# Wind Energy Update

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National Renewable Energy Laboratory

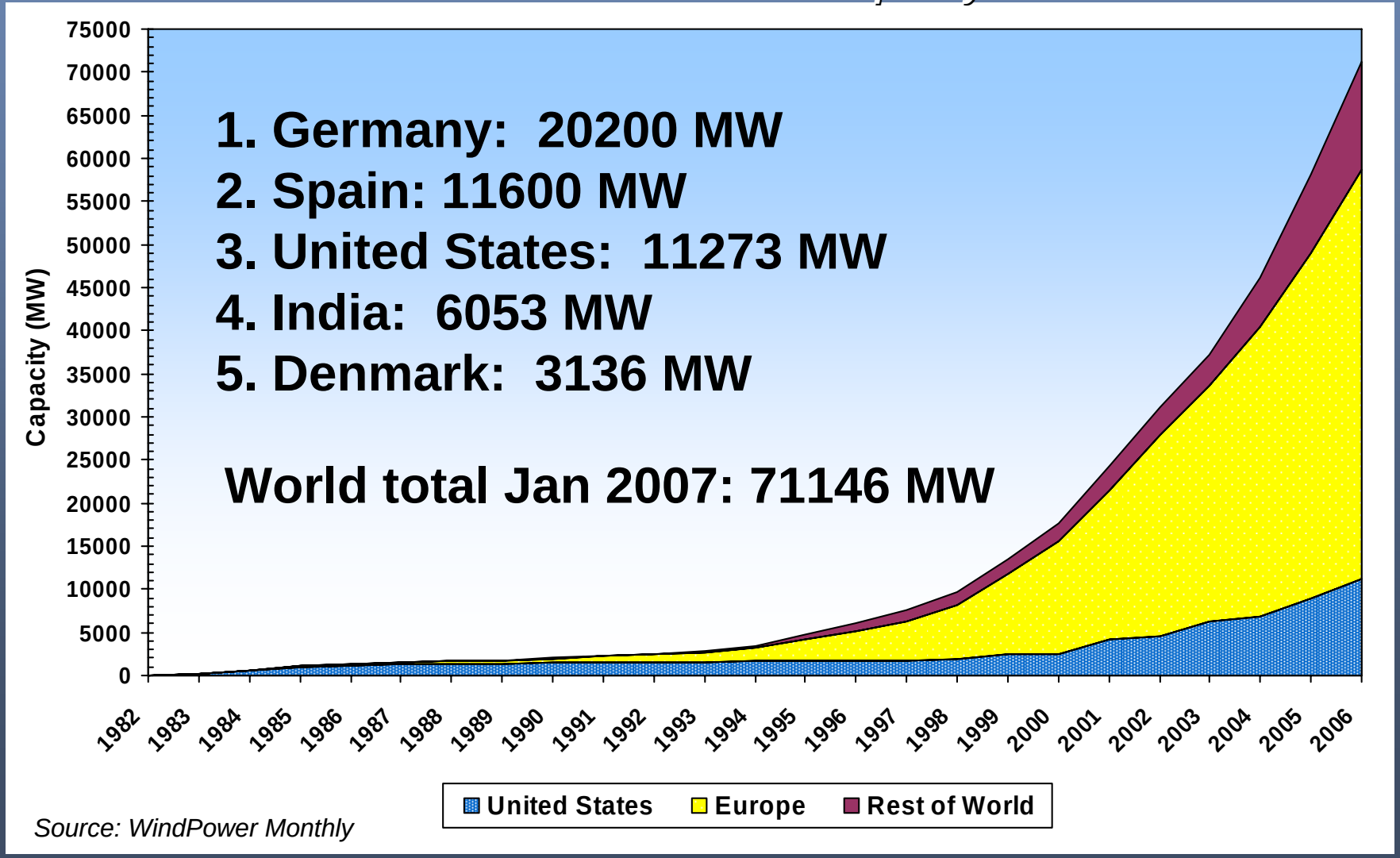

March 21, 2007

25 x ’25 Spring Meeting

Washington, DC

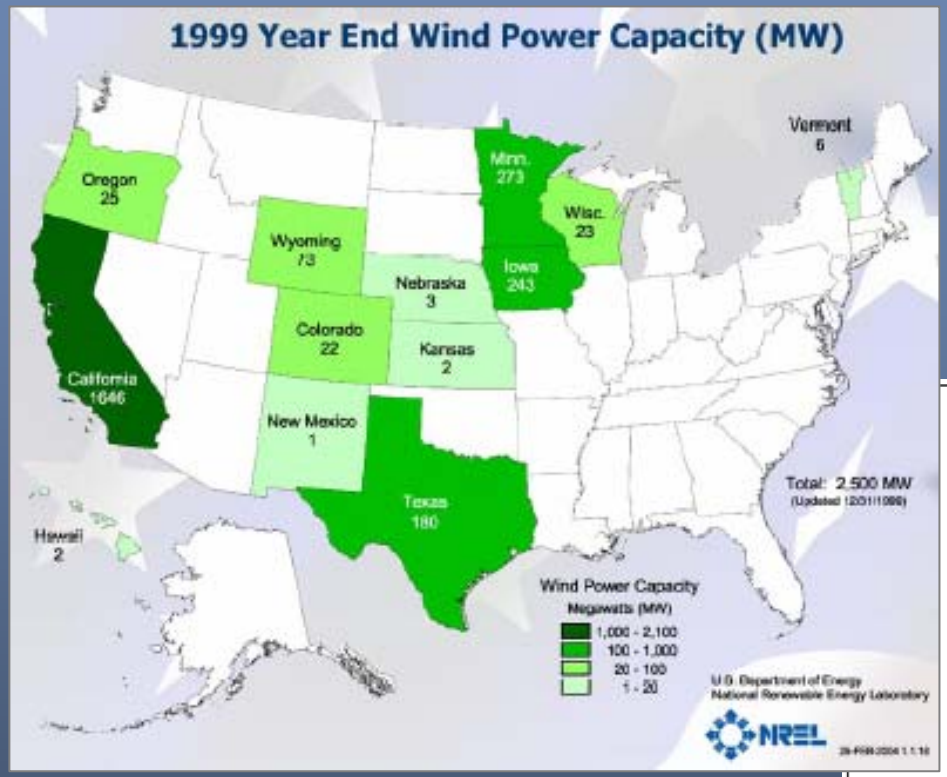
# People Want Renewable Energy!

