Overview of the Wind Energy Industry

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AWEA AMERICAN WIND ENERGY ASSOCIATION

Overview

- Basics
- Current Statistics
- US Wind Potential
- Market Drivers and Policy

Basics

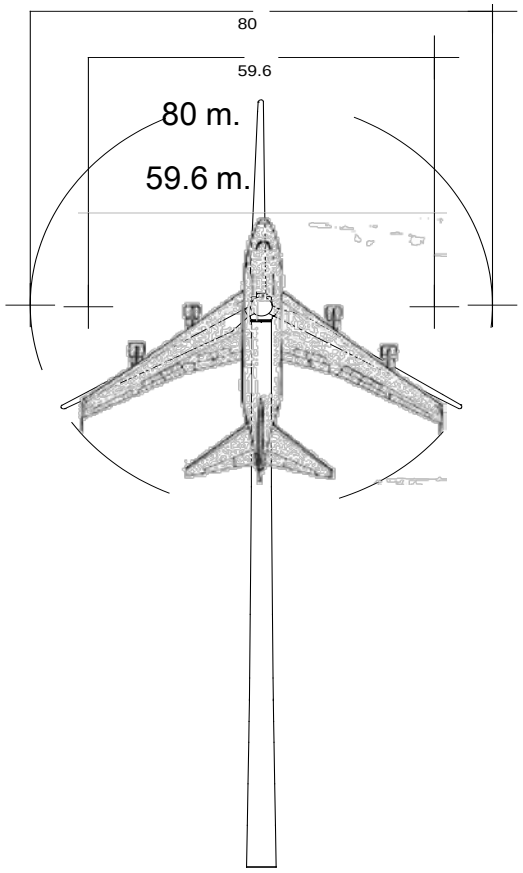
Wind Turbines: Power for a House or City

What's the average turbine or wind project?

In 2010, average turbine size was rated **1.77 MW** - enough to power over **500 homes.**

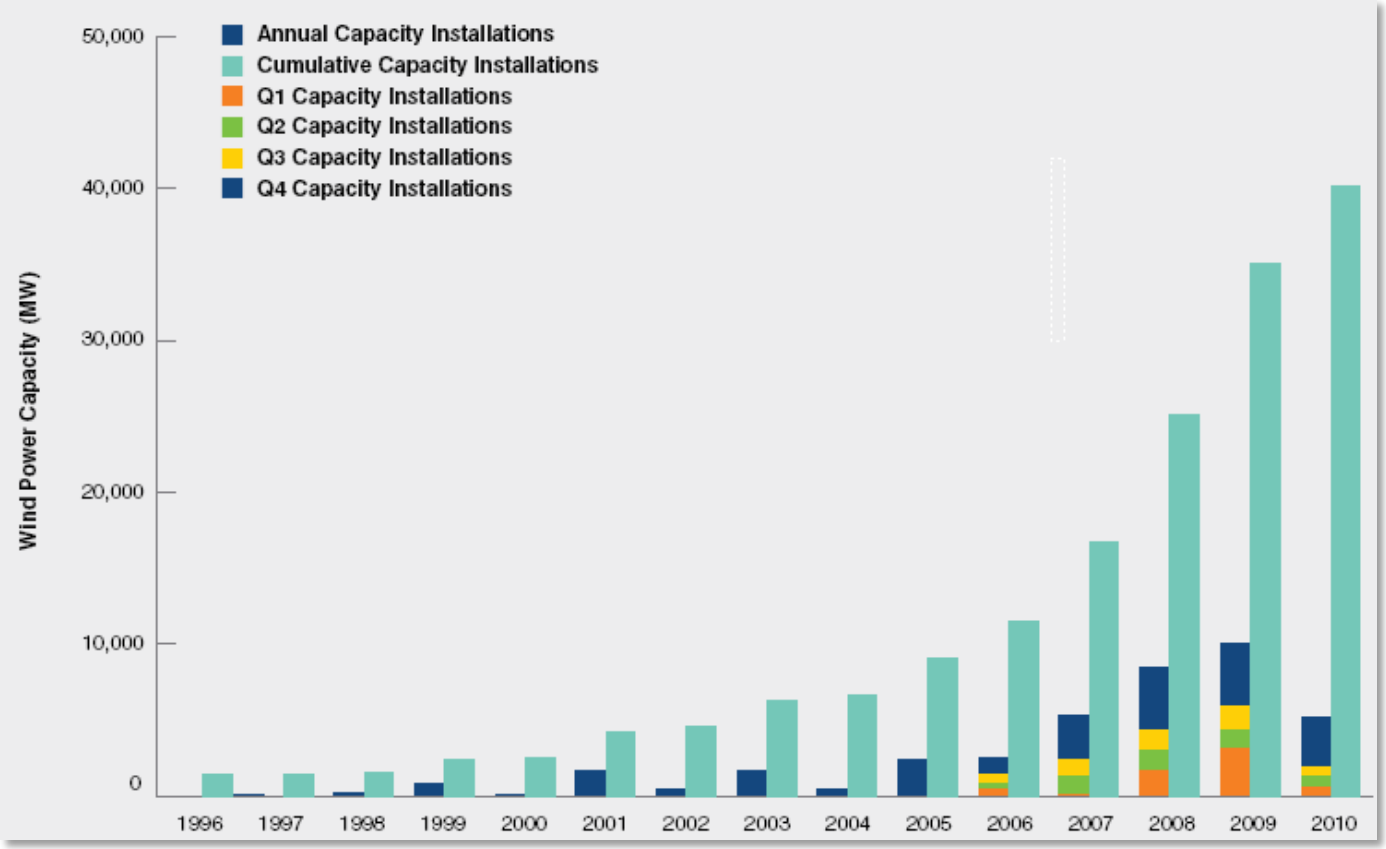
An average wind project in 2010 was **76 MW (~43 turbines)** The average project would supply electricity for over **20,000 homes.**

This picture shows a Vestas 80-meter diameter 2-MW wind turbine superimposed on a Boeing 747 jumbo jet



Current Statistics

U.S. Annual and Cumulative Wind Power Capacity Growth



- The wind industry installed 5,116 MW in the U.S. in 2010
- Installed in 1Q 11: 1,100 MW
- Total U.S. wind installations stand at 40,181 MW
- U.S. wind installations represent over 21% of global wind capacity

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

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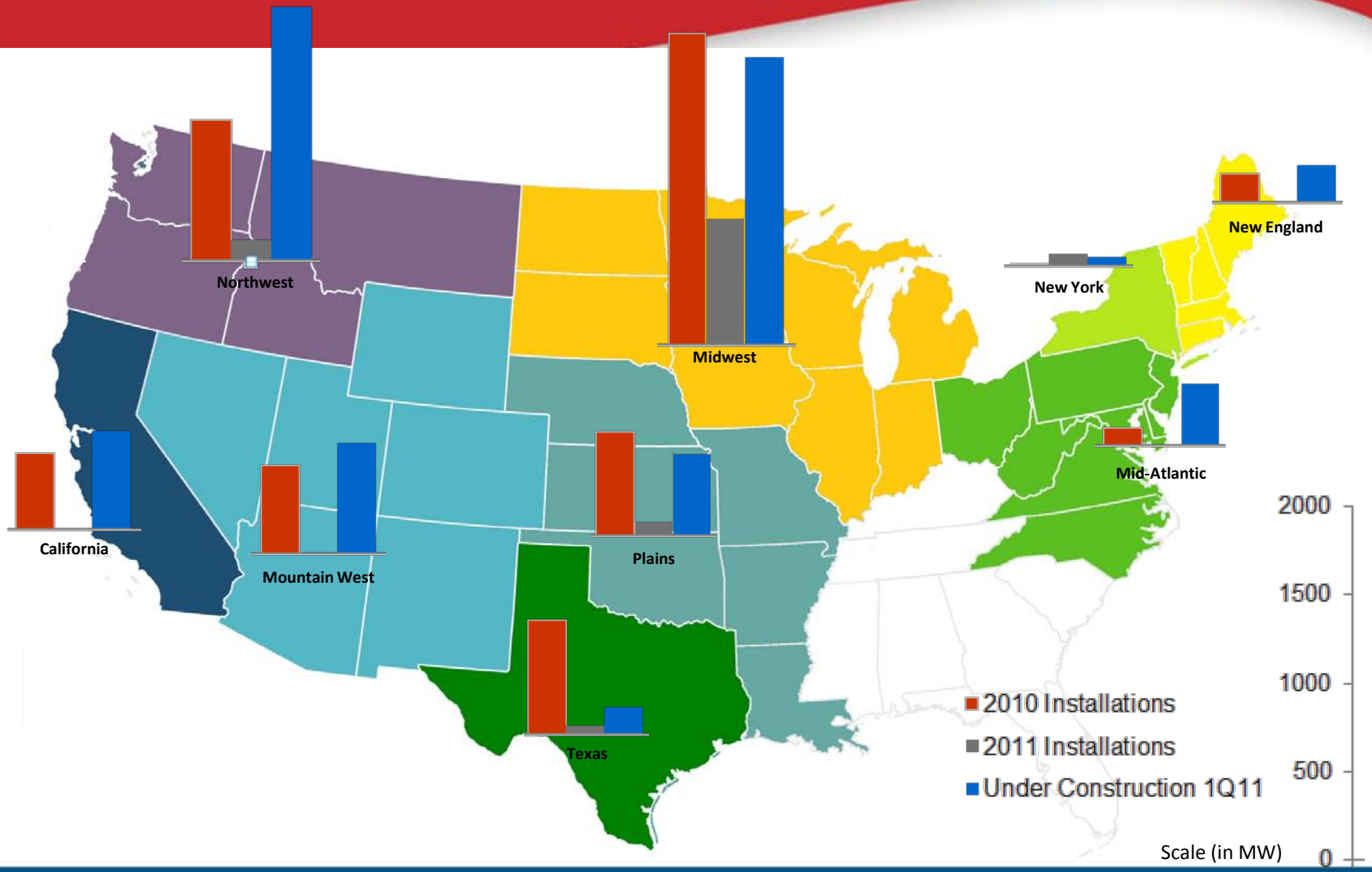
Regional Installation and Construction Activities



Source: American Wind Energy Association · 1st Quarter 2011 Market Report

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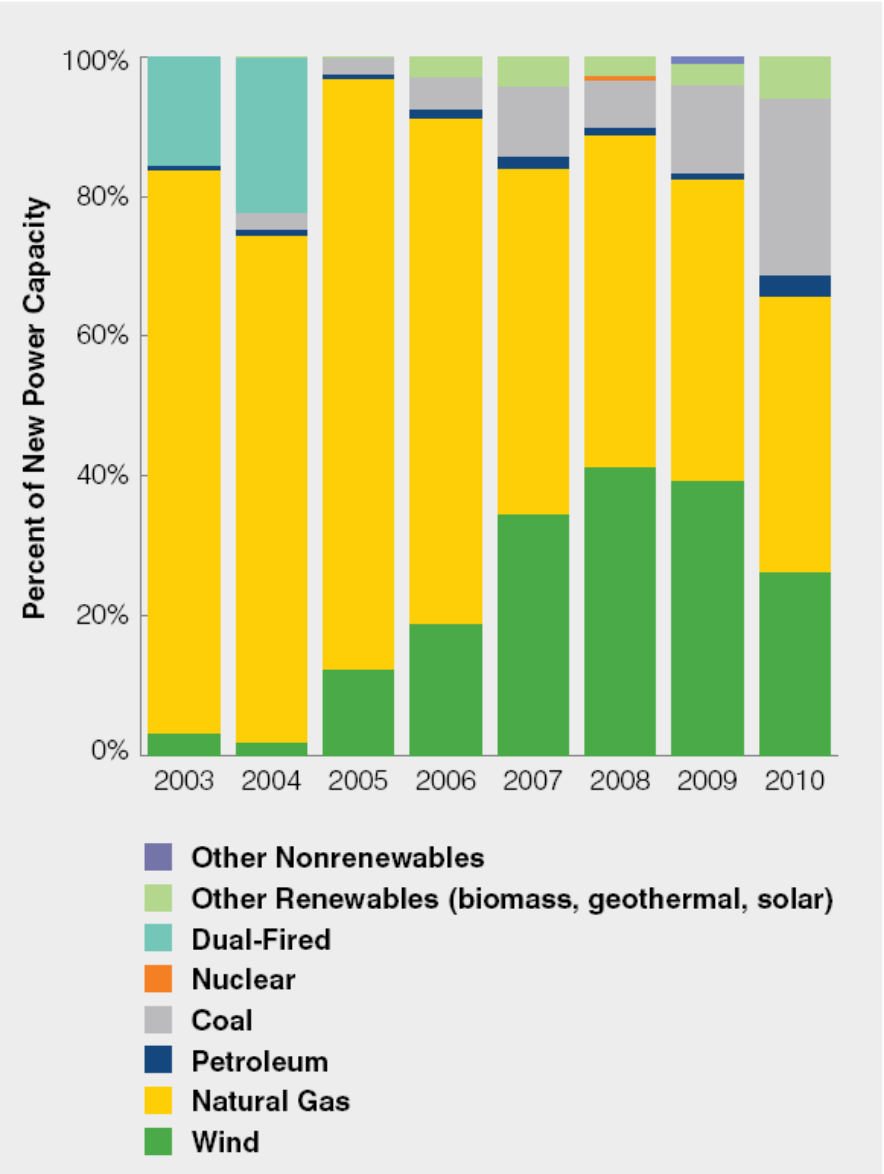
U.S. Annual Power Capacity Additions by Percentage

- » New wind capacity represented 26% of all new capacity installed in 2010
- » Wind power remained the second largest source of new installed capacity, second to natural gas
- » All renewable capacity combined represented nearly 33% of new capacity



Source: AWEA, Energy Information Administration, SNL, Solar Energy Industries Association

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

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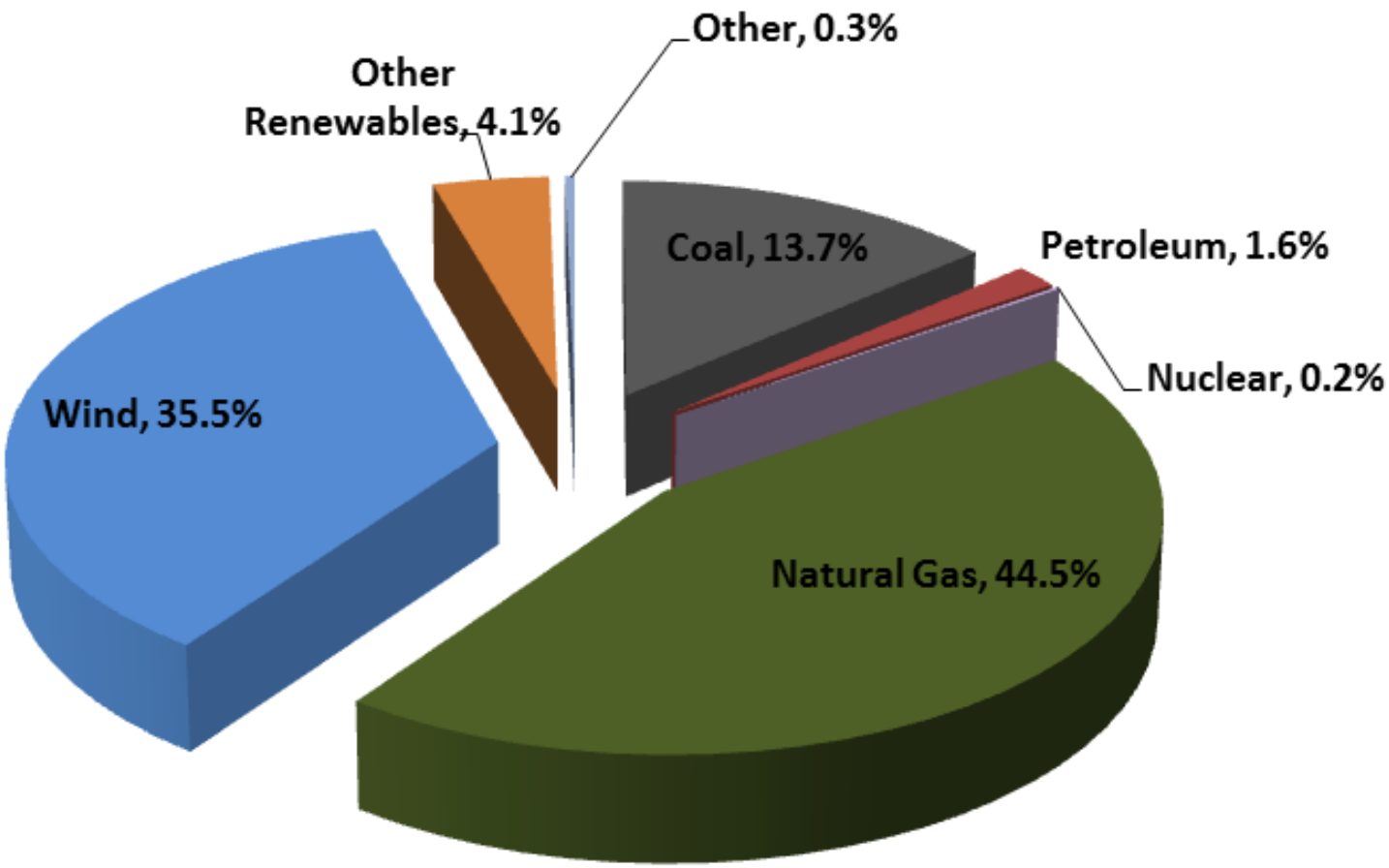
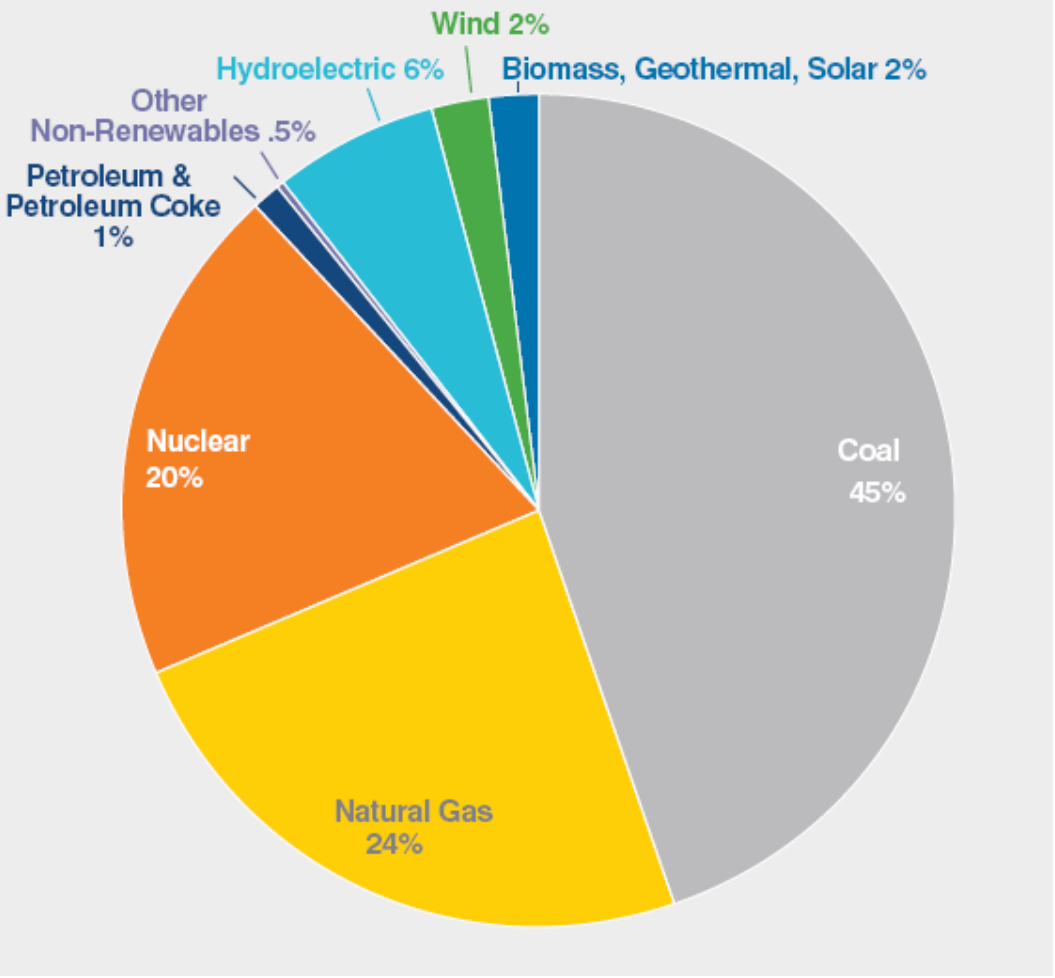
U.S. New Installed Capacity Mix 2007-2010

