

# Policy, Integration, and Transmission Solutions for the Large-Scale Deployment of Wind Power

**August 8, 2012**

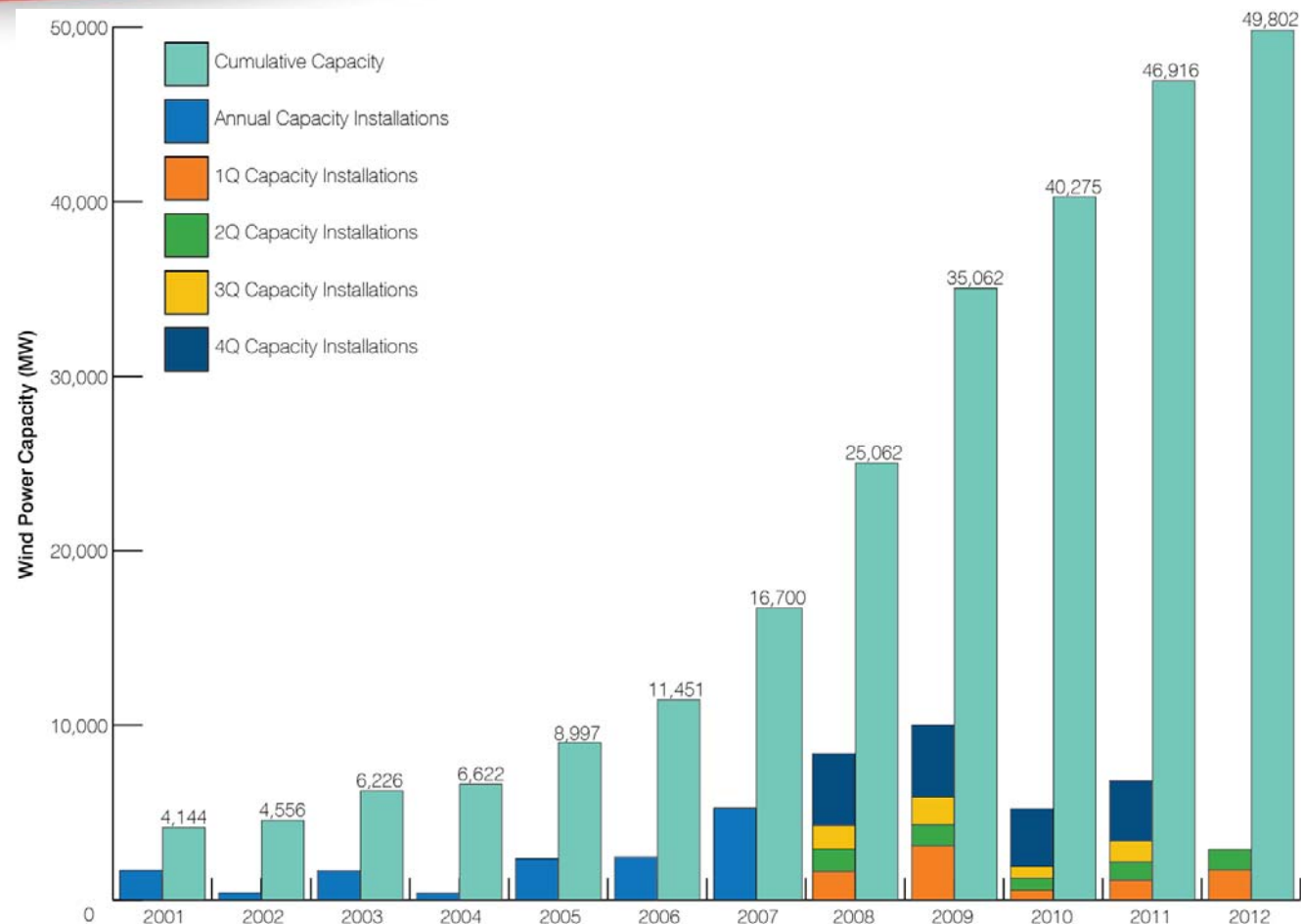
**Michael Goggin**

**American Wind Energy Association**

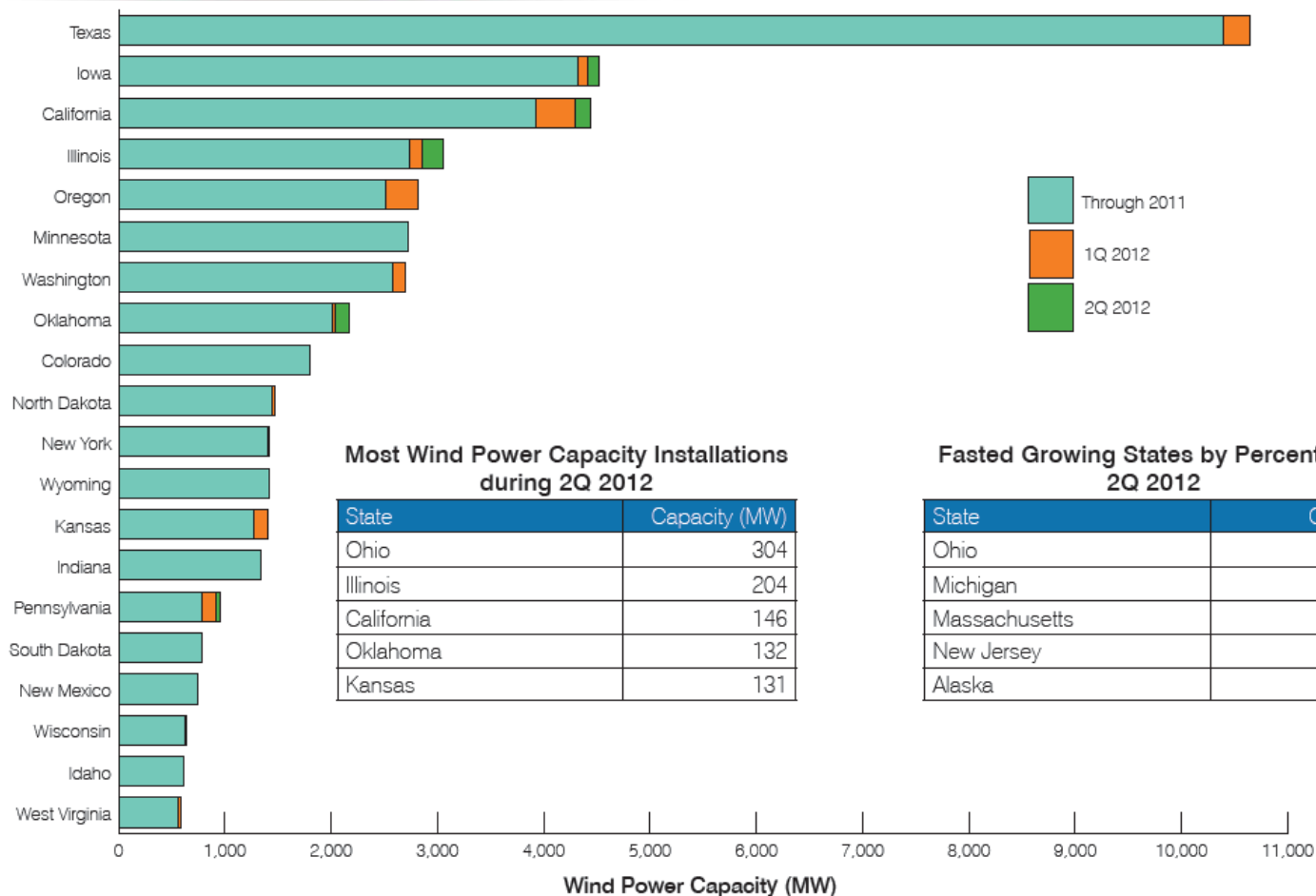
# Market and Policy Overview

# U.S. Wind Capacity Installations

- The U.S. was at 49,802 MW of installed wind capacity at the end of 2Q 2012
- ✓ 12.8 million homes
- ✓ 82 million tons of CO<sub>2</sub>/year or 14 million cars
- ✓ 30 billion gallons of water/year



