

US Wind Market Overview

WinterWind 2011



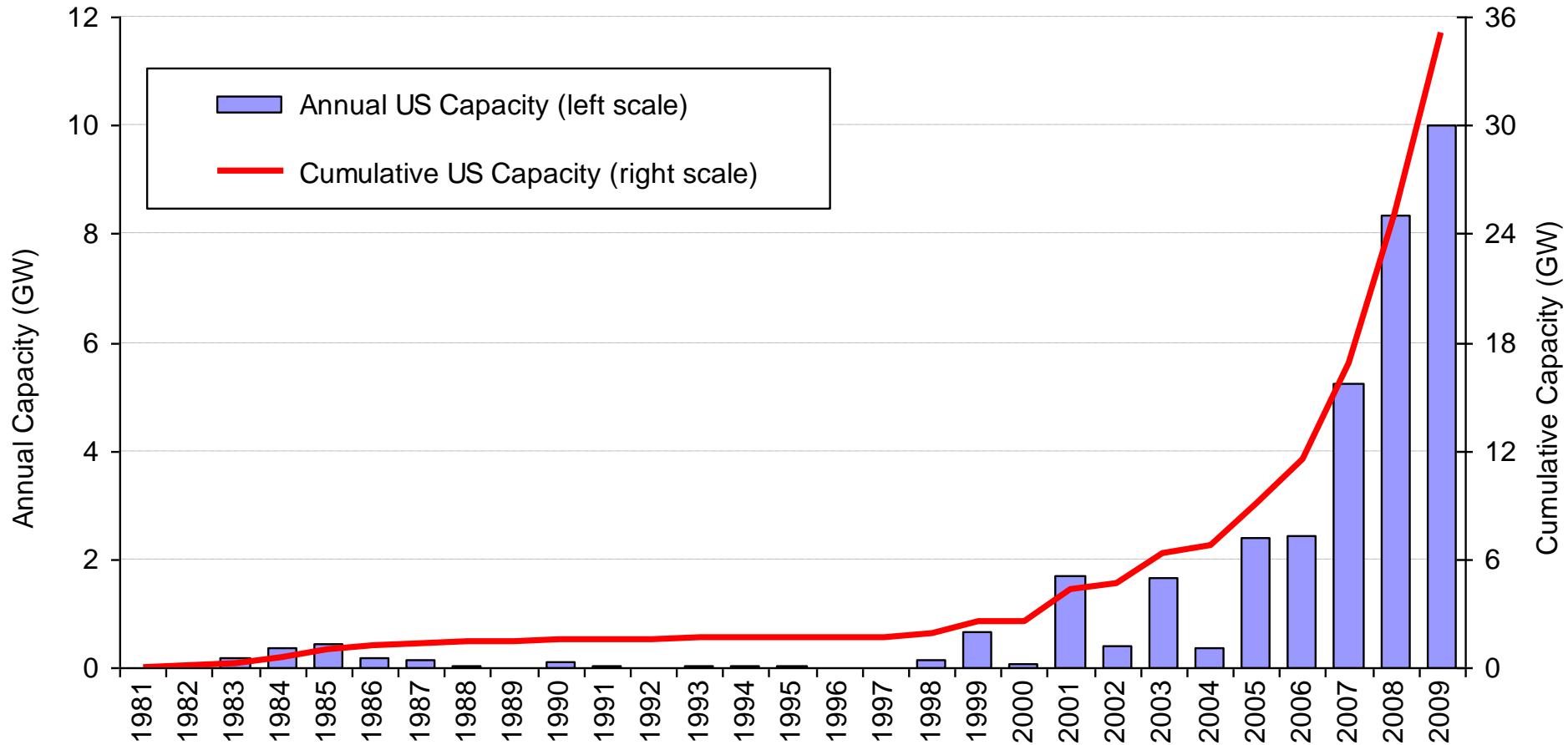
Ian Baring-Gould

National Renewable Energy Laboratory

