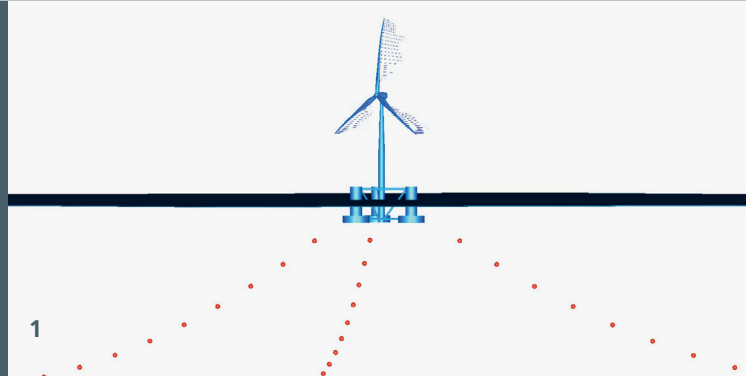


1 *Semi-submersible floating wind turbine system modeled by means of MoWiT, Figure: Fraunhofer IWES*



## GLOBAL TURBINE DYNAMICS OF FLOATING WIND ENERGY SYSTEMS

### Your advantages at a glance

- Sound project planning
  - Draft design for preliminary cost estimates
  - Plausibility check of information from manufacturers
- Cost-effective and customized solutions
  - Floating system optimized in multiple dimensions with respect to, for example, site-specific requirements
  - Scaling of floaters for wind turbines of different power classes
- Optimization potential identified based on the operating performance
- Optimal utilization of the load-yield capacity through precise evaluation of the system and plant conditions
- Customized realization of promising projects

### Growing market “floating wind turbines”

Shallow water zones such as the nearshore locations in German waters are the exception. The majority of the world's oceans have enormous water depths. To utilize these locations, the wind industry must rely on floating systems. Fraunhofer IWES is active in this dynamically growing market and can employ its expertise profitably: from general information about floating wind turbines to advice on selecting a specific floating system.

Experience with existing floating platform types, the global system behavior and dependencies on site conditions as well as innovative and system-dependent logistics concepts are all incorporated into the decision-making process. Benefit from this experience.

### Project planning – sound right from the start

Cost estimates are required right from the early stages of project planning. Fraunhofer IWES is happy to support you in the preliminary design of a floating structure with model- and simulation-based analyses. The investigations for such a draft design are usually based on standard recommendations but can also take available site-specific measurement data into account.

Fraunhofer IWES is an independent partner and as such evaluates manufacturers' information in a comprehensible manner, drawing on its expert knowledge of load calculation and the global turbine dynamics of floating wind energy systems.



2 *AlphaVentus,*  
*Photo: Areva Multibrid, Jan Oelker*

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### System selection and system optimization: cost-effective and customized

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Costs are usually a main design driver in the detailed engineering phase. However, site-specific factors and prevailing environmental conditions must also be taken into account in the design. The solution is based on design-optimization approaches. With integrated simulation of the loads and analyses of the global system behavior, Fraunhofer IWES adapts the design for a floating wind turbine individually to your interests and requirements as well as very flexibly to the local conditions. Existing standard recommendations or – if available – measurement data at the intended location form the bases for calculation here too. In the scope of further development steps or research projects, Fraunhofer IWES is happy to integrate promising aspects such as reliability criteria or the specific needs of your projects and problem-specific approaches into the design optimization.

Focusing on the best possible economic exploitation of the wind energy potential at the planned location, wind turbines in higher power classes can also be considered. This can also be investigated based on simulations via optimization-based scaling of the floating platform design for larger existing wind turbines. This approach allows dimensions, loads, and, above all, costs to be estimated in advance based on known cost models.

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### Identifying optimization potential in operation

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Fraunhofer IWES offers you support in better understanding the manufacturers' information on the operating behavior of the wind turbines under the prevailing environmental conditions at the location so as to allow you to assess the condition of the floating wind turbines during operation and, if necessary, optimize the system behavior. Conclusions on the condition of the floating systems can be drawn with the help of model-based system simulations and load calculations.

The direct monitoring of a floating wind turbine enables precise and efficient planning of maintenance and repair work as well as recording the current condition and lifetime. This can be realized by means of real-time models as digital twins, the development of which Fraunhofer IWES is happy to advance and apply in cooperation with customers for specific wind farms.

#### References

- AFLOWT project (Accelerating market uptake of floating offshore wind technology): Installation of a demonstrator of a competitive floating system as well as testing and proving of its functionality in extreme environmental conditions.

[AFLOWT IWES](#)

[AFLOWT Interreg NWE](#)

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#### [Global Turbine Dynamics](#)

Fraunhofer IWES ensures investments in technological developments in the field of wind energy and hydrogen technology through its validation services. By operating large test rigs, it accelerates the market introduction of innovative products, enhances certification processes and increases planning security by using state-of-the-art measurement techniques. Fraunhofer IWES employs around 220 scientists and administrative staff and more than 80 students at five sites: Bremerhaven, Hanover, Bremen, Hamburg and Oldenburg.

- Dissertation on "Reliability-based optimization of floating wind turbine support structures".

[EngD Thesis](#)

- Development and validation of the in-house tool MoWiT for the fully coupled dynamic simulation of floating wind turbines.

[Global Turbine Dynamics](#)