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CLEAN ENERGY IS JUST OVER THE HORIZON

Offshore Wind & Transmission Networks in Southern New England

New England Roundtable

Friday December 9, 2011

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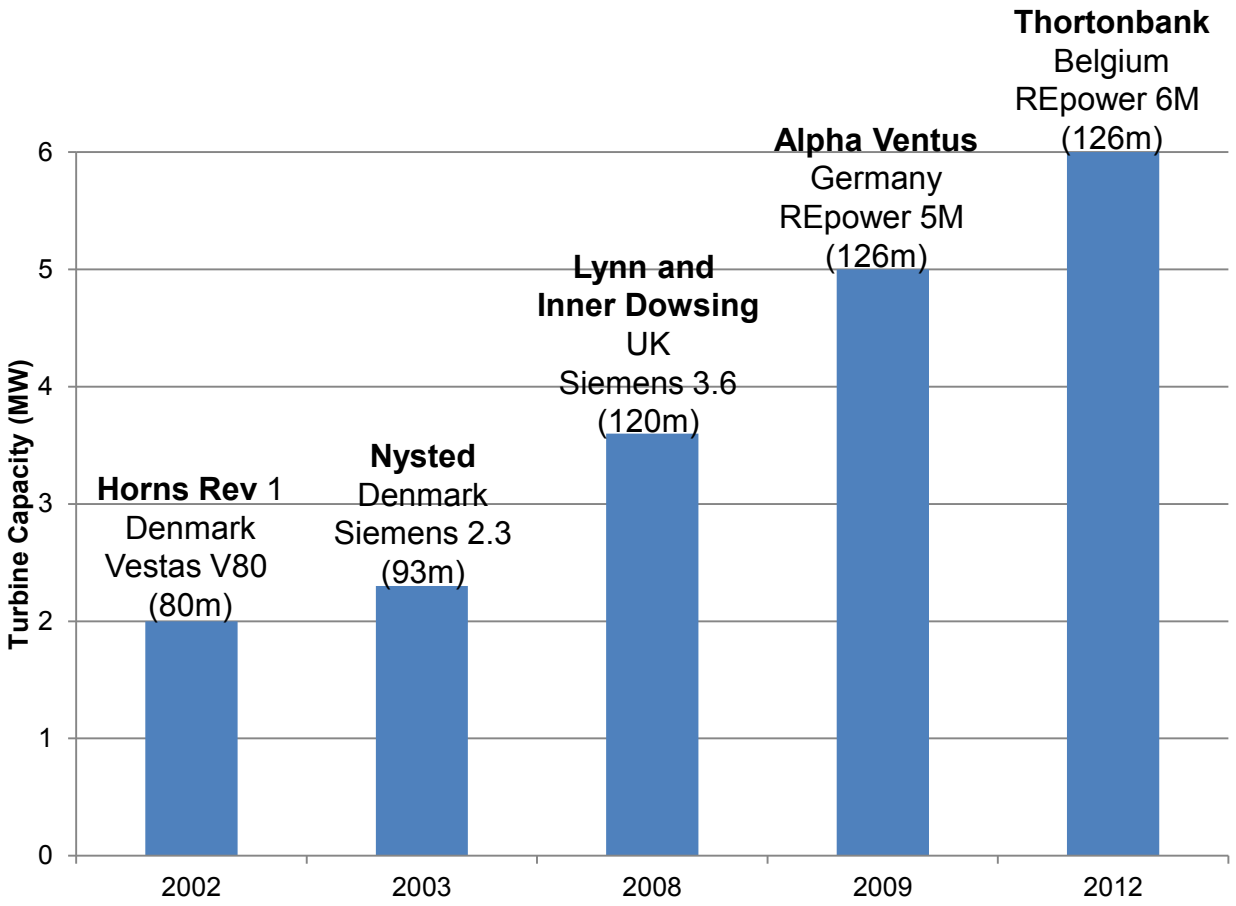
Overview

