Safer, Cost-Effecient Innovations for Offshore Wind Cabeling

The giant 100-metre long blades of a typical offshore wind turbine may be the most visible indicator of a farm's presence, but like icebergs, there's a lot going on below the surface of the ocean. With thick cabling for transmitting energy from the turbines back to shore, the underwater requirements for these behemoth installations are equally important in the journey to establishing wind as a renewable energy leader. It's no wonder this sector of the wind market is gaining interest with new tools and innovations for safer, cost-effective systems cropping up on a regular basis.

Improving Seabed Surveys for Cable Routes to Avoid Risks and Surprises

Assessing the seabed for cable laying is one of the most important steps for reducing costs of this aspect of an offshore wind farm. Most importantly, a burial assessment will reveal what depth is the most ideal in terms of providing both maximum production and minimizing installation and maintenance costs. Seabed surveys therefore play a key role in increasing the financial feasibility of a project.

One common problem for underwater cabling is the crowded nature of the seabed. Though much of the cabling already laid can be found on maps, often surveyors will find cabling that appears on no maps, no doubt laid by government agencies for secret surveillance or monitoring seismic activity. As a result, some areas of the ocean floor are quite unmapped and rather crowded. This can pose problems since, when one cable is laid on top of another, they can cause mutual damage as the ocean's currents scuff the two against one another.

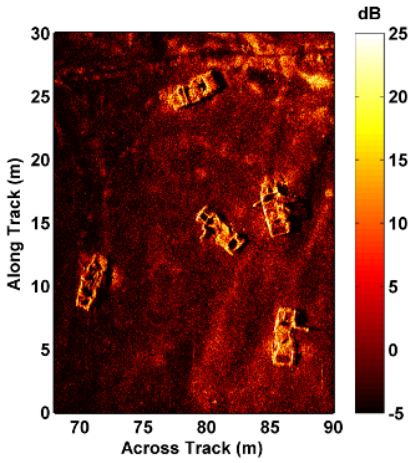
As a result, one of the keys to good offshore wind cable laying is better seabed surveys. Avoiding busy cabling routes can go a long way to preventing future cable damage, after all. More sophisticated survey equipment is being developed by a number of firms to address this problem. Deep Ocean Group, for instance, has seabed mapping and tracking rigs that employ 3D visualisations and scour

development tracking in 4D, which show the development of scour and provide valuable information for further foundation and cabling strategies.[i]

In some cases, seabed surveys will show that there are out of service cables along an intended route that can be removed and disposed of onshore in order to make way for new cabling for a wind farm. This was the case with the installation of a German offshore wind farm with Borwin2 HVDC cabling by Offshore Marine Management (OMM).[ii] Using a remotely operated underwater vehicle, OMM conducted a detailed survey of the seabed to identify the correct cables to remove and where to place the new ones.

Another common challenge wind farms must overcome is the potential to encounter unexploded naval mines, TNT bombs, and artillery shells on the sea floor. In a recent project conducted by TeenT TSO GmbH to link the Riffgat project to the grid with cabling, the company uncovered WW II mines. Proper surveying prevented problems that could have developed had cabling been destroyed by the mines, but removing the mines also added cost and time to the cable laying process.[iii]

Acoustic sampling such as that offered by sonar is often used for testing seabed conditions and collecting information for cable burial routes and the structure of foundations. New innovations in this field are bringing greater clarity to offshore wind projects by offering ultra-high image resolution with superior area coverage. Synthetic Aperture Sonar (SAS), for instance, is now available through Kraken Sonar Systems Inc. This technology offers higher resolutions over longer ranges than side-scan sonars by replacing traditional sonar hardware with sophisticated signal processing software. In this case, the receive transducer array is synthesized in software by providing a recombination of many sonar pins overlapping. This technology offers significant savings in hardware and much better resolution.[iv]



Kraken Sonar - Imagery of Volvos that were dumped in Halifax Harbour in 1969

In addition to better picture quality, SAS provides highly accurate ground velocity estimates which improve underwater vehicle navigation. This is accomplished by limiting the drift of aided inertial navigation systems to improve positional accuracy for longer surveys.

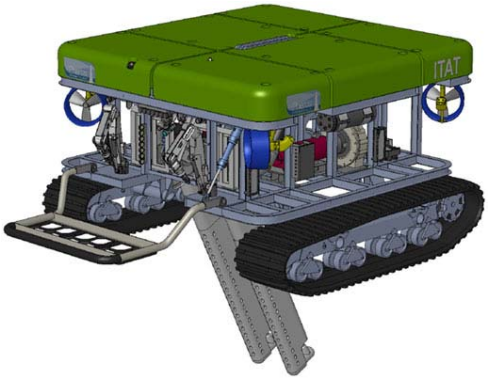
Unfortunately, the acoustic measurement of seabed conditions is not without its controversies. Surveying for the installation of cabling often requires the use of high-tech sonars to scan the seabed for seismic stability. Yet, as the Whale and Dolphin Conservation Society in Scotland recently pointed out, this type of technology can be very disorienting to whales, driving them to beach themselves and resulting in their deaths. A mass beaching of pilot whales in September 2012 resulted in 17 deaths, with more threatening to beach themselves shortly after that incident.[v]

Pressure from regulators and nature groups is mounting because of this potential problem, and could delay offshore wind projects. Though there are conflicting theories as to whether sonar is to blame for mass beachings such as these, the stigma of this type of environmental disruption will no doubt impact the wind industry if it is not able to develop seabed survey methods that pose lower threats to wildlife.

