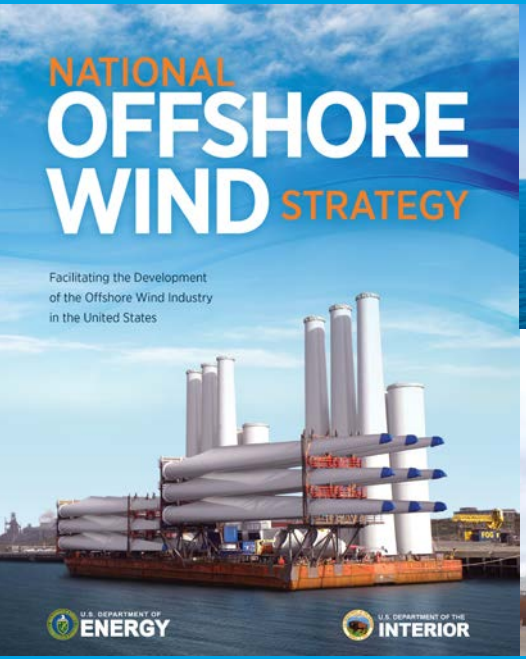



Photo Credit: Deepwater Wind


Photo Credit: Deepwater Wind

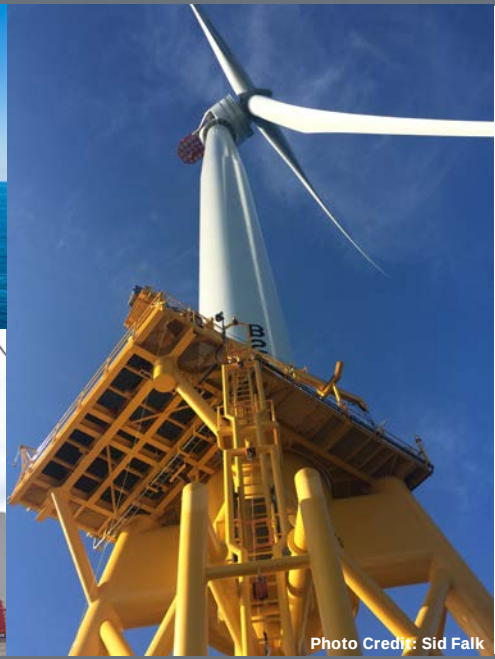


Photo Credit: Sid Falk

National Offshore Wind Strategy
From Development to Implementation

California Ocean Renewable Energy Conference
UC Davis
November 1-2, 2016

Alana Duerr, Ph.D.

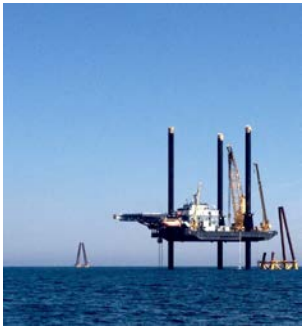
Offshore Wind Lead
Department of Energy
Wind Energy Technologies Office

2016 DOE/DOI Offshore Wind Strategy: Key Takeaways

- **Offshore Wind: A Significant National Opportunity**
  - 2,058 GW of technically accessible resource
  - Nearly 80% of US electric demand located in coastal states
  - There is a market opportunity for new generation in offshore wind regions
  - *Wind Vision* scenario of 86 GW of offshore energy in 2050 would:
    - yield a 1.8% reduction in GHG emissions
    - 5% less water consumption for the electric sector
    - create 160,000 gross jobs in coastal regions

- **Key Challenges Remain**
  - Reducing technology costs and risks
  - Supporting effective stewardship of the environment and public space
  - Improving understanding of offshore wind's benefits and costs

- **Joint Strategy Addresses Challenges**
  - Robust Plan for Federal Action
  - 34 DOE and DOI actions, addressing different 7 action areas



The Time is Now!

