

LETTERS

HAVE SOMETHING TO SAY?
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SMALL MODULAR REACTORS ARE KEY TO DECARBONISED ENERGY

The re-emergence of hydrogen as a major source of renewable energy induces a feeling of déjà vu ('Back to the future with hydrogen', *Ingenia* 76). Hydrogen was the major constituent of coal gas, later town gas, which was piped all round the country to provide lighting and heating through the 19th and 20th centuries, albeit at a low pressure of four inches water gauge in the units of the day. It has a very high burning velocity compared with natural gas, so when the great switch to natural gas occurred in the 1960s and 1970s, after the discovery of large quantities of natural gas in the North Sea, all combustion appliances had to be changed, a massive undertaking achieved by Sir Denis Rooke OM CBE FEng FRS of British Gas (a Founding Fellow of the Royal Academy of Engineering). I remember the changeover in my rambling terrace house was achieved by three specially trained, out of work, former orchestral string players.

The prospect of safely switching back to hydrogen, with its dangerously wide flammability limits of 4% to 75% by volume in air compared with 5% to 15% for natural gas, is a daunting prospect. But in the field of transport, hydrogen feeding a fuel cell

to provide electric traction for both road or rail is a very attractive proposition, provided one is not too concerned about a 'fuel tank' containing hydrogen at pressures of more than 90 million pascals.

In the 1980s, when the idea of electric taxis was ahead of its time, I drove an electric black cab a few miles around London, powered by a hydrogen-air fuel cell with the hydrogen stored in a heavy standard metal cylinder lying on the back seat. Nowadays, a high-pressure hydrogen tank onboard will give a range of 500 miles.

What is contentious is the source of the hydrogen, which must be carbon free if it is to achieve energy decarbonisation, as the editorial points out. Hydrogen is produced commercially by steam reforming of natural gas, but this process produces carbon dioxide that must then be subject to carbon capture and storage, which would be very expensive and is as yet unproven. Electrolysis of water or steam using 'clean' electricity would be a better bet. Renewable energy, such as wind or solar, could make a contribution, if the wind is blowing strongly over the UK, for example, the spare electricity could be used for hydrogen production.

Not mentioned in the editorial is clean nuclear power using the latest high temperature small modular reactors (SMRs). They can break down water thermally to hydrogen at high temperature, without having to resort to electrolysis. They generate electricity very efficiently with an availability of over 90% (unlike renewables) but can also produce carbon-free process and domestic heat. Conventional pressurised water nuclear reactors do not have this versatile ability to produce clean heat as well as electricity and 80% of our energy requirement is for heat and transport, not electricity.

SMRs will have to play a leading role if we are to decarbonise energy by 2050, but this will require government support. There is currently a competition being run by the Department for Business, Energy and Industrial Strategy to choose the best SMR technology, but government will have to assist with the expensive licensing process before potential investors will move to fund a fleet of much needed high-temperature SMRs.

Professor Ian Fells CBE FEng FRSE

DIGITAL SKILLS WILL PREPARE THE WORKFORCE OF THE FUTURE

In response to the article in September's *Ingenia* outlining the challenge of the digitally left behind community (DLBC) ('Supporting the digitally left behind', *Ingenia* 76), I wanted to first praise the authors for highlighting the issues and suggesting practical steps that we, as an engineering community, could take to address the issues raised, while recognising that the issue is not limited to the engineering community but wider society. Furthermore, I wanted to acknowledge that the piece also recognised that systems engineering has a job to do on many of the platforms and applications that we are exposed to as a necessary part of our increasingly online life. There is no doubt that this kind of approach would be enormously beneficial but it does require, in my view, a much more integrated, ambitious and urgent focus on the skills of the workforce and the population in general. While many systems could be re-engineered for better usability, there is still a huge percentage of the population who are apprehensive about the use and integrity of systems and much of that is because they lack the basic skills, training and expertise to engage effectively. This is also true in the supply side where it is reported there are, according to The Tech Partnership and other skills-based bodies, shortages of up to a million skilled IT professionals, over the next five to ten years. The very people able to create those next generation systems are also in short supply.

It is urgently important that we skill the general population as well as the existing workforce. If two thirds of 2030's workers are already in the workforce today, out of full-time education and critically short of digital skills, this is not a problem that we can leave

to schools or universities. As businesses, we must address the reskilling of the existing workforce with the help of government.

Work by Be the Business, the organisation created by business to address the chronic productivity lag in the UK, has identified that, alongside leadership skills, the distinct lack of digital skills limits the adoption of new productive digital ways of working. As a key shortfall of the UK economy, this leaves the UK languishing at the bottom end of the productivity scale of the G7 nations and some 15% to 17% behind the average.

There are hundreds of skills initiatives, funded by public and private money, that could be used to help with this reskilling challenge, but they are largely uncoordinated and can be extremely confusing to the average citizen or worker. We need to find a way of radically simplifying the landscape and aligning efforts, such that individuals and companies have a clearer path to upskilling, reskilling and acquiring the relevant skills for the next generation. The Royal Academy of Engineering can play an important part in that simplification and alignment. There have been several attempts to provide this kind of coordination, such as the Department for Digital, Culture, Media and Sport's Digital Skills Partnership and the skills initiatives in many sector deals, but even they are challenged in coralling some of the fragmented pieces. *Made Smarter*, the engineering industry and industrial sector's initiative to help to provide a much greater use of digital technologies to improve productivity, has identified the need to simplify access to, and help with navigation of, the skills system as a key objective of the soon-to-start pilot in North West England.

This initiative will hopefully address all levels of workers and citizens wishing to reskill and upskill, from the digitally elite to the DLBC. It will try to amplify existing excellent initiatives such as Movement to Work, which focuses on those not in education, employment or training, and charities that are part of the digital skills partnership.

Reassuringly, the article states the need to understand both the size and challenge of the DLBC, which I think is absolutely right and will allow us to focus more on issues of design and accessibility, often seen as unrelated to engineering, which will benefit everyone. Once again, we need to make sure we crowd-in as much existing work as possible, such as the excellent work led by Sarah Weir OBE at the Design Council and Innovate UK's funding of projects to further design in all aspects of life, from cities to healthcare.

In summary, I welcome the focus on designing and building accessible systems and the need to understand the real issues further. However, I would suggest that if we really want to crack the issue of demand as well as supply, we need to have a coordinated, ambitious and dynamic push on reskilling and upskilling the existing population and workforce. This should not be done by creating a whole load of new initiatives but by crowding in and coordinating the myriad of initiatives that many find so confusing today.

Phil Smith

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 Chair of the Digital Skills Partnership