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



U.S. Electricity Generation Mix in 2010



Source: Energy Information Administration Electric Power Monthly

» Wind provided 2.3% of U.S. electricity in 2010

» Electricity from wind power capacity in the U.S. will supply the equivalent of:

- Over 10 million American homes
- Nearly 10 nuclear power plants

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

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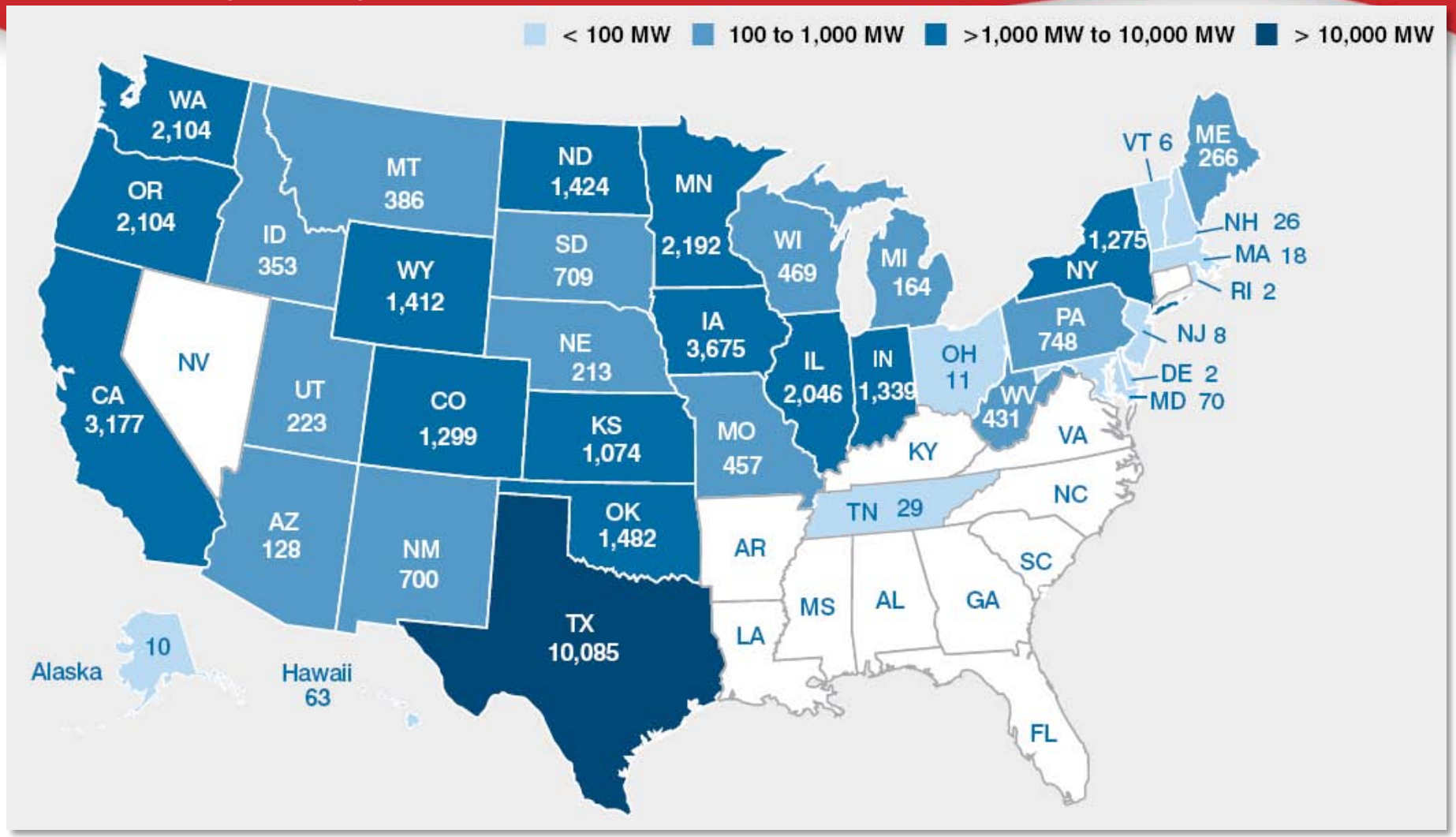
U.S. Wind Power Capacity Installations by State in 2010 (MW)



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

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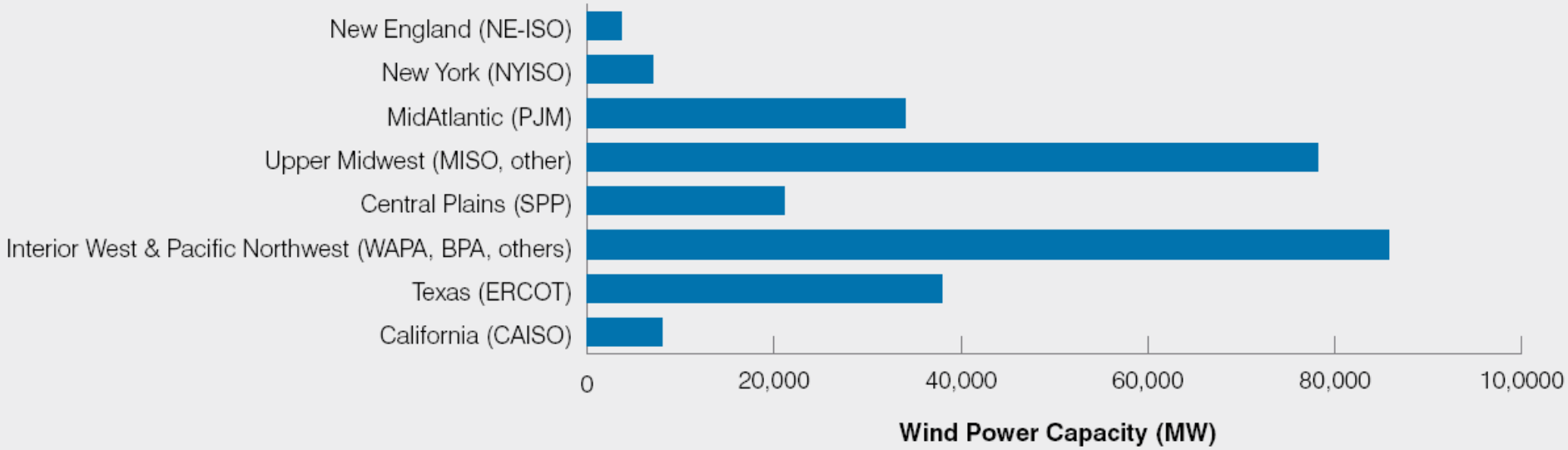
Wind Power Capacity in the Interconnection Queue (MW)



» There are roughly 275,000 MW of wind projects lined up in the interconnection queues for transmission access.

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

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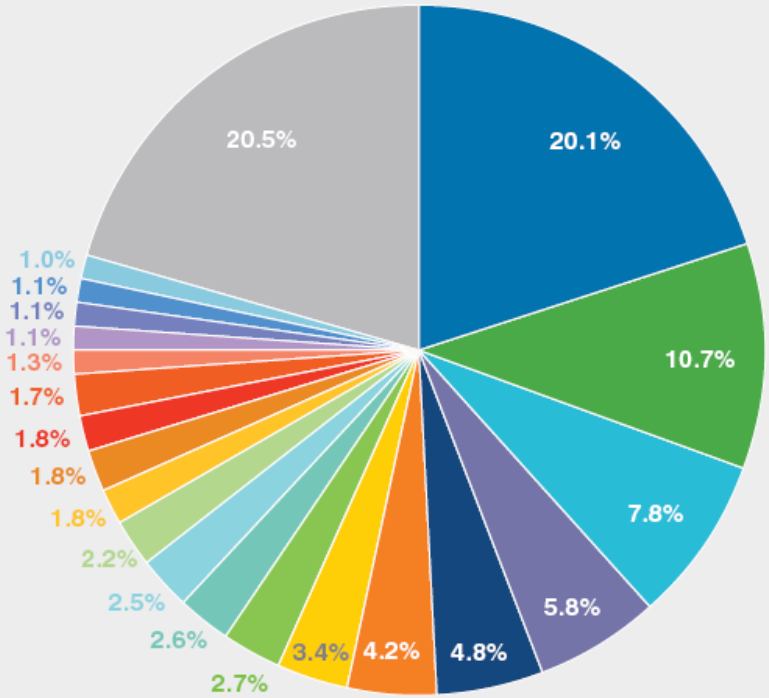
U.S. Top 20 Wind Power Capacity Owners in 2010



Company	MW under "managing ownership"
NextEra Energy Resources	8,077
Iberdrola Renewables	4,301
Horizon-EDPR	3,141
MidAmerican & PacifiCorp	2,316
E.ON Climate & Renewables	1,920
Invenergy	1,691
Edison Mission Group	1,360
Infigen Energy	1,089
AES	1,057
Duke Energy	986
enXco	878
BP Wind Energy	742
Exelon Wind	734
Noble Environmental Power	726
Terra-Gen Power	664
First Wind	503
Portland General Electric	450
Shell	449
Puget Sound Energy	429
Eurus Energy	417
Other	8,249

Ownership is on a net basis, so if two owners have a half share of a 100-MW wind farm, each company is credited with 50 MW. Ownership does not include structural investors, which may have a share of equity.

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

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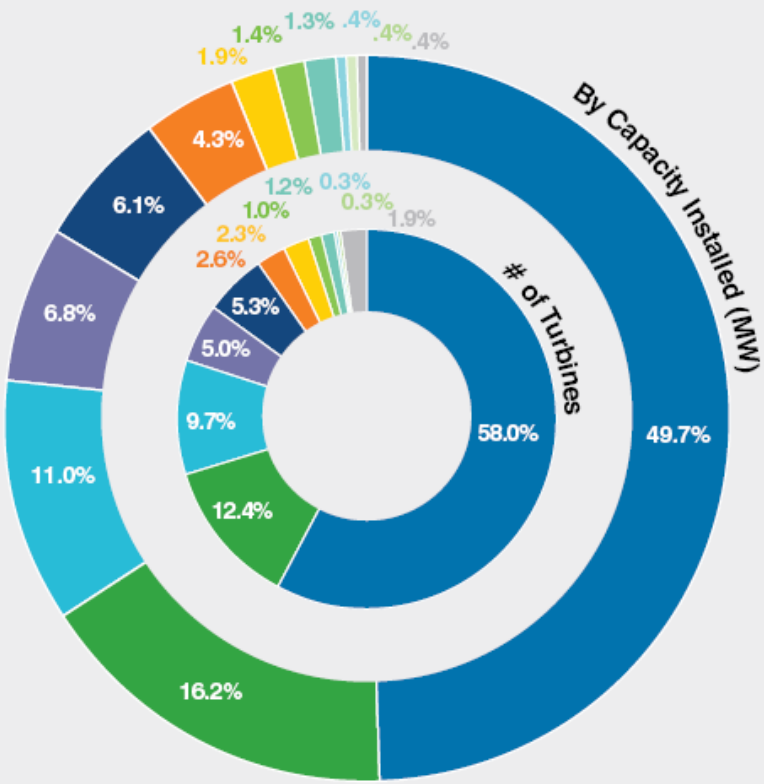
Wind Turbine Manufacturers' Share of 2010 U.S. Wind Power Installations



Company	# of Turbines	MW Capacity
GE Energy	1,679	2,543
Siemens	360	828
Gamesa	281	562
Mitsubishi	146	350
Suzlon*	153	312
Vestas	75	221
Acciona WP	66	99
Clipper	28	70
REpower*	34	68
DeWind	10	20
Nordex	8	20
Samsung Heavy Industries	3	7.5
Northern Power Systems	40	6.1
Nordic	2	2.0
EWT Americas	2	1.7
Turbowinds	4	1.6
PowerWind	1	0.9
Elecon	1	0.6
Other	1	2.0

** Suzlon owns 91% of REpower.*
Includes turbines 100 kW and larger.
Turbine installation data is reported by the project owner.

