

Subsea Cabling Systems Pose Development Challenges

Connecting offshore wind projects to the grid requires the often painstaking process of laying and routing undersea cables.

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Offshore wind farms require intricate webs of cables buried along miles of seafloor to connect turbines within arrays and transmit power to shore – either directly or through large-scale, subsea backbone transmission lines. The installation of cables in the marine environment can be a massive undertaking affecting project permitting, design and execution.

Subsea cables are buried below the seabed to protect the lines from bottom trawling, anchor sweeps and other hazards. For the Cape Wind project – the only fully permitted offshore wind project in U.S. federal waters to date – the intra-array and transmission cables will be buried to a depth of 1.8 meters below Nantucket Sound's seabed.

The installation process for offshore cabling is complex and requires specialized equipment and the mobilization of multiple vessels. Cables are buried in trenches formed by jetting – a process that uses high-pressure water to lift the seabed to create the trench – or by the use of conventional plows. Jetting is preferred over other trenching methods because it minimizes impacts on the environment.

The vessels used for cable laying and jetting are generally barges that move along the construction route by



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a method known as anchoring. The process involves dropping heavy anchors (around 10,000 pounds each) in an array around the construction barge. The anchors are positioned and repositioned dozens of times using anchor handling tugs while the barge slowly moves along the construction route. Cable burial and laying is a slow process, which can be frustrated by weather delays, rough sea-state conditions and equipment failures. Trenching and anchor drops can also disturb significant acreages of the seabed.

The cable-burial process, as well as the layout and routing of cables, can be affected significantly by what lies on, or underneath, the seabed. The seabed invariably is riddled with objects or other features – both natural and man-made – that can affect project design and construction.

Natural features, such as boulders and reef structures, can create physical barriers for cables that require routing adjustments during the proj-

ect-design phase. Man-made objects, which can include discarded refrigerators, sunken subway cars used as artificial reefs and shipwrecks, may require similar measures.

The seabed also contains features that may be considered significant cultural resources, which are protected from destruction, disturbance or removal under federal law. These cultural resources may include known or yet-to-be-discovered shipwrecks or sites containing submerged prehistoric archeological resources.

Under Section 106 of the National Historic Preservation Act, federal agencies are required to consider – as part of the environmental review for all offshore wind projects – the effects of projects on properties included on, or eligible for inclusion on, the National Register of Historic Places.

The review process, known as the Section 106 process, involves coordination with stakeholders, including designated state historic preservation officers in the affected states, tribal historic preservation officers (for impacts to Native American tribal lands and resources) and various federal agencies.

A formal consultation process is used to evaluate the project's area of potential effect, note the presence or absence of properties of traditional cultural and religious importance,

and determine the presence and significance of submerged archeological resources so that appropriate avoidance, minimization or mitigation measures can be implemented.

Determining the presence and characteristics of objects on or below the seabed can be very difficult and is accomplished by conducting detailed geophysical surveys and/or geotechnical investigations. Remote sensing equipment for such surveys generally includes a multi-component array of side-scan sonar, sub-bottom profilers, multi-beam echosounders, and magnetometers or gradiometers.

These devices are used variously to render high-resolution, three-dimensional images of the bottom and sub-bottom to identify objects located on or below the surface, or to map the distribution, shape and amplitude of magnetic anomalies that could represent either potentially significant shipwrecks or hazards to construction.

Soil samples also may be taken

at various points at the project site to provide information on changes in the environment that may have occurred over thousands of years, including in areas that were once above sea level.

If a resource is discovered during construction, BOEMRE will require additional site investigation, evaluation and consultation.

The images and other data collected during these surveys are analyzed by firms specializing in nautical archeological investigations to determine whether identified objects are, or could potentially be, significant submerged cultural resources. The archeological analyses also draw on historical and archival data from the region to determine the identity and significance of shipwrecks and other resources, both those previously known and those discovered during surveys.

