



*Renewable Energy From the Ocean*

June 21, 2007

Nanaimo, BC

# OCEAN ENERGY OPPORTUNITY FORUM

## Pacific Region



Source: BWEA / Copyright DONG Energy

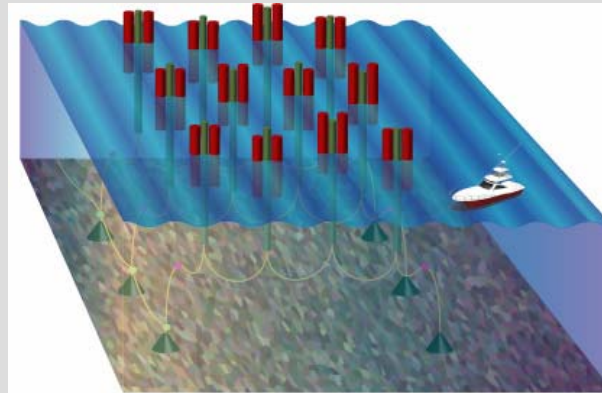


Image Courtesy SyncWave Inc.



Copyright: Clean Current Power Systems Inc.

# “Project Finance Presentation”

- **Introduction**
- **Overview: Ocean Renewable Energy**
- **Commercial Project Finance**
  - *Wind Energy Market Overview*
  - *Wind Energy Project Finance*
- **Development / Demonstration Project Finance**
  - *Tidal and Wave Energy Challenges*
  - *Shared Testing and Evaluation Facilities*

# William Y. Zakroff

- **Born in Chicago / Based in Houston since 1979**
- **Founder and CEO of Marinus Power LLC (Since 2006)**
- **Executive Director of Zakroff Group (Since 1984)**
  - *Venture Capital and Private Equity Financing Projects*
  - *General Management Consulting / Strategic Planning Projects*
  - *Business Development / International Projects*
- **Non-Executive Director of AIM / LSE Listed Company (Since 2007)**
- **Formerly with General Electric Co - Engineered Materials Group**
- **MBA – Kellogg Grad School of Mgt / Northwestern University**
- **BS Chemistry – University of New Mexico**

# Marinus Power is a Project Development Company Focused Marine Renewable Energy

## Hybrid Systems with 2 or More Ocean Energy Sources

Offshore Winds

Waves

Tides

Currents

Ocean Thermal

Methane Hydrates

- **Offshore Wind** farms have been **Operating** in N. Europe for 15+ yrs
- In-stream **Tidal and Wave** generators are in **Pre-Commercial** stage
  - Focus on technology development and demonstration projects
  - Many small device developers with minimal financial resources and limited industrial and marine engineering experience
- **Currents, OTEC, Methane Hydrates** are in early development stage

# Marinus Power LLC

William Zakroff  
Chief Executive Officer

## Project Execution

Director - Atlantic Northeast Region  
Portland, Maine

TEDEC / ANE-1    Project ANE-2    Project / ANE-3

Director - Gulf Coast Region  
Houston, Texas

Project GC-1    Project / GC-2    Project / GC-3

Director - Atlantic Southeast Region  
W. Palm Beach, Florida

Project ASE-1    Project / ASE-2    Project / ASE-3

Director - Pacific Northwest Region  
Vancouver, British Columbia

Project / PNW-1    Project / PNW-2    Project / PNW-3

Director(s) - N. Europe & Other Regions

Project / X-1    Project / X-2    Project / X-3

## Strategic Partners

Construction, Fabrication, and Project Mgt.  
Maine

Subsea Engineering and Subsea Systems  
Houston, Texas & N. Vancouver, B.C.

Marine Handling and Installation Systems  
Glasgow, Scotland

Offshore Engineering  
Houston, Texas

Electrical Equipment OEM  
Generator Design and Manufacturing

Electric Utility or Merchant Power Co.  
Power Generation and Power Marketing

## Marinus Funds

Marinus Fund I LP  
\$150-250 Million

Marinus Fund II LP

Marinus Fund III LP

## Marinus Funds

- MP LLC is General Partner
- ~ 75% for Project Development
- ~ 25% for Tech Development

