House of Commons

Science and Technology Committee

Engineering in government: follow–up to the 2009 report on Engineering: turning ideas into reality

Fifteenth Report of Session 2010–12

Report, together with formal minutes, oral and written evidence

Additional written evidence is contained in Volume II, available on the Committee website at www.parliament.uk/science

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Science and Technology Committee

The Science and Technology Committee is appointed by the House of Commons to examine the expenditure, administration and policy of the Government Office for Science and associated public bodies.

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The Committee is one of the departmental Select Committees, the powers of which are set out in House of Commons Standing Orders, principally in SO No.152. These are available on the Internet via www.parliament.uk

Publications

The Reports and evidence of the Committee are published by The Stationery Office by Order of the House. All publications of the Committee (including press notices) are on the Internet at http://www.parliament.uk/science. A list of reports from the Committee in this Parliament is included at the back of this volume.

The Reports of the Committee, the formal minutes relating to that report, oral evidence taken and some or all written evidence are available in printed volume(s).

Additional written evidence may be published on the internet only.

Committee staff

The current staff of the Committee are: Mrs Elizabeth Flood (Clerk); Dr Stephen McGinness (Second Clerk); Dr Farrah Bhatti (Committee Specialist); Xameerah Malik (Committee Specialist); Darren Hackett (Senior Committee Assistant); Julie Storey (Committee Assistant); Henry Ayi-Hyde (Committee Office Assistant); and Nick Davies (Media Officer).

Contacts

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Report

1 Introduction

1. In March 2009, our predecessor Committee published the findings of its wide-ranging inquiry into engineering in the report *Engineering: turning ideas into reality* (hereafter referred to as the 2009 *Engineering* report). The Committee had examined four case studies: (i) nuclear engineering; (ii) plastic electronics engineering; (iii) geo-engineering; and (iv) engineering in Government. Through the case study on engineering in Government, the Committee made a number of recommendations to improve the Government's use of engineering advice and expertise in policy processes, which were supplemented further by the 2009 report *Putting Science and Engineering at the Heart of Government Policy*.[1]

2. Engineering is a critical component of our national economy, and the Government clearly considers the UK to have significant engineering strengths.[2] However, changing economic and political environments have introduced new pressures on UK engineering, and we were keen to revisit the relationship between Government and the engineering community. This follow-up inquiry is part of our ongoing interest in engineering and its importance to society. Therefore in September 2011 we sought views on the following questions:

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

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

c) How has the Government's relationship with the engineering community changed?

d) Are there specific engineering sectors where engagement with Government should be improved? How could improvements be made?[3]

We held two evidence sessions in November 2011. We would like to thank everyone who contributed written or oral evidence to this follow-up inquiry.

[1] Innovation, Universities, Science and Skills Committee, Eighth Report of Session 2008–09, *Putting Science and Engineering at the Heart of Government Policy*, HC 168–I

[2] Ev14 para 2

[3] "*Inquiry into engineering in government*", Science and Technology Committee press release, 30 October 2011

2 Engineering in Government

3. We chose to focus on two key areas in this short follow-up report: engineers in the civil service and Chief Scientific Advisers to Government. However we begin by briefly examining changes in the professional engineering community. The 2009 *Engineering* report noted the Government had many organisations to which it could turn for specialist engineering advice and recommended that:

> 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.[4]

We invited Philip Greenish, Chief Executive of the Royal Academy of Engineering, to comment on whether the Government viewed the Academy as its first port of call for engineering advice and he stated:

> In reasonably large measure, yes. [...] we have seen quite a substantial change in how the Government looks to the engineering profession and, perhaps even more so, how the engineering profession organises itself so that it can support and respond to Government's needs. At about the time that that report was being concluded, we set up two particular groups across the whole of the professional engineering community in order to provide that single point of entry for those in Government who wish to access engineering advice through the professional engineering community. [...]
>
> We called the two bodies we set up *Engineering the Future*, which is the entry point and the body for general policy advice and public affairs activities that we do jointly, and E4E, which means Education for Engineering, which we set up specifically to provide co-ordinated advice from the engineering profession on all education matters that are relevant to the formation of engineers. In the last three to four years, those two bodies have started to work, I believe, very effectively and are being used by people in Government. The Academy is being used as the entry point through those mechanisms for advice.[5]

The Engineering the Future (ETF) alliance comprises 37 professional engineering institutions and associated bodies, with a combined membership of around 450,000 engineers.[6] Sir John Beddington, Government Chief Scientific Adviser (GCSA) told us that the Royal Academy of Engineering was generally the first port of call for engineering advice, but added that "a particular issue might be a civil engineering or mechanical engineering matter, and we might at some levels go directly to the appropriate institution".[7]

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[4] Innovation, Universities, Science and Skills Committee, Fourth Report of session 2008-09, *Engineering: turning ideas into reality*, HC 50–I, para 272

[5] Q 2

[6] "Partners", *Engineering the Future,* engineeringthefuture.co.uk

[7] Q 30

4. **We commend the work of the Engineering the Future alliance in coordinating engineering advice for government.**

The civil service

5. A key focus of the 2009 *Engineering* report was the need for government to act as an intelligent customer for engineering advice. This means "having civil service staff who are able to understand and evaluate engineering advice".[8] The report stated that, with the focus strongly on evidence-based policy, the civil service should have amongst its staff engineers who were able to source and assess technical evidence.[9]

6. Unfortunately, at the time of the previous inquiry, our predecessor Committee found that nobody knew how many civil servants had scientific or engineering backgrounds because, in contrast to the economist and statistician classes, government had "kept no central record of engineers in Government since the mid-1980s".[10] The report recommended that the Government maintain records on specialist staff in order to identify their qualities and experience,[11] and since 2009, the GCSA has been developing a cross-government community of scientists and engineers: the Government Science and Engineering (GSE) community. The Government's written submission to this inquiry stated that there are currently around 1,100 people in GSE with an engineering background, out of a total of about 3,500.[12] However, the GSE community is self nominating[13] and therefore cannot be taken as an accurate count of the number of engineers in the civil service.

7. The roles of engineers in the civil service are as important as the numbers, and a particular concern during the 2009 *Engineering* inquiry was that engineering did not feature highly enough in policy development.[14] Despite government guidelines stating that departments should ensure they had sufficient in-house scientific and engineering capability to act as an intelligent customer of research and advice, the ETF alliance of professional engineering organisations had "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".[15] Imperial College London considered that engineering expertise and advice should be built into policy formulation processes at all levels of Government and government agencies and suggested that this could be achieved by the use of secondments of engineers from academia and industry.[16]

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[8] Innovation, Universities, Science and Skills Committee, Fourth Report of session 2008-09, *Engineering: turning ideas into reality*, HC 50–I, para 255

[9] Ibid.

[10] Innovation, Universities, Science and Skills Committee, Fourth Report of session 2008-09, *Engineering: turning ideas into reality*, HC 50–I, paras 274-275

[11] Innovation, Universities, Science and Skills Committee, Fourth Report of session 2008-09, *Engineering: turning ideas into reality*, HC 50–I, para 281

[12] Ev14 para 10

[13] "Government Science and Engineering (GSE)", *Government Office for Science*, bis.gov.uk

[14] Innovation, Universities, Science and Skills Committee, Fourth Report of session 2008-09, *Engineering: turning ideas into reality*, HC 50–I, HC 50–I

[15] Ev29 para 1.1

[16] Ev w2 para 9

Sir John Beddington, Government Chief Scientific Adviser (GCSA) considered that seconding engineers from academia and industry into government was "a really interesting idea and one that we should follow up".[17]

8. In October 2011, the Department of Energy and Climate Change (DECC) advertised for a new Head of Engineering, a post that would report to its Chief Scientific Adviser (CSA).[18] DECC was also recruiting: nine further engineers; a Chief Technology Officer; a Technical Architect; and two engineers or scientists to work in the Office of Renewable Energy Deployment.[19] The ETF alliance welcomed this progress, and in particular the requirement for the Head of Engineering to be a chartered engineer, explaining that "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".[20] The ETF alliance stated that chartered engineers were, at the time of the previous report, "predominantly employed in agencies tasked with policy delivery, rarely in central departments able to advise on policy development".[21] Imperial College London stated that while posts such as DECC's new Head of Engineering "can provide some assurance to senior Ministers that the advice they receive makes scientific and engineering sense, these posts cannot plausibly scrutinise all the engineering decisions taken by central Departments and their many agencies".[22]

9. We asked Philip Greenish, Chief Executive of the Royal Academy of Engineering, whether the Government acted as an intelligent customer for engineering advice and he replied:

> In parts, but it has been hampered by reductions in numbers in Government Departments, so they have not been free to recruit large numbers of engineers to enable them to fulfil that role since the last report. Progress is being made.[23]

In response to the same question, Chris Aylett, Chief Executive of the Motorsport Industry Association (MIA), praised the work of the Ministry of Defence.[24] In relation to spending cuts to departments, Sir John told us that, although there had been cuts in individual departments, they had not been disproportionate and the numbers of engineers were not being disproportionately cut compared with scientists or general policy officials.[25]

10. Mr Greenish told us that while there was "undoubtedly, a much greater recognition" within Government of the importance of engineering, he was not "entirely happy" that "the follow-through does not quite match the rhetoric yet".[26] For example, he was critical of

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[17] Q 41

[18] Ev 14

[19] Ev 15 para 19

[20] Ev 29 para 1.1

[21] Ibid.

[22] Ev w1 para 7

[23] Q 19

[24] Ibid.

[25] Q 40

[26] Q 9

the Government's recent policies on higher education reforms and expressed concerns that they would provide disincentives for universities to recruit students to engineering degrees.[27] Both Mr Greenish and Mr Aylett were additionally concerned about the possible removal of design and technology from schools' curriculums as a result of the English Baccalaureate[28]—a new performance measure introduced in the 2010 performance tables that recognises grades across a specified number of core GCSE subjects, not including Design and Technology.[29] Given that the 2009 *Engineering* report concluded that "the key to solving sector-specific shortages of engineers will ultimately lie in the UK's ability to train the next generation of generalist engineers",[30] this could be a concern for the future of UK engineering. We note that the House of Lords Science and Technology Select Committee is currently conducting an inquiry on *Higher Education in STEM subjects*.[31] We plan to revisit the topic of engineering skills in future.

11. **Since the 2009 Engineering report it would appear that progress has been made in recognising the importance of engineering in the civil service. We are pleased that the Government has begun identifying engineers in the civil service, albeit through a self-nominating group. However, it is not clear whether enough engineers in the civil service are being employed in policy development as well as policy delivery and we invite the Government to provide us with a breakdown of the roles of engineers in the GSE community as an indicator.**

12. **We welcome the recruitment of a Head of Engineering to the Department of Energy and Climate Change. However, given that few other examples of good practice were highlighted during our inquiry, we are concerned that DECC's recognition of the need for engineering expertise may be the exception rather than the rule across Government Departments.**

Chief Scientific Advisers

13. A key route for engineering advice into Government is through its network of Chief Scientific Advisers (CSAs) to Departments. The 2009 *Engineering* report examined the role and effectiveness of CSAs in detail. In summary, our predecessor Committee concluded that:

a) Some departments should have Departmental Chief Engineering Advisers (DCEAs), some Departmental Chief Scientific Advisers (DCSAs), and some should have both.[32]

b) the Government Chief Scientific Adviser (GCSA) should be renamed the Government Chief Scientific and Engineering Adviser (GCSEA), and would be the head of

[27] Q 10

[28] Q 11

[29] "The English Baccalaureate", *The Department for Education*, 26 January 2012, education.gov.uk

[30] Innovation, Universities, Science and Skills Committee, Fourth Report of session 2008-09, *Engineering: turning ideas into reality*, HC 50–I, para 331

[31] "Higher Education in STEM subjects", *House of Lords Science and Technology Committee*, parliament.uk/hlscience

[32] Innovation, Universities, Science and Skills Committee, Fourth Report of session 2008-09, *Engineering: turning ideas into reality*, HC 50–I, para 307

profession for science, engineering, social science and statistics, with a more senior role in the Government with direct access to the Prime Minister.[33]

c) The GCSEA would head up the Government Office for Science and Engineering, which should be placed in the Cabinet Office. Beneath the GCSEA should be a Government Chief Engineer, a Government Chief Scientist and a Government Chief Social Scientist.[34]

14. To date, these recommendations have not been adopted by the Government. We asked Philip Greenish, Chief Executive of the Royal Academy of Engineering, whether he considered the current system provided sufficient engineering advice to departments, and he stated that "we have moved on a long way and very positively since that report".[35] He commended Sir John Beddington, the current GCSA, who had "taken great care to make sure that engineers are well represented at the level of Departmental Chief Scientific Advisers" and "clearly views himself as a Government Chief Engineering Adviser as well".[36] However, the Royal Academy of Engineering thought it would be very beneficial to have a Government Chief Engineering Adviser, and that the structure proposed by the previous Committee "had a lot to commend it".[37] The Government's written submission pointed out that a number of CSAs were professional engineers and stated:

> It remains the case that the Government is not persuaded of the need to introduce Chief Engineering Adviser positions alongside CSAs. Engineering advice, which is distinct from and complementary to science advice, is an important element of the role of the GCSA and of departmental CSAs. The role of CSAs is to ensure both are fed in to policy and operations as necessary. [...] specific engineering adviser posts exist where there is a requirement.[38]

Sir John Beddington stated that "if a Department has a Chief Scientific Adviser who is an engineer, then replication will not be necessary. It is very much for the Department's chief scientific adviser and permanent secretary and the departmental board to take a view" and added that "the entire community of chief scientific advisers recognises how important engineering is".[39]

15. **We reiterate our predecessor Committee's view that the Government Chief Scientific Adviser should be a Government Chief Scientific and Engineering Adviser, overseeing a Government Chief Engineer, a Government Chief Scientist and a Government Chief Social Scientist. The Prime Minister should give consideration to this proposed structure when considering Sir John Beddington's successor in the post of Government Chief Scientific Adviser.**

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[33] Innovation, Universities, Science and Skills Committee, Fourth Report of session 2008-09, *Engineering: turning ideas into reality*, HC 50–I, para 313

[34] Innovation, Universities, Science and Skills Committee, Fourth Report of session 2008-09, *Engineering: turning ideas into reality*, HC 50–I, para 313

[35] Q 13

[36] Ibid.

[37] Ibid.

