House of Commons
Energy and Climate Change Committee

Low carbon technologies in a green economy

Fourth Report of Session 2009–10

Volume I

Report, together with formal minutes

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The Energy and Climate Change Committee

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The Reports and evidence of the Committee are published by The Stationery Office by Order of the House. All publications of the Committee (including press notices) are on the Internet at www.parliament.uk/ecc. A list of Reports of the Committee in the present Parliament is at the back of this volume.

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Contacts

All correspondence should be addressed to the Clerks of the Energy and Climate Change Committee, House of Commons, 7 Millbank, London SW1P 3JA. The telephone number for general enquiries is 020 7219 2569; the Committee’s email address is ecc@parliament.uk
Contents

Report

Summary ........................................ 3

1 Introduction ..................................... 5

2 The green economy ............................ 7
   Green fiscal stimulus .......................... 7
   Government priorities ......................... 9
   The low carbon sector and green jobs ...... 11

3 Energy generation ............................ 13
   Clean fossil fuels .............................. 13
     Oil and gas .................................. 13
     Clean coal .................................. 14
   Nuclear ....................................... 17
   Renewables .................................. 20
     Wind ........................................ 21
     Wave and tidal .............................. 26
     Solar ........................................ 27
   Biomass ...................................... 30
   Geothermal .................................. 31
   Hydroelectric ................................ 32

4 Energy storage and transmission .......... 34
   Storage technologies ......................... 34
   The grid ..................................... 35
   Smart communications ....................... 36

5 Energy use and efficiency .................. 39
   Transport .................................... 39
     Road ........................................ 39
     Rail .......................................... 43
     Shipping .................................... 45
     Aviation .................................... 47
   Industry ...................................... 49
     Energy efficiency in buildings .......... 53
     Industrial combined heat and power .... 55
     District heating ............................ 56
   Domestic ..................................... 57
     Energy efficiency .......................... 58
     Microgeneration ............................ 61
     Smart technologies ........................ 63
6 Moving towards a low carbon future
   International action 64
   EU Emissions Trading Scheme 64
   International climate agreements 66
   Investment 67
   The green fiscal policy toolbox 68
   The role of public procurement 70
   Research and innovation 71
   Job creation and skills 72
   Green jobs 72
   The skills gap 74
   Public engagement and behavioural change 75
   Long-term framework for change 76

7 Conclusions
   Conclusions and recommendations 78
   Abbreviations 90

   Formal Minutes 93
   Witnesses 94
   List of written evidence 96
   List of Reports from the Committee during the current Parliament 98
Summary

Low carbon technologies have a vital role to play in the move towards a green economy. Such technologies have the potential to reduce the carbon intensity of processes at every stage of the energy supply chain—from low carbon energy generation, through storage and transmission, to end user efficiency. In doing so, carbon dioxide emissions will be reduced, jobs will be created, and the UK economy will grow sustainably.

The Government’s green stimulus over the past year amounts to approximately £1.4 billion. Disappointment with the level of funds committed to green initiatives was expressed almost universally by the witnesses we spoke to during this inquiry. In particular, it was argued that the Government should have done more to support energy efficiency, an area that is amongst the lowest cost options for reducing carbon dioxide emissions. Energy efficiency measures can be implemented through the installation of a number of existing technologies such as cavity wall and loft insulation, double glazing, and on-site microgeneration. The nature of this work is local, and as such there is scope for the rapid creation of local green jobs in every community across the UK in the energy efficiency and building technologies sector. Whilst we recognise that the Government is moving in the right direction, notably through its recent publication of *Warm Homes, Greener Homes, A Strategy for Household Energy Management*, it must tackle energy efficiency more aggressively—not just for the sake of UK emissions reduction targets but also for the sake of stimulating growth in local jobs and the economy.

Widespread deployment of low carbon energy generation technologies has the potential to create new jobs whilst reducing UK reliance on imported fossil fuels and thereby improving energy security. The growth of offshore wind and marine energy could revitalise manufacturing in the UK, whilst providing jobs for reskilled workers from the oil and gas sector. The UK wind industry employed 87,500 people in 2007/08. Based on forecast growth in domestic market value, this could potentially rise to 156,800 in 2014/15. The UK has substantial wave and tidal resources and therefore marine energy is a natural low carbon choice for the UK. However, given that the marine sector is at a much earlier stage of development, the creation of a significant number of jobs in this sector is not expected in the short term. Other technology sectors such as solar, biomass and geothermal also have an important role to play in the green economy. Whilst it is right that public investment is prioritised for low carbon technologies that are economically viable today, the Government must also support tomorrow’s technologies through wider policy mechanisms.
Despite the obvious benefits of low carbon energy, obtaining planning permission and public acceptance for new energy generation plants and wider infrastructure—such as wind farms, new nuclear build, CO₂ pipelines for plants fitted with carbon capture and storage technology and transmissions lines—remains a problem. We comment on the planning process in England and Wales in greater detail in our Report, *the proposals for national policy statements on energy*. There is a need for much better dialogue with the general public to promote low carbon energy generation and related infrastructure. Furthermore, the Government must engage with the public on the benefits of a smarter system for interacting with energy. Smart meters will be installed in every home by 2020. In the future, through smart communication technologies, these meters will be able to interact with the grid, household appliances and electric vehicles—allowing consumers to become much more energy efficient, taking control of how and when energy is used.

The development of low carbon technologies will require a significant degree of support from both the public and private sector; however, they have the potential to make a very significant contribution to economic growth and job creation in the UK. The global market value within the low carbon and environmental goods and services sector was £3,046 billion in 2007/8, of which the UK share was 3.5%, or £106.7 billion. There were 881,000 so-called ‘green jobs’ within the UK in 2007/08; this could potentially grow to over 1.27 million jobs by 2015. Investment in low carbon technologies must not simply be seen as part of the short-term economic recovery, but also as a means of encouraging sustainable economic growth over the decades to come.
1 Introduction

1. The contraction of the global economy over the last two years has been referred to internationally as the deepest recession in living memory. Governments across the world have responded by injecting money into troubled financial institutions, and have sought to stimulate economic growth with their own variations of a ‘green stimulus’ package for the low carbon sectors. The Department of Energy and Climate Change (DECC) told us that “the move to a low carbon economy can make a significant contribution to economic growth and job creation in Britain, not only as part of the short term economic recovery, but also through sustainable growth over the decades to come.” In this inquiry we decided to take a broad look at the spectrum of low carbon technologies that could contribute to the UK’s transition to a greener economy; we examine their potential to stimulate economic growth and job creation; and we make recommendations designed to ensure these technologies reach their full potential.

2. In addition to invigorating the economy, any green stimulus package in the UK will also support the Government’s ambitious climate change targets, which were passed into law through the Climate Change Act 2008. This introduced a legally binding target to reduce greenhouse gas emissions to 34% below 1990 levels by 2020, and to 80% below 1990 levels by 2050. The Government has also committed the UK to producing 15% of energy from renewable sources by 2020, as part of an EU target for 20% renewable energy by 2020. To achieve this, the Department of Energy and Climate Change’s lead scenario suggests more than 30% of electricity, 12% of heat, and 10% of transport energy could be generated from renewables.2

3. Despite the recent lack of success at the UN Climate Change Conference in Copenhagen to achieve a wider global agreement on greenhouse gas emissions reduction, there is still an appetite for investment in low carbon technologies in anticipation of a future international deal. Such investment would accelerate the move towards a decarbonised energy supply, improve energy security, and promote more sustainable economic growth. Whilst we are fully supportive of the Government’s efforts to secure a global deal, we feel it is important to lead by example and pursue policies that will ensure we meet our own targets. Indeed, the Government’s independent advisers, the Committee on Climate Change, in their first annual report to Parliament concluded that a step change will be needed to achieve deep emissions cuts required through the first three carbon budget periods and beyond.3 In this report we focus on the low carbon technologies that will have the biggest impact on our current emissions targets.

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1 Ev 174, para 1 [Department of Energy and Climate Change]
3 Committee on Climate Change, Meeting Carbon Budgets—the need for a step change, progress report to Parliament, October 2009, p 14
4. We received 48 submissions of written evidence, for which we are grateful.\(^4\) We also held eight oral evidence sessions during our inquiry.\(^5\) We would like to express our thanks to all those who contributed to our evidence-gathering. We particularly thank Dr Gregory Offer who joined us from Imperial College London for three months, sponsored by the Grantham Institute for Climate Change, and who provided much appreciated expert advice.

5. We visited Berlin and Copenhagen where we met policy makers and industry representatives with expertise in low carbon technologies. We spoke with Germany’s Federal Environment Ministry (BMU), the Berlin-based Renewables Academy (RENAC), the Danish Energy Agency, the Danish Energy Association, the Ministry of Climate and Energy, the Metropolitan Copenhagen Heating Transmission Company, Denmark’s leading energy company—DONG Energy, Vestas Wind Systems and the Danish Council of Environmental Economics.

6. We also visited California, a region known for its ground-breaking climate change policies, to speak with climate change policy makers, academics and leaders in innovation. We met representatives of the Institute of the Environment at UCLA, the Port of Los Angeles, the National Fuel Cell Research Center at UC Irvine, the California Energy Commission, Governor Schwarzenegger and senior environmental staff at the State Capitol, the California Chamber of Commerce, the Electric Power Research Institute, Stanford University Precourt Institute for Energy and the Global Climate and Energy Project, and a smart grid technology company—Silver Spring Networks.

7. This Report takes an overview of the low carbon technology landscape. It broadly covers the areas of energy generation, storage, transmission, use and efficiency. It draws on our first three Reports as a new select committee, UK offshore oil and gas\(^6\), The future of Britain’s electricity networks\(^7\) and The proposals for national policy statements on energy\(^8\), whilst also touching on material that we will cover in more detail in our imminent Report, Fuel poverty. We hope that our successor committee will look at the issues raised in this Report and follow up with more detailed inquiries into areas of particular interest.

\(^{4}\) List of written evidence, p 96
\(^{5}\) Witnesses, p 94
\(^{6}\) Energy and Climate Change Committee, First Report of Session 2008-09, UK offshore oil and gas, HC 341-I
\(^{8}\) Energy and Climate Change Committee, Third Report of Session 2009-10, The proposals for national policy statements on energy, HC 231-I
2 The green economy

Green fiscal stimulus

8. There have been numerous calls for a green stimulus or New Deal, internationally and in the UK:

- Ban Ki-Moon, the UN Secretary-General, called for a Green New Deal in his speech to the UN Framework Convention on Climate Change Conference in Poznan in December 2008;

- President Obama launched a green fiscal stimulus which intended to double the production of renewable energy in three years, retrofit three-quarters of all government buildings, weather-proof two million homes, and create nearly half a million jobs;

- In July 2008 the Green New Deal Group (including Andrew Simms of the New Economics Foundation) called for a Green New Deal to tackle the “triple crunch” of a credit-fuelled financial crisis, accelerating climate change and soaring energy prices;

- In a policy brief produced in February 2009, Professor Lord Stern of Brentford and others called for a green fiscal stimulus as “an effective boost to the economy, increasing labour demand in a timely fashion, while at the same time building the foundations for sound, sustainable and strong growth in the future.”

9. A report by HSBC in February 2009 showed that President Obama’s 2009 stimulus package delivers about 12% on ‘green’ initiatives, the Asia Pacific region led by China achieves 23%, France and Germany average 15%, and the UK – based on the 2008 pre-budget report – delivered only 7%.

10. Following this, in the April 2009 budget the Chancellor announced:

- £435 million of extra support to develop energy efficiency measures for homes, businesses and public buildings;

- £525 million of new financial support over the next two years for offshore wind, funded through the renewables obligation;

- the possibility of renewable and other energy projects in the UK standing to benefit from up to £4 billion of new capital from the European Investment Bank;

- a new funding mechanism to finance at least two, and up to four Carbon Capture and Storage projects (a firm commitment to support four projects was subsequently given in December 2009); and

- £405 million of new funding to encourage low-carbon energy and advanced green manufacturing.

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9 Nicholas Stern et al., An outline of the case for a ‘green’ stimulus, February 2009, p 2
10 HSBC Bank plc, A Climate for Recovery—The colour of stimulus goes green, February 2009, p 45
A reassessment of economic recovery plans was carried out by HSBC in November 2009. Taking into account the April 2009 budget, the proportion of ‘green’ initiatives in the UK stimulus package increased from 7% to 15%. Whilst this increase is welcomed, it still places the UK behind the South Korea, Australia, China, and France.11

<table>
<thead>
<tr>
<th>Country</th>
<th>Total stimulus fund USDbn</th>
<th>Total stimulus fund as a % of GDP</th>
<th>Fund period Years</th>
<th>Green stimulus fund USDbn</th>
<th>Green fund as a % of total stimulus fund</th>
<th>Green stimulus fund as a % of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Korea</td>
<td>76.1</td>
<td>3.6%</td>
<td>2009-2012</td>
<td>59.9</td>
<td>79%</td>
<td>2.8%</td>
</tr>
<tr>
<td>Australia</td>
<td>17.1</td>
<td>2.9%</td>
<td>2009-2013</td>
<td>6.8</td>
<td>40%</td>
<td>1.2%</td>
</tr>
<tr>
<td>China</td>
<td>586.1</td>
<td>3.1%</td>
<td>2009-2013</td>
<td>200.8</td>
<td>34%</td>
<td>1.1%</td>
</tr>
<tr>
<td>France</td>
<td>33.7</td>
<td>0.7%</td>
<td>2009-2010</td>
<td>6.1</td>
<td>18%</td>
<td>0.01%</td>
</tr>
<tr>
<td>Japan</td>
<td>154</td>
<td>2.4%</td>
<td>2009 onwards</td>
<td>23.6</td>
<td>15%</td>
<td>0.36%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>34.9</td>
<td>1.6%</td>
<td>2009-2011</td>
<td>5.2</td>
<td>15%</td>
<td>0.24%</td>
</tr>
<tr>
<td>Germany</td>
<td>104.8</td>
<td>1.6%</td>
<td>2009-2010</td>
<td>13.8</td>
<td>13%</td>
<td>0.21%</td>
</tr>
<tr>
<td>United States</td>
<td>787</td>
<td>2.0%</td>
<td>10 years</td>
<td>94.1</td>
<td>12%</td>
<td>0.24%</td>
</tr>
</tbody>
</table>

Source: HSBC Bank plc, Taking Stock of the Green Stimulus, November 2009, p 2 and own calculations

When questioned about the UK’s green stimulus and how we compare internationally, the Parliamentary Under-Secretary of State for Energy and Climate Change, Mr David Kidney MP, told us “when we are compared with other countries beware of not being compared on an even basis in this country of what we are doing compared with what they account for in their country.”12 He gave the example of the Carbon Emissions Reduction Target (CERT) obligation as a Government policy that results in green investment but which is not included in analyses of green stimulus. CERT is the obligation on energy companies to make savings on the amount of CO₂ emitted by households, which amounts to energy supplier investment of around £3 billion for the three years, 2008–2011.

The Government’s green stimulus over the past year amounts to approximately £1.4 billion. Disappointment with the level of funds committed to green initiatives was expressed almost universally by the witnesses during our inquiry:

- Greenpeace called for annual investment of over £10 billion;13
- The Environmental Industries Commission called for £10 billion;14

11 HSBC Bank plc, Taking Stock of the Green Stimulus, November 2009, p 2
12 Q 450 [Mr David Kidney MP, Department of Energy and Climate Change]
13 Q 39 [Dr Parr, Greenpeace]
14 Q 67 [Mr Stevens, Environmental Industries Commission]
• The Energy Savings Trust agreed with Lord Stern’s figure of approximately £11 billion;\(^{15}\) and

• The Sustainable Development Commission called for Government to commit up to £30 billion a year for the next 3 years on its green recovery, over and above the £50 billion for low carbon investment from the Comprehensive Spending Review 2007. This would represent around 50% of a total recovery package, amounting to 4% of the UK’s annual GDP.\(^{16}\)

The Sustainable Development Commission also told us:

Before the most recent budget, the total current commitment on green measures here in the UK amounted to 0.1% of annual GDP spread over three years. Even with the additional 2009 budget support this rises to a little over 0.2% spread over three years, still small compared to many other countries. For example, South Korea’s green recovery package is 30 times larger, at 3% of GDP over the same time frame. Without a commitment on this scale, there is every likelihood that the Government’s low-carbon, sustainable measures will be totally overwhelmed by “mainstream” (i.e. high-carbon and unsustainable) measures.\(^{17}\)

14. Professor Lord Stern of Brentford and colleagues from the Grantham Institute on Climate Change and the Environment and the Centre for Climate Change Economics and Policy called for at least 20% of the economic stimulus packages now being put forward to be deployed on ‘green’ initiatives. They also suggested that for the G20 countries, a stimulus amounting to around 2% of GDP would be appropriate.\(^{18}\)

15. We welcome the Government’s green stimulus package put forward in the April 2009 budget and subsequent green initiatives announced in the December 2009 pre-budget report. Building on this, we recommend that the Government progressively increase the proportion of green initiatives in future fiscal packages to a level of 20%, as recommended by the Grantham Institute on Climate Change and the Environment and the Centre for Climate Change Economics and Policy. The Government should also enhance the proportion of public money spent on greening the economy.

**Government priorities**

17. DECC’s written evidence to us indicates that the Government recognises the importance of investment in low carbon technologies:

It is clear that in order to meet our longer term climate change goals, deliver our carbon budgets, and create a low carbon resource efficient economy, we need to create the right conditions for effective low carbon economic development and technological innovation. To do this we propose to focus our approach on key sectors and technologies where the UK has the potential to take a global lead because of our natural resources, skills base and other advantages. These include:

1. Carbon capture and storage (CCS)
2. Offshore wind generation
3. Marine energy
4. Nuclear energy
5. Low carbon vehicles

18. The case for prioritisation of technologies is also put forward by the Carbon Trust in a recent report *Focus for success*:

The UK needs to make smart investments in LCT [low carbon technology] innovation by accelerating the move towards greater technology prioritisation and away from explicit technology neutrality […] However in a resource constrained environment, large-scale, short-term costs and longer-term and uncertain economic benefits mean that the UK can only have a global impact in a limited number of LCTs.

19. The Carbon Trust told us that it will not be possible to take a global leadership position with all low carbon technology development. It makes sense to prioritise UK investment in technologies that will help the UK reach its carbon targets and those that will not be developed elsewhere. For example, the UK has “the largest resource base for marine; others will not be prioritising it the same way that we could.” From an economic benefit perspective, the UK needs to think about where it has real comparative advantage. “There are 50 different technology families out there. If we try to support all of them we will not support any of them very well potentially.”

20. We raised with our witnesses the idea of the Government picking specific winning technologies. The Carbon Trust were in favour of the Government prioritising technology families. They told us that “Moving to a technology focussed policy stimulates competition within a technology family […] It stimulates competition between device types.” For example, there are many different device types that can be used in the marine energy

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17 Ev 175, para 4 [Department of Energy and Climate Change]
18 The Carbon Trust, *Focus for success*, July 2009
19 Q 155 [Mr Wilde, The Carbon Trust]
20 Q 155 [Mr Wilde, The Carbon Trust]
21 Q 159 [Mr Wilde, The Carbon Trust]
sector. Prioritisation of marine energy by the Government should stimulate competition between technologies that can best utilise the UK’s abundant marine resources.

The low carbon sector and green jobs

21. In March 2009, the Government-commissioned report Low Carbon and Environmental Goods and Services: an industry analysis was published.24 This report established a definition for the low carbon and environmental goods and services (LCEGS) sector, covering the whole environmental supply chain, from research and development, through manufacturing into distribution, retail, installation and maintenance services. The global market value within the LCEGS sector was £3,046 billion in 2007/8, of which the UK share was 3.5%, or £106.7 billion. In the UK there are 881,000 jobs within the LCEGS sector—often referred to as “green” jobs.

24 Innovas, Low Carbon and Environmental Goods and Services: an industry analysis, March 2009
<table>
<thead>
<tr>
<th>Sector</th>
<th>£ billion</th>
<th>% total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air pollution</td>
<td>0.95</td>
<td>0.89</td>
</tr>
<tr>
<td>Environmental consultancy</td>
<td>0.74</td>
<td>0.70</td>
</tr>
<tr>
<td>Environmental monitoring</td>
<td>0.15</td>
<td>0.14</td>
</tr>
<tr>
<td>Marine pollution control</td>
<td>0.12</td>
<td>0.11</td>
</tr>
<tr>
<td>Noise and vibration control</td>
<td>0.20</td>
<td>0.19</td>
</tr>
<tr>
<td>Contaminated land</td>
<td>0.91</td>
<td>0.85</td>
</tr>
<tr>
<td>Waste management</td>
<td>4.80</td>
<td>4.49</td>
</tr>
<tr>
<td>Water and waste water treatment</td>
<td>7.93</td>
<td>7.43</td>
</tr>
<tr>
<td>Recovery and recycling</td>
<td>6.48</td>
<td>6.07</td>
</tr>
<tr>
<td>Hydro</td>
<td>0.50</td>
<td>0.47</td>
</tr>
<tr>
<td>Wave and tidal</td>
<td>0.07</td>
<td>0.07</td>
</tr>
<tr>
<td>Biomass</td>
<td>4.95</td>
<td>4.64</td>
</tr>
<tr>
<td>Wind</td>
<td>11.46</td>
<td>10.74</td>
</tr>
<tr>
<td>Geothermal</td>
<td>9.22</td>
<td>8.63</td>
</tr>
<tr>
<td>Renewable consulting</td>
<td>0.48</td>
<td>0.45</td>
</tr>
<tr>
<td>Photovoltaic</td>
<td>4.43</td>
<td>4.15</td>
</tr>
<tr>
<td>Alternative fuels for vehicles</td>
<td>12.61</td>
<td>11.82</td>
</tr>
<tr>
<td>Alternative fuels</td>
<td>18.45</td>
<td>17.28</td>
</tr>
<tr>
<td>Additional energy sources</td>
<td>1.19</td>
<td>1.12</td>
</tr>
<tr>
<td>Carbon capture and storage</td>
<td>0.46</td>
<td>0.43</td>
</tr>
<tr>
<td>Carbon finance</td>
<td>5.19</td>
<td>4.86</td>
</tr>
<tr>
<td>Energy management</td>
<td>2.54</td>
<td>2.38</td>
</tr>
<tr>
<td>Building technologies</td>
<td>12.90</td>
<td>12.09</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>106.72</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

3 Energy generation

22. In 2008, the primary supply of fuels in the UK was 234.2 million tonnes of oil equivalent.\textsuperscript{25} Indigenous supply was 176.9 million tonnes of oil equivalent;\textsuperscript{26} over 80% of this comes from petroleum and natural gas (Table 3).\textsuperscript{27} The UK imported more coal, manufactured fuels, crude oil, electricity and gas than it exported; however, the UK remained a net exporter of petroleum products.\textsuperscript{28}

<table>
<thead>
<tr>
<th>Table 3. 2008 indigenous production of primary fuels</th>
<th>Million tonnes of oil equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petroleum</td>
<td>78.6</td>
</tr>
<tr>
<td>Natural gas</td>
<td>69.7</td>
</tr>
<tr>
<td>Coal</td>
<td>11.4</td>
</tr>
<tr>
<td>Primary electricity (including nuclear, wind and natural flow hydro)\textsuperscript{29}</td>
<td>13.0</td>
</tr>
<tr>
<td>Renewables and waste</td>
<td>4.2</td>
</tr>
<tr>
<td>TOTAL</td>
<td>176.9</td>
</tr>
</tbody>
</table>

*Source: DECC, UK Energy in Brief 2009, p 12*

23. The power and heavy industry sector accounts for 35% of UK emissions.\textsuperscript{30} The Government recognises the importance of decarbonising our energy supply in order to meet our greenhouse gas emissions reduction targets, and has shown a willingness to support the deployment of a diverse range of low carbon energy generation technologies.

Clean fossil fuels

Oil and gas

24. In our first Report of Session 2008-09, *UK offshore oil and gas*, we concluded that whilst it is important to decarbonise the UK economy, within the timescale for this change to take place the UK will still need to use the oil and gas resources remaining in the UK continental shelf.\textsuperscript{31} This sentiment was shared by Calor Gas Ltd. They told us:

> While climate change policies may predicate an effective shut-down of the oil industry as we know it the Budget on 22\textsuperscript{nd} April 2009 announced measures to

\textsuperscript{25} Department of Energy and Climate Change, *Digest of United Kingdom Energy Statistics*, July 2009, p 12
\textsuperscript{26} Department of Energy and Climate Change, *Digest of United Kingdom Energy Statistics*, July 2009, p 27
\textsuperscript{27} Department of Energy and Climate Change, *UK Energy in Brief* 2009, p 12
\textsuperscript{28} Department of Energy and Climate Change, *Digest of United Kingdom Energy Statistics*, July 2009, p 12
\textsuperscript{29} As defined in Department of Energy and Climate Change, *Energy Trends*, December 2009, p 54
\textsuperscript{31} Energy and Climate Change Committee, First Report of Session 2008-09, *UK offshore oil and gas*, HC 341-I, p 3
promote the extraction of an extra 2 billion barrels of oil and gas in a bid to make the North Sea an energy hub for the future […] While LPG [Liquefied Petroleum Gas—a low carbon emitting hydrocarbon fuel] presumably has no place in a pure zero carbon setting (i.e. when fossil fuels cease to be used altogether) it can nonetheless be a realistic and practical bridging technology in the interim.32

25. Domestically produced oil and gas indeed remain vital to bridging the energy gap as we move towards a low carbon energy supply. However, we continue to import a large amount of oil and gas from abroad. A recent report by Mr Malcolm Wicks MP reviewed the implications of developments in international energy markets for the UK’s future energy security:

Though alternative technologies have rich promise to provide more of the world’s energy needs, and there is scope for all countries to use energy more efficiently, world fossil fuel demand is likely to grow over the next decade […] There are clear risks that global supply of oil and gas will not keep pace with demand.33

26. As we move towards low carbon energy generation, it is vitally important that we continue to maximise economic production of domestic oil and gas to bridge the gap in supply. However within the context of our increasing reliance on imported oil and gas and the continuing risk of disruption to their supply, it is essential that the Government accelerate the deployment of alternative low carbon energy generation technologies.