- Federal – and many state – policies support a low-carbon future
- Many legacy generators are set to retire
- Ample access to ocean space
- Globally, the costs of offshore wind energy are falling
- Offshore wind energy has the potential to be a source of domestic, sustainable, large-scale, affordable electricity for the U.S.
- The first offshore wind farm in the US plans to begin operation in 2016







Developing a National Offshore Wind Strategy

Public Engagement Informed the Dual-Agency Led Strategy

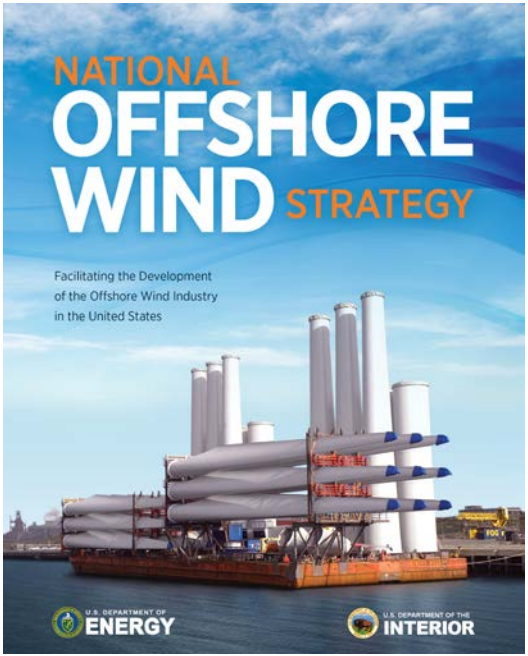
- DOE Request for Information – May 2015
- DOI Request for Feedback – September 2015
- DOE and DOI Workshop – December 2015
- Resulting in:
  - A dual-sealed document at the agency level
  - Released jointly by Secretaries Moniz and Jewell on September 9
  - A demonstration of the significant additional value of offshore wind
  - A description of the broader opportunity space for action
  - A detailed plan for specific activities DOE and DOI can take to lay the groundwork for a thriving industry
  - A 5 year plan, with aim of facilitating development of a lasting American offshore wind industry

Strategy Structure

- Value of Offshore Wind
  - Abundant Resource
  - Substantial siting and development opportunities
  - Sufficient Market Opportunity in U.S. Coastal Regions
  - Path to Achieve Competitive Cost
  - Demonstrated Economic Potential for Offshore Wind Energy
  - Economic, Energy System, and Environmental Benefits of Offshore Wind Energy

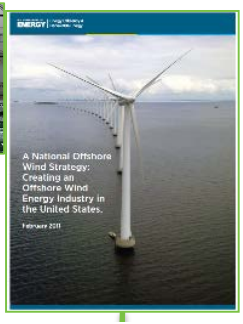
- Major Action Areas for the U.S. Offshore Wind Industry
  - Reducing Costs and Technology Risks
  - Supporting Effective Stewardship
  - Increasing Understanding of the Benefits and Costs of Offshore Wind

- Federal Offshore Wind Strategy
  - Identifies 34 actions that DOE and DOI can undertake to address issues outlined above



Over $200M Investments in Offshore Wind since 2009

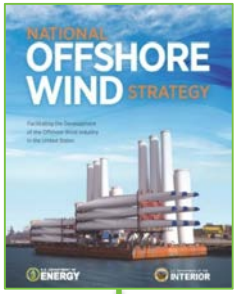
DeepCWind Consortium



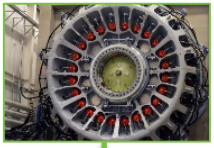
National OSW Strategy (2011)

Demonstration Projects Initiated

DOE Lidar Buoys



National Offshore Wind Strategy (2016)



ARRA Funding of Test Facilities

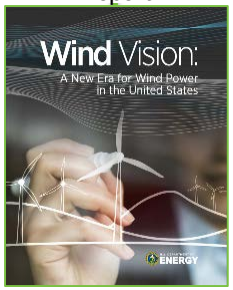
Technology and Market Barrier Funding Opportunities

Deployment of UMaine VolturnUS

2009

2015

Wind Vision Report



Strategy Framework

Purpose: To facilitate responsible development of a robust and sustainable offshore wind industry in the U.S.

