Response to CRU Consultation paper CRU/18/119

Submitted by General Electric on 13 August 2018

The comments offered below refer only to Question 2 in the Consultation document with the body of the response focussing on the deployments of HVDC technologies as a matter of course in day to day operations.

As an integrity caveat we can confirm that we have had no involvement in any aspect of the proposed project to date other than to attend public briefings but in due course we would hope to participate as a vendor in the tendering process should the project proceed.

In view of the phrasing of CRUs comments at section 4.2.1 we have included a general overview on the wide range of operational scenarios in which HVDC technology has been deployed in order to make the prima facie case that this technology option is the optimal solution for this interconnecting of the UK and Irish grids

HVDC Technology has been around for more than 50 years it has established itself as a reliable means of connecting two Electrical Networks

Today's Environment

Globally the utility environment is becoming more complex and utilities are having to manage new challenges such as:

- Increasing demand for electricity
- Connection of remote generation
- Growth of distant offshore wind
- Integration of variable renewable generation
- Need for security of supply
- Reduce carbon footprint
- Land costs becoming more expensive
- New right-of-way access permits increasing difficult to obtain

The only choice for many utilities is to restructure their grid systems to manage these challenges. Utilities are looking for cost effective solutions to transfer power and to improve the quality, stability and reliability of the grid which will anticipate their needs for the next 20 to 50 years.

HVDC Overview

High Voltage Direct Current (HVDC) solutions are ideal for supporting existing AC transmission systems or for building new power highways. HVDC is a system which interconnects two AC networks, converting AC voltage to DC voltage, and DC voltage to AC voltage utilizing power electronics technology. HVDC systems enable transfer of power, interconnection of grids, integration of renewables and maximize grid performance.

Move more power, further

Ultra HVDC can operate at voltages up to 800kV enabling bulk transport of electricity over long distances. HVDC systems have lower losses than AC systems and can transmit up to 3 times more power than AC networks. HVDC systems are more economical than HVAC for schemes with transmission distances more than approximately 700 km(~400 miles). The use of insulated cables in both submarine and underground applications, in combination with HVDC, allows more power to be transmitted across long water crossings, or buried out of sight adjacent to roads, railways and tunnels, which may accelerate the permitting process compared to AC or overhead DC transmission alternatives.

<u>Integrate renewables</u>
HVDC is a versatile and flexible technology, making it an ideal solution for integrating renewable energy in modern grids such as remote windfarms, both offshore and onshore. HVDC can provide additional controllability to network operators to support efficient management of transmission of mixed energy sources, including the increasing use of renewables combined with energy storage.

<u>Interconnect grids</u>
HVDC enables the exchange of energy between two AC networks. In some cases, this is the only means of neighbouring utilities exchanging energy since they operate at different frequencies or may not be synchronized. An HVDC interconnection has many benefits, such as allowing neighbouring utilities to reduce and share 'spinning reserve', giving access to other lower cost sources of energy.

<u>Improve quality, stability and maximize network performance</u>
All HVDC solutions provide a 'firewall' to prevent disturbances propagating from one network to another. They provide fast and highly controllable power transfer and today can provide reactive power into the local AC Network to improve the stability & quality

The CRU report makes the point that Voltage Source Converters (VSC) operating at +/- 320 kV have been recommended and there is an explicit inferred increased level of risk which has not been adequately addressed. At the outset we need to underline that VSC technology is now ubiquitous as it has been deployed for more than 10 years globally and in the EU it has become the "standard" for all present & future applications reflected thru the ENTSO-E (the European Network of Transmission System Operators for Electricity). This is not only a major endorsement for the interconnectors of today but also for the future vision of "One European Grid"

The value of 320 kV (or whatever value is defined by the shareholder) is the steady State Voltage rating of the cable. The Transient capability of the cable is much higher, type tested and guaranteed by the cable supplier. When there is a Pole fault the Voltage stresses experienced by the cable are transient and are not expected exceed the transient rating of the cable. In addition, there is back up protection installed in the form of surge Arresters

As you may be able to tell from the above overview, we do not believe this project has any significant Technical Risks. As major supplier of HVDC technology GE has designed, delivered and supports an installed HVDC capacity of more than 35 GW globally in a broad range of applications and environments including invested in one of the then largest VSC HVDC demonstration laboratories in the world. This latter comment is offered respectfully to underline the depth of understanding of the technology which exists in the wider vendor community therefore by extension Element Power will be able to attract solutions based on working technology and thus the risk to the project is minimised. This experience also includes successful working partnerships with the respective project owners which is the only way that a project of this nature with such significant complexity can be delivered. We have not commented on the Procurement arrangements as these are a matter for Element Power