

Building the U.S. Offshore Wind Supply Chain

Financing Challenges Facing the U.S. Offshore Wind Market

July 13, 2011

**Webinar: Sponsored by Clean Energy States Alliance
Co-Hosted by U.S. Department of Energy &
US Offshore Wind Collaborative**

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CESA is a non-profit, membership organization working with states to advance the renewable energy sector through:

- Information Exchange & Analysis
- Partnership Development
- Networking and Collaboration

www.cleanenergystates.org



The USOWC provides a forum for information-sharing, problem-solving, and capacity-building among government, industry, academia, energy and environmental advocates sharing the goal of realizing the great potential for coastal and Great Lakes wind to contribute to regional clean energy production, economic development and climate change mitigation.

www.usowc.org

Webinar Series: Financing to Advance US Offshore Wind

- Objectives:
 - Examine offshore wind financing gaps and possible solutions
 - Advance thinking and recommendations
 - Increase information exchange among states, federal agencies, the industry, and the investment community
- Webinar Series:
 - Kick off Webinar: lay foundation and invite input on initiative focus
 - Webinar #2: the role of states and public support mechanisms (early August)
 - Webinar #3: the role of private investors (early September)
 - Webinar #4: identifying innovative solutions (late September)
 - Offshore Wind Financing Leadership Forum (TBD)

Webinar Series: Financing to Advance US Offshore Wind

- Possible Support Activities/Outputs:
 - Establish working group to advise on solutions
 - Identify “best” strategies and mechanisms at state and federal level
 - Draft white paper for stakeholders and policy-makers
 - Establish network for continued learning and information on financing
 - Create leadership forum
 - Other?

Today's Kick-off Webinar: Financing Challenges for OSW

- **Chris Hart, Department of Energy**
 - Overview of DOE strategic work plan for OSW industry
 - DOE's OSW targets and the implications for investment and finance
 - DOE perspectives on financing challenges
 - DOE activities related to the financing challenges
- **Jim Lanard: Offshore Wind Development Coalition**
 - Overview of status of industry and projects in US
 - Developer's perspective on offshore wind risks and financing gaps
 - What is needed in the future at the state, federal, and private sectors
- **Ethan Zindler: Bloomberg New Energy Finance**
 - Lessons learned from Europe
 - Who could invest and what would it take to attract investment
 - Risks and how to underwrite
 - Possible approaches to boost pre-construction financing and fill financing gap

Introduction

- Range of constraints on offshore wind: supply chain, regulatory delays, etc.
- But pre-construction financing gap is most significant
- What level of funding is required & when?
- Immense competition for funding (EE, smart grid, other renewables, conventional power, etc.)
- Perception of high risks: construction, technology, O&M, government policy
- Government support mechanisms are needed

Some Questions to Consider Going Forward

- How to manage and “soften” the risk profile?
- What can we learn from European experience?
- How to finance transmission assets?
- What is the role of public entities?
- What government price support mechanisms are needed and viable?
- How to advance government procurement?
- What is a workable pathway to advance financing solutions?

