Wind Energy:
A Great Lakes Opportunity
(and challenge)

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National Renewable Energy Laboratory

Buffalo, NY – May 6, 2008

Questions?

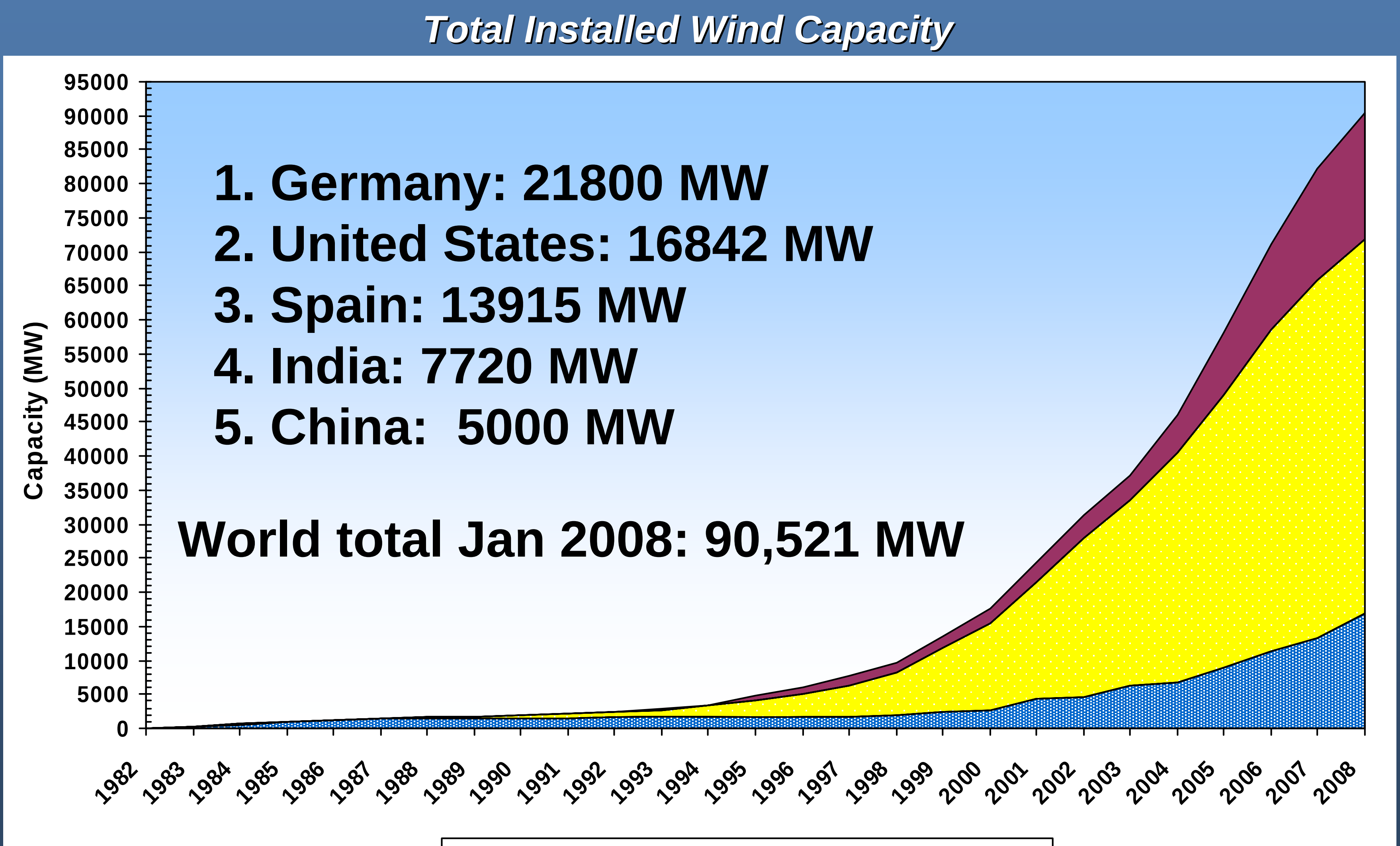
"With public sentiment nothing can fail; without it, nothing can succeed."

- Abraham Lincoln

"WPA is one of the DOE/NREL capabilities that has been most valued by the industry and that has worked hard and effectively to partner with AWEA on outreach to significant audiences."