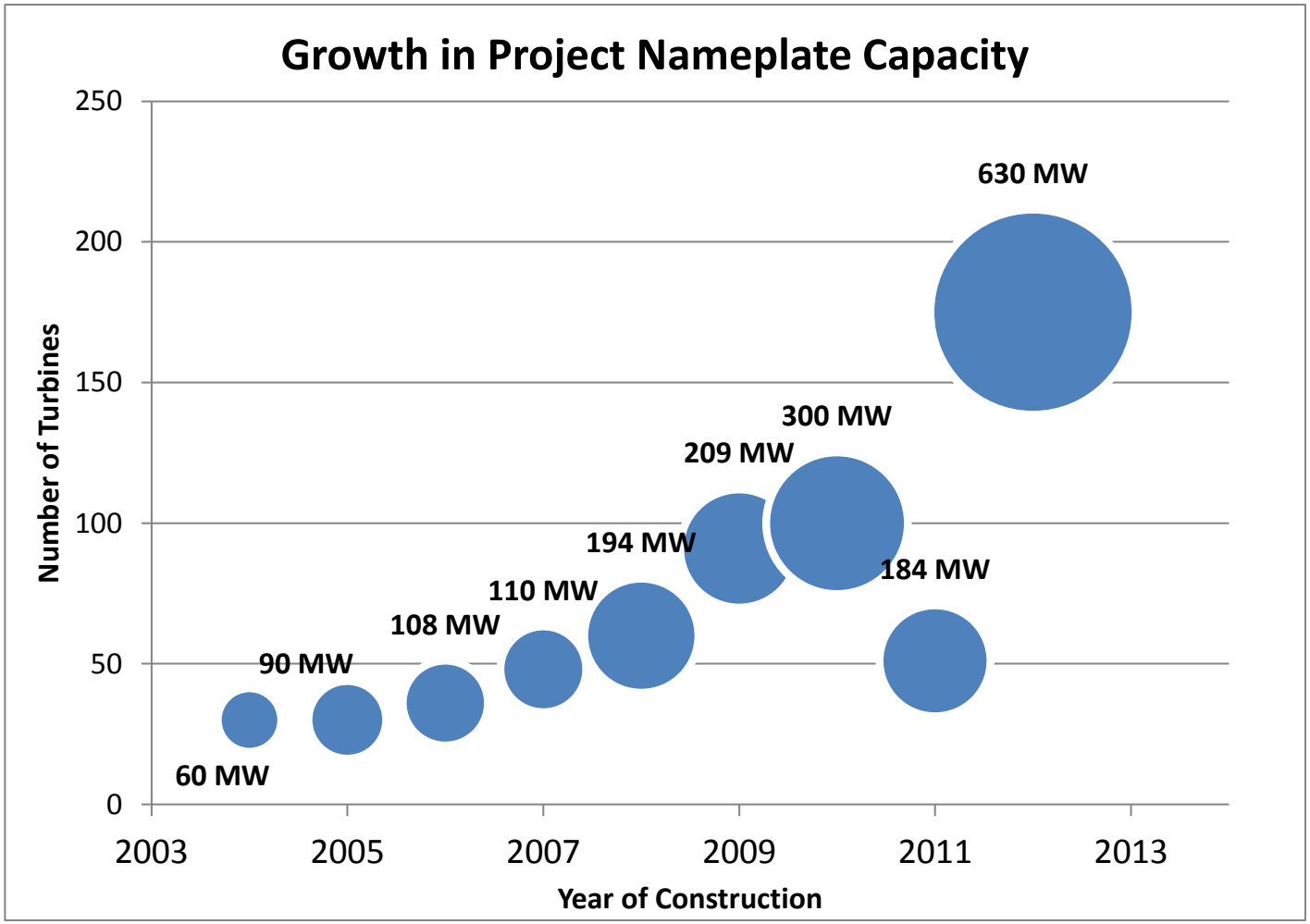
- **Recent trends in OSW technology and economics**
- **Deepwater Wind**
- **Importance of scale and innovative transmission solutions for competitive economics**

Larger-Capacity Turbines



Increases in turbine nameplate capacity reduces installation costs on a $ / MW basis

