Where is the sustainable innovation?

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Society needs energy. It would be hard to argue that the world would not have seen the rapid increase in economic activity during the twentieth century were it not for the use of concentrated fossil fuels and nuclear power. However, this has come at cost through emissions of greenhouse gases that inextricably link economic activity to global warming.

The question is what can be done to reduce the effects and the level of temperature rise anticipated by 2100. As the principal cause of global warming is the combustion of coal, oil and gas we should look at ways of reducing their use and there are two ways of doing this.

Firstly, reduce consumption. Ensure products and devices that use energy from domestic appliances to airlines are as energy efficient as possible throughout their life-cycle. This means not only the energy the product will use, but all the energy needed to create the product in the first place.

Secondly, produce energy from resources that do not contribute to global warming. Increasing the use of renewable energy, that is energy that can be obtained from the sun, wind, water and plants, is a means of helping to meet our energy requirements without causing any significant release of greenhouse gases.

Renewable energy is truly an example of sustainable innovation. Development over the last 30 years has led to the commercialisation of wind energy with wind turbines competing on economic grounds with fossil fuels. However, wind turbines are not the only solution and further development is needed to reduce the costs of other forms of renewable energy.

Research at Loughborough University's Centre for Renewable Energy Systems Technology (CREST) is investigating some of these challenges. CREST has been leading research into renewable energy for over 13 years with a particular focus on wind energy, integration of renewable energy into electricity distribution systems and photovoltaics (PV).

Whilst wind energy is now commercial, research at CREST is examining the resource potential of onshore and offshore locations through modelling air flow over complex terrains. CREST recognises the importance of the market for small wind turbines and research is supporting the development of novel small-scale wind turbines manufactured by local UK companies. CREST is participating in a project to assess the impact of climate change on the electricity supply industry. This project involves a case study on wind power generation focusing on the performance and structural response of large offshore wind turbines under extreme wind and wave loading.

The integration of renewable-energy powered generators into existing electricity networks presents many technical challenges. CREST has studied these in relation to systems ranging from sub-kilowatt PV arrays through to multi-megawatt wind farms. Efforts are now concentrated on the further development of methods that can accurately reflect the nature of electricity flow in distribution systems. Furthermore, stand-alone (off-grid) electricity systems remain important for innumerable remote sites worldwide, and CREST is currently developing renewable-energy systems that will dramatically reduce the use of diesel fuel at such sites.

There are two research groups in photovoltaics at CREST. The topics currently being investigated in the Systems Group emphasise the performance of PV from a long-term systems perspective. Research focuses on thin-film PV and its integration into buildings. The Materials Group is investigating silicon and other materials to improve the amount of sunlight converted and reduce costs. Both PV groups have recently received significant funding, leading in 2006 to the opening of the largest dedicated PV research facility in the UK. The facility represents a multi-million pound investment by Loughborough University, the Engineering and Physical Sciences Research Council, East Midlands Development Agency and the UK's PV industry.

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