



# *Wind Powering North Dakota*

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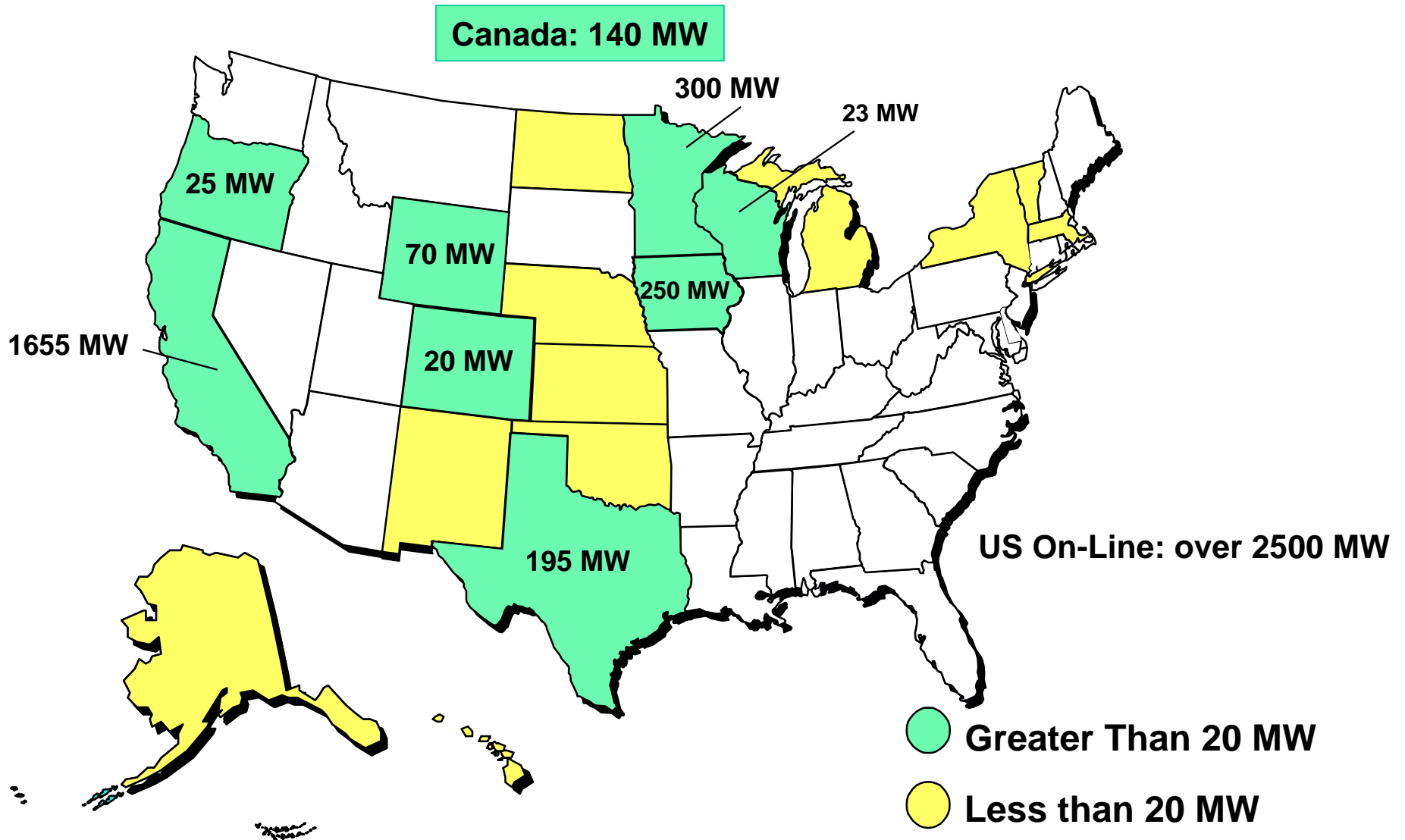
U.S. Department of Energy

