

Low Carbon Energy Technologies

Summary

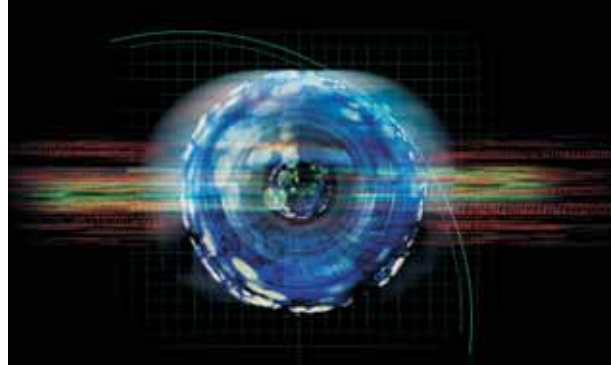
The challenge of moving towards a lower carbon economy requires us to develop a portfolio of low carbon energy technologies for the electricity, heat and transport markets.

This competition will support a relatively broad portfolio of low carbon technologies that will focus on specific barriers, which our analysis indicates will need to be addressed if we are to accelerate the development of these technologies. The programme includes a range of renewable technologies, along with hydrogen and fuel cell technologies, intelligent grid management and carbon abatement technologies. An indicative £10 million of Government funding has been allocated for Collaborative Research & Development projects in these areas.

The Technology Programme funding is part of a broader range of support from Government for these technologies. Where applicants refer to other related work supported by public funds e.g. Carbon Trust, they should provide enough detail for assessors to understand how the proposed R&D is complementary – in particular covering the outputs, timescales and funding – and noting that the assessors may not have access to such data when assessing their proposal. Proposals should not seek to duplicate work which is also being supported through the Carbon Trust.

Background

The Stern Review, published in October 2006, makes a strong economic case for taking action now to stabilise CO₂ levels in the future and makes clear that the targets of reducing CO₂ by 2050 will not be achieved using existing technologies alone. It flags technology development as a key action necessary to achieve stabilisation and clearly highlights that direct Government support is needed to deliver new technologies in the short to medium term.



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**SUCCEEDING
THROUGH INNOVATION**

Low Carbon Energy
Technologies

COLLABORATIVE RESEARCH
AND DEVELOPMENT



The Government is committed to stimulating the development and deployment of these technologies, which, as well as contributing to the UK's climate change goals and energy security goals, also represent major business opportunities for the UK with new markets being created in low carbon technologies and other carbon goods and services, with the potential to be worth hundreds of billion of dollars each year.

Scope of Applications

INTELLIGENT GRID MANAGEMENT AND ENERGY STORAGE

As new renewable and other generating technologies are developed with operational characteristics quite different from conventional plant, innovative integration technologies and techniques will be required in order to ensure that network assets are effectively utilised, connections can be made in a timely fashion. In addition there will be a need to manage the implications of integrating substantial amounts of variable-output and dispersed generation technologies at system level, to ensure that these implications do not impact negatively on system integrity and can be managed in the most cost effective fashion.

The priorities for R&D support for Intelligent Grid Management and Energy Storage are:

1. Innovations that maximise the utilisation of existing transmission and distribution assets in the face of the increasing deployment of new generating technologies with diverse operating characteristics and profiles.
2. Innovations that can facilitate the timely connection of new generation, while maintaining levels of system security and minimising the impact of constraints.
3. Innovations that can minimise the impact of energy losses.

4. The management of the impacts of variable output caused by intermittency etc at a system level, including the application of electrical storage and demand side measures, including 'smart appliances'.
5. The cost-effective integration of both onshore and offshore generation technologies, including innovation to permit the delivery of Grid Code requirements in the most cost-effective fashion.
6. The cost effective integration of micro generation technologies.
7. Innovation in low carbon network equipment, design, management, operation and control, including the development of active management systems and methodology.

CARBON ABATEMENT TECHNOLOGIES

The Carbon Abatement Technology Strategy (<http://www.dti.gov.uk/energy/sources/sustainable/carbon-abatement-tech/techstrategy/page19434.html>) set out how fossil fuel based technologies can be used in the transition to a low carbon economy. The report focused on three groups of technologies; cleaner combustion technologies, fuel switching to lower carbon alternatives and carbon capture and storage.

Although components of CCS are already in use the technologies have not yet been demonstrated together as a complete system and at full scale power plant. Research and experience to date indicates that CCS will work, but demonstration is needed at full scale from capture through to geological storage deep beneath the North Sea. If considered to be feasible, it is not expected that a demonstration plant will be up and running before 2014 and so significant R&D support will be required in the meanwhile.

The priorities for R&D support for Carbon Abatement Technologies are:

1. Improving the efficiency of existing technologies such as pulverised fuel boilers and generating turbines.

2. Develop CO₂ compression and handling technologies for subsequent transport and storage.
3. Developing further gasification technologies as well as developing newer technologies with the future potential for low to zero emissions such as oxy-fuel firing.
4. Developing further CO₂ capture technologies to enable them to handle large volumes of emissions.
5. To develop further technologies for the monitoring and verification of geologically stored CO₂.