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

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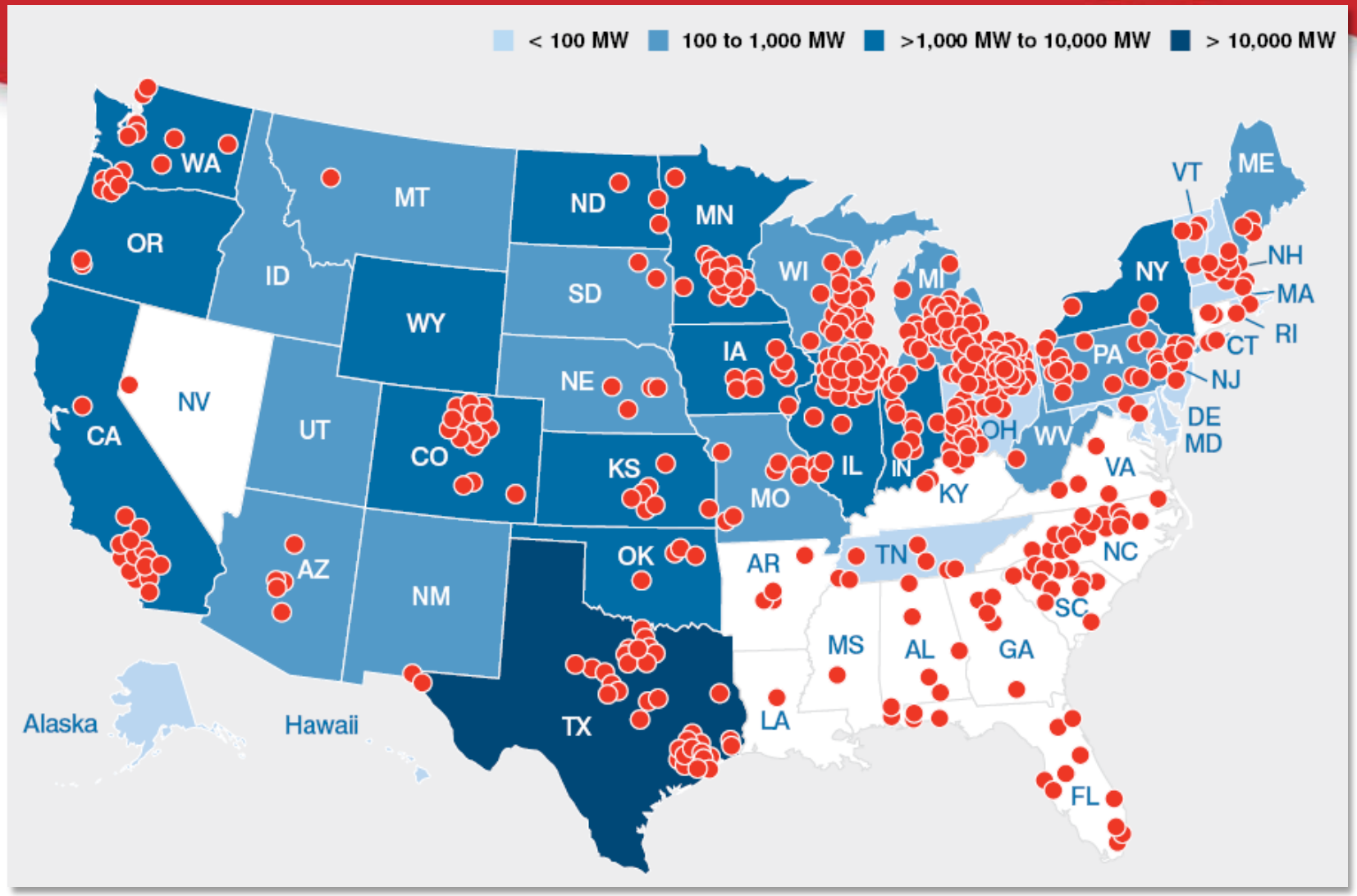
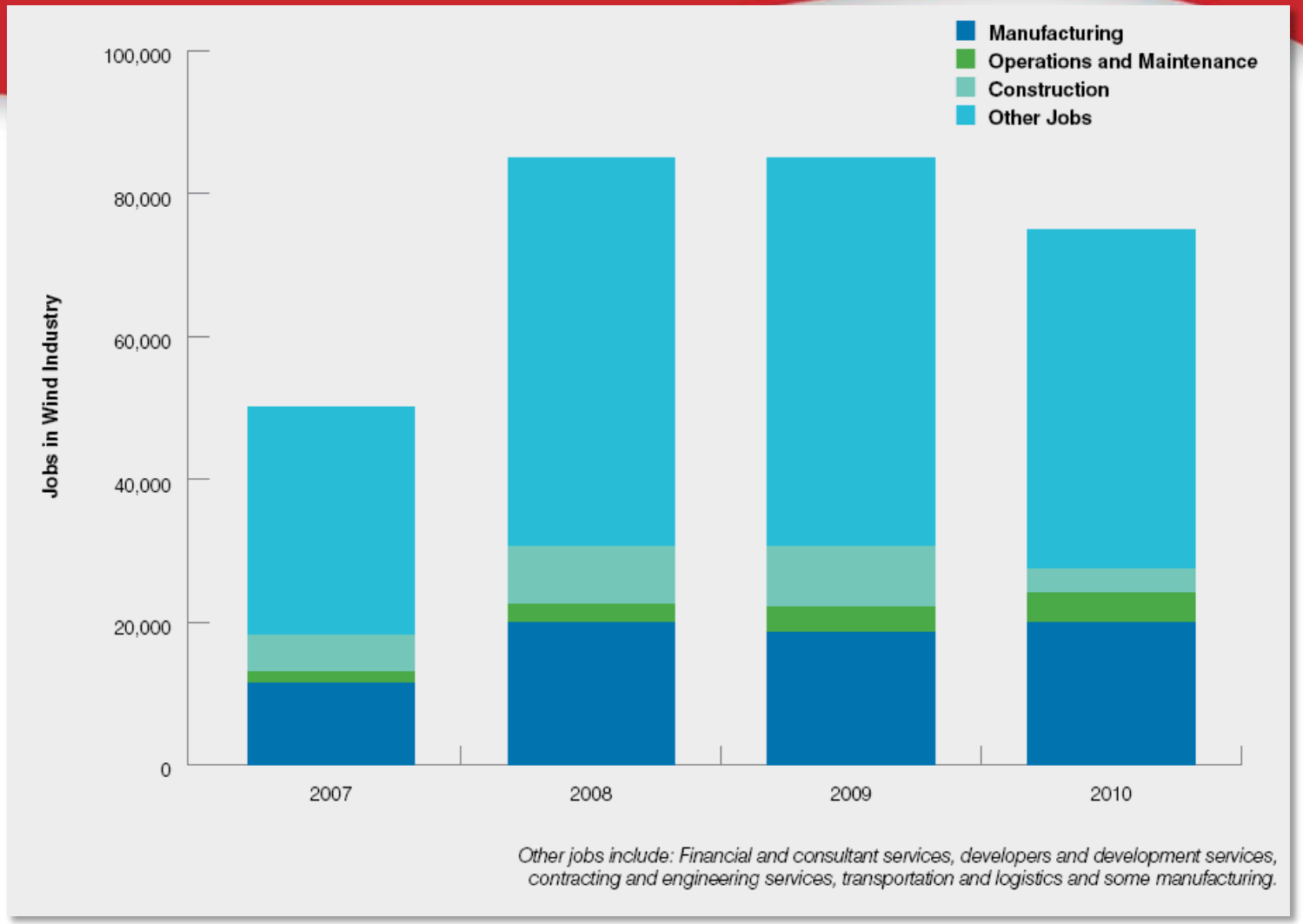
Wind Turbine & Component Manufacturing Sites



U.S. Wind Industry Total Employment Over Time

Overall, the U.S. wind industry supported 75,000 direct and indirect jobs in 2010.



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

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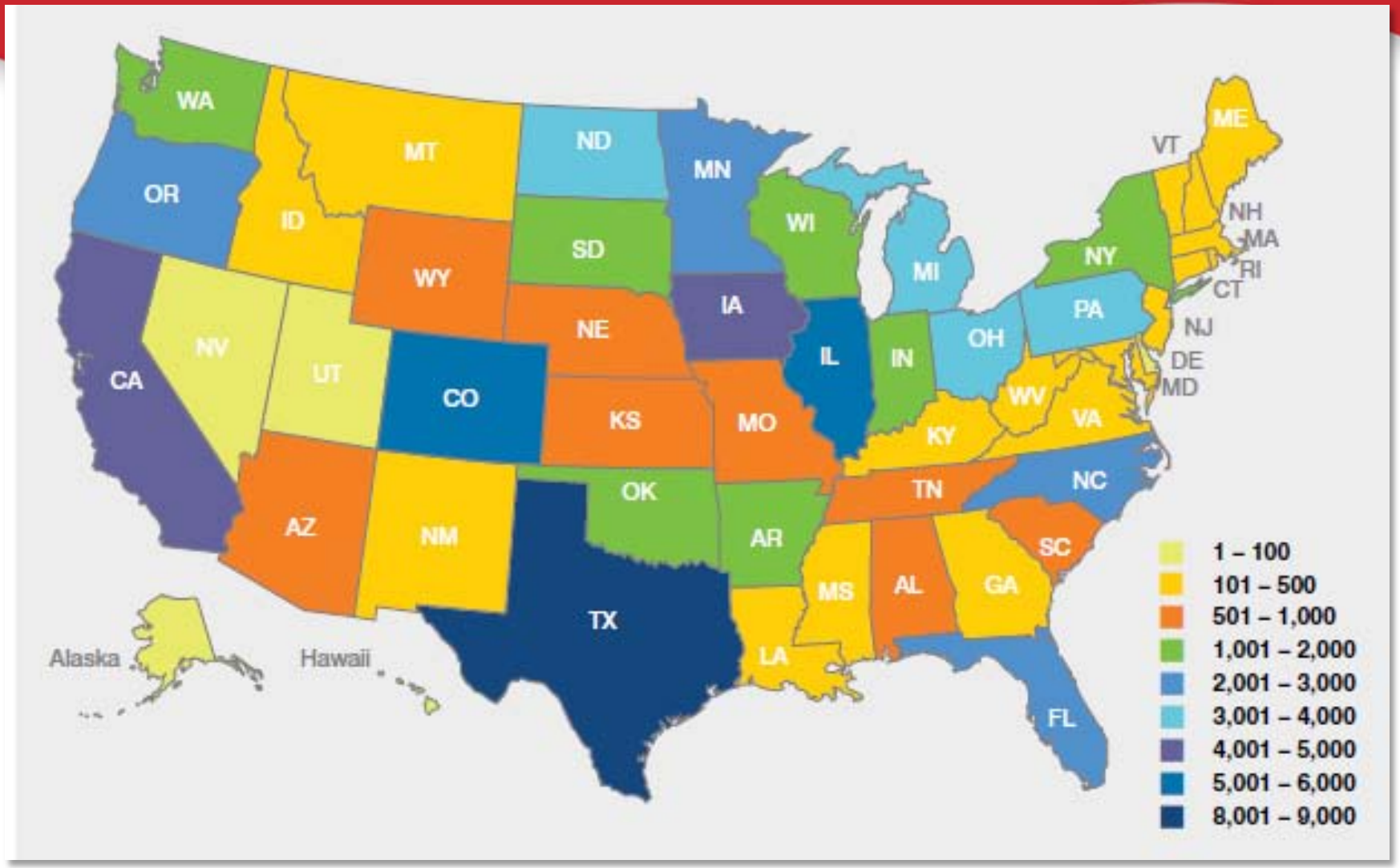
U.S. Wind Industry Jobs by State



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

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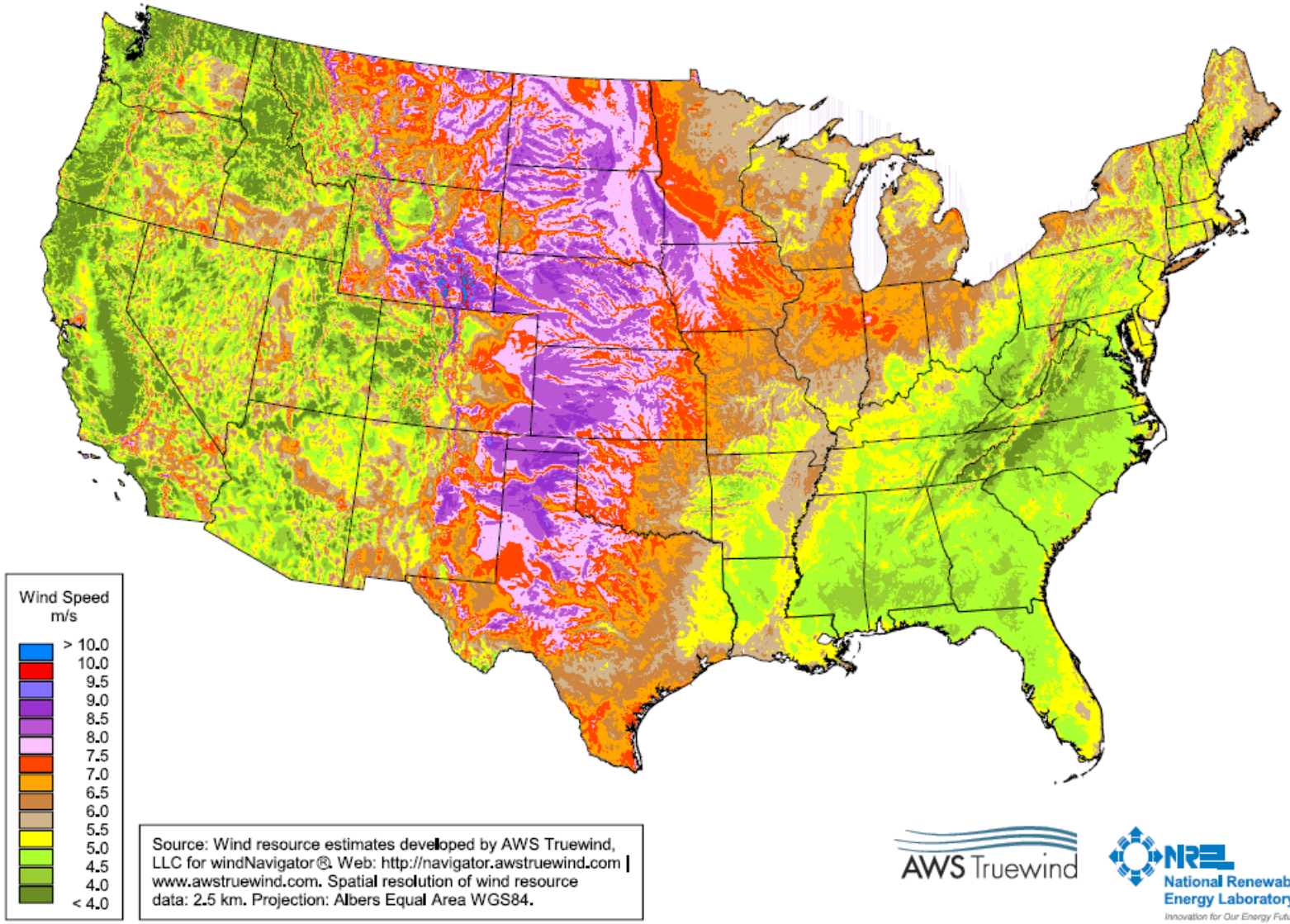
US Wind Potential

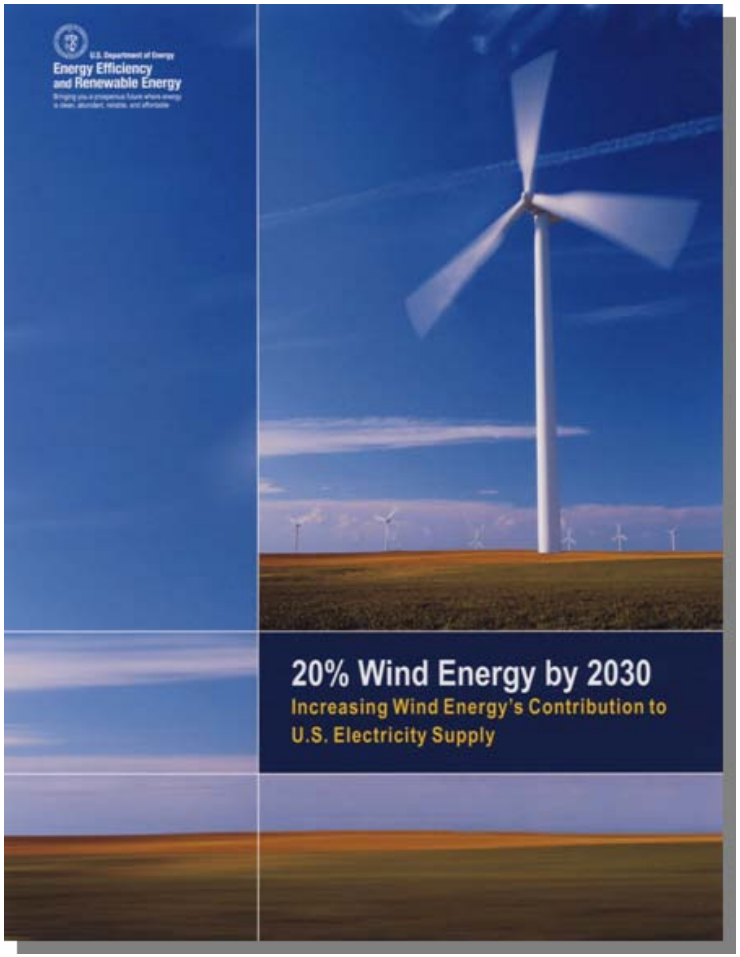
U.S. Wind Resource



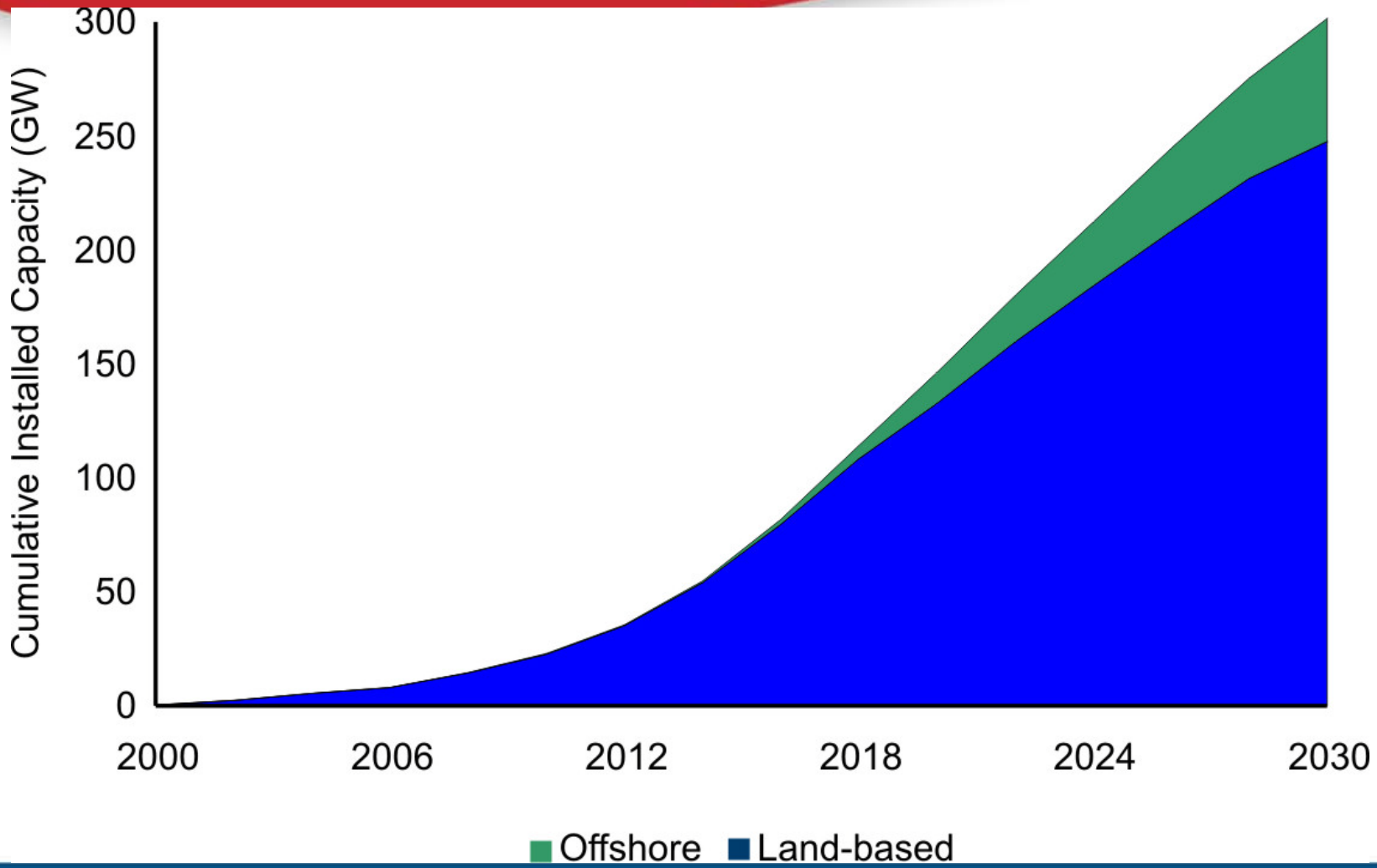
The 20% Wind Vision

"20% Wind Energy by 2030"