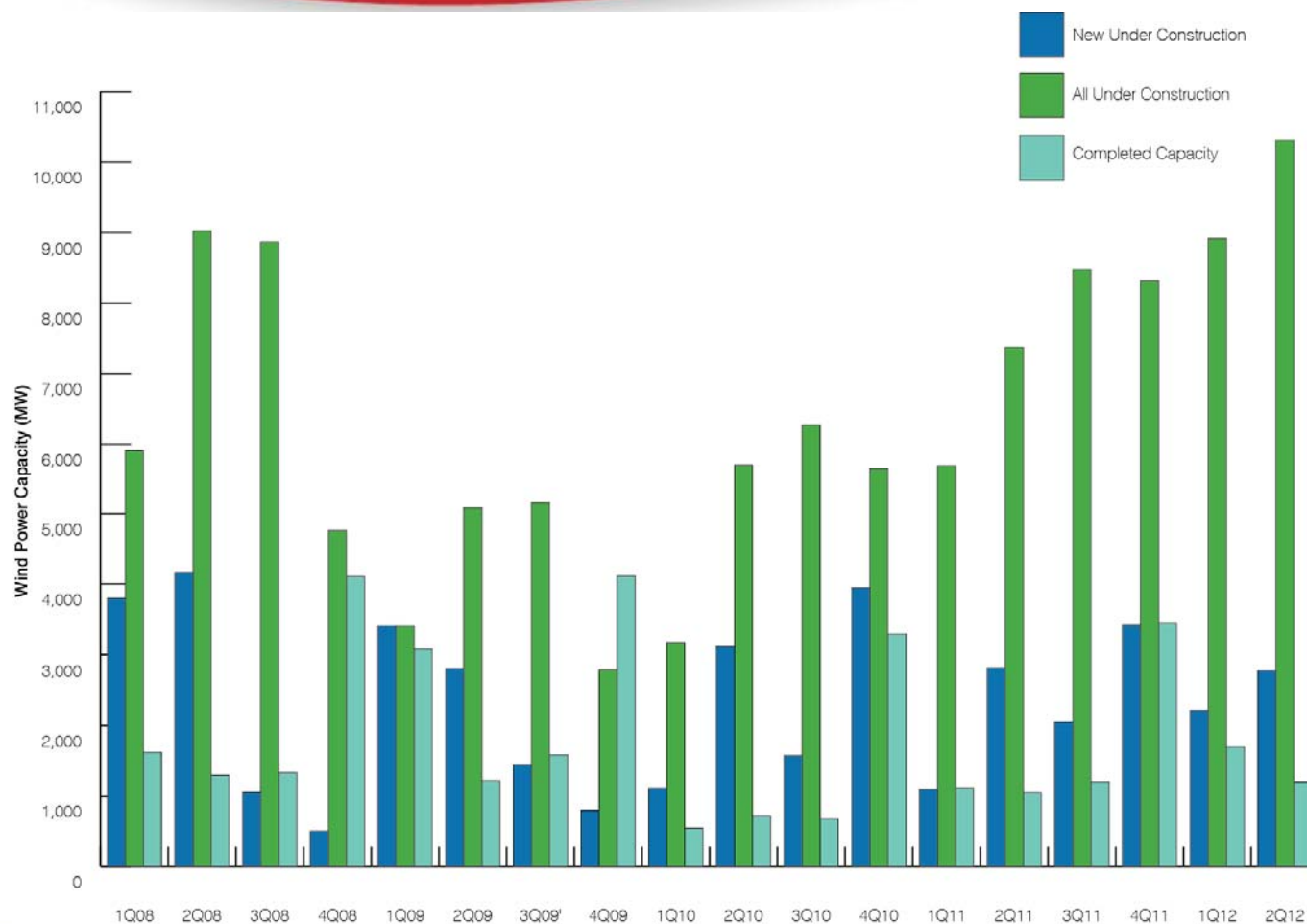
# 2Q 2012 Wind Installation Activity, by State



Source: AWEA U.S. Wind Industry Second Quarter Market Report



# Wind Project Construction Activity



- At the end of 2Q 2012, the U.S. had over 10,300 MW under construction
- 30 states + Puerto Rico have wind projects under construction
- The 5,300 turbines under construction come from 14 different turbine manufacturers

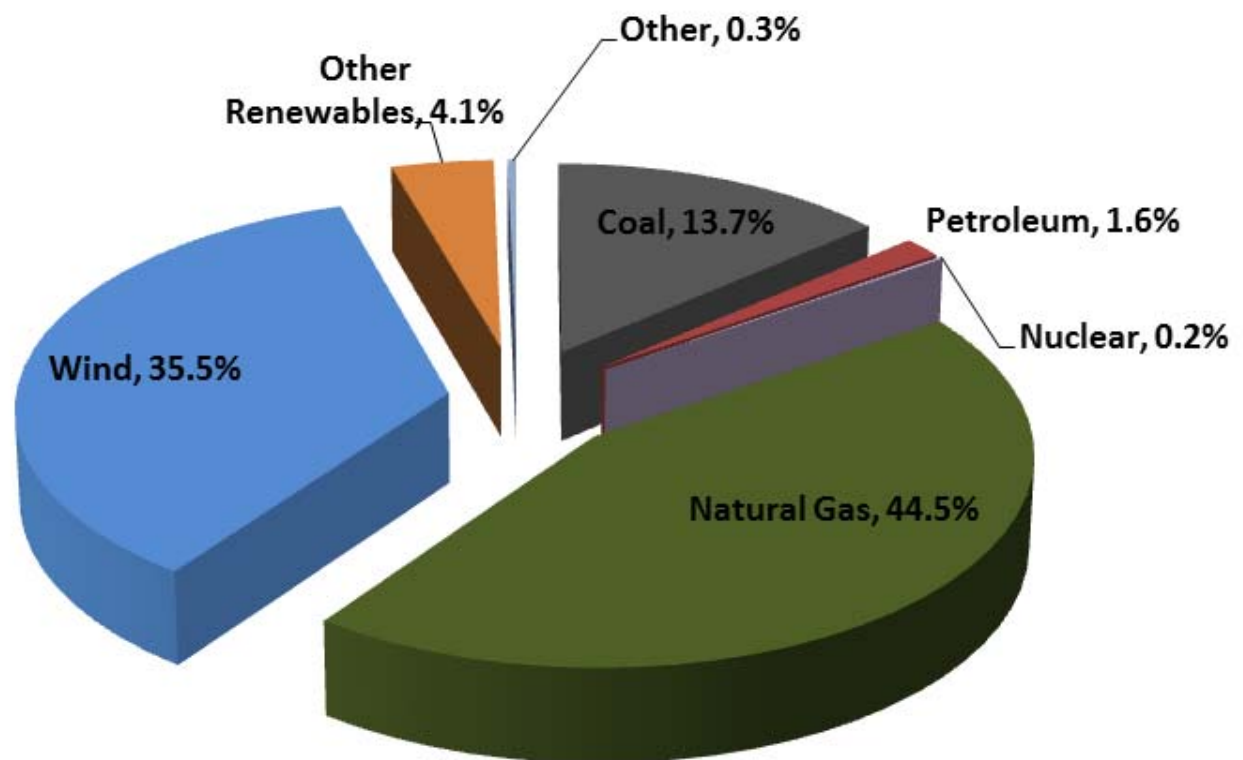
# Wind has contributed 35% of all new electric generating capacity in America since 2007