[38] Ev14 para 9

[39] Q 44

16. Our predecessor Committee concluded that "the Government could easily support its claim to recognise the importance of engineering and engineers by appointing Chief Engineering Advisers, at a minimum in positions where existing Chief Scientific Advisers act as Chief Engineering Advisers".[40] While we support this recommendation, **we recognise that it may be economically unfeasible or risk a duplication of effort to appoint Chief Engineering Advisers alongside Chief Scientific Advisers in all departments. However, we consider that in departments where engineering advice is routinely required, the Government should consider appointing a Chief Engineering Adviser instead of, or in addition to, a Chief Scientific Adviser.**

Council for Science and Technology

17. During our follow-up inquiry we discussed scientific advisory committees (SACs), in particular the Council for Science and Technology (CST), a committee that advises the Prime Minister and is co-chaired by the GCSA. There are currently seven engineers on the CST (out of a total of 20, including Co-chairs and ex officio members).[41] In response to criticisms that policies are too often developed without consideration of the engineering perspective, Sir John stated "I don't think that it is a problem" and gave the example of the President of the Royal Academy of Engineering being an *ex officio* member of the CST.[42] We delved further into the membership of the CST and asked Sir John how the balance of expertise was decided. He responded that there was no decision as to the balance of expertise:

> [A shortlist of 12] went to the Prime Minister, because it is his council, and he chose the final 11 members. As it happened, quite a few of them [six] were eminent engineers. [...] We did not set out by saying that that was what we wanted [...] It would be really pernicious to formalise it. The criterion has to be excellence.[43]

We were slightly surprised by this response, given that the Code of Practice for Scientific Advisory Committees (CoPSAC) states that:

> The SAC Chair, secretariat and Departmental CSA (or relevant senior official for non-departmental sponsors) should discuss and agree areas of expertise required in advance of appointments. These should be reflected in Person Specifications produced and checked to ensure consistency with the committee's Terms of Reference.[44]

When we asked Sir John about the CoPSAC's requirement that members' areas of expertise should be agreed in advance of appointment, he replied:

> For science advisory committees, that is relevant, but the CST is rather special. [...] I chaired Defra's science advisory council for a while, and it was very clear that we

[40] Innovation, Universities, Science and Skills Committee, Fourth Report of session 2008-09, *Engineering: turning ideas into reality*, HC 50–I, para 305

[41] "Members", *Council for Science and Technology*, bis.gov.uk/cst

[42] Q 33

[43] Qq 46–47

[44] "Code of Practice for Scientific Advisory Committees", *Government Office for Science*, 2011, bis.gov.uk

> needed an epidemiologist—someone who could comment on some of the key issues of livestock disease that Defra has. [...] When recruiting, we specified that we wanted someone with that background. [...] in the science advisory councils you are seeking particular expertise and it is therefore sensible to do it. [...] I believe that the Council of Science and Technology is different. It would be an odd composition if that council did not have a number of people from business, no one with engineering or a mainstream science background, and did not have anyone with a social research background. But the actual balance is not there.[45]

18. **We are satisfied that the Council for Science and Technology (CST) has sufficient representation of engineers amongst its membership. However, it is unclear whether the CST adheres to the Code of Practice for Scientific Advisory Committees (CoPSAC). The Government should clarify this immediately. If the CoPSAC does not apply to the CST, the rationale must be made clear and a code of practice for the CST should be published.**

[45] Q 48

3 Conclusions

19. **Since the 2009 report *Engineering: turning ideas into reality*, the Government and engineering community have made progress in integrating engineering expertise and concerns into the formulation of policy. The formation of the Engineering the Future alliance as a coordinated voice for the professional engineering community and the ongoing efforts of the Government Chief Scientific Adviser in raising the profile of engineering advice are particularly commendable. However, there is no room for complacency and the Government must ensure that engineering continues to have a high profile in policy, and particularly in policy development.**

Conclusions and recommendations

The engineering community

1. We commend the work of the Engineering the Future alliance in coordinating engineering advice for government. (Paragraph 4)

The civil service

2. Since the 2009 Engineering report it would appear that progress has been made in recognising the importance of engineering in the civil service. We are pleased that the Government has begun identifying engineers in the civil service, albeit through a self-nominating group. However, it is not clear whether enough engineers in the civil service are being employed in policy development as well as policy delivery and we invite the Government to provide us with a breakdown of the roles of engineers in the GSE community as an indicator. (Paragraph 11)

3. We welcome the recruitment of a Head of Engineering to the Department of Energy and Climate Change. However, given that few other examples of good practice were highlighted during our inquiry, we are concerned that DECC's recognition of the need for engineering expertise may be the exception rather than the rule across Government Departments. (Paragraph 12)

Chief Scientific Advisers

4. We reiterate our predecessor Committee's view that the Government Chief Scientific Adviser should be a Government Chief Scientific and Engineering Adviser, overseeing a Government Chief Engineer, a Government Chief Scientist and a Government Chief Social Scientist. The Prime Minister should give consideration to this proposed structure when considering Sir John Beddington's successor in the post of Government Chief Scientific Adviser. (Paragraph 15)

5. We recognise that it may be economically unfeasible or risk a duplication of effort to appoint Chief Engineering Advisers alongside Chief Scientific Advisers in all departments. However, we consider that in departments where engineering advice is routinely required, the Government should consider appointing a Chief Engineering Adviser instead of, or in addition to, a Chief Scientific Adviser. (Paragraph 16)

Council for Science and Technology

6. We are satisfied that the Council for Science and Technology (CST) has sufficient representation of engineers amongst its membership. However, it is unclear whether the CST adheres to the Code of Practice for Scientific Advisory Committees (CoPSAC). The Government should clarify this immediately. If the CoPSAC does not apply to the CST, the rationale must be made clear and a code of practice for the CST should be published. (Paragraph 18)

Conclusions

7. Since the 2009 report Engineering: turning ideas into reality, the Government and engineering community have made progress in integrating engineering expertise and concerns into the formulation of policy. The formation of the Engineering the Future alliance as a coordinated voice for the professional engineering community and the ongoing efforts of the Government Chief Scientific Adviser in raising the profile of engineering advice are particularly commendable. However, there is no room for complacency and the Government must ensure that engineering continues to have a high profile in policy, and particularly in policy development. (Paragraph 19)

Formal Minutes

Wednesday 25 April 2012

Members present:

Andrew Miller, in the Chair

Stephen Metcalfe	Stephen Mosley
Sarah Newton	Graham Stringer
Hywel Williams	Roger Williams

Draft Report (*Engineering in government: follow-up to the 2009 report on Engineering: turning ideas into reality*), proposed by the Chair, brought up and read.

Ordered, That the draft Report be read a second time, paragraph by paragraph.

Paragraphs 1 to 19 read and agreed to.

Resolved, That the Report be the Fifteenth Report of the Committee to the House.

Ordered, That the Chair make the Report to the House.

Ordered, That embargoed copies of the Report be made available, in accordance with the provisions of Standing Order No. 134.

Written evidence was ordered to be reported to the House for placing in the Library and Parliamentary Archives.

[Adjourned till Wednesday 2 May at 9.00 am

Witnesses

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Second Report	Technology and Innovation Centres	HC 618 (HC 1041)
Third Report	Scientific advice and evidence in emergencies	HC 498 (HC 1042 and HC 1139)
Second Special Report	The Reviews into the University of East Anglia's Climatic Research Unit's E-mails: Government Response to the Committee's First Report of Session 2010–12	HC 496
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Fifth Report	Strategically important metals	HC 726 (HC 1479)
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Seventh Report	The Forensic Science Service	HC 855 (Cm 8215)
Seventh Special Report	Astronomy and Particle Physics: Government and Science and Technology Facilities Council Response to the Committee's Fourth Report of Session 2010–12	HC 1425
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Oral evidence

Taken before the Science and Technology Committee

on Wednesday 7 December 2011

Members present:

Andrew Miller (Chair)

Stephen Metcalfe	Pamela Nash
David Morris	Roger Williams
Stephen Mosley	

Examination of Witnesses

Witnesses: **Chris Aylett**, Chief Executive, Motorsport Industry Association, and **Philip Greenish**, Chief Executive, Royal Academy of Engineering, gave evidence.

Q1 Chair: Gentlemen, I welcome you both here to our formal session. For the record, would you kindly introduce yourselves?
Philip Greenish: I am Philip Greenish. I am Chief Executive of the Royal Academy of Engineering.
Chris Aylett: I am Chris Aylett, Chief Executive of the Motorsport Industry Association.

Q2 Chair: Mr Greenish, does the Government now see the Royal Academy as the first port of call for engineering advice?
Philip Greenish: In reasonably large measure, yes. If I can elaborate, since the Select Committee's Report on "Engineering: Turning ideas into reality", we have seen quite a substantial change in how the Government looks to the engineering profession and, perhaps even more so, how the engineering profession organises itself so that it can support and respond to Government's needs. At about the time that that report was being concluded, we set up two particular groups across the whole of the professional engineering community in order to provide that single point of entry for those in Government who wish to access engineering advice through the professional engineering community.
Perhaps for clarity, I should explain what we mean by the professional engineering community. There are 36 engineering institutions that are licensed to charter engineers and accredit engineering degree courses. Some of them are large, like the IET, which is the largest, with 160,000 to 170,000 members or so. At the bottom end of the scale, there are some small, very specialist, institutions that have value within their own niche. So there are 36 of them. There is the UK's national academy of Engineering—ourselves. There are other bodies, such as the Engineering Council, which manages the licensing process, degree course accreditation and such like, and EngineeringUK, which is a body that is funded out of professional engineers' subscriptions and works on behalf of us all to promote engineering widely. There are other associated organisations that we work with. It is quite evident to anybody that, when faced with this array of bodies, anyone in Government who did not know their way around it would find it extremely difficult. The National Academy of Engineering is part funded by Government and is the natural point of entry into the profession.
We called the two bodies we set up *Engineering the Future*, which is the entry point and the body for general policy advice and public affairs activities that we do jointly, and E4E, which means Education for Engineering, which we set up specifically to provide co-ordinated advice from the engineering profession on all education matters that are relevant to the formation of engineers.
In the last three to four years, those two bodies have started to work, I believe, very effectively and are being used by people in Government. The Academy is being used as the entry point through those mechanisms for advice.

Q3 Chair: You have heard me say before that it may be the existence of the 36 institutions that does not help engineering punch its weight in the public view. Where you have brought together these alliances, such as E4E and *Engineering the Future*, does the Royal Academy take the lead role?
Philip Greenish: Yes, we do. We are careful how we use the leadership term because these are all independent, self-governing institutions under their own charters. Some of them are large, well resourced and long standing. The Institution of Civil Engineers is nearly 200 years old. There is a very grand building just round the corner from here. It is a very substantial body, and it has substantial and established relationships with certain people in Government Departments, which is perfectly right, respectable and responsible. Our collective activity does not get in the way of those relationships where they are well formed.

Q4 Chair: Going back to the issue of the relationship with Government, can you give any examples of circumstances where the Government have consulted the Academy in a timely manner when policies are being developed?
Philip Greenish: Yes, I can. Infrastructure UK is a body set up within the Treasury by Government. From the outset, Infrastructure UK invited a substantial number of expert engineers to contribute to its work. The Academy helped to set that up. We have supported the work that they have been doing,

including, most recently, preparing a timeline for the UK's infrastructure out to 2050, which is in the form of quite a simple-looking but complex chart, when you look beneath it, of all the UK's key infrastructure policies, opportunities and challenges over time and how they overlap. We did that piece of work because Infrastructure UK themselves, who had started it rolling, realised that they did not have the expertise—the germane knowledge—to do the job as well as they wished to. We were ready and available to help and support.

I can give another example, which is in the area of further education and skills. It became obvious to us a year or two ago that there was a paucity of knowledge, looking across the UK as a whole, of the output of the further education sector. There was a paucity of knowledge of what sort of training was being done, at what levels and in what subject areas. So we did an initial piece of work to set the scene, and then BIS, very willingly, funded the next set of work, which was a STEM data study, which reported this year and laid out in quite a lot of detail what sort of courses are being done, which courses are valued by employers, which ones are less valued by employers, at what levels technical education is being carried out and where the shortages are. A few alarming things came out of that. It was a valuable piece of work for BIS.

Q5 Chair: I do not know if you have seen today's papers.

Philip Greenish: Yes.

Q6 Chair: There is a very bold statement by the Deputy Prime Minister, which personally is one that I would welcome, about Britain's role in future space technologies. Would it not have been appropriate for the Royal Academy to have been consulted to make sure that the line that the Deputy Prime Minister was promoting, I guess on behalf of the Government, was in keeping with our capacity to deliver?

Philip Greenish: That is a very good point. It is, perhaps, the issue that we have most concern about in terms of Government policy making in that too often policies are made without real in-depth regard to the capacity to fulfil that policy. Our view is that it would be extremely beneficial to the UK and to policy making if we were consulted from the outset so that, as policy was being formed up, it was being properly informed by people who know what the issues are in terms of how we are going to deliver it. In answer to your question, it would have been great to have been consulted, yes.

Q7 Stephen Metcalfe: Gentlemen, good morning. Mr Aylett, following on from that point, you said in your submission that the high performance engineering and motorsport community wants "a seat at the table" when policies are being set. Can you expand on exactly how you would like to improve engagement with Government?

Chris Aylett: I sat here in envy of the policies that my colleague could trot out on engagement. I wrote a note to myself and, sadly, wrote next to it, "None". Why would a small sector with a value of just £12 billion ask for a seat at the table? At the moment we are grouped under the automotive engineering stable within BIS. The issue that our strange sector—high performance engineering, which is unique to the UK—would like to be debating is an improvement in R and D tax credits for SMEs, because 99% of our businesses are SMEs, as, indeed, are those in the UK. We would like to be involved in some of the diversification strategies that we have pioneered. It is important to us that we engage effectively with the space industry. We are R and D prototype builders. The fact that people enjoy watching those prototypes on TV trivialises it to some degree, but we have a unique resource in the UK to make these prototypes, essentially, to demonstrate them on television, but we also supply the space industry, which requires R and D prototypes.

It is the same with the automotive industry and the rest. I heard this morning that there may be an innovation policy or strategy for the UK coming forward, but we know nothing of it, other than hearing it on the radio as a layman. For example, in the automotive industry, which we have put together, a similar road map for 40 years of Britain's automotive industry was produced. That was two years ago. No account was taken of the resource of high performance engineering. We think we could have played a part in establishing that plan. We are now trying to do so, but we are backfilling and finding a place for ourselves, as we see it, at the table. We recognise that our role in the economic life of the UK is relatively small, but we gain quite a lot of traction in terms of gaining public recognition for British engineering.

Q8 Stephen Metcalfe: Do you think it is a problem within BIS itself that it does not recognise the contribution? Do you think that that problem within BIS goes wider across the whole engineering sector—that you are just a homogeneous mass?

Chris Aylett: I would not be so presumptuous as to know how to answer the whole of the BIS story. The heading "advanced engineering" as a title for the whole mass of engineering brings with it some concerns, because, if you are not in advanced engineering, what are you in? Presumably, it is pretty ordinary engineering, and there must be a lot of people in ordinary engineering.

In our area, we have decided to make a sub-brand and call ourselves "high performance engineering" to try and explain that we are not just in motorsport but in high performance, R and D spending kind of engineering. It is quite hard. I do have some sympathy in that sense with these Government Departments handling reduction in resource. I can think of many other commercial interests where, when you group them together, you would lose your account managers and you would say, "Instead of doing Yorkshire and Lancashire, let's just call it 'the north'." In a sense, that might be what is happening to the Government Departments, but they are then going to miss some jewels.

Q9 Stephen Metcalfe: Do you want to add anything, Mr Greenish?

Philip Greenish: I am delighted that there is, undoubtedly, a much greater recognition within Government of the importance of engineering to the economy, the future of society and addressing the big challenges of society. Where, perhaps, I am not yet entirely happy is that the follow-through does not quite match the rhetoric yet, and we do not see enough joined-up activity in Government to support what the rhetoric is saying. I can give you an example from the higher education reforms. It would be fair for me to say that most people recognise that this country has a requirement to increase the number of higher level engineering and technical skills coming into the economy, but we fear greatly that the higher education reforms are not going to aid that process at all. In fact, we fear that they might set that process back. There is a real concern that, although the rhetoric generally is looking better, the follow-through into policy action hiccups in certain ways, which is not helpful.

Q10 Stephen Metcalfe: Could you expand on why you think the higher education reforms will not deliver on that strategy?

Philip Greenish: Yes; I can be specific on a couple of things. If you look at how the funding model has been re-designed, with student fees being set by universities up to a maximum of £9,000 a year, student numbers are being capped across all universities in order to free up more places, at one end, for students who have AAB in their A-levels or higher. The statistics tell us, looking across the piece, that fewer students in the STEM subjects and engineering have AAB for entering university than in the arts and humanities. If you look at the incentives on the universities to recruit students, if they are going to make a comfortable profit on students in lecture-based subjects—arts and humanities—and a loss on students who come in to do laboratory-based STEM subjects, then the incentive on them is not to increase the numbers of students doing STEM subjects.

At the other end of the scale, the Government have also incentivised universities that charge less than, I think, a figure of £7,500. There again, there is a problem for high-cost subjects like engineering, because it is quite difficult to see how quality engineering education can be carried out at a higher education institution at lower than £7,500 per student. So those issues are likely to disincentivise.

On the other hand, a positive argument is that the earnings potential of graduates in STEM subjects is higher than those from non-STEM subjects. The evidence—the statistics—show that their earnings on graduation are higher. We are talking about risk rather than certainty here because, of course, we have not been through this yet. But that is one of the concerns that we think has not yet been properly addressed.

Q11 Chair: Can I go to the other part of education before we move on? Last night at the Institution of Mechanical Engineers there were some very good presentations by a number of leading players. I recall the chairman of Finmeccanica, for example, making an impassioned plea in relation to the possible removal of design and technology from the English Bacc. Would you share that view?

Philip Greenish: Yes, I would. I would absolutely share that view.

Chris Aylett: So would I.

Philip Greenish: Design and technology is a challenging subject area because it is, of course, quite diverse. We have had discussions with the Department for Education about how that can be made a more rigorous subject than it is in some schools and colleges at the moment. Indeed, the Department for Education have asked us to provide an input to them on the re-design of the design and technology curriculum. There are some real dangers if it is lost from the national curriculum.

Q12 Chair: Mr Aylett, presumably, with your industry, which does excite many young people, you could contribute massively to the improvement of design and technology teaching in the secondary sector.

Chris Aylett: Yes, we would like to think so. There is no question—it is not meant to be a lightweight comment—that children of the age of 4 or 5 are doing engineering when they play laptop games, and the most popular game is motorsport, so they adjust wing angles and aerodynamics. At 4 years of age they understand some rudimentary mechanical engineering. Motorsport is a great motivator for young people. We have just been through a period, and I endorse all that Mr Greenish is saying, where we have seen the power of attracting young people into engineering by using the evocative world of motorsport. Also, I have to say that Lord Sainsbury supported me in this one when I once trotted out: our most senior engineers earn between £8 million and £10 million a year. They are probably the highest paid engineers. I don't know about others. A mechanic will be earning between £50,000 to £60,000 a year. These are good incomes. There are not tens of thousands of them. We only employ 45,000 to 50,000. Lord Sainsbury agreed, when someone told me not to flash this kind of thing in front of people, that this is what motivates young people. That is what drives Premier League footballers. If you have cracking civil engineering stories and all the rest of it, why would you hide this light under a bushel? Our sector is very evocative and the most exciting sector of engineering, but somehow or other we are not quite matching the two together.

