ESO

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ESO Response to Alternative routes to market for new nuclear projects

Dear Alternative Routes to Market Consultation Team,

Thank you for the opportunity to respond to your consultation on the alternative routes to market for new nuclear projects.

Who we are

As the Electricity System Operator (ESO) for Great Britain, we are at the heart of the energy system, balancing electricity supply and demand second by second.

Our mission, as the UK moves towards its 2050 net zero target, is to drive the transformation to a fully decarbonised electricity system by 2035, one which is reliable, affordable, and fair for all. We play a central role in driving Great Britain's path to net zero and use our unique perspective and independent position to facilitate market-based solutions to the challenges posed by the trilemma.

Our transformation to a National Energy System Operator (NESO) is set to build on the ESO's position at the heart of the energy industry, acting as an enabler for greater industry collaboration and alignment. This will unlock value for current and future consumers through more effective strategic planning, management, and coordination across the whole energy system.

About this response

We are supportive of the Governments drive to further develop the Advanced Nuclear Technologies (ANTs) innovation market to help contribute to our energy security and net zero goals.

This response provides our key messages in relation to the consultation and where necessary we have included more detailed replies to specific consultation questions in Appendix 1. We look forward to engaging with the Government further as the nuclear power policy develops.

Our key messages

- We support the exploration of alternate routes to market for nuclear and stress the value of nuclear power stations to support the electricity system as part of a diverse mix and energy being used for other purposes, including flexible power output, and producing hydrogen, ammonia, and synthetic fuels.
- We support the use of nuclear thermal energy to be used for other purposes and see this as an enabler to decarbonising new and existing manufacturing and processing sectors, such as chemicals, paper, food and drink or data centers.
- Flexibility from nuclear power stations would be valuable, particularly with large scale roll out.

- The Strategic Spatial Energy Plan (SSEP) that is currently in development, will be a GB-wide spatial plan focused on the generation and storage of electricity and hydrogen. We strongly encourage the development of new nuclear policy be progressed alongside strategic energy planning initiatives such as the SSEP to ensure appropriate alignment.

We look forward to engaging with you further. Should you require further information on any of the points raised in our response please contact Laura Brock, Zero Carbon Technology Manager, at laura.m.brock@nationalgrid.com.

Our response is not confidential.

Yours sincerely

Alex Hart

Acting Head of Zero Carbon Operations

Appendix 1 – Consultation Question Responses

Question 1 – Are there any uses for nuclear energy (beyond those in this document) that you believe government should be considering? If yes, please explain what they are.

We support the areas that have been identified for uses of nuclear energy and believe that both industrial heat and power, as well as hydrogen and synthetic fuels are key areas to focus on for the uses of nuclear energy.

We also agree that one of the primary uses of ANTs will be to generate baseload power, providing a cost-efficient and reliable source of electricity which will contribute to security of supply and wider net zero targets. Our 2024 Operability Strategy Report[1] asserts that there is no trade-off between adequacy and meeting net zero, but it is important to bring forward investment in clean, non-weather dependent technologies, such as nuclear. Even at times of low output from renewable generation, it is possible to operate a fully decarbonised power system and meet customer demand.

Question 2 – To what extent do you agree that advanced nuclear can be a valuable energy source when combined with a Thermal Energy Storage System or for cogeneration? Please provide an explanation for your response.

We see the value in short term heat storage, especially when coupled with industrial uses that require high temperatures to facilitate processes, such as glass manufacturers. We would need to further explore the duration of stored heat when coupled with Thermal Energy Storage Systems in order to understand the value of longer-term heat storage.

We do however agree that advanced nuclear would benefit from a flexible co-generation perspective, with energy transferred to alternate uses such as hydrogen or synthetic fuel production. Please see our response to Question 5 for further detail on this.

Question 3 – To what extent do you agree that advanced nuclear could be a valuable energy source for large scale industry. Please provide an explanation for your response

We see advanced nuclear as a valuable energy source for large scale industry, and we suggest that siting of said nuclear should be considered from a whole energy system benefit perspective. Advanced nuclear should be able to meet the required demands in the areas of large-scale industry. Appropriate siting could reduce the requirement for new transmission infrastructure and/or additional network actions, and this is something that we will explore further in our role as the Strategic Energy Planner. We are already working closely with government on the development of the Centralised Strategic Network Plan (CSNP) and the SSEP and will continue to use policy inputs and priorities provided by government going forwards; as well continuing the conversation with the DESNZ Alternative Routes to Market Consultation Team.