Percent of New Installed Capacity, 2007-2010

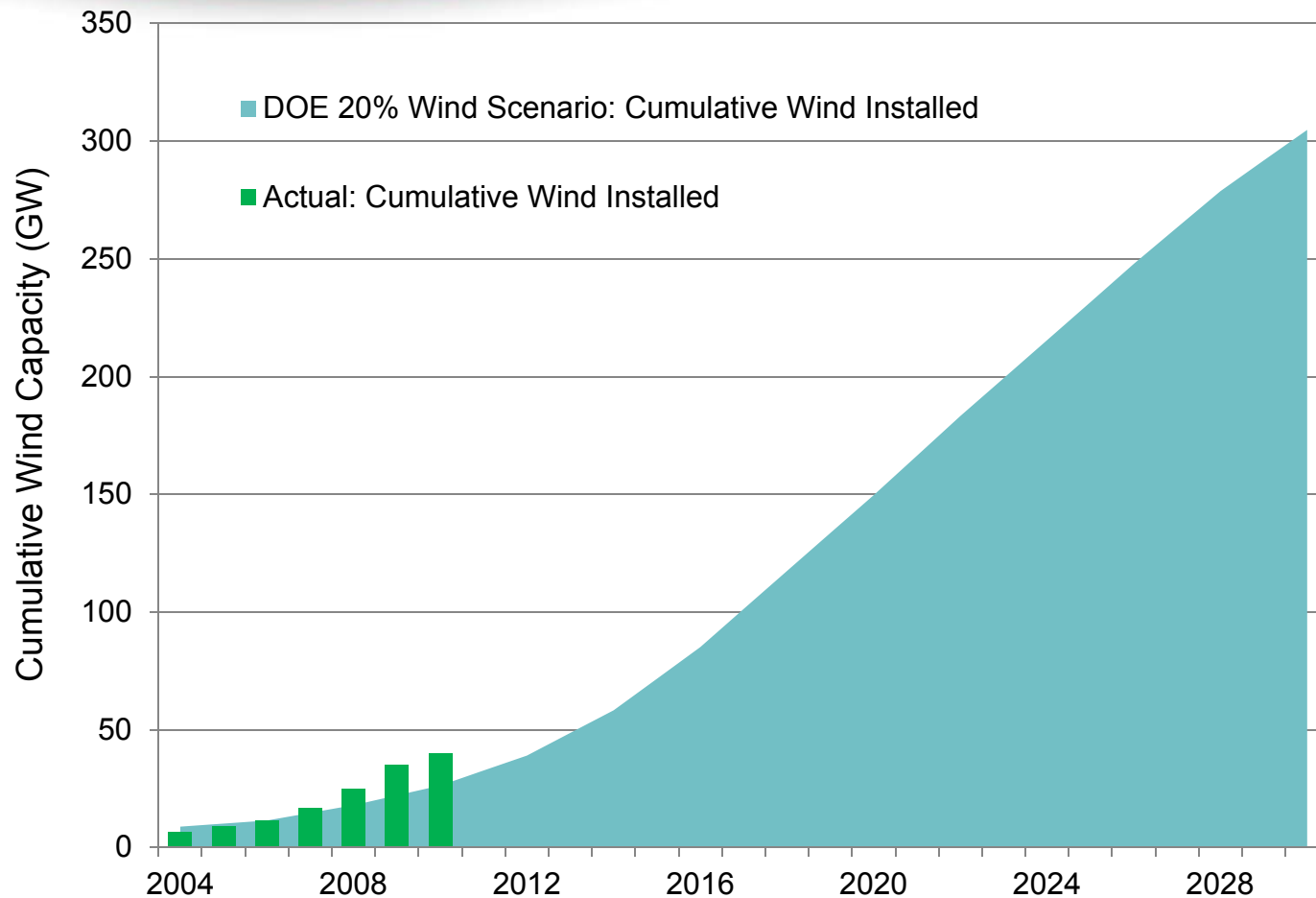
Nearly 81,000 MW of new generating capacity installed between 2007 and 2010

Wind installed over 35% of all new generating capacity between 2007 and 2010, or 28,740 MW.

Wind accounted for 32% of capacity installed in 2011.

