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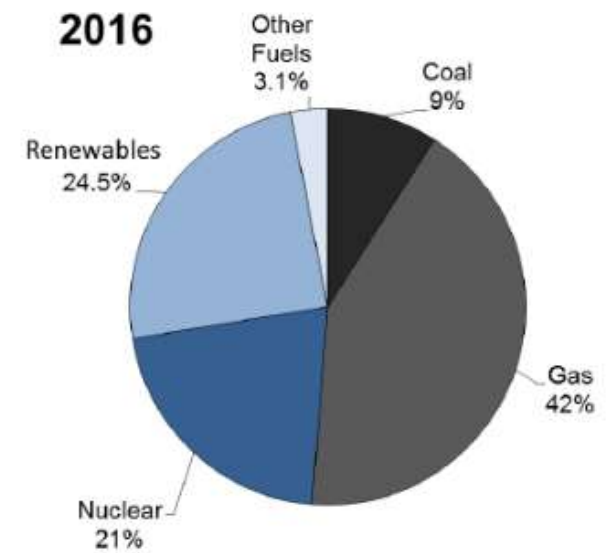
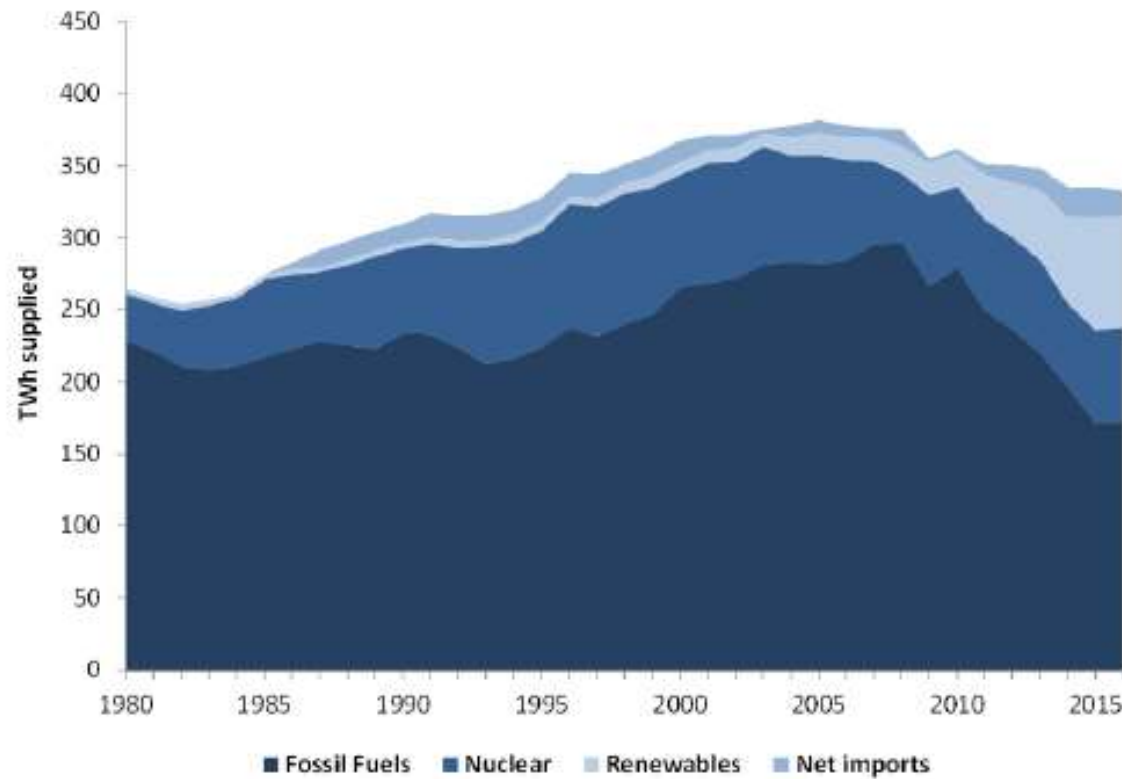
SMR TECHNOLOGY DEVELOPMENT AND DEPLOYMENT IN THE UK



