

South Yorkshire low carbon energy supply chains: Nuclear sector summary



January 2022

1. ROLE OF TECHNOLOGY IN FUTURE NET ZERO PATHWAYS

Nuclear energy currently accounts for around 20% of UK energy generation. As a low carbon generator, the Nuclear Industry Association (NIA) claims that generating electricity through nuclear fission prevents over 22million tons of carbon dioxide emissions per year.

The current focus of the nuclear sector is based around three main themes:

1. Decommissioning existing fission plants.
2. Research into fusion reactors – although still unproven on a large/continuous scale.
3. Small modular reactors (SMRs) that use fission to generate energy at a local level, i.e. 10,000s of homes.

The nuclear sector is important to the UK Government, who set out plans for the sector in terms of skills, infrastructure and jobs in several key publications (Nuclear Sector Deal, Nuclear Skills Strategic Plan).

Decommissioning fission plants is an important aspect of the nuclear sector, however engaging in this activity requires that the work takes place at the site of the power station. Nuclear fusion is still at the experimental stage and is typically focussed on researching how to harness this process to produce electricity rather than any commercial applications. Consequently, the development of fusion technology is mostly confined to universities and research institutes.

Small modular reactors (SMRs), defined as those that generate up to 300MW of power, appear to offer the greatest scope for firms in the SCR to engage with the nuclear supply chain. These reactors are regarded as being more cost effective than large scale nuclear plants as they can be built in factories and then assembled onsite rather than having to be built completely onsite. Factory construction also allows the use of standardised manufacturing techniques, faster build times, and removes uncertainties caused by adverse weather at building sites. These factors, coupled with utilising insights from similar manufacturing techniques in the aerospace and automotive sectors, are viewed as making the production process more efficient and, therefore, cheaper. Given these potential efficiency gains, the industry is aiming for SMRs to be able to generate electricity at a cost of between £40-60/MWH, compared with a figure of around £90/MWH for larger nuclear plants. As a result, SMRs are viewed as a viable and cost-effective future technology to ensure the growth of the nuclear sector. It is envisaged that the first SMR will be operational by 2030.

2. THE SECTOR

While the main economic impacts of the nuclear sector are realised outside the Sheffield City Region (North West England, £4.3 Billion and South West England £1.6 billion), the region is a key knowledge hub for the industry. University of Sheffield and Nuclear Advanced Manufacturing Research Centre (NAMRC) are key research centres in this sector and are located in the SCR. However, many UK universities also have research centres dedicated to nuclear, highlighting the fact that the knowledge supply chain is not confined to the SCR but UK wide. Therefore, while the SCR is a knowledge hub,

it is part of a larger network of knowledge centres. As well as being a centre for knowledge creation for the nuclear industry, the NAMRC is also a key player for identifying potential suppliers within the nuclear supply chain as they possess a database of those with the capabilities to produce specific components.

The nuclear industry's supply chain is vast in scope, being comprised of both national and international organisations. The UK supply chain features several multinational OEMs as well as smaller UK firms. Therefore, there is not a locational disadvantage for SCR firms to engaging with the sector.

In terms of SMRs, the UK SMR consortium, led by Rolls-Royce, has developed plans for an SMR based on a pressure water reactor that can generate up to 470MW of power. The development phase alone is forecast to create 6000 new jobs by 2025, with around 80% of the components manufactured in the Midlands and Northern England. Scaling up the programme could potentially create up to 40,000 jobs and be worth £52 billion to the economy. According to the Government, in the long term, the UK suppliers could potentially account for between 55%-70% of the SMR components.

In addition to the UK consortium, developers from outside the UK may be interested in basing their operations in the country in order to take advantage of knowledge, expertise, and skills available. These developers include Westinghouse (US), NuScale Power (US), China National Nuclear Corporation (China), Moltex Energy (Canada), and GF Nuclear (South Korea). Therefore, there is scope for the further expansion of the nuclear sector beyond the previous forecasts.

However, for firms outside the nuclear supply chain, there exists significant barriers to joining as, for safety and security reasons, the sector has stringent accreditation processes. Not only must firms be accredited but also employees must possess the relevant training and certification to operate in the sector. While this may be a barrier to entry, it is not insurmountable. Organisations such as the National Skills Academy Nuclear (NASN) and the Nuclear Industry Association run training and accreditation programmes to enable both firms and individuals to obtain the relevant clearances to work in the nuclear industry. While these are not based in the Sheffield City Region, there is no barrier to accessing these courses for firms that are in the region.

Therefore, for new entrants, the decision to enter the nuclear supply chain is not a short-term option as it requires significant investments in a time-consuming training/accreditation process to gain the relevant clearances. While these are obtainable, this must be achieved before the firm can operate within the sector.