Contact Information

www.cleanenergystates.org

www.usowc.org

Mark Sinclair

Phone: 802-223-2554

Email: msinclair@cleanegroup.org

Fara Courtney

Phone: 617-401-3145

Email: fcourt@usowc.org

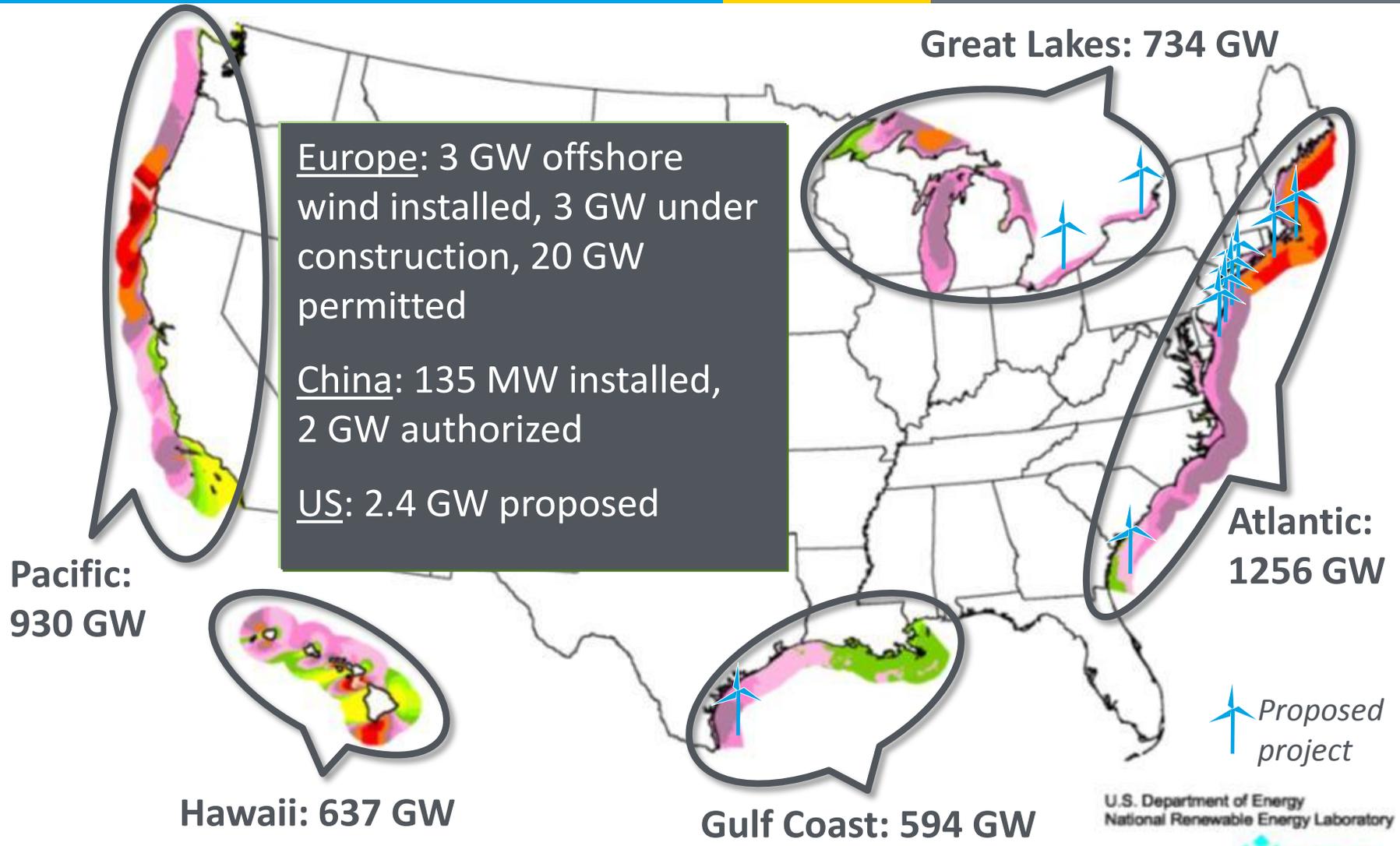


Financing Offshore Wind Power in the United States

July 13, 2011

Christopher G. Hart, PhD
Offshore Wind Lead
Wind and Water Power Program

Energy	Economy	Environment
Large renewable resource close to demand centers	Jobs manufacturing, installing, operating, and maintaining systems	Reduced emissions of GHG and air pollutants
Availability matches peak load	Economic recovery and industrial development	Reduced water consumption
Energy diversity & security	Potential for cost-competitive electricity in high-price markets	Reduced need for new land-based transmission



U.S. Department of Energy
National Renewable Energy Laboratory



Total gross resource potential does not consider exclusion zones or siting concerns

A commitment by the federal government to facilitate responsible deployment of offshore wind energy

- Provides long range strategy for
 - Lowering cost of energy
 - Prioritizing federal R&D investments
 - Addressing full range of stakeholder issues
 - Reducing timeline for permitting and deployment
- Announced by Secretary Chu and Secretary Salazar on February 7, 2011
- Backed by an initial \$50.5 M in funding for offshore wind R&D



- 1. Offshore wind can create substantial benefits for the nation:**
 - Reduced GHG emissions
 - Economic revitalization
 - Diversified energy supply

- 2. The challenges facing offshore wind deployment are daunting:**
 - **High capital & financing costs**
 - Lack of specialized infrastructure
 - Lack of site data and experience with permitting processes

- 3. To realize these benefits in spite of the challenges, DOE will:**
 - Reduce the levelized cost of energy from 26.9 ¢/kWh to 7 ¢/kWh by 2030
 - Help reduce market barriers: understand and mitigate environmental and socioeconomic impacts, build up infrastructure and transmission
 - Partner in the installation of the first demonstration-scale projects

