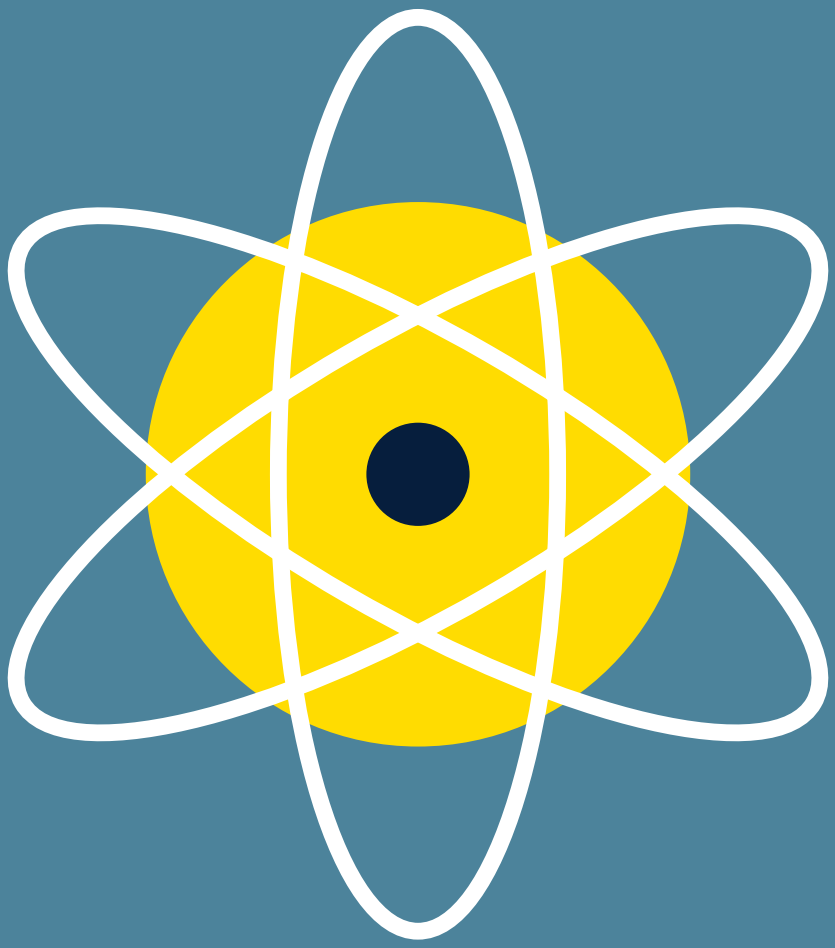


A Short Guide to...

New Nuclear

NATIONAL NUCLEAR LABORATORY

The Climate Context

As society begins to take action against the environmental crisis our planet faces, it is impossible to overestimate the scale of the challenge ahead for the UK in reaching net zero by 2050.

Nuclear is already one of the largest and most reliable low-carbon energy sources in the UK; it provides nearly a fifth of our overall electricity needs and two-fifths of our clean electricity. Without nuclear, the UK will not meet its net zero goals on time.

> "Nuclear is already one of the largest and most reliable low-carbon energy sources in the UK."

The UK Policy Landscape

Nuclear is an amazingly flexible source of energy; over the past 60 years nuclear has reliably produced baseload clean electricity. As we look beyond clean electricity to decarbonising heat and transport, nuclear can play a key role in reducing emissions across our entire energy system, including through low-carbon hydrogen and sustainable fuels.

The UK government has recognised the role for large, small and advanced nuclear technologies, as set out in its **Ten Point Plan for a Green Industrial Revolution** and **Energy White Paper**. This is further cemented in its **British Energy Security Strategy,** which sets an ambition of up to 24 GW of new nuclear deployment by 2050, alongside other low carbon innovations, to help us achieve a secure, clean energy future.

For new nuclear, this means:

- Large-Scale Reactors, which are ready to be deployed now
- Small Modular Reactors (SMRs), which could be deployed from the early 2030s
- Advanced Modular Reactors (AMRs), with the aim of deploying a demonstrator in the early 2030s

Large-Scale Reactors

Since Calder Hall opened in 1956, successive generations of large-scale reactors have been supplying the UK with its nuclear power.