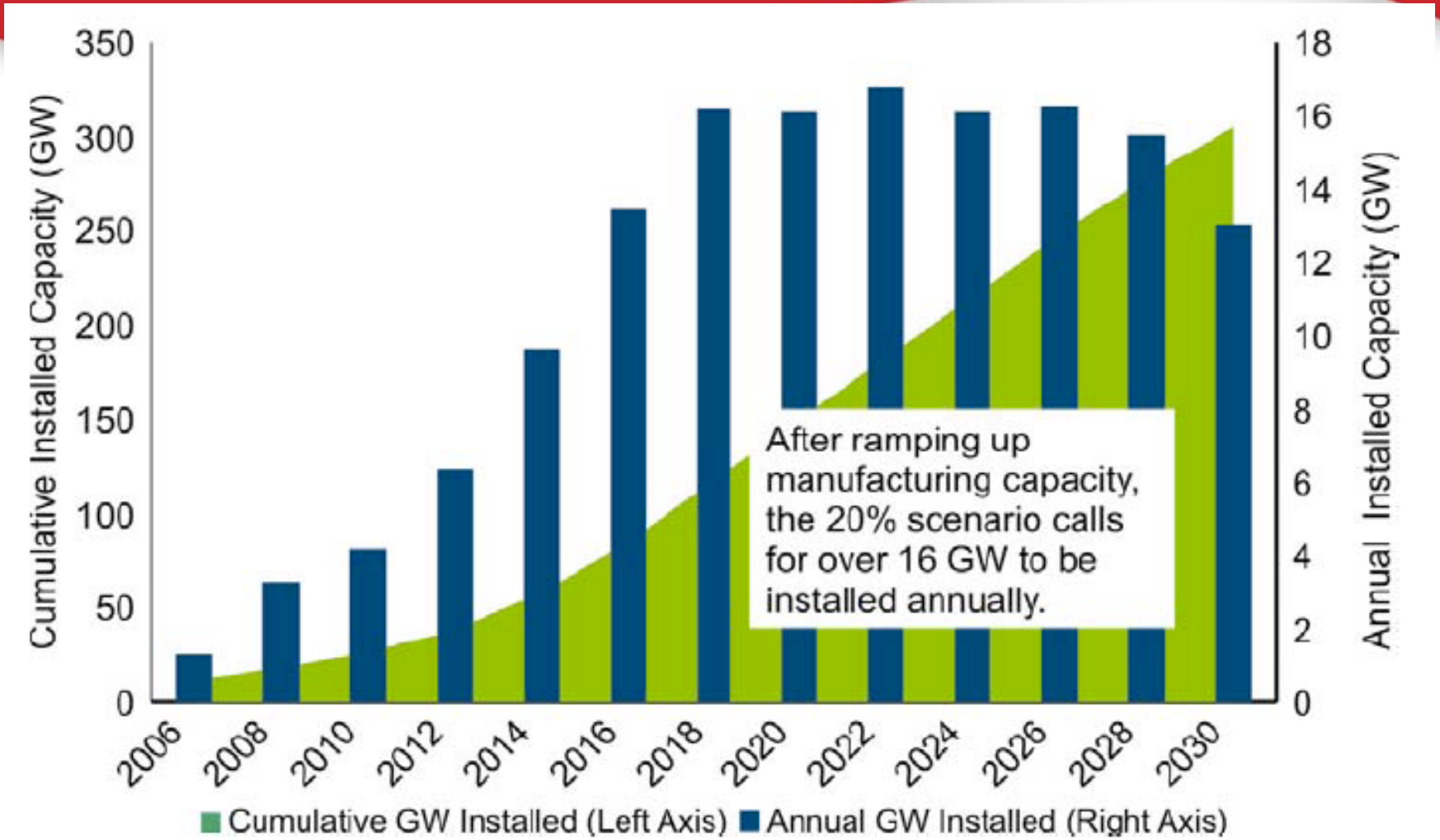
- » U.S. Department of Energy report - issued in May 2008
- » What would it take for the U.S. to get 20% of its electricity by the year 2030 ?
- » Report analyzed barriers and areas to focus on to achieve this target