- 4. Understanding and reducing financing costs are critical to this strategy**

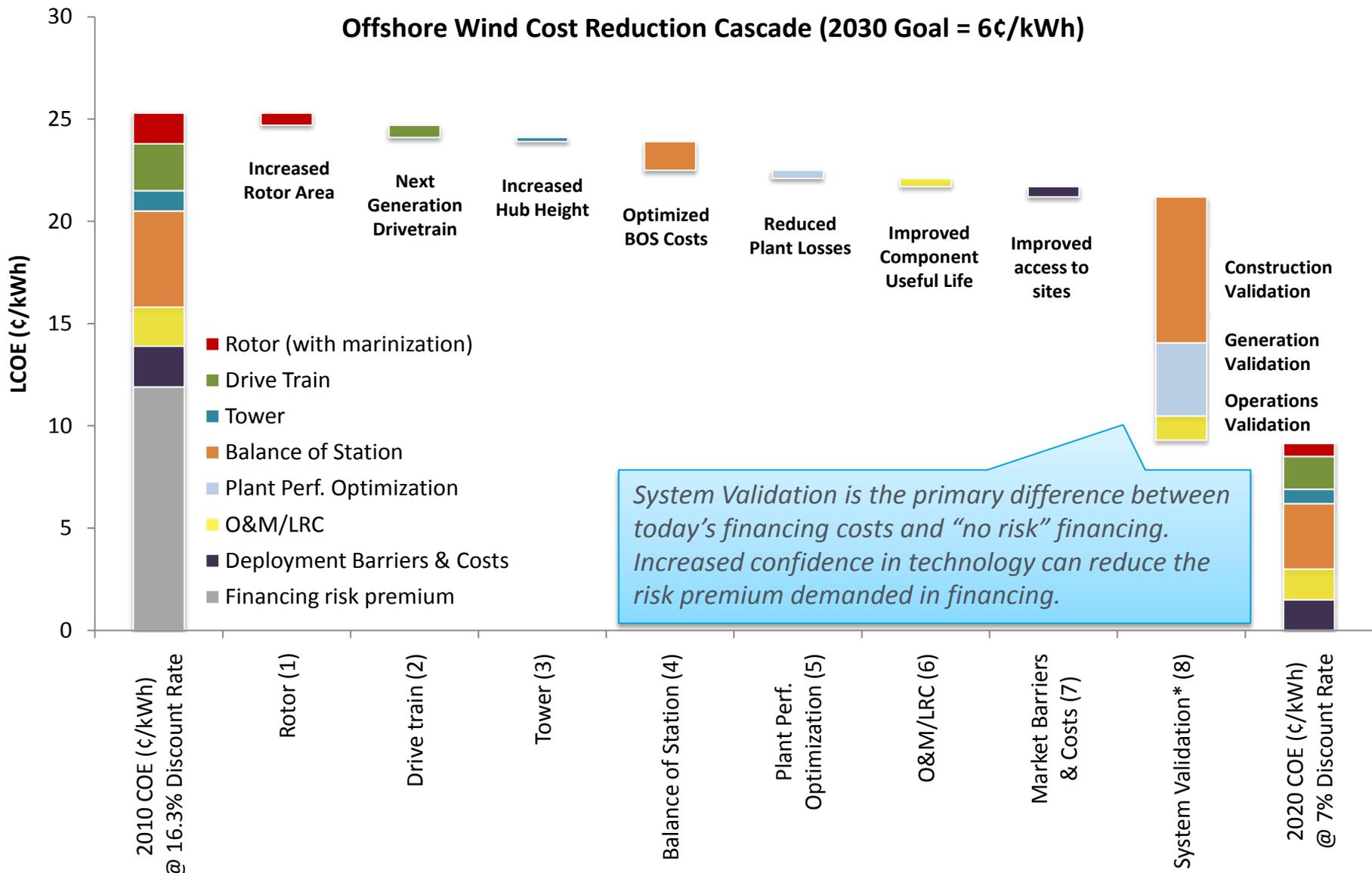
Cost of Energy

- **Reduce capital costs**
 - Larger-scale systems with greater capacities
 - Innovative foundations and platforms
- **Decrease IO&M costs**
 - Ruggedized designs to reduce maintenance
- **Decrease financing costs**
 - **Design codes & standards to reduce deployment risks**
 - **Offshore wind characterization to improve output projections**
 - **Successful demonstration of technology in U.S. context**
- **Increase energy capture**
 - Larger rotors, longer blades, and taller towers

Deployment & Infrastructure

- **Support effective siting and permitting**
 - Provide technical input & assistance to federal & state agencies
 - Applied research on key environmental and socioeconomic issues
 - Policy and economic analysis to inform decision-makers
- **Support wind resource planning**
 - Gather wind resource data for CMSP
 - Provide technical input and data
- **Promote infrastructure development**
 - Domestic supply chain development
 - Interconnection planning
 - Research on specialized vessels and IO&M technology

Financing Component of Cost of Energy



Fundamental problem: mismatch between available capital and the risks and returns of offshore wind projects

Returns

- No guaranteed market for offshore wind energy in U.S.
- U.S. incentives are 50% to 90% lower than European incentives

Risks

- Risks are not well-understood in the U.S. due to lack of projects
- Risks are front-loaded in development, construction, & initial operations phases

Available Capital

- Immense investment: \$40B for 10 GW of projects (w/o infrastructure)
- Investors with high risk appetite unimpressed by offshore project returns, while investors seeking predictable returns are risk-averse

Incentives Comparison

	U.K.	Denmark	Germany	Belgium	Netherlands	Sweden	Ireland	U.S.
Incentive	Renewable Obligation Certificate	Subsidy above market price	Feed-in Tariff	Green Certificates	Federal incentive payment	Federal Green Certificates	Feed-in Tariff	Production & Investment Tax Credits
Type	RES	Subsidy	FIT	RES	Subsidy	RES	FIT	Tax Credits
Amount (€/MWh)	110 + wholesale price	37 + wholesale price	150	107	186	15-42	140	15 + wholesale price (PTC); 30% of capital costs (ITC)
Duration	20 years	8 years	12 years	10 years	15 years	15 years	15 years	10 years
Other notes	Offshore wind generates 2x ROCs of onshore wind	FIT for indiv. projects also possible, ~84 €/MWh	Gov-owned develop. bank (KfW) offers loan guarantees	Minimum price for offshore RECs	REC is redeemable at fixed price from RES administrator			Requires tax-equity partner; in-service deadline of 2013
# Projects	13	12	4	2	4	5	2	0
MW Capacity	1,040	861	72	195	247	166	34	0

Key takeaway: robust power price support has enabled the growth of a European offshore wind industry

Political

- Uncertainties regarding long-term public policy support in U.S.

