



Department for
Energy Security
& Net Zero



Department for
Business, Energy
& Industrial Strategy

Policy paper

Advanced Nuclear Technologies

Updated 6 December 2024

Contents

What are Advanced Nuclear Technologies?

Latest news

Small Modular Reactors (SMRs)

Advanced Modular Reactors (AMRs)

Regulation

International

Understanding public perception

Contact us

Publications



© Crown copyright 2024

This publication is licensed under the terms of the Open Government Licence v3.0 except where otherwise stated. To view this licence, visit nationalarchives.gov.uk/doc/open-government-licence/version/3 or write to the Information Policy Team, The National Archives, Kew, London TW9 4DU, or email: psi@nationalarchives.gov.uk.

Where we have identified any third party copyright information you will need to obtain permission from the copyright holders concerned.

This publication is available at <https://www.gov.uk/government/publications/advanced-nuclear-technologies/advanced-nuclear-technologies>

Advanced Nuclear Technologies have an important role to play in the transition to a low carbon economy. The [Ten Point Plan for a Green Industrial Revolution](https://www.gov.uk/government/publications/the-ten-point-plan-for-a-green-industrial-revolution) (<https://www.gov.uk/government/publications/the-ten-point-plan-for-a-green-industrial-revolution>) and the [2020 Energy White Paper](https://www.gov.uk/government/publications/energy-white-paper-powering-our-net-zero-future) (<https://www.gov.uk/government/publications/energy-white-paper-powering-our-net-zero-future>) confirmed the government's commitment to developing large, small, and advanced nuclear projects. More recently, the [Net Zero Strategy](https://www.gov.uk/government/publications/net-zero-strategy) (<https://www.gov.uk/government/publications/net-zero-strategy>) reinforced the importance of nuclear in the UK's energy mix as we transition to net zero.

The Ten Point Plan announced the Advanced Nuclear Fund of up to £385 million to invest in the next generation of nuclear technologies. This includes up to £215 million for Small Modular Reactors (SMRs) to develop a domestic smaller-scale power plant technology design, and up to £170 million for a research and development programme to deliver an Advanced Modular Reactor (AMR) demonstration by the early 2030s.

In the Net Zero Strategy we announced up to £120 million for a new Future Nuclear Enabling Fund to provide targeted support to address barriers to entry. This fund will be part of the measures the government will take to inform investment decisions during the next Parliament on further nuclear projects. We will publish details of the Fund in due course.

What are Advanced Nuclear Technologies?

Advanced Nuclear Technologies encompass a wide range of nuclear reactor technologies under development. The technologies share common attributes:

- smaller than conventional nuclear power station reactors
- designed so that much of the plant can be fabricated in a factory environment and transported to site, reducing construction risk and making them less capital-intensive

Generally advanced nuclear technologies fall into one of 2 groups:

- Generation III water-cooled SMRs, similar to existing nuclear power station reactors but on a smaller scale
- Generation IV and beyond AMRs, which use novel cooling systems or

fuels to offer new functionality (such as industrial process heat) and potentially a step change reduction in costs

Latest news

December 2021: Confirmation of high temperature gas reactors (HTGRs) as technology focus for the AMR demonstration programme

See the [AMR Research, Development & Demonstration Programme](#) for more information.

November 2021: Up to £210 million announced for Rolls-Royce SMR to develop the design for a Small Modular Reactor (SMR)

See [The Low Cost Nuclear Challenge](#) for more information.

Small Modular Reactors (SMRs)

The UK government believes that SMRs could play an important role alongside large nuclear as a low-carbon energy source to support a secure, affordable decarbonised energy system. SMRs are smaller in size and could use modular, off-site manufacturing for flexible deployment.

The Ten Point Plan and the Energy White Paper announced government's intention to deploy a First-of-a-Kind SMR by the early 2030s.

Government will continue to progress work on key policy and market enablers, including finalising regulatory access, siting, and financing for SMRs.

The Low-Cost Nuclear Challenge

The Low-Cost Nuclear Challenge, proposed by a consortium led by Rolls-Royce, aims to develop an SMR designed and manufactured in the UK capable of producing cost-effective electricity. In November 2021, the

government announced up to £210 million for Rolls-Royce SMR programme to further develop their design for one of the world's first SMRs. Funding for this project will be matched by private investment.

