Centralised Strategic Network Plan: Consultation on framework for indentifying and assessing transmission investment options

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About SuperNode and Superconductors

SuperNode, headquartered in Dublin, Ireland, is a global technology development company that designs and delivers cutting-edge, superconducting cable systems for bulk electricity transmission.

Conventional transmission cables are limited in terms of current levels which in turn limit their power transfer capability. Networks based upon superconducting cable systems can move larger quantities of power over longer distances with smaller and less obtrusive infrastructure, without electrical losses and at significantly lower voltages. SuperNode's technology will connect electricity markets in a way that facilitates the integration of large-scale renewables and the achievement of a decarbonised pan-European energy system.

SuperNode was founded in 2018 by Dr. Eddie O'Connor and renewable energy developer Mainstream Renewable Power Ltd. SuperNode is jointly owned by Dr. O'Connor and Norwegian green investment group AKER Horizons.

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1. SuperNode Response

SuperNode would first like to thank Ofgem for the opportunity to submit a response to this consultation. See responses to Question 3, 15 and 19 below.

Qn 3. Do you agree that the time horizon for system need assessment should be extended to 2050?

Yes. It is critical for the UK and FSO to look forward to 2050, identify the structure and needs of an optimised and decarbonised 2050 grid and work backwards from there. Taking an incremental approach and responding to short term needs, by utilising a ten year-ahead time horizon or a narrow focus on intermediate goals like 2030, will not result in an optimal energy system and increased cost. A decarbonised global energy system by 2050 would require electricity generation to reach net zero emissions by 2040, according to the IEA. The FSO should start identifying electricity system needs in 2050 to decarbonise the economy, and planning the infrastructure needed to support that 2050 system. Otherwise the result will be a sub-optimal system.

We also agree with the consultation document that this will enable greater levels of innovation.

Qn 15. Do you have any views on our proposal on inclusion of environmental and community impacts in the CSNP CBA?

We agree that environmental and community impacts of new networks should be included into the CSNP CBA.

Environmental impact is an important consideration to include in a CBA. This is especially true for planning a long term, strategic, holistic energy system. A key factor to consider is resource efficiency. The demonstration of circularity and optimal use of materials and energy should be factored into the CBA.

Paramount consideration should be given to measures such as cost-effective end-use energy savings, demand response initiatives, and the adoption of more efficient energy conversion, transmission, and distribution systems.

One technology that aligns with these objectives is the utilisation of superconducting transmission cables. European companies are developing superconducting transmission technology that would be commercially available from around 2030. These would reduce the materials use of energy transmission dramatically. To carry one kA one metre, a superconductor (e.g. Yttrium-Barium-Copper-Oxide (YBCO) requires 30,000 times less raw material than copper. Superconducting-based power

cables and uses 85% less copper than conventional copper-cables. Superconducting cables work extremely well with DC (direct current), which is generally accepted as preferred approach to meshed grids at pan-European scale.

The deployment of high capacity cables like superconducting cables can minimise the excessive use of cables, large infrastructure (such as converter stations and offshore platforms) and onshore landing points, because a given amount of energy can be carried at far lower voltage levels than conventional power cables. This would reduce overall material use further, and thereby reduce greenhouse gas emissions along the entire supply chain while also reducing environmental impact by optimising transmission corridors and the number of landing points needed. Large savings in materials would accrue from smaller related infrastructure, e.g. from significantly smaller offshore collector stations needed in lower voltage systems. For example, a modern 2.4 GW, 525 kV offshore collector station weighs more than 15,000 tons and cost up to € 1 billion. A collector station for a superconductor cable that can carry the same amount of energy, would operate below 100 kV and weigh and cost about one third.

It is also important to consider community impacts in a CBA. Large overhead transmission lines have become increasingly challenging to build in the UK due to permitting issues and public opposition. Communities have significant impacts on the duration and even completion of grid infrastructure projects, in particular for overhead lines. The use of underground cables is much more appealing to communities when compared to overhead lines and would enable enhanced social acceptability as well as expediting project implementation by reducing opposition and permitting delays. While overhead lines to this point have been the most cost-effective way to deliver power, community opposition now seriously challenges this notion, leaving the completion of some projects uncertain. The use of underground cables should, therefore, always be a strongly considered option in light of community impact.

Furthermore, with the development of higher-capacity cable technology, such as superconducting cables which will be capable of carrying up to 10 GW in a single bipole configuration compared to a 2 GW limit with conventional cables, transmission corridors can be optimised even further and the power carrying capacity of cables will be able to compete with overhead lines. Moreover, superconducting cables emit neither heat nor electromagnetic radiation.

Qn 19. Do you agree with our proposal to introduce a requirement, as part of the new CSNP licence condition, for the FSO to make recommendations on additional interconnection and OHAs opportunities between GB and other markets?

Yes. SuperNode agrees that the FSO should make recommendations on additional interconnection and OHAs opportunities. We welcome the following point from the consultation:

"As the energy system evolves to meet Net Zero, it is vital that we take a system wide approach to planning of new interconnection and OHAs, to ensure the right types of projects are delivered where, and when, needed."

It is crucial that a long term, system wide approach, is taken. Interconnection will play a vital role in GB's decarbonisation future both as a means of reducing fossil fuel usage but also as a significant economic opportunity to become a net exporter of renewable energy. Optimal interconnection must be planned as part of a long term, system wide approach.

It should also be noted that the benefits gained from a system wide approach do not apply to just the GB system. Some of the benefits include long term stability and reliability of electricity supply, increased resilience, optimised location of renewable generation and transmission infrastructure, minimising dispatch down and excessive use of infrastructure, landing points and environmental impact. These benefits would apply on a much greater scale with a European energy system based on

variable or intermittent renewable energy such as wind and solar. It is in the UK's and its European Neighbours interest to prioritise deep interconnection as part of a pan-European energy system and to thus reap the shared benefits.