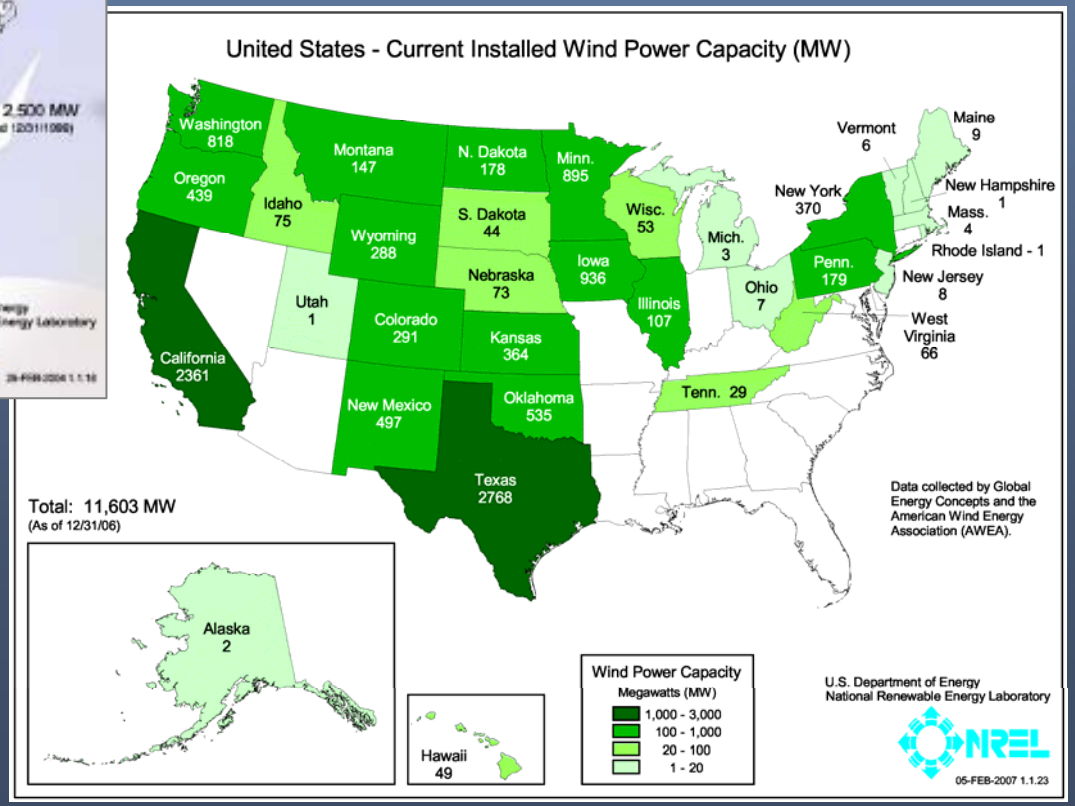
***Total Installed Wind Capacity***



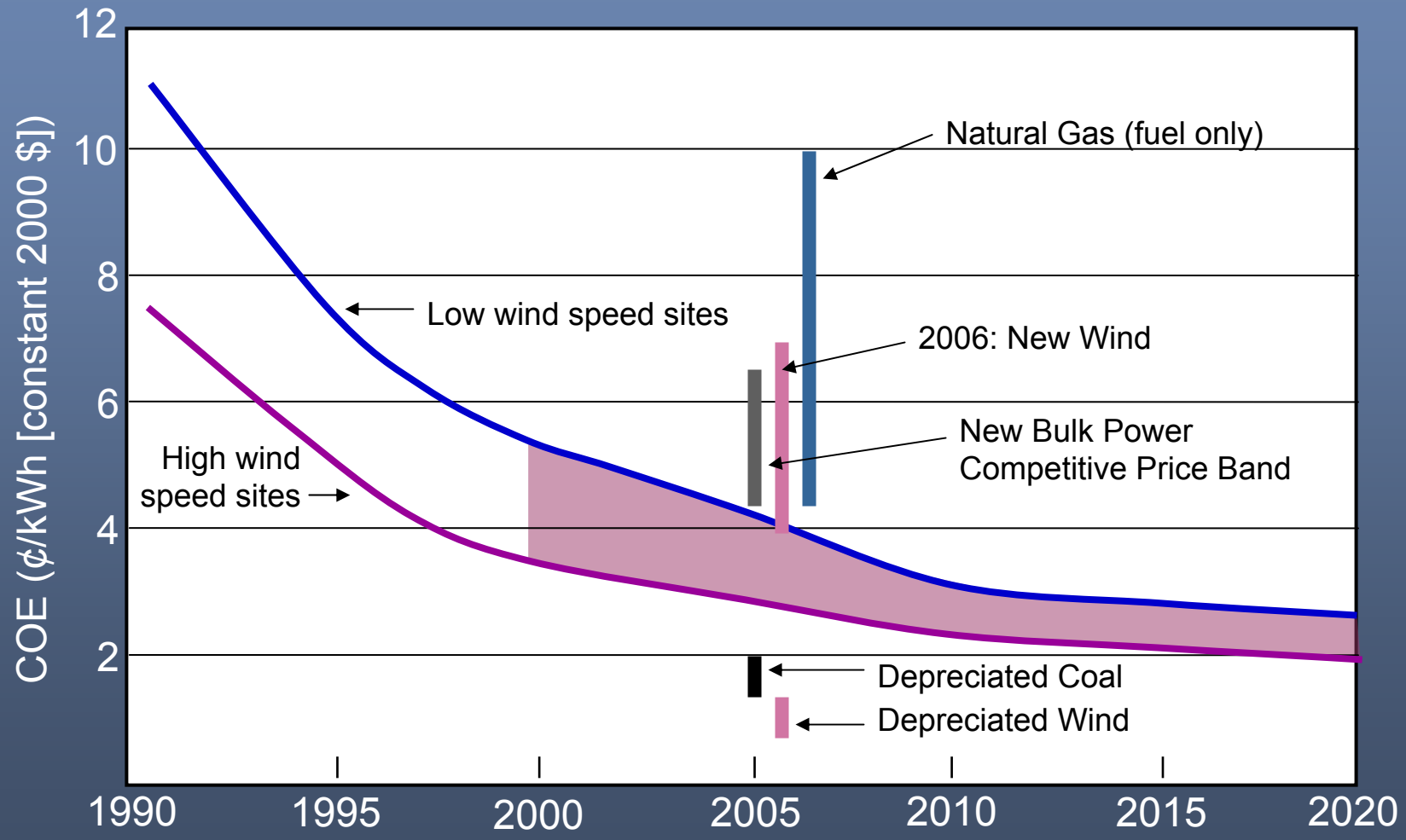

*Source: WindPower Monthly*

# Installed Wind Capacities (99-06)

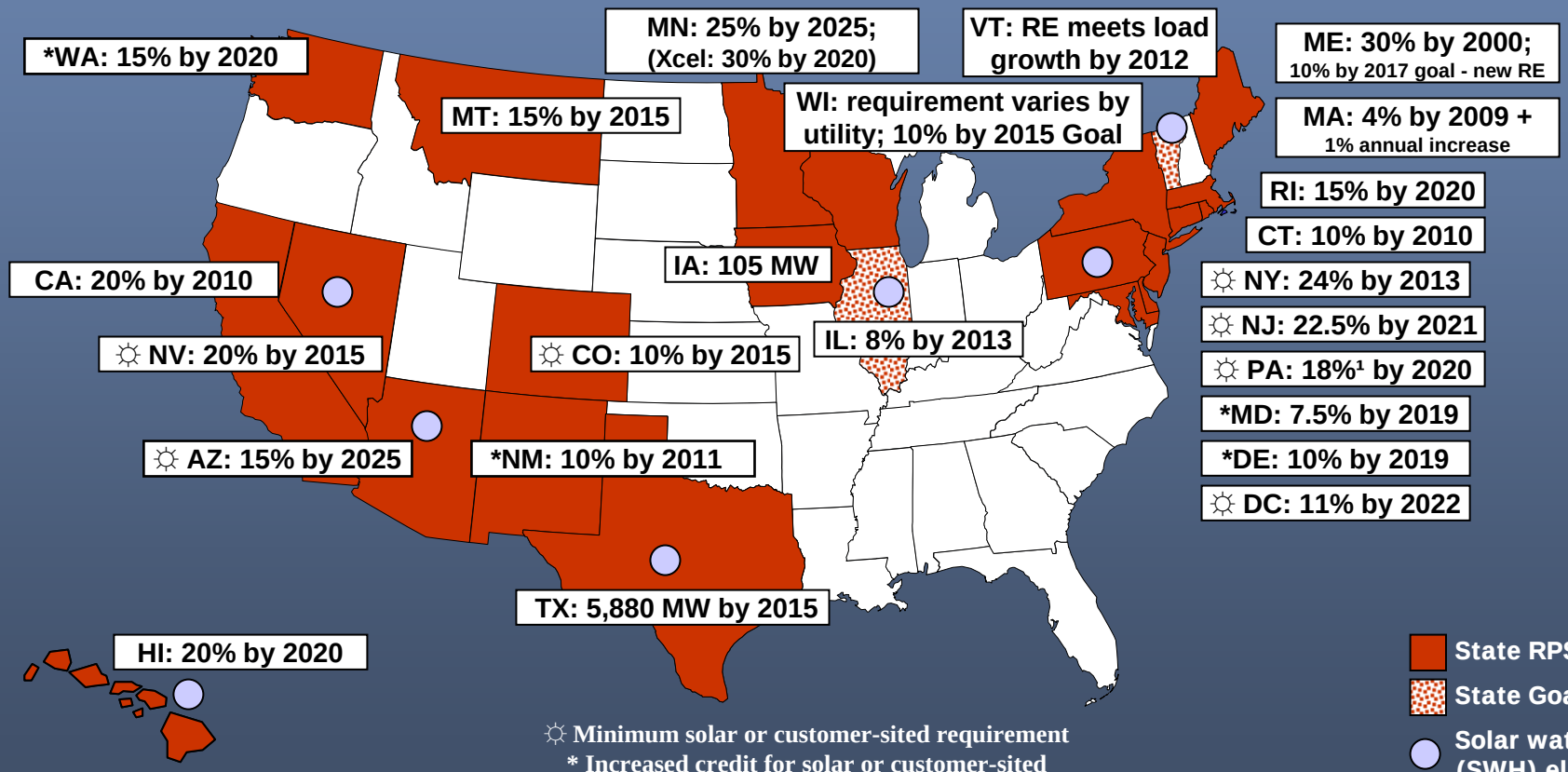


# Wind Cost of Energy



# Renewables Portfolio Standards




☼ Minimum solar or customer-sited requirement
* Increased credit for solar or customer-sited
¹PA: 8% Tier I / 10% Tier II (includes non-renewables); SWH is a Tier II resource

