



Wind Energy for Rural Economic Development



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National Renewable Energy Laboratory

Sizes and Applications



Small (≤ 10 kW)

- Homes
- Farms
- Remote Application



Intermediate (10-250 kW)

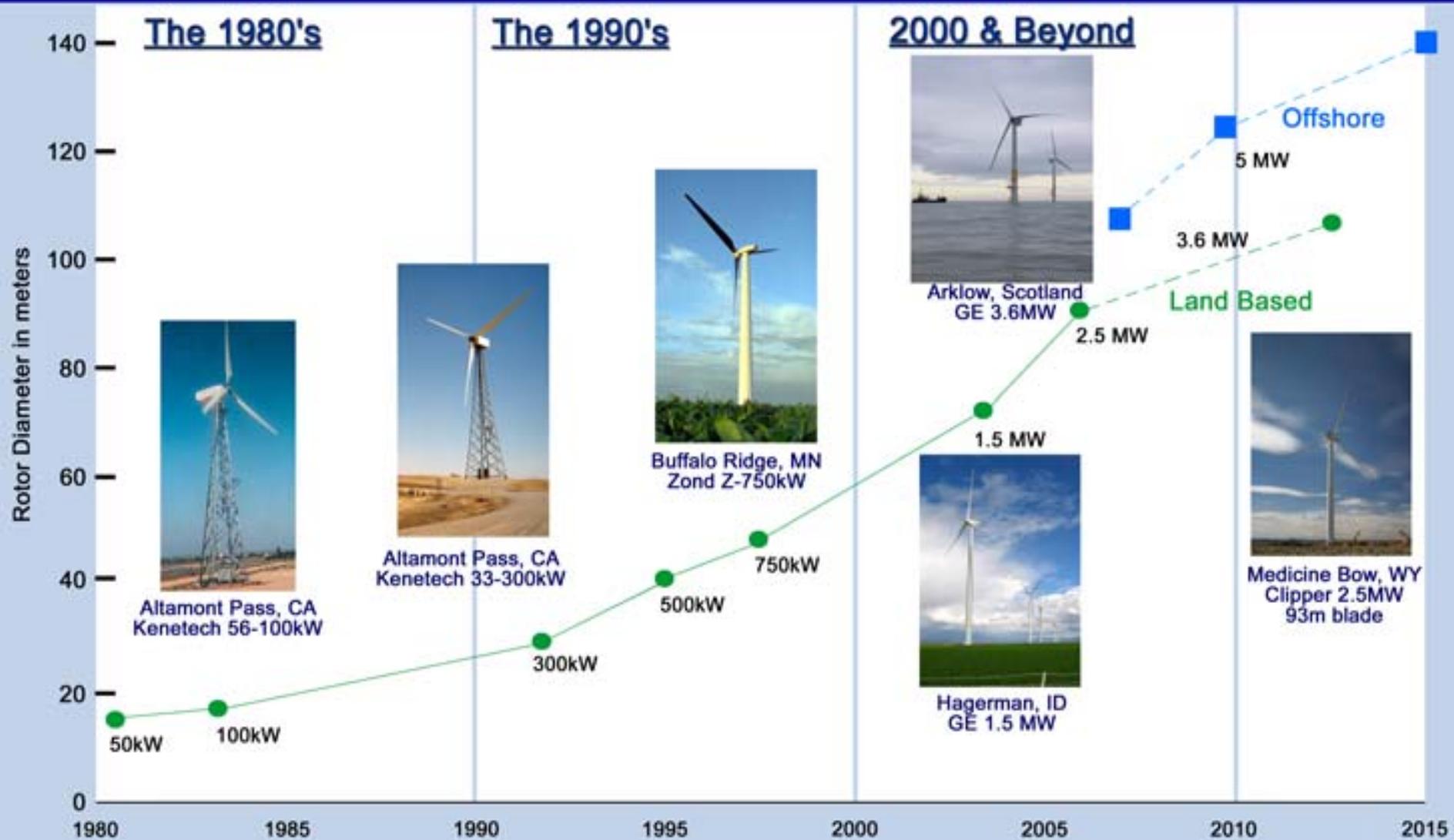
- Village Power
- Hybrid Systems
- Distributed Power



Large (660 kW - 2+MW)

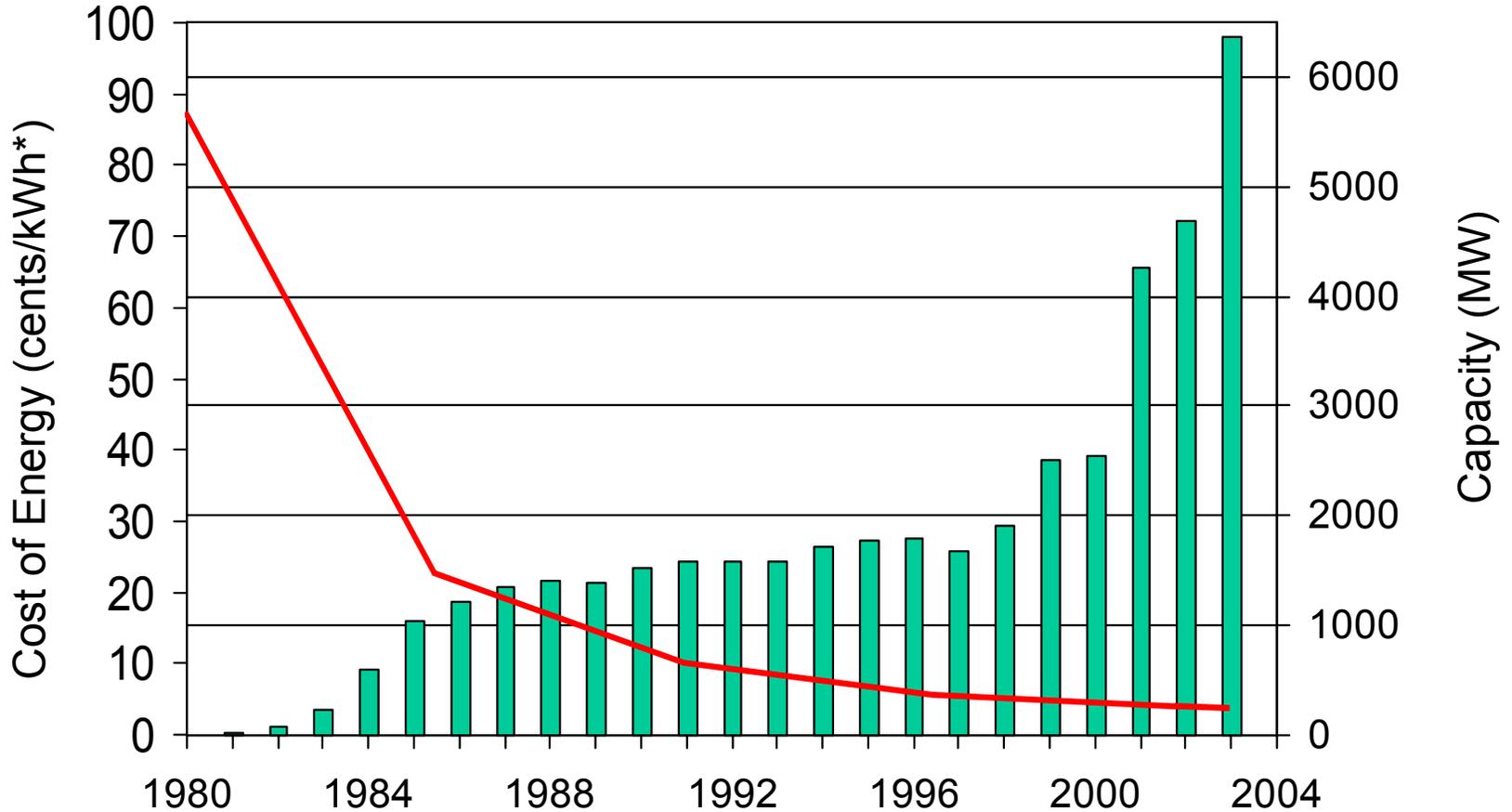
- Central Station Wind Farms
- Distributed Power
- Community Wind