Construction

- Weather delays, untested installation techniques, accident potential

Counterparty

- Subcontractors not able to meet contractual obligations

Technology

- Lack of operational history for newest turbines

O&M

- Uncertainty around long-term O&M costs, esp. for newest turbines

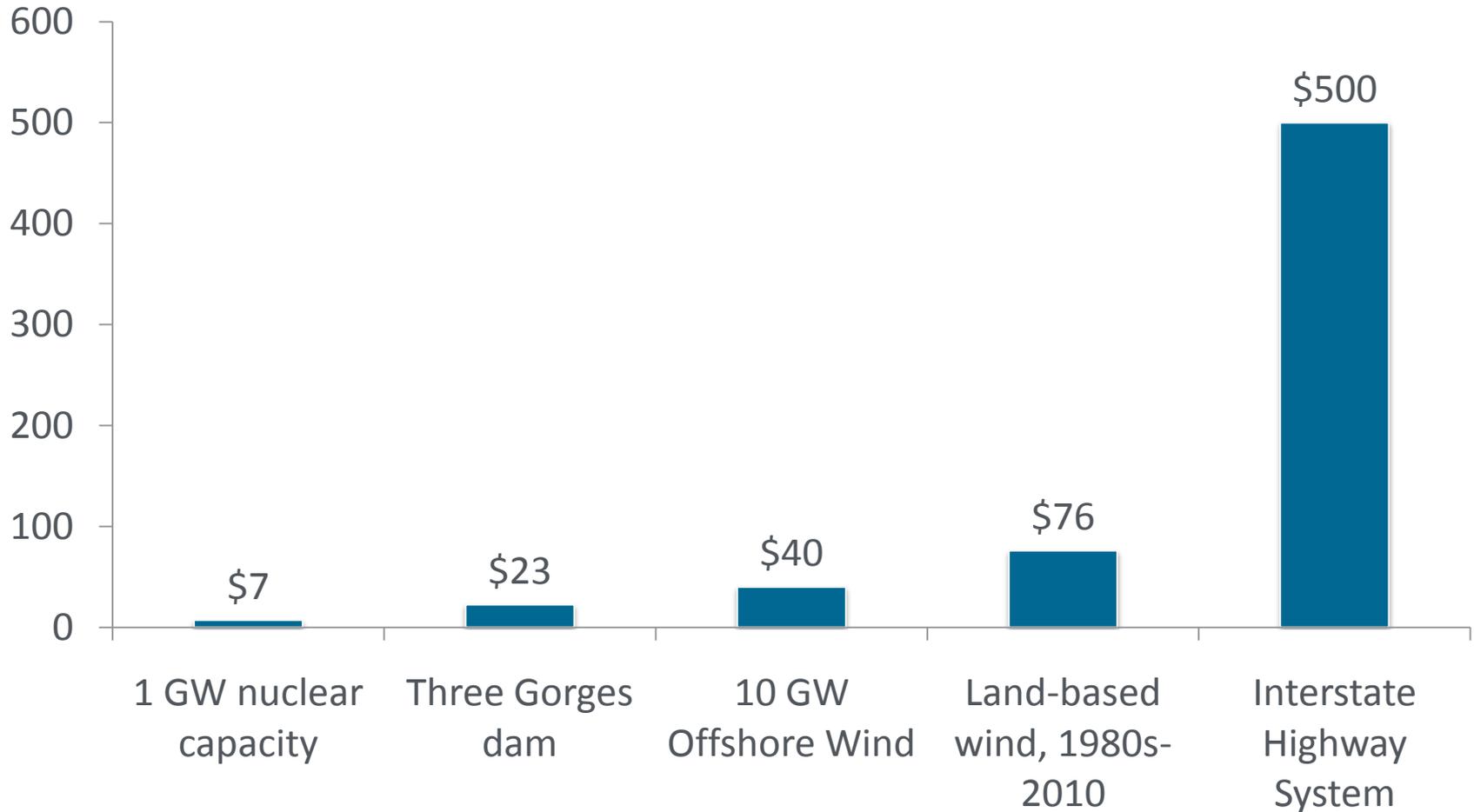
Power production

- Insufficient offshore wind data hinders long-term power projections
- Turbine reliability and availability may limit production

Power sale price

- Political: possibility of PPA renegotiation due to ratepayer pressure
- Economic: merchant power price volatility

Infrastructure Investments (\$B)



- Project finance
 - Stand-alone entity develops large infrastructure project with mix of sponsor equity and non-recourse loans
 - Repaid by cashflow generated by project
 - Allows allocation of tasks and risks to best-suited parties (in theory)
 - Challenge: banks unwilling to finance U.S. offshore wind projects due to permitting, power sale, construction, & technology risks
- Balance-sheet finance
 - Sponsor funds project as normal business activity (equity + debt secured against sponsor's assets)
 - Sponsor assumes most of the risks of the project (can be good and bad)
 - Challenge: scale of offshore wind investment dwarfs the capital expenditure budgets of most large utilities
- Hybrid Options
 - Vendor finance from turbine OEMs
 - Third-party equity investment in operating projects

Early-stage development	Pre-construction	Construction	Initial operations	Long-term operations
Developer commits substantial equity for assessment & permitting	Few banks willing to provide project finance due to limited industry track record	EPC firms won't offer guaranteed contracts, so sponsors take on construction risks	Potential to project-finance operational plant	Potential for entry of institutional investors
Limited developer equity slows project pipeline	Limited pool of available project finance and no debt syndication	Sponsors can fund project from balance sheet, but limited by CapEx budgets	Potential for entry of 3 rd -party equity	Sponsors must sell stakes to free up equity for new projects

“Offshore wind farm financing is basically a big pile of unfamiliar risk that needs to be swallowed in many simultaneous small bites by reluctant banks.”
-Jerome Guillet, *Green Giraffe Energy Bankers*

1. Study ways to improve financial incentives structures
2. Reduce risks of early-stage development work
 - Baseline environmental research to lower site assessment costs
 - Reduce permitting process uncertainties
3. Research, development, and demonstration to reduce perceived risks of offshore wind energy
 - Optimized IO&M to develop standardized installation methods
 - Standards development to create validated design standards for turbines
 - New turbine designs to improve reliability and increase power production
 - Wind resource characterization to help validate production and revenue projections

	Next-Generation Drivetrain Development	Offshore Technology Development	Market Barrier Removal
Impact	Develop core technologies for next-generation turbines, ensuring competitiveness of domestic OEMs	Develop modeling tools, optimized system designs, and components necessary for long-term R&D to reduce cost of energy	Close data gaps needed for efficient permitting; develop cost-competitive O&M strategies; transmission and interconnection planning
Topics	Stage 1: Conceptual design Stage 2: Preliminary design Stage 3: Final design and prototyping	Fully integrated wind plant designs; floating platform dynamics models; wind/wave simulation models; long-life components to reduce O&M	Market analysis; environmental risk reduction; supply chain development; ports, vessels & operations; resource characterization
Total DOE Funding	up to \$7.5M	up to \$24M	up to \$18M
Cost-Share	up to \$3.75M	up to \$4.6M	up to \$3M
Timeline	2 years	5 years	3 years
Applicants	Industry consortia with national labs, universities and engineering firms	Industry consortia with national labs, universities and engineering firms	Industry, NGO's, universities, national labs and consultancies
Award Date	June 2011	August 2011	September 2011

Thank you

U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy

Chris Hart, PhD

Offshore Wind Lead

Chris.Hart@ee.doe.gov



Financing Challenges Facing the US Offshore Wind Market: The Industry Perspective

Webinar Sponsored by the Clean Energy States Alliance
Co-hosted by US DOE and US Offshore Wind Collaborative

Presented by:
Jim Lanard, President
OffshoreWindDC
July 13, 2011

THE OFFSHORE WIND DEVELOPMENT COALITION

Founding Members and Mission

- Founders

- Apex Wind
- AWEA
- Cape Wind
- Deepwater Wind
- Fishermen's Energy
- NRG Bluewater Wind
- OffshoreMW
- Seawind Renewable

- Mission

- To advocate for legislative and regulatory policies that promote the development of offshore wind

