



National Audit Office

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**Briefing for the  
House of Commons  
Energy and Climate Change  
Select Committee**

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# Public funding for innovation in low carbon technologies in the UK

OCTOBER 2013

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Our vision is to help the nation spend wisely.

Our public audit perspective helps Parliament hold government to account and improve public services.

The National Audit Office scrutinises public spending for Parliament and is independent of government. The Comptroller and Auditor General (C&AG), Amyas Morse, is an Officer of the House of Commons and leads the NAO, which employs some 860 staff. The C&AG certifies the accounts of all government departments and many other public sector bodies. He has statutory authority to examine and report to Parliament on whether departments and the bodies they fund have used their resources efficiently, effectively, and with economy. Our studies evaluate the value for money of public spending, nationally and locally. Our recommendations and reports on good practice help government improve public services, and our work led to audited savings of almost £1.2 billion in 2012.

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

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## Summary

**1** The Coalition Government is committed to supporting innovation in low carbon technology to help meet its objectives to ensure that the UK has secure, clean and affordable energy supplies and meets legally binding targets:

- From the **EU Renewable Energy Directive 2009**<sup>1</sup>: to increase the proportion of all the UK's energy needs which are supplied from renewable sources from 1.3 per cent in 2005 to 15 per cent by 2020; and
- From the **Climate Change Act 2008**: to reduce greenhouse gas emissions by at least 80 per cent by 2050, relative to 1990 levels.

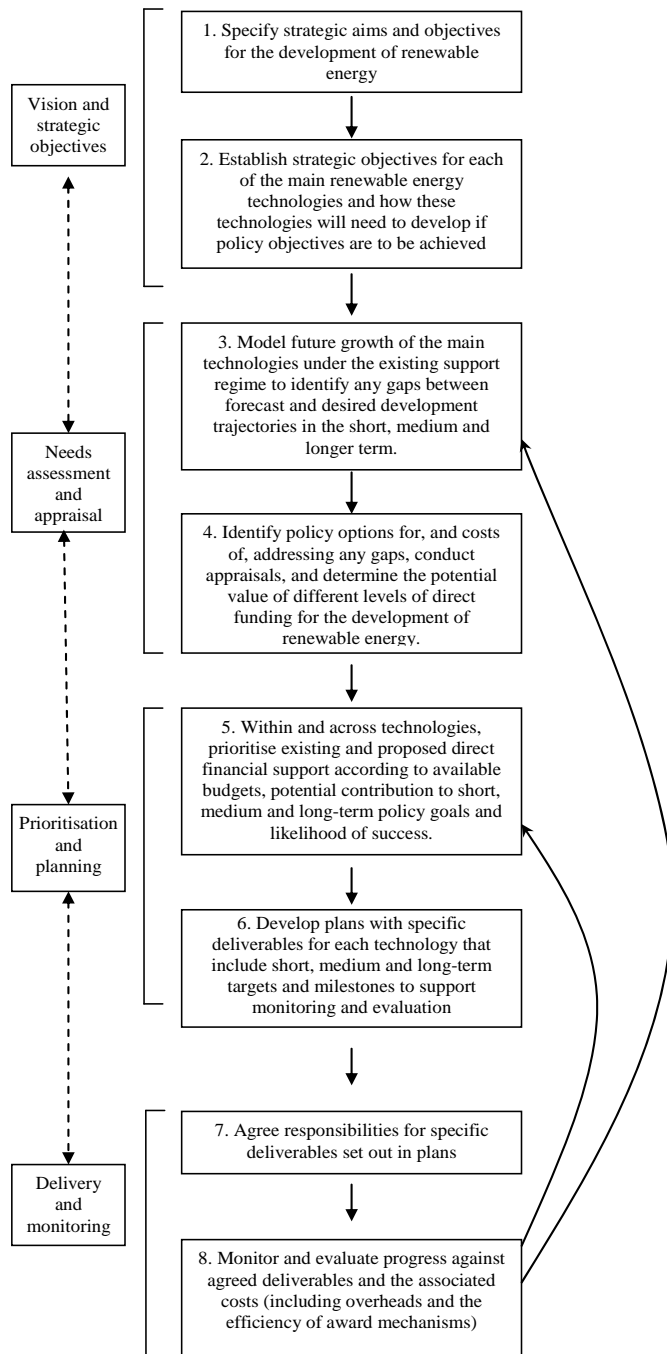
**2** In June 2010 the National Audit Office reported that the Department of Energy and Climate Change (the Department) had inherited a legacy of poor coordination of a wide range of direct public support for development of renewable energy technologies from across government departments and other public funding agencies.<sup>2</sup> The Government had no coherent delivery framework, nor a consistent approach to evaluation and reporting on the results from public funding. Without this it was not possible to demonstrate whether the Government was achieving value for money from public funding. In our report, we set out eight steps needed to achieve a disciplined approach to planning and managing direct support for the development of renewable energy technology (**Figure 1**).

<sup>1</sup> Directive 2009/28/EC of the European Parliament and of the Council, On the promotion of the use of energy from renewable sources, 23 April 2009.

<sup>2</sup> National Audit Office, Government Funding for developing renewable energy technologies, HC 35 Session 2010-11, 10 June 2010.

**Figure 1**

The steps required to achieve a disciplined approach to planning and managing direct support for renewable energy technologies



3 In response to a request from the Energy and Climate Change Committee this briefing reviews the Government's progress in addressing the issues raised in our earlier report. In particular, it examines the landscape for public funding support for innovation in technology that will reduce carbon emissions associated with the generation or use of energy, generally known as "low carbon technology". It addresses the public funders' coordination of their work; and how the Department manages, delivers and monitors the projects it funds.

- Part One sets out the Government's commitment to supporting innovation, the challenges involved and how the UK's funding in this area compares with that of other countries;
- Part Two describes the UK funding landscape provided by the Department and other organisations such as the Technology Strategy Board, the Energy Technologies Institute and the devolved administrations, and examines how effectively the Department co-ordinates the work of the organisations involved; and
- Part Three examines the Department's management of its programme of funding for low carbon innovation.

4 Our methodology, which is described in more detail in Annex A, included:

- analysing Departmental and third party data on low carbon innovation spending;
- interviewing Departmental officials, funding bodies, academics, and representative groups for the energy industry;
- an online consultation to gather views from industry on the funding process; and
- reviewing the Department's management of its low carbon funding portfolio.

### Key findings

5 **Innovation is key to achieving the Government's plans for meeting its renewable energy and carbon reduction targets. The Department has led a programme of work in conjunction with the other bodies that provide public funding to support low carbon innovation to address the weaknesses identified in our 2010 report.** The Low Carbon Innovation Co-ordination Group relaunched itself with a broader remit and an expanded core membership to include all funding bodies and with associate membership for other stakeholders. The Group has produced ten of its intended 11 Technology Innovation Needs Assessments which provide analysis to determine the case for public support for innovation and it intends to publish a collective strategy for public support for low carbon innovation early in 2014.

**6 UK public funding for innovation in low carbon technologies has fallen.** The International Energy Agency have urged governments to prioritise support for energy innovation. Total spending by Low Carbon Innovation Coordination Group members on innovation<sup>3</sup> was £351 million in 2011-12, a reduction compared to the higher level of spending in 2010-11 (£522 million). Group members have made only limited commitments as to the scale of their support for innovation beyond 2015 and some companies responding to our consultation considered this short-term approach to funding reduced their ability to plan their organisation's long term investment strategy.

**7 The Department's initial and subsequent decisions on funding priorities have been supported by robust business cases, drawing on emerging outputs from the Low Carbon Innovation Coordination Group's shared evidence base.** A successful innovation programme depends on getting the balance right not only between investment in different technologies, but also between different stages of the innovation process. Public sector funds need to be targeted at areas where the market is unlikely to deliver without support, where the UK is better placed than other countries to develop a technology, where it is unlikely that the UK could rely exclusively on other countries to develop the technologies within the required timescales, or where it will gain most benefit from a particular technology. The Department developed business cases to support the allocation of its funding to particular technology areas. It has used the Group's Technology Innovation Needs Assessments as its evidence base for flexing its allocations between technologies, for example to include support for Next Generation Carbon Capture technologies.

**8 The Low Carbon Innovation Coordination Group's Technology Innovation Needs Assessments provide a common and agreed evidence base to support the Group's forthcoming strategy. The approach to developing the Assessments was commended in 2011 by the Government Office for Science as an example of good practice in prioritising the Department's scientific and technical requirements.**<sup>4</sup> The common approach to assessing needs has identified a wide range in the potential savings to the UK from improved technologies, contributions to the UK economy, and potential for generation capacity across the technology areas. The Assessments have enabled the Group to agree priorities within a technology area. However it remains difficult to compare the return from investment across the technology areas because of the wide ranges of scenarios considered, and the assessments do not address wider barriers and opportunities such as the planning system or supply chain. The Group intends to refresh the Assessments but has not yet determined how and when it will do this.

<sup>3</sup> Spending by core Group members with a UK-wide remit. This comprises the Research Councils UK, Technology Strategy Board, the Department of Energy and Climate Change, Energy Technologies Institute, the Department for Business Innovation and Skills and indirect spend by the Department through the Carbon Trust.

<sup>4</sup> Government Office for Science, Science and Engineering Assurance Review of the Department of Energy and Climate Change, August 2012.

**9 It is not yet clear whether the Low Carbon Innovation Coordination Group's efforts to provide greater transparency and improve communication from across the funding bodies are providing better support for industry.** Each public funder has its own mission and approach. The Group has developed its website and a tracker to enable industry to understand the bodies' roles and help businesses navigate the funding landscape. The Department sees engagement with industry as critical to the success of its programme and recognises that it has more to do to raise industry awareness of its own activities and those of other funding bodies.

**10 The Department has built flexibility into its own portfolio to enable it to move funds between technologies to meet changing or emerging priorities.** For the period 2011-15, the Department allocated a total budget of £181 million for low carbon innovation and set budgets for the range of individual supported technologies totalling £185 million, allowing for some of the schemes not to make progress as intended. In response to the International Energy Agency's call for greater European collaboration, the Department is increasing its engagement in European Union activities, for example by leading an initiative under the Strategic Energy Technologies plan to identify and launch joint actions involving multiple member states

**11 The Department manages its own innovation portfolio effectively and has reduced its reliance on external specialists to support the management of the programme, but there is a risk that it will underspend its capital allocation for the period 2011 to 2015.** The Department has rigorous criteria for its invitations to bid for funding and for assessing the quality of bids. It has business cases and delivery plans for each of its schemes that set out clearly the responsibilities and processes to be used for monitoring and evaluation. We found consistent monitoring of progress against milestones and, where necessary, use of external experts to verify progress by funding recipients. The Department's Innovation Programme Board systematically assesses risk for each contract. The Department is committed to evaluating its schemes but has not always been clear about what resources will be needed to carry out its evaluations. The Department's spending in 2011-12 and 2012-13 was substantially less than budgeted due to delays in agreeing and launching its projects, but the Department is confident that it will be able to avoid a large underspend by accelerating expenditure for the final two years of the Spending Review period.