Clean coal

27. Carbon capture and storage (CCS) involves capturing carbon dioxide (CO₂) emitted from large sources such as fossil fuel power stations, transporting it, and then storing it in secure geological formations deep underground.34 Coal-fired power plants equipped with carbon capture and storage technology could reduce CO₂ emissions to the atmosphere by 80-90% compared to a plant without CCS.35 The global market value of the carbon capture and storage sector in 2007/08 was £13.28 billion; the UK had a 3.48% share of this. The UK employed 4,600 people in this sector in 2007/08. Based on forecast growth in domestic market value, this could potentially rise to 6,200 in 2014/15.36

28. In 2007, the Government launched a competition to build commercial scale CCS power plants in the UK. The project aims to demonstrate post-combustion CCS on a coal-fired power station with CO₂ stored offshore, capturing CO₂ from 300 MW net of the power station’s capacity. In April 2009 the Government confirmed that new combustion power stations at or over 300 MWe must be built Carbon Capture Ready, which means

32  Ev 155–156, para 2.3-2.4 [Calor Gas Ltd]
33  Mr Malcolm Wicks MP, Energy Security: A national challenge in a changing world, August 2009, p 3
34  CO₂ capture, transport and storage, POSTnote 335, Parliamentary Office of Science and Technology, June 2009
35  Intergovernmental Panel on Climate Change (IPCC), Carbon dioxide capture and storage: a summary for policymakers, 2005, p 4
36  Innovas, Low Carbon and Environmental Goods and Services: an industry analysis, March 2009, p 40
they should be designed so there are no foreseeable barriers to retrofitting once CCS technology at this scale is proven.37

29. The Carbon Capture and Storage Association (CCSA) told us that the Government has done very well in developing the regulatory system for carbon capture and storage. However, they complained of the length of time it has taken to get CCS projects going in the UK:

The first project is not commissioned yet. Meanwhile, our competitors in other parts of the world, for example in Canada, took exactly 11 months between announcing that they would finance three demonstration projects to choosing the three projects from quite a long list. Projects are being committed also in the USA and in Australia. The first power project with CCS may well be in China and the second may well be in Abu Dhabi and we have not got to the point yet where we have committed a single project.38

The CCSA ascribed this delay to bureaucracy and a lack of ambition. Other organisations—including Intergen and E.ON—shared these concerns about the slow progress and uncertainty of the Government’s CCS projects.39

30. Faster demonstration and deployment of CCS technology is essential if the UK is to take advantage of the huge export potential within any future global CCS market. The Energy Technologies Institute (ETI) told us:

Australia, China, the United Kingdom, Japan, America are all very interested in CCS for obvious reasons […] CCS is going to be a major global market. The companies that provide the equipment and technology will be global players […] It will be the well-known names in the engineering supply industry and energy supply.40

The ETI went on to argue that in order to re-gain the lead in this area, incentives for those kinds of companies to set up operations in the UK or to transfer to the UK need to be provided:

It is not about implementing a CCS plant in the UK and as a consequence suddenly a major multi-national relocates all its design and manufacture capability to the UK […] It will be about a sustained series of financial business incentives to actually make that happen.41

31. In July 2009, the Government announced that they would establish an Office of Carbon Capture and Storage to drive forward CCS demonstration. Following this, the Pre-Budget Report in December 2009 contained a firm commitment from the Government to supporting four commercial scale demonstrations in the UK of CCS on coal power generation. In a recent speech to the Coal UK Conference, Lord Hunt of Kings Heath OBE,

37  Department of Energy and Climate Change, www.decc.gov.uk
38  Q 360 [Mr Chapman, Carbon Capture and Storage Association]
39  Ev 225, para 7 [Intergen] and Ev 190, para 23 [E.ON]
40  Q 194 [Dr Clarke, Energy Technologies Institute]
41  Q 194 [Dr Clarke, Energy Technologies Institute]
Minister of State for the Department of Energy and Climate Change reiterated the Government’s CCS ambition:

Our ambition is to see CCS ready for wider deployment from 2020 and for any new coal plant constructed from then to be fully CCS from day one. We expect demonstration plant will retrofit CCS to their full capacity by 2025, with the CCS incentive able to provide financial support.42

32. We are disappointed by the lack of progress on CCS demonstration in comparison to international competitors. Furthermore, whilst we welcome the establishment of the Office of Carbon Capture and Storage, we are disappointed that the Office has yet to undertake any substantial work. It must be provided with the appropriate level of support to drive demonstration projects through urgently. We recommend that the model set by the Office for Nuclear Development (OND) is followed, and that one of its first priorities be the development of a roadmap for carbon capture and storage in the UK, similar to the OND’s Integrated Programme Plan and Consultation Maps. This will provide stakeholders with clearly defined timescales and milestones for the CCS demonstration projects.

33. One limitation of CCS is its energy penalty, as it uses between 10-40% more fuel for the same amount of electricity.43 Currently the UK imports 2.5 times more coal than it produces.44 Widespread deployment of CCS will not only require roughly a third more coal to sustain the same amount of power generation, increasing both the capital and running costs of coal-fired power stations, but it will also increase our dependence on imported coal and with it bring uncertainty over our energy security. When questioned about this, the Minister responded “One of the points about demonstration of these technologies [CCS] is to get some facts rather than theories about these things […] there are other factors to weigh in as well as the total amount of energy consumed, including the carbon emissions”.45 However, coal-fired power plants capable of 90% carbon capture may still have lifecycle emissions which exceed 100 g CO2eq /kWh, whilst an economy based on nuclear and renewable energy, would give lifecycle emissions of only 10 g CO2eq /kWh.46

34. Whilst future coal supply to power stations in the UK will depend on the extent to which new abated coal fired plant replaces retiring power stations, all other things being equal we are concerned by the prospect of an increased dependence on imported coal due to the extra fuel required for future coal-fired power stations fitted with CCS technology, with the attendant security of supply risk that is entailed. The Government should reconsider whether it could do more to support the UK’s own coal industry. Energy security issues should be a prime consideration when the Government is developing policies in support of low carbon technologies.

43 Intergovernmental Panel on Climate Change (IPCC), Carbon dioxide capture and storage: a summary for policymakers, 2005, p 4
44 Department of Energy and Climate Change, Digest of United Kingdom Energy Statistics, July 2009, p 50
45 Q 471 [Mr David Kidney MP, Department of Energy and Climate Change]
46 Ev 180, Annex A [Department of Energy and Climate Change]
35. Storage of captured CO₂ could be good business for the UK. Professor Stuart Haszeldine from the University of Edinburgh has said that a continental pipeline exporting CO₂ from countries like Germany could potentially earn the UK up to £5 billion a year in selling storage space.⁴⁷ The Minister reminded us that:

When some people criticise us for the speed of our progress on carbon capture and storage it is as well to remember that we have legislated for the liability about the long term storage of the carbon and we have conducted the consultation about the licenses for storing the carbon captured under the North Sea.⁴⁸

36. Some commentators claim that safe and permanent storage of CO₂ cannot be guaranteed and that even low leakage rates could undermine efforts to mitigate climate change. However, the Intergovernmental Panel on Climate Change reported that the fraction of CO₂ retained in appropriately selected and managed geological reservoirs is likely to exceed 99% over 1,000 years.⁴⁹ Despite this we questioned the Minister on the strategy for the public understanding of safe transportation and storage of CO₂. The Minister acknowledged that in due course this “will require a major public education campaign, and we are mindful that we will need to do that”.⁵⁰

37. Pipelines to transport the CO₂ will be a significant part of the overall cost in building CCS power plants in the UK.⁵¹ If each new plant is responsible for the cost of its own line to a CO₂ storage location, this may be prohibitively expensive. This cost could be shared by clusters of CO₂ generating facilities if oversized pipelines are used and a strategic overview taken of where these pipelines are located.

38. The UK could benefit from selling space for carbon storage under the North Sea, potentially to the value of £5 billion annually. The Government should consider investing in demonstration units for test injections and infrastructure development.

39. Transportation and storage of CO₂ is generally recognised as being safe. However, if the Government decides to support new-build CCS fitted or retrofitted power plants it is important to engage with the public, at an early stage, on any potential risks. It should develop a public communications strategy which would need to be central to its overall objectives on CCS. The Government should also take a more strategic overview of CO₂ transport infrastructure, including assessing the need for oversized pipelines.

Nuclear

40. The UK currently has 19 operating nuclear reactors at ten power stations, which provided 13% of the electricity generated in the UK in 2008. By 2025 all but one of these power stations will be closed down as they reach the end of their expected working lives.⁵²

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⁴⁷ "UK lined up to be Europe’s carbon storage capital”, Guardian, 8 September 2009, guardian.co.uk
⁴⁸ Q 474 [Mr David Kidney MP, Department of Energy and Climate Change]
⁴⁹ Intergovernmental Panel on Climate Change (IPCC), Carbon dioxide capture and storage: a summary for policymakers, 2005, p 14
⁵⁰ Q 470 [Mr David Kidney MP, Department of Energy and Climate Change]
⁵¹ Q 377 [Mr Phillips, Carbon Capture and Storage Association]
⁵² Department of Energy and Climate Change, www.decc.gov.uk
In 2009, the UK nuclear industry employed 45,500 people.\textsuperscript{53} The Government believes new nuclear power stations should have a role to play in this country’s future energy mix alongside other low-carbon sources; that it would be in the public interest to allow energy companies the option of investing in new nuclear power stations; and that they should take active steps to facilitate this.\textsuperscript{54}

41. In September 2008 the Office for Nuclear Development (OND) was established. DECC told us:

The OND has a role to create and support a globally competitive UK supply chain, focusing on high value added activities to take advantage of the UK and worldwide nuclear programme. The OND is also working to ensure that the skills base is sufficiently developed to support a new generation of nuclear power stations.\textsuperscript{55}

42. Through the Planning Act 2008, the Government set up a new body, the Infrastructure Planning Commission (IPC) to take responsibility for applications for nationally significant infrastructure and announced its intention to produce national policy statements (NPS) outlining policy in relation to future developments. The Government’s draft national policy statement on nuclear energy was published in November 2009. This is intended to reduce uncertainty about the siting of new nuclear power stations as applications come forward to the IPC for development consent. We have major concerns about the nature of the NPS consultation process; however, this is an issue we commented on in more detail in our Report, \textit{The proposals for national policy statements on energy}.\textsuperscript{56}

43. The Government must do more to ensure that proper consultation and good public engagement is carried out on all aspects of nuclear (including siting of new build, decommissioning and waste management) if the public are to accept it as a viable low carbon energy source. We commented in more detail in our recent Report, \textit{The proposals for national policy statements on energy}; the evidence we received during that inquiry made it abundantly clear that many consider consultation on the draft national policy statements to have been inadequate.

44. A number of organisations we heard from were supportive of the Government’s commitment on nuclear energy, including: E.ON;\textsuperscript{57} EDF Energy;\textsuperscript{58} and Centrica.\textsuperscript{59} However the Sustainable Development Commission (SDC) expressed concerns about the “long-term impacts of nuclear, issues about risk, cost and long-term waste implications. Also, most relevant here is the concern about lock-in, that significant investment in nuclear would crowd out other investments in newer technologies.”\textsuperscript{60} The SDC explained that in order to prevent this from happening the Government should focus its funding on the

\textsuperscript{53} Data from the Nuclear Industry Association

\textsuperscript{54} HM Government, \textit{Meeting the energy challenge: A white paper on nuclear power}, January 2008, p 37

\textsuperscript{55} Ev 175–176, para 9 [Department of Energy and Climate Change]

\textsuperscript{56} Energy and Climate Change Committee, Third Report of Session 2009-10, \textit{The proposals for national policy statements on energy}, HC 231-I

\textsuperscript{57} Ev 191, para 24 [E.ON]

\textsuperscript{58} Ev 193, para 10 [EDF Energy]

\textsuperscript{59} Ev 169, para 5 [Centrica PLC]

\textsuperscript{60} Q 409 [Mr Smith, Sustainable Development Commission]
development of new less proven technologies such as CCS, and that new generation nuclear technologies should be developed by the generating companies in the existing marketplace.\textsuperscript{61} However, EDF Energy told us that:

There are growing industry concerns that the current market will not provide sufficient long term support for affordable investment in new nuclear, given the prospect of large volumes of subsidised intermittent renewables, subsidies for coal and CCS and uncertainty over the carbon price. We are therefore advocating the need for UK specific carbon price support mechanisms to drive the necessary investment in low carbon generation.\textsuperscript{62}

The Minister responded to our concerns by assuring us that:

One thing that is very important about the new generation of nuclear power stations is that there will be no public subsidy and the business plans of the various consortia, the men stepping forward with proposals for the next generation of nuclear power stations in this country, know that part of their cost is that they will have to contribute to paying for that long term storage of waste.\textsuperscript{63}

However the Minister conceded that a certain amount of public money is indirectly contributing to the nuclear industry through the Nuclear Skills Academy for Nuclear and wider training in STEM (Science, Technology, Engineering and Mathematics) subjects.\textsuperscript{64}

45. We share the concerns put to us that investment in new nuclear could crowd out investment in renewables and believe that the Government must consider this carefully when developing policies for support of low carbon energy. Whilst it is right to support a diverse energy mix including all low carbon energy generation technologies, we do not think that the Government should directly fund the development of new nuclear technologies—this should be left to the energy generating companies.

46. The New Economics Foundation (NEF) cited work by an analyst, David Fleming, “who has worked out that when you do a full life-cycle energy analysis of potential new nuclear and you look at the energy involved in its long-term safe storage, construction, mining, etc, etc, nuclear can provide no more energy than you will need in its full life-cycle to manage its mining, building, decommissioning and long-term safe storage”.\textsuperscript{65} The work by David Fleming draws on research carried out by, amongst others, Dr Manfred Lenzen at the University of Sydney, Australia.\textsuperscript{66} The Department of Energy and Climate Change also provided us with lifecycle analyses of nuclear energy and other energy generation technologies.\textsuperscript{67} This also cited research by Dr Lenzen and others. While there is some

\textsuperscript{61} Q 416 [Mr Smith, Sustainable Development Commission]
\textsuperscript{62} Ev 193, para 9 [EDF Energy]
\textsuperscript{63} Q 475 [Mr David Kidney MP, Department of Energy and Climate Change]
\textsuperscript{64} Q 477 [Mr David Kidney MP, Department of Energy and Climate Change]
\textsuperscript{65} Q 34 [Mr Simms, New Economics Foundation]
\textsuperscript{67} Ev 180, Annex A [Department of Energy and Climate Change]
disagreement over the exact numbers, it is clear that the lifetime greenhouse gas emissions of nuclear are at least an order of magnitude smaller than those of unabated coal (Table 4).

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Source: Department of Energy and Climate Change, Ev 180, Annex A

47. There is much debate on the lifecycle emissions of nuclear power compared to other low carbon technologies. The evidence we have received relates predominantly to the experiences of other countries. We believe that it would be beneficial for the Government to commission its own independent, systematic research on the lifecycle analyses of low carbon energy generation technologies in the UK. Data from such research would add value to the debate on the most appropriate UK energy mix.

Renewables

48. Renewables accounted for 5.5% of electricity generated in the UK in 2008, up from 4.9% in 2007. The Government hopes to increase this to 30% of electricity from renewables, in addition to 12% of heat from renewables and 10% of transport energy from renewables by 2020, helping the UK reach its legally binding target of 15% of energy from renewables by that date. There can be no doubt that renewable energy sources, by their very nature, can provide the biggest reduction in greenhouse gas emissions. The issue with renewables has been and remains their commercial viability. In a world reliant on cheap fossil fuels, renewable energy technologies currently need to be heavily subsidised through a range of support mechanisms.

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68 Department of Energy and Climate Change, UK Energy in Brief 2009, p 29
49. Current financial support mechanisms for renewables are listed below but will be discussed in more detail later in this report.

- **Renewables Obligation**

  The Renewables Obligation (RO) is the Government’s main mechanism for supporting the generation of renewable electricity. The RO requires electricity suppliers to source an annually increasing percentage of their sales from renewables. For each megawatt hour (MWh) of renewable energy they generate, they receive a tradable certificate called a Renewables Obligation Certificate (ROC). Suppliers can meet their obligation by acquiring ROCs, by paying a buy-out price—currently £37.19/MWh, or a combination of these options.\(^{69}\)

- **Feed-in tariff**

  The feed-in tariff (FIT) provides a mechanism for householders and communities who install small scale low carbon electricity technology such as solar photovoltaic panels and wind turbines (up to 5 MW) to be paid for the electricity they generate, commencing in April 2010. The level of payment depends on the technology and is linked to inflation.

- **Renewable Heat Incentive**

  The Government is currently consulting on a Renewable Heat Incentive (RHI) scheme, which is intended to provide financial support to those who install renewable heat technologies, including air and ground-source heat pumps (and other geothermal energy), solar thermal, biomass boilers, renewable combined heat and power, use of biogas and bioliquids and the injection of biomethane into the natural gas grid. It is hoped that this will be introduced in April 2011.

**Wind**

50. The UK has some of the best wind resources in Europe.\(^{70}\) Both onshore and offshore wind farms are expected to be major contributors to the UK’s emissions reduction targets for 2020 and beyond. The global market value of the wind energy sector in 2007/08 was £351.41 billion; the UK had a 3.26% share of this. The UK industry employed 87,500 people in 2007/08. Based on forecast growth in domestic market value, this could potentially rise to 156,800 in 2014/15.\(^{71}\)

**Onshore wind**

51. On 10 November, DECC announced up to £1.4 billion in new loans for onshore wind farms (£700 million from the European Investment Bank and matching funds from three UK-based banks). The Secretary of State for Energy and Climate Change, Rt Hon Ed Miliband MP said "The UK now has 4 GW of wind capacity. And the pace of installation is

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\(^{69}\) Department of Energy and Climate Change, www.decc.gov.uk

\(^{70}\) Ev 190, para 18 [E.ON]

\(^{71}\) Innovas, *Low Carbon and Environmental Goods and Services: an industry analysis*, March 2009, p 40
picking up. It took us 14 years to build the first gigawatt, and just one year to build the last. But we still need a 6-fold increase in renewables by 2020 to hit our renewables target.”

The target of 15% renewable energy would require an increase from 39 TWh (terawatt hours) in 2008 to 239 TWh in 2020. Terawatt hour is a measure of energy, whilst terawatt and gigawatt are measures of power. The load factor of a power plant is the ratio of the actual energy output over a period of time to the total potential power output if the plant was working at full capacity. In this context, terawatt hour measurements takes account of the load factor of different types of power plant thereby providing a measure of the actual energy output one can expect from new plants.

52. New renewable energy generation plants are described in terms of their capacity in gigawatts. It would be more meaningful if, alongside this—in reports, strategies, roadmaps, speeches—the Government would systematically define the estimated capacity value of new power plants expressed both as a percentage of installed capacity and in estimated terawatt hours of generation per annum. This would take into account the load factor of different energy generation technologies, and would enable easier analysis of the Government’s progress towards meeting its renewable energy targets.

53. Evidence from the British Wind Energy Association (BWEA) suggests that 14 GW capacity of onshore wind energy is possible in the UK by 2020, but they currently expect 11 GW: “there are approximately 3 GW of wind power operating, nearly 1 GW under construction and a further 3 GW with consent. If two-thirds of the 7 GW currently in the planning system is consented, roughly the historic pass rate, then a total of about 11 GW of projects [by 2020] will result from projects already in the system.” The Government attribute the growth in onshore wind generation, from 1.3 TWh in 2002 to 5.8 TWh in 2008, to the Renewables Obligation. BWEA agree with this assessment, and believe the Renewables Obligation will also catalyse growth in the offshore wind industry.

54. BWEA and E.ON both told us that the planning process for onshore wind farms remains a huge barrier to development. The Planning Act 2008 enabled the introduction of the Infrastructure Planning Commission (IPC) to approve planning applications for nationally significant infrastructure. This will include renewable electricity generating plants greater than 50 MW onshore and greater than 100 MW offshore. In addition to this the Government has drafted National Policy Statements (NPS) setting out policy on energy infrastructure. As most of the planning applications for onshore wind in England are 50 MW or less in size, they will not come under the remit of the IPC. However, local planning authorities should have regard to these documents when preparing local strategies and when taking planning decisions.

72 Department of Energy and Climate Change press notice, Up to £1.4 billion in new loans for onshore wind farms, 10 November 2009, www.decc.gov.uk
74 Ev 153, para 13 [British Wind Energy Association]
76 Q 107 [Mr Edge, British Wind Energy Association]
77 Q 113 [Mr Edge, British Wind Energy Association] and Ev 190, para 19 [E.ON]
78 Planning Act 2008
55. Greater public acceptance for onshore wind farms can be achieved through community engagement and participation. The Westmill Wind Farm Co-op is an example of a community owned wind farm whereby members of the local community benefit from a share in the wind farm. Funds are also provided for energy conservation measures within the local community. We met with Vestas during our visit to Berlin and Copenhagen and they told us that in Denmark, 20% ownership of wind farms must be offered for sale to local residents; this helps reduce local opposition and increases the chances of getting planning consents.

56. The Government has stimulated the market for wind power through the Renewables Obligation; however, onshore planning is still a huge problem. We commented on the planning process in greater detail in our recent Report, The proposals for national policy statements on energy. There is a need for better dialogue with the general public to promote onshore wind and emphasise the importance of utilising the UK’s natural wind resources, thereby preventing reliance on unsustainable fossil fuels. Local government should find ways of encouraging community ownership schemes such as the Westmill Wind Farm Co-op. We believe that the Government should introduce legislation stipulating that a percentage of new wind farms should be offered for sale to local residents, as in Denmark, as a way of increasing public acceptance.

Offshore wind

57. A number of organisations we heard from believe that energy generation from offshore wind will be key to the UK reaching its renewable energy targets. The Government identified a potential 39 GW of UK offshore wind by 2020, this includes 33 GW from rounds 1, 2 and 3 licensing, plus up to 6 GW in Scottish territorial waters. Offshore wind could provide enough energy to power nearly all the homes in the UK. The BWEA told us “If the delivery of offshore wind in the UK is ramped up to perhaps 3 GW per year in 2020, out of a wider European market of 6-7 GW per year, then it is possible to have 20 GW of operating capacity in that year.” However, they also explained that the limiting factor in delivering this would be the supply chain. The Crown Estate shared this concern, they told us:

The supply chain (for offshore wind in particular) is currently heavily constrained, with a very limited number of suppliers available, in particular for offshore wind turbines. There are also constraints and long delays in the supply of offshore cables and transformers together with a lack of installation vessels for construction. This is having a marked effect on the time taken for developers to construct offshore wind farms following award of the requisite consents. It is evident that if the supply chain

80 Ev 172 [The Crown Estate], Ev 162 [Carbon Trust], Ev 217 [Global Marine Systems] and Ev 152 [British Wind Energy Association]
82 Department of Energy and Climate Change press notice, Offshore wind expansion biggest ambition in the world, 8 January 2010,  www.decc.gov.uk – 1 GW of offshore wind can power 680,000 homes, based on average household consumption of 4,500 KWh and a load factor of 35%
83 Ev 153, para 14-15 [British Wind Energy Association]
could be presented with a steady long-term market, then it would be more likely to commit to the significant investment required in order to gear up to the needs of the UK, presented by the 2020 targets.84

58. The South East England Development Agency (SEEDA) also highlighted the importance of UK ports in the offshore wind energy supply chain: “suitable UK Port facilities, especially for concrete construction and turbine assembly, are both a critical anchor and conduit for the involvement of the UK supply chain.”85 Both BWEA and E.ON pointed out that the UK already has many of the skilled workers needed in the supply chain. BWEA told us:

This country has a distinguished tradition of heavy electrical engineering and capabilities in manufacturing areas such as aerospace and motor vehicles which could be transferred. The expertise in offshore structures and operations developed in the course of extracting oil and gas from the North Sea is also very relevant.86

59. The Minister told us that he had met with companies in the oil and gas industry that carry out construction work for the offshore wind industry, and that there are big opportunities for moving into this sector.87 However, Energy and Utility Skills warned us that “the returns to individuals working in the oil and gas industry were more lucrative than were likely to appear in the renewables industry in the first instance and therefore the attractiveness [of moving into a new sector] was going to be difficult.”88

60. In the future the supply chain for offshore wind could be constrained by a lack of offshore cables, transformers and installation vessels. This poses a risk to the UK’s ability to meet its renewables targets. There is huge potential for workers in the oil and gas sector to help overcome this by utilising their skills in emerging renewable industries such as offshore wind. The Government should bring key stakeholders together in these industries to develop a skills transfer strategy to identify specific opportunities and barriers that may be faced. This should complement other skills strategies that are being developed to encourage new entrants into renewable energy industries.

61. E.ON, the Carbon Trust, Global Marine Systems, and Greenpeace told us that there is a major opportunity for the UK to reap economic benefits through growth in offshore wind.89 The Carbon Trust explained that it was an immense challenge to deliver the level of offshore wind power needed, but “Success would [...] enable the UK to meet renewable energy targets, cut carbon emissions by 14%, create 70,000 new jobs and bolster energy security.”90

84 Ev 172 [The Crown Estate]
85 Ev 259, para 4 [South East England Development Agency]
86 Ev 152, para 4 [British Wind Energy Association]
87 Q 453 [Mr David Kidney MP, Department of Energy and Climate Change]
88 Q 209 Mr Corrigan [Energy and Utility Skills]
89 Ev 187 [E.ON], Ev 162 [Carbon Trust], Ev 217 [Global Marine Systems] and Ev 221 [Greenpeace]
90 Ev 162 [Carbon Trust]
62. The pre-budget report in December 2009 announced that all offshore wind projects accredited between April 2010 and March 2014 would qualify for 2 ROCs and that £50 million would be provided for investment in the industry. A number of organisations, whilst being in favour of Government support for renewables through the Renewables Obligation, told us that there was a need for longer term support. The Crown Estate told us “A consistent Government policy framework (targets, regulations, grid, economics, supply chain) is essential. Investment will move to the countries with the best framework.”

