20% Wind Energy by 2030…

and the transmission grid required for our carbon constrained future

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20% Wind Energy by 2030

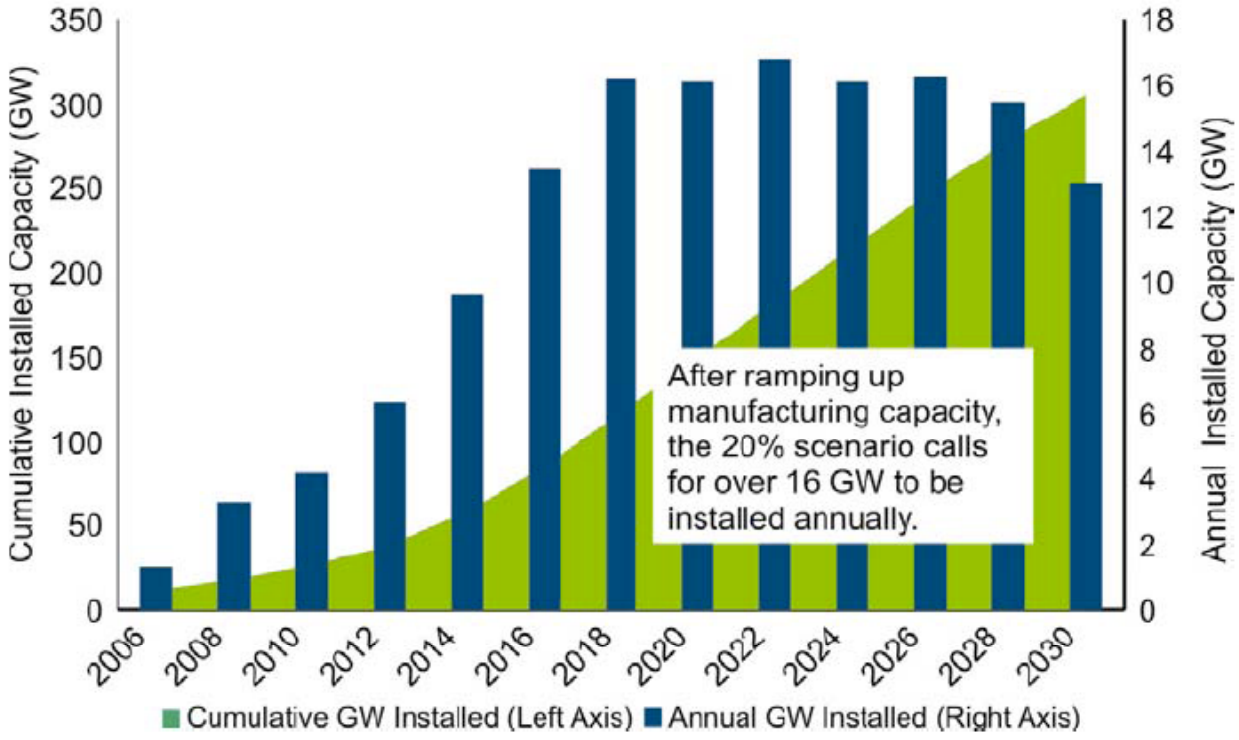
Growth Path to 20% Wind by 2030

Only a **fraction of total wind potential** would be needed to reach 20%.

Total capacity would grow to nearly **305,000 MW**, or an **additional 293,000** MW over the 11,600 MW installed at the end of 2006.

Annual installations would increase to over **16,000 MW per year** by 2018.