Evolution of U.S. Commercial Wind Technology



Capacity & Cost Trends

Cost of Energy and Cumulative Domestic Capacity

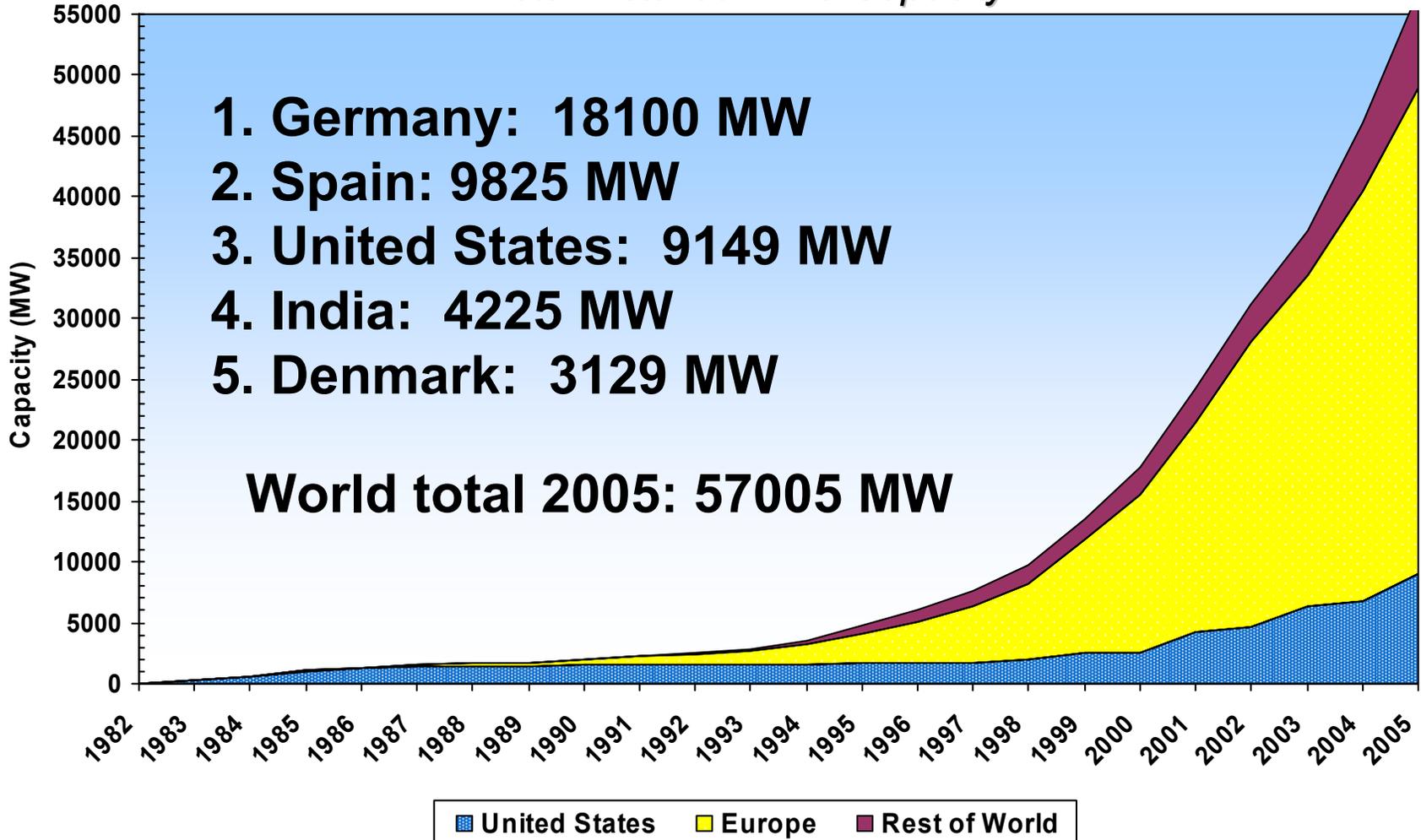


*Year 2000 dollars

Increased Turbine Size - R&D Advances - Manufacturing Improvements

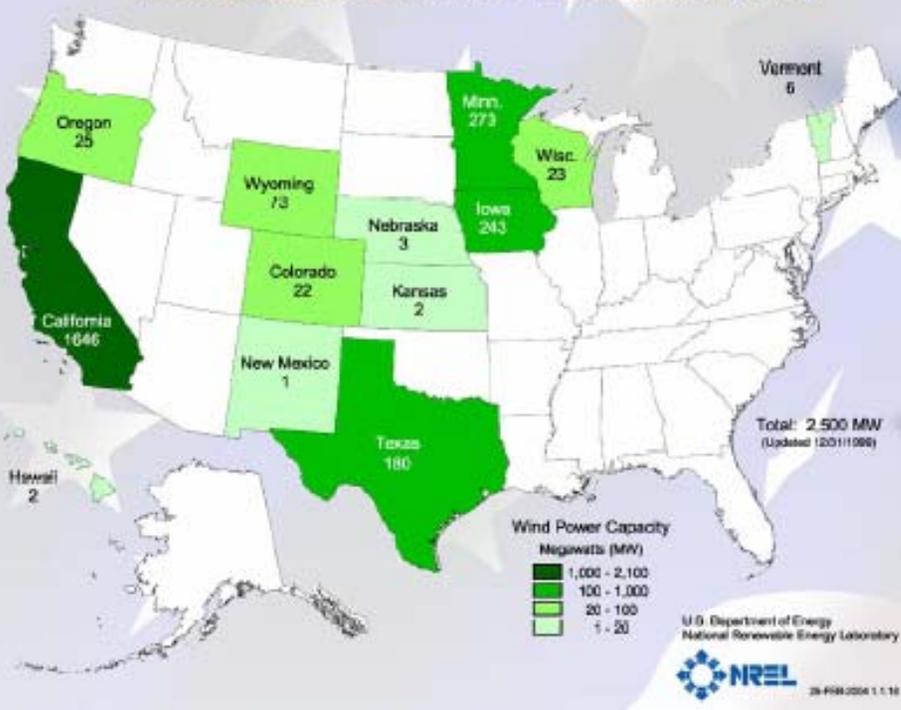
World Growth Market

Total Installed Wind Capacity

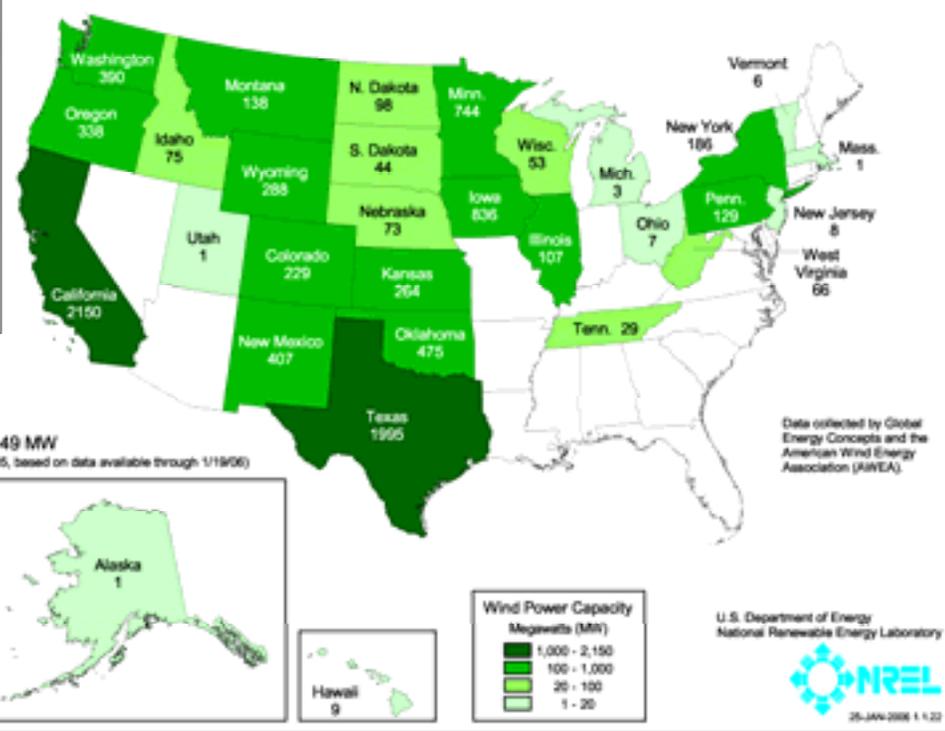


Installed Wind Capacities (99-05)

1999 Year End Wind Power Capacity (MW)



United States - 2005 Year End Wind Power Capacity (MW)