The Carbon Trust, Global Marine Systems and BWEA agreed that a clear long term commitment from Government would encourage a strong, stable market and allow industry to invest with confidence. Centrica explained their thoughts on long term commitment from the Government:

For the longer term, we believe that new projects should be guaranteed 20 years of support under the Renewables Obligation. This will signal the long-term nature of the UK renewables sector and will encourage the necessary investment in projects, skills and in growing a UK supply chain. Existing projects should not receive support beyond 2027 as this would not represent value for money for consumers.

The Government has attempted to assure renewables developers of its long term commitment to the sector. In the 2008 pre budget report, the Government announced its intention to extend the Renewables Obligation for an additional ten years, from 2027 to 2037.

63. We welcome the announcement in the pre-budget report that all offshore wind projects accredited between April 2010 and March 2014 will qualify for two Renewables Obligation Certificates. However, industry still calls for a longer term commitment from the Government to provide it with the certainty it needs to invest in offshore wind energy and other renewables. The Government needs to do more to provide certainty about the minimum level of support that industry can expect.

64. The difficulties of connecting offshore wind farms to the onshore transmission network remains a challenge for the UK that many organisations raised with us during this inquiry. They include: the Crown Estate, Carbon Trust, Global Marine Systems, Greenpeace, and Centrica. This is a subject we have recently commented on in our report *The future of Britain’s electricity networks*. In that report, we conclude:

There are many challenges associated with the expansion of the electricity network offshore. It is important the regulatory framework reflects these difficulties and treats generators connecting offshore equitably vis-à-vis their onshore counterparts. The offshore wind industry presents a significant commercial opportunity for British

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91 Ev 172 [The Crown Estate]
92 Ev 162 [Carbon Trust], Ev 217 [Global Marine Systems] and Ev 152 [British Wind Energy Association]
93 Ev 169, para 9 [Centrica PLC]
industry, which requires a regulatory regime that will stimulate domestic investment in cabling and associated equipment manufacture.95

**Wave and tidal**

65. The UK has an estimated practical wave resource of around 50 TWh of electricity a year and a practical tidal stream resource of around 18 TWh a year. This represents around 35% of Europe’s wave energy resource and 50% of Europe’s tidal energy resource.96 The global market value of the wave and tidal energy sector in 2007/08 was £1.98 billion; the UK had a 3.7% share of this. The UK employed 600 people in this sector in 2007/08. Based on forecast growth in domestic market value, this could potentially rise to 900 in 2014/15.97 Further growth in the number of jobs in this sector is expected over a longer time scale, and will depend upon the demonstration and deployment of marine technologies that are currently in their infancy.

66. The Government identified marine energy as one of five priority areas for low carbon technologies.98 One project that has been given much attention is the Severn Tidal Power scheme, which could generate 5% of the UK’s electricity. A feasibility study is currently underway to assess whether or not to develop tidal power in the Severn Estuary; the study is expected to end in 2010. **We have taken evidence about the Severn Feasibility Study from the Minister of State for Energy and Climate Change, Lord Hunt of Kings Heath OBE.** We look forward to receiving details of the findings of the feasibility study later this year. We recognise the potential offered by such a scheme whilst noting the significant economic and environmental barriers involved. We hope this is an area our successor committee will return to in the new Parliament.

67. The Government introduced a £50 million Marine Renewables Deployment Fund (MRDF) in 2004 to support the deployment of marine technologies ready for commercialisation. During the course of our inquiry we heard from Greenpeace that, disappointingly, only a few million of this had been spent to date.100 The Renewable Energy Association told us that leading technology companies such as Pelamis Wave Power Ltd are developing their products outside the UK because of the long term financial support offered in countries like Portugal.101 In September 2009, the Government created the Marine Renewables Proving Fund (MRPF)—a new £22 million initiative, designed to accelerate the most promising marine devices to the point where they can qualify for the MRDF. When questioned, the Minister explained that the MRDF had been created in consultation with the marine sector but developers later realised they had been over-optimistic about the stage of development of marine devices.102 Funding was awarded from

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96 Ev 175, para 8 [Department of Energy and Climate Change]
97 Innovas, Low Carbon and Environmental Goods and Services: an industry analysis, March 2009, p 40
98 Ev 175, para 4 [Department of Energy and Climate Change]
100 Q 53 [Mr Simms, Greenpeace]
101 Q 110 [Mr Wolfe, Renewable Energy Association]
102 Q 456 [Mr David Kidney MP, Department of Energy and Climate Change]
the MRPF to the six most promising technologies in February 2010. Pelamis was one of the companies that will benefit from the proving fund, and the Minister told us “Pelamis’ developers in fact think that they will be the first to ask for the deployment fund money.”

68. Given the substantial wave and tidal energy resources in UK waters, it is important that the UK remains a leader in developing and deploying marine technologies. It is extremely disappointing that five years have been lost whilst the Government and developers in the marine sector came to the slow realisation that support was needed at an earlier stage of development. However, we welcome the recently established Marine Renewables Proving Fund and are pleased that funds are being awarded for the development of commercial scale devices. The Government must undertake more careful assessment of the stage of development of emerging technologies in order to avoid wasting time in the future.

69. In July 2009, the Government established an Office for Renewable Energy Deployment (ORED). ORED’s mission is “To accelerate the deployment of renewable energy in order to reduce carbon emissions, increase energy security and create business opportunities in the UK.” ORED’s work includes renewables financial incentives, onshore and offshore wind (including an effective planning system), promoting bioenergy, and deployment of marine devices.

70. We welcome the establishment of the Office for Renewable Energy Deployment. However, due to the varying stages of development of different renewable energy technologies (for example, wind verses wave), we are concerned that the marine energy sector and other emerging renewable sectors might be neglected in favour of the well established wind sector. Given the prioritisation of marine technologies, the Government should consider whether there are any benefits in establishing a separate Office for Marine Energy Deployment to tailor specifically support towards this emerging sector.

**Solar**

71. The main solar technologies that can be exploited in the UK are solar photovoltaics and solar thermal. Photovoltaic (PV) technologies convert solar energy into electricity. The global market value of the photovoltaics sector in 2007/08 was £141.98 billion; the UK had a 3.12% share of this. The UK employed 38,000 people in this sector in 2007/08. Based on forecast growth in domestic market value, this could potentially rise to 63,300 in 2014/15. Solar thermal technologies convert energy from the sun directly into heat. Solar Thermal Magazine recently reported that “The European solar thermal market achieved a spectacular growth of 60% in 2008. By 2050 solar thermal has the potential to cover 47% of the EU low-temperature heat demand. In terms of economic effects, the impact on
employment would be considerable. In total, the solar thermal sector would provide 470,000 full-time jobs in 2020, in the European Union domestic market alone. 107

72. Solar technologies have not been given high priority by the Government in the Renewable Energy Strategy lead scenario. The UK Photovoltaic Manufacturers’ Association called solar photovoltaics the forgotten technology of the Renewable Energy Strategy. They said “last year we installed 0.3 per cent of what was installed in Germany”. 108 The Solar Trade Association has complained of a similar lack of support for solar thermal technologies: “We have somewhere in the region of 60,000 square metres of solar thermal being installed per annum in the UK. In Germany last year there were 2.1 million square metres installed”. 109

73. The Minister denied that solar technologies had been forgotten. He told us:

If you take the Low Carbon Building Programme of grants for people to install renewable energy technologies of £131 million, £50 million of that has been spent on solar insulations. In addition to that £50 million, another £55 million was spent on the Major Demonstrations Programme for Solar. Of course, next April [2010] feed-in tariffs arrive in the UK. 110

74. The Chief Scientific Advisor for the Department of Energy and Climate Change, Professor David MacKay, went on to tell us that the lead scenario in the Renewable Energy Strategy “is just a projection, a possible outcome—that projection is based on the economic costs. Solar photovoltaics are still really quite an expensive way to generate electricity. Hopefully these costs are going to come down”. 111 The Carbon Trust agreed with this evaluation, stating that “Solar energy holds enormous potential but the costs are still high.” 112 However, Professor MacKay acknowledged that air source heat pumps were a very well established solar thermal technology, and could potentially play a larger part in the UK’s renewable energy targets. 113

75. We understand that the costs of some solar technologies are still very high. However, the UK has an excellent history of solar technology research and development and if we are to develop cheaper technologies, it is important to send out a positive signal to developers and industry. We are pleased to hear that the Chief Scientific Advisor for the Department of Energy and Climate Change has been scrutinising the lead scenario for renewables, and we hope that work will identify those solar technologies which offer the most cost effective contribution to moving to a low carbon economy in the longer term.

107 “By 2050 solar thermal energy could provide 47% of the UK’s low temp demand”, Solar Thermal Magazine online, 25 September 2009, solarthermalmagazine.com
108 Q 324 [Mr Leggett, UK Photovoltaic Manufacturers’ Association]
109 Q 328 [Mr Johns, Solar Trade Association]
110 Q 461 [Mr David Kidney MP, Department of Energy and Climate Change]
111 Q 462 [Professor MacKay, Department of Energy and Climate Change]
112 Ev 162 [Carbon Trust]
113 Q 463 [Professor MacKay, Department of Energy and Climate Change]
On 1 February 2010, the Government announced the final details of the new feed-in tariff scheme.\textsuperscript{114} During the course of this inquiry we had heard disappointment from the solar industries about the level of tariff that the Government had proposed in early drafts of the feed-in tariff consultation. Photovoltaics in domestic retrofit were due to receive a financial incentive of 36.5 pence per kilowatt hour (p/kWh) of electricity generated. Solarcentury told us that this needed to be ten pence higher.\textsuperscript{115} The Government’s final tariff for domestic retrofit photovoltaics was 41.3 p/kWh. The Solar Trade Association told us that they would have liked to see the Renewable Heat Incentive (RHI) introduced at the same time as the feed-in tariff. However, they acknowledged “there is more complexity over a heat incentive, and in fact it has never been done across Europe so it is quite an ambitious project that DECC have undertaken”.\textsuperscript{116}

The introduction of a feed-in tariff will provide a much-needed boost to the domestic renewable electricity industry. The Government has taken on board industry feedback and increased the tariff rate for photovoltaic technologies. As details for the Renewable Heat Incentive scheme are developed, we hope that a similarly appropriate level of support will be introduced for solar thermal technologies through better dialogue with industry.

Concentrated solar power (CSP), involves the use of lenses or mirrors to focus a large area of sunlight onto, for example, a small photovoltaic surface. Desertec told us of the potential to “generate colossal amounts of clean electricity in desert regions using [this] proven technology” and transmit it across a super-grid through Europe.\textsuperscript{117} Although such a project would not be implemented in time to contribute to the UK’s near-term renewables targets, it could be extremely important in the long-term move towards a decarbonised energy supply.

We have recently commented on the super-grid in our report the future of Britain’s electricity networks.\textsuperscript{118} In that report, we conclude:

> The ‘super-grid’ could make a significant contribution to a low-carbon economy. However, there are major technical and regulatory challenges, while the necessary funding would likely require the redirecting of capital from domestic investment in network and renewable energy infrastructure. The super-grid would have some energy security benefits such as reducing Britain’s exposure to fossil fuel price volatility, but would also bring with it new energy security risks, for example, through a new energy dependency on North African countries. We recommend the Government remains engaged at a European level in exploring the super-grid’s potential. Any future decision to invest would require a robust analysis of the

\textsuperscript{114} DECC press release, Cash Rewards for Low Carbon Electricity and Heating, 1 February 2010

\textsuperscript{115} Q 345 [Mr Newman, Solarcentury]

\textsuperscript{116} Q 329 [Mr Johns, Solar Trade Association]

\textsuperscript{117} Ev 185 [Desertec]

\textsuperscript{118} Energy and Climate Change Committee, Second Report of Session 2009-10, The future of Britain’s electricity networks, HC 194-I
scheme’s cost-effectiveness relative to other means of securing electricity supplies, such as greater demand flexibility.\textsuperscript{119}

**Biomass**

80. Biomass can be used in a number of different ways to create bioenergy. Depending on the type of biomass, it can be: combusted to generate heat or electricity; digested to generate biogas; processed to produce bioliquids for heat or power generation; or used as a transport biofuel. The global market value of the biomass sector in 2007/08 was £140.14 billion; the UK had a 3.53% share of this. The UK employed 45,800 people in this sector in 2007/08. Based on forecast growth in domestic market value, this could potentially rise to 68,700 in 2014/15.\textsuperscript{120}

81. A report published by the Environment Agency, *Biomass – carbon sink or carbon sinner?*,\textsuperscript{121} concluded that using energy crops or waste materials as fuel for generating electricity and heat could play an important role in meeting the UK’s renewable energy and greenhouse gas emission reduction targets, but only if good practice—such as high level performance in fuel production, processing and transport, and energy conversion efficiency—is followed. Greenhouse gas emissions from energy generated using biomass are generally, but not always, less than those from energy generated using fossil fuels. **Biomass that is used to produce heat or electricity must be from a sustainable source.** The Government must ensure that policies are in place to prevent biomass combustion which results in a relative deterioration of air quality, compared to the combustion of fossil fuels.

82. The Carbon Trust told us:

> Biomass heating technology is relatively widely deployed in some continental European countries (e.g. Finland and Austria), where it has a strong performance track record. However, installations in the UK (of which there are only a few hundred examples) tend to be costly and can offer long payback periods.\textsuperscript{122}

One area in which biomass is efficiently being used to create renewable energy is the food and drink sector. Tesco told us:

> Tesco is keen to explore anaerobic digestion as an efficient ‘closed loop’ waste to energy system for the business. However, our individual sites—or even clusters of sites—generally do not produce enough waste to supply a plant. An ideal supplement would be municipal waste, but EU procurement regulations require that a PFI-like [Private Finance Initiative] process be undertaken in order to obtain this, and negotiations with local authorities can take up to five years.\textsuperscript{123}


\textsuperscript{120} Innovas, *Low Carbon and Environmental Goods and Services: an industry analysis*, March 2009, p 40

\textsuperscript{121} Environment Agency, *Biomass – carbon sink or carbon sinner?*, April 2009

\textsuperscript{122} Ev 162 [Carbon Trust]

\textsuperscript{123} Ev 284, para 26 [Tesco]
The Food and Drink Federation (FDF) also acknowledged that planning permission and joined up local authority approaches were difficult issues.\footnote{Ev 216, para 18 [Food and Drink Federation]}

83. We have heard that the process for procuring municipal waste for use in anaerobic digestion plants can take up to five years through negotiations with local authorities. The Government should review procurement regulations and definitions of waste to ensure that they do not create unnecessary barriers to renewable energy generation. If necessary, the Government should be prepared to raise this issue with European counterparts to ensure EU regulations are part of the solution and not the problem.

84. Renewable gas also has the potential to make a significant contribution to the UK’s renewable energy targets. Injecting renewable gas such as biomethane into the grid is advantageous because, as the National Grid told us, “Unlike other options, such as district heating and heat pumps, renewable gas utilises the existing heat infrastructure (i.e. gas grids) which are already largely paid for by the consumer.”\footnote{Ev 240 [National Grid]} Baxi Group UK agreed, stating “there would be little need for disruptive infrastructure development or any major inconvenience to consumers in their homes or in their streets.”\footnote{Ev 145, para 4 [Baxi Group UK]}

85. Renewable gas, such as biomethane, could supply a significant proportion of gas in the UK with little disruptive infrastructure development. We recommend that the Government re-assess the contribution that biogas could make to its 2020 renewable energy targets and ensure that the development of biogas injection into the gas grid is an integral part of any future roadmap.

**Geothermal**

86. Geothermal energy is energy extracted from heat stored in the earth. There is currently one geothermal power plant operating in the UK, in Southampton. Geothermal energy is currently not included in the renewable energy strategy lead scenario; however, support for large-scale geothermal projects has been provided in the form of the £6 million Deep Geothermal Challenge Fund. Geothermal energy can also be used on a smaller scale through ground source heat pump technology. The global market value of the geothermal sector in 2007/08 was £276.39 billion; the UK had a 3.33% share of this. The UK employed 75,800 people in this sector in 2007/08. Based on forecast growth in domestic market value, this could potentially rise to 115,100 in 2014/15.\footnote{Innovas, *Low Carbon and Environmental Goods and Services: an industry analysis*, March 2009, p 40}

87. Installation of ground source heat pumps in public sector buildings or charitable bodies is currently supported through phase two of the Government’s Low Carbon Building Programme (LCBP). Phase one had previously provided support for individual householders interested in generating their own heat.\footnote{lowcarbonbuildings.org.uk and lowcarbonbuildingsphase2.org.uk} Whilst heat pumps require electricity to run, as the UK’s electricity supply is decarbonised, these technologies will...
become more beneficial in terms of carbon reduction.\textsuperscript{129} We heard an example of the private sector struggling to install ground source heat pump technology. Tesco told us:

We have struggled to get abstraction licences from the Environment Agency; this has made it difficult to install any ground source heat pumps, and means that a lot of potential on our sites is lost. We have also suffered from changes in advice. A specific example is at our store in Shrewsbury, where in 2007 we installed an open loop geothermal system exchanging heat with the local water table, on the basis of our understanding of the rules in place at the time of installation. However, the geothermal heat load generated by the store was greater than expected, and so the system is now unable to meet the operating criteria set by the Environment Agency. As a result, the geothermal system is not currently operating and we are amending the store heating/cooling system to run on more traditional lines. This is obviously a great disappointment: we are left with an expensive stranded asset and have not made the ambitious emissions reductions planned at the site. With clearer guidelines at the outset we could have avoided this outcome.\textsuperscript{130}

88. \textit{We are concerned by the evidence we have heard from Tesco that ground source heat pumps are being installed and left not operating. The Government should work with the Environment Agency to ensure that the process for obtaining abstraction licenses and the guidelines for the operating criteria of ground source heat pumps are clarified.}

\textbf{Hydroelectric}

89. The UK currently generates 1.3\% of its electricity from hydroelectric schemes.\textsuperscript{131} The global market value of the hydro sector in 2007/08 was £12.75 billion; the UK had a 3.92\% share of this. The UK employed 4,800 people in this sector in 2007/08. Based on forecast growth in domestic market value, this could potentially rise to 6,000 in 2014/15.\textsuperscript{132}

90. We received evidence from the Small Hydro Company (SHC), who have recently announced a partnership arrangement with British Waterways. This has created the platform for the Company to deliver (with its supply chain) sufficient renewable electrical supply to 45,000 households. SHC told us:

This level of investment will meet most if not all of the Government 2010 Renewable Targets for hydro as defined in the various Regional Spatial Strategy statements […] SHC has 25 sites in the development stage, which when completed will represent the single largest investment in run of the river low head hydro seen in this country to date.\textsuperscript{133}

\textsuperscript{129} Q 179 [Mr Lewis, Energy Savings Trust]
\textsuperscript{130} Ev 284, para 27 [Tesco]
\textsuperscript{131} Department of Energy and Climate Change, www.decc.gov.uk
\textsuperscript{132} Innovas, \textit{Low Carbon and Environmental Goods and Services: an industry analysis}, March 2009, p 40
\textsuperscript{133} Ev 262, para 2.3–2.4 [Small Hydro Company]
91. British Waterways told us that the permitting process was “unnecessarily burdensome”,\textsuperscript{134} whilst the SHC were concerned that the length of time taken for the Environment Agency to acknowledge license applications was having a negative impact on the deployment of hydroelectric power.\textsuperscript{135} However, the Environment Agency told us they have “launched a major programme of work aimed at streamlining the permitting process for hydropower developers, and improving the evidence base. This will address most of the concerns raised by the Small Hydropower Company”.\textsuperscript{136}

92. The Government must ensure that the Environment Agency continues to engage in active dialogue with hydroelectric developers in order to overcome unnecessary administrative barriers to the deployment of hydroelectric power.

\textsuperscript{134} Ev 151 [British Waterways]
\textsuperscript{135} Ev 265, para 4.5.2 [Small Hydro Company]
\textsuperscript{136} Ev 207 [Environment Agency]
4 Energy storage and transmission

93. The move towards low carbon energy generation will be challenging because of the intermittent nature of renewable energy sources, as supply may not coincide with demand. For this reason energy storage and transmission will become increasingly important in a green economy.

Storage technologies

94. The main types of energy storage technologies currently in use and being developed are:

• Batteries: A combination of one or more electrochemical cells, used to convert stored chemical energy into electrical energy. Conventional batteries include nickel-cadmium, nickel-metal hydride, and lead-acid. Lithium-ion batteries are currently the dominant technology in laptops and mobile phones. Considerable research is ongoing to develop more efficient and longer-life batteries for hybrid electric vehicles.

• Supercapacitors: Capacitors with very high energy density. A capacitor consists of two conducting metal plates, separated by an insulator. Energy is stored in a capacitor by applying a voltage, which separates positive and negative charge. This charge separation creates a potential between the metal plates that can later be harnessed in an external electronic device.

• Fuel cells: An electrochemical cell that generates electricity when a fuel (e.g. hydrogen) combines with oxygen, producing water as a by-product. These differ from batteries because the fuel can be stored outside the electrochemical cell.

• Pumped-storage hydroelectricity: Stores energy in the form of water by pumping it from a low elevation reservoir to a higher elevation reservoir. The stored water can be released through turbines when needed, generating electricity.

• Thermal energy storage: Traditionally, these are water-based technologies that store energy in the form of heat for later use in space heating, hot water or to generate electricity. Molten salt technologies can also be used.

95. Energy storage technologies are vital to the green economy. For example, advances in batteries will help to increase the efficiency of electronic devices such as televisions and household appliances, whilst domestic fuel cell micro-CHP (combined heat and power) is being developed to burn gas, producing space and water heating as well as generating 3,000 kWh of electricity annually. E.ON told us “Given that fuel cell micro-CHP can deliver electrical efficiencies in excess of 60%, and the technology makes use of the existing gas infrastructure, micro-CHP is well suited for the UK.”

96. Energy storage encompasses many of the enabling technologies that will play an extremely important role in underpinning the move towards a green economy. The

137 Ev 189, para 15 [E.ON]
Government should consider a long-term programme of support for energy storage research, development, demonstration and deployment.

The grid

97. Solarcentury told us they advocate the use of “the grid as a battery, so that you are feeding in during the day and taking out at night.”138 However, constraints on access to the electricity grid represent a major challenge for both existing and future renewable energy generation projects. About 17 GW of renewable electricity developments – of which nearly 6 GW have received planning consent – are currently awaiting connection to the grid, and developers in some parts of the country have been offered an earliest connection date of 2020.139 We recently published a comprehensive report on the future of Britain’s electricity network that deals with the subject of grid access in greater detail. In this report we take an overview of the main issues and focus on the potential for the grid to contribute to a low carbon future.

98. We heard from a number of organisations about the need to invest in Britain’s electricity network if the Government’s targets for renewable generation are to be met. The Crown Estate told us “In order that the most efficient and economic solution for network investment is delivered, it is essential that a strategic plan is developed and implemented.”140 The Energy Technologies Institute (ETI) agreed with this, they told us:

“The UK has a significant industrial and technological capability in software development, control systems and information management. Integration of these various capabilities with new generation and demand technologies (including low carbon vehicles) offers the potential for rapid introduction of smart-grid systems with the potential for significant benefits to both plant operators and users including the public consumers. Creating industrial and economic benefit in this highly competitive global sector is likely to require the rapid introduction and implementation of a coherent strategy across a range of government bodies with the focus on regulatory structures and business offerings just as much as smart meter roll-outs and support.

This coherent integrated approach is starting to emerge in the specific case of low carbon transport and plug-in electric vehicles (all electric and hybrids). Linked with this, a range of government initiatives at regional and national level are underway with the next phases becoming better coordinated as ETI strengthens its leadership role with industry and government. Applying a similar approach to the ‘smart grid’ aspects of low carbon energy should yield similar benefits.”141

99. The Sustainable Development Commission told us that in order to redesign the grid, the Government needed to “commit up to £5 billion a year on grid improvements of one

138 Q 326 [Mr Leggett, UK Photovoltaics Manufacturers’ Association / Solarcentury]
140 Ev 172 [The Crown Estate]
141 Ev 205 [Energy Technologies Institute]
kind or another, over and above the £7.6 billion expected to be delivered through CSR 07 [Comprehensive Spending Review 2007].^142

100. Alongside a smarter grid system, smart meters will provide consumers with the information necessary to manage their energy use and carbon emissions in real time. The Government is committed to installing smart meters in all homes by the end of 2020. We will discuss the use of smart meters in greater detail later in this report (paras 192-195). In December 2009, the Government published Towards a Smarter Future: Government response to the consultation on electricity and gas smart metering, which outlines the decisions that will be the basis of the smart meter implementation programme. At the same time, they published a discussion paper, Smarter Grids: the opportunity, setting out a high level vision of what a UK smart grid might look like. The Government intends to develop a more detailed smart grid route map as part of its 2050 roadmap in Spring 2010.

101. We are pleased that the Government is producing a detailed smart grid route map in collaboration with Ofgem and industry representatives and look forward to receiving further information. The Government has rightly stated in its recent discussion paper, Smart Grids: the opportunity, that smart meter policy decisions and investment must take into account the goals of a smarter grid system, in particular regarding decisions on smart meter functionality and communications infrastructure. We would like to see a fully integrated smart meter and smart grid implementation plan produced by the Government that takes these issues into account.

**Smart communications**

102. There is huge potential for demand-side management of energy supplies through the combination of a smarter grid with smart meters and smarter appliances, for example, white goods that are capable of responding to changes in price or demand as signalled by a smart meter. However this will only be possible if the grid, meters and appliances can reliably communicate with one another.

103. During our visit to California, we met with a company that specialises in smart grid communication technologies, Silver Spring Networks (SSN). They outlined the main requirements for a smart grid communication platforms:

- Open—open standards to maximise competition and consumer choice
- Secure—grid and consumer protection
- Future-proof—flexibility to accommodate advances in technology
- Ubiquitous—ability to reach urban, suburban and rural homes
- Low latency—available capacity for new services
- Scalable—able to roll out to tens of thousands of homes daily
- Cost-effective—low build cost and very low operating cost

^142 Ev 279 [Sustainable Development Commission]
A wide range of communication platforms are available, including broadband, mobile, tower RF (radio frequency), and RF mesh (also known as wireless mesh). In countries such as Australia and the United States where the full range of technologies are available, utility companies have overwhelmingly chosen wireless mesh as the technology of choice for their smart grid programmes. Wireless mesh is a communications network made up of radio nodes, which allow appliances and meters to communicate with each other. Utility companies representing over 40 million homes in Australia and the U.S. are now implementing wireless mesh-based communications.

