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Campaign for Science and Engineering in the UK

CaSE response to the Innovation, Universities, Science and Skill Committee inquiry into:

Engineering

Introduction

1. The Campaign for Science & Engineering (CaSE) is a pressure group aiming to improve the scientific and engineering health of the UK. Our objective is to communicate to Parliament and the nation as a whole the economic and cultural importance of science and engineering, and the vital need for its funding by government and industry. CaSE is supported by its members, which includes individuals, corporations, universities, research charities and learned and professional societies.

2. CaSE is concerned about science and engineering policy from school education through teaching and research in Higher Education Institutions and on to how the public and private sector fund and use R&D. CaSE is therefore pleased the IUSS Committee is holding an inquiry into engineering in the UK. This response is to the general engineering inquiry and not the case studies.

The role of engineering and engineers in UK society

3. Engineers are critical to the research and development of goods, services and infrastructure that benefit society. They are at the forefront in creating technological solutions to the big issues facing the UK and the rest of the world, such as energy supply, adapting to climate change, transportation, communication and health. Most engineering advancements benefit the vast majority of people, as reflected in a recent survey that found that 94% of people believe that engineering makes a good contribution to society.[1]

4. It is vital that engineers communicate to the public the importance of engineering. The US National Academy of Engineers identified both the great engineering achievements of the 20th century and the grand challenges for the 21st century.[2] These initiatives combined to show how engineering has transformed modern society and can lead us to a better future. Similar initiatives could be taken to raise the profile and importance of engineering in the UK. This should help increase the attractiveness of the discipline to students as well as raising public interest and hopefully eventual understanding of how engineering impacts upon all of our lives.

5. Engineering advances can have a major impact on society and societal values can impact engineering. This complimentary relationship means that it is important to improve public dialogue on engineering issues. A good example of this, are the proposals for nanotechnology produced by the Royal Academy of Engineering and the Royal Society.

The role of engineering and engineers in UK's innovation drive

6. Engineering is central to the UK's innovation drive. Most countries see investing in scientific discovery and engineering applications as the main drivers to

innovation and economic competitiveness. Investment in engineering research and the training of engineers leads to advances both in established fields and the development on new ones. High-technology innovations are often at the crossroads between scientific discovery and engineering application.

7. Unfortunately, the Innovation White Paper, *Innovation Nation*, did not fully reflect the vital contribution that engineering, or science, makes to the UK's innovation drive. Compared to the previous Science and Innovation White Paper, there was not the same importance given to science and engineering. At a time when other countries, most notably China and India, are ramping up their investment in engineering the UK cannot afford to become complacent.

State of the engineering skills base in the UK

8. The future supply of engineers in the UK is dependent on the UK's ability to train home grown engineers or attract them from abroad.

9. The first step is to excite students about engineering, to make sure they understand what it is, and the career opportunities that it leads to. Better public communication of the role of engineering should help as well as more specific improvements in careers advice, as currently underway. There are increasing STEM outreach schemes working in this area. It is important that these schemes are of an appropriate standard, delivered in a way that is most beneficial to their goals (e.g. influencing subject choice) and targeted to those groups that most need them.

10. In order to have home grown engineers there will need to be improvements in the provision of mathematics and physics in schools. There is no point exciting students about engineering if they are not able to study it properly. The shortage of specialist teachers in physics and mathematics limits our supply of well-trained engineers, as does the small number of schools offering separate science GCSEs (and therefore a good grounding in physics). Getting the secondary education system right is critical to improving the uptake of engineering in higher education. Numerous Government initiatives have tried to improve the teaching situation, but it seems that more radical approaches need to be taken to increase recruitment. More attention should be paid to retention of teachers (currently about 50% over 5 years) and a mechanism needs to be developed to target specialist teachers to the schools where they are most needed (i.e. offering financial incentives to work in schools that had experienced persistent vacancies in shortage subjects).

11. Overall, the number of students taking engineering subjects at university level has been fairly constant whilst other subjects have been increasing. However, nearly 30% of engineering and technology students in higher education are from outside of the UK. For postgraduate courses (taught and research) the percentage of non-EU students is almost half in most engineering disciplines.[3] The UK needs to consider the implications of its increasing reliance on international engineers and how it can continue to attract, educate and collaborate with them in the future.

12. Although there are a number of initiatives to engage under-represented groups in engineering more work are needed to ensure that there is a diverse range of people in engineering. Outreach initiatives, such as science and engineering

clubs, should be focusing on engaging with these groups in particular. Educating and retaining an appropriate level of women in engineering would massively increase the UK's engineering potential.

Engineering and R&D

13. The research base is the bedrock which enables and supports private and public sector R&D. There is a growing concern that basic research is being squeezed within Research Councils' budgets, due to a greater emphasis on economic impact. For the UK's future economic success it is vital that the UK maintains a healthy research base that is able to take risks and innovate. It is also vital that the UK ensures that government departments and industry as a whole increase their investment in R&D.

14. Engineering is a fundamental component to private sector R&D. It is a very strong component of the UK's aerospace and defense sector, which is the UK's second largest sector for R&D after pharmaceuticals and biotechnology. It is also vital to the UK's automotive, telecommunications, energy, computing industries and a range of other technology-oriented industries. However, it is also worth noting that engineers bring valuable skills to other sectors, such as finance and management consulting.

15. R&D investment is a key factor in determining a company's future success. The UK needs to improve its standing as a place for R&D investment. The UK's competitive advantages are a relatively strong research base and linkages between different scientific and engineering disciplines. The UK needs to ensure that it produces enough highly skilled engineers and technicians needed for industry.

16. The public sector also invests in engineering R&D. However, not at the same scale it once did. The Sainsbury Review recommended that government departments increase their investment in R&D. Government departments need to create better mechanisms to stimulate engineering solutions to particular public policy issues, be it flooding, sustainable cities, low carbon energy, etc. It is critical that mission-oriented research comes out of departmental R&D budgets rather than the science budget.

The roles of industry, universities, professional bodies, Government, unions and others in promoting engineering skills and the formation and development of careers in engineering

17. The Committee has rightly identified a range of actors that need to support the development of engineering in the UK. The Government needs to take the lead by investing in the science and engineering base to train engineers and to fund basic research. It must also fund and deliver quality STEM education for all students. It should also take the lead role in ensuring the coordination of publicly funded initiatives to promote engineering skills and careers advice. Engineers in all government departments and agencies should be supported. DIUS needs to continue and develop its support for the science and engineering profession within government departments.

18. Professional bodies need to promote their disciplines and provide professional accreditation. Professional bodies also play an important role in supporting the development of their discipline and fostering a sense of community.

19. Universities need to provide the training and careers advice necessary to produce trained engineers. It very difficult if not impossible to maintain high standards in teaching engineering in a university that is not research active. Therefore, the consequences of focusing research into fewer research-intensive universities may have negative affects on producing engineers.

20. Industry has an important role in engaging students about the career opportunities that an engineering degree provides and providing valuable apprenticeship and work placement schemes.

Further Information

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[1] Royal Academy of Engineering and ETB (2007) Public Attitudes to and Perceptions of Engineering and Engineers 2007

[2] See National Academy of Engineering websites: http://www.greatachievements.org/ and http://www.engineeringchallenges.org/.

[3] ETB (2007) Engineering UK