**12 The Low Carbon Innovation Coordination Group is piloting and evaluating a set of output and outcome metrics to enable it to evaluate performance on a common basis.** The Group has developed seven common metrics on outputs and outcomes linked to capacity building, energy policy goals and economic benefits. These do not include a measure of the cost of the support to enable the Group to compare cost-effectiveness using a common approach. The Department considers it will take two to three years to achieve full implementation of the agreed metrics.



### **Areas of interest to the Committee**

**13** The Committee may wish to consider the following issues arising from this briefing:

- whether the UK's programme is in line with the priority low carbon innovation is given by the international community;
- whether short-term public funding horizons are holding back private sector investment in innovation;
- whether the Technology Innovation Needs Assessments and the Low Carbon Innovation Coordination Group's forthcoming strategy will drive a strong portfolio approach to funding across the funding landscape;
- whether the structure of the public funding landscape is a barrier to private sector investment in innovation and the extent to which the Low Carbon Innovation Coordination Group mitigates this; and
- whether the Department could do more to promote and benefit from collaboration with the EU and its member states.

# Part One

## Background

1.1 In this part, we examine:

- the Government's commitment to supporting low carbon innovation;
- the main challenges to innovation; and
- UK research spending compared to that of other countries.

### **The Government's commitment to low carbon innovation**

1.2 Support for innovation is an important part of the Government's plans to meet its objectives to ensure that the UK has secure, clean and affordable energy supplies and to meet the associated legally binding targets:

- From the **EU Renewable Energy Directive 2009**<sup>5</sup>: to increase the proportion of all the UK's energy needs which are supplied from renewable sources from 1.3 per cent in 2005 to 15 per cent by 2020; and
- From the **Climate Change Act 2008**: to reduce greenhouse gas emissions by at least 80 per cent by 2050, relative to 1990 levels.

The Government also considers that support for innovation in low carbon technology that is technologies to reduce the carbon emissions associated with the generation or use of energy, can stimulate investment in new jobs and businesses.<sup>6</sup>

1.3 In the 2010 Spending Review, the Government announced that it would provide funding of more than £200 million over the four years 2011-15 for the development of low carbon technologies, including Offshore Wind Technology and manufacturing facilities at port sites. The Department subsequently allocated a budget of £181 million over four years to support low carbon innovation and separately allocated funding to support manufacturing facilities.

<sup>5</sup> Directive 2009/28/EC of the European Parliament and of the Council, On the promotion of the use of energy from renewable sources, 23 April 2009.

<sup>6</sup> <https://www.gov.uk/government/policies/increasing-the-use-of-low-carbon-technologies>, accessed on 3 July 2013.

**1.4** In December 2011 the Department reported that it would introduce a new more disciplined approach to planning and managing direct public support for low carbon innovation. The Department reviewed its approach in response to the June 2010 National Audit Office report on government funding for developing renewable energy technologies, which found that there was poor coordination of public support across government departments and other public funding agencies. The Department committed to:

- relaunch the Low Carbon Innovation Group to make it a group that would coordinate the activities of all departments and bodies with key low carbon innovation interests, with a secretariat provided by the Department. The new group would strengthen and enhance the Government's vision and strategic objectives for low carbon innovation and develop and adopt a toolbox of strategic outcomes and metrics;
- develop Technology Innovation Needs Assessments (TINAs) to provide a shared evidence base for technology plans and ensure consistent prioritisation of public funding;
- publish a collective strategy for public support for low carbon innovation and provide greater transparency about the sources of public funding available.<sup>7</sup>

**1.5** In its December 2011 Carbon Plan<sup>8</sup>, the Government further confirmed the importance of innovation to its plans to meet the statutory carbon reduction target by 2050. The Government's plan is to achieve competition between technologies to deliver energy most cost-effectively and not to pick technology winners. Its alternative potential scenarios for meeting the target depend on the outcome of innovation in Renewable Technologies, Nuclear, Carbon Capture and Storage, and Energy Demand and Efficiency. In support of this the Government stated it would:

- work with industry to reduce costs;
- support the development and demonstration of new low carbon generation technology, such as carbon capture and storage and less mature renewable technologies; and
- support innovation to help reduce demand for energy.

<sup>7</sup> Department of Energy and Climate Change, Low Carbon Innovation Delivery Review: Executive Summary, 2011 ([https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/48263/3981-low-carbon-innov-delivery-review-summ.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48263/3981-low-carbon-innov-delivery-review-summ.pdf))

<sup>8</sup> HM Government, The Carbon Plan: Delivering our Low Carbon Future, December 2011.

## The challenges in securing innovation in the energy sector

1.6 In June 2012, the International Institute for Applied Systems Analysis (IIASA)<sup>9</sup> observed in the Global Energy Assessment<sup>10</sup> that it prepared to contribute to the Rio Plus 20 conference, that innovation and technological change are integral to achieving the energy system transformations that are necessary. They noted that innovation does not happen in isolation: interdependence and complexity are the rule under an increasingly globalized innovation system. The Institute concluded that the magnitude and multitude of challenges meant that innovation should not be focused only on particular technologies or parts of the energy system, or particular innovation stages or processes. They also noted that:

- the generation of knowledge required independent and stable institutions to balance the competing needs and interests of the market, policy makers, and the research and development community;
- innovation policies should use a portfolio approach; and that
- clear, stable, and consistent expectations about the direction and shape of the innovation system are necessary for innovators to commit time, money, and effort with only the uncertain promise of distant returns.

## UK innovation spending on energy compared with other countries

1.7 Data submitted to the International Energy Agency<sup>11</sup> show that expenditure on energy research, development and demonstration increased in most countries between 2006 and 2011<sup>12</sup> with the notable exception of Japan, where it was 15 per cent lower in real terms. In the UK, expenditure in 2011 was more than double its 2006 level and the UK ranked seventh internationally behind the USA, Japan, France, Canada, Australia and Germany (**Figure 2**).

<sup>9</sup> IIASA conducts research into global problems that are too large or complex to be solved by a single country or discipline. It is sponsored by national member organisations across Africa, Asia, Europe and the Americas.

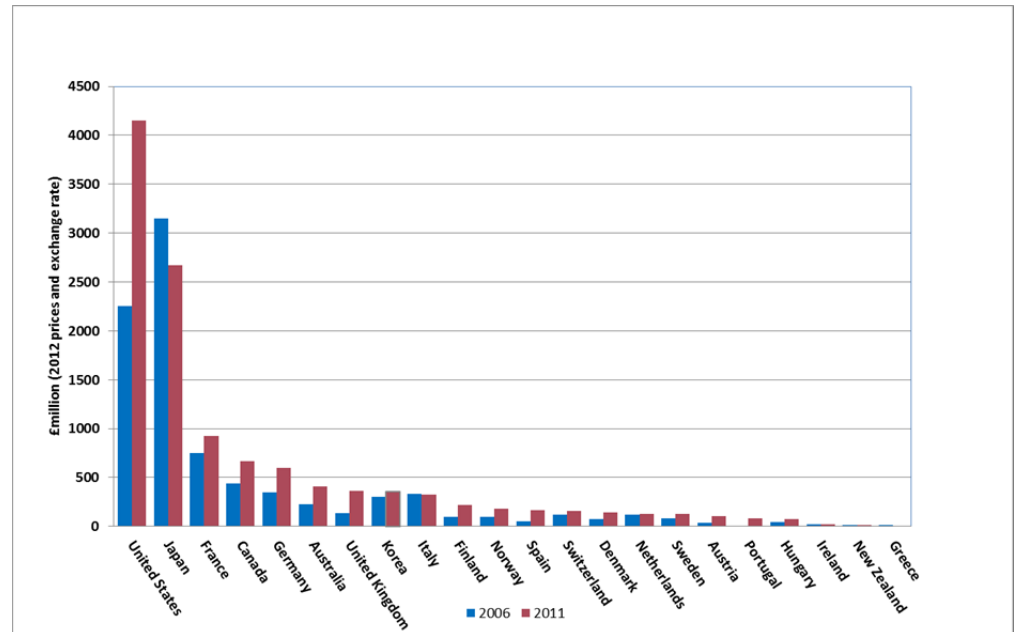
<sup>10</sup> The Global Energy Assessment drew on more than 500 scientists, policy-makers, industrial specialists and energy experts from 70 countries. A summary report can be found here: <http://www.iiasa.ac.at/web/home/research/Flagship-Projects/Global-Energy-Assessment/GEA-Summary-web.pdf>

<sup>11</sup> The International Energy Agency (IEA) is an autonomous energy policy advisor for the governments of its 28 member countries to promote reliable, affordable and clean energy. As such, one of its priorities is to collect data on research, development and demonstration (RD&D) spending in the field of energy. Although the IEA data have limitations (they are collected from member nations via a questionnaire so the completeness and accuracy of the data depends entirely on each participant), they are the only comprehensive source of data on national spending on energy research, and our view is that they do provide a useful indication of comparative spending and trends.

<sup>12</sup> Comparison with 2012 data is not yet possible because of missing data for many countries.