The consortium believes that a UK SMR programme can support up to 40,000 jobs at its peak with each SMR capable of powering 450,000 homes.

For further information visit [UKRI Low-Cost Nuclear Challenge \(https://www.ukri.org/our-work/our-main-funds/industrial-strategy-challenge-fund/clean-growth/low-cost-nuclear-challenge/\)](https://www.ukri.org/our-work/our-main-funds/industrial-strategy-challenge-fund/clean-growth/low-cost-nuclear-challenge/).

Advanced Modular Reactors (AMRs)

The government refers to Generation IV reactors as AMRs. These reactors use novel and innovative fuels, coolants, and technologies to generate low carbon electricity, and take advantage of the same modular-build principles as SMRs.

There are a wide range of new reactor technologies under development in a diverse advanced nuclear market across many nations. Many designs have the potential for a range of applications beyond low-carbon electricity generation, including:

- production of hydrogen
- direct heat for industrial or domestic use
- nuclear waste management solutions

AMR Research, Development & Demonstration Programme

The Ten Point Plan announced government's intention to invest up to £170 million through the Advanced Nuclear Fund to support an AMR demonstration by the early 2030s.

A Call for Evidence on the government's preference to explore the [potential of high temperature gas reactors \(HTGRs\) via the AMR Research, Development & Demonstration Programme \(https://www.gov.uk/government/](https://www.gov.uk/government/potential-of-high-temperature-gas-reactors-(HTGRs)-via-the-AMR-research-development-&-demonstration-programme)

[consultations/potential-of-high-temperature-gas-reactors-to-support-the-amr-rd-demonstration-programme-call-for-evidence](#)) closed on 9 September 2021. The call found no significant, additional evidence to materially change the outcome of our underpinning analysis. As a result, the Programme will focus on HTGRs, aiming to lead to a HTGR demonstration by the early 2030s at the latest.

We are now [developing the scope of the Programme](https://www.gov.uk/government/publications/advanced-modular-reactor-amr-research-development-and-demonstration-programme) (<https://www.gov.uk/government/publications/advanced-modular-reactor-amr-research-development-and-demonstration-programme>).

Government's preference for HTGRs is for the demonstration programme only and will complement its wider activities on nuclear policy and broader AMR technologies.

This builds on the previous Advanced Nuclear research funded through the BEIS's [Energy Innovation Programme](https://www.gov.uk/guidance/funding-for-nuclear-innovation#the-nuclear-innovation-and-research-advisory-board-nirab-reconvenes) (<https://www.gov.uk/guidance/funding-for-nuclear-innovation#the-nuclear-innovation-and-research-advisory-board-nirab-reconvenes>), including:

- up to £40 million for the [AMR Feasibility and Development Competition](https://www.gov.uk/government/publications/advanced-modular-reactor-amr-feasibility-and-development-project) (<https://www.gov.uk/government/publications/advanced-modular-reactor-amr-feasibility-and-development-project>) to accelerate development of promising reactor designs
- up to £46 million for the [Advanced Fuel Cycle Programme](https://afcp.nnl.co.uk/) (<https://afcp.nnl.co.uk/>), led by the National Nuclear Laboratory, to develop the next generation of nuclear fuels and fuel cycles
- up to £26 million for the [Advanced Materials and Manufacturing Competition](https://www.gov.uk/government/publications/nuclear-innovation-programme-advanced-manufacturing-and-materials-competition-phase-2-successful-projects) (<https://www.gov.uk/government/publications/nuclear-innovation-programme-advanced-manufacturing-and-materials-competition-phase-2-successful-projects>), to help demonstrate advanced manufacturing and construction techniques

The 2020 Nuclear Innovation and Research Advisory Board Annual Report

The Nuclear Innovation and Research Advisory Board (NIRAB) was convened by government to provide advice on nuclear research and innovation in the UK. Their [2020 Annual Report](https://www.nirab.org.uk/our-work/annual-reports) (<https://www.nirab.org.uk/our-work/annual-reports>) made several recommendations on how the government could support the deployment of Advanced Nuclear Technologies.