# **Overview: Ocean Renewable Energy**

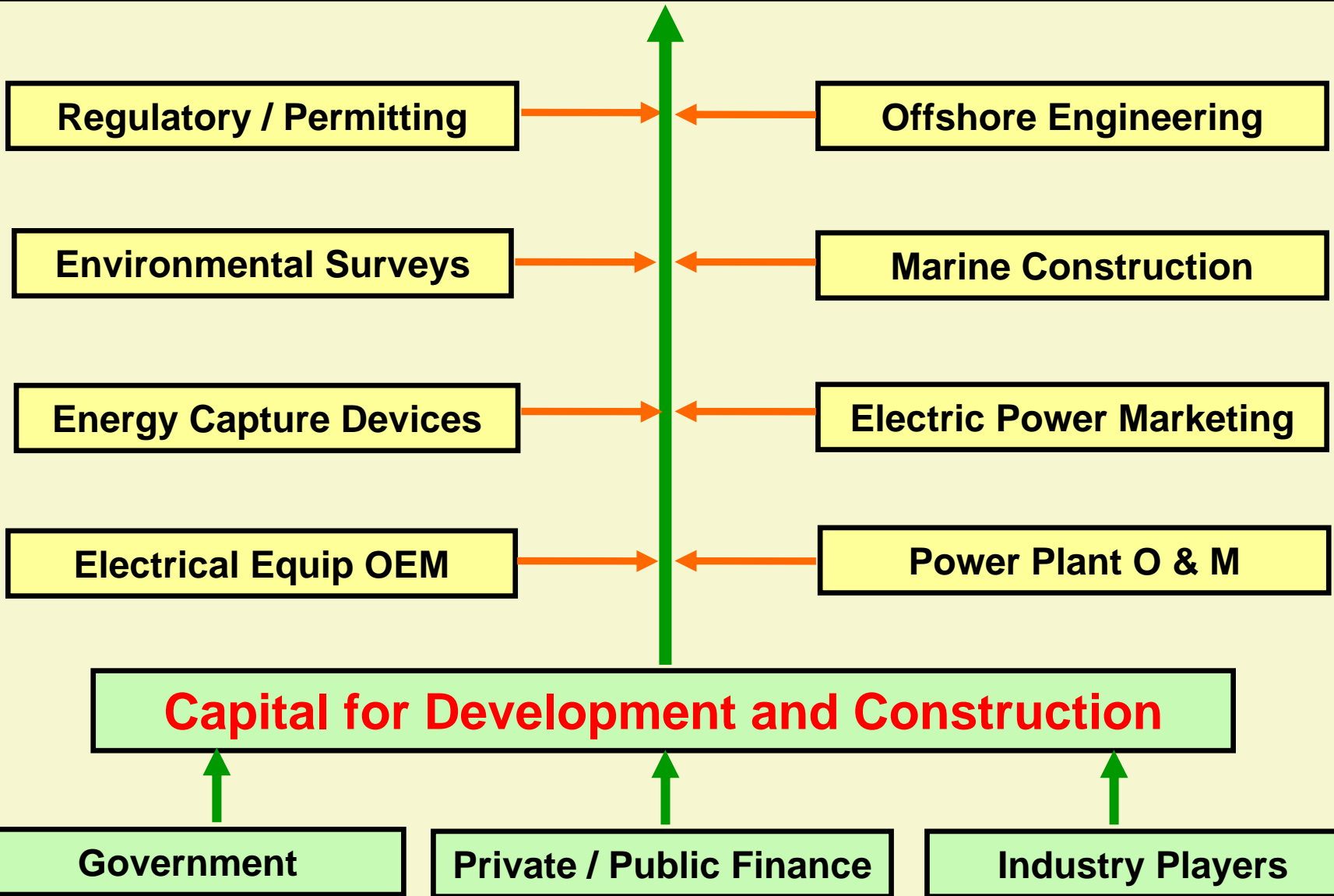
# Ocean Energy Opportunity

- **“Hot Topic” with positive image**
  - **Addresses energy security and global warming**
  - **Benefits from increasing prices for oil, gas, and other carbon based fuels**
  - **Fast growing demand for “Green” energy: ROCs, RPS, PTCs**
- **Large amounts of capital looking for renewable energy investments but ocean energy is still new and has not received much attention**
- **Marine Renewables are still in the early stages of market and technology development: both an opportunity and a challenge**
  - **Offshore wind is growing rapidly in Europe but just starting to develop in North America**
  - **No commercial tidal and wave projects have been developed beyond a few pioneering projects installed decades ago**
- **Emerging market for OEMs, project developers, and financiers**

# Ocean Energy Challenges

- **Tidal and wave energy capture devices are technically immature and pre-commercial: are not ready for commercial project finance**
- **Permitting and regulatory environment is still sorting itself out**
- **Constituencies / stakeholders all require education and comfort:**
  - **The public**
  - **Government regulators and permitting agencies**
  - **Suppliers and contractors**
  - **Environmentalists and lobbyists**
  - **Financiers, banks, insurance companies**
- **Offshore engineering and construction is well understood by O&G industry but unknown to power utilities and most financial / VC firms**
- **Capital flows into Marine Renewables to date have been very limited:**
  - **Unfamiliar industrial sector with no commercial history**

# Requirements To Develop Ocean Energy Projects



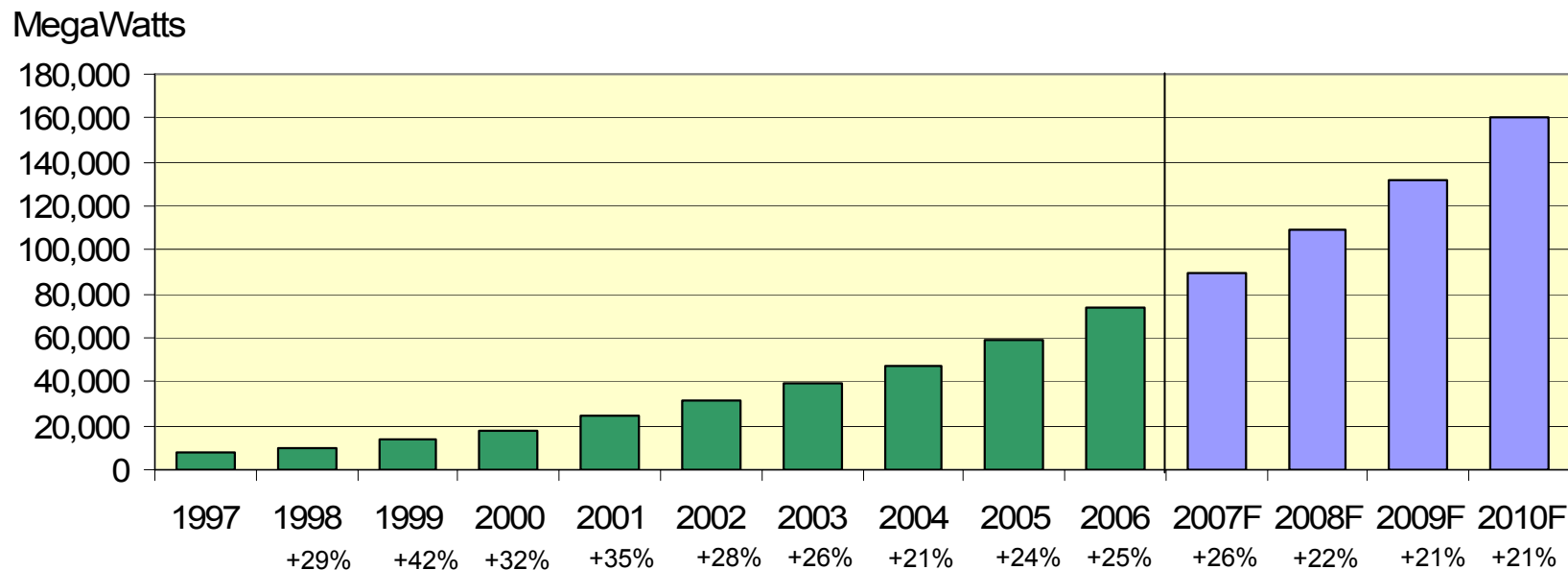
# Financing Risks for Ocean Energy Projects

