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WHITE PAPER

End-of-Life Planning for Offshore Wind Farms Cannot Wait

By The 1898 & Co. Team

What goes up must eventually come down. That is true for onshore and offshore wind farms alike. As owners undertake new offshore projects, they can learn much about end-of-life planning from their onshore counterparts in the U.S. and abroad. Lesson No. 1: The best time to consider decommissioning is before construction even begins.

The first generation of offshore wind farms is now approaching its end of life. Within the first half of the 2020s, more than 120 offshore wind turbines around the world are scheduled to reach an age when turbine removal or repowering would be necessary, according to the International Renewable Energy Agency. By the early 2030s, owners of about 3.5 gigawatts (GW) of offshore wind capacity in Europe, Asia and elsewhere are expected to face decisions about retirement and removal.

While no North American offshore wind farms were included on any decommissioning watchlist in the early 2020s, owners are cautioned to monitor efforts in other regions closely for best practices. Decommissioning practices at land-based wind farms differ in important ways from offshore installations, but they can help inform decision making for offshore facilities. Here are some key lessons that should be kept in mind:

Include decommissioning in the initial offshore wind planning process.

Offshore wind farms are designed to operate, on average, for 20 to 30 years. When their useful life ends, the cost of decommissioning — removing wind farm structures and restoring the site — can rival initial construction costs. If these costs are omitted from an offshore installation's financial model, owners run the risk of miscalculating a development's total life cycle cost and return on investment. Decommissioning costs, like changes in electricity prices, capacity issues and years of operation, can have a significant impact on investment decisions and should be included in any cost analysis.

Lack of a decommissioning plan can impact construction permitting.

In the U.S., onshore wind farms are required to provide an estimate of end-of-life decommissioning costs as part of the upfront permitting process. Before construction can begin, the county or other government body with jurisdiction over these projects may also compel owners to provide a bond or letter of credit to provide assurance that funds will be available to cover these expenses. Depending on the location of an offshore project, the jurisdiction responsible for permitting may or may not have such a requirement. Either way, it is in the developer's best interest to understand its obligations and plan ahead.

Planning documents should define end-of-life responsibilities.

Because the history of offshore wind farm decommissioning is short, particularly in North America, today's owners are often setting precedent. Working with the Bureau of Ocean Energy Management, U.S. Coast Guard and other federal and state regulators, today's owners have the opportunity to establish clear roles and responsibilities regarding who makes decommissioning decisions, who performs the work, who foots the bill and when. In addition, parties should reach agreement on whether any elements at a site can be abandoned in place rather than removed, as well as how to define dust, noise control, and other site-specific requirements. This information becomes part of a new installation's construction and operations plan. In addition to guiding the decommissioning process, this plan can help prevent future claims and disputes when the project's end of life arrives. Done well, these plans also become the models that others will follow.

Decommissioning offshore wind farms is an exercise in reverse construction.

While explosives are a common demolition tool, demolition of a land-based wind farm is typically performed in a more controlled manner, through reverse construction. A similar reverse construction process can be applied for offshore projects that require experience in dismantling and removing a structure without polluting the water or disturbing the surrounding marine life. Optimal candidates for handling such jobs are crews that are familiar with both construction and deconstruction of wind turbines, offshore power substations and other such components. They will be asked to reverse the construction process, working backward to disassemble each component in the order it was installed.

Decommissioning costs vary by location, turbine size and technology age.

The Institute for Energy Research reports that new European wind projects commit to set aside 2% to 3% of the capital cost each year of its operating life to cover decommissioning costs. In addition to labor costs, estimates for end-of-life activities should also factor in productivity rates, equipment rental and transportation costs. A decommissioning plan should delineate the parts and materials from an installation that can and cannot be recycled. Nonrecyclable materials include the fiberglass used for turbine blades, as well as concrete foundations, which are typically crushed before being transported by barge for landfilling.

The cost of decommissioning can be partially offset by selling recyclable materials as scrap.

Wind farms contain large amounts of steel, copper, aluminum and other recyclable materials and the value of those materials can be significant. For example, a recent demolition study estimated that decommissioning a 100-MW onshore wind farm in New York would cost $6 million. However, the value of recyclable materials at the site was estimated at $4 million, leaving a net decommissioning cost of $2 million. But there was a catch: Because of volatility in the scrap metal market, the county with jurisdiction over the wind farm was unwilling to provide any credit whatsoever for the scrap and required the owner to bond the decommissioning project's full $6 million gross cost. Depending on their appetite for risk and familiarity with scrap markets, other jurisdictions may take similar positions.

However, history demonstrates that it is unrealistic to assume the scrap materials will have no value. Demolition contractors typically include significant credits for scrap in their fixed-price estimates. In doing so, they accept both the risks and the rewards of price volatility. Owners willing to accept pricing risks may choose to receive direct reimbursement for scrap and compensate the demolition contractor based on the actual cost of the work, but that requires oversight and monitoring of the quantities of scrap coming from the sites.

Environmental considerations can impact cost and decision-making.

An offshore location changes the equation on some important elements of wind farm decommissioning as compared to land-based estimates. For example, the concrete in a land-based wind turbine's foundation typically only must be excavated at 3-to-4-feet below grade, which can result in significant time and cost savings. Offshore foundation decommissioning presents a much greater challenge if the entire foundation, including transition pieces, is to be dismantled and removed. The complexity of foundation systems and volume of concrete add to the difficulty of the deconstruction process.

Similarly, the underground cabling in land-based installations is typically abandoned in place due to the approaches many states have adopted to minimize disturbance of agricultural land. For offshore wind installations, the final disposition of cabling is not

so black-and-white. Cables left on the ocean floor often become hosts for coral and other forms of marine life over their operating life. In those cases, leaving cables in place will cause less disruption to the aquatic world than their removal.

Decommissioning is not the only end-of-life option.
Though decommissioning is expected to be the final step when an offshore wind facility reaches the end of its operating life, that date is not written in stone. Owners can delay decommissioning by extending the life of the installation and its individual components.

For example, repairs and maintenance activities can help keep an installation operating beyond its planned life. In other cases, an offshore wind turbine can be partially or fully repowered. With partial repowering, old towers and other assets can be replaced with new technology. A full repowering involves replacing aging turbines with new, often more powerful ones. While this strategy is common with onshore wind developments, it is more challenging on offshore projects. If higher-capacity solutions are installed, difficult and costly upgrades may be required for foundations and other operations as well. Even if a site's life is extended through repowering, it will still need to be eventually decommissioned. Both repowering costs and complete removal costs must be accounted for in the project life cycle costs.

Reaching the bottom line.
Owners developing offshore wind projects should conduct decommissioning studies that address removal costs and end-of-life options. By factoring decommissioning costs into their project's total life-cycle costs and the cost of power generation, they can more accurately estimate their return on investment and avoid cost shocks when the end of life arrives for an offshore wind facility.

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