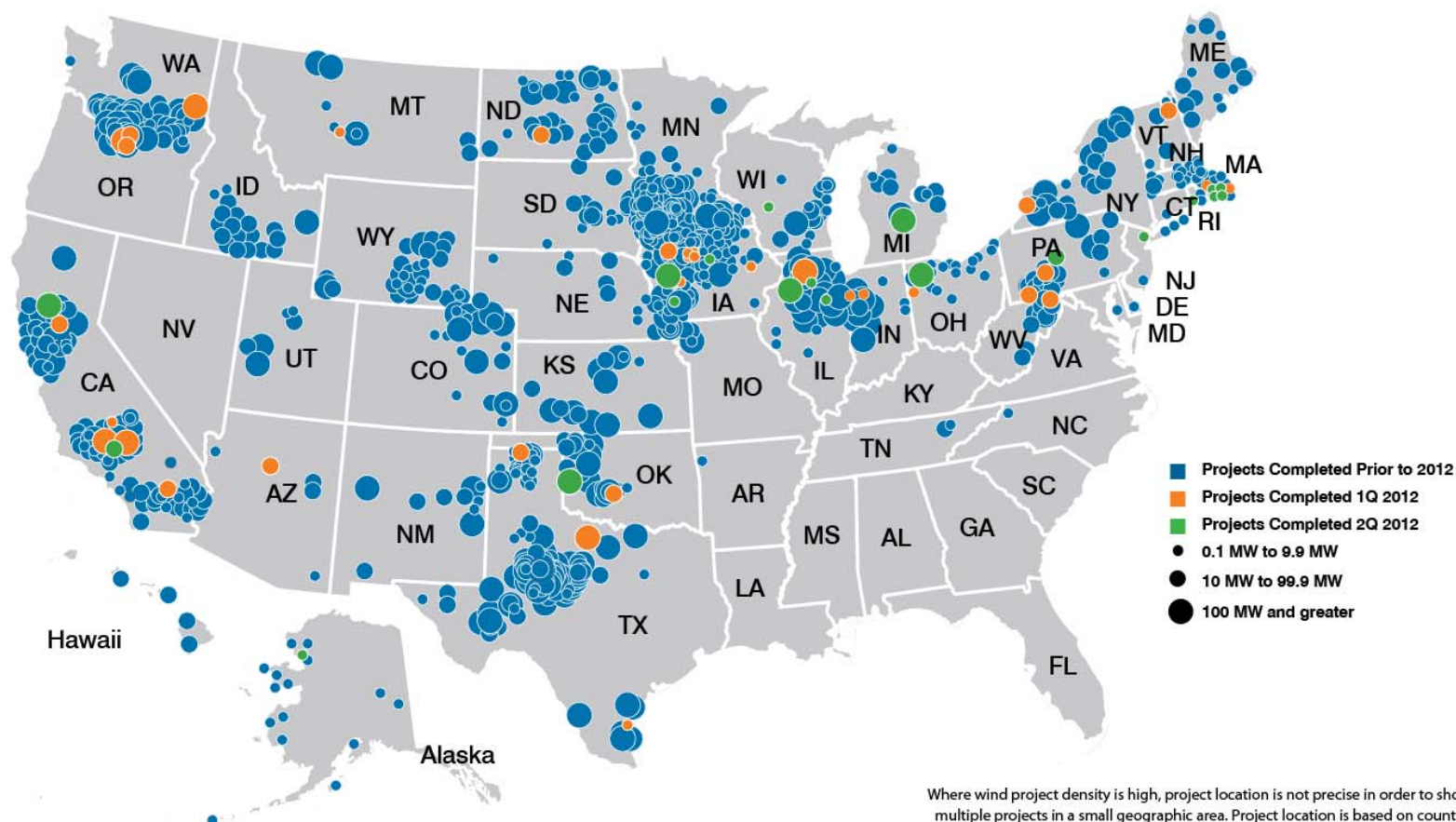


# U.S. Wind Power Installations are Ahead of Projected Path for 20% by 2030



Data Source: AWEA , U.S. DOE 20% Wind Energy by 2030

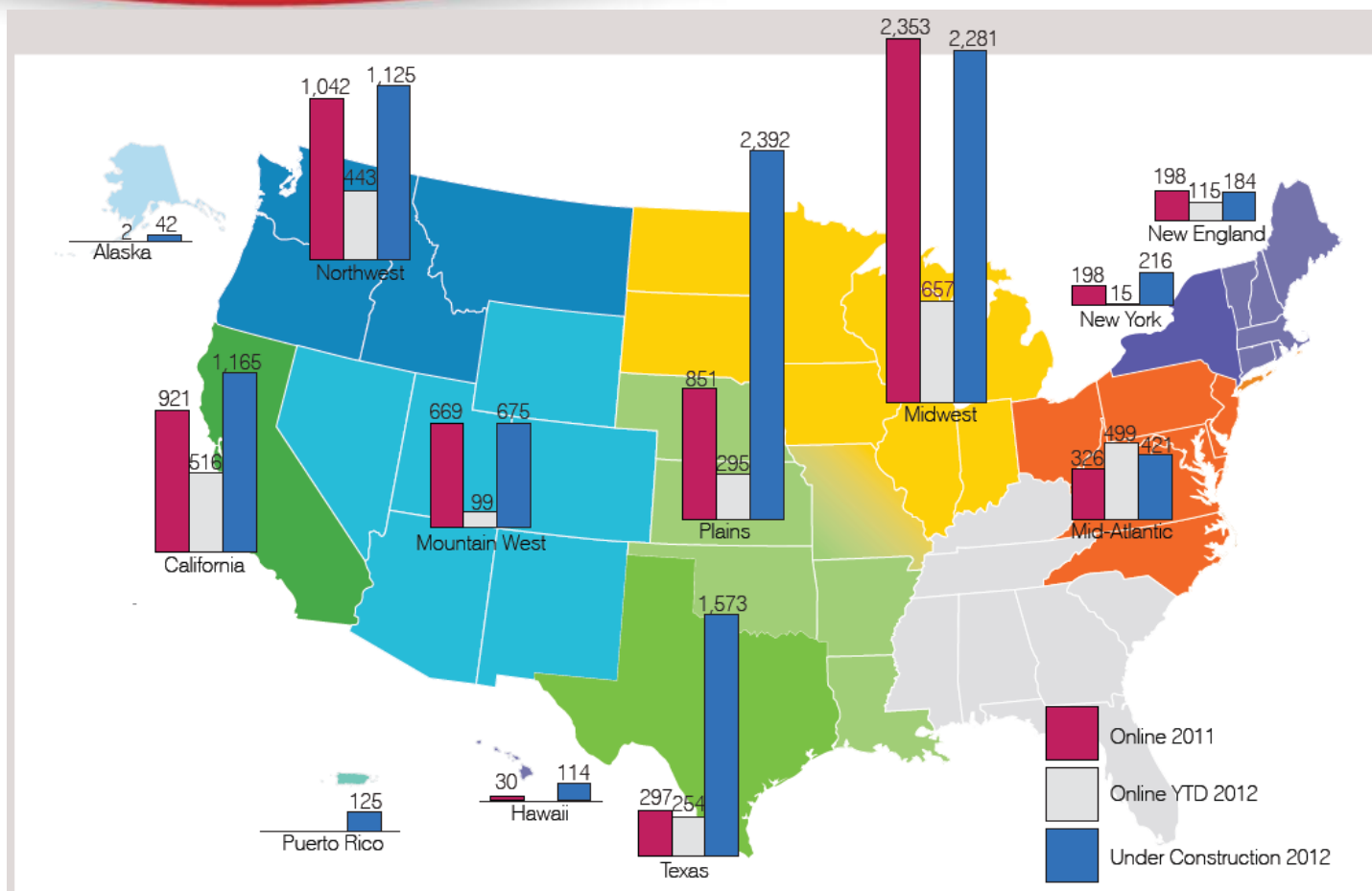
# Wind Project Locations



Source: AWEA U.S. Wind Industry Second Quarter Market Report

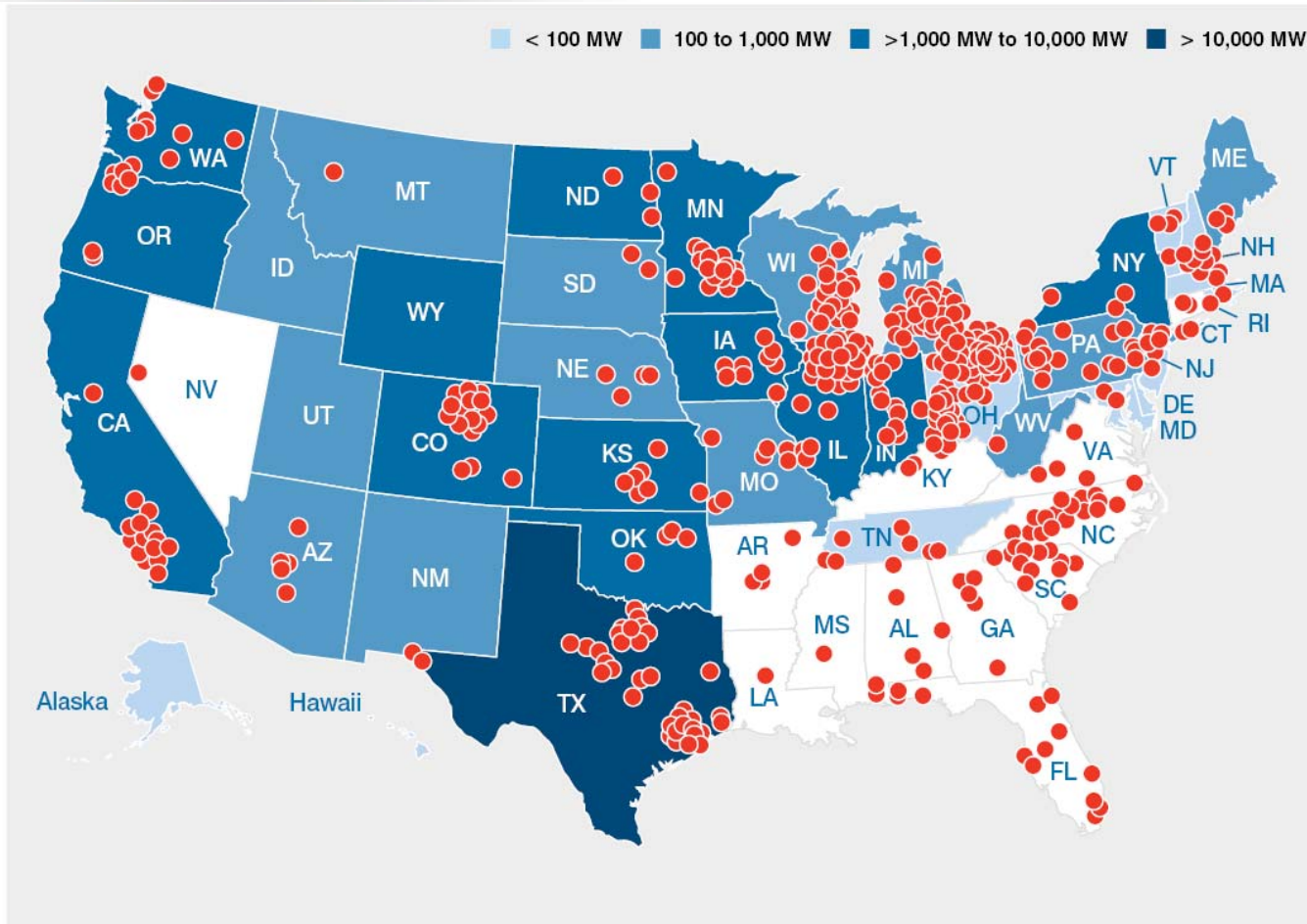


# Wind Project Activity, by Region



Source: AWEA U.S. Wind Industry Second Quarter Market Report

# With 400 Facilities, Wind is One of the Fastest-Growing Sources of U.S. Manufacturing Jobs



Source: AWEA, U.S. Wind Industry Annual Market Report Year Ending 2010

# Policy Update - PTC

- On August 2, 2012, the Senate Finance Committee passed a tax extenders package that included an extension of the renewable energy production tax credit (**PTC**) and investment tax credit (**ITC**) by a bipartisan margin of 19 – 5.
- The extension allows projects whose construction starts in 2013 to qualify for the PTC, instead of requiring them to be placed in service by the end of 2013.

# Next Steps - PTC

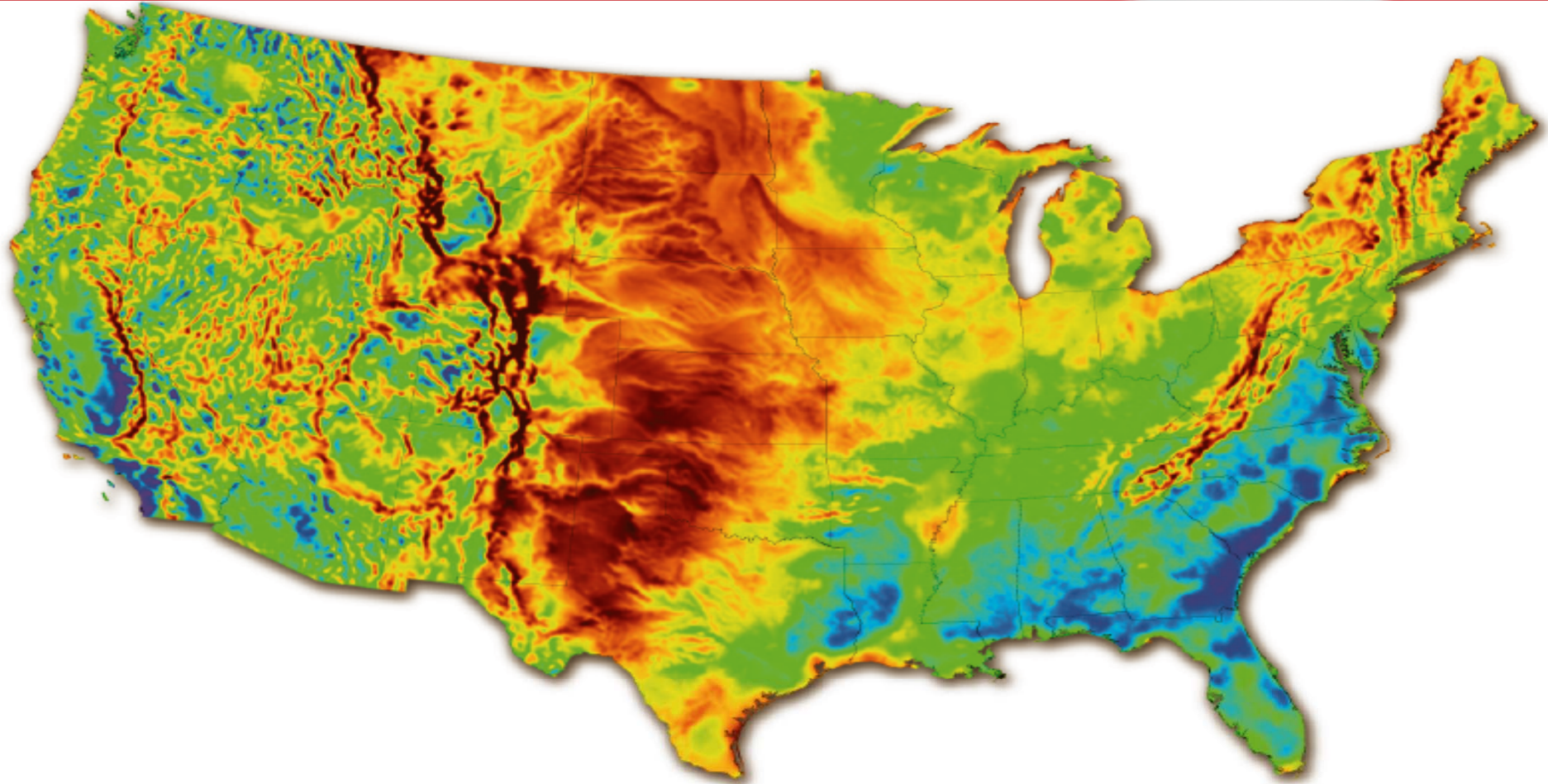
- Full Senate vote on the extenders bill proposed by the Senate Finance Committee
  - After August recess
- Tax extension legislation to be taken up by the House of Representatives
  - The House of Representatives has stated that it will not take up tax extension legislation prior to the November 6 elections

