OPPORTUNITY FOR HOSTING STEP PROGRAMME NUCLEAR FUSION DEMONSTRATOR PROJECT – BRIEFING NOTE

A – Nuclear fusion - a future source of clean energy

The UK intends to decarbonise its energy supply by 2050, during which time electricity demand is forecast to quadruple with the electrification of transportation and heat. The Government therefore published in late 2020 its Energy White Paper and "Green Industrial Revolution" 10 point plan, including an ambition for the UK to develop a leading role in nuclear fusion as part of our future generation of clean energy.

Fusion is an advanced nuclear technology and is fundamentally different to the nuclear fission deployed at current power stations such as Hinkley Point. All the nuclear power stations in the world today derive their energy from nuclear fission. By comparison, fusion energy involves a completely different technology which will be more efficient and produces less waste. Fusion energy involves fusing light atomic nuclei such as hydrogen isotopes, whereas fission involves the splitting of very heavy nuclei such as uranium. A more detailed summary of the benefits of fusion energy are set out in the annex to this information sheet.

B – Government plans and ambitions for nuclear fusion

The United Kingdom Atomic Energy Authority (UKAEA) is pursuing for Government the goal of the UK being first in the world to develop and deploy a fusion power station – through its Spherical Tokamak for Energy Production (STEP) programme. The STEP programme aims to deliver a prototype reactor and put electricity from fusion onto the grid by 2040. STEP is a long term multi-£bn opportunity and the Government is initially investing £220mn through UKAEA to establish the programme. Over the next four years, the programme will involve the creation of a concept design and developing understanding of the market and how the reactor will be built.

On behalf of Government the UKAEA has launched a UK wide search for a location for the STEP demonstrator. Letters have been sent to every LA CEO in England informing them of this and wider partners, including Local Enterprise Partnerships (LEPs) alerted to this opportunity as well.

Further details about the STEP programme can be fund via Spherical Tokamak for Energy Production - STEP (ukaea.uk)

In summary the programme will be delivered in 3 Phases

Phase 1 - During the first phase a concept design will be produced and a site for the STEP prototype will be selected. The concept design will provide an outline of the entire plant and integration of the different systems required.
Phase 2 - The design will be further developed through detailed engineering design while all necessary permissions and licences to build the power plant will be sought.

Phase 3 - Construction of the prototype power plant will begin with operations beginning in the early 2040's.

C - STEP programme siting exercise

The UKAEA has invited initial expressions of interest by 31 March 2021 from localities across the UK keen to host the fusion demonstrator plant and associated research and development infrastructure. This is an initial phase of the site selection process from which the UKAEA will subsequently work to identify a preferred site. The UKAEA is looking for 100 hectares of land for this purpose. A great deal of interest is expected in this process because of the opportunity it provides localities to grow and anchor the capability a role in one of the most complex engineering challenges in the world and secure the research and development and wider economic spin offs from this.

UKAEA Anticipates long term and enduring economic benefits to the host community. This will be a major infrastructure project in itself and as a supply chain develops to support the programme, this could also establish the host community as a global hub for this high technology, low carbon industry.
UK a EA has already allocated resource is to support an apprentice training scheme in the local area and will work with local education and training providers at the earliest opportunity.

D – Making the case for Somerset to host the STEP demonstrator

The STEP demonstrator provides a huge opportunity for Somerset to capitalise on the county's prominent position in nuclear and if secured would enable us to secure a lasting legacy from the investment made for the Hinkley Point C project. While the siting exercise is likely to be very competitive the infrastructure, skills base and project delivery experience developed in Somerset through the Hinkley Point C project provides us with a potentially strong case to make in the siting exercise. The long term nature of the STEP programme means that there are opportunities to link provision for the development to land released from the Hinkley A and B decommissioning processes and associated infrastructure such as the National College for Nuclear at Cannington, the skills centres established by Bridgwater and Taunton College and the Somerset Energy Innovation Centre campus can all support a compelling proposition. In addition wider regional assets, including the significant knowledge base about nuclear physics and technologies at Bristol University (South West Nuclear Hub) is important to this.

For these reasons the Heart of the South West Local Enterprise Partnership is working with a range of partners, including, Bristol University, This is Gravity, the industry body Nuclear South West and Somerset County Council, Sedgemoor and Somerset West and Taunton District Councils, to develop an expression of interest for submission to UKAEA in March 2021. We are also ensuring that senior level stakeholders, including local MPs. Magnox, EDF Energy and the Nuclear Decommissioning Authority are aware of our interest in this opportunity and the potential strengths and future benefits of our proposals.

Annex A - Benefits of fusion

The benefits of fusion as a source of clean energy include:

- ***No carbon emissions.*** The only by-product of fusion is small amounts of helium, which can be safely released without harming the environment;
- ***Abundant fuels.*** Deuterium can be extracted from water and tritium will be produced inside the power station from lithium, an element abundant in the earth's crust and seawater. Even with widespread adoption of fusion power stations, these fuel supplies would last for many thousands of years;
- ***Energy efficiency.*** One kilogram of fusion fuel could provide the same amount of energy as 10 million kilograms of fossil fuel. A 1 Gigawatt fusion power station will need less than one tonne of fuel during a year's operation;
- ***Less radioactive waste than fission.*** There is no radioactive waste by-product from the fusion reaction and only reactor components become radioactive; and
- ***Safety***. A large-scale nuclear accident is not possible in a fusion reactor. The amounts of fuel used would be very small (about the weight of a postage stamp at any one time); and
- ***Reliable power***. Fusion power plants will be designed to produce a continuous supply of large amounts of electricity. Once established in the market, costs are predicted to be broadly similar to other energy sources.