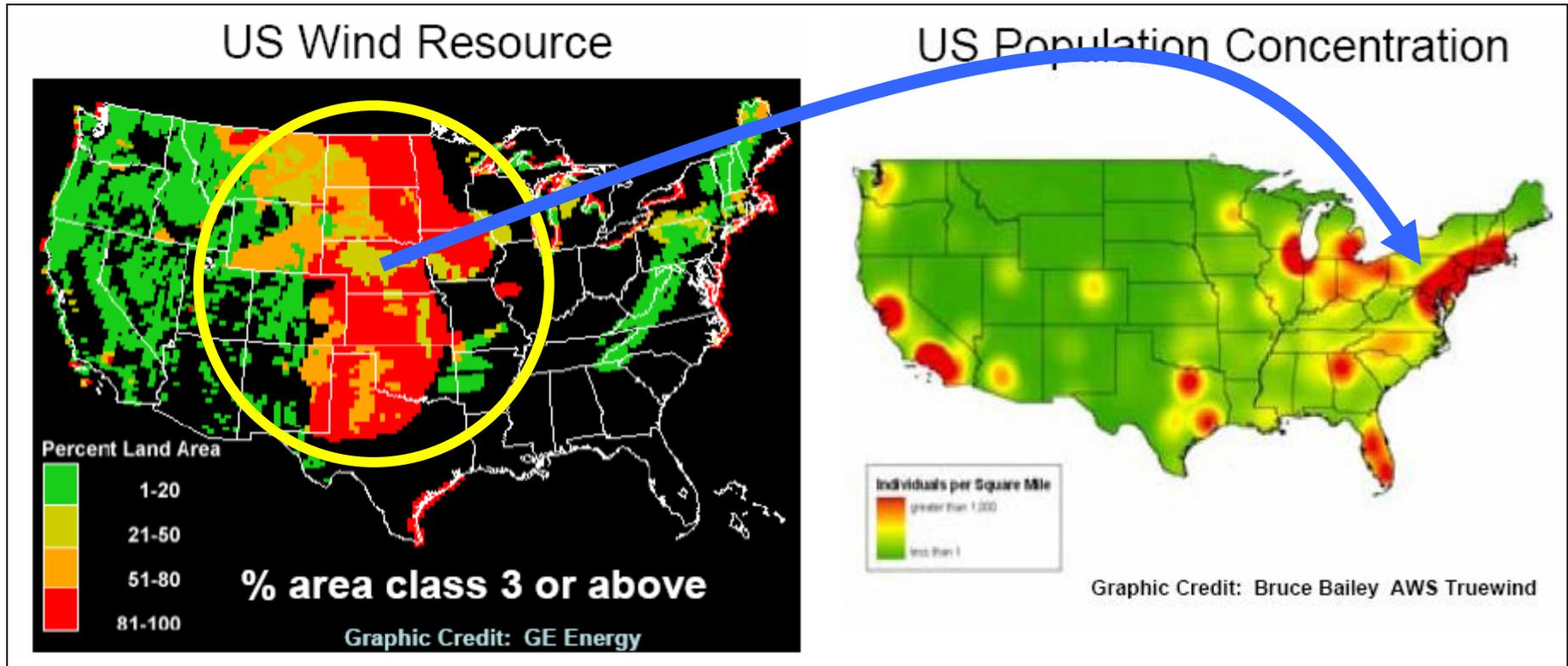
THE OFFSHORE WIND DEVELOPMENT COALITION

Supply Chain Member Categories

- Turbine suppliers
- Substation suppliers
- Wind resource experts
- Construction firms
- Insurance brokers
- Vessel builders
- Geotech/Geophys
- Barge companies
- Submarine Cable suppliers
- Electrical engineers
- Environmental permitting firms
- Design firms
- Law firms
- Marine survey firms
- Avian, Marine Mammal surveyors

WHY OFFSHORE WIND?

Large-scale land-based wind power is not accessible to East Coast population centers