# Transmission

# Lack of Transmission is a Problem

- How a lack of transmission hurts renewables:
  - Renewable projects cannot connect to the grid – Around 200,000 MW of proposed wind projects waiting in interconnection queues
  - Country's best wind and solar resources are far from cities
  - Project output can be curtailed because of inadequate transmission
  - Cannot capture benefits of geographically diverse wind resources

# Wind Resources Distant from Demand

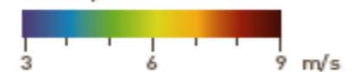


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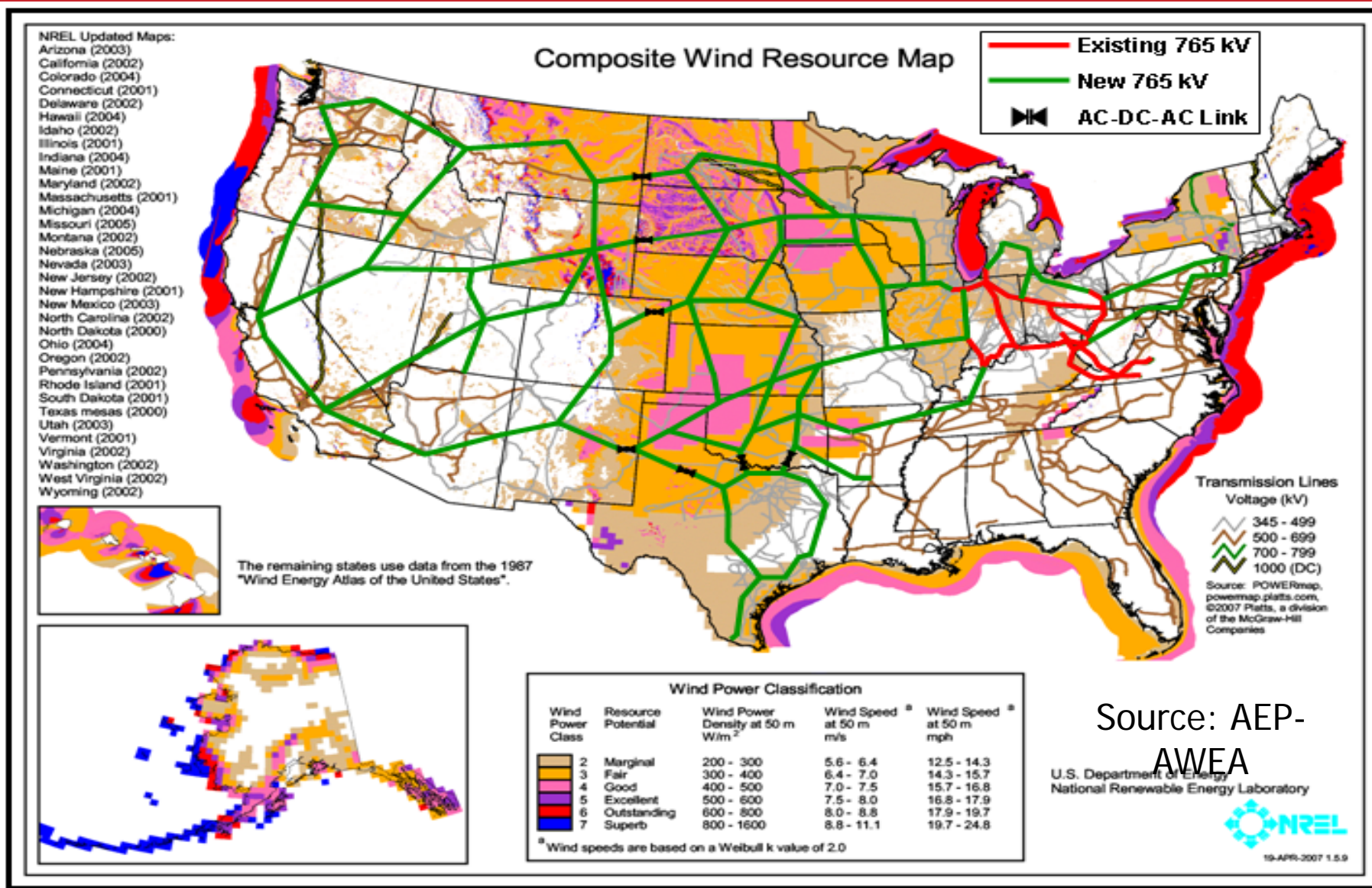
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5km Wind Map at 80m