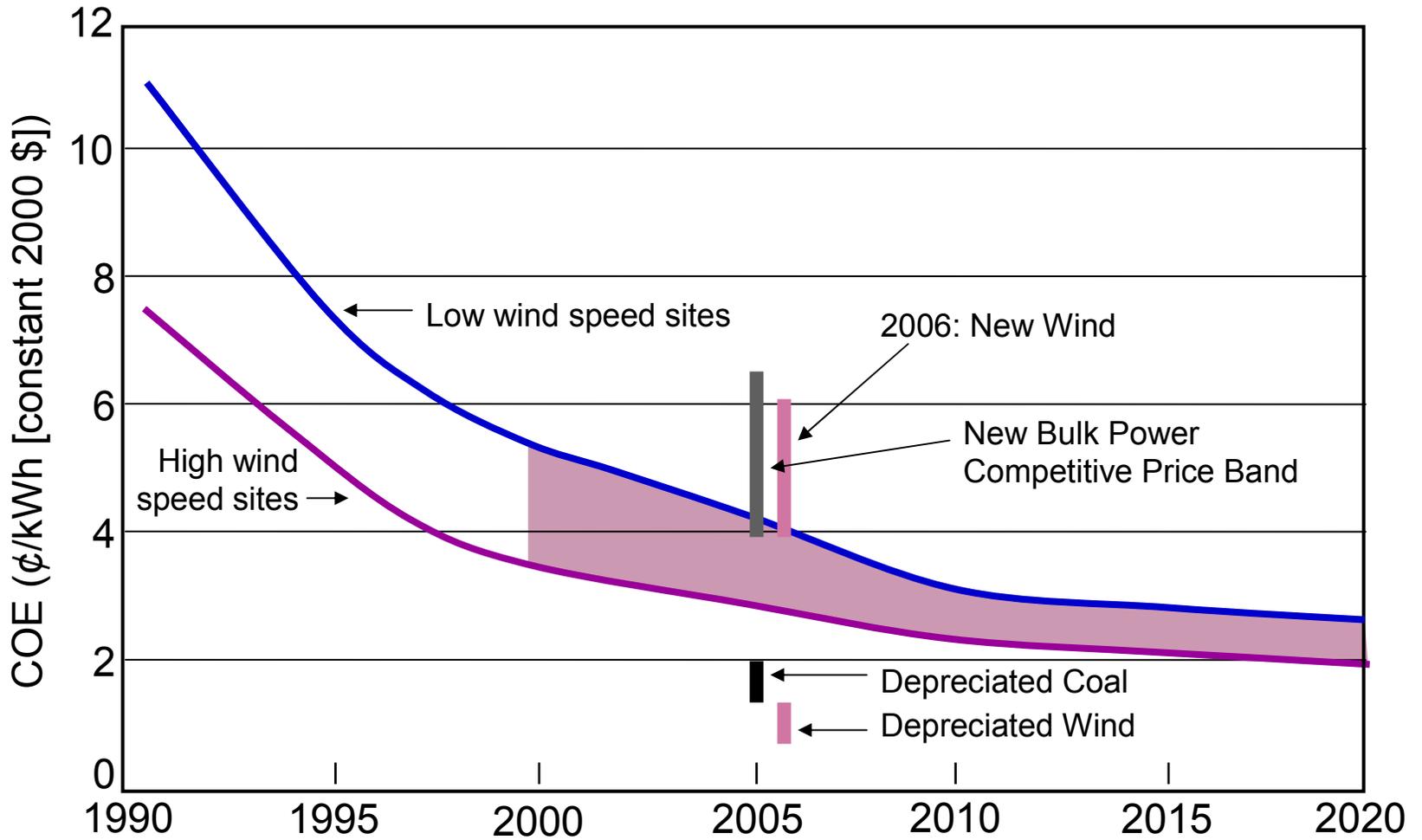


Drivers for Wind Power

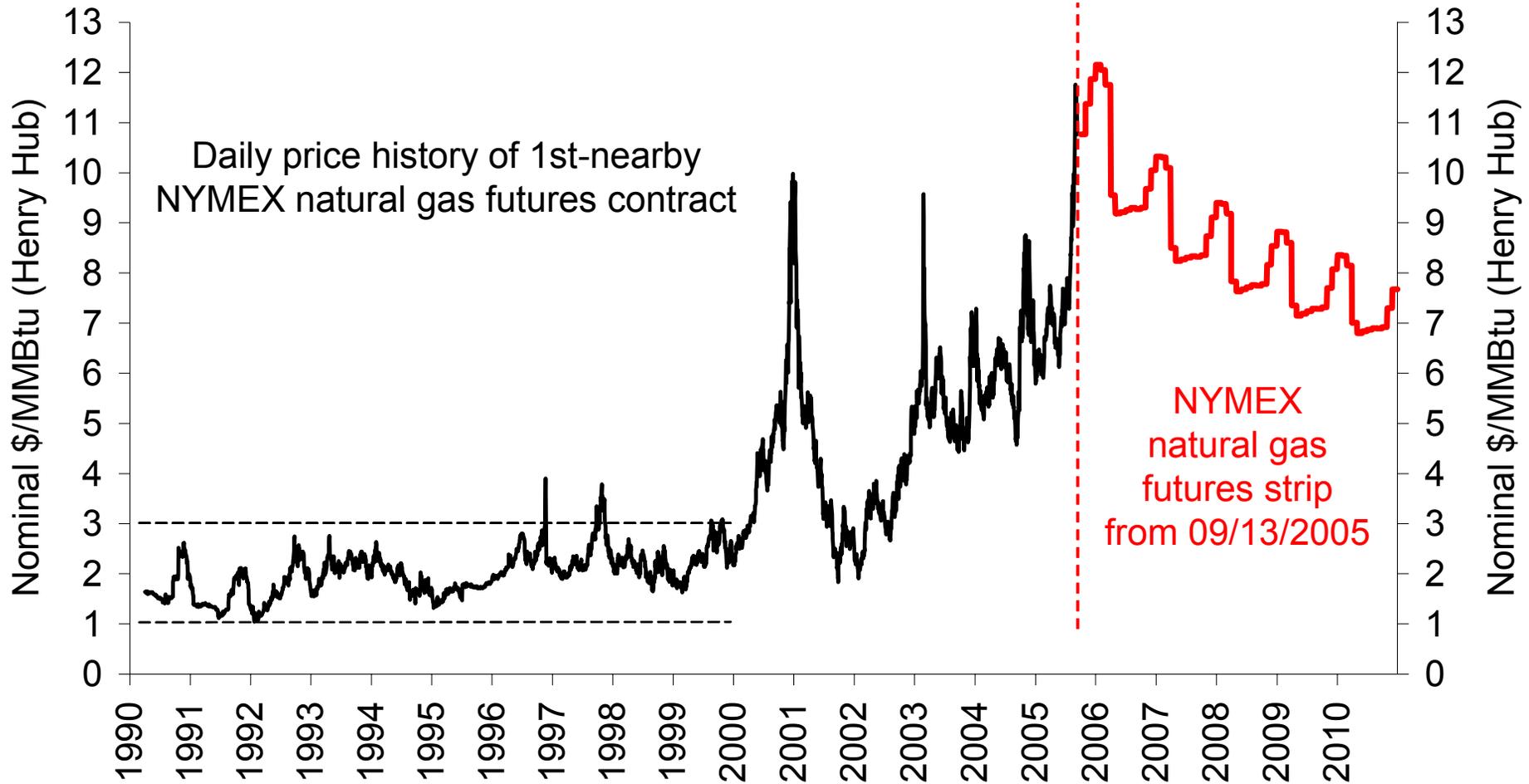
- Declining Wind Costs
- Fuel Price Uncertainty
- Federal and State Policies
- Economic Development
- Green Power
- Energy Security



