PO.025

A Game Changer for O&M

David Matthews, General Manager UK
Fred. Olsen Windcarrier

Fred. Olsen Ocean

Abstract

Strategies for O&M for larger projects developed far offshore depend on both transit time to the turbine and turbine accessibility, the latter a consequence of sea conditions and vessel behaviour. Strategic approaches to such project logistics currently widely propose to use a floating offshore accommodation vessel namely an Service Operation Vessel (SOV). Based on a recent study this paper reports that new alternatives are now available when considering fixed offshore accommodation to improve turbine time-based availability. This report demonstrates the complexity of modelling O&M scenarios and introduces the game changing concept developed by Fred. Olsen Ocean – a fixed offshore accommodation and service platform which is designed to accommodate a mix of vessel spreads including crew transfer vessels (CTVs) stationed offshore alongside the platform. This report shows on this reference site that turbine time-based availability improves and provides personnel comfort in a fixed platform thus improving health and safety standards and increases productivity by reducing seasickness. The proposed, Fred. Olsen Windbase, is relevant to large far offshore wind farm developers where WTG numbers exceed 70. Fred. Olsen Windbase drives down LCOE by improving safety and productivity of people. Fred. Olsen Windbase is a game changer for these large unique projects and challenges, current thinking and strategies. To properly study the concept, industry consultation was carried out and an O&M simulation was conducted.

Objectives

The objective was to simulate a project and test the robustness of the proposed marine logistics solutions available for large scale offshore wind farms. To do this, various scenarios have been created. The more availability, the higher the revenue generated by turbines. Two key parameters where used to define success of one system over another:

1. Time based availability of the wind farm. Time based availability is an important measure of the performance of a wind farm which is the proportion of the time that a wind farm as a whole, is technically capable of producing electricity.
2. The cost per hour of availability which is a measure of the total cost of the logistics divided into the hours of availability.

Note: It is important to remember that each site is different. The site used in this study was UK based, 100km from the nearest O&M port and used Metocean data specific to this site. Others site would conclude differently on the best and most economical marine spread.

Methods

A careful analysis of the large scale far offshore wind farm O&M marine logistics simulations was conducted using the MAINSYS™ software[1] to understand which logistics solution would provide maximum turbine availability at the lowest cost.

Fred. Olsen Windbase worked closely with developers, turbine manufacturers, and Fred. Olsen related companies such as Global Wind Service, Fred. Olsen Windcarrier, Dolphin Drilling, Marine Operations and Harland and Wolff to gather data for this simulation.

Three logistics solutions were considered:

1. 1 x SOV combined with offshore helicopter support
2. 2 x PSVs combined with Windbase with offshore helicopter support
3. 3 x CTVs combined with Windbase with offshore helicopter support

Note: Platform Supply Vessels (PSV) are converted vessels from O&G that have a walk to work system similar to an SOV but without the cost or complexity. Personnel would sleep on Fred. Olsen Windbase when not working.

Particular attention was paid to define the strategy for workflow from alarm to repair, work order and logistics prioritisation and assignment process, failure modelling, failure rates and repair procedures.

