

Offshore Wind Development in Atlantic Canada – Regional Metocean and Geotechnical Design Considerations and Opportunities

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Abstract ID: 67

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What Theme Are You Submitting for?: Data, Modeling, and Simulation

Keywords: Wind development, anchor, codes, data, extreme events, floater, geotechnical, icing, monopile, mooring, sea ice, seabed, waves, wind

Atlantic Canada Offshore has enormous potential for developing wind farms, given the strong winds in the region and experience developing offshore oil and gas facilities. Depending on the specific location, there can be hurricanes, strong winter storms, sea ice, icebergs and icing conditions. Other considerations include the varying water depths, seabed soil conditions, distances to shore, and port and electricity infrastructure. The electricity demand also varies between the four provinces.

Wind turbine structures are designed to be relatively light. As a result, environmental loads can result in significant non-linear effects with coupling between the turbine and supporting structure responses, and susceptibility to fatigue. The choice of structure type will be critical. A significant part of the region is at water depths that are intermediary between those ideal for fixed and floating structures.

The presented work provides an overview of the conditions across the region and specific challenges and information gaps. It builds on previous studies of the applicable standards, such as IEC 61400-3-1 and -2, the variation of wind conditions over the region, the relative severities of hurricanes versus winter storms, and the potential for sea ice and iceberg impact loads on floating and monopile support structures. Example OpenFAST analyses are presented for monopile and semi-submersible systems to demonstrate the potential influence of soil conditions on the structural response of the monopile and mooring and anchoring considerations for the semi-submersible. The risk of icing at different locations and potential downtime is assessed. Areas where standards could be better adapted for the specific conditions in Atlantic Canada are highlighted.