Grand Forks, North Dakota

November 10, 1999

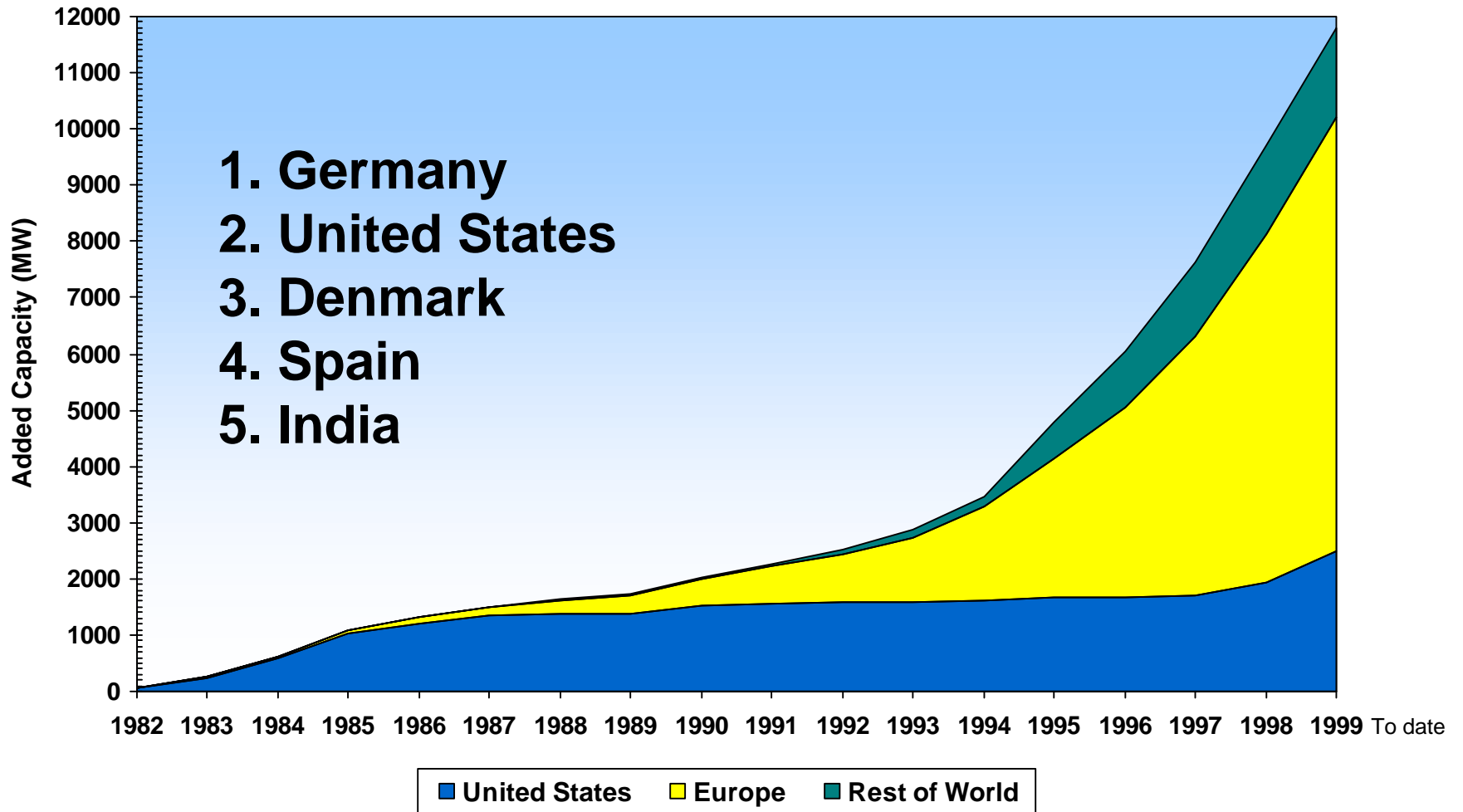


# Sweeping Across North America





# Wind Power Taking Off Worldwide



Based on information supplied by International Energy Agency.



