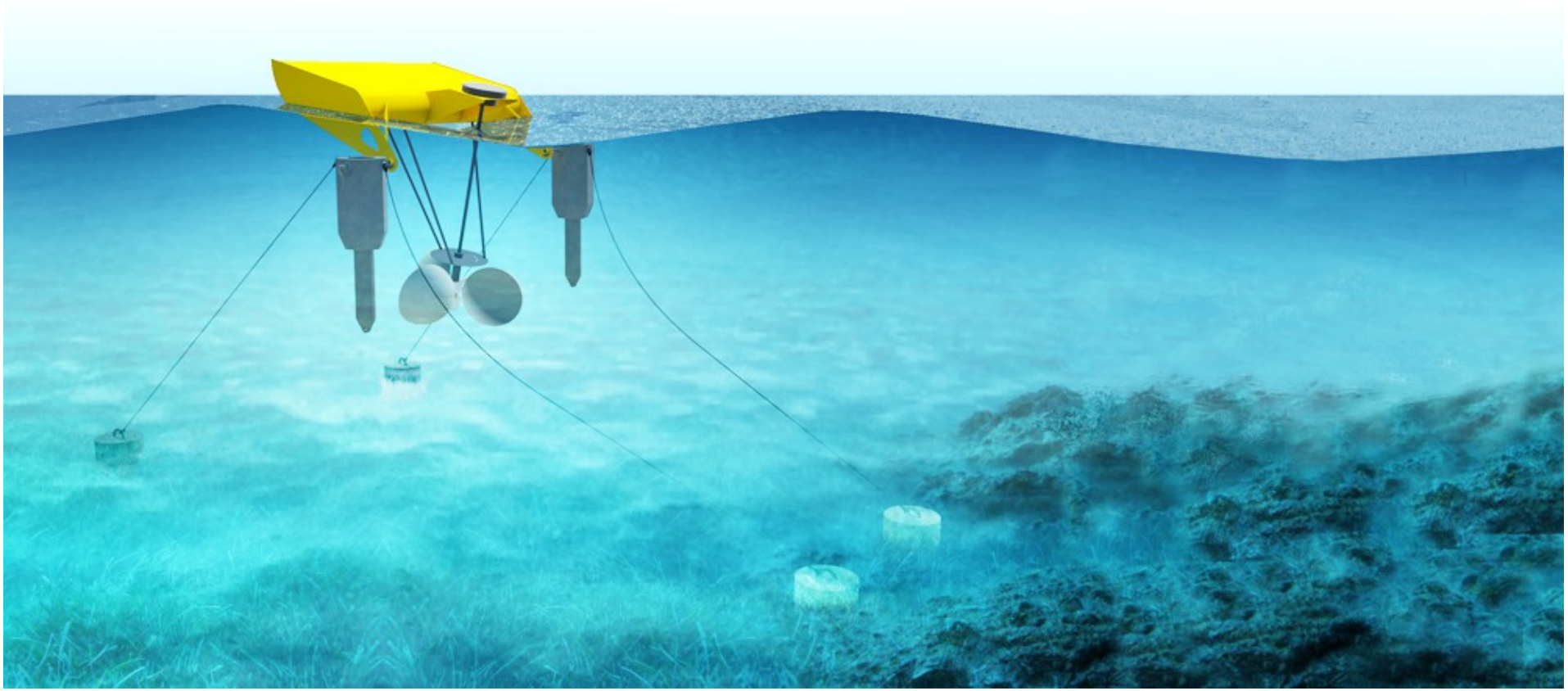
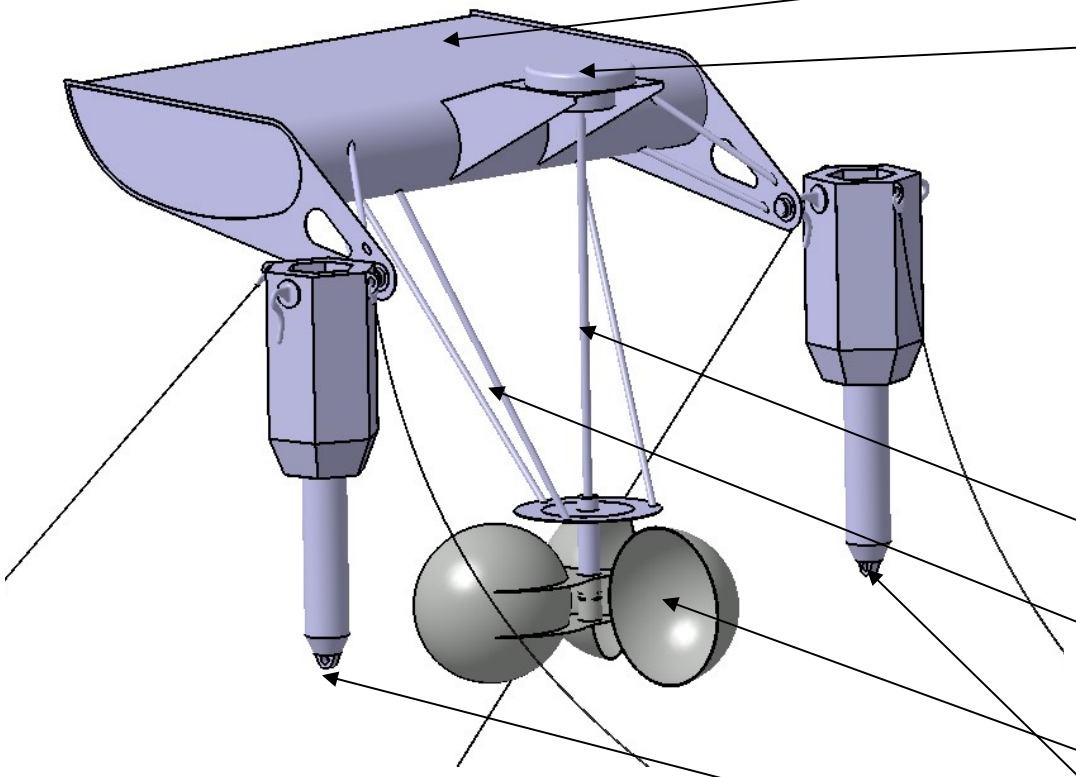
Wave NRG