I worry about design and technology. We have just had a chap called Adrian Newey, who yet again beats the world as a British designer. Where is that generation coming from if they never even learn the rudiments at school?

Philip Greenish: We would maintain that an exposure to the right sort of activities in design and technology, at the right ages, captures a young person. These are young people with every level of academic ability and it inspires them to carry on with subjects that lead to careers in engineering and technology. It is very important.

Q13 Pamela Nash: Good morning, gentlemen. The Engineering report recommended that some Departments have Departmental Chief Engineering Advisers. Would each of you agree that this is

necessary or do you think that the current system provides sufficient engineering advice to Departments?

Philip Greenish: I would start by saying that we have moved on a long way and very positively since that report. I take my hat off to Sir John Beddington, the Government Chief Scientific Adviser, who very clearly views himself as a Government Chief Engineering Adviser as well. He has taken great care to make sure that engineers are well represented at the level of Departmental Chief Scientific Advisers. There have been a couple of gaps in key Departments for far too long—BIS and the Department for Transport—but I have heard that they are going to be filled by engineers. So we have seen a very positive move in the right direction.

We have been asked by DECC to help their Chief Scientific Adviser recruit engineers into his part of DECC to support what is going on there. That is my starting point, and I would not want to diminish in any way anything that Sir John and his team have been doing. I would add, though, that we believe it would be very beneficial to have a Government Chief Engineering Adviser. The structure that was proposed by the IUSS Committee three or four years ago had a lot to commend it.

Chris Aylett: I would defer to that. Sir Mark Welland is coming to see Motorsport Valley in a few months' time. So far as I know, Bob May, when he was Chief Scientific Adviser, understood the value of what we do. In fact, he is coming on one or two trips to Motorsport Valley with some folk, but, in general, we have very little contact at that level in either direction. If we have little contact with the Department as a whole, then you can imagine it is quite difficult to go straight to the Chief Scientific Adviser.

Philip Greenish: May I add one further point, which is that over the last three or four years the connections to the engineering community from the Departmental Chief Scientific Advisers have generally improved considerably. They are our main points of contact on engineering advice into Government. If I said there was a particular shortcoming, it is that they are the main points of contact, and there are not enough other points of contact with parts of Government Departments outside the CSA arena.

Q14 Pamela Nash: You mentioned that the Academy had been consulted by DECC when they were recruiting engineering advisers. Is that standard procedure for other Departments as well, particularly for their Chief Scientific Advisers, if they are having to wear both hats?

Philip Greenish: Yes, it is. I would not like to say that it happens all the time, but we are consulted a lot over these sorts of appointments. We are invited to help identify the sort of people who we think would be suitable and might be willing to take on these roles. Sometimes we help to advertise and broadcast opportunities at the higher levels of the engineering community.

Q15 Pamela Nash: Are you aware if you have that role solely, or do you know if Departments might consult other engineering institutions as well for advice?

Philip Greenish: Possibly, they do. Again, that is because other engineering institutions have embedded relationships with some Departments. It would be entirely natural for a particular Government that has a strong relationship with an institution to use that link directly. I will give you an example. The Energy Institute is a mid-sized institution. It is specifically focused on the world of energy. I would expect the Department of Energy and Climate Change to be talking to them a lot. I would hope that they would also consult them on such issues as expert engineers in the energy world that they want to recruit.

Q16 Pamela Nash: I am aware that the Academy nominates one member of the Home Office Scientific Advisory Committee. Is that the case for the advisory committees of any other Departments?

Philip Greenish: Yes, but I do not have particular figures. There are people that we have nominated and are in post in the scientific advisory committees.

Q17 Pamela Nash: Is that information that you could provide to the Committee?

Philip Greenish: Yes, I could.

Q18 Chair: Coming back to your comments about engagement with Government via the Academy, clearly, you have members of the Academy who work in the field of high performance engineering. Do you see yourself as representing that sector when meeting Government?

Philip Greenish: No. It would be wrong for us to say that. There are other bodies that represent sectors. What we can do, and what we do, is to provide people or groups of people who are expert in particular areas in their own individual right. If we are invited to put together, or if we ourselves want to put together, a collective view on a particular policy or collective advice, then we will draw on those individuals, but we are not a sectoral representative body.

Q19 Stephen Mosley: Going back to the 2009 Engineering report, one of its key focuses was that Government should act as an intelligent customer for engineering; in other words, they should have civil service staff who are able to understand and evaluate engineering advice. Does the Government act as an intelligent customer?

Philip Greenish: In parts, but it has been hampered by reductions in numbers in Government Departments, so they have not been free to recruit large numbers of engineers to enable them to fulfil that role since the last report. Progress is being made. I have mentioned the recruitment into DECC, which has been positive.

The Government Science and Engineering community, which is now a more formed grouping of scientists and engineers within Government, is now working to create a cadre of people who have a collective sense of identity. We have been supporting that community in providing opportunities for training and for them to attend events and activities which

might broaden their understanding of engineering issues and policies across the piece.

Again, coming back to DECC, the recruitment of chartered engineers for particular roles is very positive. We would like to see that much more widely spread in other Government Departments, but I do not think it is happening yet.

Chris Aylett: Let me make a point that you may be interested in along those lines. When you mention "customer", it is almost corporate activity, which is my area, where we do represent sectoral interests. For a very large beast, I have to say that the MOD has been particularly progressive in engaging with our small sector. Under the new Minister and, indeed, the last Minister of Defence Procurement, they have become very proactive. To my mind, that is a Government Department and they are seeking ways of using our SMEs as some kind of model to say, "Actually, these guys are really good." We have created tens of millions of pounds worth of business in the last two years with defence from, one might say, an unlikely source. If you take motorsport to Afghanistan, it is similar to the Paris-Dakar rally. Parts of these vehicles are now being manufactured in motorsport.

Just recently, we have received an invitation to take a small group down to DSTL in Porton Down, where they realise, paraphrasing what I have been told, that they have a substantial amount of research capability and they would like to meet exploiters who can rapidly exploit that Government research, if necessary, outside the defence market. I understand that this is relatively unique. They are saying, "Please can we engage with you?" They are going to put on a display. Their chief scientists are going to present the outcomes of their research to a group of engineers. That is a Government Department actively reaching out to an SME community, which I applaud them on.

Q20 Stephen Mosley: Are there any other areas that you can see from your position where engineering could help the Government or sectors of industry but it is not doing so at the moment? Are there any gaps at the moment?

Philip Greenish: There are gaps probably everywhere. You are going to ask me for examples, and my mind will be blank, but I can add a general point. We would wish for Government Departments to have the right level of expertise to understand when they need to have more of it, not necessarily to provide it all themselves. Sometimes that is not the case.

Q21 Stephen Mosley: Can I push you a bit and ask where?

Philip Greenish: The classic example goes back a bit, and I would add that I would not want to criticise this currently. When the policies on wind energy were first being produced, very little regard was paid to the practicalities of creating a wind infrastructure of the scale that exists at the moment. There are still issues in that regard, but I would not like to be too critical because it is work in progress and it is a huge challenge.

Q22 Stephen Mosley: As a Government Back Bencher, I will nod at that last comment because I would disagree there.

Philip Greenish: Let me add a further point, which is that the reason why we have established the *Engineering the Future* grouping, and a portal into this very large profession, is so that people in policy-making positions in Government can have access to the expert engineering advice when they need it. To date, I have already said that most of the requests come through the CSA community. It is more push from us than pull from Government. That tells me that this is work in progress. When we get to the position where we have much more pull from Government in terms of requesting advice and information than push from us, then I will know that we have succeeded. Then we will have the challenge of meeting the demand, but that is the sort of challenge that we would like to have. One can then make decisions on priorities.

If we compare it with the system that operates in the USA with their national academies, it is much more structured. Congress and the Administration have a legal right and responsibility to invite their national academies to advise on all sorts of areas of policy. They deliver that through a policy staff that numbered, at the last count, a little over 1,200, leaving aside the other things that they do. We could not go that far, and perhaps we would not want to. There is a happy medium which is somewhere further down the line from where we are now.

Chris Aylett: Let me give you one short example that addresses, from my perspective, your question. Engineering is, indeed, a vast area. It is critical. We are a home of innovative engineers. If anything else, Britain's future is innovation generally as opposed to rhetorically. We genuinely innovate, and you can count many such people involved. Government Departments do not facilitate diversification. So an engineer who takes a discipline from one area and sees an extraordinary market opportunity in another has a very strange maze to travel through the realm of Government to make sure that he locks into it. We are finding by the day that we have to re-engage with the Ministry of Defence. We have to re-engage with the Department that handles marine and we have to re-engage with aerospace. For an SME community of innovative engineers that spends 30% of its sales on R and D, it just wants to get on and do some good business. That structure does not ease the passage and the exploitation of the engineering talent that we have.

Q23 Stephen Mosley: Let me turn to something else that you said earlier, Mr Greenish. You were talking about headcount reductions and the effect that that might have on the engineering community within Government. Are you able to quantify that or give any specific examples of where that has caused problems?

Philip Greenish: No. I cannot think of a specific example. It is, perhaps, to the Government's credit that we have not seen specific examples where expertise has just evaporated; at least I have not.

Q24 Roger Williams: Engineering as a trade or profession can be typified as being male and white.

As a group of MPs, I do not think that we can take the high ground on that matter. The Government cut funding to the United Kingdom Resource Centre for Women in Science, Engineering and Technology. Mr Greenish, was the Royal Academy consulted about that?

Philip Greenish: No, we were not. I was aware that it was likely to happen, but we were not consulted.

Q25 Roger Williams: What would you have said if you had been consulted?

Philip Greenish: I would have said that it is a huge issue in the UK. The proportion of female undergraduates in engineering, technology and related courses has remained stubbornly at about 13% for a number of years, having climbed gradually from virtually nothing in the '80s and '90s. We are not cracking it. The UK is the lowest of all European countries in terms of the proportion of women entering professional careers in engineering. One could say that it seems a strange time to remove funding from the body that was established to promote gender diversity in STEM.

However, I would not be qualified to judge on why that decision was made and whether a view was taken that there were better ways of spending money. Through the last spending review, the Government did allocate a small sum of money to the Royal Academy of Engineering to lead diversity in engineering. It is £200,000 a year, which is enough to fund a post and a small range of work, but we are taking a different approach to this situation. Our approach is taking our leadership position across engineering and working down into the profession to get other people to do the work. It is fair to say that a lot of the valuable work that the UK Resource Centre was doing was embedded in companies and organisations, so quite a lot of it was bottom up. We do not have the resources to do anything other than that type of work.

Q26 Roger Williams: The Government implied that working towards diversity should be mainstreamed into other work programmes. Is there any evidence that that is happening, or is that a real consideration when programmes are constructed?

Philip Greenish: There is evidence that it is happening in all sorts of places. There is evidence in industry that many big engineering companies are doing a lot of work to improve the gender diversity of their companies. They are working in schools, colleges and with the profession; so, many companies are working with us and others in the profession to do this. To give you some specifics, you may be aware of the Big Bang: UK Young Scientists and Engineers Fair. It is part-funded by Government, part-funded by industry and heavily supported by the profession. A lot of that effort is focused on getting young girls as well as boys interested in STEM subjects. If you go to it, you will see that it is very broadly based across the whole of science and engineering, but the engineering is right in your face. It is very exciting. This year it is taking place in Birmingham, and we expect to have 40,000 to 50,000 people attending. It has grown to that level in less than four years, which is extraordinary. We also have a collective of programmes which are supported by industry and third sector deliverers. They take place in schools, where they school tomorrow's engineers. We deliver it jointly with EngineeringUK, and the gender diversity is pretty evenly spread.

Our own Academy has a range of schemes at the higher levels of school, college, university and post-grad. The gender diversity is pretty good in our post-doctoral research fellowship scheme, for example. Over 40% are women. There are signs of progress, but, overall, we are not yet shifting the body of the kirk sufficiently.

Q27 Roger Williams: Mr Aylett, perhaps I could ask you a very unfair question. Could you tell us when a woman is going to be on the podium?

Chris Aylett: How soon? It won't be that long; it really won't. I want you to know this. I am focusing on engineering, not driving. Driving is another Department, surely. A young British lady—we think she might be the first—was the race engineer at Le Mans. Her car was the Audi that came over. She trained as an aeronautical engineer and started in motorsport only six years ago. To win Le Mans, which is a battle of giants in terms of spending—she is an English girl who has a job with Audi and has won Le Mans—it means base engineering. She was standing on a pit wall for the 24 hours and she called the whole race, as they say. Strangely enough, her sister is in the same position on the Mini World Rally team. We have quite a good list but, strangely enough, I did think that this question might come up. We are also in the area of 15% to 20% of women employees within motorsport, which is a very macho industry. I think it is not bad progress.

Strangely enough, we also have the same thing at schools. From the school competitions that we are involved in, you would quite happily say that this is very diverse in terms of gender. We have Formula Schools and Formula 1 in Schools. Many girls are thoroughly enjoying it. I have interviewed many of them who say that motorsport is cool, clean, fresh and exciting, but they don't necessarily then get a job in it. Something happens between going to college and university and getting a job.

Philip Greenish: We are severely hampered by the fact that only 20% of those who take A-level physics are female. Physics is not necessarily an absolute requirement for an engineering degree, but it is important. That is the pool we are talking about for engineering. That is a real problem.

Q28 Stephen Metcalfe: I have a quick question to drill down into that. Engineering is a very wide sector. Are there any particular sub-sectors within that sector that are doing much better than others? You said 15% to 20% are interested in motorsport. Are there any sectors that are doing better and, if so, why are they doing better?

Philip Greenish: Yes, there are—in biomedical engineering. I do not think that the profession has yet succeeded in getting the message across that, whatever branch of engineering you are in, you are contributing to the benefit of society. With biomedical engineering, it is quite clear to everybody that there

are immediate, tangible and personal benefits. This information is a year or two out of date, but I was told that, at Imperial College's biomedical engineering degree course, more than half of the students are women. Chemical engineering has done very well in terms of recruiting more than its fair share of women. In contrast, sadly, mechanical engineering is still struggling.

Q29 Chair: I have a final question to you, Mr Aylett. It is something that is dear to my heart as it is a local issue that re-surfaced recently when I was talking to the Williams Team. This was, if I can use the pun, the spin-off company out of Eurenco that then created an energy storage device, which the Williams Team is now working on. That struck me at the time, and I had fierce rows with the head of British Nuclear Fuels, as a classic example of the Government not recognising what they had their hands on. Potentially, it was a very valuable piece of technology that they were not prepared to develop to production. I now know that in Stephen's constituency, which abuts mine, there are several small businesses that are crawling over Government patents and looking at potential areas of exploiting those patents. Is it your experience that it is widespread across Government that there may be an awful lot of untapped material because of the lack of understanding of the science and engineering that Government Departments are sitting on?

Chris Aylett: I will call you after I go to Porton Down because, strangely enough, that is almost exactly what they are saying. They are saying that they have all this research which has been funded. If it is not exploited by the defence primes, who is going to exploit it? They met our group and they have been very actively interested in what we are doing and seeing us deliver in fast order. They said, "Please come and look at our treasure trove of research and help us exploit it." I would say that in that particular area, yes, it must be true. I was unaware of Porton Down and unaware of the DSTL until someone said, "Gosh, we've got a lot of cool research down here. You're good exploiters. Come and have a go." I cannot imagine that there would not be other pockets of research.

I will go on a negative note, I am afraid, Chairman. The Government may not have noticed the value of Williams' hybrid powers, but the Qatari Government did. They have set up an R and D centre in Qatar in partnership with Williams Formula 1. The reason I am probably sitting here is, as Harvard have said, how can you have a jewel in the crown like our sector sitting in front of you at very difficult times for the UK and watch other Governments rape and pillage it? It seems that we ought to use some of our assets better.

Chair: That is a very good note on which to finish. Thank you very much, gentlemen, for your attendance this morning.

Wednesday 14 December 2011

Members present:

Andrew Miller (Chair)

Stephen Metcalfe
Pamela Nash
Graham Stringer
Roger Williams

Examination of Witness

Witness: **Sir John Beddington**, Government Chief Scientific Adviser, gave evidence.

Q30 Chair: Sir John, welcome; it is good to see you again. As you know, we are exploring the relationship between the Government and the engineering sector, and looking to see how that has changed, if at all, since our predecessor Committee wrote "Engineering: turning ideas into reality" in 2009. Do you and the Government now see the Royal Academy of Engineering as the first port of call for engineering advice?

