The WindFloat Project

An industrial opportunity for Portugal and Europe

WavEC Seminar 2012

Lisboa, 26th of November 2012
Are we creating sustainable value from our oceans? How can we do it? Energy as a sustainable value creation driver @ sea

“Ocean Energies... can contribute to the development of a “blue economy” in Europe... provide jobs and spur economic growth. Innovation and technology will drive this new economy.”

ENERGY
SEA
TECHNOLOGY AND INNOVATION
VALUE CREATION
JOBS
OPPORTUNITY FOR EUROPE
Agenda

- EDP and its renewable energy positioning
- WindFloat Project
- Industrial opportunity for Portugal and Europe
#3 wind energy player in the world with 7,500 MW of installed capacity in 11 countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Installed MW</th>
<th>FY2011 EBITDA MW + ENEOP</th>
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EDP is partnering with Repsol for the development of Offshore Wind Projects in the UK

UK Offshore Wind Partnership

EDPR is leading the development of up to 2.4 GW of wind offshore projects with a 60% stake

- Partnering with Repsol, 1st class company in Energy Sector with strong commitment to wind offshore capacity development
- Sites to be developed in “transitional waters” (30-60m of depth), 15-25 km shore distance
- Upon getting key consents, construction and operation could begin between 2015 and 2020
The WindFloat project was structured as a Joint Venture, WindPlus

The Project is being developed by...

...in a joint venture...

WindPlus*

...with the support from...

* WindPlus shareholders are edp, repsol, inovcapital, principle power and a. silva matos
The WindFloat technology – its main characteristics lead to High Stability even in rough seas

**Turbine Agnostic**
- Conventional turbine (3-blade, upwind)
- Changes required in control system of the turbine

**High Stability Performance**
- Static Stability - Water Ballast
- Dynamic Stability - Heave Plates and active ballast system
  - Move platform natural response above the wave excitation (entrained water)
  - Viscous damping reduces platform motions
- Efficiency – Closed-loop Active Ballast System

**Depth Flexibility (>40m)**

**Assembly & Installation**
- Port assembly – Reduced risk and cost
- No specialized vessels required, conventional tugs
- Industry standard mooring equipment
The WindFloat technology – key figures

- Platform Displacement: 2.750 ton
- Structural weight: 1.200 ton
- Water ballast: 1.300 ton
Workshop Fabrication of main components

A. Silva Matos was the responsible for the fabrication of the WindFloat
Mooring Pre-Lay in parallel with the fabrication
Turbine Installation in the Dry Dock using the shipyard’s gantry crane
Tow from Setúbal to Aguçadoura (~400 km) using the same vessel that was used for the mooring installation
Hook-up at final location
In Operation since December 2011!
The WindFloat is monitored 24 hours a day remotely.
Survivability and performance proved in normal and extreme conditions

- **22 Oct 2011**: Installation complete
- **01 Nov 2011**: 15 meters wave
- **20 Dec 2011**: First Electron produced
- **03 Jan 2012**: Operation in $H_s=6m$ and $H_{max}=12.6m$
WindFloat is commissioned and producing at its nominal capacity. 3.4 GWh and counting!
WindFloat is behaving well in line with the models and turbine is following its original power curve – no losses due to motions
WindFloat technology can lead to \(~100 \text{ €/MWh}\)

Main Drivers of Improvement:

1. Increase the Power of the turbine as:
   - The size of the platform is mostly driven by the metocean conditions \(^{(1)}\)
   - Turbines of 7 MW – 15 MW are currently in development (Vestas 7MW announced) and in final testing phases

2. Improve the installation procedure and O&M strategy

3. Cheaper materials

4. Synergetic commercial activities
The WF technology revives traditional sectors with technological innovation and without significant infrastructure investments

**Main sectors of activity directly involved in the project:**

1. Engineering Services
2. Maritime Construction - Shipyards
3. Metal-Working
4. Maritime Transport
5. Electrical and Electronic Equipment
6. Offshore Equipment
7. Legal services
8. Financial Services - Insurance
The WindFloat technology requires highly skilled labour in European traditional sectors.

FTE’s involved in the WindFloat Prototype (%)

- WindFloat Prototype:
  - 90% of highly skilled workers
  - More than 70% of European Suppliers

- WindFloat Pre-Commercial Project:
  - More than 450 highly skilled workers involved in a three year project
  - More than 90% of European Suppliers

* Not including other indirect participants also involved in engineering, investment and management activities from A. Silva Matos, EDP Innovation, EDP Renewables and InovCapital.
Final remarks

• WindFloat Project and deep offshore wind represent a significant industrial opportunity for Europe - highly skilled labor and value adding activities in traditionally strong European sectors

• The fabrication and assembly were successfully completed. Being able to construct the unit in Portugal (no offshore experience) indicates that it is possible to adapt naval infrastructures successfully and without major investments

• Offshore installation strategy successful. Supply chain breakthrough?

• The technical results of the first 6-9 months of operation of the WindFloat are very promising. Need to evaluate long term performance and impacts

• Pre-commercial phase is the next meaningful step to bridge the gap between demonstration and market. Pre-commercial project development is starting and finding and adequate funding structure will be key
Thank You

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