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Low-carbon innovation: Developing technology for the future

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Developing and deploying low-carbon technologies is key to meeting the UK's long-term targets on climate change. It will take a co-ordinated effort from government and business to ensure the UK is ready to exploit the potential of a low-carbon economy. The UK needs to act now if it is to be a low-carbon leader in the future.

In its report *Climate change: everyone's business*,[1] The CBI Climate Change Task Force highlighted the critical importance of technology in delivering the emissions cuts required to meet the government's climate change targets. This brief outlines the urgent need for a high level of commitment to low-carbon technologies and identifies the key components needed to ensure the right technological solutions are developed and deployed to allow the UK to be a world-class low-carbon leader. These are:

- Establishing low-carbon technology as a national priority
- Fast-tracking existing technologies to full deployment
- Focusing longer-term research on low-carbon 'technology families'
- Streamlining business support through the whole research and development (R&D) lifecycle
- Enabling public procurement to aid technology demonstration and avoid 'lock-in'
- Securing the right skills set to capitalise on low-carbon opportunities.

The UK has a tradition of innovation with a strong presence of a number of R&D intensive sectors, including pharmaceuticals and aerospace. With increasing globalisation the UK needs to capitalise on its ability to add high levels of value, in what the Sainsbury review[2] described as a 'race to the top'. Low-carbon technologies offer an opportunity for the UK to enter and lead in new markets estimated at $1trillion, but there is currently a general lack of ambition and vision on how to achieve this, and the UK is in danger of missing the opportunity altogether.

Establishing low-carbon technology as a national priority

Government and business have both highlighted the role of technology in delivering a low-carbon future, but confused messages and a lack of direction and ambition are preventing the UK taking advantage of these opportunities. A much stronger link between the UK's climate change and innovation objectives needs to be established quickly. Without this the UK is in danger of being overtaken by other countries in key low-carbon technology markets.

CBI on **climate change**

In the longer term, a robust price for carbon in the market will act to pull through new technologies. In the meantime, however, stronger signals need to be sent through increased investment by government and business in achieving low-carbon objectives and in overcoming barriers to the take-up of these technologies. Focusing more of the UK's R&D spend on climate change solutions and fast-tracking known low-carbon technologies are two ways of linking the climate change and innovation agendas.

Escalating the proportion of R&D spend on low-carbon technology

The UK is currently an average investor in R&D (**Exhibit 1**), with government and business contributing at relatively similar levels in comparison with other countries (**Exhibit 2**). Government R&D spending is set to increase to an average EU target of 3% GDP by 2010 following the agreement of the Lisbon Agenda to promote competitiveness in 2000, and it is essential that this commitment is met. Business will also need to invest more. While current economic constraints could make significant increases in overall R&D spending difficult to achieve, there are opportunities for making better use of existing capacity.

In order to meet the UK's demanding targets of 15% renewable energy by 2020 and 80% CO_2 reduction by 2050 public and private spending on R&D for low-carbon technologies will have to increase significantly. Spending on defence R&D is nearly 30% of the government's total R&D budget, equivalent to a purchasing power of around £2.6bn. Our ambition should be to match this level of R&D funding for low-carbon technologies. The Stern review[4] on climate change showed that investment to reduce carbon emissions now will be more cost efficient than delaying spending. Many of the key technologies are already known and priority should be given to bringing these into service.

Demonstrating and deploying known technologies

Analysis conducted by McKinsey for the CBI climate change report identified the key technologies that will allow the UK to meet its long-term carbon reduction objectives. The four areas where these technologies will deliver the most carbon reduction are: buildings, energy production, transport and industrial processes. There is general consensus on what the main technologies to 2020 are going to be. There are several reasons why these technologies are not already in use and we are expecting recommendations from the government's Climate Change Committee at the end of 2008 on how the UK can bring them forward. Where low-carbon technologies have yet to reach commercialisation, bringing them to the market should be a priority and we would like to see low-carbon technologies that can be taken up within the next ten years fast-tracked and receive a disproportionate amount of R&D funding.