Growth in European Project Sizes

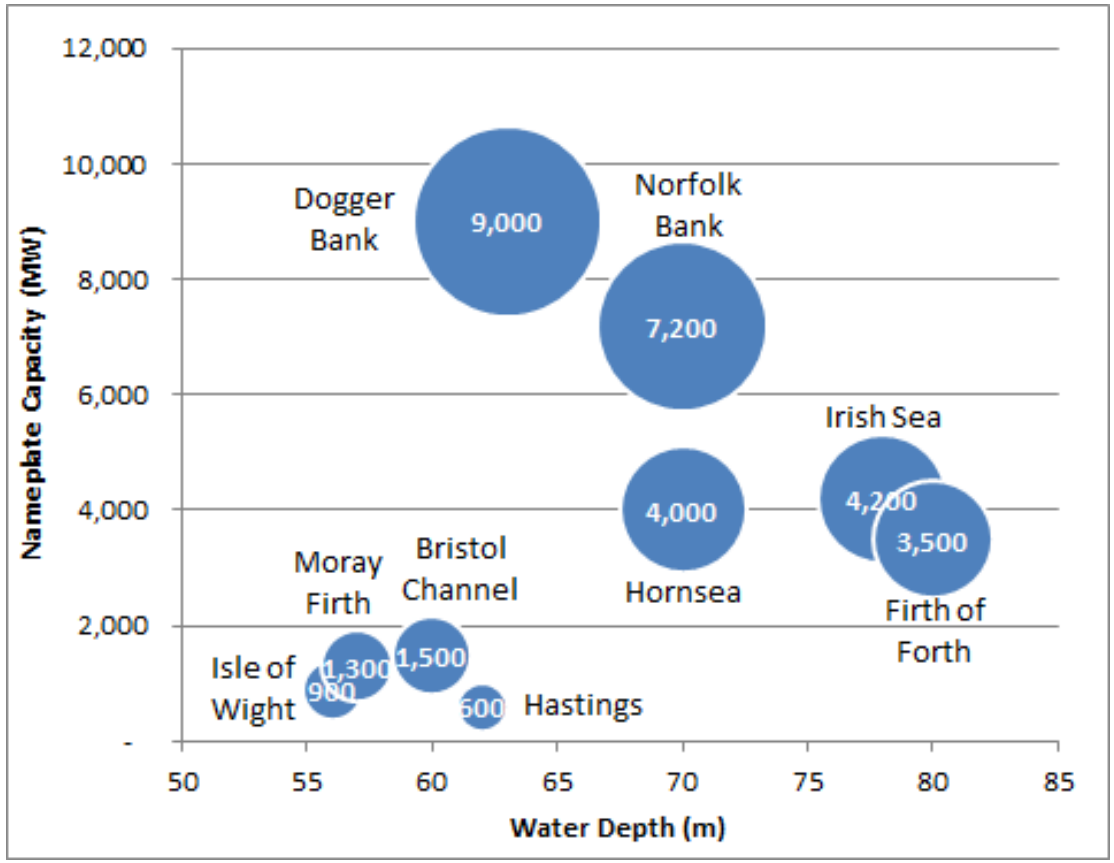


Today's offshore wind projects are much larger – both in number of turbines and in total capacity – than those of just a few years ago

Future Projects will be even Larger

Foundations in deeper waters allow projects to be built cost-effectively on a gigawatt scale

Offshore UK wind farm zones



Economies of Scale for Offshore Wind

Improved Equipment Pricing

- *Larger orders of turbines, foundations and cable yield better unit pricing*

Economies in Operations & Maintenance

- *Larger projects will incur roughly the same fixed O&M costs, which can spread such cost over greater capacity*

Reduced Logistics and Installation Costs

- *Larger projects can justify the fixed costs of local fabrication, yielding much lower transportation costs.*

Over the horizon wind

- **Reduced visibility.** Locate 13-20+ miles offshore to avoid controversy.

- **Proven technology.** Use jacket foundations to build in deep water.

- **Stronger wind resource.** Deep-water sites are more energetic.

- **Economies of scale.** Larger projects with larger turbines will have lower unit costs..

- **Regional Energy Centers.** Supply clean power to entire regions, not just individual states, with innovative transmission solutions.

