DOE Wind Program Update

March 2007

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Wind and Hydropower Technologies Program

Program works closely with industry to provide the market transformation support and R&D needed to drive wind development.

Energy Efficiency & Renewable Energy

Motivating Factors

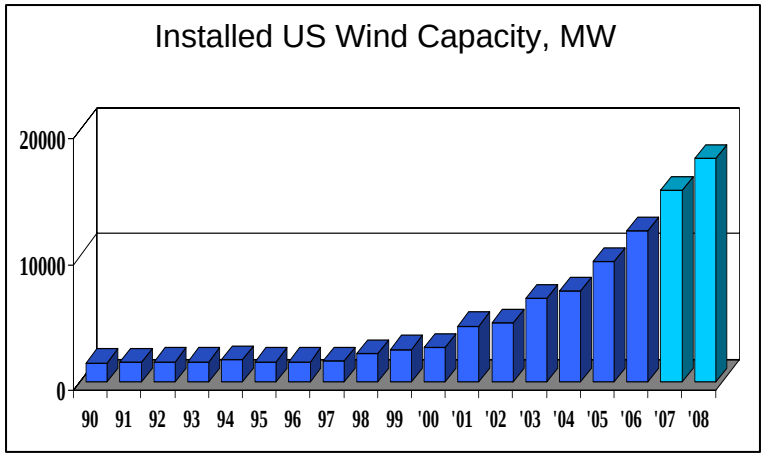
- U.S. Energy Demand to Increase 40%+ over next 25 Years
- $Billions investment required
- Security/Economic Vulnerabilities to Business as Usual

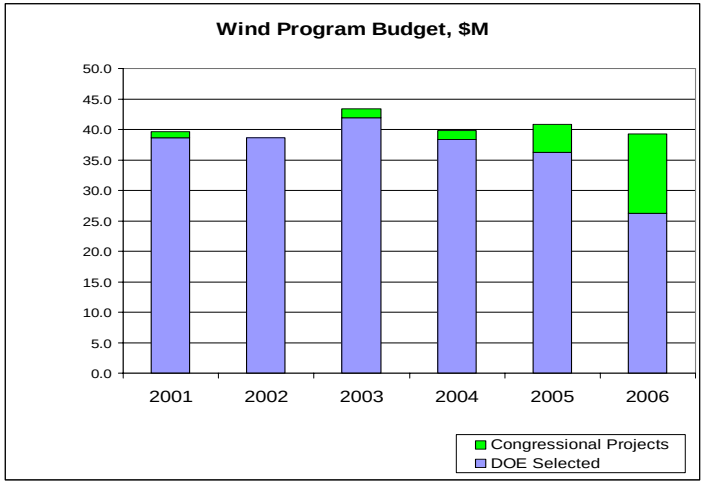
Choices

- Develop U.S. wind resources or increase energy imports
- Clean energy vs. vulnerable generation
- Expand transmission or strand resources

Program Accomplishments

- A drop in the cost of wind energy from 40 cents/kWh in 1980 to as low as 4 cents/kWh today
- 19 States with over 100 MW of wind installed today vs. 4 in 1999





Since the 1970's, DOE has spent just over $1B in developing a market, which will reach over $4B in commercial investment in 2006 alone.

Showstoppers

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Deployment driven by incentives

- W/out PTC AEO projects 20 GW in 2025
- 10-20% uncertainty premium

Rising costs of wind

- Materials
- Limited US Production – Exchange rates

Siting barriers

- Environmental
- Radar
- Public acceptance

Turbine reliability

- Gearbox / Drivetrain
- Blades
- Young fleet
- Small test facilities

Transmission Issues

- Integration / Variability
- Low Utilization
- Critical Corridors
- Long haul efficiency