Exhibit 1 **R&D expenditure of selected countries in 2006 (OECD)**[3]

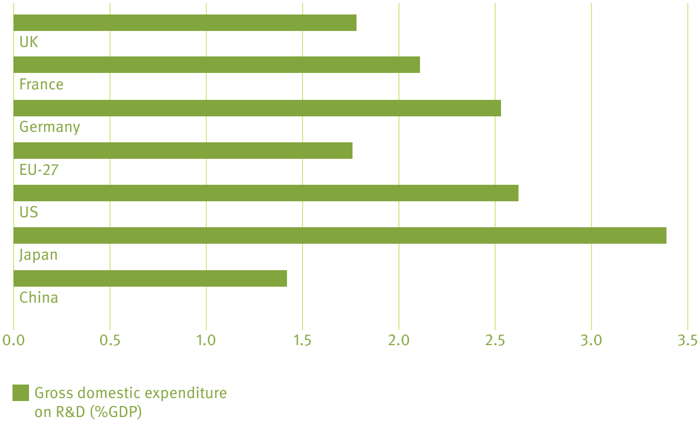
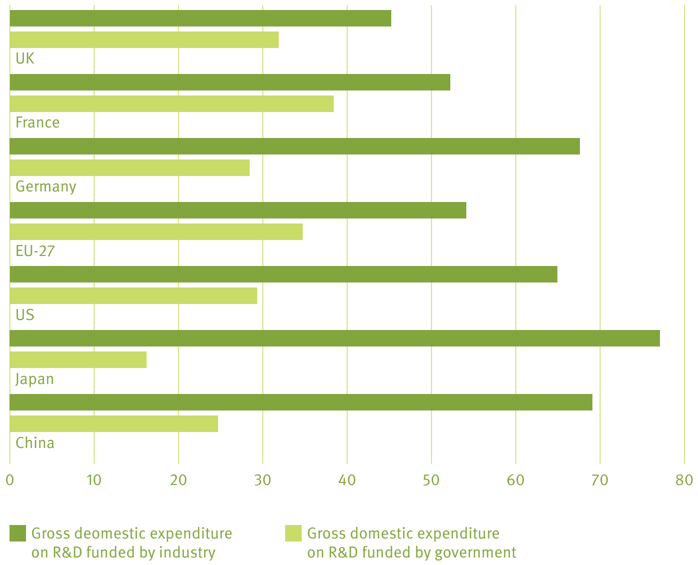


Exhibit 2 **Contribution of government and industry to R&D expenditure (OECD)**



Possible fast-track candidate technologies:

- New generation offshore wind – size, scale, construction, maintenance
- New generation biofuels – incorporating environmental and social criteria
- Application of ICT – to logistics, buildings, power management
- Building lighting and cooling – increased efficiency, building design
- Increased efficiency vehicles – engine and non-engine measures.

Nurturing longer-term technology families

In the longer term, it is clear where carbon savings can be made, but assessing which individual technologies will deliver these savings is less clear. Funding to bring such technologies forward is still crucial, but care must be taken not to direct resources into specific technologies too early i.e. to try to pick a winner at an early stage. Focusing longer-term research on low-carbon 'technology families' will reduce the risk of failure overall, while still aiming for a low-carbon outcome. Focusing on technology families will enable investment in areas where there are real opportunities for the UK to add value and develop expertise: we should aim to be global leaders in key low-carbon technology families.

Examples of low-carbon 'technology families':

- Alternative fuels – biofuels, methane
- Energy storage – batteries, capacitors
- Energy management systems – software, user interfaces
- Vehicle technology – fuel efficiency, hybrids, hydrogen
- Electrification – vehicles, rail
- Carbon capture and storage – pre and post combustion, geological and marine storage
- Marine power – wave and tidal
- Agricultural technologies – biomass use, more efficient carbon sequestration.