STRATEGIC THEMES	ACTION AREAS
Reducing Technology Costs & Risks	1 Offshore Wind Power Resource & **Site Characterization** 2 Offshore Wind **Plant Technology Advancement** 3 Installation, Operation & Maintenance, and **Supply Chain** Solutions
Supporting Effective Stewardship	4 Ensuring Efficiency, Consistency & Clarity in the **Regulatory Process** 5 Managing Key **Environmental & Human Use** Concerns
Improving Understanding of the Benefits of Offshore Wind	6 Offshore Wind **Electricity Delivery & Grid Integration** 7 **Quantifying/Communicating** the Costs & Benefits of Offshore Wind

Reducing Technology Costs & Risks
Site Characterization

Since 2011 DOE has awarded $16.2M

CHALLENGE: Significant lack of data and standardized methodologies for collection at U.S. project sites

DOE ACTIONS:

- Gather and disseminate U.S. metocean & geological data
  - DOE Metocean Buoy Program
- Validate innovative site characterization methods

TAKEAWAY: DOE & DOI plan to support the collection and dissemination of resource characterization data and advance standardized data collection methodologies.

Reducing Technology Costs & Risks

Plant Technology Advancement

Since 2009 DOE has awarded over $270M

CHALLENGE: R&D needed to decrease costs of technology and adapt to the unique conditions of the U.S. resource and markets

ACTIONS:

- Demonstrate advanced offshore wind technology
- Advance partnerships to address unique U.S. offshore challenges
- Improve reliability of offshore wind systems
- Develop design standards

TAKEAWAY: DOE to support demonstration projects that leverage technologies to address U.S.-specific challenges, e.g., hurricanes, deep water, and icing conditions.

Reducing Technology Costs & Risks
Supply Chain

Since 2011 DOE has awarded $16.2M

CHALLENGE: U.S. supply chain dispersed — lacks experience and project pipeline necessary to support a cost-competitive domestic industry

DOE ACTIONS:

- Support a regularly updated U.S. supply chain inventory
- Evaluate supply chain bottlenecks, costs, risks, and future scenarios

TAKEAWAY: DOE plans to support efforts to inventory the existing supply chain, evaluate supply chain bottlenecks and identify investments needed to achieve the *Wind Vision* targets.

Supporting Effective Stewardship
Environmental & Human Uses

Since 2011 DOE has awarded $8M

CHALLENGE: Data needed to verify impacts of development on sensitive biological resources and existing human uses

DOE ACTIONS:

- Collect environmental impact data and support testing of monitoring and mitigation technology
- Synthesize environmental impact data and develop predictive models
- Evaluate and support mitigation of unique impacts of offshore wind on coastal radar systems and other Federal missions
- Support social science to understand the drivers of opposition and acceptance of offshore wind farms
- Aggregate and disseminate environmental information

TAKEAWAY: DOE & DOI will continue to support efforts to collect, synthesize, and disseminate data to validate the impacts of offshore wind.

Improving Understanding of Benefits

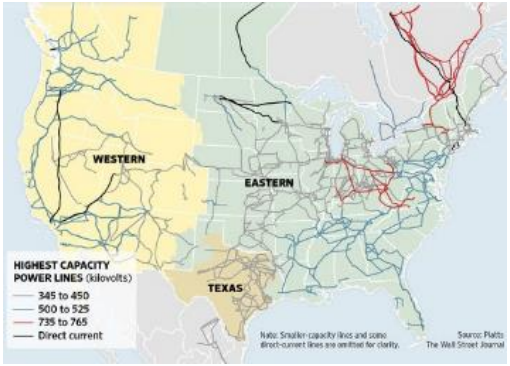
Electricity Delivery & Grid Integration

Since 2011 DOE has awarded $2.4M

CHALLENGE: Integration of large amounts of offshore wind have not been evaluated, especially on the state level

DOE ACTIONS:

- Analyze optimized offshore wind grid architectures
- Analyze state and regional offshore wind integration strategies



TAKEAWAY: DOE plans to analyze optimal offshore grid architecture and state-level integration.