Daniel Mathers

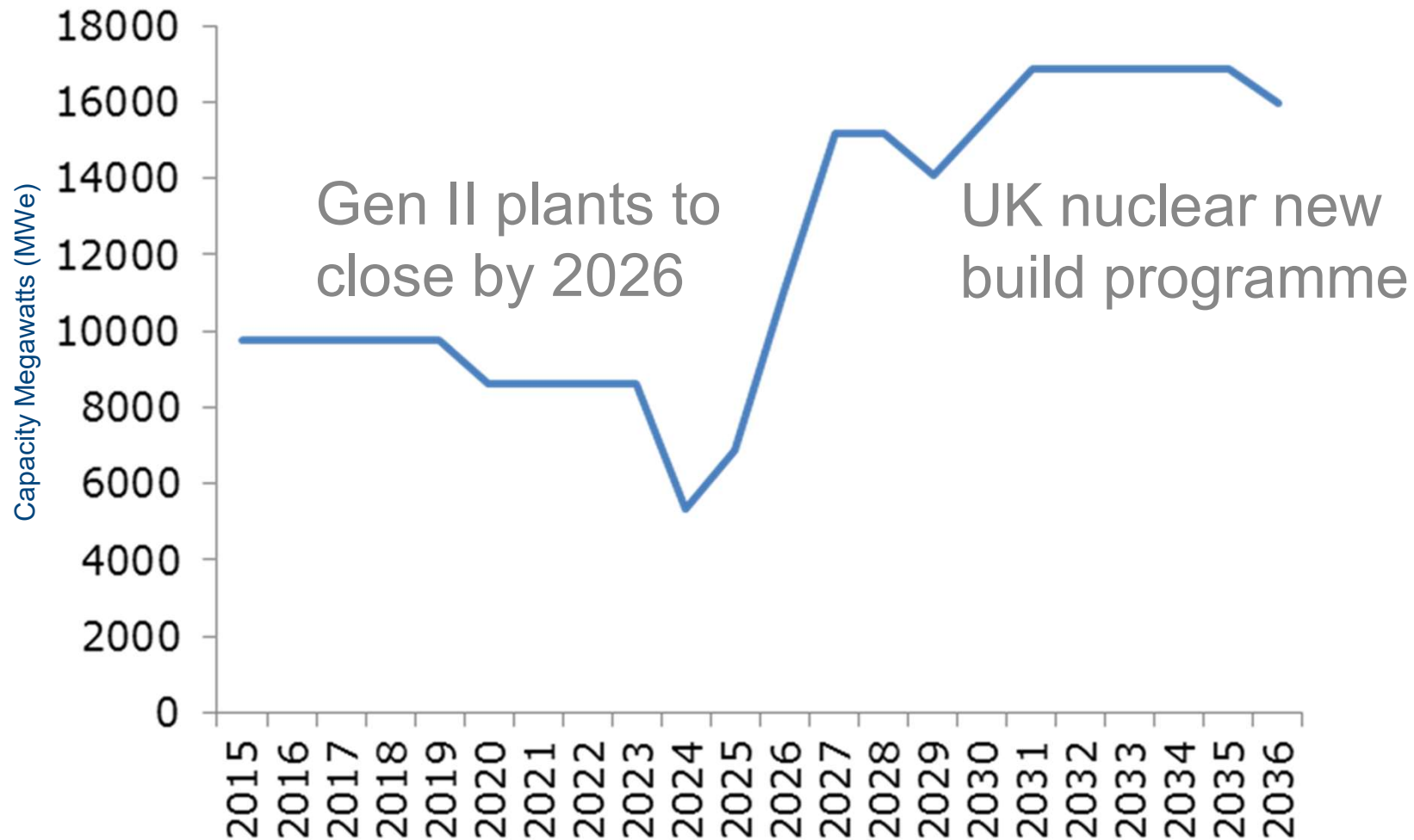


UK energy mix





Planned nuclear generation in UK





Small nuclear reactors - role in energy mix

- Nuclear energy has important role in transition to low-carbon economy.
- ~18GW of proposed new nuclear capacity over coming decades.
- Small nuclear reactors offer the potential to reduce costs through modularisation and leverage skills and expertise in UK.
- Could be space for both small and large scale nuclear in future mix.