UK R&D and Supply Chain Capability for Advanced Modular Reactors

Government have commissioned and published a landscape report on the UK's R&D and Supply Chain capabilities to support AMR technologies, from the National Nuclear Laboratory. This report outlines the AMR market opportunities and actions that could be taken by government and the nuclear sector to support the domestic development and deployment of AMR technologies.

[Read the full report \(https://www.gov.uk/government/publications/uk-rd-and-supply-chain-capability-for-advanced-modular-reactors\)](https://www.gov.uk/government/publications/uk-rd-and-supply-chain-capability-for-advanced-modular-reactors).

Regulation

The UK has one of the safest and most robust nuclear regulatory regimes in the world, and all nuclear operators are answerable to our independent regulators – the Office for Nuclear Regulation, and the national environmental regulators such as the Environment Agency.

As announced in the [Clean Growth Strategy \(https://www.gov.uk/government/publications/clean-growth-strategy\)](https://www.gov.uk/government/publications/clean-growth-strategy), the government provided up to £12 million to the nuclear regulators to build the capability and capacity needed to support and assess Advanced Nuclear Technologies.

The Office for Nuclear Regulation (ONR) and Environment Agency published their guidance on the Modernised Generic Design Assessment (GDA) process in October 2019:

- ONR: [new GDA guidance for Requesting Parties \(http://news.onr.org.uk/2019/10/new-gda-guidance-for-requesting-parties/\)](http://news.onr.org.uk/2019/10/new-gda-guidance-for-requesting-parties/)
- Environment Agency: [new nuclear power plants: Generic Design Assessment guidance for Requesting Parties \(https://www.gov.uk/government/publications/new-nuclear-power-plants-generic-design-assessment-guidance-for-requesting-parties/new-nuclear-power-plants-generic-design-assessment-guidance-for-requesting-parties\)](https://www.gov.uk/government/publications/new-nuclear-power-plants-generic-design-assessment-guidance-for-requesting-parties/new-nuclear-power-plants-generic-design-assessment-guidance-for-requesting-parties)

In May 2021, the UK government declared the Generic Design Assessment (GDA) open to Advanced Nuclear Technologies and published new Guidance for Entering GDA.

The Generic Design Assessment allows the UK's independent nuclear regulators to assess the safety, security, and environmental implications of

new reactor designs and to provide the confidence that these new designs are capable of meeting the UK's statutory regulatory requirements.

The GDA Entry process is designed to be an open and ongoing invitation to apply, with decisions based on the readiness of the Requesting Party to complete the rigorous GDA process.

The department will maintain a public register of requesting parties whose applications are being assessed against the GDA Entry criteria. The department is currently assessing:

- newcleo SA

Apply for Entry to the Generic Design Assessment Process

[Read the full guidance and details on how to submit a GDA Entry application \(https://www.gov.uk/government/publications/entry-to-the-generic-design-assessment-for-advanced-nuclear-reactors\)](https://www.gov.uk/government/publications/entry-to-the-generic-design-assessment-for-advanced-nuclear-reactors).

International

International collaboration is a fundamental part of the government's policy to successfully realise the opportunities of Advanced Nuclear Technologies.

The UK is a founding member of the [Generation IV International Forum \(https://www.gen-4.org/gif/\)](https://www.gen-4.org/gif/) (GIF), created as a cooperative international endeavour seeking to coordinate research and development on fourth generation nuclear systems.

The UK is also a member of the [Clean Energy Ministerial \(http://www.cleanenergyministerial.org/\)](http://www.cleanenergyministerial.org/) (CEM), a global forum focused on the transition to global clean energy, and co-leads on the [CEM Flexible Nuclear Campaign \(http://www.cleanenergyministerial.org/campaign-clean-energy-ministerial/flexible-nuclear-campaign\)](http://www.cleanenergyministerial.org/campaign-clean-energy-ministerial/flexible-nuclear-campaign), which looks to understand and communicate the benefits of Advanced Nuclear reactors with highly-flexible power outputs.

