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Landing Marine-derived Renewable Energy: Optimising Power Cable Routing in the Nearshore Environment

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Numerous studies have demonstrated that a vast unexploited source of energy can be derived from the marine environment. Recent evolution of the energy market and looming EU renewable energy uptake targets for 2020 have driven a huge explosion of interest in exploiting this resource, triggering both governments and industry to move forward in undertaking feasibility assessments and demonstration projects for wave, tidal and offshore wind farms across coastlines.

The locations which naturally lend themselves to high yield energy capture, are by definition, exposed and may be remote, located far from the end user of the electricity generated. A fundamental constraint to successfully exploiting these resources will be whether electricity generated in high energy, variable and constantly evolving environments can be brought safely and reliably to shore without the need for constant monitoring and maintenance of the subsea cables and landfall sites. In the case of riverine cable crossings superficial sediments would typically be used to trench and bury the cable. High energy coastal environments may be stripped of soft sediments. Any superficial sediments present at the site may be highly mobile and subject to re-suspension throughout the tidal cycle or under stormy conditions.

EirGrid Plc. and Mott MacDonald Ireland Ltd. have been investigating the potential for routing a cable across the exposed Shannon estuary in Ireland. Information regarding the geological ground model, meteo-oceanographic and archaeological conditions of the proposed site was limited, necessitating a clear investigation strategy. The investigation included gathering site information on currents, bathymetry and geology through desk studies, hydrographic and geophysical surveys, an intrusive ground investigation and coastal erosion assessments at the landfall sites.

The study identified a number of difficulties for trenching and protecting a cable through an exposed environment such as the Shannon estuary. Such difficulties include limited availability of superficial sediments for cable trenching and protection; where sediments were present there were indications that the sediments were either mobile sands, or difficult to trench glacial tills. Areas of the estuary feature steep side slopes and rocky outcrops, which also provide a challenge for cable installation and long-term protection. Difficult ground conditions were set against an aggressive meteo-oceanographic environment, tidal currents reached 5-7 knots on the ebb tide with reverse eddies around the landfalls coupled with an active wave climate. These conditions pose implications on the working time, installation vessels and methodology. The estuary is also a designated Special Area of Conservation for the protection of bottlenose dolphins, therefore, the cable installation methodology needed to consider ecological sensitivities. Additionally, an area near to the southern landfall has historically been an area of strategic significance and has a number of fortifications adding archaeological constraints for the cable route.

The increasing need and importance of investigation and planning for submarine cable routes will be discussed alongside potential methods for installation in the aggressive nearshore environment, this paper will summarise findings and observations of working in a high energy environment, will consider options for installation and protection of cables, will discuss the key lessons learned and look at potential implications for offshore electricity generation.