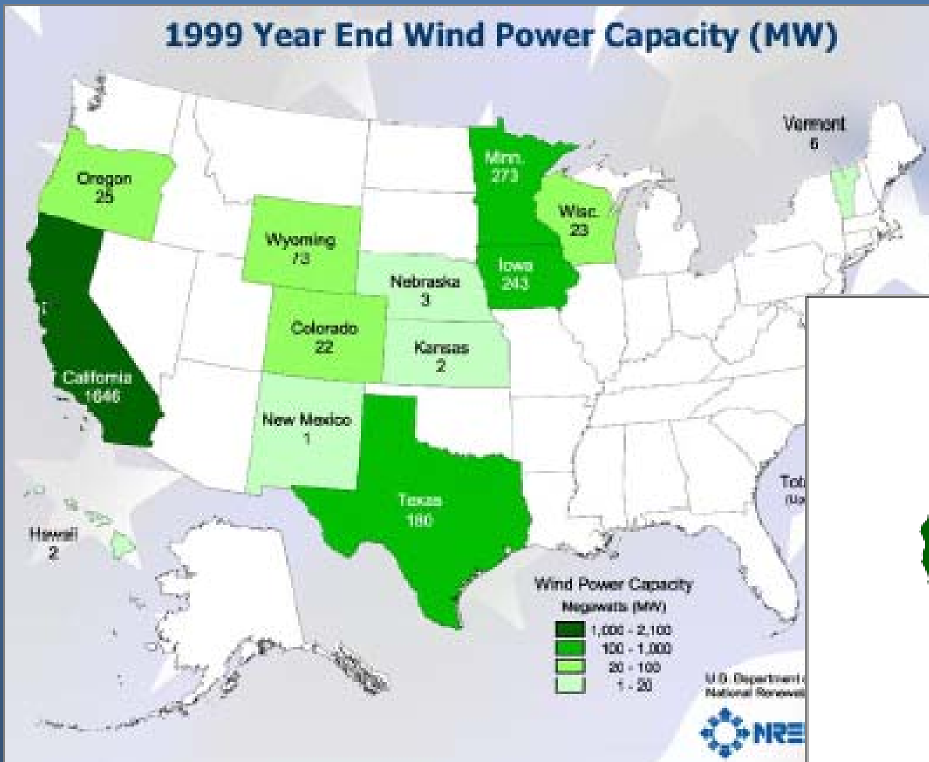
Randy Swisher, AWEA Executive Director

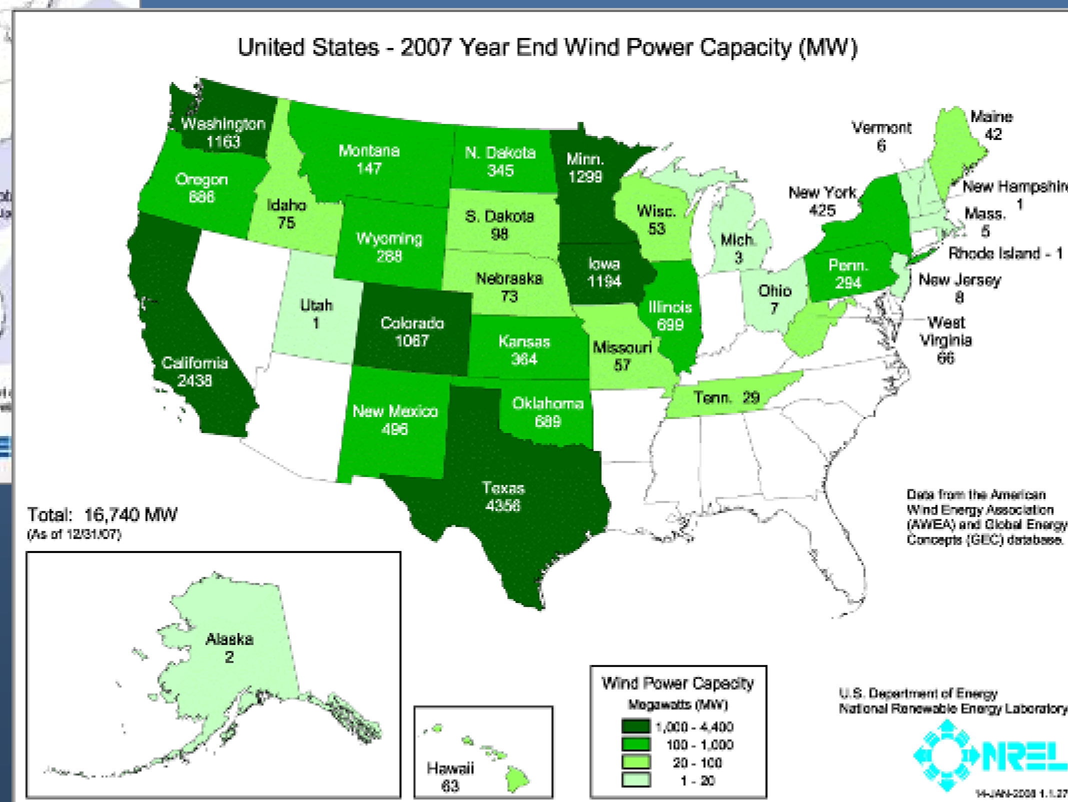
People Want Renewable Energy!



Source: WindPower Monthly

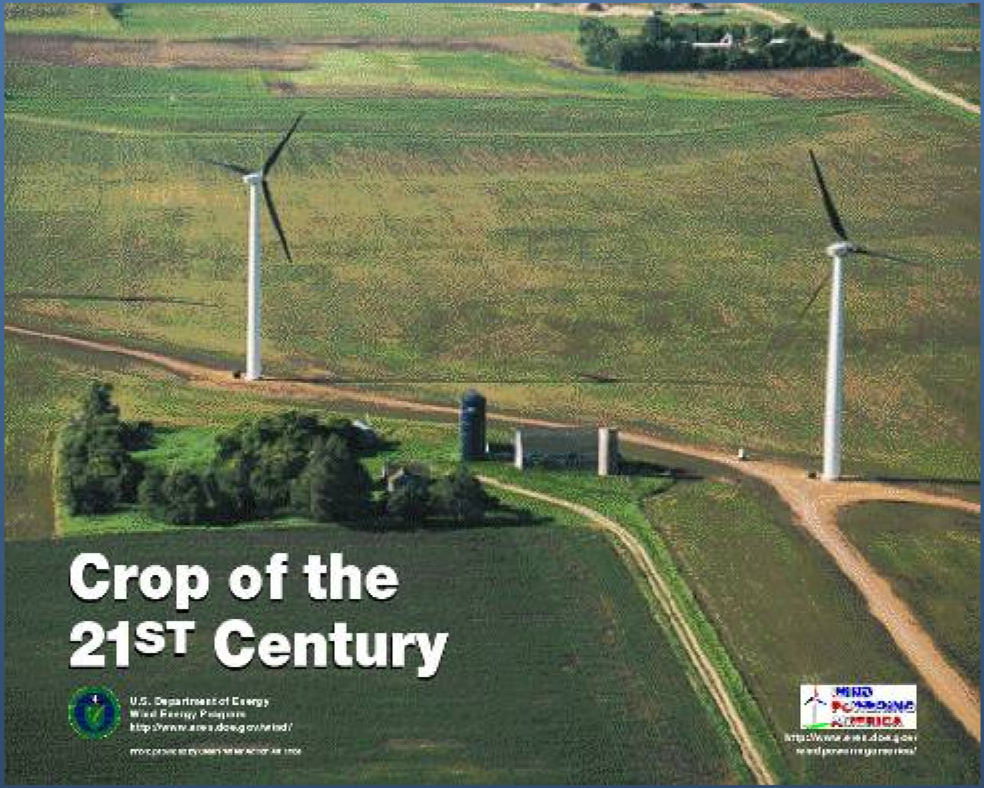
Installed Wind Capacities ('99 – Aug 07)