# Wind Energy Investors

SIEMENS

BP Solar

JOHN DEERE

FPL

Vestas

AEP AMERICAN ELECTRIC POWER

Gamesa

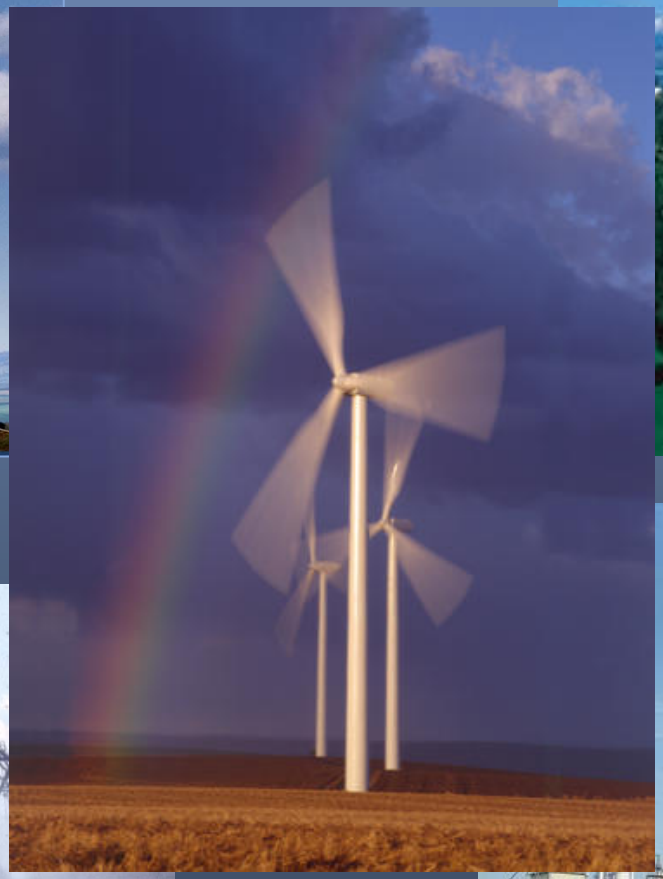
Xcel Energy Windsource®

AES

MIDAMERICAN ENERGY HOLDINGS COMPANY

Goldman Sachs

# Energy-Water Nexus

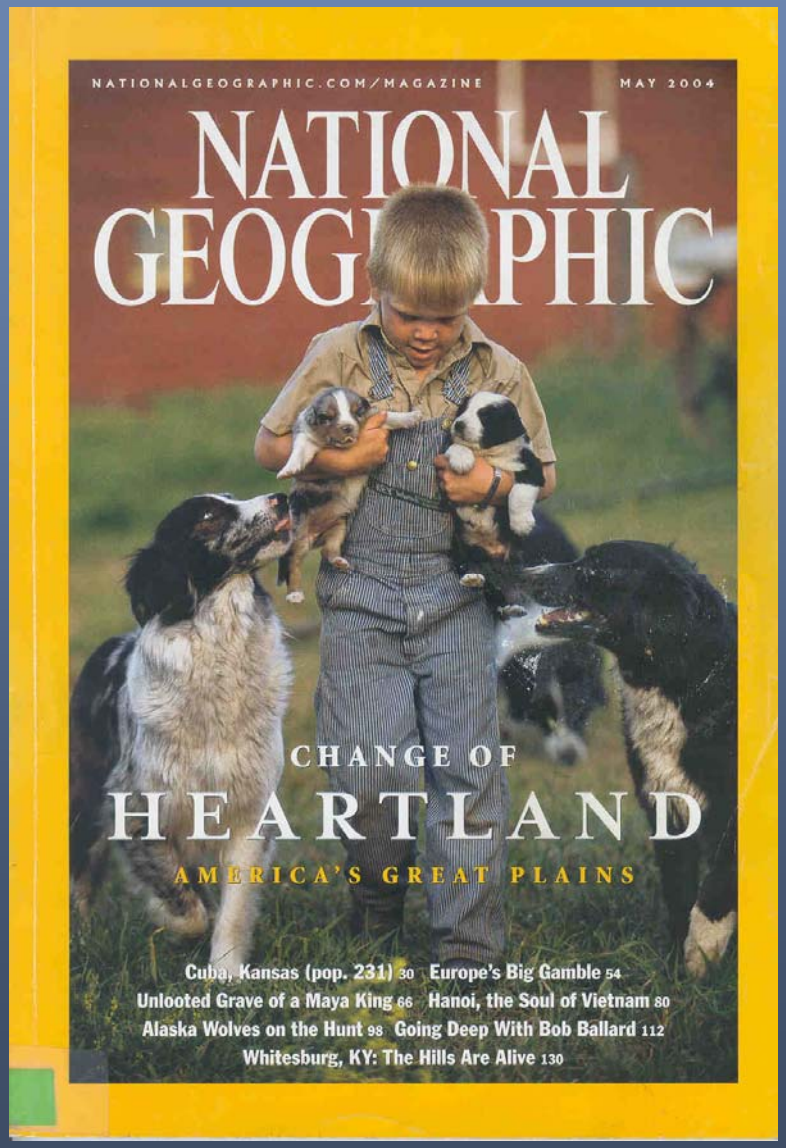


# Local Ownership Models

- Minnesota farmer cooperative (Minwind)
- FLIP structure
- Farmer-owned small wind
- Farmer-owned commercial-scale