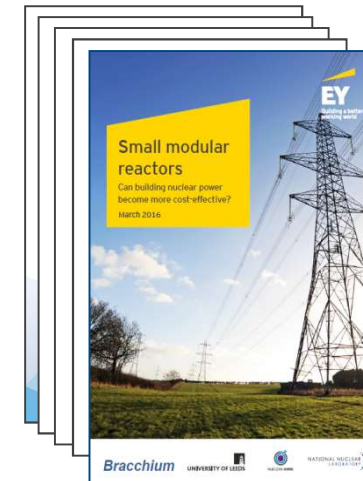
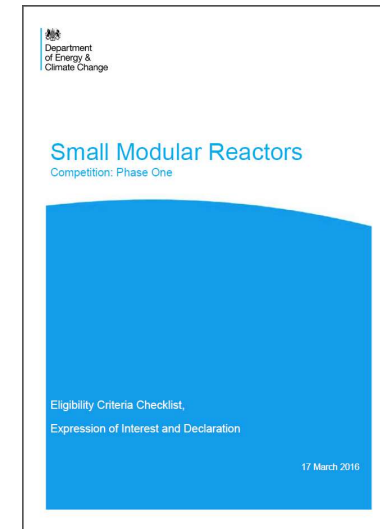


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Some background

- Government has been working closely with industry to explore potential, through the SMR Competition and studies such as the Techno-Economic Assessment.
- The evidence has shown that there are a wide range of technologies, at different levels of maturity and market readiness.
 - Vendors identified the UK as a key market and are seeking to leverage the UK's expertise in civil nuclear.
 - Mature technologies could be deployed in the UK by 2030.
 - If SMRs achieve predicted learning rates they could be cheaper than comparative technologies.
- Early engagement with regulator key to understanding licensing and design assessment challenges.
- Participants wanted clarity over policy objectives



<https://www.gov.uk/government/publications/small-modular-reactors-techno-economic-assessment>



Advanced Nuclear Technologies

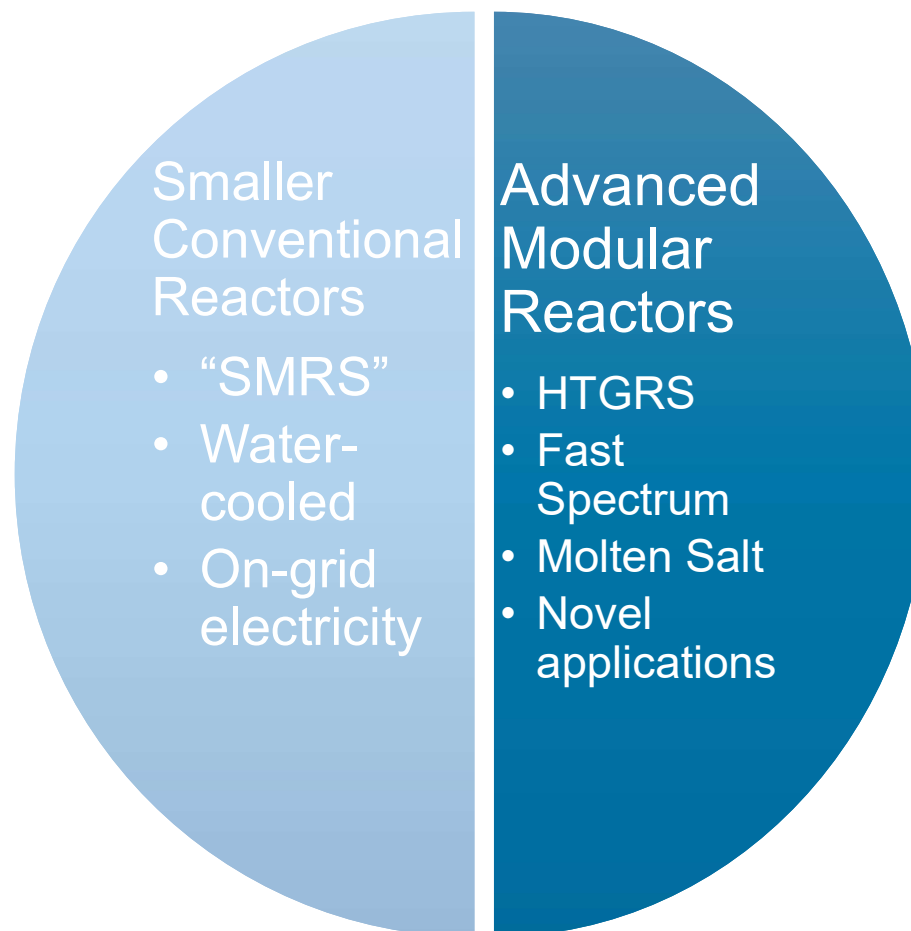
Government recognises there is a very wide range of new reactor technologies under development