Massive transmission constraints limit the ability to move power

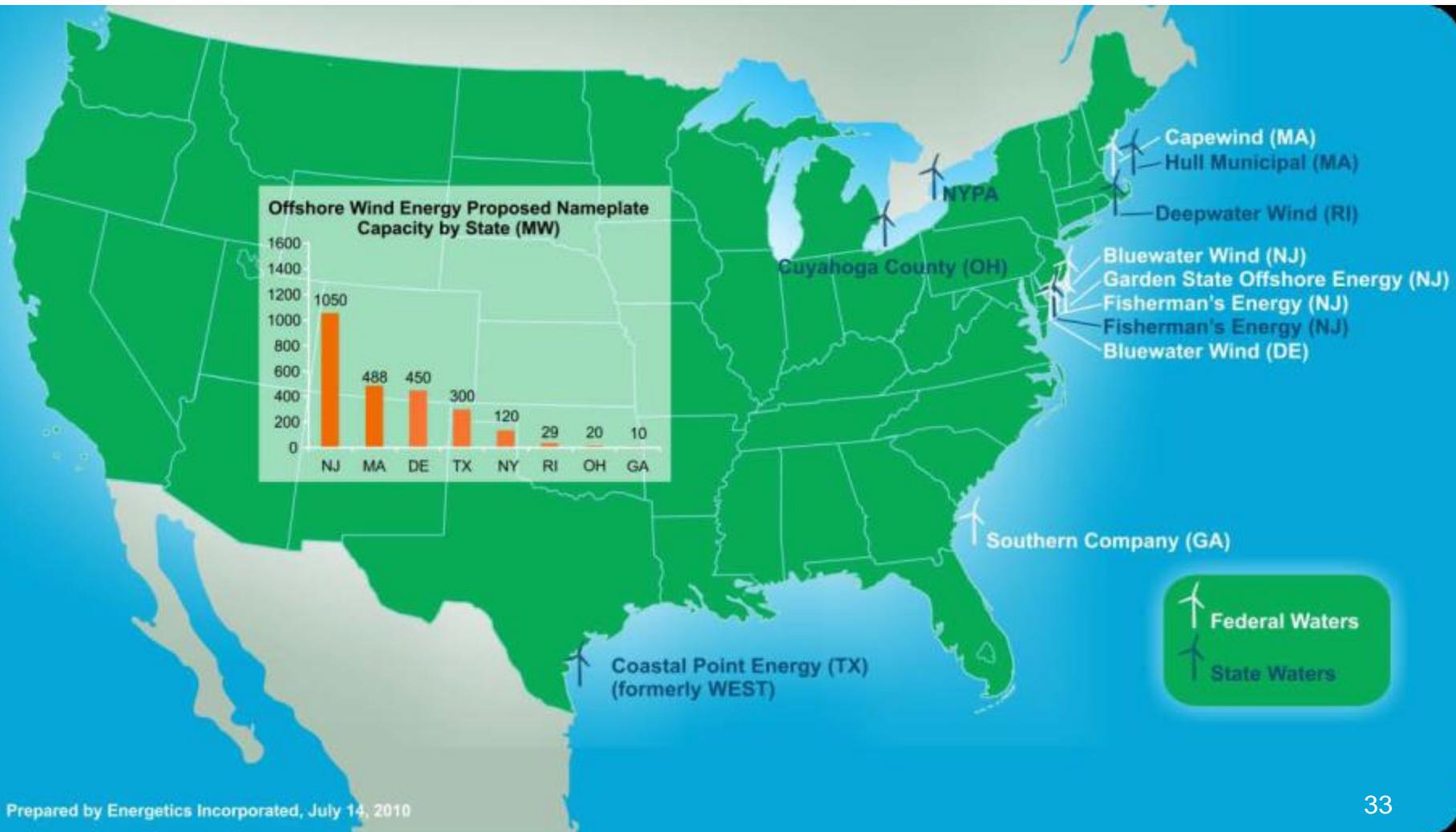
Supporting the efforts to fight climate change and sea level rise

- A 1,000 MW utility-scale offshore wind farm generates enough power ***each year*** to:
 - Avoid 2,500,000 tons of CO² emissions
 - Avoid the import of 50 million gallons of oil
 - Provide 300,000 households with their power needs
- An offshore wind farm produces only 2% of the carbon emissions of a coal-fired power plant, per unit of power delivered.
- Offshore wind guarantees stable prices, since the fuel – the wind – is free; said another way, there will never be a fuel adjustment charge associated with offshore wind.

Creating Jobs and Economic Development

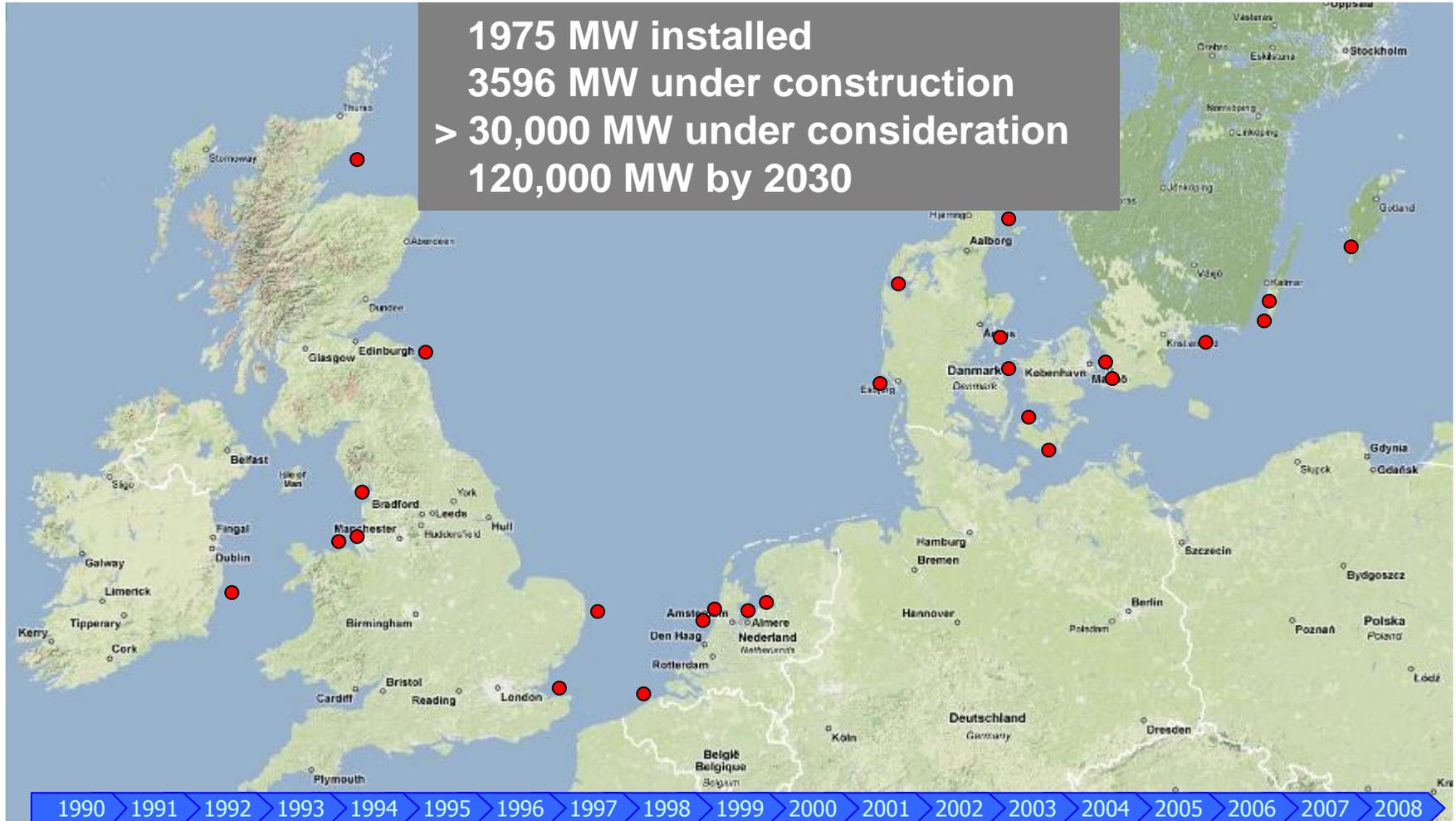
- President Barack Obama – Earth Day, 2009
 - “It’s estimated that if we fully pursue our potential for wind energy on land and offshore, wind can generate as much as 20% of our electricity by 2030 and create a quarter-million jobs in the process – 250,000 jobs in the process, jobs that pay well and provide good benefits. It’s a win-win: It’s good for the environment; it’s great for the economy.”
- European Wind Energy Association
 - “By 2030, more than 375,000 people should be employed directly in the sector – 160,000 onshore and 215,000 offshore.”
 - Over 33 projects (or 1,400 MW) built in waters offshore in eight countries
 - 16 offshore wind projects under construction (2,900 MW)
 - 120,000 MW of offshore wind capacity expected by 2030