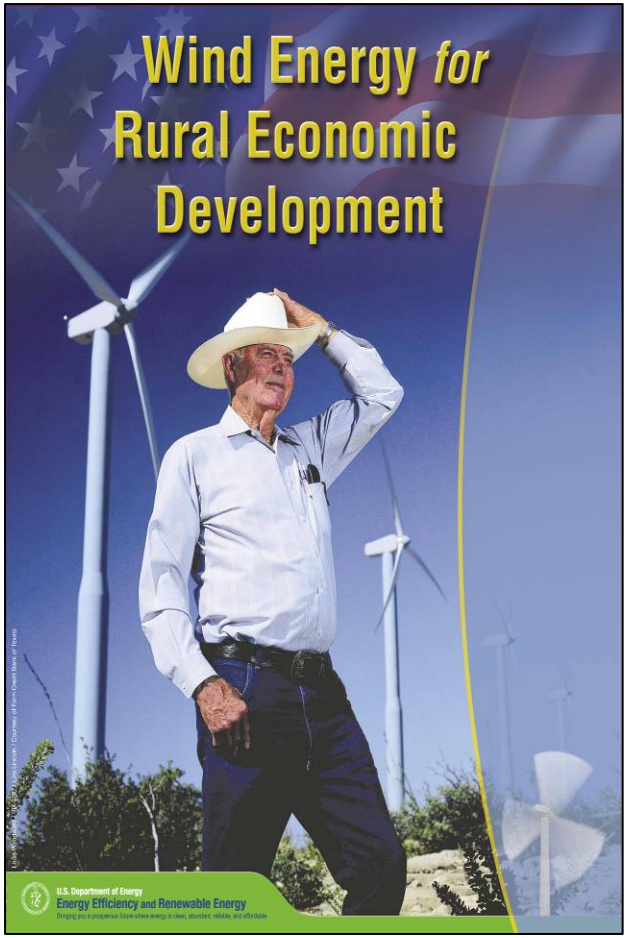
Sources: BTM Consult Aps, Sept 2005
Windpower Monthly, January 2006

Program Realignment Underway

Energy Efficiency & Renewable Energy

New Direction Given:

- Stronger Near-term & Deployment Focus
- Better Balancing of R&D Activities to Support Sustainable Industry
- Taking Stronger Policy Role
- Addressing Existing/New Barriers



Key Transformation Activities

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Federal Collaboration – Removing the Rocks
- Wind Radar Group
- Federal Agency Wind-Siting Issues Coordination

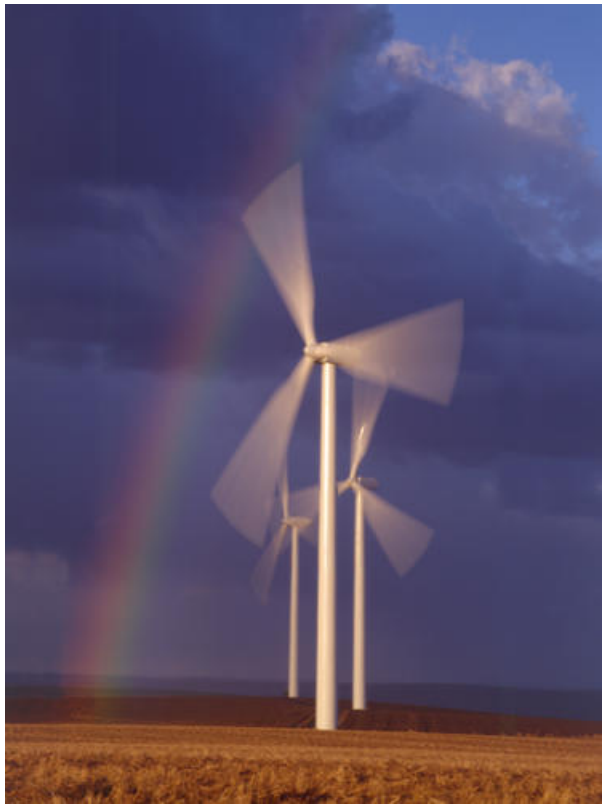
Program Outreach
- Wind Powering America
- State Based Wind Working Groups
- Regional Deployment Activities

Clean Energy Super Highway
- OE Collaboration
- National Governors Association

Turbine Reliability
- Reduce Risk to Fleet
- Lower Cost of M&O

Support DOE Policy Development

Community Acceptance Research



Major Changes

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- **Reduced funding for Low Wind Speed Technology/Offshore Wind**
  - Decreased need for government support of large scale, land-based wind turbine system development.
  - Support research and testing to increase turbine reliability and performance
  - Reduced use of cost-shared partnerships; increased CRADAs & new arrangements