We have also recently submitted a consultation response to the 'Approach to siting new nuclear power stations beyond 2025'. Please refer to this consultation response for more details on siting criteria.

Question 4 – In your opinion, what further measures should government take to enable industrial applications of advanced nuclear? Please provide an explanation of the type of support required.

Lead times for new nuclear can span many years due to the complexity of design, planning, construction, and commissioning. Government taking measures to focus on standardisation, particularly in relation to supply chains and skilled workforces, could potentially reduce the lead times for deployment of advanced nuclear.

A focus on ensuring advanced nuclear is replicable and scalable, with solid supply chains, would allow for greater deployment of advanced nuclear, and low carbon heat power, in a wide range of energy-intensive industries.

[1] ESO Operability Strategy Report 2024 – Adequacy: Page 49

Question 5 – To what extent do you agree that advanced nuclear could be a valuable energy source for hydrogen and synthetic fuel production? Please explain your answer.

We agree that advanced nuclear could be a valuable energy source for hydrogen and synthetic fuel production. Hydrogen can support the decarbonisation of the UK economy, providing a pathway to reduce emissions from industry, power, and transport. Low-carbon hydrogen has a broad range of possible uses, including as a heat source for industrial processes or as a feedstock for chemicals production and transport fuels, to provide long duration energy storage, and as a replacement for natural gas.

Production rates of hydrogen from advanced nuclear are high due to the efficiency of the heat production generated by advanced nuclear, and this is outlined in a recent Hydrogen UK production report published in September 2023[2]. However low temperature electrolysis which can be combined with large or small nuclear reactors has the greatest commercial and technical readiness levels of all the options[3]. It is not yet clear whether nuclear connected electrolysis produced like this would be cost competitive - whilst the electrolysers will be able to operate with relatively high load factors, the electricity they use is likely to be higher cost directly from nuclear generators than the low-cost system electricity at times of high renewable output. This will be explored further through Centralised Strategic Network Planning (CSNP)[4].

Producing hydrogen through electrolysis offers demand side flexibility to the electricity system and converting it back to power offers supply side flexibility. If hydrogen is not used immediately for heat or transport, it can be transported for use elsewhere or stored for later use in potentially very large volumes. Large-scale energy storage supports security of supply and is essential to meeting net zero, but the amount needed is dependent on the rollout of hydrogen, hydrogen storage, and other sources of flexibility[5].

We note that there are still questions around the hydrogen network and associated storage areas, and it is imperative to ensure both are aligned. The deployment of advanced nuclear and the deployment of hydrogen production facilities, or off takers for hydrogen or other synthetic fuels, should be a focus, to ensure greatest value.

Question 6 - To what extent do you agree government should explore the opportunity of using nuclear plants to provide district heating to help decarbonise our domestic and commercial buildings? Please provide an explanation and include suggestions on mitigating any potential barriers.

Nothing from the ESO at this time.

Question 7 - What do you think are the opportunities and challenges associated with other potential uses for nuclear power? Please explain your answer.

We see further opportunities for advanced nuclear, in particular for multiple small modular reactors (SMRs), by working together and providing greater flexibility through load following capability or the ability to close some units[6]. In our most recent FES publication, we assume large-scale nuclear typically operates at baseload, is operationally constant other than for maintenance, with a load factor across the fleet of around 82%. SMRs however, are assumed to operate more flexibly, they achieve typical load factors between 50% and 55% when dispatched within our hourly dispatch model[7].

This system flexibility option can also be seen as an economic challenge. SMRs that can operate more flexibly offers the potential to mitigate the risk of summer minimum demand, however the lower the load factor they operate under, the more challenging the economic case for delivering them becomes[8]. As the ESO we would be interested in continuing the conversation with government and industry to further understand how flexible advanced nuclear can be when operating on the electricity system.

Question 8 - To what extent do you agree that the current regulatory pathways cover new uses? Are there any areas that are not covered? Please explain your answer.

No ESO response at this time.

[2] Hydrogen UK – Electrolytic Hydrogen Production – Page 9
[3] FES 2023 – Low carbon hydrogen supply: Page 149
[4] FES 2023 – Low carbon hydrogen supply: Page 149
[5] FES 2023 – Hydrogen storage: Page 192
[6] FES 2023 – Electricity supply: Page 139
[7] FES 2023 – Electricity supply: Page 140
[8] FES 2023 – Electricity supply: Page 141

Question 9 - What, if any, are the main opportunities and challenges for streamlining regulation while maintaining high standards of safety, security and environmental protection? Please explain your answer.