**Figure 2**

Comparative investment in energy research, development and deployment 2006 and 2011



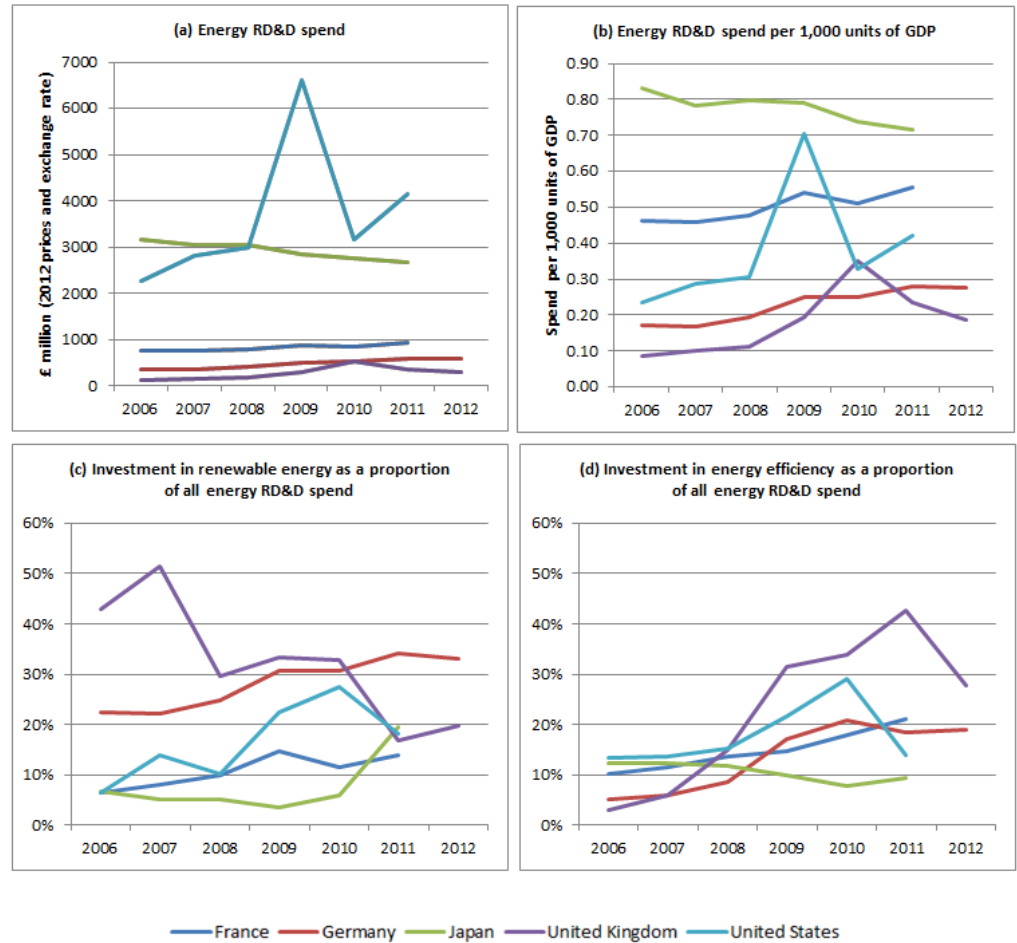
Source: NAO analysis of International Energy Agency data

**1.8** The International Energy Agency data show that compared to the USA, France, Germany and Japan:

- Since 2006 the UK has spent less than the other countries on energy research, and energy research has accounted for a lower proportion of its GDP in every year except 2010 (**Figures 3(a)** and **3(b)**).
- From 2006 to 2010 the UK focused more of its energy research on renewable energy. In 2011, the UK's focus on renewables declined steeply to a level below that of Germany, France and Japan (**Figure 3(c)**).
- From 2008 to 2011 the UK focused more of its energy research on energy efficiency. Although the proportion declined in 2012, it is still above that of the other countries (**Figure 3(d)**).

**Figure 3**

Comparative investment in energy research, development and deployment 2006 and 2011



**NOTE**

1. Data for France, Japan and the United States are not available for 2012

Source: NAO analysis of International Energy Agency data

**1.9** Internationally, the Rio Plus 20 conference in 2012 recognised the importance of research and development in the energy sector to reduce carbon emissions and contribute to sustainable development, and the need for all countries to promote research and development.

**1.10** The International Energy Agency reported in 2012 that the share of energy-related investment in public research, development and demonstration (RD&D) fell from a global average of 12 per cent in 1980 to under 4 per cent in 2010. The Agency urged governments to reverse this relative decline in energy research funding, and to better align their innovation support with measures to support market deployment, as this is likely to trigger additional private investment in RD&D and technological innovation.<sup>13</sup> The IEA and OECD do not systematically collate data on countries' forward commitments for their funding on energy research.

**1.11** In a separate report in 2013<sup>14</sup>, the IEA recommended that governments should share technology-specific data on public spending on energy RD&D to help develop a global picture of RD&D gaps and needs. In addition, governments should consider joint RD&D efforts to improve the performance and reduce the costs of technologies at the early innovation phase, including sharing lessons learned on innovative RD&D models.

**1.12** Every four years, individual member countries' policies are reviewed by a team led by the International Energy Agency. They reported in their 2012 review that the UK had all of the elements of a solid energy RD&D strategy in place but needed to pull this together into a full innovation strategy. They also recommended UK participation in international collaboration to share both costs and risks, accelerate technology development and diffusion, and help communicate broadly the lessons learned across this network.<sup>15</sup>

<sup>13</sup> International Energy Agency, Energy Technology Perspectives 2012, OECD/IEA, June 2012.

<sup>14</sup> International Energy Agency, Tracking Clean Energy Progress, OECD/IEA, 2013.

<sup>15</sup> International Energy Agency, Energy Policies of IEA countries: the United Kingdom, OECD/IEA 2012.

## Part Two

### The funding landscape for low carbon innovation

**2.1** In this part, we set out:

- the main sources of public funding for low carbon innovation in the UK;
- the role of the Low Carbon Innovation Coordination Group in coordinating public funding;
- the prioritisation of public funding and its level; and
- the Low Carbon Innovation Coordination Group's progress in developing Technology Innovation Needs Assessments.

#### **The main sources of public funding**

**2.2** In our 2010 report we noted that the Department has specific accountability for achieving the UK's renewable energy target but that a range of other independent public bodies also provided a significant amount of research funding for the sector. Although the 2010 report focused on renewable technologies, many of the issues apply equally to innovation support for all low carbon technologies. There remain at least eight public bodies in addition to the Department that contribute towards the funding of low carbon innovation in the UK. The funding landscape is less complex than it was in 2010 with the Technology Strategy Board taking over the nine Regional Development Agencies' funding for low carbon research and, with effect from April 2012, the removal of the Department's core funding to the Carbon Trust (**Figure 4**). The Department is now phasing out its remaining grant funding to Carbon Trust projects and the Trust's membership of the Low Carbon Innovation Coordination Group is currently under review.



**Figure 4****Main sources of public funding for low carbon innovation**

<b>Organisation</b>	<b>Interest in low carbon innovation</b>
Department of Energy and Climate Change (DECC)	<p>Ensuring secure, clean affordable energy supplies and promoting international action to mitigate climate change.</p> <p>In addition to its £181 million innovation portfolio for the period 2011-15, which includes Offshore Wind, Carbon Capture and Storage, Bioenergy, and Nuclear, Buildings, the Department is also investing £1 billion into enabling the development of the UK's first commercial Carbon Capture and Storage demonstration plant.</p>
Department for Business Innovation and Skills (BIS)	<p>Boosting economic growth and employment. BIS sponsors the Technology Strategy Board and the UK Research Councils, and through them, the Energy Technologies Institute.</p>
Carbon Trust	<p>The Carbon Trust is an independent company helping businesses and governments accelerate the move to a sustainable, low carbon economy through carbon footprinting and reduction expertise, and developing, commercialising and deploying innovative low carbon technologies and solutions, from energy efficiency to renewable power. The Department presently funds the Carbon Trust to deliver three schemes, including a large collaborative programme with the Offshore Wind industry.</p>
Energy Technologies Institute (ETI)	<p>The ETI is a private sector organisation operating as a public/private partnership, with six global companies. It brings together the collective knowledge, expertise and experience of its diverse members to address future energy needs; and funds projects that accelerate the development of affordable, clean, secure technologies required to help the UK meet its legally binding 2050 targets.</p> <p>The ETI makes targeted commercial investments in nine programme areas including Offshore Wind, Carbon Capture and Storage, Bioenergy, Buildings, and has to date announced £210 million in projects, half of which is met through public funding.</p>
Technology Strategy Board (TSB)	<p>The TSB is a non-departmental public body, funded by BIS to stimulate UK economic growth through innovation. The TSB expects to commit up to £35 million per annum to its energy programme until 2015. It has worked with the Department on a number of joint calls including Offshore Wind and Carbon Capture and Storage, with Scottish Enterprise to fund a Marine Energy competition, and with the Research Councils to co-fund many competitions. In addition the TSB is funding the Offshore Renewable Energy Catapult Centre which will facilitate innovation in offshore renewables and provide a central point of access to the UK R&amp;D base, test facilities and other UK assets.</p>
Engineering and Physical Sciences Research Council (EPSRC)	<p>The Research Councils UK Energy Programme brings together the work of EPSRC, the Biotechnology and Biological Sciences Research Council, the Economic and Social Research Council, the Natural Environment Research Council, and the Science and Technology Facilities Council.</p> <p>The programme aims to position the UK to meet its energy and environmental targets and policy goals through world-class research and training. Its vision is to help solve some of the most serious challenges facing the UK today and in the future. It is investing over £540 million over four years (2011-15) in research, skills and knowledge transfer.</p>

Scottish Government	The transition to a low carbon economy is a strategic priority within the Scottish Government's Economic Strategy. The Scottish Government works with a variety of organisations to establish new technology hubs and alliances to act as focal points for low carbon innovation in the Energy sector. These include the Energy Technology Partnership, the Scottish Funding Council, Enterprise Agencies, the Scottish European Green Energy Centre and European Structural Funds. These initiatives link to EU and UK funding programmes and attract overseas R&D investment. The Scottish Government also support low carbon innovation through direct funding to the Energy Technology Partnership and Scottish Enterprise.
Scottish Enterprise	Scottish Enterprise is Scotland's main economic, enterprise, innovation and investment agency. Scottish Enterprise works with partners to stimulate economic growth, exploit low carbon opportunities, improve Scotland's business infrastructure and support businesses. Innovation, Renewable Energy and transition to a low carbon economy are three of Scottish Enterprise's top five priorities. In recent years they have provided support for low carbon innovation through a range of bespoke support programmes for the Offshore Wind and Wave and Tidal sector.
European Union	The European Union's energy technology development activity is coordinated through the Strategic Energy Technologies (SET) plan. The European Union has a wide range of initiatives and funding streams that support energy and low carbon technologies with the aim of helping the EU to meet its energy and economic growth objectives. The largest of these funding streams is the Horizon 2020 framework programme for research and innovation which is expected to invest in excess of €5.2 billion in energy technology research and development between 2014 and 2020.

