California Offshore Wind Update
Principle Power, Inc.

September 2017
Principle Power is a leader in deep water offshore wind technology.

We’re committed to unlocking the world’s renewable energy potential.
Principle Power is a global technology leader for floating offshore wind energy

- Headquartered in Emeryville, California with offices in Portugal and France
- Backed by global energy and utility leaders
- Globally patented, proven floating platform technology: the WindFloat
- Global project development based on low cost of energy and low technology risk
WindFloat is a proven technology: Successful 5 year Lifecycle Demonstration in North Atlantic

• 2011-2016 WindFloat 1 (2 MW)
• Successfully proved floating platform technology
• Generated over 17 GWh of clean energy
• Endured intense storms: 55’ waves, 60 knot winds
• Incorporated lessons to improve next generation of technology
The WindFloat foundation creates platform stability in all weather conditions

1. **Turbine Agnostic**
   - Any conventional commercial Turbines
   - Minimum redesign in:
     - Control system – software
     - Tower – structural interface

2. **Hull Trim System (Active ballast)**
   - Displaces some water between columns to compensate for changes in mean wind velocity and direction

3. **Water Ballast (Operational draft)**
   - Located at the bottom of each column and used to achieve operating draft
   - More water in the columns not supporting the turbine

4. **Heave Plates (Dynamic Stability)**
   - Move platform natural response above the wave excitation (mass of entrained water)
   - Viscous damping reduces wave induced motions
Floating Wind has Emerged as a Legitimate Energy and Industrial Opportunity
Already executing on projects in different geographies, which fully prove low risk and cost competitiveness

<table>
<thead>
<tr>
<th>WindFloat Atlantic</th>
<th>Golfe du Lion</th>
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<tbody>
<tr>
<td>25 MW, Portugal, Operational 2019</td>
<td>24 MW, France, Operational 2020</td>
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<tr>
<td>- 3x 8.3 MW MHI Vestas</td>
<td>- 4x 6 MW GE</td>
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<tr>
<td>- 20 km out; 100 m deep</td>
<td>- 18 km out; 70-100 m deep</td>
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<tr>
<td>- Local Shipyard Construction</td>
<td>- Local Shipyard Construction</td>
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<tr>
<td>- Certified by ABS</td>
<td>- Certified by BV</td>
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<tr>
<td>- Feed-In Tariff</td>
<td>- Feed-In Tariff (through competitive process)</td>
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<tr>
<td>- Equity Financing complete w/ strong international sponsors</td>
<td>- Very strong consortium with major energy companies and industrials</td>
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<td>- First on-Recourse Project Finance of a Floating Wind Farm (Financial Investment decision in summer 2016)</td>
<td>- Major innovations to advance technology to the next level of competitiveness</td>
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Deep waters off Pacific Coast require floating technology

220 GW of potential offshore wind along Pacific Coast; 95% in waters deeper than 60 m.

Principle Power’s WindFloat system is the leading technology to deploy offshore wind in deep waters at large scale and low cost.

1. Floating wind turbines are configured in an array to optimize the capture of wind energy.

2. Energy captured by the turbines is conveyed through a transmission line to a floating substation.

3. A transmission cable transmits the power from the floating substation to the shore, where it is connected to the onshore electric system.
Offshore wind energy in California offers numerous benefits

Valuable complement to solar & “Duck Curve”
Offshore wind reduces curtailment, ramping, and storage needs of large solar deployments.

Cost savings
Competitive cost of energy and avoids expensive transmission upgrades.

Economic development
Revitalization of coastal industrial areas.
Investment in port infrastructure and shipyards.

Grid stability and resilience
System is designed to withstand natural disasters, reducing vulnerability to extreme events.

Figure 17. Diurnal power output for a single 6-MW offshore wind turbine in the sample month of March
Offshore wind industry in California offers significant economic development potential

- 14,000+ potential direct construction and operations jobs from offshore wind in California.

- $20-50B in state GDP growth from construction, operations, and support functions.

- Additional shipyard infrastructure investment and ship construction can revitalize industrial port areas.

Figure 4-1. Construction-phase California Jobs for both scenarios
California Market: Offshore wind development is moving ahead with significant state/market interest

- California has a renewable energy requirement of 50% by 2030; likely to increase to 100% soon
- Existing proposals that use the WindFloat: 1 GW site off Morro Bay (Trident Winds)
- Global energy companies are examining the market (ex: Statoil and DONG from Europe)
- California and U.S. Federal government created an Intergovernmental Task Force to examine offshore wind siting in California
- Auction process expected to begin in 12-18 months

Average wind speed along California coast
Proving the industry is technically viable; now showing economic and financial viability to be commercial end of decade

Phase 1
Technology Demonstration
- Technology Development and patents
- Successful fabrication, installation and operation

Phase 2
Pre-Commercial
- Building demonstration scale farms in 1 or more geographies to prove concept financially and economically
- Focus on technology Roadmap and Levelized Cost of Energy Reduction

Phase 3
Commercial
- Competing in the Marketplace with other technologies and sources of energy

Maturity

2007-2012
2013-2018/19
> 2018/19
WindFloat Commercialization Pathway on track to reduce LCOE below $100/MWh by the early 2020s

LCOE (USD/MWh)

- **WF1 (2 MW)**: >400
- **Pre-Commercial Demos (20-50 MW)**: 180-220
- **Commercial Projects (>200 MW)**: <100

**Cost Reduction Goal**: USD 100 / MWh
California BOEM Leasing Process – Renewable Energy Leasing: Leasing auctions within 12-18 months

Still very early in process. Call for Information expected this summer.
Planning for commercial WindFloat projects in California

- Can’t change where the winds are...
- WindFloat units supporting future Wind Turbines of 10+ MW capacity
- Hull Fabrication Site = anywhere in the world but preferably on West Coast (CA)
- Hull Assembly and Turbine Erection Site = Assembly Port in CA
- Throughput: 1 platform completed/week
Key Take-Aways

1. The WindFloat, developed in California, is already proven technically, and is now proving its financial and economic viability.

2. Several Projects are ongoing worldwide, both in execution in the near term and in commercial pipeline globally.

3. Floating Wind competitive with current offshore wind levels and on track to be competitive to deploy at large commercial scale after 2020.

4. Offshore Wind can play a key role in the energy mix in CA, with a steady resource close to load centers, complementing solar, avoiding transmission costs from out-of-state wind and In-State Economic potential.

5. Current focus is to identify the supply chain in California, and to understand and advance development opportunities for the WF.