Small Modular Reactors - commonly understood to be around 300MWe - are just one part of the advanced nuclear market which ranges in scale from micro, small and medium scale reactors, and

Spans technology types from conventional water-cooled reactors, to 4th generation reactors using novel fuels and coolants, as well as fusion reactor concepts.

New smaller reactor designs have the potential for a wide range of applications. These include:

- Low carbon electricity
- Load following electricity generation
- Heat generation for domestic or industrial use
- Nuclear waste management solutions.





Advanced Nuclear Technologies

Market Enabling Framework

Enablers	Policy Initiatives
Policy	Providing options to Ministers mid 2018
Financing	Expert Finance Working Group to advise on small reactor financing – report end of May
Regulatory Framework	Funding to increase regulator capacity and capability Regulator 1-to-1 engagement programme throughout April/May 2018
Land & Siting	Looking at options for land
Supply Chain Development	Potential advanced manufacturing initiative in the Nuclear Sector Deal
Public Acceptability	Commissioned project to explore public perception of small reactors
International Collaboration	Exploring opportunities with key partners
Research & Evidence	Nuclear Innovation Programme, including AMR programme



Advanced Nuclear Technologies

Announced Policies

1. **The Advanced Modular Reactor (AMR) Programme.** Up to £44m to assess the feasibility of innovative reactors projects and to accelerate the development of promising designs.
2. **Funding for the UK Regulators.** Up to £12m to ONR/EA to increase the capability and capacity to assess, license and permit new designs. This includes funding for a 1-to-1 vendor/regulator engagement programme.
3. **The Expert Finance Working Group.** Tasked with exploring the financial models of small and advanced reactor developers and advising Government on how small reactor projects could raise private investment. Due to report in May.
4. **Nuclear Innovation Programme.** R&D to support the UK nuclear sector going forward





AMR Programme

- Up to £44m over the next 3 years
- Run by Innovate UK
- Phase 1 – Feasibility Studies
 - In-depth technical and commercial assessments of the reactor designs to test the proposals and validate numbers
 - Bidding closed mid-Feb
 - Over 20 applicants
 - Multiple assessors to provide a holistic, accurate and independent view on each proposal
 - Kick-off expected in May
- Phase 2 – Development stage where grants of ~£10m may be offered for technology development

The aim of the AMR programme is to assess the feasibility of innovative reactor projects and to accelerate development of promising designs.