Source: National Audit Office

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**2.3** The Department for Business Innovation and Skills (BIS) plays a key role in the funding landscape and works closely with the Department. While the Department of Energy and Climate Change has the lead role in energy, BIS leads on research and innovation and on industrial policy. BIS sponsors the Technology Strategy Board and the UK Research Councils and, through them, the Energy Technologies Institute. The two departments share common objectives in seeking to deliver a secure affordable energy supply and to maximise UK growth opportunities, and work together through the Low Carbon Innovation Coordination Group and through frequent contact between officials from the two departments.

**2.4** Because of the number of organisations involved in funding innovation, it may be difficult for potential innovators to understand the landscape and to engage with it. There is also a risk of an incoherent approach overall that could cause gaps and overlaps in funding. All the funding bodies have their own missions and their own areas of expertise. For example, the Technology Strategy Board (TSB) is a non-departmental public body that seeks to accelerate economic growth in the UK by stimulating and supporting business-led innovation. Its energy programme takes a business-led approach and focuses on opportunities in the UK or overseas by supporting the best new technology developments and helping to build collaborative supply chains. The Energy Technologies Institute (ETI) is a public/private partnership which aims to identify opportunities and develop technologies that optimise the UK's

energy system for the lowest cost. The ETI's strategy is to demonstrate how the most carbon could be saved at least cost. The TSB therefore may decide to support a UK business with high growth potential from a new technology with global markets, whereas the ETI supports technology development and innovation providing energy system cost benefits to the UK in the wider context of delivering the UK's energy and climate change targets. The ETI and TSB consider their roles to be complementary but recognise that there needs to be careful co-ordination of their respective programmes to prevent overlap and duplication. Senior TSB, DECC, BIS and Research Council officials are members of ETI's Board. Their teams also work closely to deliver this coordination through the Low Carbon Innovation Coordination Group and, for example, through TSB and DECC specialists being a key part of ETI's programme advisory boards.

**2.5** The ETI, TSB and the Research Councils have all recently been reviewed to establish the value they bring, and whether changes should be made to their operating models.

- In March 2013 the mid-term review of the ETI concluded that an abrupt end to its work at the end of its intended ten year term in 2017 would destroy much of the value it had created so far, and recommended to Government and industry that they extend the ETI's remit to 2022. The review was commissioned by the Board at the request of its public funders and overseen by a Panel, which was independently chaired. The Review found that the ETI was providing useful input into Government understanding of low carbon technologies. However the ETI was not going to achieve its original target of public/private investment of £1 billion over 10 years. The review acknowledged that it had been clear from the outset that the operation would take some time to set up and that ETI's project portfolio would take several years to reach full capacity.
- A triennial review of the TSB was announced in July 2012 and the report is expected to be published by the end of 2013.
- The report of the review of the Research Councils is also expected before the end of the 2013.

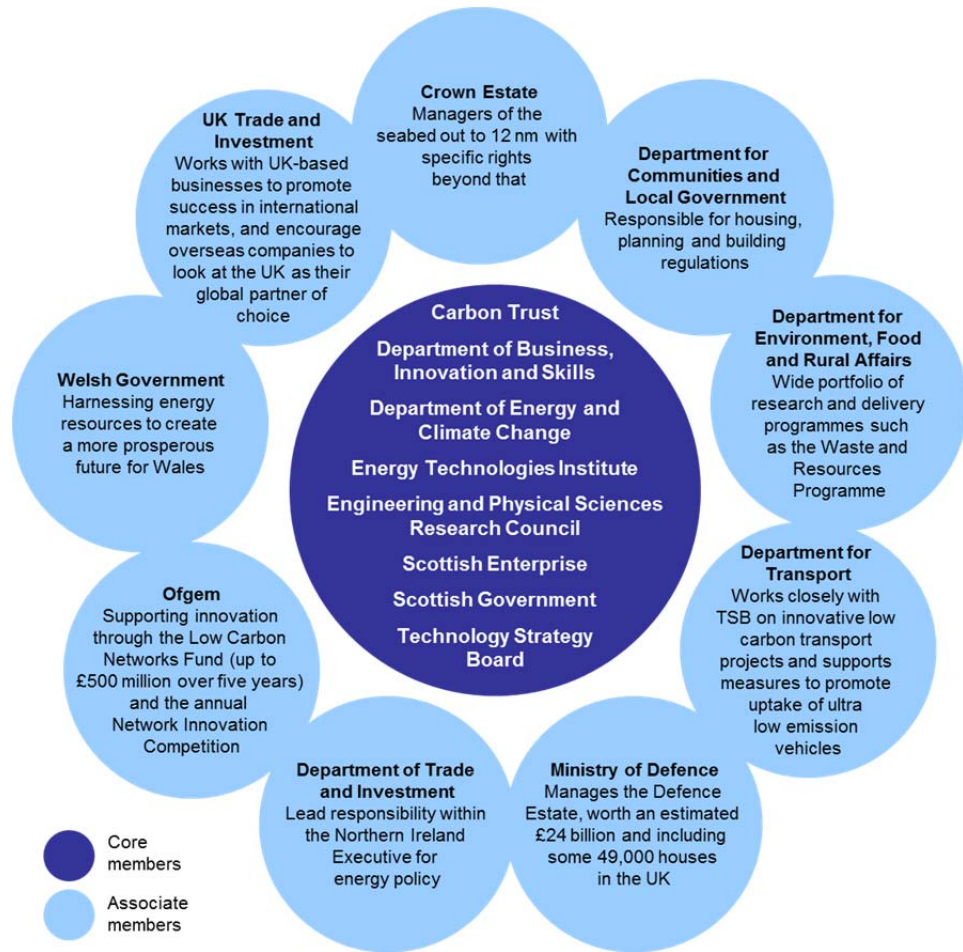
### **Coordination of public funding for low carbon innovation**

**2.6** In 2010, we reported that coordination of direct support for renewable energy development had been limited, although the Low Carbon Innovation Group (as it was then) had provided an additional forum for discussing the activities of its member organisations.

**2.7** In late 2011, the Group relaunched itself as the more inclusive Low Carbon Innovation Coordination Group as part of a suite of actions undertaken in response to the NAO's report in 2010. The Group now has core membership for all of the bodies involved in funding low carbon innovation. Other relevant stakeholders, such as Ofgem, the Crown Estate and other relevant government departments, have associate membership (**Figure 5**).

**Figure 5**

Membership of the Low Carbon Innovation Coordination Group



Source: National Audit Office

**2.8** The Group's aim is to maximise the impact of UK public sector funding for low carbon technologies in order to deliver affordable, secure, low carbon energy for the UK, to deliver UK economic growth and to develop the UK's capabilities, knowledge and skills. The Department, in conjunction with other members of the Group, has agreed a work programme designed to address the recommendations in our 2010 report which includes the following work packages:

- facilitating information sharing and joint working to produce shared intelligence updates and forward plans;
- building a shared evidence base and a common understanding of the key innovation needs of low carbon technologies through developing Technology Innovation Needs Assessments;
- reviewing Group members' current programmes to ensure activities are complementary and to evaluate the extent to which they collectively address innovation needs;
- developing a shared view of the long term priorities for UK support for innovation until 2020;
- measuring and maximising the impact of public sector funding; and
- ensuring the Group's role is understood in the innovation community and that outputs reach the correct audience.

**2.9** The Group has made good progress in delivering this work programme, although it is yet to publish its strategy for low carbon innovation. The Group published Technology Innovation Needs Assessments between February 2012 and April 2013 for ten of its 11 focus areas - Bioenergy, Carbon Capture and Storage, Domestic Buildings, Energy Networks and Storage, Heat, the Industrial Sector, Marine, Non-domestic Buildings, Nuclear Fission, and Offshore Wind. The Assessment for Hydrogen will be published by the end of 2013 and the Group expects to publish its strategy for low carbon technology innovation early in 2014.

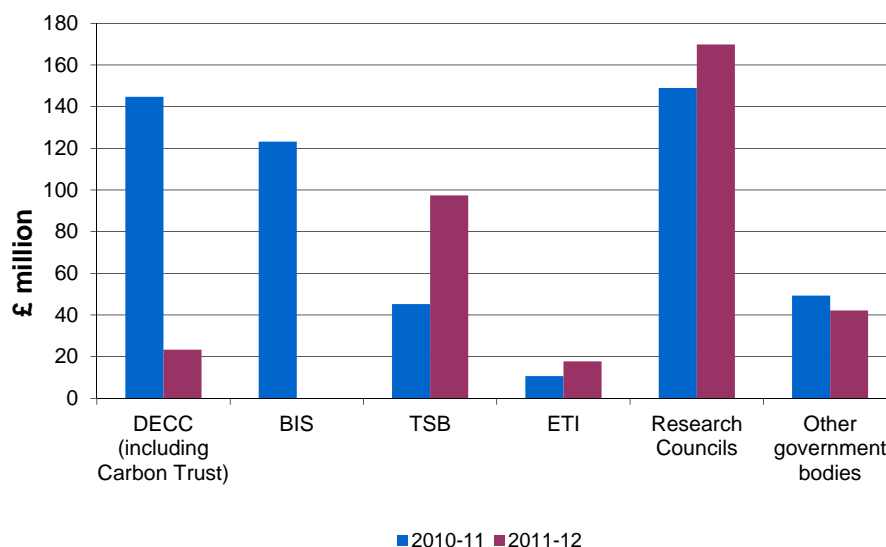
### **Prioritisation of public sector funding for low carbon innovation**

**2.10** Public spending on low carbon innovation for the period 2011-15 was determined in the 2010 Spending Review. The Spending Review was completed before the relaunch of the Low Carbon Innovation Coordination Group and before the Group had fully developed its shared evidence base. Spending Review bids however were informed by DECC's in-house analysis, including its 2050 Pathways analysis, as well as the Group's early work. The Department's initial priorities for the individual schemes in its Innovation Programme were then informed by the emerging outputs of the Group's shared evidence base and priorities were kept under review as the evidence base matured.

2.11 Total spending by Low Carbon Innovation Coordination Group members on low carbon innovation<sup>16</sup> has fallen from the historic high point of £522 million in 2010-11 to £351 million in 2011-12, a reduction of 33 per cent. In 2010-11, the Department was the second largest public funder of low carbon innovation after the Research Councils, but in 2011-12, Research Councils' spending increased by 14 per cent, while the Department's spending decreased by 84 per cent (**Figure 6**). Spending was lower in 2011-12 for all technologies except Hydrogen (which increased from £25 million to £54 million) and Energy Networks and Storage (which increased from £13.5 million to £17 million) (**Figure 7**). The Group has not yet collated figures for its spending in 2012-13.