To address these and other cable-laying related issues, some groups are being organized to work on regulatory structures for managing these problems. For instance, a group of organisations have come together to discuss guidelines for sharing the crowded UK seabed. This group includes The Subsea Cables UK, Renewable UK, Renewable Energy Association, and The Crown Estate, as well as various wind farm developers. Their report, “The Proximity of Offshore Renewable Energy Installations & Submarine Cable Infrastructure in UK Waters” provides generic guidelines for identifying turbine locations and associated infrastructure. Though they have yet to be finalized, the group is suggesting a guideline of 750 metres between projects to avoid damage and conflicts.[vi]

Innovative Trenching Tools for Greater Cable Safety

Cost can certainly be saved with properly seabed surveys and site evaluations, but another way to lower these expenses is to use more advanced vehicles for trenching and cable laying. A great example of the innovations in the field of trenching tools is the Pharos ITAT 800™ Inter Turbine Array Trencher. It a self-propelled trenching ROV that is designed using commercially available parts, allowing anyone to make quick repairs using parts available anywhere in the world. The Commercial-Off-The-Shelf (COTS) design also makes the initial price lower than similar trenchers and minimizes operational and maintenance costs as well.



Pharos ITAT 800™ Inter Turbine Array Trencher

Additionally, this trencher uses a water-jetting technology to cut the seabed that fluidizes the sea floor material to allow cabling to sink in. This results in a safer installation than that created by a metal plough, according to the company. The company has also produced a maintenance version of the ROV called the MENTOR 800™which uses the same jetting capability at depths up to 3,000 metres.


Canyon Jetting Trenchers

Canyon Offshore has similar technology in their T200, T600, and T750 trenchers which use high-pressure nozzles for trenching, eduction, and burying in one pass to customized burial depths. They operate using free-fly, cable-follow, or tracked modes.

Better Laying Methods for Subsea Power Cables

Damage is a common problem for cabling, according to industry experts. In fact, most cable experiences damage over the course of its lifetime, according Cliff McDougall, director of renewables operations for Pharos Offshore Group, an organization with significant experience in laying cable for telecom and the oil and gas industry.[vii] The majority of the damage comes as a result of ship or fishing anchors, causing breaks in a cable. This ultimately causes the affected turbine or series of turbines to trip off.

Any disruption in energy export is a cost to the bottom line of the farm, but when the break occurs in the export cable connecting an entire farm to land, the consequences can be significant. In fact, as one Dutch grid operator from TenneT explains, in severe cases a break in an export cable can cause an entire farm to go down for years as the wait for replacement parts can be quite long.[viii] In the case of the Thanet wind farm in the UK, for instance, kinks in their export cabling during 2011 cause the wind farm to operate at only half power during repairs.[ix]

Industry experts are experimenting with new methods to make these types of brakes less common and less costly. One method being used is to embed fibre optic cables within the outer layer of the power cables. Using light signals, this cable helps repair crews quickly identify the point of the break so that it can be replaced in a timely fashion. Not only does this make fixes more time-efficient, it also ensures a more accurate diagnosis of the problem so that cost-effective solutions can be found quickly.

Another method many projects are starting to use for avoiding catastrophic disruptions in energy export from an offshore wind farm is to have backup cabling manufactured and then stored on standby in a climate-controlled environment and accessible by ship. This would mean a much quicker turnaround for repairs, even including the time it takes to get a ship loaded and out to the site of the break.

Achieving Greater Wind Energy Efficiencies through Better Trenching & Cabling

The fact that up to 40% of the value of a wind farm is not in the turbine itself but in supporting systems such as underwater cabling presents compelling reasons for investing in better trenching and cabling systems.[x] The cost and efficiency involved in the laying and maintenance of wind farm cabling is a significant factor in the profitability of wind energy, offering many opportunities for making wind energy more profitable.

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A student of all things green, Maryruth has a special interest in cleantech and green buildings. In recent years, Maryruth has worked as the senior editor of The Green Economy magazine, is a regular blogger for several green business ventures, and has contributed to the editorial content of not one, but two eco-living websites: www.ecolife.com and www.GreenYour.com. You can learn more about Maryruth's work by visiting her site, www.jadecreative.com.

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