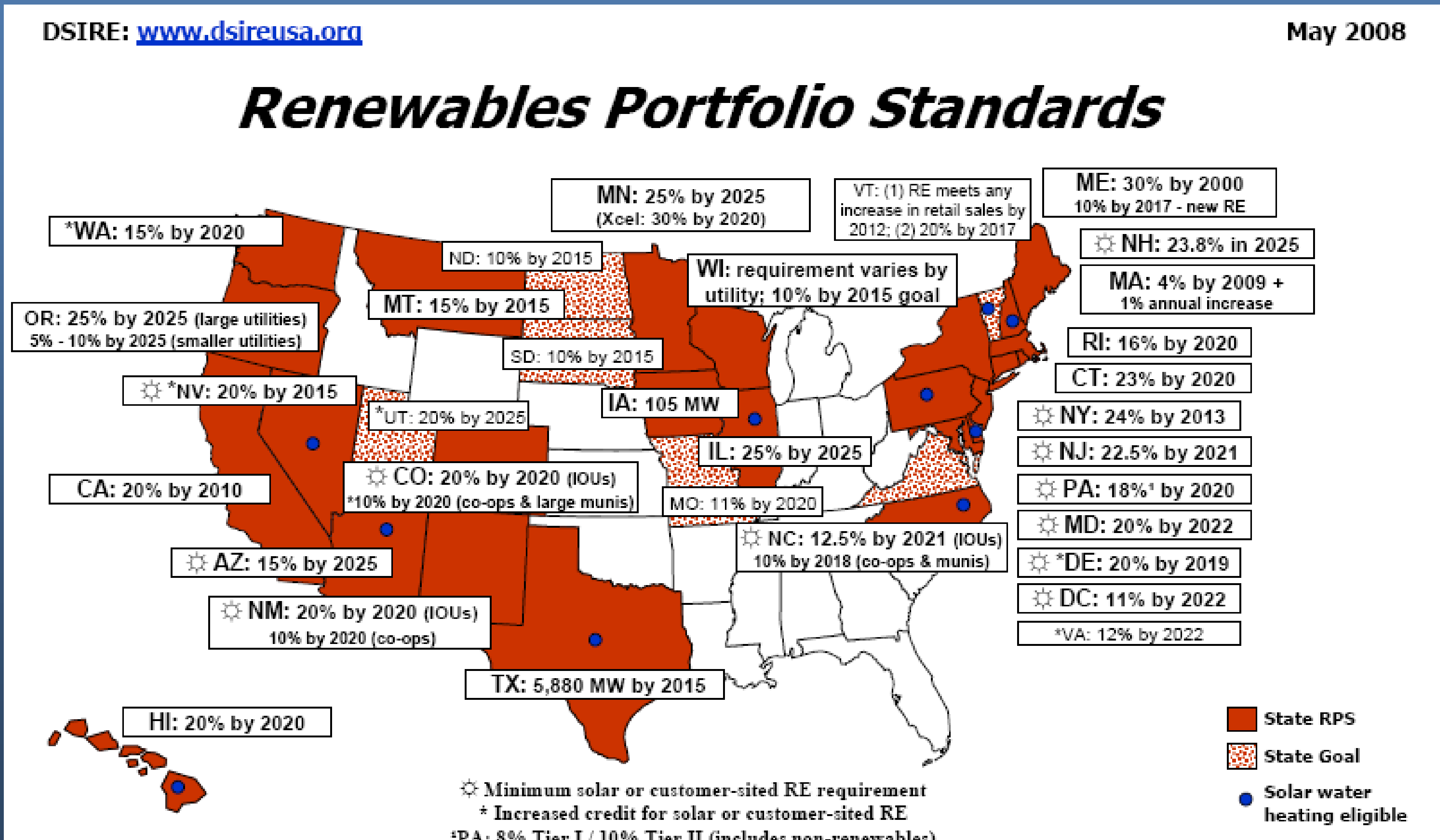


Drivers for Wind Power

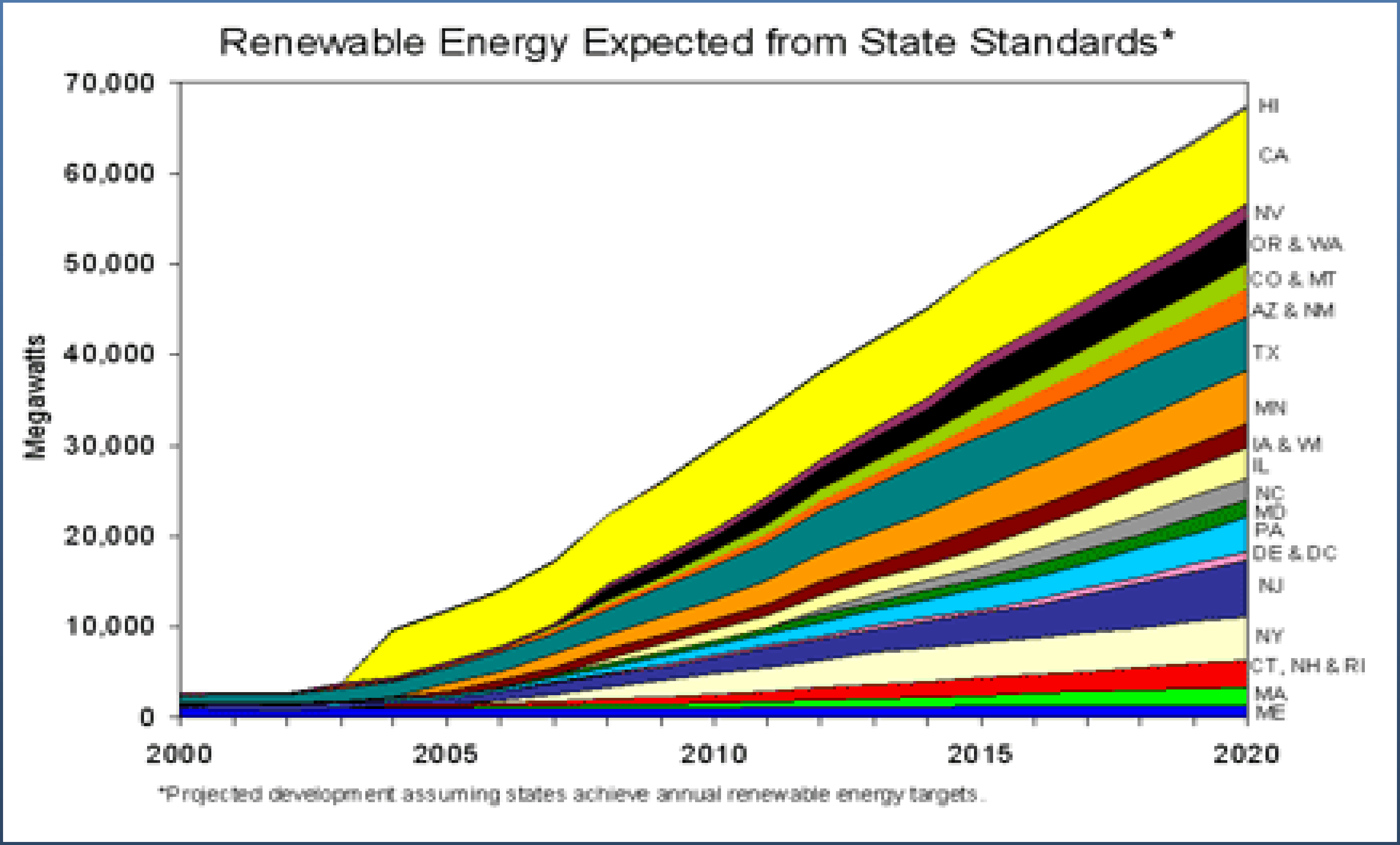
- Declining Wind Costs
- Fuel Price Uncertainty
- Federal and State Policies
- Economic Development
- Public Support
- Green Power
- Energy Security
- Carbon Risk



