

# Alstom's Tidal In Stream Energy Converter Demonstration Project

WREC 2011

Philippe GILSON

Bali, October 17<sup>th</sup> , 2011

POWER

**ALSTOM**

## Alstom in Ocean Energy

Alstom's Tidal In Stream Energy converter : BELUGA 9

BELUGA 9 demonstrator status

# Alstom : Four sectors (as of July 4<sup>th</sup> 2011)



**Grid**

24%

**Transport**

24%



**Renewable  
Power**

9%

**Thermal  
Power**

**Sales by Sector (proforma figures)**

43%

Source: Alstom2010/11

**Hydro, Wind, Other Renewables**



**Gas, Steam, Nuclear, PAC**



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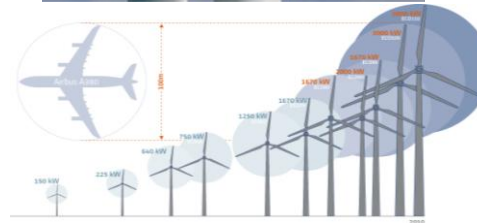
# Alstom competencies for Ocean Energy



## ALSTOM HYDRO



## ALSTOM WIND



## ALSTOM GRID



**Tidal  
In  
Stream  
Energy  
Converter**



**Wave  
Energy  
Converter**

# Tidal Stream technology selection



**Reliability & reduced maintenance**

**Social & Environmental acceptance**

**Economies of scale**



Only one rotating part

Completely submerged

Growth potential



**Clean Current**  
Renewable Energy Systems

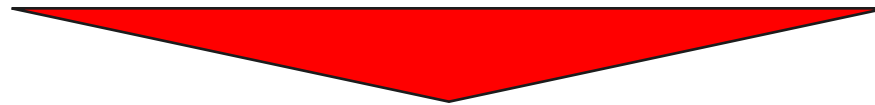
**Technology licensed from Clean Current Power Systems**