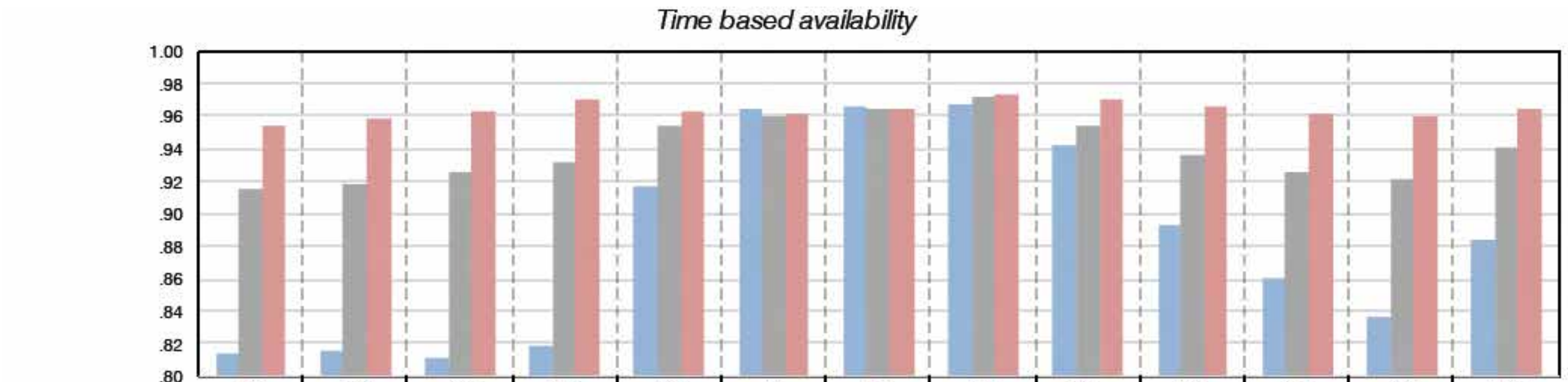
Simulations used 5 failures per WTG per year increasing to 10 failures per year. This sensitivity analysis allowed the simulation to test the robustness of each logistics spread. Each simulation was run for a period of 18 years.

Results

The simulation results show a significant difference when unscheduled failures rise. As the failures start to rise above 5 per year per WTG the systems start to fail for different reasons. The worst case scenario shows the 1 x SOV start to fail first dropping from 95% to 82%. The second best was 2 x PSV which fell from 96.5% to 90% and best performing when stressed was the 3 x CTVs which fell from 97.5% to 95%.

When comparing the total cost per hour of availability a single SOV was in first place. In second was the 3 x CTVs with Fred. Olsen Windbase and in third was the 2 x PSVs with Fred. Olsen Windbase.

Multiple access systems significantly increase time-based availability. The reduced time to respond to WTG failures is significantly different from one system over another when stressed with weather and random failures. Failures randomly occur across the total area of the wind farm, this challenges the speed at which vessels can deploy technicians. The fuel each system burns in this simulation also plays a role in the total evaluation of one system over another.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
HP/SOV/Heli+seas.	81.44%	81.53%	81.04%	81.85%	91.70%	96.42%	96.59%	96.67%	94.21%	89.34%	86.06%	83.57%	88.41%
WB/2PSV/Heli+seas.	91.50%	91.78%	92.49%	93.23%	95.35%	96.03%	96.40%	97.18%	95.45%	93.63%	92.59%	92.13%	93.99%
WB/3CTVs/Heli+seas.	95.37%	95.91%	96.28%	97.02%	96.24%	96.15%	96.48%	97.33%	97.02%	96.63%	96.20%	95.93%	96.38%

Figure 1. 10 failures per WTG per year (worst case)

The simulation output in Figure 1.10 from the worst case shows the relative capability of one system over another. All systems performed well in the short summer months but failed drastically in the winter months when revenues are highest.

Conclusions

1. SOVs are an excellent solution. At some point the ability of a single SOV is compromised by the number of WTGs and the area it covers. The walk to work system is best suited for sites where sea states are consistently higher than normal and cannot be sufficiently covered using traditional larger CTVs coming to market today. Fuel consumption, charter rates and the walk to work reliability should also be considered when one SOV is used.

2. Utilisation of personnel is key to the time-based availability. Personnel should be deployed quickly and in parallel in short weather windows. This can only be done if multiple access systems are deployed. Larger WTG number mean 30-40 technicians. Having them stood waiting through the day to access WTGs is a poor utilisation of resource.

3. Simulate and keep simulating. Software and increased processing power and speeds means that simulations can be done quickly with multiple sensitivities in play. This reduces risk and takes the burden of knowing offshore away from the developer and into the hands of those companies that create simulation software.

4. Fixed offshore solutions like Fred. Olsen Windbase have a role to play in creating an efficient and safer working environment offshore.

References

1. Marine Logistics Study Report for Hornsea One, Shoreline
2. Wind Farm Service Vessels – An Analysis of Supply and Demand, 4C Offshore
3. Offshore Wind Power: Big Challenge, Big Opportunity, The Carbon Trust