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WHITE PAPER / **OFFSHORE WIND MARKET COMPARISON**

LESSONS THE U.S. OFFSHORE WIND MARKET CAN — AND CAN'T — LEARN FROM EUROPE

BY Tony Appleton

It's estimated the U.S. has over 4,000 GW of offshore wind potential — four times the amount of electricity needed to power the country. Given Europe's 15-year head start in this sector, U.S. developers might be tempted to take an identical approach. But it's not that simple.

The attraction of utility-scale offshore wind power generation to U.S. developers is undeniable. Offshore wind has the potential to supply vast amounts of clean, renewable energy to cities along the nation's coastlines — without provoking some of the traditional not-in-my-backyard opposition that typically accompanies new power projects. If Europe's more extensive experience with offshore wind is any indication, it can be an economical source of power as well, with costs rapidly dropping in some areas and already rivaling the expense of onshore wind generation.

Given the technological advances in large-scale wind turbines, subsea cabling, offshore foundations and installation vessels, the U.S. would appear well-positioned to leverage the tools of the offshore trade already in use in Europe and elsewhere. Indeed, the experience and technologies of European offshore wind developers is invaluable and can inform the U.S. approach. But key differences between the markets and their supply chains must be understood and addressed first.

FIRST, THE SIMILARITIES

The benefits offered by wind generation to both the U.S. and European power grids are virtually identical. Done properly, offshore wind improves grid reliability and resiliency, reduces congestion and adds capacity while providing economical access to a renewable source of power. It does all this in places that are out of sight to populations that do not want or have space available for new infrastructure.

The U.S. and Europe are also similar in that both are comprised of independent governing bodies that are competing with one another to attract development. Each U.S. state along the Atlantic Coast is analogous to a United Kingdom, Germany or other European country. These states — not unlike many European countries — have a troubled track record of working together on projects, including interstate electric transmission.

In the U.S., individual states are only now beginning to set stakes in the ground to claim their places in the offshore wind supply chain. Some states are taking the initiative to explore how they might participate. For example, Rhode Island and New Jersey are considering ways to become leaders in research, while Massachusetts is considering a focus on training. Other states are reviewing options as well. For offshore wind to be successful, however, interstate cooperation will be necessary.

Fragmentation in both the U.S. and Europe is exacerbated by the web of regulators and operational authorities controlling the power industry and government policy. In the U.S., independent system operators (ISOs) and regional transmission organizations (RTOs) also have a stake in these projects — especially offshore grid projects that cross multiple states. To date, little inter-ISO/RTO coordination related to offshore wind transmission has taken place. While also fragmented, European nations have agreed upon and are working toward national renewable energy action plans.

NEXT, THE DIFFERENCES

From market size and maturation to design and contracting approaches, comparing the U.S. and European offshore wind markets is like comparing apples to oranges.

Market development — The first commercial offshore wind project in the U.S. — a five-turbine, 30-megawatt (MW) wind farm in the ocean waters off Rhode Island — began operating in late 2016. Europe, by comparison, had 105 offshore wind farms among 11 countries at the end of 2018. Europe has a combined 18.5 gigawatts (GW) of offshore wind capacity, as reported by Wind Europe. That is roughly 10% of Europe's total installed wind energy capacity.

European nations built their network of wind farms one by one, beginning with small 5-, 10- and 50-MW projects in the early rounds and building up to larger-scale projects as developers mastered the learning curve. In the U.S., there is an appetite among developers to leverage the technological gains made in Europe and elsewhere and leapfrog directly to megasize developments. This steep development trajectory could create challenges for supply chain and labor resources.

Project drivers — In Europe, offshore wind projects are driven primarily by the desire for cheap, renewable energy, with economic development a secondary, but increasingly

important, consideration. Both factors are also driving forces behind the U.S. offshore wind market — although their relative importance is flipped. States entering the offshore wind market typically lead with the market's significant economic impact, as measured by the potential for tens of thousands of new jobs and billions of dollars in investment.

Given the state goals announced by New Jersey, New York and Massachusetts, the regional market is expected to reach at least 15,000 MW by 2030, resulting in the creation of more than 36,000 full-time jobs and hundreds of millions of dollars in economic impact. That includes, for example, the jobs at wind turbine assembly facilities and in offshore wind farm construction.

The addition of economic development to the equation means several things to U.S. developers, ranging from the prospect of financial incentives to policy ramifications, as well as new rules by which projects are evaluated and awarded.

Design considerations — U.S. developers anticipate leveraging much of the turbine technology, equipment, cabling and substation technology developed for European applications. But they must also do their design homework.

Conditions off the U.S. Eastern Seaboard are different from those in the primary areas for European offshore wind development, which can impact everything from foundation design to equipment installation. For example, wind conditions on the Eastern Seaboard are more consistent than in the North Sea, where a giant wind farm is now being planned to power all of northern Europe. There, competing winds from the Arctic, Atlantic and Sahara are complicating designers' efforts to accommodate changes in wind direction.

In the U.S., wind farms are likely to be located close to shore — usually within 50 miles. In Europe, early projects were constructed within 50 miles of coastal lands, but new projects now under consideration will likely be located hundreds of miles from the coast. Most European wind farms use either monopile foundations — large-diameter steel pipes that are driven into the seabed's sand, silt and clay soils — or jacket-type foundations (similar to small oil and gas platforms), depending on water depth. New technology is also now being used in Europe, including gravity-based foundations and suction bucket foundations. The soils in European and U.S. seabeds are also different, and the use of the cheaper monopile foundation design — the most common in Europe — may not be possible in the northeastern U.S., where gravel and boulders are commonly found below the seabed.

The presence of the endangered North Atlantic right whale and other sea mammals also precludes the use of monopiles in the U.S. due to the excessive noise created during their installation. Instead, American developers are more likely to gravitate toward other foundation solutions, including gravity-based structures that don't require piles or special installation vessels.

Contracting methods — In Europe, offshore wind developers have a number of different contracting methods to choose from. Given that the risks in the European wind market are now generally known and understood, risk concerns are no longer a major stumbling block when considering new contracting methods.

Because the U.S. offshore wind market is still in its early stages, risk is much more difficult to predict and control. Each state has its own regulatory requirements, and the transmission system is largely unplanned. The scope of undefined variables means that developers have — for now — not yet settled on a particular contracting methodology.

Rather, owners of and investors in early U.S. offshore wind projects will carry the bulk of the risk. But they recognize they cannot do it alone. Current onshore wind developers and others seeking to enter the market are forming partnerships with European offshore wind developers and U.S. power design and construction firms that can help them navigate the complex — and often yet unwritten — rules and regulations that will eventually govern offshore generation and transmission, and then bring these projects to completion.

Shipping — Among the biggest differences between the U.S. and European markets are issues related to shipping and the Jones Act, a U.S. law that prevents foreign-owned ships from carrying cargo between U.S. ports. In Europe, vessels can move from country to country and work freely in each. The Jones Act potentially forces developers to use U.S.-built, -owned and -crewed vessels at a time when the number of U.S. offshore wind vessels is limited, creating a potential roadblock in market development.

CONCLUSION

In Europe, the levelized cost of electricity (LCOE) for offshore wind is falling as these projects grow larger and developers leverage technological advances. The U.S. can capitalize on these savings as its presence in the offshore wind market grows. Before diving in, however, it is critical for U.S. market participants to tailor solutions that combine applicable lessons from Europe with the unique needs of the U.S. market. To be successful, the U.S. needs its own offshore wind model. And the time to begin its development is now.

BIOGRAPHY

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