A New Dawn for UK Nuclear: Small Modular Reactors on the Horizon

Facing the twin pressures of surging electricity demand and the retirement of its aging fleet of large reactors, the UK government has made the decision to reverse decades of under-investment in nuclear power and restore Britain's leadership in the sector. The UK has set an ambition target of up to 24 GW of nuclear capacity by 2050, to be delivered through a mix of small modular reactors (SMRs), advanced modular reactors (AMRs), and large-scale projects.

In June 2025, following a two-year competitive evaluation process, the government selected a Rolls-Royce design to lead the first wave of the UK's domestic SMR program. Backed by strong government support and a defined roadmap, the program positions SMRs to play a central role by the mid-2030s, delivering low-carbon energy while enhancing the UK's energy security, stabilizing the grid, creating high-value jobs, and unlocking export opportunities.

The Next Chapter in the UK's Nuclear Story

The UK was the first country to deploy commercial nuclear power, which began in 1956 with the world's first civil nuclear program at the Calder Hall Nuclear Station on England's northwestern coast. At its peak in the mid-1990s, the UK generated approximately 13 GW of power from nuclear energy, but today output has fallen to about 6 GW.

Furthermore, despite the new Hinkley Point C Nuclear Station being under construction and the Sizewell C project advancing, no new nuclear power station has been connected to the grid since Sizewell B began operating in 1995. And most of the country's reactors in operation today are due to be retired by the end of this decade. Meanwhile, energy demand is projected to double by 2040, driven by growing electricity needs (e.g. heat pumps, electric vehicles, and data centers).

To close this gap, the government has decided to reverse decades of under-investment and to "recover" the UK's leadership in the nuclear sector. The country has set an ambitious target of up to 24 GW of nuclear capacity by 2050, which would cover up to one-quarter of its projected electricity demand, contributing to energy security, industrial decarbonization, and grid stability.

To achieve this target, the UK will aim to secure investment decisions to deliver 3–7 GW of nuclear power capacity every five years from 2030 to 2044. Under the current plan, this will likely require a combination of technologies, including SMRs, AMRs, and large-scale projects.

SMRs and Great British Energy—Nuclear

The UK government has committed to a programmatic approach to SMR deployment, in order to give industry and investors the confidence needed to build projects at pace and reduce costs through learning and replication of modular designs. In 2023, it established Great British Nuclear (GBN), which was renamed "Great British Energy – Nuclear," a body with the role of driving delivery of new nuclear projects on behalf of government. The UK Energy Act 2023 sets out GBN's role to "facilitate the design, construction, commissioning, and operation of nuclear energy generation projects for the purpose of furthering any policies published by His Majesty's government."

GBN's first priority was to run a competitive technical evaluation process to select the SMR technologies capable of reaching a Final Investment Decision (FID) by 2029, and delivering operational projects in the mid-2030s, potentially releasing multi-billion pounds of private and public investment. Alongside its role in leading this evaluation process, GBN will access sites and establish delivery capability to bring projects forward.

SMR Competition and Selection

In July 2023, GBN launched a technology selection competition, inviting SMR technology vendors to register their interest in the process.

There are many players in the SMR landscape, however, only six companies have been successful in the initial stage of the GBN competition and were invited to

Figure 1 **Rolls-Royce SMR Design Illustration**
Source: Rolls-Royce

submit bids for contracts.
The six companies include:

- Électricité de France (EDF);
- GE Hitachi;
- Holtec Britain;
- NuScale;
- Rolls-Royce SMR; and
- Westinghouse Electric Co. UK.

The six were invited to submit initial tenders by July 2023, and EDF, whose Nuward SMR was in the running, dropped out at that stage.

On June 10, 2025, following a two-year evaluation process, the UK government selected Rolls-Royce to lead its first wave of SMR development (**Figure 1**). It also pledged £2.5 billion (US$3.4 billion) toward the development of SMRs over the current spending review period, helping advance Rolls-Royce's technology and early site preparation.

The Rolls-Royce SMR consortium, a mix of public and private investors, has already secured £210 million (US$283 million) in government support for the regulatory assessment process of its SMR design, as well as £280 million (US$377.3 million) of its own funding. ČEZ Group, the Czech Republic's state-controlled utility, has a 20 percent stake in the Rolls-Royce SMR consortium as part of a wider strategic partnership between the two companies. Other partners include private investment vehicle BNF Resources, US-based Constellation Energy, and the Qatar Investment Authority. The government funding for Rolls-Royce, which is still subject to final agreements, involves support to help develop three initial SMRs with nearly 1.5 GW in nuclear generation capacity.

Streamlining Regulatory Processes

Navigating the permitting, licensing, and regulatory landscape for new nuclear power plants can be complex and time consuming. To accelerate progress, the UK government provided direct funding to the Office for Nuclear Regulation (ONR) to review its process for design assessment and nuclear site licensing in an effort to identify opportunities for simplification and streamlining.