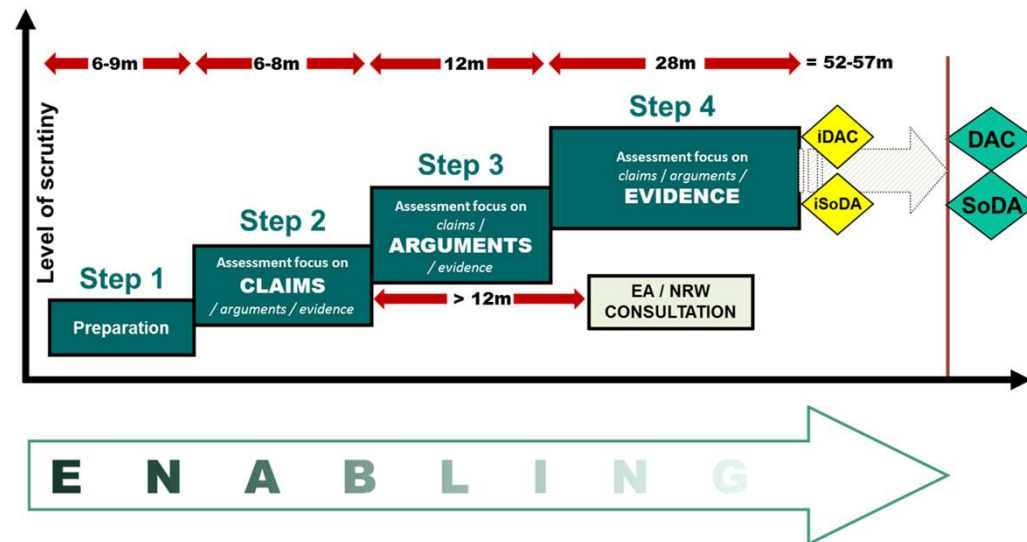


Funding for the UK Regulator

Up to £12m to ONR/EA to increase the capability and capacity to assess and license and permit new designs. This includes:

- 1-to-1 vendor/regulator engagements will take place throughout 2018.

Generic Design Assessment process



DAC: ONR's Design Acceptance Confirmation (iDAC: interim DAC)

SODA: EA/NRW's Statement of Design Acceptability (iSODA: interim SODA)

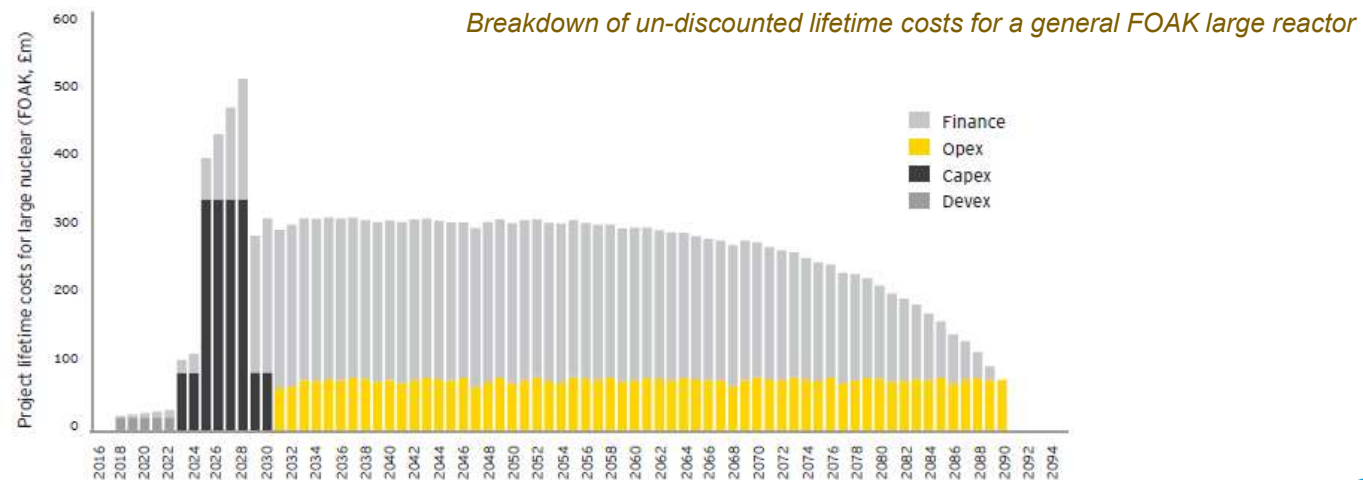
- Review vendor reports (from AMR feasibility stage 1) that summarise the key design features for safety, security and environmental performance of the proposed AMR design and provide a view of regulatory confidence
- Review of the Design Assessment process, to determine if a more efficient and flexible process (than GDA) can be deployed, which can accommodate Small Nuclear Reactor requirements.



Expert Finance working group

Expert Finance Working Group has been set up by UK Government to advise on small reactor financing.