Renewables Portfolio Standards

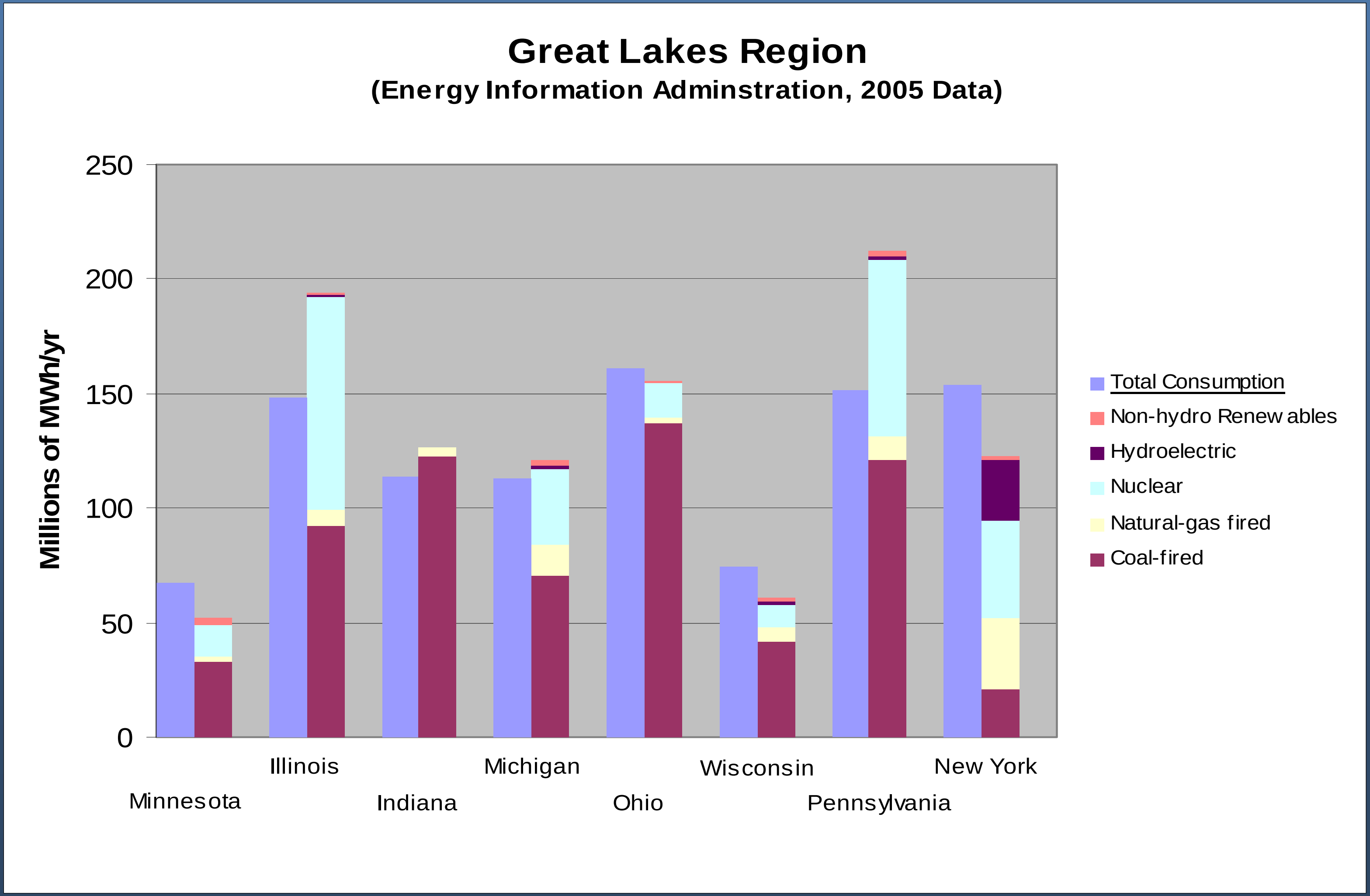


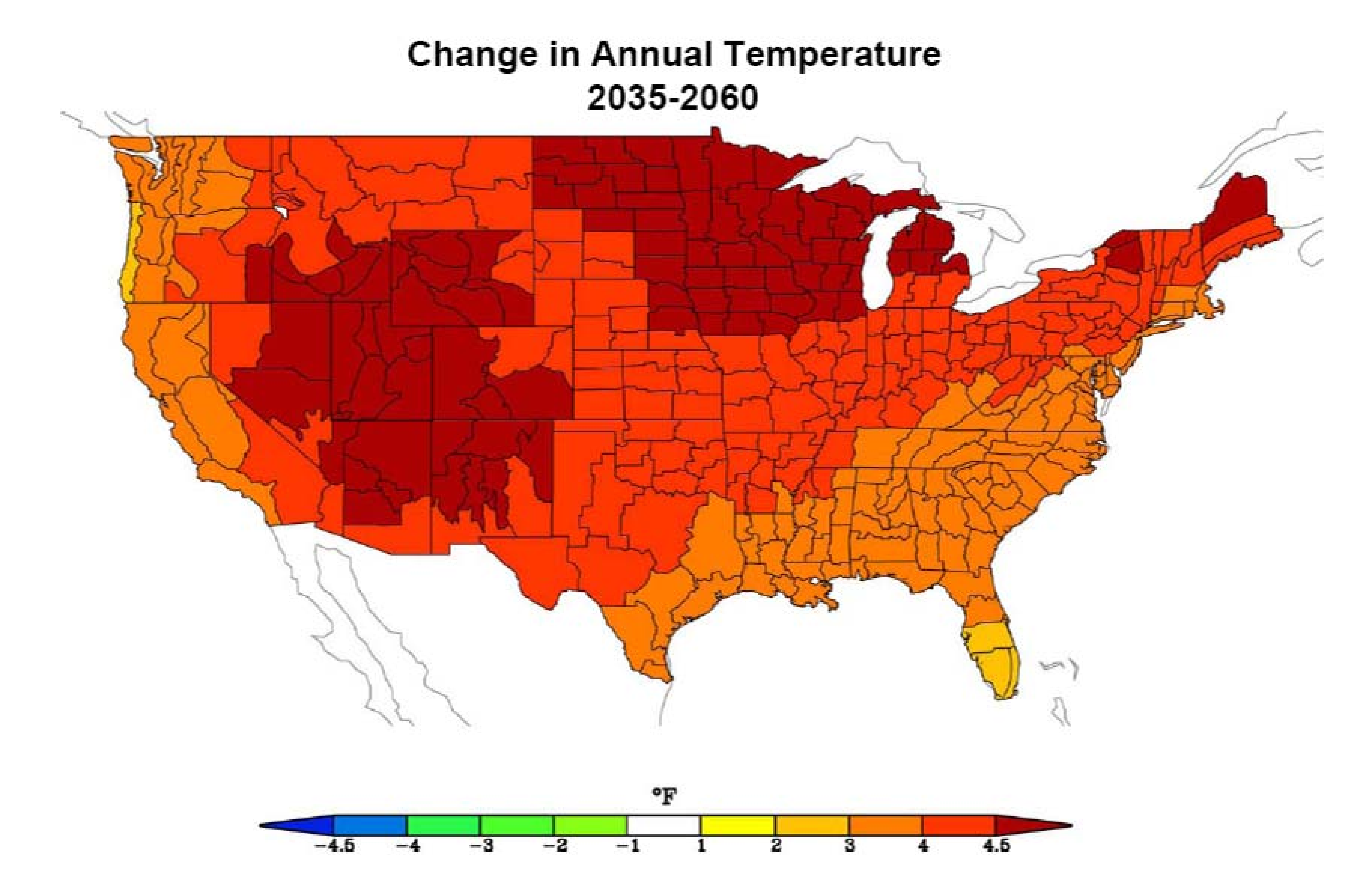
RE Expected from State Standards



Source: UCS

Generation And Consumption by State and Fuel Source



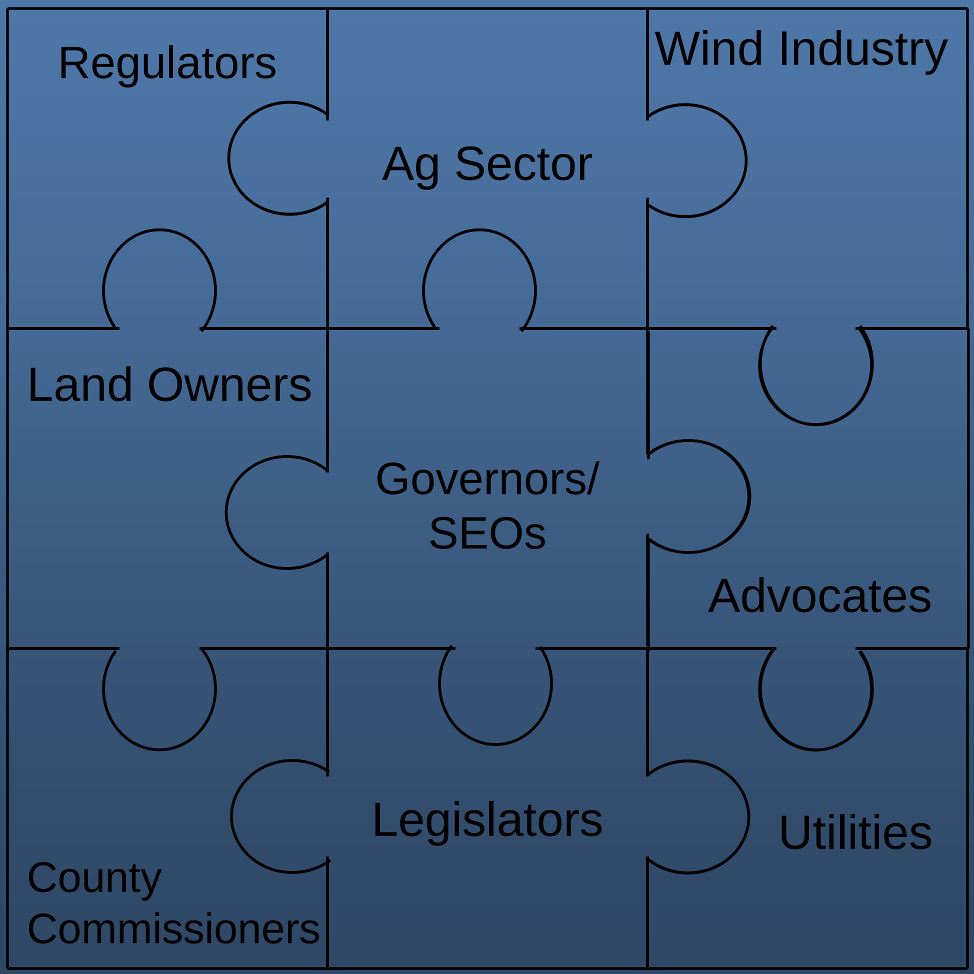


Source: NOAA

Environmental Benefits

- No SOx or NOx
- No particulates
- No mercury
- No CO_2
- No water

Wind Stakeholders



Key Issues for Wind Power

- Policy Uncertainty
- Siting and Permitting: avian/wildlife, noise, visual, water, land use, radar
- Transmission: FERC rules, access, new lines
- Operational impacts: intermittency, ancillary services, allocation of costs
- Accounting for non-monetary value: green power, no fuel price risk, reduced emissions

Siting and Wildlife Interactions

Objective of the Research:

*20% wind energy by 2030 will require **understanding, minimizing, and mitigating environmental impacts to wildlife**.*