# Wave Energy technology selection

**Availability**

**Social &  
Environmental  
acceptance**

**Economies of  
scale**



Modular concept  
Dry air circuit

Off-shore deployment

2.5 MW / unit  
Low mass per MW

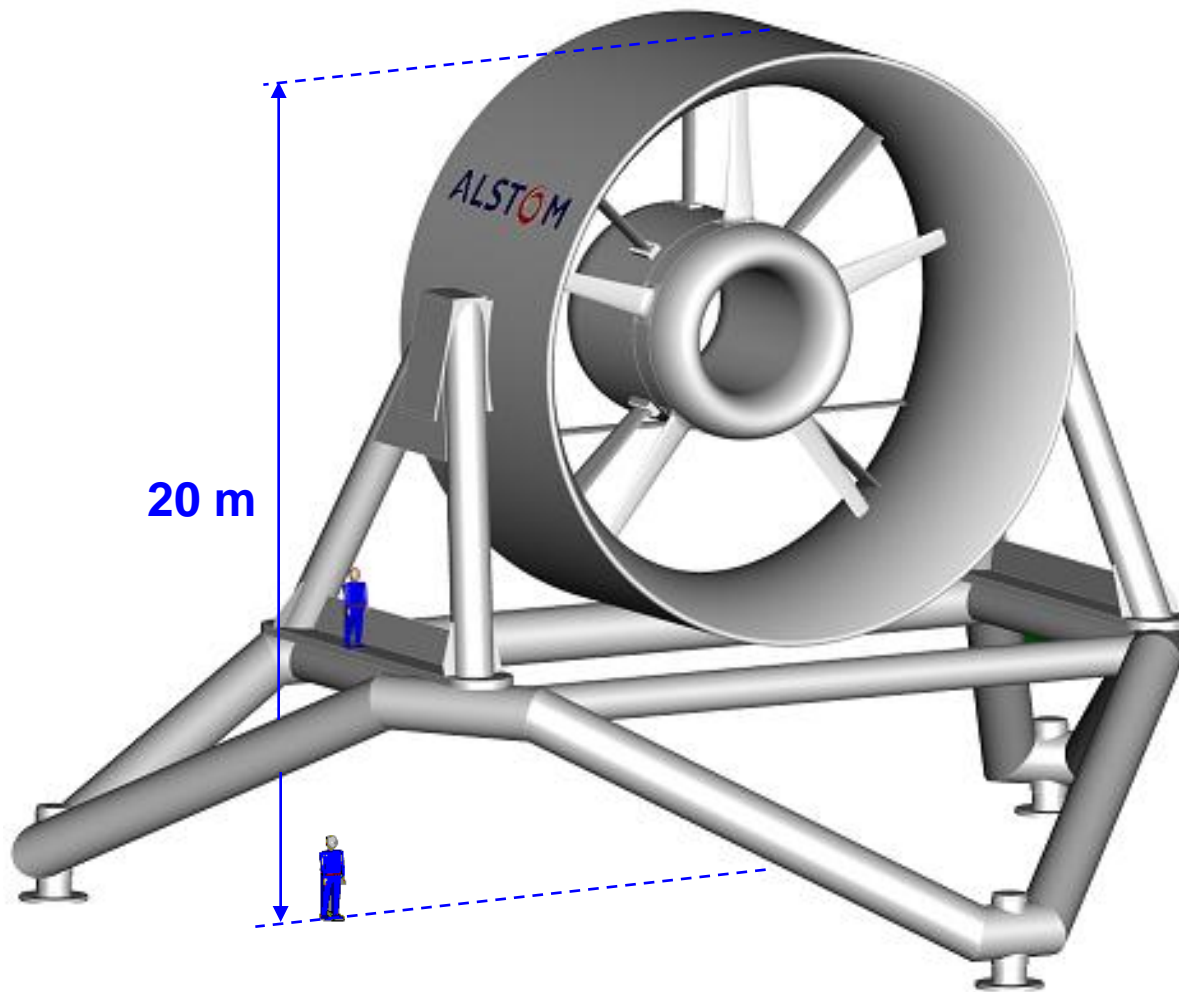


**40% Investment in AWS Ocean Energy Ltd (Scotland)**

## Alstom in Ocean Energy

### Alstom's Tidal In Stream Energy converter : BELUGA 9

## BELUGA 9 demonstrator status



## BELUGA 9

- Power = 1 MW @ 3,5 m/s
- Reversible operations
- Outer diameter = 13 m
- Permanent Magnet Generator
- Variable speed < 50 rpm
- Fixed blades
- Sea water lubricated

## **BELUGA 9** (up to 9 knots)

## Alstom in Ocean Energy

### Alstom's Tidal In Stream Energy converter : BELUGA 9

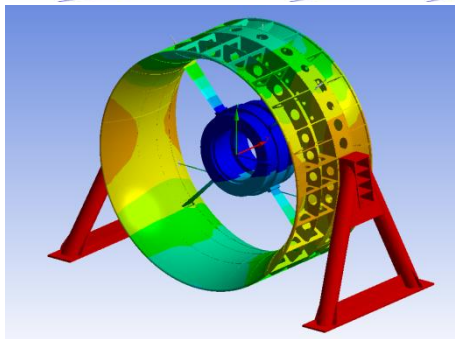
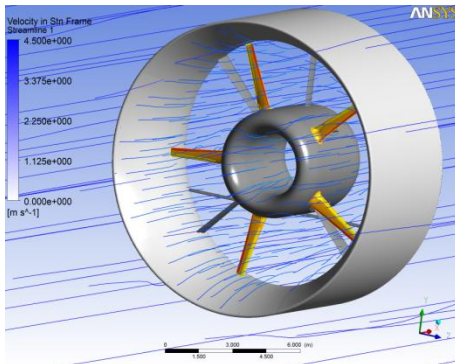
#### BELUGA 9 demonstrator status

