

2009

# ENERGY FROM THE OCEAN

RENEWABLE FUELS



## Wave energy - our next renewable energy source

Wave energy has large potential. Vattenfall is taking part in tests and development activities and sees the possibility of establishing commercial wave farms within 10 to 15 years.

We are testing different technologies under various conditions. Off the Norwegian coast, outside the island Runde we are testing Seabased wave power equipment. We are also acting outside Great Britain and Ireland where we will test other types of equipment.

### Our test site in Norway

The coast of Runde has a rough climate and it will be a challenge to test wave power equipment under these circumstances.

We have supported Uppsala University since 2005 in their research project outside of Lysekil on the Swedish west coast. The equipment is being commercialised by the company Seabased.

We have obtained this equipment and are now continuing with tests and evaluation analysis in what we call "the Maren project". This project is carried out together with our local partner, Norwegian Generation and Distribution company Tussa. We are also carrying out an environmental monitoring programme assisted by expertise from Runde Environmental Centre (RMS).

The permissions we have received from the Norwegian authorities give

us the possibility to test the equipment up to five years.

### The goal of the project

The goal of the Maren project is to test the functionality, reliability and survivability of the equipment and to build up an efficient and skilled organisation within Vattenfall.

### Two buoys create electricity

Two wave energy converters are placed on the bottom of the sea, each one is attached to a buoy that converts the energy of the waves into electricity.

They are connected by submarine cables to a submarine low-voltage switchgear. This switchgear will be connected to Tussa's high-voltage





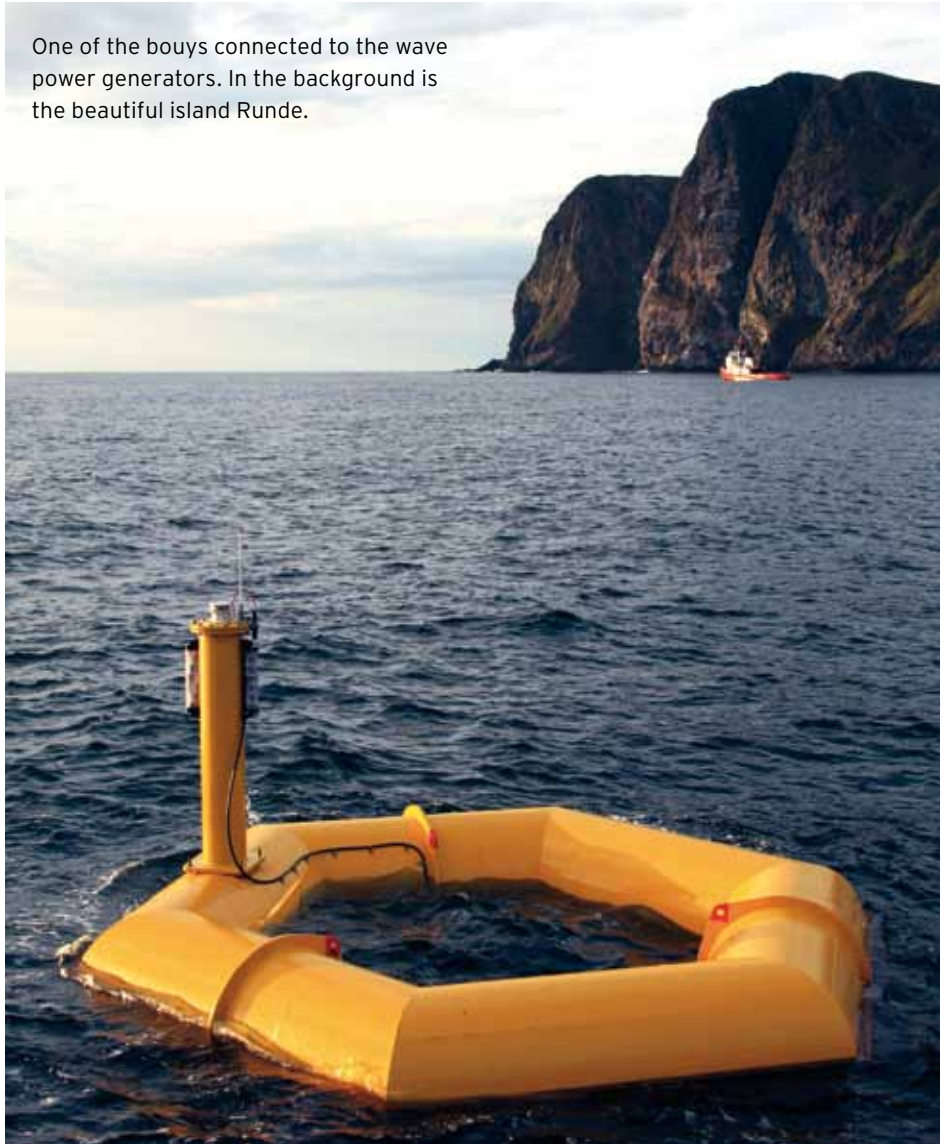
Research shows that the hollow spaces in the concrete construction act as artificial reefs and actually improves the conditions for marine life.

→ electrical grid onshore by a 22 kV submarine power cable.  
To make it possible to receive correct information about the waves we have also launched a measurement buoy.

### Climate and environmental issues

Vattenfall needs to be well prepared for future commercial wave power. International research about wave power and environmental issues are important to us. We investigate whether marine organisms like fish and mammals as well as human activities like fishery, tourism, recreation, shipping and military interests are affected. We are also investigating if the presence of our wave power devices, and the underwater noise they emit, can be a disturbance or an obstacle.

Ocean Energy is expected to become the next renewable energy source. The sea's energy resources are vast and the environmental impact of the energy conversion is limited. ●



One of the bouys connected to the wave power generators. In the background is the beautiful island Runde.

### Facts: Vattenfall R&D

Vattenfall is Europe's fifth largest generator of electricity and the largest generator of heat.

We have 39.000 employees and are active at all stages of the electricity chain, generation, transmission, distribution and sales.

Research and development is directed to support Vattenfall's strategic ambitions regarding reduced emissions of carbon dioxide, increased share of renewable fuels and to contribute to "Making Electricity Clean."

We are taking part in the development of new sustainable energy solutions for the future.



### Tussa - our partner in Norway

Tussa has been producing and supplying electricity to the northwest coast of Norway for 60 years. Tussa has demonstrated a capacity for readjustment and adaption and has now emerged as a leading power company with 300 employees. Tussa is to carry out business operations based on the production, transmission and sale of energy and communication products.

More information about wave power and the different technologies is available at [www.vattenfall.com](http://www.vattenfall.com)