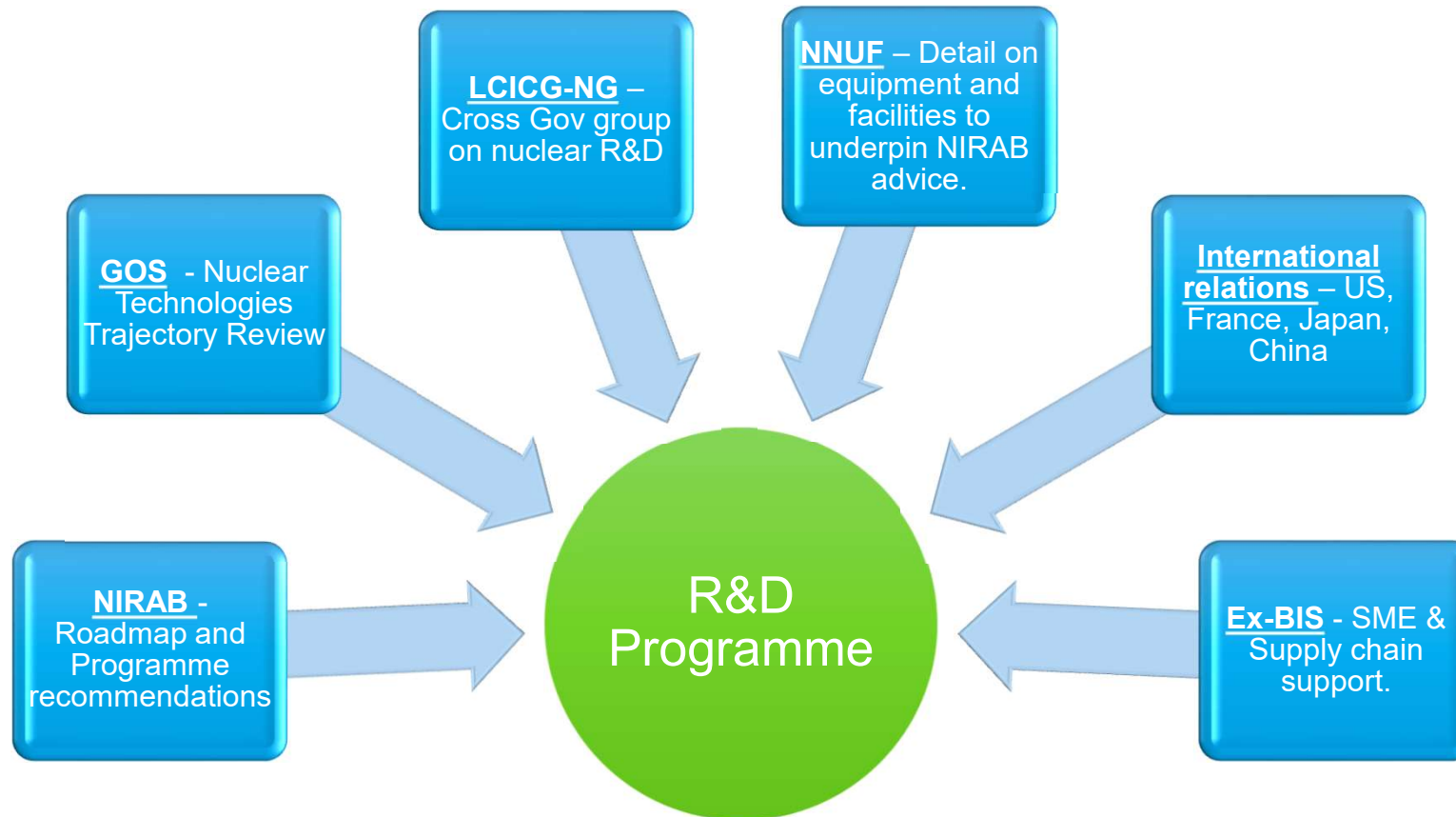
- The group is tasked with exploring the financial models of small and advanced reactor developers and advising Government on how small reactor projects could raise private investment. Due to report in May.
- It brings together nuclear, academic and financial sector expertise
- The characteristics of SMRs/AMRs, such as lower upfront capital costs and quicker deployment times due to off-site manufacturing and modularisation, suggest there are great opportunities for innovative financing of small reactor projects.