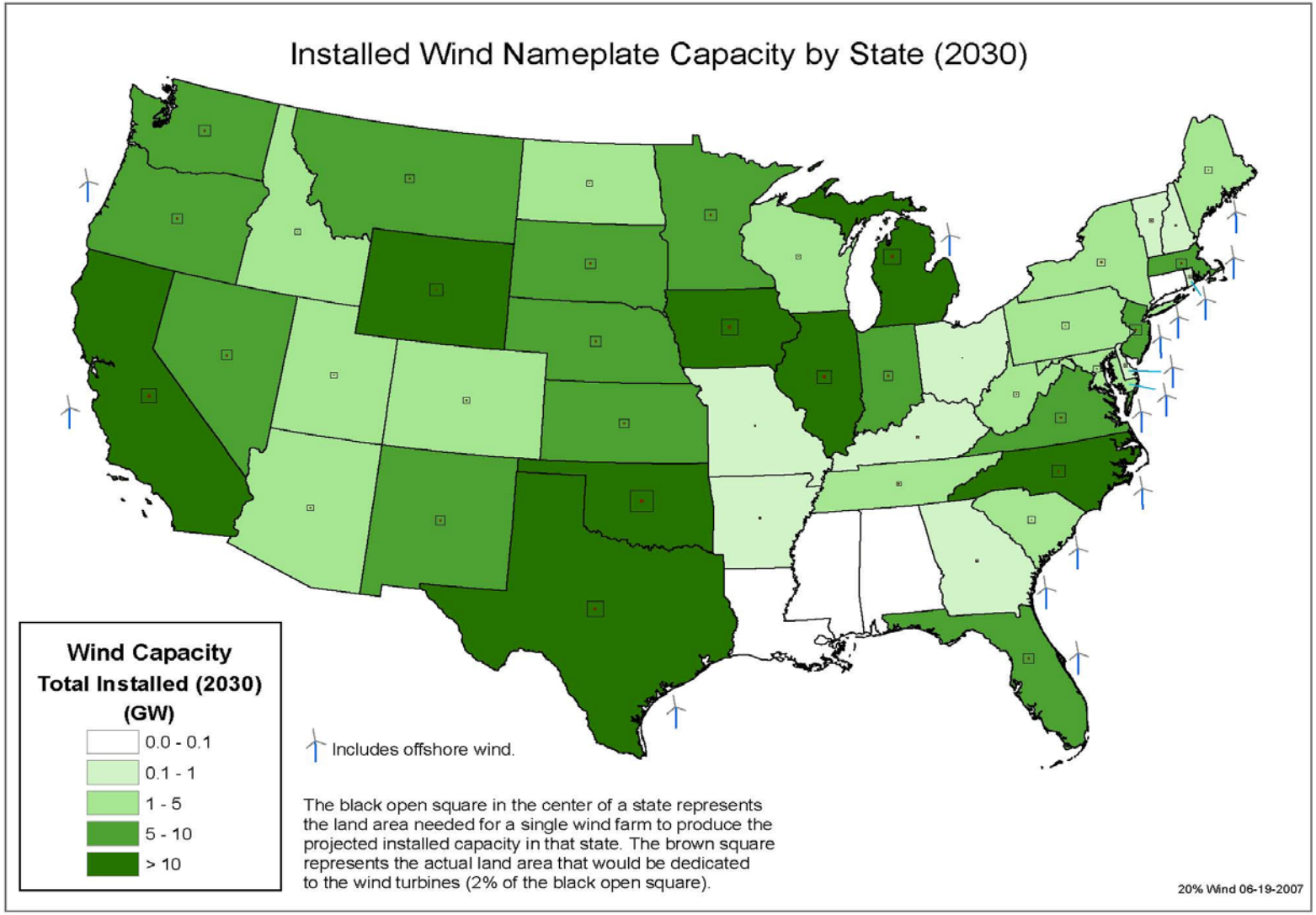
20% Wind: Cumulative Installed Capacity



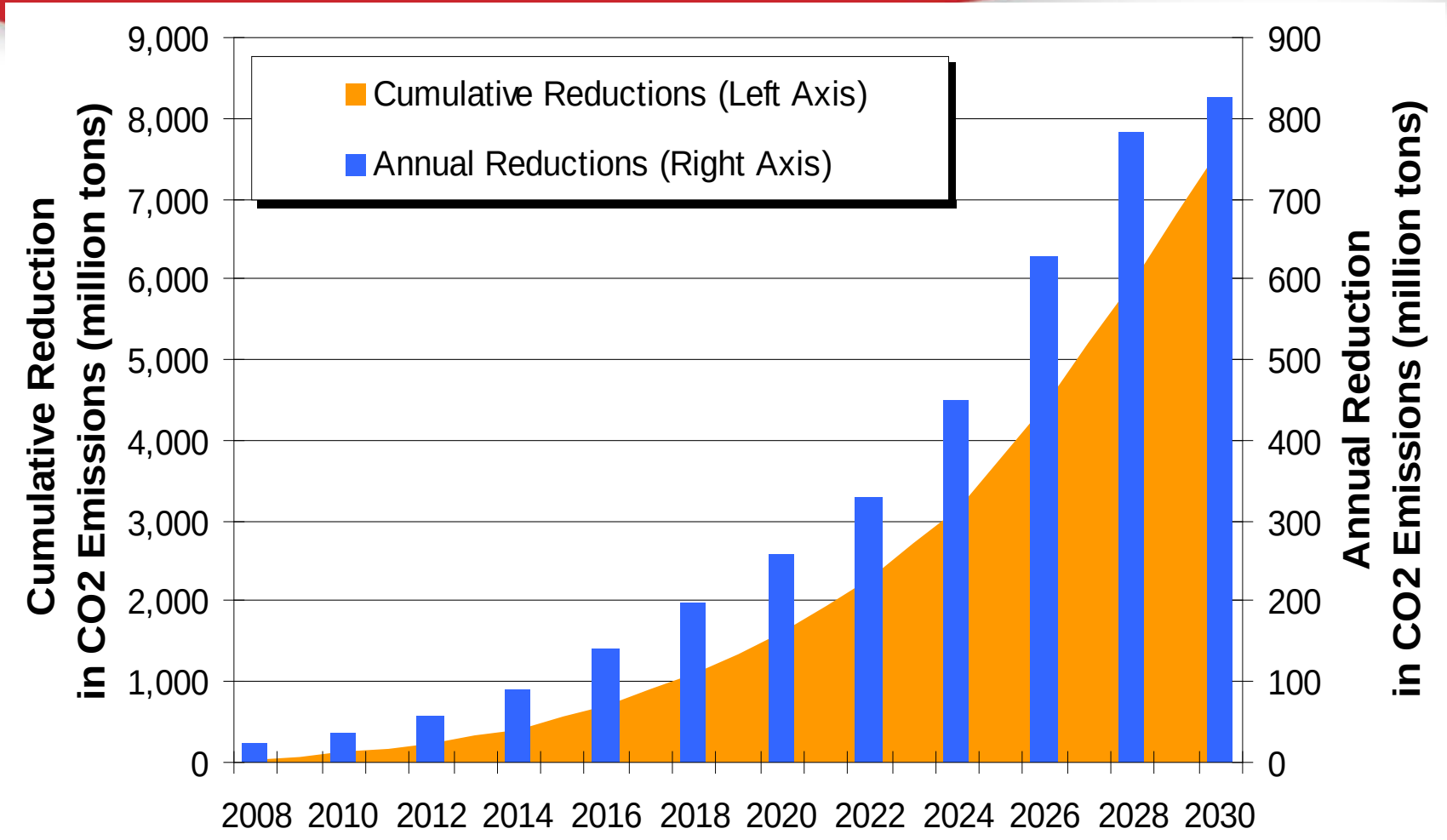
20% Wind: Growth Path



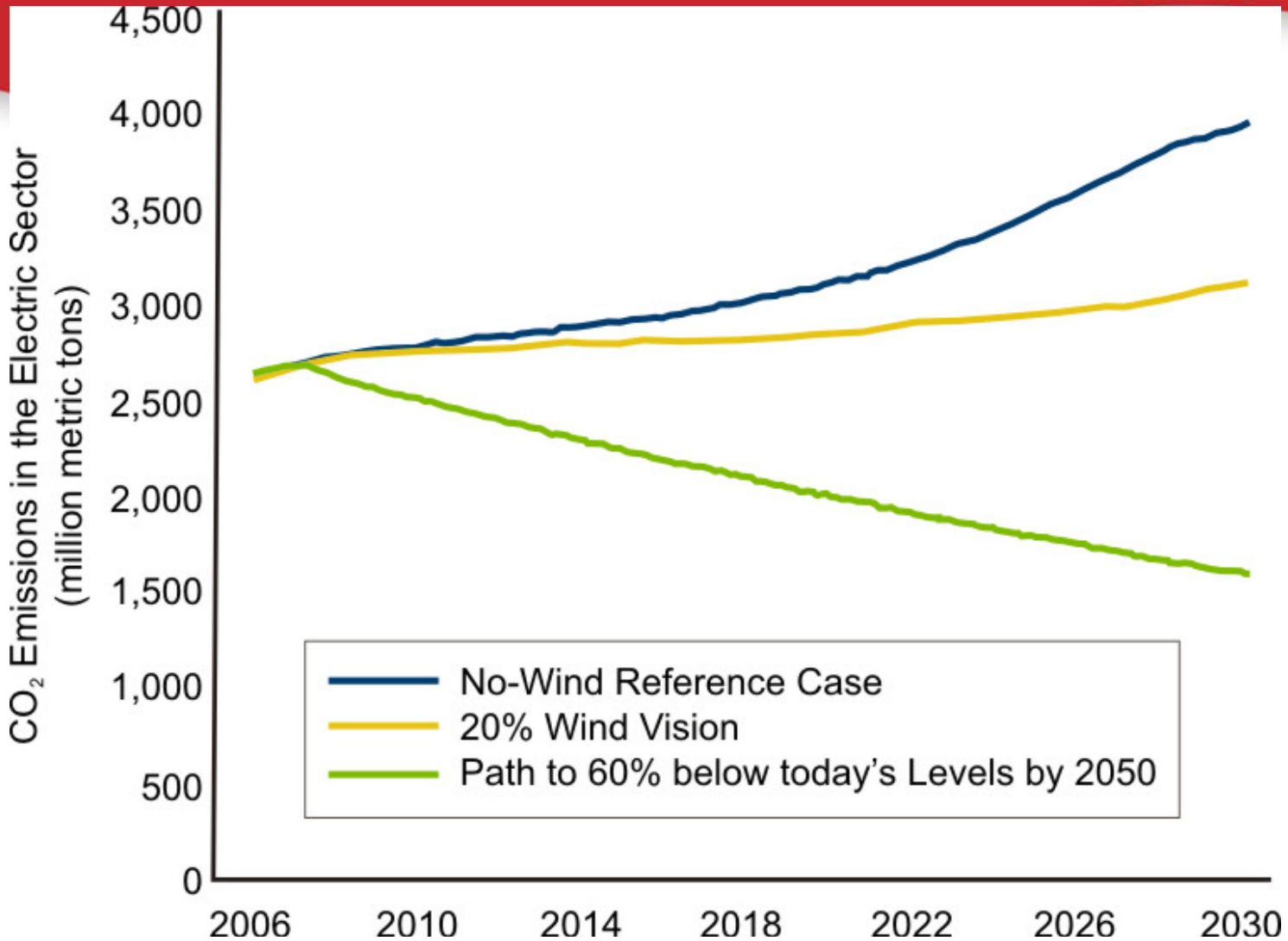
20% Wind: Installations by State



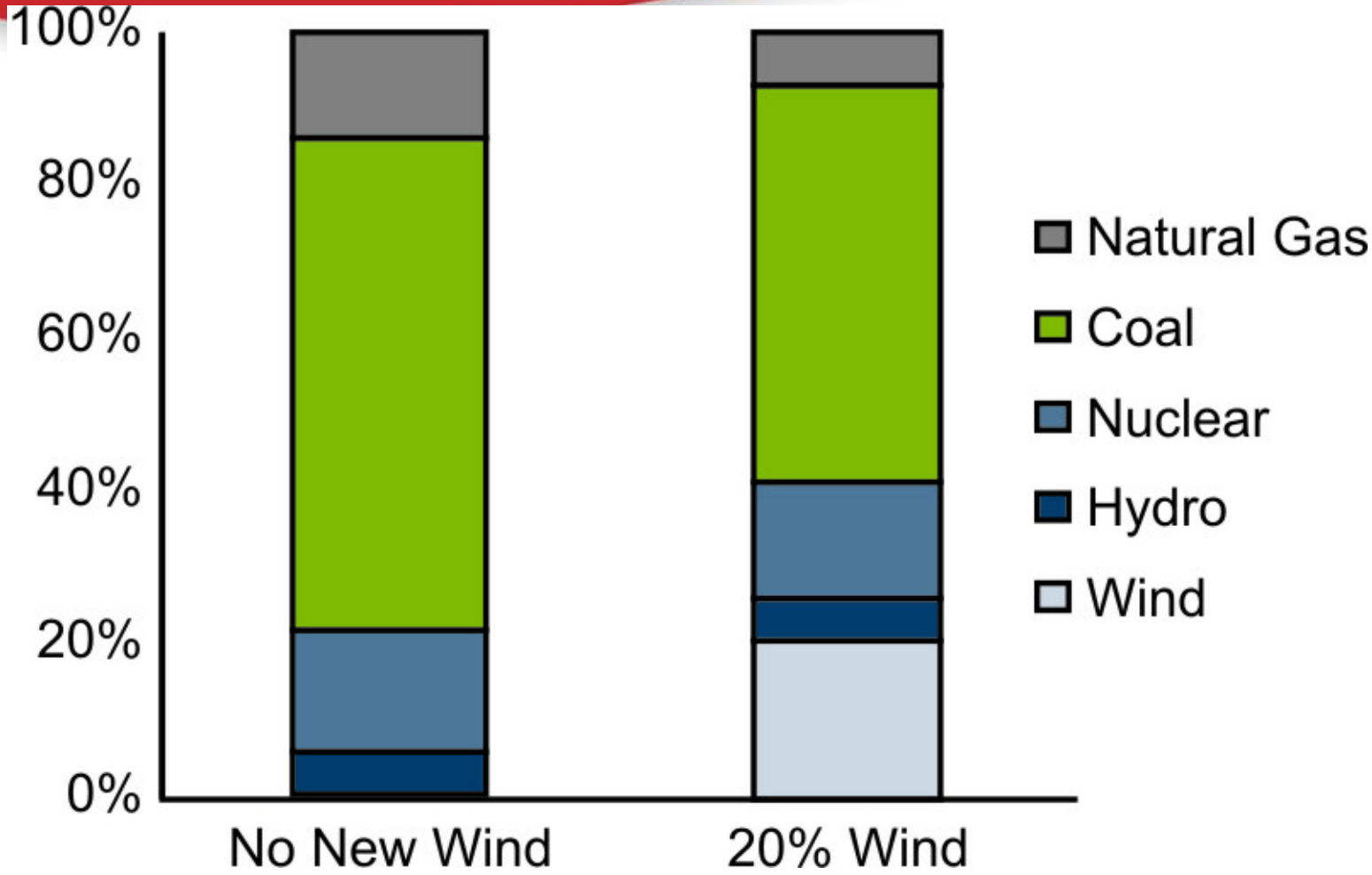
20% Wind: CO_2 Reductions



20% Wind: Flattens Electric Industry CO_2 Emissions

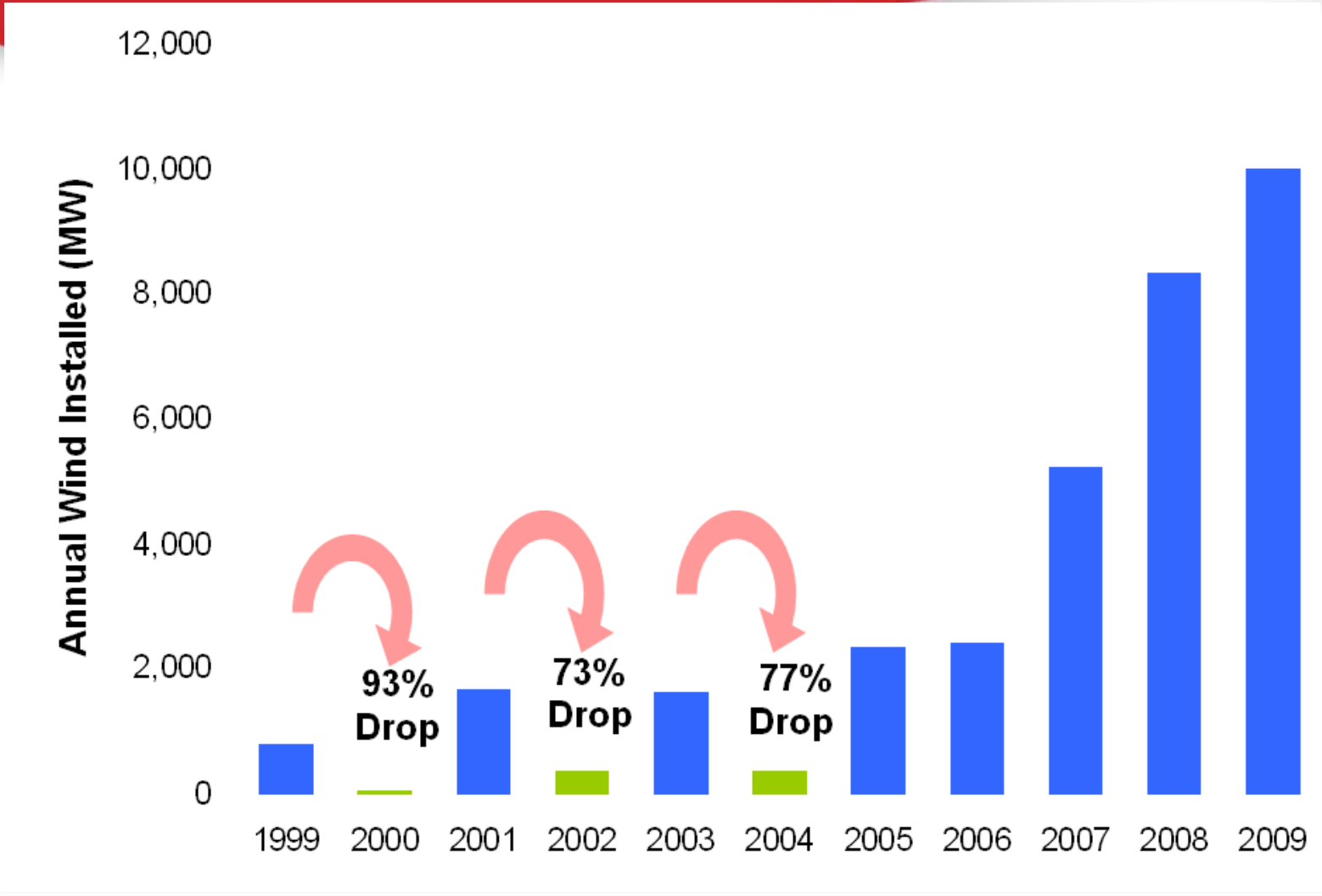


20% Wind: Wind Electricity Generation Mix



Market Drivers and Policy

History of Boom & Bust Tax Credit



Demand Drivers

1. **State RPS: 3-4 Gigawatts/year**

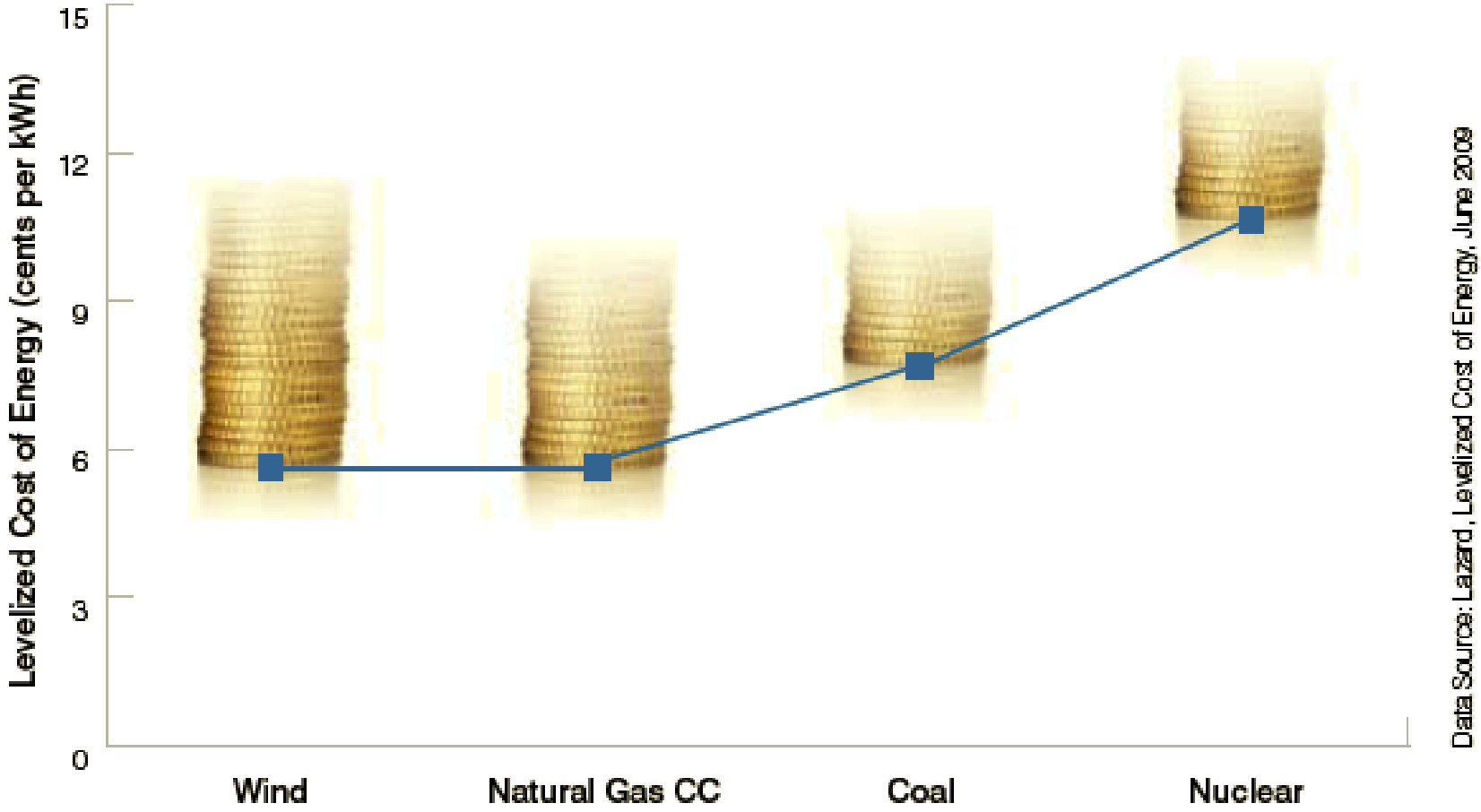
   - CA and Mid-Atlantic each 1-2 GW/year 2011-13

2. **Power Demand: 2.5 GW/year if wind supplies 25% of demand growth**

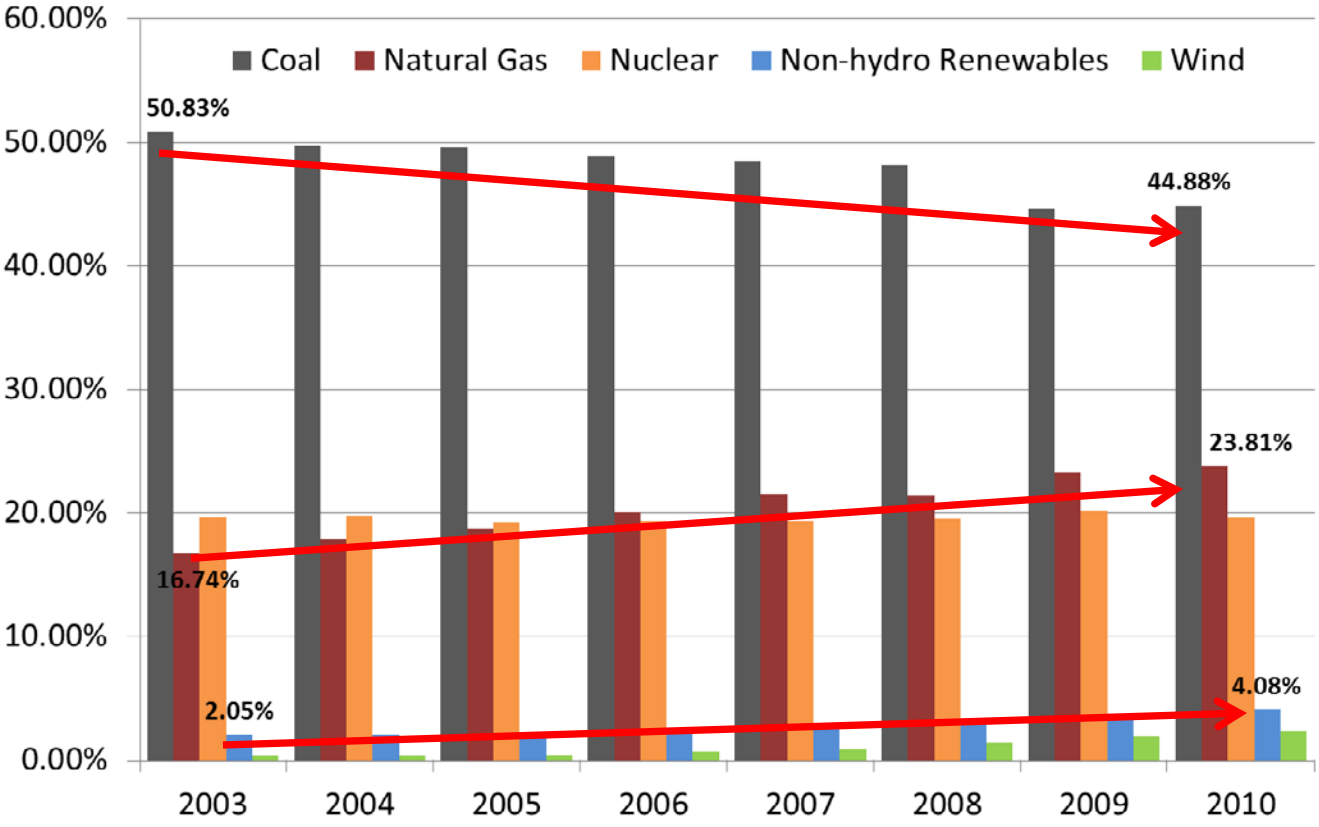
3. **Retirements due to environmental regs: 450 MW/year if wind supplies 25% of this market**

4. **Other policies…**

Market-Driven Growth Possible



Policy Motivation: Diversity of Power Sources



Coal Market Share, Drop Since 2003
- 6.0 percentage pts

Natural Gas Market Share Increase Since 2003
+ 7.0 percentage pts

Renewable Market Share, Increase Since 2003
+ 2.0 percentage pts

Source: EIA, Net Generation All sectors
*All Renewables does not include hydro

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Tax Credits: PTC/ITC

- **Production tax credit (PTC) of 2.2 cents/kWh for large wind available through 2012**
  - **Or 30% investment tax credit (ITC), and receive cash grant in its place through 2011**
- **Prospects for extension:**
  - **Treasury direct payment option not favored.**
  - **PTC/ITC extension prospects as good as ever. Need a tax vehicle to move.**
  - **Severe budget constraints, apply more to spending than tax credits.**

Federal RES/CES

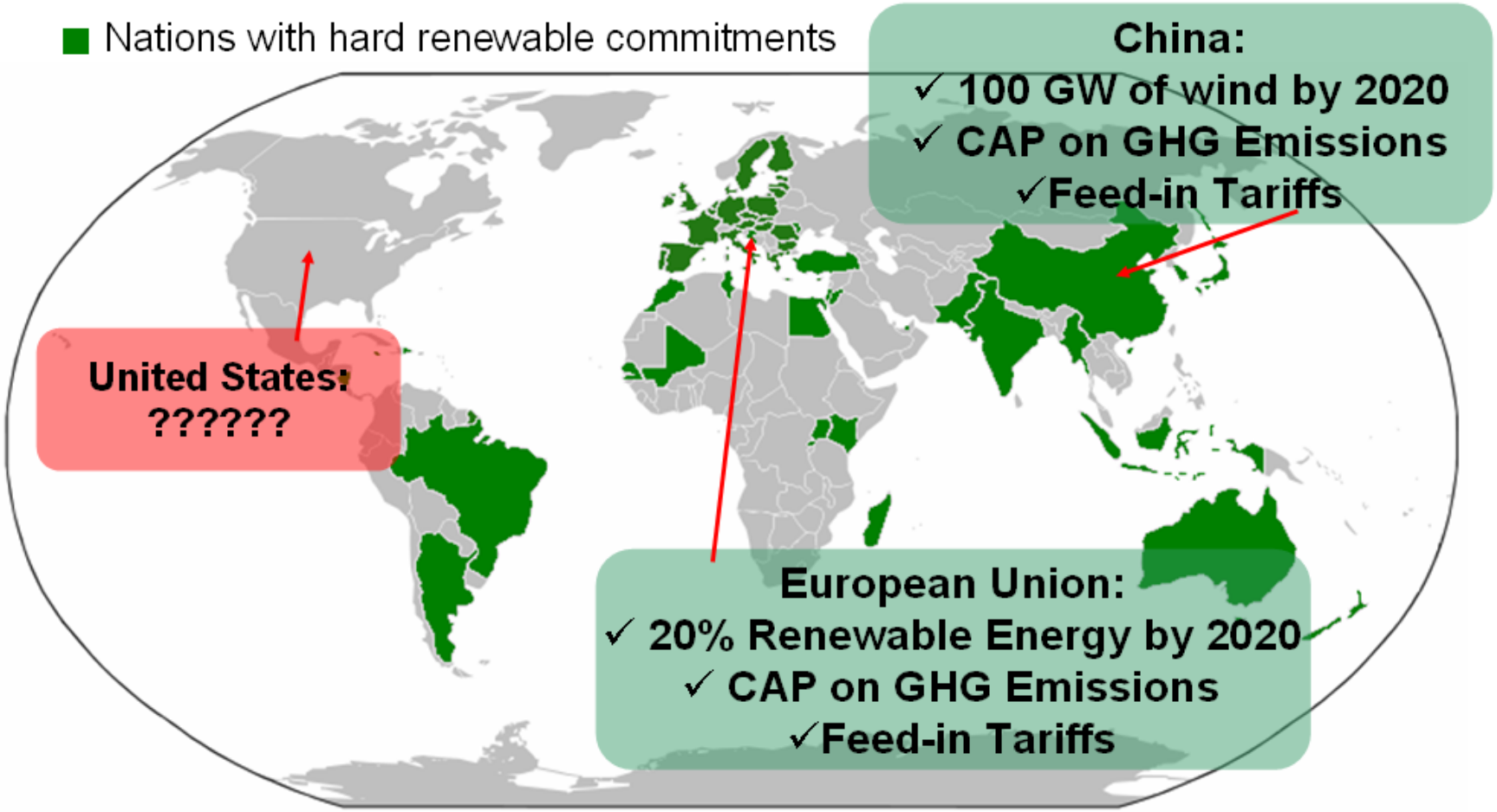
- **With new Congress, proponents of clean energy have broadened Renewable Electricity Standard (RES) to include low carbon sources in a Clean Energy Standard (CES).**
  - **Republicans not clear on what they will push yet.**
  - **Gasoline prices, EPA regulations, and challenges with natural gas, nuclear, and coal drive interest in acting on energy.**

Call to Action:
National Renewable Electricity Standard

- ✓ **Short-term policy does not drive projects or manufacturing.**
- ✓ **U.S. is competing the countries around the world.**
- ✓ **U.S. has infrastructure, workforce, skill-set and power demand making us the perfect candidate for building a new manufacturing sector.**

The wind industry simply needs a long-term and stable market signal to make the investment in renewables.