Unfortunately, a lack of appropriate sub-GHz radio spectrum prevents the use of this technology in the UK. Current frequency allocations and rules do not permit a practical, cost effective use of ubiquitous wireless mesh as an option. However, Silver Spring Networks told us that there is a chance to change this. Ofcom is currently consulting on the future use of the 872-876 MHz and 917-921 MHz frequency bands. These are not used by other technologies at present, and are ideally suited for smart grid use. SSN argues that the proximity of these bands to those used in Australia and the U.S. offers the potential for the UK to benefit from substantial economies of scale, since it should be possible to use the same radios across all markets.

When we questioned the Minister about smart grid communication technologies, he told us “We are aware of the wireless option […] but there are other options […] third generation broadband lines and even GPS-type solutions […] we are discussing them all with Ofcom as well as the industry as we go forward.” The Minister followed up by sending us supplementary evidence explaining that a radio frequency band at 2.4 GHz is “already available in the UK (and around the world) on a license-exempt (i.e. unlicensed) basis.” One company is piloting wireless mesh technology for smart meters at this band in Ireland. However, sub-GHz frequency bands propagate and penetrate (through trees, walls and other potential barriers) further than would a band at 2.4 GHz, thus allowing a more robust communications network. The Department of Energy and Climate Change went on to explain that with regard to the recent Ofcom consultation, “responses confirmed that there are a range of uses that this spectrum [872-876 MHz and 917-921 MHz] could be put to […] only one respondent, Silver Spring Networks, expressed an interest in this band for smart meters.”

We do not advocate picking or favouring specific communications technologies for the smart grid and smart meters at this stage. However, we believe strongly that there should be a level playing field, and that all technologies should be given the opportunity to demonstrate both their strengths and weaknesses as the Government develops a universal smart meter implementation programme. Rural communities often suffer from a lack of broadband and GPS coverage. One of the benefits of wireless mesh technology is that through the use of multiple radio nodes, communication across both urban and rural areas is possible. Given the choice, the market will decide which communication technology is best suited. Having heard that utilities in other leading countries have overwhelmingly chosen sub-GHz wireless mesh technology, it would be absurd to exclude such a
technology from the UK. The fact that only one respondent to Ofcom’s recent consultation (on the future use of the 872-876 MHz and 917-921 MHz frequency bands) expressed an interest in this band for smart meters does not detract from the argument that this spectrum currently provides the only opportunity for sub-GHz wireless mesh technology to be trialled in the UK.

108. In light of the Government’s target of rolling out smart meters to every home by the end of 2020 and the wider GHG emissions reduction targets, there is no time to waste in assessing smart grid communications technologies. We recommend that the 872-876 MHz and 917-921 MHz frequency bands be reserved for smart grid and meter communications immediately. The result for UK consumers and energy providers can only be increased choice, greater innovation and lower prices. If, after utility companies have completed pilot projects using sub-GHz wireless mesh technology, they overwhelmingly choose other communications technologies, the radio frequency bands could be reallocated. The UK must not be at a disadvantage compared to countries that are quickly moving forward with smart grid communication technologies.
5 Energy use and efficiency

Transport

109. In 2008, the amount of energy used by the transport sector in the UK was 58.81 million tonnes of oil equivalent.\textsuperscript{146} Transport is the third largest producer of CO\textsubscript{2} emissions in the UK, of which cars and light-duty vehicles are almost 70%.\textsuperscript{147}

Road

110. The Government has prioritised low carbon vehicles as one of its five key sectors and technologies where the UK has the potential to take a global lead.\textsuperscript{148} The vehicle scrappage scheme, unveiled in the 2009 Budget, similar to those introduced in other countries, offered consumers £2,000 towards a new car or van if they traded in a 10 year old plus vehicle which they had owned for 12 months or more. The scrappage incentive is made up of £1,000 from the Government and £1,000 from the motor industry. In general, the scheme lead to replacing older more polluting cars with newer more fuel-efficient vehicles.

111. The scrappage scheme was described by the Energy Savings Trust as a “huge missed opportunity […] which could have been defined in such a way as to require that the new vehicles bought with that public investment had a significant lower CO\textsubscript{2} emission.”\textsuperscript{149} Professor Julia King, Aston University, shared this concern, stating that “it [the scrappage scheme] was introduced without a requirement on new cars being, for example, at least below the 130 grams per kilometre [threshold for CO\textsubscript{2} emissions], which will be the new European Union requirement for 2015.”\textsuperscript{150} The New Economics Foundation described it as a “perverse incentive to keep us locked into an energy-intensive form of transport.”\textsuperscript{151} However, the Minister told us “the scheme was announced to help at a very difficult time in the recession a very important sector in this country, the car industry, and it was a business support measure and it was a job support measure to keep people in jobs. It was not designed to be an environmental measure at all.”\textsuperscript{152} But, the Low Carbon Vehicle Partnership (LCVP) noted that “the scrappage scheme was introduced primarily in order to support the UK motor industry because of the pressure that it was under […] cars bought under the scrappage scheme are averaging 134 grams per kilometre [CO\textsubscript{2} emissions], whereas the average for the UK this year is 150 grams per kilometre.”\textsuperscript{153}

112. The vehicle scrappage scheme has had a positive effect in reducing emissions by accident; any future stimulus for the automotive industry should be designed to

\textsuperscript{146} Department of Energy and Climate Change, Digest of UK Energy Statistics, Annex, Table 1.1.5
\textsuperscript{147} Q 262 [Professor King, Aston University]
\textsuperscript{148} Ev 174 [Department of Energy and Climate Change]
\textsuperscript{149} Q 149 [Ms Spain, Energy Savings Trust]
\textsuperscript{150} Q 248 [Professor King, Aston University]
\textsuperscript{151} Q 22 [Mr Simms, New Engineering Foundation]
\textsuperscript{152} Q 516 [Mr David Kidney MP, Department of Energy and Climate Change]
\textsuperscript{153} Q 249 [Mr Archer, Low Carbon Vehicle Partnership]
stimulate a move towards low carbon vehicles, for example, by requiring that the new vehicles purchased have a CO₂ threshold below 130 grams per kilometre.

113. In April 2009, the Government published its strategy *Ultra Low Carbon Vehicles in the UK*. The Government introduced a £2.3 billion package of support (the Automotive Assistance Programme) for the automotive sector in the downturn, which has been tailored to support development of low carbon products. The Government is also providing £100 million to support research and demonstration; £250 million for consumer incentives to buy lower carbon vehicles (around £20 million of this will be used to develop an electric vehicle charging infrastructure framework, leaving £230 million in the form of subsidies for new purchases); and £20 million procurement of Low Carbon Vehicles for government.¹⁵⁴ The LCVP noted that the “£230 million investment to support purchase will give you around 50,000 vehicles.”¹⁵⁵ However the Committee on Climate Change have called for 1.7 million vehicles.¹⁵⁶ Professor King told us “the £230 million in support for electric vehicles from 2011 onwards is good, but […] we have suggested that the figure needs to be, realistically, more like about £800 million.”¹⁵⁷

114. In February 2010, the Government announced further details of how these funds will be spent. A new Plug-in Car Grant will provide consumers with up to £5,000 towards the cost of ultra-low carbon cars at the point of purchase. These grants will be available from January 2011. The Government also announced that £30 million will be spent on charging infrastructure in London, Milton Keynes and the North East.¹⁵⁸

115. We welcome the Government’s Plug-in Grant programme, which provides support for consumers choosing electric vehicles from 2011 onwards. We recommend that the amount invested in subsidies between now and 2020 should be increased substantially, reflecting the ambitious target of 1.7 million electric vehicles set by the Committee on Climate Change.

116. Electric and hybrid electric vehicles have the potential to significantly decarbonise road transport even with the current carbon intensity of grid-generated electricity. However, the full benefits of the electrification of road transport emerge when the electricity generation sector is decarbonised. The timing of recharging of electric vehicles is crucial. National Grid noted that:

> for electric vehicles to succeed to mass-market levels and enjoy the greatest environmental and economic benefits, the charging process must be concentrated overnight. […] Moreover, we believe that smart metering and smart grids will play an essential role in facilitating overnight charging behaviour with customers.¹⁵⁹
117. The long-term benefits of electric vehicles will only be achievable with a smart-grid that has been designed with electric vehicles in mind. The development and implementation of a smart grid and smart meters must be carried out in consultation with developers of electric vehicles.

118. There are significant opportunities for the UK to develop and export low carbon technologies in the transport sector. The LCVP told us:

> there are some genuine areas in which the UK has real world leading expertise. I would highlight particularly electric vans where we have companies like Smith and Modec who are supplying around the world. We have tremendous expertise in the power electronics industry […] Companies like Zytek, Ricardo and Lotus Engineering, for example are doing huge amounts of work in this area.\(^{160}\)

Professor King described the low carbon vehicle demonstration project, which by 2010 will result in 340 ultra-low carbon vehicles across a small number of cities in the UK:

> Things like the low carbon vehicle demonstration project […] have attracted the world’s attention to us and the announcement of that was followed quite rapidly by Toyota’s announcement that we would be one of the first two countries in which they would be building the new Prius and then Nissan’s announcement that they would be bringing battery manufacturing to the UK and potentially also their electric vehicle, the Leaf, to be manufactured in the UK. […] The requirements for us going forward, I think, are to make sure that our supply chain is well positioned to adapt to the new technologies that will be needed in vehicles of the future.\(^{161}\)

119. Whilst low carbon vehicles (electric or hydrogen) offer huge potential to decarbonise the transport sector the LCVP commented that “there is probably at least a 50% improvement that we could deliver in the efficiency of our existing vehicles by mid 2025 to 2030 through a whole range of technologies: new engines, new aerodynamics, better light, better tyres, so on and so forth.”\(^{162}\) Advanced biofuels also have a role to play. E.ON told us “in the short term there is the opportunity to pursue more efficient conventional petrol and diesel technologies (including the use of biofuel) whilst the first alternatively fuelled vehicles are brought to market.”\(^{163}\)

120. The LCVP told us that there are certain areas in which the Government can afford to be entirely neutral between rival technologies. However, there will be other areas, particularly where new infrastructure is required, “where government will need to actually make choices because it will be too expensive in order to invest in a whole range of different technologies”.\(^{164}\) LCVP went on to explain:

> there are a small number of technologies which are now emerging as likely to be medium and long-term solutions. Electrification, both pure EV [electric vehicle] and

\(^{160}\) Q 253 [Mr Archer, Low Carbon Vehicle Partnership]  
\(^{161}\) Q 253 [Professor King, Aston University]  
\(^{162}\) Q 263 [Mr Archer, Low Carbon Vehicle Partnership]  
\(^{163}\) Ev 191, para 25 [E.ON]  
\(^{164}\) Q 261 [Mr Archer, Low Carbon Vehicle Partnership]
plug-in hybrid, is likely to have an important role [...] biofuels will have an important role also and it may be that that role in the longer term is more as a power source for a range extended hybrid vehicle rather than being used in combination with petrol and diesel in an internal combustion engine. If we can address the challenges of hydrogen and fuel cells, it may be that the hydrogen and fuel cells become cost-effective in some period beyond 2030, at which point government will have to decide whether or not we need to make the investment in that technology then or, indeed, our existing mix of technologies is fit for purpose for the foreseeable future.¹⁶⁵

121. AIR products told us they were concerned that the UK is failing to prioritise the need to invest in hydrogen.

A ‘hydrogen fuel cell - electric hybrid’ vehicle has a much broader user-potential than current plug-in electric vehicles. The batteries used to power electric vehicles cannot offer the same range, performance and refuelling time of a conventional vehicle and will therefore be attractive only to a niche market. By contrast, electric-hydrogen hybrid vehicles can compete with conventional vehicles in terms of range, performance and refuelling time and like electric vehicles give off no emissions at the point of use. [...] In fact, hydrogen vehicles are closer to commercialisation than many think. Hydrogen is already a realistic transport fuel today. In California an extensive hydrogen powered fleet already exists with further plans to extend the network of fuelling stations.¹⁶⁶

Indeed, we visited the National Fuel Cell Research Centre (NFCRC) in California and were impressed by the progress that has been made towards deploying hydrogen fuel cell-electric hybrid vehicles.

122. We note that hydrogen is essentially a carrying fuel and that it is only as low carbon as the source from which it has been derived. We draw attention to the production of hydrogen that may be possible as a by-product of the pre-combustion Carbon Capture and Storage process.

123. We are encouraged that the UK appears to be moving in the right direction and making the most of the opportunities to develop an export industry in low carbon vehicles. It is clear that the UK is particularly strong in the automotive supply chain, which should be supported and encouraged by the Government. Improvements to existing technology and the replacement of fossil derived liquid fuels with lower carbon alternatives present the fastest opportunity to reduce emissions. Electrification of road vehicles presents a more sustainable route to total decarbonisation but represents a less mature technology that requires significant support during the demonstration phase. Hydrogen and fuel cells represent a longer-term aspiration, although a significant number of major automotive manufacturers will be ready to offer vehicles within the next few years. We are concerned that the Government, whilst supporting battery electric vehicles, is not offering the same level of support to hydrogen fuel cell powered vehicles.

¹⁶⁵ Q 261 [Mr Archer, Low Carbon Vehicle Partnership]
¹⁶⁶ Ev 141 [AIR Products PLC]
124. Reducing transport CO₂ emissions can also be done through behavioural change rather than the development of new low carbon vehicles. Professor King told us “if we were to enforce the 70 mile per hour speed limit on motorways, we would save 1.4 megatonnes of CO₂ per year. If we were to reduce it to 60 and to enforce that, we would save another 1.5 megatonnes of CO₂ per year. That is over five per cent of the transport CO₂ emissions.”

In addition to investing in new low carbon vehicles, the Government should engage with the public on the issue of reducing CO₂ emissions and reducing the cost of journeys by driving slower. In future campaigns, the Government should articulate the need for adhering to the national speed limit by reference to reducing emissions and cost to drivers as well as for reasons of road safety.

### Rail

125. The rail network carries 3.5 million passengers a day, while contributing less than half a percent to the UK’s domestic carbon dioxide emissions. Total rail CO₂ emissions are estimated at 3.3 million tonnes for 2006/07 of which 2.7 million tonnes is from passenger rail and 0.6 million from freight rail. The average carbon dioxide emissions per passenger kilometre for a passenger rail journey is about half that of an equivalent car journey and about one-quarter of an equivalent journey by air.

126. In terms of track miles, the rail network in the UK is approximately 40% electrified. The majority of electric routes use 25 kV 50 Hz AC (Alternating Current) overhead electrification, and the rest is made up of third rail 750 V DC and some 1500 V DC (Direct Current). Approximately 60% of passenger kilometres are on the electrified network. Dr Stuart Hillmansen, University of Birmingham, told us “[AC systems and DC systems] are connected to the electricity grid and to some extent the tailpipe emissions, if you like, are the same as those in the power station. So in the future the railway automatically benefits from any decarbonisation or increased renewables penetration into the grid mix.”

127. In July 2009 the Government announced a £1 billion plan to electrify the main rail route between London and Swansea, and a second smaller line between Liverpool and Manchester. This will increase the proportion of electric train journeys in Britain from 60% to 67%. Network Rail told us they very much welcome this announcement, “but we believe it should mark the start of a rolling programme of electrification, given the clear environmental benefits it brings. In particular, Network Rail would like to see the Government commit to the electrification of the Midland Mainline.”

128. Lightly used parts of the rail network are unlikely to be electrified, as it would not be cost-effective. Dr Hillmansen told us “those parts of the railway […] may need to look at alternative technologies to provide propulsion power and there will be technology transfer from other sectors. The work that is happening in the automotive industry, for instance on battery technology and high efficient motors […] can be transferred over to the railway

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167 Q 283 [Professor King, Aston University]
168 Ev 247 [Network Rail]
169 Ev 223 [Dr Hillmansen, University of Birmingham]
170 Q 273 [Dr Hillmansen, University of Birmingham]
171 Ev 247 [Network Rail]
industry in due course.”\textsuperscript{172} The knowledge transfer network (KTN) responsible for bringing together industry, research and government stakeholders in transport, is the Intelligent Transport Systems KTN.

129. \textbf{We welcome the announcement of a £1.1 billion programme for Network Rail to electrify the Great Western Mainline (London to Swansea) and the shorter line connecting Liverpool and Manchester. However, we hope to see a more strategic long-term approach to rail electrification from the Government. We would also like the Government to assure us that steps are being taken to ensure the effective transfer of technology from the automotive industry to the rail industry through the Intelligent Transport Systems Knowledge Transfer Network, or other appropriate knowledge transfer networks.}

130. Although rail transport has the potential to be zero carbon if the majority of passenger kilometres are on electrified routes and the electricity supply is decarbonised, Dr Hillmansen acknowledged, “An empty train may be very efficient but if there is no-one on it then it is an environmental disaster. So increasing the load factor is an important issue.”\textsuperscript{173} However, domestic rail travel is often prohibitively expensive in comparison to domestic air travel.

131. In August 2009, Network Rail published a study setting out options for a new high-speed line. Network Rail recommended a new high-speed line connecting London with Birmingham, Manchester, Liverpool, Glasgow and Edinburgh.\textsuperscript{174} Furthermore:

\begin{quote}
Network Rail found that this new line would reduce road vehicle journeys by 3.8 million a year and flights by 2.8 million a year by 2030, reducing CO\textsubscript{2} emissions annually by 39,000 tonnes and 250,000 tonnes respectively. The study also found that this high speed line would also generate revenue and benefits worth almost £55 billion, paying for itself 1.8 times over.\textsuperscript{175}
\end{quote}

132. \textbf{The average carbon dioxide emissions per passenger kilometre for a passenger rail journey are about one-quarter of an equivalent journey by air. Domestic air travel is generally faster than the equivalent rail journey, encouraging more people onto a form of transport with a larger carbon footprint. The Government must do more to address this if it is serious about reducing UK carbon emissions. We recommend the Government introduce regulations designed to ensure the introduction of fairer transport pricing structures that reflect the climate impact of various modes. We also hope to see firm commitments and timetables for delivering more high-speed rail.}

\textsuperscript{172} Q 273 [Dr Hillamsen, University of Birmingham]
\textsuperscript{173} Q 273 [Dr Hillamsen, University of Birmingham]
\textsuperscript{174} Network Rail, \textit{New Lines Programme: Strategic Business Case, August 2009}
\textsuperscript{175} Ev 247 [Network Rail]
Shipping

133. The shipping industry is vital to the world economy, carrying over 80% of international trade by volume.\textsuperscript{176} In 2007, the UK shipping industry directly employed 96,000 employees, and with a turnover of £9.5 billion, the industry directly contributed £4.7 billion to UK GDP.\textsuperscript{177} Carbon dioxide emissions from international shipping account for approximately 2.7% of total global emissions.\textsuperscript{178} However, the Chamber of Shipping told us “we are by far, by a long way, the least carbon-emitting transport mode, ten times less than road and significantly less than [aviation].”\textsuperscript{179} Despite this, the Environmental Audit Committee report, \textit{Reducing CO$_2$ and other emissions from shipping}, concluded that emissions from shipping cannot be allowed to grow uncontrolled, and that it will take several years before technical changes start to make a significant difference.\textsuperscript{180}

134. In recent times, the shipping industry has started to adopt various measures that should help to reduce emissions, such as improving current propulsion technologies, engine improvements, fleet management techniques, cold-ironing and reducing steaming speeds. The Chamber of Shipping told us

> These technologies […] can be implemented, but the nature of the industry means quite often that the person who has control over the application of those methods might not necessarily be the shipowner, it could well be the charterer […] industry assessment is that these existing technologies rolled out to their maximum might yield an improvement generally of between about 15 and 25 per cent [lower emissions].\textsuperscript{181}

135. Other technologies that may help to reduce carbon emissions in the medium to long term include:

- Wind power technologies such as ‘sky-sails’, essentially large kites: these could save up to 35% of a ship’s fuel with relatively small capital costs;
- Biofuels: a viable near-term option which can displace fossil fuels and reduce emissions (up to 80%), the barriers to which are economic rather than technical;
- Nuclear power: unlikely to be cost effective or viable in the short to medium term, with barriers perceived to be safety issues and public perception of the technology;
- Hydrogen fuel cells: not fully developed for commercial implementation, and hydrogen production from renewable sources with current technology and energy prices would be prohibitively expensive—this could be a long term option; and,

\textsuperscript{176} Chamber of Shipping et al., \textit{A global cap-and-trade system to reduce carbon emissions from international shipping}, September 2009
\textsuperscript{177} Oxford Economics, \textit{The economic contribution of the UK shipping industry in 2007}, February 2009
\textsuperscript{178} International Maritime Organization, \textit{GHG Study}, April 2009
\textsuperscript{179} Q 292 [Mr Brownrigg, Chamber of Shipping]
\textsuperscript{180} Environmental Audit Committee, Fourth Report of Session 2008-09, \textit{Reducing CO$_2$ and other emissions from shipping}, HC 528
\textsuperscript{181} Q 307 [Mr Ashdown, Chamber of Shipping]
Electric propulsion, battery electric and hybrids: best suited to vessels that have variable patterns of operation—full hybrids incorporating energy storage (batteries) are in initial stages of development, but savings are unknown.\(^{182}\)

136. Delivering new technologies in new ships can be problematic. The Chamber of Shipping explained:

> Shipowners find it very difficult to go and buy the most efficient ships because the shipyards hold the whip-hand and they will build a ship which is most convenient for their production platforms [...] the IMO [International Maritime Organization] is addressing this [...] through something called the 'energy efficiency design index' which is mandating new standards for every new ship to be built to. We were very much hoping, from an industry perspective, that that would be a mandatory requirement, but at present, because of the sensitivity of international negotiations around carbon, some of the nation states of the IMO have held that back and it is just voluntary at the moment.\(^{183}\)

They added that technologies such as wind, nuclear, hydrogen fuel cells and electric propulsion were “at a prototype stage for land-based sources, let alone ships [...] they need to be proven and robust before they are likely to be rolled out across the fleet.”\(^{184}\)

137. We note that technologies such as wind, hydrogen fuel cells and electric propulsion are at prototype or early commercialisation stage on land. The Government should ensure that knowledge transfer networks working in the transport sector are active in transferring technologies from land-based transport sectors to the shipping sector.

138. Negotiators at the United Nations Framework Convention on Climate Change (UNFCCC) had started to address issues relating to shipping and aviation prior to the UN Climate Change Conference in Copenhagen last year. Carbon dioxide emissions from these sectors are not covered under the Kyoto Protocol and it was hoped that a new global agreement at Copenhagen would change this. Unfortunately, this did not happen. The national shipowner associations of Australia, Belgium, Norway, Sweden and the United Kingdom have stated:

> Shipping is the glue that holds world trade together, and is already the most carbon-efficient means of transporting goods. Shipping must be permitted to grow so that it can continue to service the demands of world trade and a rapidly expanding global population – but needs to do so in a sustainable way. Trading under a cap is the only option which would permit international shipping to do just that – and thereby to meet both the needs of environmental and trade policy.\(^{185}\)

139. The shipping industry has shown a commitment towards reducing carbon dioxide emissions despite the fact that their emissions are not included in the UK carbon

\(^{182}\) AEA Energy & Environment, Low carbon commercial shipping, March 2007, p 46-8

\(^{183}\) Q 309 [Mr Ashdown, Chamber of Shipping]

\(^{184}\) Q 310 [Mr Ashdown, Chamber of Shipping]

\(^{185}\) Chamber of Shipping et al., A global cap-and-trade system to reduce carbon emissions from international shipping, September 2009
budgets, or governed by any international agreement. They have determined that an international cap-and-trade scheme is the best way of achieving emissions reduction. The Government must push for an international binding emissions reduction target for shipping with a clear timetable for delivering policies to meet it.

**Aviation**

140. UK aviation CO₂ emissions have grown by over 50% in the past ten years due to increasing demand in both passenger and freight traffic; aviation CO₂ emissions now account for around 5% of total UK greenhouse gas emissions.\(^{186}\)

141. A common criticism of aviation is the environmental impact of short-haul flights, which are often achievable using other modes of transport. Aviation is also considerably less energy efficient per passenger kilometre than other modes of transport, such as rail, which can also be far more easily decarbonised than aviation. However, National Air Traffic Services (NATS) told us:

> Our calculations show that domestic air traffic represents around about a fifth of the 2.4 or so million movements that we handle as NATS in the UK every year, but that actually only accounts for 14 per cent of the CO₂ emitted in the system, so those flights are operated by relatively efficient twin-engine aircraft, so their emissions are less than the proportion of the traffic.\(^{187}\)

142. In December 2009, the Committee on Climate Change (CCC) reported that fuel efficiency and operational improvements in aviation are likely to result in a 30% reduction in carbon emissions per seat km flown and that sustainable biofuels could account for 10% of aviation fuel use in 2050. For this reason, it argued, aviation policy should be based on the assumption that demand growth between now and 2050 cannot exceed 60% if the UK is to meet the Government’s target that aviation emissions in 2050 must not exceed 2005 levels. Faster technological improvements are possible, but unless they are achieved, it is not prudent to assume that demand increases of more than 60% are compatible with the target.

