Eirgrid: Powering Up Dublin

04/05/2023

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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

1.1. Do you have any additional information which we should consider in the design or construction phase of the project?

Urban Congestion Challenges

The Powering Up Dublin project is an important step for Dublin. As the 'Powering Up Dublin' Consultation states "Dublin's electricity infrastructure is ageing and reaching its end of life." Congestion is already creating significant challenges to Dublin's grid at both a transmission and distribution levels. Dublin's grid needs to be updated and upgraded to replace old and ageing infrastructure but it must also be modernised to enable Ireland's decarbonisation goals. As we bring more renewables onto the system and we continue to electrify more and more of our economy (transport and heat), urban congestion problems will continue to worsen.

There is already a limitation on new capacity that can be brought into Dublin. This limits our ability to construct new offshore wind generation in the Irish Sea, with limited available capacity to connect to our biggest energy consumers. This is a serious issue which could result in missed opportunities, missed targets, lower economic growth, security of supply risks, and could threaten to derail the green agenda.

Dublin grid congestion affects not only the Green transition, but the broader economic wealth of the state as well. We cannot locate any further data centers in the Leinster area because of grid congestion. We cannot electrify energy in Dublin because of insufficient grid capacity.

For all these reasons, 'Powering Up Dublin' is a critical project that must be planned and executed properly. This response seeks to ensure that Eirgrid have considered the best possible options and available technologies for the cabling to be used in the initiative.

Superconductivity

SuperNode would like to propose for consideration the use of superconducting cables as well as High Voltage XLPE cables with copper or aluminium conductors. Superconducting cables may not be appropriate for some of the planned projects but given their unique characteristics and huge potential benefits, SuperNode urges Eirgrid to consider their usage on each cable project and in the stations. Many of the urban use cases with superconducting cables were commercially advantageous because their lower voltage obviated the need for transformers, to relocate substations and/or improved grid performance.

Superconductivity has two great attributes which work in a city environment: it has a tiny footprint, compared to the conventional copper or aluminium based cable solutions, and it can transfer extremely large amounts of power from Substation A to Substation B. Superconducting cable systems are already operating in other major cities with years of reliable operational experience. There is a project in planning for Munich which will transfer 500MW over 12km at 110kV and another in Chicago that is already moving power over a distance of 4 to 5km using superconducting cable technology. These cities all faced similar urban congestion problems as Dublin. The technology is mature and reliable and would be suited to Dublin's electricity needs.

Superconducting cables will increase the resilience, the reliability, and most importantly the capacity of Dublin to accept more transmitted power (especially from our planned offshore wind farms), as well as the ability to mesh the distribution grid and deliver that power to where it is wanted.

Superconducting cables can, therefore, future proof Dublin by creating much higher capacity to meet the growing electricity needs of a Dublin energy system in transition.

Superconducting cables would fulfill four of the five categories in Powering Up Dublin's stated 'Project Benefits' in 'Security and reliability of supply', 'Meet Future Needs', 'Sustainability' and 'Economic'.

Furthermore, SuperNode and its partners are leading efforts in the superconducting industry to develop superconductors for new applications such as long-range, bulk transmission, both onshore and offshore, capable of carrying GWs in a single cable[1]. SuperNode's experience and contacts can also be leveraged to connect with and attract developers and operators of mature superconducting cable technology to Ireland, to coordinate with Eirgrid, ESB and any interested, involved stakeholders on the proviso that there is a genuine willingness to consider.

Long-Term Benefits

It has become clear now that Ireland is facing the biggest economic and environmental opportunity in generations in our offshore wind resources. The development of our offshore wind resource will allow Ireland to fully decarbonise while also becoming a major exporter of power with the potential to provide up to 10% of Europe's overall power, as part of an interconnected European energy system based predominantly on renewable energy. It is up to Ireland now whether we can turn this comparative advantage into a competitive one.

For Ireland to achieve this, we are going to need an onshore and offshore grid capable of moving the massive amounts of power (the government's target is 37GW by 2050) produced off our shores, both around Ireland itself as well as exporting it to our European neighbours, desperate to secure an adequate supply of European, indigenous renewable energy. Grid technology today is simply not capable of moving around this level of power. The development, demonstration and deployment of innovative new grid technologies capable of carrying much higher levels of power, up to 10GW in a single cable, will be critical in the long run.

It is already increasingly difficult to construct large overhead lines due to public opposition and current underground HVDC cable technology is capacity constrained and is not likely to ever be able to carry the required levels of power. Today's state-of-the-art 525kV copper cables are capable of carrying 1GW of power per cable. This capacity constraint will severely limit the power flows of a renewable based energy system, it will hinder our ability to decarbonise and jeopardise Ireland's opportunity to become a renewable energy superpower.

It should therefore be a high priority of Eirgrid, in collaboration with ESB, to recognise and establish a clear vision of the energy system in 2050 and start innovating, demonstrating and developing technologies that will contribute in the future so that when they are commercially ready, there is no delay in adopting them. The implementation of superconducting cables to solve Dublin's congestion problems would offer the dual benefits of alleviating Dublin's issues in the short term as well as developing experience, expertise and relationships in what could be a critical technology in the medium to long-term.

There is an incredible opportunity for Ireland in the coming green industrial revolution. This is an opportunity that we must take. But in order to do that we must not wait until there is a problem to solve but rather we must be proactive and seize the initiative.

[1] Best Paths 2018 demonstrator of 3.2 GW per cable at 320kV DC