Float body

Electricity generating module

- unidirectional clutch
- flywheel
- multipole generator

Transmission shaft

Column

Turbine

Floating ballasts

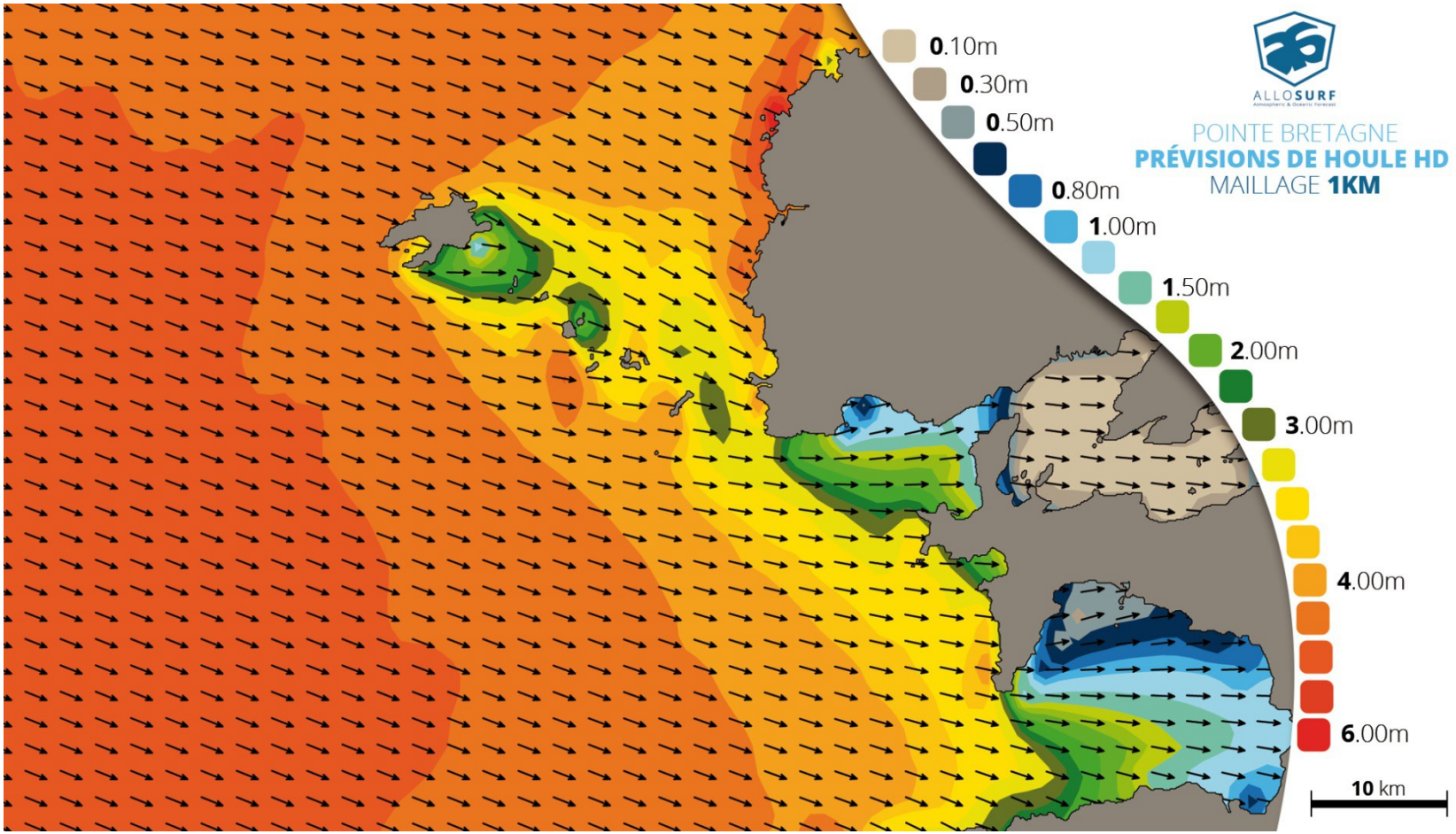
- Dimension of float body : 11 x 8 m
- Mass of Wavenrg float : 30 tones
- Submergence of turbine : 10 m
- Minimal power of float : 30 kW *
- Maximum power of float: 150 kW
- Cost of power generation : 62,5 €/MWh *

