

THE TECHNOLOGY PROGRAMME
SPRING 2006 COMPETITION FOR FUNDING

Emerging Energy Technologies: 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. 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 a major business opportunity for the UK, as global demand for these technologies is set to expand significantly in future years.

This competition will support a relatively broad portfolio of low carbon technologies but 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 portfolio includes a range of renewable technologies, along with hydrogen and fuel cell technologies, intelligent grid management and carbon abatement technologies. An indicative £15 million of funding has been allocated for Collaborative Research & Development projects in these areas. Additional funding from EPSRC is also 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.

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



Scope of Applications

Intelligent Grid Management and Energy Storage

Fundamental changes to the nature of the UK electricity networks will be required in order to meet the challenges of the future. The introduction of new dispersed generating technologies together with the deployment of significant amounts of renewable sources with variable output will over time require major changes to the way our electricity networks are designed, operated and controlled.

The costs and complexity of the changes involved could present a major barrier to the deployment of new generating technologies and the achievement of the Government's environmental targets and aspirations. It is therefore essential that innovation plays its full role in addressing the challenges of accommodating a radically changed and dispersed generation portfolio having diverse operating characteristics and often connecting in remote or inconvenient areas from a network point of view. Responses to these challenges will need to be effective, cost efficient and have the potential to at least maintain traditional levels of demand security and network resilience.

Proposals are therefore invited which seek to address the technical, regulatory or commercial implications of connecting significant amounts of dispersed generation, both large and small, to the electricity networks and managing the consequences as seen at both a local network and "system" level. Concepts might include the application of intelligent metering, automated and intelligent network control devices or strategies. Proposals are also sought which quantify or propose means of dealing with the consequences of connecting large amounts of generation with variable output to the electricity networks, either onshore or offshore. These consequences might include increased reserve of capacity

requirements, rapid and significant variations in generator output and power transfers together associated with the impact of weather systems etc. Proposals which involve the development or application of distributed or utility-scale storage technologies to mitigate the implications of an increasingly diverse generation portfolio would be particularly welcome, as would proposals that involve the development or deployment of demand side measures to counter the growth of generation with more variable output.

Hydrogen and fuel cell applications

Proposals are sought for collaborative research and development projects which will address the major techno-economic barriers to the deployment of fuel cells and hydrogen energy.

Research and development is required to address each of the key stages in hydrogen deployment: production, distribution and storage. For example, improvements to the efficiency of hydrogen production on a small scale (either using electrolysis or reformation) would allow the cost-competitive production of hydrogen at retail sites, greatly facilitating the introduction of hydrogen powered vehicles. Distribution, whether by road or by pipeline adds substantially to the cost of delivered hydrogen, and hydrogen embrittlement is a significant issue. The currently commercial methods for storing hydrogen (compressed gas or cryogenic liquid) do not provide sufficient on-board capacity to provide vehicles with the range demanded by consumers, so R&D on solid state hydrogen storage materials is required.

Fuel cells remain too costly, except for niche applications, and improvement to stack lifetimes are required in order for fuel cells to compete with the well developed incumbent technologies for power generation and automobile propulsion.

So R&D to address the fundamental issues such as reduced catalyst loadings, the substitution of cheaper materials with increased performance, and design for volume manufacturing is required in order to address these barriers. There should be particular emphasis on the supply chain.

The priorities are:

- Design, construction and evaluation of efficient, low cost hydrogen production systems suitable for on-site vehicle refueling.
- Design, construction and evaluation of advanced fuel cell systems in real-world applications.
- Development of novel, durable and lower cost materials, manufacturing processes and components for hydrogen storage, hydrogen electrolyzers and fuel cell systems. (For direct methanol fuel cells, development target parameters must include low methanol crossover).
- Development of components and stack designs that increase the operating temperature of PEM fuel cells for improved efficiency and simplified system design.

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.

Carbon Abatement Technologies

The UK's Carbon Abatement Technologies Strategy Report (www.dti.gov.uk/energy/coal/cfft/catstrategy) outlines a Strategy for supporting the technical development and commercial deployment of Carbon Abatement Technologies both in the UK and globally. It sets out how fossil fuel based technologies can play their part in the transition to a low carbon economy. The report focuses on three groups of technologies; cleaner

combustion technologies, fuel switching to lower carbon alternatives and carbon capture and storage.

R&D proposals are invited in all three areas. Proposals that focus on the following technologies would be of particular interest:

- Combustion technologies that improve plant efficiency and reduce CO₂ emissions (CO₂ Capture Ready advanced supercritical/ultra-supercritical pulverised coal boilers, CO₂ capture ready IGCC, fluidised bed combustion, oxy-fuel firing which is CO₂ capture ready for example);
- More efficient turbine technologies (steam, gas and hydrogen);
- Co-firing with CO₂ neutral fuels (energy crops and other biomass);
- Carbon Capture Technologies, from pre or post combustion or oxy-fuel firing technologies;
- CO₂ transport and offshore geological storage (transportation, enhanced oil recovery, CO₂ storage and monitoring and verification technologies are of particular interest).

Renewables

Wave and Tidal Stream

Funding is available to help further understand and improve the prospects for wave and tidal stream energy.

Of particular interest, in order of priority will be:

- 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. Our preference is that such proposals should include collaboration with one or more leading device developers.