<b>Project Development Challenges</b>	<b>Capital Risks</b>
<b>Basic Energy Capture Device Technology</b>	<b>Low</b>
<b>Marine Construction &amp; Installation</b>	<b>Low</b>
<b>Economically Viable and Commercial Systems</b>	<b>Moderate</b>
<b>Offshore Engineering Experience and Know-How</b>	<b>Moderate</b>
<b>Environmental Considerations &amp; Impact</b>	<b>High</b>
<b>Approval &amp; Permitting (Control &amp; Timing)</b>	<b>High</b>

# **Commercial Wind Projects**

# Global Wind Energy Capacity Increased 25% in 2006

## Total Worldwide Wind Energy Capacity (Land and Offshore)



Source: World Wind Energy Association

- 80 Gigawatts (“GW”) total wind capacity now installed worldwide with offshore at 1 GW
- Average annual rate of growth in total installed wind capacity now running around 25%
- In 2006, U.S. was #3 worldwide with 11.3 GW and #1 in new capacity with 2.5 GW added

# In 2006 Canada Was #12 in Total Wind Capacity Installed

Ranking Total 2006	Country	Capacity (MW) Added 2006	Growth Rate 2006	Capacity (MW) Total 2006	Capacity (MW) Total 2005	Ranking Total 2005
1	Germany	2,194	11.9%	20,622	18,428	1
2	Spain	1,587	15.8%	11,615	10,028	2
3	United States	2,454	26.8%	11,603	9,149	3
4	India	1,840	41.5%	6,270	4,430	4
5	Denmark	8	0.3%	3,136	3,128	5
6	China	1,145	90.9%	2,405	1,260	8
7	Italy	405	23.6%	2,123	1,718	6
8	United Kingdom	610	45.1%	1,963	1,353	7
9	Portugal	628	61.4%	1,650	1,022	11
10	France	810	107.0%	1,567	757	13
11	Netherlands	336	27.5%	1,560	1,224	9
12	Canada	768	112.4%	1,451	683	14
13	Japan	354	34.0%	1,394	1,040	10
14	Austria	146	17.8%	965	819	12
15	Australia	238	41.1%	817	579	15
16	Greece	183	31.9%	756	573	16
17	Ireland	147	29.6%	643	496	18
18	Sweden	54	10.6%	564	510	17
19	Norway	55	20.4%	325	270	19
20	Brazil	208	717.2%	237	29	34
	Others	730	48.4%	2,238	1,508	
	<b>TOTAL</b>	<b>14,900</b>	<b>25.3%</b>	<b>73,904</b>	<b>59,004</b>	

# Offshore Wind Has Been Commercial In Europe Since 1991

## Offshore Wind Farm Installations Worldwide (as of 2004)

<u>Online</u>	<u>Country</u>	<u>Location</u>	<u>MW</u>	<u># Units</u>	<u>Equipment / Ratings</u>
1991	Denmark	Vindeby	5.0	11	Bonus (Siemens) 450 KW
1994	Netherlands	Lely (Ijsselmeer)	2.0	4	NedWind 500 KW
1995	Denmark	Tunø Knob	5.0	10	Vestas 500 KW
1996	Netherlands	Dronnten (Ijsselmeer)	11.4	19	Nordtank 600 KW
1997	Sweden	Gotland	2.5	5	Wind World 500 KW
2000	UK	Blyth Offshore	3.8	2	Vestas 2.0 MW
2001	Denmark	Middelgrunden, Copenhagen	40.0	20	Bonus (Siemens) 2.0 MW
2001	Sweden	Uttgrunden, Kalmar Sound	10.5	7	GE 1.5 MW
2001	Sweden	Yttre Stengrund	10.0	5	NEG Micon (Vestas) NM72
2002	Denmark	Horns Rev	160.0	80	Vestas 2 MW
2003	Denmark	Frederikshaven	10.6	4	2 Vestas 3 MW, 1 Bonus 2.3 MW, 1 Nordex 2.3 MW
2003	Denmark	Samsø	23.0	10	Bonus (Siemens) 2.3 MW
2003	UK	North Hoyle	60.0	30	Vestas 2.0 MW
2004	Denmark	Nysted	158.0	72	Bonus (Siemens) 2.3 MW
2004	Ireland	Arklow Bank	25.2	7	GE 3.6 MW
2004	UK	Scroby Sands	60.0	30	Vestas 2.0 MW
		<b>Total Operational</b>	<b>587.0</b>	<b>316</b>	

\* British Wind Energy Association Web Site

- In the 1990's, offshore wind first appeared in Denmark, the Netherlands, and Sweden
- In 2002, **Horns Rev** in Denmark was the [first offshore wind farm with over 100 MW](#)
- The UK installed its first offshore wind farm in 2000 followed by Ireland in 2004
- Three OEMs now dominate the offshore wind turbine market: **GE, Siemens, and Vestas**