* - Atlantic ocean, 20 years of service, 2.5 m wave height, work time: 6000 hrs per year

Wave height	Power of wave	Power gained by one unit	Power gained by wave farm *
1 m	3,2 kW/m	5 kW	10 MW
1,5 m	7,3 kW/m	11 kW	22 MW
2 m	13,0 kW/m	19 kW	38 MW
2,5 m	20,3 kW/m	30 kW	60 MW
3 m	29,2 kW/m	44 kW	88 MW
3,5 m	39,8 kW/m	60 kW	120 MW
4 m	52,0 kW/m	78 kW	156 MW
4,5 m	65,8 kW/m	98 kW	196 MW
5 m	81,2 kW/m	122 kW	244 MW
5,5 m	98,3 kW/m	147 kW	294 MW
6 m	117,0 kW/m	175 kW	350 MW

* - Wave farm consists of 20 rows of floats, each row contains 100 floats,
Total surface area: 1,2 km2

- Energy density of an offshore wind farm is in the region of 8 MW/km² and can achieve 15 to 20 MW/km² in areas that are very windy.
- Energy density of a wave farm with WaveNRG floats is in the region of 50 MW/km² and can achieve 250 MW/km² in areas with waves 5 – 6 meters high.



Anticipated wave heights (Brittany, France)

Benefits of WaveNRG Technology

- Number of installed floats can vary with energy demands.
- Installation at sea at depths greater than 20 m.
- Supply electricity to offshore drilling rigs in deep waters.
- Supply electricity to aquaculture farms at sea.

Benefits of WaveNRG Technology

- Europe: every row of energy floats can be towed from land to installation location.
- World: All subassemblies can be transported in shipping containers and installed on location. *
- In the event of the failure of the electricity generating module, the module can be detached from float and replaced.

* - float body is composed of 5 pieces: 2.25 x 8 m each

Benefits of WaveNRG Technology

- Installing energy floats in 40% of the surface area an offshore wind farm occupies will double the energy production.
- In case of wind stoppage there isn’t a sudden stop to production of energy. WaveNRG system will produce similar amount of energy for few days, and then will steadily drop its production.