Sir John Beddington: Yes, in general that would be the case, but it depends. For example, a particular issue might be a civil engineering or mechanical engineering matter, and we might at some levels go directly to the appropriate institution. But if it is a general engineering thing I would immediately go to the Royal Academy of Engineering.

In fact, if you would allow me to expand on that a little, one of the issues that is coming up is that of shale gas and how we are going to deal with it. There is quite a lot of uncertainty. The Foundation for Science and Technology had an open meeting on it, which I think you attended. I also had a meeting with the chief scientific advisers, and we said that there are real issues here. My first port of call was to contact the Royal Academy of Engineering and the Royal Society to say that we would be very interested if they were in some way to think of examining the question of shale gas. That is under discussion within the two academies, and I hope that they will be taking it forward. But that would certainly be the first port of call, for example, for something that is very current.

Q31 Chair: Absolutely. I was discussing the matter with some scientists only yesterday, and we were slightly amused at the BBC's choice of a so-called independent adviser, which happened to be Benny Peiser. The Geological Society is quite adamant about their views on safety in the context of the supposed earthquakes. Is that the kind of view that is coming through?

Sir John Beddington: If I may, I would rather wait until I have heard the results of the deliberations of the Royal Academy of Engineering and the Royal Society on safety, potential reserves and so on. My concern is that we should have a detailed and authoritative evidence base before we start making policy on this.

Q32 Graham Stringer: There has already been one Select Committee report on shale gas. Do you think that this Committee should take a look at the subject? Would that be of help to you?

Sir John Beddington: I would probably say again that we are hoping to get advice from the Royal Society and the Royal Academy of Engineering. A small taskforce has been set up to look at shale gas in particular in the British Geological Survey. It is a very active discussion. It might be appropriate for your Committee to look at the subject once a report or some form of advice has come from those two bodies, and talking to the chairman of the Committee or the appropriate officers within it would then seem to be perfectly in order. As to whether you need to have a comprehensive inquiry, that is not my role, but there is a lot of uncertainty at the moment, and it is rather important to get the evidence base fixed first. I have hopes that we would have some form of assessment by Easter or early summer.

Q33 Chair: Let us return to this inquiry. It is true to say that, over the last four or five years, relationships between engineers and the Government have improved. However, we sometimes hear that policies are too often developed without consideration of the engineering perspective. Do you agree that that remains a problem?

Sir John Beddington: I don't think that it is a problem. I have seen these comments, but they are not underpinned by much in the way of examples. In terms of this sort of generic issue, there are a few things that I have done at an institutional level. One is that I have arranged for the president of the Royal Academy of Engineering to sit ex officio on the Prime Minister's Council for Science and Technology. I have also arranged for the Royal Academy of Engineering to have an ex officio position on GSIF, which I am reminded is the Global Science and Innovation Forum. You can see that I am not a civil servant because my ability to master acronyms is not good.

Chair: Or to invent them.

Sir John Beddington: The Global Science and Innovation Forum previously had only the Royal Society on it, but we now have the Royal Academy of Engineering as an ex officio member and the Academy of Medical Sciences. We are doing that. In addition to the Council for Science and Technology currently having Sir John Parker as an ex officio member, six of its members are in fact qualified engineers. For example, Colin Smith is chief engineer at Rolls-Royce. The CST has a very significant number of engineers on it.

Also, we are looking to engineers fairly regularly. A recent example was the tragic floods in Hungary. Our Prime Minister met the Hungarian Prime Minister and offered help, and we were asked to put it together. We

were able to get a team from BGS and engineers from Newcastle university to go to Hungary to provide advice on mitigating future problems and to advise on the general environmental effect. That was very successful, and the Hungarian Minister for Environment and Water came over to Britain specifically to develop these links. So we are calling it in appropriately. I am sure that you will ask me later on, but in terms of the CSA community there will be some announcements this week which will be favourable in that direction, if I can put it that way.

Q34 Chair: For the record, you will be interested to know that I was speaking in Hungary a couple of weeks ago, and the president of the Hungarian Academy of Sciences specifically asked me to pass on his thanks for your involvement in that chemical spillage.

Sir John Beddington: Thank you.

Q35 Chair: The other aspect about which engineers are expressing some angst—it also came out in two rather brilliant BBC programmes recently about the Airbus wing and Rolls-Royce engines—is the undoubtedly huge concern about our skills base, particularly regarding tuition fees policies. Do you think that the potential impacts of that on the future supply of engineers have been given sufficient consideration by BIS and the Department for Education when developing policies?

Sir John Beddington: They were certainly thought about, but it is probably too early to judge whether there has been a significant detrimental effect. It is interesting that I have seen evidence indicating a decline in engineering in Scotland, where tuition fees have not been imposed. As for whether there will be any significant effect, the jury is out. It is certainly a concern even outside the debate on tuition fees that we need more scientists, and we certainly need more engineers.

In order to address the problem, we have to up the image of engineers quite substantially. The initiative to set up the Queen Elizabeth prize for engineering, which came from the Government, is one that I strongly support. I hope that it will show that the UK takes engineering extremely seriously. We have engaged with industry to put funding into the prize, which the Government strongly support, and the Queen has lent her name to the prize. That is extremely important, as it shows that the UK is taking engineering extremely seriously. Whether some 17-year-old deciding on their A-levels is going to be influenced by the potential of winning the Queen Elizabeth prize for engineering in 30 years I cannot say, but the hope is that sufficient publicity will be associated with it to drive the message that engineering is really important. In my capacity, I will certainly do everything that I can to help that go forward. I am a special adviser to a trust that has been set up to examine appointing a panel to choose the potential winner or winners of the prize.

Q36 Chair: There are all sorts of companies. I shared a platform the other day with Kevin Tebbit, gamekeeper turned poacher, I guess, in his capacity as chairman of Finmeccanica, and we were discussing the development of the curriculum with the Design and Technology Association. There are real worries out there about design and technology being taken out of the English curriculum. Do you share those worries?

Sir John Beddington: It is an area that has been drawn to my attention, and we need to think very hard about it. It is a discussion that Sir Adrian Smith and I have been having. To an extent, it is a bit removed from my immediate responsibilities, but I have talked to Adrian Smith about this and I think that we need to examine it. Arguably, if there is sufficient evidence for it, it needs to be rethought.

Q37 Chair: It may be removed from your immediate area of responsibility, but the successor to your successor's successor will have no job if you do not have a supply of scientists and engineers in this country.

Sir John Beddington: I thoroughly agree with that, and it is very high on my agenda, but I thought that you were asking particularly about design and I am not well enough briefed to give a detailed answer on that. However, I have discussed the matter with Adrian, and he will engage with HEFCE if there is evidence that this is a real problem. There is absolutely no doubt—I have made many a speech on the subject and taken action—that we need significantly to up the role of engineers and the attraction of that career. There must be ways to do that. The ambassador scheme, which was developed several years ago, which has practising engineers and scientists going into schools and talking about what they do, has been really very successful. I think that we need more of the same.

It may seem slightly facetious, forgive me, but it seems to me that TV has enormous power in attracting young people into certain careers. The forensic sciences had a major increase in students wanting to study the subject at university, and the causal mechanism was a lot of TV programmes on it. Brian Cox's programmes on the universe, cosmology and basic physics have also brought about an increase in people interested in reading physics. Perhaps this Committee could persuade the BBC that they need to make programmes showing engineers as serious heroes.

Chair: It is a pity that they were not here yesterday televising the STEMNET awards, for example.

Q38 Stephen Metcalfe: May I pick up on a point made by the Chairman? His original question was about the potential link between tuition fees and the drop-off in the take-up of STEM subjects. Regardless of the link, now that that policy is established, do you think it would be better to spend more time talking to the students and explaining the ramifications of the changes, rather than kicking it around like a football? Should we not be explaining that it is not like any other debt and you pay back a percentage of what you earn? Actually, engineers are statistically very high on the graduate pay scales, and their earning potential is much greater than for many other subject areas.

Perhaps we should make those points more clearly to them.

Sir John Beddington: You make an excellent point. As you say, it is not an up-front fee; it is paid once the salary increases above a threshold. Those engineers that graduate, by and large, are pretty well paid compared with other graduates, and some are extraordinarily well paid if they move into the City of London and use their engineering skills there. Even in more conventional engineering, it is less of a problem. Engaging in that way is really important, and it is a very good suggestion.

Q39 Stephen Metcalfe: Thank you. I will now turn to the area that I was going to chat to you about. You mentioned shale gas and said that you were seeking advice on that. Does that indicate that the Government are now an intelligent customer, if you like, for engineering advice and that civil servants are better equipped to understand when that advice is needed?

Sir John Beddington: I would say that requiring the Government to be an intelligent customer is very much my job. It is the job of the chief scientific adviser in each Department. As I indicated earlier, I think that more engineers will be entering over the next month or so. However, the key is that chief scientific advisers need to point out when engineering advice is needed. For example, if there is concern that we don't have an appropriate intelligent customer base on a particular area, we need to work out ways of getting it done. That is very much recognised by the Departments. Going back to shale gas, there is interest in a number of Departments on this such as the Department of Energy and Climate Change, Defra and so on, but the Treasury also has an interest. The recognition that we need authoritative engineering advice on this issue came directly from a discussion that we had at the chief scientific advisers' breakfast meeting. It is too complicated. We need to be intelligent enough to say that we need expert advice from the very best people, whether it is about science—and there is a lot of science—or engineering. The answer to that is yes, but of course there will be times when things are problematic. DECC's decision to appoint a chief engineer reporting to the chief scientific adviser and providing a role as head of profession for engineers in DECC is an indication that it recognises it needs more engineering advice. Indeed, that is just part of it; the Department is recruiting a number of new engineers into the Department.

Q40 Stephen Metcalfe: Rather than seeing a reduction in engineering expertise across Government, following the recent changes in departmental budgets, you can see it improving the number of engineers across Government.

Sir John Beddington: The aggregate figures would need to be addressed, because they will be different in different Departments. The analysis that I and the permanent secretary to the Treasury did, which was shared with this Committee and the Committee in the other House, indicated that, albeit there had been cuts in individual Departments, they had not been disproportionate and engineers were not being disproportionately cut compared with scientists or, indeed, general policy people. There are variations, of course. DECC is a particular example; there has been an increase in the number of senior engineers there, but in the other large science and engineering-using Departments the cuts are pretty much proportionate to the overall finances.

Q41 Stephen Metcalfe: Are there alternative ways of increasing the capacity to use engineers and engineering advice across Government, perhaps by seconding academics or industrial engineers into Government?

Sir John Beddington: That is a really interesting idea and one that we should follow up. The sort of thing that we need to be thinking about is, in a sense, what is in it for them. If we can persuade a number of academics to sit on science advisory councils—many advisory councils have engineers on them—that would be a good thing. I think I have told this Committee in the past that one exercise I have undertaken is to hold meetings, some under the auspices of the Royal Society and some under the auspices of the Royal Academy of Engineering, to inform academics about Government and how they could help Government. That is something to take forward.

I have also set up a meeting—it will probably happen in March—with the vice-chancellors or their nominees of most of the key universities where engineering is a discipline. I have asked them to come down for a meeting with CSAs from key Departments, Adrian Smith and me to explore ways in which academia can feed into the Government process. The CSA from DECC could be telling them of the Department's problems and saying that he would welcome advice; the same goes for other Departments. I hope that that will engage the academic community so that we can assure vice-chancellors that this is something we value.

Q42 Roger Williams: Some members of my family would not agree that engineers are well paid. However, they would agree that, if they had taken their skills into other sectors such as finance, they would be more adequately rewarded. By dint of their responsibilities, a number of Government Departments may require engineers as their chief scientific advisers. Would you say that that is the case? Should the default situation be that they have engineers?

Sir John Beddington: I am in a slightly awkward position, because two announcements are to be made tomorrow. My answer to that question in practical terms will be made manifest once these announcements have been made. I think it is quite clear—you will see it in the advertisements—that the Department for Transport and BIS indicated that an engineer would be completely appropriate for the position of chief scientific adviser. A similar advert went out for the Ministry of Defence chief scientific adviser, which is in process. It is recognised. Going through individual Departments, some call for, if not a straight engineer, at least someone with the physical or chemical sciences that are appropriate, but others

such as Defra might want someone with more of a background in the biological or environmental sciences. I agree with your specification. Action has been taken in respect of the advertisements. As for the practical results, watch this space, but I think it indicates how the Government are treating the matter.

Q43 Roger Williams: So you are not going to answer my second question on what tomorrow's announcement by BIS and the Department for Transport is going to be.

Sir John Beddington: All I can say is that I would be delighted to answer it, and I think the style of this conversation indicates that the answers will be to your liking.

Q44 Roger Williams: That is manifest. You have already said that DECC has appointed a chief engineering adviser to report to the chief scientific adviser. That follows very closely the recommendation made by the predecessor to this Committee that that should be the case. Will that be replicated in other Departments?

Sir John Beddington: If a Department has a chief scientific adviser who is an engineer, then replication will not be necessary. It is very much for the Department's chief scientific adviser and permanent secretary and the departmental board to take a view. The situation is open. For example, in the Home Office, the prima facie requirement for engineering might arguably be less than in the MOD or DECC. The Home Office's chief scientific adviser, Bernard Silverman, is a mathematical statistician, and he has engineers working within the science and engineering community, primarily on border security and the sensing of hazards. A community of engineers out there reports to Bernard, and it works reasonably well. Whether it would be enhanced by having a very senior engineer is something for the Department to decide.

We are open to all solutions, and individual Departments will have individual structures which merit it. For example, the chief scientific adviser to the Department for International Development is a medic, but much of that Department's work is to do with mitigating and adapting to climate change, and dealing with some of the major resources needed for that. But he is an expert in malaria, so he appointed a deputy chief scientific adviser with expertise in climate change and resource management. There is no one-size-fits-all answer. If I was asking engineering questions of a particular scientific adviser and wanted to know how he was dealing with them, essentially I would be concerned if I was getting no indication that they were being dealt with properly, and the science and engineering reviews of which you are aware aim to explore that.

It is a rather bland one-size-doesn't-fit-all answer, but we are very open. The entire community of chief scientific advisers recognises how important engineering is.

Q45 Roger Williams: In general, in recruiting chief scientific advisers and engineering advisers, is the recruitment process aimed at academics or is there a broader approach to it? Perhaps you could comment generally in recruitment terms. Do people come mainly from the academic sector?

Sir John Beddington: No, not entirely. We target industry and academia in our adverts. There is a slight problem in salary levels if you are moving into government from industry; it is arguably slightly less attractive than for academics moving into government. But we aim to do it. In some areas, if you had someone from academia in a key Department where engineering was important, or indeed that business was important, we would want to be confident that they had engaged substantially and that would be one of the criteria of choice.

I cannot remember exactly how many chief scientific advisers I have appointed in the last four years—it seems to be quite a lot—but one of the criteria that we use in particular areas is to ask how much they have engaged with the key stakeholder community. For example, to take it away from engineering, in DFID we would want to explore whether the person had worked in the developing world and knew the NGO community and the major stakeholders in the international aid banks and so on. That is the sort of engagement. For example, the chief scientific adviser at BIS, prior to being appointed, must have had some significant engagement with an industrial base.

Q46 Pamela Nash: With your Council for Science and Technology hat on, how do you decide the right balance of expertise in the membership of the council? In particular, how do you ensure that it has engineering expertise?

Sir John Beddington: We did not really decide on the right balance. It is fair to say that we did not say we wanted six engineers, half a social scientist and two economists. However, that is what came through. We placed adverts and phoned around, contacting people who we thought might be attracted to the job.

We then had something that I have never encountered before; it was called a conversation with a purpose. It would be interesting to examine the antithesis of what that might be—gossip, I suppose. We had a series of conversations with a purpose with something in the order of 25 candidates from a field of about 80 applicants. During those conversations with a purpose, we filed them down to about 12 individuals, perhaps slightly more, who we felt were appropriate for appointment. That list then went to the Prime Minister, because it is his council, and he chose the final 11 members. As it happened, quite a few of them were eminent engineers. For instance, Christopher Snowden, the vice-chancellor at the university of Surrey, is an FRS and FREng and has worked in industry—a classic. Another appointment was the straightforward engineer, Colin Smith, who is chief engineer at Rolls-Royce. Others involved in engineering include Keith Burnett, the vice-chancellor of Sheffield university; he is a physicist, but much of his work in Sheffield was dealing with advanced manufacturing. We did not set out by saying that that was what we wanted, but that is what happened and I feel very comfortable with it.

Our engagement with the Prime Minister has been really quite successful, in the sense that we have had the input of engineers at all stages. That has helped.

