Can Offshore Wind Overcome Port Challenges in Time to Meet Expansion Goals?

The offshore wind energy sector will only grow in so far as its ports can support the development of the industry. Ports are required to move everything from skilled personnel to massive turbine components between factory, base port, and sea, and without ports of sufficient number and size, the offshore wind energy sector will stymie.

Certainly it is possible to transport anything from one location to another given sufficient force of will and determination, but the more complex and involved the procedure, the more expensive it becomes. Given the hoped-for rapid expansion of the offshore wind energy sector, costs for transport must remain affordable in order to keep the industry competitive with other forms of power generation.

Unfortunately, in some regions, it appears that less thought has been given to developing the necessary ports that will support the expansion of offshore wind energy – a failure that may prove to be the undoing of the industry if it is no attended to, and soon. Both port owners and turbine manufacturers and transporters will need to work together in collaboration to find solutions in order for today's offshore wind energy industry to take its place as a global leader in energy generation.

Unique Challenges of the Offshore Wind Energy Sector

Compare offshore wind turbine components to a simple sea shipping container and you soon begin to appreciate that the demands of the wind sector are far from ordinary. If the size and weight of these components wasn't enough to require differentiated equipment – they're so large that they require specialized handlers to move them – than the shape certainly is.

Consider that the average wind turbine component cannot fit inside a container, and is not easily organized or stacked. Turbine blades are long and fragile, and towers and nacelles are heavy and awkward. In addition to the specialized handling

equipment required to transport these components, additional space on land is required for manufacturing, assembly, and staging for transport.

And unfortunately, the size and shape challenges of wind energy components is not likely to get better in the future, but rather more pronounced, especially given the latest 6 MW and 7 MW turbines which are bigger than ever. The European Wind Energy Association (EWEA) estimates that as wind farms are located further offshore where wind speeds are substantially higher, the turbines will continue to grow in size rather than shrink as they have done historically in the electronic sector.

The land to sea transport challenges directly related to ports as they pertain to wind turbine components are not unique to ports. Getting components to ports also impacts how well a port functions as a conduit to developing the offshore wind industry. Not only do ports need to be ideally located for transporting turbine components, they will also need to be adequately connected to both railways and roads that can handle the size and quantity of equipment being shipped out to sea. The size of wind turbine components creates unique challenges for both rail and road transportation, and many ports are located in urban centres where there is insufficient space to manoeuvre them into place.

And since many components will be pre-assembled at port, ports used for the movement of turbine components also need to have adequate space for staging and moving components in the assembly process. Here again, urban centres may prove to be ill-suited to the offshore wind turbine industry given that the manufacture and assembly of these structures requires a great deal of land and space.

Further, quays need to be of sufficient strength, cranes need to be of sufficient capacity, and the water at these ports needs to be of sufficient depth in order to handle these massive components and the ships that will transport them. Yet because of environmental and tidal restrictions, many ports are unsuitable. They either cannot be dredged to increase the water depth, or the seabed cannot handle the increased weight of larger quays.

Another important challenge related to ports and offshore wind energy development is the need for a workforce with the necessary engineering and technical skills close

at hand. All of these factors play an important role in determining the success or failure of the port expansion needed to support the wind energy sector, and may prove to be the lynchpin that severely slows the progress of the industry.

Offshore Wind Expansion Plans Outstrip Port Expansion Plans

Yet despite these challenges, the offshore wind sector is determined to grow. Consider, for instance, that the UK currently has plans to expand the offshore wind energy sector by adding 15,000 turbines over the next 15 years. Given that 5% of all offshore wind turbines will require maintenance within the first year, the number of ship movements solely related to the offshore sector could number close to 10,000 per year.

The A2Sea Design

And keep in mind that the EWEA has set 40 GW of energy as the target for the offshore wind energy sector by 2020. That will require the manufacturing, installation, and start-up of three to four offshore wind turbines every single working day over the next 12 years throughout the EU.

This poses not only a tremendous opportunity for expanding ports in the UK and other European nations for shipyards, shipping and logistics companies, port operators, and specialized facilities and ships, but also an enormous challenge.

Some have argued that the recent financial downturn had a big impact on activity at UK ports, making room for the increased activity that the offshore wind energy sector would stimulate over the next 15 years. And although this may have been true in 2011, it is no longer the case given that regular activity at UK ports has picked up again.

Thankfully, the UK government recently invested £60 million in infrastructure for the ports, but more is definitely needed. Other European countries, like Germany, are planning similar port expansions to keep up with the demand. At the same time, the upfront costs required for port development need to remain within manageable limits in order to ensure the profitability of the wind energy sector – too high, and investors may feel the expansion is not worth it.

Innovations for Making Port Transport of Offshore Wind Components Affordable

Both port owners and manufacturers of offshore components are working hard to come up with affordable solutions for making the expansion of the offshore wind sector possible. One solution for overcoming transportation challenges for large turbine components is to locate the manufacturing facility as close to the port as possible. But as already mentioned, this is a limited solution for many ports given land constrictions.

Even more effective is to create wind turbine installation vessels (WTIVs) which can accommodate the assembly of turbines at sea. Sometimes known as mono-vessels, WTIVs are carry and install turbines and foundations. Traditionally, tugs were used to move vessels carrying components to and from the installation site, but WTIVs have larger capacity and are self-propelled, making it possible for them to collect components from the production line and then perform the installation themselves. This helps to minimize costs associated with movement from

The Gravity Base Foundations design

port to sea.

The A2Sea Sea Installer is one such model. This wind turbine installation vessel has a higher transport speed than conventional vessels and can operate efficiently in challenging offshore conditions. In some cases, the vessels can receive components directly from the production facilities, with the capability of stacking blades across the back deck and allowing them to overhang the front, making loading logistics much simpler. It is also designed with exceptionally long legs, which enables it to work in deep water. The main crane is positioned to maximize deck space to further facilitate installation. Together, these innovations make the transition from land to see much smoother.[i]

Gravity Base Foundations (GBF) is tackling the port problem in another way. They have created their specialized foundations to make onshore assembly the priority in order to minimize the need for costly offshore assembly. Unlike jack-up barges and floating cranes which are expensive and difficult to come by, these foundations work by adding and subtracting ballast to sink and raise the deck for loading and unloading the turbine as it is put together. It can then be sunk into position for installation at sea, and refloated when it's ready to pick up the next turbine. These foundations operate in up to 55 metre depths in a range of seabed soil conditions and up to 200 miles offshore.[ii] The design helps to improve safety and quality and speed productivity.

Next Steps for Offshore Wind Development and Port Improvements

Given increased interest in offshore wind and their expanding sizes, the port challenges for this specialized area will become even more complex in the coming years. Greater ingenuity is required to overcome these issues.

In addition to modifications of individual component design, size, and weight, as well as tweaks to where and how turbines are manufactured and assembled, the industry may need to look for ways to develop unconventional ports to replace conventional cargo, fishing, and passenger ports. Using a combination of innovative techniques, this approach may be a more manageable solution for achieving the expansion goals of the offshore wind turbine industry.

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Sources:

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[i] *SEA INSTALLER: The Installation vessel for the future*. (n.d.). Retrieved April 9, 2012, from A2Sea: http://www.a2sea.com/fleet/sea_installer.aspx

[ii] *Integrated Solution for Offshore Wind Turbines*. (n.d.). Retrieved April 9, 2012, from GBF: http://gbf.eu.com/index.html