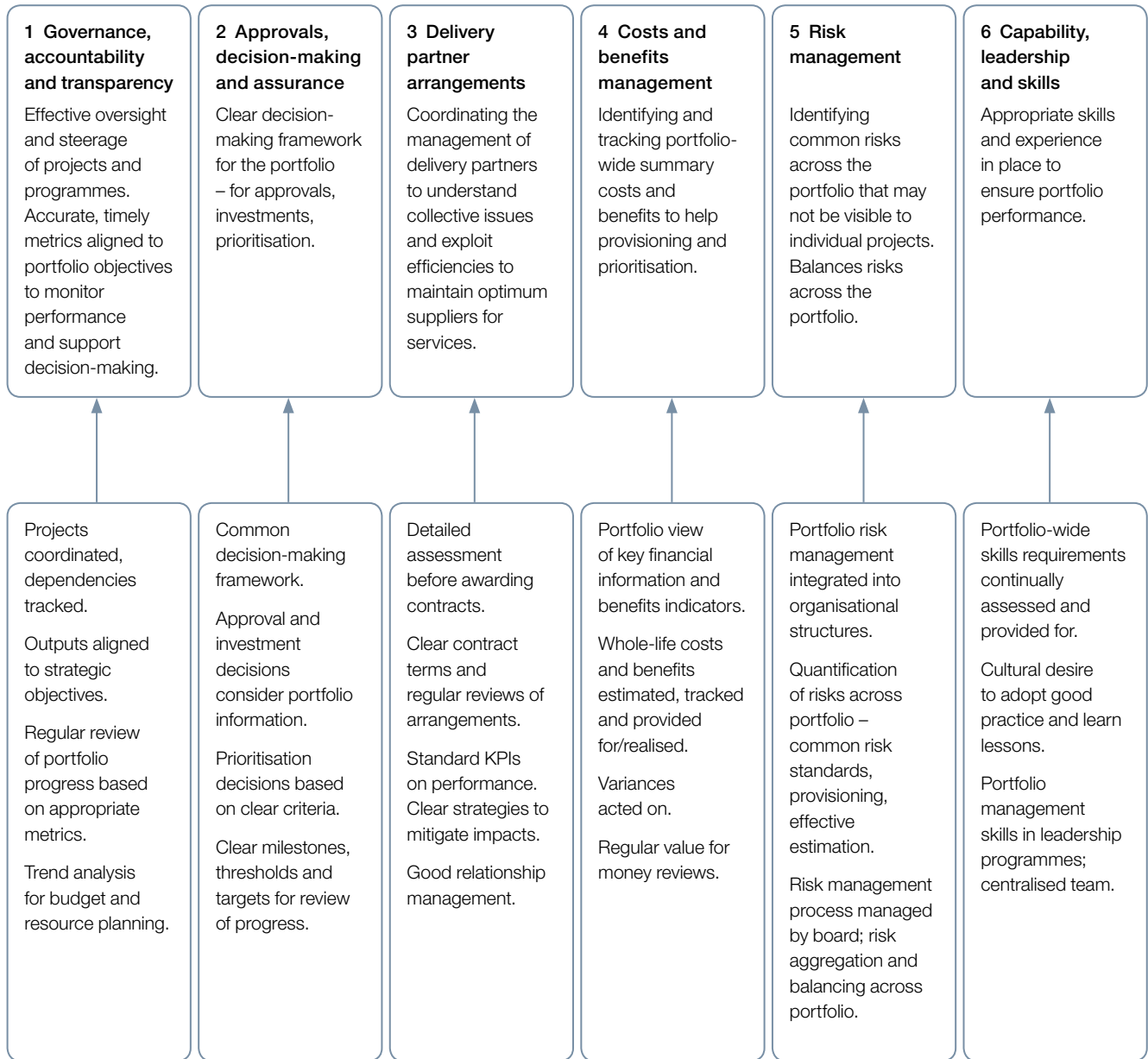
Source: Department of Energy and Climate Change

**4.4** The Department is accountable to the cross-government National Emissions Targets Board, which is chaired by its Permanent Secretary, for progress towards decarbonising the electricity sector by 2030. This board oversees those working towards delivering the Carbon Plan and monitors and challenges government performance in meeting carbon budgets. The Department also routinely publishes statistics on electricity supplies and carbon emissions and the cost of its policies for consumers.

