

## Introduction

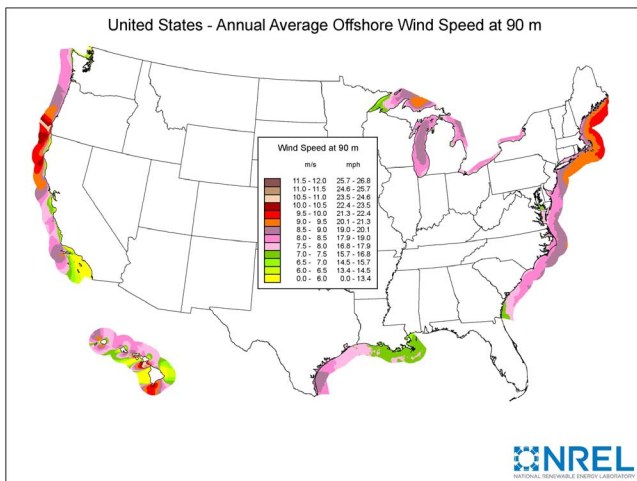
The development of an offshore wind resource database is one of the first steps necessary to understand the magnitude of the resource and to plan the distribution and development of future offshore wind power facilities. The U.S. Department of Energy supported the production of offshore wind resource maps and potential estimates for much of the United States. This presentation discusses:

- NREL's 2010 offshore wind resources report
- Current U.S., regional, and state offshore maps
- Methodology for the wind mapping and validation
- Wind potential estimates
- Geographic Information Systems (GIS) database
- Future work and conclusions.

## NREL Offshore Wind Resources Technical Report (Published June 2010)

- Estimated the offshore wind speed at a 90-m height and presented 26 state maps for:
  - Atlantic Coast
  - Western Gulf of Mexico
  - Great Lakes
  - Pacific Coast
  - Hawaii.
- Calculated the wind electric potential based on the area of "windy water"
  - Annual wind speed: 7 m/s and higher
  - Extent of maps and potential estimates: 50 nautical miles from shore
  - 5 MW of potential installed capacity per square kilometer of water
  - **No environmental or other water use exclusions were included in the potential estimates.**
- Total gross potential: 4,150 gigawatts
- Website: [www.windpoweringamerica.gov/wind\\_maps/offshore.asp](http://www.windpoweringamerica.gov/wind_maps/offshore.asp)

## U.S. Offshore Wind Resource Map (Updated January 2011)



Pacific Coast and Hawaii maps were based on data from onshore mapping projects (50-m, 70-m, or 100-m heights). Maps were extrapolated out to 50 nautical miles from the coast.

Florida, Alabama, and Mississippi did not have previous offshore mapping data. Estimating 90-m wind speed from buoy and satellite data is too problematic.

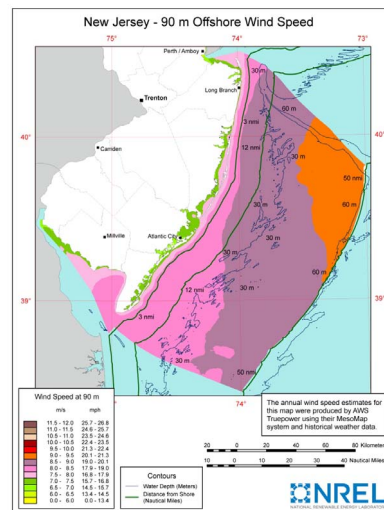
Discontinuities near state boundaries (OR/CA) will be eliminated with completion of updated maps.

## Wind Potential by Region (7.0 m/s and Greater)

Region	GW by Depth (m)			Total
	0-30	30-60	>60	
New England	100.2	136.2	250.4	486.8
Mid-Atlantic	298.1	179.1	92.5	569.7
South Atlantic Bight	134.1	48.8	7.7	190.7
California	4.4	10.5	573.0	587.8
Pacific Northwest	15.1	21.3	305.3	341.7
Great Lakes	176.7	106.4	459.4	742.5
Gulf of Mexico	340.3	120.1	133.3	593.7
Hawaii	2.3	5.5	629.6	637.4
<b>Total</b>	<b>1,071.2</b>	<b>628.0</b>	<b>2,451.1</b>	<b>4,150.3</b>

## Methodology: Offshore Wind Mapping and Validation

- Updated 90-m maps are based on numerical model output.
  - Maps have a horizontal resolution of 200 m.
  - AWS Truepower produced preliminary model data under subcontract to NREL.
  - NREL validated preliminary data using:
    - Buoys
    - Satellite data (10-m wind speeds)
    - Light stations, Coast Guard stations, coastal automated stations.
  - Validation results are based on a 50-m comparison between model estimates and adjusted measurement data.
    - Most available offshore measurements are only 5 m and 10 m above the surface
    - Relatively few measurements between 30 m and 50 m offshore.
    - Measurements above 50 m are scarce.
  - Sufficient measurement data does not exist to confidently extrapolate 5-m and 10-m measurements up to 90 m.



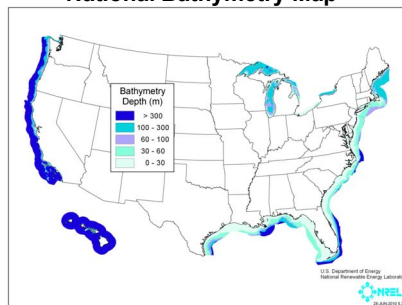
## New Jersey Offshore Wind Map

- Annual wind speeds of 8.5 m/s and higher are found within 12 nautical miles of the coast in the northern half of the state.
- Wind speeds of 8.0 m/s and greater are generally found within 3 nautical miles of the coast.
- The eastern end of Delaware Bay also has annual wind speeds greater than 8.0 m/s.

## NREL's Offshore GIS Database

- Wind speed, bathymetry, distance from shore, and state administrative area data
- Horizontal resolution: 100 m
- Water depth interval: 10 m
- Distance from shore: increments of 1 nautical mile
- Uses best available state and federal administrative boundaries.

## National Bathymetry Map



## Future Work and Conclusions

- Updated resources for Pacific Coast, Hawaii, Florida, Alabama, and Mississippi have not yet been calculated.
- The GIS database incorporates new data as updated maps are completed.
  - The last group of states to be incorporated was Rhode Island to South Carolina in January 2011.
  - It will eventually contain wind resource information for all 50 states.
  - Environmental and water use exclusions will be included in future versions of the database.
  - Other ocean renewable energy data, such as wave power resource, will be included.
- **The United States has enormous gross energy potential from the offshore wind resource.**