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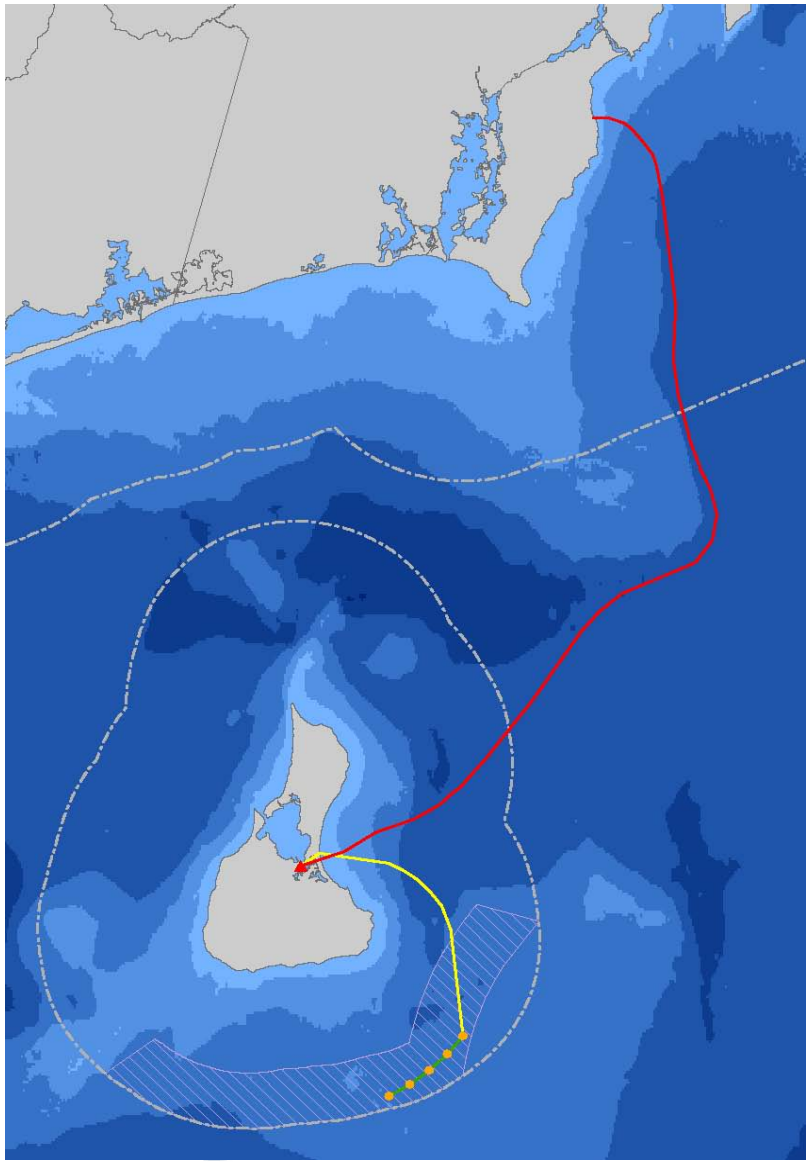
Siemens 6MW x 154m dd for Block Island

- Siemens will supply the Block Island Wind Farm with its latest purpose-built offshore turbine
- 6 MW (67% larger than 3.6 MW) + 154m rotor (44% larger than 107m)
- First deployment in the US and only the second in the world
- Higher output means lower unit cost of energy – fewer turbines installed for the same power output
- Direct drive = 50% fewer rotating parts = lower maintenance costs + greater reliability

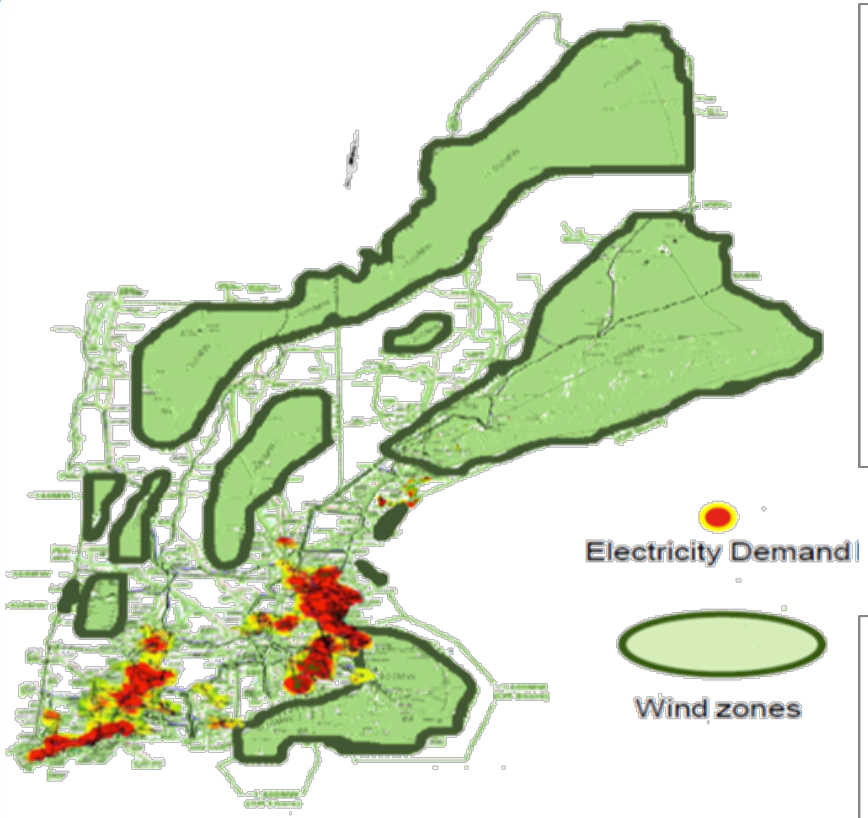
Transmission must be Designed to meet Market Need