**4.5** The Major Projects Authority has reviewed 12 of the Department's main projects. Of these, around half, including the energy markets reform programme, carbon capture and storage, and new nuclear project are for electricity systems. The Authority has identified this as a high-risk portfolio. The Department's infrastructure projects are also supported by Infrastructure UK and the Cabinet Committee on Infrastructure.

**Figure 14**  
Key elements of good practice in portfolio management

The National Audit Office has identified six key elements to good portfolio management



Source: National Audit Office

## The Department aims to strengthen relationships with its delivery partners

**4.6** The Department relies on electricity market participants, Ofgem, and some key delivery partners to achieve its electricity objectives. Ofgem, through its Ofgem E-Serve business unit, administers several of the Department's environmental programmes and National Grid is the proposed delivery body for electricity market reforms. The National Audit Office has highlighted that the Department needs to work closely with industry to understand and address key risks and to have the skills to be an intelligent customer.<sup>24</sup>

**4.7** The Department has recognised that it needs to clarify the roles of its key delivery partners. In 2011, the Department reviewed its arrangements with delivery partners and, separately, the role of Ofgem. It concluded that it should introduce a statutory 'strategy and policy statement' setting out its relationship with Ofgem, a memorandum of understanding covering its relationship with Ofgem E-Serve, and detailed arrangements for each programme that Ofgem E-Serve administers. The Department is working towards implementing these proposals. The Department's commercial team is increasing its contact with banks and other key commercial players.

**4.8** The Department expects National Grid's additional role from the electricity market reforms will include advising the government on market requirements as well as implementing the contractual arrangements for contracts for difference and the capacity mechanism. This could create the risk of conflicts of interest, and in March 2012 the Department launched a public consultation on how this risk can be managed.

## The Department is developing how it manages and provides accountability for the cost of its policies

**4.9** The Department sets out its estimates of the economic costs and benefits of individual interventions in published impact assessments. As its proposals develop, the Department updates its modelling to reflect the latest evidence base, for example on technology costs, and assumptions such as future fossil fuel prices. This can result in significant changes in estimated economic costs and benefits because modelling results are highly sensitive to the assumptions used. For example, the costs and benefits of the electricity market reform package of measures has changed considerably, from £3.9 billion in December 2010<sup>25</sup> to £9.1 billion in the White Paper in 2011<sup>26</sup> to £0.2 billion for the draft Energy Bill in 2012.<sup>27</sup> The Department outlines the uncertainties and key changes in its impact assessments and undertakes analysis highlighting the significant range of outcomes. It provides explanations of the many changes in assumptions and, at a high level, their impact on its estimates. However, it does not provide a full reconciliation between assessments on the grounds that it is methodologically complex

24 Comptroller and Auditor General, *Preparations for the roll-out of smart meters*, Session 2010-2012, HC 1091, National Audit Office, June 2011; Comptroller and Auditor General, *Carbon Capture and Storage: lessons from the competition for the first UK demonstration*, Session 2010-2012, HC 1829, March 2012, National Audit Office.

25 <http://www.decc.gov.uk/assets/decc/Consultations/emr/1042-ia-electricity-market-reform.pdf>, Summary sheet for Policy Package Option 2.

26 <http://www.decc.gov.uk/assets/decc/11/policy-legislation/EMR/2180-emr-impact-assessment.pdf>, Table 2, page 16.

27 <http://www.decc.gov.uk/assets/decc/11/policy-legislation/Energy%20Bill%202012/5342-summary-of-the-impact-assessment.pdf>, page 11 and Table 4.

to isolate the exact contribution of individual assumption changes. The increase in estimated benefits of electricity market reform between 2010 and 2011 resulted from changes that included adding the effects of the carbon price floor and revising assumptions about biomass costs and revenues. The changes between 2011 and 2012 were due mainly to revised assumptions about future electricity demand and fossil fuel prices, and updated technology costs.

**4.10** The Department monitors the costs of its policies to the Exchequer, including those related to electricity sector policies. It also monitors current energy prices and has modelled the cost of its policies to consumers and compared prices with other EU member states. The Department has recognised the need for a benefits management framework, to improve its monitoring of the impacts from its policies, which would include the wider costs of its policies to the economy, such as the costs to business from the CRC Energy Efficiency Scheme.

**4.11** Since 2010, the Department has also sought to control the combined total cost to consumers of the Renewables Obligation, Feed-in Tariffs, and the Warm Home Discount Scheme through the 'levy control framework'. This framework sets a cap on the cost of these policies during each spending review period, and has been set at £11.8 billion over the four years to 2014-15. The Department and HM Treasury have agreed the level of acceptable headroom above the cap, which is the level of permissible variation from agreed plans before the Department has to rapidly agree changes to bring policies back into line with an agreed profile. The acceptable headroom has initially been set at 20 per cent of the total cap.