No ESO response at this time.

Question 10 - Following government's streamlining work to date, do you agree the next phase should focus on process efficiencies? Please explain your answer.

No ESO response at this time.

Question 11 - To what extent do you agree that advanced nuclear technologies and new uses of nuclear are accommodated within the existing legal landscape? Please explain your answer.

No ESO response at this time.

Question 12 - What are the opportunities and the challenges of the proposed engagement approach? Please explain your answer.

No ESO response at this time.

Question 13 - Are there new or additional nuclear safeguard challenges associated with ANT innovation and/or new uses of nuclear energy? Please explain your answer

No ESO response at this time.

Question 14 - What else should government do to ensure that new nuclear projects can be brought to market? Please explain your answer.

No ESO response at this time.

Question 15 - What, if any, structures do you think are appropriate for advanced nuclear technologies? Please explain your answer.

No ESO response at this time.

Question 16 - What are some key areas government should consider in a potential business model to bring a first-of-a-kind project to market? Please explain your answer.

No ESO response at this time.

Question 17 - How do you think the support required for projects should differ for later, nth-ofa-kind projects compared with a first-of-a-kind project? Please explain your answer.

No ESO response at this time.

Question 18 - What financial risks sit with government and cannot be transferred to private actors? What is the minimum protection that government will need to provide to mitigate financial risks to taxpayers? Please explain your answer.

No ESO response at this time.

Question 19 - How should government mitigate insolvency risk at privately funded nuclear plants? How can this be achieved without imposing undue costs on taxpayers? Please explain your answer.

No ESO response at this time.

Question 20 - What support infrastructure, or other enablers, would help bring projects to market, in addition to those highlighted above? Should government introduce measures to help private developers bring projects to market? Please explain your answer.

No ESO response at this time.

Question 21 - To what extent do you agree that government will always need to put measures in place to protect citizens, consumers, and taxpayers, even where a nuclear project is entirely privately financed? Please explain your answer.

No ESO response at this time.

Question 22 - To what extent do you think companies wishing to negotiate with government should be tested against suitability criteria before entering negotiations? Please explain your answer.

No ESO response at this time.

Question 23 - To what extent do you think companies wishing to negotiate with government should be tested against suitability criteria before entering negotiations? Please explain your answer.

No ESO response at this time.

Question 24 - What further steps should government take to support R&D for Advanced Nuclear Technologies? Please explain your answer.

No ESO response at this time.

Question 25 - To what extent do you agree that there are current or future gaps or constraints in the UK R&D landscape for Advanced Nuclear Technologies, either for that high TRL R&D and demonstration or earlier stage R&D? Please explain your answer.

No ESO response at this time.

Question 26 - To what extent do you agree that there are current or future gaps or constraints in the UK supply chain for Advanced Nuclear Technologies? Please explain your answer.

No ESO response at this time.

Question 27 - Please add any comments or reflections which have not been covered in the previous questions.

We note that the challenges and costs to decommissioning nuclear should be considered when building the business case. With the investment challenges referenced in Chapter 3 of this consultation document, to the fact that back-loaded decommissioning and waste disposal costs are uncertain for advanced nuclear, we suggest that Government should also drive innovation in the decommissioning space.

We are delighted that we will be taking on a new role as Regional Energy Strategic Planner (RESP), and we would be happy to engage further with government and the Nuclear Decommissioning Authority (NDA) on the decommissioning point, and the topic of new nuclear more generally.

Question 28 - The Public Sector Equality Duty (PSED) requires government to have due regard to the need to eliminate unlawful discrimination, harassment, victimisation, and other conduct prohibited by the Equality Act 2010, advance equality of opportunity between people who share a protected characteristic and those who do not and foster good relations between people who share a protected characteristic and those who do not.

Protected characteristics include age, gender reassignment, being married or in a civil partnership, being pregnant or on maternity leave, disability, race, religion or belief, sex, and sexual orientation.

Do you have any views about the implications of the policy measures explored in this consultation on people with protected characteristics? If you have identified any positive or negative impacts in the consultation, please provide any relevant evidence.

No ESO response at this time.

Question 29 - The Environment Act 2021 sets out a legal duty for government ministers to have due regard for the Environmental Principles Policy Statement (EPPS) when making policy.

Do you have any views about the implications of the policy measures explored in this consultation on environmental protection? If you have identified any positive or negative environmental impacts in the consultation, please provide any relevant evidence.

No ESO response at this time.