**Figure 6**

Total outturn spend by UK funding bodies on low carbon innovation in 2010-11 and 2011-12



**NOTE**

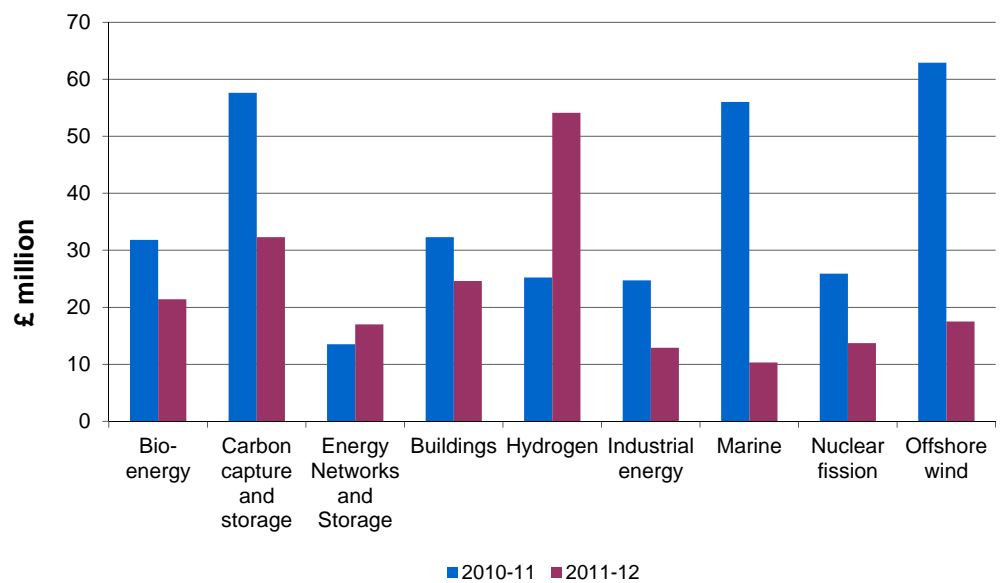
The figures exclude expenditure by the devolved governments and EU grants to UK companies.

Source: NAO analysis of Departmental data

<sup>16</sup> Spending by core Group members with a UK-wide remit. This comprises the Research Councils UK, Technology Strategy Board, the Department of Energy and Climate Change, Energy Technologies Institute, the Department for Business Innovation and Skills and indirect spend by the Department of Energy and Climate Change through the Carbon Trust.

**Figure 7**

Outturn spend by UK funding bodies on low carbon innovation in 2010-11 and 2011-12 by technology

**NOTES**

1. The figures exclude Ofgem's Low Carbon Network Fund, as this is funded through a levy operated by Ofgem under the electricity distribution price control that runs until 2015, and is therefore not public funding.
2. Data for 2012/13 were not available at the time of publication.

Source: NAO analysis of Low Carbon Innovation Coordination Group data

**2.12** The Department aims to continue its low carbon innovation programme but has not yet determined its allocation of funding from the 2013 Spending Review allocation for 2015-16. There are limited public funding commitments beyond that date. Across the landscape of funding bodies, only the ETI has had certainty over its funding over a longer time period as, when it was established in 2007, the Government committed to matching private sector funding over the ten years to 2017. The Low Carbon Innovation Coordination Group's inability to guarantee funding beyond the end of the Spending Review periods makes it harder for them to attract private sector investment. The view of some companies responding to our consultation was that the funding bodies focus more on short term results rather than on long term goals. As a result, companies lack confidence in future public funding to be able to plan their long term investment strategy.

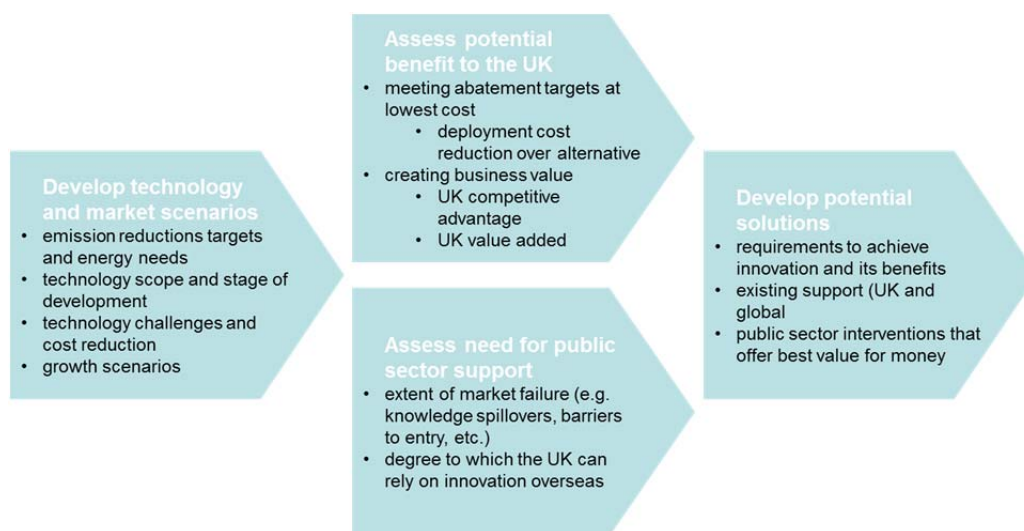
## Developing a shared evidence base for future prioritisation of funding

**2.13** The Low Carbon Innovation Coordination Group has developed Technology Innovation Needs Assessments to inform future prioritisation of funding, and is using them to inform the development of its strategy. Although the Group has collectively agreed the Assessments, it has published them with the caveat that the Assessments do not describe or replace the published policies of individual members of the Group. In 2011, the Government Office for Science commended the Group's approach to developing the assessments as an example of good practice in prioritising scientific and technical requirements.<sup>17</sup>

**2.14** The Assessments use a common framework to assess the costs and benefits of support for the Group's 11 focus areas for research (**Figure 8**). The Carbon Trust coordinated the analysis on behalf of the Group, gathering evidence from multiple sources and using a range of models including the ETI's Energy Systems Modelling Environment (ESME) model and Markal modelling by the Committee on Climate Change. They also created bespoke models with the support of specialist consultants for individual technologies.

**Figure 8**

### Overview of Technology Innovation Needs Assessments methodology



Source: Carbon Trust

<sup>17</sup> Government Office for Science, Science and Engineering Assurance Review of the Department of Energy and Climate Change, August 2012.



**2.15** A formal sensitivity analysis was not carried out to test the robustness of the conclusions drawn. However the Assessments were extensively reviewed by a range of different experts and organisations. Key data and conclusions from each Assessment were reviewed in detail through workshops involving industry and academic experts. Each member of the Low Carbon Innovation Coordination Group then reviewed the findings and cross-checked the conclusions against their own analyses. Differences were discussed and a consensus view was agreed so that all organisations were able to sign up to the conclusions reached.

**2.16** The Group has published ten of the 11 Assessments so far, but the detailed analysis packs that underlie the summary reports to allow users to understand the source of the evidence have not yet been made public. The Group intends to review and refresh the Assessments but has not yet determined how and when it will do this.

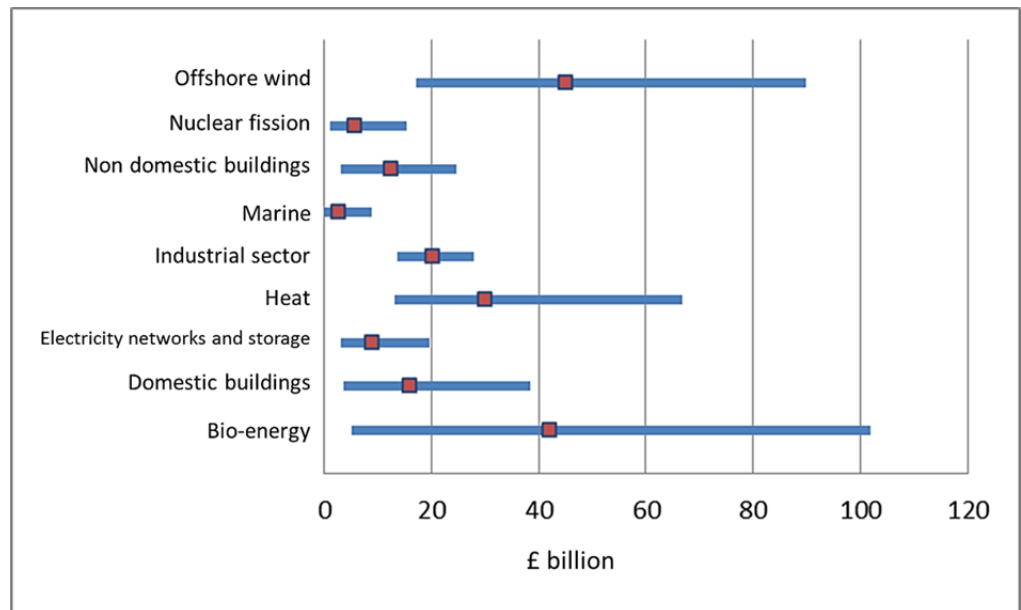
**2.17** The Group has used the Assessment results to analyse and agree, for each technology:

- the extent to which the UK can rely on other countries to provide the technological innovations needed to help the UK meet its Carbon Emission targets of 2050;
- the extent to which market barriers are impeding innovation;
- the green growth potential;
- cost reduction potential; and
- priorities for future public sector innovation support.

**2.18** Comparison between the Technology Innovation Needs Assessments suggests that support for Offshore Wind and Bioenergy has the largest potential to provide financial savings and economic growth for the UK by capturing a share of the global market for low carbon technologies, shown as 'green growth' in the Assessments (**Figures 9 and 10**). It shows that Energy Networks and Storage could also deliver a relatively large amount of green growth when compared with other technologies. Despite the common methodology used to prepare the Assessments these comparisons are only indicative, due to the inherent uncertainty about the amount of deployment that would arise as a result of innovation support for the different techniques within each technology.