Wind Cost of Energy



Natural Gas – Historic Prices

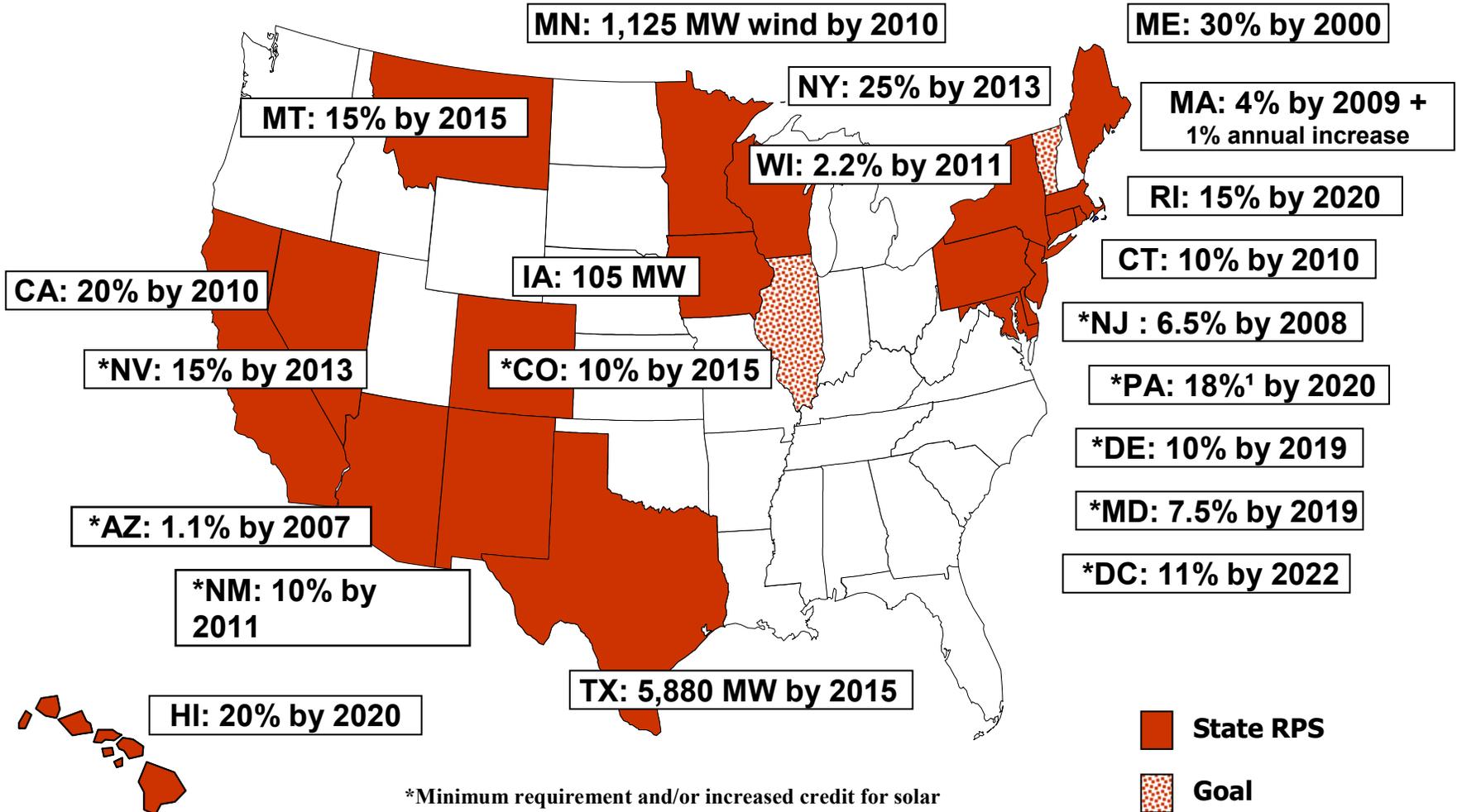




“Wind energy adds diversity to our generation fleet and provides a hedge against fossil fuel price increases. In addition, the development of renewable energy resources is widely supported by the public and our customers.”

Rick Walker, director, Renewable Energy Business Development, AEP Energy Services, Inc., Dallas, TX

People want renewable energy (Renewables Portfolio Standards)

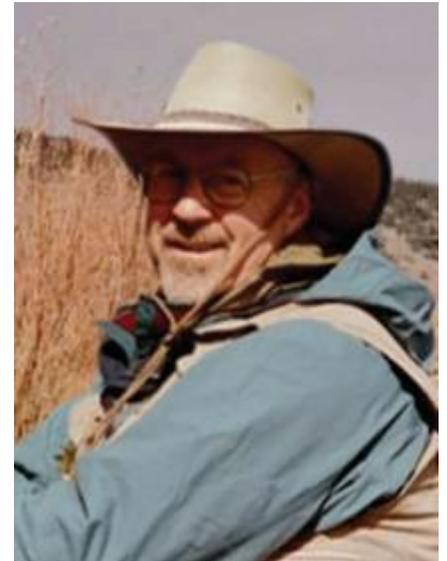


*Minimum requirement and/or increased credit for solar
¹ PA: 8% Tier I, 10% Tier II (includes non-renewable sources)



“You don’t have to be a utility commissioner to see that we need better regulatory policies to achieve the diversity, economic development, and environmental benefits of wind power.”