The Generic Design Assessment (GDA) process is an internationally recognized feature of the UK's approach to regulating new nuclear power stations. The ONR has previously undertaken work to benchmark the GDA process against similar "pre-licensing" processes in other countries, notably the USA and Canada, to ensure consistency with international good practice. It is an upfront, non-site-specific assessment of a design that allows vendors, developers, and investors to gain early insight as to the acceptability of designs prior to making significant financial and resource commitments.

The Rolls-Royce SMR is the first design to undergo assessment under the new process and is progressing through the final stage of the assessment by UK nuclear regulators. Rolls-Royce began its GDA in April 2022 and expected to complete it by 2026.

The flexibility of the GDA means that the regulators have started the assessment while the design is still being developed to enable future site-specific deployment. The GDA process identifies regulatory issues ahead of construction, which can reduce risk and uncertainty and inform decision making for future licensing, permitting, and construction activities.

Costs and Financing

With a capacity of roughly 470 MW, the Rolls-Royce Pressurized Water SMR is larger than many similar designs. The company estimates that the first unit will cost £2-3 billion (US$2.7-4.0 billion), with costs falling as more reactors are built. Rolls-Royce SMR is

targeting costs of £40–60 (US$53.89-$80.84) per MWh over its projected 60-year lifespan, significantly below current UK retail electricity prices. If realized, this could yield stable, lower cost energy for households and industries. Factory fabrication and modular construction are expected to drive costs down through learning curve effects, similar to the aerospace and shipbuilding industries.

Financing is one of the major barriers to the development and deployment of new nuclear, due to high upfront costs and long construction periods. To address this, the UK government has made available funding models to support the financing of nuclear projects. These include the Contract for Difference (CfD) model agreed for the Hinkley Point C project and the Regulated Asset Base (RAB) funding model planned to be deployed for the Sizewell C project, and potentially for SMR projects.

The RAB is a well-understood approach that has previously mobilized significant investment into infrastructure projects in other sectors. It gives an eligible company the right to a regulated revenue stream throughout the construction, commissioning, and operations phases, unlike the CfD, which provides revenue only once the power station is generating electricity (**Figure 2**).

Siting for SMR Plants

In 2011, the UK government identified eight sites for "new nuclear" (large reactors) at the existing Bradwell, Hartlepool, Heysham, Hinkley Point, Oldbury, Sellafield, Sizewell, and Wylfa nuclear sites. However, to meet the ambitious 2050 nuclear goals, additional sites will be required, along with greater flexibility in the site selection process to enable new technologies. Therefore, a new approach to siting has been proposed by the government, and for the first time SMRs and AMRs generating heat and power will be brought into the new national planning policy framework alongside large-scale projects.

In 2022, Rolls-Royce announced it had identified four priority locations to build SMR-based power stations in the UK, including Trawsfynydd, Sellafield, Wylfa, and Oldbury—all on land owned by the UK Nuclear Decommissioning Authority.

In 2025, Prime Minister Sir Keir Starmer said he would cut planning "red tape" to make it easier for developers to build smaller nuclear reactors on additional sites across the country. "Certain criteria would have to be met," Starmer said. "No sites would be approved close to airports, military sites, or pipelines. Locations valuable for nature or at risk of flooding would also be ruled out."

GBN aims to allocate a preferred site for the first Rolls-Royce SMR later this year, with a FID targeted for 2029. Preferred locations are likely to include old industrial sites, such as former nuclear power plants, or old coal mines close to the grid.

Supply Chain

Deploying SMRs will require new factories, workforce expansion, and innovation in manufacturing. To address this, the government is working closely with the nuclear industry to accelerate the development and deployment of advanced manufacturing processes. This includes, for example, supporting the University of Sheffield Nuclear Advanced Manufacturing Research Centre (Nuclear AMRC).

The Nuclear AMRC operates across nuclear new build, operations, decommissioning, and technology development. It is home to a variety of state-of-the-art manufacturing equipment, including the largest electron beam welding chamber available for collaborative research and development (**Figure 3**).