## Wind Energy Getting Cheaper

**1979: 40 cents/kWh**

- Increased Turbine Size
- R&D Advances
- Manufacturing Improvements

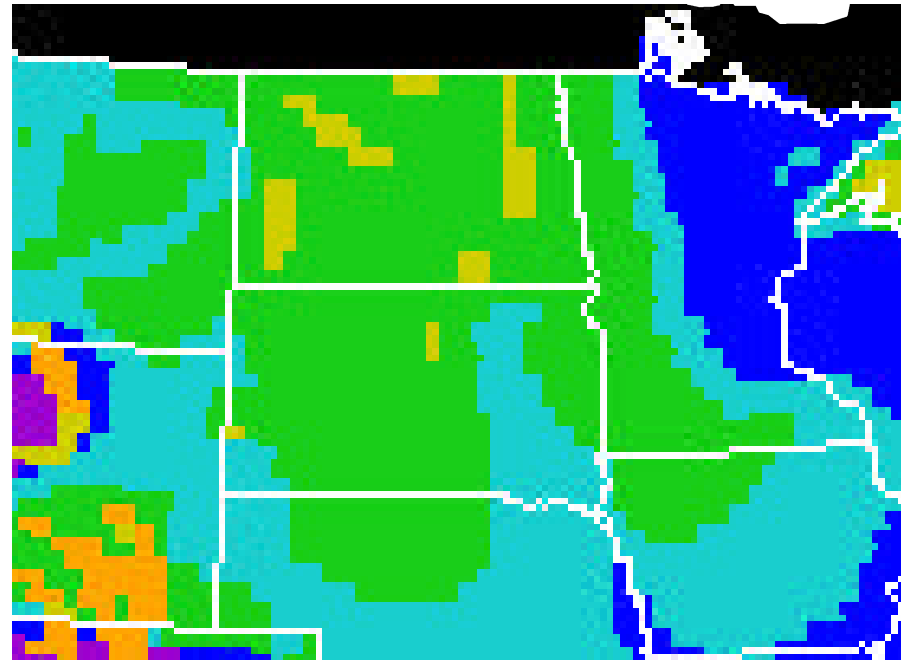


**1999: 4 cents/kWh (unsubsidized)**  
**NSP 107 MW Lake Benton wind farm**



# North Dakota: “The Saudi Arabia of Wind”

Rank	State
1	North Dakota
2	Texas
3	Kansas
4	South Dakota
5	Montana
6	Nebraska
7	Wyoming
8	Oklahoma
9	Minnesota
10	Iowa
17	California



