

## **Designing Cable Protection into Offshore Wind Farms**

Cable damage is becoming an ever-increasing problem within the offshore wind industry. In numerous projects throughout Europe, cable failures both during installation and during operation are hampering the development and production of offshore wind energy. For instance, recent damage to cabling in both the Thanet and London Array have had British offshore wind farm operators looking for ways to prevent such challenges. In the London Array, the problem arose during export cable laying when the cable was damaged by a leg of an installation rig. For the Thanet wind farm, the problem arose when an inspection found a kink in two export cables, which ultimately required replacement. Repairs meant the farm could only operate at half power, and required the special conversion of a VSMC vessel on short notice to conduct repairs.<sup>i</sup>

But these problems will only intensify in the years to come. Offshore wind farms get bigger and bigger with every passing year, with many predicting that offshore installations will have turbines numbering in the thousands in the years to come. Combining this burgeoning size of the offshore wind farm with the fact that they'll be installed even further offshore, the complications associated with choosing and installing submarine cabling. Problems such as accidents during installation, poor reliability of transmission during operation, and difficult maintenance will all have a detrimental impact on profitability of these power systems, making the need for highly reliable transmission systems extremely high.



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### **Tougher Regulations for Offshore Cable Laying Pushing Industry to Develop Better Survey Methods**

Governments worldwide are paying greater attention to the impact cable laying has on their marine environments, resulting in a shifting regulatory landscape that will impact the offshore wind industry for all future projects. Several factors unique to the offshore wind industry are playing into the changing landscape for cable laying requirements. One of the biggest factors influencing how cable is laid is offshore

environments is the farm’s distance from shore. Whereas previously wind farms were installed in much shallower waters, today wind farms are being sited in areas with much deeper waters and significantly more challenging weather conditions. Installation in these zones will require a whole new level of understanding of marine environments and safety considerations never before encountered.

Another complicating factor is that intertidal operations are very different from those seen in previous oil and gas installations, and soil conditions have also become more complex as different locales are explored. Both factors require further vessel and equipment specialization, as well as further understanding of these deep water marine ecosystems.

In particular, greater concern for environmental protection and safety is leading more and more authorities to require more demanding burial protection measures be taken. For instance, in the UK, the Scottish Government has compiled a list of concerns concerning wildlife and offshore wind installations. They’ve identified that entanglement issues for whales and other marine wildlife is likely with wave-OREG devices that are moored with slack lines. Though they are still in the process of developing mitigation measures to minimize the whale interactions with these types of developments, it is definitely on the radar.<sup>ii</sup>

It is these types of concerns that are tightening regulations related to cable surveying and wind farm design. To meet new regulations, the industry is developing more robust survey methods. Take the example of the MMT Sweden AB project which is set to include cabling that runs from Shetland to the Caithness landfall. Original surveys in 2008 and 2010, including geotechnical, geophysical, and environmental surveys, determined that there were many unsuitable cable laying areas, requiring further surveys. Certainly the costs of such surveys are high, but had the team not conducted their surveys ahead of time, additional costs may have been incurred in the project had gone ahead without proper planning.<sup>iii</sup>

As with the case study noted above, one method for mitigating the environmental impacts of cable lying is better surveying methods for more targeted equipment selection. By involving survey and cable installation contractors earlier in the site investigation process, the selection of cable suitable for the particular environment can ensure as minimal an environmental impact as possible. This solution results in better engineering solutions as well which helps to reduce installation durations and overall costs.

In particular, many wind farm sites are undergoing a probabilistic software-led surveying approach during the initial project design to prevent losses similar to that experienced at the Lillgrund site which compromised the 110 MW project’s 48 Siemens turbines.<sup>iv</sup> This type of analysis takes many factors into consideration, including geology and seabed topology, turbine wake interaction, and water depth.



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Plugging this information into the software tool, the system outputs information such as suggested operations and maintenance costs, as well as aerodynamic efficiency of the wind farm.<sup>v</sup>

The idea is to balance the initial costs of cable purchase and installation with the costs and benefits that the particular configuration produces during operation. Up to this point, this kind of early analysis has not generally been sufficient, resulting in negative financial implications and low profitability that was unexpected.

What surveys generally indicate for most offshore installations today is that there are extremely limited options for cable layout because of factors such as complexity of installation and requirements for cable lengths that are as short as possible. These limitations will only become amplified in the years ahead as wind farms increase in size and move farther offshore, further increasing the need for highly specific site surveys. The need for efficient wind farm installation and maintenance along with even higher demands for reliability will no doubt push the industry to look for even more exacting methods for surveying and better cable layout design.

### **Accounting for Difficult Terrain & Distant Installations: Newest Innovations and Technologies**

In addition to conducting surveys sooner in the project and in greater detail, new technologies are also being developing to boost the number of data points and their accuracy. For instance, a new technology introduced recently by Innovatum could provide a solution to some of the surveying challenges associated with the installation of offshore farms. Their Cougar XT Compact is a small, low-profile, powerful survey system that could drastically reduce inshore survey costs. It can be deployed from a small vessel and is capable of holding steady even under strong currents and tidal flows common in the southern North Sea. It is constructed with a thin tether cable to reduce drag as well as reduced buoyancy and weight. It uses the company's Smartrak system to sense both AC and DC current cables, and even cables that carry no current at all. But perhaps the biggest breakthrough is its six highly responsible thrusters which allow for quick and precise maneuverability.<sup>vi</sup>

The industry is also doing a better job at selecting appropriate vessels for cable installation in order to compensate for difficult terrain, especially those far offshore. To adapt to the more complex soil conditions located a long way offshore, dynamic position (DP) vessels are being used instead of barges that would have used anchored mooring systems for installation. This DP method helps to mitigate

weather delays by allowing vessels to stay offshore for longer periods of time and then recommence installation more quickly once inclement weather passes.<sup>vii</sup>

### **More Stability Needed in Offshore Cabling Protection Industry**

Given the fast-changing nature of the offshore wind industry, many companies come and go, resulting in a massive lack of experience and consistency, particularly when it comes to expertise in the site survey segment of wind development. At present, no one solution has been identified as the most effective or cost-efficient, and as such, many within the offshore wind sector are hoping that research will soon result in solid solutions that will stand the test of time – and that companies that can provide these solutions will stick around long enough to develop sufficient experience to keep the development of the industry on track.

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Maryruth can't help but seek out the keys to environmental sustainability - it's the fire that gets her leaping out of bed every day. With green writing interests that range from sustainable business practices to net-zero building designs, environmental health to cleantech, and green lifestyle choices to social entrepreneurship, Maryruth has been exploring and writing about earth-matters and ethics for over a decade. You can learn more about Maryruth's work on [JadeCreative.com](http://JadeCreative.com).

### **Sources**

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