Technology family in detail: carbon capture and storage (CCS)

CCS is a family of technologies with methods for capturing, transporting and storing carbon that could be applied to a range of processes producing carbon including energy generation and large-scale industrial processes. These component technologies are at various stages of technological maturity, from the research stage for some storage technologies, to full commercialisation for transportation.

The government has already committed to a UK demonstration project for CCS, but a second demonstration project in the UK, together with others in other EU member states will be required to bring whole CCS systems to the commercial market. The European Technology Platform for Zero Emission Fossil Fuel Power Plants (ZEP) estimates that to fund 12 EU CCS demonstrator projects by 2015 will carry an incremental cost of at least €6-10bn compared to conventional non-CCS plants. Although by no means low cost, CCS is a technology family allowing the UK and the EU to export expertise to reduce international CO2 emissions in countries with a heavy reliance on fossil fuels. The UK could lose out on CCS-related opportunities if it does not gain the experience of hosting more than one demonstrator project.

Recommendations to government:

- Escalate the UK's total R&D spend to 2010 in line with the EU Lisbon Agenda on competitiveness.
- Department for Innovation, Universities and Schools (DIUS) and HM Treasury should set up a process to fast-track funding through existing organisations to known low-carbon technologies which will deliver carbon savings in the next ten years.
- Focus longer-term research on low-carbon 'technology families' where the UK can be a world leader by making a low-carbon economy a priority for innovation policy. DIUS and other relevant departments such as the Department for Energy and Climate Change (DECC) and the Environment Agency (EA) should agree on long-term low-carbon objectives.

The CBI will:

- Publish low-carbon roadmaps for buildings, energy production, transport and industrial processes in early 2009 bringing together the need for uptake of existing efficiency technologies, development of new technologies, and the political landscape in which decisions are made.
- Support government and business in identifying low-carbon opportunities where the UK can become a centre of expertise and global leadership (with a CBI report on opportunities to follow in 2009).

It is essential to establish a strategic commitment to the development of low-carbon technologies and focus resource on areas where the UK can lead the world. But, there are also specific areas where action should be taken to reduce barriers to and improve the uptake of low-carbon technologies. These include streamlining business support, making public procurement outcome-focussed and ensuring the UK has the right mix of skills.

Streamlining business support through the whole R&D lifecycle

Adequate funding of R&D is crucial if low-carbon technologies are to deliver real carbon savings, but the availability of funding varies across the R&D lifecycle (**Exhibit 3**). The Sainsbury review of the government's science and innovation policies in 2007 showed that the main investment gaps are in securing the initial capital and in the development/ demonstration stage. Government support is crucial in determining where investment occurs, but navigating the business support landscape can be complex. Venture capital investment is often key to bridging these gaps, but can also be difficult to obtain.

The CBI has been working with the Department for Business, Energy and Regulatory Reform (BERR) on streamlining business support particularly in the energy sector. We will continue to do so for other sectors and to make obtaining business support easier, especially for SMEs.

Recommendations to government:

1 BERR must continue to streamline business support, minimising funding gaps and ensuring cross-sector coverage, building on the work already completed on the Environmental Transformation Fund.

The CBI will:
- Continue to work with BERR on the streamlining of business support.

Key elements of current business support for energy innovation:

- Technology Strategy Board – provide R&D funding across a range of innovation platforms
- Research Councils – provide funding for academic research of around £2.6bn a year
- R&D tax credits – up to 150% tax relief for companies on R&D activities
- Energy Technology Institute – public-private partnership to develop practical solutions to energy problems
- Carbon Trust – government- funded company investing in low-carbon technologies
- Environmental Transformation fund – government fund to bring forward the development of low-carbon energy and energy efficient technologies
- Government departments: including BERR and DIUS, set objectives and funding levels
- European Union – funding available through a range of initiatives and strategic direction eg on CCS demonstrators
- Regional Development Agencies – regional funding and incentives available.