BEIS Nuclear Innovation Programme

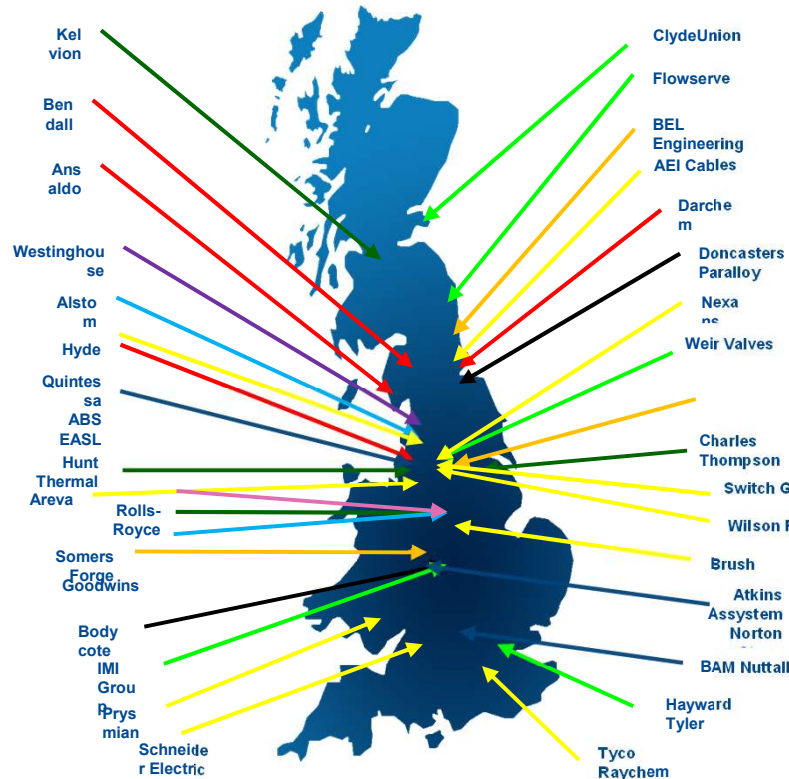
Inputs to programme definition



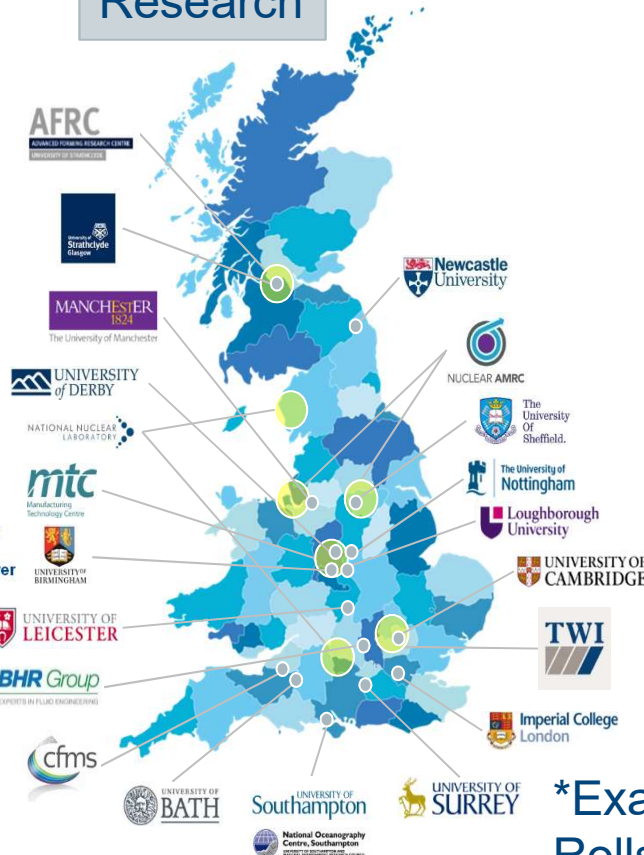


UK Nuclear Sector - Capability engaged in a UK SMR project*

Supply Chain Capability



Research



+ Cross-sector
engagement

+ international
collaboration

*Example taken from
Rolls Royce SMR project



BEIS Nuclear Innovation Programme

Advanced Nuclear Fuels	Advanced Nuclear Manufacturing and Materials
Advanced Nuclear Reactor Design	Nuclear Fuel Recycle and Waste Management
Nuclear Safety and Security Engineering	Nuclear Facilities and Strategic Toolkit