# Comparison of UK Land Versus Offshore Wind Projects

	<u>Operational</u>			<u>Under Construction</u>			<u>Consented Projects</u>			<u>Submitted Projects</u>			<u>Total UK Capacity</u>		
<u>Onshore</u>	<u>#</u>	<u>MW</u>	<u>%</u>	<u>#</u>	<u>MW</u>	<u>%</u>	<u>#</u>	<u>MW</u>	<u>%</u>	<u>#</u>	<u>MW</u>	<u>%</u>	<u>#</u>	<u>MW</u>	<u>%</u>
England	59	342	16.5%	11	173	12.8%	36	465	12.6%	74	1,291	12.1%	180	2,271	12.8%
N Ireland	12	112	5.4%	3	29	2.1%	4	86	2.3%	44	1,109	10.4%	63	1,336	7.5%
Scotland	40	1,007	48.8%	14	562	41.6%	38	999	27.0%	90	5,291	49.7%	182	7,859	44.2%
<u>Wales</u>	<u>24</u>	<u>301</u>	<u>14.6%</u>	<u>3</u>	<u>5</u>	<u>0.4%</u>	<u>6</u>	<u>68</u>	<u>1.8%</u>	<u>18</u>	<u>335</u>	<u>3.1%</u>	<u>51</u>	<u>709</u>	<u>4.0%</u>
<b>Sub-Total</b>	135	1,762	<b>85.3%</b>	31	769	<b>56.9%</b>	84	1,618	<b>43.7%</b>	226	8,026	<b>75.4%</b>	476	12,175	<b>68.5%</b>
<b>Offshore</b>															
England	4	244	11.8%	4	392	29.0%	4	1,908	51.5%	7	2,625	24.6%	19	5,169	29.1%
N Ireland	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
Scotland	0	0	0.0%	3	190	14.1%	0	0	0.0%	0	0	0.0%	3	190	1.1%
<u>Wales</u>	<u>1</u>	<u>60</u>	<u>2.9%</u>	<u>0</u>	<u>0</u>	<u>0.0%</u>	<u>2</u>	<u>180</u>	<u>4.9%</u>	<u>0</u>	<u>0</u>	<u>0.0%</u>	<u>3</u>	<u>240</u>	<u>1.4%</u>
<b>Sub-Total</b>	5	304	<b>14.7%</b>	7	582	<b>43.1%</b>	6	2,088	<b>56.3%</b>	7	2,625	<b>24.6%</b>	25	5,599	<b>31.5%</b>
<b>Both</b>															
England	63	585	28.3%	15	565	41.9%	40	2,373	64.0%	81	3,916	36.8%	199	7,440	41.9%
N Ireland	12	112	5.4%	3	29	2.1%	4	86	2.3%	44	1,109	10.4%	63	1,336	7.5%
Scotland	40	1,007	48.8%	17	752	55.6%	38	999	27.0%	90	5,291	49.7%	185	8,049	45.3%
<u>Wales</u>	<u>25</u>	<u>361</u>	<u>17.5%</u>	<u>3</u>	<u>5</u>	<u>0.4%</u>	<u>8</u>	<u>248</u>	<u>6.7%</u>	<u>18</u>	<u>335</u>	<u>3.1%</u>	<u>54</u>	<u>949</u>	<u>5.3%</u>
<b>Total</b>	140	2,065	100.0%	38	1,351	100.0%	90	3,706	100.0%	233	10,651	100.0%	501	17,774	100.0%

\* British Wind Energy Association Web Site - Posted As of April, 2007

- The UK has 0.3 GW of offshore wind online representing 14.7% of total installed capacity
- Offshore wind is 43% of UK capacity under construction and 56% of consented projects
- Offshore wind in UK will increase from 304 MW to 2,974 MW within the next 3-4 years
- 226 land projects (36 MW avg.) awaiting consent vs. 7 offshore projects (375 MW avg.)

