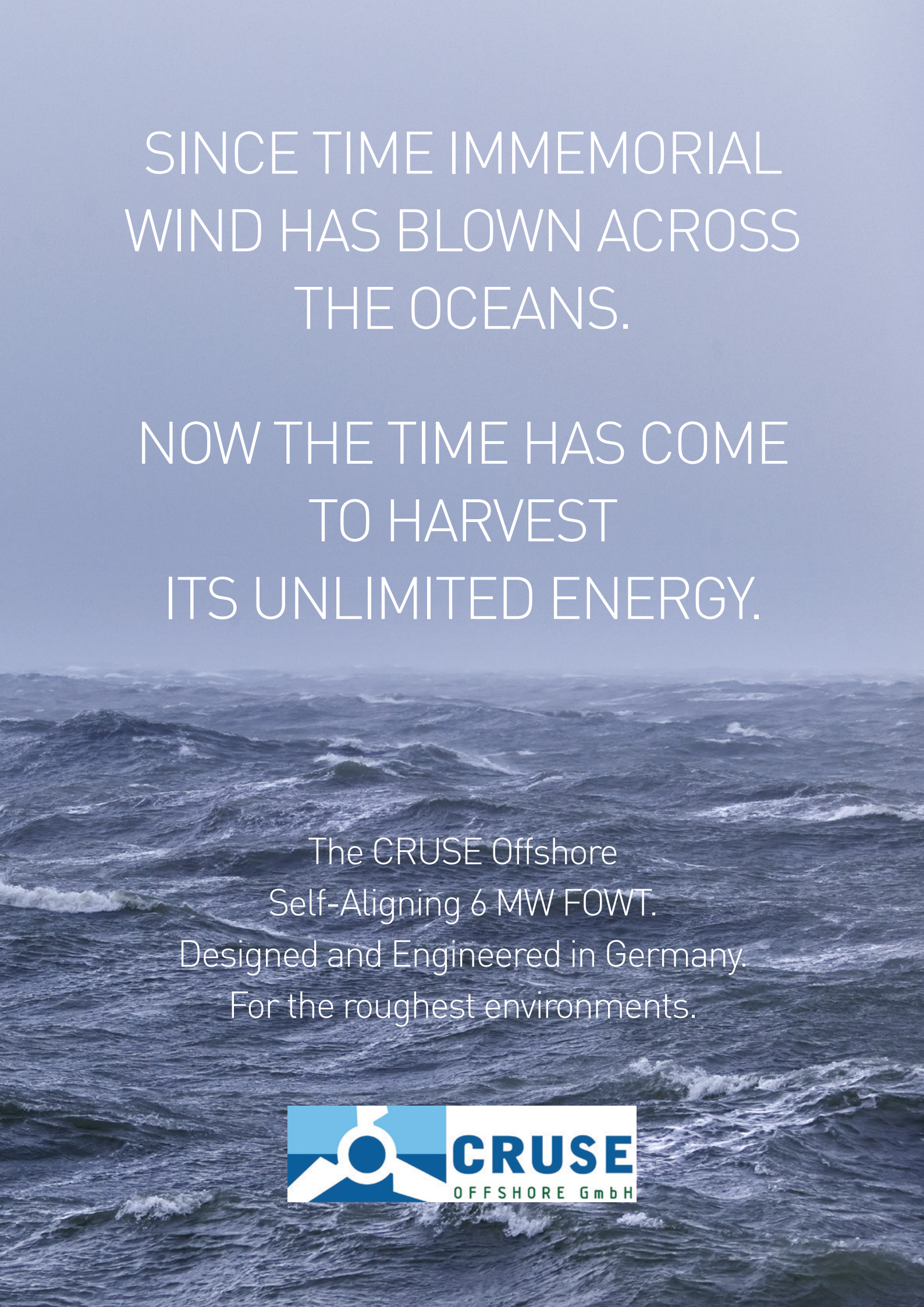

SINCE TIME IMMEMORIAL
WIND HAS BLOWN ACROSS
THE OCEANS.
NOW THE TIME HAS COME
TO HARVEST
ITS UNLIMITED ENERGY.
The CRUSE Offshore
Self-Aligning 6 MW FOWT.
Designed and Engineered in Germany.
For the roughest environments.
CRUSE
OFFSHORE GmbH

THE SUN'S ENERGY pouring into the earth's atmosphere excites the molecules of oxygen, nitrogen, carbon dioxide and other gases in our planet's envelope, and once warmed, they rise. Simply said, the vertical movement, depending on the amount of molecular activity, makes weather systems with high and low pressures, cold and warm fronts, troughs, jet streams, clouds and precipitation.