Bob Anderson, Montana Public Service Commission, Helena, Montana



Wind Energy Investors



SIEMENS



BP Solar



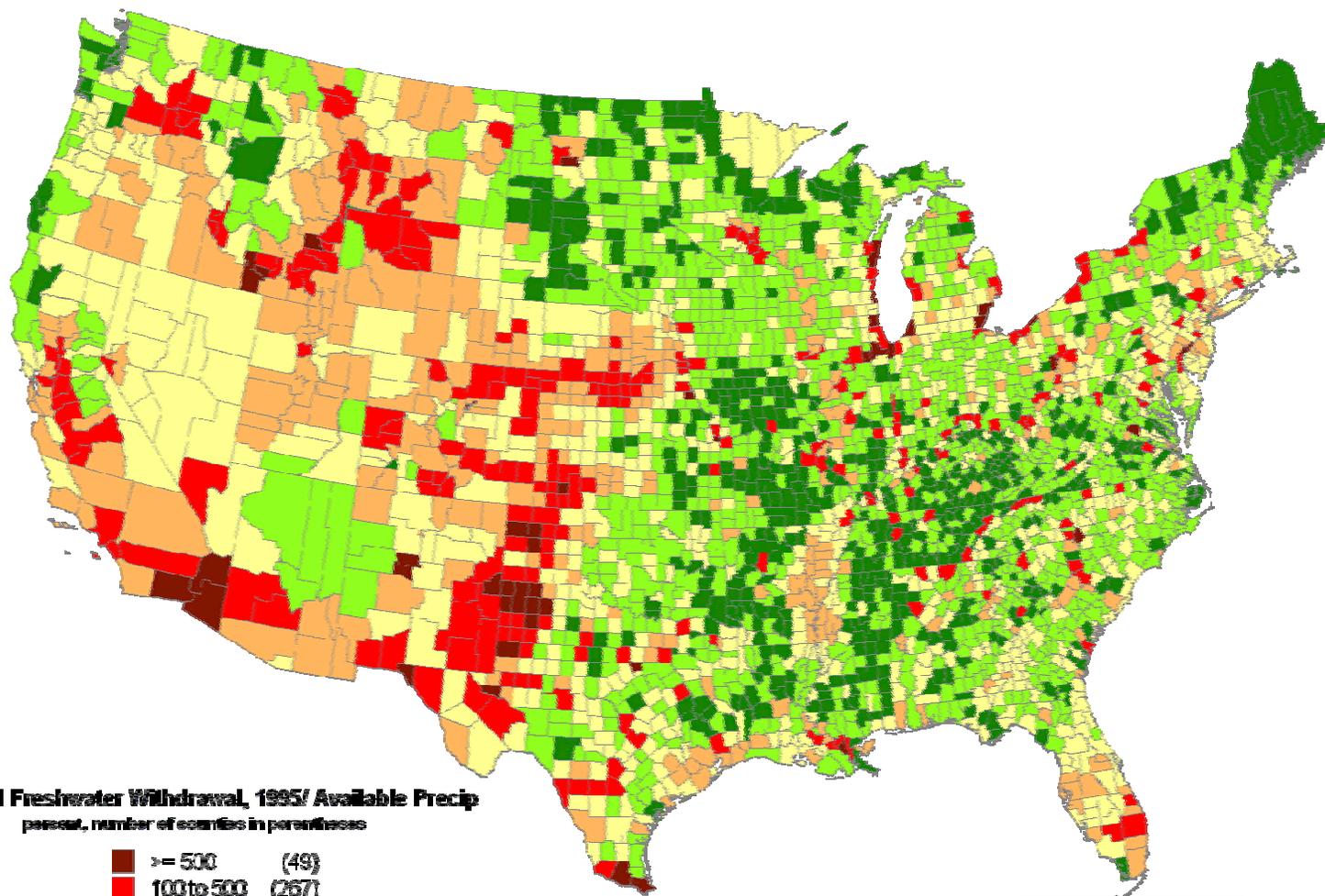
JOHN DEERE



Wind energy doesn't consume water



Sustainable Withdrawal Of Freshwater Is National Issue



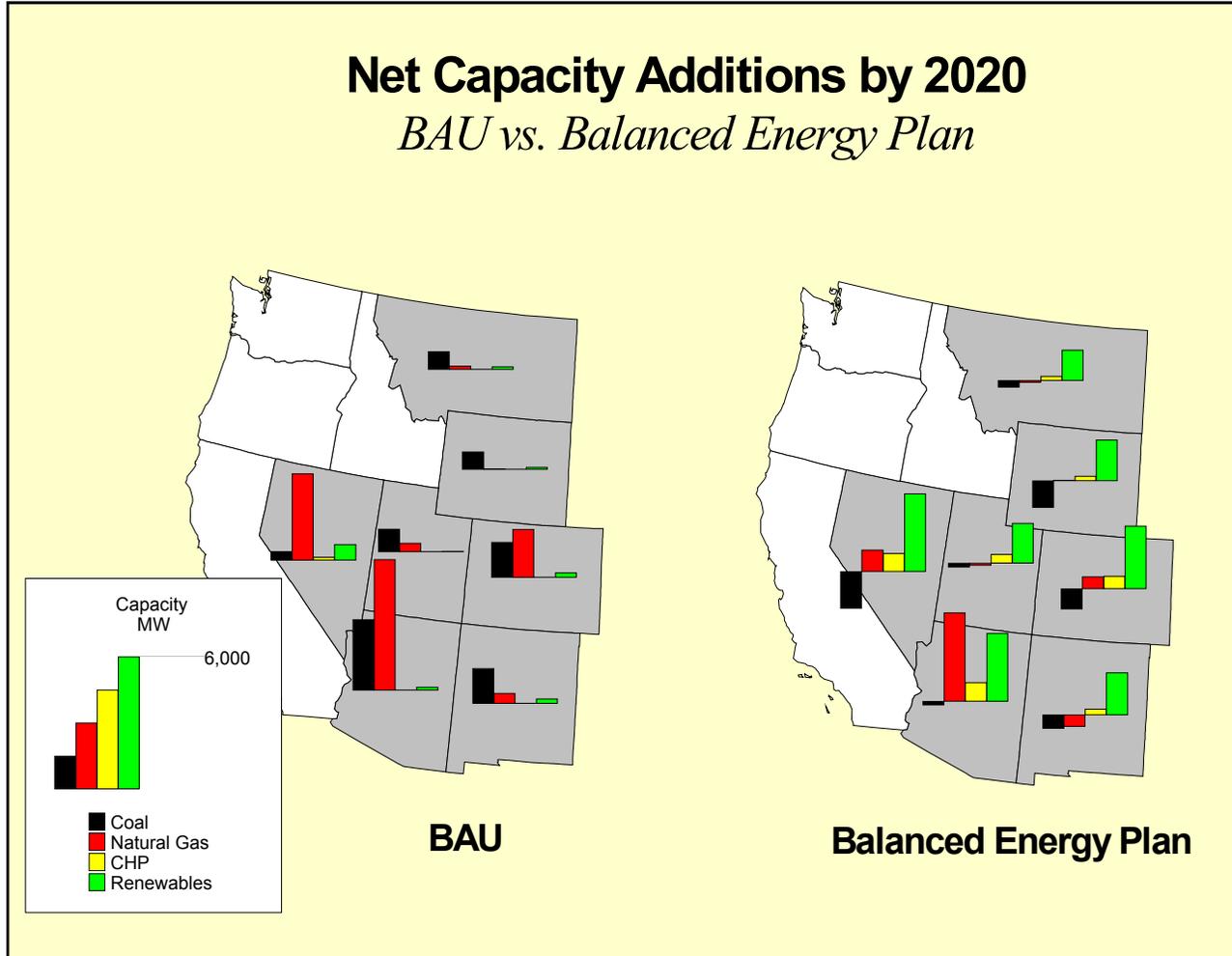
Total Freshwater Withdrawal, 1995/ Available Precip
percent, number of counties in parentheses

	>= 500	(49)
	100 to 500	(267)
	30 to 100	(363)
	5 to 30	(740)
	1 to 5	(1078)
	0 to 1	(614)

Source: EPRI 2003

Interior West Capacity Additions

Net Capacity Additions by 2020 *BAU vs. Balanced Energy Plan*



Balanced Plan:

- 15,400 MW renewables
- 3000 MW CHP
- 7800 MW natural gas
- Retires 5000 MW of coal

BAU

- 16,000 MW natural gas
- 10,000 MW coal
- 1500 MW renewables
- 150 MW CHP

Windy Rural Areas Need Economic Development

United States - Wind Resource Map

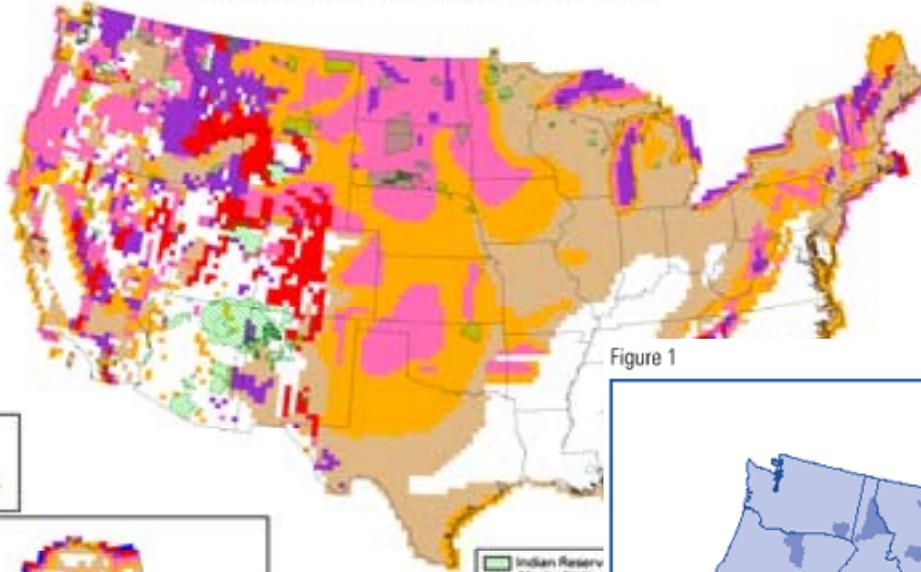
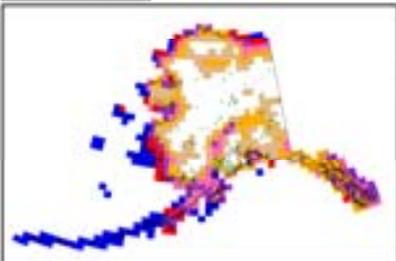


Figure 1

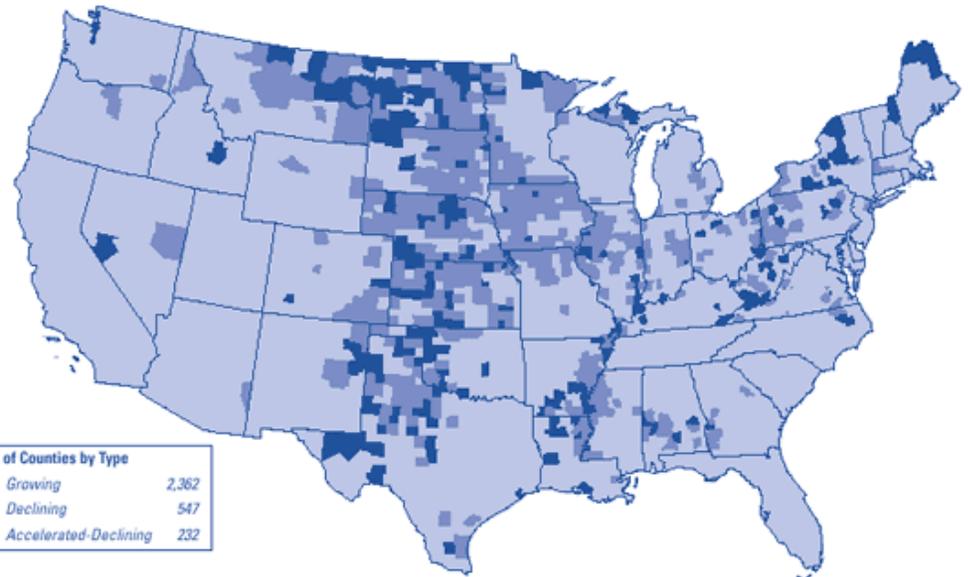


Wind Power Class	Resource	Wind Power Density at 50 m. W/m ²	Wind Speed at 50 m. m/s
2	Marginal	200 - 300	5.6 - 6.4
3	Fair	300 - 400	6.4 - 7.0
4	Good	400 - 500	7.0 - 7.5
5	Excellent	500 - 600	7.5 - 8.0
6	Outstanding	600 - 800	8.0 - 8.8
7	Superb	800 - 1800	8.8 - 11.1