The presence, or even the suspected presence, of significant cultural resources such as shipwrecks can have substantive effects on project design and construction. For example, if a significant cultural resource is identified on a federal lease block on the Atlantic Outer Continental Shelf, the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) typically establishes a “no activity” buffer zone around the resource. No-activity zones prohibit the installation of facilities within the zones and prevent other project-related impacts – such as anchor drops – from construction vessels installing nearby facilities.

These restrictions – particularly when multiple zones are established for a project site – can require developers either to conduct more intensive archeological investigations or to move and reconfigure turbines, cables and other facilities.

In addition to establishing no-activity zones for identified resources, BOEMRE may require the avoidance of resources that are suspected – but not conclusively determined – to be significant cultural resources. To prevent

extensive, and perhaps unnecessary, modifications to projects to avoid unconfirmed objects, developers can conduct further field investigations. These investigations include video surveys using remotely operated vehicles or first-hand inspection by archeologists who can identify the

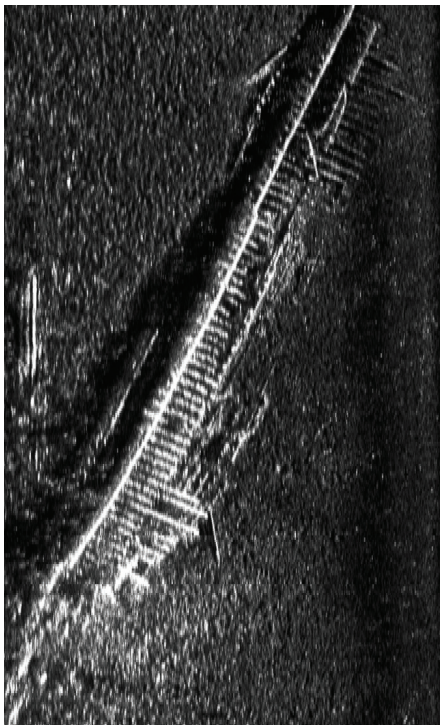
object and determine whether it is significant.

Significance is defined in the Code of Federal Regulations, and the classes of resources that possess significance are broad. Thorough and high-quality archeological surveys during project planning can reduce such exposure.

If a resource or suspected resource is discovered during project construction, BOEMRE also will require, under a “chance finds clause” included in site leases, that work activities be halted pending additional site investigation, evaluation and consultation. Such suspensions can be extremely costly to developers, given the high-cost mobilization of vessels and the pay rates of work crews, which may stay idle while a resource is evaluated and permission is obtained from regulators to continue construction.

The potential presence of shipwrecks and submerged archeological resources, particularly on the Atlantic coast, is vast. For example, well over 6,200 shipwrecks have been identified along the Atlantic Seaboard, and that is only a fraction of the potential total number.

The types of vessels include pre-colonial vessels of exploration, merchant ships, privateers, blockade runners, ocean liners and naval combatants. The list includes the Alligator, the first U.S. Navy submarine that was lost during the Civil War



Sonar image of a 19th-century wooden sailing vessel. Photo courtesy of R. Christopher Goodwin & Associates

near Cape Hatteras, N.C.; SS Andrea Doria, an ocean liner that was lost off the coast of Nantucket, Mass.; and SS Central America, the side-wheel steamer lost off North Carolina in 1857 carrying a cargo of gold.

The USS Monitor, lost in 1862, and the German submarine U-352, lost in 1942, are now marine sanctuaries off North Carolina. In fact, it is very common for large-scale offshore surveys to record undocumented wrecks, especially in areas that historically witnessed high-frequency vessel traffic, such as off the coasts of large port cities or along traditional shipping lanes.

As U.S. offshore wind farm proposals continue to grow, the challenges associated with cabling systems will also increase. Wind farms with larger wind turbines will require greater distances between turbines and likely will be sited much farther from shore, requiring both longer cables within the arrays and longer transmission cables to grid-connect projects.

Large-scale backbone transmission projects will face similar challenges because transmission lines could span hundreds of miles along the ocean floor.

Careful project planning, site evaluation, and coordination with regu-

lators and other stakeholders during project reviews is necessary to help address the many challenges associated with subsea cabling and to help avoid potential problems during the construction process. **SNP**

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