- 2) Proposals for R&D projects to reduce the cost and enhance the power capture of existing device concepts, for example through the use of new materials, control systems, power take off mechanisms and so on. By “existing device concepts” we mean ones that have already had a full or near-full scale prototype deployment at sea whose costs and performance are already established. Proposals should be to evaluate specified innovations and should not be of an exploratory nature intended to identify what these innovations should be. Ideally we would be looking for innovations likely to give large step change improvements compared with existing levels of cost and performance.
- 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 tank testing and detailed techno-economic modelling the results of which are sufficiently promising to suggest that the device-concept may have long-term commercial prospects. Proposals should include a rigorous programme of detailed monitoring of device energy output and resource energy input over a period of at least one full calendar year.
- 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 may have long-term commercial prospects. Techno-economic modelling should be based on a detailed costings using supplier quotations based on detailed drawings of an optimised design configuration together with estimates of power capture performance calculated using detailed mathematical models of device performance.

Offshore Wind

Proposals are sought for R&D projects that will accelerate cost reductions across all elements of the offshore wind farm value chain. The need to reduce the costs of offshore wind projects is one of the key factors in improving the economics of this technology and is essential to drive forward future investment in this sector.

In particular there is a pressing need to reduce capital and construction costs – this could be achieved by innovative proposals aimed at reducing installation time or reducing cost and risk.

Offshore development costs are currently higher than onshore due to the need for relatively expensive marine foundations and the high costs of transporting and installing at sea. Innovative proposals are invited for technological solutions that seek to reduce these costs.

Operation & Maintenance costs are also higher than expected for offshore wind projects and proposals for innovative solutions that seek to reduce these costs through enhancing reliability or making maintenance easier are also invited. This includes remote control and monitoring solutions.

In addition, the move to larger machines offshore using existing technology will increase the weight of machines. The need to reduce costs means proposals are invited where design, and materials, may lead to savings through improvements in weight saving, speed of installation and performance and reliability.

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. Lessons and innovations that may be applied from different industry sectors where the UK

has particular strengths – e.g. the offshore oil and gas industry and major civil construction works – may in particular apply here.

The interaction of wind turbines and radar remains a key barrier to both onshore and offshore development so proposals that seek to mitigate this problem are sought, including air traffic control mitigation solutions.

Microgeneration/Photovoltaics

Many microgeneration technologies are well understood mature technologies. However 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 projects focused on the barriers to improving the competitiveness of the cost of electricity that it generates. Projects in this area are therefore likely to focus on the identification, development and evaluation of novel materials and/or cell structures that offer prospects for significant improvements above current PV performance and generation costs, with the ultimate goal of achieving competitiveness with mainstream energy sources. More incremental technology developments will also be considered where they have the potential to offer significant reduction in the cost of electricity generated.

These are significant challenges. Applicants should therefore 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 demonstrate technical advantages over competing approaches and good prospects for sustainable business in the UK.

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 are therefore as follows:

- Research and development of 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;
- Research that will improve the understanding of how biofuels behave in combustion and other thermal processes, and how their physical and chemical properties impact on the reliability and performance of practical equipment;
- Research and development of viable, cost effective supply chains – including energy crops and wastes/co-products;
- Research and development of “biorefinery” concepts, to improve the value of biomass and encourage the integrated manufacture of renewable fuels and chemicals;
- Research and development of next generation transport biofuels [not replication of existing technologies].

Proposals should describe the current state of the art and quantify the economic improvement that the innovation would deliver if successful. Proposals should also provide simple energy balances and economic projections.

Funding Allocation and Project Details

An indicative £15m of funding 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. Additional funding from EPSRC is also 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 projects, aimed at establishing technical feasibility, through to applied research and experimental development projects configured to produce technology demonstrators. It is anticipated, however, that the majority of the total funding will be allocated to projects in the applied research category.

In this technology area, applications may fall into only one of two categories of projects.

Fast Track Applications

Applicants for projects that seek £250,000 or less of support may choose to be assessed against the Programme criteria in a "Fast Track" process or in a Two Stage process. Typically, Fast Track projects will be industry led and of no more than 2 years duration. Fast Track projects are likely to involve fewer collaborators and modest academic involvement. Applicants will use the "Outline" application form and applications will be assessed in a single-stage process. It is envisaged that up to £3million of the funding for this technology area will be allocated to supporting these projects.

Key dates:

Competition opens at launch event at Barbican Centre, London on 26 April 2006.

Deadline for registering your intention to submit an application: 12 June.

Deadline to submit an application: 19 June.

Applicants should expect a decision by 7 August.

Successful applicants will be expected to accept or decline any grant offer by 9 October.

Successful applicants will be expected to start their project by 8 January 2007.

Two-Stage Applications

All projects that seek in excess of £250,000 of support will be assessed against the Programme criteria in a two-stage process. Typically, such projects will be of 2-3 years duration and have a significant business contribution. The two-stage process will consist of an Outline Application and Full Application.

Key dates:

Competition opens at launch event at Barbican Centre, London on 26 April 2006.

Projects seeking excess of £8million public sector support must register their intention to submit an application by 24 May.

Projects seeking less than £8million public sector support have until 12 June to register their intention to submit an application.

Deadline to submit an outline application: 19 June.

Outline stage assessment decision: 18 July.

Deadline to submit a full stage application: 12 September.

Full stage assessment decision: 7 November.

Successful applicants will be expected to accept or decline any grant offer by 17 January 2007.

Successful applicants will be expected to start their project by 18 April 2007.

Competition Events

- 26 April 2006 Technology Strategy and Programme Information Day, Barbican Centre, London
- 4 May Technology Programme Partnering Event, Guoman Towers, London
- 10 May Technology Programme Partnering Event, Midland Hotel, Manchester

For more information and to register for these event, visit <http://www.dti.gov.uk/technologyprogramme/forthevents.html>

Contact

If you have any queries about the technical scope of the competition or the application process, please contact the Technology Programme helpline on **01355 272155** or email info@technologyprogramme.org.uk