Introduction to AMRs

Nuleaf Steering Group, Wednesday 14th June 2023

What is an AMR?

"Over the next decade we need to continue to deploy all known low carbon technologies at scale to ensure optionality is maintained, whilst developing new options to mitigate delivery risk and reduce costs“ – Net Zero Strategy, October 2021*

Gigawatt Reactors

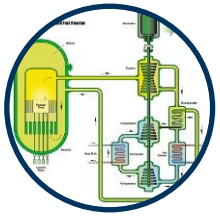
Current

- 440 operating globally
- HPC due on line 2027
- SZC under discussion
- Interest in Bradwell, Wylfa and Moorside

Small Modular Reactors

Aiming for early 2030s deployment

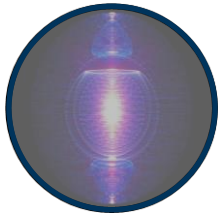
- Existing light-water technology deployed in smaller units
- Innovative manufacturing/construction models. Heat output around 300°C
- Potential future outputs: desalination, hydrogen production, district heating



Advanced Modular Reactors

Aiming for early 2030s demonstrator

- Generation IV reactor technologies
- Novel coolants and/or fuels
- Heat output around 600-950°C
- Potential future outputs: high temperature heat for difficult-to-decarbonise industries; hydrogen production; synthetic fuels; ammonia production



Nuclear Fusion

Aiming for 2040s-2050s

- UK STEP
- Global Lead
- Demo 2040s

Advanced Nuclear HMG Commitments

2020 – The Ten Point Plan

- Ambition to deploy SMR and have **AMR demonstration** by early 2030s.
- Up to **£385m Advanced Nuclear Fund** to support R&D in advanced nuclear technologies. Included funding for an **Advanced Modular Reactor Research, Development and Demonstration Programme** (**AMR RD&D**).

2021 – Net Zero Strategy

- Announced **£120m Future Nuclear Enabling Fund**.

2022 – British Energy Security Strategy

- Announced plans for up to **24GW of civil nuclear power by 2050.**
- Intention to take one project to FID this parliament and two projects to FID in the next parliament.

2023 – Powering Up Britain

- Launched **Great British Nuclear (GBN),** a delivery body to help projects through every stage of the development process.

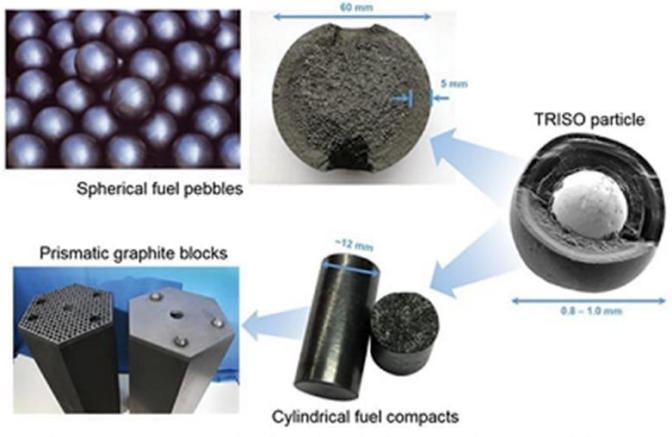
UK Demonstrator Programme: AMR RD&D

- UK selected HTGRs based on NIRO analysis of all AMR technologies.
- Phase A provided £2.5M for feasibility studies (pre-FEED).
  - 4 reactors and 2 fuel studies
- Phase B (up to March 2025) will award up to £55M for up to two projects to develop reactor design maturity to progress through regulation.
- Fuel development was split off, in recognition of importance to maintain sovereign supply and expertise.
- Phase C of the programme will run from March 2025 to the early 2030s.
  - Subject to HMG approval and SR commitments
- **Overall aim is to build a UK HTGR Demonstrator by the early 2030s.**

Safety

- AMR designs have enhanced safety features over current water-cooled reactors. Some examples are:
  - New fuel types that can withstand very high temperatures.
  - Coolants that either cannot boil because they are already gas (helium) or that have a very high boiling point (molten salts and liquid metals).

- General principles are well understood, but further R&D is required to understand detailed behaviour for safety regulation - hence the funding for vendors and the nuclear regulators to close this gap.



Other Enabling Policy

Siting

- To decarbonise industrial processes, AMRs may need to be built next to industrial sites or in industrial clusters.
- The current NPS, EN-6, specified eight sites as being potentially suitable for deployment of new nuclear generating infrastructure by the end of 2025.
- Developing a new NPS to cover deployment of new nuclear power stations beyond 2025.
- Consulting later this year on a policy for how new nuclear developments might be located, including the potential for deployment of AMRs.
- Aim for the new NPS to be in place by 2025, following public consultation and parliamentary scrutiny.

Regulation

- DESNZ published guidance for Advanced Nuclear Technologies (ANTs) to enter the Generic Design Assessment (GDA), the first stage of the UK's nuclear regulatory process, fulfilling our commitment to open GDA to SMRs & AMRs.
- GDA Entry is an open and ongoing process, with a standing invitation for ANT companies to apply when they believe they are ready to do so.
- GDA is intended to assess whether a proposed technology could be constructed, operated, and decommissioned in Great Britain while meeting the high standards for safety, security, and environmental protection.

Waste Management

- Fuel for HTGRs will be TRISO mixed with graphite - more stable than current fuel but will require waste management plans and disposability assessments.
- Reactors with liquid metal or salt coolants will need to develop disposal routes for these materials.
- Consultation: Nuclear Decommissioning and Managing Radioactive Substances policy framework
- Based on:
    - a proportionate risk-based lifecycle approach to the management of radioactive substances
    - “Polluter pays” principle
    - International obligations and best practice

- Funded Decommissioning Plan
    - Decommissioning and Waste Management Plan
    - Disposability

Thanks for listening

Contact details for any further inquiries

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