- **Increased funding for Systems Integration**
  - Collaboration with the Office of Electricity Delivery & Energy Reliability
  - Expanding wind plant characterization, integration, and interconnection studies;
  - New initiatives

- **Increased funding for Technology Acceptance**
  - Address siting, permitting, and environmental barriers to the use of wind technology
  - Address/mitigate environmental, public acceptance and wildlife issues
  - Enhanced Wind Powering America; Wind for Schools/Regional Wind Institutes

- **Increased funding for Distributed Wind Technologies**
  - Residential, small commercial, farm, and community wind markets
  - Focused technology development and application support
  - Expand support for turbine testing in support of state-based incentive programs

Wind Program Budget

Energy Efficiency & Renewable Energy

(dollars in thousands)

	FY 2006 Appropriations	FY 2007 Request	FY 2007 Expected	FY 2008 Request
Wind Energy				
Technology Viability	17,829	35,905	31,249	27,200
Low Wind Speed Technology	4,662	19,142	10,847	5,843
Distributed Wind Technology	553	481	750	3,850
Supporting Research & Testing	12,614	15,310	18,592	16,966
SBIR/STTR	0	972	1,060	541
Technology Application	7,634	7,914	12,570	12,869
Systems Integration	2,466	3,970	6,926	5,942
Technology Acceptance	2,646	3,856	5,644	6,919
Supporting Engineering & Analysis	2,522	0	0	0
SBIR/STTR	0	88		8
Congressional Directed Activities	12,870	0	0	0
Transmission Corridor Support	0	0	5,500	0
Wind Energy Total	**38,333**	**43,819**	**49,319**	**40,069**
Hydropower Technology				
Technology Viability	150	0	0	0
Technology Application	345	0	0	0
Hydropower Total	**495**	**0**	**0**	**0**
Wind and Hydropower Technologies Total	**38,828**	**43,819**	**49,319**	**40,069**

Large Wind Technologies - Improving Reliability and Performance of Existing Technology

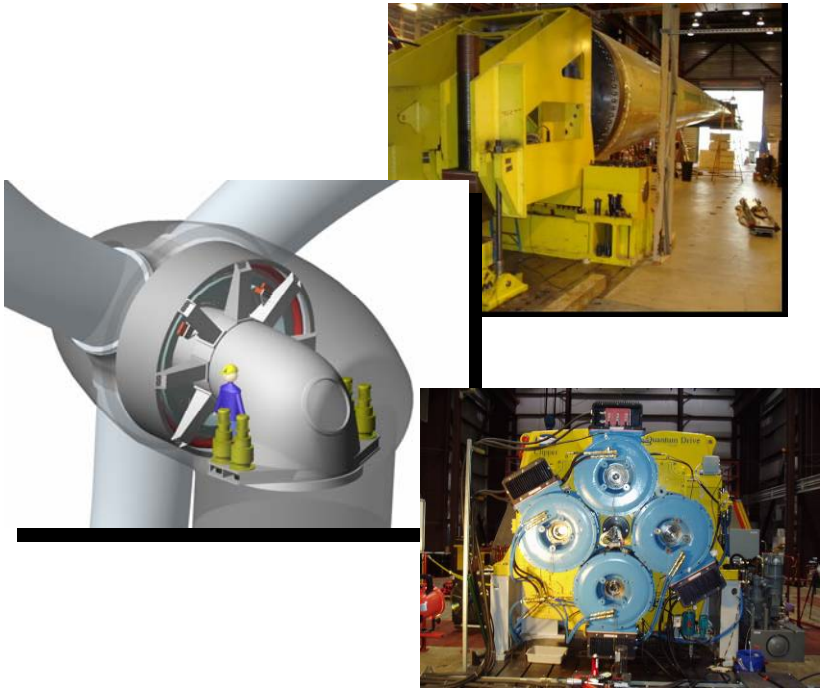
Energy Efficiency & Renewable Energy

Main Themes

- Increase the reliability of current wind technologies
- Improve the performance of wind systems
- Expand the market for wind by bringing it closer to load centers

