

D7.4 State-of-the-Art FOWT design practice and guidelines

This report provides an overview of the state-of-the-art design practice of floating wind turbine substructures and the relevant guidelines, which are applied in the design process. It summarizes the disciplines addressed in the work packages of LIFES50+: Design, experimental practices, numerical simulation practices, industrialization considerations, and levelized cost of energy (LCOE) and risk considerations, and can be used as benchmarks at the end of the project.

Based on previous research and communication with partners from the LIFES50+ consortium, a general design process was established. This process is based on three key design stages (conceptual, basic and detailed design, see Figure 1: State-of-the-art design process) and includes categories and topics addressing relevant disciplines to be applied in the first life cycle phase of floating offshore wind turbine (FOWT) substructures.

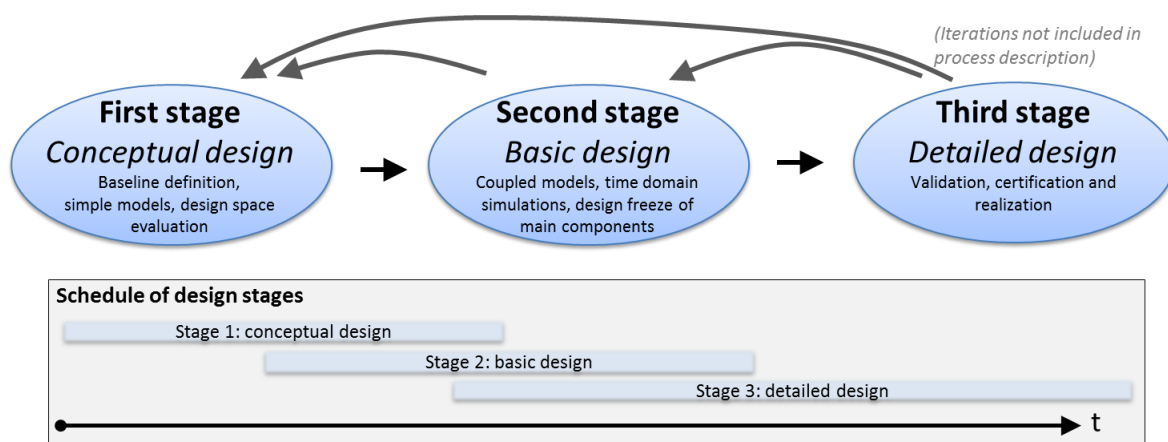


Figure 1: State-of-the-art design process

Adding to this overview, specific topics are addressed in detail:

- **Certification procedures:** The scope of this report is in line with the first steps of the certification process (concept, design base and design). The required steps are addressed in detail to provide indication of the tasks that need to be performed and the information that needs to be provided to the certification body.
- **Design of main components:** Design and evaluation procedures are described for the main components of the FOWT substructure: environmental conditions, tower and transition piece, controller, floating support structure, mooring and anchoring system and umbilicals / dynamic cables. For the assessment of the controller design, a questionnaire was submitted to contacts in industry and research, addressing topics of feedback control, supervisory control and the safety system. The main findings of this questionnaire are described.
- **Experimental design practices:** The different options for FOWT model tests are summarized and common workflows for model validation and certification are described. Additionally, an overview of available testing facilities is provided.
- **Numerical simulation design practices:** Numerical models for the description of hydrodynamics, aerodynamics, structural dynamics and mooring dynamics of floating offshore wind turbines are described theoretically as well as their application in simulation tools at different design steps.

- Industrialization consideration in design practice: Follow-up processes such as standardization, manufacturing, transportation, installation and operation and maintenance that follow the design of the main components are addressed.
- LCOE and Risk: Different approaches for LCOE calculation are presented and the necessary components as well as available calculation tools are described. Methods for risk management assessment of FOWT are summarized and the influence of risk on LCOE is addressed.

The overall design process presented can be used as general reference when designing substructures for floating wind turbines but should be regarded as a high level overview of the complex procedures performed in the industry. The process presented does not cover all details, but covers the basic procedures that are performed. Where applicable, reference is made to available summaries and work from the LIFES50+ project regarding work packages.