The greater the pressure difference between weather systems, the greater the windspeed and force, the latter which takes off in an exponential curve. On the Beaufort scale at Force 0, the pressure exercised by wind blowing on to a square meter panel (which has more or less the same size as the silhouetted surface of an average human being) is practically nil. At Force 3, the wind generates 7,7 kilograms per square meter (kg/m^2) of pressure causing wavelets to appear on the water. In a lively Force 6, the pressure has now risen to 29,9 kg/m^2, larger white capped waves become common. In a Force 9 – a strong gale – the pressure on a square meter has now arrived at 75,6 kg/m^2, waves are high, crests whip off as spindrift. Any person now in the open risks being blown off his feet – the wind pressure equals – or is larger – than many people's own body weight.

In Force 12 – a full blown gale – the square meter is now subjected to 195,5 kg/m^2 of violent force. Waves are huge, the breaking sea is completely white and the air filled with blinding spray. Although the Beaufort scale stops counting at Force 12 or 64 knots windspeed (118 km/h), far higher velocities are known.

Peter Neumann / RESPEKT / published 2015

This is free energy.

On the doorstep.
Just waiting to be collected ...

The CRUSE Self-Aligning 6 megawatt FOWT.*
Engineered in Germany. Designed to harvest nature's boundless energy.
Under the worst conditions.

*FOWT = Floating Offshore Wind Turbine

The Cruse Offshore Self-Aligning 6 megawatt FOWT.

Details, information.

GENERAL

- Windmills have been used by mankind for more than 4,000 years.
- German physicist Albert Betz (1885-1968) conducted path-breaking theoretical studies of wind turbines. According the laws named after him, a wind turbine can convert up to 59% of the wind's kinetic energy into mechanical energy.
- A single wind turbine can power anything up to 1,000 homes.
- Offshore wind is plentiful, it could easily power the entire United States.
- Wind energy is the world's fastest growing method for producing electricity.
- Offshore wind farms benefit from steady, strong winds.
- Per annum, one megawatt of wind energy generated with a windturbine offsets approximately 2,600 tons of CO_2.

39% of Danish electricity was wind-farm produced in 2014

ENGINEERING / CONSTRUCTION

- CRUSE Offshore's FOWT design implements proven quality management standards.
- Conceived to be made of standard steels.
- Designed to be built at any shipyard in the world under existing quality management and under the supervision of a classification society's supervision.
- The simple design of the CRUSE Offshore's FOWT is ideal for automated or small serial production methods.
- Full land-based/shore-side construction that includes the installation of the rotor and nacelle.
- Single Point Mooring (SPM) hook-up for mooring and slip-ring power transport. The SPM consists of a suction bucket anchorage system proven in the offshore oil and gas industry for deep and shallow water deployment.

OPERATIONAL BENEFITS

- As a semi-submersible, ballasted four-legged platform stabilized with 5,000 tons of water, acceleration levels at the hub height of 100 meters remain below the 0.4 g limit, even under high-wind conditions and five meter waves.
- Profiled cross sections of the cantilevered tower brackets are designed to reduce leeward turbulences and thus eliminate blade impact damage of the down-wind rotors.
- Wind forces acting on the symmetrically profiled tower and blades, together with the SPM solution forward, insure continual alignment of the rotor into the wind nearly rectangular to the wind flow, even in cross water currents.
- The CRUSE Offshore's FOWT is boarded via the leeward floater, which in comparison to a fixed body, opens up larger weather windows. Approach and transfer manoeuvres are considerably easier, require less sophisticated equipment, and thus increase safety and boost bottom line results.
- Being towable, large repairs and upgrades are conducted ashore. Major offshore maintenance/construction work is eliminated.

THE CRUSE OFFSHORE 6 MW FOWT'S COST BENEFITS

- The completed, ready-to-operate unit is towed to its working position. In a simple manoeuvre it is hooked up to the Single Point Mooring (SPM) connector without requiring jack-up vessel assistance.
- Maintenance free connection to the turbine. The 360° rotorhead yaw system, as necessary in a conventional wind turbine, is superfluous.
- Significantly reduced building, erecting and life-cycle cost structures.
- Low commissioning and decommissioning costs.
- Expected immediate cost reductions (investment, construction and installation) of up to 30% per unit.
- CRUSE Offshore's FOWT units can be moored in continental shelf water depths, an so vastly reduce costs as the assistance of jack-up vessels is eliminated.