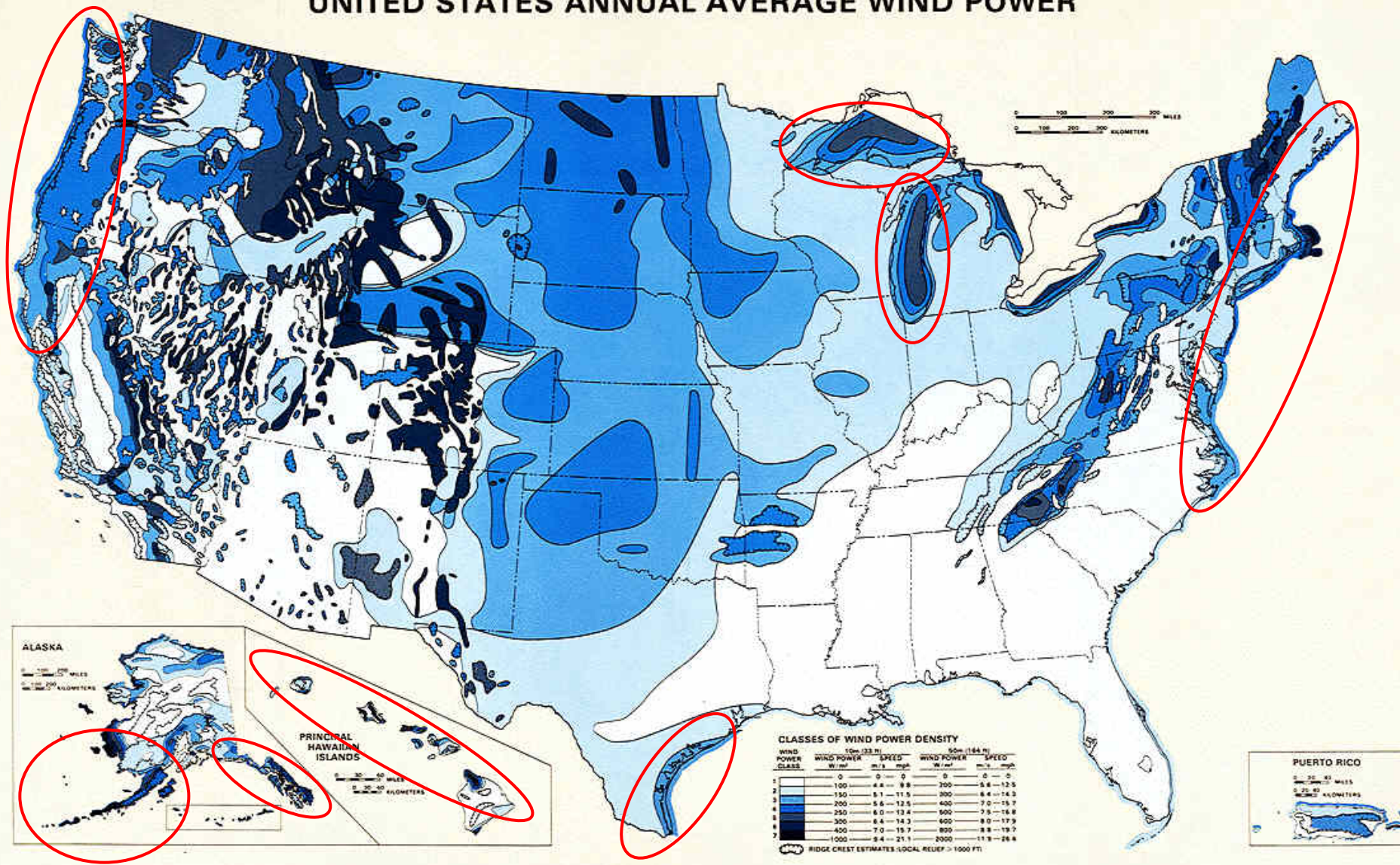
# Several 500+ MW Offshore Wind Farms Under Development

Belgium	Thorton Bank	200
Canada	Naikun - Queen Charlotte Is, BC	700
Denmark	Horns Rev II	200
Ireland	Kish Bank	250
Ireland	Arklow	500
Netherlands	Mouth Western Scheldt River	100
Netherlands	Ijmuiden	100
Spain	Cape Trafalgar	500
Sweden	Lillgrund Bank	48
Sweden	Uttgrunden II	72
Sweden	Barsebank	750
UK	Thames - Greater Gabbard	500
UK	Thames - London Array	1,000
UK	North West - Gwynty Mor	750
UK	North West - West Duddon	500
UK	Greater Wash - Triton Knoll	1,200
UK	All Other UK (23 Projects)	4,699
USA	Cape Wind (MA)	420
USA	Long Island (NY)	140
USA	Galveston-Offshore Wind (TX)	150
USA	Boffin Bay (TX)	250
<u>Other</u>	<u>Other Offshore Projects (Est.)</u>	<u>6,971</u>
<b>New Offshore Projects Underway or Pending</b>		<b>20,000</b>

- Last 2-3 years, the number and size of offshore wind projects in Europe has been rapidly increasing
- At least 9 **500+ MW** projects underway in Canada, Ireland, Spain, Sweden, UK
- Assuming **\$2.5 million / MW** for installed offshore wind capacity, CAPEX is similar to an offshore oil and gas project
- **4 U.S. offshore wind projects** now in planning and permitting stages
- Many other offshore wind projects are underway worldwide: Australia, China, Germany, Japan, New Zealand, etc.
- Installation and maintenance economics are challenging but can be addressed
- Turbine **survivability** in **hurricanes** is an opportunity for **technical “value-add”**