Improving Understanding of Benefits
Quantifying & Communicating

Since 2011 DOE has awarded $2 M

CHALLENGE: Quantifying and communicating the unique benefits and costs of offshore wind for decision-making

DOE ACTIONS:

- Quantify offshore wind social and environmental costs and benefits
- Quantify offshore wind electricity market costs and benefits
- Communicate costs and benefits of offshore wind

TAKEAWAY: DOE & DOI proposed to support analysis which demonstrates the unique value of OSW.

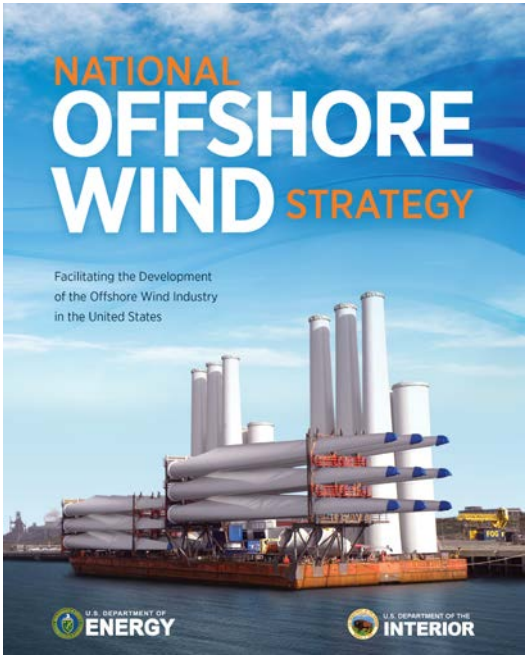
Improving Understanding of Benefits
Quantifying & Communicating

Offshore Wind Benefits

GHG (Cumulative)	Air Pollution (2050)	Water (2050)
1.8% reduction in cumulative GHG emissions (1,600 million tonnes CO_2-equivalents), saving $50 billion in avoided global damages	$2 Billion in avoided mortality, morbidity, and economic damages from cumulatie reductions in emissions of SO_2, NO_x and fine PM	5% less water consumption and 3% less water withdrawals for the electric power sector

Energy Diversity	Jobs	Local Revenues
Increased offshore wind power adds fuel diversity in key regions of the country, including populous coastal metropolitan areas, ultimately reducing sensitivity to changes in fossil fuel costs. Similarly, by reducing demand for fossil fuels offshore wind can support fuel cost savings for consumers based on lower prices outside of the electric sector.	Offshore wind investments could support approximately 160,000 gross jobs in coastal regions and around the nation	By 2050, $440 million annual lease payments and approximately $680 million in annual property tax payments

Implementing the Strategy



- DOE and DOI created the Strategy based on the stakeholder input we received – this is YOUR document
- We seek continued feedback
- As funding is made available, there is a feedback loop for stakeholders to provide information
- Create the conditions to support the offshore wind industry together

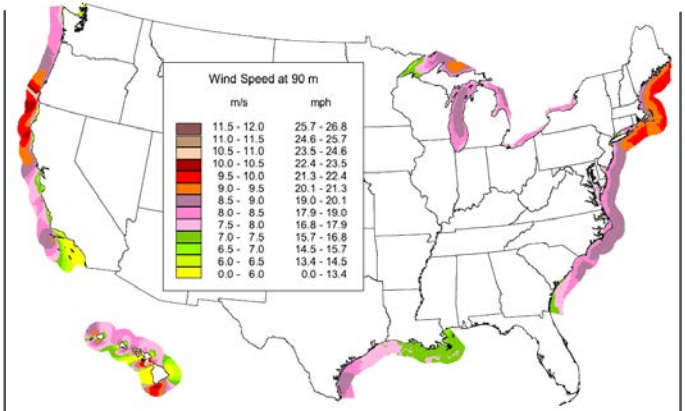
Thank you.