February 9, 2011

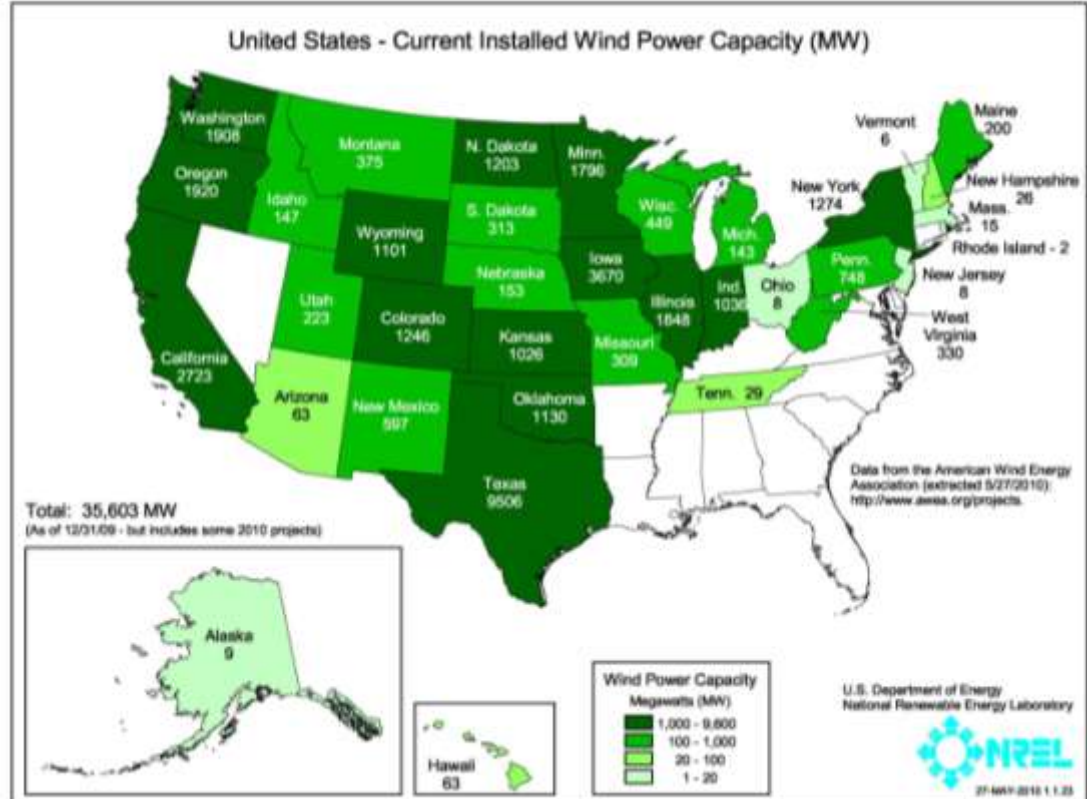
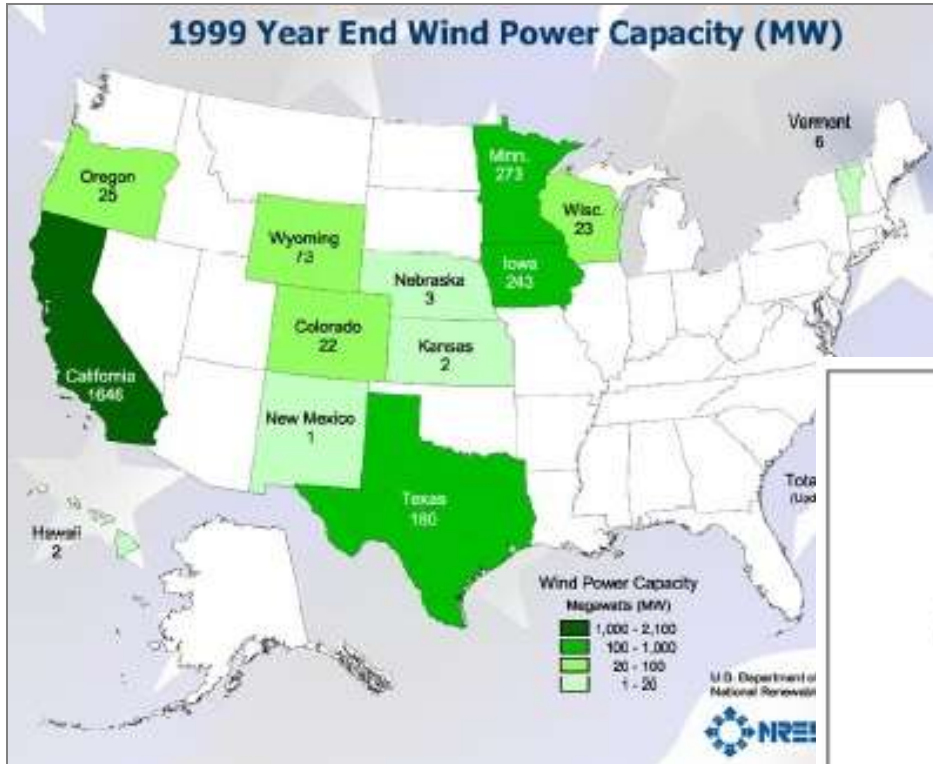
Five Years of Strong Growth:

