

Our Ref: PPL18077-BD-LET-001-v00
Your Ref: CRU/18/119

Commission for Regulation of Utilities,
The Exchange,
Belgard Square North,
Tallaght,
Dublin 24,
Ireland

9th August 2018

GREENLINK ELECTRICITY INTERCONNECTOR – CONSULTATION REPORT

Dear Sirs,

Prysmian PowerLink S.r.l. has read with interest your recent consultation report in respect of the Greenlink Electricity Interconnector. It is, for us, a high priority project that we have followed for some time and one that we hope to see as part of the UK-Ireland transmission systems. You may know that the Prysmian Group of companies is the world's largest cable manufacturer, with a long tradition and experience in providing significant interconnector projects globally. We would like to take this opportunity, not only to express our strong support of this important project, but also to reflect some general views on the technical section. These are set out below.

Maturity of the cable technology

For the transmission of power up to a level of approximately 1000 MW per bipole (or symmetrical monopole), HVDC extruded insulation cable technology operating at a voltage level of ± 320 kV and used in conjunction with Voltage Source Converters (VSC), is considered state of art for both submarine and land connections. Although the service experience of this type of connection is more limited in respect of time, with approximately 10 years or more of in service cables, the quantity of HVDC extruded insulation cables installed has grown rapidly and has reached lengths comparable to those of the more traditional Mass Impregnated Paper (M.I.) cable technology. Long term tests have been conducted on ± 320 kV VSC cable systems providing positive results for operational life up to 40 years and recent tests showed that the technology can be used up to a voltage of 600kV, thus with considerably higher electrical stresses than the ones which could be used for Greenlink. In conclusion, a high level of performance and reliability in service can therefore be expected, thanks to the operational experience gained in the last years and the tested cable parameters which show good safety margins on the applied design criteria.

Reliability/ Operation & Maintenance

Submarine Cable systems are designed as intrinsically maintenance free, due to the characteristics of the technology but also considering the associated operational costs. It is therefore of paramount importance to have a reliable system able to operate without

interruption for its design lifetime, typically around 40 years. Reliability can be verified by many parameters, not least of which the following:

- Performing the required qualification testing. These tests simulate an accelerated ageing of 40 years by imposing high temperature and voltage to the cable for durations up to 1 year.
- Adopting a proper burial protection strategy. It has been demonstrated by several studies that buried submarine cables have a failure rate much lower than unburied/unprotected cable systems.
- Residual failures can be estimated by analytical studies, either based on test, mathematical models or statistics. Typically, a system is considered reliable when it is expected to have less than 2 failures (from internal or external origins) during its entire lifetime.
- To cover this remaining risk, monitoring plays a key role in predicting the possible faults. Different types of monitoring are currently available to measure temperature (DTS), Partial discharges (PD) or impacts on cable (DAS), with different maximum monitored lengths. The use of monitoring systems enables predictive and preventive actions and to reduce outages time, by knowing in advance any fault development. These technologies are advancing rapidly.
- The addition of a 3rd metallic return cable/sea electrode can provide additional reliability, as the system can still operate with half the nominal power even in case of 1 cable fault. However, this feature should be analysed in detail as it has an impact in submarine cable supply costs, submarine installation costs and converter cost too due to different topology.
- In addition to the monitoring systems mentioned above, the cable system reliability is further enhanced through the development of dedicated Operation & Maintenance services. Prysmian has already developed a marine base in Middlesbrough, UK which can provide this full range of monitoring and maintenance services, including repair response times up to 70% lower than the average.

References of similar projects

As mentioned above, the experience with this cable type is now quite extensively established. Prysmian has many systems both operational and in construction, including the following:

- Transbay (San Francisco, USA) – ± 200 kV system rated at 400MW - Operating
- Helwin 1 (Germany) – ± 250 kV system rated at 576MW – Operating
- Borwin 2 (Germany) – ± 300 kV system rated at 800MW – Operating
- INELFE (France-Spain) – ± 320 kV system rated at 2000MW – Operating
- Sylwin 1 (Germany) – ± 320 kV system rated at 864MW – Operating
- Helwin 2 (Germany) – ± 320 kV system rated at 690MW – Operating

- Borwin 3 (Germany) – $\pm 320\text{kV}$ system rated at 900MW – In construction
- Dolwin 3 (Germany) – $\pm 320\text{kV}$ system rated at 900MW – Operating
- Cobra (Denmark-Netherlands) – $\pm 320\text{kV}$ system rated at 700MW – In construction
- Piedmont-Savoy (France-Italy) – $\pm 320\text{kV}$ system rated at 1200MW – In construction
- ElecLink (France-UK) – $\pm 320\text{kV}$ system rated at 1000MW – In construction
- IFA2 (France-UK) – $\pm 320\text{kV}$ system rated at 1000MW – In construction

Worldwide there are many other similar systems from other suppliers operating at various voltages and ratings, but using the same basic technology.

We hope that you will find our comments helpful to support your considerations of the Greenlink project. We are always available to discuss any questions you might have regarding the cable technology.

Yours faithfully

A handwritten signature in black ink that reads 'I. Knowles'.

Ian Knowles
Sales Manager, Prysmian PowerLink S.r.l.

Contact details

T +44 (0)23 8029 5503

M +44 (0)797 112 9575

F +44 (0)23 8029 5002

E.Mail ian.knowles@prysmiangroup.com