**Figure 9**

Projected potential saving to the UK from innovation by 2050



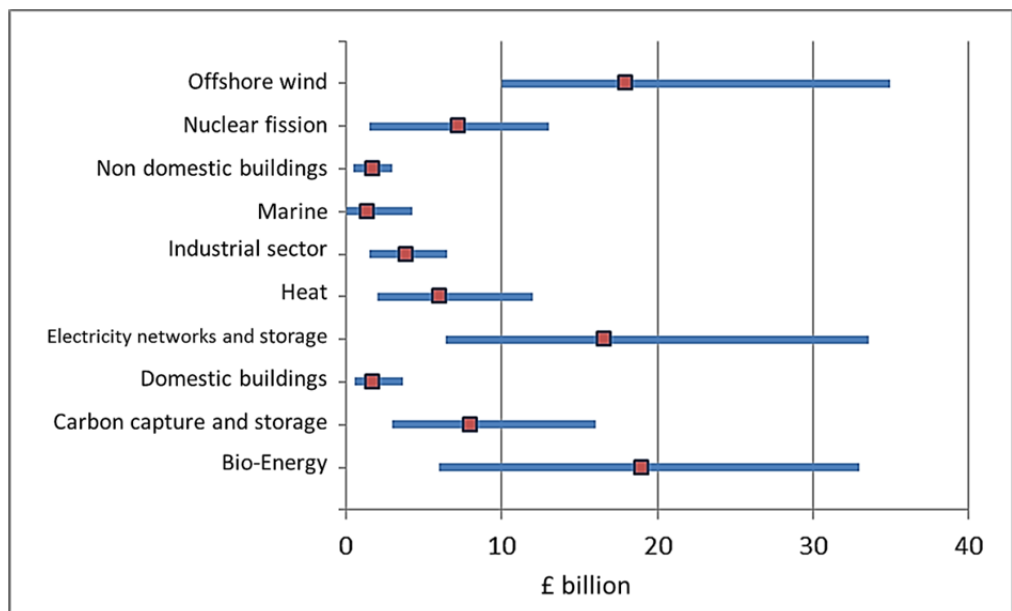
**NOTES**

1. Potential savings are based on literature reviews and expert estimates for changes in various cost-elements as a result of innovation and take-up of the technologies and economies of scale from expected deployment.
2. The minimum and maximum level of savings from innovation is represented by a high-low line with a marker to show the most likely potential savings in each technology area to the UK by 2050.
3. The TINA states that deployment of carbon capture and storage would lead to potentially "hundreds of billions" of savings but that the technology has not yet been demonstrated at large scale. Due to this uncertainty, we have omitted carbon capture and storage from the analysis.

Source: NAO analysis of Technology Innovation Needs Assessments

**Figure 10**

Estimated net contribution to the UK economy if the UK achieves its potential market share ("green growth")

**NOTES**

1. Contribution to the economy is calculated as gross value added, with global market estimates based on IEA estimates and expert estimates, taking account of the portion of the market which will not be "tradable" or not likely to be available to UK exports.
2. The minimum and maximum level of contribution from is represented by a high-low line with a marker to show the most likely additional business value in each technology area to the UK by 2050.

Source: NAO analysis of Technology Innovation Needs Assessments

**2.19** The Technology Innovation Needs Assessments have introduced more rigour and a shared approach to assessing the case for support for innovation for different technologies, but they are limited as a source of quantitative evidence for prioritisation between technologies. The Low Carbon Innovation Coordination Group highlights that the Assessments do not consider barriers and opportunities beyond those directly associated with innovation, such as barriers arising from the planning system, the supply chain, related infrastructure, and finance.<sup>18</sup> The Group has pulled together shared conclusions on the priority that they draw from the evidence, categorising individual aspects of each technology into a "high", "medium" or "low" priority. These

<sup>18</sup> The disclaimer appears at [http://www.lowcarboninnovation.co.uk/working\\_together/technology\\_focus\\_areas/overview/](http://www.lowcarboninnovation.co.uk/working_together/technology_focus_areas/overview/) (accessed 14 August 2013).

provide an assessment of relative priority within a technology but do not easily allow comparison of priority between technologies. For example a "high" priority for investment in one area may be less of a priority than a "medium" or even a "low" priority in another. The Department has told us, however, that analysis based on the data has been carried out to allow comparisons between technologies and that this analysis will inform future programme planning and spending bids. They will not however feature in detail in the Group's forthcoming Strategy, which it expects to publish in early 2014.

### **Engagement with the innovation community**

**2.20** Communication with industry is one of the Low Carbon Innovation Coordination Group's six agreed work packages (see paragraph 2.8). The Group aims to ensure that the innovation community understands its role and that its outputs reach the correct audience.

**2.21** The Group has developed its website as its principal means of engaging better with the innovation community. It has created a search engine to assist companies in navigating the diverse range of innovation funds available, and the differing eligibility criteria for each. The Low Carbon Funding Landscape Navigator<sup>19</sup> provides details of all calls for proposals or invitations to tender from Group members as well as funding opportunities from non-Group members such as the European Union and overseas corporations. The site provides background information on funding bodies, and offers a facility for innovators to identify potential partners or to register an interest in particular funding opportunities to facilitate consortium bids for funds.

**2.22** Group members and stakeholders were generally confident that the Group had close engagement with the innovation community but we and the Department have found it difficult to obtain broad stakeholder feedback to confirm this. In 2012, the Department commissioned a survey of businesses, to establish the extent to which private sector organisations were investing in low carbon innovation and understand barriers to future investment. However, because of weaknesses in the survey methodology, the results of the survey were not sufficiently reliable to be of use.<sup>20</sup> We carried out an online consultation inviting organisations involved in low carbon innovation to give us their views on the Department and the wider funding landscape. The consultation was widely published, on our own website, the Committee's website and the websites of the Department, the Low Carbon Innovation Coordination Group and many of the individual funding bodies, but we received only 24 responses.

<sup>19</sup> <http://www.lowcarbonfunding.org.uk/>

<sup>20</sup> The sample for the survey was compiled from a mixture of the general business population and a sample of low carbon companies drawn from trade association websites. The justification for combining these and analysing them as a single sample is not clear. Furthermore, the size of many of the subgroups from which comparisons are drawn are too small to be statistically robust.

**2.23** The Department sees engagement with industry as critical to the success of its Programme. The Department's Chief Scientific Adviser co-chairs the Energy Research Partnership which brings together a broad range of industry representatives to review energy research activities. Senior officials from the Department regularly attend and present at industry-sponsored conferences and workshops. Ministers also occasionally speak at some of the major industry events. In the development of the Technology Innovation Needs Assessments and the Low Carbon Innovation Coordination Group's strategy, the Department has canvassed industry views and tested emerging findings through a series of workshops with industry.

**2.24** Nevertheless, we found, through our interviews with industry representative bodies such as Energy UK, that there was little awareness of Technology Innovation Needs Assessments in industry. The Department's feedback gained through 35 interviews with businesses over the spring of 2013 also showed low levels of awareness of the Assessments. The Department and the Low Carbon Innovation Coordination Group have not so far seen promotion of the Assessments to industry as a priority, as this was not their primary purpose and their resources to do so are limited. The Department recognises however that the Group could do more to raise awareness of the Assessments, the Group's activities and the Funding Navigator.

### **Common metrics for measuring performance from support for low carbon innovation**

**2.25** The Low Carbon Innovation Coordination Group has developed a potential set of common metrics for monitoring their support for innovation, but have not yet formally adopted them either collectively or individually. The Group has developed the potential common metrics in response to our 2010 recommendation that there should be a common approach to performance reporting to allow evaluation on a consistent basis across the public funding portfolio to support better prioritisation.<sup>21</sup>

**2.26** Choosing the best metrics for monitoring innovation is challenging. Successful innovation programmes by their nature should encourage experimentation and therefore permit a range of outcomes and a degree of failure. Metrics that are designed to measure successful outcomes cannot easily accommodate this aspect. Boston Consulting Group found in 2010 that only 41 per cent of respondents to their annual innovation survey<sup>22</sup> were satisfied with their company's innovation measurement practices. The major flaws they found were not choosing enough different metrics to provide sufficient information, measuring the wrong things, and failing to tie incentives to metrics. The challenge of developing appropriate metrics is in this case exacerbated by having to agree common metrics across a number of diverse organisations.

<sup>21</sup> National Audit Office, Government Funding for developing renewable energy technologies, HC 35 Session 2010-11, 10 June 2010.

<sup>22</sup> Boston Consulting Group, Innovation 2010 Report, April 2010.

**2.27** The Low Carbon Innovation Coordination Group has proposed seven common metrics for outputs and outcomes (**Figure 11**), but has not included a common metric for costs to allow comparison of the cost-effectiveness of different funding routes. The Group considered including other "green growth" indicators such as jobs created, but concluded that it would not be possible to develop and agree a robust and consistent approach to this. In addition to the seven outcome based metrics, the Group is currently piloting a template to capture qualitative information on the design and delivery of projects to support the sharing of good practice and lessons learned between members of the Group and to inform future activities.

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### Figure 11

#### New metrics proposed by the Low Carbon Innovation Coordination Group

Capacity building	New patents
	New collaboration and networks
	Value of financial leverage
Energy	Reduced unit energy costs
	Reduced emissions
Economic	Growth in gross value added <sup>1</sup>
	Growth in exports

#### NOTE

1. An economic ratio of output minus intermediate consumption that is considered to provide a useful comparable measure of productivity or competitiveness.

Source: Low Carbon Innovation Coordination Group

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**2.28** Members of the Group are positive about the value of adopting the new metrics. For example, the Engineering and Physical Sciences Research Council told us that the metrics would be very useful and more systematic than its previous qualitative method of relying on case studies. However, the Department believes the challenges that will be involved in incorporating them in members' monitoring systems could mean that full implementation will take two to three years from when a decision is taken to adopt them. The Department pointed to the potential cost of adopting the metrics in its monitoring of its own portfolio. Other challenges for Group members will include differentiating low carbon activities (whether research or business interventions) for measurement within wider programmes. The Department expects the Group to decide in October 2013 whether the common metrics framework is ready for launch following piloting and evaluation during the summer of 2013.

## Part Three

### The Department's management of its own low carbon innovation funding portfolio

**3.1** In this part, we examine the Department's:

- budget for low carbon innovation and spending to date;
- the cost of administering its portfolio;
- management of the schemes; and
- monitoring and evaluation.

