

Engineering in government

Response to the House of Commons Science and Technology Select Committee
Engineering in government inquiry from *Engineering the Future*.

November 2011

The *Engineering the Future* alliance of engineering professional organisations is pleased to respond to the House of Commons Science and Technology Select Committee's Engineering in government inquiry which is a follow-up investigation from its case study on Engineering in government, published in 2009.

This response has been coordinated by The Royal Academy of Engineering with significant input from all partners in the *Engineering the Future* alliance. A list of partners who support this submission is provided in Annex A.

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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.

Executive summary

The overall engagement between the policy machinery of government and the engineering profession has improved significantly. There remains, however, considerable further progress to be made.

In response to the IUSS Committee's 2009 inquiry into engineering two alliances have been created – Education for Engineering (E4E) and *Engineering the Future* (EtF) that address education and policy respectively. These two programmes have led to greater accessibility and a more managed interface between the engineering community, the government and civil servants.

To further improve the engagement between government and engineering the following recommendations are made:

- There is still a need for more Chartered Engineers to be employed in key roles within the civil service.
- The Government Science and Engineering (GSE) community project managed within GO-Science should be given continued support by both government and the engineering profession.
- Government must work with the engineering profession to create a strategy to define and optimise the future relationship.

The engineering profession, as represented by the organisations supporting this response, is keen to build on the contribution to national policy by means of joint working over the past two years. Engineers have much to offer in the policymaking process – as well as technical knowledge, engineers can design and deliver projects that work and provide whole-systems analysis to predict the consequences of policy decisions.

It is hoped that this latest inquiry will help continue to improve the engagement necessary to meet the challenges ahead.

Introduction

Since the March 2009 House of Commons Publication *Engineering: turning ideas into reality*, the overall engagement between the policy machinery of government and the engineering profession has improved significantly. There remains, however, considerable further progress to be made.

In its 2009 report, the IUSS Committee identified the following issues that had contributed to sub-optimal engagement by government with the professional engineering community:

“The Government has itself pointed out that it has “many organisations” to which it can turn for specialist advice. This represents a further problem in our view: many officials do not have sufficient knowledge of the sector to be able to decide who to turn to for advice. We are not even convinced that all DCSAs, the majority of whom do not have an engineering background, and some of whom do not even have a scientific background, would know all the players in this complex landscape.”

“As Professor Snowden warned us, currently ‘different departments in government are very happy to go to different institutions’ and as a result they end up with an unnecessary ‘diversity of input.’”

This evidence led to the following recommendation:

“For engineering advice, the Government should consider The Royal Academy of Engineering as its first port of call. The Academy can then bring together the relevant experts, including representation from the relevant professional institutions, to provide impartial, expert and timely input to policy formulation.”

The engineering profession acknowledged these factors and had, indeed, already begun to address them. As a result, the Academy, the professional engineering institutions, the Engineering Council and EngineeringUK took the initiative to create a single portal to government for engineering expertise and advice. This has resulted in the formation of two alliances, Education for Engineering (E4E), which provides coherent, authoritative and impartial advice on matters of education and training of engineers at every level, and *Engineering the Future*, which works in partnership with government departments on policy projects.

These two programmes, the secretariats of which are now funded by the Department for Business, Innovation and Skills (BIS), have led to greater accessibility and a more managed interface between the engineering community, the government and civil servants.

Some of the results delivered by *Engineering the Future* include (a full summary is included in Annex B):

- Working with Defra to produce a report on *Infrastructure, Engineering and Climate Change Adaptation – ensuring services in an uncertain future* (February 2011). This document examines the vulnerabilities in different sectors of the national infrastructure to the effects of climate change and the modifications that would be needed to increase resilience. It also considers vulnerabilities that affect the infrastructure system as a whole and which arise as a result of interdependencies between different sectors. This report fed into Defra’s pan-governmental climate change adaptation programme.