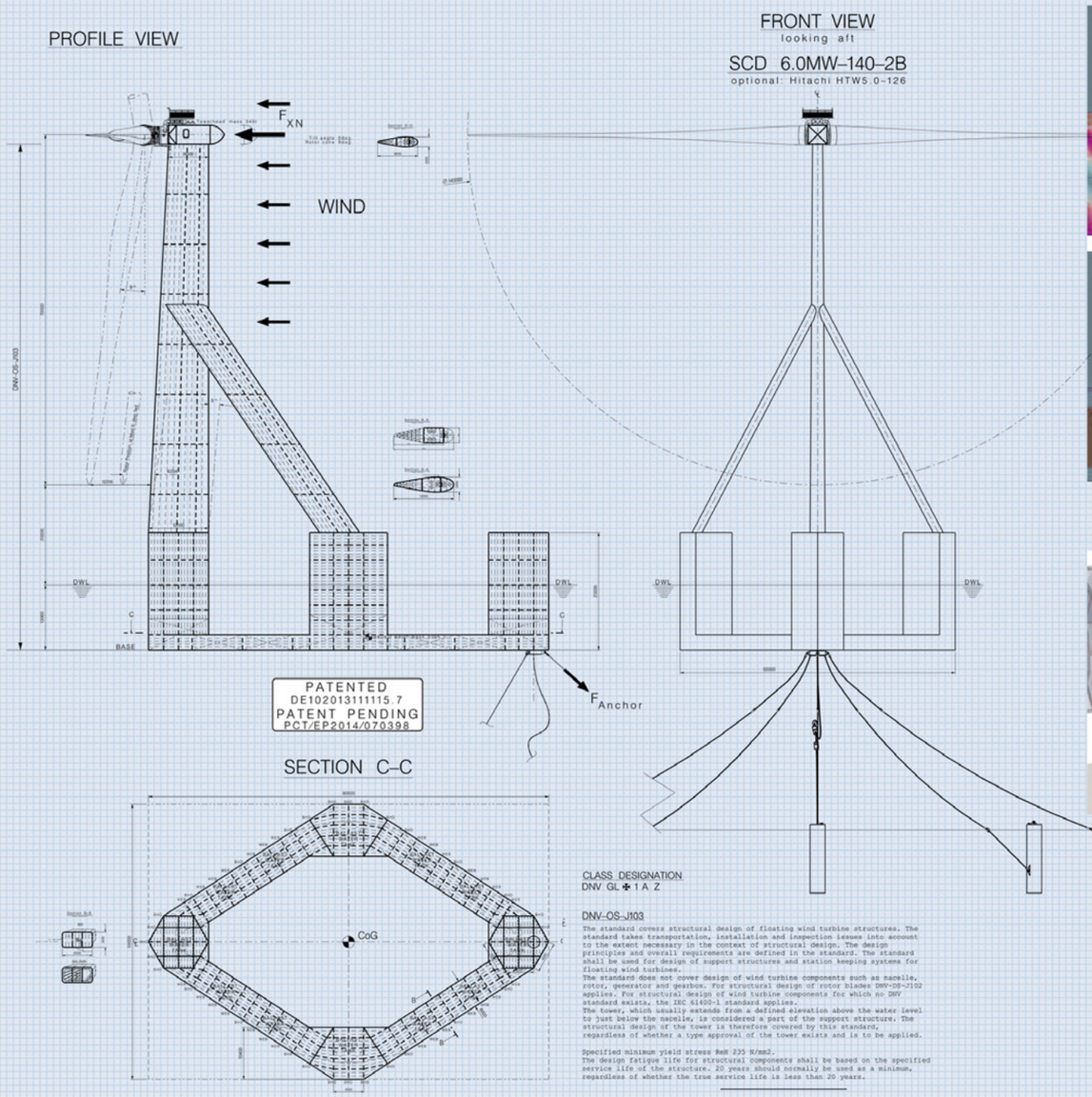
ENVIRONMENT

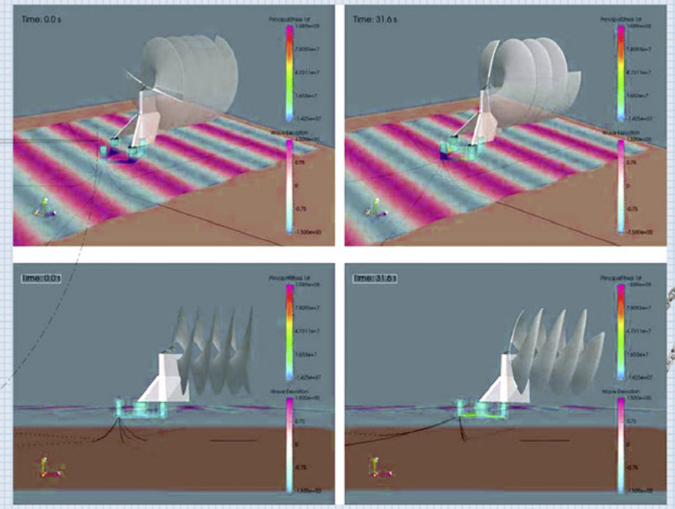
- Problematic pile driving noise is a matter of the past as the CRUSE Offshore FOWT is easily moored with a suction bucket anchorage system that is easily installed (and removed).
  Furthermore, such a system requires only a small area of the sea floor, and no further underwater construction works.

CRUSE Offshore FOWTs have little impact on marine life, pile ramming is superfluous.

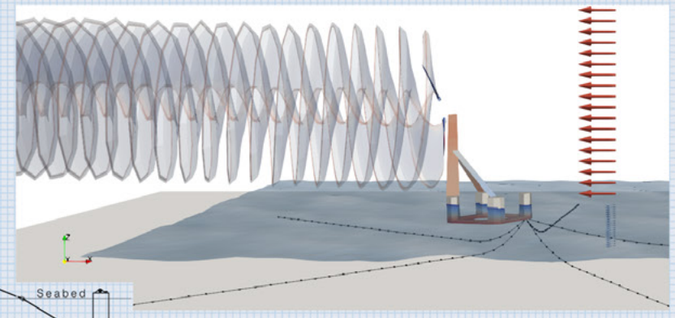
The CRUSE Offshore Se lf-Aligning 6MW FOWT.

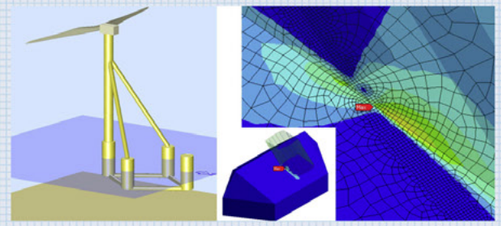
Simulated, analysed and optimise d by experienced research teams.