Wind Resource



Source: AWEA

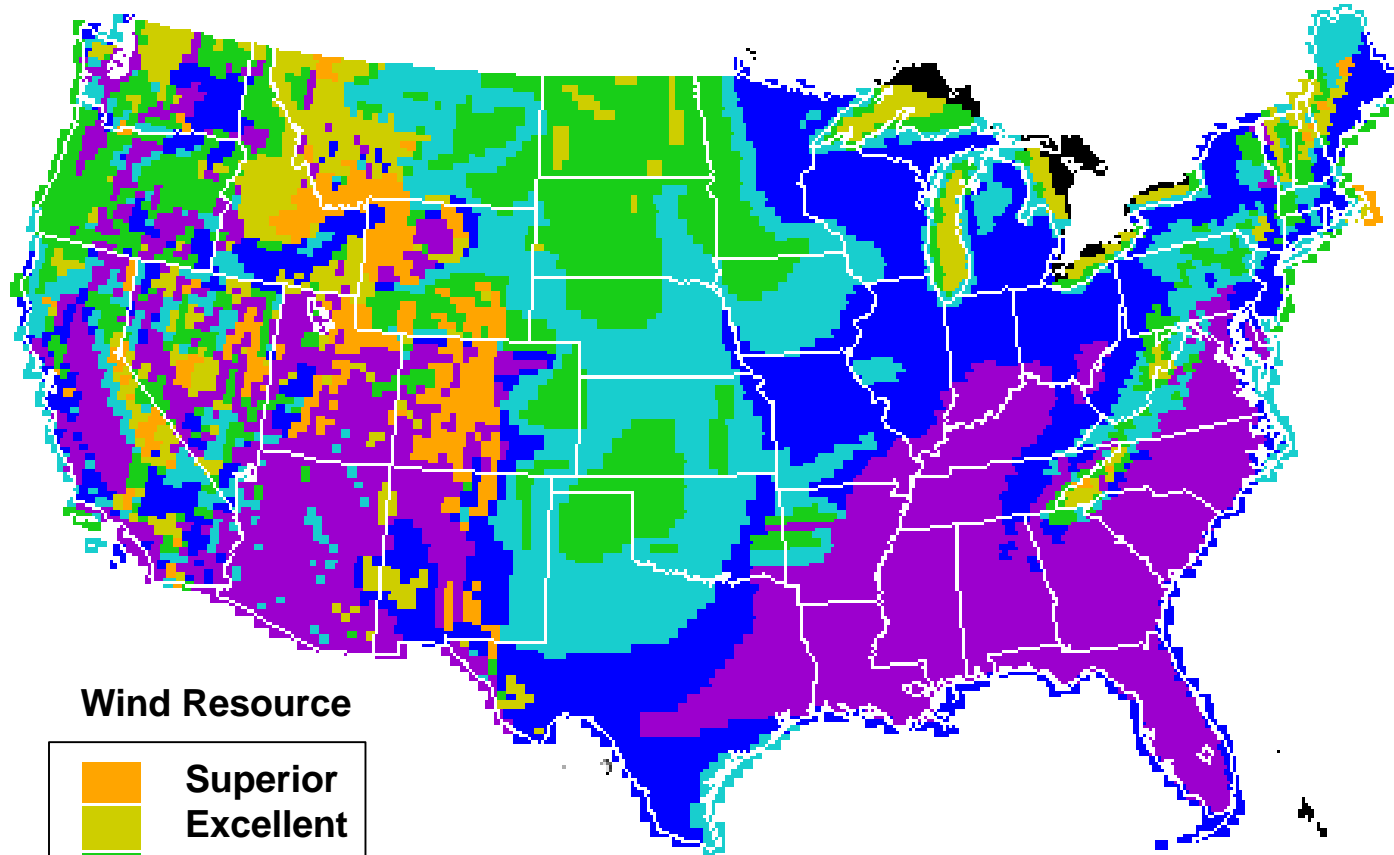
## World Class Wind Potential

Germany's Potential: 100 GW

North Dakota's Potential: 250 GW



# Wind: An All-American Resource



Wind Resource

	Superior
	Excellent
	Good
	Fair
	Poor
	None



## Farmers: The Original Wind Pioneers



**Then: Pumping water for  
crops and livestock**



## Farmers: The Modern Wind Entrepreneurs



**Now: Exporting  
power for profit**





## The Answer is Blowing in the Wind



**“We grow corn on the ground and generate power in the air -- all on the same piece of property.” - Delbert Watson, Iowa farmer**



## The Economics of Wind Farming

A 1000-acre farm could earn as much as \$80,000 per year in royalties from wind generation:

- Spacing of one 750 kW turbine per 26 acres (one-acre footprint): 40 turbines
- Average royalty of \$2,000 per turbine per year



