

Could Small Modular Reactors Revolutionise the Nuclear Industry?

Few projects demonstrate the current issues faced by the nuclear industry like the Flamanville Unit 3 nuclear reactor, in France. When EDF began construction back in December 2007, the French energy giant estimated that commercial operations would begin in 2012, with a total build time of 54 months at an estimated cost of €3.3 billion. However, beset by supply chain issues and safety concerns, the reactor still hasn't come online. Commissioning is now tentatively planned for the end of 2022, at an eye-watering total cost of €19.1 billion. It is a similar story at the Finish Olkiluoto nuclear power plant – there, as in France, construction of a third unit is over a decade behind schedule. Both sites are based on the same European Pressurised Reactor (EPR) design currently under construction at Hinkley Point C in Somerset. When finished, Hinkley's 3.2 GW twin unit reactor will generate enough electricity to meet over 7% of UK demand. It too is over budget and behind schedule, though not to the same degree as its continental counterparts. Concerns about cost have plagued the nuclear industry in recent years, particularly in the wake of the plunging cost of renewables. But proponents argue that nuclear, which produces virtually zero carbon dioxide once operational, is the only viable means of providing reliable, baseload power in the post-fossil fuel era. In recent years, a new generation of nuclear reactors – Small Modular Reactors (SMRs) – have been proposed as a cost effective alternative to goliath projects like Hinkley C. Could SMRs hold the key to the revitalisation of the nuclear industry?

The SMR concept is simple – build smaller, standardised components (or 'modules') at a central facility before transporting them to the build site for installation. In theory, the degree of standardisation reduces complexity, shortens build time and crucially, lowers costs. As the name might suggest, a typical SMR produces

considerably less output than a standard reactor – usually less than 300 MW, compared to the 1.6 GW that will eventually be produced by each of Hinkley's EPR units. Reducing reactor dimensions is not a new concept – the US commissioned its first SMR back in 1955 (it was closed after three years due to safety concerns), and both US and Russian navies have nuclear powered vessels.

However, advocates argue that a new generation of SMRs could circumnavigate many of the issues associated with traditional nuclear power. For starters, the compact SMR would have a much smaller footprint than a traditional plant. Take the SMR currently under development by Rolls Royce. Considered large by SMR standards, Rolls believes its proposed 400 MW reactor occupies a 'sweet spot' in terms of economies of scale. Nevertheless, it would only occupy the equivalent of two football pitches. The size of SMRs could see them deployed to power remote towns and energy hungry industrial facilities. Retired coal plants, whose footprint is much smaller than an average nuclear power plant, could be cleared to make way for SMRs that provide ongoing job security for those in the energy industry. It is easy to see the political benefit of such a move in regions still heavily dependent on coal for jobs.

Standardisation should also bring cost benefits, though the magnitude of this benefit remains purely speculative. One recent study suggests that a factory produced pressurised water SMR might be up to 40% cheaper than a traditional plant scaled to provide equivalent energy output. But from a balance sheet perspective, the issue is less about competition within the industry, but from outside it – the cost of renewables has plummeted in recent years. NuScale, founded back in 2007, is one of several companies aiming to bring SMR technology to market. It expects its first SMR, based in Utah,

to be operational by 2027 at a levelised cost of \$65 per MWh. But by 2025, the US Energy Information Administration estimates that the levelised cost of solar will be just \$32.80, albeit with intermittent generation. In regions where supply exceeds demand, hydrogen production and desalination have been proposed as means of additional revenue generation for SMRs.

There are other issues, too. For starters, SMRs use the same fuel as conventional facilities, and therefore produce the same waste. The lack of a clear waste storage strategy has long curtailed the enthusiasm of potential investors – the US has been searching for a permanent location to store its nuclear waste since the late 1980s. The current array of reactor design proposals creates another problem. To maximise cost savings, standardisation is key, but with limited demand there is a distinct possibility that no single manufacturer will achieve the level of mass production required to benefit from economies of scale. Regulation is another key unknown that may hinder a potential SMR roll-out. The existing nuclear industry is no stranger to strict regulatory constraints, and despite their reduced size and output, there is little reason to think that SMRs will receive a light regulatory touch relative to conventional units. In fact, the dizzying array of designs is

likely to generate even greater scrutiny.

What's the outlook for SMRs? For investors looking to ascertain the future of the nuclear industry, the main hurdle is a lack of real world demonstration. It will be at least the late 2020s before a working unit is brought to market. Certainly, a recent and highly controversial proposal by the EU to label nuclear power as 'green' would provide a much needed boost. But given the delays experienced across the industry, a burgeoning SMR sector is highly unlikely until at least the late-2030s, and this might be too late. The precipitous fall in the cost of wind and solar has outpaced even the most optimistic market forecasts. Battery storage costs, which could help bridge the intermittency issues linked with renewables, are also falling rapidly. Perhaps the greatest threat for SMR nuclear is that, by the time the technology reaches maturity, the energy market may have moved on entirely.

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