



## **Voith Hydro Wavegen**

Deployment of OWC technology -  
past, present and future

**4<sup>a</sup> Jornada Internacional sobre  
ENERGIAS MARINAS**

14 April 2011

## Voith – Sales and employees by division

Voith AG					
Group Divisions	Voith Hydro	Voith Industrial Services	Voith Paper	Voith Turbo	Group
Sales	€ 1 157 million	€ 962 million	€ 1 723 million	€ 1 349 million	€ 5 191 million
Employees	5 238	19 119	9 353	5 422	39 132

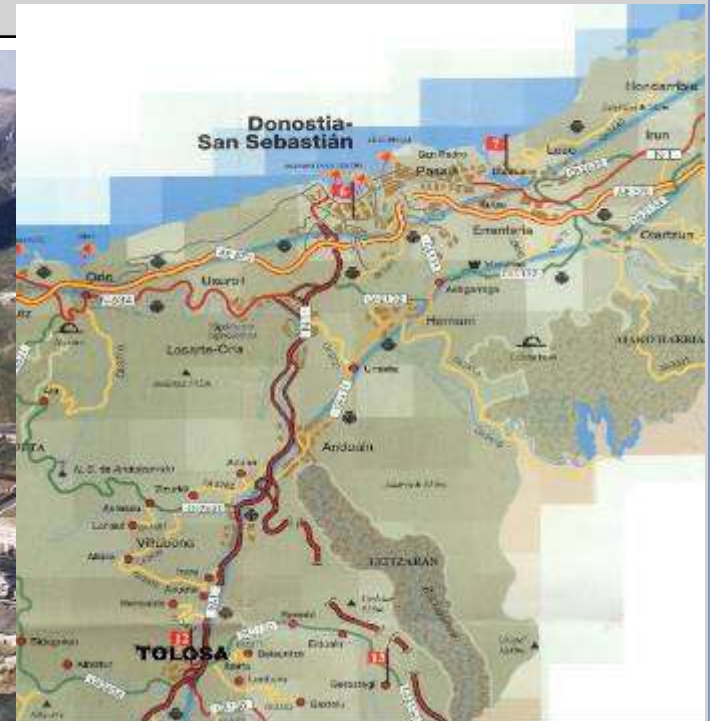
*Fiscal year 2009/2010*

## Voith is innovative



- Voith – where smart people like to work.
- 11,000 active patents.
- 400 new patents every year.
- Preference based on innovation.
- Investments for Research & Development lie above industry average, with 5.1% of sales.

# Voith Hydro in Tolosa



## Voith Hydro in Tolosa

VHTO Offices 450 m<sup>2</sup>  
Design 20.000 h / y  
Total offices 2.000 m<sup>2</sup>

Workshop 60.000 h / y  
7.300 m<sup>2</sup> (possible up  
to 11.000 m<sup>2</sup>)  
Site erection 30.000 h / y



## Voith Hydro Wavegen



### Inverness

- Headquarters.
- Wave tank.
- Turbine test rig.

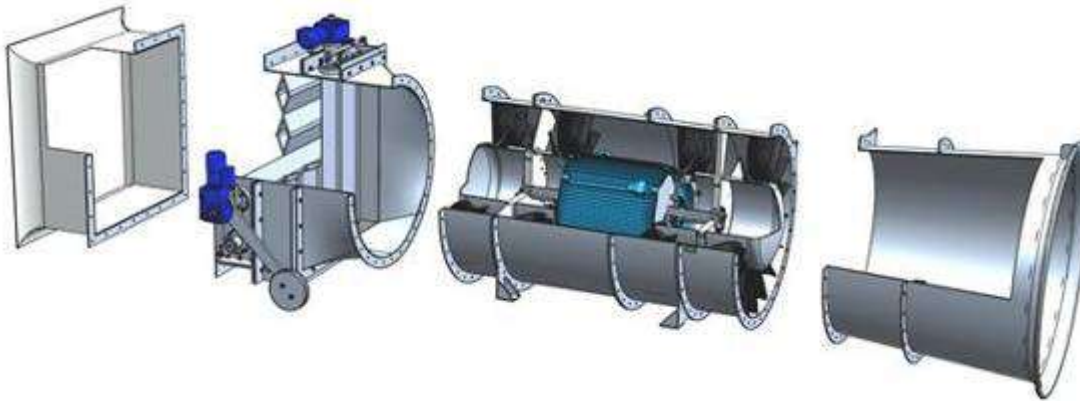
### Islay

- Limpet Test Facility.