# National Benefits

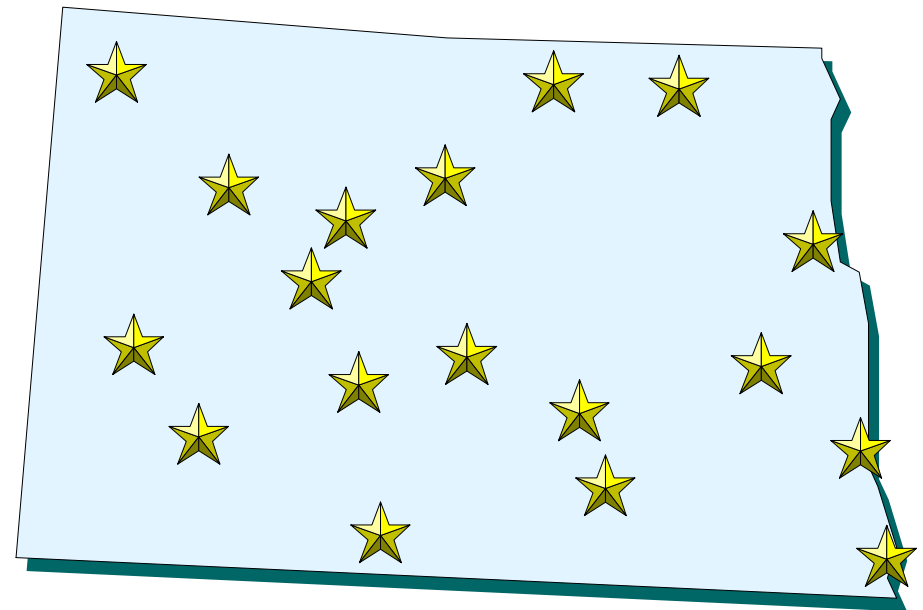
- \$60 billion in capital investment in rural America over 20 years
- \$1.2 billion in new income for farmers, Native Americans, and rural landowners over 20 years
- 35 million tons of carbon displaced in 2020
- 80,000 permanent jobs by 2020





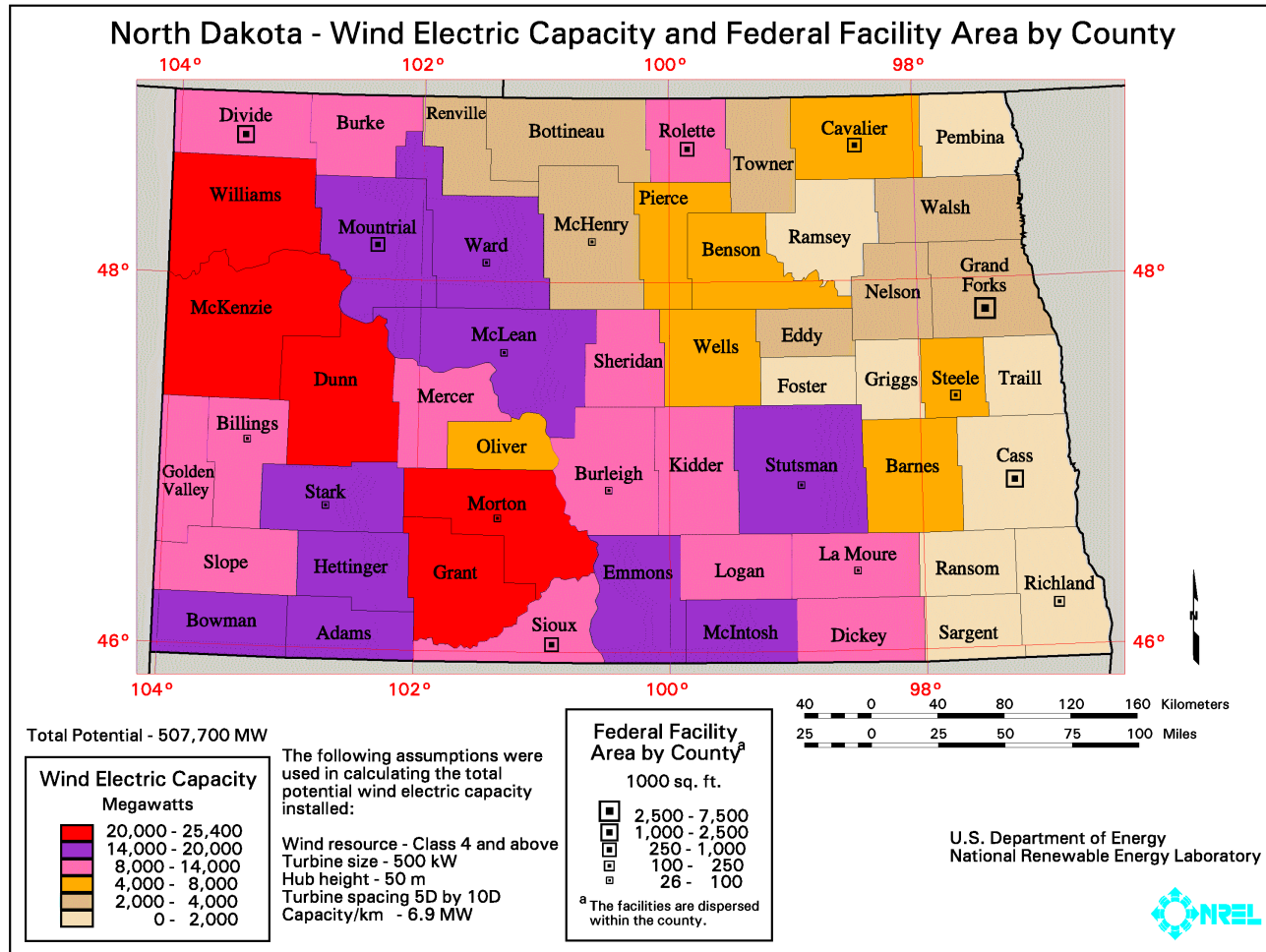
# Federal Facilities: Major Wind Opportunities

