

Written Evidence Submitted by the National Engineering Policy Centre (NEPC)

Summary

The National Engineering Policy Centre (NEPC) welcomes this opportunity to respond to this inquiry. This response draws on evidence from the expertise of its members and is compiled by The Royal Academy of Engineering and EngineeringUK. The NEPC provides impartial, expert engineering advice to inform UK policy. The Centre is an ambitious partnership, led by the Royal Academy of Engineering, between 43 different UK engineering organisations representing 450,000 engineers.

Engineering is vital for ensuring the prosperity and growth of the UK economy and is central to achieving the country's Net Zero ambitions. However, significant pre-existing skills shortages in engineering are exacerbated by increasing demand driven by expansion of Net Zero related jobs. The response highlights current education and skills challenges and provides recommendations for ensuring the UK has a sufficiently skilled engineering workforce.

The following response includes links to relevant work in this area. If you would like to discuss any of this work, or any recommendations made, we would be delighted to discuss further.

Recommendations

1. We recommend that government strengthen the Unit for Future Skills to become the hub guiding government on workforce issues.
2. We support recommendations advocating for the Lifelong Loan Entitlement to provide means-tested grants for disadvantaged learners, including funds to cover the costs of maintenance.ⁱ In addition, to support workers in reskilling, loans should be available to people who want to build on their existing post-18 qualifications.
3. We advocate a holistic approach to addressing STEM education challenges, and therefore assert here the importance of a STEM Education Strategy. For further information on our recommendations for a STEM Education Strategy please see the [NEPC's submission to the 2021 spending review](#).
4. We recommend that the private sector should both encourage their employees to become professionally registered, including implementing incentives, and work closely with Professional Engineering Institutions (PEIs) to ensure that CPD is closely aligned with the needs of industry.
5. We suggest that the government can and should explore:
 - a. Piloting STEM student mentoring programmes at universities. Initial pilot studies suggest that mentoring programmes have positive impacts on pupils.ⁱⁱ
 - b. Collaboration with National Academies and wider STEM sector to develop programmes that encourage and enable more STEM professionals to enter teaching.
 - c. A research programme for improving STEM teacher recruitment and retention.
 - d. Funding STEM professional development courses for teachers.
6. We recommend an urgent implementation of initiatives focused on diversity and inclusion within academia is required.

1. STEM Skills

This response focuses on engineering skills specifically, not STEM skills in their broadest sense. The extent of 'STEM skills' supply challenges vary across different STEM disciplines. For example, there is significantly less supply of graduates across engineering and technology subject areas compared with, for example, biological sciences. In 2018/19, there were approximately 58,000 UK domicile first degree entrants for biological science, by contrast to 26,000 engineering and technology graduates.ⁱⁱⁱ

Is the STEM gap growing?

EngineeringUK analysis, pre-pandemic, projected shortfalls of between 37,000 to 59,000 in meeting an annual demand for 124,000 core engineering roles requiring Level 3+ skills, including an expected graduate-level shortfall of at least 22,000 per year.^{iv} However, the pandemic and the UK's decision to leave the EU will undoubtedly have had an impact on skills supply and demand. While it is too early to ascertain the true scale of the challenge, it is probably safe to suggest that the demand for engineering skills is growing, as a result of the move to net zero but also factors such as the UK's decision to leave the EU and increasing digitalisation. The government's 2021 Green Jobs Taskforce report, for example, estimated an additional 500,000 new jobs to meet net zero challenges by 2050 in sectors such as offshore wind, national grid infrastructure upgrades, new nuclear, building retrofit, electrification of vehicles – and associated charging infrastructure, domestic heating and cooling and hydrogen supply. This demand is on top of business-as-usual engineering activity across the economy which was not being met by current supply.^v

Are business able to recruit people with appropriate STEM skills?

Businesses are unable to recruit sufficient engineers and technicians. The Institute of Engineering and Technology's 2021 Skills Survey found that almost half of engineering employers report skills shortages in recruitment to the external market, along with 44% reporting skills gaps internally.^{vi} The greatest level of reported skills shortages is within 'advanced skilled' roles (A-Level, advanced apprenticeships, and other Level 3 qualifications), followed closely by 'highly skilled' roles (Bachelor's degree (level 6) and higher).^{vii} For instance, the health of the mining sector is at serious risk due to a shortage of suitably skilled graduates.^{viii} Existing skills shortages at Level 3 and above, and the need to rapidly employ people into jobs that meet the UK's net zero ambitions, suggests that upskilling and reskilling of existing workers is equally as vital to addressing the skills demand as is ensuring that we have the engineering workforce of tomorrow.

The most effective means of addressing skills shortages is to focus on a plurality of local skills shortages, alongside, an over-arching national approach for those skills where the demand will be ubiquitous.^{ix} This enables diverse approaches to addressing specific skills needs. Identifying both local and national shortages enable skills-gap challenges to be identified and targeted with the requisite training programmes - be that further investment in apprenticeships, skills bootcamps, or alignment of higher education institutions with local skills demand. The Unit for Future Skills' recent introduction of a Local Skills Dashboard is welcome; however, further action should be taken to target STEM skills shortages specifically, and those that serve a strategic national imperative.