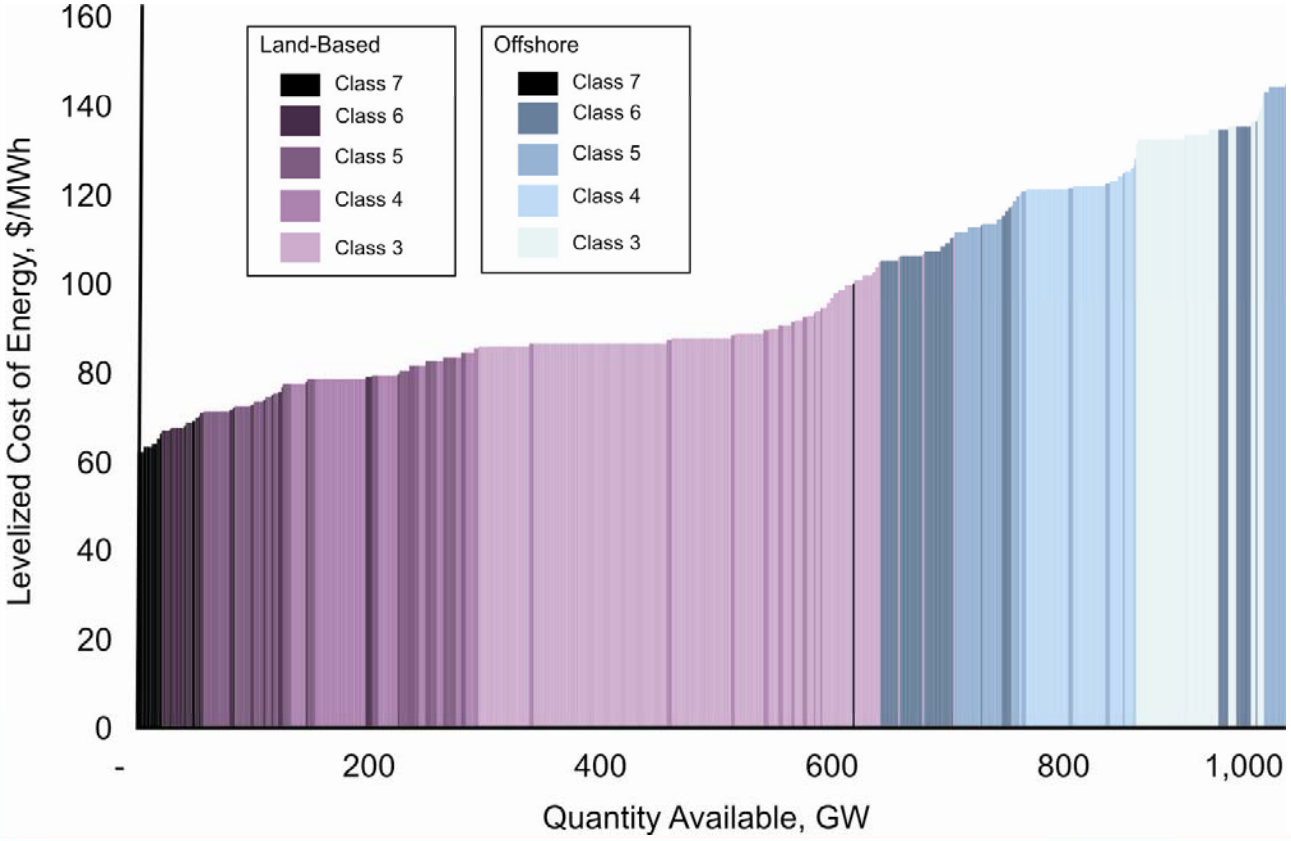
Annual and Cumulative Wind Installations by 2030



20% Wind Energy by 2030

Wind Resource Supply Curves

Wind Resource Potential in the U.S.



Once existing transmission availability of 10% and integration costs are included, over 600 GW of wind is still available at competitive levels.