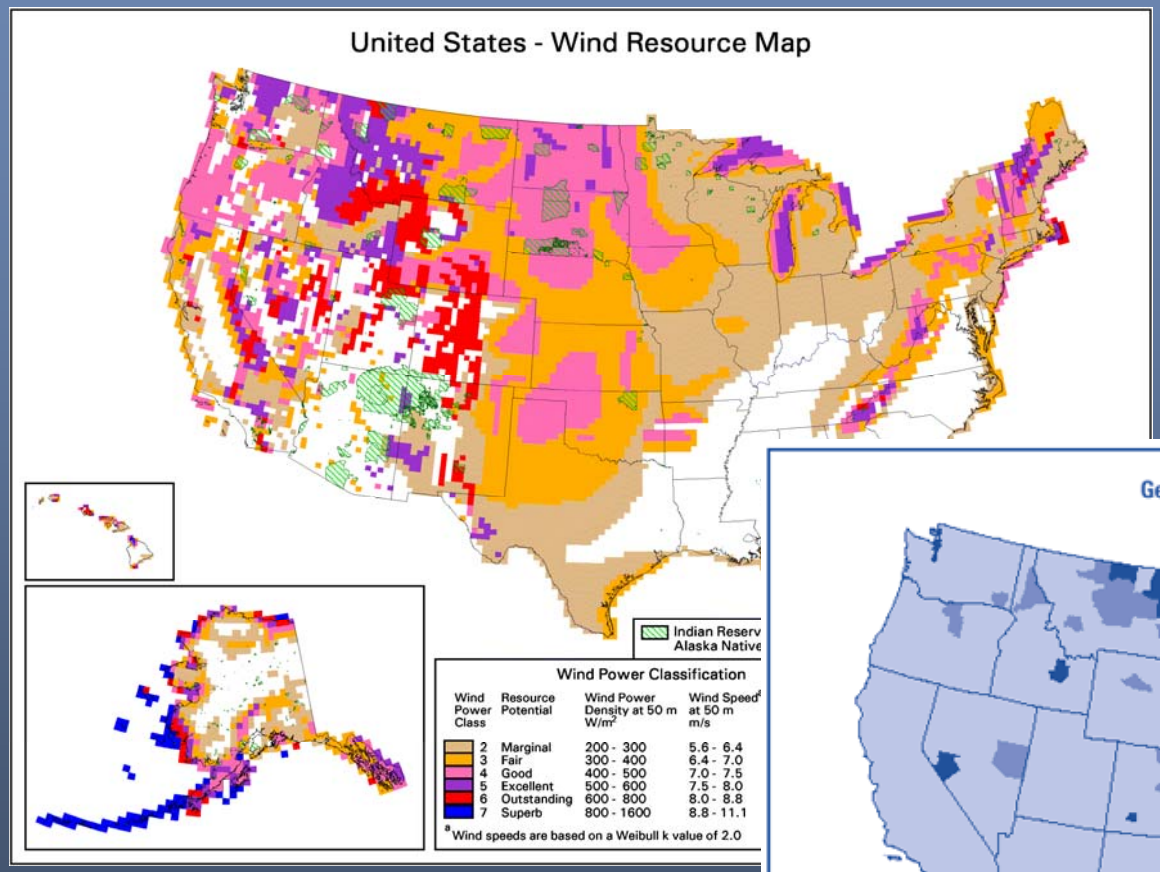
© L. Kennedy

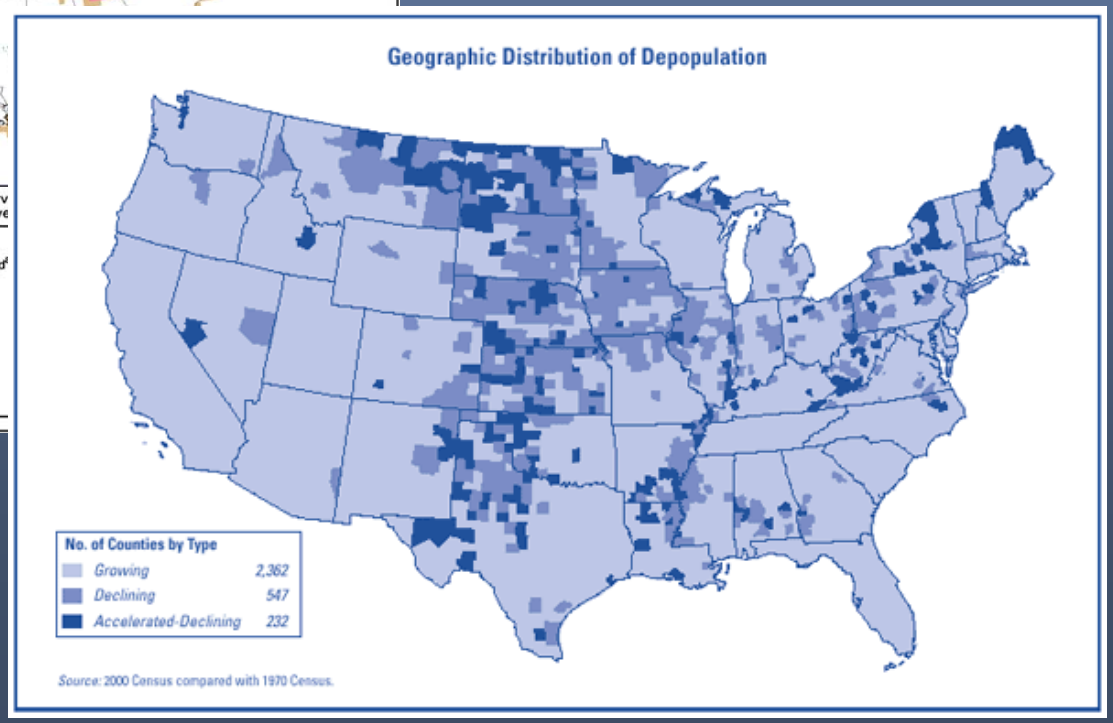
# The Depopulation of the Great Plains




***"When you lose the school," said a retired teacher, "you've lost the town."***

# Windy Rural Areas Need Economic Development



# Economic Development Impacts

- Land Lease Payments: 2-3% of gross revenue $2500-4000/MW/year
- Local property tax revenue: 100 MW generates $500K-$1 million/yr
- 100-200 jobs/100 MW during construction
- 6-10 permanent O&M jobs per 100 MW
- Local industry: concrete, towers, electrical services
- Manufacturing and Assembly plants expanding in U.S. (e.g. IL, CA, ND, PA, IA, MN, CO?)

# Case Study: Texas

Utilities and wind companies invested $1B in 2001 to build 912 MW of new wind power, resulting in:

- **2,500 quality jobs with a payroll of $75M**
- $13.3M in tax revenues for schools and counties
- $2.5M in 2002 royalty income to landowners
- Another 2,900 indirect jobs as a result of the multiplier effect
- $4.6M increase in Pecos County property tax revenue in 2002

# Case Study: Minnesota

**107-MW Minnesota wind project**

- **$500,000/yr in lease payments to farmers**
- $611,000 in property taxes in 2000 = 13% of total county taxes
- 31 long-term local jobs and $909,000 in income from O&M (includes multiplier effect)

# Case Study: Iowa

**240-MW Iowa wind project**

- $640,000/yr in lease payments to farmers ($2,000/turbine/yr)
- $2M/yr in property taxes
- $5.5M/yr in O&M income
- **40 long-term O&M jobs**
- **200 short-term construction jobs**
- Doesn't include multiplier effect

# Case Study: New Mexico

- 204-MW wind project built in 2003 in DeBaca and Quay counties for PNM
- 150 construction jobs
- 12 permanent jobs and $550,000/yr in salaries for operation and maintenance
- $550,000/year in lease payments to landowners
- **$450,000/year in payments in lieu of taxes to county and school districts**
- Over $40M in economic benefits for area over 25 years

Photo: PNM

Source: PNM, New Mexico Wind Energy Center Quick Facts, 2003.

