Mary Jane Parks, **SVP Project Development**

**US Offshore Wind Development**
Long-period waves
Deep (floating) offshore wind
Kelp to gas
Deep (floating) offshore wind
Offshore geothermal

Tidal current
Deep (floating) offshore wind
Macro-algae to gas
Short-period waves
Shallow (fixed) offshore wind
Micro-algae to oil
Ocean current

Shallow (fixed) offshore wind

Source: George Hagerman

US Offshore Renewables

Source: PRINCIPLE renewable energy delivered
Principle Power Inc.

Founded in 2007

Mission
- Renewable Energy IPP and Project Developer
- Commercialize disruptive renewable technologies

Offshore Renewables – WindFloat
- Patented, floating foundation for >50M depth
- Exclusive, world-wide license from MI&T

Concentrated Solar – Cool Earth Solar
- MOI for exclusive development rights in specific markets

Strong and Experienced Management Team
Offshore Renewables Potential

Generation in TWh/yr
- Wave ~ 250-260
- Tidal ~ 150
- Offshore wind
  - Shallow > 300
  - Deep > 900
- Potential is >40% of present energy generation

U.S. Annual Electric Power Generation by fuel type in 2004 was 3,971 Terawatt-Hours (TWh)

- Coal 49.8%
- Natural Gas 17.9%
- Other Renewables 2.3%
- Other Gases 0.4%
- Petroleum 3.0%
- Hydroelectric * 6.5%
- Nuclear 19.9%
- Other 0.2%

* Note: Hydroelectric includes generation from pumped-storage facilities after subtracting energy used for pumping
US Offshore Wind Energy

Source: NREL
Deep Ocean Offshore Wind Concepts

WindSea (semi-submersible)

Hywind (spar)

Blue H (tension leg)
Safety First – Themes

Technology
- Water depth independent semi-submersible
- Strong mooring configuration
- Overturning moment absorbed by hydrostatics
- Foundation stability
- Minimize pitch and yaw

Installation
- Port assembly – lower cost and practical
- Turbine/mast installation – known location and equipment
- Benefit of offshore installation
- Longer deployment window
- Mooring installation vessels
Offshore Wind in California

- **Utility interest**
- **Project Description**
  - Phase One – 10 MW (2 turbines)
  - Scale to 150MW (30 turbines total)
- **Grid Connection**
  - Interconnection at Shore Substation
- **Community Involvement**
  - Recreational Interests
  - Local Fishermen
  - Community Environmental
- **Green Pricing/Green Credits**
Power Plant Visibility

10 miles offshore

5 miles offshore
Equipment

Source: Libherr Cranes
Source: Talisman Energy / Beatrice
Overall Timeline

- Stakeholder Involvement
- Environmental Studies
- Regulatory Application, Review, Approvals
- Phased Construction
- Commercial Operation Date
- Operation, Maintenance, Monitoring
Project Layout

- Mooring footprint: 8 x water depth
- Predominant Wind directions: North and South
- Area permitted: < 5 square miles
Site Selection

- Wind resource > 7 m/s
- Grid capacity & expansion
- Distance to fabrication site
- Dedicated assembly site
  - Successive fabrication,
  - Assembly and installation
  - Vessels on long term contract
  - Shore infrastructure near major highway
### Permits

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