# ACTIVITIES AND ACHIEVEMENTS QUESTIONNAIRE

## 1. Non-Technical Summary

A 1000 word (maximum) summary of the main research results, in non-technical language, should be provided below. The summary might be used by ESRC to publicise the research. It should cover the aims and objectives of the project, main research results and significant academic achievements, dissemination activities and potential or actual impacts on policy and practice.

The aim of this project was to understand how microgeneration might be deployed, and to explore policies to support investment by consumers and energy companies. The research was undertaken by an interdisciplinary team drawn from three universities: University of Sussex, University of Southampton and Imperial College. It was carried out in parallel with significant policy developments, notably the government Microgeneration Strategy, the Climate Change and Sustainable Energy Act and the wider Energy Review.

The research found that it was important for policy makers support a diversity of routes to microgeneration deployment, with incentives for both householders and energy companies. The project analysed three different models of microgeneration deployment to explore the possibilities and implications. This included 'Plug & Play' deployment by individual consumers wishing to assert their independence from established suppliers; 'Company Driven' deployment by incumbent energy companies that shift their focus towards the delivery of energy services rather than energy supply; and 'Community Microgrid' deployment as part of decentralised microgrids.

The project considered three micro-generation technologies: solar photovoltaics (PV), micro-wind and micro-combined heat and power (micro-CHP). It shows that the performance of these technologies is subject to wide variations. It is well known that solar PV's output varies with orientation – with south facing arrays performing best. Stirling engine micro- CHP units are more economic in large and/or inefficient houses that have high heat demand. Our calculations show that micro-wind is likely to be most economic in areas with an excellent wind resource such as rural or seaside locations – if installed in many urban areas, its performance will be poor. They also show that all of these technologies are likely to reduce $CO_2$ emissions significantly. However, uncertainties remain about the extent of these reductions for micro-wind and micro-CHP due to a lack of operational experience.

This project's economic analysis showed that microgeneration is not particularly attractive for consumers or energy companies under current conditions. Whilst economics are not the only driver for investment in micro-generation technologies, many consumers are put off by high up-front costs and the long payback times involved. Other factors that may discourage consumers from investing at present include the perceived risks of new technology, regulatory barriers such as the need for planning permission, and a lack of information.

Although many of these barriers are now being addressed, the research found that there are significant shortcomings in current policies for microgeneration, and in the

government's broader strategies to help consumers reduce their energy demand. These policies miss opportunities to support micro-generation as part of a broader shift towards demand reduction and consumer behaviour change. In particular, the research focused on two areas in which microgeneration and household energy saving investments suffer from an uneven playing field – the fiscal system and the market settlement system for electricity. The rationale for this is that removing anomalies might partly obviate the need for specific subsidies such as capital grants from the current Low Carbon Buildings Programme.

Levelling the playing field for microgeneration in these two areas could significantly improve the economics of microgeneration. Crucially, they combine lower up-front costs and financial rewards for exported power. This is achieved by allowing consumers and energy companies to offset investment costs against their tax bill, and by extending the settlement system so that exported electricity can be sold for the real-time market price. Whilst both reforms come with significant costs attached, they are potentially more accurate and durable than the alternatives. Furthermore, they also open up possibilities for wider engagement with consumers – for example through the installation of smart meters and information displays at the same time as the microgeneration technology itself. These could provide direct incentives for consumers to change their patterns of energy consumption and reduce demand.

The potential for a transition from energy supply to the provision of energy services has been discussed for many years. But a market for these services has yet to emerge in the domestic sector. Whilst Ministers trailed the Energy Review with promises to reform energy regulation to encourage this market, this is not likely to be implemented before 2011. The project concluded that the government and regulator should consider earlier implementation of these reforms to speed up more Company Driven models of microgeneration deployment which could form part of wider energy service packages.

Going further still, the advent of microgeneration has implications for the development of energy and related infrastructure. The project considered these wider energy system impacts by analysing the disruptiveness of each of its deployment models for different actors. For example, Plug & Play models of deployment suggest changes in consumer-supplier relationships as consumers become energy producers. Community Microgrid models are more disruptive since they suggest a system of energy provision that is different to the centralised model that prevails today.

The design of infrastructure such as buildings and energy networks has a direct impact on demand patterns and the scope for policy intervention. The project identified some key issues through a series of interviews with people from policy, industry and other actors. One area that was extensively discussed is metering. Smarter designs of meter are now available that can measure real-time imports and exports and can be linked to display systems for consumer feedback. Research has shown that such feedback can lead to reductions in demand through behaviour change. Microgeneration deployment presents an ideal opportunity to start the installation of these newer meters. The case for a national roll out of smarter meters should also reviewed since they could be seen as an essential element in a reoriented energy market based on services rather than supply.

There are significant opportunities to build microgeneration into new construction developments. The Climate Change and Sustainable Energy Act is important since it encourages local authorities to set targets for this. In addition, the research found that it will be desirable to include flexible service areas and space (eg as cellars) in new buildings so that future developments in micro-generation and home energy automation can be accommodated. If sustainable visions for larger developments such as Thames Gateway are to be realised, strong intervention is likely to be required by government. This is because such developments are substantially different from the UK's current energy system. In the absence of strong intervention, an opportunity for the implementation of more pervasive local energy systems based on Community Microgrid models linked to new district heating networks could be lost. Energy regulation has a role to play here too. The Registered Power Zone scheme developed by the regulator, Ofgem allows electricity network companies to experiment with new network concepts and recover costs from consumers. So far, the rules governing this scheme have proved to be too restrictive to rebuild capacity for innovation with the electricity network companies.

Overall, the research showed that microgeneration can make a potentially powerful contribution to a sustainable energy future – in terms of carbon reductions and wider social impacts. Microgeneration can be both a result of ongoing changes in existing energy systems and the cause of potentially radical change. Our research has also underlined the interdependence of technical, institutional and social factors that inhibit or enable the diffusion of sustainable technologies. Technically, energy networks will have to be able to cope with two-way flows. Policies, regulations and institutions will need to change and to acknowledge that the distinction between energy supply and demand is not as sharp for micro-generators. Finally, consumers could have a new position in the energy system – whether as hosts of microgeneration installed by company or as 'co-providers' of their own energy services.