**4.12** The early review of feed-in tariff rates, which was prompted by concerns that the levy control framework cap would be exceeded, demonstrates that the Department has acted to control consumer funded costs. Decisions on which policies are covered by the framework are taken by HM Treasury in consultation with the Department. The framework excludes some policies for which consumers pay, such as smart meters and the carbon emission reduction target. The framework is not independently audited. Policies covered by the framework involve long-term cost commitments beyond the spending review period.

### **The Department's risk management process addresses risks to its electricity sector programmes**

**4.13** The Department has a corporate risk management strategy and has recently refreshed its approach and central guidance. Risk registers highlight priority risks and their current rating to help the Department assess risks, develop mitigating actions and monitor changes to ratings. The Department's board considers risks quarterly and its audit and risk committee considers risk management at every meeting. The Department's board reviews the top ten risks to the Department's strategic objectives, and the groups and project boards routinely monitor other identified risks.

**4.14** The Department's risk monitoring focuses on the highest risks to meeting its electricity objective, including electricity market reform, carbon capture and storage, and new nuclear. The Major Projects Authority's reviews of these programmes have highlighted their inherent risks. In particular it noted the uncertainties associated with energy prices and construction costs and the Department's arm's-length relationship with those delivering the investment needed. The Authority noted in October 2011 that the realisation of short-term deliverables from electricity market reform appeared feasible. However, it concluded that the achievement of security of supply, decarbonisation and affordability of electricity appeared doubtful given the early stage of the programme and uncertainties involved.

**4.15** The Departmental board's focus on the highest risks has been at the expense of early detailed consideration of lower level risks, such as overspend on its small-scale feed-in tariffs. The Department has also acknowledged that risk is not generally examined in portfolio prioritisation. In June 2012, the Department introduced new risk management procedures. These include an executive committee to escalate and manage risks outside regular risk review meetings and a permanent risk coordinator to help implement the risk management policy and integrate risk management across the Department.

### **The Department is building its staff skills and capacity to deliver its work**

**4.16** The Department considers that its staffing, capability and skills are a material risk to meeting its objectives. Its 2009 Capability Review set the Department the challenge of transforming from a purely policy organisation to one with the ability to manage a large and complex delivery programme.

**4.17** In common with other Departments, the administration budget for the Department and its arm's length bodies during the four years to 2014-15 was reduced in the 2010 Spending Review by 33 per cent in real terms. The Department responded to this by prioritising its portfolio, strengthening its most important work areas, including the team managing the electricity market reform proposals, and recruiting necessary specialists. It has recruited over 100 specialists since April 2011.

**4.18** The Department's latest Capability Review, published in May 2012, recognised that progress had been made but concluded that continued effort was still required to improve delivery capability. The Department had introduced some key project and programme management processes, and business cases and delivery plans were in place for all major projects. However, the review identified that recruitment had been slow and that the Department still did not have the capacity to deliver all of its current programmes. It also lacked mechanisms to ensure capability matched its aims, to prioritise resources, or to understand the impact of scarce resources on delivery timetables and policy outcomes. In its action plan the Department committed to use a portfolio management approach to match its delivery capability to its ambition, taking account of cumulative risk and interdependencies, and to prioritise scarce resources. The Department also committed to using succession planning, skills development and recruitment to ensure it has the critical skills it needs.

**4.19** At 31 March 2012, 761 of the Department's 1,494 staff were working in teams contributing towards meeting electricity objectives. However, not all of these were working exclusively on electricity. Of the 761 staff, some 130 were on temporary or short-term contracts or were secondees, and the Department was in the process of recruiting 116 staff to replace identified vacancies. The Department offers training for staff on project management, commercial skills, contract management, negotiating and influencing skills, stakeholder engagement and customer insight and behavioural and social research capability.

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### **Issues for the Committee**

This part of the report has described how the Department will try to deliver its portfolio of interventions and identifies areas for improvement. Key issues for discussion include:

- accountabilities for delivery;
  - managing costs and benefits;
  - managing risks; and
  - skills to deliver.
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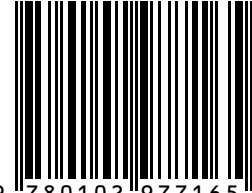
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