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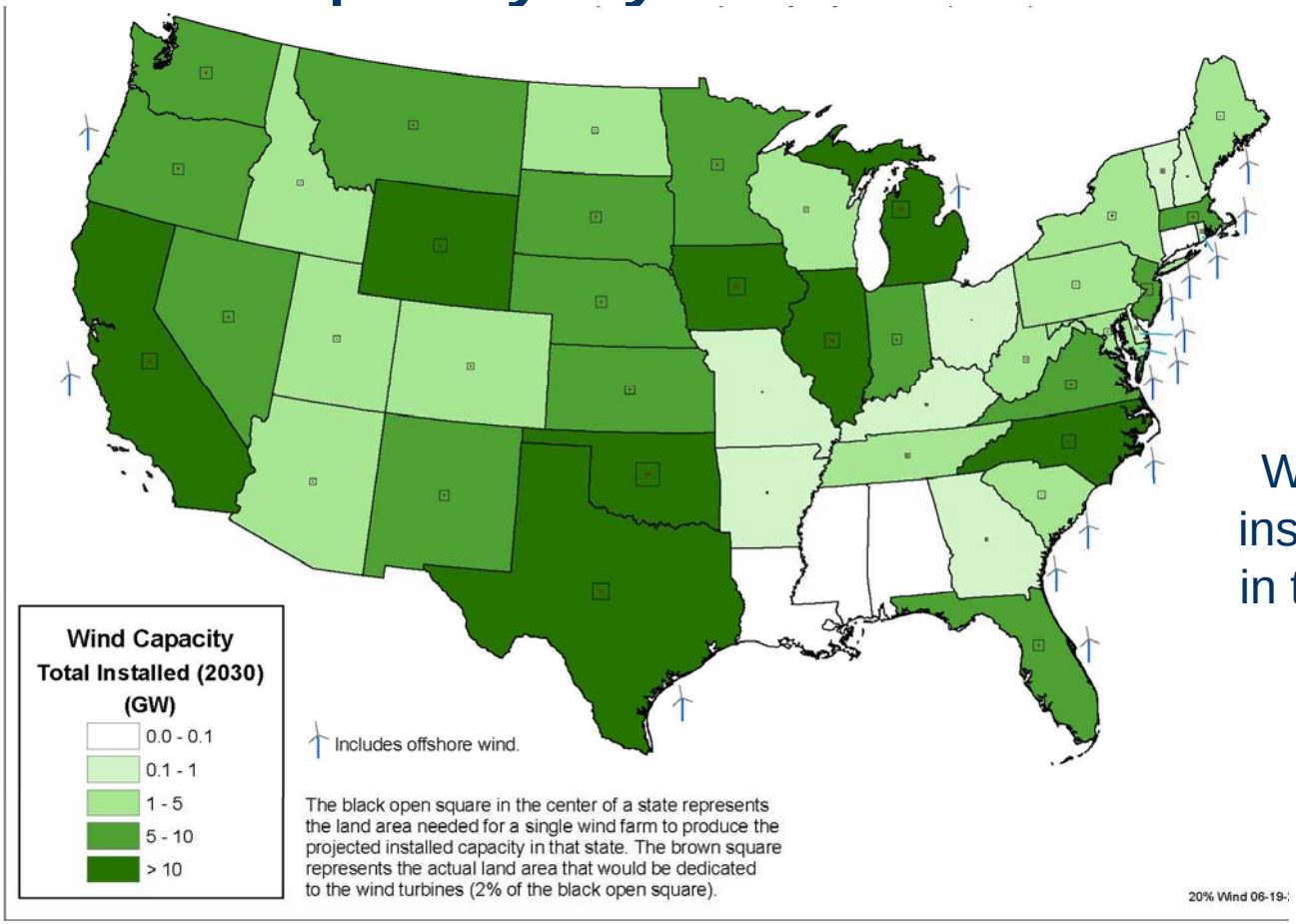
Wind Capacity by State



Installed Wind Nameplate Capacity by State (2030)

Wind capacity would be installed across **46 states** in the 20% wind scenario.

