

## The future begins here!

**Wave Star Energy has developed a sustainable wave energy concept, which is to help secure all of us another untappable, 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 focusing on the development of reliable, commercial wave technology.

With its first 500 kW machine, the company is facing the breakthrough which will ensure the company a position as one of the leading wave energy producers in the world.

After nearly 3 years' constant operation in the sea, Wave Star has proved that the patented concept behind its 1:10 test machine holds. Day in and day out – and still undamaged after 15 storms - the machine has delivered power, which is a milestone within international wave energy!

### **Advantages and potential**

Compared to wind energy, wave energy has the huge advantage that it comes and goes slowly – in a predictable way. It is 3 to 4 times more stable than wind energy – and at the same time it is predictable 24 to 36 hours ahead.

From the time the wind abates, there is a time span of 6 to 12 hours before the sea is affected. This is of vital importance when it comes to meeting a continuously increasing demand for renewable energy in the grid.

British Carbon Trust estimates that the potential of wave energy is 2,000 to 4,000 TWh per year. In comparison, the world's total power production was just under 15,000 TWh in 2003. In other words, roughly a third of the world's power might come from wave energy in the future.

### **Wave energy is advancing**

Wave Star Energy is now busy producing its first series-produced 500 kW wave energy machine for the open seas. During the summer of 2009, the first

section of the machine will be put into operation off Hanstholm in the North Sea. Wave Star Energy will thus move one big step closer to an international, commercial breakthrough – both for the company and wave energy.

After extensive testing, the remaining part of the machine will be added and in 2010 the full machine is expected to be in operation.

Within the next 2 to 3 years, i.e. in 2011/12, the first commercial 500 kW Wave Star wave energy machine is expected to have been finally tested and optimised after which it will be ready for delivery in the whole world. And as is the case with wind turbines, wave energy will soon be a natural part of our energy supply.

### This is 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 instead 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, which 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.

## Facts about Wave Star Energy

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- **Wave Star Energy's scale 1:10 machine** is 24 m long and has a power of 5.5 kilowatt. 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 m in diameter and generate electricity already at 5-cm high waves.
- **The scale 1:10 machine** was built in the exact same way as the 150 m long Wave Star machines of the future. It is placed in a wave environment which corresponds to 1/10 of North Sea waves. Here it has been in operation for almost 3 years and has survived 15 storms without being damaged.
- **The next milestone** is the launching of the first section of a commercial 500 kW machine in the summer of 2009. It will be a shortened version of the complete machine with only two of the 10 arms and with floats on each side. It will be situated 300 m off Hanstholm in the North Sea at a water depth of 7 m.
- **The complete 500 kW machine** will be finished and ready for sale in November 2011. The machine will be 75 m long and has a total of 20 floats with a diameter of 5 m each. It is to be placed in the North Sea approx. 1 km from Hanstholm where it is to supply 500 households with power.
- **The Wave Star machine has the same power factor** per MW as a sea wind turbine. When the size of the 500 kW machine is doubled, it will have a performance of 6 MW and will thus match even the very biggest offshore wind turbines.
- **The goal is to make the Wave Star machines** neutral in the sea environment. The 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's Carbon Footprint** must be as minimal as possible. This is done by continuously reducing the amount of CO<sub>2</sub> used for the production and transportation of the machines compared to the CO<sub>2</sub>-free kWh, the machine produces in its lifetime.
- **The concept behind Wave Star** was originally developed by the two Danish inventor brothers, Niels and Kjeld Hansen, who are both still attached to the company, which has a total of 26 employees.
- **The company was founded** in 2003 and has family Clausen from Danfoss as main shareholders. Jørgen Mads Clausen is the Chairman of the Board of Directors.

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