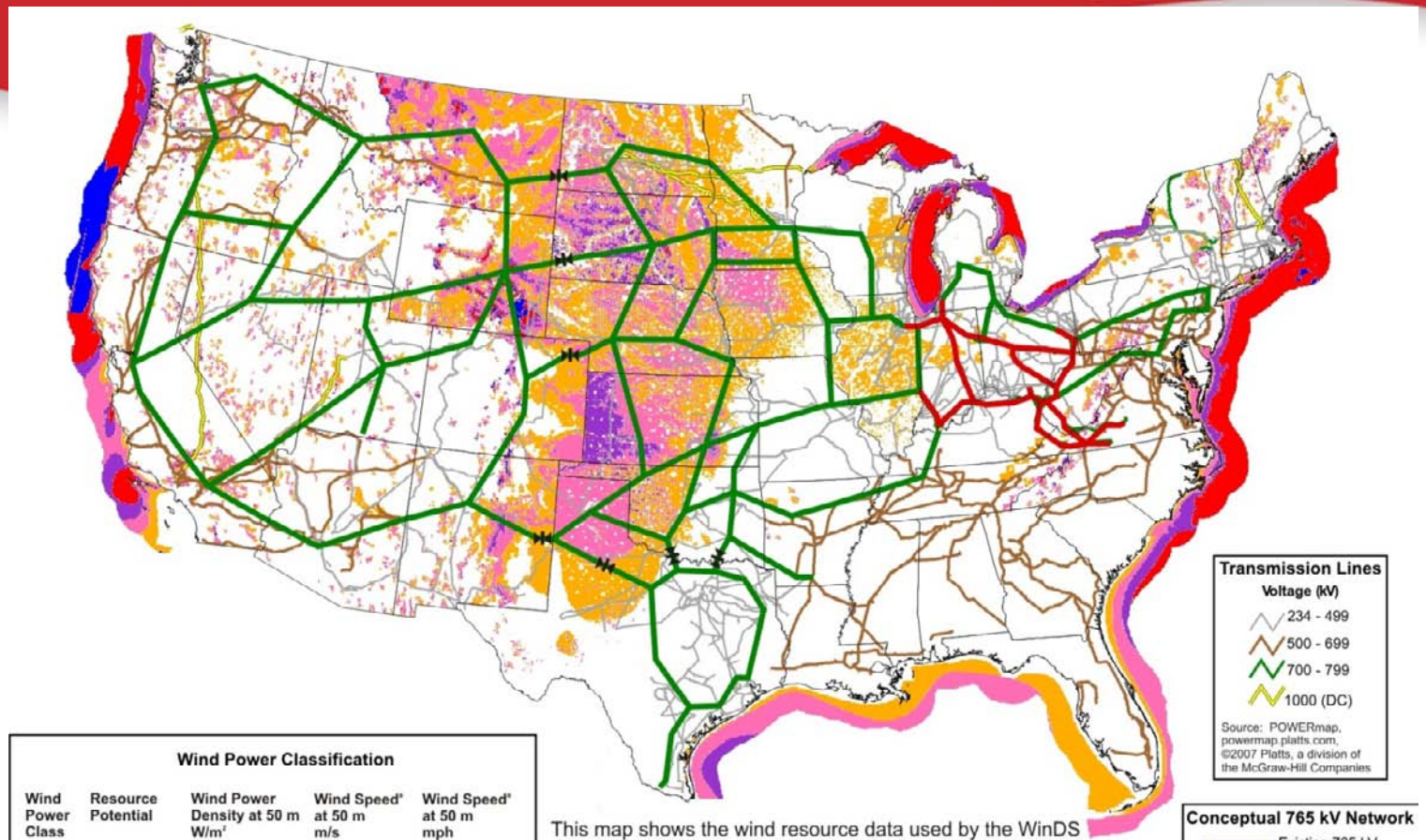
Call to Action:
National Renewable Electricity Standard



Long Term Policy Outlook

- Wind cost-competitiveness shows great promise, both in unregulated markets and in the estimated cost of RPS.
- Predictable policy is now a widely supported goal in Washington…but the budget "scoring" of long term tax credits remains a barrier.
- Promoting clean energy is more popular than regulating pollution.
- Water will be an increasingly important policy and market driver.

Conceptual Transmission Plan



Wind Power Classification

Wind Power Class	Resource Potential	Wind Power Density at 50 m W/m²	Wind Speed* at 50 m m/s	Wind Speed* at 50 m mph
3	Fair	300 - 400	6.4 - 7.0	14.3 - 15.7
4	Good	400 - 500	7.0 - 7.5	15.7 - 16.8
5	Excellent	500 - 600	7.5 - 8.0	16.8 - 17.9
6	Outstanding	600 - 800	8.0 - 8.8	17.9 - 19.7
7	Superb	800 - 1600	8.8 - 11.1	19.7 - 24.8

* Wind speeds are based on a Weibull k value of 2.0

This map shows the wind resource data used by the WinDS model for the 20% Wind Scenario. It is a combination of high resolution and low resolution datasets produced by NREL and other organizations. The data was screened to eliminate areas unlikely to be developed onshore due to land use or environmental issues. In many states, the wind resource on this map is visually enhanced to better show the distribution on ridge crests and other features.

Questions ?

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WIND POWER 2011
The Business of Wind

Introduction to Project Siting

Presented By

Kevin A. Martin

Director of Environmental Permitting

Terra-Gen Power, LLC

What is Siting?

- The step-wise evaluation of the potential effects from the development, construction, and operation of a wind farm with respect to local, state, and federal requirements that lead to design or operation considerations by the developer.

Purpose of Siting

- To avoid, minimize and mitigate the effects to the environment.
- To prepare the operational wind farm for financial security and continued operation.

Steps for Siting

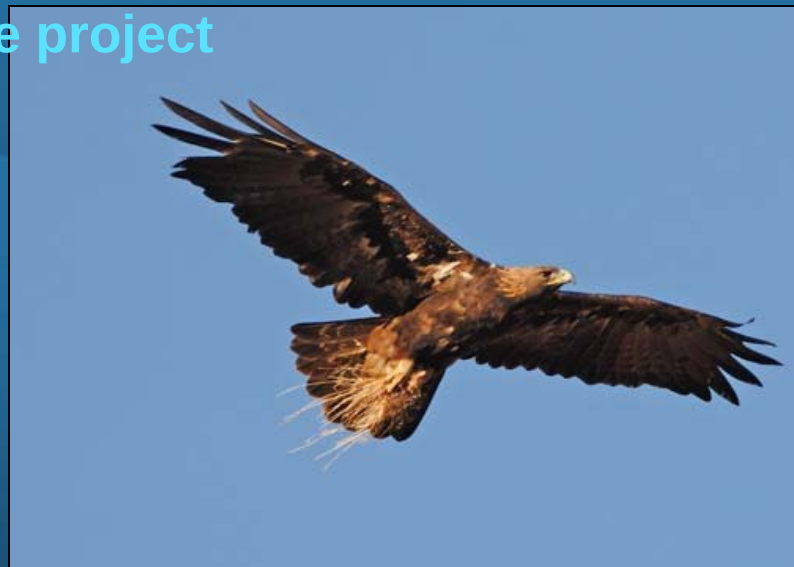
- Establish the Enviro-Socio-Geographic setting of the project
- Establish the Regulatory environment of the project
- Identify critical issues
- Evaluate the project activities against issues related to E-S-Geographic and regulatory setting
- Address issues through design modification or mitigation

Enviro-Socio-Geographic Setting

- This needs to be done to identify issues that are expected to develop based on environmental or sociologic conditions or species that occur on the project site or within the project area.
- Prepare as detailed a project description as possible
  - Foot print, roads, turbine layout, transmission, etc.
- What type of lands are you dealing with
  - Public , Private, Mixed
- Are the lands developed, used agriculture, natural conditions, protected
- Are there dwellings or sensitive activities adjacent to the project

Regulatory Environment

- Are there any discretionary action required?
  - Federal Agency
  - State Agency
  - County, Local Government
- What are the ordinances, laws, regulations for each
- Establish the permitting path for the project



Project Description/Design

E-S-Geo Setting

Identify the Studies Required
Wind Resource Assessment
Establish Dates and Timelines for Surveys
Public Input
Identify Sensitive Resources

Regulatory Environment

Identify Authority(s) for Approval
Identify Type of Approval Required
Coordination with agencies
Select Interdisciplinary Team
Identify Permits Required
Establish Timelines for Permitting

E-S-Geo Setting

Regulatory Environment

Environmental Documents
Proforma
Design Approvals
Mitigation Measures
Site Use Conditions

Constructible
Reduced Operational Risk
Reduced Financial Risk

Proper Siting Means Environmentally Sound and Economically Viable.

Relative Timelines

Assuming Surveys Complete

Private Land, No Critical Resources, Agricultural Use, No Social Issues

Local Permitting and Approval – Less than one year

Public Land/Federal Nexus, No Critical Resources, Agricultural Use, No Social Issues

Federal Environmental Document: Environmental Assessment : 12-18 months

Private Land, Listed Species, Agricultural Use, No Social Issues

Section 10 requiring Habitat Conservation Plan : EIS 2-5 years

Public Land / Federal Nexus, Listed Species, Agricultural Use, No Social Issues

Section 7 requiring consultation : EA 12-18 months; EIS 18-24 months

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WIND POWER 2011
The Business of Wind

Economics of Wind Power

Presented By

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ECONOMICS OF WIND

- Discussion will focus on:
  - Project level economics
    - Revenue
    - Costs
      - Development
      - Construction and Equipment
      - Capital

Source: BNEF, AWEA, GWEC

THE MACRO VIEW

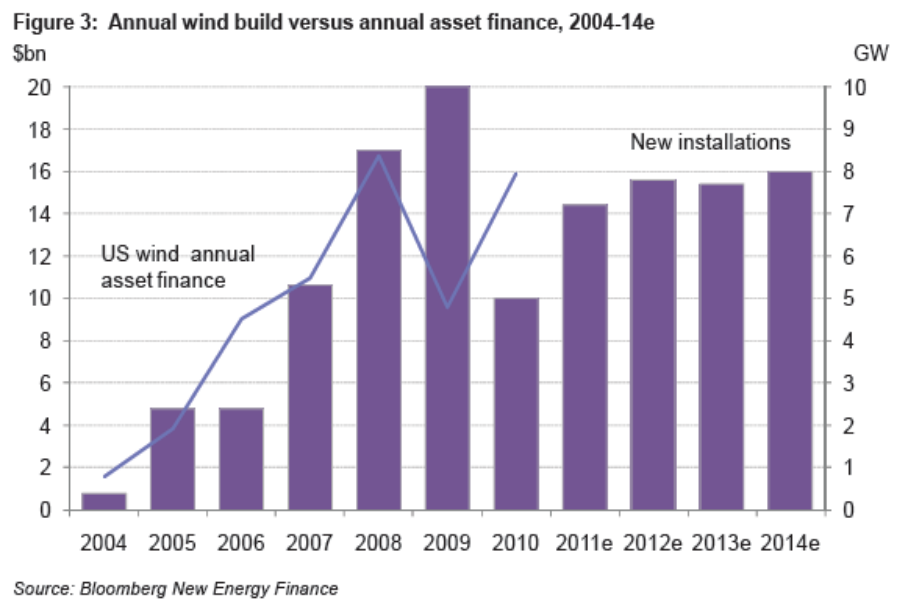
- The global wind power industry:
  - Over 35,900 MW of wind power was installed in 2010
  - Despite a 5.5% drop in growth in 2010, the industry has grown at a CAGR of 21% over the last 5 years

- The U.S. wind power industry:
  - Approximately 5,000 MW of wind power was installed in 2010
  - New build dropped by ~50% in 2010
  - 2010 asset finance in North America totaled ~$16 billion

Source: BNEF, AWEA, GWEC

THE MACRO VIEW

- Despite a weak year in 2010, US market is expected to return to a new build rate of 7 – 8 GW per annum
  - Lower installed capacity driven by lower electricity demand and low natural gas prices
  - Credit markets are stabilizing
- US now trails China as the leader in annual capacity
- Growth within national and state markets can be very volatile
  - Impacted by local drivers



	Installed MW 2010	Cumulative Installed Capacity
China*	18,923	44,733
United States	5,600	40,180
Germany	1,551	27,215
Spain	1,527	20,676
India	1,258	13,065
Italy	950	5,797
France	1,086	5,660
Great Britain	1,112	5,204
Canada	690	4,008
Denmark	309	3,743
Portugal	345	3,702

* Only 31,070 MW are in operation

Source: World Wind Energy Association

PROJECT ECONOMICS

- Drivers
  - Wind regime (capacity factor of the facility)
  - Price for power
  - Turbine prices
  - Turbine performance (availability and power curve)
  - Balance of plant costs / O&M costs
  - Cost of financing
- Potential killers
  - Real estate complexity
  - Permitting regime
  - Transmission
  - Regulatory regime
  - Misconceptions of “market” for prices charged by capital providers

PROJECT ECONOMICS

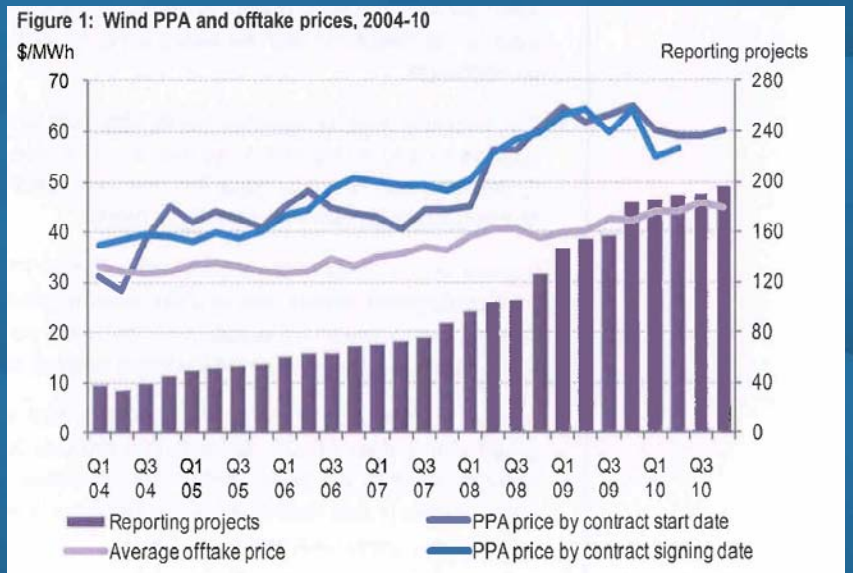
- Development Profit = Capital cost minus NPV of developer's ownership interest in operational cash flows
  - NPV will vary based on the stage of project development
- No fuel cost, low O&M cost so cash flows primarily driven by two factors:
  - Wind resource
  - Power price
- No industry standard level of profit, varies greatly from project to project, but generally the value of a project will depend on its:
  - Stage of development – operating assets bear a lower discount rate than development projects
  - Relationship between projected revenues and expected costs

REVENUE

- Wind Resource
  - P-50 is a statistical construct with describes an amount of annual wind intensity that will be exceeded in 50 out of 100 years; similarly, wind resource is expected to exceed P-90 levels in 90 out of 100 years
  - Install 50-60 m towers for preliminary assessment followed by 80 m after proving project viability
  - Correlation with long-term data sets from government sources
- PPA pricing
  - Contracts starting through Q4 2010 had average prices of $60 / MWh
  - May separately contract for RECS depending on market
  - Importance of contracted revenue: output that is contracted is financeable