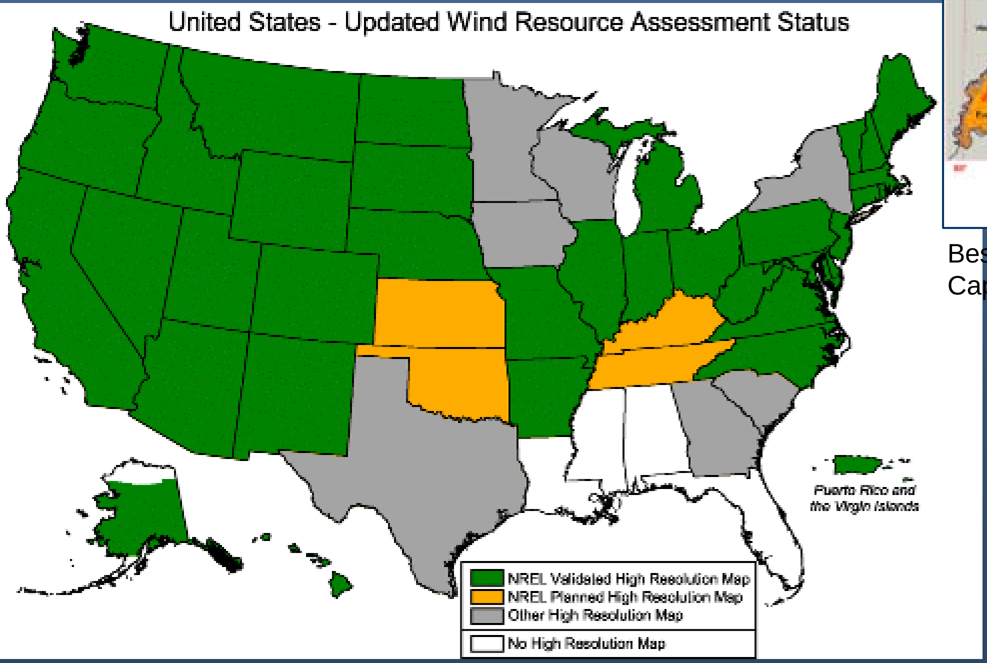
- Scientifically quantify the impacts to species
- Determine acceptable levels of losses
- Identify possible changes in operating paradigms
- Minimize barriers to development:
  - Siting Guidelines
  - Regulatory Approval
  - Consistent & Standard Rules

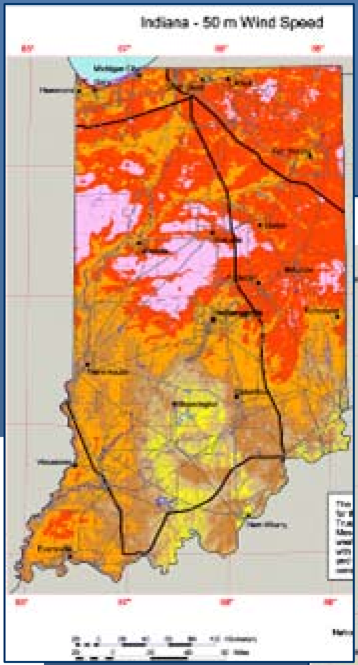
Major FY2008 Wildlife Activities:

- Federal Advisory Committee Participant
- Supporting NWCC Wildlife Workgroup R&D
- Sponsor Grassland/Shrub Steppe Species R&D Collaborative (G3SC)
- Sponsor the Bats and Wind Energy R&D Cooperative (BWEC)
- USGS avian and bat migratory flyways study

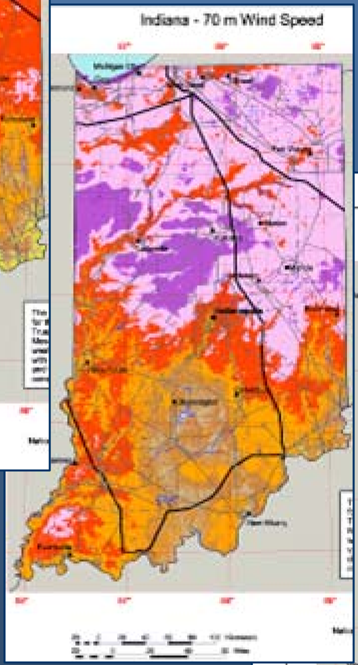
Wind Mapping Activities

80-m to 100-m validated wind maps (Great Lakes and Great Plains emphasis)

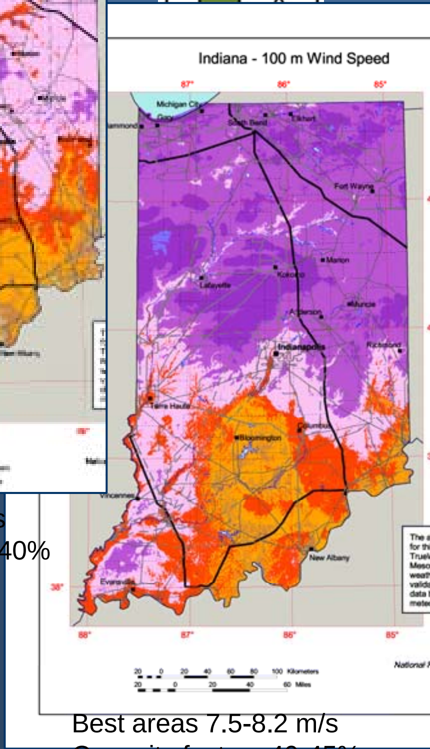




Best areas 6.5-7 m/s
Capacity factors 30-35%



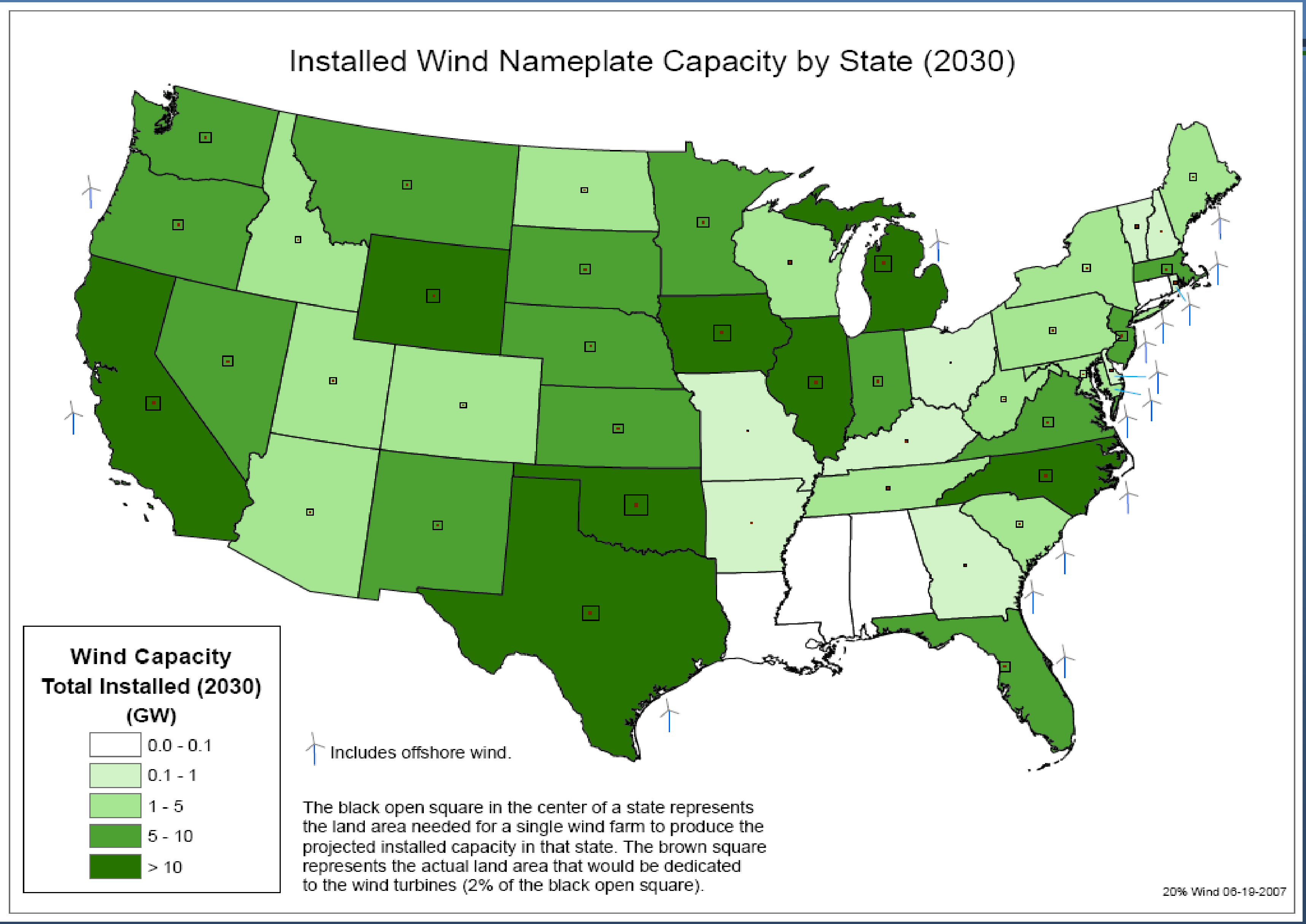
Best areas 7-7.5 m/s
Capacity factors 35-40%