Program Activities

- Turbine gearbox and drive train reliability
- Performance enhancement through technology development and testing
- Advanced component development (blades, advanced controls & generators)
- Applied research; aerodynamics, materials, and design codes
- International collaboration and standards development



The testing of large turbine technology is critical to lower financial risk of projects

Through collaboration with industry and targeted research improve the reliability and lower the risk for wind technology

Distributed Wind Technologies - Improving Reliability and Performance of Existing Technology while Reducing Barriers to Project Development

Energy Efficiency & Renewable Energy

Main Themes

- Reliable residential turbine technology
- Availability of mid-sized turbine technology (10 to 600 kW) for the farm and industrial sector
- Support for the community wind market

Program Activities

- Testing of residential wind turbines
- Technology deployment partnerships with industry
- Educational and market outreach on the benefits of wind technology on rural development.

Distributed wind applications enables communities and individuals to play an active role in supporting the Nation's energy future

Promoting advanced distributed wind technology as a cost effective option for powering rural areas.

Wind Systems Integration - Enhancing Critical Energy Infrastructure

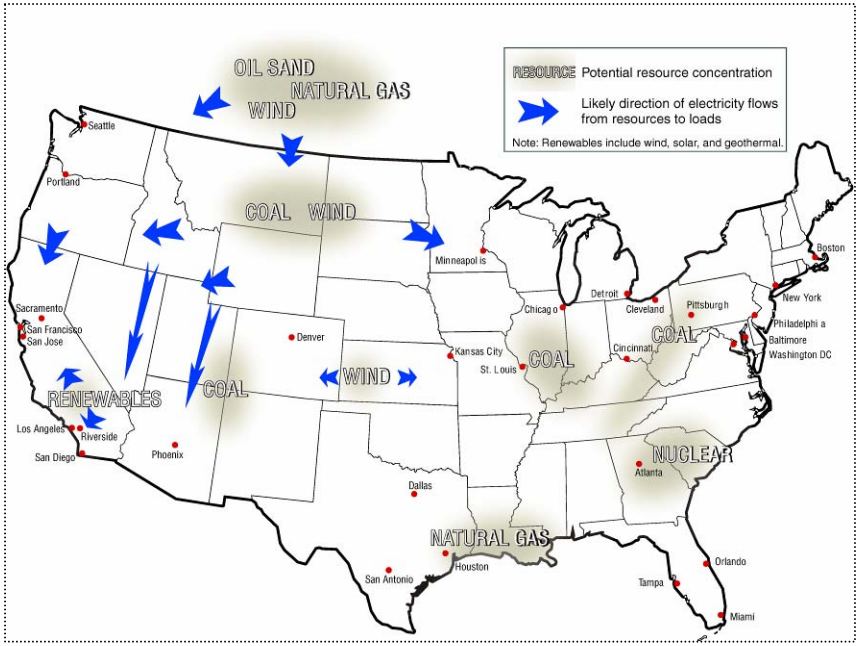
Energy Efficiency & Renewable Energy

Main Themes

- Critical transmission corridors
- Integration of wind into the national energy system
- Fair and equal interconnection policy for wind technologies

Program Activities

- Actively supporting the development of major Clean Energy Superhighways
- Collaboration with the DOE Office of Electricity Delivery and Energy Reliability
- Outreach to federal, state and local organizations and utilities
- Research the impact of wind technology on the electricity grid



Transmission will play a key role in the Nation's ability to use its wind resources effectively.

Address electric power market rules, interconnection impacts, operating strategies, system planning and transmission needed for wind to effectively compete in the Nation's energy markets**.**