We recommend that government strengthen the Unit for Future Skills to become the hub guiding government on workforce issues. The Unit should provide:

- **Regular national labour market forecasts, ensuring it applies a holistic 'systems approach' that recognises the interdependencies between different industries.**
- **Publicly available forecast data for industries to undertake granular, sector-level analysis.**

- **Regular ‘back-casting’ to identify the number of technical and engineering students needed to be entering STEM subjects from A level, T level, and advanced apprenticeship level onwards.**
- **Insights into reskilling and upskilling requirements across different the UK economy.**
- **Early warnings and policy recommendations on anticipated skills shortages.**
- **Analysis of workforce demographic characteristics to inform government strategy on workforce diversity and representation.**

What is being done to allow for people to develop STEM skills across multiple disciplines throughout their career? What could improve this?

The introduction of the Lifelong Loan Entitlement is welcomed as it will provide people with the opportunity to train and upskill in response to changing skills needs through a wider range of learning opportunities, such as micro-qualifications.^x However, given that the initiative relies on a loan system, individuals without assets or savings may be dissuaded, which could further entrench social inequality in access to training. To prevent this, we support recommendations advocating for **the inclusion of means-tested grants for disadvantaged learners, including funds to cover the costs of maintenance.**^{xi} In addition, **to support workers in reskilling, loans should be available to people who want to build on their existing post-18 qualifications.**

The creation of micro-qualifications is an exciting development for upskilling. However, the regulatory system needs simplification to ensure an agile, responsive training system to meet employer needs. Currently, publicly funded qualifications are regulated by Ofqual. This is important to ensure high-quality, robust qualifications paid through public finances. However, there is significant bureaucracy associated with the creation of these qualifications, and as such, it is limited to a few large-scale organisations (e.g Pearson, City and Guilds etc.) with qualifications often expected to last for many years. To open provision for more providers offering short duration courses with likely shorter lifespans, a lighter-touch regulatory system will be required.

Are STEM graduates being sufficiently prepared for highly skilled careers?

The 2021 Institute of Engineering and Technology Skills Report revealed that employers believe that fewer than half of new engineering recruits possess the technical or soft skills required within industry.^{xii} In response, many universities are adopting more design-led learning approaches, and new universities such as NMITE and TEDI London, are delivering entire degree programmes through problem-based-learning approaches. The Royal Academy of Engineering is currently undertaking research to understand the extent of this provision across the HE sector. University-industry collaboration is another important mechanism for ensuring industry relevant skills. Accreditation of engineering degrees by professional engineering institutions require universities to establish industry panels to inform teaching and learning and ensure relevant industry skills. Other programmes such as [Visiting Professors](#) from industry help to provide real-world challenges to students.

Engineering Degree Apprenticeships are a means of developing practical industry skills alongside gaining a higher education qualification. They also promote social mobility, with disadvantaged students more likely to pursue this pathway than full-time taught courses.^{xiii} Many employers are already supporting engineering degree apprenticeships, however according to DfE data, there were only 3,250 apprenticeship starts in 2018/19 (latest available), compared with ~ 37,200 entrants to engineering and technology first degrees in the same year.^{xiv} In addition to a lack of practical

industry skills, we also believe that current higher education engineering qualifications do not sufficiently prepare graduates to meet Net Zero challenges. The profession is working with the charity Engineers Without Borders to develop a framework of best practice for developing Net Zero skills within higher education and across the sector.

What role should the private sector play in retraining or supporting workers to retrain?

Professional Engineering Institutions (PEIs) occupy a central role in bridging the gap between the profession and the private sector in relation to retraining or supporting workers to retrain. PEIs offer a multitude of training opportunities in the form of continued professional development (CPD). However, of the approximate 5.5 million people within the engineering workforce, only 229,000 are professionally registered.^{xv} **The private sector should therefore both encourage their employees to become professionally registered, including implementing incentives, and work closely with PEIs to ensure that CPD is closely aligned with the needs of industry.**

2. Education Sector

The NEPC advocates a holistic approach to addressing STEM education challenges, and would like to see government develop a STEM Education Strategy addressing many of the concerns referred to in the questions below, but also questions around investment in STEM careers advice and guidance and the quality of teaching. For further information please see the [NEPC's submission to the 2021 spending review](#)¹.

Do cultural influences such as social media have a role to play in increasing uptake in STEM careers? Could the government do more to encourage this?

In 2018, the [This is Engineering](#) campaign was launched, led by the Royal Academy of Engineering in partnership with EngineeringUK. The campaign seeks to address the lack of young people applying for engineering courses and jobs, by challenging misconceptions about engineering and presenting inclusive industry images. Central to this campaign is the use of social media for engaging young people through a series of short videos profiling the innovative and exciting work of young engineers. The impact of this campaign has been considerable. Since 2018, *This is Engineering* social media content has received over 57 million views by a gender balanced audience and has encouraged more than one million teenagers to consider a career in engineering.^{xvi} The demonstrable impact of social media for promoting STEM careers should provide government with the impetus to work with campaigns such as *This is Engineering* to support expanding their reach.

