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The U.S. Can Learn From European Offshore Ops

While the emerging U.S. offshore industry awaits federal clearance, Europe's offshore industry yields some valuable lessons.

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The North American offshore wind marketplace is awaiting U.S. Interior Secretary Ken Salazar's final determination of the fate of the Cape Wind project in Nantucket Sound off Cape Cod.

The ruling – which will be based largely on an environmental assessment and environmental impact statement from the Minerals Management Service (MMS), the federal agency that reviews renewable energy projects on the outer continental shelf – will determine whether Cape Wind Associates receives a permit to commence construction. Should the MMS decide favorably, its decision is expected to usher in the U.S. offshore wind industry.

However the issue is settled, the U.S. should look to Europe – particularly North Sea-bordering countries that have already invested heavily in offshore wind farm construction – for guidance about how to effectively build an offshore wind industry.

On the surface, it appears that the U.S. has taken similar steps to European nations by awarding development rights to project developers for offshore wind farm projects in several Northeast coastal states, and by establishing federal programs aimed at financing wind and grid interconnection projects.

However, unlike their European counterparts, these offshore projects are mired by administrative red tape that is severely hindering the development process and the ability to bring these projects online.

Critical support by decision-makers at the federal level is lacking for expediting the permitting process, constructing new grid transmission lines and developing a method to enhance more rapid cooperation among federal, regional and state decision-makers regarding these issues.

As a matter of national policy, such measures at the federal level are necessary to propel the current state of U.S. offshore wind farm development. As demonstrated by European counterparts, key elements are essential for offshore turbine installation, including the following: political and governmental support at the highest levels, sufficient financing, expeditious navigation of permitting and other administrative hurdles, and ample grid interconnection.

European marketplace

By tracing commonalities among various European offshore wind farms, one can see the elemental framework needed to realize proposed U.S. offshore wind farms and why U.S. investment in offshore wind makes economic sense as a long-term strategy.

For years, Europeans in North Sea-bordering countries have embraced offshore wind as a tremendous source of energy generation. This trend has only escalated. Offshore wind power installations in Europe last year grew approximately 57% from 2008, totaling approximately 577 MW of installed capacity.

Currently, nearly 100 GW of European offshore wind farms are being planned by project developers and utilities.

According to the European Wind Energy Association, in 2009, the U.K. (at 285 MW) and Denmark (at 230 MW) led all European countries in offshore wind installations.

Notably, all power generated from these turbines were transmitted through new grid interconnection lines built specifically to connect these turbines to the European grid.

The U.K. and Scotland are focused on capitalizing on offshore wind. Scotland has set a goal of generating from wind power approximately 30% of its electricity by 2011 and 50% of its electricity by 2020.

To date, several installations of large offshore wind turbines have been made in Moray Firth, a triangular inlet in the North Sea, with additional turbine installations forthcoming under the Crown Estate wind power expansion plan.

Together with upcoming installations in the Firth of Forth – where Scotland's River Forth flows into the

North Sea – approximately 5 GW of offshore wind capacity is expected to be generated and transmitted.

In early January, the Crown Estate, the entity responsible for renewable energy development in the U.K.'s surrounding waters, announced the successful developers/bidders in the third round of its offshore wind licensing program. Nine offshore wind farms were selected. Estimates suggest the energy produced from these wind farms will be approximately 32 GW.

As Denmark's offshore wind installations illustrate, it is best to take a long-term approach.

The Crown Estate historically has been instrumental in propelling the U.K.'s offshore wind industry. The first round of winning bids was announced in December 2000. The second round, which resulted in the awarding of 41 projects to 15 developers, was announced in December 2003.

Governmental support through legislative initiatives, coupled with support from senior government executives, is playing a crucial role in round three and other offshore initiatives.

For example, the U.K.'s Planning Act 2008 is intended to expedite the approval process for nationally significant infrastructure projects (NSIPs), including energy facilities like wind farms. Through the act, the Infrastructure Planning Commission (IPC) was formed in October 2009. The IPC takes the decision-making and approvals process out of local areas and puts it in the realm of the IPC.

The IPC was created to accomplish certain goals, including adhering to a strict timetable for hearings and the decision-making process for wind farms, as well as being the entity in which final approval authority for major infrastructure projects is vested, thereby eliminating the secretary of state's having final say over major infrastructure decisions.

The IPC is endeavoring to create a fast-track process, wherein the approvals process for NSIPs is shortened from approximately seven years to approximately one year. This is a positive step, as having an expedited review process will alleviate the approval time bottleneck for offshore wind projects.

Top British government officials have endorsed legislative initiatives impacting offshore wind and the energy sector. Ed Miliband, British secretary of state for energy and climate change, has extolled the virtues of capitalizing on the U.K.'s access to prime European wind resources to promote the British energy industry's growth.

