

OFFSHORE WIND TURBINES

Structural Analysis



INTRODUCTION:

Wind Turbines Offshore areas are characterized by strong environmental energy, consequently the loads transmitted to the supporting structure are significant and have a markedly dynamic character. TECNOCONSULT capability, in term of wind offshore design, in addition to the wind resource assessment to capture the technical and economical feasibility, is able to perform the **structural design** of the wind tower / jacket / Tripod (depending on WD and environmental conditions) and the foundation design.

OFFSHORE WIND STRUCTURES:

- JACKET;
- TRIPOD;
- MONOPILE.

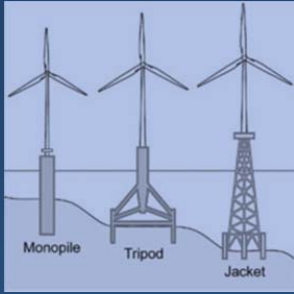


Fig.1 - Offshore wind

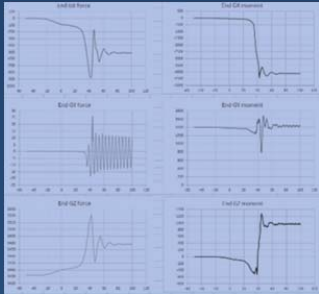


Fig.2 - Force time History to RNA

DESIGN PHASES:

TECNOCONSULT design capability can be summarized as following:

1. GLOBAL ANALYSIS and turbine force time history generation
2. STRUCTURAL DETAILED ANALYSIS:
 - **STATIC ANALYSIS:** response of structural members subjected to the static wind and current drag load and quasi-static maximum wave slamming load.
 - **MODAL ANALYSIS:** Calculation of modal shapes and natural frequencies (Campbell Diagram)
 - **DYNAMIC ANALYSIS :** Calculation of the responses of the structure subjected to the passing stream function wave and the quasi-static tower base loads obtained from the global analysis phase. Calculation of the maximum transient responses of the structure subjected to the wave slamming load.
 - Foundation check with non-linear soil behavior.
 - Joint can check;
 - Fatigue analysis;
 - Seismic analysis.
3. Code Check:
 - LRFD by IEC 61400-3 (2009);
 - ISO-19902 (2007);
 - WSD by ABS;
 - API-RP-2A -WSD (2007);



Figure 3 - Modal Analysis

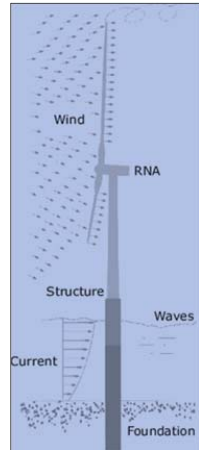


Figure 4 - Dynamic and Seismic

TECNOCONSULT structural modelling are performed by commercial software: ORCAFLEX®, SACS®, ANSYS®.

LOADS and REACTIONS:

The actions / reactions that act on the structure are:



- WIND ON THE BLADES;
- WIND ON THE TOWER;
- WAVES AND CURRENT;
- PILE/SOIL REACTION;

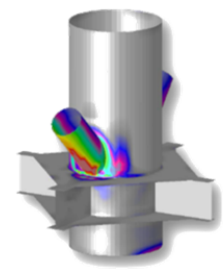
Other specific analysis such as:

- BREAKING WAVES SLAMMING LOADS;
- SCOURING TO THE FOUNDATIONS;

Fig.5 - Environmental Loads

OUTCOMES:

Tecnoconsult is able to calculate global and local deformations, stresses and UC's of the structure assembly subjected to static and dynamic loads during the wind farm lifetime.



FEM ANALYSIS

ENVIRONMENTAL LOADS