143. We heard about the types of technologies that are likely to have the biggest impact on the aviation industry from Sustainable Aviation, a strategic group of the UK’s leading airlines, airports, aerospace manufacturers and air navigation service providers:

> Engine and airframe developments, together with second-generation biofuels, offer the greatest long-term potential for reducing aviation-related CO₂. In the shorter term, air traffic management offers environmental efficiencies through new tools enabling improved procedures and more efficient use of airspace. Airports are working with airlines, on-airport businesses, and passengers to influence further carbon reductions; for instance, on-site renewable energy, and fixed electrical ground

\(^{186}\) Committee on Climate Change, *Meeting the UK aviation target – options for reducing emissions to 2050*, December 2009, p 34

\(^{187}\) Q 302 [Mr Jopson, NATS and Sustainable Aviation]
power (FEGP) to aircraft, which removes the need to run aircraft power units whilst on the ground.188

144. Sustainable Aviation went on to explain that partnership between the Government and industry is necessary to bring forward these technologies:

Some of these will be incremental technologies, improved combustion, improved materials, lighter aircraft, but some of them are potentially step-change technologies. We are looking at the moment at contra-rotating open rotors, going back to very efficient propellers. Now, these can be 15 per cent more fuel-efficient than even the best enclosed jet engines today, but this is technology which none of us has touched since the 1980s […] However, to launch the programmes necessary to bring those open rotor-powered aircraft needs a huge and co-ordinated investment that the industry alone certainly cannot afford, […] so it does need government intervention, as I say, both at a UK level and a European level.189

They also pointed out that there was an enormous opportunity to have an impact on global aviation emissions by investing in UK industry:

We have the wings from Airbus, we have Rolls-Royce engines and we have air traffic management systems all exported from the UK all over the world. By investing in that technology, you are touching 70 per cent of future aircraft all over the world, so there is a huge gearing worldwide from investing in the technology base of UK industry, not to mention the economic benefits of doing so.190

145. **We note the work of the UK aviation industry in developing new technologies and systems to reduce carbon dioxide emissions. The Government should acknowledge this and continue to support the industry through developing and maintaining the right legal and fiscal frameworks. Furthermore, the Government should facilitate the export of these technologies and systems to other countries.**

146. In addition to technological opportunities for reducing climate change, emissions can be reduced through better control of air traffic. NATS provides air traffic service at 15 of the largest airports in the UK. In 2008, NATS became the first air traffic control organisation in the world to set stretching climate change performance targets. Sustainable Aviation told us “The UK model for reducing CO₂ emissions related to air traffic management is the first of its kind in the world and NATS is looking to export its methodologies in order to spread the benefit.”191 NATS explained some of the initiatives being trialled at UK airports:

We currently have, what we call, an ‘inbound speed trial’ which is really trying to slow aircraft en route to the hold, to slow them down so that we can reduce the time they spend in the hold. We have also recently introduced an aircraft control tool called ‘A-man’, an arrivals manager, which allows us to better sequence the aircraft in

188  Ev 276, para 3.1.1 [Sustainable Aviation]
189  Q 305 [Professor Parker, Sustainable Aviation]
190  Q 305 [Professor Parker, Sustainable Aviation]
191  Ev 276, para 3.4.2 [Sustainable Aviation]
order to get them through that holding situation and on to the ground as safely and as efficiently as possible and, as a result, reduce carbon emissions. While the use of technologies and changes in air traffic control are helping the aviation industry to reduce emissions, they acknowledge that real progress requires the implementation of a cap-and-trade scheme. Sustainable Aviation told us “We accept that [a cap and trade scheme] is the best route forward, but we also accept that it is the best route forward not just for our industry, but for the world getting its carbon emissions down in the most cost-effective way.” Despite the lack of a global agreement at Copenhagen in December 2009, aviation is due to be included in the European Emissions Trading Scheme from 2012. Sustainable Aviation told us that there would be a greater emphasis on fuel efficiency when a carbon premium is added to the price of the fuel. The impact this will have on prices depends on the carbon price and on the way in which efficiency can be improved within the industry.

148. **It is fundamentally important to have a globally agreed deal on aviation emissions as regional emissions schemes may lead to carbon leakage. The Government must push for a legally binding global deal based on global aviation emissions reduction targets.**

**Industry**

149. In 2008, the amount of energy used by industry in the UK was 30.53 million tonnes of oil equivalent. Table 5 shows the breakdown of energy use in 2008 by industrial group.
Table 5. Industrial energy consumption by main industrial consuming group in 2008

<table>
<thead>
<tr>
<th>Group</th>
<th>Thousand tonnes of oil equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron &amp; steel</td>
<td>1,524</td>
</tr>
<tr>
<td>Non-ferrous metals</td>
<td>959</td>
</tr>
<tr>
<td>Mineral products</td>
<td>2,553</td>
</tr>
<tr>
<td>Chemicals</td>
<td>5,456</td>
</tr>
<tr>
<td>Mechanical engineering &amp; metal products</td>
<td>1,485</td>
</tr>
<tr>
<td>Electrical &amp; instrument engineering</td>
<td>986</td>
</tr>
<tr>
<td>Vehicles</td>
<td>1,373</td>
</tr>
<tr>
<td>Food, drink &amp; tobacco</td>
<td>3,591</td>
</tr>
<tr>
<td>Textiles, leather, clothing</td>
<td>956</td>
</tr>
<tr>
<td>Paper, printing, publishing</td>
<td>2,226</td>
</tr>
<tr>
<td>Construction</td>
<td>510</td>
</tr>
<tr>
<td>Other industries</td>
<td>5,913</td>
</tr>
<tr>
<td>Unclassified</td>
<td>3,001</td>
</tr>
<tr>
<td>TOTAL</td>
<td>30,534</td>
</tr>
</tbody>
</table>

Source: DECC, Digest of UK Energy Statistics

150. The top five energy using industrial groups are:

- chemicals;
- food, drink & tobacco;
- mineral products;
- paper, printing, publishing; and
- iron & steel.

151. With a turnover in excess of £50 billion, the chemical industry is one of the UK’s largest manufacturing industries. The International Council of Chemical Associations produced a report in July 2009, Innovations for Greenhouse Gas Reduction, analysing the chemical industry’s impact on greenhouse gas emissions. In 2005, the emissions linked to the chemical industry were approximately 3.3 GtCO₂e (gigatonnes—or, billion metric tonnes—of carbon dioxide equivalent). However, gross savings via the chemical products and technologies provided to other industries were estimated at between 6.9 and 8.5

GtCO₂e. In other words, for every GtCO₂e emitted by the chemical industry, 2.1-2.6 GtCO₂e was saved elsewhere. The biggest levers for emissions savings were identified as:

- insulation materials for the construction industry;
- chemical fertilisers and crop protection to improve agricultural productivity; and
- advanced lighting solutions e.g. compact fluorescent lamps (CFLs)\(^ {196}\)

The report also assessed how the industry’s impact on GHG emissions would change in two scenarios to 2030. The chemical industry will benefit from wider decarbonisation of energy generation and energy efficiency measures. However, there are also major opportunities to develop more sustainable use of available feedstocks and develop new technologies for better disposal, recovery and recycling.

152. The UK food and drink industry is the largest manufacturing sector in the country; with a turnover of £72.4 billion it represents approximately 14% of total UK manufacturing.\(^ {197}\) It is also a major energy user, with annual consumption around 45 TWh, which corresponds to primary CO₂ emissions of 11.3 MTe per annum.\(^ {198}\) In recent years, the industry set CO₂ emissions reduction targets and is making good progress towards achieving its goal. The Food and Drink Federation (FDF) told us:

> In November 2007, as part of its public Five Fold Environmental Ambition, FDF members committed to an industry-wide absolute target to reduce CO₂ emissions by 20% by 2010 against a 1990 baseline. We are on target to achieve this. We also set an aim to achieve a 30% reduction by 2020, in order to send a clear signal nationally and internationally about the scale of change required and to show leadership on behalf of the sector.

Energy efficiency improvements, investment in new more efficient plant, process design, supply chain optimisation and, increasingly, renewables will all be important in achieving this goal. In its first annual progress report, published in November 2008, FDF was pleased to report a reduction of 17% by 2006 compared to 1990 – an average saving of 58,000 Te CO₂ per year.\(^ {199}\)

153. We welcome the progress made by the chemical industry in identifying its impact on greenhouse gas emissions and congratulate the food and drink industry on its reduction in carbon dioxide emissions. The Government should encourage the sharing of best practice between industries so that others may follow.

154. Mineral products include the aggregates, asphalt, cement, concrete, lime mortar and silica sand industries. The Mineral Products Association (MPA) told us that CO₂ emissions reduction is particularly important for the cement industry as cement manufacture leads to the emission of CO₂ directly from the process. The MPA told us:

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\(^ {197}\) Ev 214, para 1 [Food and Drink Federation]

\(^ {198}\) Ev 215, para 4 [Food and Drink Federation]

\(^ {199}\) Ev 215, para 5–6 [Food and Drink Federation]
In the cement industry a great deal of early action has already taken place. Over the last 10-15 years there has been widespread rationalisation and investment in lower carbon technology. Between 1990 and 2008, the MPA Cement member companies have reduced direct CO₂ by 38.8% and 2008 emissions were 5.18 MtCO₂ lower than 1990.200

155. The most significant low carbon technology for the cement industry is carbon capture and storage. The Committee on Climate Change’s first report stated that carbon capture and storage is clearly feasible and no fundamental research breakthrough is required for the cement industry.201 However, the MPA told us “there is a great deal of research needed to ensure that the product (which is very carefully regulated by European Standards) is unaffected by the changes to the kiln system”.202 They go on to explain that:

The European Commission non-paper aimed at the co-financing of 12 CCS demonstration projects has missed an opportunity in the cement industry. It states in its eligibility criteria that a cement CCS demonstration project should be 500 kt/y avoided CO₂ at 85% capture. This is not demonstration scale but full scale for many of the UK plants and the UK Government should aim to approach CCS in the industrial sectors at a more achievable and realistic level.203

156. The iron and steel industry will also benefit from CCS demonstration in industry. The Carbon Capture and Storage Association told us:

Whilst the initial and biggest prospect for CCS is in power generation, with the potential to reduce CO₂ emissions by up to 90 per cent, the technology cuts across many sectors of a future low-carbon economy. For example, certain parts of industry, such as cement and steel, will have little or no other option for reducing carbon dioxide emissions besides CCS.204

157. We are concerned by the Mineral Product Association’s claims that EU financing of cement CCS is for plants at full scale rather than demonstration scale in the UK. The Government should assess whether financing for CCS demonstration in the cement and steel industries can be achieved at a more realistic scale.

158. Nationally, the manufacture of pulp, paper and paper products together with printing and publishing is a £44 billion per annum turnover industry employing 410,000 people.205 The production of one tonne of paper uses 24 trees, requires 1.5 tonnes of coal for electricity generation, and emits five tonnes of carbon dioxide.206 A move from print to electronic products may appear to be a viable solution to unnecessary carbon dioxide

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200 Ev 229, para 4.2 [Mineral Products Association]
201 Committee on Climate Change, Building a low carbon economy – the UK’s contribution to tackling climate change, December 2008, p 47
202 Ev 230, para 5.1 [Mineral Products Association]
203 Ev 231, para 7.4 [Mineral Products Association]
204 Ev 159, para 6 [Carbon Capture and Storage Association]
emissions. However, a study by the Swedish Royal Institute for Technology found that if somebody read the news in a printed newspaper each day they would be responsible for emitting 28 kg of carbon dioxide per year. Alternatively, reading it online for 30 minutes a day would result in 35 kg carbon dioxide per year because of the electricity used by the computer, network etc.\textsuperscript{207} However, this may change as we move towards a decarbonised electricity supply. Technologies for reducing carbon dioxide emissions from the sector are similar to those in other business environments—sourcing green energy, building technologies, and energy efficiency measures.

\textit{Energy efficiency in buildings}

159. Energy efficiency measures are often described as low-hanging fruit in relation to reducing carbon dioxide emissions. This is the case in both domestic and non-domestic buildings, and whilst many low carbon technologies will work in both sectors, there are some that are specifically tailored to non-domestic buildings such as factories, offices, schools and hospitals. Buildings in the non-domestic sector account for around 18\% of total UK emissions.\textsuperscript{208} Willmott Dixon told us that the Government should set legislation rather than ambitions for non-domestic buildings to achieve carbon targets by 2020.\textsuperscript{209}

160. The British Electrotechnical and Allied Manufacturers Association (BEAMA) told us that support for low carbon industry shouldn’t simply focus on green start-up companies and renewable technologies, and that existing industries also have an important part to play.\textsuperscript{210} The Energy Services and Technology Association (ESTA) explained that “energy efficiency is good for business, because it reduces waste and improves profitability.”\textsuperscript{211} Indeed, the Department of Energy and Climate Change acknowledged that UK businesses could save £6.4 billion per year through low and no cost resource and energy efficiency measures.\textsuperscript{212} However, Tesco told us that the incentive of reduced energy bills is not always in itself a sufficient driver to improve the energy efficiency of buildings.\textsuperscript{213}

161. BEAMA identified some of the technologies with the biggest potential for stimulating a low carbon economy and improving the energy efficiency of buildings:

\begin{itemize}
  \item Smart metering systems for electricity, gas and water utilities deliver significant energy reductions. They achieve this by providing information for consumers, by automatically controlling equipment, and by facilitating demand response techniques. Conservative carbon reductions of 5-10\% are reported from world examples.
  \item Advanced heating controls are available for use with all gas heating systems. Independent evidence shows that savings of 6\% are achieved compared with
\end{itemize}

\textsuperscript{207} KTH Centre for Sustainable Communications, \textit{Screening environmental life cycle assessment of printed, web-based and tablet e-paper newspaper}, 2007

\textsuperscript{208} Ev 212, para 4.1 [Energy Services and Technology Association]

\textsuperscript{209} Ev 288 [Willmott Dixon]

\textsuperscript{210} Ev 151, para 32 [British Electrotechnical Allied Manufacturers Association]

\textsuperscript{211} Ev 151, para 32 [British Electrotechnical Allied Manufacturers Association]

\textsuperscript{212} Ev 177, para 21 [Department of Energy and Climate Change]

\textsuperscript{213} Ev 285, para 29 [Tesco]
traditional well-controlled systems. Significantly higher savings can be achieved by upgrading all systems to minimum levels of control (10-20%).

Building Automation [and Control] Systems (BACS) in commercial buildings can save up to 20% of Heating Ventilating & Air Conditioning (HVAC) consumption. Actual efficiency figures depend upon site-specific factors and installation and maintenance. Lighting controls using constant dimming and occupancy and time switching for commercial and domestic buildings. Energy use reductions vary, but robust evidence shows on average 20% – 30% reductions in lighting usage.

Lighting controls using constant dimming and occupancy and time switching for commercial and domestic buildings. Energy use reductions vary, but robust evidence shows on average 20% – 30% reductions in lighting usage.\(^{214}\)

162. Despite the downturn in the economy, sales of energy efficiency products and technologies are still growing. ESTA told us “demand for the latest automatic Monitoring & Targeting (aM&T) systems is seeing growth in the order to 25% per annum. Lighting control systems are likewise showing continued growth (a slightly lower figure of around 10% per annum)”.\(^{215}\) However, further support through a long-term policy framework would be welcomed by the industry. BEAMA cited recent good examples of long-term policy decisions including “the long-term commitment to building zero carbon homes by 2016, the phasing out of incandescent lamps by 2011 and the three year advance notice of the switch to condensing boiler installations in 2005.”\(^{216}\) One suggestion from ESTA was to make more use of Display Energy Certificates (DECs). These are currently required on large public sector buildings (more than 1,000 m\(^3\) area), which are visited frequently by members of the public. “ESTA believes this tool should be used on all buildings, except the smallest. Where they are already in use, they must be renewed annually and we see this as a useful tool for building operators to assess - and improve - building energy performance on a regular basis”.\(^{217}\) The Carbon Trust told us:

> There are about 40,000 buildings with those certificates [DEC]. One could enforce or mandate that all public sector buildings implement the cost effective opportunities linked to those certificates. In doing that you would save around a billion pounds per annum on energy bills and save about 23 million tons of CO\(_2\) and really stimulate the supply chain in the buildings industry.\(^{218}\)

Willmott Dixon also called for more widespread use of DECs, to include hotels, supermarkets, and privately owned buildings that are frequently visited by the public.\(^ {219}\) Evidence we received from Tesco went further, recommending that the Government could:

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214 Ev 149, para 17 [British Electrotechnical Allied Manufacturers Association]
215 Ev 213, para 6.1 [Energy Services and Technology Association]
216 Ev 149, para 9 [British Electrotechnical Allied Manufacturers Association]
217 Ev 213, para 7.2–7.3 [Energy Services and Technology Association]
218 Q 147 [Mr Wilde, Carbon Trust]
219 Ev 288 [Willmott Dixon]
offer reduced business rates for those properties that achieve low emissions, based on an existing measurement system such as that used for Display Energy Certificates [...] for instance, a 10p tax cut in the multiplier for achieving a particular energy rating would finance £100,000 of energy savings at a typical Tesco superstore and would significantly influence investment decisions. This could be made cost-neutral, either within the business rates system (with commensurate penalties for the worse performing buildings), or more widely within the tax system.220

Greenpeace were also in favour of reducing business rates as a way of increasing interest in energy efficiency, in particular for small and medium companies.221

163. Energy efficiency technologies for non-domestic buildings include smart metering, advanced heating controls, building automation and control systems, and lighting controls. Most of these technologies have already been developed and are ready for widespread deployment. We have heard that whilst energy efficiency is good for business profitability, a reduction in energy bills is often not enough of an incentive for companies to invest. Government should introduce more effective policies to encourage businesses to become energy efficient. Existing systems such as the Display Energy Certificates (DECs) provide an excellent means of measuring the energy efficiency of a building. DECs should be rolled out to all medium to large private sector buildings and the Government should investigate the feasibility of reducing business rates for businesses that improve their energy efficiency rating.

**Industrial combined heat and power**

164. Combined heat and power (CHP) is the simultaneous generation of usable heat and power. It can deliver low carbon heat and electricity if the energy input has a low carbon footprint, for example, sustainable biomass or gas from anaerobic digestion. The Food and Drink Federation (FDF) told us:

> The food and drink manufacturing sector is already a significant user of CHP with around 500 MWe installed capacity, though this tends to be concentrated at larger installations. It is recognised that there is significant further potential, however relatively few new installations have come on stream in recent years largely due to poor payback periods.222

165. Current financial support mechanisms for industrial CHP include Climate Change Levy exemptions, Levy Exemption Certificates for exported power and Enhanced Capital Allowances (ECAs). The FDF told us “Further incentive for renewables CHP could come from additional financial support such as higher (>100%) ECAs or increased renewable obligation certificates (ROCs)”.223

166. However, Centrica were less optimistic about the potential of CHP. They explained that it provided lower CO₂ emissions reductions than renewables, nuclear and CCS. They
told us “Much of the technical potential is not economically feasible, and any short term gains are likely to be outweighed by the long-term negative effect of locking businesses into fossil-fuel based heat production.” In contrast, E.ON told us: “Combined heat and power on an industrial scale continues to have a very important role in ensuring the more efficient use of fossil fuels.”

167. **Combined heat and power can be an effective low carbon technology in particular sectors where there is easy access to sustainable fuel, for example, biomass or gas from anaerobic digestion in the food and drink industry. In these circumstances, the Government should actively encourage industry by providing an appropriate level of support. This should be kept under review and determined in consultation with industry. However, the use of CHP technology fuelled by unabated fossil fuels has no place in a green economy driven by the need to address emissions reduction targets.**

**District heating**

168. District heating involves the use of a centralised system which provides heating requirements, such as space heating and hot water, for a cluster of local properties or through heat networks for hybrid supply of heat to commercial, industrial and public buildings, along with domestic properties. It can help to reduce the cost of energy to consumers because large scale generation of heat is more cost effective than generating heat using individual boilers in individual properties. District heating can also lower CO₂ emissions, although the extent to which this happens depends on the type of fuel used. The use of CHP technologies in district heating projects allows the efficient, integrated generation of usable heat and electricity for local communities. Greenpeace told us it is important to move towards district heating not simply because of the energy savings that CHP offers but also because of the strategic advantage, so that as we move to low carbon energy sources, it will be easier to convert one centralised installation serving 1,000 homes, than to convert the heating systems in 1,000 individual properties. The recent Government report, *Warm Homes, Greener Homes: A Strategy for Household Energy Management*, calls for wider take up of district heating in urban areas and in commercial and public sector buildings.

169. **District heating provides efficiency savings through the large scale generation of energy and is best suited to densely populated urban areas or large buildings (such as hospitals and schools). We support the Government’s call for wider uptake of district heating in these areas. However, the Government must ensure that every effort is made to source low carbon fuel for district heating projects if it is serious about meeting emissions reduction targets.**

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224 Ev 171, para 22 [Centrica PLC]
225 Ev 190, para 17 [E.ON]
226 Q 40 [Dr Parr, Greenpeace]
Domestic

170. In 2008, the amount of energy used in the domestic sector in the UK was 45.64 million tonnes of oil equivalent.228 Baxi Group UK told us “Domestic CO₂ emissions account for 27% of total UK emissions in 2005 and over three quarters of energy used in the home is for heating and hot water.”229 Energy efficiency measures in domestic buildings will be met through the introduction of existing and new building technologies (including windows, doors, insulation and building control systems). The global market value of the building technologies sector in 2007/08 was £390.48 billion; the UK had a 3.30% share of this. The UK employed 107,000 people in this sector in 2007/08. Based on forecast growth in domestic market value, this could potentially rise to 154,800 in 2014/15.230

171. The Government has an ambitious target in place for all new homes to be zero carbon by 2016. However, it is important that all domestic buildings, existing and new-build, are energy efficient if the UK is to meet its carbon dioxide emissions reduction targets for 2020 and 2050. The Micropower Council told us that at least 70% of the existing housing stock will still be in place in 2050, therefore, emissions from these existing homes must be tackled as part of any commitment to reduce emissions.231

172. The Government has put in place a number of mechanisms to encourage the uptake of energy efficiency measures in existing domestic buildings:

- The Carbon Emissions Reduction Target (CERT) commenced in April 2008. It is the Government’s flagship household sector energy and carbon saving scheme. CERT places a 3-year obligation on energy suppliers to meet household carbon saving targets. Suppliers meet these targets by promoting the take-up of energy saving measures, including loft and cavity wall insulation and high-efficiency lighting and appliances. The Government is consulting on an extension to CERT until December 2012.

- The Community Energy Savings Programme (CESP) commenced in September 2009. It encourages energy companies to work with local councils and voluntary organisations to carry out house-to-house calls to promote energy efficiency measures in deprived areas. However, it has been introduced on a fairly limited basis, covering only 100 areas and approximately 90,000 households.

- The Warm Front Scheme commenced in 2000. It is designed to provide grants for people on qualifying disability or income related benefits to install energy efficient measures in their homes. It provides a package of insulation and heating improvements up to the value of £3,500 (or £6,000 where oil, low carbon or renewable technologies are recommended).

173. The Minister told us Warm Front has funding until 2011, the CERT will be extended to 2012, and the CESP will run until 2012.232 In the 2009 Pre-budget Report, the

228 Department of Energy and Climate Change, Digest of UK Energy Statistics, Annex, Table 1.1.5
229 Ev 145, para 2 [Baxi Group UK]
230 Innovas, Low Carbon and Environmental Goods and Services: an industry analysis, March 2009, p 40
231 Ev 227 [Micropower Council]
232 Q 491 [Mr David Kidney MP, Department of Energy and Climate Change]
Government also announced a new Boiler Scrappage Scheme. This is a scheme to upgrade household heating systems by offering a £400 voucher to replace a working G-rated boiler with a new A-rated boiler or a renewable heating system, for example a biomass boiler or a heat pump. The Government is also piloting a home energy Pay As You Save (PAYS) scheme in conjunction with the Energy Savings Trust. This scheme is testing out new ways to finance home energy makeovers. Consumers are given the opportunity to invest in energy efficiency and microgeneration technologies with no upfront cost. Repayments are spread over a period of time and are paid through the savings that are made through the consumers’ energy bills. In March 2010, the Government published *Warm Homes, Greener Homes: A Strategy for Household Energy Management*. One of the proposals in this strategy is to expand the PAYS scheme by introducing legislation to allow Pay As You Save loans to be tied to the property.233

**Energy efficiency**

174. Despite the Government’s many initiatives and the ease with which most energy efficiency measures, for example insulation, can be installed, consumers are surprisingly slow to act. E.ON told us “from an energy policy perspective, investment in improving energy efficiency is amongst the lowest cost options for reducing CO₂ emissions.”234 One specific challenge is that of improving the energy efficiency of rented accommodation, where the cost of high energy bills falls to the tenant but the cost of home improvement would naturally fall to the landlord. The Government has acknowledged this challenge; in its household energy management strategy it proposes to consult on setting minimum energy efficiency standards for rented properties.235

175. We heard from a number of organisations that the Government’s green stimulus for energy efficiency was inadequate. The Sustainable Development Commission believes there is scope for an £11 billion per year domestic retrofit programme. They told us:

> this would reach an average of one million households a year and above those reached by existing and currently envisaged policy measures. By contrast, the 2009 budget provided an additional £375 million to support energy and resource efficiency in businesses, public buildings and households over the next two years.236

176. Greenpeace have reported that an energy efficiency programme of £525 million per year would be required just to meet fuel poverty needs. To meet longer-term needs, they claim that public and private investment will need to be of the order of £5 billion per year.237 Retrofitting the existing building stock is by its very nature work that has to be done locally. Advocates of stimulating green jobs in this industry argue that not only are jobs local, but they are created quickly and don’t require lengthy training programmes. Greenpeace told us “for every €1 million of investment we get about 8 to 14 directly created

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234 Ev 189, para 12 [E.ON]
236 Ev 279 [Sustainable Development Commission]
237 Greenpeace, *The case for including energy efficiency in the fiscal stimulus package*, March 2009
jobs and between 9 and 40 indirectly created jobs.”\textsuperscript{238} New jobs that are created in this sector must be designed to promote energy efficiency measures rather than a business-as-usual approach to home improvement. According to research by BEAMA, 70\% of people have said that the heating installer made the decision on their heating system.\textsuperscript{239} Installers of building technologies must be ambassadors for energy-saving technologies.

