Government progresses demonstration of next generation nuclear reactor

- Ministers consider high temperature gas reactors (HTGRs) for £170 million Advanced Modular Reactor Demonstration Programme
- as well as producing low carbon electricity for the grid, advanced modular reactors (AMRs) could produce clean hydrogen and high temperature heat to decarbonise heavy industry
- government also announces pilot of new Advanced Nuclear Skills and Innovation Campus, as UK harnesses new and advanced nuclear technology to help UK reach net zero by 2050

The UK government's plan to have the latest nuclear technology up and running within the next decade has moved a step closer today as part of the drive to reach net zero emissions.

A Call for Evidence, published today (29 July), sets out the government's suggested approach to building the first advanced modular reactor (AMR) demonstrator. This will specifically explore high temperature gas reactors (HTGRs) as the most promising model for the demonstration programme, which ministers are investing £170 million into delivering by the early 2030s.

AMRs are typically smaller than conventional nuclear power stations, more flexible, and could be built at a fraction of a cost. It is hoped that as well as safely creating electricity to power homes on the grid, HTGRs will also be able to generate low-carbon hydrogen. In addition, thanks to also generating extremely high temperature heat, they could help decarbonise industry and potentially power district heating networks by the 2040s.

Around a third (37%) of the UK's carbon emissions come from heat, with a significant portion from heavy industrial processes. By generating heat at between 500 and 950°C – higher than other types of AMR – HTGRs could significantly cut emissions from processes such as cement, paper, glass and chemical production in the UK's industrial heartlands.

Ministers are today inviting views from industry and the public on the government's preference to explore the potential of HTGRs for its AMR demonstration project.

Minister of State for Energy, Anne Marie Trevelyan, said:

> While renewables like wind and solar will become an integral part of where our electricity will come from by 2050, they will always require a stable low-carbon baseload from nuclear. That is why, alongside negotiations with the developers of Sizewell C in Suffolk, we are pressing ahead with harnessing new and exciting advanced nuclear technology.

> Advanced modular reactors are the next level of modern nuclear technology and have the potential to play a crucial role not only in tackling carbon emissions, but also in powering industry and driving forward Britain's economic growth, as we build back greener.

Today's step builds on the commitment made in the Energy White Paper and the Prime Minister's Ten Point Plan for £170 million of investment in an R&D programme for Advanced Modular Reactors, as part of a £385 million package to accelerate the development of more flexible nuclear technologies.

AMRs use new types of fuel and coolants compared to conventional reactors, which tend to use water for cooling. Internationally, there are 6 main types of AMR technology, which could play a role in achieving net zero, with some potentially re-using spent nuclear materials as new fuel. However, with one of the highest temperature outputs, HTGRs are being considered for the demonstrator programme.

Independent research from the University of Manchester's Dalton Nuclear Institute, Royal Society and the Energy Systems Catapult have concluded that AMRs could play a vital role in supporting a future clean energy system.

While today's reactors are already extremely safe, AMRs also seek to build even further on the high safety features of conventional reactors.

Fellow at the Royal Society and the Royal Academy of Engineering, Dame Sue Ion, said:

> This proposal is extremely welcome news and demonstrates the tremendous potential of advanced nuclear power, which could be expanded safely to improve the overall efficiency of our energy system, but also help decarbonize difficult to help heavy industry, to help meet the UK's net-zero goal.
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> This Advanced Modular Reactor demonstration plays to the UK strengths in nuclear fuel and gas cooled reactors in building a technology platform for HTGRs for the UK to exploit and potentially export internationally.

The government continues to support the development of a wide variety of nuclear technologies, and is today also announcing the piloting of an Advanced Nuclear Skills and Innovation Campus, being developed by the National Nuclear Laboratory. Located in Preston, it will serve as an innovation hub, bringing together industry and academia to collaborate on projects which help develop and commercialise advanced nuclear technologies.

Meanwhile, the Department for Business, Energy and Industrial Strategy (BEIS) is preparing to submit a summary of evidence on nuclear energy to the Energy Working Group (EWG), which will help inform how to address nuclear energy in the Green Taxonomy.

The Green Taxonomy will be a common framework setting the bar for investments that can be defined as environmentally sustainable, helping clamp down on greenwashing – unsubstantiated or exaggerated claims that an investment is environmentally friendly. It will make it easier for investors and consumers to understand how a firm is impacting the environment to encourage greater investments in funds that will help the UK achieve net zero.

This Call for Evidence seeks to strengthen the government's evidence base around the potential of advanced modular reactors (AMRs) and high temperature gas reactors (HTGRs) in particular, to support net zero by 2050, as committed in the Ten Point plan and Energy White Paper. Feedback will be used to support the development of an AMR R&D demonstration programme.

There are many possible types of AMRs but 6 have been selected by the Generation IV International Forum for further research and development:

- gas-cooled fast reactor (GFR)
- lead-cooled fast reactor (LFR)
- molten salt reactor (MSR)
- supercritical water-cooled reactor (SCWR)
- sodium-cooled fast reactor (SFR)
- very high temperature gas reactor (VHTR/HTGR)

Read the Royal Society's report on the benefits of AMRs and HTGRs in particular.

AMRs are one of 2 types of advanced nuclear technologies being explored by the government. The other is small modular reactors (SMRs), which use existing pressurised water reactor (PWR) technology, and which are likely to be able to be mass-produced and transported, flat-pack-style, to parts of the country that need them.

The government is also to extend the Advanced Fuel Cycle Programme, delivered in co-operation with the National Nuclear laboratory (NNL). This will continue to build world-leading capability in advanced nuclear fuels for use in more near-term SMRs and AMRs.