Best areas 7.5-8.2 m/s
Capacity factors 40-45%

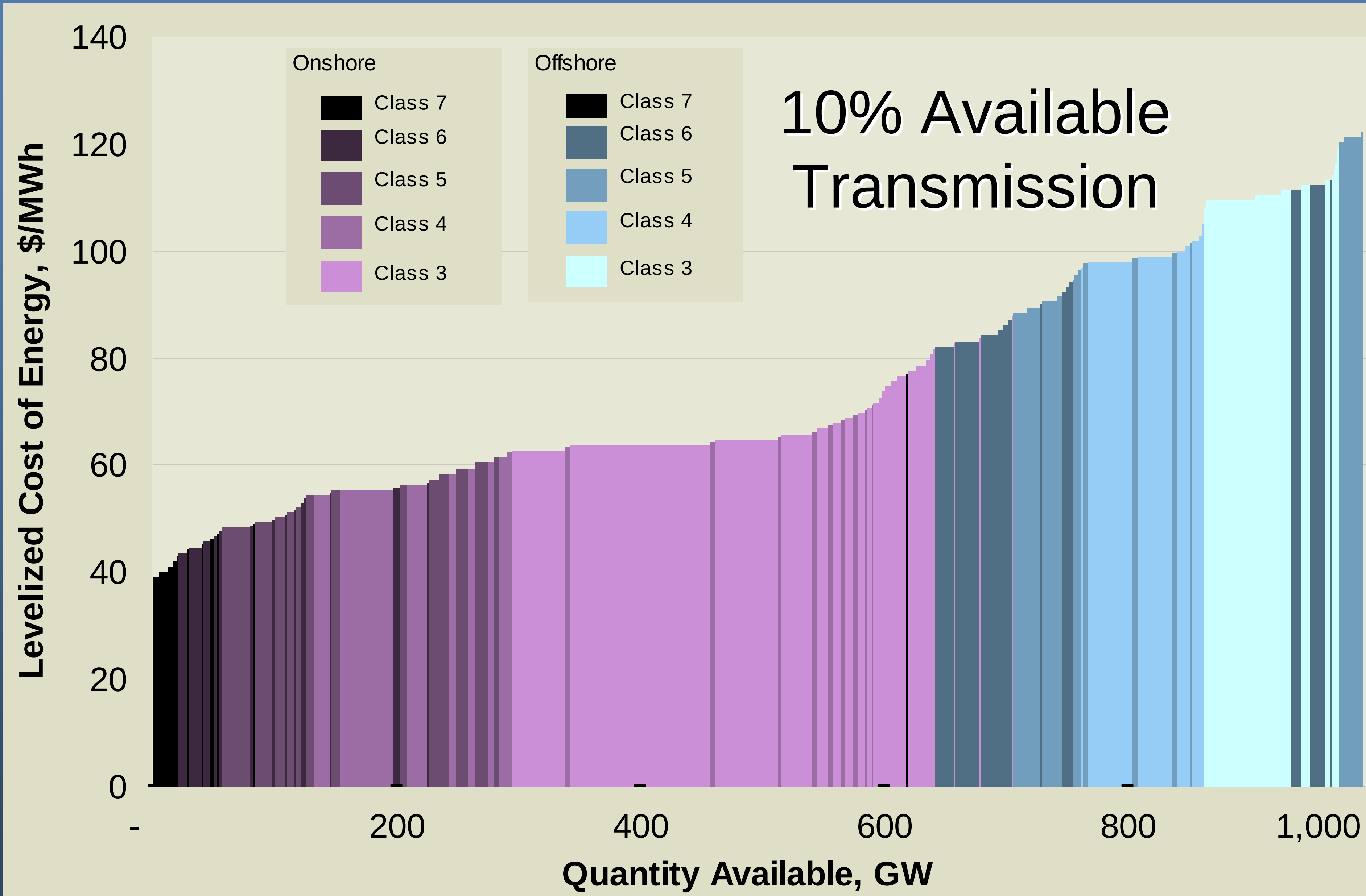
“The future ain’t what it used to be.”

- Yogi Berra


Installed Wind Nameplate Capacity by State (2030)
Wind Capacity
Total Installed (2030)
(GW)
0.0 - 0.1
0.1 - 1
1 - 5
5 - 10
> 10
Includes offshore wind.
The black open square in the center of a state represents the land area needed for a single wind farm to produce the projected installed capacity in that state. The brown square represents the actual land area that would be dedicated to the wind turbines (2% of the black open square).
20% Wind 06-19-2007