#### **How the Department allocated its budget for low carbon innovation**

**3.2** The Department's bid for the Spending Review period 2011-15 was determined before the re-launch of the Low Carbon Innovation Coordination Group and the development of the Technology Innovation Needs Assessments but the Department's subsequent work to determine funding priorities was informed by emerging outputs from the Group's shared evidence base and kept under review as the evidence base matured<sup>23</sup> We found that the Department:

- focused on technologies that it believed were critical to avoid putting UK decarbonisation and energy security objectives in 2020 and 2050 at risk. These technologies comprised: Nuclear Power, Wind Power, Carbon Capture and Storage, Bioenergy (including energy from waste), Energy Efficiency measures, Heat Pumps and Battery Technology for Electric Cars;
- used sensible criteria for narrowing down support within these technologies. The Department identified areas where there was a clear market failure, where other countries were unlikely to solve the problem, and where there was a pressing need to invest quickly;
- used appropriate economic techniques to estimate the impact of the investments. The Department used net present value calculations to check that the benefits of each investment outweighed the costs; and
- clearly indicated its priorities by splitting the favoured technologies between three categories: critical need, clear and immediate need, and clear need.

<sup>23</sup> Revised Spending Review Proposal for low carbon technology innovation support, 14 July 2010.

**3.3** Following the Spending Review announcement of over £200 million for capital spending on both low carbon technology innovation and manufacturing of low carbon technology (such as offshore wind turbine parts) at port sites, the Department undertook more detailed business planning to prioritise innovation schemes for funding. Although the business plans were not as detailed as would have been possible with the benefit of the Technology Innovation Needs Assessments, they appropriately addressed the schemes' policy goals, the net present value of programme benefits, plus the overall costs of each programme to 2050, and likelihood of success. They drew on lessons learned from previous innovation funding in that area from across the public funding bodies. Although the Department lacked enough details to calculate the net present values for programmes it intended to deliver in later years, it made a commitment to review these values before they launched the schemes.

**3.4** The Department used sensible governance arrangements to scrutinise the individual business cases and agree an overall innovation portfolio approach that involved flexibility across the individual schemes. Following business planning within the Department, a budget of £181 million was allocated to low carbon innovation for the period 2011-15. The Department has subsequently made allocations totalling up to £185 million to its portfolio of technologies, allowing amounts higher than its budget to allow for schemes starting later or securing fewer applications than planned.

**3.5** The Department's portfolio includes a wide variety of projects across all of the technologies in its original plans with the exception of Electric Cars (**Figure 12**). Offshore Wind, Nuclear, Marine, Electricity Networks and Storage, and Carbon Capture and Storage each account for more than 10 per cent of the Department's portfolio (**Figure 13**).



**Figure 12**

## The Department's allocated funding for low carbon innovation schemes

<b>Project title</b>	<b>Description</b>	<b>Departmental funding allocation<sup>1</sup></b>
<b>NUCLEAR</b>		
Research and development	Grant to the National Nuclear Laboratory	£1.4 million
Supply chain analysis	To stimulate innovation in the civil nuclear power sector	£3 million
National Nuclear User Facility	A joint project between DECC and BIS, delivered through ESPRC, to build equipment for universities and companies carrying out research into nuclear technology	£5 million
Jules Horowitz Reactor	Contribution towards the construction of a state of the art reactor	£12.5 million
Other grants for nuclear		£0.3 million
<b>BIOENERGY</b>		
ERANET programme	Collaborative projects that demonstrate innovative steps towards demonstration at a pre-commercial stage	£6 million
Wetland biomass	To develop and demonstrate a bioenergy process that optimises wetland management activities and utilises the biomass arisings	£2 million
Pyrolysis challenge	A Carbon Trust project to develop a commercially viable pyrolysis oil upgrading process	£7 million
<b>MARINE</b>		
Marine Energy Array Demonstration (MEAD)	To support two pre-commercial projects to demonstrate the operation of wave and/or tidal devices in array formation	£20 million
<b>OFFSHORE WIND</b>		
Offshore wind component technologies development and demonstration	A series of proposal calls - the fourth launched in February 2013 - for the development and demonstration of components	£15 million
Offshore wind accelerator	A joint industry project, managed by Carbon Trust and involving nine offshore wind developers, to reduce the cost of offshore wind by 10 per cent by 2015.	£15 million

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<b>ENERGY NETWORKS AND STORAGE</b>		
Electricity storage components	To improve components and materials used for energy storage systems or to develop feasibility studies to explore how storage systems can be used in the UK electricity network	£3 million
Electricity storage demonstrator	To encourage the development of innovative, pre-commercial energy storage technologies	£17 million
<b>HYDROGEN</b>		
Hydrogen and fuel-cell innovation	Funding delivered through TSB to support companies focusing on hydrogen technologies	£2 million
Polymer fuel cells challenge	Run by the Carbon trust, its aim is to accelerate the commercialisation of breakthrough polymer fuel cell technologies	£5 million
<b>CARBON CAPTURE AND STORAGE (CCS)</b>		
CCS	For the development of next generation CCS technologies	£20 million
<b>NON-DOMESTIC BUILDINGS</b>		
"Invest in Innovative Refurb" programme	To reduce the risk and cost of innovative technologies or processes that can demonstrate significant energy and carbon savings in non-domestic buildings	£10 million
Advanced storage	To assess the viability of compact heat storage materials	£3 million
<b>DOMESTIC BUILDINGS</b>		
Thermal storage	Grant to British Gas to trial thermal (hot-water) storage integrated with heat pumps in domestic buildings	£2.8 million
<b>ENERGY ENTREPRENEURS</b>		
Energy entrepreneurs	To support the development and demonstration of innovative, new technologies, products and processes in building technologies and power generations and storage	£35 million
<b>TOTAL DEPARTMENTAL FUNDING ALLOCATIONS</b>		<b>£185 million</b>

**NOTE**

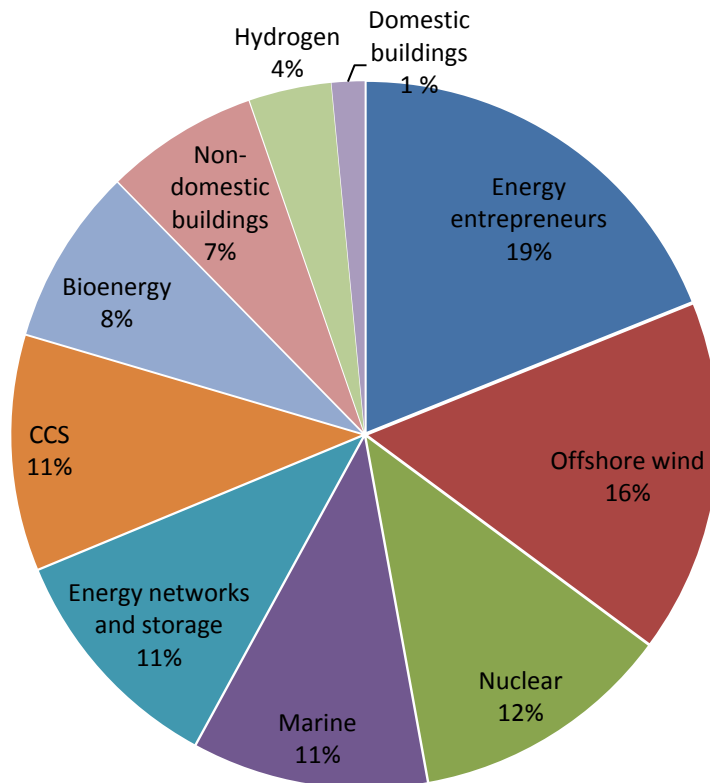
1. The Department allocated "up to" this amount for each project. The Department 's portfolio approach allows it flexibility to move funds between schemes taking account of their progress.

Source: Department of Energy and Climate Change

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**Figure 13**

The Department's allocation of funding across technologies



Source: Department of Energy and Climate Change

**3.6** The Department confirmed delegation of responsibility for delivering the innovation support programme to an Innovation Programme Board, chaired by the Director of Science and Innovation, the Senior Responsible Owner for the portfolio. The Department's Innovation Programme Board is responsible for ensuring the value for money of individual programmes, and for overseeing detailed programme planning and delivery, including provision for monitoring and evaluation.

**3.7** The Department's portfolio approach has provided flexibility to alter the allocations of budgets to schemes and to substitute schemes in response to new evidence about need for support. On individual schemes the Department may vary the original budget if the quality of applications is high or if live projects make quicker progress than expected. For example, the Department has allocated funding to three schemes not prioritised in the 2010 Spending Review bid - Energy Entrepreneurs,

Electricity Storage and Next Generation Carbon Capture and Storage. In 2010 the Department did not consider it timely to support Next Generation Carbon Capture and Storage, but subsequently revised its view as a result of the Technology Innovation Needs Assessments, concluding that there was a case for a broad "open call" for leading ideas with breakthrough potential.<sup>24</sup> The Department launched a £20 million fund for innovative Carbon Capture and Storage technologies to replace the Carbon Dioxide Storage demonstration scheme included in its original portfolio. Since this scheme was launched in April 2012, the Department has funded 14 projects.

**3.8** In its latest review of the UK's policy in 2012, the International Energy Agency called for the UK to be more actively involved in international collaborations (see paragraph 1.12). The Department has taken steps to increase its engagement and influence in EU activities and maximise the use of EU research and development funding and programmes in achieving the UK's objectives. The UK is part of a new four country Bureau (alongside Spain, Austria and Sweden) which is supporting the European Commission in delivering the EU's Strategic Energy Technologies (SET) plan. Department officials are leading an initiative under the plan to identify and launch more 'joint actions' involving multiple member states. These joint actions have the potential to combine EU, member states and industry funding to achieve greater collective impact. The Department is leading two such programmes in Bioenergy and developing others including in Offshore Wind and Carbon Capture and Storage. The Department has also collaborated with EUROGIA+<sup>25</sup> and the Technology Strategy Board to launch a new funding mechanism, Eurogia-UK, to encourage UK companies to participate in transnational collaborations to develop innovative industrial RD&D projects for low carbon energy technologies. Bids for the Eurogia-UK programme will be considered on a rolling basis alongside bids for the Energy Entrepreneurs scheme from September 2013.

**3.9** The Department's work to determine its funding allocations and develop and launch its schemes took longer than anticipated and, as a result, its spending has been lower than budgeted and lower than the historical high reached in 2010-11. The budgets for different technologies were agreed part-way through 2011-12. The delay was in part due to slow recruitment of staff to the Department's in-house delivery team. The full team was not in place until early 2012. Departmental outturn spending on innovation fell by 84 per cent (from £147 million to £24 million) between 2010-11 and 2011-12. It then increased to £36.9 million in 2012-13, and the Department forecasts that it will increase further to £57.9 million in 2013-14.

<sup>24</sup> Low Carbon Innovation Co-ordination Group, Technology Innovation Needs Assessment: carbon capture and storage in the power sector – Summary Report, August 2012.