# Primary Coastal Areas for Offshore US Wind Projects

UNITED STATES ANNUAL AVERAGE WIND POWER

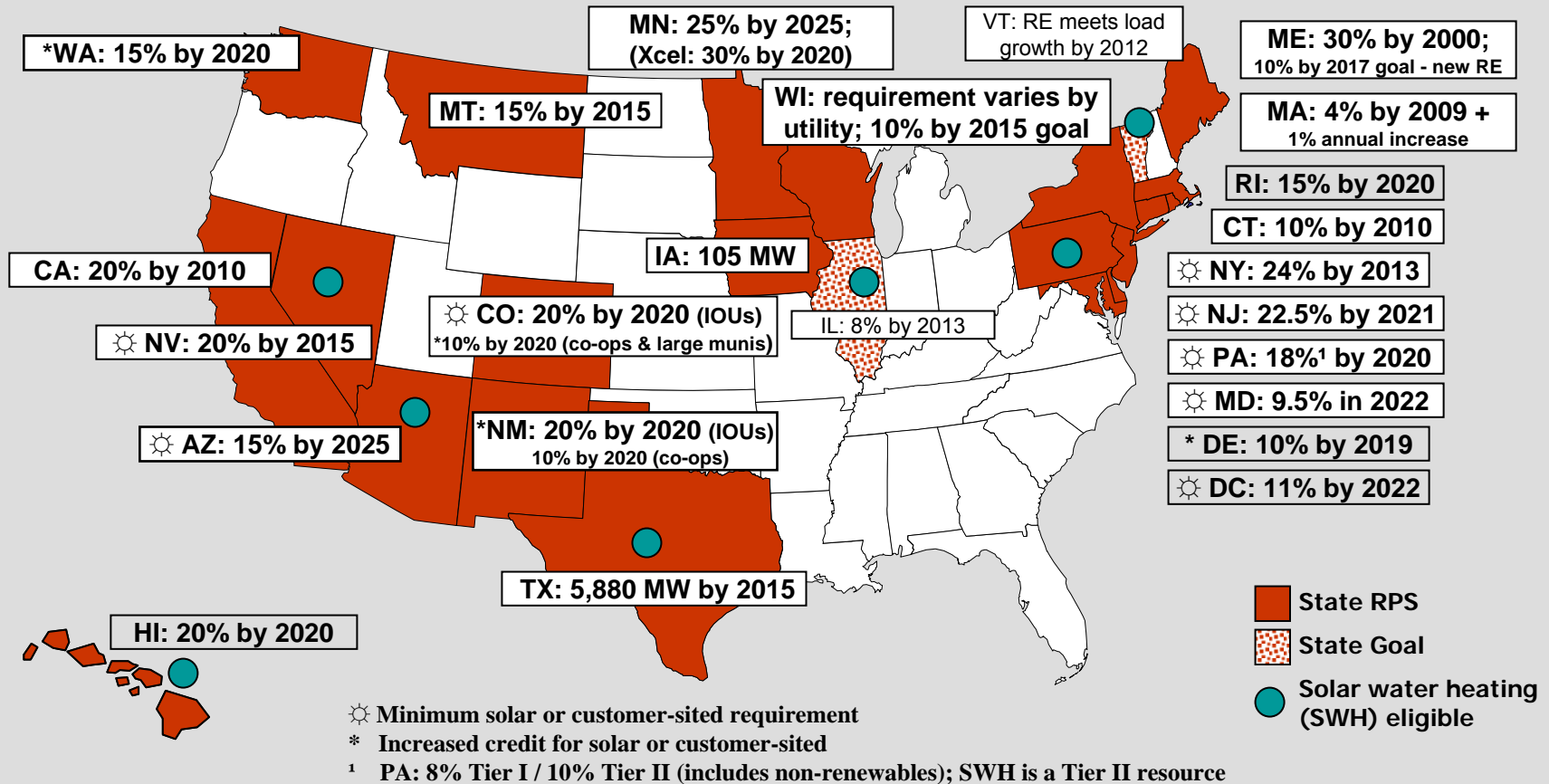


# State Renewable Portfolio Standards Driving U.S. Transformation

DSIRE: [www.dsireusa.org](http://www.dsireusa.org)