- Executive Order 13123
- Wind Powering America goal:  
5% of Federal electricity use by  
2010
- Projects under way:
  - San Clemente Island, U.S. Navy  
Project
  - Ascension Island, U.S. Air Force  
Project
  - Utility-scale project planned at  
Fort Bliss (TX): A model for  
replication across the country
  - Alaska Army base potential site





# Federal Facilities: Major Wind Opportunities







# San Clemente Island Naval Station

Three wind turbines operational July 2, 1999



Long range plan for 100% renewable power supply



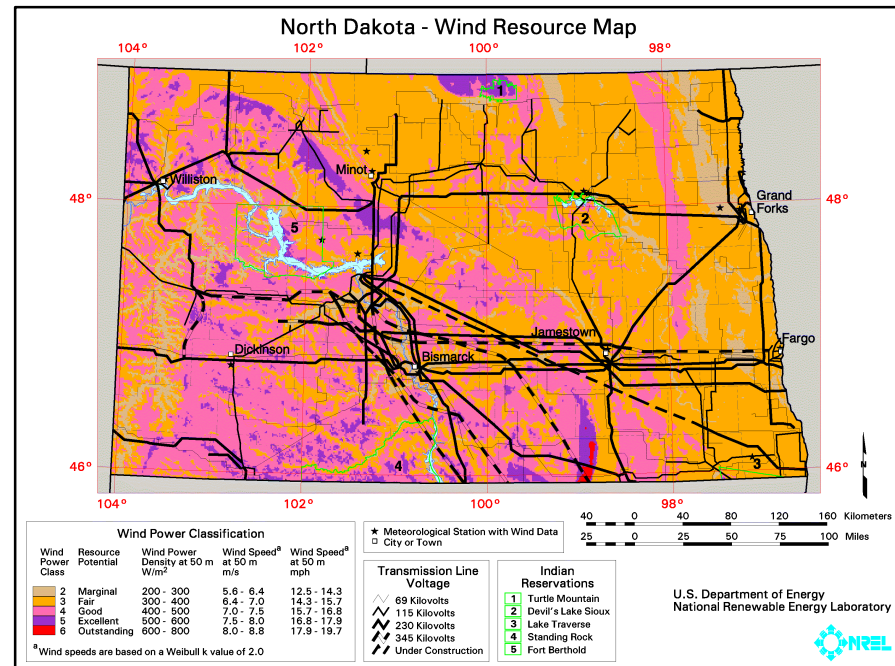
\$346,000 Projected annual savings vs. diesel fuel