Key to providing our country's baseload electricity, the UK currently has 9 operational nuclear reactors – but all except one of these are due to come offline by 2028.

The most common reactor type globally is a Light-Water Reactor (LWR), which is moderated (how the rate of nuclear reaction is controlled) and cooled using water.

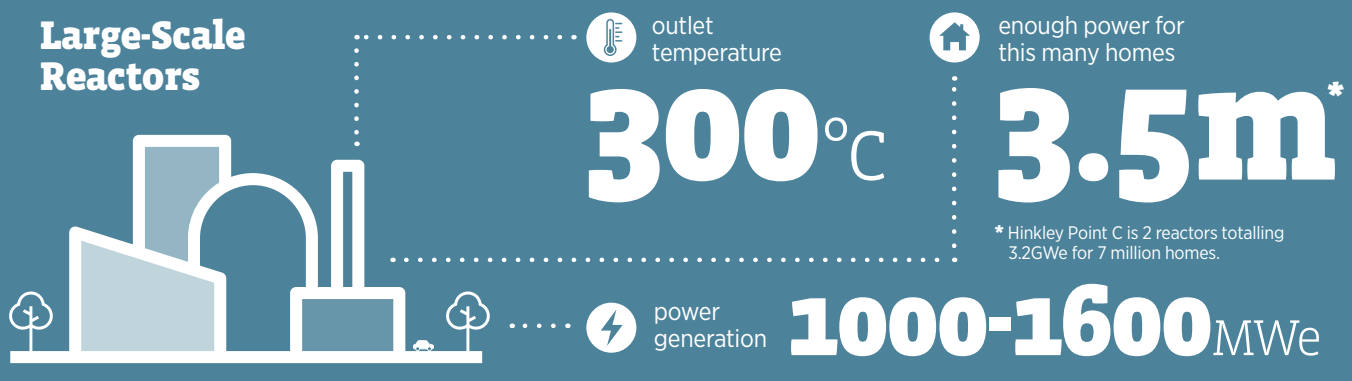
To safeguard our future energy security, the UK government has committed to supporting the building of new nuclear power stations

In Somerset, Hinkley Point C is currently under construction, which when operational will provide enough power for around 6 million homes – representing about 7% of current UK electricity needs.

A new plant at Sizewell C in Suffolk is being progressed after the government announced £700m funding in November 2022 – this would be a near identical design to Hinkley Point C, reducing the build time and bringing costs down.

The government and nuclear developers are considering other potential sites across the UK, including Wylfa in North Wales.

Helping to pave the way for this is a new funding model – the Regulated Asset Base (RAB) – as set out in the government's Nuclear Energy (Financing) Act 2022. The RAB model aims to encourage investment in new nuclear projects through a predictable revenue stream from the start of construction, as opposed to the start of operations.



Small Modular Reactors (SMRs)

An important complement to large-scale nuclear plants, SMRs are based on proven water-cooled reactors but on a smaller scale.

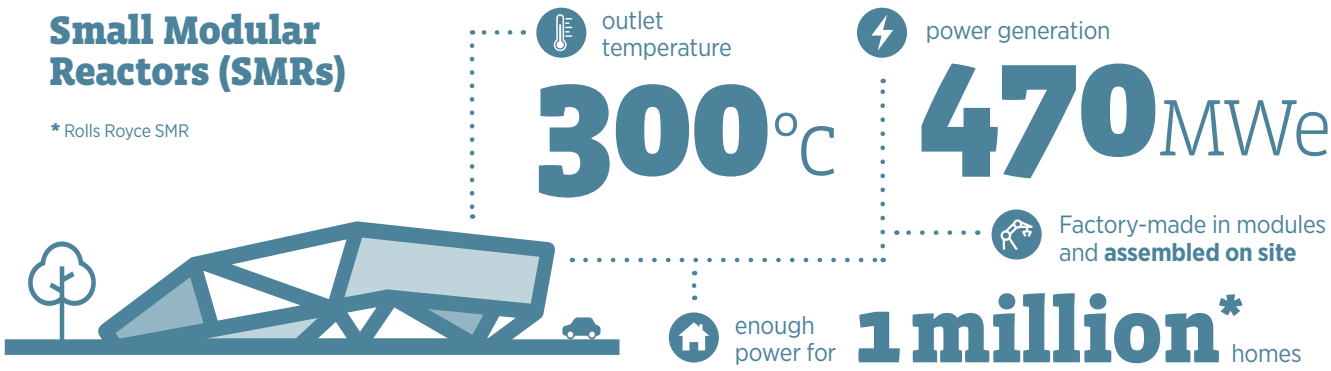
Using modular off-site construction, their components can be manufactured in purpose-built factories and then transported to the nuclear build site, making them quicker to deploy and cheaper to finance.