In December 2021, the G7 Nuclear Safety and Security Group (NSSG)

issued [a joint statement \(https://www.gov.uk/government/publications/g7-nuclear-safety-and-security-group-statement-2021/g7-nuclear-safety-and-security-group-statement-9-december-2021\)](https://www.gov.uk/government/publications/g7-nuclear-safety-and-security-group-statement-2021/g7-nuclear-safety-and-security-group-statement-9-december-2021) that reaffirms its commitment to promoting the highest standards of nuclear safety and security worldwide. The Statement reflects the productive discussions of the Group under the UK's G7 presidency and identifies areas of importance and opportunities for collaboration on key policy topics including on small modular reactors and advanced nuclear technologies.

Understanding public perception

Advanced Nuclear Technologies Public Dialogue

BEIS, with support from UK Research and Innovation's Sciencewise programme, has delivered a public dialogue exploring citizens' attitudes towards Advanced Nuclear Technologies (ANT). This includes views on:

- the future siting and deployment of ANT
- the role for ANT in achieving net zero
- potential 'beyond-grid uses', for example hydrogen production or heat for industrial processes

The dialogue was designed and delivered by Traverse and evaluated by 3KQ: see the [final engagement report \(https://www.gov.uk/government/publications/public-dialogue-on-advanced-nuclear-technologies-ants\)](https://www.gov.uk/government/publications/public-dialogue-on-advanced-nuclear-technologies-ants). [Sciencewise website \(https://sciencewise.org.uk/2020/12/public-dialogue-commences-on-public-views-of-modular-nuclear-technologies/\)](https://sciencewise.org.uk/2020/12/public-dialogue-commences-on-public-views-of-modular-nuclear-technologies/).

BEIS Public Attitudes Tracker

The BEIS Public Attitudes Tracker is a survey that collects data on public attitudes towards the department's policy areas and runs 4 times a year. The survey includes an annual question on awareness of SMRs: "Before today, how much, if anything, did you know about Small Modular

Reactors?”.

[Read the results from each wave \(https://www.gov.uk/government/collections/public-attitudes-tracking-survey\)](https://www.gov.uk/government/collections/public-attitudes-tracking-survey). See Wave 37 for data collected in May 2021, and the most recent data from December 2021 in the Autumn edition.

Contact us

smrteam@beis.gov.uk

Publications

- 2021: [Entry Guidance for the Generic Design Assessment for Advanced Nuclear Technologies \(https://www.gov.uk/government/publications/entry-to-the-generic-design-assessment-for-advanced-nuclear-reactors\)](https://www.gov.uk/government/publications/entry-to-the-generic-design-assessment-for-advanced-nuclear-reactors)
- 2020: [Energy White Paper: Powering our net zero future \(https://www.gov.uk/government/publications/energy-white-paper-powering-our-net-zero-future\)](https://www.gov.uk/government/publications/energy-white-paper-powering-our-net-zero-future)
- 2020: [Ten Point Plan for a Green Industrial Revolution \(https://www.gov.uk/government/publications/the-ten-point-plan-for-a-green-industrial-revolution\)](https://www.gov.uk/government/publications/the-ten-point-plan-for-a-green-industrial-revolution)
- 2020: [UK R&D and supply chain capability for Advanced Modular Reactors \(https://www.gov.uk/government/publications/uk-rd-and-supply-chain-capability-for-advanced-modular-reactors\)](https://www.gov.uk/government/publications/uk-rd-and-supply-chain-capability-for-advanced-modular-reactors)
- 2019: [Energy Innovation Needs Assessments – Nuclear Fission \(https://www.gov.uk/government/publications/energy-innovation-needs-assessments\)](https://www.gov.uk/government/publications/energy-innovation-needs-assessments)
- 2018: [CEM Nuclear Framework Brochure \(https://www.cleanenergyministerial.org/publications-clean-energy-ministerial/advanced-nuclear-technologies-uk-framework\)](https://www.cleanenergyministerial.org/publications-clean-energy-ministerial/advanced-nuclear-technologies-uk-framework)
- 2015: [Small Modular Reactors: Techno-Economic Assessment \(https://www.gov.uk/government/publications/small-modular-reactors-techno-economic-assessment\)](https://www.gov.uk/government/publications/small-modular-reactors-techno-economic-assessment)

OGI

All content is available under the [Open Government Licence v3.0](#), except where otherwise stated



© [Crown copyright](#)