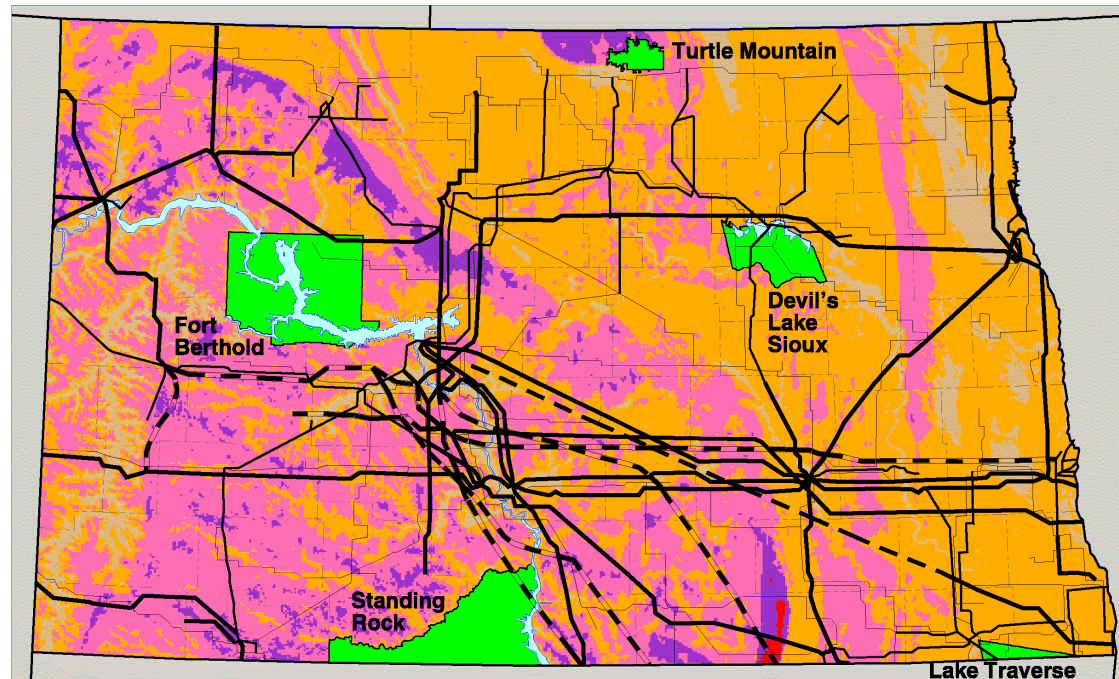
# North Dakota Opportunities

- Out of State Green Power Demand
- Transmission System Expansion
- New Income for Farmers
- Potential Synergy with Coal





# Native American Opportunities



Wind Power Classification	
Wind Power Class	Resource Potential
2	Marginal
3	Fair
4	Good
5	Excellent
6	Outstanding

Transmission Line Voltage	
	69 Kilovolts
	115 Kilovolts
	230 Kilovolts
	345 Kilovolts
	Under Construction

Indian Reservations

U.S. Department of Energy  
National Renewable Energy Laboratory







# Exporting Green Power

## Foote Creek Rim, Wyoming

- 41 MW wind power plant -- 69 turbines
- Power exported to Washington and Oregon to serve green power demand
- Generation equivalent to a \$140,000/year royalty payment to landowners