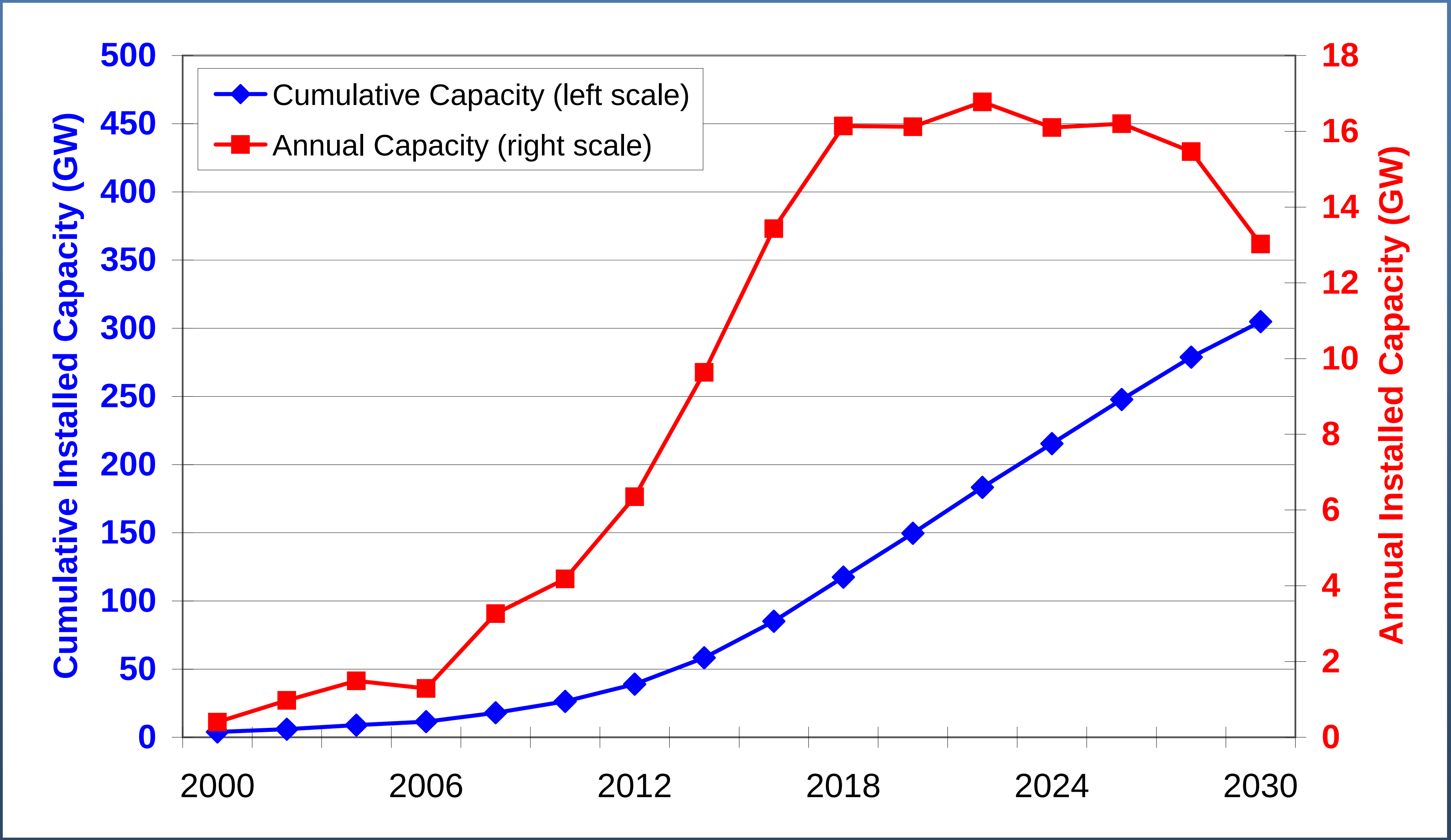
Market Challenges

- National and state policy uncertainty
- Mixed stakeholder perspectives and knowledge
- Electricity supply planning based on capacity
- Variable wind output viewed as unreliable
- Incomplete comparative generation assessments
- Mismatch of wind and transmission development timeframes
- Federal lending all source requirements for G&T’s
- Lack of interstate approach to transmission development
- Lack of utility financial incentives to own wind facilities
- High cost and low turbine availability for community projects
- High cost and permitting challenges of <1 MW turbines
- Uncertainty in emerging emissions REC markets



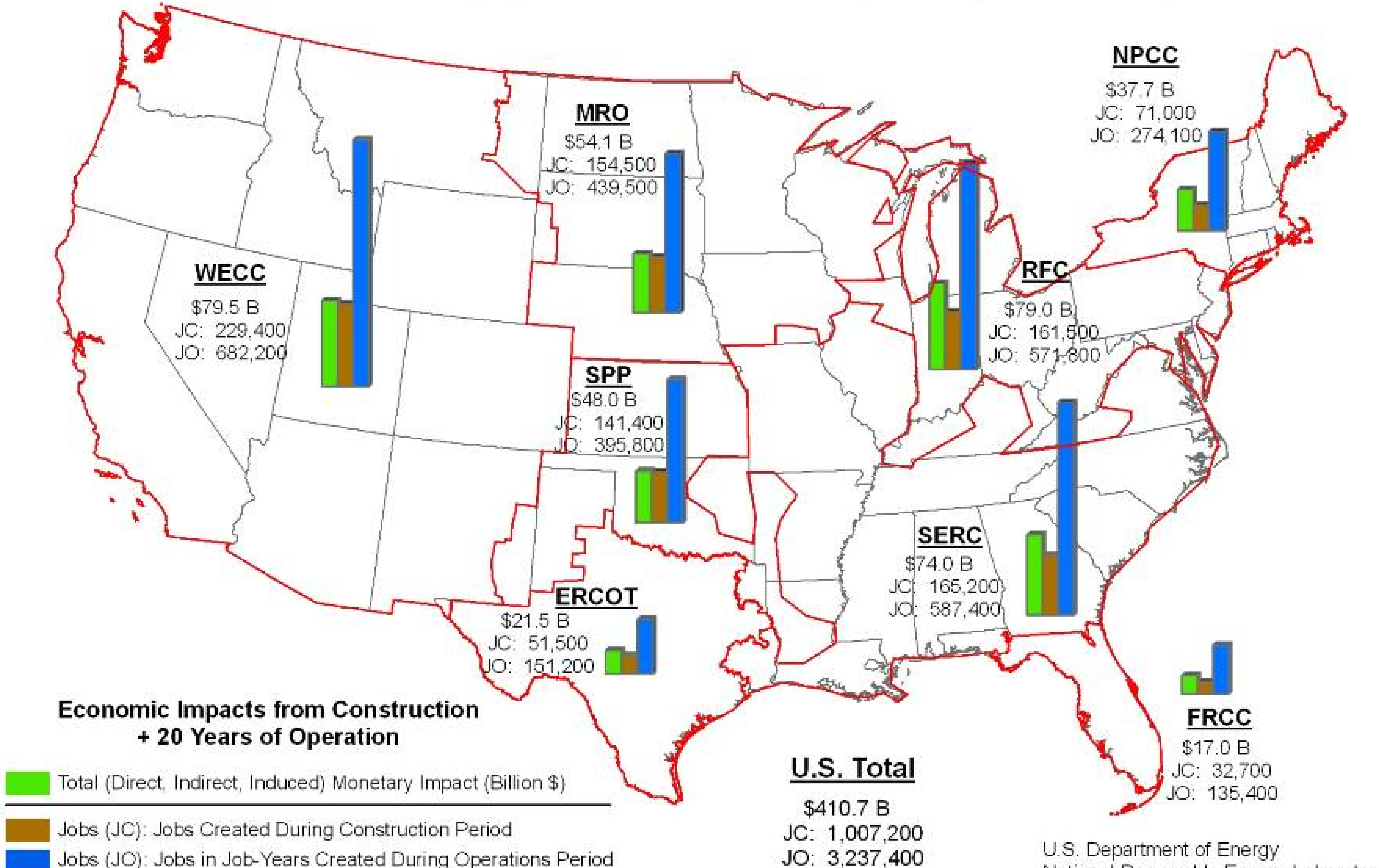
2010 Costs w/ PTC, $1,600/MW-mile, w/o Integration costs

What does 20% Wind look like?



Source: AWEA 20% Vision

20% Wind Electricity by 2030 - Economic Impacts by NERC Region



Wind Vision case = 304 GW of wind capacity.
All job values rounded to the nearest 100.

U.S. Department of Energy
National Renewable Energy Laboratory

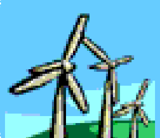
Wind_Vision_06-19-2007 - DRAFT

Great Lakes Region – Economic Impacts (Onshore and Offshore)

From the 20% Vision
(61.5 GW new development)

Wind energy's economic "ripple effect"

Direct Impacts



Payments to Landowners:
- $156 Million/year

Local Property Tax Revenue:
- $640 Million/year

Construction Phase:
- 91.3 thousand new jobs
- $12.0 Billion to local economies

Operational Phase:
- 14.9 thousand new long-term jobs
- $1.4 Billion/yr to local economies

Indirect Impacts

Construction Phase:
- 36.1 thousand new jobs
- $3.6 Billion to local economies

Operational Phase:
- 3.7 thousand local jobs
- $420 Million/yr to local economies