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

Indian Reserv
Alaska Native

Geographic Distribution of Depopulation

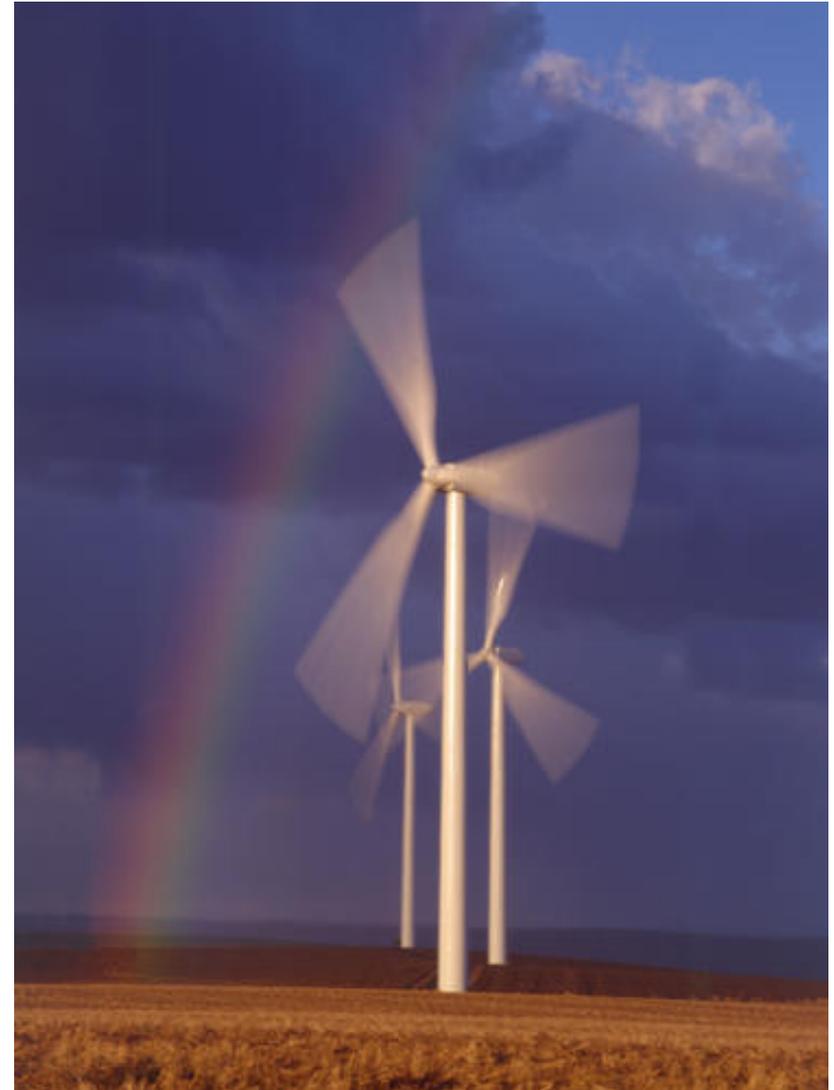


No. of Counties by Type	
Growing	2,362
Declining	547
Accelerated-Declining	232

Source: 2000 Census compared with 1970 Census.

Economic Development Impacts

- Construction
- Operations and maintenance
- Property tax revenues
- Landowner revenues
- Manufacturing
- Multiplier effect
- Net economic development impacts of wind vs. fossil fuels





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

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)



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



- 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

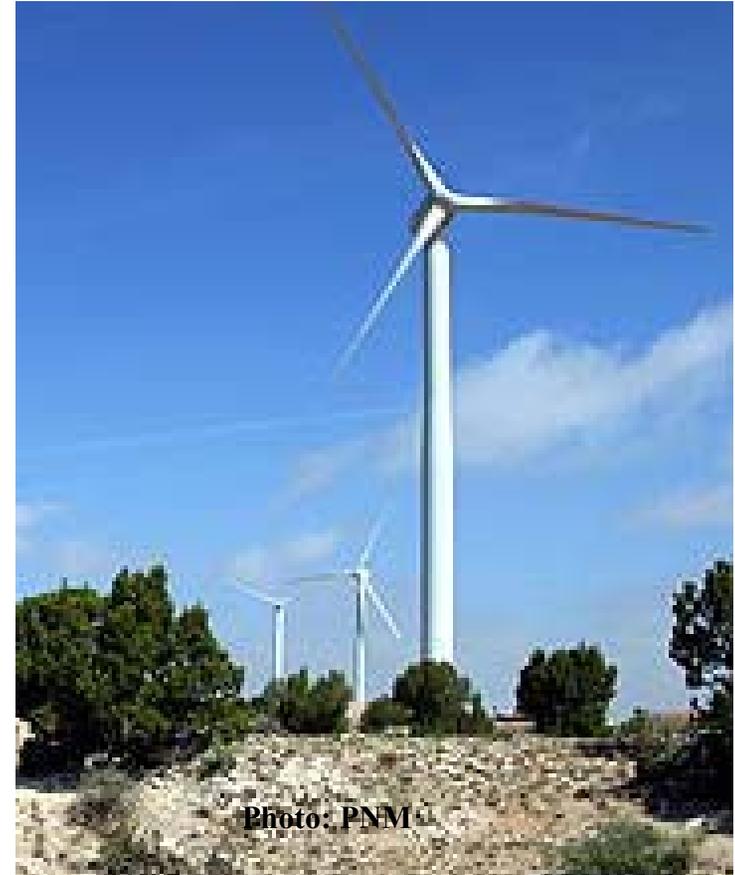


Photo: PNM

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

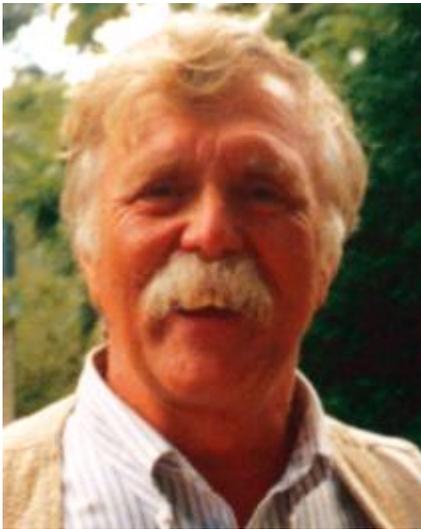
“Converting the wind into a much-needed commodity while providing good jobs, the Colorado Green Wind Farm is a boost to our local economy and tax base.”

John Stulp, county commissioner, Prowers County, Colorado

Local Ownership Models

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





“Wind is a homegrown energy that we can harvest right along side our corn or soybeans or other crops. We can use the energy in our local communities or we can export it to other markets. We need to look carefully at wind energy as a source of economic growth for our region”

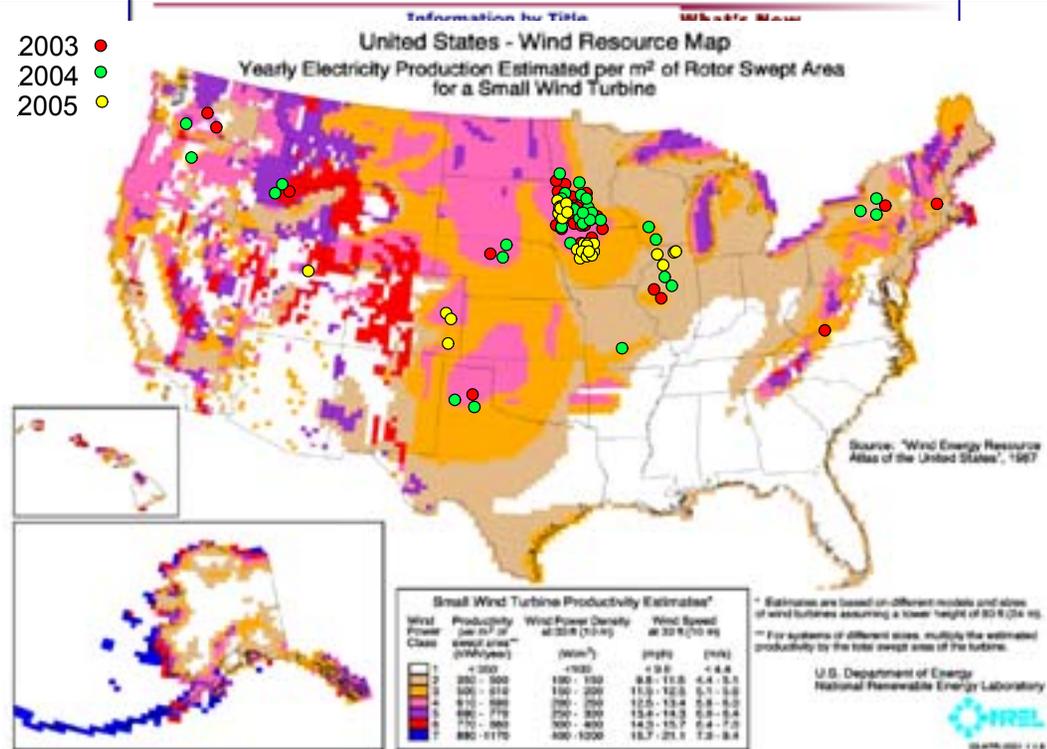
David Benson, Farmer and County Commissioner, Nobles County, Minnesota