# The Time is Right

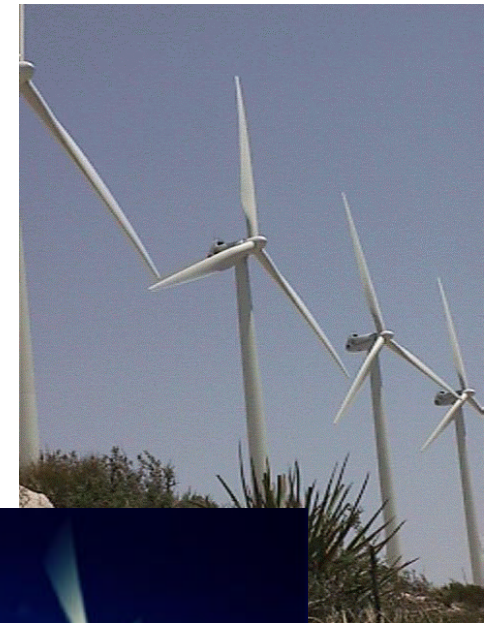
- Wind Technology Readiness
- Rural Economic Development Needs
- Electric Industry Restructuring
- Climate Change





# National Strategy

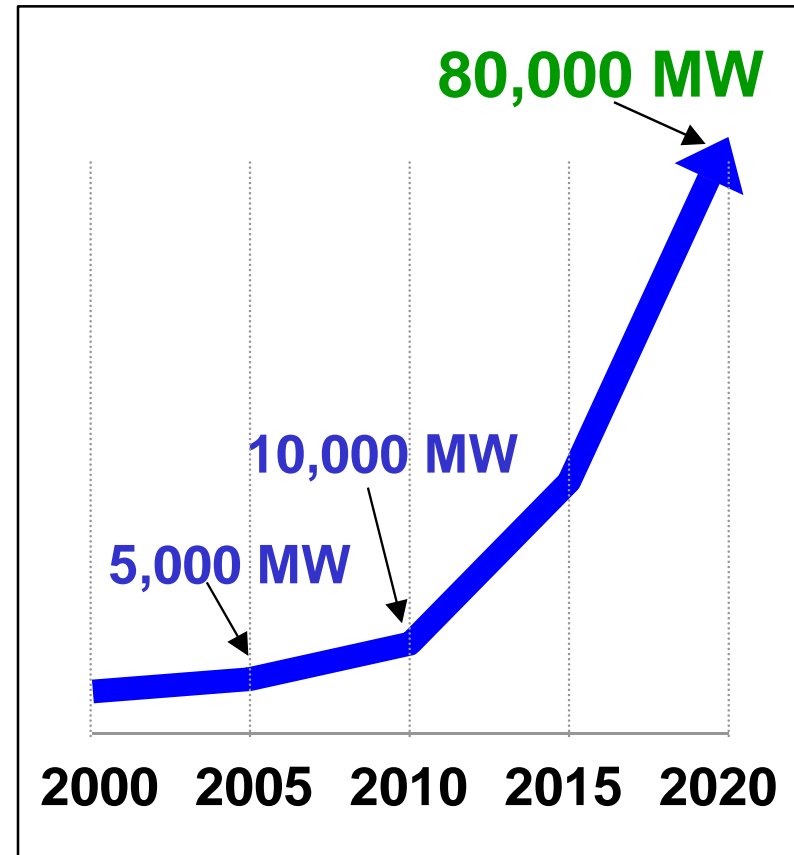
- Provide Federal Leadership
- Develop State and Local Partnerships
- Accelerate Technology Development
- Educate American Public





## Three Goals

- 5% of nation's electricity by 2020
- Double the states with 20 MW installed to 16 by 2005, and then to 24 by 2010
- 5% of Federal electricity use by 2010 (1,000 MW)





# North Dakota Actions

- WAPA transmission study
- Updated North Dakota wind map, siting study
- Wind Empowerment Zones
- Native American developments
  - *Fort Berthold Reservation wind project*
  - *Tribal wind power capacity assessment (NREL)*
- Building a Partnership



# Challenges

- Cost of Electricity
- Small Load In-State
- Transmission
- Siting
- Lack of Public Understanding