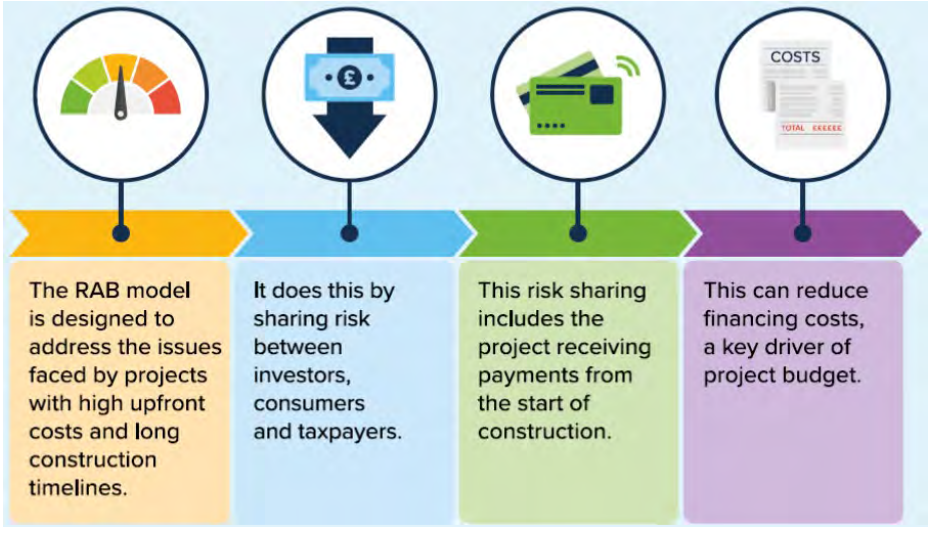

Figure 2 **Regulated Asset Base Financing Model**
Source: UK Government

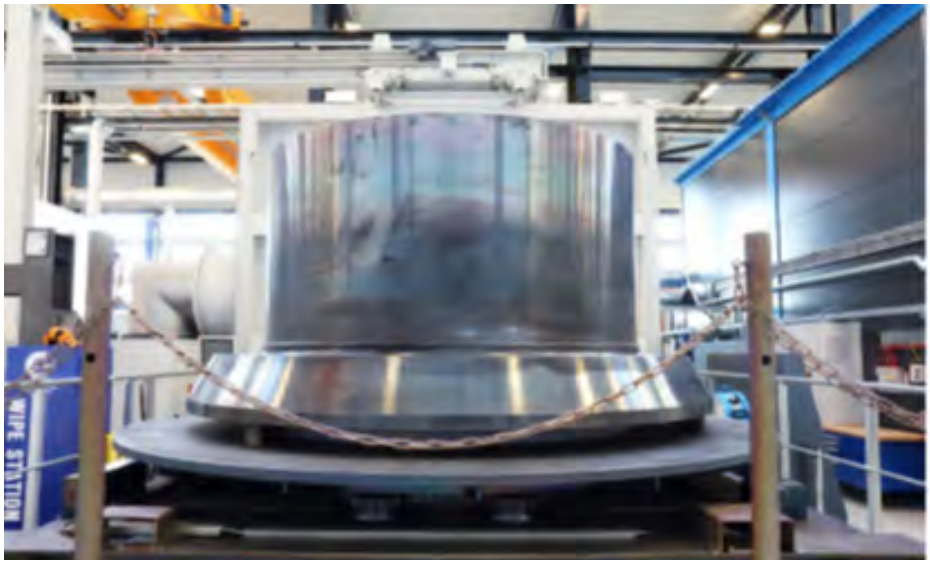

Figure 3 **Electron Beam Welding Machine at Nuclear AMRC's Research Factory, UK**
Source: UK Government

Electron beam welding has the potential to revolutionize the production of reactor pressure vessels, as this method could cut production time for SMR pressure vessels from two and a half years to less than one year. As well as radically increasing productivity, electron beam welding can reduce failure rates and in-service inspection requirements, and also reduce CO_2 emissions.

Through its Fit for Nuclear (F4N) program, the Nuclear AMRC also helps UK manufacturers qualify for nuclear contracts. By late 2023, 107 companies had achieved F4N status, winning around £2.1 billion (US$2.8 billion) in new contracts, creating nearly 3,000 jobs, and unlocking £42 million (US$56.6 million) in private investment.

Export Opportunities

International partnerships—with the Czech Republic, where Rolls-Royce SMR is already selected to provide up to 3 GW of electricity, and Hungary—are positioning the UK as a potential SMR technology exporter.

Rolls-Royce is also one of two remaining bidders in a SMR technology competition in Sweden. In addition, ULC-Energy, an Amsterdam-based nuclear project developer, selected in 2022 Rolls-Royce's design as its preferred technology solution for deployment of SMRs in the Netherlands.

Final Remarks

Almost a century ago, then-UK Prime Minister Winston Churchill predicted that nuclear energy would bring advances "incomparably greater than those produced by the steam engine." For the UK to truly fulfill that vision much remains to be done. Transforming the nation's energy mix into one that is greener, more resilient, and more independent is a formidable undertaking—but one for which the UK is uniquely equipped. Decades of nuclear expertise, world-class academic and research institutions, and full-cycle fuel capabilities provide a strong foundation.

The government's official commitment to a domestic SMR program centered on the Rolls-Royce design marks a decisive step forward, backed by political support and a clear roadmap. Yet, the path is not without obstacles: financial risk, regulatory complexity, supply chain vulnerabilities, and local opposition could all slow progress. If these challenges are managed effectively, however, SMRs could deliver reliable, affordable, and low-carbon power by the 2030s—strengthening UK energy security, supporting grid stability, creating skilled jobs, and opening valuable export markets. In doing so, the UK would not only advance its climate and energy goals but also move closer to realizing Churchill's bold vision for the nuclear age.