- Delivering a report for the Office of Nuclear Development on *Nuclear Lessons Learnt* (October 2010). This report focuses on the lessons that are of relevance to construction of new nuclear power stations in the UK from recent and past nuclear build projects and was welcomed by Charles Hendry MP, Minister of State for Energy. Following this, the alliance is producing best practice guides on safety culture, welding and concrete.
- Producing a report for GO-Science on *Global Water Security – an engineering perspective* (April 2010). The document considers the challenges of and the approaches required to ensure a secure global and national water supply. Following this, a series of meetings on aspects of water security is underway.
- Jointly running the Manufacturing Summit (March 2011) day event for SMEs, addressed by Business Minister Mark Prisk MP.
- Working with Infrastructure UK to develop an Infrastructure Roadmap to 2050 (on-going). This is a two stage project that will provide a timeline that will be incorporated into the National Infrastructure Plan 2011 and a more detailed analysis of infrastructure challenges and opportunities as well as consideration of the interdependencies between different elements of infrastructure.
- Producing over 17 responses to government and Parliamentary consultations that harness the expertise of a number of engineering disciplines and are therefore more helpful to the policy effort.

Within government, these initiatives have been warmly supported by the Chief Scientific Adviser Professor Sir John Beddington and his team of Departmental Chief Scientific Advisers, particularly so in the case of Professor Brian Collins (formerly BIS/DfT), Professor David MacKay (DECC), and Professor Jeremy Watson (CLG).

The Education for Engineering (E4E) alliance has undertaken the following:

- Research commissioned by BIS, on the further education sector's contribution to STEM education, following advice from E4E to government on this issue.
- Input into National Curriculum review on subjects of importance to engineering education. For example, following a meeting with Michael Gove MP, the Secretary of State asked for E4E input into the Design and Technology curriculum review.
- Work with BIS to ensure engineering careers information is incorporated into the new national careers service.
- Meeting and engaging with David Willets MP, Minister for Universities and Science, on key higher education issues including –
 - The unintended consequences of higher education reform for which E4E undertook to carry out a risk analysis study of the impact of the changes.
 - Undertaking a study of student participation in sandwich courses in higher education.
- Submitting joint evidence to a wide range of consultations on the education and skills agenda.

The *Engineering the Future* alliance has provided its views on the subject of the use of scientific and engineering advice in policymaking through the following responses:

- Guidelines on scientific analysis in policy making, a response to the Government Chief Scientific Adviser (February 2010)
- Scientific advice and evidence in emergencies, a response to the House of Commons Science and Technology Committee (September 2010)

- Code of practice for Scientific Advisory Committees, a response to the Chief Scientific Adviser (December 2010)

Led by The Royal Academy of Engineering, the engineering profession is working to support the Government Science and Engineering (GSE) community project managed within GO-Science which aims to increase recognition of the profession's contribution to policy as well as build a strong and vibrant community with robust links between the different analytical streams and policymakers.

Questions

1. Since the 2009 Engineering inquiry, has the role of engineering evidence, expertise and advice in Government improved?

As outlined above, the engineering professional community has made strenuous efforts to improve its capacity to inform and support policy design and delivery, especially in all matters relating to the growth agenda. A number of government departments now make use of this opportunity to enlist expert, impartial professional advice and support for policy design and delivery. The Royal Academy of Engineering has positioned itself as the first point of contact in matters of general, cross-disciplinary engineering with the relevant specific institutions still taking a lead in more specialised issues. There remain however areas of government which do not routinely engage with the professional engineering community through this mechanism.

The Government Chief Scientific Advisor, Professor Sir John Beddington FRS has been instrumental in improving the coherence on the government side of the interface, along with the network of Departmental Chief Scientific Advisors (DCSAs).

In its role as the national academy, The Royal Academy of Engineering is regularly asked to recommend candidates for advisory roles in government departments and to support recruitment of engineers into government posts. This role has grown over time.

The Education for Engineering (E4E) partnership has contributed to a number of key issues in the education and skills agenda, as detailed in the introduction. The involvement and engagement of the partnership in National Curriculum improvements and further education and higher education issues reflects government's trust and confidence in the engineering community to be able to provide clear advice and recommendations.

Engineering the Future has addressed a broad range of areas in collaboration with government including: global water security, nuclear build lessons learnt, and infrastructure and climate change adaptation. Furthermore there have been a number of joint responses to key government consultations as well as jointly hosted Parliamentary events to address key infrastructure challenges. Through its partnership approach, *Engineering the Future* has improved the way government can access and utilise engineering advice and expertise.