How easy is it to recruit teachers with scientific skills and expertise? What more can be done to encourage highly skilled individuals from all backgrounds to go into STEM education?

We have great concerns about the lack of subject specific STEM teachers in England and the difficulties experienced in recruiting more specialists into teaching. Research by the National Foundation for Educational Research (NFER) suggests that the Department for Education's School Teachers' Review Body on pay proposals are unlikely to meet teacher supply targets for STEM subjects in England in 2022-25 and based on current figures, Physics, Design & Technology, Computing, and Mathematics will all fail to meet recruitment targets for the end of 2022 by some margin.^{xvii} In addition to missing recruitment targets, we also have significant concerns about teacher subject knowledge within STEM. There needs to be a significant increase in subject specific CPD for STEM teachers.

¹ <https://www.theiet.org/media/8836/2021-comprehensive-spending-review.pdf>

The Royal Academy of Engineering, EngineeringUK, and Institute of Physics have been working with the Department for Education to promote physics teaching to engineering undergraduates. This has led to the development of a new PGCE [Engineers Teach Physics](#) programme. Just 1% of engineering graduates entering teaching would have a disproportionate impact of 30% on the number of teachers. We believe that such measures are a step in the right direction, as is the £3,000 additional tax-free payments to physics teachers in disadvantaged schools. If this is successful, we would encourage the government to explore rolling this out across Mathematics, Computer Science, and Design & Technology. In addition to these measures, we suggest that the government continues to work on developing a greater understanding of what works in terms of recruiting and retention of STEM teachers.

We suggest that the government can and should explore:

- **Piloting STEM student mentoring programmes at universities. Initial pilot studies suggest that mentoring programmes have positive impacts on pupils.^{xviii}**
- **Collaboration with National Academies and wider STEM sector to develop programmes that encourage and enable more STEM professionals to enter teaching.**
- **A research programme for improving STEM teacher recruitment and retention.**
- **Funding STEM professional development courses for teachers.**

3. Quality of Academic careers

What major challenges face those in academic scientific careers?

Academics make a vital contribution to STEM, particularly from a R&D perspective. Fulfilling and sustainable careers in R&D should be open to everyone, but as the R&D People and Culture Strategy acknowledges, this is not currently the case.^{xix} Women represent just 16% of EPSRC PI applicants, on average receiving 37% less funding than men despite similar success rates.^{xx} The BAME applicant success rate has decreased year-on-year. **An urgent implementation of initiatives focused on diversity and inclusion within academia is required.**

Business-university collaboration is an important component of the innovation ecosystem, providing a myriad of benefit, however, many barriers exist. For example, the perception that collaborating with industry, or spending time in industry, is damaging to an academic career path persists and detracts from the attractiveness of such activities for academics. **There needs to be increased promotion of successful examples of researchers who derived particular benefit from collaborating with industry, and this should be a mark of esteem that enriches their careers.** In addition, **university recruitment and promotion criteria should reward individuals who have achieved excellence in translational, entrepreneurial, and collaborative activities.** Despite these clear advantages and its excellent academic research-base, much remains to be done to transform academic excellence into significant R&D and economic gains.^{xxi}

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- ⁱ [Lifelong Learning Entitlement should include means-tested grants](#), Lifelong Education Committee (2022)
- ⁱⁱ [Ascent 121 Support for Science](#), Education Endowment Foundation (2019)
- ⁱⁱⁱ [Engineering Pathways into Engineering](#), EngineeringUK (2020)
- ^{iv} [2019 Excel Resource](#), EngineeringUK (2019)
- ^v [Green Jobs Taskforce](#), BEIS (2021)
- ^{vi} [Skills and Demand in Industry 2021 Survey](#), IET (2021)
- ^{vii} **Ibid**
- ^{viii} [The Mining Sector’s Strategic Need for UK Mining Engineering and Mineral Processing Graduates](#), UK Mining Education Forum (2022)
- ^{ix} [Focus on the Demand for STEM Jobs and Skills in Britain](#), EMSI (2018)
- ^x [Lifelong Loan Entitlement](#), DfE (2022)
- ^{xi} [Lifelong Learning Entitlement should include means-tested grants](#), Lifelong Education Committee (2022)
- ^{xii} [Skills Survey](#), Institute of Engineering and Technology (2021)
- ^{xiii} [Make degree apprenticeships a force for social mobility](#), Office for Students (2019)
- ^{xiv} [Apprenticeships and Traineeships Data](#), DfE (2020)
- ^{xv} [Professional Registration](#), Engineering Council
- ^{xvi} [This is Engineering](#), Royal Academy of Engineering
- ^{xvii} [Teacher Labour Market in England](#), National Foundation for Educational Research (2022)
- ^{xviii} [Ascent 121 Support for Science](#), Education Endowment Foundation (2019)
- ^{xix} [R&D People and Culture Strategy: People at the heart of R&D](#), BEIS (2021)
- ^{xx} [Diversity Data](#), UKRI (2020)
- ^{xxi} [“Science and technology superpower”: more than a slogan?](#), House of Lords (2022)