House of Commons

Energy and Climate Change Committee

Low carbon technologies in a green economy

Fourth Report of Session 2009–10

Volume I

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The Energy and Climate Change Committee

The Energy and Climate Change Committee is appointed by the House of Commons to examine the expenditure, administration, and policy of the Department of Energy and Climate Change and associated public bodies.

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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, CO_2 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."[1] 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]

2 HM Government, *The UK Renewable Energy Strategy*, July 2009, p 8

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.

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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

7 Energy and Climate Change Committee, Second Report of Session 2009-10, *The future of Britain's electricity networks*, HC 194-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]

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]

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

11. 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 1. International green stimulus packages

Country	Total stimulus fund USDbn$	Total stimulus fund as a % of GDP	Fund period Years	Green stimulus fund USDbn$	Green fund as a % of total stimulus fund	Green stimulus fund as a % of GDP
South Korea	76.1	3.6%	2009-2012	59.9	79%	2.8%
Australia	17.1	2.9%	2009-2013	6.8	40%	1.2%
China	586.1	3.1%	2009-2010	200.8	34%	1.1%
France	33.7	0.7%	2009-2010	6.1	18%	0.13%
Japan	154	2.4%	2009 onwards	23.6	15%	0.36%
United Kingdom	34.9	1.6%	2009-2011	5.2	15%	0.24%
Germany	104.8	1.6%	2009-2010	13.8	13%	0.21%
United States	787	2.0%	10 years	94.1	12%	0.24%

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

12. 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 CO_2 emitted by households, which amounts to energy supplier investment of around £3 billion for the three years, 2008–2011.

13. 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

16. In July 2009, the Government published four reports outlining its low carbon policies and priorities: *The UK Low Carbon Transition Plan, The UK Renewable Energy Strategy, The UK Low Carbon Industrial Strategy* and *Low Carbon Transport: A Greener Future*. These describe the Government's strategy for meeting its legally-binding target of a 34% cut in emissions on 1990 levels by 2020, and 15% of the UK's energy from renewable sources by 2020. They also set out some of the first investments from the £405 million for low carbon industries and transport announced at Budget 2009.

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15 Q 148 [Mr Lewis, Energy Savings Trust]

16 Ev 279 [Sustainable Development Commission]

17 Ev 279 [Sustainable Development Commission]

18 Nicholas Stern et al., *An outline of the case for a 'green' stimulus*, February 2009, p 13

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[19]

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.[20]

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."[21] 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."[22]

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."[23] For example, there are many different device types that can be used in the marine energy

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19 Ev 175, para 4 [Department of Energy and Climate Change]

20 The Carbon Trust, *Focus for success*, July 2009

21 Q 155 [Mr Wilde, The Carbon Trust]

22 Q 155 [Mr Wilde, The Carbon Trust]

23 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 2. UK market value of LCEGS sector with percentage of total

	Sector	£ billion	% total
Environmental	Air pollution	0.95	0.89
	Environmental consultancy	0.74	0.70
	Environmental monitoring	0.15	0.14
	Marine pollution control	0.12	0.11
	Noise and vibration control	0.20	0.19
	Contaminated land	0.91	0.85
	Waste management	4.80	4.49
	Water and waste water treatment	7.93	7.43
	Recovery and recycling	6.48	6.07
Renewable energy	Hydro	0.50	0.47
	Wave and tidal	0.07	0.07
	Biomass	4.95	4.64
	Wind	11.46	10.74
	Geothermal	9.22	8.63
	Renewable consulting	0.48	0.45
	Photovoltaic	4.43	4.15
Emerging low carbon	Alternative fuels for vehicles	12.61	11.82
	Alternative fuels	18.45	17.28
	Additional energy sources	1.19	1.12
	Carbon capture and storage	0.46	0.43
	Carbon finance	5.19	4.86
	Energy management	2.54	2.38
	Building technologies	12.90	12.09
	TOTAL	**106.72**	**100.00**

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

3 Energy generation

22. In 2008, the primary supply of fuels in the UK was 234.2 million tonnes of oil equivalent.[25] Indigenous supply was 176.9 million tonnes of oil equivalent;[26] over 80% of this comes from petroleum and natural gas (Table 3).[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.[28]

Table 3. 2008 indigenous production of primary fuels

	Million tonnes of oil equivalent
Petroleum	78.6
Natural gas	69.7
Coal	11.4
Primary electricity (including nuclear, wind and natural flow hydro)[29]	13.0
Renewables and waste	4.2
TOTAL	176.9

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

23. The power and heavy industry sector accounts for 35% of UK emissions.[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.[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 22nd April 2009 announced measures to

25 Department of Energy and Climate Change, *Digest of United Kingdom Energy Statistics*, July 2009, p 12

26 Department of Energy and Climate Change, *Digest of United Kingdom Energy Statistics*, July 2009, p 27

27 Department of Energy and Climate Change, *UK Energy in Brief 2009*, p 12

28 Department of Energy and Climate Change, *Digest of United Kingdom Energy Statistics*, July 2009, p 12

29 As defined in Department of Energy and Climate Change, *Energy Trends*, December 2009, p 54

30 HM Government, *The UK Low Carbon Transition Plan*, July 2009, p 9

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 (CO_2) 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 CO_2 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 CO_2 stored offshore, capturing CO_2 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

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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 *CO_2 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,

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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 CO_2eq /kWh, whilst an economy based on nuclear and renewable energy, would give lifecycle emissions of only 10 g CO_2eq /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.**

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42 Lord Hunt of Kings Heath, *Speech to Coal UK Conference*, 22 February 2010, www.decc.gov.uk