HYDROGEN AND FUEL CELL

Proposals are sought for innovative and collaborative research and development projects which will address the key development issues that affect the commercial prospects for the achievement of a hydrogen economy and/or the widespread deployment of fuel cells.

There should be particular emphasis on the supply chain and the planned route to commercial exploitation of the results in the UK and Europe. In addition, proposals must also explain how the work would fit into the overall context of R&D across the EC and the priorities of Framework Programme 7. Proposals that would form part of wider collaborations under the EC's Framework Programme 7 will be welcomed. (However proposals to the Technology Programme must still include at least two UK organisations.)

The priorities for R&D support for Hydrogen and fuel cell are:

1. Development of novel materials and systems for hydrogen storage, capable of high volumetric and gravimetric hydrogen content, with low cost and high energy efficiency. In particular, these storage systems must offer the prospect of operating temperatures and pressures that would make them suitable for ready integration with automotive fuel cell systems.
2. R&D into novel, more durable and lower cost materials, manufacturing processes and components for hydrogen electrolysers and fuel cell systems. (For direct methanol fuel cells, development target parameters must include low methanol crossover).
3. Development of innovative components and stack designs that increase the operating temperature and performance of PEMFCs, for improved efficiency and simplified system design.
4. System development for advanced fuel cells focussed on real-world automotive and CHP (combined heat and power) applications.
5. Design, construction and evaluation of efficient, low cost hydrogen production systems suitable for on-site vehicle refuelling.

For any of the above priorities, the outline proposals **must** include numerical development targets for the project, together with the relevant performance and cost targets for the ultimate application.

RENEWABLES

Wave and Tidal Stream

It is proposed to include wave and tidal stream in the current call to help further understand and improve the prospects for wave and tidal stream energy.

The priorities for R&D support for Wave and Tidal Stream are:

1. Proposals for the development and evaluation of generic technologies; such as installation techniques, operation and maintenance techniques, mooring or fixing techniques and so on likely to contribute to cost reductions or performance enhancements of marine energy facilities.
2. Proposals for R&D projects to reduce the cost and enhance the power capture of existing device concepts, for example by the use of new materials, control systems, power take off mechanisms.



3. Proposals for R&D projects to conduct full or near-full scale prototype deployment at sea of device-concepts that have completed a programme of laboratory scale (for example 1/3rd) tank testing and detailed techno-economic modeling and are sufficiently promising to indicate that the device-concept would deliver a significant step-change in cost of energy compared to current leading devices.
 4. Proposals for R&D projects to conduct detailed laboratory-scale tank testing and detailed techno-economic modelling on device concepts that have had an initial desk-based evaluation study and that are sufficiently promising to indicate that the device-concept would deliver a significant step-change in cost of energy compared to current leading devices.
2. Proposals to reduce costs through enhancing reliability or making maintenance of offshore turbines easier are invited, including remote control and monitoring solutions as operation and maintenance costs offshore remain high.
 3. The move to larger turbines offshore will also increase the weight of machines so proposals that seek to reduce costs through design and materials that will lead to improvements in weight saving, speed of installation and performance and reliability are sought.
 4. Proposals that seek to mitigate the interaction of wind turbines and radar (including air traffic control mitigation solutions) as this remains a key barrier to both onshore and offshore development are sought.

Proposals that include collaboration between at least two or more existing device developers will be particularly welcomed. Proposals should not seek to duplicate work which is also being supported through the Carbon Trust. Proposers should include robust evidence for any costs and performance of devices stated in the proposal.

Offshore Wind

Offshore Wind Offshore wind is one of the key technologies with the potential to contribute to the growth in renewable energy to meet the UK's 2010 target of 10% of generation from renewable sources and the 2020 aspiration of 20% of generation. The development of offshore wind in the UK should create world-class capabilities and the UK has the opportunity to maximise its share by encouraging other countries to promote wind development on the basis of successful projects demonstrated in the UK.

The priorities for R&D support for Offshore Wind are:

1. Proposals that seek to reduce the high costs of transporting and installing wind turbines in the sea, including innovative solutions to reduce the cost of expensive marine foundations.

Microgeneration/Photovoltaics

Many microgeneration technologies are well understood mature technologies. This competition invites proposals that seek to tackle barriers to the development of a whole systems approach to integrating microgeneration in buildings.

This competition also invites proposals focused on photovoltaics specifically, and in particular research that could lead to large reductions in the cost or significant improvements in cell efficiency. We are also for the first time encouraging a joint transnational pilot project between researchers in different European member states under the PV ERA NET. This pilot will focus on the field of polymer solar cells. (However proposals to the Technology Programme must still include at least two UK organizations).

The priorities for R&D support for Microgeneration/Photovoltaics are:

1. Proposals which seek to tackle barriers to the development of a whole systems approach to integrating microgeneration in buildings. We are particularly seeking proposals which facilitate how different microgeneration technologies work together in order to aid efficient provision of heat and/or electricity from more than one technology.