That is not to say that the social scientists involved are not helpful—they are, as are the mainstream scientists—but having that mix across the spectrum is really important.

Q47 Pamela Nash: Is that something that would have to be formalised in the future, or are you quite confident about achieving that balance informally?

Sir John Beddington: It would be really pernicious to formalise it. The criterion has to be excellence. My own view is that, if you have someone really excellent, then they will be able to move outside their immediate field. For instance, could the engineers really comment on issues to do with biodiversity? I would expect them to be able to do so. Similarly, if we hired people who were chemists, I would expect them to be able to make comments on engineering aspects. In my view, excellence has to be the prerequisite of appointments, but formalising it, no. However, we have formalised the ex officio appointment of the presidents of the Royal Society, the Royal Academy of Engineering, the Academy of Medical Sciences and the British Academy. In that way, science, engineering, medical science and social science and the humanities are represented. That is how to do it, rather than saying that we need six of this, three of the other and so on.

We are in the process of appointing another co-chair for me, as Dame Janet will be stepping down at the end of the year. The process is ongoing—the application deadline was last week—and we are in the process of appointing a co-chair. To an extent, we might want to think a bit about balance in that appointment—a bit of balance for me, as I come from a particular area, and there might be merit in having someone who works in a different area as co-chair. However, that is specific.

Q48 Chair: On the question of expertise—I am trying to get my head round this—the code of practice for the scientific advisory committee states, "The SAC Chair, secretariat and Departmental CSA (or relevant senior official for non-department sponsors) should discuss and agree areas of expertise required in advance of appointments."

Sir John Beddington: For science advisory committees, that is relevant, but the CST is rather special. For example, I chaired Defra's science advisory council for a while, and it was very clear that we needed an epidemiologist—someone who could comment on some of the key issues of livestock disease that Defra has. That was a perfectly sensible thing to do. When recruiting, we specified that we wanted someone with that background. You can do that; it is perfectly legitimate in individual Departments for the departmental science advisory councils to do that. It would be crazy if, by wanting excellence in Defra, you had people who were expert only on biodiversity, but in the science advisory councils you are seeking particular expertise and it is therefore sensible to do it. You cannot be comprehensive in a Department like Defra or you would have a science advisory council of about 80. Within the constraints of numbers, it is sensible to have a broad brush.

I believe that the Council of Science and Technology is different. It would be an odd composition if that council did not have a number of people from business, no one with engineering or a mainstream science background, and did not have anyone with a social research background. But the actual balance is not there.

Q49 Pamela Nash: Last week, the chief executive of the Royal Academy of Engineering told us that it normally nominates members for specific departmental scientific advisory committees. He was not able to tell us there and then which ones. Would you be able to shed any light on that?

Sir John Beddington: We can find out. I do not know it off the top of my head, but, when we recruit for any position, we would certainly consult the Royal Society, the Royal Academy of Engineering, the Academy of Medical Sciences, and we would also talk to the research councils. In a sense, they are the people who have the expertise and know who is active and where the skills are. There is quite a broad consultation.

As for whether the Royal Academy of Engineering has been approached, I would be surprised if it was not approached by DECC for its suggestions for a chief engineer in that Department. DECC now has a science advisory group, and I would be surprised if it had not been asked for advice on who might be there, for example, to provide a bit of expertise, because the Department's advisory group has people who are experts on geoengineering, nuclear engineering and so on. Some advice from the engineering community would be sought, but I am not aware of the particulars.

Q50 Pamela Nash: Could you provide us with information in writing on that?

Sir John Beddington: Yes, I am sure that we can.

Q51 Pamela Nash: On that point, are any other engineering bodies routinely consulted by the Government, or is it only the Royal Academy?

Sir John Beddington: I think it is all the main institutions. For example, we asked for some help from the engineering community about water management and the problems of water security, and civil engineers and others put together a very detailed presentation with suggestions on how to deal with water security. It is horses for courses. For example, if we had issues to do with the transport system, we would expect one of the first ports of call to be the Institution of Mechanical Engineers. In a sense, the thing goes in an odd way; if I contact the Royal Academy of Engineering, it will often say that it would be much better to talk to this or that group. It is a relatively fluid process.

When I first became involved as chief scientific adviser, I had regular meetings with the chief execs of a number of the key engineering institutions, mainly because we did not know them. Now I do, so we not have those regular meetings, but we often have groups from the engineering community attending a meeting of the Chief Scientific Advisers Committee. That has happened on several occasions in the last year.

Q52 Pamela Nash: So the relationship is good and informal.

Sir John Beddington: It is fair to say that the direction of travel since I became chief scientific adviser pleases me. I think we are much more intimately linked in with the engineering community than we were when I arrived. That is entirely to the good.

Q53 Pamela Nash: Very quickly, because the bell tells us that we are running out of time, to clarify the matter do you or does anyone else have overall responsibility for ensuring that there is engineering expertise on each of the scientific advisory committees?

Sir John Beddington: I am afraid the buck stops with me. My responsibility is for the quality of all science and engineering in Government, including social science. That is the job description, so it ends with me. As for the head of profession role that I play, I have told the Committee before that I take it quite seriously in setting up the Government's science and engineering community. In fact, we had the chief executive of a Formula 1 company present a meeting of scientists and engineers in government about two months ago, and Colin Smith has agreed to address the GSE annual conference that takes place in January. We are engaging at that level. Interestingly, we have about 3,500 members in that community, and just under 50% are engineers, of which a significant proportion have professional qualifications as well as engineering degrees—so the balance is not bad now.

Q54 Pamela Nash: Finally, do you think that your successor in your role should be an engineer?

Sir John Beddington: That is for the Prime Minister to say, but there is absolutely no reason why not. I would feel completely comfortable if my successor was an engineer, but I would not say that it has to be an engineer. That would be unwise. Again, you would hope to have someone who can do the job. I have to say that I was spectacularly surprised to be offered the job.

Chair: Sir John, as usual, you have been very open with us. We look forward to tomorrow's announcements, and we may be able to read in your answers something about the qualifications of some of the appointees. Thank you very much for your attendance, and have a good holiday.

Written evidence

Written evidence submitted by Government Office for Science

This memorandum was prepared by the Government Office for Science with input from other departments including significant contributions from DECC, DCLG, MOD, DFID, Defra, Home Office and BIS.

INTRODUCTION

1. The Government welcomes this inquiry. The Government is committed to making well-informed decisions that will stand the test of time. Ensuring policy makers have access to the best science and engineering advice is critical to this.

2. While not the focus of this follow up inquiry, it is worth restating the importance of engineering to the UK economy. The UK has significant engineering strengths and must make the most of them. An important element of the Government's growth agenda is to develop these strengths and ensure they play their part in delivering a strong economy. The Government is also committed to strengthening science, technology, engineering and maths (STEM) education and promoting engineering as a career.

3. The UK needs to get better at recognising and celebrating these successes. For example, the development of a new international Engineering Prize is intended to demonstrate to the world the UK's strengths in engineering and its importance to the economy, whilst also inspiring and promoting engineering amongst the wider public, particularly young people.

4. Alongside its contribution to the economy, the Government recognises the importance of engineering evidence and analysis to policy. The Government agrees with the sentiment of the previous Committee's report and continues to see better use of engineering advice as an area for continuous improvement.

5. We now turn to the four questions asked in the Committee's Call for Evidence.

Q1. *Since the 2009 Engineering inquiry, has the role of engineering evidence, expertise and advice in Government improved*?

6. The Government believes that engineering advice is used increasingly effectively in developing and implementing policies. As set out above, there is always room for improvement: engagement with engineers and the use of engineering evidence, expertise and advice is something which departments are always seeking to improve.

7. The Government Chief Scientific Adviser's (GCSA's) *Guidelines on the use of Science and Engineering Advice in Policy Making*[1] (the Guidelines) have been strengthened with explicit reference to engineering in relevant sections throughout the document.

8. As set out in the Guidelines, it is the role of departmental Chief Scientific Advisers (CSAs) to ensure that departmental decisions are informed by the best available advice. To do this, they and their teams seek and marshall advice from all relevant sources, including engineering. There is now a CSA position in every major spending department including the Treasury. This means that every department has access to the network of CSAs and can draw on its engineering expertise.

9. It remains the case that the Government is not persuaded of the need to introduce Chief Engineering Adviser positions alongside CSAs. Engineering advice, which is distinct from and complementary to science advice, is an important element of the role of the GCSA and of departmental CSAs. The role of CSAs is to ensure both are fed in to policy and operations as necessary. At any given time, a number of the CSAs are professional engineers reflecting the relative importance of engineering to the work of their departments. In addition specific engineering adviser posts exist where there is a requirement; for example, DECC is in the process of recruiting a Head of Engineering (see paragraph 19 below), a post which will report to the DECC CSA.

10. The GCSA has also been developing the cross-Government community of scientists and engineers; Government Science and Engineering (GSE). We now hold figures on numbers of people in GSE with engineering qualifications and experience. There are currently around 1,100 people in GSE with an engineering background out of a total of some 3,500. Of these, around 425 have chartered status or membership of a professional body which requires continuous professional development (CPD).

11. Specific events and activities relevant to engineers working in government have included:

— An engineering development scheme for civil servants, piloted with the Royal Academy of Engineering (RAEng) in 2010 and planned to be repeated in future years. As well as providing learning, development and professional networking opportunities for engineers working in government, this scheme provides an opportunity for engineers from the private sector meet with civil service counterparts and better understand government activity.

[1] Guidelines on the use of science and engineering advice in policy making (http://www.bis.gov.uk/go-science/publications#anchor7).

— The GSE annual conference held in January 2010 had the theme of UK infrastructure.

— The July 2010 GSE workshop *Planning for our Future* focussed on professional development activities such as working towards chartered status. A further seminar for government engineers on getting chartered is planned for November 2011.

— Development of a handbook for GSE members on continuing professional development.

— The Chief Executive Officer of Williams F1, Alex Burns, was the keynote speaker at the GSE Civil Service Live event in June 2011, speaking about expertise and efficiency in a high-tech engineering company.

Engineering in departments

12. The following paragraphs set out some examples of developments in the use of engineering advice in departments since the 2009 inquiry.

Department of Energy and Climate Change

13. The Department of Energy and Climate Change (DECC) offers a good example of how engineering is increasingly being embedded in the business of Government. Since its creation in 2008, DECC has developed the role of engineers in policy. DECC's priority is to deliver secure, low carbon energy, cost-effectively. This requires a range of specialist expertise, including engineering.

14. DECC appointed Professor David MacKay FRS as CSA in October 2009. David MacKay is Professor of Natural Philosophy at the Department of Physics, University of Cambridge, and a Fellow of the Royal Society. One of Professor MacKay's key objectives is to ensure policy and advice at DECC is founded on rigorous science and engineering principles. Dr Paul Hollinshead OBE was subsequently appointed as Director of Science and Innovation in September 2010.

15. DECC's CSA is recognised in the academic, industrial and business communities as an authority on sustainable energy and has written extensively on the subject. He has effective networks within leading national and international Learned Societies. Through the scientists and engineers in his Science and Innovation Group, the CSA has both formal links and informal networks with all the Research Councils in the UK and professional bodies, for example the RAEng and the Institute of Mechanical Engineers (IMechE).

16. Professor Mackay has regular bilateral meetings with the Secretary of State, Ministers and the Permanent Secretary, and provides ad-hoc challenge and advice on a range of topics, including engineering issues, important to DECC.

17. As part of the DECC's business planning process in late 2010, following the 2010 Spending Review, DECC Ministers agreed to substantially increase DECC's capacity and expertise for a range of professions, including engineering. This increase will in part be delivered by recruiting professional engineers to posts in DECC.

18. DECC is recruiting a team of engineers to the CSA's Group, who will provide expertise to DECC across a range of engineering disciplines. The Permanent Secretary has also made Senior Responsible Owners responsible for the evidence and analysis used to inform their programmes and asked Directors General of relevant Groups in DECC to recruit additional specialists to work within their programmes. In some cases these will be additional engineers. As a result, DECC will increase the number of professional engineers employed directly by the department.

19. As of 7 October 2011, DECC is recruiting through external adverts: a Head of Engineering (SCS Pay Band 1); nine further engineers (ranging from Grade 6 to SEO); a Chief Technology Officer; a Technical Architect; and two engineers or scientists to work in the Office of Renewable Energy Deployment.

20. This substantial increase in in-house engineering expertise is expected to:

— decrease DECC's reliance on external expertise (although this will still be sought when necessary);

— improve DECC's use of engineering in evidence and analysis to inform policy;

— improve DECC's "intelligent customer" function, as a user of engineering expertise; and

— improve DECC's engagement with stakeholders.

21. Following the outcome of the DECC business planning round in early 2011, the Science and Innovation Group, the Chief Economist's Directorate and the Strategy Directorate have been merged into one group, the Strategy and Evidence Group. The Group brings together scientists, strategists, economists, statisticians, operational researchers and social researchers: joining up the evidential underpinning and strategic overview for what DECC does. The Group aims to improve DECC's ability to carry out effective multidisciplinary analysis. It will ensure that the Permanent Secretary and Ministers have one internal source of integrated and robust analysis.

22. Professor MacKay has also established an interim Science Advisory Group (SAG), comprised of world-leading independent scientists, engineers and social researchers to provide advice to him and DECC. SAG

members with engineering expertise include Professor Dame Sue Ion, FREng, Professor Nick Jenkins, FREng and Professor Jon Gibbins.

23. Professor MacKay's primary route for providing advice and challenge is through his formal role in departmental governance. He was a member of DECC's Management Board until March 2011. This board was dissolved in March 2011 and replaced by a Departmental Board chaired by the Secretary of State. Although Professor MacKay is not a member of the Departmental Board, he has an open invitation to attend board meetings where there is discussion of scientific and/or technical issues.

Department of Communities and Local Government

24. Professor Jeremy Watson FREng is CSA at the Department of Communities and Local Government (DCLG), and is an engineer with 20 years of experience in industrial power electronics and control. He has a separate part-time role as Global Research Director at Ove Arup and Partners, and maintains close links with the engineering community through his fellowship with the RAEng, the Institution of Engineering and Technology (IET) and the Institution of Civil Engineers (ICE). He is also a Council member of Engineering and Physical Sciences Research Council (EPSRC), a visiting professor at Southampton and Sussex Universities and industrial adviser at Cambridge, UCL and Imperial College.

25. DCLG uses science and engineering challenge in a number of policy areas including building regulations, planning and fire & resilience. Working closely with the other heads of profession, Professor Watson applies STEM quality assurance reviews to policy proposals and to research applications. He recently acted as Senior Responsible Officer on a cross-departmental initiative for housing as it pertains to the Climate Change Risk Assessment.

26. In cross-departmental work, Professor Watson has contributed engineering expertise to HM Treasury's Infrastructure UK programme, serving on the Engineering and Interdependency Expert Group, and to the Energy Research Partnership, to BIS under the Construction Innovation Growth Team, and to the Research Councils UK Living with Environmental Change (LWEC) programme, where he is a member of both the user panel and the business advisory board.

27. Recent work at DCLG seeks to bridge engineering disciplines with social and behavioural sciences, and Professor Watson has established a voluntary academic network to study the behavioural influences possible by combining engineering with design, for example for low carbon occupancy of housing and commercial buildings.

Ministry of Defence

28. Engineering remains fully integrated into MOD policy making and major procurement decisions. Since the 2009 Engineering Inquiry, the MOD has made significant efforts to increase the support provided by engineering professionals and, more specifically, to ensure relevant engineering input is sought as early as possible in decision making processes.

29. The *Equipment, Support, and Technology for UK Defence and Security* Green Paper of 2010[2] underlines these aspirations. Early consultation with industry and the wider engineering community ensured a sound technical and engineering foundation was in place for the forthcoming White Paper to be written. The Green Paper also states that:

> "Prioritisation of our investment must provide a balance between developing new Science and Technology (S&T) against maintaining our ability to be an intelligent customer…".

30. It is acknowledged therefore, that in order to achieve the technical understanding necessary to achieve value for money in procurement, and to understand the aspects of safety, legal, ethical and environmental constraints, the MOD's network of engineering expertise and advice must be maintained to uphold the Department's role as the "intelligent customer".

31. In 2009, Defence Equipment & Support (DE&S) received two reports that identified the need to strengthen the MOD's capabilities in engineering: the Gray Report to the Secretary of State on Acquisition; and the Haddon-Cave report on the Nimrod XV230 fatal crash. Since then, DE&S has strengthened processes to assess the current state of engineering in DE&S and set out the skills required over the next decade to retain a robust and sustainable engineering capability. The organisation is now working to develop on such requirements. MOD has also set up a new Military Aviation Authority (MAA) and more recently a Defence Safety and Environmental Authority (DSEA), both of which will provide independent safety and regulatory functions to support high-hazard defence activities.