Technology Acceptance - Reducing Barriers to Project Development

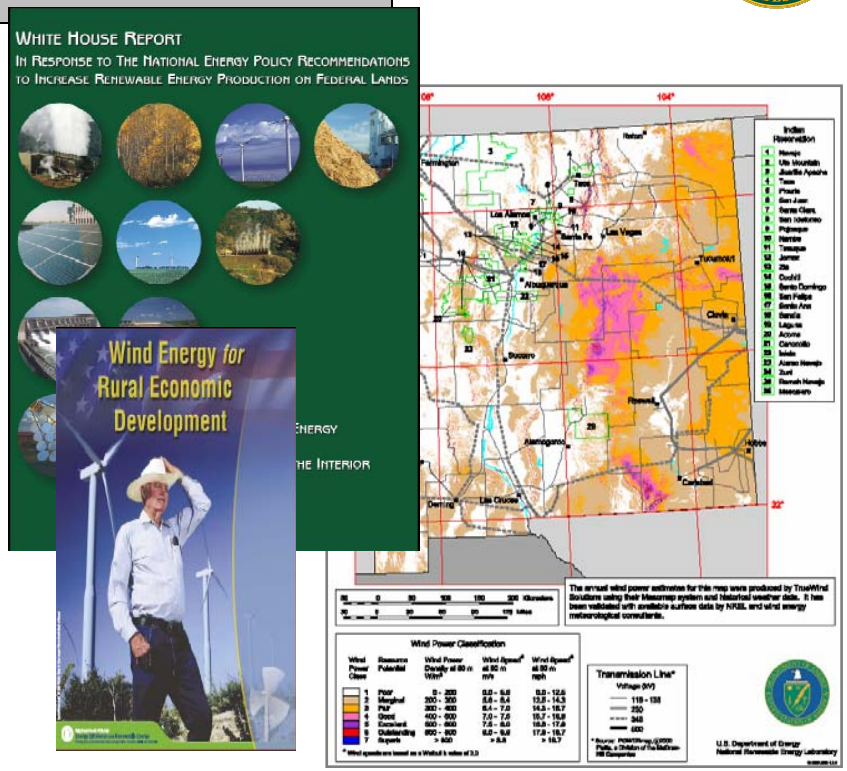
Energy Efficiency & Renewable Energy

Main Themes

- Enhance Public Acceptance
- Promote Supportive Public Policies
- Engage Key Stakeholders
- Address Wind System Siting Issues
- Facilitate Environmental Assessment

Program Activities

- Wind Powering America Program
- Interagency Collaboratives
- Targeted Tribal and Utility support



Accurate and timely information about wind energy is critical to project development

Build State-Local Wind Stakeholder Network and Engage Key Decision-makers to Promote Wind Development

Contact Information

Energy Efficiency &
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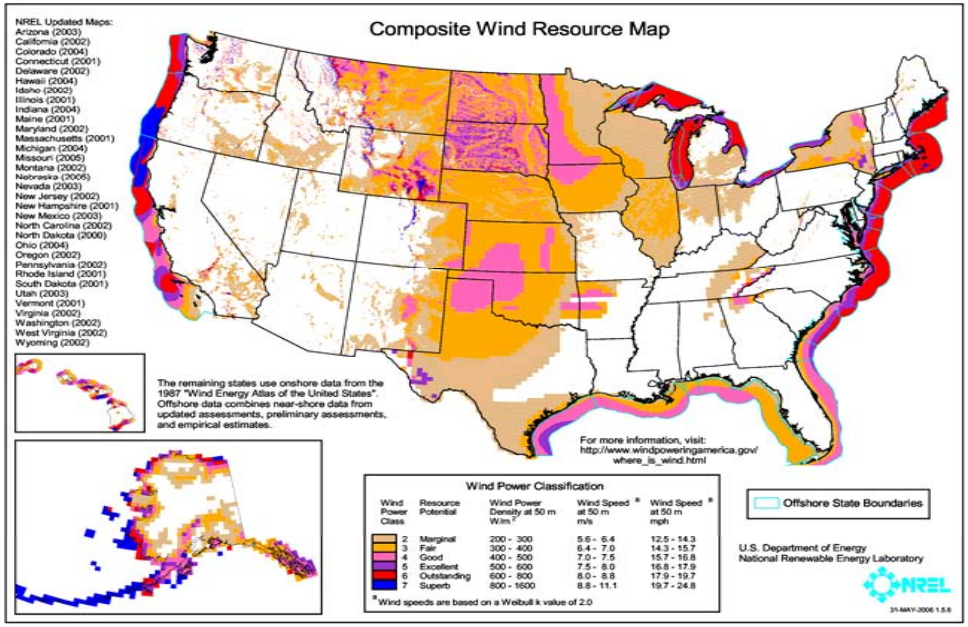
Additional Slides

The President's Advanced Energy Initiative highlights the potential to produce 20% of the nations electricity from wind – a technically feasible vision.