Capacity of proposed U.S. offshore wind projects that have made significant progress



OFFSHORE WIND IN EUROPE

A Growing Success Story



Source: TUDelft Offshore Engineering / ECN

OFFSHORE WIND CHALLENGES

Regulatory Certainty

- Developing a Workable Regulatory Framework
 - US DOI Smart from the Start Initiative
 - Marine Spatial Planning
 - Standard Setting
 - Federal and state government agency coordination
 - Differentiate between Offshore Oil and Gas and Offshore Wind
- Engaging Stakeholders Early in the Process
 - National and Regional Environmental Organizations
 - Other Ocean Users
 - Commercial Fishermen
 - DOD and USCG
 - Shipping Industry
 - Recreational Users
 - Tribal Nations
 - Atlantic Coast Governors Offshore Wind Consortium

OFFSHORE WIND CHALLENGES

Revenue Certainty – I

- Ensuring Financial Viability – Federal Government Role
 - Investment Tax Credits
 - Loan Guarantees
 - Grants
 - Dormant Commerce Clause
 - Royalty Payments
 - Lease Auction Process
- Ensuring Markets – State Role
 - Enforceable Renewable Portfolio Standards
 - Power Purchase Agreements
 - Offshore Wind Carve-outs; e.g., NJ ORECs
 - Infrastructure support; e.g., ports, staging areas

OFFSHORE WIND CHALLENGES

Revenue Certainty – II

- Managing Costs – Developer Role
 - Engineering – Hurricanes, Ice
 - Achieving Scale
 - Turbines
 - Foundations
 - Transmission
 - Energy Storage
- Creating Benefits for States – Developer Role
 - Creating Jobs
 - Fostering Economic Development



OFFSHORE WIND PROJECTS

Managing Risk: The Vital Role of Third Party Reviews

- Utility-scale offshore wind projects cost from \$1 billion to \$3 billion each. Investors, bankers and insurers want to know about:
 - Wind resources
 - Technology and design
 - Will the turbines last for 20 years?
 - Will the structures withstand huge ocean wind and wave forces?
 - Budget and cost of the products; e.g., 100 turbines per wind farm @ ~ \$7M each = \$700 Million
 - Installation costs
 - Weather delays
 - Vessel availability and back up options
 - Transmission reliability
 - Operation and maintenance costs
 - Insurability
- All of this is tied into critically important risk management planning.
 - How the risk is distributed among developer, vendor, insurer, investor and ratepayer

CAPITAL REQUIREMENTS AND CAPITAL STRUCTURE

- Requirements
 - Development Costs: \$10M to \$40M
 - Construction Costs: \$1B to \$3B
- Structure
 - Development Funds – Early-In Investors
 - Construction Funds (at Financial Close)
 - Project Finance
 - Debt and Equity

INVESTORS IN OFFSHORE WIND IN THE US

- First-Mover Developers

Apex Wind

Baryonyx

Cape Wind

Deepwater Wind

Fishermen's Energy

NRG Bluewater Wind

OffshoreMW

Seawind Renewable

- Recent Entrants

enXco (France)

Iberdrola (Spain)

Mainstream Renewable (UK)

Orisol Energy (Spain)

RES Offshore (UK)

OFFSHORE WIND FARM BASICS



1. *Foundation*
2. *Wind Turbine Generator (WTG)*
3. *Nacelle*
4. *Inter-Turbine Submarine Cables*
5. *Offshore Sub-Station & Export Submarine Cable*
6. *On-Shore Grid Connection*