3. EMPLOYMENT AND SKILLS

Nationally, the civil nuclear sector employs over 65,000 people in the UK and contributes £6.4 billion per year to the economy (Nuclear Industry Association). In addition, GVA per employee in the sector is £96,600, suggesting that productivity levels are high. Over the period 2016 to 2021 the industry's workforce was expected to grow to 100,000, indicating that this is a growth sector. In addition, the industry's existing attrition rate means that 7,000 new entrants were required per year to ensure the workforce can meet this level of growth.

The Nuclear Skills Strategic Plan was updated in 2018 and outlines skills requirements and delivery plan for the sector. The plan sets out several broad objectives, the most significant being the aims to:

- Enhance leadership skills.
- Develop local apprenticeships.
- Ensure sector transferability.
- Increase visibility of nuclear sector as a career of choice.

The plan also highlights several 'fragile skills,' i.e. those that are regarded as in short supply within the current workforce. Several of these are not specific to the nuclear industry, providing opportunities for SCR based training schemes to address including: electrical engineers, chemistry, steel fixers, concreters, scaffolding, and civil engineering. Furthermore, producing SMRs through utilising production techniques from aerospace and automotive broadens the skills base and offers further opportunities for the development of relevant skills among the SCR workforce. Skills in the following areas have been highlighted as important for future manufacturing needs:

- Robotic manufacturing.
- Single-platform machining.

- Cryogenic cooling.
- Intelligent fixturing.
- On-machine inspection.
- Electron beam welding.
- Diode laser cladding.
- Automated arc welding.
- Bulk additive manufacturing.

It is also envisaged that once the multiple contracts for SMRs are signed and production increases, the ongoing development and refining of the design and technology will promote the expansion of technical skills within the sector's workforce to be developed. As such, training programmes must remain flexible and open for development in order to ensure that these keep up with industry demands.

4. OPPORTUNITIES FOR SHEFFIELD CITY REGION

4.1. Opportunities for Firms

The prospects for firms in the Sheffield City Region to benefit from the increased production of small modular reactors is significant. The recently announced £400 investment in SMRs (representing £215m in public money and £195m in private investment led by Rolls Royce) provides a clear sign that this technology is becoming more viable. Indeed, this initial announcement offers a clear opportunity for Sheffield firms to provide a broad range of inputs into the supply chain, for example components such as castings, forgings and fixings as well as offering expertise in metals to the sector. Furthermore, the political will appears to be in place to back Sheffield businesses to benefit, with Secretary of State for Business, Energy, and Industrial Strategy Kwasi Kwarteng, commenting that "Sheffield has great history, great skills, a great university and I think it will be at the forefront of our push to lead the world."¹

However, the important caveat is that any suppliers must first of all overcome the regulatory hurdles associated with the sector. While this is not insurmountable, for those firms seeking

accreditation to join the supply chain it is not an instant process. Therefore, careful planning is required to take advantage of increased demand for components from the nuclear sector. Furthermore, these requirements may also act as a barrier to new start-ups joining the supply chain, with those without the industry insight or necessary clearance unable to react quickly to opportunities in this sector as they may in other low carbon technologies.

4.2. Opportunities for Employment

Estimates vary on the total number of jobs to be created through SMRs, but the first wave of production is forecast to create around 6000 jobs by 2025. Furthermore, up to 40,000 new jobs have been predicted to be created in the coming years with the commissioning of 16 new reactors in the UK coupled with exporting the technologies to other markets.

As noted previously, working in the nuclear sector requires specific training and accreditation of workers as well as firms. Therefore, in seeking to benefit from securing these jobs in the Sheffield City Region some foresight is required in order to effectively plan to expand employment through attracting workers with the appropriate skills as well as training and accrediting workers that are new to the sector.

5. RECOMMENDATIONS

In order for the Sheffield City Region to take advantage of the expansion of the nuclear sector to produce small modular reactors, the following recommendations are made:

- A regionally focussed support and sign posting programme to enable firms and workers to be trained and accredited for working within the nuclear sector. This support is available through the national Skills Academy Nuclear and Nuclear Industry Association, necessitating close links between regional policymakers with these organisations.

¹ [Sheffield will lead world in nuclear power says business secretary Kwasi Kwarteng | The Star](#)

- Continued support of the NAMRC to ensure that the region is at the forefront of new knowledge and technology in this area. In addition, as the NAMRC provides a repository of all suppliers to the nuclear sector, this organisation could be an initial starting point for those seeking producers of particular components.
- Provision of specialist start-up support within the Sheffield City Region to enable new businesses to be created and take advantage of emerging opportunities in the sector.

Other Reports

- Low Carbon Energy Supply Chains, Employment and Skills in South Yorkshire: Headline Findings
- South Yorkshire low carbon energy supply chains: Carbon Capture, Utilisation and Storage (CCUS) sector summary
- South Yorkshire low carbon energy supply chains: Heat Networks sector summary
- South Yorkshire low carbon energy supply chains: Heat Pumps sector summary
- South Yorkshire low carbon energy supply chains: Hydrogen sector summary
- South Yorkshire low carbon energy supply chains: Insulation sector summary

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