Group 06 - ReWIND

The sustainable energy goals set by The Netherlands rely heavily on the upscaling of offshore wind energy. However, the sector faces countless challenges such as wind farm losses and limited available space. Multi rotor systems (MRS), can achieve larger unit capacities than traditional turbines making it a cost-effective alternative. Additionally, by installing a flow control system, vertical momentum fluxes can be created in order to reenergize the lower Atmospheric Boundary Layer, maximizing upscaling advantages and achieving higher energy densities in wind farms.

Mission Objective

The ReWIND project aims to design a 30 MW offshore horizontal multi rotor system wind turbine capable of re-energizing the atmospheric boundary layer using active flow control, resulting in an increased energy density above 10 MW/km^2. Additionally, it seeks to reduce the environmental impact by 40% and decrease energy production costs 45%, ultimately achieving a better overall Life Cycle Analysis Performance.

System Design

The 30 MW ReWIND multi rotor wind turbine system is designed to fit 34 rotors in a honeycomb shape. The chosen rotors are able to deliver up to 882 kW, jointly achieving the rated power of the wind turbine. A truss structure which supports the rotors is placed on top of a monopile in a fixed-bottom foundation.

Each turbine rises 403 m above the sea level, while its truss structure spreads 278 m width and 365 m high. Multiple walkable platforms are installed along the width of the structure to allow for maintenance jobs. Additionally, an electric pulley system is installed at the top to aid in major repairs and the assembly.

The re-energization of the flow is provided by an active flow control system consisted of three retractable multi-element wings. A chord of 50 m allows the wings, which are placed along the width of the structure, to generate up to 6.5 MN of lift.

The wind turbine is rotated using a differential pitching yaw system accompanied by a motor. During storm conditions, the yaw system is preemptively used to rotate the turbine perpendicular to the incoming winds.

The assembly of the turbine is performed in the port of Rotterdam. Where all the components are built by a diversified and stratified supply chain. After being assembled, a skidway is used to load the structure onto two barges which are used to transport it. During the mating process, the boats are lowered and the structure is placed on its foundation.

In the next weeks, the rough edges of the design will be smoothed out. In effect, the levelized cost of energy (LCOE) will be calculated to ensure the design can remain competitive in the wind energy market. Additionally, the life cycle analysis (LCA) will be performed to ensure emissions of the turbine from assembly to decommissioning are reduced compared to current technology.