May 2007

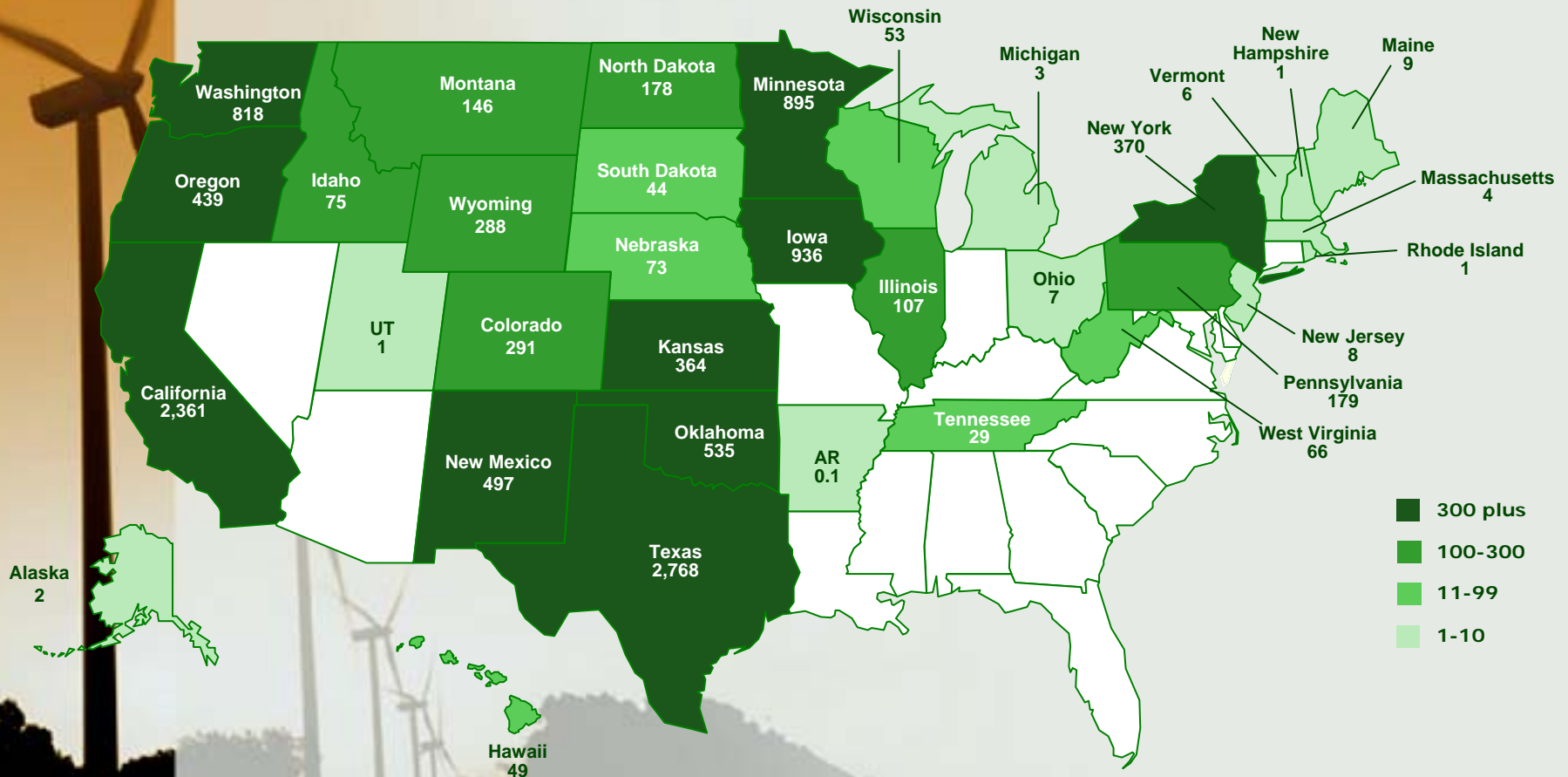
## Renewables Portfolio Standards



RPS with Production Tax Credits have generated major growth in U.S wind capacity

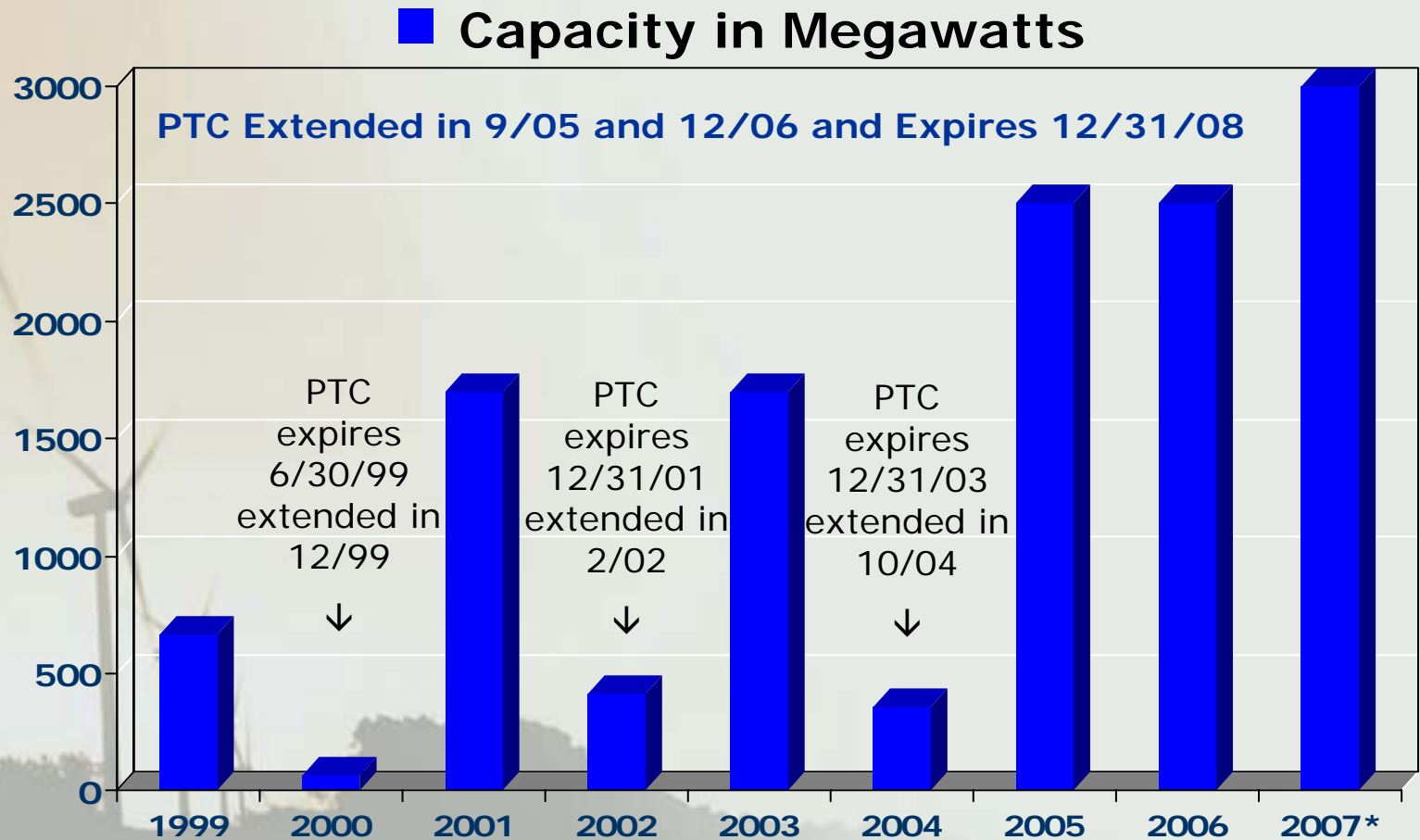
# U.S. Wind Power Capacity

## 11,603 MW By End of 2006



Wind farms across the U.S. are expected to generate 25 billion kilowatt-hours in 2006. That's about 0.5% of total U.S. electricity generation, or enough to serve 2.4 million average U.S. households.