177. The Government’s strategy for household energy management, \textit{Warm Homes, Greener Homes}, proposes to overhaul the scope of Energy Performance Certificates to give households a better understanding of what they can do to improve the energy efficiency of their homes. This would include an online modelling system so homeowners can do a virtual green makeover before taking action.\textsuperscript{240}

178. \textbf{Energy efficiency is described as low hanging fruit when discussing ways of reducing emissions. However, despite Government initiatives, consumers are often slow to take advantage of support for insulation and other energy efficiency measures. To date, Government initiatives on energy efficiency have not been nearly ambitious enough. However, we welcome the proposals within the strategy on household energy management, \textit{Warm Homes, Greener Homes}. We hope the Government will pay particular attention to introducing new regulations to tackle the energy efficiency of existing housing stock, such as requiring properties to achieve a minimum energy efficiency standard before sale or lease is permitted. We would also like the Government to investigate the feasibility of encouraging households to improve their energy efficiency rating, as defined in the Home Information Packs (HIPs), in exchange for lower council tax rates.}

179. The UK also has strengths further up the supply chain in the development of new low carbon technologies. E.ON pointed out one example of an area where the UK is particularly strong—organic light emitting diodes (LEDs) and optoelectronics for lighting and displays.\textsuperscript{241} The Carbon Trust also highlighted this area; they told us:

\begin{quote}
[LEDs] are going to commercialise by 2014. The private sector are putting a lot of investment into LED technology […] There are niche opportunities for the UK, particularly in the luminaire designs, so we could help stimulate luminaire design. The types of policies we need are the ones that will unlock the barriers for implementation of LEDs and get them in fast because we need cost effective energy efficiency as soon as possible, ideally all implemented by 2020 across the building stock.\textsuperscript{242}
\end{quote}

180. They went on to explain that targeted policies are needed for specific technologies, rather than a generic incentive mechanism, for example changing the way building regulations look at lighting or altering the way information is presented on lighting

\begin{footnotes}
\item[238] Q 44 [Dr Parr, Greenpeace]
\item[239] Q 441 [Mr Timmins, British Electrotechnical Allied Manufacturers Association]
\item[241] Ev 189, para 12 [E.ON]
\item[242] Q 159 [Mr Wilde, Carbon Trust]
\end{footnotes}
products so that it is easier for consumers to make a comparable decision on the relative benefits of LED lighting versus other types of lighting.

181. There are also areas of energy efficiency, such as solid wall insulation, where there are currently few affordable technology solutions. The Energy Savings Trust told us “Unless we can really invest in things like solid wall insulation and work out how we are going to make it work, then we are going to be missing huge opportunity to reduce the UK’s carbon emissions.”

182. It is important to tailor specific policies to specific technologies to overcome barriers unique to the deployment of those technologies. Light emitting diodes (LEDs) are a good example of one technology that will benefit from this approach over the next four years. We hope the Government will work closely with technology developers and industry to determine potential barriers to the widespread commercialisation of LEDs (and other new technologies) and address these ahead of their deployment. Where there are specific challenges that need to be addressed, such as solid wall insulation, the Government should fund research and development of technologies that will overcome these.

183. The responsibility for supporting and implementing energy efficiency measures is spread across a number of stakeholders, from central and local government to organizations such as the Energy Savings Trust and the energy utility companies. E.ON told us:

> We favour a regional franchise approach to upgrading the UK housing stock from 2013 onwards in which a single organisation is charged by Government with delivery within defined geographical area supported by the availability of low interest loans for consumers.

184. National Energy Action have proposed a whole-house retrofit approach to energy efficiency:

> The whole-house retrofit programme will identify the basic measures required by the household such as draughtproofing; double glazing; and cavity and loft insulation. Beyond this, more costly measures will be assessed including solid wall insulation, the requirement for renewable/low carbon generation in/on the property and the potential for connection to district heating.

Greenpeace are also in favour of this approach. They described the ‘Green Concierge Service’, which they would like to see improved and rolled out proactively: “The Green Concierge is someone who comes in, gives the advice, says what needs to be done, and actually manages the project. So that unpicks some of the potential barriers.” The Government’s recently published strategy for household energy management, *Warm Homes, Greener Homes*, proposes to introduce a one stop shop energy helpline for people

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243 Q 159 [Mr Lewis, Energy Savings Trust]
244 Ev 189, para 12 [E.ON]
245 Ev 232, para 8 [National Energy Action]
246 Q 57 [Dr Parr, Greenpeace]
to access trust-worthy information about how to benefit from energy efficiency measures.\textsuperscript{247}

185. \textbf{We encourage the Government to take a more detailed look at the ‘whole-house’ approach to energy efficiency.} We welcome its proposals to introduce a one stop shop energy helpline; however, the Government should consider a more ambitious ‘Green Concierge’ scheme, which would involve on-site consumer advice on energy efficient home improvements. Our forthcoming report on fuel poverty will also look at some of the options available for increasing energy efficiency.

186. \textbf{Most particularly, it is vital as a matter of urgency to introduce a national programme to retrofit existing housing stock.} A major street by street, house by house scheme needs to be introduced. This could run alongside the current proposal to install smart meters.

\textbf{Microgeneration}

187. \textbf{Microgeneration is the localised generation of low carbon energy by households and businesses.} We heard from the Solar Trade Association that it is important to install energy efficiency measures first, followed by pure renewable microgeneration technologies such as wind turbines and solar panels, and then back that up with other fuel based technologies, for example micro-CHP.\textsuperscript{248} However it is not appropriate to put solar panels on every surface or wind turbines on every home. The Micropower Council acknowledged this in their evidence to us:

\begin{quote}
Tackling retrofit is very challenging due to the wide range of different house types, available heating sources and planning restrictions such as conservation areas and listing. The appropriate solution for each house is different and, therefore, formulating policy is difficult as, if highly prescriptive, it will probably be very inappropriate for some, if not most, dwelling types. The wide range of microgeneration technologies, however, facilitates an appropriate low carbon solution for a given house type.\textsuperscript{249}
\end{quote}

188. \textbf{The introduction of the Government’s Feed-in Tariff in April 2010 is widely expected to increase consumer demand for electricity microgeneration technologies.} The Renewable Heat Incentive, expected to roll out in 2011, is expected to do the same for heat microgeneration technologies. Centrica told us “the Feed-in Tariff for electricity and the Renewable Heat Incentive can deliver the step change necessary to take microgeneration into the mass-market mainstream.”\textsuperscript{250} The Renewable Energy Association highlighted that decentralised energy offers strong job creation opportunities, especially in the rural economy.\textsuperscript{251}

\textsuperscript{247} HM Government, \textit{Warm Homes, Greener Homes: A Strategy for Household Energy Management}, March 2010
\textsuperscript{248} Q 349 [Mr Matthews, Solar Trade Association]
\textsuperscript{249} Ev 227 [Micropower Council]
\textsuperscript{250} Ev 170, para 12 [Centrica PLC]
\textsuperscript{251} Ev 253 [Renewable Energy Association]
189. E.ON told us that they see a big role for heat pumps:

Heat pumps represent a highly cost efficient and carbon effective way of providing heat and hot water. By sourcing heat from the ground or air, using a grid electricity input, the heat pump is able to convert one unit of heat and in the right conditions produce up to three units of heat in return. Heat pumps are highly effective heat-led solutions in hard to treat locations off the gas grid.252

EDF Energy was positive about the potential for air source heat pumps (ASHP). “As a conservative assumption, around 2 million high temperature ASHPs can be installed in the period to 2020, providing there is appropriate financial support and installer skills are developed.”253 However, Calor Gas was less positive about ground source heat pumps (GSHP); they told us “ground source heat pumps are disruptive to fit and at up to £14,000 to install are a very expensive way of addressing the problem, particularly in rural areas which would also require a very significant investment in electricity infrastructure.”254

190. We have already discussed the potential of combined heat and power (CHP) in industry and in district heating schemes. CHP also has a role to play as a microgeneration technology in domestic buildings as well. Micro-CHP has the potential to replace traditional gas boilers in a centrally heated home. E.ON told us “It [micro-CHP] burns gas to produce space and water heating, whilst simultaneously generating around 3,000 kWh of electricity annually.”255 Centrica outlined the full potential of this technology in the UK:

Current forecasts suggest that mCHP [micro-CHP] boilers could provide energy bill savings for the average household of approximately 25% per year and reduce annual household carbon dioxide emissions by up to 2.5 tonnes. Over 80% of the 21 million centrally heated homes in the UK are on the gas network and the overwhelming majority of these homes will use gas as a heating fuel. Approximately 1.5 million boilers are replaced each year in Great Britain and one scenario puts residential CHP as taking 30 per cent of this market by 2015. Collectively, the new mCHP boilers could save the equivalent CO2 emitted by eight power stations. A significant number of households use Liquid Petroleum Gas (LPG) boilers which are virtually identical to conventional gas boilers so there is no reason why LPG would not also benefit from mCHP, ultimately further extending the reach.256

191. Microgeneration technologies are often expensive to install. We welcome the Government’s Feed-in Tariff, which will commence in April 2010. We hope the Government will consult the relevant industries to the same extent in developing the right level of support for various technologies through the Renewable Heat Incentive.

252  Ev 189, para 14 [E.ON]
253  Ev 193, para 7 [EDF Energy]
254  Ev 157, para 5.2 [Calor Gas Ltd]
255  Ev 189, para 15 [E.ON]
256  Ev 170–171, para 18 [Centrica PLC]
**Smart technologies**

192. A smarter energy network is touted as the best way of increasing consumer interest and involvement in energy efficiency. Smart meters will be a key component of this network; the Government intends to have smart meters installed in every home within the next ten years. Mr Phil Wynn Owen, Director General, National Climate Change and Consumer Support, Department of Energy and Climate Change, explained to us that smart meters would be accompanied by a real-time display that would tell consumers what energy they are using and when they are using it. These displays will help consumers to understand and manage their consumption.257 Whilst there is value in this as a tool for encouraging consumers to use less energy, the smart meter will only reach its full potential when used in conjunction with a smart grid and smart electrical appliances. Centrica told us that they have partnered with Vphase, a developer of energy saving products for residential and commercial properties. This partnership will see Vphase products offered to British Gas customers.258 Smart appliances and products would be capable of communicating with the electricity or gas grid via the smart meter. For example, they could potentially be triggered to switch to an energy saving mode during times of peak demand, or future products such as electric vehicles could be set up to begin charging overnight when demand for electricity is low. Such a system would result in savings in consumer energy bills as well as providing the utility companies with an element of demand management.

193. However, BEAMA warned us of the importance of consumer buy-in on smart meter technologies:

> If the consumers do not believe that by having this technology [smart meters] in their homes it will give them a benefit, it will help them control their lives better and give them lower bills, basically it will not be accepted, it will not be used and it will be a waste of money. There is a real effort there needed. It includes education, it includes regulation, it includes local authorities, very importantly, to help people, it involves charities, and it involves central government providing the framework for really educating and informing consumers what they can do in their homes.259

194. National Grid also showed concern, calling for “a coordinated and consistent communication campaign to achieve early education of consumers in how to exploit the potential from smart meters and appliances.”260

195. **The Government should work in closer partnership with the utility companies, the electrotechnical industry and other stakeholders to ensure that an open two-way dialogue is achieved between them and consumer groups about the potential benefits of smart meters and a smarter energy network.**

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257  Q 502 [Mr Wynn Owen, Department of Energy and Climate Change]
258  Ev 171, para 20 [Centrica PLC]
259  Q 437 [Dr Porter, British Electrotechnical Allied Manufacturers Association]
260  Ev 243, para 37 [National Grid]
6 Moving towards a low carbon future

International action

EU Emissions Trading Scheme

196. In January 2005, the European Union Emissions Trading Scheme (EU ETS) commenced, as a cap-and-trade scheme that will help European countries meet their emissions reduction targets. Emissions trading is a key policy mechanism that allows emissions to be reduced at the lowest possible cost. The cost of emissions allowances is determined by the carbon market, and by the demand for, or availability of, allowances. The EU ETS covers electricity generation and the main energy-intensive industries – power stations, refineries and offshore, iron and steel, cement and lime, paper, food and drink, glass, ceramics, engineering and the manufacture of vehicles. Combined, these account for around 43% of UK CO₂ emissions.\(^\text{261}\) We are currently in phase II of the EU ETS, which ends in 2012. Preparations are already being made to extend and improve phase III, which will run from 2013-2020. It is hoped that phase III will deliver more emissions reductions, more predictable market conditions and more certainty for industry.

197. However, the EU ETS has received much criticism. The Environmental Industries Commission told us:

The emissions trading scheme sadly to date has not been ambitious enough to drive the emissions reductions that are required and to stimulate a high enough carbon price that encourages investment and makes investment in low carbon alternatives cost effective. It remains to be seen whether that happens in phase three which will start in 2013.\(^\text{262}\)

198. EDF Energy blamed the lack of robust carbon constraints and the weak price of carbon:

Low carbon investors face uncertainty created by a lack of a robust carbon constraint (despite the statutory UK budgets) and the weakness in the price formation process in the EU ETS. This price formation process will more than likely be based on short run marginal or avoidable costs (SRMC), rather than the long run marginal cost of more capital intensive low carbon technologies. This means that the EU ETS cannot provide a bankable price capable of underpinning the capital investment in low carbon technologies required to deliver deep cuts in CO₂ emissions. These present significant hurdles for early investment in low carbon technologies. The Government should recognise the role that the EU ETS can play in providing the right incentives to optimise operational decisions and should equally recognise the limitations of the EU ETS as an instrument to underpin long term investment.\(^\text{263}\)

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\(^{261}\) Department of Energy and Climate Change, www.decc.gov.uk

\(^{262}\) Q 78 [Mr Stevens, Environmental Industries Commission]

\(^{263}\) Ev 194, para 27-28 [EDF Energy]
199. Others agreed: the Association of Electricity Producers told us “the primary driver for investment, leading to development and deployment of low-carbon technologies in the UK, is a carbon price”;264 the Regional Development Agencies told us, “the substantial fall in the price of carbon under the EU Emissions Trading Scheme is having a detrimental impact on low carbon investment and needs to be addressed”;265 and, the New Economics Foundation stated, “A tight carbon cap is needed to drive a price signal which will make any difference”.266 Without additional clarity to investors on the price of carbon, there is a risk that investment in low carbon technologies will not occur. This would threaten the UK’s ability to meet its carbon budgets and decrease the likelihood of Europe reaching its emissions reduction targets. EDF Energy warned us “There is a further risk that failure to support the EU ETS in delivering its objectives may eventually lead to the failure of the EU ETS itself”.267

200. We questioned the Minister about the need for a tight cap in order to give investors certainty about the price of carbon. He told us:

   We must make the market in carbon trading effective, and our view is that in the European Emissions Trading Scheme one way we can do that is to give a credible cap and an effectively working Emissions Trading Scheme. So we want to see phase 3, to have a very tight cap; we want to see the Copenhagen Agreement reach a deal that does lead to higher commitments by the developed world to make carbon emission reductions, as a part of which the European Union will move its offer up from 20 per cent reduction by 2020 to 30 per cent, and we think then that if the cap in phase 3 represents that tighter position that we will start to see a decent and meaningful price for carbon that is reliable. So our view is that it is that kind of market mechanism that gets the price of carbon to where we need it to be, not artificial interference by politicians.268

201. We were also concerned about the effectiveness of an emissions trading scheme if some countries agree a floor price for carbon, and others opt for a completely open market. The Minister acknowledged that such an approach would be dangerous:

   “It does contain within it the seeds of potential destruction of the whole because, as you say, people would be for artificial reasons buying and selling in one place rather than another, so it would be extremely dangerous for individual Member States to go down that road.”269

The Department of Energy and Climate Change followed up on this point with supplementary evidence to us, stating that a unilateral floor price in, for example, the UK, “would be subject to a number of significant legal barriers, some of which breach EU

264  Ev 145, para 10 [Association of Electricity Producers]
265  Ev 250 [Regional Development Agencies]
266  Q 28 [Mr Simms, New Economics Foundation]
267  Ev 195, para 31 [EDF Energy]
268  Q 479 [Mr David Kidney MP, Department of Energy and Climate Change]
269  Q 485 [Mr David Kidney MP, Department of Energy and Climate Change]
law”.270 This assures us that it would be extremely difficult for any one country to proceed with a floor price in the absence of EU-wide agreement.

202. Companies interested in low carbon technologies need a robust and high price of carbon to drive investment. The Government must push for a tighter cap in the third phase of the EU Emissions Trading Scheme in order to encourage investment in low carbon technologies. Failure to achieve this will inevitably lead to a growing demand for the Government to introduce, at a domestic level, a floor on the price of carbon.

International climate agreements

203. It was hoped that a robust international climate change deal at Copenhagen would be the driving force needed for the EU to enforce a much tighter cap on the EU ETS. E.ON told us “An agreement is required which will enable the EU to commit to a 30% reduction in GHG emissions by 2020 which will in turn lead to a tighter cap on emissions under the EU ETS over the period and a more robust carbon price”.271 The UK has worked hard on negotiating a global agreement, and a number of organisations, including the Association of Electricity Producers (AEP) and the Energy Technologies Institute (ETI) recognised that the UK has led by example on climate change issues.272 The AEP were concerned that “without a strong agreement being reached in Copenhagen there is a risk that the emissions reductions targets could have a negative impact on the competitiveness of the UK”.273 In addition to UK competitiveness, other drivers for an international agreement on climate change include energy security and economic development.

204. No legally binding deal on emissions reduction was reached during negotiations at Copenhagen. However, it is important that the UK continue to push ahead with the move towards a greener economy in the absence of an international agreement. The ETI told us “the risk of failing to address the twin challenges of climate change and the depletion of North Sea oil and gas reserves is probably greater than any other risk to a sustainable UK economy.”274 EDF Energy also outlined the importance of continued investment in low carbon technologies:

While this [future international agreement] may be considered to be an ideal outcome in the long term, investor uncertainty will remain in the medium term. This is particularly relevant to the UK where decisions on the role of low carbon technologies in replacing capacity over the next 10 to 15 years need to be taken now and which will have a significant impact on the UK’s carbon footprint over the next 30 years.275

205. We spoke to the Minister during the final week of negotiations at Copenhagen. At the time he told us, “[After Copenhagen] the markets ought to have some kind of reassurance

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270 Ev 183, Annex D [Department of Energy and Climate Change]
271 Ev 187, para 3 [E.ON]
272 Ev 143 [Association of Electricity Producers] and Ev 205 [Energy Technologies Institute]
273 Ev 145, para 12 [Association of Electricity Producers]
274 Ev 205 [Energy Technologies Institute]
275 Ev 195, para 29 [EDF Energy]
about what is going to happen. If it does not then you are right, we need to be talking about other measures about taxation”.276

206. The move towards a low carbon economy is in the UK’s strategic and economic interest. The Government must push ahead with the deployment of low carbon technologies in the UK regardless of how other countries are choosing to deal with climate change. It is important for the Government to continue to lead by example whilst continuing to work towards securing a legally binding international agreement.

**Investment**

207. As we wait for a tighter cap on the EU ETS and a future international deal on climate change, it is important that other measures are implemented to stimulate investment in low carbon technologies so that the UK can meet its own emissions reduction target. The Department of Energy and Climate Change told us that they were developing a supportive market structure for the deployment of technologies, which included the use of tax credits, Renewable Obligation Certificates (ROCs) and the up-coming renewable heat incentive and feed-in-tariff for small scale electricity. We have already discussed the ROCs, feed-in tariff and renewable heat incentive in the context of different energy generation technologies, and we are broadly supportive of those measures. The Government’s research and development (R&D) tax credit scheme is one policy measure that we have heard is encouraging the development of low carbon technologies, particularly in the aviation industry.277 However, the South East England Development Agency (SEEDA) told us:

While the current R&D tax credit system allows companies to claim a tax repayment in cash based upon a percentage of losses incurred due to ‘approved’ R&D expenditure, these tax losses would normally only be recoverable as a reduction in taxes payable on future profits generated by the firm. While useful to increase cash inflow from losses, the amount that can be recovered is restricted to only a small percentage of the total losses incurred by companies involved in new product development – typically 5% of losses incurred. However, the ‘Green Bond’ would involve an immediate cash payment based on 100% of the unutilised accumulated tax losses, which would substantially increase the short term cash flow of the business and serve as a bridge financing through to commercialisation.278

208. The Government must maintain and continue to improve the research and development tax credit scheme, in order to encourage private sector investment in low carbon technologies. However, given the scale of the challenge we face, especially after the failure of Copenhagen, the Government must expand its green fiscal policy toolbox.

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276  Q 481 [Mr David Kidney MP, Department of Energy and Climate Change]
277  Ev 276, para 3.4.1 [Sustainable Aviation]
278  Ev 260, para 14–15 [South East England Development Agency]
**The green fiscal policy toolbox**

209. The Crown Estate told us that they were seeing the impact of the economic downturn on demand and investment for low carbon technologies.\(^{279}\) There is a need for a policy framework that is flexible enough to adapt to accommodate emerging technologies over time, whilst providing the long-term stability that the market needs to create a step-change in the investment in existing low carbon technologies. The Environmental Industries Commission argued for:

a combination of demand side policies – such as tax, regulation and the rationing of emissions through carbon markets – that will create new markets for climate change solutions, and supply side policies – such as R&D and training – to facilitate the innovation, production and use of low carbon technologies.\(^{280}\)

210. However, with limited public funding, it is important to focus public spending on technology areas where we have real strengths, or where there is an overwhelming need for public investment. The Association of Electricity Producers argue that “UK and EU energy policy should aim to facilitate a steady climate for long-term investment in low-carbon technologies and the Government must avoid ‘picking winners’”.\(^{281}\) However, the Carbon Trust advocates an approach of picking winning ‘technology families’ and tailoring policy support towards those areas:

Having prioritised technology families, the next critical thing is having customised policy for that specific technology area. The commercial and technical barriers are fundamentally different for each technology type and those policies need to cover the technology push, so your R&D support, the proving funds […] and then the barrier removal. There is no point proving a technology if you cannot connect it to the grid or other types of planning barriers et cetera. Then you also need to create the right pull mechanisms, whether that is an incentive mechanism or whether that is just clarity for the market as to how to use this particular piece of equipment. It is really important to customise technology support. Neutral mechanisms essentially often favour the most mature technology and disfavour the less mature so you are making choices by doing that.\(^{282}\)

211. Public funding is limited and therefore it is right that the Government prioritises its investment in low carbon technologies towards specific technology families where the UK has real strengths or where there is an overwhelming need for public investment. However, the Government must be careful of the way it portrays this message. Prioritisation of funding should not result in other technology families being completely disregarded. The Government’s policy toolbox should provide flexible support for all low carbon technologies in addition to more specific policy mechanisms that address the technical barriers unique to individual technologies. These should be developed in consultation with the specific industry as and when they are needed.

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\(^{279}\) Ev 172 [The Crown Estate]

\(^{280}\) Ev 195 [Environmental Industries Commission]

\(^{281}\) Ev 145, para 10 [Association of Electricity Producers]

\(^{282}\) Q 155 [Mr Wilde, Carbon Trust]
Today’s emerging technologies might then develop to a stage where they could be prioritised in the future for more significant levels of public investment.

212. The Sustainable Development Commission (SDC) reported in *A sustainable new deal* that to fund a green recovery package “Four broad options present themselves: deficit spending; raising money through environmental taxation or the auctioning of carbon permits; issuing green bonds; or increasing the public ownership of energy-related assets”.\(^{283}\) They argued, “the Government has a long-standing commitment to the principle of environmental taxation but has completely failed to capitalise on it so far”.\(^{284}\)

213. The Renewable Energy Association are also in favour of new sustainable financing approaches. They showed particular support in their evidence to us for:

- Establishing a Green Infrastructure Bank to catalyse private sector investment through the effective and efficient use of public finance to implement low carbon infrastructure investment.

- Raising new finance through ‘Green Bonds’ for both institutional and retail investors to fund low carbon infrastructure and energy efficiency programmes.\(^{285}\)

They went on to say that the fiscal system should be used to support the sustainable energy infrastructure through the following measures:

- Reinstating 100% capital allowances for leased renewable energy infrastructure and generation assets.

- Application of Enhanced Capital Allowances for all renewable energy equipment.

- Adjustments to the commercial rating calculation methodology to ensure that energy users are not penalised for installing renewable energy systems.\(^{286}\)

214. Green bonds have been promoted by a number of organisations as an excellent way of attracting investors to low carbon technologies and related infrastructure. The Minister told us “We like green bonds and we think the market should be delivering green bonds now. We do not think everybody has to wait for us to give them permission or for us to do it for them”.\(^{287}\) We commented that a framework for developing green bonds would be helpful in terms of encouraging the market to introduce such bonds. The Minister agreed this was an interesting idea and told us, “we have not at the moment got a proposal that we would give guidance to the market about the design of a green bond, but I will take it away and give some more thought to it”.\(^{288}\)

215. **We recommend that, as a matter of urgency, the Treasury and the Department of Energy and Climate Change work together to develop a set of environmental taxation**

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\(^{283}\) Sustainable Development Commission, *A sustainable new deal*, April 2009, p 34

\(^{284}\) Sustainable Development Commission, *A sustainable new deal*, April 2009, p 34

\(^{285}\) Ev 253 [Renewable Energy Association]

\(^{286}\) Ev 253 [Renewable Energy Association]

\(^{287}\) Q 530 [Mr David Kidney MP, Department of Energy and Climate Change]

\(^{288}\) Q 531 [Mr David Kidney MP, Department of Energy and Climate Change]
options and assess other green fiscal measures that could be used to drive forward investment in low carbon technologies. These should include auctioning carbon permits, issuing green bonds, increasing the public and community ownership of energy-related assets, or establishing a green infrastructure bank. In particular, we would like the Government to encourage the use of green bonds by establishing guidance to the market on the design and development of green bonds.

The role of public procurement

216. Through public procurement the Government can play a critical role in driving investment in and development of low carbon technologies, resulting in stimulus for industry and job creation. The Energy Savings Trust believed that:

If government is seen to be taking a lead on this issue, then it will inspire others to do so and add weight to their claims to be a leader on tackling climate change. Public buildings are also ideal in terms of providing anchor loads for large scale district heating and CHP systems. These can then be expanded to include building in the nearby areas.289

and the Energy Technologies Institute notes that:

The scale of public procurement is such that it should play a major role in building the demand for goods and services that are closely related to consumer needs. Buildings retrofit and energy management and low carbon vehicles present the greatest opportunities. Minimum standards are also a powerful way to improve the performance of consumer goods and services, whether they are double glazing units, lights or refrigerators.290

217. The British Electrotechnical and Allied Manufacturers Association also noted that public procurement also provides an opportunity to set more rigorous standards: “The benefits of this are to establish the credibility and performance of ‘new’ technologies, to drive a focus on lifetime costing approaches rather than just capital cost, and to ensure that the public sector is setting the right example”.291 The area of lifetime costing is fundamental to achieving zero carbon buildings. Willmott Dixon told us that although the Government’s recent procurement documents do not specifically mention whole life costing/life cycle costs “The Office of Government Commerce Centre for Expertise in Sustainable Procurement has recommended that whole life costing should be considered in projects by public sector clients.” 292

218. There is potentially an enormous role for public procurement in the move towards a green economy that will allow the Government to lead by example. This is especially the case for public buildings. In order to achieve zero carbon buildings, we believe that the Government’s procurement documents for building materials and technologies should specifically mention whole life costing/life cycle costs.