2. Research that could lead to large reductions in the cost of crystalline silicon PV modules, such as new techniques for growing or processing crystalline silicon, or significant improvements in cell efficiency
3. Process development for thin and/or large area wafer that could lead to lower cost/improved performance.
4. Research into new types of PV cells, with a focus on improved cost, efficiency and stability, including:
 - Low-cost, high-performance TCO materials for thin-film cell designs.
 - Sensitised-oxide-based and other nanostructure solar cells and modules.
 - Organically sensitised cells and modules.
 - Novel conversion concepts for super-high efficiency and full spectrum utilisation.
 - Novel ultra low-cost approaches.
5. Research on polymer solar cells (joint transnational pilot, see above)

Bioenergy

The development of viable, cost-effective fuel supply chains, and the subsequent use of energy crops in conversion processes, is essential to any substantial and long-term development of bio-energy in the UK. It is equally important to reduce the current high level of capital and operating costs to improve the viability of bioenergy projects under the Renewables Obligation, and to improve the overall efficiency of resource usage.

The priorities for R&D support for Bioenergy are:

1. advanced biomass conversion technologies with high electrical and overall efficiencies that will significantly improve the cost effectiveness of combined heat and power in process and space heating/cooling applications;
2. Underpinning research that will improve the understanding of how biomass fuels, and mixtures of fuels, behave in combustion and other thermal processes used for heat and electricity production, and how their physical and chemical properties impact on the reliability and performance of practical equipment;
3. viable, cost effective supply chains – including energy crops and wastes/co-products;
4. biomass processing concepts that improve the overall efficiency of utilisation of biomass feedstocks by the integrated manufacture of renewable fuels, chemicals and energy;
5. production of next generation transport biofuels by thermo-chemical routes and biological processes using ligno-cellulosic feedstocks. [not the impact of these fuels on engine performance]

Funding Allocation and Project Details

The Technology Strategy Board advises on the selection of priority technology areas and the allocation of funding for the Technology Programme. The Technology Strategy Board is currently being established as an executive non-departmental public body and will in future be responsible for the development and delivery of the Government's programme of technology support, including the Technology Programme.

These are significant challenges. Proposals that address the above technology areas are sought for Collaborative Research & Development projects. Applicants should offer credible teams who have the necessary scientific and industrial skills and financial resources and who demonstrate a commitment to longer-term development.

Proposals should include the following:

- describe the current state of the art and quantify the economic improvement that the innovation would deliver if successful.
- critical development issues, thereby offering significant prospects for improving our understanding of the potential of these technologies improving their economic attractiveness
- provide simple energy balances and economic projections.



- demonstrate technical advantages over competing approaches and good prospects for sustainable business in the UK.
- robust evidence for any costs and performance of devices stated in the proposal.

Assessors will be looking for clearly identified industrial application and/or commercial potential for the UK.

An indicative £10m of Technology Programme support has been allocated to Collaborative Research and Development projects that address one or more of the areas indicated above and involve science-to-business and business-to-business interactions.

Typical projects would have 2-3 year duration, require support around £500k-£2m, although no project will be rejected on the grounds of size alone, and generally aim to implement significant business change in a 5-7 year time frame rather than shorter-term payback. Larger projects will be considered but the case must be exceptional. In particular we would encourage projects that can demonstrate benefits to a number of business sectors, and ideally should include at least one partner with defined end-user needs.

Contacts

If you have any queries about this technology area, please contact Jonathan Gibbard at AEA Energy & Environment (programme managers for the low carbon energy competition) on **0870 190 2926** or jonathan.gibbard@aeat.co.uk

For general enquiries about the application process please contact the helpline on **01355 272155** or email info@technologyprogramme.org.uk

Key Dates

Competition opens: 24 April 2007

Competition event in London - 25 April 2007. For more information about this and other events use the web address below.

Low Carbon event in London - 10 May 2007.

Deadline for registering your intention to submit an application: 11 June 2007

Deadline for all Academic Finances through the Je-S systems: 14 June 2007

Deadline for all Outline applications: 18 June 2007

Full stage opens: 16 July 2007

Deadline for receiving full stage applications: 11 September 2007

Decision and feedback to applicants: October 2007

For details on how to register and apply go to:

<http://www.dti.gov.uk/innovation/technologystrategy/index.html>

Additional funding from EPSRC may be available for projects where there is a significant high quality academic component and in particular for those projects that demonstrate added value to its existing portfolio; by building on or being complementary to existing research programmes.

Projects can range from small, highly focused basic research aimed at establishing technical feasibility, though to applied research, and to experimental development projects. It is anticipated that most of the funding will be allocated to proposals in the applied R&D (attracting 50% public funding) or experimental development (25% public funding) categories. Projects involving industry oriented basic research (75% public funding) will also be considered but a robust case must be made to support the requested level of funding. Definitions of the above categories of research can be found in the Guidance for Applicants – see <http://www.dti.gov.uk/innovation/technologystrategy/index.html>

The Technology Strategy Board will require all projects to provide a non-commercially confidential summary, at the start and the conclusion of the project, for dissemination.