They do not require the vast quantities of sea water needed to cool larger plants, so are potentially suitable at a number of sites across the country.

Rolls-Royce SMR projects that each of its power stations will power approximately one million homes for the UK, with a footprint at around a tenth of the size of a large-scale nuclear plant.

To progress these designs in the UK ready for commercial deployment, Rolls-Royce SMR has secured £280m in private investment, unlocking an existing £210m grant from the government.

Rolls-Royce SMR is currently progressing through the UK's regulatory process, known as the Generic Design Assessment.



Advanced Modular Reactors (AMRs)

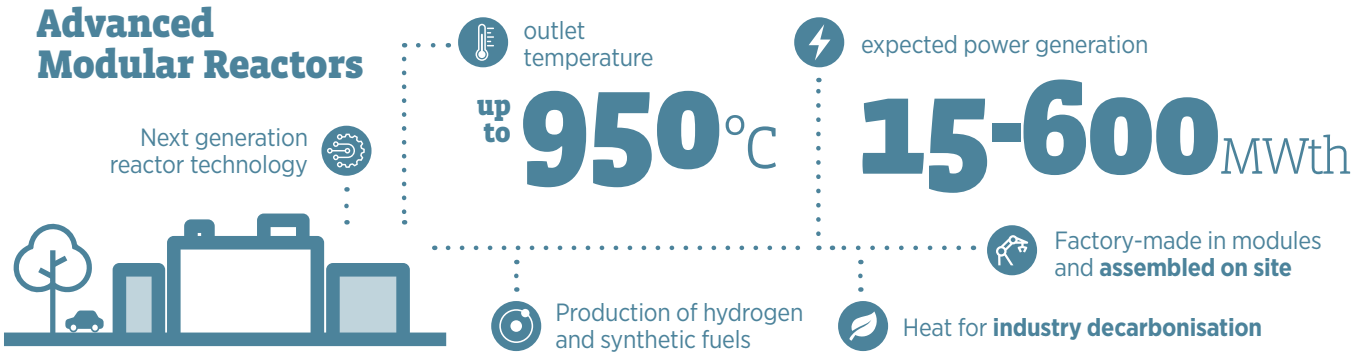
There is a global race to develop advanced nuclear technologies which unlock the potential of nuclear for many more clean energy applications .

AMRs are the next generation of nuclear technologies; they use novel cooling systems or fuels to offer new and significant functionalities, alongside the production of clean electricity and opportunities for decarbonisation.

Due to fundamental characteristics of their design, AMRs offer a wider range of siting options compared to conventional reactor technologies.

As with SMRs, they propose to use modular off-site construction to make the reactors less expensive, making the energy output more affordable and sustainable.

The UK government has selected High Temperature Gas Reactors as its preferred type of modular reactor.



High Temperature Gas-Cooled Reactors (HTGRs)

HTGRs are the most technically-advanced mature AMR technology and thus provide the greatest opportunity for making a significant contribution to net zero by 2050. They are considered as evolutions of the current fleet of gas-cooled reactors. The UK is the only country with a fleet of gas-cooled reactors and has decades of operational experience.

Because HTGR's operate at over 800°C – compared to the ~300°C of current reactor technologies – this provides the opportunity for heat from the reactor to be used directly to help decarbonise a range of **'hard to abate'** industrial processes, for example, chemicals manufacture and steel production, as well as unlocking more efficient production of hydrogen and synthetic fuels.