Wind speed

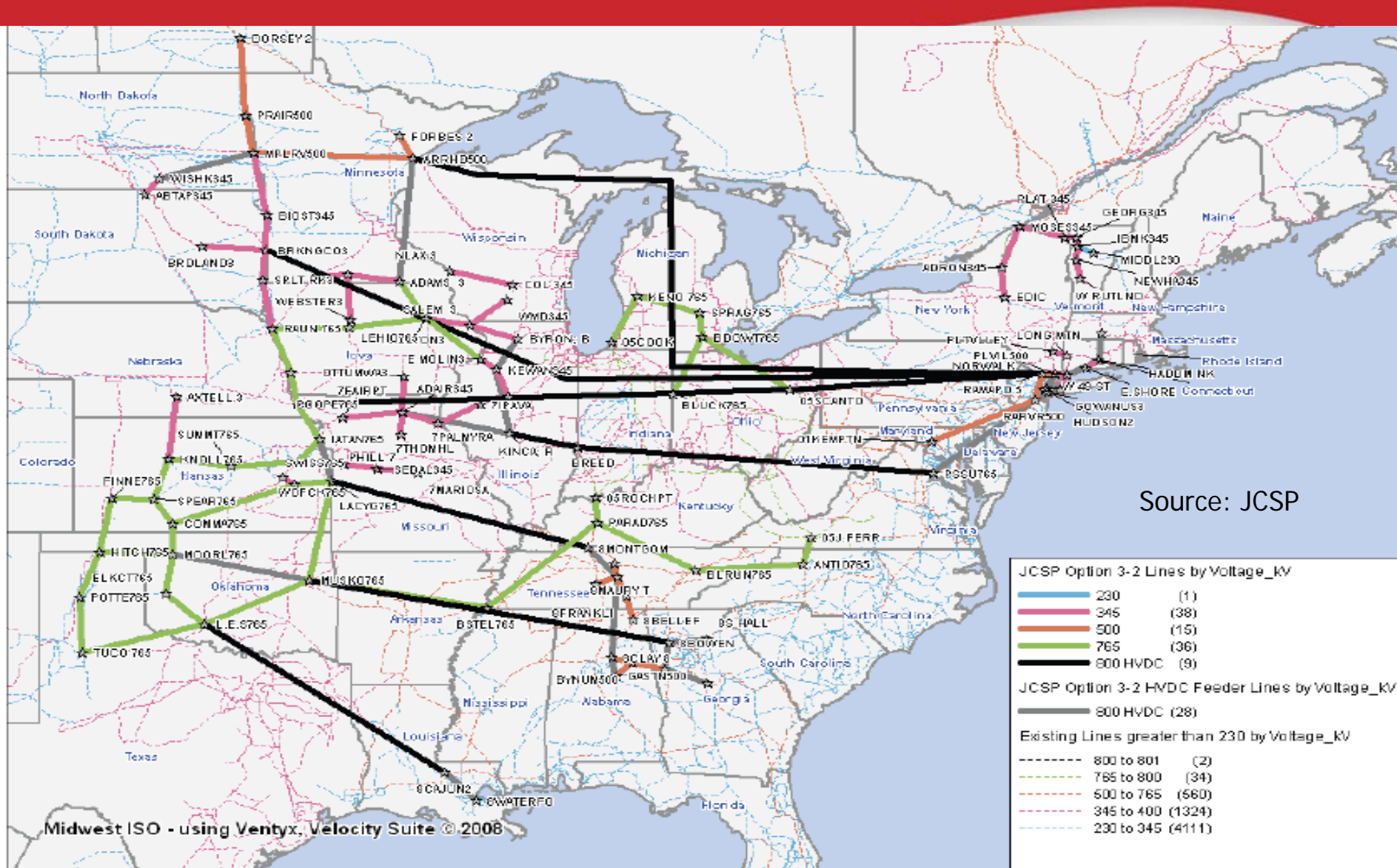


# AC Scenario

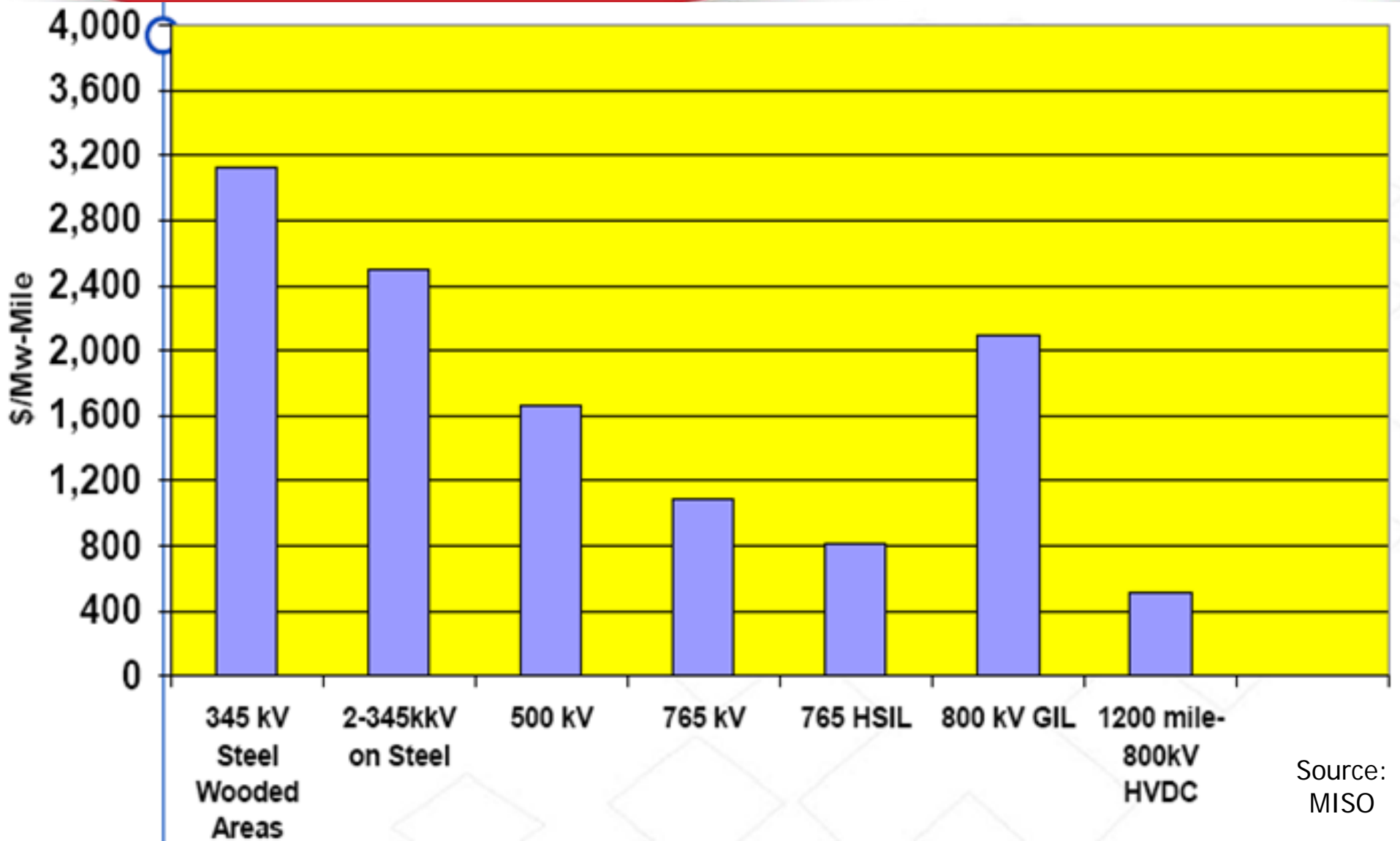




# DC scenario



# Economies of Scale for High-Capacity Transmission



Source:  
MISO

# Reduced Land Use

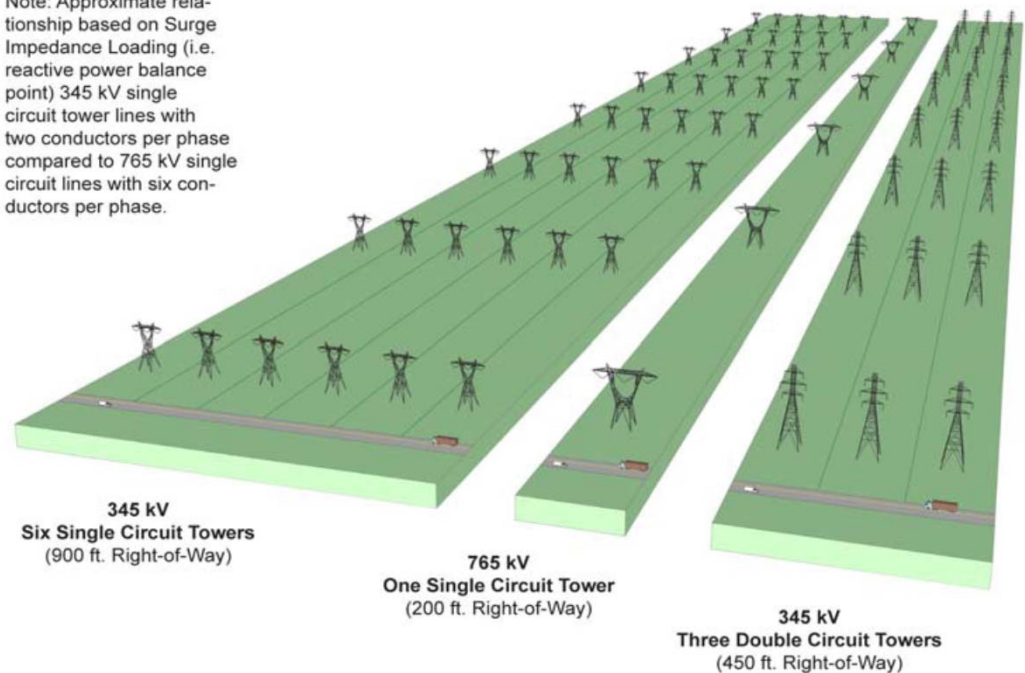
765-kV benefits are substantial over 500-kV and 345-kV.

Description	765	500	345	345
Circuits/Tower	1	1	1	2
Conductors/Phase	6	3	2	2
SIL per Line (MW)	2400	910	400	800
Lines Required for 2400 MW Capacity	1	3	6	3
ROW per line (ft)	200	200	150	150
Total ROW (ft)	200	600	900	450
ROW utilization factor	100%	38%	22%	44%
Typical Height (ft)	132	124	110	172
*Cost/Mile (\$M) for 2400 MW capacity	2.6	6.9	6.6	4.5

\* Cost in 2007 \$US, based on average terrain.

\*\* SIL is a relative capacity measure, thermal capacity is over 4000 MW for 765 kV and ~ 2000 MW for 500 kV.

