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Rolls-Royce SMR

The **Rolls-Royce SMR**, also known as the **UK SMR**,^[1] is a small modular reactor (SMR) design being developed by the Rolls-Royce (RR) company in the United Kingdom.

The company has been given financial support by the UK Government to develop its design. In 2019 it was estimated that the 470 MWe units would cost around £1.8 billion once in full production, compared with £22 billion for a full-sized nuclear power station such as the planned 3,300 MWe Sizewell C. Construction time and site size needed would also be lower.

History


RR began design work on the SMR c.2015 with a team of about 150 people, with decisions made near the start of the project to use light water^[a] as both coolant and moderator.^[2]

In 2016, it was reported that the UK Government was assessing Welsh SMR sites - including the former Trawsfynydd nuclear power station - and on the site of former nuclear or coal-fired power stations in Northern England. Existing nuclear sites including Bradwell, Hartlepool, Heysham, Oldbury, Sizewell, Sellafield and Wylfa were stated to be possibilities.^[3]

In 2017, the consortium headed by RR needed to seek UK government finance to support further development.^{[2][4][5]} In December 2017 The UK government provided funding of up to £56 million over three years to support SMR research and development.^[6]

In 2018, the UK SMR industry sought billions of pounds of government support to finance their putative First of a Kind projects. The Expert Finance Working Group on Small Reactors produced a report stating that there was "a current market failure in supporting nuclear projects generally" and identifying options for government to support SMR development in the UK.^{[7][8]}

In 2019, the government committed a further £18 million to the development from its Industrial Strategy Challenge Fund, to begin designing the modular system.^{[9][10]} In November 2021, the UK

Rolls-Royce SMR	
	SMR
Status	Regulatory Assessment
Main parameters of the reactor core	
Fuel (fissile material)	²³⁵ U
Primary moderator	light water
Primary coolant	light water
Reactor usage	
Operator/owner	Rolls-Royce Holdings (76%, November 2023)
Website	www.rolls-royce-smr.com (https://www.rolls-royce-smr.com/)

government provided funding of £210 million to further develop the design, partly matched by £195 million of investment by Rolls-Royce Group, BNF Resources UK Limited and Exelon Generation Limited.^{[11][12]} At that point they expected the first unit would be completed in the early 2030s.^[13]

In 2022, the CEO stated that the Rolls-Royce SMR investment business case was based on selling many hundreds of SMRs by 2050.^[14]

On 1 April 2022, the regulatory Generic Design Assessment (GDA) of the Rolls-Royce SMR started.^[15] The assessment will begin once the timescales and resources have been agreed.^[16] The assessment is likely to take about 4 years, and be complete by 2026.^{[17][14]}

In October 2022, Rolls-Royce announced that it was exploring eight possible sites in the UK to build the first of three expected factories for parts of the SMR.^[18] In November 2022, four sites were identified suitable for multiple SMR units: Trawsfynydd, Sellafield, near Wylfa, and near Oldbury.^[19]

In March 2023, Rolls-Royce stated that the current programme funding of £500 million will run out by the end of 2024, and requested negotiations with the UK government to find fresh investment. Hiring of new staff was stopped. About 600 staff work on the programme in Derby, Warrington and Manchester.^{[19][20]} At the end of March 2023, the CEO and finance officer of the SMR unit were replaced by the newly appointed CEO of Rolls-Royce.^[21]

In July 2023, Energy Secretary Grant Shapps said he was launching an international competition to select up to four different SMR technologies "to go through to the final design stage", supported by up to £157 million of finance. He said the final investment decision will be taken by the next parliament, and UK SMRs might start operating by the 2030s.^[22]

In November 2023, Rolls-Royce owned 76% of Rolls-Royce SMR Limited, with minority investments by the Perrodo family 11%, Qatar 10% and Constellation Energy 3%.^[23]

In April 2024, Rolls-Royce announced it had dropped plans to build a SMR pressure vessel factory, instead buying them from a third party supplier, with Sheffield Forgemasters in the UK being a possible supplier.^[24] In 2024, the cost of each SMR was expected to be between £2 billion and £3 billion.^[25]

In August 2024, Rolls-Royce SMR stated it was seeking further investment, for a stake in the subsidiary, to finance the company in 2025.^[23] In October 2024, The ČEZ Group took a 20% stake in Rolls-Royce SMR at a cost of "several hundred million pounds"; ČEZ plan to deploy up to 3 GWe of SMR generation capacity in the 2030s in the Czech Republic.^[26]

Design

RR is preparing a small modular reactor (SMR) design called the UK SMR, a close-coupled three-loop pressurized water reactor (PWR) design.^[27] Power

External image

output was initially designed to be 440 MWe, and subsequently increased to 470 MWe which is above the usual range considered to be a SMR.^{[2][28][27]} It should be able to power a city the size of Sheffield.^[9]

The intended fuel is uranium dioxide (UO₂).^[29] A modular forced draft cooling tower will be used.^[27] The design targets a 500 day construction time, on a 10 acres (4 ha) site.^{[29][30]} Overall build time is expected to be four years, two years for site preparation and two years for construction and commissioning.^[31]

In 2020 the original target cost for a 470 MWe Rolls-Royce SMR unit was £1.8 billion for the fifth unit built,^[32] or around £3.8 million per MWe. As a comparison the estimated cost for the full-size 3.3 GWe Sizewell C nuclear power station was £22 billion, or around £6.7 million per MWe.^[9] In 2024, the SMR cost was expected to be between £2 billion and £3 billion.^[25]

See also

- List of small modular reactor designs
- Nuclear power in the United Kingdom
- U-Battery, a micro-SMR development also supported by the UK Government


References

Notes

- a. The term *light water* is used to specifically distinguish from heavy water in the context of a nuclear reactor

Footnotes

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2. WNN 2017a.
3. McCann 2016.
4. WNN 2017b.
5. Hollinger & Pfeifer 2018.
6. NEI 2017.
7. Vaughan 2018.
8. DBEIS 2018.
9. Rowlatt 2020.
10. WNN 2019a.
11. BBC 2021a.
12. DBEIS 2021.

 [Cross section of Rolls-Royce SMR \(https://www.rolls-royce.com/~media/Images/R/Rolls-Royce/innovation/smr/convincing-alternative-page.jpg?h=744&iar=0&w=1402\)](https://www.rolls-royce.com/~media/Images/R/Rolls-Royce/innovation/smr/convincing-alternative-page.jpg?h=744&iar=0&w=1402) (CGI render)

13. WNN 2021.
14. "Corrected oral evidence: UK energy supply and investment" (<https://committees.parliament.uk/oralevidence/10083/html/>). *Economic Affairs Committee (Lords)*. UK Parliament. 5 April 2022. Retrieved 19 April 2023. "Tom Samson: We anticipate selling many hundreds of these units between now and 2050. That is a business case upon which we have attracted the capital today and those investors who came to the table in November last year have done their analysis. We have done market studies and research, and with that cost competitiveness there is a huge demand for this technology. That is the premise on which we are building the business."
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