The WindFloat Journey:
CHANGING THE PARADIGM OFFSHORE WIND
WindFloat – is a “Game Changer”
Most of the WindFloat assembly works are done onshore, reducing risk and cost

Eliminates current depths limitations
- Transitional 40 to 60 m water depth
- Deep water below 40m

Dampens wave and turbine induced motion
- enabling installations in previously inaccessible locations with superior wind resources

Turbine Agnostic
- can be used with any commercially available turbines

High Stability Performance
- static stability – water ballast;
- dynamic stability - heave plates, active ballast system

Assembly & Installation
- Onshore assembly - reduces risks and costs;
- Uses standard mooring equipment
- Requires only anchor handling vessels for installation
The WindFloat® – It’s what you **DO NOT** see that matters...
## Windplus, S.A. - Portugal

<table>
<thead>
<tr>
<th>Phases</th>
<th>Capacity</th>
<th>Units</th>
<th>Location</th>
<th>Turbine</th>
<th>Install Date</th>
<th>O&amp;M period</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prototype</td>
<td>2 MW</td>
<td>1</td>
<td>• Aguçadoura</td>
<td>2 MW Vestas V80</td>
<td>2011</td>
<td>3-4 yrs</td>
<td>Completed</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Grid connected</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• ~5km offshore</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• 40-50m water depth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-Comm</td>
<td>~25 MW</td>
<td>3 - 4</td>
<td>• Location - TBD</td>
<td>&gt; 5 MW</td>
<td>2017</td>
<td>25 yrs</td>
<td>Awarded NER300</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Grid connected</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• &gt; 50m water depth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comm</td>
<td>Add ~125 MW</td>
<td>20+</td>
<td>• Same as Pre-Comm</td>
<td>&gt; 5 MW</td>
<td>TBD</td>
<td>25 yrs</td>
<td>TBD</td>
</tr>
</tbody>
</table>

Windplus, S.A.
WindFloat® Prototype – Lab to Full Scale in 30 Months
WindFloat Prototype – Mooring Pre-lay
WindFloat Prototype – Fabrication Using Existing Capacity
WindFloat Prototype – January 19, 2013

Hs > 8m
Hmax > 18m
WindFloat Prototype – January 6, 2014 Storm (Hs – 9m)
WindFloat Prototype: Performance Demonstration
Has been in operation for 3 years, successfully surviving above design criteria storms

Timeline/Key Dates
• 22 October, 2011 – Installation completed
• 29 February, 2012 – Commissioning and Trial Operations completed, imposed test limits removed
• 15 April, 2012 – 1GWh reached

Production to date: > 11 GWh
Max Capacity factor reached: > 47%
How Long to Commercial Projects?

- **Model Testing Feasibility:** 2008
- **2MW Prototype:** 2011
- **24-30MW Pre-Commercial PT, UK, US, Japan:** 2013 - 2017
- **Commercial:** 2018 onwards
Development Projects In Key Global Markets promote Market Adoption

**Small Scale**
- Up to 30MW
- 6-8MW WF units in the Pacific
- High Wave/ High Wind

**Prototype**
- Conservative design
- Verify numerical models
- Operational learning

**Small Scale**
- 25MW
- 6-8MW WF units in the Atlantic
- High Wave/Medium Wind

**Pre-Commercial**
- Design optimization
- Global metocean
- Turbine size/ type

**Pilot**
- WF1 (2MW)
- 2MW WF in the Atlantic Ocean
- High Wave/ Medium Wind

**Other Small Scale projects**
- 10-50MW in the UK and Japan
- 6-8MW WF units
- Medium Wave/ Very High Wind

**Commercial**
- Fully optimized
- World-wide design
- LCOE below market

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Other Small Scale projects
- 10-50MW in the UK and Japan
- 6-8MW WF units
- Medium Wave/ Very High Wind
WindFloat: Scaling-up......

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>2MW Prototype</th>
<th>6-8MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotor Diameter</td>
<td>80m</td>
<td>≈155m</td>
</tr>
<tr>
<td>Hub height</td>
<td>56m</td>
<td>100m</td>
</tr>
<tr>
<td>Turbine/Tower</td>
<td>400 ton</td>
<td>1000 ton</td>
</tr>
<tr>
<td>Displacement</td>
<td>2800 ton</td>
<td>6000 ton</td>
</tr>
<tr>
<td>Design life</td>
<td>5 years</td>
<td>25 years</td>
</tr>
</tbody>
</table>
WindFloat Atlantic - 3 phases
With a demo phase ongoing and important results achieved and a pre-com phase under development

Phase 1 – Demonstration

- **Capacity:** 2MW WindFloat® prototype
- **Location:** Aguçadoura, grid connected
  - ~6 km of coast, 40 - 50 m water depth
- **Turbine:** 2MW offshore wind turbine
- **Test period:** 24+ months

In operation since late 2011

Phase 2 - Pre-commercial (WindFloat Atlantic)

- **Capacity:** 25MW
- **Location:** Portuguese Pilot Zone
- **Turbine:** Multi MW, TBD

Estimated installation in 2016/2017

Phase 3 - Commercial

- **Capacity:** 150MW, gradual build-out
- **Location:** TBD
- **Turbine:** TBD
WindFloat Atlantic
The pre-commercial phase will take place in the North of Portugal, an area that presents very favorable conditions.

- **Total capacity**: 25 MW capacity
- **Total investment**: > 100M€.
- **Location**: off the coast of Viana do Castelo.
- **Wind resource**: NCF from 34.7 to 39.4% depending on turbine model (using a mesoscale model calibrated at different points close to the site including current pilot project at <30km from future site. A floating Lidar will be installed in 2014 to measure wind on site).
- **Water depth**: ~100m.
- **Geology**: sand and sediments, suitable for mooring (geological campaign to be conducted in 2014).
- **Construction**: several shipyards options available close to final location. Turbine installation quayside.
- **No need for offshore substation** (direct connection at 30 or 60kV).
- **Interconnection**: offshore interconnection to be conducted and financed by REN. Proven interconnection capacity onshore, <20m from the shore.
- **Floating structure certification**: will be conducted throughout design, construction and installation by an independent party (e.g., ABS).
- **Projected project lifetime**: 25 years.
WindFloat Pacific: Creation of a New Industry
THE Start of West Coast Offshore Wind Developments

Retirements of fossil and nuclear power plants
- Creates near-term need for large-scale resources
  - San Onofre, CA – 2,150 MW
  - Boardman, OR – 550 MW

West Coast has excellent offshore wind resource
- Can deliver energy directly into densely-populated coastal areas
- Winter peaking supply corresponds to peak demand periods

WFP is critical to the West Coast to
- Build capabilities
- Demonstrate feasibility
- Position to add large-scale offshore wind resource on line
WindFloat Pacific

- Up to 30 MW
- Up to 5 WindFloats
- 18 miles due west of Coos Bay, Oregon
- 350 meters water depth
- 25 year project life
- Interconnection - PacifiCorp Substation

Strong wind resource
- Annual NCF ~ 42.5%

Industrial community
- Deep, protected harbor

Organized Fishing Presence
- Consensus on project location

Existing BOEM state task force (OR)

Favorable state policy disposition
- Renewables/ocean energy
- Market pull from Regional Utilities