

Foresight projects

Response from the engineering profession (Engineering the Future) which includes:

- The Royal Academy of Engineering
- The Institution of Engineering and Technology
- The Institution of Civil Engineers
- The Institution of Mechanical Engineers
- The Institution of Chemical Engineers
- The Engineering Council
- Engineering UK

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Chief Scientific Advisor to HM Government

March 2011

Engineering the Future is pleased to have the opportunity to input into the process of identifying future topics of inquiry for the Foresight programme. While the member organisations of Engineering the Future were approached individually to provide responses, we have responded jointly under the Engineering the Future banner. We recognise the value of the Foresight programme in identifying long term policy issues which have implications for the UK and internationally. The importance of engineering input into Foresight programmes becomes apparent in identifying not just what will be technically possible in the future, but what will be technically probable.

This response has been coordinated by the Royal Academy of Engineering on behalf of Engineering the Future.

Engineering the Future is a broad alliance of engineering institutions and bodies which represent the UK's 450,000 professional engineers.

We provide independent expert advice and promote understanding of the contribution that engineering makes to the economy, society and to the development and delivery of national policy.



Introduction

The Foresight programme has provided a valuable contribution to the policy making process in the UK, taking a view on policy issues well into the future on timescales that no individual administration is able to. Examining these long term issues with a high quality, evidence based analysis, helps focus research agenda and catalyses shorter term action across government, the private sector and civil society.

We understand that topics suitable for Foresight programmes need to have a time horizon of at least 40 years. They also need to be amenable to backcasting from that vision to identify pathways and policy interactions to make that vision either more or less likely, depending on its favourability. The use of scenarios for possible ways in which society might develop over these timescales has proved to be exceptionally useful in some of the recent Foresight studies, in particular, Intelligent Infrastructure Systems.

While the output of Foresight programmes often identify technological issues and consequences, the topic itself might appear more general. For example, the Royal Academy of Engineering contributed significantly to the thinking in the Foresight study “Tackling Obesity: Future Choices”, bringing in engineering led evidence from the food processing industry, biomedical engineering and the built environment.

Potential topics

There is any number of topics that would be suitable and timely for a Foresight programme. In this response, we have attempted to identify some suitable topics which have implications for the engineering community or where developments in engineering could have wider societal impacts. We have canvassed the views of a number of people within the community through the Engineering the Future partnership and created a list of potential topics that brings those ideas generated together into programmes of the breadth, scale and timescale suited to the Foresight process.

1. Autonomous systems, robotics and working practices

It is apparent that robotics and autonomous systems will become more important in many industrial sectors over the coming years. The technical advances behind these developments are quite easy to envisage, but the impact on the world of work, the types of jobs and skills that will be required in the future are less easy to divine.

The programme might look at the impacts of autonomous systems and robotics in a wide range of industrial sectors and even societal implications.

The current development of autonomous systems and robotics is being driven by military requirements. Technologies to reducing exposure to dangerous situations has applications well beyond the battle field and just within the civil engineering sector it is easy to envisage the use of robotics in the demolition of buildings, nuclear decommissioning (where their use is beginning to become important) and work in confined spaces. Taking the human out of those hazardous situations has implications for the skills needed – radically changing the role of today's site labourer into a highly technical role. As well as taking operatives out of dangerous situations, the higher precision afforded by robotics is of use in the medical field for surgery and other applications.

Autonomous systems will also have a societal impact, changing what we do and how we do things in our everyday lives, much as automatic systems have since their introduction over the past five decades. There has already been much discussion about the use of autonomous systems in helping the elderly remain independent for longer, especially in helping those with dementia function more independently.

2. Multi-use infrastructure

A recent study by Engineering the Future on behalf of DEFRA, “Infrastructure, Engineering and Climate Change: ensuring services in an uncertain future” identified the growing interdependence of national infrastructures. It also identified potential for dual-, or multi-use infrastructure where, although capital costs may rise, the utility of such projects still provide enhanced value for money.

Particular areas of potential might include railway or road embankments that also provide flood defences or ensuring that fibre-optic cable and other infrastructure services are laid along the path of the proposed HS2 high speed rail line.

Funding for major infrastructure projects is currently difficult enough and the prospects of adding to that cost to provide an indirect benefit to another party is an understandable hindrance in today's climate.

An evidence based examination of where and how such multi-use projects could add value within the economy by providing greater efficiencies for given capital spending could help government formulate policies which, over time, will make the consideration of additional uses of major infrastructural projects a routine aspect of planning.

3. Resource efficiency

A recent study by Engineering the Future on behalf of the Government Office of Science, “Global Water Security”, concluded that although the UK is relatively efficient in its use of water, it effectively imported water use in other areas of world though the ‘embedded water’ in imported food and agricultural produce. Additionally, there has been much recent discussion about the ‘embedded carbon’ of imported manufactured goods.

Resource efficiency needs to be examined not just in terms of the use of a physical material or its recycling, but the global implications for energy and water use when goods are imported to or exported from the UK economy. Energy and resource security for the UK in a global market is also becoming interlinked with resource efficiency and it should be recognised that the relatively high population density of the UK is a key factor.

A Foresight programme on resource efficiency might examine the basic resource efficiency of the UK, how it can be improved and the impacts internationally of efficiency with which materials and products are processed. Providing a rigorous evidence base on resource efficiency would help policymakers plan for a future where embedded energy and water become as important a part of imports and exports as the materials and products themselves.

4. Biomanufacturing

Recent advances in synthetic biology and systems biology are beginning to have an effect directly on the pharmaceutical industry and will have implications for the energy industry and others.

The UK has an established chemicals industry that is highly interlinked and interdependent. Products and feeds from various chemical plants follow complex, interlinking pathways and the development of synthetic biology pathways will come as a disruptive change to the industry.

There is a real chance for the UK to become a world leader in the development of biomanufacturing and the benefits will be felt across all industrial sectors that currently rely on the traditional products and feedstocks of the chemical industry. An evidence based study into the implications of developing a biomanufacturing industry in the UK will allow rational decisions at policy and private sector levels on the future development of the industry and create the chance for the UK to take a technological lead as the possibilities and types of products available change in the future.

Interaction

The Engineering the Future partnership has access to the widest range of engineering expertise. It is likely that most, if not all, topics chosen for future Foresight programmes will have elements that can benefit from an engineering input. As a partnership, we are able to provide experts in a variety of areas and are keen to help in any ways we can in supporting the foresight programme.