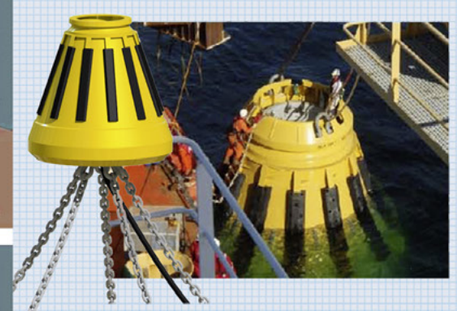


▲▼FSI simulation results of the CRUSE Offshore FOWT in waves and wind at t=0 s and t=31.6 s (time where large surge and pitch motion occurs)

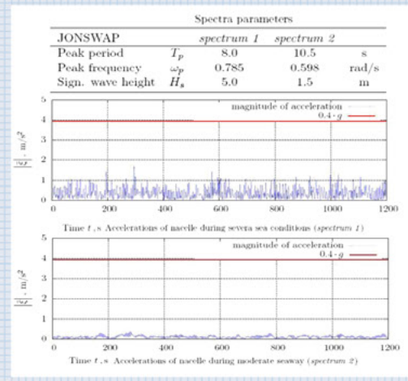




▲Fully coupled bladed model (left) and detailed FE based fatigue analysis (right).



▲SINGLE POINT MOORING (SMP)
The CRUSE Offshore FOWT is attached to a turret buoy as deployed in the demanding offshore oil and gas industry. The whole FOWT rotates 360° momentum-free around the single mooring point (SMP) located at the upwind corner of the rhombus shaped floating structure. The SMP doubles up as the outlet for the power cable.