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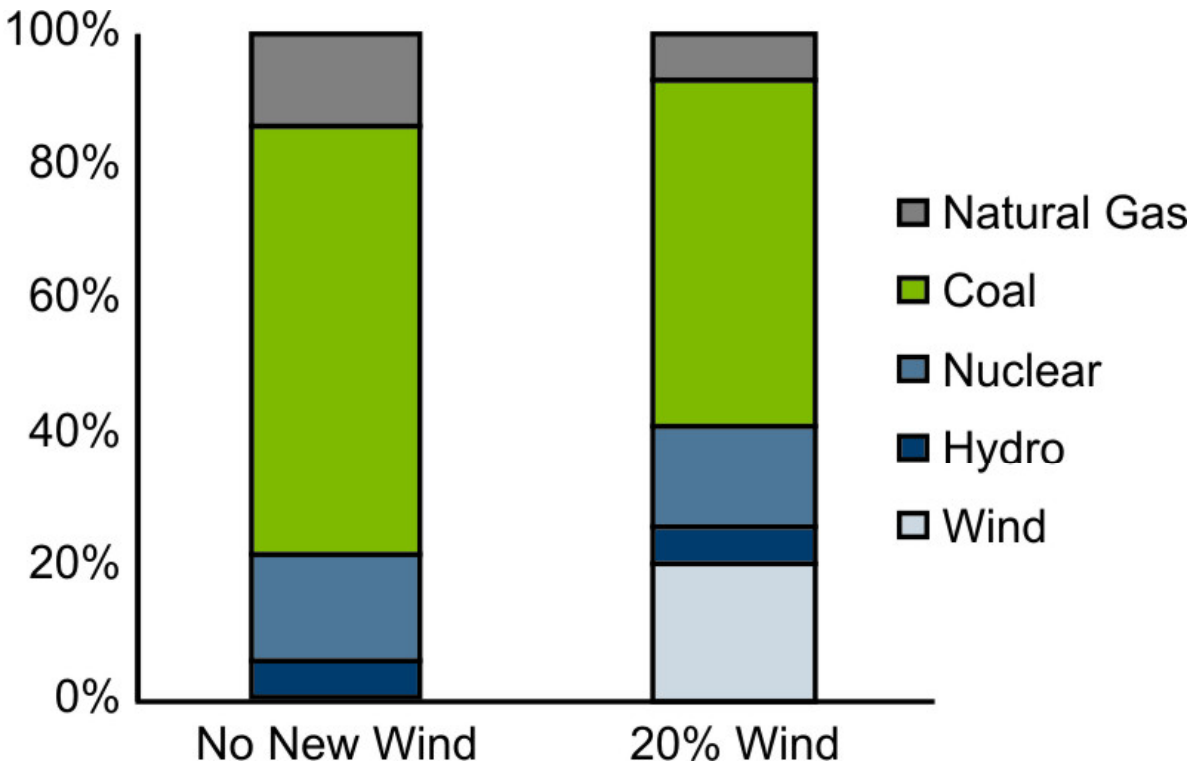
Electricity Generation Mix



The 20% Wind Scenario would decrease generation from natural gas by 50% and generation from coal by 18%.