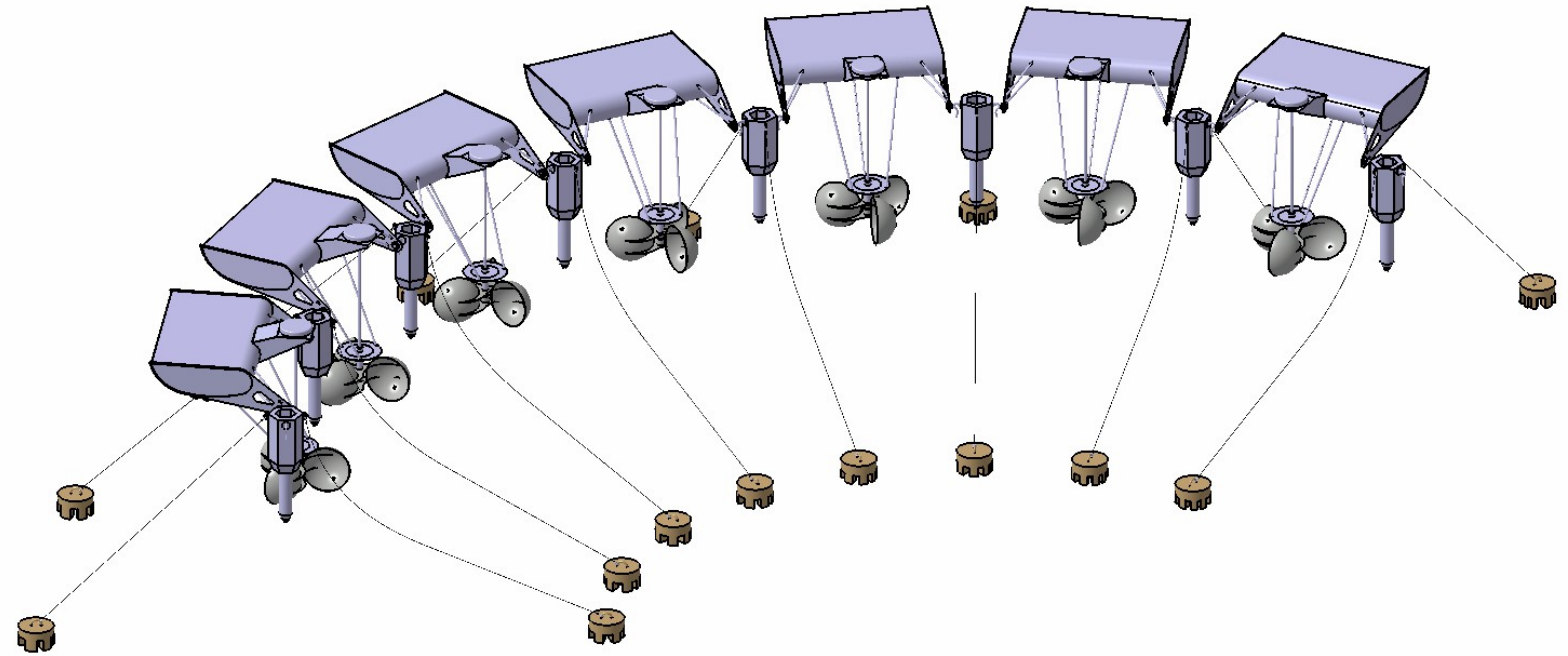
Benefits of WaveNRG Technology

- Float system can withstand storms.*
- Possibility of additionally mounting solar panels to body of float.

* - In event of waves 10 – 12 m tall, float of body will be completely underwater, sitting practically vertically, with front pointing up and pulling heavy floating ballasts

Example of farm with 7 floats in single row

- Minimal power in 6000 hrs per year– 0,2 MW
- Maximum power – 1 MW



Annex

Cost analysis of energy production for a wave farm consisting of 100 floats

Maximum power – 15 MW
Minimum power (in 6000h/yr): 3 MW
Duration in service: 20 years
Amount of energy produced: 3 x 6000 x 20 = 360 000 MWh

Production costs 100 floats – 17 M€
Cost of concrete anchors - 0,2 M€
Cost of towing – 0,3 M€
Cost of installation at sea– 0,5 M€
Cost of connecting power cable to electricity generating module – 0,5 M€
Operation cost over 20 years – 4 M€

Total costs – 22,5 M€

Costs for producing electrical energy – 62,5 €/MWh

Aneks

Here are a few words to explain how our system works.

The functioning of our wave energy converter is similar to the functioning of the Salter Duck system. A swivel stowed float is set in pendulum motion by waves. The efficiency for capturing wave energy from the swell of such a system is good, but the transformation of mechanical energy obtained by float into electrical energy poses a great problem.

We have solved this difficulty by fixing to the hull of the float a column of a certain length, with a turbine at the end of this column. Despite the resistance of the turbine in its displacement under water with speeds greater than 2 m / s, the system continues to make its pendulum movement. This is possible thanks to mooring's system of the float which ensures the pivoting of the float around an axis, as was foreseen in the Salter Duck system.

Because it is technically difficult and very costly to rigidly fix the swivel axis of the float in the open sea, we have opted to fix, in a well-defined position, on each side of the float's hull, a tubular ballast. The two fixing points of the tubular ballasts on the hull of the float determine a theoretical axis of its pivoting. The tubular ballasts are then moored by cables or chains and anchored to the seabed. The tubular ballasts, each with a large mass, have a buoyancy close to zero. This type of anchorage should allow the system to work properly, ensuring its indestructibility in the event of a storm at sea.

The displacement of the turbine under water, in a pendulum movement of the float with the column, generates a mechanical torque on the turbine and its rotation, which is transmitted directly by the transmission shaft to the electricity generating module. The shape of the blades of the turbine ensures its rotation only in one direction, independently of the direction of displacement of the column. Because the rotational speed of the turbine varies as a function of the speed of movement in a pendulum movement of the column, the electricity generating module is composed of: unidirectional clutch; flywheel; multipole generator.

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WAVE ENERGY CONVERTER

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