32. Strategic Defence Science and Technology direction continues to be provided by the Department's Chief Scientific Adviser. The MOD maintains its belief that the term "scientific" incorporates both science and engineering and that the role of engineering in Government is therefore not undermined. This is reinforced in the recent recruitment exercise for a new CSA where the MOD set out it was seeking:

[2] Equipment, Support and Technology for UK Defence and Security: A Consultation Paper, December 2010.

> "As an internationally recognised and distinguished scientist or engineer, you will have the credibility, authority and presence to lead the MOD's science and technology community; ensuring that key strategic decisions made at the highest levels across Government and with our key international allies are informed by high quality, expert scientific advice and analysis".[3]

Department for International Development

33. DFID is viewed as a world class institution, with one of its key strengths and comparative advantages being the capacity, capability and expertise of its professional advisory staff. Maintaining and developing this expertise to ensure it is able to respond to global and policy priorities is important in ensuring DFID's position as a leading development agency. Professional advisers bring unique sets of technical competencies and professionalism to the organisation, which are valued internally and externally.

34. DFID currently employs a total of 39 infrastructure advisers covering the infrastructure sectors of transport, energy, water and urban development. Of these, 32 have engineering degrees and 26 are chartered engineers. A further three are associate members of engineering professional institutions and are working towards chartered status. Through a recent recruitment exercise an additional seven professionals have been identified to join the cadre as posts are identified.

35. Each is assessed against a comprehensive technical competency framework before being accredited to the professional infrastructure cadre. Senior advisers are required to have achieved chartered engineer status from a professional body recognised by the UK Engineering Council.

36. The cadre is overseen by the Head of Profession who is an A1 Senior Adviser. Infrastructure is positioned within the Climate, Environment, Livelihoods and Infrastructure family of professions managed by a Chief Professional Officer who is a Senior Civil Servant at Pay Band 1.

37. DFID's infrastructure advisers are deployed throughout the organisation in the centre (including Policy and Research, the Private Sector Department, and Africa Regional Department) and in country offices including India, Nigeria, Rwanda, Nepal, Pakistan and Afghanistan. Nine senior advisers are currently seconded to the Multilateral Development Banks, the European Investment Bank and the UN System where their presence has a significant role in influencing infrastructure and development activities.

38. DFID infrastructure advisers also support colleagues working on human development sectors. For example school construction is a significant share of education sector expenditure; DFID spends approximately £38 million each year on educational facilities. Infrastructure advisers have developed best-practice notes to improve the quality and value-for-money of these programmes.

39. Not all infrastructure-related work in DFID country offices is managed by an accredited infrastructure adviser. Advisers working in country teams may need to cover infrastructure as well as other governance, economic and environmental areas. Posts with a broad agenda are often filled by advisers of other professional cadres. In such cases, advisers are supported in disciplines where they are not expert. This takes place through specific senior adviser intervention, the professional cadre network as well as through the DFID resource centres and framework agreements.

40. Resource centres are an important component of DFID's knowledge system, providing a technical support network to support and complement the professional advisers. DFID currently has two resource centres covering infrastructure—TI-UP (Technology, Infrastructure and Urban Planning) which focuses on transport, energy and urban issues and DEW Point which focuses on water and sanitation.

41. The resource centres are the responsibility of the Heads of Profession and have responsibility for bringing knowledge from the global stock into DFID to inform policy-making and programme implementation. The resource centres provide a range of core services, including knowledge management and technical helpdesk support on infrastructure policy and technical issues. Resource centres are available to provide commissioned services to carry out consultancy utilising the global expertise of consortium members and a consultant database.

42. DFID also has an Engineering Framework Agreement (ENGAGE) combining the expertise of 13 specialist consulting firms comprising two major global consultancies, Mott MacDonald and Halcrow, and 11 other consultants with expertise in development planning, policy, infrastructure management, appropriate technology and sustainability. ENGAGE focuses on infrastructure works in key sectors such as water, energy, sanitation and transport and is available to be commissioned by DFID and its country office programmes to undertake a wide variety of infrastructure projects from small-scale and short-term to extensive and complex.

43. DFID is currently restructuring how professional cadres are managed with a view to strengthening professionalism across the department. This aims to bring a more consistent approach to managing advisers, to reinforce professional standards and improve the quality of evidence and its use in DFID. Priority is being given to improving current recruitment and posting practices for advisory staff to ensure that only those with appropriate expertise are appointed, and to improve support and supervision for non-infrastructure staff who manage infrastructure programmes.

[3] Chief Scientific Advisor Press Advert, www.odgersberndtson.co.uk

Department of Health

44. The Department of Health (DH) obtains expert input and advice on policy development and other initiatives from three Strategic Health Authority senior scientists who have medical physics and clinical engineering backgrounds and are clinical directors of major departments, as well as from other recognised experts across the NHS. Additionally, the Department's Chief Scientific Officer regularly meets with members of the relevant professional bodies.

45. The UK Modernising Scientific Careers programme has included the requirements of the engineering workforce to ensure fit for the future sustainable education and training programmes from vocational qualifications linked to apprenticeship schemes through to BScs and MScs to doctorate-level qualifications. This has involved extensive clinical engineering expertise in strategic planning and developments.

Other examples of effective use of engineering in government

46. There are a number of examples since the 2009 Inquiry from across departments of progress and good use of engineering advice worth mentioning.

47. A joint example from DECC and BIS is that of Energy Intensive Industries. This joint project used in-house and external expertise to review the engineering and technology constraints on energy intensive business sectors whose competitiveness is most likely to be affected by energy and climate change policies.

48. In June 2009, the Prime Minister's Council for Science and Technology published its report *A National Infrastructure for the 21st Century.*[4] The previous Government accepted its recommendation that more should be done to develop a vision for the future of the UK national infrastructure, coordinate work across government and drive collaboration with business leaders and regulators to identify key future investment and engineering challenges facing the UK. The Government has since established Infrastructure UK[5] within HM Treasury to work in partnership with the private sector and facilitate long term investment in priority areas. Infrastructure UK is advised by an Engineering and Interdependency Expert Group, chaired by Professor Brian Collins, former CSA for BIS, a chartered engineer and fellow of the RAEng.

49. The position of Director for Science, Engineering and Technology was created at the Home Office in December 2009 so that these professions are linked closer to the direction and priorities of the Department. Reporting to the Home Office CSA, this post oversees and coordinates the work of approximately 200 scientists and engineers and ensures that this group has a strategic focus. Additionally, this post is the Head of Profession for Science and Engineering in the Home Office and is the representative for the department on the Heads of Science and Engineering Profession (HoSEP) Group. This post also acts as the link to the relevant Research Councils.

The role of the GCSA and the Government Office for Science

50. The GCSA's Science and Engineering Assurance reviews are helping departments to ensure that their decisions and the development and delivery of their policies are supported by sound science and engineering evidence and relevant expertise. In particular, the reviews help departments to ensure that they have effective structures and processes for accessing the relevant science and engineering expertise and maintaining the requisite internal capability.

51. The GCSA's Foresight Programme helps policy makers take evidence-based decisions that incorporate future uncertainties. It brings together government departments, academics, and many other organisations and individuals to tackle complex policy issues, deliver new perspectives and provide a rigorous evidence base for informing integrated policy and decision-making. All relevant disciplines (science, engineering, economics, social sciences) are used to produce the evidence base.

52. Engineering has comprised a significant element of the evidence base in about half of the Foresight projects to date and also of the findings of the Technology and Innovation Futures report from Foresight's Horizon Scanning Centre.

53. It was a crucial element informing the findings of the Sustainable Energy Management and the Built Environment (SEMBE), Intelligent Infrastructure Systems (IIS), Cyber Trust and Crime Prevention (CTCP), Exploiting the Electromagnetic Spectrum, Cognitive Systems and Flood and Coastal Defence (FCD) projects.

54. The current Computer Trading in Financial Markets (CTFM) project is exploring how computer generated trading in financial markets might evolve in the next ten years or more, and how this will affect:

- financial stability;
- the integrity of financial markets including price information and liquidity;
- competition;
- market efficiency for allocating capital;
- transaction costs on access to finance; and

[4] http://www.bis.gov.uk/assets/bispartners/cst/docs/files/whats-new/09–1631es-national-infrastructure-executive-summary.pdf
[5] http://www.hm-treasury.gov.uk/ppp_infrastructureuk.htm

— the future role and location of capital markets.

55. The CTFM project will also assess options for addressing the key challenges ahead, and consider how the opportunities offered by advancements in computer technologies could be capitalised upon by the financial sector, which includes the human and computer interface. An initial exploration of these issues was covered in a Working Paper published in Autumn 2011.[6]

56. The Technology and Innovation Futures (TIF) report in 2010[7] highlighted seven potential growth areas for the 2020s: manufacturing-on-demand, smart infrastructure, the second internet revolution, the energy transition, new materials, regenerative medicine and intellectual property. The first four of these have a strong engineering component. Leading engineers from academia and business contributed to the study. The TIF report also had some influence on Infrastructure UK's work reflected in the National Infrastructure Plan.

57. Key messages that TIF identified were that:

— there are strong opportunities for growth in the UK economy through the 2020s if businesses can harness scientific and industrial capabilities to take advantage of technology-enabled transformations in manufacturing, infrastructure and the internet.

— longer-term thinking, planning and support are all vital for sustainable growth. There is an opportunity for government to put in place frameworks and institutions to support this approach.

Developments in the engineering community

58. There has been a marked improvement in the ability of the engineering community to provide coordinated, and therefore more influential, advice to Government, with the RAEng providing overall leadership. Examples include:

— RAEng was one of several key stakeholders consulted about the allocation of funds within the science and research budget under the latest Spending Review. They submitted comprehensive written advice both before and after the Spending Review announcement, and took part in a high-level roundtable meeting with David Willetts to discuss the challenges facing research in the context of the Spending Review. RAEng input, on behalf of the engineering community, formed an important part of the evidence base that helped secure a strong settlement for science and research.

— *Education for Engineering* (www.educationforengineering.org.uk) was established in October 2009 as a forum through which the engineering profession offers coordinated and clear advice to Government on education and skills, for example responses to Government consultations. It is hosted by RAEng, with a wide membership drawn from the professional engineering community.

— *Engineering the Future* (www.engineeringthefuture.co.uk) is an alliance of the UK's leading engineering organisations, including RAEng, through which the engineering profession speaks with one voice on engineering issues of national and international importance, such as the report they prepared for Defra on Infrastructure, Engineering and Climate Change Adaptation.

— In September 2011, representatives of the BIS Knowledge & Innovation and Business & Skills Groups and RAEng took part in a roundtable meeting to discuss common interests and plan future work.

Q2. *Are structures within Government now designed to optimise engagement with engineering communities and input to decision-making*?

59. This is an ongoing process. Relationships with the engineering institutions continue to develop and improve the way in which engineering advice feeds into Government.

60. The 2009 report recommended that a formal working group be set up. It remains the case that the Government believes that informal arrangements will offer the most effective way for different departments to interact with the engineering institutions as appropriate. That said, with the reconstitution of the Council for Science and Technology (CST) in 2011, the President of the Royal Academy of Engineering was appointed an *ex officio* member (alongside the Presidents of the Royal Society, the British Academy and the Academy of Medical Sciences). There are currently six engineers on the Council: Sir John Parker FRS FREng, President of the Royal Academy of Engineering; Dr Paul Golby CBE FREng, CEO of E.ON; Dr Hermann Hauser CBE FREng, co-founder of Amadeus Capital Partners; Colin Smith, FREng, Director of Engineering at Rolls-Royce; Professor Chris Snowden FRS FREng, Vice-Chancellor and CEO of Surrey University; Michael Lynch OBE FREng; and Professor Michael Sterling FRS FREng, Chairman of the Science and Technology Facilities Council.

61. The Chief Scientific Advisers network continues to develop and strengthen its engagement with the wider community including engineering. Regular (currently biannual) meetings are held between CSAs and key members of the wider scientific and engineering community, including Chief Executives of the Research Councils (including EPSRC) and senior staff from the National Academies (including RAEng). The President

[6] http://www.bis.gov.uk/assets/bispartners/foresight/docs/computer-trading/11–1276-the-future-of-computer-trading-in-financial-markets.pdf

[7] http://www.bis.gov.uk/assets/bispartners/foresight/docs/general-publications/10–1252-technology-and-innovation-futures.pdf

of the RAEng has recently been invited to meet with the CSAs at their breakfast meetings; it is envisaged that this will be a regular event.

62. The Royal Academy of Engineering, representing the engineering profession, is actively involved in Science and Society programmes and advisory groups.

Structural developments within departments

63. The appointment of a Head of Engineering in DECC (see paragraph 19 above) should further improve the working relationship between DECC and the engineering community and, through the CSA network, will facilitate further engineering input to the work of other departments.

64. The Home Office maintains close links with the EPSRC. The Home Office CSA and the Director of Science, Engineering and Technology meet at least annually with the EPSRC Chief Executive, and more frequently at a working level. The Home Office also has a number of engineers on its science advisory committees with the RAEng nominating one member to the Home Office Science Advisory Committee (HOSAC) on which there are presently three members representing the various aspects of engineering.

65. Paul Morrell was appointed as Chief Construction Adviser in BIS in December 2009 and worked in close collaboration with industry experts to develop the Low Carbon Construction Action Plan.

66. In DH, their Chief Scientific Officer has established a network of 10 Strategic Health Authority senior scientists who meet regularly to input into policy and advice. In turn, they are responsible for the establishment of scientific networks across the NHS in England, engaging with the whole of the non-medical scientific workforce, including the 5,000 staff within the physical sciences and engineering sector of the workforce. They support the spread and adoption of new technology as well as being a source of local advice and expertise within the NHS. These structures have proved very effective in feeding in views of the engineering community as part of the professional response to the development of plans for the future NHS and into other policy developments.

67. In MOD, the Defence Science Advisory Council (DSAC) continues to provide the Secretary of State with independent advice from a scientific, engineering, technological and analytical perspective on all aspects of the MOD's R&D Programme.

68. The GCSA's Science and Engineering Assurance Review of the Ministry of Defence was published on 28 September 2011. It reviewed the role and the functionality of the DSAC. The review recommended that the DSAC:

> "continues to be a source of high-calibre, scientifically-literate subject matter experts; should focus its activities on strategic and in particular more forward-looking and cross cutting S&T advice." The MOD's CSA is undertaking work to ensure such focus.

69. The basis for strategic direction and governance of engineering in the MOD's DE&S Group has been put in place by establishing an Engineering Committee. The Committee meets quarterly, is chaired by Director Safety and Engineering and has membership comprising Principal Engineers (by Operating Centre) and Technical Development Partners (by domain). Continuous improvement, in line with the strategic direction set out by the Engineering Committee, will be taken forward under the guidance of the Engineering Working Group.

70. In December 2010, under the aegis of the former National Defence Industries Council, MOD established a new cross-Defence Skills Working Group to address the issues associated with skills continuity among MOD and suppliers. This group has already started to develop a common taxonomy for the skills structures as a framework within which the MOD can identify strategic skills risks and consider mitigations

The work of the Government Office for Science

71. The follow-up work of the Government's Foresight programme, takes forward the projects' action plans and ensures that relevant input from the engineering community into Foresight projects forms part of the context for decision-making.

72. For example, as part of the action plan resulting from the Sustainable Energy Management and the Built Environment (SEMBE) project, DCLG and Foresight held a workshop in May 2009 to support the development of the Eco-towns programme and to explore ways of raising interest levels and increasing cross-governmental participation. The workshop attracted widespread attendance from across government and was informed by presentations from several members of SEMBE's expert panel. It was an important step forward in ongoing work between CLG and SEMBE to capture the potential of the Eco-towns programme to drive sustainable, low-carbon development.

73. Foresight also identified area-based initiatives in DECC and the Commission for Architecture and the Built Environment (CABE)—Sustainable Development Commission (SDC), and facilitated a joining of forces that led to the then DECC Secretary of State's announcement of the Low Carbon Community Challenge. Foresight then used support from the DECC Secretary of State and the Government's Chief Scientific Adviser to help the Low Carbon Challenge team interact with Research Council officials to discuss the monitoring and

evaluation of these proposed pilot schemes. In Scotland, the Report informed the Scottish Government Energy Efficiency Action Plan and continues to influence the futures thinking on energy and the built environment. These connections served to link DECC's Big Energy Shift to the Scottish Government, and led to a further link to the Northern Ireland Assembly.

Q3. *How has the Government's relationship with the engineering community changed*?

74. As with the input of advice and structures, the Government's relationship with the engineering community continues to develop. Recent events such as the severe weather in 2009 and 2010 have informed how the Government uses engineering.

