

# WAVE STAR<sup>®</sup> ENERGY

## The world's strongest wave power concept!

**Wave Star Energy has developed a sustainable wave energy machine, which is to secure all of us a new unlimited, green energy source. Within the near future, commercial 500 kW Wave Star machines will be ready for the open seas.**

Since 2003 Wave Star Energy has been dedicated to the development of a reliable, commercial wave energy technology. With the new 500 kW prototype, the company has stated its position among the leading wave energy developers in the world.

### Commercial machines ready in 2011

In September 2009 a research section of the commercial 500 kW wave energy machine was installed in the North Sea in Denmark. It is impressive 40 meters long - with floats of a 5 meter diameter. It is a shortened version of the complete machine which will be 70 meters long. The research section is located 300 meters off Hanstholm in the North Sea at a water depth of 7 meters. It is connected to the grid.

After the testing and optimization on the research section, the complete 500 kW machine will be produced and ready for sale in 2011/12. With this technology Wave Star Energy offers a real opportunity to diversify the electricity generation capacity and ensure continuous production of clean energy.

### Reliable production of green energy

The Wave Star system will be able to offer production of up to several Megawatts per installation, which is equivalent to off-shore wind turbine farms. Wave Star has a significant higher output than other wave energy systems and produces power already in small waves. Waves are predictable 24 to 36 hours ahead and the production continues 6-8 hours after the wind

settles. This makes wave energy an ideal complement for wind turbines – and is of vital importance when it comes to meeting a continuously increasing demand for renewable energy in the grid.

### Proven concept

After more than 3 years of constant operation in the sea, Wave Star Energy has proved the patented concept with the scale 1:10 test machine. Day in and day out the machine has been working - through more than 15 storms and with a minimum of maintenance. This is, in itself, a milestone in international wave energy.

### How it works!

The fundamental basis of Wave Star differs markedly from that of other wave power concepts. The Wave Star machine does not form a barrier against the waves - with a view to harnessing all their energy – but cuts in at right angles to the direction of the wave. In this way the waves run through the length of the machine and the energy is utilized in a continuous process.

On each side of the oblong Wave Star machine, there are a number of hemisphere-shaped floats, which are half submerged in the water. When a wave rolls in, the floats are pressed up – one after the other – until the wave subsides.

Each float is positioned at the end of its own arm. Every time a float is raised, a piston presses oil into the machine's common transmission system at a pressure of up to 200 bars. The pressure drives a hydraulic motor, which is connected to a generator that produces the electricity. As the machine is several wave lengths long, the floats will work continuously to harness energy and produce a smooth output.

The machine has an efficient storm protection concept, which has been documented. When the waves reach a certain height, the floats are automatically lifted up.

The machine is based on standard offshore technology.

Unlimited clean energy

## Facts about Wave Star Energy

- **The concept behind Wave Star** was initially developed by the two Danish brothers, Niels and Kjeld Hansen, who are still connected to the company, which has a total of 26 employees. Wave Star Energy was founded in 2003 and has family Clausen from Danfoss as main shareholders. Jørgen Mads Clausen is Chairman of the Board. The Wave Star machine is protected by a number of strong patents.

- **Wave Star Energy's scale 1:10 machine** was installed in Nissum Bredning, Denmark, in 2006. It is 24 meters long and has a power of 5.5 kW. It is connected to the grid and generates power corresponding to the energy consumption of two one-family houses. The floats on the 1:10 scale machine are 1 meter in diameter and generate electricity already at 5 centimeter high waves. The scale 1:10 machine was built in the exact same way as the upcoming commercial Wave Star machines. It is placed in a wave environment which corresponds to 1/10 of North Sea waves. It has been in operation for more than 3 years and has been through 15 storms without being damaged.

- **In September 2009** a research section of the 500 kW machine was installed. It is a shortened version of the complete 500 kW machine with only two of the 20 arms and floats. It is situated 300 meters off Hanstholm in the North Sea at a water depth of 7 meters. The power per float is expected to be minimum 25 kW - and up to 50 kW, as a result of optimization of the test section.

- **The test section** will provide the basis for detailed testing and optimization of the commercial 500 kW machine, which will be 70 meters long and with a total of 20 floats. The complete 500 kW machine will be completed and ready for sale in 2011/12.

- **The power factor** of the Wave Star machines are the same per MW as a sea wind turbine. When the size of the 500 kW machine is doubled in the future, it will have a performance of 6 MW and will thus match even the biggest offshore wind turbines. The space efficiency of wave energy machines is high compared to wind turbines (relatively small use of sea space).

- **The Wave Star machine** has an aesthetic design and a low visible impact. The aim is to make them as neutral in the sea environment as possible. The three years of experience from the scale 1:10 machines shows that new wildlife is developed at the bottom of the sea under the machine.

Wave Star Energy is continuously working on reducing the amount of CO<sub>2</sub> used for the production and operation of the machines compared to the CO<sub>2</sub>-free kWh, the machine produces in its lifetime.



## Contact

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