HISTORIC PPA PRICING

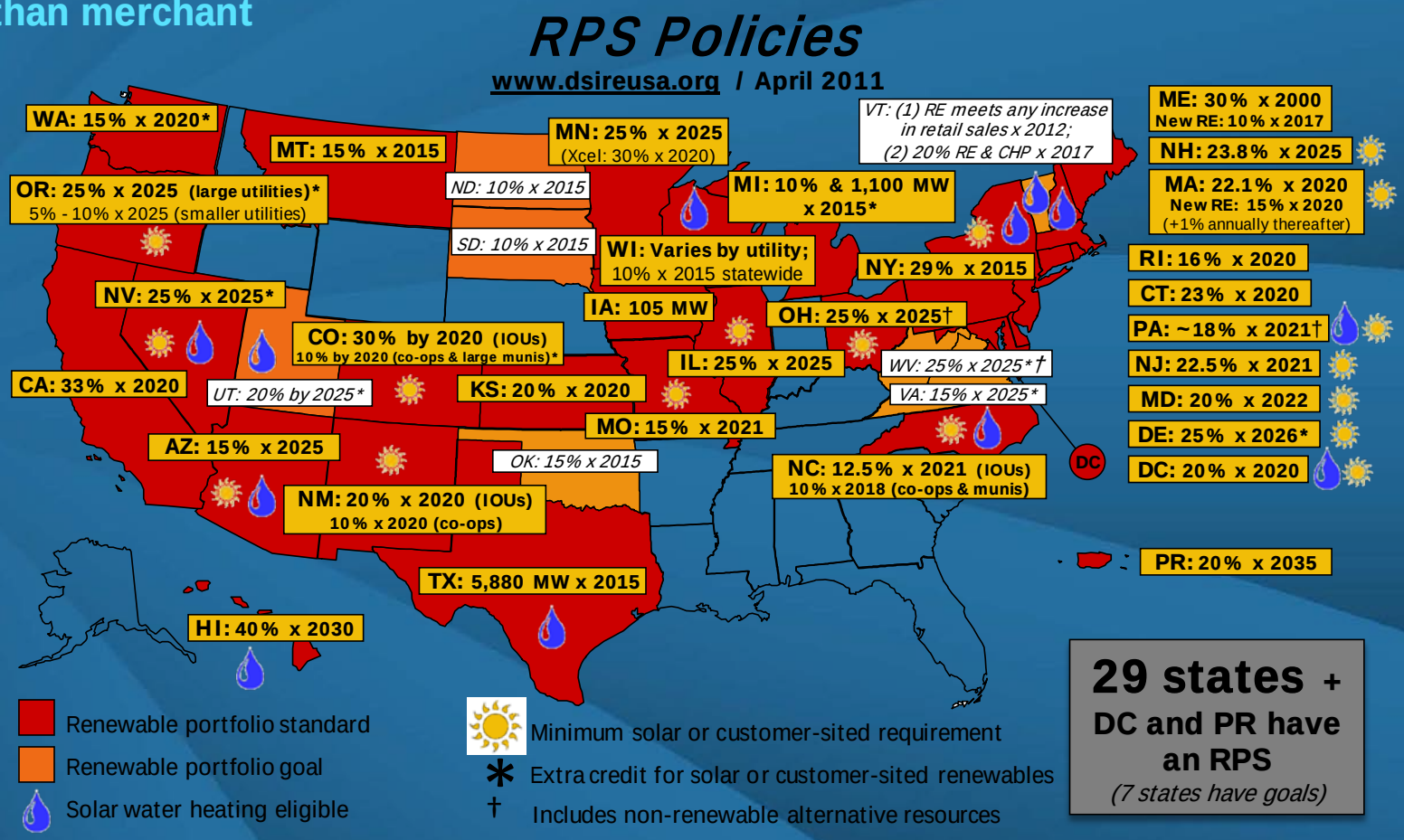
- Economic conditions and lower natural gas prices have resulted in low power prices
- Demand for renewable generation continues to be driven by compliance with RPS mandates; demand in the absence of RPS is soft
- Significant variation by region: recent reported prices range from $.027 to nearly $.09



Source: Bloomberg New Energy Finance, FERC Note: Average offtake prices includes all projects commissioned before 2004 and merchant and banded sales. PPA prices do not include banded structures because of inherent offtake price variability. Small sample size causes some variability in first few years.

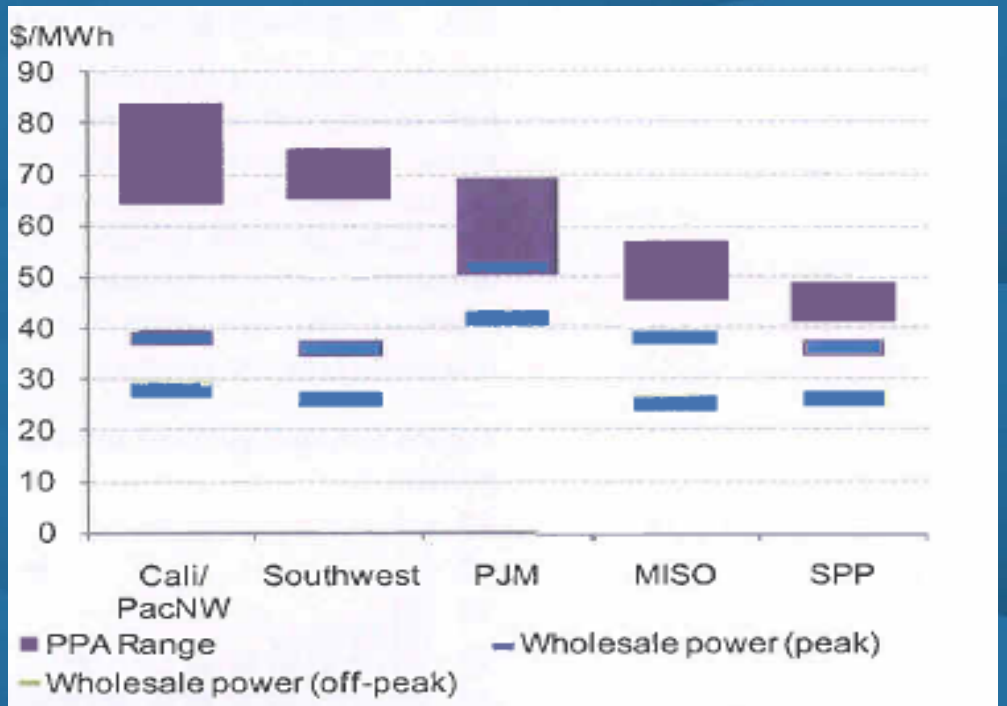
RPS POLICIES

- State-level RPS mandates are the primary driver of demand for renewable generation
- States that have fallen behind their RPS goals strike PPA prices significantly higher than merchant



RPS PREMIUM

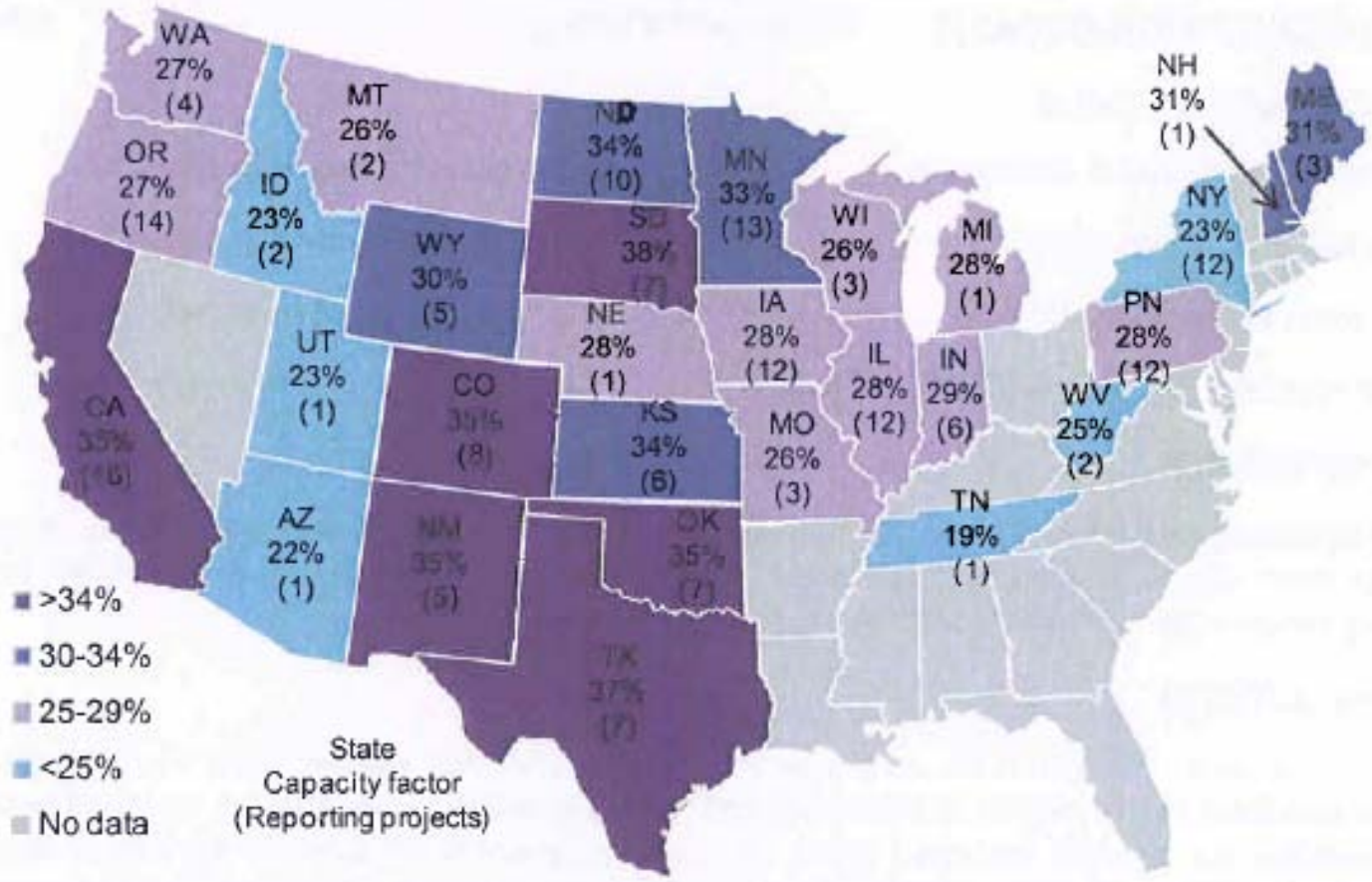
- While prices generally are down, PPA pricing strength relative to wholesale rates is expected to continue in western states as a result of stronger RPS driven demand



Source: Bloomberg New Energy Finance, Bloomberg Data, FERC, analyst estimates. Wholesale power is year to date around the clock average for most common node within region.

CAPACITY FACTORS

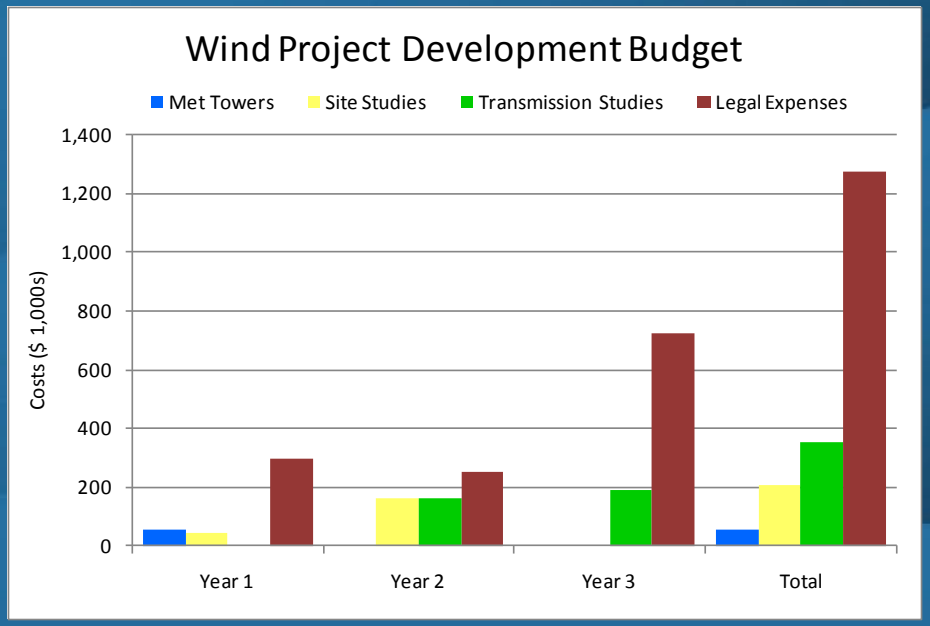
Figure 12: Average wind project capacity factor, 2010



Source: Bloomberg New Energy Finance, FERC Note: Sample sizes are small for some state and should not represent general wind resources. Capacity factors are averaged over the life of a project. Only includes projects operating for at least one year.

INDICATIVE DEVELOPMENT COSTS

- Project development in the US takes 2 to 3 years
- Met towers are required which have minimal cost but long lead time
  - Usually install 50 - 60 m towers for preliminary assessment followed by 80 m after proving project viability
  - More reliable wind resource data provides greater comfort to financiers
- Site and transmission costs vary by geography and utility/ISO
  - Projects on critical habitats or state/BLM lands could add significant costs of purchasing additional environmental land



INDICATIVE CONSTRUCTION COSTS

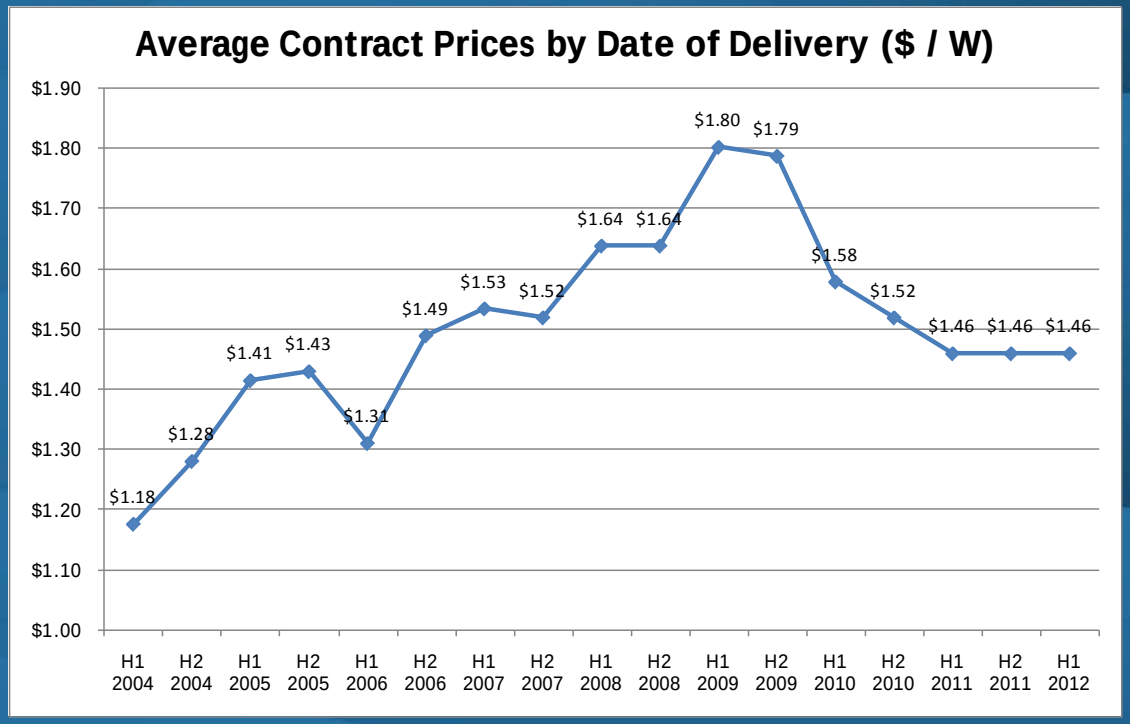
- Turbine costs comprise the bulk of the construction costs
- 1603 expiration puts pressure on swift funding and execution of construction before year-end
- For lager projects, a more substantial BoP budget may be required to fund the upgrade of transmission facilities
- Pre-construction deposits for turbines, PPA and interconnection = higher development equity

	$ / kW [(a)]	% of total
Turbines	$1,400	72%
Balance of Plant		
Mechanical	$90	5%
Civil	90	5%
Electrical	90	5%
Other Engineering	90	5%
G&A	50	3%
Total BoP	$410	21%
Soft Costs		
Engineering	$15	1%
Electrical	15	1%
Legal	15	1%
Financing	15	1%
G&A	50	3%
Total Soft Costs	$110	6%
Transaction Costs	10	0.5%
Construction Insurance	5	0%
Total Construction Costs	$1,935	100%

(a) Reflects midpoint of estimated range for projects built in 2011.