1.1 Government as an intelligent customer

In its joint response to the IUSS Committee's report, the engineering profession made the point that there is a need for more Chartered Engineers to be employed in the civil service. There are few areas of government policy that do not have an engineering dimension to their delivery. This strategic capacity is therefore critical when commissioning engineering consultancy, designing major engineering projects and receiving engineering advice relevant to policymaking. The experience of Chartered Engineers in delivering projects and their

ability to think at a systems level mean that engineers in the civil service can make valuable contributions right through the policymaking and policy delivery cycles.

The joint response identified that there were a number of Chartered Engineers working in government, but they were predominantly employed in agencies tasked with policy delivery, rarely in central departments able to advise on policy development.

The June 2010 document *The Government Chief Scientific Advisor's Guidelines on the Use of Scientific and Engineering Advice in Policy Making*¹ states that "Departments should ensure they have sufficient in-house scientific and engineering capability to act as an intelligent customer of research and advice". We have yet to see the results of a shift in culture and practice being implemented across government, especially in the case of engineering advice relating to project management and policy delivery.

However, some welcome progress has been made: for example The Department of Energy and Climate Change (DECC), has been actively recruiting engineers, most recently recruiting a Head of Engineering to increase capacity. *Engineering the Future* welcomes the requirement by DECC for this individual to be a Chartered Engineer, and hopes that government will look for professionally registered engineers when recruiting for future engineering posts.

1.2 Repeated failures

Where engineering advice is sought, it is important that the government employs people who have the ability to understand the significance of the advice being given and how best to use it to support policy. This is particularly relevant in public sector procurement where capacity of government to scope, commission and manage projects has been repeatedly poor.

Recent, high-profile, high-cost failures in IT illustrate the point. The National Programme for IT in the NHS (£17.7 billion) and the Fire Control Centres project in CLG (approximately £500 million) displayed almost identical errors of definition, scope, procurement and control. In the *Engineering Values in IT*² report by The Royal Academy of Engineering, British Computer Society and the Institution of Engineering and Technology (IET) case study material was incorporated into the report to explain the issues to policymakers. These results point to the need for a fundamental review and revision of public sector procurement of software-based systems.

New 'smart systems' under discussion such as smart meters, smart grid and smart transport are cases in point. Government must continue to consult early, ensure the right expertise is at the table in the scoping stage of commissioning such projects and ensure that it has the capacity to perform as an intelligent customer through employing engineering expertise from early on in the policy process.

1.3 Improving engagement

There is a growing interest in science and engineering policy at a number of UK universities which should help to expand and improve advice given to government. Engagement by a small number of policy makers in the Centre for Science and Policy (Cambridge) Policy Fellow programme is to be welcomed. Though the programme concentrates predominantly on science interactions and providing evidence to support policy decisions rather than policy

¹ <http://www.bis.gov.uk/assets/bispartners/goscience/docs/g/10-669-gcsa-guidelines-scientific-engineering-advice-policy-making.pdf>

² http://www.raeng.org.uk/news/publications/list/reports/Engineering_values_in_IT.pdf

implementation or deliverability, we look forward to seeing an increase in participants on this programme. We also welcome the recent appointment of Professor Brian Collins FREng FRS as Professor of Engineering Policy at University College London.

2. Are structures within Government now designed to optimise engagement with engineering communities and input to decision-making?

Much work has been undertaken within the GO-Science team led by Professor Sir John Beddington FRS and others to optimise engagement with the scientific community. In the joint response to the 2009 inquiry, the profession called for the introduction of a Chief Engineering Advisor and Departmental Chief Engineering Advisors in certain government departments on the basis that engineering advice to government can be very different in nature from scientific advice (engineering advice, as distinct from scientific advice, will concern a range of possible solutions and the probability of successfully implementing such a policy). We remain of the view that this would enhance the advisory network and strategic capacity within government.

2.1 Scientific or engineering advice?

Academic-based engineering advice has an important role in influencing policy making, but the urgent and continuing need is for the calibre of engineering advice that can only come from those with real world industrial and practical experience of project management and implementation.