# Effect of PTC on Wind Power Capacity Additions



Graph by Union of Concerned Scientists

\* Estimated

# 2006 Tax Equity League Table

15 Transactions  
\$3.1 billion awarded

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13 Transactions  
\$2.7 billion closed

Lead Investor <sup>1</sup>	Megawatts <sup>2</sup>	Number of Transactions <sup>2</sup>	Estimated Value <sup>2</sup>
JPMorgan	1,266	8	\$1.4 billion
GE	853	3	\$600 million
Morgan Stanley	320	1	\$350 million
UBOC	205	1	\$225 million
Lehman Brothers/Prudential	205	1	\$225 million
Fortis	26	1	\$30 million

<sup>1</sup> Full credit to Lead Investor

<sup>2</sup> Based on awarded transactions

Additional participants include:

Northwestern Mutual

Wells Fargo

New York Life

Wachovia

ABN Amro

# 2006 Debt Deals

Sponsor	Project	Mega-watts	Loan	Lead Lenders
Babcock	Multiple Projects	800.0	\$1 Billion Construction Loans	BayernLB, HSH Nordbank Mizuho
FPL	Lonestar	606.5	\$600 Million Term Loan \$100 Million Letter of Credit	BayernLB, Fortis, Mizuho
Airtricity	Turbine Supply		\$220 Million (2007 build)	HVB, BayernLB, Nord/LB
	Forest Creek	125.0	\$200 Million Construction \$50 Million Backleverage	HVB
	Sand Bluff	90.0	\$167 Million Construction Loan \$37 Million Backleverage \$12.5 Million Letter of Credit	HVB
enXco	Fenton	205.5	\$295 Million Construction Loan \$162 Million Term Loan \$25 Million Letter of Credit	Union Bank of California (UBOC) Fortis
UPC	Turbine Supply	125.0	\$310 Million Turbine Supply	HSH Nordbank
	Mars Hill	42.0	\$70 Million Construction Loan	HSH Nordbank
Last Mile Electric Co-Op	White Creek	205.0	\$352 Million Construction Loan	HSH Nordbank
AES/Seawest	Buffalo Gap II	233.0	\$320 Million Construction Loan	HVB, Dexia, West LB
Horizon	BCII Maple Ridge Wind		\$263 Million Term Loan	BayernLB, Goldman Sachs, Mizuho
Invenergy	Scurry County	130.0	\$217 Million Construction Loan	Fortis
Noble	Turbine Supply		\$130 Million Turbine Supply (2007/2008 Build)	CIT

# Major Issues / Challenges



- **Turbine Shortages - Are They For Real - Secondary Markets**
- **Turbine Price Increases and Weaker Terms**
- **PTC Expiration - Holiday Gift From Congress - 1 Year Extension Through 2008**
- **PPA Pricing - Low Pricing Driving Hedge Structures**
- **Permitting Delays**
- **Transmission Constraints**

## **Key Objectives to Obtain Financing for Wind Projects**

- **Secure options / rights to develop project site**
- **Quantify resource (meteorological studies) to P95 levels**
- **Obtain various government / regulatory permits and “social license”**
- **Secure interconnect / grid approvals within acceptable cost parameters**
- **Secure Power Purchase Agreement or PPA Hedge**
- **Secure position on wind equipment delivery queue**

## **Wind Energy Project Finance Is Now Mainstream: Why?**

- **Fund managers and the public now understand wind**
- **Wind is by far the largest and most attractive option for investment in renewable energy**
- **Mature technology (on land) with predictable performance and O&M costs**
- **Clear and stable permitting and approval processes**
- **“Opening” of interconnect and grid access**
- **Utilities have gained technical understanding of how to manage the power flows**

# Tidal and Wave Energy

# Financing for Technology Development and Demonstration Will Come From Government and Venture Capital Sources

## Financing for Tidal and Wave Energy Device Development

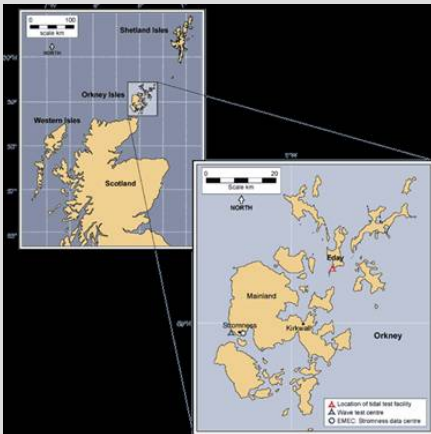
- While government incentives and grants are critical and necessary, the private sector must still lead the development, funding, and commercialization of this nascent industry
- “**Silicon Valley**” venture capital model will not work for financing tidal and wave energy device companies due to extreme industrial challenges of designing, constructing, and maintaining large, complex electro-mechanical systems that must operate offshore
- However, a “**Hybrid**” approach that combines the financial attributes of High Tech venture capital with the expertise and resources of industrial partners should be highly effective with lower risk

# **Tidal and Wave Project Finance Model Will be Similar to Offshore Wind Once Devices Become Commercially Viable**

## **Commercial Tidal and Wave Projects**

- **As the better tidal and wave energy devices move from demonstration models into commercially viable machines, the financing of commercial tidal and wave energy projects will commence**
- **In current U.S. permitting process for tidal and wave energy demonstration projects has allowed “site banking” abuses by both device and project developers**
  - **However, many of these sites will become available to qualified developers with capital**

# European Marine Energy Centre ([www.emec.org.uk](http://www.emec.org.uk))



- Charter: *“Stimulate and accelerate the development of marine energy devices from prototype stage into the commercial marketplace”*
- First and only of its kind in world
- Located Orkney Islands, Scotland
- £15 M from 7 government groups



- **Wave Test Facility** (Operational with “Pelamis 750” from OPD currently under test)
  - Receives uninterrupted Atlantic waves of up to 15m in height
  - 4 offshore “berths”, 2 km long power and fiber optic cables to substation, 2.2 MW capacity
  - Connected to UK power grid with ROCs (Renewable Obligations Certificate) registration
  - Sophisticated environmental sensing and logging, data collection centre
  - Fully accredited as a measurement and testing laboratory
- **Tidal Test Facility** (Completed in the Fall of 2006)
  - 8 knot maximum currents
  - 5 offshore “berths”, 3.5 km power and fiber cables to different substation, 5 MW capacity
  - Connected to UK power grid with sophisticated environmental sensing and logging, and common data collection centre