Supported by SIEMENS Gamesa RENEWABLE ENERGY

Wind Turbine Assembly Stability Project

Project Scope

This project focuses on the installation process of offshore wind turbines, specifically the so-called pre-assembly activities carried out at the harbor quayside. During this phase (Fig. 1), towers without rotor-nacelle assembly are temporarily erected on freestanding (gravity-based) foundations prior to being loaded out onto special vessels.

Towers are arranged in clusters at close center-to-center distance to ease crane operations (smaller operative radius). Foundations typically have a square mesh of 2xi tower positions, with i=2,3,…,6. Multiple foundations may be present simultaneously, depending on the installation logistic.

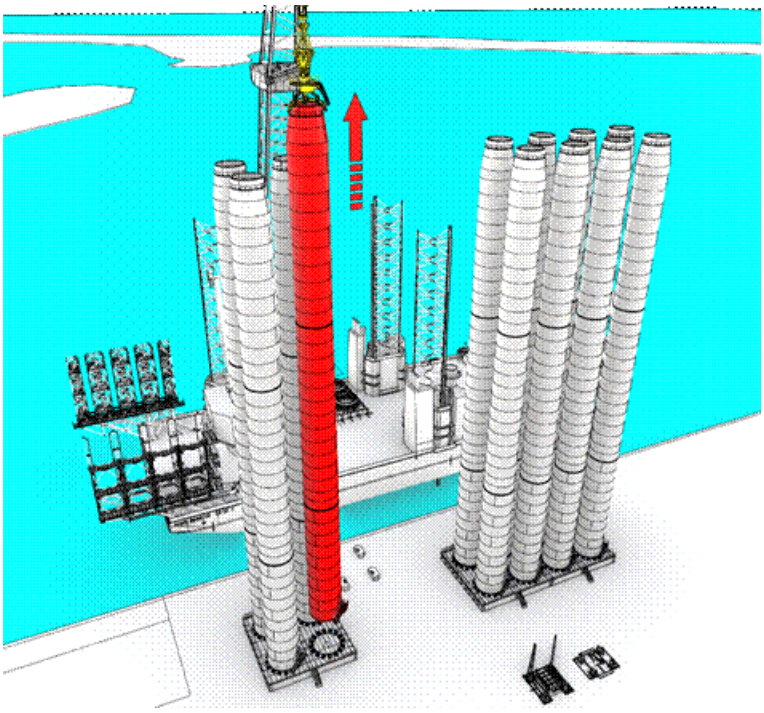

Figure 1: Rendering of towers on the freestanding foundation prior to being loaded out onto the installation vessel (©Siemens Gamesa Renewable Energy).

Towers stay at the quayside for a period typically ranging from 6 to 12 months, depending on the number of wind turbines to be installed and the capabilities of the installation vessels. During this period, the number of towers standing on the foundation varies continuously, following the installation flow. These towers are exposed to environmental actions, such as wind and earthquakes, and the mitigation of environmental-induced vibrations is fundamental to ensure the structural integrity and fatigue resistance of the system.

The scope of this project is to develop a damping device concept to mitigate vibrations induced by earthquakes and/or wind storms. The design should consider the following constraints and input parameters:

- The foundation is a freestanding parallelepiped with dimensions 20 m x 20 m x 2 m (width x length x height). Up to four towers are arranged on the foundation in a square mesh with 10 m spacing, geometrically centered with respect to the foundation footprint.
- The mass of the foundation can be adjusted from 120 t to 300 t per tower position by ballasting with loose material.
- Towers are steel tubes as specified by Table 1 (density of 7850 kg/m3 and Young's modulus of 210 GPa).
- Towers are connected to the foundation via bolted connections.
- The use of tuned mass dampers and tuned liquid dampers inside the towers is not permitted.
- The geometry of the tower cannot be modified.
- The damping device should be adaptable/tunable for towers with different geometry (mass deviations plus-minus 30%).

Segment	*Length [m]*	*Bottom diameter [m]*	*Top diameter [m]*	*Thickness [mm]*
1 (base)	30	6.0	6.0	50
2	40	6.0	6.0	40
3 (top)	30	6.0	4.0	25

Figure 2: Geometry of the tower. All diameters should be read as external diameters.

The damping device should be presented in the form of a 15-minute presentation, including:

- a schematic of the concept;
- results of preliminary analyses/calculations;
- steps forward to further develop and implement the concept.

Timeline

This competition has two phases: the first ends at the beginning of January, wherein each team presents their design to judges online; from here, 2 projects are selected from each university for the in-person finals.

6 October 2025	Applications Open
17 October 2025	Applications Close
20 October 2025	Teams formed
24-28 November 2025	Mentor Check-In (Feedback given)
12-16 Jan 2026	Phase 1 Presentations (Feedback given)
9-13 February 2026	Mentor Check-In (Feedback given)
20 March 2026	Finals