Alana.duerr@ee.doe.gov

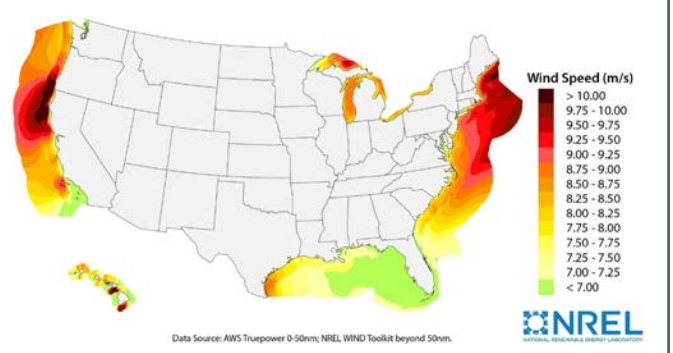
Back-Up Slides

Demonstrating Opportunity: Resource Assessment

- NREL performed previous resource assessment in 2010
- As technology advances, resource assessments need to be reevaluated
- Assumptions were revisited and refined
- New NREL Technical Report
  - http://www.nrel.gov/docs/fy16osti/66599.pdf



2010



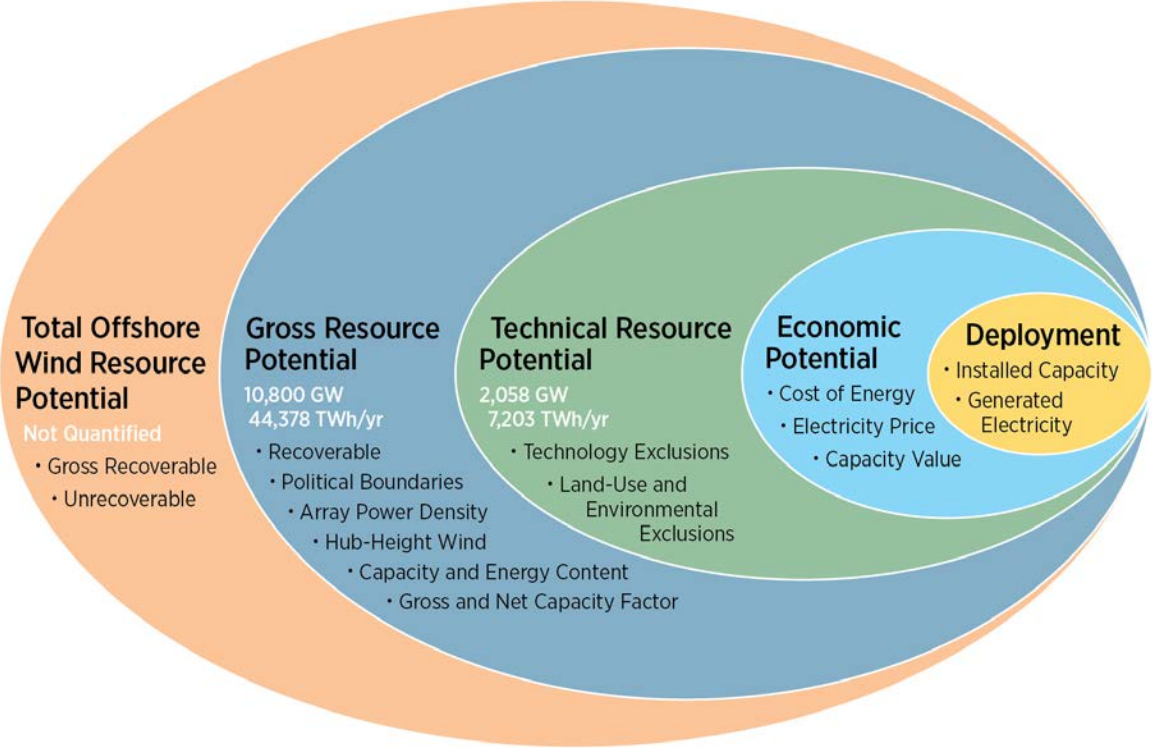
2016

Refining the Resource Assessment

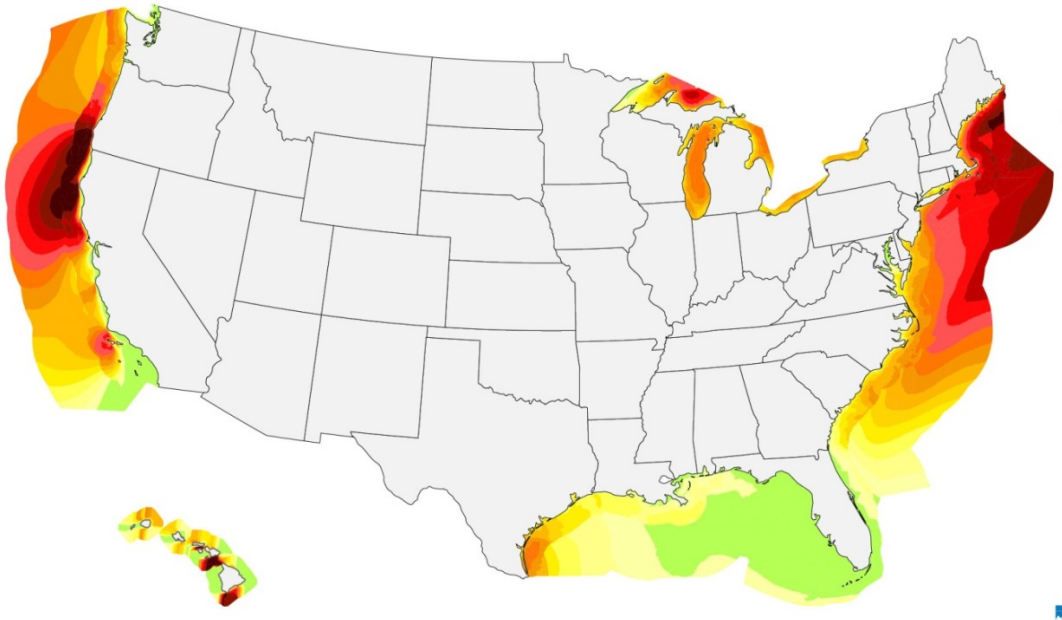
	2010 Assessment	2016 Assessment
Framework	Evaluated of the Gross Resource Potential out to 50 nm	Defines the different resource potentials [Total, Gross, Technical, Economic, Deployment] and evaluates US Gross and Technical
Hub Height	90-m	100-m
Distance from Shore	50 nm	200 nm
Power Density	5 MW/km^2	3 MW/km^2
Gross Potential	~4,000 GW	~10,800GW, 44,378 TWh/yr
Technical Potential	Technical Potential **not** evaluated	~2,000 GW Water depths <1,000 m Deployment in ice <60 m Wind speeds <7m/s
Net Capacity Factor	Not Calculated	Based on 6 MW turbine power curve

Resource Assessment Framework

A framework that allows for comparison between the offshore wind resource and other energy resources



