

Key Innovations & Research Required for Floating Offshore Wind Turbines Major Repairs

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1. Introduction

There is no significant body of knowledge around floating offshore wind turbine major repair due to the novelty of floating offshore wind technology. Major repair concepts currently applied to floating offshore wind turbines are adapted from fixed bottom offshore wind turbines, oil and gas installations, and marine industries such as ship building. This cross industry application approach to major repair leaves significant gaps that need to be addressed on floating offshore wind turbines due to the unique nature of floating offshore wind turbines.

A research study which forms part of a PhD research was conducted to understand the key issues around major repair on floating offshore wind turbines. This research was carried out by interviewing a cross section of industry experts.

2. Approach

Floating offshore wind is still in its infancy thereby making it difficult to find significant operational experience. So at the moment, ideas on major repair of floating offshore wind turbines come from operational experience of other marine industries such as oil and gas, fixed bottom offshore wind turbines, marine infrastructures such as ship building, bridges, ports, etc.

The approach adopted in this research is to interview a selection of experienced personnel across these allied industries to understand from these experts where practices from these industries could be applied directly to floating offshore wind major repairs, and where they think innovation will be required to modify practices in these industries before they could be applied to floating offshore wind, or even where new research and innovation are required to develop entirely new practices and procedures fit for floating offshore wind major repairs.

3. Main body of abstract

Major repair on offshore wind turbines usually involve the replacement of major components at nacelle level. Major components that fall under this category are: blades, drivetrain, gearbox, main bearings, and generator. These are fairly heavy components that require to be removed or lifted into place using big crane vessels offshore. Therefore heavy lift is a critical aspect of major repair on offshore wind turbines.

For fixed bottom offshore wind turbines, jack-up crane vessels are used to provide heavy lift operations for major repairs. However most floating offshore wind turbines will be installed in water depth greater than 45m which is currently the technical and economic threshold of jack-up vessels. Therefore the options of carrying out heavy lift on floating offshore wind turbines are:

- a. Floating crane vessel.
- b. Jack-up vessel at port or sheltered water.
- c. Innovative method.

Either of these methods present their own challenges which are not currently well understood, or are understood but there are no qualified and acceptable tools or procedures for the operations. Therefore this research study has identified those key issues requiring further research to fully understand them, or those issues which are well understood, but innovative solutions will be required to develop the tools and procedures which will allow safe and economic heavy lift operations on floating offshore wind turbines to be undertaken.

4. Conclusions

The research has highlighted a number of important innovations and further research that need to happen in order to develop acceptable processes and procedures around major repair on floating offshore wind turbines.

These innovations and issues requiring further research are:

- a. Major component lift into and out of the nacelle
- b. Crew transfer to floating offshore turbines
- c. Crew wellbeing on floating offshore turbines during major component replacement
- d. Crane vessel requirements
- e. Electrical circuit layout due to disconnection of floating turbines
- f. Dynamic cable disconnection and connection and associated fatigue
- g. Repair commissioning
- h. Turbine major components reliability

5. Learning objectives

The findings from this research will help to inform academia and researchers where significant research is needed to understand the issues presented here. They also help to inform the supply chain where innovation is required to develop robust technologies, processes and procedure that will be required to enable safe and economic major repair on floating offshore wind turbines.