ASSEMBLY ON LAND



CONSTRUCTION AT SEA



CONSTRUCTION AT SEA



SUBMARINE CABLE INSTALLATION



MIDDELGRUNDEN AND NYSTED, DENMARK

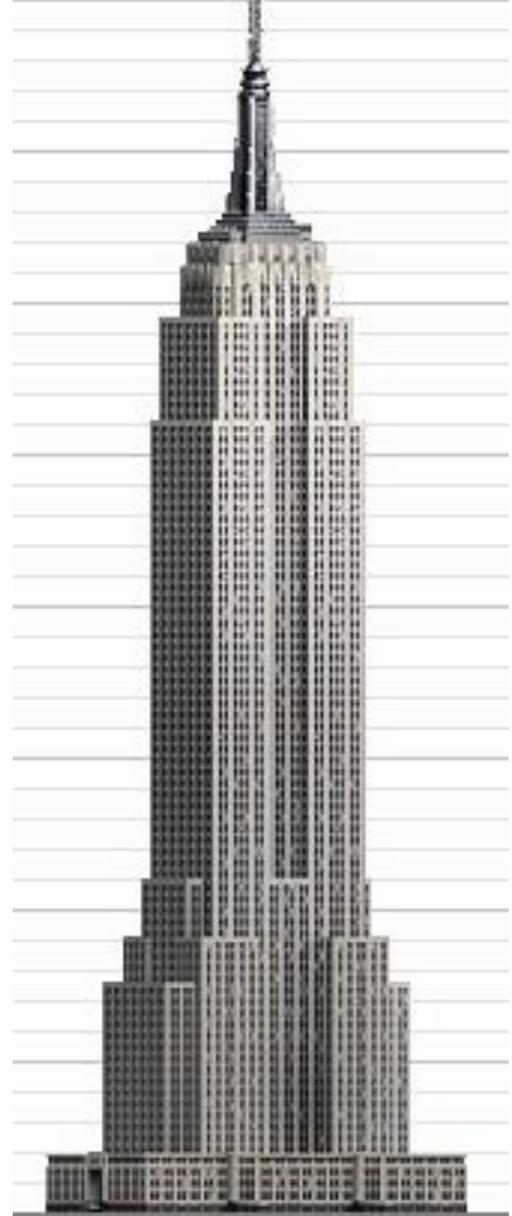
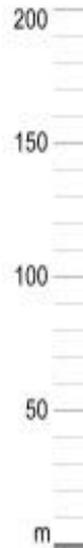
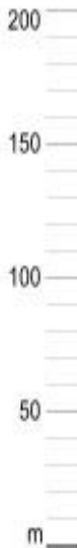


Middelgrunden, Denmark - 40 MW



Nysted, Denmark - 165 MW

Scale of an Offshore Wind Turbine



US Capitol
87.7 m

Average
Turbine
121 m
Tip at 12:00

Washington Monument
169.3 m

Empire State Building
448.7m

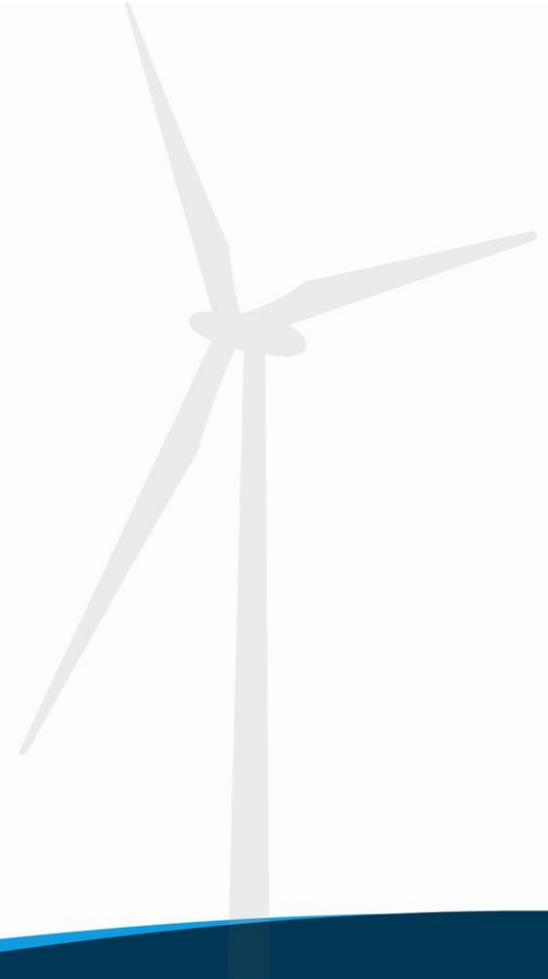
THANK YOU!

For more information, please contact:

Jim Lanard, President
Offshore Wind Development Coalition
1130 Connecticut Avenue , NW
Suite 300
Washington, DC 20036

JLanard@OffshoreWindDC.org
202.688.1424

www.OffshoreWindDC.org



FINANCING CHALLENGES FACING OFFSHORE WIND

CLEAN ENERGY STATES ALLIANCE WEBINAR

ETHAN ZINDLER, HEAD OF POLICY ANALYSIS

13 JULY 2011



Bloomberg
NEW ENERGY FINANCE

OFFSHORE WIND LEADERSHIP FORUM 2010

Two-day forum for 55 leading figures in the offshore wind market using presentations, panels and interactive sessions to discuss whether the market was on track to meet projected growth and to identify both challenges and solutions

- Day 1 concentrated on the challenges facing offshore market including financing, policy and technical issues
- Day 2 focused on supply chain dynamics and potential constraints
- A White Paper and communiqué will be published to disseminate key findings



Partners and sponsors



OFFSHORE WIND LEADERSHIP FORUM: COMMUNIQUÉ

- 1. Invest in national transmission assets:** *prevent bottle necks at crucial nodes and avoid massive price differentials.*
- 2. Educate investors:** *The industry is battling the perception, founded on challenges in early demonstration projects, that it is a high risk investment. Major improvements in the technology and installation have reduced this.*
- 3. Address the equity funding gap:** *utilities can't fund all of this. More investors are required. A combination of education and incentives are required.*
- 4. Address the debt funding gap:** *There are too few project finance banks ready to lend against offshore wind assets. New banks and additional third party capital need to be attracted.*
- 5. Avoid gaps in support mechanisms:** *In the short time before bonuses in UK & Germany expire the industry will not have cut costs sufficiently to maintain investment after these dates. The schemes should be extended.*
- 6. Fix broken regulation:** *eg. the Offshore Transmission Owner (OFTO) regulatory regime in the UK is widely seen as complex and counterproductive.*
- 7. Don't rely on power exports:** *Transmission costs, market access and lack of control over the timing of offshore wind power generation mean that the exports will command a low value in the European internal electricity market*
- 8. Work towards a European standard for connection to the super grid:** *After 2015 the ability to transmit power between markets will be important to optimise power generation. Standardised connection requirements are needed.*

FINANCING CHALLENGES FACING OFFSHORE WIND

ETHAN ZINDLER, EZINDLER@BLOOMBERG.NET

TWITTER: @ETHANALL

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Carbon Markets

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Carbon Capture & Storage

Power

Water

Nuclear

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