289  Ev 203, para 6.1 [Energy Savings Trust]
290  Ev 205 [Energy Technologies Institute]
291  Ev 151, para 34 [British Electrotechnical Allied Manufacturers Association]
292  Ev 288 [Willmott Dixon]
Research and innovation

219. The Government supports the development and deployment of low carbon technologies through a number of targeted funding policies at a European, National and Regional/Devolved level. This includes funding designed to support technologies at each stage of their development: underpinning scientific research is funded by the Research Councils; the Technology Strategy Board, the Carbon Trust and Energy Technologies Institute support the development and early deployment of emerging technologies; and finally, the Environmental Transformation Fund (ETF) and other funding programmes within it provide support for pre-commercial deployment. The Environmental Transformation Fund is not open to direct funding requests. Instead, funding programmes within the ETF publicise when funds are available.

220. Despite the various agencies and types of funding, there is still a perceived gap in funding—the so called ‘valley of death’—for technologies that have emerged from the research and development phase as proven concepts but have not yet reached a point where they can be commercialised. We have already discussed the failure of the Marine Renewables Deployment Fund and the improvements made by Government in developing a Marine Renewables Proving Fund (para 67). However, the valley-of-death remains a problem for low carbon technologies in other sectors.

221. E.ON are currently working with the Energy Technologies Institute on technologies at the pre-commercialisation stage:

E.ON is currently working on a pioneering project, within the ETI, for example, to develop a next-generation offshore wind turbine with Rolls Royce. The ETI will also be addressing technologies such as carbon capture and storage and electric vehicles. Traditionally, E.ON’s R&D department (E.ON Engineering) has also been involved as active members of bodies including the Engineering and Physical Sciences Research Council (EPSRC) and the Electric Power Research Institute (EPRI), which include a wide industry membership base. E.ON conducts collaborative research with industry partners through both public funded means (e.g. via the Technology Strategy Board) and private partnerships with original equipment manufacturers (OEMs) such as Alstom and Doosan Babcock, as well as other utilities.293

However, E.ON recognised that funding for university spin-outs and start-up companies as they go from small scale prototypes to commercial deployment is still a problem. They warned that often, the investment model involves a short-term view: “Typically this involves a rush to premature commercialisation, followed by technology failure, which damages industry confidence and sets back progress, allowing better supported competitors from overseas to become market leaders”.294

222. The Carbon Trust were also aware of this problem, they are trying to overcome it through their Business Incubators scheme:

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293 Ev 188, para 8 [E.ON]
294 Ev 188, para 9 [E.ON]
Our Business Incubators help them [early stage companies] to find the funding they need. We provide expert advice from business planning, HR strategy and market analysis to preparing for that vital pitch to investors. So far we have helped 82 companies to raise £84 million in private investment.  

In addition to this, the Carbon Trust’s Venture Capital fund has invested £12.5 million in its 12 portfolio companies, leveraging £110 million from the private sector.

223. Pushing technology through the demonstration phase remains a major barrier to commercial deployment. We welcome the introduction of the Marine Renewables Proving Fund, which has bridged the gap between research and development funding and funding for pre-commercial deployment in the marine sector. However, the stage between proven concept and full scale commercialisation remains a problem in other sectors. We recommend that DECC set up a science and innovation advisory group to bring together energy innovation stakeholders (including the Carbon Trust, Technology Strategy Board, Energy Technologies Institute and others), with a view to overcoming barriers to innovation. The advisory group’s first task should be to conduct a review of the effectiveness of the Environmental Transformation Fund and funding programmes within it. The advisory group should also consider whether it would be advantageous for DECC to set up a funding programme that is open to direct funding requests, rather than specific calls for projects.

**Job creation and skills**

**Green jobs**

224. Last year’s report by Innovas, *Low Carbon and Environmental Goods and Services: an industry analysis*, identified approximately 881,000 so-called ‘green jobs’ in the UK’s low carbon and environmental goods and services sector. This could potentially grow to over 1.27 million jobs by 2015.
Table 6. Potential growth in employment numbers in the LCEGS sector 2007/8-2014/15

<table>
<thead>
<tr>
<th>Sector</th>
<th>Employed 2007/8</th>
<th>Potential employed 2014/15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air pollution</td>
<td>8,900</td>
<td>10,700</td>
</tr>
<tr>
<td>Environmental consultancy</td>
<td>6,800</td>
<td>9,000</td>
</tr>
<tr>
<td>Environmental monitoring</td>
<td>1,400</td>
<td>1,900</td>
</tr>
<tr>
<td>Marine pollution control</td>
<td>900</td>
<td>1,200</td>
</tr>
<tr>
<td>Noise and vibration control</td>
<td>1,900</td>
<td>3,100</td>
</tr>
<tr>
<td>Contaminated land</td>
<td>7,900</td>
<td>10,000</td>
</tr>
<tr>
<td>Waste management</td>
<td>42,100</td>
<td>52,400</td>
</tr>
<tr>
<td>Water and waste water treatment</td>
<td>68,800</td>
<td>78,500</td>
</tr>
<tr>
<td>Recovery and recycling</td>
<td>53,700</td>
<td>68,800</td>
</tr>
<tr>
<td>Hydro</td>
<td>4,800</td>
<td>6,000</td>
</tr>
<tr>
<td>Wave and tidal</td>
<td>600</td>
<td>900</td>
</tr>
<tr>
<td>Biomass</td>
<td>45,800</td>
<td>68,700</td>
</tr>
<tr>
<td>Wind</td>
<td>87,500</td>
<td>156,800</td>
</tr>
<tr>
<td>Geothermal</td>
<td>75,800</td>
<td>115,100</td>
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<tr>
<td>Renewable consulting</td>
<td>4,400</td>
<td>5,500</td>
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<tr>
<td>Photovoltaic</td>
<td>38,000</td>
<td>63,300</td>
</tr>
<tr>
<td>Alternative fuels for vehicles</td>
<td>104,600</td>
<td>144,800</td>
</tr>
<tr>
<td>Alternative fuels</td>
<td>162,200</td>
<td>237,100</td>
</tr>
<tr>
<td>Additional energy sources</td>
<td>10,300</td>
<td>14,100</td>
</tr>
<tr>
<td>Carbon capture and storage</td>
<td>4,600</td>
<td>6,200</td>
</tr>
<tr>
<td>Carbon finance</td>
<td>21,800</td>
<td>35,400</td>
</tr>
<tr>
<td>Energy management</td>
<td>21,900</td>
<td>30,000</td>
</tr>
<tr>
<td>Building technologies</td>
<td>107,000</td>
<td>154,800</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>881,300</strong></td>
<td><strong>1,274,300</strong></td>
</tr>
</tbody>
</table>

Source: Innovas, Low Carbon and Environmental Goods and Services: an industry analysis, March 2009

As we move towards a green economy and expand our low carbon industries, there is likely to be a negative impact on jobs in the traditional fossil fuel based power industry. We heard from the California Chamber of Commerce that often a green job is not a new job, it replaces an old job; for example, a coal worker becomes a wind worker. There is a balance
to strike between job creation and job destruction and it is more accurate to talk in terms of
the net effect on employment.

226. As we move from old technologies to new low carbon technologies, old jobs will be
replaced by new green jobs. The Government should develop methodology for
reporting the number of net jobs created, taking into account jobs lost through
displacement of old industry.

227. We have already expressed our support for the Government’s prioritisation of
certain low carbon technology families. As a matter of principle, when deciding which
technology family to support, the Government should take into account not just the
possible contribution of those technologies to reducing carbon emissions, but also their
employment and economic potential. There is no reason why supporting low carbon
technologies cannot be combined with the UK’s economic self-interest.

The skills gap

228. A number of organisations—including the Regional Development Agencies, National
Grid, Global Marine Systems, Energy and Utility Skills, and the Sustainable Development
Commission—recognised the importance of a skilled workforce in delivering a low carbon
economy. However, Energy and Utility Skills (EU Skills) warned us about the potential
skills gap in delivering a low carbon economy:

If you look at the ageing workforce that already exists in the power industry and …
the needs that they are going to have increasingly over the next three sets of five year
periods…against the backdrop of a poor sector attractiveness [and] against the
backdrop of demographic change. That is going to have a significant impact on our
ability to deliver the low carbon economy opportunity. If we do not look at those in a
combined way we will not be able to deliver the skills that are needed for both
sectors.

229. Train to Gain is currently one of the Government’s flagship programmes to support
employer-focussed training. However, EU Skills told us that many of the skills needed for
the low carbon economy would be incremental, “adding new capabilities to individuals
with established skills.” One of the implications of this is that “people who develop those
incremental skills will not obtain full new qualifications and they are not eligible for Train
to Gain type support.” To date there has been a fragmented approach to skills training
for renewable energy and low carbon technologies. However, the Minister told us EU Skills
has successfully persuaded the Government that there should be a national skills academy
for power. Moving forward, this should drive a more coordinated approach.

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298 Ev 250 [Regional Development Agencies], Ev 240 [National Grid], Ev 217 [Global Marine Systems], Ev 200 [Energy and Utility Skills], and Ev 279 [Sustainable Development Commission]
299 Q 205 [Mr Corrigan, Energy and Utility Skills]
300 Ev 201, para 5 [Energy and Utility Skills]
301 Ev 201, para 5 [Energy and Utility Skills]
302 Q 541 [Mr David Kidney MP, Department of Energy and Climate Change]
230. In addition to up-skilling existing workers in the power industry, it is also important to prepare the next generation of workers with the appropriate skills for the green economy. The Minister told us “Every school in the country, every FE college and every university will be delivering this and equipping people with the skills for this low-carbon economy of the future”.303

231. The Train-to-Gain programme is of no use in providing the incremental skills training that is necessary to re-skill workers transferring from old industry jobs to new green jobs. We recommend that the Government reassess the efficacy of the Train-to-Gain programme, as it is currently not appropriate for the needs of the green economy.

Public engagement and behavioural change

232. A key driver in the deployment of low carbon technologies and the move towards a green economy is consumer choice. The British Electrotechnical and Allied Manufacturers Association (BEAMA) told us that the Government needs to work with industry to overcome the lack of consumer awareness about the energy saving products available in the marketplace and the often simple steps that need to be taken to deliver efficiency savings.304

233. The Government has made a concerted effort to engage the public on the issue of climate change through its Act on CO\textsubscript{2} campaign. As part of this campaign, the Department of Energy and Climate Change launched its 'bedtime-stories' advert last year. The advert aims to make adults think about the impact their carbon emissions are having on their children's future. The Advertising Standards Authority (ASA) received over 350 complaints about the advert, with most complainants questioning the scientific basis of the claim that climate change is man-made. The last few months has seen a series of events, including the hacking of emails from the Climate Research Unit at the University of East Anglia and inaccuracies in reports by the Intergovernmental Panel on Climate Change, which have damaged the credibility of climate science.305 This has resulted in increasing public scepticism about the basis for the Government’s carbon budgets. The Minister told us:

> People ask why are we making all this effort, and it is one thing to say that there is a scary future out there if we do not make this change because of very catastrophic climate change, but another much more positive message is that we can have a clean, green and prosperous future.306

234. The Energy Services and Technology Association told us “When the battle against anthropogenic climate change has been won, a much more all-encompassing one concerning sustainable consumption patterns will still need to be addressed.”307

303 Q 541 [Mr David Kidney MP, Department of Energy and Climate Change]
304 Ev 148, para 7 [British Electrotechnical Allied Manufacturers Association]
306 Q 536 [Mr David Kidney MP, Department of Energy and Climate Change]
307 Ev 214, para 10.4 [Energy Services and Technology Association]
Public cynicism about the evidence for human responsibility for climate change has the potential to destroy the Government’s chances of meeting its carbon budgets. However, the use of low carbon technologies and the move towards a green economy is not just good for the environment, it also makes good economic sense. Energy efficiency reduces consumer bills and low carbon industries have the potential to create new green jobs to help pull the country out of recession. Public attitudes can change, but only if the public sees a direct benefit. The Department of Energy and Climate Change should commission a study through the Economic and Social Research Council to investigate the best way to achieve long-term behavioural change in energy efficiency.

Long-term framework for change

The scale of the potential challenges we face with respect to energy supply and changing climate are enormous. The Minister acknowledged, “the country needs a step-change to get to where we need to be in 2020 and in 2050.” In the UK Low Carbon Transition Plan the Government committed to producing a Roadmap to 2050, which we hope will provide more detail about this long-term transition.

We look forward to seeing the Government’s ‘Roadmap to 2050’, which should take an overview of milestones between now and 2050 that will help the country meet its carbon budgets. The Government must develop technical roadmaps in collaboration with industry for all major low carbon technology initiatives, for example, the deployment of CCS or the development of marine energy. The move to a green economy will be a long-term transition. The Government must continue to seek cross-party support for low carbon initiatives to avoid letting party politics get in the way of achieving emissions targets.

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308 Q 546 [Mr David Kidney MP, Department of Energy and Climate Change]
7 Conclusions

238. The UK must rapidly move towards a greener economy if it is to meet its ambitious climate change targets for 2020 and 2050, and the associated interim carbon budgets. Emissions reduction will be achieved through a combination of measures, including: decarbonising the UK energy supply; domestic and industrial energy efficiency; and low carbon transport solutions. Low carbon technologies have a vital role to play in each of these. There is the potential for these technologies to reduce the carbon intensity of processes at every stage of the energy supply chain—from low carbon energy generation, through storage and transmission, to end user efficiency.

239. The development of low carbon technologies will require a significant degree of support from both the public and private sector; however, they have the potential to make a very significant contribution to economic growth and job creation in the UK. In 2007/8, there were 881,000 so-called ‘green jobs’ in the UK’s low carbon and environmental goods and services sector. This could potentially grow to over 1.27 million jobs by 2015. There is scope for the rapid creation of local green jobs in every community in the energy efficiency and building technologies sector. In the longer-term, the growth of low carbon industries such as offshore wind and marine energy could revitalise manufacturing in the UK, providing jobs for reskilled workers from the oil and gas sector.

240. Investment in low carbon technologies must not simply be seen as part of the short-term economic recovery, but also as a means of encouraging sustainable economic growth over the decades to come.
Conclusions and recommendations

The green economy

1. We welcome the Government’s green stimulus package put forward in the April 2009 budget and subsequent green initiatives announced in the December 2009 pre-budget report. Building on this, we recommend that the Government progressively increase the proportion of green initiatives in future fiscal packages to a level of 20%, as recommended by the Grantham Institute on Climate Change and the Environment and the Centre for Climate Change Economics and Policy. The Government should also enhance the proportion of public money spent on greening the economy. (Paragraph 15)

Clean fossil fuels

2. As we move towards low carbon energy generation, it is vitally important that we continue to maximise economic production of domestic oil and gas to bridge the gap in supply. However within the context of our increasing reliance on imported oil and gas and the continuing risk of disruption to their supply, it is essential that the Government accelerate the deployment of alternative low carbon energy generation technologies. (Paragraph 26)

3. We are disappointed by the lack of progress on CCS demonstration in comparison to international competitors. Furthermore, whilst we welcome the establishment of the Office of Carbon Capture and Storage, we are disappointed that the Office has yet to undertake any substantial work. It must be provided with the appropriate level of support to drive demonstration projects through urgently. We recommend that the model set by the Office for Nuclear Development (OND) is followed, and that one of its first priorities be the development of a roadmap for carbon capture and storage in the UK, similar to the OND’s Integrated Programme Plan and Consultation Maps. This will provide stakeholders with clearly defined timescales and milestones for the CCS demonstration projects. (Paragraph 32)

4. Whilst future coal supply to power stations in the UK will depend on the extent to which new abated coal fired plant replaces retiring power stations, all other things being equal we are concerned by the prospect of an increased dependence on imported coal due to the extra fuel required for future coal-fired power stations fitted with CCS technology, with the attendant security of supply risk that is entailed. The Government should reconsider whether it could do more to support the UK’s own coal industry. Energy security issues should be a prime consideration when the Government is developing policies in support of low carbon technologies. (Paragraph 34)

5. The UK could benefit from selling space for carbon storage under the North Sea, potentially to the value of £5 billion annually. The Government should consider investing in demonstration units for test injections and infrastructure development. (Paragraph 38)
6. Transportation and storage of CO2 is generally recognised as being safe. However, if the Government decides to support new-build CCS fitted or retrofitted power plants it is important to engage with the public, at an early stage, on any potential risks. It should develop a public communications strategy which would need to be central to its overall objectives on CCS. The Government should also take a more strategic overview of CO2 transport infrastructure, including assessing the need for oversized pipelines. (Paragraph 39)

**Nuclear energy**

7. The Government must do more to ensure that proper consultation and good public engagement is carried out on all aspects of nuclear (including siting of new build, decommissioning and waste management) if the public are to accept it as a viable low carbon energy source. We commented in more detail in our recent Report, *The proposals for national policy statements on energy*; the evidence we received during that inquiry made it abundantly clear that many consider consultation on the draft national policy statements to have been inadequate. (Paragraph 43)

8. We share the concerns put to us that investment in new nuclear could crowd out investment in renewables and believe that the Government must consider this carefully when developing policies for support of low carbon energy. Whilst it is right to support a diverse energy mix including all low carbon energy generation technologies, we do not think that the Government should directly fund the development of new nuclear technologies—this should be left to the energy generating companies. (Paragraph 45)

9. There is much debate on the lifecycle emissions of nuclear power compared to other low carbon technologies. The evidence we have received relates predominantly to the experiences of other countries. We believe that it would be beneficial for the Government to commission its own independent, systematic research on the lifecycle analyses of low carbon energy generation technologies in the UK. Data from such research would add value to the debate on the most appropriate UK energy mix. (Paragraph 47)

**Renewable energy: wind**

10. New renewable energy generation plants are described in terms of their capacity in gigawatts. It would be more meaningful if, alongside this—in reports, strategies, roadmaps, speeches—the Government would systematically define the estimated capacity value of new power plants expressed both as a percentage of installed capacity and in estimated terawatt hours of generation per annum. This would take into account the load factor of different energy generation technologies, and would enable easier analysis of the Government’s progress towards meeting its renewable energy targets. (Paragraph 52)

11. The Government has stimulated the market for wind power through the Renewables Obligation; however, onshore planning is still a huge problem. We commented on the planning process in greater detail in our recent Report, *The proposals for national policy statements on energy*. There is a need for better dialogue with the
general public to promote onshore wind and emphasise the importance of utilising the UK’s natural wind resources, thereby preventing reliance on unsustainable fossil fuels. Local government should find ways of encouraging community ownership schemes such as the Westmill Wind Farm Co-op. We believe that the Government should introduce legislation stipulating that a percentage of new wind farms should be offered for sale to local residents, as in Denmark, as a way of increasing public acceptance. (Paragraph 56)

12. In the future the supply chain for offshore wind could be constrained by a lack of offshore cables, transformers and installation vessels. This poses a risk to the UK’s ability to meet its renewables targets. There is huge potential for workers in the oil and gas sector to help overcome this by utilising their skills in emerging renewable industries such as offshore wind. The Government should bring key stakeholders together in these industries to develop a skills transfer strategy to identify specific opportunities and barriers that may be faced. This should complement other skills strategies that are being developed to encourage new entrants into renewable energy industries. (Paragraph 60)

13. We welcome the announcement in the pre-budget report that all offshore wind projects accredited between April 2010 and March 2014 will qualify for two Renewables Obligation Certificates. However, industry still calls for a longer term commitment from the Government to provide it with the certainty it needs to invest in offshore wind energy and other renewables. The Government needs to do more to provide certainty about the minimum level of support that industry can expect. (Paragraph 63)

Renewable energy: wave and tidal

14. We have taken evidence about the Severn Feasibility Study from the Minister of State for Energy and Climate Change, Lord Hunt of Kings Heath OBE. We look forward to receiving details of the findings of the feasibility study later this year. We recognise the potential offered by such a scheme whilst noting the significant economic and environmental barriers involved. We hope this is an area our successor committee will return to in the new Parliament. (Paragraph 66)

15. Given the substantial wave and tidal energy resources in UK waters, it is important that the UK remains a leader in developing and deploying marine technologies. It is extremely disappointing that five years have been lost whilst the Government and developers in the marine sector came to the slow realisation that support was needed at an earlier stage of development. However, we welcome the recently established Marine Renewables Proving Fund and are pleased that funds are being awarded for the development of commercial scale devices. The Government must undertake more careful assessment of the stage of development of emerging technologies in order to avoid wasting time in the future. (Paragraph 68)

16. We welcome the establishment of the Office for Renewable Energy Deployment. However, due to the varying stages of development of different renewable energy technologies (for example, wind verses wave), we are concerned that the marine energy sector and other emerging renewable sectors might be neglected in favour of
the well established wind sector. Given the prioritisation of marine technologies, the Government should consider whether there are any benefits in establishing a separate Office for Marine Energy Deployment to tailor specifically support towards this emerging sector. (Paragraph 70)

**Renewable energy: solar**

17. We understand that the costs of some solar technologies are still very high. However, the UK has an excellent history of solar technology research and development and if we are to develop cheaper technologies, it is important to send out a positive signal to developers and industry. We are pleased to hear that the Chief Scientific Advisor for the Department of Energy and Climate Change has been scrutinising the lead scenario for renewables, and we hope that work will identify those solar technologies which offer the most cost effective contribution to moving to a low carbon economy in the longer term. (Paragraph 75)

18. The introduction of a feed-in tariff will provide a much-needed boost to the domestic renewable electricity industry. The Government has taken on board industry feedback and increased the tariff rate for photovoltaic technologies. As details for the Renewable Heat Incentive scheme are developed, we hope that a similarly appropriate level of support will be introduced for solar thermal technologies through better dialogue with industry. (Paragraph 77)

**Renewable energy: biomass**

19. Biomass that is used to produce heat or electricity must be from a sustainable source. The Government must ensure that policies are in place to prevent biomass combustion which results in a relative deterioration of air quality, compared to the combustion of fossil fuels. (Paragraph 81)

20. We have heard that the process for procuring municipal waste for use in anaerobic digestion plants can take up to five years through negotiations with local authorities. The Government should review procurement regulations and definitions of waste to ensure that they do not create unnecessary barriers to renewable energy generation. If necessary, the Government should be prepared to raise this issue with European counterparts to ensure EU regulations are part of the solution and not the problem. (Paragraph 83)

21. Renewable gas, such as biomethane, could supply a significant proportion of gas in the UK with little disruptive infrastructure development. We recommend that the Government re-assess the contribution that biogas could make to its 2020 renewable energy targets and ensure that the development of biogas injection into the gas grid is an integral part of any future roadmap. (Paragraph 85)
Renewable energy: geothermal

22. We are concerned by the evidence we have heard from Tesco that ground source heat pumps are being installed and left not operating. The Government should work with the Environment Agency to ensure that the process for obtaining abstraction licenses and the guidelines for the operating criteria of ground source heat pumps are clarified. (Paragraph 88)

Renewable energy: hydroelectric

23. The Government must ensure that the Environment Agency continues to engage in active dialogue with hydroelectric developers in order to overcome unnecessary administrative barriers to the deployment of hydroelectric power. (Paragraph 92)

Energy storage

24. Energy storage encompasses many of the enabling technologies that will play an extremely important role in underpinning the move towards a green economy. The Government should consider a long-term programme of support for energy storage research, development, demonstration and deployment. (Paragraph 96)

Transmission and smart communications

25. We are pleased that the Government is producing a detailed smart grid route map in collaboration with Ofgem and industry representatives and look forward to receiving further information. The Government has rightly stated in its recent discussion paper, Smart Grids: the opportunity, that smart meter policy decisions and investment must take into account the goals of a smarter grid system, in particular regarding decisions on smart meter functionality and communications infrastructure. We would like to see a fully integrated smart meter and smart grid implementation plan produced by the Government that takes these issues into account. (Paragraph 101)

26. In light of the Government’s target of rolling out smart meters to every home by the end of 2020 and the wider GHG emissions reduction targets, there is no time to waste in assessing smart grid communications technologies. We recommend that the 872-876 MHz and 917-921 MHz frequency bands be reserved for smart grid and meter communications immediately. The result for UK consumers and energy providers can only be increased choice, greater innovation and lower prices. If, after utility companies have completed pilot projects using sub-GHz wireless mesh technology, they overwhelmingly choose other communications technologies, the radio frequency bands could be reallocated. The UK must not be at a disadvantage compared to countries that are quickly moving forward with smart grid communication technologies. (Paragraph 108)
Transport: road

27. The vehicle scrappage scheme has had a positive effect in reducing emissions by accident; any future stimulus for the automotive industry should be designed to stimulate a move towards low carbon vehicles, for example, by requiring that the new vehicles purchased have a CO2 threshold below 130 grams per kilometre. (Paragraph 112)

28. We welcome the Government’s Plug-in Grant programme, which provides support for consumers choosing electric vehicles from 2011 onwards. We recommend that the amount invested in subsidies between now and 2020 should be increased substantially, reflecting the ambitious target of 1.7 million electric vehicles set by the Committee on Climate Change. (Paragraph 115)

29. The long-term benefits of electric vehicles will only be achievable with a smart-grid that has been designed with electric vehicles in mind. The development and implementation of a smart grid and smart meters must be carried out in consultation with developers of electric vehicles. (Paragraph 117)

30. We are encouraged that the UK appears to be moving in the right direction and making the most of the opportunities to develop an export industry in low carbon vehicles. It is clear that the UK is particularly strong in the automotive supply chain, which should be supported and encouraged by the Government. Improvements to existing technology and the replacement of fossil derived liquid fuels with lower carbon alternatives present the fastest opportunity to reduce emissions. Electrification of road vehicles presents a more sustainable route to total decarbonisation but represents a less mature technology that requires significant support during the demonstration phase. Hydrogen and fuel cells represent a longer-term aspiration, although a significant number of major automotive manufacturers will be ready to offer vehicles within the next few years. We are concerned that the Government, whilst supporting battery electric vehicles, is not offering the same level of support to hydrogen fuel cell powered vehicles. (Paragraph 123)