Energy Efficiency & Renewable Energy

Wind Technology Market

- 1 Turbine = 1.5 Megawatts (MW)
- 12,000 MW installed in the U.S. ~1% of US energy production.
- 70,000+ MW installed World Wide
- 3,000,000 MW of land based resource potential in the U.S.
- One of the fastest growing energy producing technologies



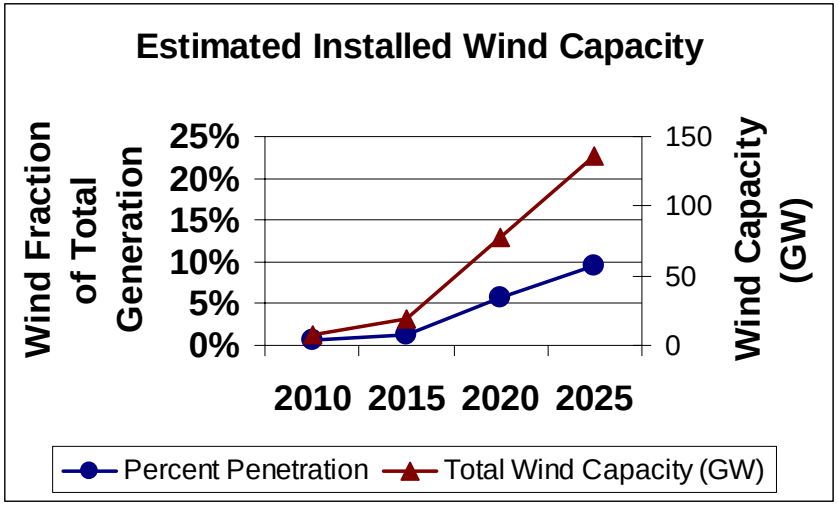
The Wind Industry is preparing for a 20 fold increase in current production to reach one-fifth of electricity production in the U.S.

Program Impacts

Energy Efficiency & Renewable Energy

Each 1,000 MW of wind results in:

- Capital investment of over $1.5 billion
- $2 million/yr to rural landowners for land lease
- Over $5 million/yr in property tax payments
- 1500 new construction jobs with salaries of $50 million per year during construction
- 10 billion cubic fee of strategic natural gas annually saved worth $70 billion
- $30 million annually in utility bills saved from stabilized electricity prices
- 1.68 million metric tons of carbon avoided annually
- 33.0 million short tons of coal displaced



By 2025, over 135,000 MW of installed wind capacity currently estimated by DOE -- 100,000 MW as a result of program activities

Program Activities will actively Enhance National Security, Stimulate Rural Economies, Save Strategic Natural Gas Resources, and Stabilize Electricity Prices

Pros & Cons

Energy Efficiency & Renewable Energy

- Negative environmental impacts (habitat, birds, bats)
- Ugly, noisy and dangerous
- Small amounts of power
- Costs customers too much
- Developers make tons of money
- Industry relies heavily on tax incentives
- Projects are not subject to regulation and can be put anywhere
- National investment in wind technology is waste of taxpayer funds

= Wind isn't worth "it"

- Low environmental impacts vs. traditional generation
- Power generation technology
- Small is a relative term
- Stabilize costs to customers
- Stimulates economic activity
- Wind tax incentives relatively small
- Wind projects are subject to variety of local, state and federal regs
- National investment in wind technology is matter of economic and national security

= Wind is worth "it"

Breakthrough Products based on Industry Collaboration

- General Electric Wind, 1.5 MW Turbine - 40+ % of 2005 new US capacity
- Clipper 2.5 MW Liberty Turbine – New advanced drive train
- Southwest Wind Power Skystream 1.8 kW – Cost effective residential turbine