For example, in the case of climate change, scientific advice is essential to explain what is happening to the globe and why, as well as predicting its evolution under certain assumptions, but engineering advice is crucial to advise on the optimum strategy to mitigate these effects both globally and locally and to deliver the relevant policies effectively.

2.2 Mechanisms for providing engineering advice

The Departmental Chief Scientific Advisor posts are currently part-time. This will inevitably affect the influence that DCSAs can bring to bear on their departmental activity. The Royal Academy of Engineering submission to the IUSS committee in 2008 stated:

“The impact of the GCSA depends to a large extent on the influence of the individual DCSAs within their Departments and the strong leadership provided by the GCSA ensuring the role of the DCSAs is appreciated and understood at Cabinet level. The recent GCSAs have done a very effective job of raising the profile of the scientific aspects of policy issues, especially in the arena of climate change. The status and impact of the DCSAs depend in part on how many opportunities they have to speak to ministers. The support they get in terms of staff is also an issue as most of the DCSAs are part-time positions. Building the influence of DCSAs within their Departments might be helped by making the posts full-time and ensuring that DCSAs have appropriate and effective staff resources within Departments.”

An example of a system that could provide more robust engineering advice to both government and Parliament is the US model. The US has a system of funding that allows all branches of government to commission advice from the professional engineering (and scientific) community through the US National Academy of Engineering and the US National Academy of Sciences.

The Council for Science and Technology (CST) is a key advisory body that has a remit to advise the Prime Minister on strategic issues that cut across the responsibilities of individual government departments. The CST is co-chaired by Sir John Beddington, and has historically included engineers in its membership as reflected in the number of Fellows of the Royal Academy of Engineering who have been members. The *Engineering the Future* alliance welcomes the strengthening of the Council's membership through the inclusion of the Presidents of The Royal Academy of Engineering, the Royal Society, the Academy of Medical Sciences and the British Academy as ex-officio members. We hope the Prime Minister continues to use and take advice from this valuable resource.

3. How has the Government's relationship with the engineering community changed?

Engineering the Future (EtF) and Education for Engineering (E4E) offer a single point of contact through The Royal Academy of Engineering for all parts of government seeking professional engineering advice or support. This simplified access to engineering advice has resulted in interactions which we believe provide proof of value.

The work that *Engineering the Future* and Education for Engineering (E4E) currently undertake with and for government draws on a considerable amount of resource and goodwill by the wider engineering profession. We recognise that, should government use the opportunity to obtain our advice on every project and in every area of policy where we could add value, the currently available resources and channels of communication would be inadequate. We would therefore recommend that government now works with the engineering profession to create a strategy to define and optimise the future relationship. The aim would be to create a sufficient, sustainable long-term model for increasing government's own strategic capacity while deploying the support of the profession optimally across all parts of government policy where it is needed. Given the pending cessation of the Scientific and Engineering Assurance reviews in government departments, an element of the future advisory support provided by EtF might look to add value around this function.

4. Are there specific engineering sectors where engagement with Government should be improved? How could improvements be made?

The value of engineering advice to government goes beyond the sector. Engineers create systems that work, design and deliver projects to time and cost – all valuable skills for government. *Engineering the Future* spans the engineering profession as a whole and can deploy expertise from individual sectors as required. Most policy issues are multi-disciplinary: the engineering profession can configure and has indeed delivered its support to meet that need.

ANNEX A

Engineering the Future partners

BCS The Chartered Institute for IT
British Institute of Non-Destructive Testing
Chartered Institute of Plumbing & Heating Engineering
Chartered Institution of Water & Environmental Management
Energy Institute
Engineering Council
Engineering UK
Institute of Acoustics
Institute of Cast Metals Engineers
Institute of Highway Engineers
Institute of Marine Engineering, Science and Technology
Institute of Materials, Minerals & Mining
Institute of Measurement & Control
Institute of Physics & Engineering In Medicine
Institution of Agricultural Engineers
Institution of Chemical Engineers
Institution of Civil Engineers
Institution of Engineering Designers
Institution of Fire Engineers
Institution of Gas Engineers & Managers
Institution of Lighting Engineers
Institution of Mechanical Engineers
Institution of Railway Signal Engineers
Institution of Royal Engineers
Institute of Water
Nuclear Institute
Royal Aeronautical Society
Society of Environmental Engineers
The Chartered Institution of Building Services Engineers
The Chartered Institution of Highways & Transportation
The Institution of Engineering and Technology (IET)
The Institute of Healthcare Engineering and Estate Management
The Institution of Structural Engineers
The Royal Academy of Engineering
The Royal Institution of Naval Architects
The Society of Operations Engineers
The Welding Institute