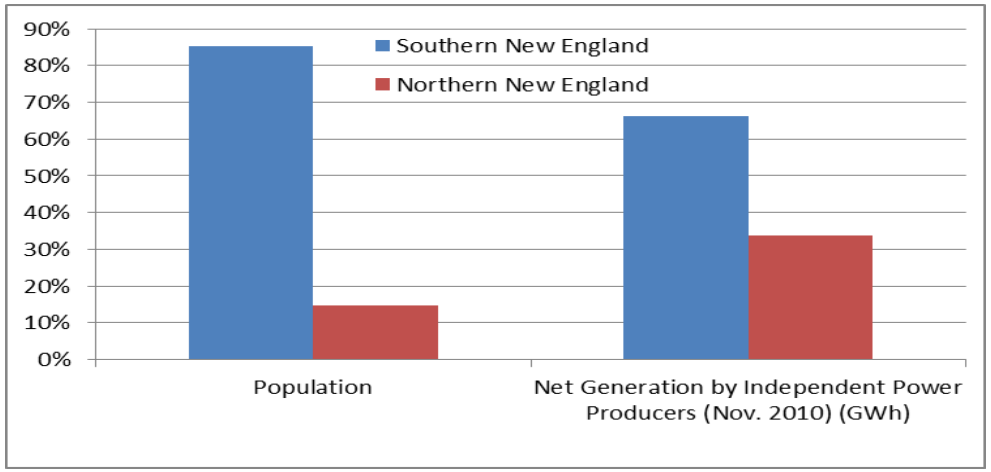
- Three types of market needs:
  1. **Intermittency Balancing** - - providing access to addition resources to firm wind power
  2. **Multi-Market Distribution** - - providing multiple markets with access to a utility scale wind farm
  3. **Cost Effective Delivery** - - minimizing transmission cost

- Deepwater's Block Island Transmission System provides balancing for our Block Island Wind Farm:
  - **Exports power to mainland** when wind farm produces more than Block Island needs
  - **Imports power from mainland** when wind farm (rarely) produces less than Block Island needs

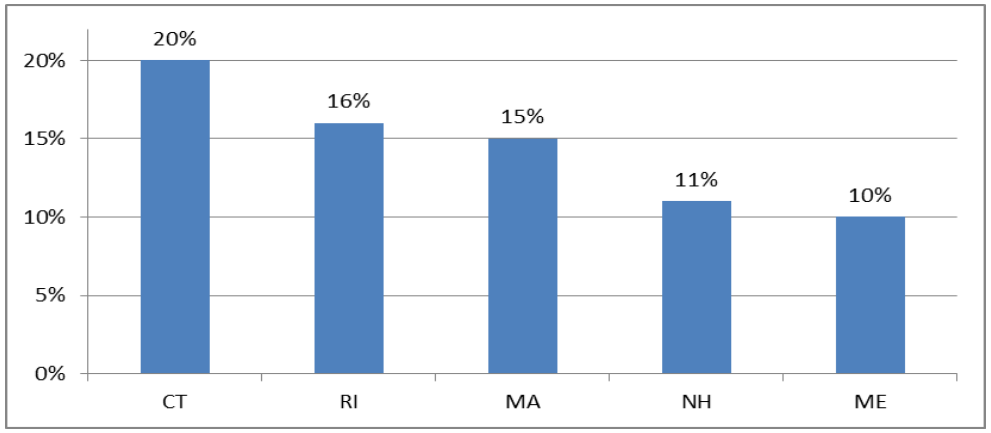
Offshore Wind is Important for New England



Offshore wind is the renewable resource **closest to the region's population and electricity demand centers**.