# BELUGA 9 Demonstrator status



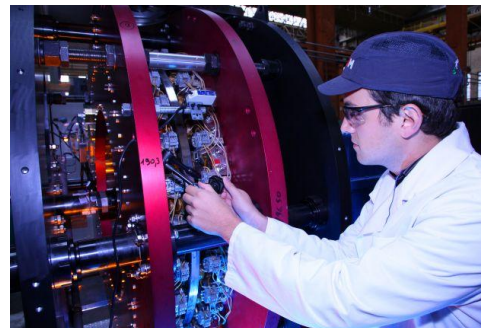
## Design studies

Completed



## Scale models tests

Completed



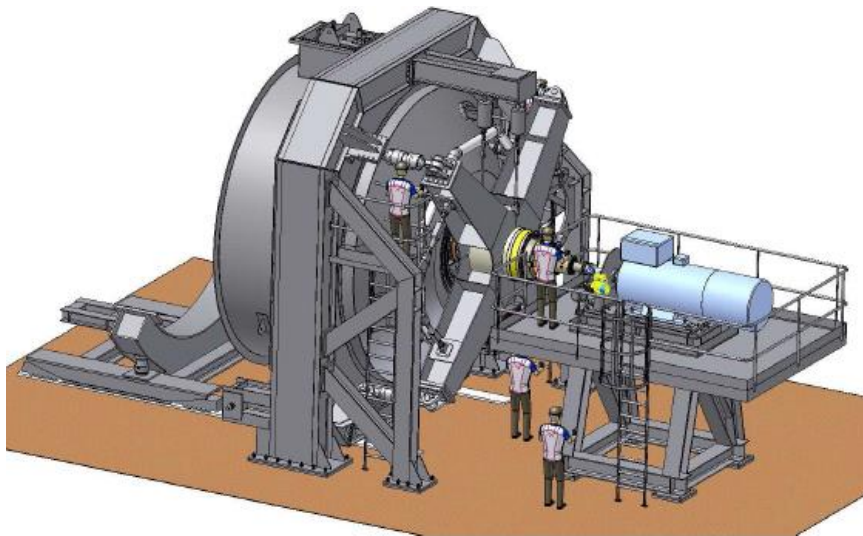
## Full scale fabrication

In progress



**Design validated - Fabrication ongoing**

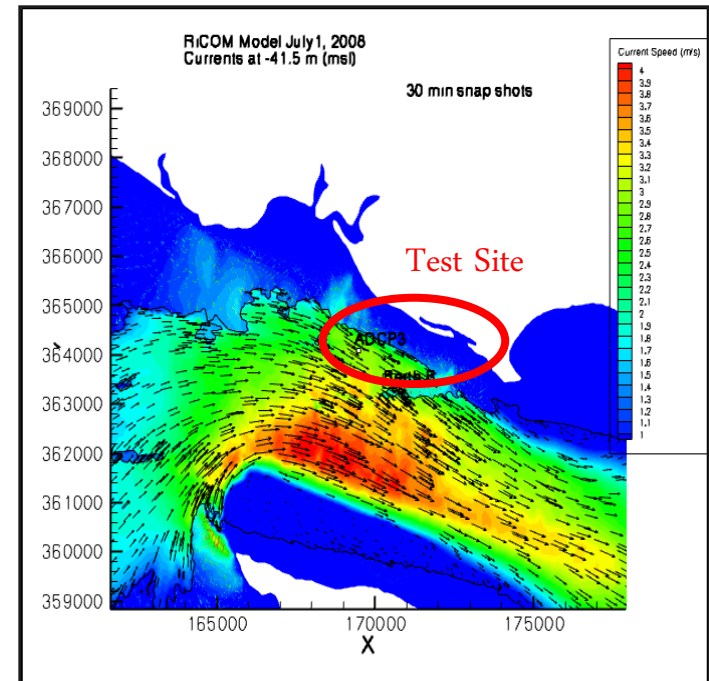
- Factory tests of the full scale demonstrator
  - Shaft and bearings tests
  - Generator tests
  - Control & Condition Monitoring systems validation



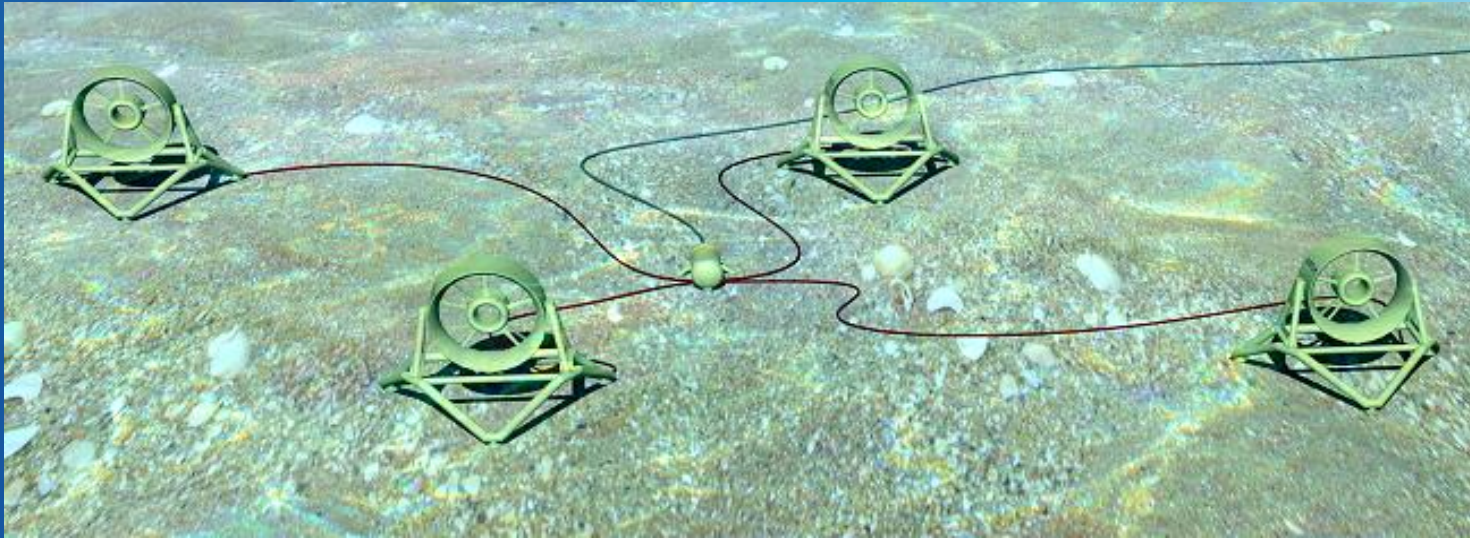
## First landbased full scale TISEC test facility

# BELUGA 9 Demonstrator status

- Deployment at sea in 2012
  - Bay of Fundy, Canada
  - $V > 3.5$  m/s
  - Depth = 50 m
  - Project supported by SDTC



## Pilot tidal farm



[www.alstom.com/power](http://www.alstom.com/power)

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