31. In addition to investing in new low carbon vehicles, the Government should engage with the public on the issue of reducing CO2 emissions and reducing the cost of journeys by driving slower. In future campaigns, the Government should articulate the need for adhering to the national speed limit by reference to reducing emissions and cost to drivers as well as for reasons of road safety. (Paragraph 124)

Transport: rail

32. We welcome the announcement of a £1.1 billion programme for Network Rail to electrify the Great Western Mainline (London to Swansea) and the shorter line connecting Liverpool and Manchester. However, we hope to see a more strategic long-term approach to rail electrification from the Government. We would also like the Government to assure us that steps are being taken to ensure the effective transfer of technology from the automotive industry to the rail industry through the Intelligent Transport Systems Knowledge Transfer Network, or other appropriate knowledge transfer networks. (Paragraph 129)
33. The average carbon dioxide emissions per passenger kilometre for a passenger rail journey are about one-quarter of an equivalent journey by air. Domestic air travel is generally faster than the equivalent rail journey, encouraging more people onto a form of transport with a larger carbon footprint. The Government must do more to address this if it is serious about reducing UK carbon emissions. We recommend the Government introduce regulations designed to ensure the introduction of fairer transport pricing structures that reflect the climate impact of various modes. We also hope to see firm commitments and timetables for delivering more high-speed rail. (Paragraph 132)

Transport: shipping

34. We note that technologies such as wind, hydrogen fuel cells and electric propulsion are at prototype or early commercialisation stage on land. The Government should ensure that knowledge transfer networks working in the transport sector are active in transferring technologies from land-based transport sectors to the shipping sector. (Paragraph 137)

35. The shipping industry has shown a commitment towards reducing carbon dioxide emissions despite the fact that their emissions are not included in the UK carbon budgets, or governed by any international agreement. They have determined that an international cap-and-trade scheme is the best way of achieving emissions reduction. The Government must push for an international binding emissions reduction target for shipping with a clear timetable for delivering policies to meet it. (Paragraph 139)

Transport: aviation

36. We note the work of the UK aviation industry in developing new technologies and systems to reduce carbon dioxide emissions. The Government should acknowledge this and continue to support the industry through developing and maintaining the right legal and fiscal frameworks. Furthermore, the Government should facilitate the export of these technologies and systems to other countries. (Paragraph 145)

37. It is fundamentally important to have a globally agreed deal on aviation emissions as regional emissions schemes may lead to carbon leakage. The Government must push for a legally binding global deal based on global aviation emissions reduction targets. (Paragraph 148)

Industrial energy use

38. We welcome the progress made by the chemical industry in identifying its impact on greenhouse gas emissions and congratulate the food and drink industry on its reduction in carbon dioxide emissions. The Government should encourage the sharing of best practice between industries so that others may follow. (Paragraph 153)
39. We are concerned by the Mineral Product Association’s claims that EU financing of cement CCS is for plants at full scale rather than demonstration scale in the UK. The Government should assess whether financing for CCS demonstration in the cement and steel industries can be achieved at a more realistic scale. (Paragraph 157)

Industrial energy efficiency

40. Energy efficiency technologies for non-domestic buildings include smart metering, advanced heating controls, building automation and control systems, and lighting controls. Most of these technologies have already been developed and are ready for widespread deployment. We have heard that whilst energy efficiency is good for business profitability, a reduction in energy bills is often not enough of an incentive for companies to invest. Government should introduce more effective policies to encourage businesses to become energy efficient. Existing systems such as the Display Energy Certificates (DECs) provide an excellent means of measuring the energy efficiency of a building. DECs should be rolled out to all medium to large private sector buildings and the Government should investigate the feasibility of reducing business rates for businesses that improve their energy efficiency rating. (Paragraph 163)

Industrial combined heat and power

41. Combined heat and power can be an effective low carbon technology in particular sectors where there is easy access to sustainable fuel, for example, biomass or gas from anaerobic digestion in the food and drink industry. In these circumstances, the Government should actively encourage industry by providing an appropriate level of support. This should be kept under review and determined in consultation with industry. However, the use of CHP technology fuelled by unabated fossil fuels has no place in a green economy driven by the need to address emissions reduction targets. (Paragraph 167)

District heating

42. District heating provides efficiency savings through the large scale generation of energy and is best suited to densely populated urban areas or large buildings (such as hospitals and schools). We support the Government’s call for wider uptake of district heating in these areas. However, the Government must ensure that every effort is made to source low carbon fuel for district heating projects if it is serious about meeting emissions reduction targets. (Paragraph 169)

Domestic energy efficiency

43. Energy efficiency is described as low hanging fruit when discussing ways of reducing emissions. However, despite Government initiatives, consumers are often slow to take advantage of support for insulation and other energy efficiency measures. To date, Government initiatives on energy efficiency have not been nearly ambitious enough. However, we welcome the proposals within the strategy on household energy management, Warm Homes, Greener Homes. We hope the Government will
pay particular attention to introducing new regulations to tackle the energy efficiency of existing housing stock, such as requiring properties to achieve a minimum energy efficiency standard before sale or lease is permitted. We would also like the Government to investigate the feasibility of encouraging households to improve their energy efficiency rating, as defined in the Home Information Packs (HIPs), in exchange for lower council tax rates. (Paragraph 178)

44. It is important to tailor specific policies to specific technologies to overcome barriers unique to the deployment of those technologies. Light emitting diodes (LEDs) are a good example of one technology that will benefit from this approach over the next four years. We hope the Government will work closely with technology developers and industry to determine potential barriers to the widespread commercialisation of LEDs (and other new technologies) and address these ahead of their deployment. Where there are specific challenges that need to be addressed, such as solid wall insulation, the Government should fund research and development of technologies that will overcome these. (Paragraph 182)

45. We encourage the Government to take a more detailed look at the ‘whole-house’ approach to energy efficiency. We welcome its proposals to introduce a one stop shop energy helpline; however, the Government should consider a more ambitious ‘Green Concierge’ scheme, which would involve on-site consumer advice on energy efficient home improvements. Our forthcoming report on fuel poverty will also look at some of the options available for increasing energy efficiency. (Paragraph 185)

46. Most particularly, it is vital as a matter of urgency to introduce a national programme to retrofit existing housing stock. A major street by street, house by house scheme needs to be introduced. This could run alongside the current proposal to install smart meters. (Paragraph 186)

**Microgeneration**

47. Microgeneration technologies are often expensive to install. We welcome the Government’s Feed-in Tariff, which will commence in April 2010. We hope the Government will consult the relevant industries to the same extent in developing the right level of support for various technologies through the Renewable Heat Incentive. (Paragraph 191)

**Smart technologies**

48. The Government should work in closer partnership with the utility companies, the electrotechnical industry and other stakeholders to ensure that an open two-way dialogue is achieved between them and consumer groups about the potential benefits of smart meters and a smarter energy network. (Paragraph 195)
International action

49. Companies interested in low carbon technologies need a robust and high price of carbon to drive investment. The Government must push for a tighter cap in the third phase of the EU Emissions Trading Scheme in order to encourage investment in low carbon technologies. Failure to achieve this will inevitably lead to a growing demand for the Government to introduce, at a domestic level, a floor on the price of carbon. (Paragraph 202)

50. The move towards a low carbon economy is in the UK’s strategic and economic interest. The Government must push ahead with the deployment of low carbon technologies in the UK regardless of how other countries are choosing to deal with climate change. It is important for the Government to continue to lead by example whilst continuing to work towards securing a legally binding international agreement. (Paragraph 206)

Green investment

51. The Government must maintain and continue to improve the research and development tax credit scheme, in order to encourage private sector investment in low carbon technologies. However, given the scale of the challenge we face, especially after the failure of Copenhagen, the Government must expand its green fiscal policy toolbox. (Paragraph 208)

52. Public funding is limited and therefore it is right that the Government prioritises its investment in low carbon technologies towards specific technology families where the UK has real strengths or where there is an overwhelming need for public investment. However, the Government must be careful of the way it portrays this message. Prioritisation of funding should not result in other technology families being completely disregarded. The Government’s policy toolbox should provide flexible support for all low carbon technologies in addition to more specific policy mechanisms that address the technical barriers unique to individual technologies. These should be developed in consultation with the specific industry as and when they are needed. Today’s emerging technologies might then develop to a stage where they could be prioritised in the future for more significant levels of public investment. (Paragraph 211)

53. We recommend that, as a matter of urgency, the Treasury and the Department of Energy and Climate Change work together to develop a set of environmental taxation options and assess other green fiscal measures that could be used to drive forward investment in low carbon technologies. These should include auctioning carbon permits, issuing green bonds, increasing the public and community ownership of energy-related assets, or establishing a green infrastructure bank. In particular, we would like the Government to encourage the use of green bonds by establishing guidance to the market on the design and development of green bonds. (Paragraph 215)
54. There is potentially an enormous role for public procurement in the move towards a green economy that will allow the Government to lead by example. This is especially the case for public buildings. In order to achieve zero carbon buildings, we believe that the Government’s procurement documents for building materials and technologies should specifically mention whole life costing/life cycle costs. (Paragraph 218)

Research and innovation

55. Pushing technology through the demonstration phase remains a major barrier to commercial deployment. We welcome the introduction of the Marine Renewables Proving Fund, which has bridged the gap between research and development funding and funding for pre-commercial deployment in the marine sector. However, the stage between proven concept and full scale commercialisation remains a problem in other sectors. We recommend that DECC set up a science and innovation advisory group to bring together energy innovation stakeholders (including the Carbon Trust, Technology Strategy Board, Energy Technologies Institute and others), with a view to overcoming barriers to innovation. The advisory group’s first task should be to conduct a review of the effectiveness of the Environmental Transformation Fund and funding programmes within it. The advisory group should also consider whether it would be advantageous for DECC to set up a funding programme that is open to direct funding requests, rather than specific calls for projects. (Paragraph 223)

Jobs and skills

56. As we move from old technologies to new low carbon technologies, old jobs will be replaced by new green jobs. The Government should develop methodology for reporting the number of net jobs created, taking into account jobs lost through displacement of old industry. (Paragraph 226)

57. We have already expressed our support for the Government’s prioritisation of certain low carbon technology families. As a matter of principle, when deciding which technology family to support, the Government should take into account not just the possible contribution of those technologies to reducing carbon emissions, but also their employment and economic potential. There is no reason why supporting low carbon technologies cannot be combined with the UK’s economic self-interest. (Paragraph 227)

58. The Train-to-Gain programme is of no use in providing the incremental skills training that is necessary to re-skill workers transferring from old industry jobs to new green jobs. We recommend that the Government reassess the efficacy of the Train-to-Gain programme, as it is currently not appropriate for the needs of the green economy. (Paragraph 231)
Public engagement and behavioural change

59. Public cynicism about the evidence for human responsibility for climate change has the potential to destroy the Government’s chances of meeting its carbon budgets. However, the use of low carbon technologies and the move towards a green economy is not just good for the environment, it also makes good economic sense. Energy efficiency reduces consumer bills and low carbon industries have the potential to create new green jobs to help pull the country out of recession. Public attitudes can change, but only if the public sees a direct benefit. The Department of Energy and Climate Change should commission a study through the Economic and Social Research Council to investigate the best way to achieve long-term behavioural change in energy efficiency. (Paragraph 235)

Long-term framework for change

60. We look forward to seeing the Government’s ‘Roadmap to 2050’, which should take an overview of milestones between now and 2050 that will help the country meet its carbon budgets. The Government must develop technical roadmaps in collaboration with industry for all major low carbon technology initiatives, for example, the deployment of CCS or the development of marine energy. The move to a green economy will be a long-term transition. The Government must continue to seek cross-party support for low carbon initiatives to avoid letting party politics get in the way of achieving emissions targets. (Paragraph 237)
Abbreviations

AC—Alternating Current
AEP—Association of Electricity Producers
aM&T—automatic Monitoring and Targeting
ASA—Advertising Standards Authority
ASHP—Air Source Heat Pump
BEAMA—British Electrotechnical Allied Manufacturers Association
BWEA—British Wind Energy Association
CCC—Committee on Climate Change
CCS—Carbon Capture and Storage
CCSA—Carbon Capture and Storage Association
CERT—Carbon Emissions Reduction Target
CESP—Community Energy Savings Programme
CFL—Compact Fluorescent Lamp
CHP—Combined Heat and Power
CO₂—Carbon dioxide
CO₂eq—Carbon dioxide equivalent
CSP—Concentrated Solar Power
DC—Direct Current
DEC—Display Energy Certificate
DECC—Department of Energy and Climate Change
ECA—Enhanced Capital Allowance
EPRI—Electric Power Research Institute
EPSRC—Engineering and Physical Sciences Research Council
ESTA—Energy Services and Technology Association
ETF—Environmental Transformation Fund
ETI—Energy Technologies Institute
EU ETS—European Union Emissions Trading Scheme
EU Skills—Energy and Utility Skills
EV—Electric vehicle
FDF—Food and Drink Federation
FEGP—Fixed Electrical Ground Power
FIT—Feed-in Tariff
GDP—Gross Domestic Product
GHG—Greenhouse Gas
GHz—Gigahertz
GPS—Global Positioning System
GSHP—Ground Source Heat Pump
GtCO₂e—Gigatonnes of carbon dioxide equivalent
GW—Gigawatt
HIP—Home Information Pack
IMO—International Maritime Organization
IPC—Infrastructure Planning Commission
IPCC—Intergovernmental Panel on Climate Change
KTN—Knowledge Transfer Network
kWh—Kilowatt hour
LCBP—Low Carbon Building Programme
LCEGS—Low Carbon Environmental Goods and Services
LCT—Low Carbon Technology
LCVP—Low Carbon Vehicle Partnership
LED—Light Emitting Diode
LNG—Liquefied Natural Gas
LPG—Liquefied Petroleum Gas
MHz—Megahertz
MRDF—Marine Renewables Deployment Fund
MRPF—Marine Renewables Proving Fund
MTe—Megatonne equivalent
MW—Megawatt
MWe—Megawatt equivalent
MWh—Megawatt hour
NATS—National Air Traffic Services
NEF—New Economics Foundation
NFCRC—National Fuel Cell Research Center
NPS—National Policy Statements
OND—Office for Nuclear Development
ORED—Office for Renewable Energy Deployment
PAYS—Pay As You Save
PV—Photovoltaic
R&D—Research and Development
RF—Radio frequency
RHI—Renewable Heat Incentive
RO—Renewables Obligation
ROC—Renewables Obligation Certificate
SDC—Sustainable Development Commission
SEEDA—South East England Development Agency
SHC—Small Hydro Company
SRMC—Short run marginal costs
SSN—Silver Spring Networks
STEM—Science, Technology, Engineering and Mathematics
TWh—Terawatt hour
UNFCCC—United Nations Framework Convention on Climate Change
Formal Minutes

Wednesday 10 June 2009

Declarations of interest:

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Sir Robert Smith declared the following interest: Shareholdings in Shell; Vice-Chairmanship of the All-Party Parliamentary Group for the offshore oil and gas industry; and Honorary Vice President of Energy Action Scotland.

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Wednesday 1 July 2009

Declarations of interest:

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John Robertson declared the following interest: Chair of the All-Party Parliamentary Group on Nuclear Energy.

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Wednesday 4 November 2009

Declarations of interest:

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Sir Robert Smith declared the following interest: A visit to Total’s carbon capture and storage demonstration plant in Lacq, paid for by Total.

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Wednesday 17 March 2010

Members present:

| Mr David Anderson | Paddy Tipping |
| Colin Challen   | Dr Desmond Turner |
| Charles Hendry  | Mr Mike Weir     |
| Judy Mallaber   | Dr Alan Whitehead |
| Sir Robert Smith|                 |

In the absence of the Chair, Paddy Tipping was called to the Chair in accordance with the resolution of 20 May 2009.

Draft Report (*Low carbon technologies in a green economy*), proposed by the Chair, brought up and read.

*Ordered*, That the Chair’s draft Report be read a second time, paragraph by paragraph.

Paragraphs 1 to 240 read and agreed to.

Abbreviations and Summary agreed to.
Resolved, That the Report be the Fourth Report of the Committee to the House.

Ordered, That the Chair make the Report to the House.

Ordered, That embargoed copies of the Report be made available, in accordance with the provisions of Standing Order No. 134.

Written evidence was ordered to be reported to the House for printing with the Report, together with written evidence reported and ordered to be published on 10, 17 June, 8, 15 July, 14, 21 and 28 October in the last Session of Parliament, and 16 December.

[Adjourned till Wednesday 24 March at 9.00 am]

Witnesses

Wednesday 10 June 2009

Mr Andrew Simms, Policy Director and Head of Climate Change Programme, New Economics Foundation
Dr Douglas Parr, Chief Scientific Adviser and Policy Director, Greenpeace

Wednesday 1 July 2009

Mr Adrian Wilkes, Chief Executive, and Mr Danny Stevens, Policy Director, Environmental Industries Commission
Mr Gordon Edge, Director of Economics and Markets, British Wind Energy Association,
Mr Philip Wolfe, Non-Executive Director, and Mr Martin Wright, Chief Executive, Marine Current Turbines, Renewable Energy Association

Wednesday 8 July 2009

Mr James Wilde, Director of Insights, and Mr Mark Williamson, Director of Innovations, Carbon Trust, Mr Rob Lewis, Strategy Manager, and Ms Marian Spain, Director of Strategy, Energy Saving Trust
Dr David Clarke, Chief Executive Officer, Energy Technologies Institute

Wednesday 15 July 2009

Mr Frank Corrigan, Director of Strategy and Development, Energy and Utility Skills

Wednesday 21 October 2009

Professor Julia King, Easton University, Mr Greg Archer, Managing Director, Low Carbon Vehicle Partnership, and Dr Stuart Hillmansen, University of Birmingham
Mr Roger Wiltshire, Secretary-General, British Air Transport Association, Professor Ric Parker, Director of Research and Technology, Roll-Royce Plc, and Mr Ian Jopson, Head of Environmental and Community Affairs, NATS, Sustainable Aviation, and Mr Mark Brownrigg, Director General, and Mr Robert Ashdown, Head of Technical Affairs, Chamber of Shipping
Wednesday 4 November 2009

Dr Gerry Wolff, DESERTEC, Mr Derry Newman, Chief Executive, and Mr Jeremy Leggett, Chairman, Solarcentury, UK Photovoltaic Manufacturers Association, Mr David Matthews, Chief Executive Officer, and Mr Howard Johns, Chairman, Solar Trade Association

Dr Jeff Chapman, Chief Executive, Mr Philip Sharman, Director, Technology, External Affairs, Alstom, and Mr Ian Phillips, Director CO2 Infrastructure, CO2 Deepstore Limited, Carbon Capture and Storage Association, and Dr Jon Gibbins, Imperial College London

Wednesday 11 November 2009

Mr Maf Smith, Acting Chief Executive, and Mr Tim Jenkins, Senior Policy Analyst Economics, Sustainable Development Commission

Dr Howard Porter, Chief Executive Officer, and Mr Colin Timmins, British Electrotechnical and Allied Manufacturers Association, and Mr Alan Aldridge, Executive Director, Energy Services and Technology Association

Wednesday 16 December 2009

Mr David Kidney MP, Parliamentary Under-Secretary of State, Mr Phil Wynn Owen, Director General, National Climate Change and Consumer Support, Professor David MacKay, Chief Scientific Officer, Department of Energy and Climate Change
<table>
<thead>
<tr>
<th></th>
<th>Name</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Air Products PLC</td>
<td>Ev 141</td>
</tr>
<tr>
<td>2</td>
<td>Association of Electricity Producers (AEP)</td>
<td>Ev 143</td>
</tr>
<tr>
<td>3</td>
<td>Baxi Group UK</td>
<td>Ev 145</td>
</tr>
<tr>
<td>4</td>
<td>British Electrotechnical and Allied Manufacturers Association (BEAMA)</td>
<td>Ev 148</td>
</tr>
<tr>
<td>5</td>
<td>British Waterways</td>
<td>Ev 151</td>
</tr>
<tr>
<td>6</td>
<td>British Wind Energy Association (BWEA)</td>
<td>Ev 152</td>
</tr>
<tr>
<td>7</td>
<td>Calor Gas Ltd</td>
<td>Ev 155</td>
</tr>
<tr>
<td>8</td>
<td>Carbon Capture and Storage Association</td>
<td>Ev 159</td>
</tr>
<tr>
<td>9</td>
<td>Carbon Capture and Storage Association (supplementary)</td>
<td>Ev 161</td>
</tr>
<tr>
<td>10</td>
<td>Carbon Trust</td>
<td>Ev 162</td>
</tr>
<tr>
<td>11</td>
<td>Centrica Plc</td>
<td>Ev 168</td>
</tr>
<tr>
<td>12</td>
<td>Crown Estate</td>
<td>Ev 172</td>
</tr>
<tr>
<td>13</td>
<td>Department of Energy and Climate Change (DECC)</td>
<td>Ev 174</td>
</tr>
<tr>
<td>14</td>
<td>Department of Energy and Climate Change (DECC) (supplementary)</td>
<td>Ev 180</td>
</tr>
<tr>
<td>15</td>
<td>Desertec</td>
<td>Ev 184</td>
</tr>
<tr>
<td>16</td>
<td>Desertec (supplementary)</td>
<td>Ev 185</td>
</tr>
<tr>
<td>17</td>
<td>E.ON UK</td>
<td>Ev 187</td>
</tr>
<tr>
<td>18</td>
<td>EDF Energy</td>
<td>Ev 191</td>
</tr>
<tr>
<td>19</td>
<td>Environmental Industries Commission (EIC)</td>
<td>Ev 195</td>
</tr>
<tr>
<td>20</td>
<td>Energy and Utility Skills</td>
<td>Ev 200</td>
</tr>
<tr>
<td>21</td>
<td>Energy Saving Trust</td>
<td>Ev 202</td>
</tr>
<tr>
<td>22</td>
<td>Energy Technologies Institute</td>
<td>Ev 205</td>
</tr>
<tr>
<td>23</td>
<td>Environment Agency</td>
<td>Ev 207</td>
</tr>
<tr>
<td>24</td>
<td>Energy Services and Technology Association (ESTA)</td>
<td>Ev 211</td>
</tr>
<tr>
<td>25</td>
<td>Food and Drink Federation</td>
<td>Ev 214</td>
</tr>
<tr>
<td>26</td>
<td>Global Marine Systems</td>
<td>Ev 217</td>
</tr>
<tr>
<td>27</td>
<td>Green2Go</td>
<td>Ev 219</td>
</tr>
<tr>
<td>28</td>
<td>Greenpeace</td>
<td>Ev 221</td>
</tr>
<tr>
<td>29</td>
<td>Dr Stuart Hillmansen</td>
<td>Ev 223</td>
</tr>
<tr>
<td>30</td>
<td>Intergen</td>
<td>Ev 225</td>
</tr>
<tr>
<td>31</td>
<td>Micropower Council</td>
<td>Ev 227</td>
</tr>
<tr>
<td>32</td>
<td>Mineral Products Association</td>
<td>Ev 229</td>
</tr>
<tr>
<td>33</td>
<td>National Energy Action (NEA)</td>
<td>Ev 232</td>
</tr>
<tr>
<td>34</td>
<td>National Grid</td>
<td>Ev 240</td>
</tr>
<tr>
<td>35</td>
<td>National Physical Laboratory</td>
<td>Ev 245</td>
</tr>
<tr>
<td>36</td>
<td>Network Rail</td>
<td>Ev 247</td>
</tr>
<tr>
<td>37</td>
<td>Regional Development Agency</td>
<td>Ev 250</td>
</tr>
<tr>
<td>38</td>
<td>Renewable Energy Association</td>
<td>Ev 253</td>
</tr>
<tr>
<td>39</td>
<td>South East England Regional Development Agency (SEEDA)</td>
<td>Ev 258</td>
</tr>
<tr>
<td>40</td>
<td>Sheffield City Region</td>
<td>Ev 260</td>
</tr>
<tr>
<td>41</td>
<td>Small Hydro Company</td>
<td>Ev 262</td>
</tr>
<tr>
<td>42</td>
<td>Solarcentury – UK Photovoltaic Manufacturers Association</td>
<td>Ev 268</td>
</tr>
<tr>
<td>No.</td>
<td>Organisation</td>
<td>Page</td>
</tr>
<tr>
<td>-----</td>
<td>-------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>43</td>
<td>Solarcentury – UK Photovoltaic Manufacturers Association (supplementary)</td>
<td>Ev 272</td>
</tr>
<tr>
<td>44</td>
<td>Sustainable Aviation</td>
<td>Ev 274</td>
</tr>
<tr>
<td>45</td>
<td>Sustainable Development Commission</td>
<td>Ev 279</td>
</tr>
<tr>
<td>46</td>
<td>Tesco</td>
<td>Ev 281</td>
</tr>
<tr>
<td>47</td>
<td>Water UK</td>
<td>Ev 285</td>
</tr>
<tr>
<td>48</td>
<td>Willmott Dixon</td>
<td>Ev 288</td>
</tr>
<tr>
<td>49</td>
<td>Wormser Energy Solutions</td>
<td>Ev 289</td>
</tr>
<tr>
<td>50</td>
<td>Mr James Page</td>
<td>Ev 292</td>
</tr>
<tr>
<td>51</td>
<td>New Economics Foundation</td>
<td>Ev 293</td>
</tr>
<tr>
<td>52</td>
<td>Ceres Power</td>
<td>Ev 295</td>
</tr>
<tr>
<td>53</td>
<td>Calor Gas (additional)</td>
<td>Ev 297</td>
</tr>
</tbody>
</table>
List of Reports from the Committee during the current Parliament

The reference number of the Government’s response to each Report is printed in brackets after the HC printing number.

Session 2009–10
First Report Work of the Committee in Session 2008-09 HC 133
Second Report The future of Britain’s electricity networks HC 194
Third Report The proposals for national policy statements on energy HC 231
Fourth Report Low carbon technologies in a green economy HC 193

Session 2008–9
First Report UK offshore oil and gas HC 341 (HC 1010)