Also, British Prime Minister Gordon Brown has publicly lauded the third-round efforts to advance offshore wind in the U.K., noting that policies supporting offshore wind energy have catapulted it ahead of other countries in reducing carbon dioxide emissions. Brown, in keeping with the aims of the IPC, has stated that the British government will work with developers and the Crown Estate to remove obstacles to rapid deployment of offshore wind turbines.

Denmark

Denmark exemplifies how a relatively small, densely populated country that has limited space for onshore wind farms can reap the rewards of offshore wind.

Approximately 20% of Denmark's energy production currently comes from wind power – an amount proportionally higher than any other country's, in terms of wind power integration and usage. Denmark has set a goal of using wind power to meet 75% of its energy needs by 2025. Given the offshore turbine installations Denmark has implemented over the past few years, this goal appears attainable.

In 2007, Denmark built Horn's Reef – the world's largest offshore wind farm. Located in the North Sea approximately 10 miles off Denmark's westernmost point, Bladvanshuk, Horn's Reef produces 160 MW annually.

More recently, in September 2009, construction was completed on Horn's Reef 2, a neighboring wind farm that will generate 209 MW. Collectively, both Horn's Reef projects produce enough energy to power approximately 350,000 homes each year.

Similar to the positive governmental support in the U.K. for offshore wind, Denmark's energy minister, Flemming Hansen, has endorsed offshore wind power, stating that Denmark's future belongs to offshore wind turbines, even if they are expensive.

This is because offshore turbines, while more expensive than onshore utility-scale turbines, are more efficient, because sea winds are stronger and steadier than onshore winds and because offshore turbines are more powerful and less disruptive to people in established urban environments.

Denmark's experience also illustrates that countries must take a long-term economic perspective when analyzing offshore wind farm investment. If analyzed in a vacuum, short-term start-up costs may appear cost-prohibitive. However, the returns in energy-production cost savings that can be realized over the long term are sizable, substantially outweighing the initial expenses associated with turbine and grid connection.

The U.S. offshore market

The examples that North Sea-bordering countries provide are instructive for states along the U.S.' Atlantic coast.

The U.S. Department of Energy's National Renewable Energy Laboratory's Wind Energy Resource Atlas of the U.S. estimates the amount of wind power available for a particular area in terms of seven wind pow-

er density classes, with Class 1 being the lowest and Class 7 being the highest.

As the wind atlas shows, northern coastal states from New Jersey to Maine have access to Class 3 (suitable for turbines) or higher winds.

Indeed, Class 4 winds (ranging from 12.5 to 13.4 mph) are found in the Atlantic Ocean, including along most of New Jersey's coast; in the southern coastal areas of Long Island, New York; on New Hampshire's east coast; and on Maine's southern coast.

Massachusetts has access to some of the best offshore wind in the country, as areas along the Massachusetts Bay coast and areas surrounding Martha's Vineyard boast Class 4 and Class 5 winds (ranging from 12.5 to 14.3 mph), as well as Cape Cod and Nantucket Island, where winds are classified as Class 6.

The Obama administration needs to support coastal, deepwater and offshore development.

Cape Wind, a 130-turbine wind farm proposed to be located in Nantucket Sound to take advantage of these winds, would be able to generate enough energy to supply approximately 75% of Cape Cod's power needs.

Northern coastal states, which are relatively small and densely populated, like Denmark, need to consider the differential in the amount of energy offshore wind turbines generate versus onshore wind turbines.

The power that can be derived from wind is proportional to the cube of the wind speed. Therefore, wind in an area with an average Class 4 wind speed of 13 mph could theoretically generate 30% more electricity than an area with an average Class 3 wind speed of 12 mph, as the cube of 13 (13 x 13 x 13 = 2,197) is approximately 30% greater than the cube of 12 (12 x 12 x 12 = 1,728).

Small differences in wind speeds have a substantial impact on the amount of electricity generated. In turn, the potential amount of energy that offshore wind can generate is considerably greater than what onshore turbines can produce – particularly in northern coastal states, where on-land wind speeds are generally weaker.

As densely populated urban areas provide limited siting options for utility-scale onshore wind farms near major transmission and distribution centers, northern coastal states should seriously consider the benefits they could reap over the long term by investing in offshore wind farms.

Grid capacity

Grid transmission and restructuring are major issues for wind power development. The current energy grid was not built to accommodate power from multiple renewable energy sources that connect to the grid at the source of generation and can produce a surplus of energy.

As a result, transmission and load capacity are not presently suited for a large-scale influx of wind energy. Currently, curtailment – the situation when the power produced from utility-scale wind turbines exceeds the capacity that the grid line can handle – is a significant issue.

As energy transmission organization statistics illustrate, wind energy has significant potential for powering northern coastal states. The regional transmission organization that coordinates the movement of wholesale electricity in much of this area is PJM Interconnection.

Of the active generation in the PJM Interconnection queue as of September 2009, approximately 44.5 GW of energy generation – more than half of the total amount of energy generation in the grid interconnection queue – was from wind power, with natural gas (approximately 23 GW), coal (7.8 GW) and nuclear energy (7.5) being the second-, third- and fourth-largest energy generators, respectively.