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 CO_2 could be good business for the UK. Professor Stuart Haszeldine from the University of Edinburgh has said that a continental pipeline exporting CO_2 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 CO_2 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 CO_2 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 CO_2. 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 CO_2 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 CO_2 storage location, this may be prohibitively expensive. This cost could be shared by clusters of CO_2 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 CO_2 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 CO_2 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.[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.[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.[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, *The proposals for national policy statements on energy*.[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, *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;[57] EDF Energy;[58] and Centrica.[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."[60] The SDC explained that in order to prevent this from happening the Government should focus its funding on the

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53 Data from the Nuclear Industry Association

54 HM Government, *Meeting the energy challenge: A white paper on nuclear power,* January 2008, p 37

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

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

57 Ev 191, para 24 [E.ON]

58 Ev 193, para 10 [EDF Energy]

59 Ev 169, para 5 [Centrica PLC]

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.[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.[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.[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.[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".[65] The work by David Fleming draws on research carried out by, amongst others, Dr Manfred Lenzen at the University of Sydney, Australia.[66] The Department of Energy and Climate Change also provided us with lifecycle analyses of nuclear energy and other energy generation technologies.[67] This also cited research by Dr Lenzen and others. While there is some

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61 Q 416 [Mr Smith, Sustainable Development Commission]

62 Ev 193, para 9 [EDF Energy]

63 Q 475 [Mr David Kidney MP, Department of Energy and Climate Change]

64 Q 477 [Mr David Kidney MP, Department of Energy and Climate Change]

65 Q 34 [Mr Simms, New Economics Foundation]

66 Lenzen, M. (2008) *Life cycle energy and greenhouse gas emissions of nuclear energy: A review*. Energy Conversion and Management 49, 2178-2199

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).

Table 4. Total lifetime greenhouse gas emissions for different electricity generation technologies. Units are g CO_2eq /kWh electricity generated

Source	Coal	Gas	Nuclear	Wind	PV
Postnote	~1000	500	5	4.6 (onshore) 5.3 (offshore)	58 (UK) 35 (Southern Europe)
Lenzen and co-workers	941 863 (supercritical)	577	58 (baseline: coal economy) 33 (gas economy) 10 (nuclear & renewables economy)	21 (onshore)	106 (Australia)
Paul Scherrer Institut	1180	680	13	15	51 (USA)
World Energy Council (2004)	847 (USA) CCS, 90% capture: 247 (USA) 130 (Australia)	411 (UK)	3–40	7–15	13–104
CONCAWE		440 (North Sea Gas) 660 (imported LNG)			

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.[68] 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.

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."[72] The target of 15% renewable energy would require an increase from 39 TWh (terawatt hours) in 2008 to 239 TWh in 2020.[73] 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."[74] 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.[75] BWEA agree with this assessment, and believe the Renewables Obligation will also catalyse growth in the offshore wind industry.[76]

54. BWEA and E.ON both told us that the planning process for onshore wind farms remains a huge barrier to development.[77] The Planning Act 2008 enabled the introduction of the Infrastructure Planning Commission (IPC) to approve planning applications for nationally significant infrastructure.[78] 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.

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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

73 HM Government, *The UK Renewable Energy Strategy*, July 2009, p 37

74 Ev 153, para 13 [British Wind Energy Association]

75 HM Government, *The UK Renewable Energy Strategy,* July 2009, p 42

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.[79] 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.[80] 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.[81] Offshore wind could provide enough energy to power nearly all the homes in the UK.[82] 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."[83] 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

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79 HM Government, *The UK Renewable Energy Strategy,* July 2009, p 163

80 Ev 172 [The Crown Estate], Ev 162 [Carbon Trust], Ev 217 [Global Marine Systems] and Ev 152 [British Wind Energy Association]

81 HM Government, *The UK Renewable Energy Strategy*, July 2009, p 101

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]

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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."[91] 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.[92] 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.[93]

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*.[94] 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]

94 Energy and Climate Change Committee, Second Report of Session 2009-10, *The future of Britain's electricity networks*, HC 194-I

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.[99] 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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95 Energy and Climate Change Committee, Second Report of Session 2009-10, *The future of Britain's electricity networks*, HC 194-I, p 42

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]

99 Oral evidence taken before the Energy and Climate Change Committee on 14 October 2009, HC (2008-2009) 1011-i

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.[103] 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."[104]

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."[105] 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.[106] 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

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103 Carbon Trust press notice, *Marine energy ready for mass deployment by 2020*, 2 February 2010, www.carbontrust.co.uk

104 Q 456 [Mr David Kidney MP, Department of Energy and Climate Change]

105 Department of Energy and Climate Change, www.decc.gov.uk

106 Innovas, *Low Carbon and Environmental Goods and Services: an industry analysis*, March 2009, p 40

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.**

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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]

76. On 1 February 2010, the Government announced the final details of the new feed-in tariff scheme.[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.[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".[116]

77. **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.**

78. 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.[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.

79. We have recently commented on the super-grid in our report *the future of Britain's electricity networks*.[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

114 DECC press release, *Cash Rewards for Low Carbon Electricity and Heating*, 1 February 2010

115 Q 345 [Mr Newman, Solarcentury]

116 Q 329 [Mr Johns, Solar Trade Association]

117 Ev 185 [Desertec]

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.[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.[120]

81. A report published by the Environment Agency, *Biomass – carbon sink or carbon sinner?*,[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.[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.[123]

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119 Energy and Climate Change Committee, Second Report of Session 2009-10, *The future of Britain's electricity networks*, HC 194-I, para 132

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

121 Environment Agency, *Biomass – carbon sink or carbon sinner?*, April 2009

122 Ev 162 [Carbon Trust]

123 Ev 284, para 26 [Tesco]