TURBINE COST

- Contracts signed in late 2010 for delivery in 2011 were struck at a 7% discount to contracts signed in 2009
- Low PPA prices have put pressure on turbine pricing
- Prices expected to stabilize around current levels

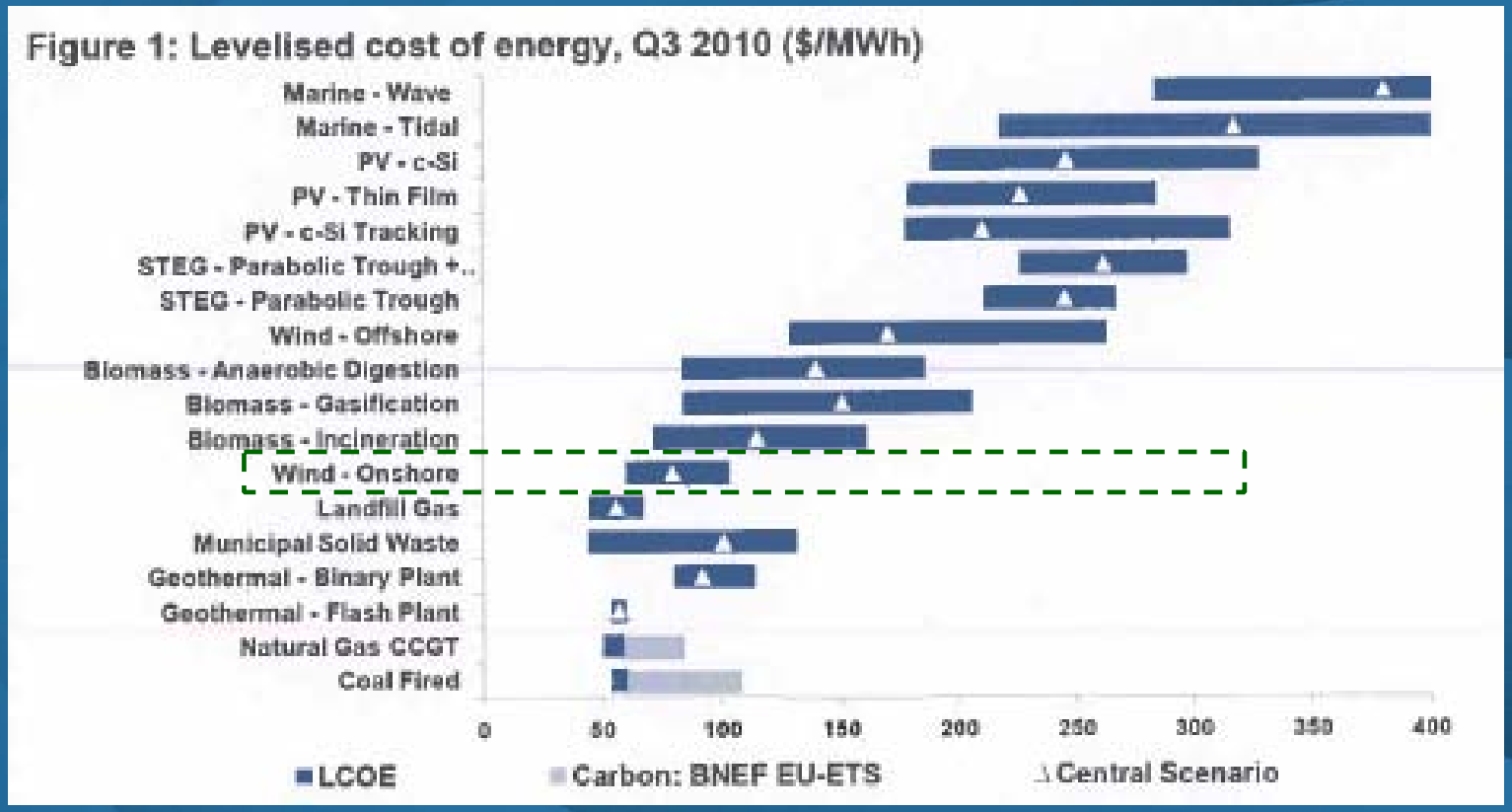


Source: BNEF February 2011 Wind Turbine Price Index.

Note: Contract prices include turbine plus towers and transport to site, and they exclude VAT and installation costs.

LCOE

- Wind is increasingly cost-competitive among generation technologies, but is intermittent (i.e., can's be dispatched) and may be weighted toward off peak hours

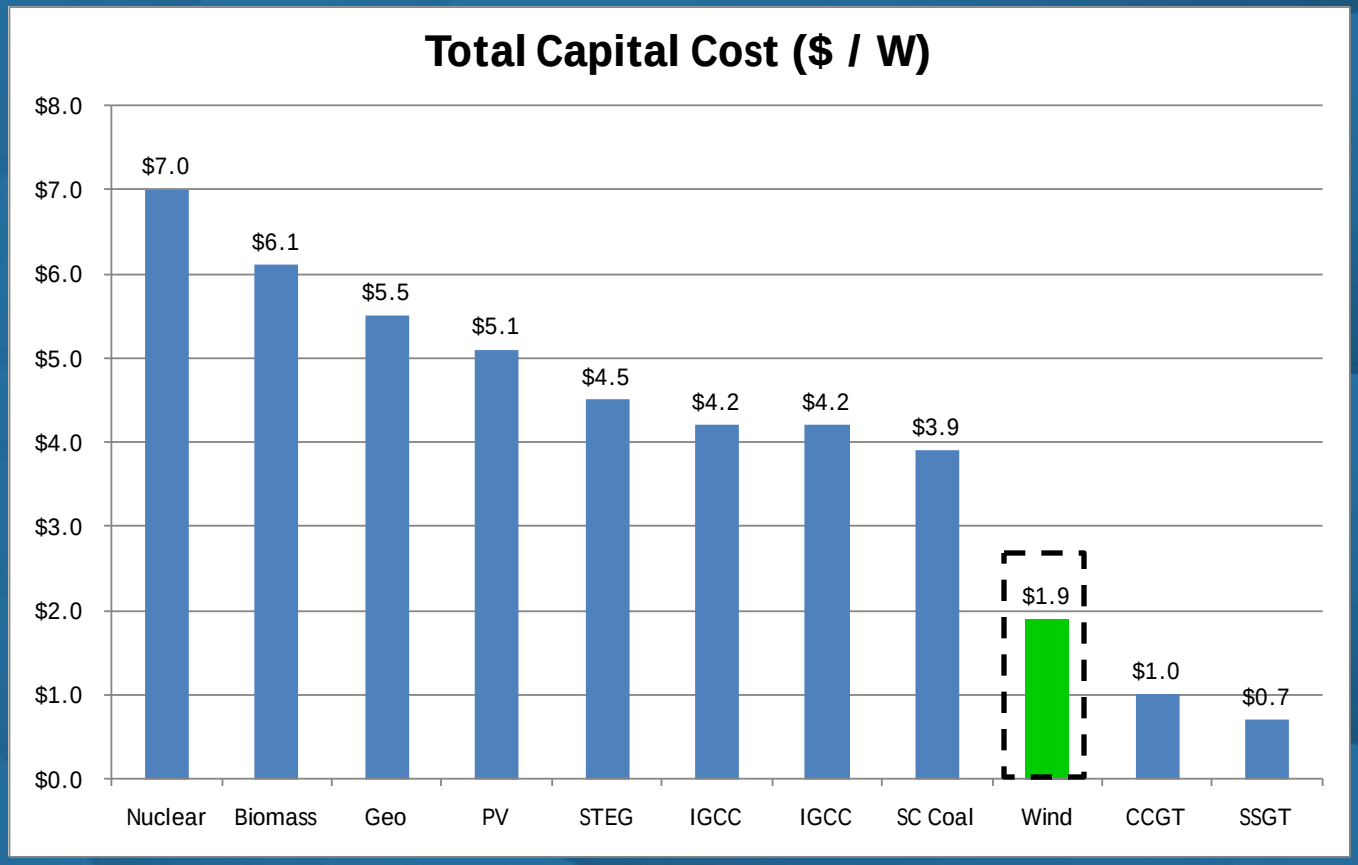


Source: EIA Annual Energy Outlook.

Note: EU-ETS 10-yr market horizon forecast from September 2010.

FULLY INSTALLED $ / W

- Wind is increasingly cost-competitive among generation technologies at ~$1.9 / W installed



Source: Wood Mackenzie 2010 Long-Term View. Estimates are prepared from various Integrated Resource Plans (IRPs) across the country, quotes form projects under construction or advanced stages of development and discussions with market participants.

Note: Assumes no price on carbon and no utilization of carbon capture technologies.

SENIOR SECURED DEBT

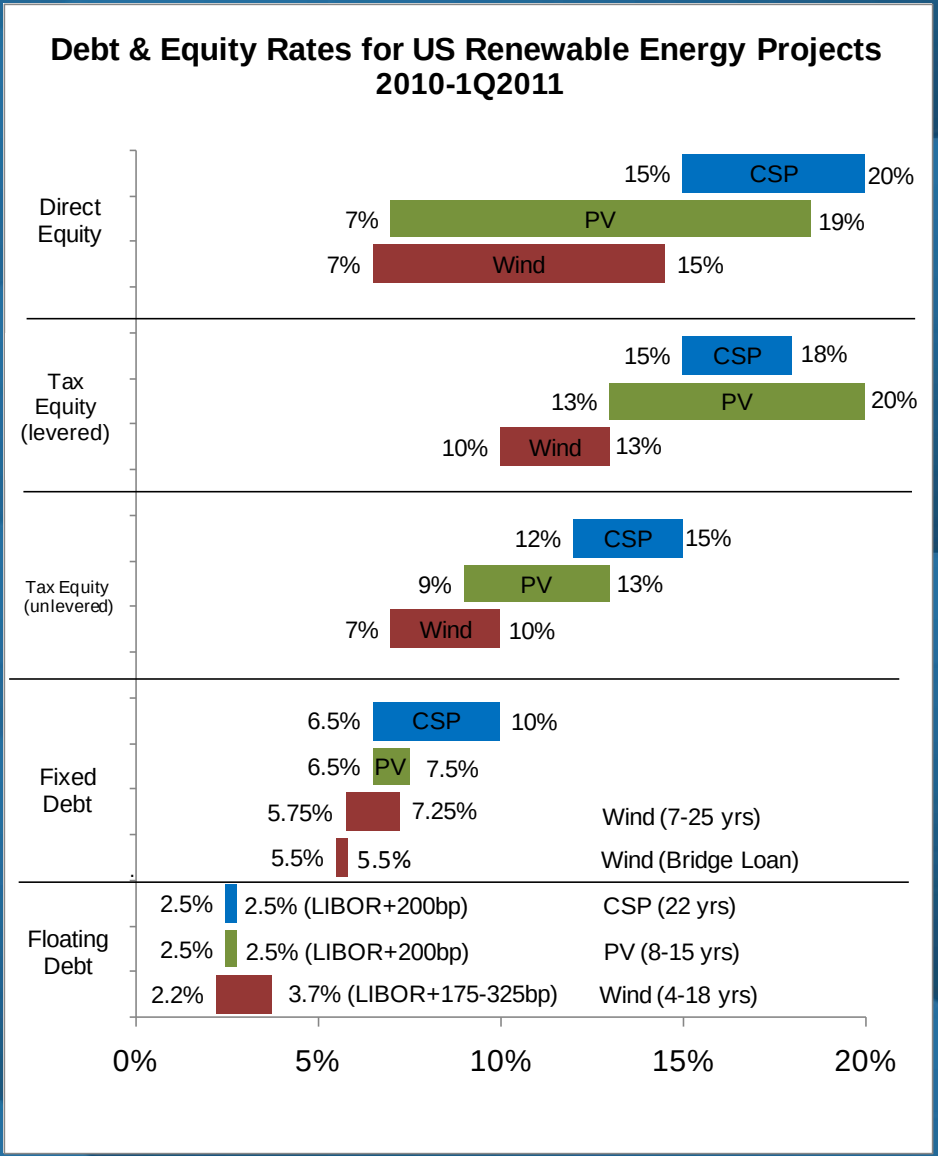
- Active market- 25+ active lenders
- Debt is sized at Debt Service Coverage Ratio ("DSCR") of ~1.4x at P50, 1.0x at P99
  - (Revenue - Operating Costs) / (Interest Expense + Scheduled Amortization)
- Tenor up to17 years post COD from banks; longer tenor from life insurance cos
- Pricing for banks is LIBOR plus 225 with step ups; for life cos Treasuries plus 325
- Debt Service Reserve Account is 3-6 months of scheduled debt service
- Distribution Blocks trap cash at project if DSCR drops below 1.2x in any period
- Restrictive covenants on action by the Borrower
- Upfront fees for banks are ~2% of loan value
- Transaction costs are ~0.5% - 1.0% of total deal value, and cover admin agent, independent engineer report, insurance, legal and accounting

TAX EQUITY

- Tax equity investors are large corporates with stable taxable income
  - Enables Project to monetize tax credits and depreciation, subject to tax rules
  - Favors large projects in terms of minimum investment
  - Market volume is around $6 billion
- Structures for wind projects include partnership flip ("partnership") and sale leaseback ("lease")
- Tax equity owns either a partnership interest or is Lessor in lease
- Tax equity is allocated the tax benefits plus some portion of cash
- In partnership, preferred return to tax investor; relative interests "flip" when a target return is achieved
- Lease = fixed payments over life of lease
- Purchase options to sponsor at higher of FMV at stipulated amount
- Inter-creditor issues arise with senior debt

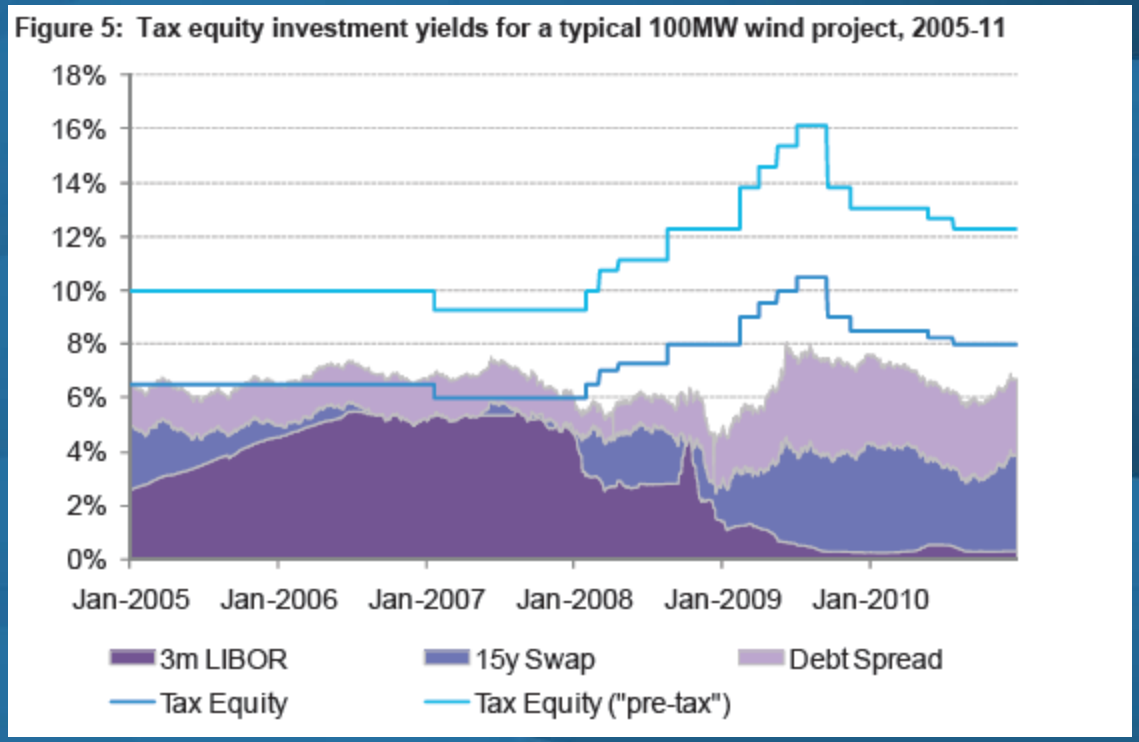
COST OF CAPITAL

- Senior debt capital is least expensive because it takes the least risk in the project
  - May be difficult to source in small amounts
- Construction and bridge loans will price at a discount to term loans
- Tax equity prices like a debt product, and its required return increases if senior debt is placed ahead of it
  - Role of tax equity to increase in the event 1603 is not extended



COST OF CAPITAL (cont'd)

- Tax equity investors have made a resurgence in 2010 and 2011
- 1603 Cash Grant in lieu of tax credits expires in 2011
  - IRC Section 45 Production Tax Credit
  - IRC Section 48 Investment Tax Credit
- Tax equity returns are measured on an after tax basis
  - Pre-tax equivalent is higher



ABOUT THE SPEAKER

- Ed Feo is a founder and managing partner of USRG Renewable Finance and USRG Clean Energy Capital. USRGRF provides long term financing to renewable energy projects. USRGCEC provides mezzanine and senior debt to smaller projects and companies. Previously, Ed was a partner in the international law firm of Milbank, Tweed, Hadley & McCloy LLP and headed the Firm's Power & Energy practice.
- Mr. Feo was named in 2010 by the National Law Journal as one of "The Most Influential Lawyers of the Decade" for his work on energy and environmental transactions. He has been named in the California Lawyer magazine as an "Attorney of the Year" in the Energy category and by The American Lawyer as a "Deal Maker of the Year." He was named as one of the Top 100 Lawyers in California by The Daily Journal for five consecutive years, and was named one of the "Five Most Influential People in Renewable Energy" in 2008 by Institutional Investor.
- Mr. Feo is a well known speaker at renewable energy conferences, including at the American Wind Energy Association annual conference, the European Wind Energy Association annual conference, the National Renewable Energy Laboratory Growth Forum, Solar Power International, the American Council on Renewable Energy annual conference, the Geothermal Resources Council, the World Renewable Energy Conference, the Renewable Energy Finance Forum, and numerous other industry events. He is also a frequent writer on renewable energy topics, including as a columnist for North American Clean Energy and as a contributor to Reuter's/PFI Clean Energy Finance. He is on the board of editors of The Journal of Structured Finance.

ABOUT USRG

- US Renewables Group ("USRG") is a private equity firm specializing in renewable energy. USRG includes debt funds called USRG Renewable Finance ("USRG RF") and USRG Clean Energy Capital ("USRG CEC")

- USRG RF successfully launched in 2010 with a $1.5 billion commitment from a global investment bank to fund Department of Energy Loan Guarantee Deals

- USRG CEC is aimed at small and middle market companies in the renewable energy space spanning power projects (both non-recourse and project hold co), equipment manufacturers, fuels and chemicals projects and energy efficiency companies

- **QUESTIONS?**

- **QUESTIONS?**