75. The Foresight programme has always had a close relationship with the engineering community. We believe their input into ideas for potential new projects is invaluable; the RAEng, IMechE, IET and the ICE are always included when the GCSA is requesting such ideas. In addition, as mentioned in response to Q1, engineers from relevant sectors are always involved in relevant Foresight projects. This includes forming part of the Lead Expert Group, which helps steer each project, especially in the involvement of specific areas of science and engineering; as well as contributing to the evidence base through the reviews of the latest developments which underpin all Foresight projects.

The role of the Royal Academy of Engineering

76. Since 2009 Inquiry, the Royal Academy of Engineering has strengthened its role as the primary interface between Government and the engineering community. This is a helpful development from the perspective of departments. The Academy interacts with government at many levels.

77. At a senior level, the President of the Academy now sits on CST (see paragraph 60 above).

78. At a more operational level, BIS and the Academy held a September Roundtable to review and discuss:

- — the relationship between BIS and the Academy;
- — the Growth Agenda;
- — Low Carbon Economy;
- — Future Technologies; and
- — STEM Skills.

79. The meeting identified a number of areas for deeper engagement for the future including: further discussion on marine energy and low carbon vehicles; *See Inside Manufacturing* and showcasing leading up to the Olympics; business engagement on skills; and ICT as an enabler. It also gave a steer to where the Academy could best support BIS on their policy agenda.

Relationships with the other engineering institutions

80. While the relationship with the RAEng has strengthened, it remains the case that many departments interact directly with other engineering institutions as appropriate.

81. For example, BIS has good links with the EEF on a wide range of issues. The BIS Advanced Manufacturing and Services Directorate has account manager responsibility for the EEF which enable them to more effectively connect into BIS and for BIS to communicate its key messages. In terms of manufacturing policy, the EEF have worked closely with BIS to help inform policy in developing the Advanced Manufacturing Growth Actions, and continues to contribute in assessing implementation and impact of those actions.

82. The level of dialogue and partnership-working between Defra and the engineering community has increased considerably over the past few years and there is now a much more collaborative approach. Engineering representatives provide help on policy development steering groups and are sometimes asked or offer to lead reviews. There is an ongoing working relationship with the ICE and the Chartered Institution of Water Engineers and Mangers (CIWEM) through Capacity Building and support for professional accreditation in training schemes throughout government.

83. Professor Jeremy Watson, CSA at DCLG is a trustee of the Institution of Engineering and Technology (IET) and the Board member with responsibility for engineering policy.

Relationships with the engineering community more generally

84. There are a number of other good examples of improved ways of working with the engineering community.

Defra's use of engineering advice

85. Working in partnership and collaborating with a wide range of communities including engineering is now a well established approach within Defra and its agencies for both developing and implementing policy.

There is an increasing understanding of the importance of engineering and technical skills in assessing and managing risks to which communities in the natural and built environment are exposed.

86. For example, on Flood and Coastal Erosion Risk Management, the Environment Agency, Internal Drainage Boards and Regional Flood Defence Committees provide a high level of engineering advice to Defra and are engaged in all its policy making activities. The Environment Agency in particular use engineers for technical appraisal and engineering judgement decisions for the capital investment programme and their engineers are at the heart of managing flood incidents such as experienced in Cumbria November 2009 and Carlisle in January 2005.

87. The wider engineering community (consultants and contractors) provide services and advice for much of the evidence base which supports policy making and is active in providing comments to consultations relating to flood and coastal erosion risk management. Defra works closely with CIWEM and ICE in providing these communities with regular updates of floods policy development by providing speakers at their regular conferences. Defra also uses these events to gauge views and gather feedback on developing policy and its implementation. Defra uses the Local Government Groups Communities of Practice website to monitor and get feedback from practising engineers in local authorities who are implementing and helping to develop policy.

Power Electronics Strategy

88. BIS, through its work with companies and stakeholders in the electronics industry, had noted the growing importance of power electronics as a contributing enabler of the low carbon economy. While activities were taking place to address individual issues, there was no coherent strategy or plan to create the right market framework to enable the sector to grow in the UK. We believed that the industry would benefit from the time taken to develop a strategy to help maximise the benefits, both to them and the wider UK economy, from this opportunity.

89. BIS therefore approached the NMI, the main trade association representing companies in this sector, and with them created a working group with members from companies across the various branches of engineering that make up power electronics, the academic community, other trade associations and public sector stakeholders such as the Technology Strategy Board (TSB) and EPSRC. The group was able to collect the necessary data and evidence from their communities and via a number of workshop events and evaluate this to produce a document that sets out the key growth challenges for the sector and how they might be addressed by industry and government. The main legacy from the work will be a Power Electronics Forum which will maintain the cross discipline relationships established in the project working group and ensure that the strategy actions are taken forward.

Aerospace

90. BIS has a long established productive relationship with the Aerospace sector and its Research and Engineering divisions. However, the Department continues to review how this operates and over the past quarter the Aerospace team have been increasingly proactive in engaging with Industry and its research and technology community. For example:

- Proactive dialogue with industry research and technology teams to further establish UK as a centre of excellence for wing technology in areas such as materials science, flight physics and advance manufacturing research.
- Proactive dialogue with industry and its engineering community on advanced engine technologies.
- Increased visibility and engagement with industry and the research and technology community at UK and European programme level.
- Increased involvement and representation on Aerospace technology steering committees.

Television Digital Switch Over

91. Government has engaged closely with the engineering community throughout the television Digital Switchover (DSO) programme whilst retaining control of the overall policy direction and end objectives. We have formulated the policy and timeframe in consultation with stakeholder community including Arqiva, BBC, consumer equipment manufacturers and Ofcom and have based our decisions on advice provided by the broadcast engineering community.

92. This has meant that the DSO process has been able to proceed with minimal disruption to the viewer whilst complex issues such as international co-ordination, customer equipment development and matching coverage to the analogue service have been dealt with utilising sectorial expertise. Government has worked together with the broadcast engineers and industry to generate the necessary evidence base in order to support the policy and subsequent decision making processes.

Broadband

93. The Government's delivery arm Broadband Delivery UK is currently undertaking procurements with telecoms companies. The team has a number of consultants within it with specialist knowledge of the sector,

who have roles in helping to act as informed client for the procurement process, in order to ensure effective outcomes.

Home Office use of engineering in cargo screening

94. The focus for the Home Office's use of engineering has been through the Home Office Scientific Development Branch (HOSDB). This was re-structured in April 2011 and is now the Centre for Applied Science and Technology (CAST). CAST has established a Systems Engineering Lead (to be appointed) and functional areas for Electronic and Electrical Engineering; Mechanical Engineering, Materials Science and Civil Engineering; ICT, Software and Systems Engineering.

95. CAST is adopting a more standardised approach to working with academia and industry across the range of business rather than within individual programmes. This will be driven by CAST Capability Advisers who act as expert customers, helping shape policy and operational plans where science, engineering and technology have a role to play and being clear when they do not. They will work with customers at various levels (from operational practitioners to strategic managers) to understand the outcomes they are seeking to achieve, linking to staff with more detailed technical, policy or operational knowledge to help identify options to solve customers' problems, working in partnership with industry and academia as appropriate.

96. The efficient, safe and effective screening of containers to identify contraband (drugs, weapons, explosives) and those seeking to enter the country illegally, remains a major challenge to the Home Office and its delivery partners. The problems are technically highly challenging and likely to need multiple engineering and scientific approaches to address.

97. The Home Office worked with the EPSRC to jointly run a "Sandpit" event from which five research projects worth over £2.5 million were subsequently funded. The event involved science and engineering academics working with a range of government stakeholders including UK Border Agency, DfT, HOSDB (now CAST), Office of Security and Counter-Terrorism and Organised and Financial Crime Unit (OFCU). Participants were given the opportunity to question stakeholders and to visit the cargo screening facilities at Gatwick, Dover and the Channel Tunnel, Calais to see the facilities and operations first hand and gain a deeper appreciation of the problems faced. The projects included research on novel methods for spectroscopic imaging and acoustic screening of cargo, remote sampling methods and evaluating and optimising the cargo screening process.

98. CAST and UKBA have maintained contact with, and provided guidance to, the project teams throughout the funding period. The projects are now mostly concluding, with final presentations expected early in 2012.

DFID Supporting Private Sector Investment in Infrastructure

99. DFID is committed to promoting better services and growth by supporting developing countries to invest in infrastructure. Recognising that the private sector has a role to play in financing and implementing infrastructure, DFID supports a range of private sector infrastructure facilities with other donors and the private sector. These attract private sector skills and finance in delivering better services to poor people.

100. The Private Infrastructure Development Group (PIDG) works to encourage private investment and participation in infrastructure to support wealth creation and service delivery to poor people. DFID was the first and remains the largest supporter of the group. PIDG companies and facilities have supported 79 projects in over 35 countries, of which 72% are in low income countries, 50.1% in fragile states and 58% in sub-Saharan Africa. Of this portfolio of projects, 55 have reached financial close and have generated private investment commitments of US$10.5 billion, meaning that every $1 of PIDG donor funding has helped, or is expected to help, deliver $27 of private investment in infrastructure in developing countries. This has lead to 22.8 million people having new access to infrastructure and 170,000 long-term jobs created following PIDG activities.[8] DFID also supports an Infrastructure Project Preparation Facility within New Partnership for Africa's Development (NEPAD) to improve the supply of projects for private sector involvement.

101. DFID supports the Public Private Infrastructure Advisory Facility (PPIAF) which has improved the enabling environment for private infrastructure through 826 initiatives including: developing legislation; establishing legal and regulatory frameworks that maximize the benefits to poorer groups; providing training; and capacity building. Sub-National Technical Assistance (SNTA) is a PPIAF initiative assisting sub-national utilities and municipalities to access finance. A recent evaluation found that 13.3 million people are already benefiting from improved services due to SNTA interventions. DFID also supports the Global Partnership for Output-Based Aid (GPOBA) which seeks to encourage the use of output and results based aid. GPOBA now includes 31 schemes with a total value of US$124.9 million. Nearly 755,000 people have benefited from GPOBA pilots.[9]

Department of Health

102. In the Department of Health, advice is now obtained in a systematic way through engagement at a national level to inform policy development by recognised experts, at a regional level through the ten senior

[8] PIDG (2010) PIDG Annual Review 2009.
[9] World Bank (2010) Global Partnership for Output Based Aid 2010 Annual Report.

scientists and at a local level through the established scientific networks. Clinical engineers are also involved in all governance, advisory and developmental processes relating to the workforce in the NHS.

DFID Support for Low Carbon Development

103. A key part of DFID's low carbon development approach is to provide support and funding to countries to help develop their energy infrastructure as part of a low carbon pathway. Developing countries require a massive scaling up of investment into clean energy that facilitates economic growth and brings energy services to the poor. Private sector investment and new business models are also crucial. New energy production urgently needs to be generated from renewable sources to avoid harmful emissions and the economic vulnerabilities related to fossil-fuel dependence.

104. DFID and DECC are supporting the Clean Technology Fund (CTF), one of the Climate Investment Funds. The CTF has now endorsed over 12 country level investment plans for funding. DFID and DECC have provided £385 million and the UK contribution to the CTF, when combined with other donor funding, is expected to leverage over $40 billion of investment in low carbon projects, including energy projects. Estimated annual emissions savings are 33 Mt CO_2/year (equivalent to taking over 12 million cars off the road). These investments are expected to provide 18 million people with low carbon and affordable transport, and provide over 12 gigawatts of clean electricity and thousands of jobs to local communities. Countries participating so far include Colombia, Egypt, Indonesia, Kazakhstan, Mexico, Morocco, the Philippines, South Africa, Thailand, Turkey, Ukraine, Vietnam and a regional pilot covering the Middle East and North Africa region. DFID is also supporting the fifth replenishment of the Global Environment Facility to deliver work on low carbon development at a cost of £210 million. DFID hopes to fund 0.5 gigawatt of new renewable energy capacity. Also through the Clean Technology Fund new urban mass transport projects are being planned in Mexico, Egypt, the Philippines and Colombia. These integrated projects will both reduce CO2 emissions and to encourage the introduction of low-carbon bus technologies and modal changes from private to public transport by providing cheap, efficient, public transportation to some 18 million city dwellers.

105. DFID and DECC also support the Scaling-up Renewable Energy Program to directly benefit up to three million households in low-income countries at a cost of £50 million. The initial six pilot countries are Ethiopia, Honduras, Kenya, Maldives, Mali and Nepal. DFID works bilaterally in three of these countries. Both of these programmes focus on the rapid deployment of low carbon and renewable technologies in middle and low income countries respectively.

106. DFID provides core funding to the Energy Sector Management Assistance Programme (ESMAP) which provides sustainable energy policy advice to developing countries. DFID has also supported an ESMAP managed programme to promote small and medium enterprises in energy services. Thirteen energy projects in twelve countries and one regional program in Africa were developed under the programme. Results include leverage of donor funding for a $23 million renewable energy and electricity access project in Mongolia; and legal and regulatory regimes, policy constraints and incentives addressed in at least ten countries.

Engineering Education

107. The Department for Education (DfE) continues to develop its approach to ensuring that engineering is promoted in the education system.

108. Diplomas are currently offered across 14 subjects, including Engineering. Engineering Diploma qualifications were introduced in September 2008 and implemented in three phases (from September 2008, 2009 and 2010). Data published by the Joint Council for Qualifications shows that 10,456 Diplomas were achieved during 2010–11 (9,069 at Levels 1 & 2 and 1,387 at Level 3). With regard to Engineering passes, the most Diplomas passed at Level 2 (Higher) included Engineering (1,481). The highest number of Diploma passes at Level 1 (Foundation) were in Engineering (238).

109. DfE is rolling out University Technical Colleges (UTCs) as newly-established 14–19 Academies that deliver technical education to engage young people and meet the needs of modern business. In March 2011, The Baker-Dearing Trust, which promotes UTCs, asked the RAEng to identify the technical qualifications in STEM that would be respected by the STEM community. The report *Respected—Technical qualifications selected for use in University Technical Colleges* was published on 7 October 2011. The main aim of this report is to identify qualifications which could be taught alongside a suite of GCSEs as the technical component of the UTC curriculum at Level 2, and in various combinations to form the core of the UTC curriculum at Level 3.

110. The Government wants to attract more engineering students to train to become teachers. This is demonstrated by the top rate of training bursary (£9,000) being offered to trainees taking postgraduate initial teacher training courses in engineering in 2011–12. In addition, the Secretary of State announced on 13 September 2011 that the Training and Development Agency for Schools (TDA) will work to pilot a programme of physics with maths in conjunction with the Institute of Physics (IoP). The Secretary of State said:

> "…At a time when we desperately need more physics teachers, it makes sense to think of ways we can make entering the profession more attractive. With only 0.4% of engineering graduates going into teaching,

we need to look at how we might tap in to that pool. The Institute of Physics' new pilot PGCE in Physics and Maths is exactly the sort of innovation we need and we strongly support it…".

111. Discussions with the IoP and the RAEng have shown that many physics and engineering students want to train as teachers of physics (or physics and maths) but they are put off by the way that training is organised currently, because many physicists and engineers do not want to teach chemistry or biology. The TDA has therefore just written out to initial teacher training providers to invite bids to develop innovative training courses designed to attract more physics and engineering students to train to become teachers.

112. The Schools White Paper *The Importance of Teaching*, published in November 2010, committed us to introducing engineering prizes for boys and girls. We are currently consulting with engineering organisations about the focus of these prizes and will be making a further announcement in due course.

Effective promotion of engineering as a career

113. To help promote the engineering profession and change public misconceptions of engineers and engineering, and attract more young people into the sector, BIS continues to build and maintain strong working relationships with leading engineering organisations and key individuals, and to look to the RAEng to provide overall leadership for the profession. Engineering is playing an increasingly important role in policy delivery:

- Engineering faces some of the greatest, often historically-based and ingrained diversity issues. BIS has asked RAEng to develop a diversity programme for the engineering community. This will build on the Academy's existing and excellent relationships with a diverse mix of engineering institutions, and place a much greater emphasis on challenging the leaderships at all levels to take on responsibility for delivering the change needed to promote equality.
- In partnership with RAEng, and using the Academy's expertise and connections with industry, BIS recently commissioned a research project to understand the motivations and rewards for, and barriers to, public engagement within STEM-based businesses. The report,[10] published in September 2011, aims to provide the wider science and engineering public engagement community with a resource that will enable them to develop more fruitful relationships and partnerships with the business community.
- The Government has committed to reducing net migration over the lifetime of the Parliament but recognises the importance of being able to attract the best scientists and engineers to the UK. A new category has been created under Tier 1 (non-EU economic migration) to allow persons of exceptional talent and achievement in science and the arts to come to the UK without a job offer. RAEng is acting as an endorsing body for engineering applications.
- Part of National Science and Engineering Week, the Big Bang Fair, led by EngineeringUK and supported by BIS, is the UK's first national fair celebrating young people's achievements in science and engineering and showcasing the exciting and rewarding opportunities available to those with science and technical qualifications. In 2011 there were over 29,000 participants, up from 20,000 in 2010 and 5,000 at the inaugural event in 2009.
- The BIS-funded FE STEM Data Project, led by RAEng, is addressing the long-standing lack of data to inform the contribution of further education (FE) to the STEM agenda.