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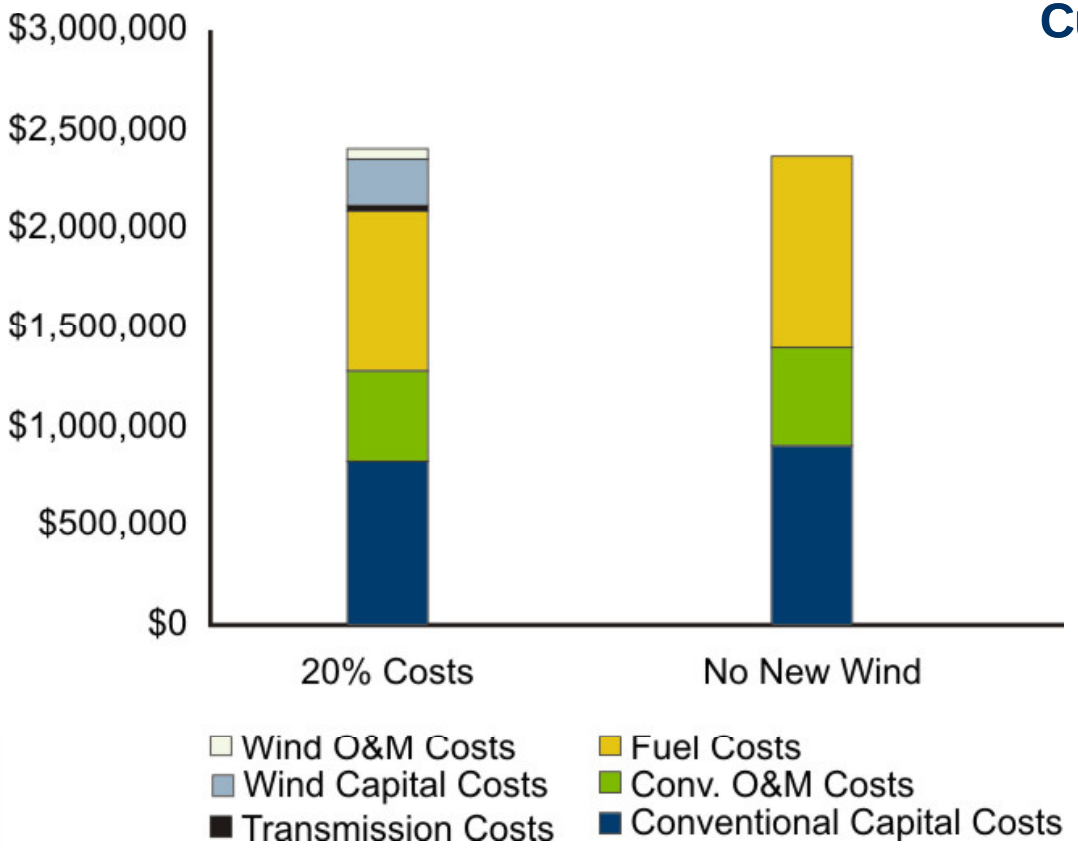
Estimated Electric System Costs



Cumulative Discounted Electric System Cost through 2030 (Millions of 2006 Dollars)

Approximately a 2% **increase in cost**, or $43 billion in net present value.

Equivalent of 50 cents per month per household, not accounting for positive, offsetting impacts.

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Projected Impacts and Major Challenges