# Case Study: Hyde County, South Dakota

**40-MW wind project in South Dakota creates $400,000 - $450,000/yr for Hyde County, including:**

- More than $100,000/yr in annual lease payments to farmers ($3,000 - $4,000/turbine/yr)
- $250,000/yr in property taxes (25% of Highmore's education budget)
- 75 -100 construction jobs for 6 months
- 5 permanent O&M jobs
- Sales taxes up more than 40%
- Doesn't include multiplier effect

# Case Study: Prowers County, Colorado

- 162-MW Colorado Green Wind Farm (108 turbines)
- $200M+ investment
- 400 construction workers
- 14-20 full-time jobs
- Land lease payments $3000-$6000 per turbine
- **Prowers County 2002 assessed value $94M; 2004 assessed value +33% (+$32M)**
- **Local district will receive 12 mil tax reduction**
- Piggyback model

"Converting the wind into a much-needed commodity while providing good jobs, the Colorado Green Wind Farm is a boost to our local economy and tax base."

*John Stulp, county commissioner, Prowers County, Colorado*

# School Wind Projects across the U.S.

Spirit Lake, IA

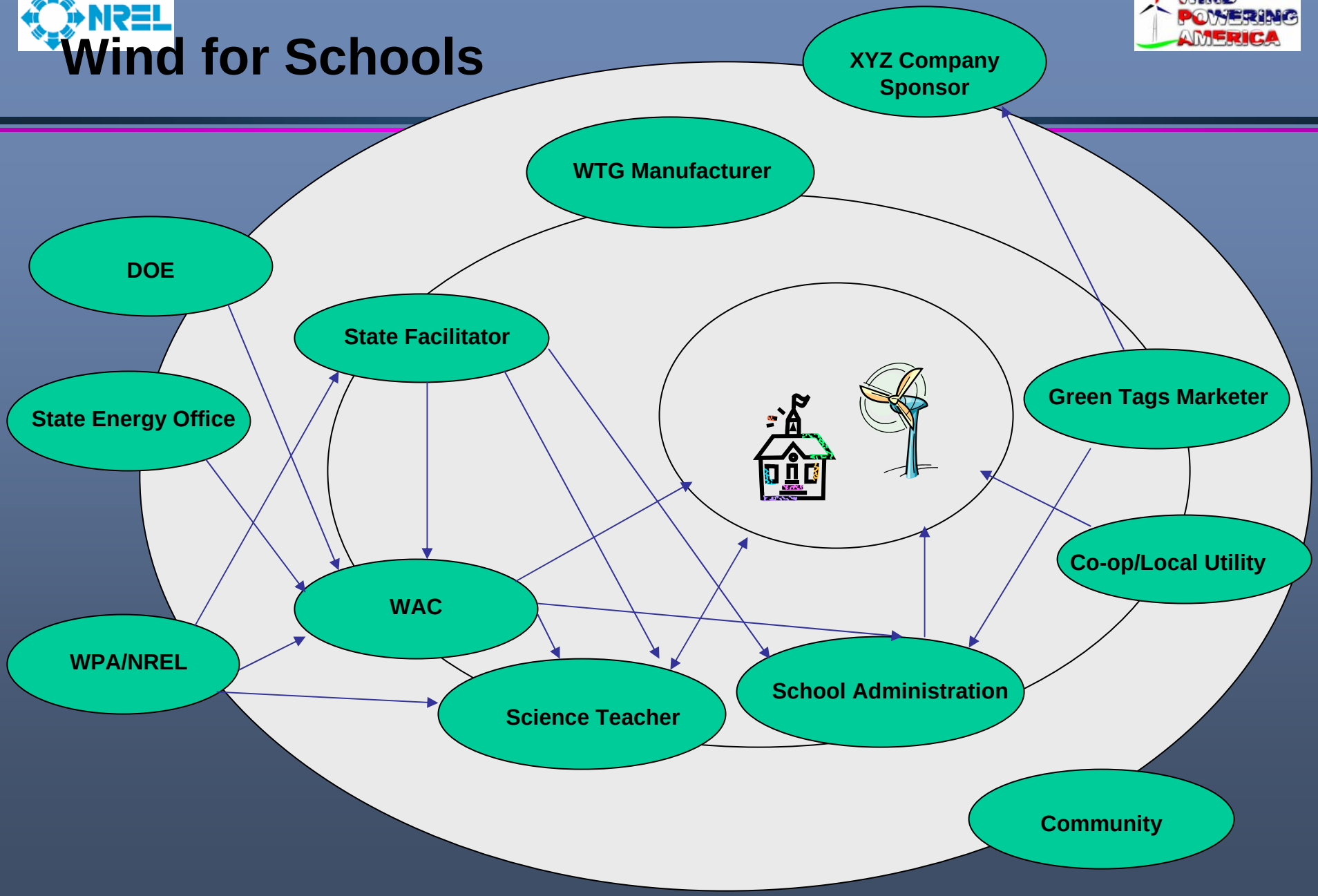
Holland, MI

Beverly, MA

Walsenburg, CO

Eldora, IA

# Wind for Schools



# A New Vision

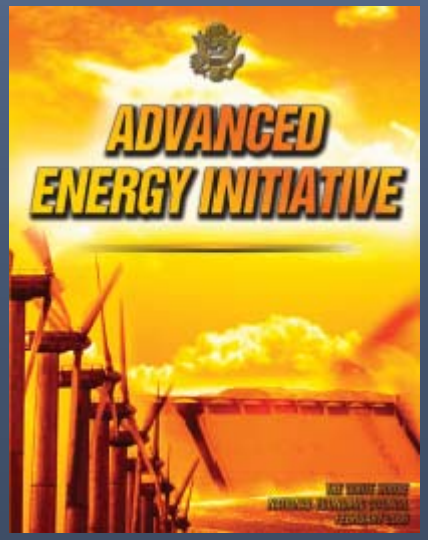
## *For Wind Energy in the U.S.*

***State of the Union Address***

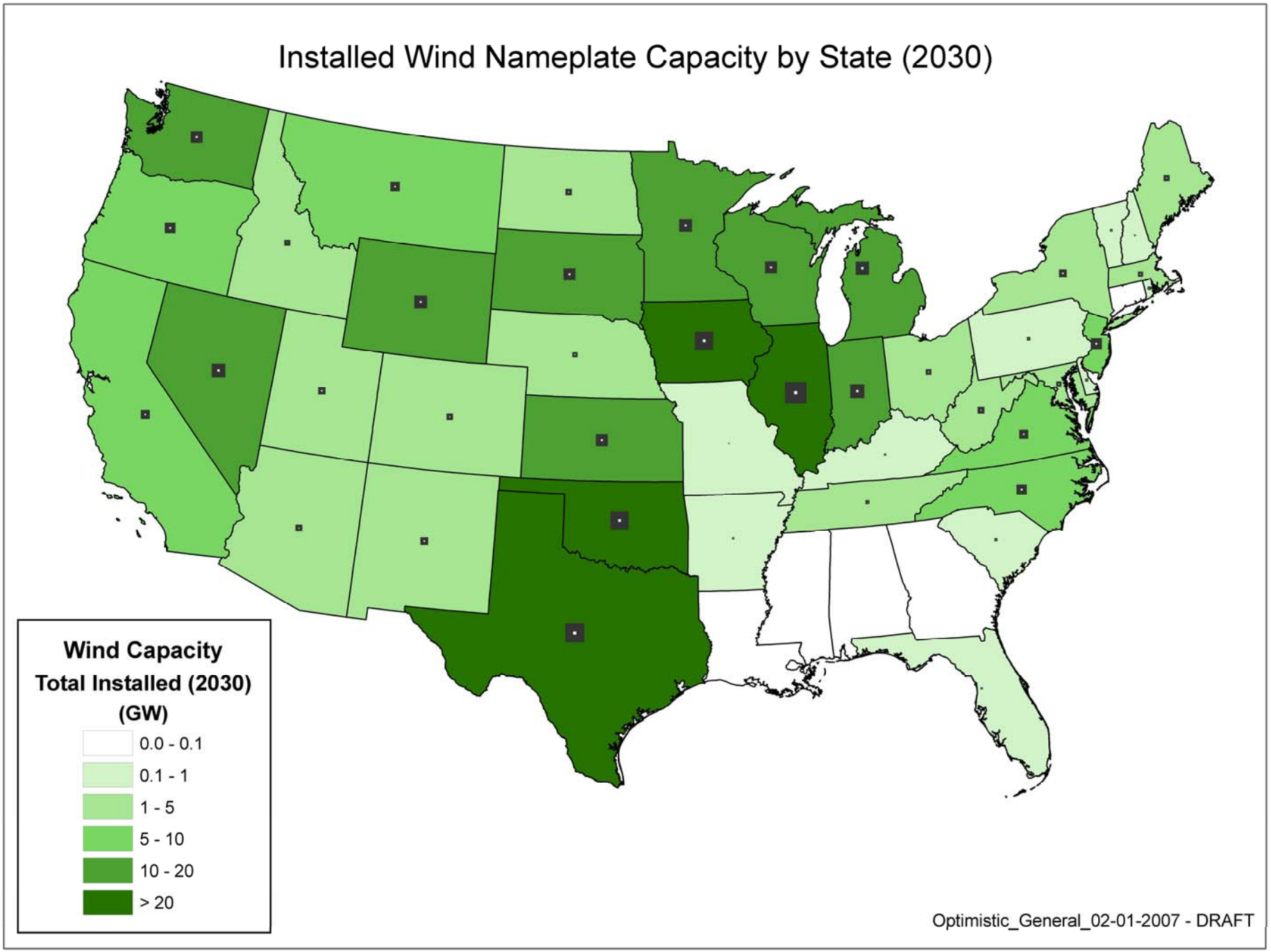
"…We will invest more in … **revolutionary** and…**wind technologies**"

