Voith Hydro

VOITH

Wave power

Wavegen®

Wave power

at Voith Hydro Wavegen

Generating energy from the power of water represents large amounts of clean, renewable energy. 71 percent of the earth's surface is covered by water. The World Energy Council estimates that the energy that can be harvested from the world's oceans is equal to twice the amount of electricity that the world produces now.

Voith Hydro Wavegen is a wave energy company dedicated to the development of marine renewable energy technology.

Formerly a separate enterprise known as Wavegen, the company was formed in 1990 and is based in Inverness in the highlands of Scotland. In 2000 the company became the first company to connect a commercial scale wave energy plant to the grid. Since 2005 it has been the center of competence for wave energy within Voith Hydro.

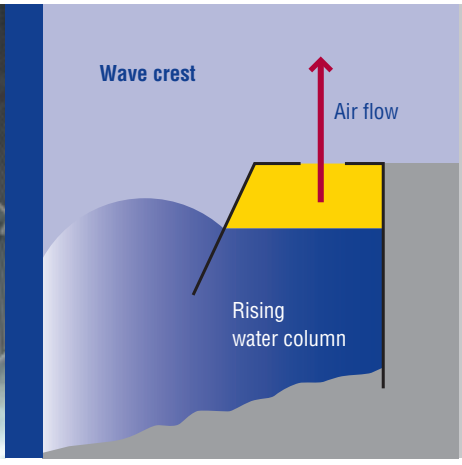
Our vision

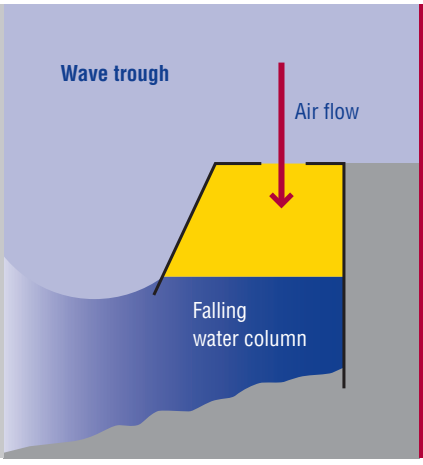
The rising demand for energy and the need to reduce emissions will enhance the implementation of new forms of renewable energy. Ocean Energies – mainly wave and tidal – fulfill the requirement of providing new renewable energy at reasonable cost. Voith Hydro with its expertise in traditional hydro, its R&D excellence and its value-oriented customer solutions is a strong player in the development of this industry.

Technology

Wave power technology is very young compared to generating electricity from hydro or wind turbines. Voith Hydro Wavegen is at the leading edge of developing methods to harness wave power and convert it into electricity using processes and technologies that do not damage the environment.

100 kW Wells turbine





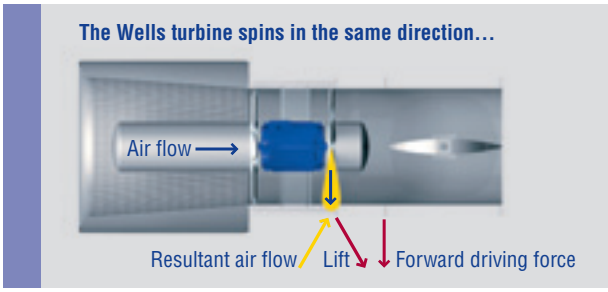
Technology

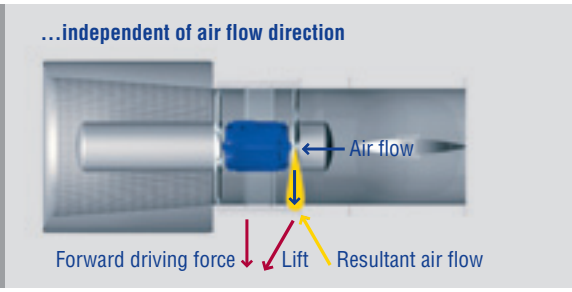
Voith Hydro Wavegen's technology is based on the Oscillating Water Column (OWC) with Wells turbine power take-off.

The Wells turbine is a fixed pitch machine with only one direction of rotation. Therefore the rotor is symmetric with respect to the rotation plane.

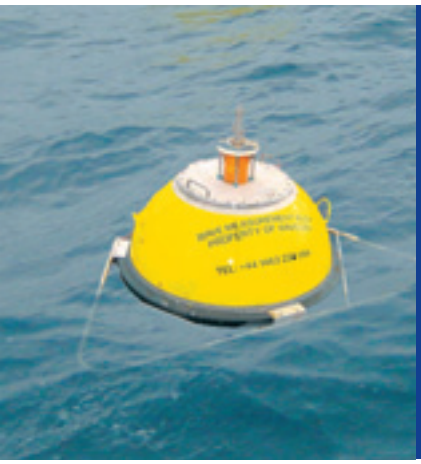
Advantages of Wells turbines

- No gearbox
- No hydraulics
- Bi-directional
- Variable flow
- No pitching blades
- Works with air
- Simple and robust
- Reliable





Test facilities



Waverider buoy

Wave tank to simulate wave conditions

Limpet – world's first commercial scale wave energy plant

Wave tank test facilities

Voith Hydro Wavegen owns and operates one of the most advanced marine renewable development test facilities available. This enables us to simulate a wide range of wave conditions at model scale, including site specific conditions measured with our own waverider buoy.