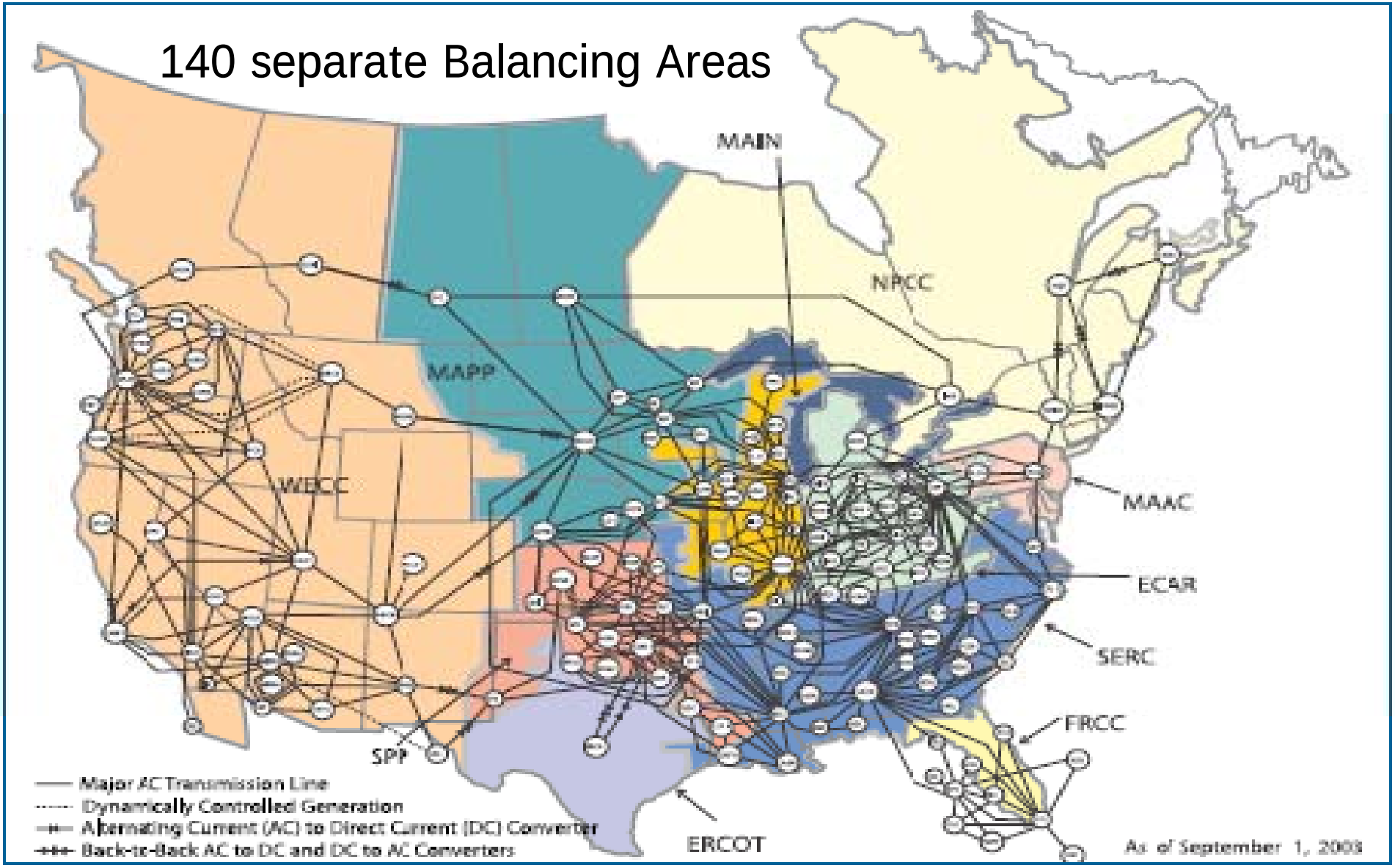
20% Wind Scenario: Projected Impacts

- **Environment:** Avoids air pollution, reduces GHG emissions, and reduces water use in electricity generation. Reduces electric sector CO_2 emissions by 825 million metric tons.
- **U.S. energy security:** Diversifies our electricity portfolio and represents an indigenous energy source with stable prices not subject to fuel volatility
- **Energy consumers:** Wind potentially reduces demand for fossil fuels, in turn reducing fuel prices and stabilizing electricity rates
- **Local economics:** Creates new income source for rural landowners and tax revenues for local communities in wind development areas.
- **American workers:** Generates well-paying jobs in sectors that support wind development, such as manufacturing, engineering, construction, transportation, and financial services. The new manufacturing will cause significant growth in the wind industry supply chain.
- **Water savings:** Reduce cumulative water use in the electric sector by 8% (4 trillion gallons)