114. Since 2009, the MOD has continued its work with several engineering institutions to establish new paths for membership for military and civilian personnel where there are recognised and repeatable career progressions. This was demonstrated when the Director of Safety and Engineering signed an agreement with the Institute of Mechanical Engineers (IMechE) to commit a new Special Authorised Process (SAP) which provides a streamlined route for civilian engineers within DE&S to apply for registration.

115. More widely, the MOD continues to develop the status of registered engineers at chartered or incorporated levels in our governance of high risk decisions. MOD seek to adopt widely recognised standards where new initiatives are being pursued, the most evident being the Systems Engineering standard (ISO 15288), where there are multiple engagements with industry. For example, MOD works closely with industry in the System of Systems Approach Community Forum to spearhead its use as a capability critical to give the UK a comparative advantage in complex systems integration.

116. The GO-Science Science and Engineering Assurance Review of MOD reviewed the effectiveness of MOD engagement with industry, academia and international research bodies. The recommendations for improvement will be addressed in the forthcoming White Paper.

Q4. *Are there specific engineering sectors where engagement with Government should be improved? How could improvements be made*?

117. We continue to seek to attract engineers into senior roles (including the current recruitment for Chief Scientific Advisers in MOD, DfT and BIS).

[10] http://www.raeng.org.uk/news/publications/list/reports/engaging_the_public_in_science_and_engineering.pdf

118. The Government also seeks to promote wider recognition of the value of engineering skills set (project management, ability to handle wide range of technical and economic considerations, drive for solutions, customer focus) in the civil service more generally (particularly policy and operational delivery roles).

119. Since 2009, the MOD has made significant strides in establishing a strategy for the management of nuclear skills within the Royal Navy and DE&S, working with our supply chain to understand the threat to our business if resurgent civil nuclear power programmes suddenly stepped up demand. While ostensibly to protect the Naval Nuclear Power and Weapons programmes, the MOD believe that the injection of support this is giving to the nuclear community will benefit the UK as a whole.

120. As previously mentioned (see paragraph 31 under Q1) the 2009 Haddon-Cave report outlined several issues in regulation and assurance of military airworthiness. These have been scrutinised further across MOD (not just aviation) and led to the formation of the MAA and more recently, the DSEA. These organisations bring together, under an independent unitary body, the existing functions and people who deliver Defence safety/regulation.

Conclusion

121. Overall, the use of engineering evidence and advice by government and the relationship of departments with the engineering community have improved since 2009. But as set out at the start, there is always room for improvement. The Government therefore looks forward to hearing the Committee's views.

Government Office for Science

November 2011

Supplementary written evidence submitted by Government Office for Science

Response to Question from the Committee Following Sir John Beddington's Oral Evidence on 14 December 2011

1. Following Sir John Beddington's evidence session on 14 December, the Committee asked for a list of Scientific Advisory Committees (SACs) that the Royal Academy of Engineering (RAEng) nominates members for.

2. There are two SACs with positions specifically identified for nominated RAEng appointments:

- The President of the Academy is an ex-officio member of the Prime Minister's Council for Science and Technology (CST).
- The Home Office has a standing RAEng appointment on their Scientific Advisory Committee (HOSAC). Appointments are made for a maximum term of six years. Professor Nigel Shadbolt is the current incumbent.

3. Where appropriate, departments will also seek the input of the RAEng when recruiting to their SACs. The following are recent examples:

- The RAEng was asked to encourage appropriate applications from Fellows for membership of the CST during recruitment last year.
- The MOD asked the RAEng to encourage applications from Fellows when recruiting to the Defence Science Advisory Council (DSAC).
- DECC had discussions with the RAEng at the time of the creation of their Science Advisory Group (SAG). The Academy did not formally nominate any members but provided advice about Fellows with relevant expertise.

January 2012

Written evidence submitted by Engineering the Future

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.

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*[11] 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*[12] 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 implementation or deliverability, we look forward to seeing an increase in

[11] http://www.bis.gov.uk/assets/bispartners/goscience/docs/g/10–669-gcsa-guidelines-scientific-engineering-advice-policy-making.pdf

[12] http://www.raeng.org.uk/news/publications/list/reports/Engineering_values_in_IT.pdf

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 lesson 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.

Engineering the Future

November 2011

Supplementary written evidence submitted by Engineering the Future

1. Philip Greenish, on behalf of the Royal Academy of Engineering and the *Engineering the Future* alliance, gave evidence to the House of Commons Science and Technology Committee on the "Engineering in government: follow-up" evidence session held on 7 December 2011.

2. During the evidence session, Pamela Nash MP directed the following questions to Philip Greenish (questions and response included in quotations below):

> "**Q16 Pamela Nash**: I am aware that the Academy nominates one member of the Home Office Scientific Advisory Committee. Is that the case for the advisory committees of any other Departments?
>
> ***Philip Greenish:*** Yes, but I do not have particular figures. There are people that we have nominated and are in post in the scientific advisory committees.
>
> **Q17 Pamela Nash**: Is that information that you could provide to the Committee?
>
> ***Philip Greenish:*** Yes, I could."

3. The following set of bullet points sets out some of the organisations/bodies/roles that the Royal Academy of Engineering has been consulted upon:

- Government and Departmental Chief Scientific Advisers.
- Departmental Scientific Advisory Committees.
- Science and Engineering Assurance Review teams.
- Chief Executives and Chairs of relevant Research Councils.
- Members of the Council for Science and Technology.
- Expert review teams where engineering is of particular relevance.
- Council members for European Research Council and European Institute of Technology.
- Research Assessment Exercise/Research Excellence Framework panel chairs.

4. Please note that this differs to the Home Office science advisory committee whereby the Royal Academy of Engineering has a dedicated place on the group, and the Academy can nominate a person for that role.

Engineering the Future

January 2012

Written evidence submitted by the Motorsport Industry Association

MIA members represent a large proportion of the UK Motorsport Industry, a fact recognised by several Ministers, the Department of Business Innovation and Skills, UK Trade and Investment and the Foreign & Commonwealth Office. Their specialist trade association has access to an unparalleled depth of Industry knowledge and would therefore welcome an invitation to provide further oral evidence to the Select Committee.

Your inquiry asks...

- Are structures within Government now designed to optimise engagement with engineering communities and input to decision-making?
- How has the Government's relationship with the engineering community changed?
- Are there specific engineering sectors where engagement with Government should be improved? How could improvements be made?

In reply, on behalf of our industry members, the Motorsport Industry Association has pleasure in putting forward the following submission.

1. "In March, 2010—the following headline appeared from Parliament...Government should not be complacent about UK leadership in global motorsport says BIS Select Committee Report recommending Establishment of Motorsport Policy Team—"*Full speed ahead: maintaining UK excellence in motorsport and aerospace*" examined the future of these two crown jewels of UK manufacturing".

2. The Committee said they were "struck by the lack of understanding and effective engagement by Government" adding this is "an industry of national importance …which must engage more effectively with Central Government. The establishment of a dedicated policy unit (at BIS) would be an important first step in ensuring this happens".

3. Currently, despite these recommendations of a Select Committee nearly two years ago, and ongoing pressure from the industry members of the MIA, there remains no focussed point for effective engagement by the HPEM community within BIS, or any other Department. The BIS Automotive Unit, whilst not resourced to handle HPEM, generously offers helpful assistance as and when it can, but only when such issues are linked to automotive policy.

4. HPEM seeks more effective engagement with Government—"a seat at the table"—so that when policies are set, the value of their unique value proposition for the UK is recognised, better understood and hence taken

into account. This, we believe, in turn will alert other UK and international sectors to this R&D, science-based community of technology and knowledge.

5. Simply put, we believe the business opportunities created will reward HPEM, creating jobs, further inward investment and economic improvement for the UK engineering sector.

6. In recent years the sector has, proactively, strategically diversified into adjacent sectors within the UK, and overseas, to great effect—yet with no direct input from Government.

The sector now supplies technology and engineering solutions, based on its science-based knowledge, to defence, marine, aerospace, space, medical, UAVs, simulation and recently, automotive. A recent MIA organised visit for MPs to the Science Museum's hugely successful, display named "*Fast Forward: 20 ways F1 technology is changing the world*" demonstrated the wide diversity of technology products from HPEM companies.

7. In defence, their technologies now supply the Pentagon and the MOD in the air with UAVs, on the ground with Foxhound and Supacat, and even unmanned submarines too. In automotive, for example, Williams F1 team have recently been chosen by JLR to produce the Jaguar C-X75 hybrid electric car by 2014—"the world's most significant concept car" award winner.

8. The valuable opportunity for UK jobs and economy, which is being overlooked by Government, is that these SME companies are an internationally-funded unique powerhouse of innovative R&D, delivering prototypes and science and technology-based solutions, in exceptionally short timelines. These solutions are NOT purely for automotive use—they are, demonstrably, of value to a wide range of UK industries, as shown above and will create more employment.

9. By encouraging, when setting policy, others to engage or consider this HPEM resource, more jobs in the UK would result and more economic success secured. Currently, this SME resource is left to its own devices, outside of any Government department, to find business where it can—much of which is outside the UK.

10. Virtually all HPEM engineering outputs are in constant development, rarely if ever entering "production or manufacture", as they constantly create prototypes as part of ongoing research and development. It is this relentless quest for knowledge, and delivery of fast results, that Professor Porter of Harvard University identified as a unique "world-class community of knowledge" and the "jewel in the crown of British engineering".

11. Endless innovation and investment is the stock-in-trade of this proven world-class and world-beating industry—without innovation there is simply no motorsport business. Competitive advantage is not gained purely by innovating, but by innovating *faster,* and more continuously, than any competitor.

12. As a result, the motorsport industry's use of the HMRC R&D Tax Credits scheme is vital, regular and extensive. This excellent scheme has proven, demonstrably, to help SMEs to maintain their high level of annual R&D spend (at more than 30% of sales revenue). This industry's use of R&D Tax Credits is totally in line with the scheme's original intention which encourages SMEs to invest more in innovation for competitive advantage—and it is working.

13. In many cases, the cash flow advantages of these credits have kept small businesses alive and innovating during the recession. The MIA wishes this R&D-Based sector to be directly involved in policy discussions which affect this valuable scheme. In fact, the MIA wants to see the R&D Tax Credits Scheme urgently improved and enhanced for SMEs—or specific grants be made more readily available as part of quantitative easing.

14. Many of these companies secure significant inward investment which they invest in their R&D programmes—from India, Malaysia, Germany, France, USA, Russia, Japan, and the Gulf Region. One market town alone—Brackley in Northamptonshire—has secured over $1 billion of inward investment into HPEM during the last decade!

15. The UK's Motorsport Valley is home to the most successful high performance engineering and motorsport business cluster in the world. Over 3,500 companies employ nearly 40,000 people who produce £6 billion worth of engineered goods a year, mostly R&D-based prototypes, 65% of which are exported. It reinvests well over 30% of these sales into R&D—more than three times the ratio of the automotive sector—valued at nearly £2 billion every year.

16. The message the industry presented in March 2010 was that the Government was "complacent" about globally-influential UK leadership in this sector. It felt that Government had failed to pro-actively engage with the Sector for some years.

17. The BIS Committee's opinion, following the inquiry, was that, indeed, the Government had not taken these concerns seriously enough, and recommended they establish a dedicated motorsport policy unit to address this weakness, to support the industry as it grows and help it build on its international success.

18. Our weakness may be that we are operating across too many sectors—frankly, we find science and technology wherever we can, and rapidly use this for commercial gain—across, into and out of any "sector".

We do not recognise, nor feel bound by, sectors and boundaries. This seems to be the root of the problem with successful Government engagement—we operate "outside of the box" of the Departmental structure.

19. BIS Committee Chairman Peter Luff MP said: "Motorsport is an industry of national importance, the Government needs to recognise this. We find it difficult to imagine any other country sidelining such an important industry. The Government needs to address this and help it flourish".

20. The Committee found this innovative, highly-rewarding industry was not being well served by universities. While many offered motorsport engineering courses, which were popular with students and boosted application numbers, very few had proved capable of providing graduates with the skills needed by industry, which was, and still is, desperate to recruit the world's best engineers to meet demand. "Universities use the powerful 'motorsport' brand to promote their courses, and increase their intakes to meet Government targets, but don't deliver the skills we want" says the industry.

21. The value, influence and importance of HPEM to the education of young engineers could be enormous, yet is under-utilised by Government and largely ignored. HPEM has the charisma of being the UK's NASA in the eyes of young people—who see this engineering-based sport as being the modern face of "cool" manufacturing and technologies. The most popular computer games in the world are based on motorsport, and young people know this.

22. HPEM already, successfully, excites and enthuses thousands of young people through school and university "competitions". All funded by the industry or charity—almost completely without Government support.

23. Whilst the Government has created a welcome network of research facilities and "centres of excellence" to develop new technologies, these are currently proving to be of little value or interest to this research-based industry, which is hungry for innovation. No targeted effort to encourage HPEM to utilise these resources has been undertaken as far as we know.

24. Motorsport has, over the past decade, done much to contribute to efforts to reduce carbon emission. By its actions encouraging "lower carbon solutions" to win major iconic events—such as Le Mans with diesel and F1 with hybrids cars using kinetic energy recovery systems, motorsport moves this important debate beyond dry discussion unappealing to the public, to a more exciting arena where the role of advanced technology and innovation can be seen to address climate change.

25. As the UK is positioning its automotive industry as the global centre of "low carbon" innovation, it seems sad that the opportunity to pro-actively lead an engagement programme between this sector and automotive has been largely overlooked by them. If it were not for the sponsorship provided by motorsport SMEs for a low-key MIA initiative—"Motorsport to Automotive" over the past year, very little engagement would have occurred. Some TSB engagement has been seen with a handful of motorsport companies so far.

26. The sector has an urgent need for updated national economic research into the UK industry so that its value can be fully understood and strategic decisions made by industry, Government and agencies. The last research report was delivered by the MIA (with support from UKTI, DTI, and the Regions) in 2000—nearly 12 years ago! Ministers and Departments regularly rely on these (significantly outdated), figures in their answers and speeches—yet they are increasingly inaccurate.

27. The MIA has raised this in Parliament, to Departments and MDUK, regularly over the past decade—in 2009 in the two Motorsport-related debates in the House of Lords, led by Lord Astor of Hever—specifically requiring a response from Baroness Vadera. No action or funding has been approved and all still remain in the dark. It is hard to imagine any other country so consistently ignoring such a vibrant and innovative cluster and not wishing to understand and celebrate its growing success.

28. With funding from various sources including RDAs, Governmental Departments and the industry itself, the MIA suggests that another *National Survey of Motorsport Engineering and Services* is conducted—following the same methodology as before. Such a survey and subsequent report would provide HMG, RDAs, the industry, and its trade association, with an understanding of how this cluster of high value-added businesses has performed since the last survey in 2000. Up-to-date figures would also help key stakeholders to identify the strengths, weaknesses, opportunities and threats associated with the UK's motorsport industry and attract new investment.

The Motorsport Industry Association (MIA)

The MIA was founded in 1994 by executives from High Performance Engineering and Motorsport (HPEM) industry to promote, protect, and provide a voice for these sectors in the UK. It strives to secure long-term, repetitive and competitive business advantage for its many members and a strong, viable future for the Industry as a whole.

The MIA is now the leading global trade association for these sectors, co-ordinating services from its international HQ at Stoneleigh Park, near Warwick. It serves over 360 corporate members who, as a group, annually and globally transact over £3.5 billion HPEM business—employing some 15 to 18,000 individuals.

The MIA is a not-for-profit private company, owned by its industry members and limited by guarantee. Its Committee and Directors are elected by the membership, annually, and its work is undertaken by a full time Chief Executive and staff.

Any surpluses generated are re-invested into programmes which improve the wider industry and further develop its members' businesses.

The MIA is recognised by UK Trade & Investment (UKTI) as the only Accredited Trade Organisation (ATO) for the HPEM sector. UKTI and the MIA enjoy a good working relationship which has seen International Business Development Visits, overseas exhibitions and Inward Missions take place. UKTI support, although more than halved in the past three years, is nevertheless important for British motorsport SMEs, who derive over 60% of annual turnover from international trade. The MIA has overseas offices in Detroit and Atlanta, USA.

The MIA acts as Joint-Secretary of the All Party Parliamentary Motor Group, alongside the SMMT and The RAC Foundation.

Further information can be found on www.the-mia.com

Motorsport Industry Association

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