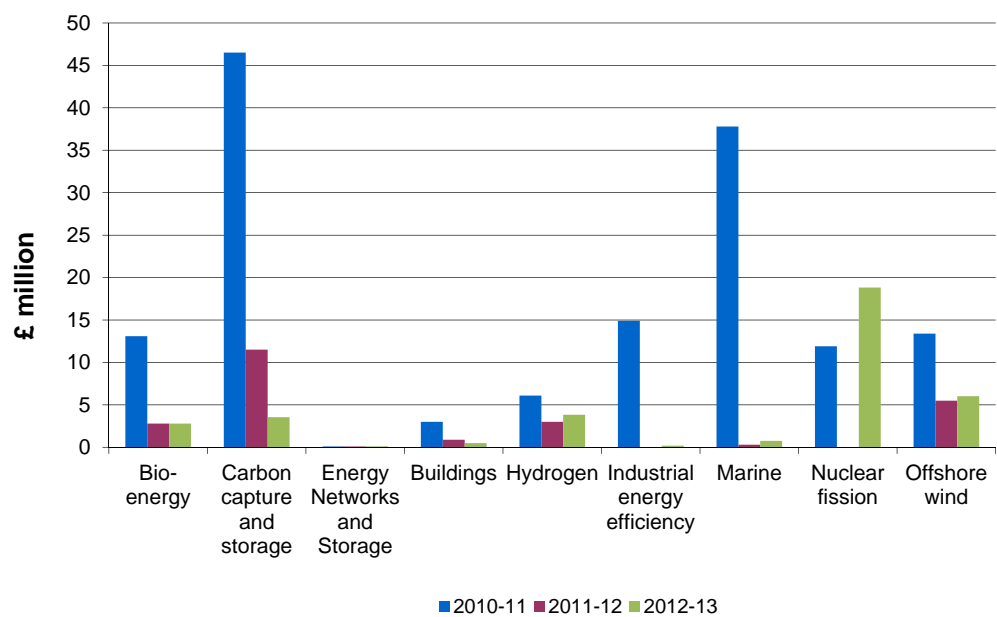
<sup>25</sup> Eurogia+ is a cluster of the Eureka network, a decentralised inter-governmental initiative started in 1985 to enhance European competitiveness by supporting businesses, research centres and universities that take part in transnational projects.

**3.10** In 2011-12, the Department's total expenditure was £26.6 million against a budget of £42.5 million, and in 2012-13 it was £37.9 million against a budget of £64.9 million. The Department is accelerating expenditure for the final two years of the Spending Review period and forecasts total expenditure over the four year period of £173.2 million against the original budget of £181.0 million.

**3.11** The Department's expenditure in each technology area has fallen between 2010-11 and 2011-12, and in many fell further in 2012-13, as the Department carried out its work to rationalise its portfolio. Only in nuclear fission was 2012-13 expenditure higher than its 2010-11 level (**Figure 14**).

**Figure 14**

Departmental outturn spend on low carbon innovation technologies in 2010-11 to 2012-13



**NOTES**

1. The chart shows combined spending by the Department and Carbon Trust.
2. The figures exclude funding that was not specific to a single technology. For example, the 2012/13 data exclude £663,000 paid to Carbon Trust for work on developing the Technology Innovation Needs Assessments.

Source: NAO analysis of Departmental data

### **The cost of administering the portfolio**

**3.12** The Department's in-house Energy Innovation Delivery Team has reduced the costs of administering its support for innovation. The Delivery Team manage the Department's portfolio of innovation support schemes, reporting to its Innovation Programme Board. The creation of the Delivery Team and Board in mid-2011 brought together responsibility which had previously been spread across the Department. The team administers the portfolio and individual schemes largely using in-house resources, but with some additional external specialist support where necessary.

**3.13** We estimate that the Department will spend around £5.3 million on external specialists to support the management of the Department's schemes over the course of the Spending Review period. This is equivalent to 3 per cent of the value of the programme. In our 2010 report, we reported that the six of the Department's schemes with total funding commitments of £200 million had external scheme management costs totalling £9.5 million, or 4.7 per cent of the programme value. In 2011-12, the Department employed 12 full-time equivalent staff to manage the programme at a cost of approximately £650,000, or an estimated £2.3 million over the Spending Review period. Before the current programme was launched, the Department, like the other funding bodies at that time, did not routinely collect and monitor other administration costs, such as staff and research costs for their schemes, so it is not possible to compare the total management costs now with those of the earlier programme.

**3.14** Although neither the Department nor the Low Carbon Innovation Coordination Group is responsible for the total of administration costs across its membership we found good examples of the Department acting with other members to reduce collective costs, while making the best use of available expertise. For example, in the Nuclear Supply Chain innovation programme the Department has acted to minimise administrative costs and leverage extra funding by forming a collaborative scheme with the Technology Strategy Board (who manage the scheme), the Nuclear Decommissioning Authority and the Engineering and Physical Sciences Research Council, all of which are providing financial support.

### **The Department's management of its schemes**

**3.15** To maximise the performance of its schemes the Department aims to set clear criteria for each scheme's intended impacts and attract and select high quality projects to fund. For the schemes that we reviewed in detail we found that the Department had:

- prepared detailed invitations to tender, consistently setting out the policy context, funding priorities, and criteria against which they intended to assess bids;
- used multiple channels successfully to attract bids for its funding schemes: direct invitations to tender, press notices, announcements on the Department's website, direct approaches to trade associations and academia, and presentations at trade events;
- established clear criteria for selecting successful bids. Due to the technical nature of the bids in some cases, the Department prepared selection criteria and

guidance on how to apply them, but contracted out the bid evaluation work to external assessors. For all the schemes we examined we saw evidence that its external assessors had also applied the criteria rigorously in practice.

**3.16** The schemes we reviewed attracted a reasonable number of bids. Interest varied between technologies, ranging from nine bids for the Marine Energy Array Demonstrator (MEAD) scheme to 170 bids for the Energy Entrepreneurs fund (Figure 15).

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### Figure 15

#### Number of bids received for innovation funding competitions

Scheme	Number of application	Number of applicants awarded funding
Marine Energy Array Demonstrator (MEAD) <sup>1</sup>	9	2
Carbon Capture and Storage (CCS)	21	13
Electricity Storage Demonstrator	25	4
Nuclear Supply Chain	34	16
Offshore Wind Components (first three calls)	41	17
Energy Entrepreneurs Fund (first two calls)	170	30
Jules Horowitz Reactor	Single tender	1

#### NOTE

1. Awards for the Marine Energy Array Demonstrator are conditional on state aid clearance and projects reaching financial close.

Source: Department of Energy and Climate Change

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**3.17** The Department's business cases, delivery plans and funding awards for each of the schemes set out clearly the responsibilities and processes to be used for monitoring and evaluation. Awards of funding specified clearly the expected outputs and milestones for those outputs, and how progress should be monitored. For the schemes we reviewed, project managers were monitoring how individual projects were performing against their milestones. Where appropriate, the Department is employing external experts to help monitor the progress made by funding recipients. For example, for the Carbon Capture and Storage scheme the Department employs technical experts to verify all milestone reports prior to review by the Department's project manager and before making payments according to milestones achieved.

**3.18** The Department's monitoring includes monthly reporting to its Innovation Programme Board and financial reporting, which is considered by the Department's Executive Committee and Management Board. From September 2013, the Innovation Programme Board will receive a report that systematically assesses the risk to delivery for each contract. Previously, the Board had been given narrative reports that provided less detail on the contracts. The Department currently forecasts that there are either medium or serious risks to the delivery of seven out of the 84 contracts which it has assessed. The major causes of risk include operational problems such as locating appropriate test sites and recruiting sufficiently-qualified technical staff.

**3.19** The Department is committed to evaluating the impact of its projects when they are completed. Evaluation of schemes against their business cases provides critical information to allow the Department to adjust the current programme and to inform future programmes. Of the seven schemes we reviewed, five had detailed evaluation plans with features such as evaluation objectives and questions, data requirements, analysis of stakeholders' interests in the evaluation, and plans to feed any lessons learnt into future project design. The Department is still finalising its evaluation plans for Offshore Wind Components and the Jules Horowitz Reactor project. Only two of the evaluation plans specified the resources required to carry out the evaluation, with one of the other plans noting that the Department had not allocated a separate budget for evaluation.



# Annex A

## Methodology

**1** We assessed how the Department had responded to our 2010 recommendations by:

- interviewing Departmental managers within the Energy Innovation Delivery Team
- reviewing Departmental audit committee minutes and other documents such as board minutes, strategy documents and Technology Innovation Needs Assessments

**2** We compared UK spending on low carbon energy innovation in other countries by analysing annual energy RD&D budget/expenditure statistics published by the International Energy Agency

**3** We reviewed how the Department had changed the delivery landscape since 2010 by:

- using an online consultation to gather the views of individuals and organisations on public sector funding for low carbon innovation and funding opportunities available for these technologies<sup>26</sup>
- interviewing representatives of the Department and other funding bodies, including the Department for Business, Innovation and Skills, Carbon Trust, Energy Technologies Institute, Engineering and Physical Sciences Research Council, Research Councils UK, and Technology Strategy Board.
- interviewing other private sector and academic stakeholders, including Centre for Low Carbon Futures, Energy UK, Environmental Change Institute, Renewable Energy Association, SSE, and UK Energy Research Centre.

<sup>26</sup> We have made little use of the evidence from the consultation due to the very small number of responses received (see paragraph 2.22).

**4** We reviewed how the Department has managed its energy portfolio and individual projects by:

- interviewing Departmental managers within the Energy Innovation Delivery Team
- reviewing Departmental documents such as board minutes, Spending Review submissions, progress reports, business cases, delivery plans, bid assessments and evaluation plans. We looked in detail at a selective sample of seven technology projects, which are listed in **Figure 16**.

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### Figure 16

#### Innovation schemes examined by the NAO

Scheme name	TINA area	Funding Allocation
Marine Energy Array Demonstrator (MEAD)	Marine	£20m
Innovative Carbon Capture & Storage technologies	Carbon Capture and Storage (CCS)	£20m
Electricity Storage Demonstrator	Energy Networks and Storage	£17m
Offshore Wind Components	Offshore Wind	£15m
Nuclear Supply Chain	Nuclear	£3m
Jules Horowitz Reactor	Nuclear	£12.5m
Energy Entrepreneurs	Domestic and non-domestic buildings and networks and storage	£35m

Source: National Audit Office

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National Audit Office

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