Gross Resource Potential

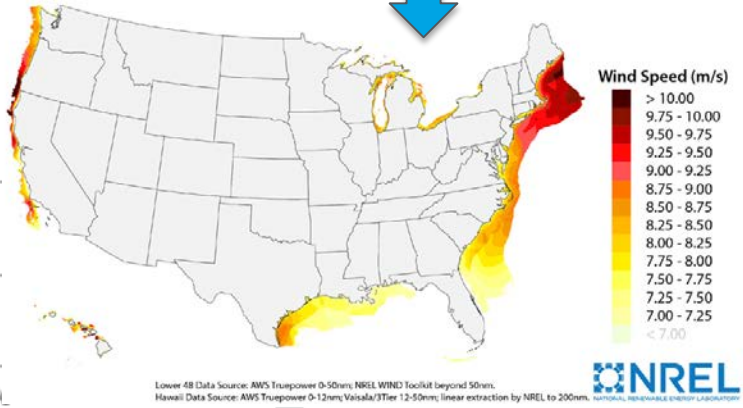


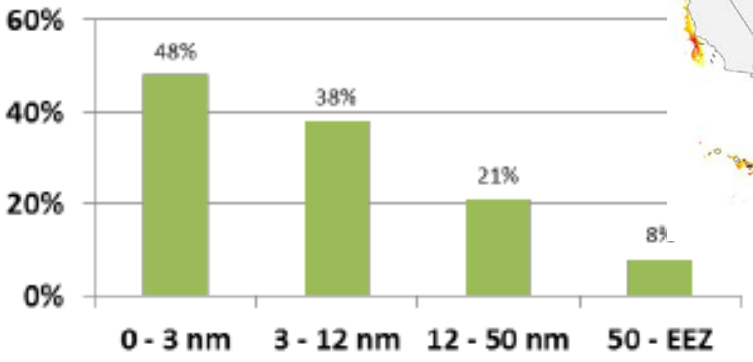
Data Source: AWS Truepower 0-50nm; NREL WIND Toolkit beyond 50nm.

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Getting to Technical Potential

Technology Exclusions



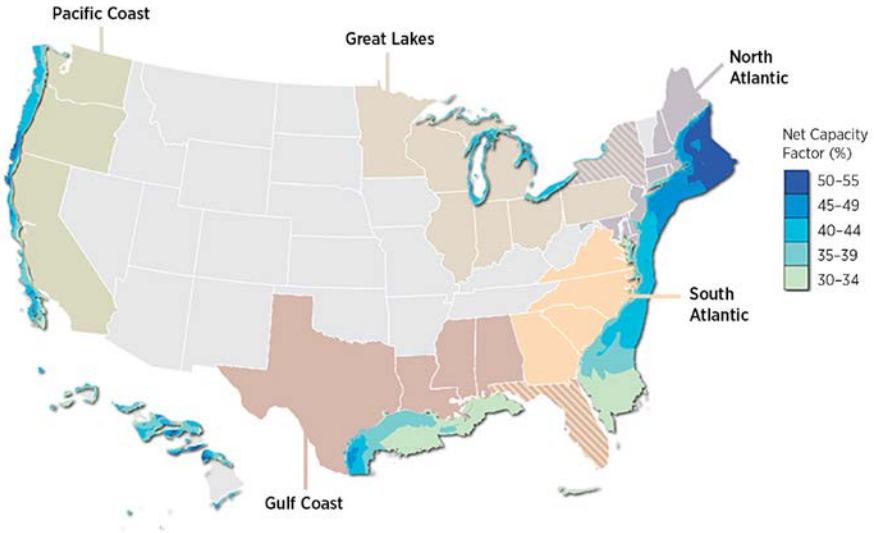


Area Exclusions by Distance from Shore

Land Use and Environmental Exclusions

Technical Potential in Net Energy Terms

- Calculated Site Specific Net Capacity Factors
  - 6-MW turbine power curve
  - Array losses in 600 MW plant
  - Assumes no losses between plants
  - Electrical Losses
  - Availability



A National Opportunity

- Assessment of offshore wind capacity (GW) and energy potential (GWh/year)
- All five regions have potential – and all five regions have need
- Solving technical challenges will open up significant opportunity on Pacific Coast and Great Lakes