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OPERATIONS AND MAINTENANCE of an OFFSHORE HYDROGEN WIND TURBINE FARM

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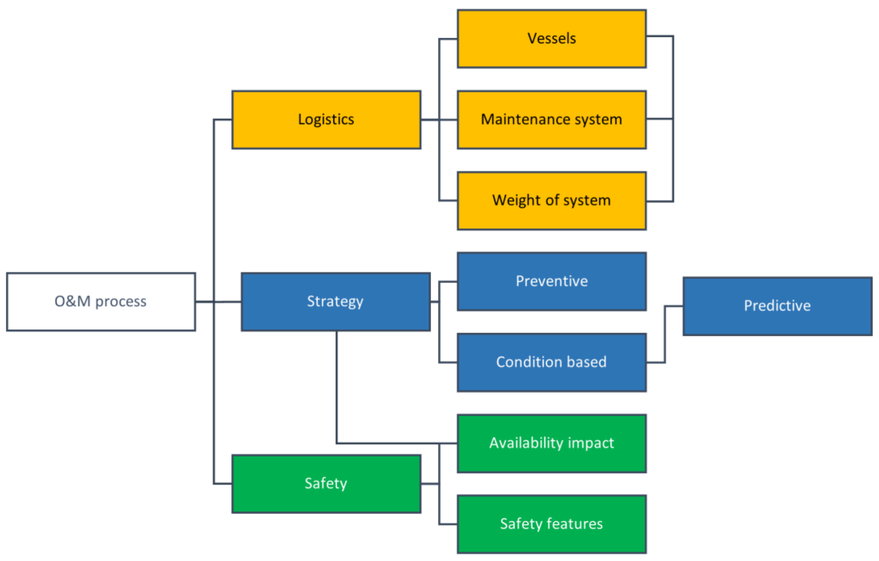
1. Abstract

With the expected growth of the Hydrogen market in the coming years, developing a low-priced green hydrogen is key to ensure the transition to a sustainable energy system. The Offshore Hydrogen Wind Turbine (OHWT) project investigates the concept of possibly integrating an electrolyser with an offshore wind turbine. This report has a purpose of studying several different scenarios and configurations presented by Siemens during the meeting and in the project documentation, and determining how the scheduling of maintenance, that varies in frequency, failure rate (probability) and downtime, of those scenarios impacts yearly production of hydrogen. Overview of selected configurations with detailed descriptions and backgrounds is presented and followed up by the simulations to quantify presumptions and provide a clearer picture of the configuration's operational period. Lastly, these ideas and developments are summed up in the conclusion chapter with reflections and suggestions being proposed for future work..

2. Offshore Hydrogen Wind Turbine

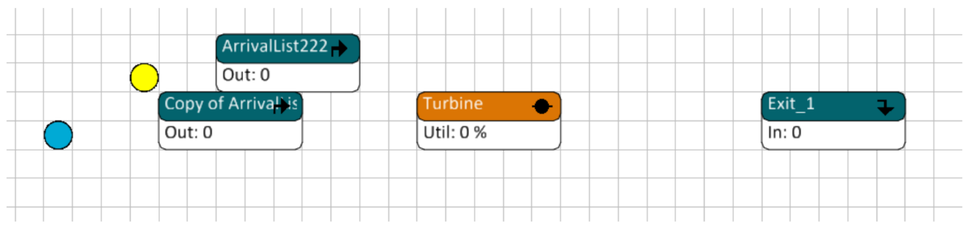
Hydrogen holds significant potential in various market sectors, such as aviation, industry, maritime, trucks, building heating, and power generation. In aviation, hydrogen is seen as a promising fuel, offering zero greenhouse gas emissions and the potential for substantial carbon footprint reduction. The industry requires advancements in fuel cell technologies and hydrogen refueling infrastructure for widespread adoption. In the industrial sector, hydrogen serves as a valuable alternative as a sustainable energy source, particularly in chemical production, fertilizer industry, steel manufacturing, and reducing emissions in industrial heating.



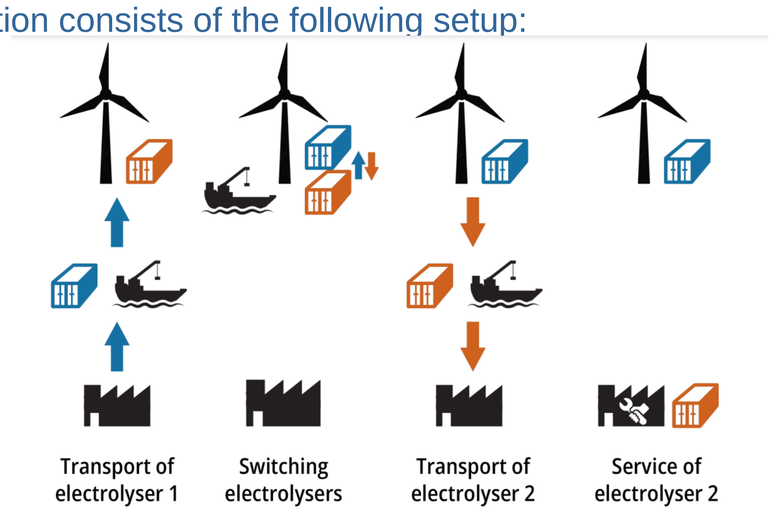
It is important to understand the intricacies of managing the operational and maintenance logistics for offshore wind turbines. This includes the careful planning and coordination necessary to ensure the continuous functionality of these immense structures amidst the challenges posed by harsh marine environments and remote locations. From mobilizing personnel and equipment to optimizing maintenance strategies and supply chain operations, this chapter examines the essential components for the smooth operation of offshore hydrogen wind farms.

3. Simulations and configurations

The main goal of this simulations is to illustrate a general influence of different kinds of maintenance on the yearly production of hydrogen. While as a parameters, other than type of maintenance, also having failure probability and maintenance frequency over a one-year period.



The operations and maintenance for this particular configuration focuses on the optimal availability while implementing a newly designed system that is the high-pressure electrolyser. This configuration consists of the following setup:



The critical points of this configuration is the ability to implement upgrades into the future. If it is expected that a lot of maintenance may be required in the first few years of the use of high-pressure electrolyser, this would be a justified use.

4. Conclusions

For future design of the whole system it is important to keep the operations and maintenance in mind when designing components for the offshore hydrogen wind turbines. The configuration with a high pressure electrolyser and a condition based strategy where the systems are constantly monitored to see when a system needs to be serviced can be interesting for different reasons. As the hydrogen market is expected to grow significantly in the for seen future to 2050 a condition based system can help to spark new upgrades and faster implementations of higher capacity systems. This will result in a more reliable system into the future while still full filling the growing needs for the market.

Regarding the simulation results, the conclusion comes naturally. The less maintenance is performed the less money is lost due to the down time. However, there are several interesting results worth noting and first is the difference between the lost profit in scenarios with three and six maintenance.

Acknowledgement

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