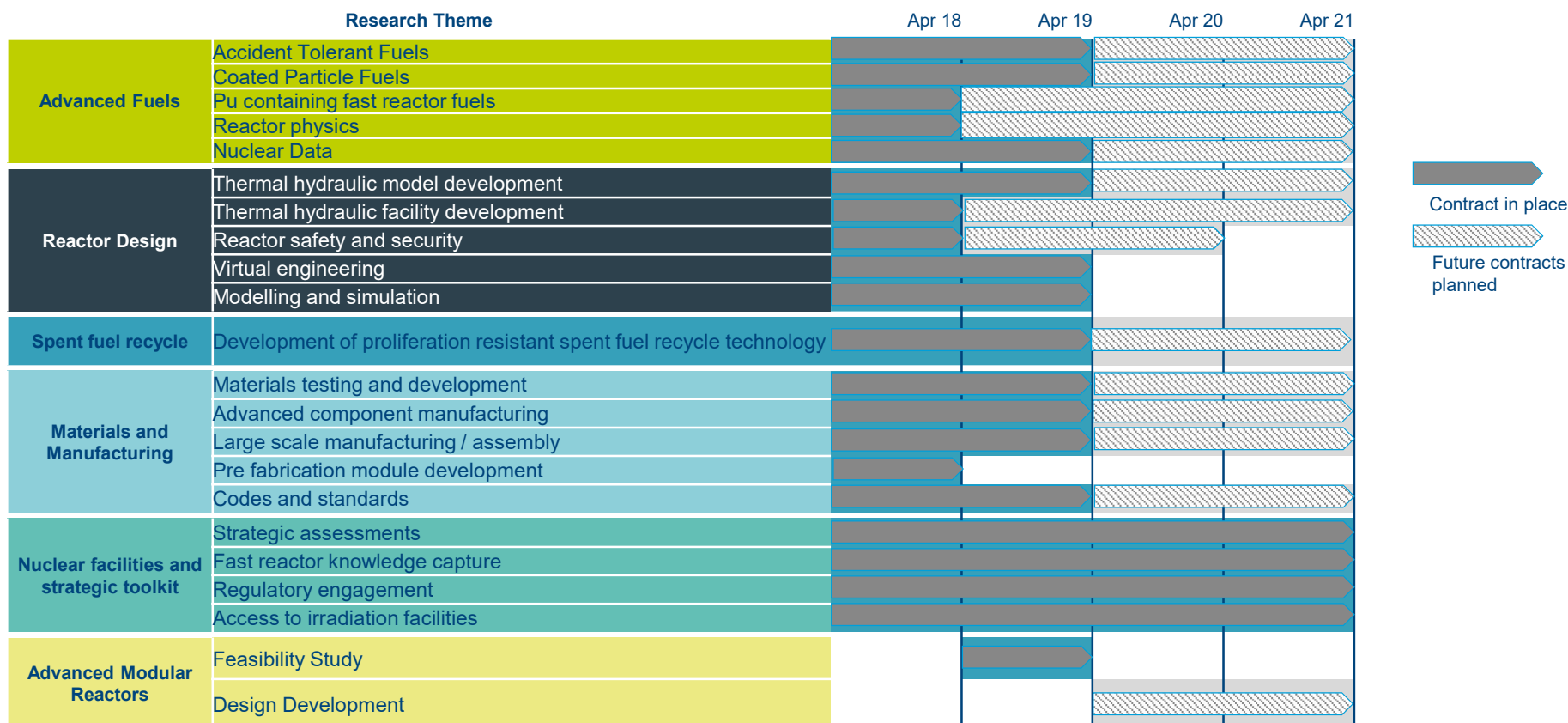


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BEIS Nuclear Innovation Programme

“BEIS expects to invest around £180 million in nuclear innovation between 2016 and 2021”



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Thank you for listening

Questions?

daniel.mathers@beis.gov.uk