Exhibit 3: **The R&D lifecycle – overlapping elements of government support by technology readiness levels (from BERR)**

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<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th></tr>
<tr><td colspan="2">Basic research</td><td colspan="3">Applied research & development</td><td colspan="2">Demonstration</td><td colspan="2">Pre-commercial deployment</td><td>Commercialisation</td></tr>
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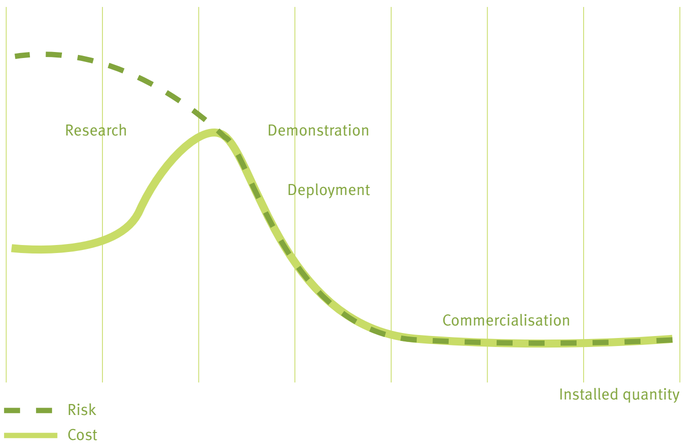
Enabling public procurement to aid demonstration and avoid 'lock-in'

The government spends around £150bn a year on product and service procurement. Public procurement can act to pull pre-commercial technologies through to commercialisation, although in general it is a notoriously risk-averse process. In some sectors high levels of regulation mean technology choices are severely restricted and mixed messages leave product and service providers finding it difficult to offer the most sustainable options.

The CBI Climate Change Task Force report singled out the demonstration phase as a point at which technologies often falter (**Exhibit 4**), a risk which could be reduced through an increased role for public procurement in large-scale technology demonstration for example in low-energy lighting or building energy management systems.

Exhibit 4: **Risks and cost of bringing forward technologies**

The largest cost of developing technologies is often at the demonstration phase



Putting increased emphasis on the outcome and future benefits, as opposed to the initial expenditure would enable public procurement to exert an increased pull for low-carbon technologies, without requiring additional expenditure. Indeed the whole-life cost of many projects could be lower. Supporting pre-commercial technologies in this way will help to meet low-carbon R&D funding ambitions.

The UK government has committed to being among the leaders in the EU on sustainable procurement by 2009, and has already set itself targets in relation to buildings and cars. While many Whitehall departments are well on their way to meeting short-term efficiency targets, longer-term targets and how to achieve them are less well defined. This creates uncertainty among businesses working with public procurers as to what might be required in the future.

In highly regulated sectors such as energy and water, technological specifications can be restrictive. Technological options available for example the uptake of energy efficiency measures in the water sector are often limited by the regulations governing how companies can invest. This over-specification can lead to technology lock-in where it is virtually impossible for new technologies or services to break into the market. Regulators such as Ofgem and Ofwat must be engaged in the debate to ensure this barrier is overcome.

Recommendations to government:

- HM Treasury should work with the Office of Government Commerce (OGC), which is responsible for public procurement, to move away from an emphasis on initial capital investment towards focusing public procurement on outcomes and long-term overall benefits
- The Treasury, OGC and other relevant departments such as DECC and the EA and regulators including Ofgem and Ofwat should work together to clarify longer-term objectives for 'green' public procurement and set appropriate targets including demonstrating new technologies.

The CBI will:

- Engage with relevant regulators such as Ofgem in the development of the CBI's low-carbon roadmaps
- Highlight the opportunities for business in low-carbon innovation in a report in 2009
- Continue to call for an outcome-focused approach to public procurement as part of the CBI's public service reform campaign.

Securing the right skills set to capitalise on low-carbon opportunities

Transition to a low-carbon economy provides opportunities for developing 'green jobs'. It is estimated that by 2050 the low-carbon energy sector could employ more than 25 million people worldwide and that if the UK maintains its share of global growth there could be over a million people employed in environmental industries in the next two decades. But does the UK have the skills to attract and keep these jobs?