WPA Farm Bill Activities

- Collaborate with USDA in developing process and outreach materials
- Fact sheets, Web site, Webcasts
- Sample application development
- Workshops for potential applicants (jointly with USDA and State WWGs)
- Review proposals for technical quality
- Farm Bill wind awards:
 - '03: \$4.8M, 13 projects
 - '04: \$7.9M, 38 projects
 - '05: \$12.4M, 43 projects
- Total projects value >\$250M



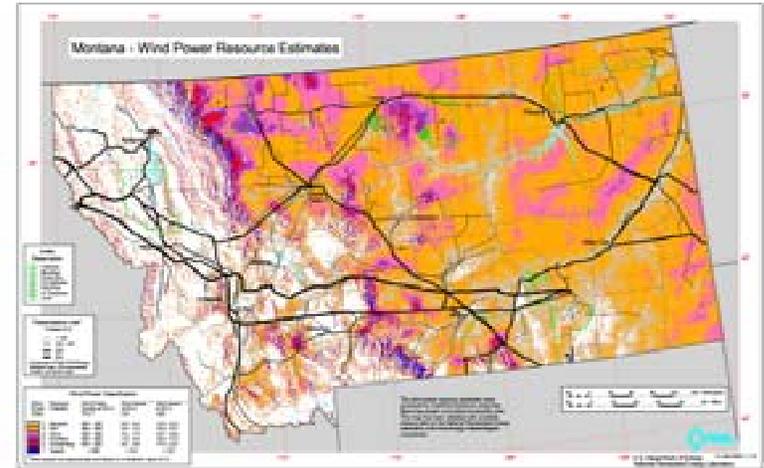
- 2003 ●
- 2004 ●
- 2005 ●



Job and Economic Development Impact (JEDI) Model

- **Assesses the economic development impacts of constructing and operating wind plants**
- **Based on IMPLAN**

County, Local Ownership %	Project Size (MW)		
	5.0	20.0	100.0
Cascade			
0%	\$ 1,411,518	\$ 5,630,655	\$ 28,130,155
50%	\$ 1,558,729	\$ 6,219,499	\$ 31,074,375
Glacier			
0%	\$ 1,023,166	\$ 4,080,456	\$ 20,383,970
50%	\$ 1,111,328	\$ 4,433,104	\$ 22,147,210
McCone			
0%	\$ 862,354	\$ 3,435,991	\$ 17,159,815
50%	\$ 943,539	\$ 3,760,733	\$ 18,783,526
Park			
0%	\$ 1,073,558	\$ 4,281,226	\$ 21,386,617
50%	\$ 1,172,194	\$ 4,675,770	\$ 23,359,337
Prairie			
0%	\$ 789,234	\$ 3,144,651	\$ 15,704,830
50%	\$ 870,008	\$ 3,467,749	\$ 17,320,322



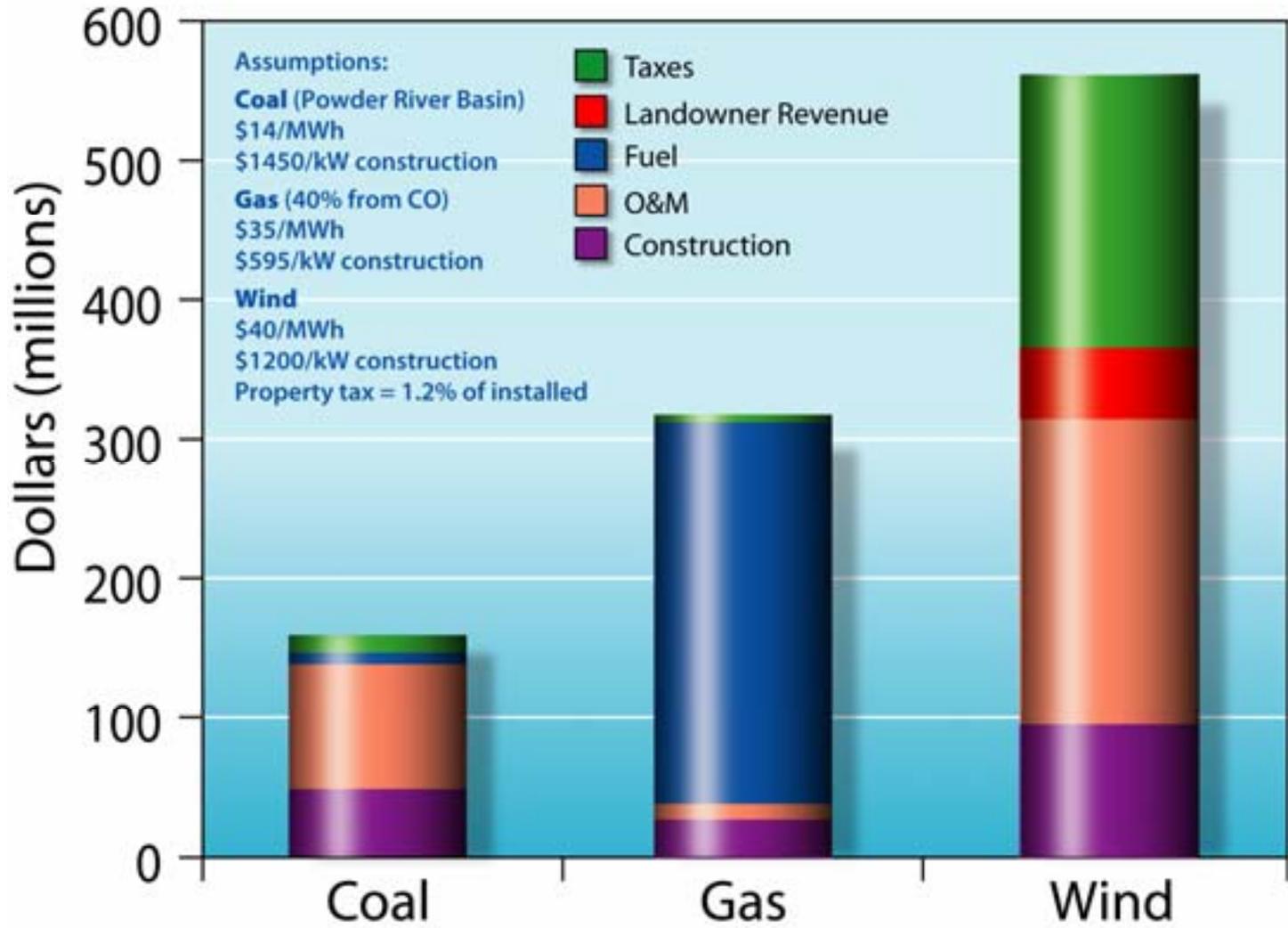
- **Users: project-specific data**
- **Model calculates project expenditures, economic activity, and number of jobs generated**
- **Working with state agricultural universities and state WWGs to analyze potential impacts in windy counties**