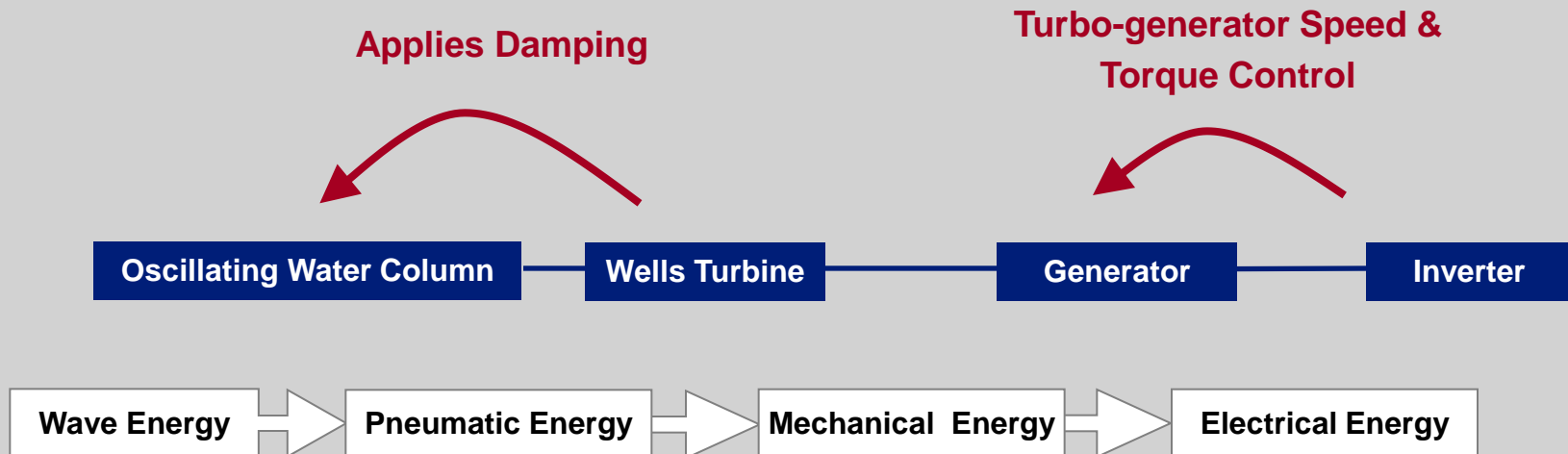
## Wells Turbine advantages



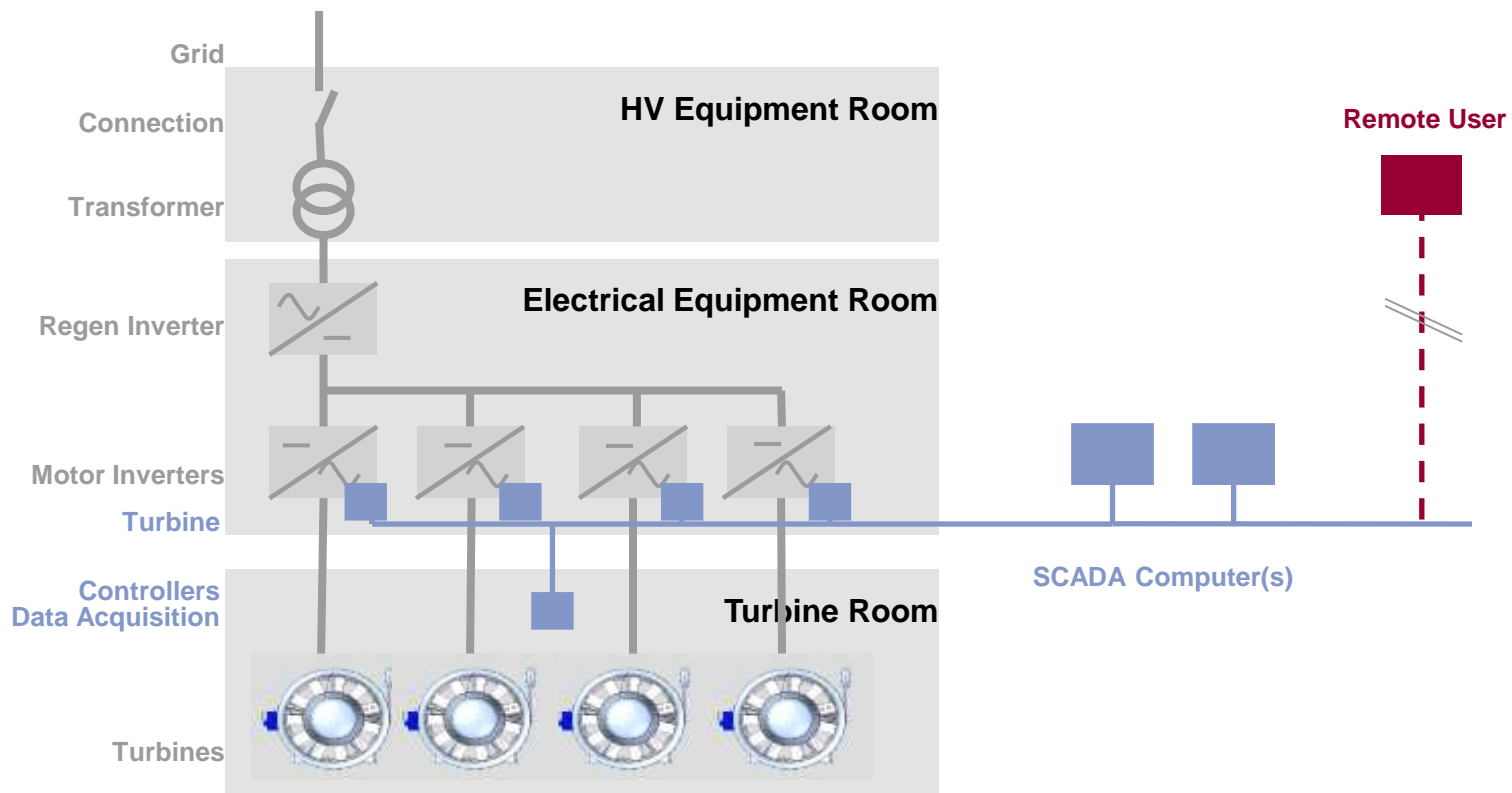
- Simple - minimum moving parts.
- Uses air - no contact with water.
- No gearbox.
- Flexible and reliable.
- Easy maintenance.