The CBI 2008 education and skills survey shows that 53% of employers are not confident they will be able to access the skills required to meet their future recruitment needs. In specialist sectors, such as energy, this increases to 73%. The Climate Change Task Force identified the need for workforce skills to be developed across the economy. There are three main areas where action should be focused: science, technology, engineering and maths (STEM) skills, Technical skills, and business skills.

STEM skills

The shortage of graduates with STEM qualifications has been noted for a number of years. The survey found that 59% of employers were having difficulties recruiting individuals with STEM skills. The CBI has set out a five point plan to encourage uptake of STEM courses but this needs to be accompanied by a general 'greening' of further and higher education to allow students to take advantage of opportunities presented by the move to a low-carbon economy.

Five point plan for STEM uptake:

- Automatic opt-in to triple science GCSE – to improve the uptake from current low levels
- Improve school science facilities and make the commitment a reality – the Government is currently behind schedule on its Building Schools for the Future programme
- Upgrade careers advice – one-to-one advice could help address misconceptions about studying maths and science
- Timetable specialist teachers to deliver triple science – financial incentives should also help increase the number of specialist science teachers, making timetabling easier
- Offer financial incentives – up to £1,000 towards tuition fees would show the national importance of STEM skills.

Technical skills

A low-carbon economy will require new technical skills, such as the maintenance of offshore wind installations and the redeployment of existing skills – in building refurbishment, for example. Although the UK is generally well placed in terms of these skills, improved training for technicians which can adapt to future skills requirements needs to be available. Education providers need to work with business to see that relevant skills requirements are anticipated and provided to allow the UK to take advantage of identified low-carbon priority areas.

Business skills

Low-carbon products and services could be impeded by a general lack of entrepreneurial activity. This is an area where the US in particular consistently ranks ahead of the UK and despite the lack of regulatory drivers towards reducing carbon emissions, there is still considerable innovation in that area in the US. Government, business and education providers need to work together to encourage an interest in business and to promote entrepreneurial activity.

Recommendations to government:

- DIUS to continue to focus on the uptake and development of STEM subjects in the curriculum
- Work with education providers and business to ensure technical training courses anticipate future skills requirements to deliver low-carbon opportunities for the UK

The CBI will:

- Continue to push for increased uptake of STEM subjects in the education system
- Publish low-carbon roadmaps which will identify where skills shortages could stand in the way of delivering low-carbon technology
- Use the CBI Higher Education Task Force to promote links between higher education providers and business which will benefit entrepreneurial activities
- Emphasise the importance of attracting and retaining STEM graduates for a low-carbon economy and ensue suitable career opportunities are promoted

Footnotes

1 *Climate change: everyone's business*. A report from the CBI Climate Change Task Force. 2007. http://www.avtclient.co.uk/climatereport/

2 *The race to the top: a review of Government's science and innovation policies*. 2007. http://www.hm-treasury.gov.uk/independent_reviews/sainsbury_review/sainsbury_index.cfm

3 OECD Main Science and Technology Indicators. Volume 2008/1 ISSN 1011-792X

4 *The Stern Review on the Economics of Climate Change*. 2006. http://www.hm]treasury.gov.uk/Independent_Reviews/stern_review_economics_climate_change/sternreview_index.cfm

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Climate change: everyone's business

The CBI climate change board: building a low-carbon economy

The CBI climate change board was set up in 2008 to deliver the commitments set out in the CBI 2007 climate change taskforce report 'Climate change: everyone's business.' The report recognised that government, business and consumers all have a role to play in making the shift to a low-carbon economy. The board brings together senior business leaders from a range of sectors to demonstrate business commitment to managing the risk of climate change by:

- promoting business-led policy solutions to realise carbon savings
- showcasing business opportunities for green growth
- leading by example on corporate commitments to manage carbon footprint
- monitoring progress by government and business in realising the UK's carbon targets
- influencing a post-2012 international climate change agreement.

www.cbi.org.uk/climate change

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