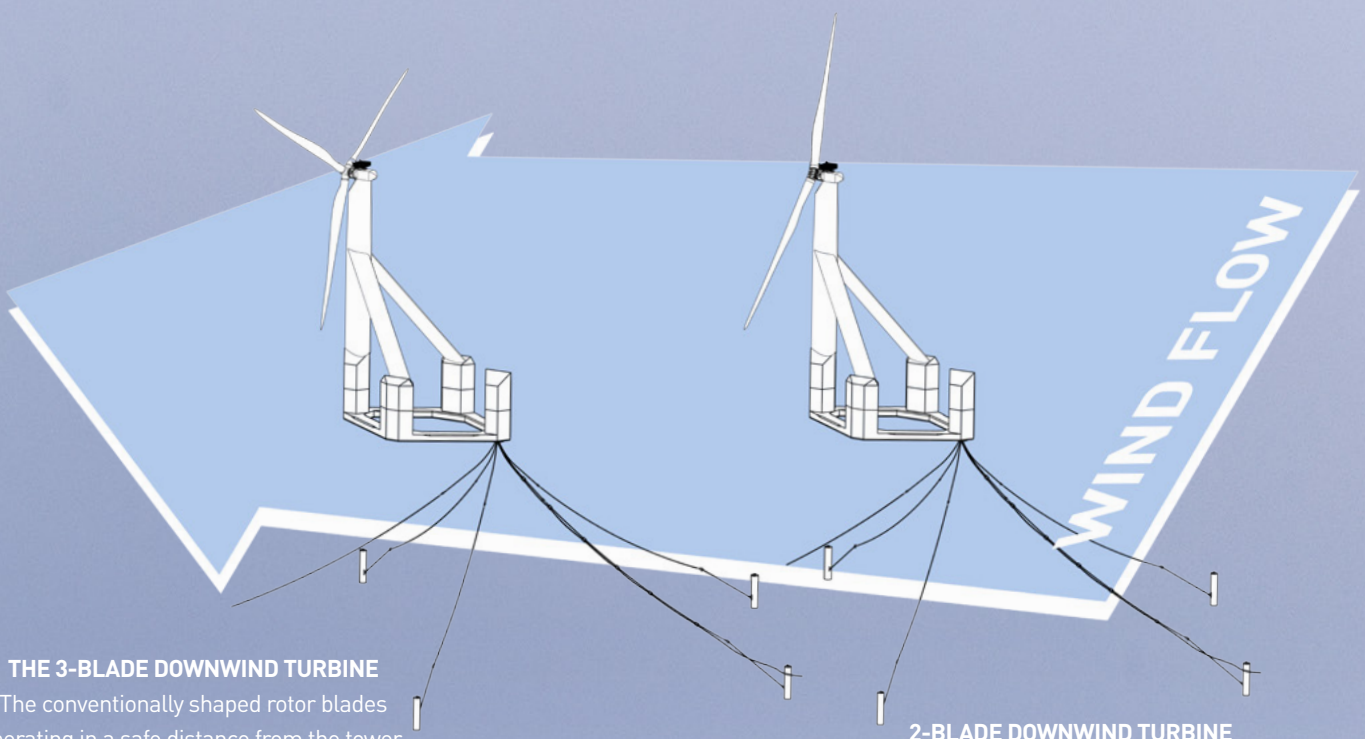


▲CRUSE OFFSHORE 6 MW FOWT MOTION ANALYSIS IN A SEAWAY
Studies conducted at the renown TUHH* conclude acceleration forces at the nacelle to be significantly lower than the 0.4 g limit in a five meter seaway. **Technische Universität Hamburg-Harburg*

The development of the CRUSE Offshore Self-Aligning 6 megawatt FOWT was supported by the adjacent renown German institutions and companies:

Bundesministerium für Wirtschaft und Energie
Fraunhofer CML
TUHH Technische Universität Hamburg-Harburg
DNV·GL
aerodyn
JBO Beratende Ingenieure im Bauwesen

The CRUSE Offshore Self-Aligning 6 megawatt FOWTs.



THE 3-BLADE DOWNWIND TURBINE

The conventionally shaped rotor blades operating in a safe distance from the tower, in lee, minimize the dangers of blade strikes. Furthermore this configuration allows softer rotor blades.

2-BLADE DOWNWIND TURBINE

Less weight aloft. Simpler rotor blade behaviour comparable with existing downwind designs. Locked in a horizontal position, rotor blade hazards for helicopter operations are greatly reduced. This robust FOWT is ideal for deployment in high-wind regions.

CRUSE OFFSHORE GmbH

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