State Economic Impacts



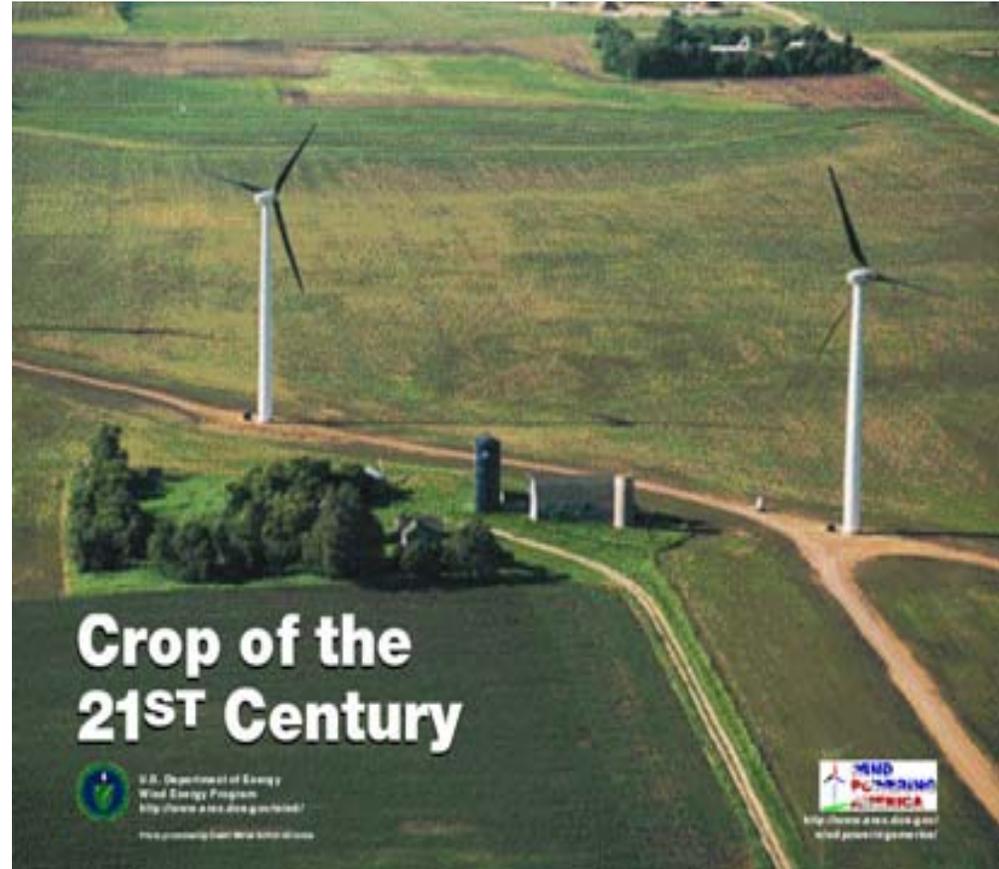
		WI - 100 MW	IL - 100 MW	SD - 100 MW	ND - 100 MW
Totals					
Construction Period					
	Total Jobs	273	249	304	280
	Total Earnings (\$)	\$ 9,330,000	\$ 10,670,000	\$ 7,730,000	\$ 7,730,000
	Total Output (\$)	\$ 27,800,000	\$ 29,060,000	\$ 27,380,000	\$ 25,370,000
	Total Impact (Earnings + Output)	\$ 37,130,000	\$ 39,730,000	\$ 35,110,000	\$ 33,100,000
Operations (Each Year)					
	Total Jobs	38	37	37	36
	Total Earnings (\$/year)	\$ 1,420,000	\$ 1,590,000	\$ 1,270,000	\$ 1,230,000
	Total Output (\$/year)	\$ 3,040,000	\$ 3,410,000	\$ 2,790,000	\$ 2,670,000
	Total Impact (Earnings + Output)	\$ 4,460,000	\$ 5,000,000	\$ 4,060,000	\$ 3,900,000
	Total 20 year Operations Impact	\$ 89,200,000	\$ 100,000,000	\$ 81,200,000	\$ 78,000,000
Total Project Impact (Construction + O&M)		\$ 126,330,000	\$ 139,730,000	\$ 116,310,000	\$ 111,100,000

Comparative Economic Development Impacts



Key Issues for Wind Power

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

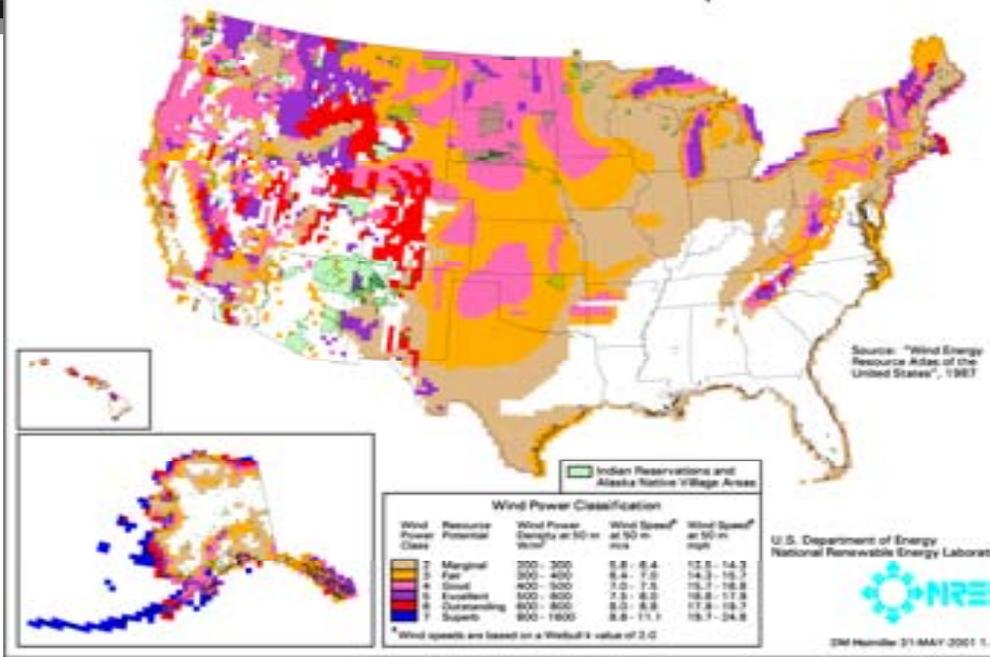


2000 POPULATION DISTRIBUTION IN THE UNITED STATES



Prepared by Geography Division, U.S. Department of Commerce, Economic and Statistics Administration, U.S. Census Bureau

United States - Wind Resource Map



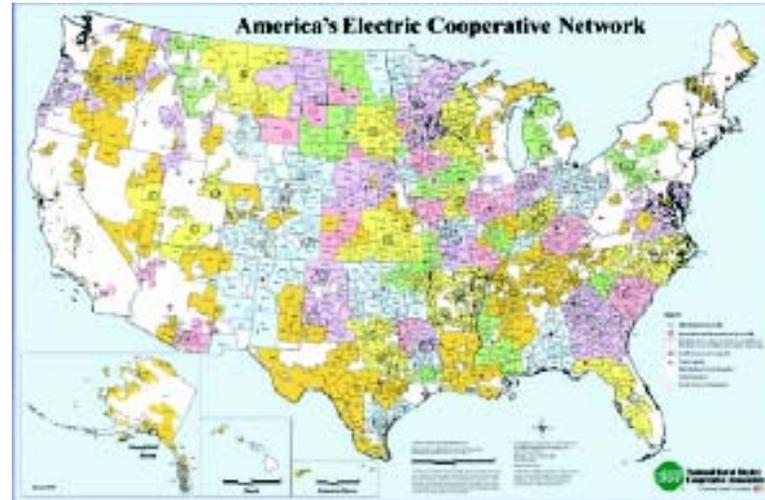
Source: "Wind Energy Resource Atlas of the United States", 1987

U.S. Department of Energy
National Renewable Energy Laboratory



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Co-op's can own, purchase, or wheel wind generation



- Basin Electric Power Cooperative, ND
- East River Electric Cooperative, SD
- Great River Energy, MN
- Corn Belt Power Cooperative, IA
- Sunflower Electric Power Corporation, KS
- Dairyland Power Cooperative, WI
- Western Farmers Electric Cooperative, OK
- Minnekota Power Cooperative, ND
- Tri-State G&T Association, CO
- Bonneville Power Administration*, OR
- Tennessee Valley Authority*, TN
- Alaska Village Electric Cooperative, AK
- Kotzebue Electric Association, AK
- Holy Cross Electric, CO

Wind Energy Economic Security Benefits

Wind energy is an **indigenous**, homegrown, energy resource that contributes to national security.

Wind energy is **inexhaustible** and infinitely renewable.

Wind displaces electricity that would otherwise be produced by burning natural gas, thus helping to **reduce gas demand** and limit gas price hikes.

Wind energy is the **least cost** new energy source.

Wind energy boosts rural **economic development**.

Unlike most other electricity generation sources, wind turbines **don't consume water**.

Wind energy has many **environmental benefits**.

Wind energy can be used in a **variety of applications**.

Wind energy is the fuel of **today and tomorrow**.