# Operating Principle



# Turbine Control & Electrical Equipment



## Product Range

- 20kW to 250kW Turbines.
- Deployed in multiple MW arrays.

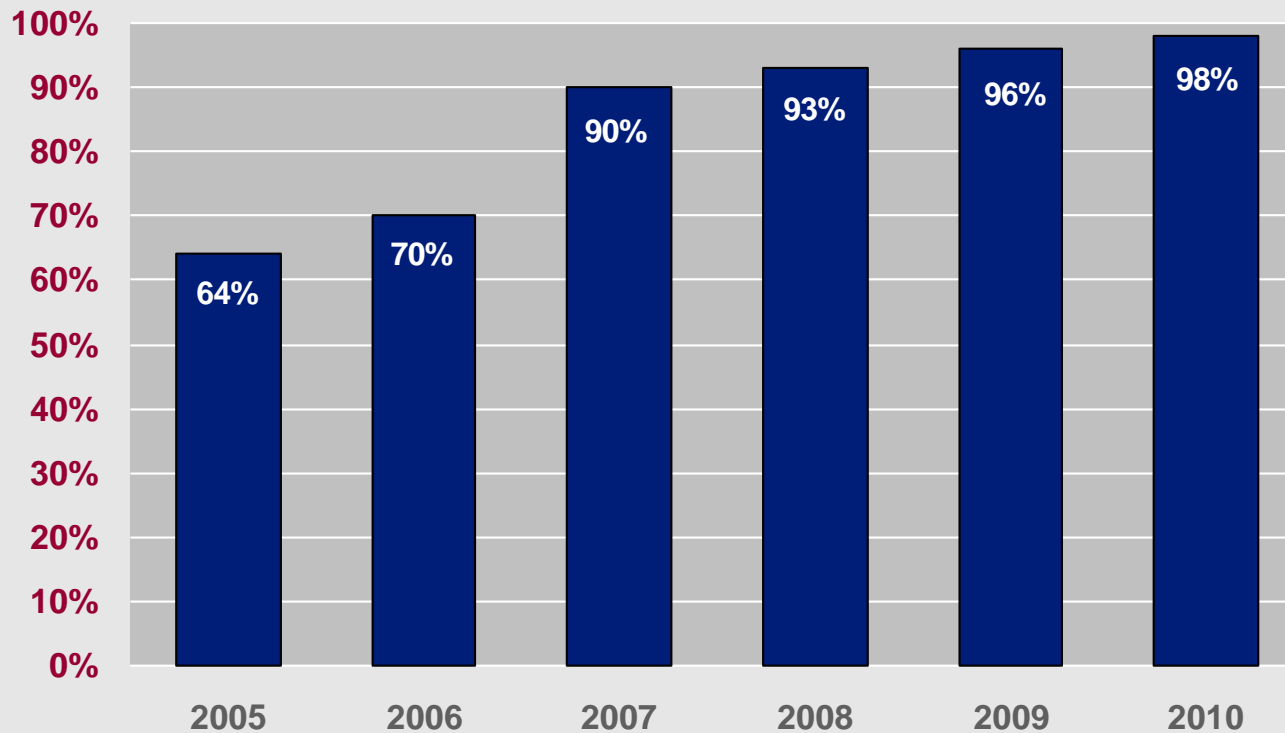


## Limpet

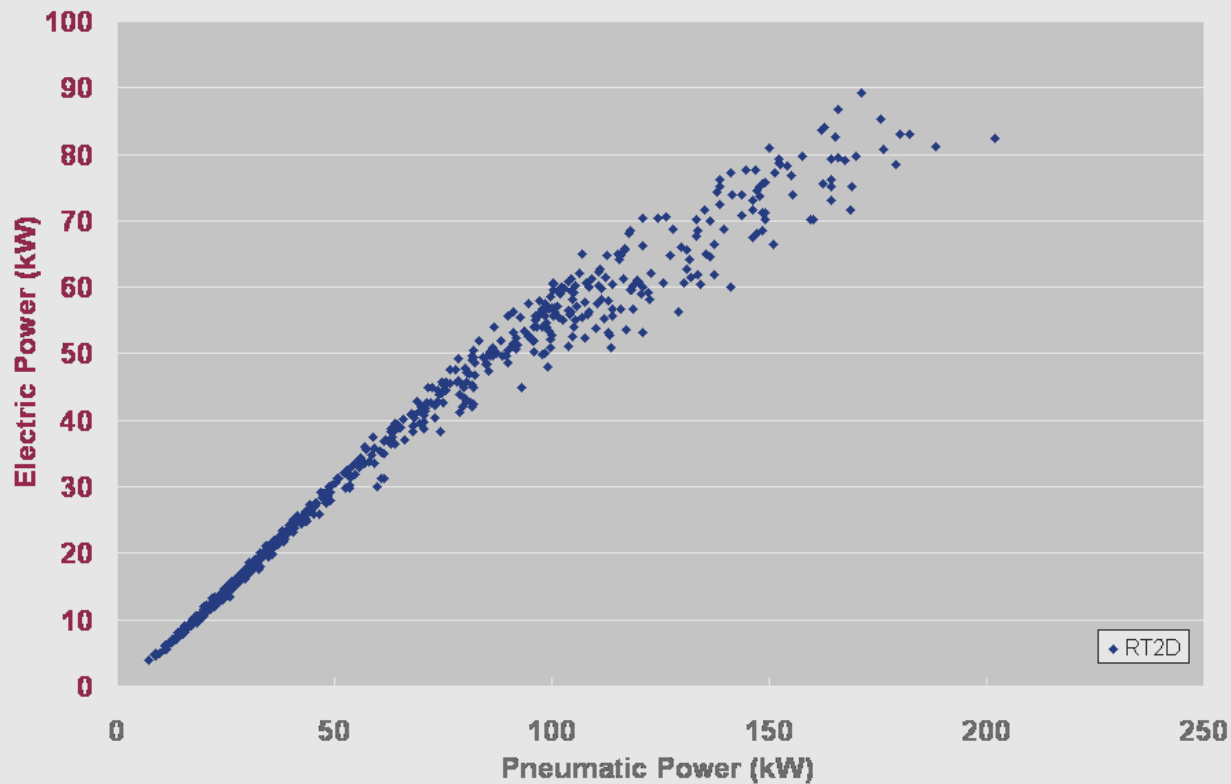
- 10 years grid connected operation.
- World's first commercial scale grid connected wave energy plant.
- Reference plant and test bed.



## Availability of Test Machines



## Performance



*Early 2011 - 5 min averages*

**Unrivalled operating experience**

**10 years**  
**60,000+ hours**  
**Guarantees**

## Mutriku



- Client: Ente Vasco de la Energía (EVE).
- Power plant integrated into breakwater.
- 300kW (16 turbines).
- Support under EU FP6



## Mutriku - Turbine testing at Limpet



- >4 years operation
- >31,000 running hours
- 97% Availability for 2010/11
- Ongoing operation provides maintenance forecasting

*Turbine hall & acoustic attenuator*

## Mutriku – Equipment manufacture

- All equipment completed on time.