***Advanced Energy Initiative***

"Areas with good wind resources have the potential to **supply up to 20% of the electricity** consumption of the United States."

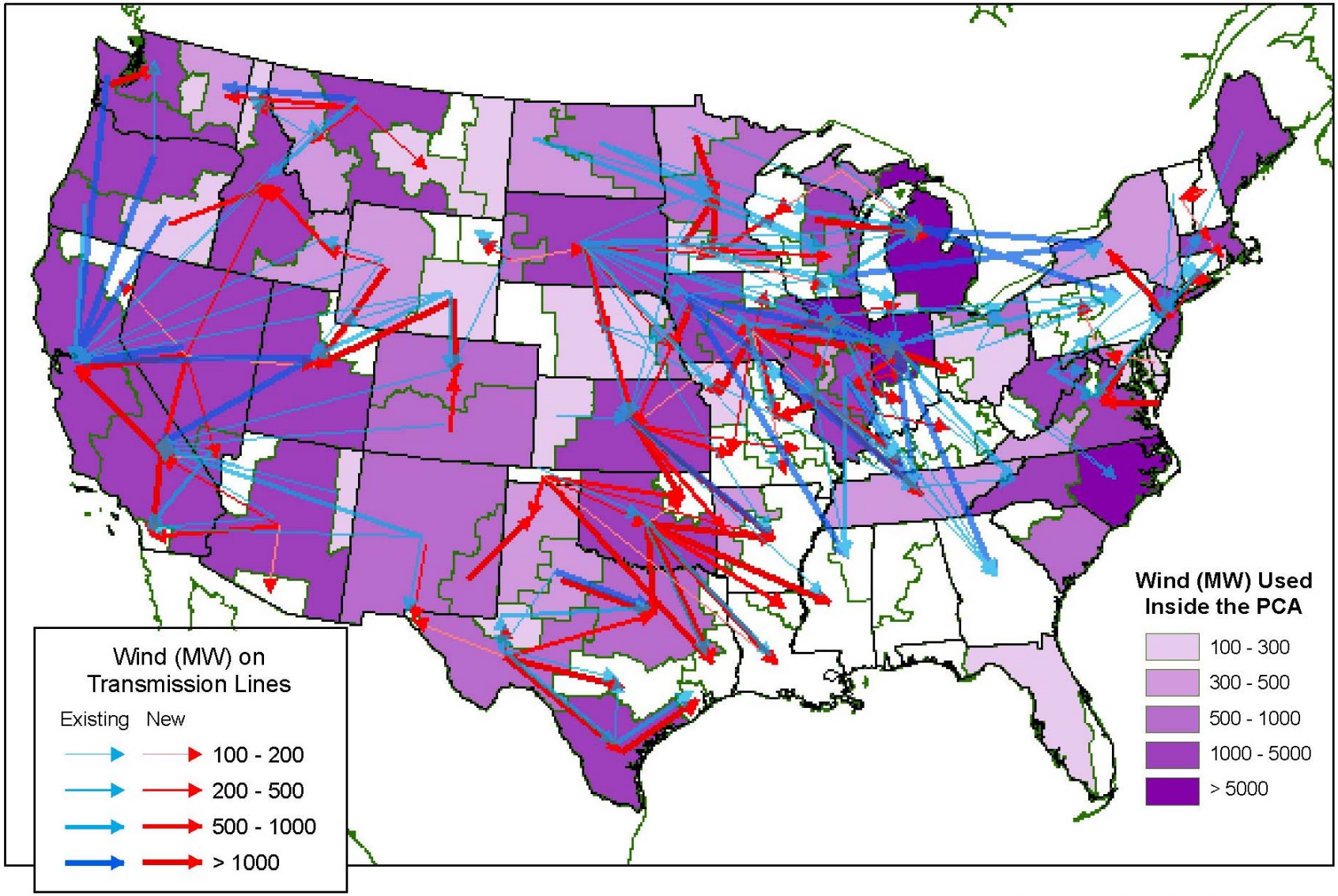


# Installed Wind Nameplate Capacity by State (2030)



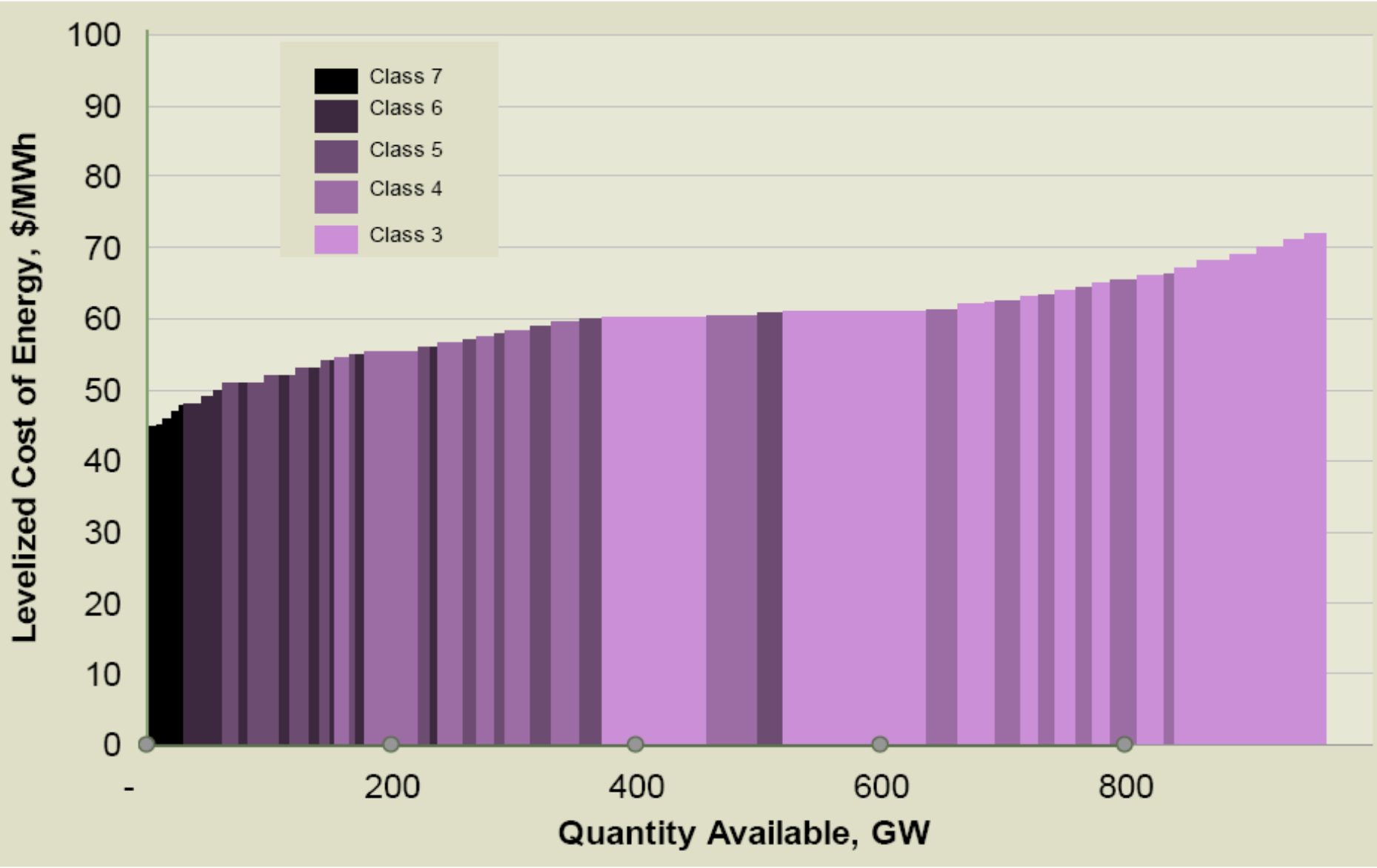
# 2030 - Between PCA Transfers and In-PCA Use for Wind (All Classes)

Total Between PCA Transfer >= 100 MW (all power classes, onshore and offshore)
Arrows originate and terminate at the centroid of the PCA for visualization purposes; they do not represent physical locations of transmission lines.