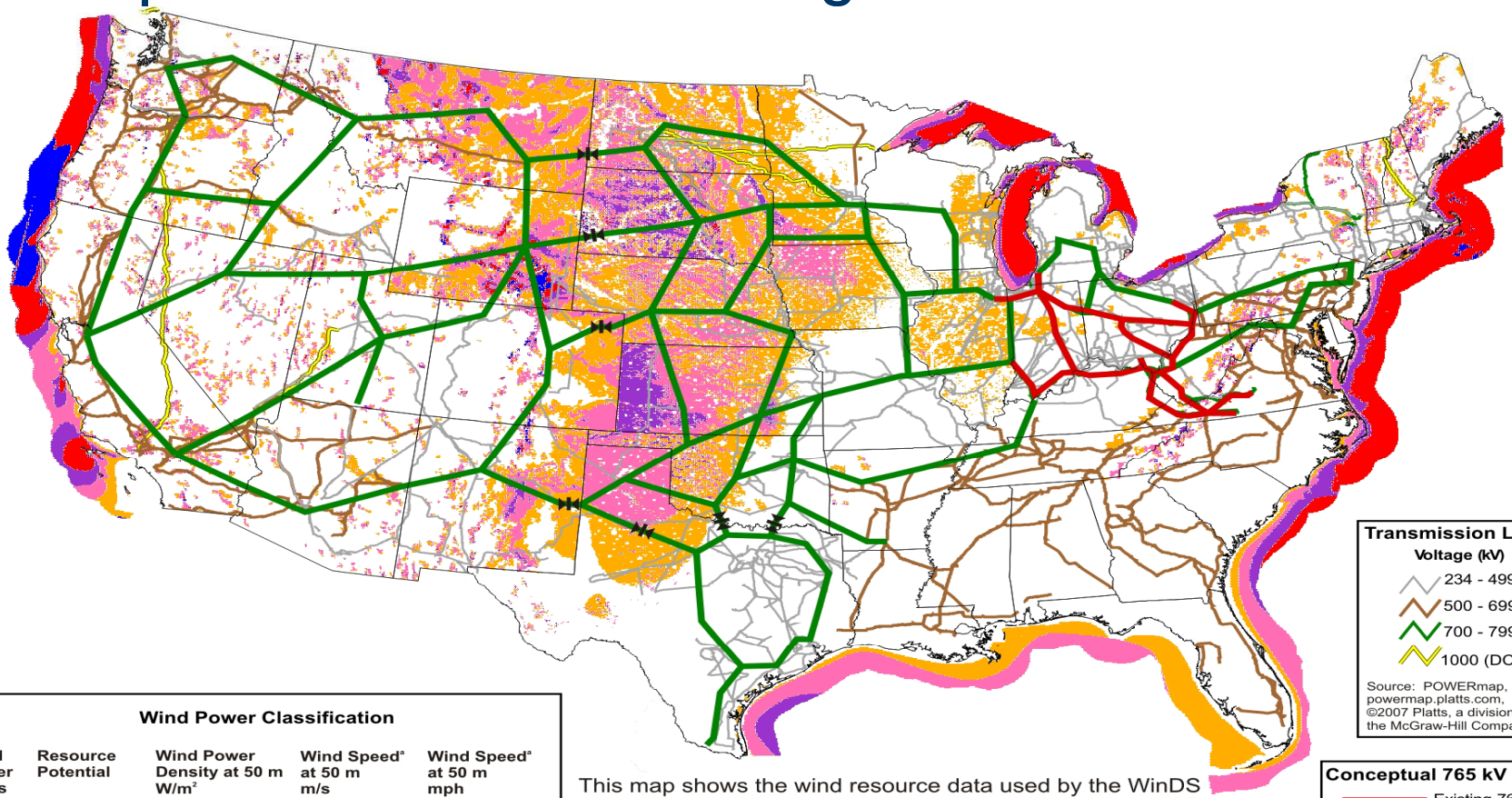
20% Wind Scenario: Major Challenges

- Investment in the nation's transmission system so the power generated is delivered to urban centers that need the increased supply;
- Larger electric load balancing areas, in tandem with better regional planning, so that regions can depend on a diversity of generation sources, including wind power;
- Continued reduction in wind capital cost and improvement in turbine performance through technology advancement and improved manufacturing capabilities; and
- Addressing potential concerns about local siting, wildlife, and environmental issues within the context of generating electricity.

Today's balkanized grid limits renewables



Transmission Superhighways and Regional Grid Operation Needed for High Wind Penetration



Wind Power Classification

Wind Power Class	Resource Potential	Wind Power Density at 50 m W/m²	Wind Speed[a] at 50 m m/s	Wind Speed[a] 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

[a] Wind speeds are based on a Weibull k value of 2.0

Transmission Lines
Voltage (kV)
- 234 - 499
- 500 - 699
- 700 - 799
- 1000 (DC)

Source: POWERmap, powermap.platts.com, ©2007 Platts, a division of the McGraw-Hill Companies

Conceptual 765 kV Network
- Existing 765 kV
- New 765 kV
- AC-DC-AC Link

Source: American Electric Power (AEP)

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.