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Subsea Superconducting Power Cables for Offshore Renewable Energy Integration

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Offshore renewable energy, such as wind, tidal and wave energy, represents a potential solution to the future energy demand, while the world's energy consumption continues to grow rapidly and the production of both oil and gas is waning. Serious consideration has been given to the development of offshore wind farms, particularly in Europe, North America and Asia. Many projects have been approved and several farms are already under construction. To integrate these offshore farms and transfer power from them to shore-based power networks, efficient subsea power cables are urgently required, since conventional cables cannot play this irreplaceable role with very limited power capacity and considerable loss. Superconductors, which are only being utilized for developing land power cables so far, are a perfect solution.

Prof. Li, on behalf of the Applied Superconductivity Centre in the University of Edinburgh, will for the first time present their research work on applying superconductors to develop subsea superconducting power (SSP) cables. Such SSP cables are expected to entirely upgrade the present power network.

Both advantages and potential risks of SSP cables will be presented, followed by analysis of their reliability. An SSP cable with suitable configuration for subsea power transmission is proposed. Based on numerical modelling, its electrical and magnetic properties are studied and its loss characteristics are analysed. Results show that the SSP cables can greatly benefit subsea power networks with ultimate power capability and extremely low loss. However, efficient cooling is essential along with the protection of physical damage and fault current. All results will be presented and relevant discussion will be carried out.

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