Engineering 2050: a sustainable, prosperous and competitive future

There are two major, cross-sector challenges that will define our times – delivering net zero, and building a responsible digital future. Addressing these challenges correctly will drive economic growth, skills, jobs, and make the UK a world leader in emerging technology.

Engineering is at the core of both delivering net zero, and building a responsible digital future – and providing the solutions to these challenges will drive long-term prosperity in all corners of the United Kingdom. In other words, engineering is central to the government's economic, environmental, and scientific strategy.

Strong collaboration between industry, government, and academia is essential to this vision of prosperity, and levelling-up the UK economy. Below, The Institution of Engineering and Technology (IET) sets out the most critical recommendations to government on facing these broad challenges, and outlines key enablers in terms of skills, innovation, and infrastructure.

About the IET

The IET is a trusted adviser of independent, impartial evidence-based engineering and technology expertise. We are a registered charity and one of the world's leading professional societies for the engineering and technology community with over 155,000 members worldwide in 148 countries. Our strength is in working collaboratively with industry, academia and government to engineer solutions for our greatest societal challenges. We believe that professional guidance, especially in highly technological areas, is critical to good policy making.

Engineering to deliver net zero

Delivering net zero will stimulate the UK economy and mitigate the impacts associated with the effects of climate change. From decarbonising transport and energy production, to building energy efficient homes, **delivering net zero is an engineering challenge**.

There must be a focus on technological solutions that work *with* society to mitigate the impact of climate change and decarbonise. Engineering ensures that these solutions are implemented in an economically viable and safe manner. **It is crucial to have a skilled workforce that can deliver this.** Of organisations surveyed with a sustainability strategy, 81% said they would need additional skills to deliver it.

While the ambition of the government's net zero Strategy is welcome, there remain significant practical challenges. The technology to decarbonise exists, but the government's long-term

plan needs to address the whole system with joined-up policies that consider the roles of scaled-up industry, the workforce, and the public in delivering net zero.

Key recommendations

- Continued support from government and a drive from business to reskill and upskill the existing workforce is vital.
- A 'system of systems' approach to net zero would improve both energy efficiency and infrastructure resilience. This means recognising the interdependencies of systems such as transport, healthcare, manufacturing and energy. Therefore, changes in the UK need to be overseen by a system architect that has oversight and accountability for net-zero to avoid unintended consequences.[1]
- There must be a real focus on energy efficiency. Efficiency measures in homes and businesses can reduce the UK's 2050 electricity demands by 30%. Government commitment to net zero new builds, alongside a large-scale drive to retrofit existing builds, will increase the UK's energy security, create jobs, and grow the economy.

Engineering a responsible digital future

Artificial intelligence, data, and digitalisation will transform our lives. The UK has world-leading expertise on these topics, but government leadership is needed to ensure that the British economy is well-placed to capitalise on it, and that the resulting changes benefit society.

Key recommendations

- Setting-up targeted challenge funds and a National Institute for AI and ageing research would encourage innovation and help propel the UK to the forefront of this rapidly growing sector**.** Machine learning-led approaches to healthcare delivery could reduce the NHS expenditure by £12.5bn per annum.[2]
- Cyber-physical infrastructure is enabling engineers to better understand and optimise the performance and safety of complex systems – from production lines to buildings. This increases the efficiency of systems, which will boost productivity, and help to deliver net zero. Government should support initiatives to optimise complex systems through cyber-physical infrastructure.
- New safeguards are needed to protect the UK from cyber threats. While the coming digital revolution promises great societal benefits, the government must be proactive

[1] The IET has highlighted the example of the public switched telephone network withdrawal to emphasize its unintended effects on the gas energy network as an example in its report 'Interdependencies and Resilience in Digital Transformation'
[2] https://www.ippr.org/files/2018-05/lord-darzi-review-interim-report.pdf

about future-proofing digital legislation, such as the Online Safety Bill, against the misuse of emerging technologies such as the Metaverse.

Key enablers – innovation, skills, and infrastructure

Addressing these challenges requires investment in key underpins that will also charge productivity and economic growth

Key recommendations

- **Fundamental to both delivering net zero and building a responsible digital future, is a focus on energy supply security to minimise exposure to fuel price volatility.** Cyber security should also be prioritised to prevent system vulnerabilities. Such liabilities can dampen business confidence with knock-on effects on investment, growth, and employment opportunities.
- Solutions to these challenges should also work to level-up communities.
    - **This includes ensuring a fair and just transition to net zero.** This will bring its own economic benefits, and provide health and social improvements for individuals.
    - **Levelling-up digital infrastructure should mean that 5G connectivity is available to *all* communities by 2030.**
- Engineers are among the most in-demand professionals, with almost half of engineering / technology employers reporting difficulty recruiting. Moreover, employers report chronic skills shortages in net zero-related and digital skills.
    - **The STEM education-to-engineering pipeline should be strengthened, alongside greater incentives to enter a STEM career. However, it is also key that there is a focus on reskilling and upskilling the existing workforce to meet skill demand.** 78% of employers support at least one government action that could help them meet their digital skills needs, and 40% of employers support grants or loans for training programmes / reskilling.
    - **There should be a broad level of understanding on how to use new technologies to support growth and innovation across the workforce.** The IET's research shows that engineering employers who are seeing a skills gap around adapting to new equipment or IT skills report that it reduces their productivity (49%), restricts their growth (35%), or makes it harder to innovate (35%). While most employers have a strategy to improve digital skills, 92% need additional skills to deliver their strategy.