The paddles develop highly repeatable wave conditions under controlled experimental conditions, including regular, irregular and multi-directional waves for operational and survival sea states.

The Limpet plant

The Limpet plant on the island of Islay, off the west coast of Scotland, is the world's first grid connected commercial scale wave energy plant. The plant was commissioned in November 2000. It is a shoreline wave energy converter utilising an inclined oscillating water column (OWC) with Wells turbine power take-off. This full scale plant has enabled Voith Hydro Wavegen to validate results from wave tank tests and numerical models.
The Limpet plant is also used as a full scale test bed for the development of new turbines.

Applications

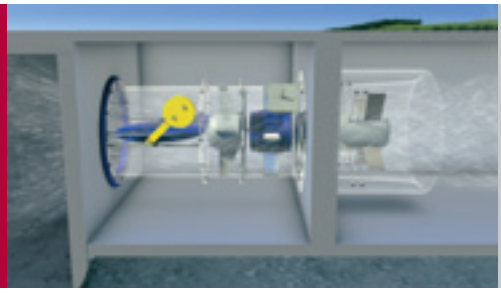
The OWC with Wells turbo-generator technology can be applied in a number of locations:

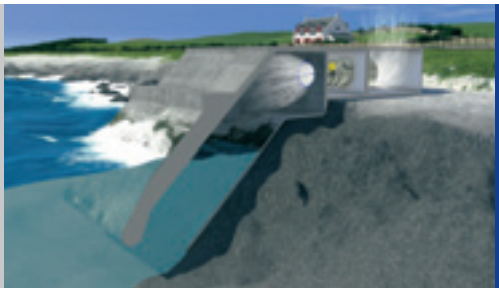
- Shoreline
- Breakwater, coastal defence, port
- Near-shore
- Offshore

Voith Hydro Wavegen has developed small turbo-generators for incorporating into breakwaters, coastal defences, land reclamation, port walls and community power schemes. Installation or removal can be achieved using a small mobile crane. These turbines are the fifth generation and incorporate all the learning and cost reduction experience gained from previous designs and operation of the Limpet plant.

Active breakwaters

- Easy access and maintenance
- Simplified planning and consents
- Shared civil costs
- Simple/reliable plant
- Easy to access/maintain
- Close to grid connection
- Can help breakwater gain environmental consents
- Reduced reflections



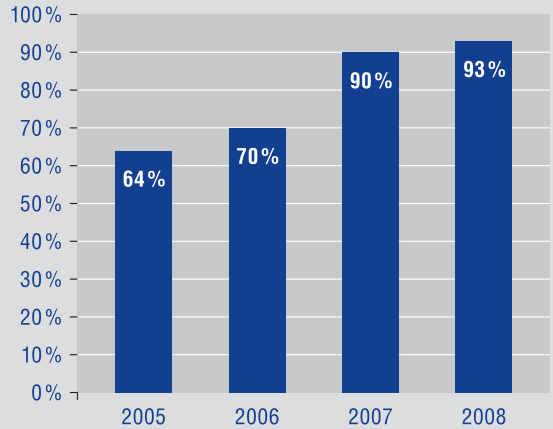


Plant reliability

Testing and development of turbines at Voith Hydro Wavegen's Limpet facility on Islay continues with prototypes for both the Mutriku and Siadar projects under test.

The chart highlights the benefits gained by Voith Hydro Wavegen from its extensive testing and development programme with high plant availability continuing to be demonstrated. The Siadar prototype, developed with support from the Scottish Government's Wave and Tidal Energy Support Scheme (WATES) has now been operating since July 2008, and is demonstrating similar reliability to its smaller sister machine. The Islay plant also allows the live testing of improvements identified through the combination of CFD analysis and turbine testing at Voith Hydro Wavegen's turbine test facility in Inverness.

Mutriku test turbine availability



Mutriku breakwater wave power station during construction

Projects

Voith Hydro Wavegen is working with clients worldwide to develop commercial wave energy projects.

The optimum locations are generally west coasts with large ocean fetches, and where there is some developed electricity and support infrastructure. A further market is in remote communities where the cost of power generation is high, and where these communities want to be more independent of distant fuel sources.

Mutriku

The world's first breakwater wave power station is being built in Mutriku on the Atlantic coast of Spain in 2009.

At a glance

- Customer is EVE – Basque Energy Board
- Incorporation into a new outer breakwater
- Multiple Oscillating Water Column technology
- 4 years of field testing at Limpet
- 16 Wells turbines
- Supply to around 250 households
- Rated power of 300 kW

Siadar Wave Energy Project

The Siadar Wave Energy Project on the Isle of Lewis in the Outer Hebrides is a joint project between RWE npower renewables and Voith Hydro Wavegen. It is an exciting proposal consisting of an "active breakwater" which would harness power from the Atlantic waves in Siadar Bay to generate up to 4 MW of installed capacity.

At a glance

- Fully consented project
- Customer is RWE npower renewables
- 200 m 'active' breakwater structure
- Up to 40 turbo-generators located 350 m offshore
- Voith Hydro Wavegen's proven Oscillating Water Column technology
- Supply to around 1,500 homes in the Western Isles
- 100 kW prototype installed in Limpet facility

Siadar Wave Energy Project
Photomontage courtesy of RWE npower renewables

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t3347 e 07.2009 1000 MSW Technical data and illustrations subject to change.