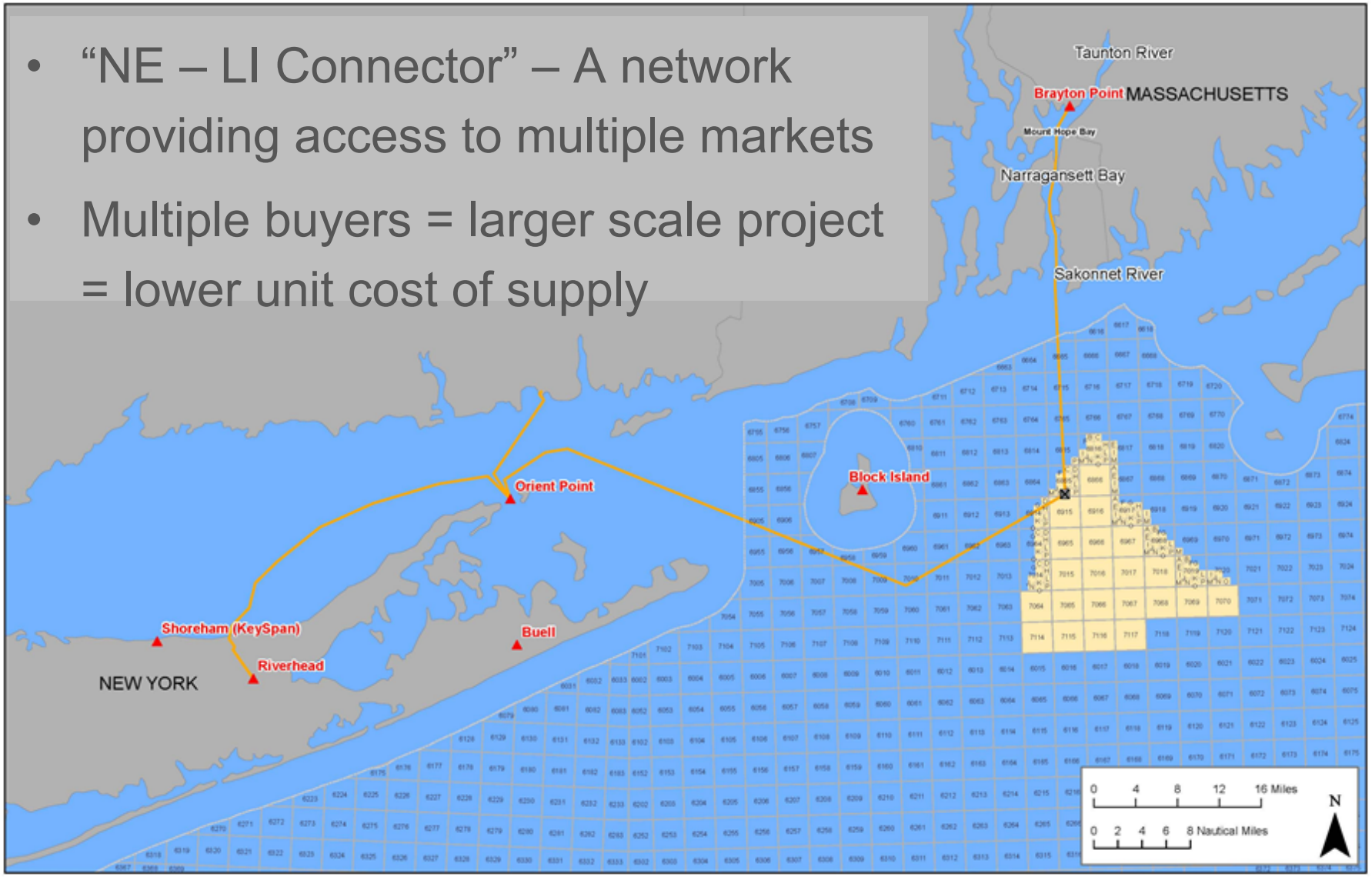
The south of New England has **more population and generation** than the north



Southern New England has **more aggressive RPS targets** than Northern New England.

DWEC 1 GW : *a regional energy center in the AMI*

- "NE – LI Connector" – A network providing access to multiple markets
- Multiple buyers = larger scale project = lower unit cost of supply



Why networks?

Reach multiple energy markets at lower unit cost

- *Scale Drives Costs*
  - Build at 1GW size ➔ lower $/MWH
- *Regional Procurement*
  - Multiple states each receive smaller, cheaper allotment of much larger, more efficient “regional energy center”

Multiple grid interconnect points in adjacent RTOs

- *Improve grid reliability*
- *Exploit price arbitrage between markets*
- *Reduce single-point interconnection risks*

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Conclusions

Commercial Realities

- *Offshore wind will succeed in NE only with lower pricing*

Dominance of Scale Economies

- *Technical change in design of WTGs and HVDC systems*
  ➔ *clear cost advantage for larger scale OSW projects*

The Missing Link

- *Innovative transmission systems ➔ GW-scale projects*

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