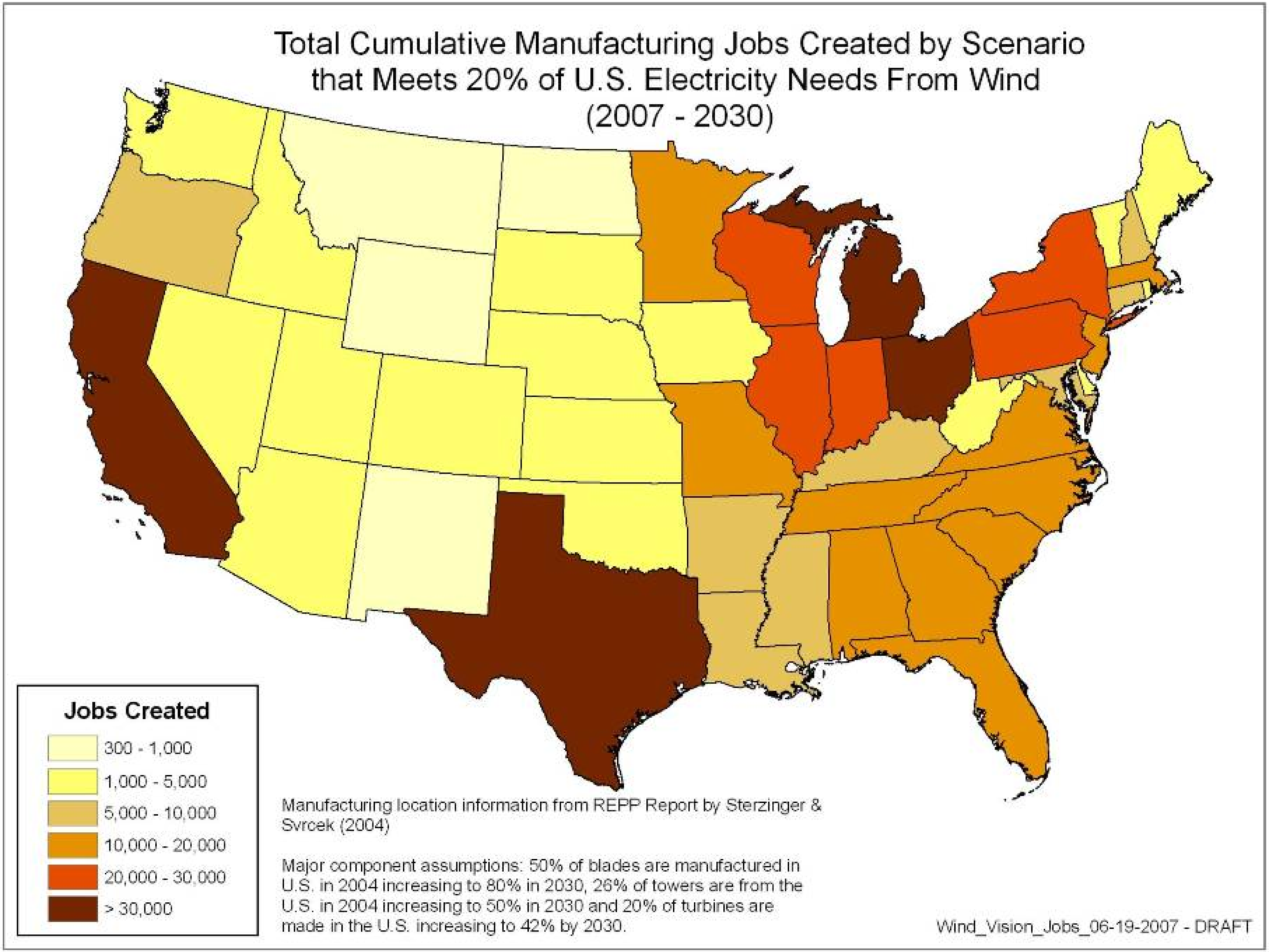
Induced Impacts

Construction Phase:
- 55.2 thousand new jobs
- $5.7 Billion to local economies

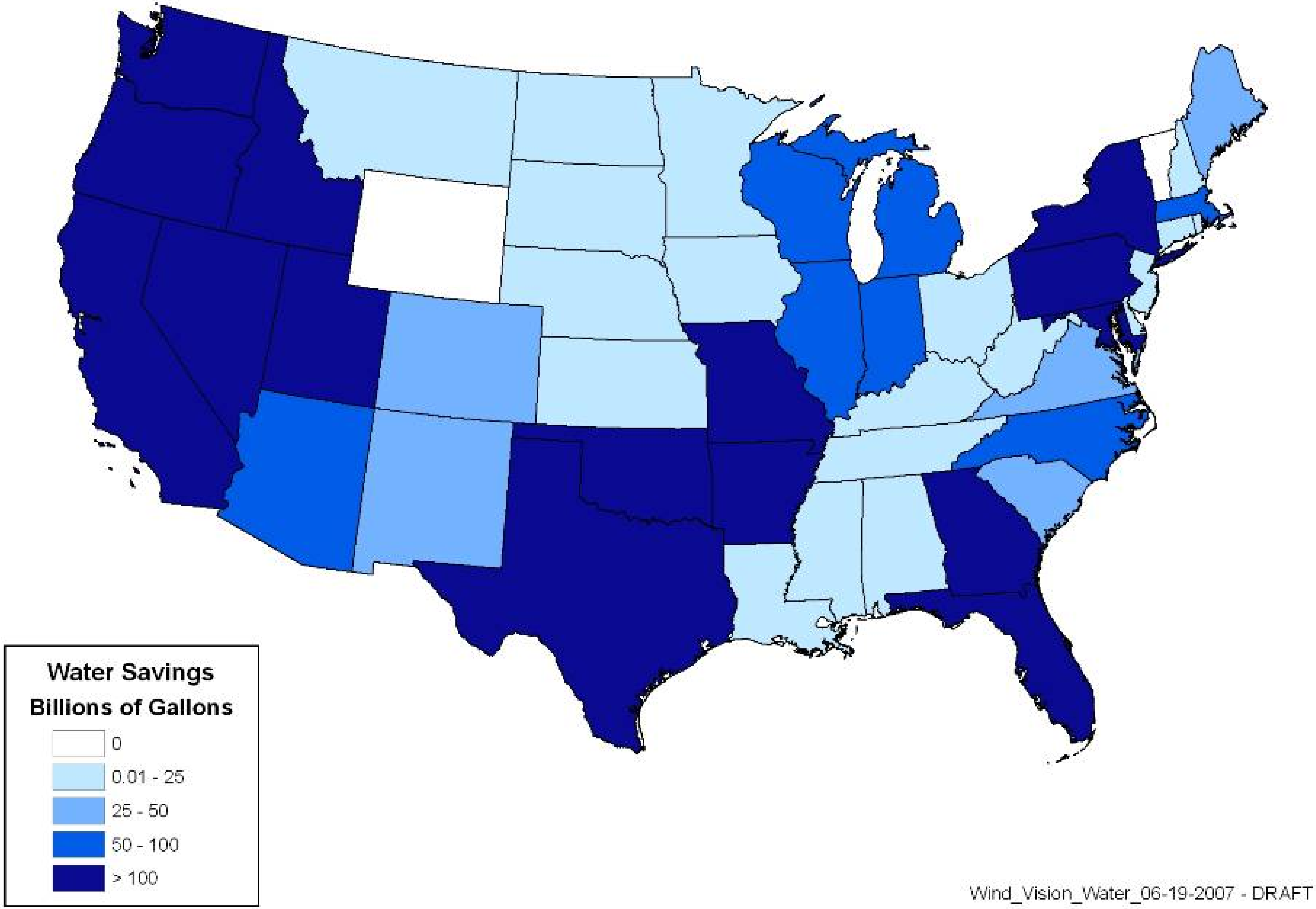
Operational Phase:
- 10.5 thousand local jobs
- $1.1 Billion/yr to local economies

Totals (construction + 20 yrs)
Total economic benefit = $79 Billion
New local jobs during construction = 182,600
New local long-term jobs = 29,100

Construction Phase = 1-2 years
Operational Phase = 20+ years


Total Cumulative Manufacturing Jobs Created by Scenario
that Meets 20% of U.S. Electricity Needs From Wind
(2007 - 2030)
Jobs Created
300 - 1,000
1,000 - 5,000
5,000 - 10,000
10,000 - 20,000
20,000 - 30,000
> 30,000
Manufacturing location information from REPP Report by Sterzinger & Svrcek (2004)
Major component assumptions: 50% of blades are manufactured in U.S. in 2004 increasing to 80% in 2030, 26% of towers are from the U.S. in 2004 increasing to 50% in 2030 and 20% of turbines are made in the U.S. increasing to 42% by 2030.
Wind_Vision_Jobs_06-19-2007 - DRAFT

Cumulative Water Savings Due to Deployment of Wind Energy (2008 - 2030)



Conclusions

- 20% wind energy penetration is possible
- 20% penetration is not going to happen under business as usual scenario
- Policy choices will have a large impact on assessing the timing and rate of achieving a 20% goal
- Key Issues: market transformation, transmission, project diversity, technology development, policy, public acceptance
- 20% Vision action plan: May 2008

Source: AWEA 20% Vision

Stakeholders

"With public sentiment nothing can fail; without it, nothing can succeed."

- Abraham Lincoln

Carpe Ventem

www.windpoweringamerica.gov