As these statistics illustrate, wind power comparatively dwarfs the other sources of energy in terms of potential new production supply, generating more energy by itself than all the other energy sources in PJM combined.

Because offshore wind's energy potential has not yet factored heavily into the mainstream American public's consciousness, renewable energy-use projections in PJM states are estimated to total only 8% of the energy mix by 2015.

While there are currently no renewable energy deliverability requirements, wind energy's potential for contributing large amounts of clean energy into the energy grid should not be underestimated, particularly insofar as a number of states have set state renewable portfolio standards to utilize wind and other renewable energy sources to meet increasing total energy demand.

The problem, though, is that there is an immense amount of west-to-east flow of renewable energy across the transmission system, wherein a tremendous amount of wind energy is imported into northern coastal states from land-based generation sites in the Midwest.

PJM's transmission projections show that states such as New Jersey, which has several offshore wind farms slated for construction off its coast, will be importing a vast amount of wind energy from wind farms in North Dakota, South Dakota and Nebraska.

Billions of dollars will need to be invested in transmission infrastructure to make a cross-country, interconnected grid viable. When weight is given to the overall carbon footprint created by the vehicles, machinery and equipment involved in the creation of such a Midwest-to-East Coast transmission system, the relative size of the overall carbon footprint is enormous. Consid-

eration must be given to whether the all-in costs of such transmission lines are an optimal proposition or if there is another more viable solution.

It makes more sense economically for northern coastal states to minimize their reliance on wind power generated in other states by installing their own offshore wind farms and related interstate transmission lines.

Interconnection

Interconnection points for wind transmission play a major role in the ability to integrate wind energy onto the electric grid. Northern coastal states' densely populated urban areas provide limited siting options for large wind farms near major transmission and distribution centers, making onshore wind farms close to these areas relatively unfeasible and offshore turbine sites the better choice for new points of grid interconnection.

In March 2010, the Governors' Wind Energy Coalition, a bipartisan group comprising 29 U.S. governors, issued its 2010 wind energy recommendations in a report titled "Great Expectations: U.S. Wind Energy Development."

Recognizing that wind is clean, abundant and readily deployable – and that there is strong public support for expanded development of renewable energy – the report calls for the current administration to support coastal, deepwater and offshore wind development; streamline the permitting process for offshore wind projects; and launch a new interstate electric transmission system that will provide access to offshore wind farms.

Encourage prompt development of offshore wind. Calling for increased research, development and federal funding, the report recognizes the need for the development and installation of offshore turbines and the placing of transmission lines in deep water.

Not surprisingly, the report cites the U.K., Germany and Denmark as examples the U.S. should follow in the active deployment of offshore wind turbines.

One distinction the report makes between European coastal waters and those of the northern coastal states is that European coastal waters tend to be shallow, extending to depths of 100 feet or less, whereas in the U.S., the continental shelf drops off more steeply.

While the report indicates that advances in deepwater turbine deployment are in their initial stages, it expresses that prompt, further investment and investigation into this area is necessary, as the U.S. stands to lose any competitive advantage it may gain in this technological race if it does not take expeditious and aggressive action.

Several governors deem offshore wind development a national energy priority.

The governors advocate for prompt implementation of measures outlined in the Wind Energy Research and Development Act of 2009 (H.R.3165), which passed the U.S. House of Representative in September 2009.

Some of these measures include investing in the wind manufacturing sector to enhance domestic technological innovations in transmission, turbine blade design and other offshore applications.

The governors, consequently, implore the administration to deem offshore wind development a national energy priority and to mandate that federal government agencies work with states to actualize offshore wind opportunities.

Launch a pilot program for a streamlined permitting process. Summoning Congress to approve legislation that facilitates efficient and prompt review of wind farms on federal lands and offshore coastal areas, the report proposes the establishment of a pilot program for streamlined permitting.

The program the governors envision would last three years and be coordinated at the federal level. It would accommodate collaboration among federal agencies (such as the U.S. Department of the Interior, the U.S. Department of Defense, the Federal Aviation Administration, the U.S. Environmental Protection Agency and the Federal Energy Regulatory Commission) and states, where overlapping jurisdictional matters are an issue. Strides could then be made to implement an expedited regulatory review process at both the state and federal levels.

Develop a new interstate transmission system. Noting that transmission investment has not kept pace over the last 20 years to accommodate renewable power and that the cost of a new transmission system would be offset several times by the savings that would occur, the report expresses the need for a national policy that facilitates state and regional coordination for the siting, permitting and construction of new interstate transmission projects for renewable resources.

The governors acknowledge that access to distant resources for renewable energy transmission requires the passage of energy through several intermediate systems over wires that may be inadequate for handling increased electron traffic. Recognizing that each state has its own energy transmission approval process, the report makes a request for federal and regional cooperation and coordination among states to facilitate the transmission-line approval process, including the addressing of concerns from all stakeholders. WP

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