ANNEX B

Key *Engineering the Future* achievements:

Projects with government

- Working with Defra to produce the **Infrastructure, Engineering and Climate Change Adaptation – ensuring services in an uncertain future** report (February 2011). This document examines the vulnerabilities in different sectors of the national infrastructure to the effects of climate change and the modifications that would be needed to increase resilience. It also considers vulnerabilities that affect the infrastructure system as a whole and which arise as a result of interdependencies between different sectors.
- Delivering a report for the Office of Nuclear Development on **Nuclear Lessons Learnt** (October 2010). This report focuses upon the lessons that are of relevance to construction of new nuclear power stations in the UK from recent and past nuclear build projects.
- Writing a report for GO-Science on **Global Water Security – an engineering perspective** (April 2010). The document considers the challenges of and the approaches required to ensure a secure global and national water supply.
- Working with Infrastructure UK to develop an **Infrastructure Roadmap to 2050** (on-going). A two stage project that will provide a timeline that will be incorporated into the National Infrastructure Plan 2011 and a more detailed analysis of infrastructure challenges and opportunities as well as consideration of the interdependencies between different elements of infrastructure.

Responses to government consultations

- *Engineering the Future* response to the Energy and Climate Change Committee on The Future of Marine Renewables (September 2011)
- Response to House of Lords Select Committee on Science and Technology inquiry into the role and function of Departmental Chief Scientific Advisors (September 2011)
- Response to the Department for Transport's consultation on High Speed 2 (July 2011)
- Response to the House of Lords Select Committee on Science and Technology on Nuclear Research and Development Capabilities (April 2011)
- Response to the Government Office for Science on suggested topics for future Foresight projects (April 2011)
- Response to the Technology Strategy Board as part of the open consultation following the publication in January 2011 of the Technology and Innovation Centres prospectus (February 2011)
- Response to the House of Lords Science and Technology Select Committee's call for evidence on "public procurement as a tool to stimulate innovation"
- Response to EU Framework Programme Call for Evidence: A response to the Department for Business, Innovation and Skills (January 2011)
- Response to the House of Lords Science and Technology Select Committee's call for evidence on "public procurement as a tool to stimulate innovation (January 2011)
- National Policy Statements: response from *Engineering the Future* to the Department of Energy and Climate Change (Feb 2010)
- National Policy Statements: response from *Engineering the Future* to the House of Commons Energy and Climate Change Committee (January 2010)

- Response to Research Excellence Framework, second consultation a response to the Higher Education Funding Council for England (December 2009)
- Response to Setting science and technology research funding priorities House of Lords Science and Technology Committee (October 2009)
- A framework for the development of clean coal: A response for the Department of Energy and Climate Change (September 2009)
- Smart metering for electricity and gas: Response for the Department of Energy and Climate Change (August 2009)
- Green jobs and skills inquiry: Response for the Environmental Audit Committee (June 2009)
- Eco Towns draft Planning Policy Statement: Response for the Department for Communities and Local Government (April 2009)

Events

- **Engineering the future of water** (autumn 2011). A series of events following on from the work undertaken for the Global Water Security report, continuing the debate about approaches to tackling the challenges of water security. The three events will focus on water recycling, water transfer and behaviour change and demand management.
- *Engineering the Future* and the Parliamentary and Scientific Committee event **Wetter, warmer, windier.....will the UK's infrastructure cope?** (October 2011). A follow up to the Infrastructure, Engineering and Climate Change Adaptation report this parliamentary event continues the debate and discussion about UK infrastructure's capacity to deal with the challenges of climate change.