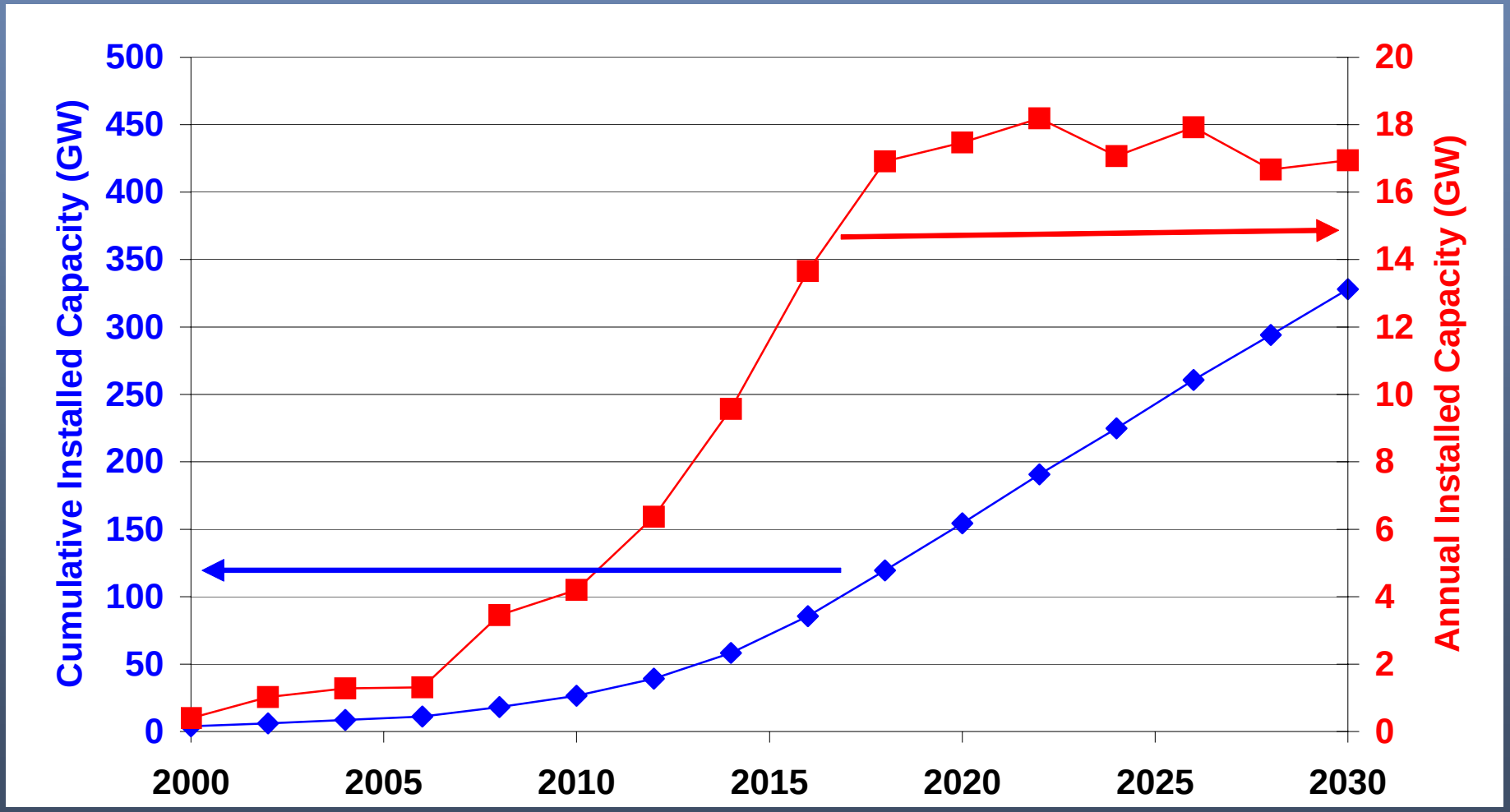

Optimistic_General_02-01-2007 - DRAFT

# National Supply Curve, 20% Available Transmission



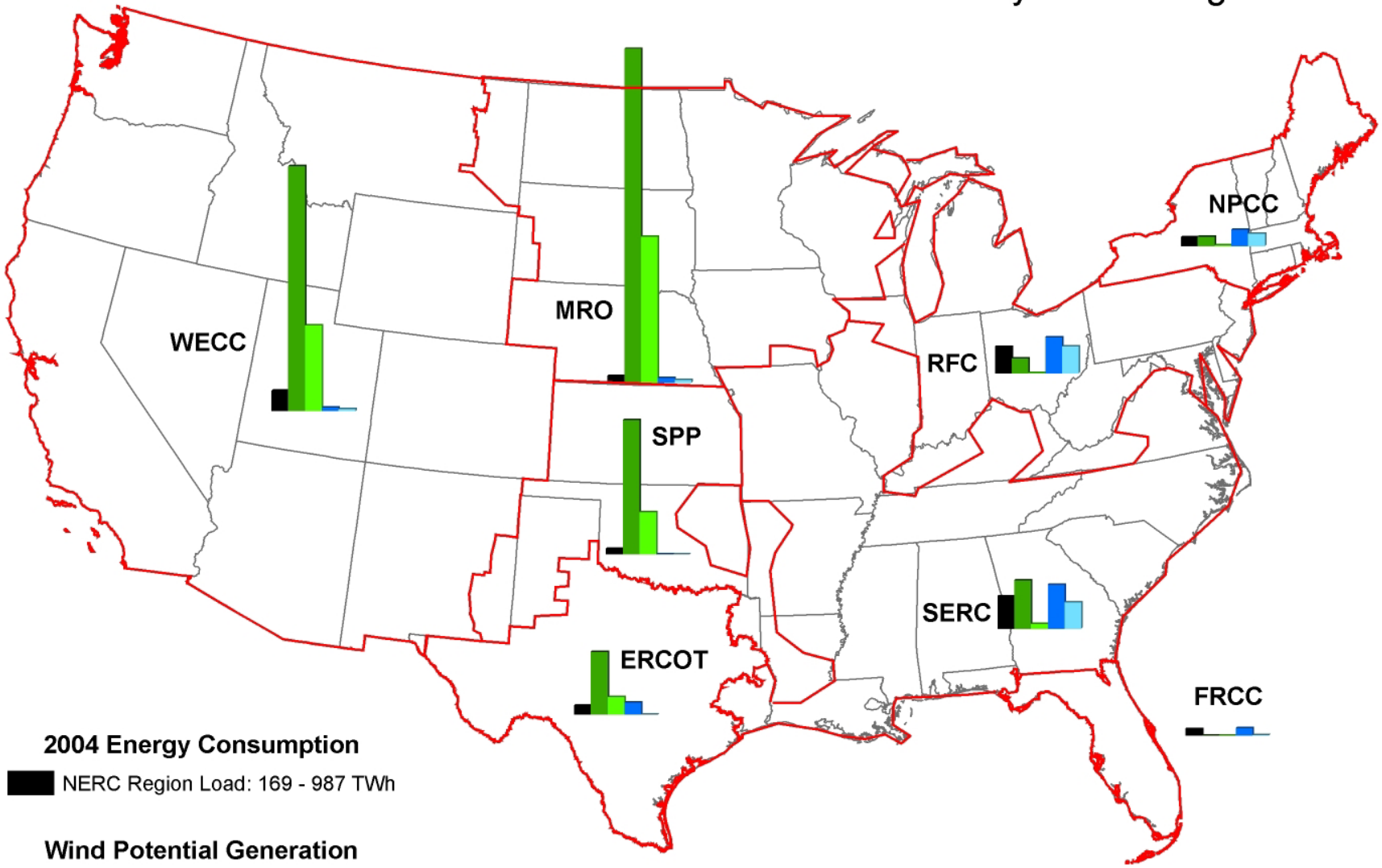

Wind costs are with PTC and do not include integration costs

# What does 20% Wind look like?




Source: AWEA 20% Vision

# Onshore and Offshore Wind Generation Potential by NERC Region




**2004 Energy Consumption**

NERC Region Load: 169 - 987 TWh

**Wind Potential Generation**

Onshore, Class 3 and greater: 0 - 10,013 TWh

Onshore, Class 4 and greater: 0 - 4,390 TWh

Offshore, Class 4 and greater: 0 - 1,325 TWh

Offshore, Class 5 and greater: 0 - 803 TWh

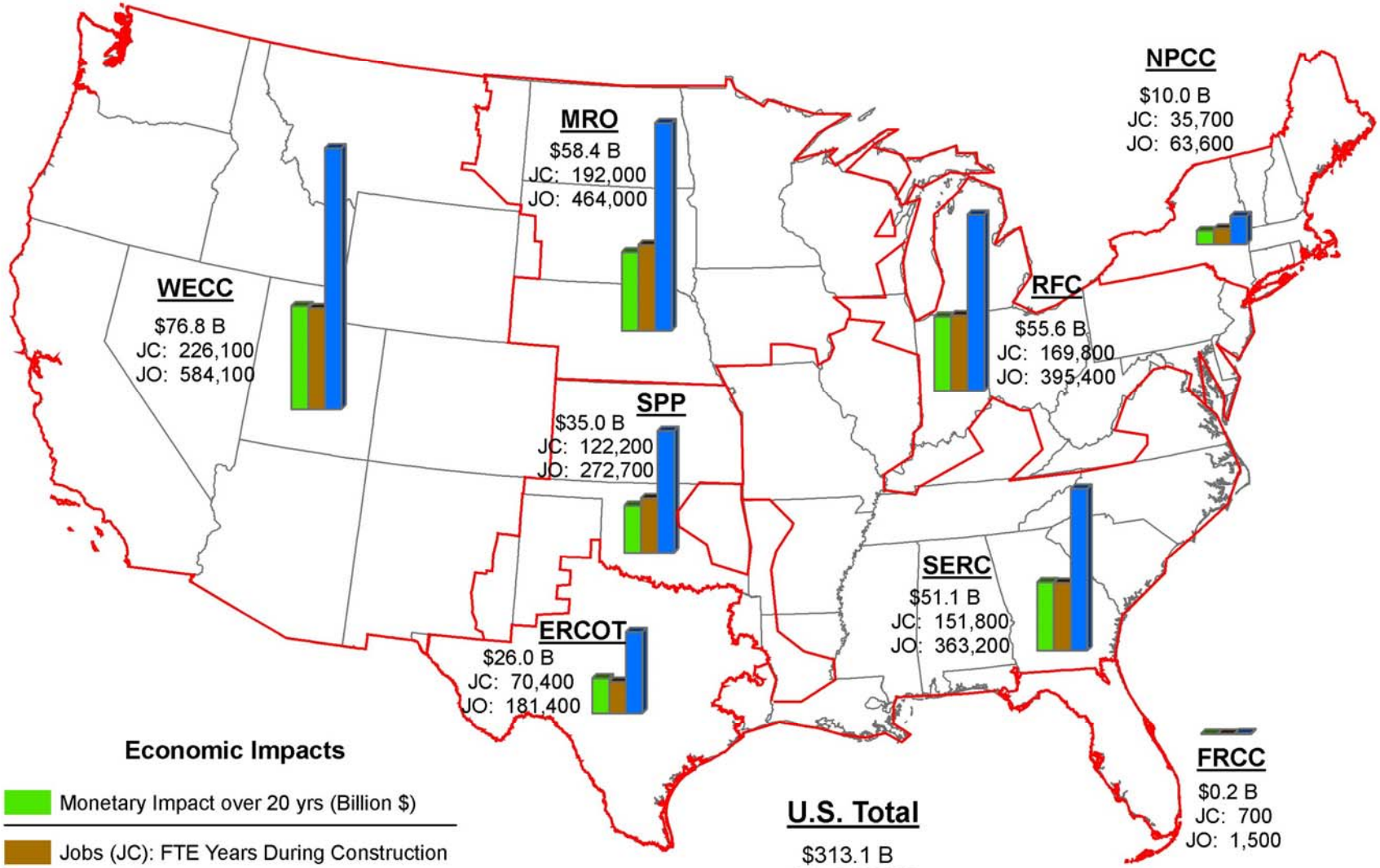
Exclusions were applied to the onshore wind resource areas. Offshore resource was limited to shallow areas (<30 m) within 50 nm of shore.

U.S. Department of Energy
National Renewable Energy Laboratory

NREL

02-JUN-2006

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




**Economic Impacts**

- Monetary Impact over 20 yrs (Billion $)
- Jobs (JC): FTE Years During Construction
- Jobs (JO): FTE Years over 20 yrs Operation

Optimistic case = 323 GW of wind capacity.
All job values rounded to the nearest 100.

**U.S. Total**

$313.1 B
JC: 968,900
JO: 2,326,000

U.S. Department of Energy
National Renewable Energy Laboratory

Optimistic case - DRAFT - 02/02/2007

19-MAR-2007

# Conclusions

- 20% wind energy penetration is possible
- 20% penetration is not going to happen under business as usual scenarios
- 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: WindPower 2007

Source: AWEA 20% Vision

# *Carpe Ventem*

www.windpoweringamerica.gov