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Editorial

Managing energy in the built environment: Rethinking the system

Climate change and energy security are high on political agendas worldwide, and the UK is no exception. Creating a sustainable, equitable and habitable built environment in an era of climate change is an especially difficult problem. And it is impossible to imagine a sustainable future that does not pay attention to the built environment. About half of UK's energy use takes place in towns and cities, and about a third in homes, whether urban, suburban or rural. Most people in the world live in towns and cities.

The recognition that fossil fuels do not offer a sustainable future pathway for the human race is entering the mainstream. However, recognising the challenge does not mean that the solutions are immediately clear. Governments, the private sector and societies in general disagree about the way forward. For that reason, the Foresight Programme of the Government Office for Science commissioned a project to examine the future of sustainable energy management and the built environment. Our aim was to explore how the UK built environment could evolve to manage the transition, over the next five decades, to secure, sustainable, low-carbon energy systems that meet the needs of society, the requirements of the economy and the expectations of individuals.

This special issue of Energy Policy brings together one strand of the project's work. It includes the comprehensive and diverse evidence base, assembled by the project. It comprises the commissioned State of Science reviews authored by a wide range of experts in science, engineering, energy, urban development and other topics.

Foresight projects are designed to take a long-term look at complex policy issues. Their final reports and the evidence are intended to help government think systematically about the future. While government is its main audience, Foresight also seeks to inform discourse and debate elsewhere: in business, academia and the voluntary sector.

In common with other Foresight projects, the Sustainable Energy Management and the Built Environment project (SEMBE) have used a wide range of experts from diverse disciplines to provide it with advice. A series of futures workshops, designed to develop a range of plausible but challenging scenarios for the built environment out to 2050, have also been central to the project. Over 60 participants from a very diverse range of backgrounds provided a rich source of material and ideas.

The State of Science reviews are not only a key component of the evidence base for the project. They are also an invaluable resource in their own right. As well as asking experts to summarise current knowledge, Foresight invites them to contemplate developments in the longer term, out to the year 2050 in this case. The broad scope of the project is reflected in the subject matter of the papers in this special issue, all of which have been peer reviewed by experts. To help make the papers more accessible to the reader, we have divided them into 10 groups, each containing between four and seven papers.

This special issue also includes 24 papers originally commissioned for a short project looking specifically at the full range of energy futures, especially energy generation in the future, carried out as a precursor to SEMBE in 2006. Some have been revised for publication here. Five of these papers are in the first section of this special issue, which is concerned with forms of large-scale energy generation in the future. They examine the long-term prospects for nuclear fission and fusion, and the possibilities of clean fossil fuel burning.

The second section consists of seven papers examining future means of storing and distributing energy. Future power networks are likely to be more intelligent and may use new technology such as fuel cells to store electricity, to accommodate the fluctuating nature of future renewable energy sources. In the third section the development of wind and other renewables, especially solar power and bioenergy, and the severe challenges for engineering that affect the practicality of offshore energy, is considered. The important question of how ownership of renewable technologies of the future will be organised is also posed. Might community groups, rather than large energy organisations, have a role?

Energy is generated to be used, and the fourth section of papers examines how energy use might change in the future. The arrival of smart metering may make it simpler to visualise and reduce energy consumption. At the same time, demand for services that use energy, such as heating and cooling equipment, appliances and ICT systems, has been growing. A better understanding of people's attitudes to energy-based services is needed.

The fifth section considers how the energy efficiency of existing buildings, both homes and commercial buildings, can be improved. Because the UK housing stock is renewed at a rate of only about one per cent a year, most of the homes we will be occupying in 2050, the outer time horizon of this project, already exist. So it is vital to improve their energy performance as well as building new homes to the highest standards.

The call to decarbonise our energy use comes at a time when centralised energy systems that have worked well for many decades are getting old. And suspicions are growing that the economies of scale that are claimed may be too narrowly drawn. In the sixth section we take this debate forward by examining the scope for decentralised systems to wholly or partly replace centralised systems.

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In the seventh set of papers we consider how buildings might be constructed in the future and the drivers that will influence their development. New materials and methods that might be used to create buildings in the future, and the forces that may encourage greener building practice are examined. This is followed by a consideration of the setting in which these buildings will exist. The built environment will need to adapt to a world that is warmer and wetter, where there may be damaging droughts, and where the cooling benefits of open space are more important. In this context the regulations that control the built environment will also have to change to help achieve greener towns and cities.

The remaining sections consider the businesses which currently supply energy in the UK and their customers. The first asks whether we can have economic growth with less energy use and how we might make the UK more innovative in energy technology. The second considers the way energy demand is changing in the UK, for example with the growth of the 24/7 culture and the energy needs of different types of built environment. How will the growing number of one-person households use energy? Does home working save energy, or will home workers use more energy heating their home than if they used public transport to go to an office in a town centre?

It is tempting to think that by 2050, many of the energy problems of the built environment will have been solved. But the papers in this collection cast doubt on this assumption. The evidence assembled here suggests that soft barriers to progress are likely to be as important as hard ones such as the need to develop new technology. For example, neither the owners of rented buildings, who do not pay for the fuel the occupants use, nor their tenants, who may have no plans to stay long term, have any incentive to invest in energy efficiency. How can we provide the necessary incentives to change this behaviour to meet the longer-term challenges?

Finally, how will buildings be constructed in 2050? New buildings already have fewer site-built components and more parts made in factories. But the construction industry has been slow to change its working practices in other ways. We know that new buildings often fail to match the energy efficiency standards to which they were designed, and that low build quality is one reason for their disappointing performance. New energy standards are likely to drive new construction methods, as are developments in robotics and materials science. Another powerful driver for change will be skills shortages. The people who know how to design and construct new and energy-efficient buildings are certain to be in demand, as are experts who know how to run them efficiently.

These State of Science reviews are designed to bring a critical body of evidence to a broad audience and to contemplate possible future developments in a constructive way. We hope that they will contribute to strategic thinking for the longer term in an area that requires urgent and sustained attention. The full report of the SEMBE project will be published in November 2008. The Foresight website address is www.foresight.gov.uk.

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