Feeder solution, installation and maintenance using motion compensation in the USA

The offshore wind market in the U.S. is about to take off and there are enormous growth projections. For the installation of the first wave of U.S. wind parks starting in 2020, European built and operated installation jack-ups will be needed, because currently no U.S. built jack-ups have the capacity to install the turbines. Nor will this type of equipment be built in time in the U.S. PES takes a closer look at the options.
There are plans to build installation jack-ups in the U.S., but it is likely that these will only kick-off after the first wind farms prove to be a success. Aside from this, the infrastructure of the U.S. ports is not suitable for these big vessels, there are bridges and hurricane breakers preventing the jack-up installation vessels to enter or leave the harbors. New hubs and ports will have to be developed before U.S. flagged installation jack-ups will become a practical tool for the installation of the parks.

The problem with using European installation jack-ups, apart from the mentioned infrastructural problems, is the Jones Act. The Jones Act requires vessels transporting merchandise from U.S. point to U.S. point to be U.S. manned, built, flagged and owned. Offshore wind farms are defined as U.S. point and turbine components are defined as merchandise. Consequently, the European installation jack-ups will not be able to transport the turbine parts to the wind parks from U.S. ports. This means a feeder solution is necessary to transport the turbine parts to the jack-ups.

Traditional feeder solutions are small jack-ups or feeder barges. The first Block Island wind park in the U.S. was constructed using small U.S. jack-ups as feeder barges. A normal feeder barge is extremely limited by swell and waves, creating a small operating window and unsafe situations for lift-off. So, finding a suitable supply solution for the U.S. offshore wind market is crucial for the kick-off.

A solution is to use motion compensation for the feedering. A motion compensated platform can be placed on any U.S. flagged vessel or barge, with the wind turbine components on top. After transportation to the Installation jack-up, the motion compensation can be turned on, creating a stable lift-off platform, eliminating the wave motions, increasing the safety and the operating window.

To increase the number of turbine parts to be transported, multiple systems can be used. Either integrated into one system, with a higher capacity, or operating stand alone. They can also be combined with a skidding frame. After one component is safely lifted off the motion compensated platform, the motion compensation can be turned off and the next component can be skidded onto the platform. After the motion compensation is turned on again the operation can be repeated as necessary.

Barge Master launched their motion compensated platform, the BM-T700, in 2013 and the platform has proved the feeder concept works in various supply operations. By compensating the motions of the vessel, the platform effectively turns the deck space into a perfectly stable working area. The BM-T700 creates a
stable lift-off base for a maximum weight of 700 tons, in sea states up to heights of 2.5 meters. It is also certified by Lloyds under the lifting appliances rules.

An added benefit of using a feeder solution to the installation jack-ups is that they can continue their work offshore and don’t need to sail up and down to the HUB. Hence, this motion compensated feeder solution could also be of huge potential to the ‘regular’ offshore wind market in Europe. The installation jack-up goes from turbine to turbine and the motion compensated feeder barge sails up and down. This also means there is no need to use expensive dry docks in the ports and smaller access is required.

Looking ahead, there is a big possibility that the future U.S. wind parks, and even European parks, will consist of floating turbines, so as to overcome the deep-water depths and NIMBY (Not In MY Back Yard) effect. In this happens new installation techniques will be unavoidable and floating motion compensated installation and maintenance necessary.

Floating maintenance and installation:

This example of a motion compensated feeder barge shows the potential that motion compensation can have for the installation and maintenance of offshore wind parks. The offshore wind industry is an exciting and relatively new field, but too often old techniques are being used. We have seen that motion compensated gangways have become a commodity in the market, but other motion compensated solutions are still barely used, even though the applications are limitless.
Motion compensation can be used for blade replacement. We know that the blades on some of the first turbines are ready for replacement, which is a very costly operation to do with jack-ups. By equipping a simple vessel with a motion compensated platform and crane with a blade replacement jib on top, the blades can be replaced floating. This makes the operations a lot quicker, more independent of weather conditions and ultimately cheaper.

Drilling of the foundation piles for the turbines can be done by placing a drill set, with a simple land-based crawler crane, on top of a motion compensated platform. This also decreases the environmental impact because the sea bed does not have to be touched with a floating solution and increases the available options.

Looking at even bigger motion compensated systems, there is the development of the motion compensated pile gripper. This gripper allows for floating installation of monopiles, offering a real alternative to the installation jack-up.

Next to these developments other smart new techniques are becoming available, which have huge potential, but too often the different systems are not fully integrated and so miss out.

The Dutch start-up Next Ocean has developed wave prediction software, with very promising first results. If this software can be integrated with motion compensation, the operating window can be largely increased. Only one wave limiting the workability can be detected and operations can therefore continue in higher sea states.

The Dynamic Positioning (DP) of the vessel can be smartly integrated with other systems, like for example a motion compensated gangway. A motion compensated gangway operates best in its midstroke position, by making sure the systems work together. The midstroke position of the gangway can be used as a reference point for the DP, increasing the operability.

Bosch Rexroth is developing the concept of predictive motion compensation. This algorithmic software can increase the workability of motion compensated systems even more.

Smart solutions are needed for smart installations. By using motion compensation technology, a big part of the offshore operations can be done by floating from much smaller vessels. It can change the logistics of offshore operations, as well as making installation in deeper waters possible.

New methods need to be used for the wind parks of the future. Motion compensation can play a crucial role in supplying, installing and maintaining these parks more efficiently, cheaper and most importantly safely.

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