*Voith Hydro Tolosa Warehouse - September 2008*

## Mutriku - Breakwater construction

- Build out from ongoing breakwater construction.
- Locally cast 45T sections used to build OWC chambers.



*Courtesy Basque Government Department for Transport and Public Works*

## Mutriku - Breakwater construction

- Significant storms during 2007-2009.
- Possible damage during construction.
- Resultant breaks in some external walls.
- New outer wall built in 2010.



*Mutriku new outer wall*

## Mutriku – Breakwater



*March 2011*



## Mutriku - Plant room

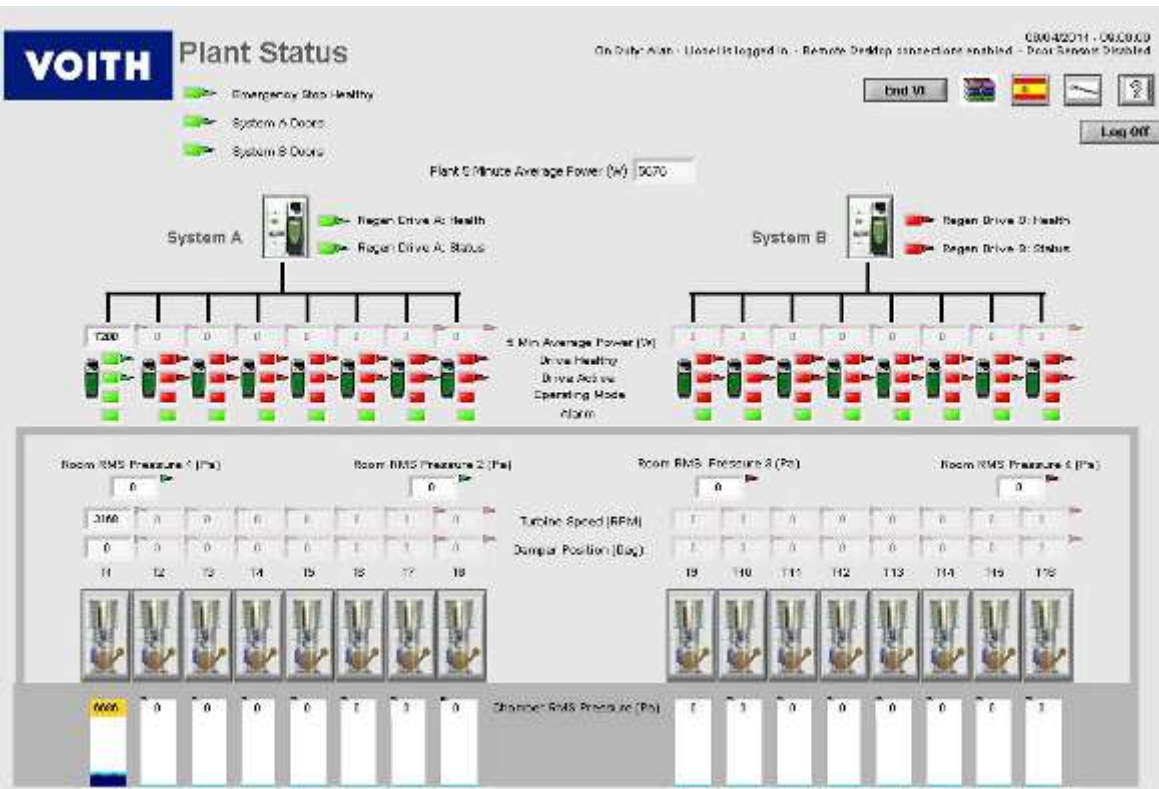


*March 2011*



*Late March 2011*

# Mutriku – Control system



Screen shot

- Control system tested at Limpet.
- Operated since May 2007.

## Mutriku - Summary



- Installation completed end of March 2011.
- Commissioning to start end of April 2011.
- Guarantees:
  - Performance
  - Availability



## Siadar Wave Energy Project



*Image courtesy of RWE npower renewables*

- Client: RWE npower renewables.
- 4MW, 200m long breakwater.
- Fully consented.
- Energy Output Guarantee (combines performance and availability).

## Well on the Way to Commercialisation



- Excellent access for installation and O&M.
  - 60,000 generating hours gives commercial confidence.
  - Proven high availability.
  - Standard power equipment contract including guarantees.
- ➔ Economic viability.

# VOITH

*Engineered reliability.*