1.5 MW, 1.5s Series

2.5 MW Liberty

1.8 kW Skystream

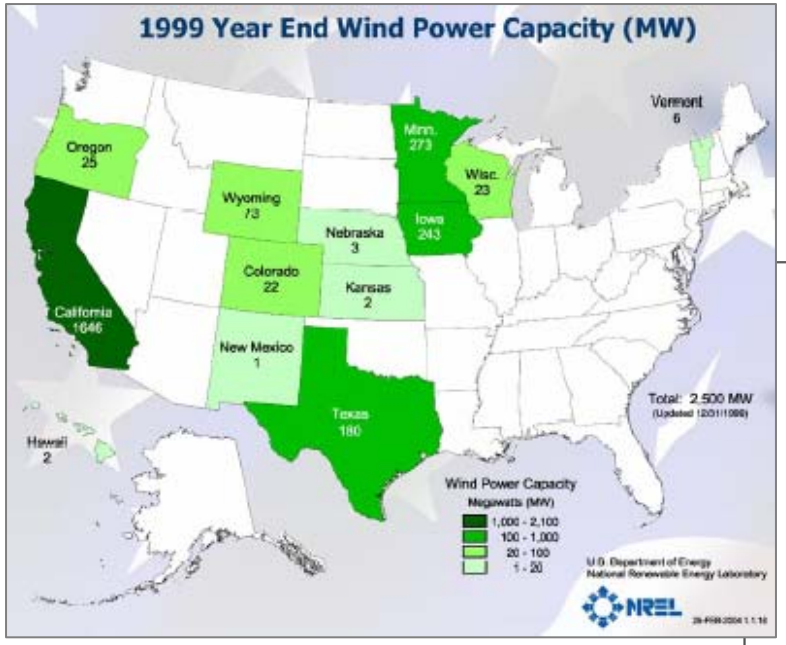
"Clipper's Liberty Turbine is not only one of the most advanced wind turbines ever produced, it may well be the most efficient wind turbine in the world."

Samuel Bodman - Secretary of Energy August 2, 2006

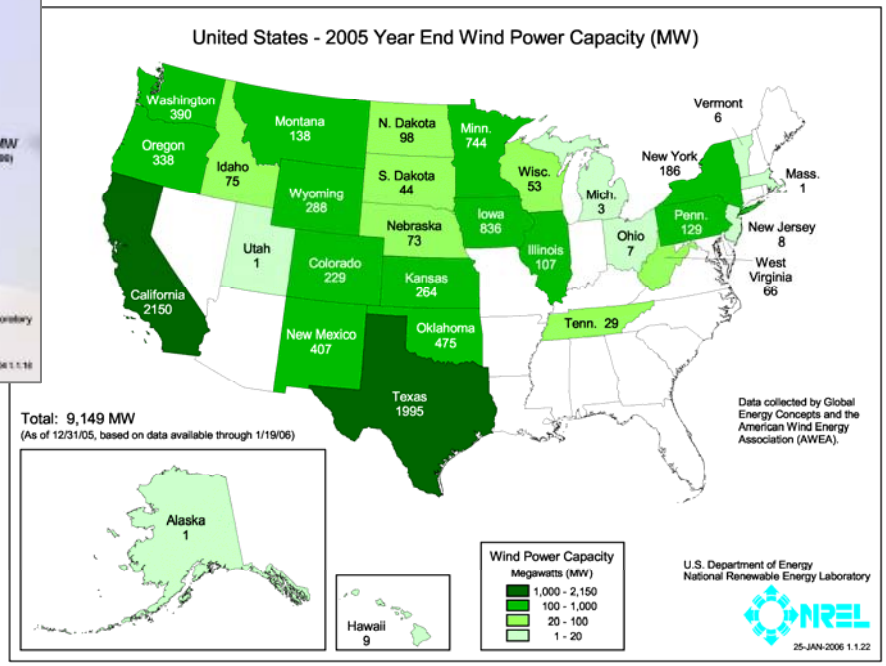
DOE technology development activities have and continue to play a critical role in today's market

Benefits and Impacts of DOE's Wind Energy Technology Application Activities

Energy Efficiency & Renewable Energy



Wind capacity deployment has increased 5 fold since 1999



19 States with over 100 MW of wind installed today from 4 States in 1999 – New Investment of $15 Billion