Note: Approximate relationship based on Surge Impedance Loading (i.e. reactive power balance point) 345 kV single circuit tower lines with two conductors per phase compared to 765 kV single circuit lines with six conductors per phase.



Source: AEP

Transmission voltage selection significantly affects performance, cost and the environment.

# The Market Failures

- Economic benefits of transmission do outweigh costs:
  - Joint Coordinated System Plan: Benefit-Cost ratio of 1.7 to 1
  - Synapse study for MISO: 2-1 B-C ratio
  - Reliability benefits
  - Fuel price volatility benefits
  - Benefits of connected renewables: environmental, economic development, energy security
- Why don't we just build the transmission?

# Transmission Policy

- Policies for new transmission construction
  - Planning (pro-active planning)
  - Paying (broad regional cost allocation)
  - Permitting (streamlined siting)
- AWEA-SEIA “Green Power Superhighways” white paper at [www.awea.org](http://www.awea.org)



# FERC Transmission Planning and Cost Allocation Order 1000 – July 2011

- Three planning requirements for transmission providers:
  1. Required to participate in planning process as laid out in 890 – must produce single plan
  2. Required to consider public policy requirements
  3. For interregional planning, required to coordinate if there are more efficient or cost effective solutions to the needs of two regions

# FERC Transmission Planning and Cost Allocation Order 1000 – July 2011

- Three cost allocation requirements:
  1. Required to participate in planning process that is tied to cost allocation – six principles to meet
  2. Must have common inter-regional cost allocation method – six principles
  3. Allow participant funding, but not as the regional or inter-regional cost allocation



# FERC Transmission Planning and Cost Allocation Order 1000 – July 2011

- Right of First Refusal

ROFR for regional and inter-regional lines would result in discrimination, so it is revoked

- Compliance:

Filings with FERC within 12 months for regional, 18 months for inter-regional requirements

## AWEA Filings on Order 1000

- Order 1000 contains many of the planning and cost allocation policies AWEA has advocated
- AWEA filed for rehearing asking FERC to go further than requiring policy to be “considered” in transmission planning
- Also asked FERC to go further, and take a hard line against compliance filings that fall short
- AWEA has worked with Congress to generate support for FERC’s efforts, oppose legislation like Corker amendment
- AWEA planning to work with partners and members to review compliance filings, make sure FERC takes a hard line approach against filings that fall short

# FERC Transmission, SPP Cost Allocation

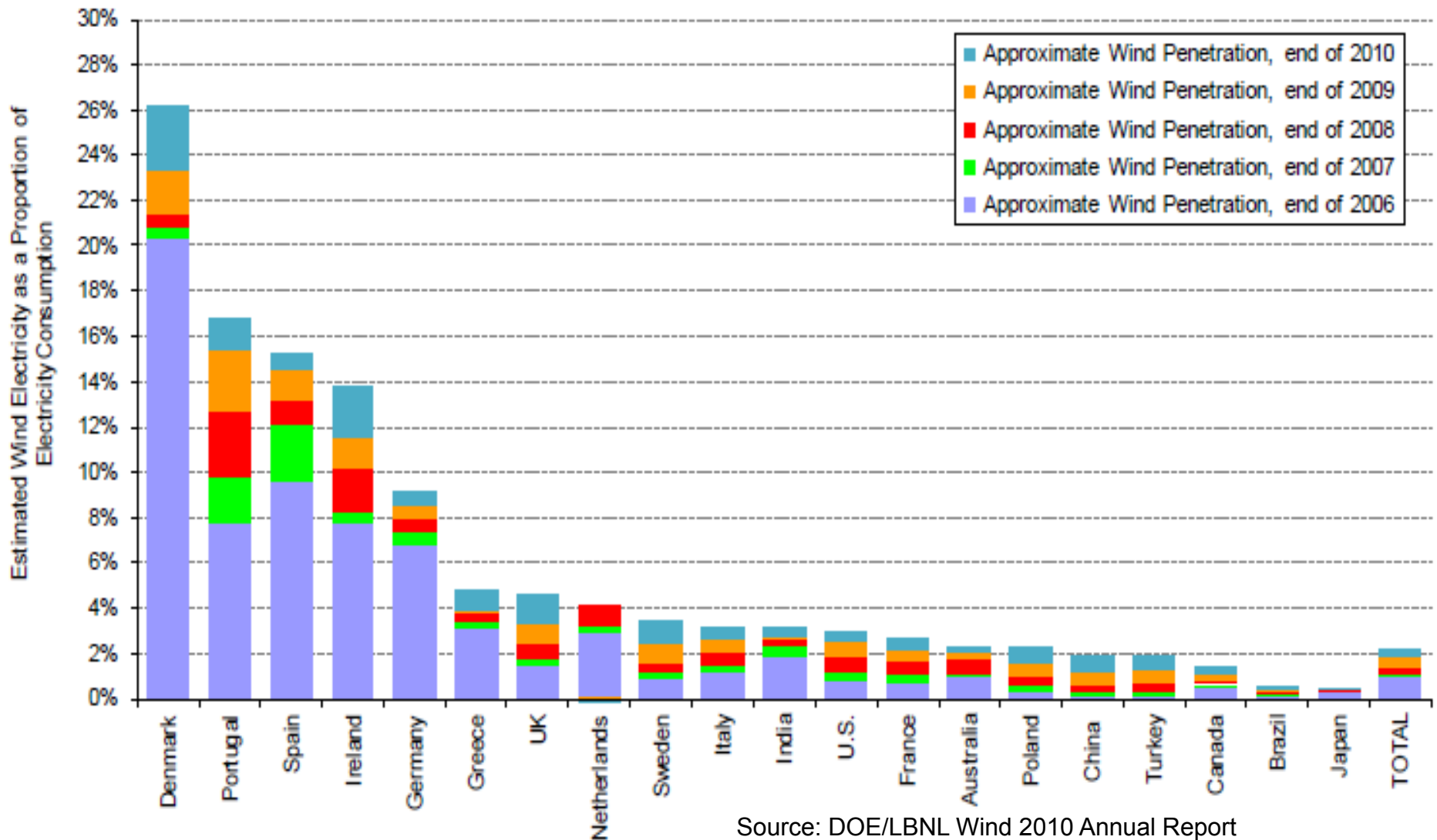
- SPP's Highway/Byway proposal broadly spreads costs of high-voltage transmission
- Proposal reflects fact that benefits of high-voltage transmission are broadly distributed
- FERC accepted SPP's proposal in June 2010

# FERC Transmission, MISO Cost Allocation

- MISO's interim (2009-2010) cost allocation assigned 90-100% of transmission costs to generators, making transmission investment very difficult
- MISO's 2010 proposal broadly spreads costs for "Multi-Value Projects," which includes projects that help meet state renewable requirements, while keeping 90-100% cost allocation for other projects
- AWEA asked FERC to provide greater clarity that renewable transmission projects fall under MVP
- FERC accepted MISO's proposal in December 2010

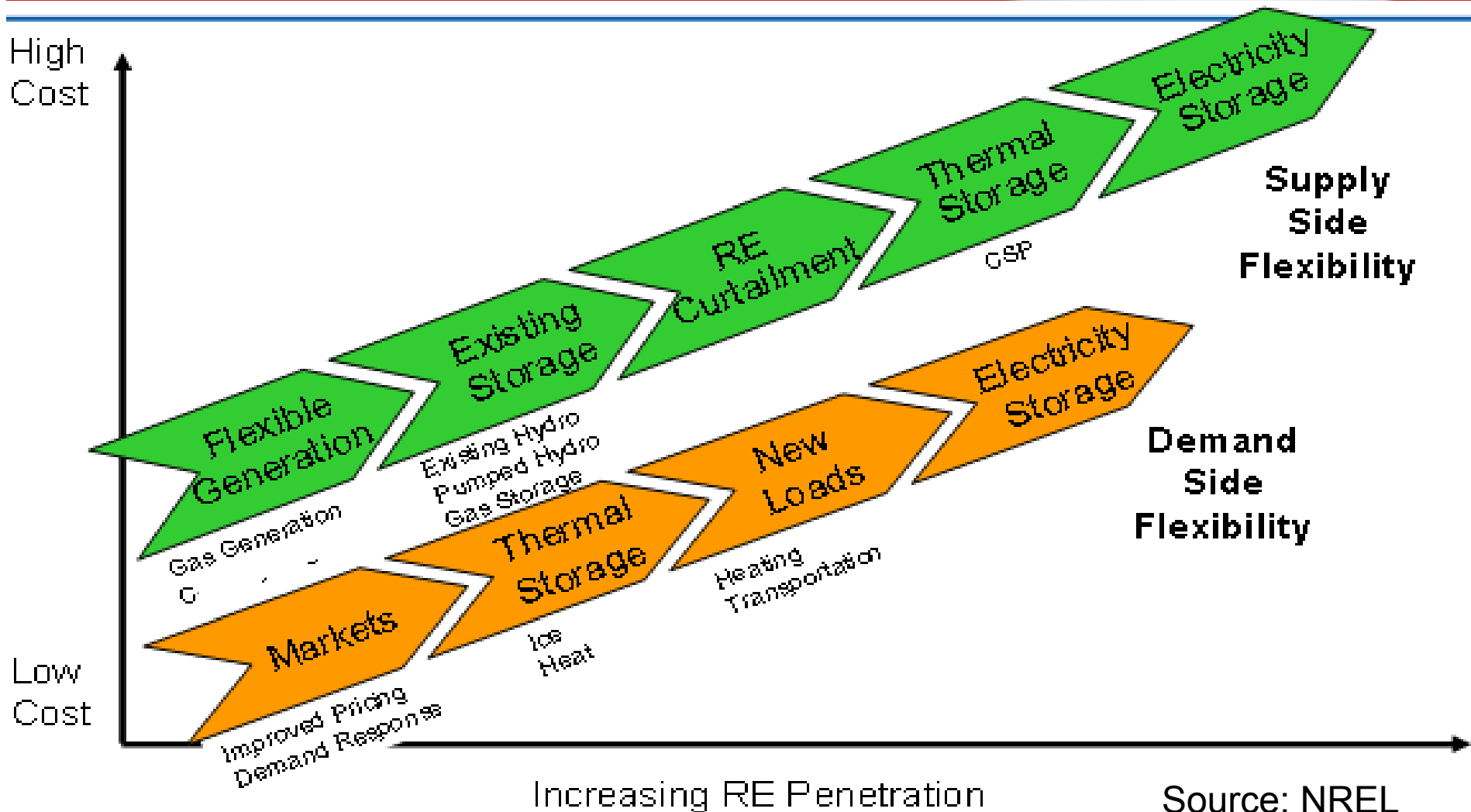
# Wind Integration

# Many Countries have Reliably Integrated Large Amounts of Wind



Source: DOE/LBNL Wind 2010 Annual Report

# The Flexibility Supply Curve



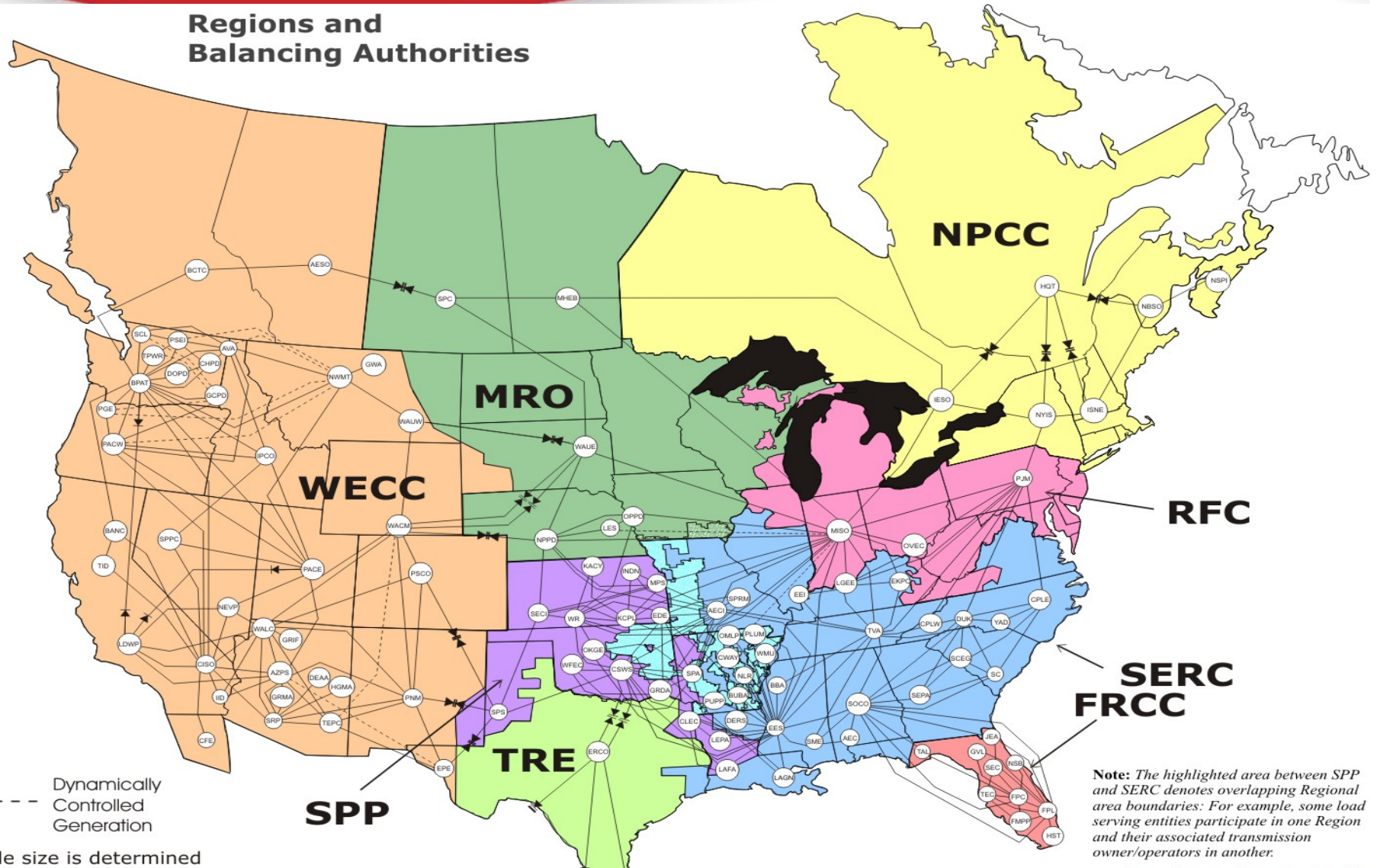
# Solutions: Larger Balancing Areas

- Allow excess power in one region to be shared with neighboring regions
- Enable diverse wind resources spread over a larger area to be connected to the same grid, canceling out their variability
- Create cost savings
  - Midwest ISO estimates savings from consolidating its 26 balancing areas into one are 3.7 to 6.7 times greater than the costs
  - Savings are large even on power systems without wind energy
- Consolidation can be done physically or virtually



# Grid Balkanization Impairs Wind Integration

**Regions and Balancing Authorities**



# Short Scheduling and Dispatch Intervals

- NERC: “More frequent and shorter scheduling intervals for energy transactions may assist in the large-scale integration of variable generation.” (NERC IVGTF, p. 61)
- In much of the U.S., power plants are scheduled to operate for hourly intervals, and expensive reserves are used to accommodate intra-hour variability
- Using 5- or 10-minute dispatch intervals accommodates intra-hour variability without reserves
- Studies show significant savings from moving to 5- or 10-minute intervals instead of hourly:
  - Bonneville Power: 80% reduction in wind integration costs
  - Avista: 40-60% reduction in wind integration costs

# Flexibility Through Markets

- **NERC: “Additional sources of system flexibility include the operation of structured markets, shorter scheduling intervals, demand-side management, reservoir hydro systems, gas storage and energy storage.” (p. 48)**
- **Ancillary services markets provide incentives for generators, demand response, and other flexible resources to offer their services to the grid**
- **Markets ensure that lowest-cost resources provide needed flexibility services**

# Wind Forecasting

- NERC IVGTF: “Forecasting is one of the key tools needed to increase the operator’s awareness of wind plant output uncertainty and assist the operator in managing this uncertainty.”
- Reduced uncertainty allows the grid operator to more efficiently commit and utilize generation resources
- Wind industry is united in supporting government efforts to improve forecasting

# FERC Integration Rulemaking

- Notice of Inquiry on integration issues in spring 2010, proposed rulemaking issued November 2010, comments submitted March 2011, final order issued in June 2012

## AWEA comments on FERC's three proposals:

- 1. 15-minute scheduling is a step in the right direction, should be expanded to include dispatch
- 2. Wind energy forecasting proposal is helpful, wind industry willing to step up and provide data
- 3. Proposed generator regulation service needs changes:
  - Cost should be broadly allocated like other integration costs, FERC precedent
  - Service should be non-spin, not regulation
  - Should not take effect until grid reforms are implemented