2009: 9,994 MW Added; \$21 billion Investment

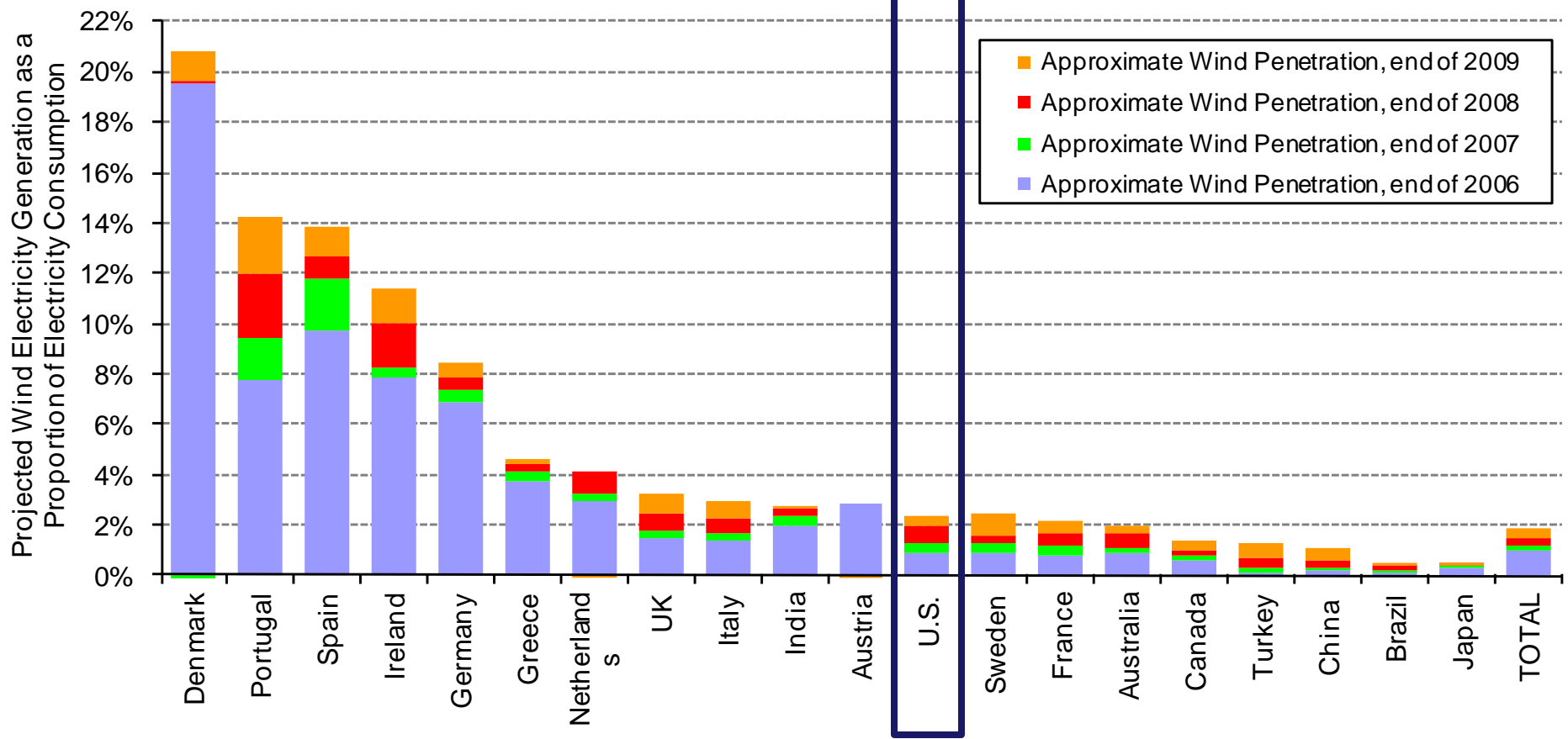


2nd largest market (behind China) in 2009 capacity additions; largest market in terms of cumulative capacity

Installed Wind Capacities ('99 – '10)

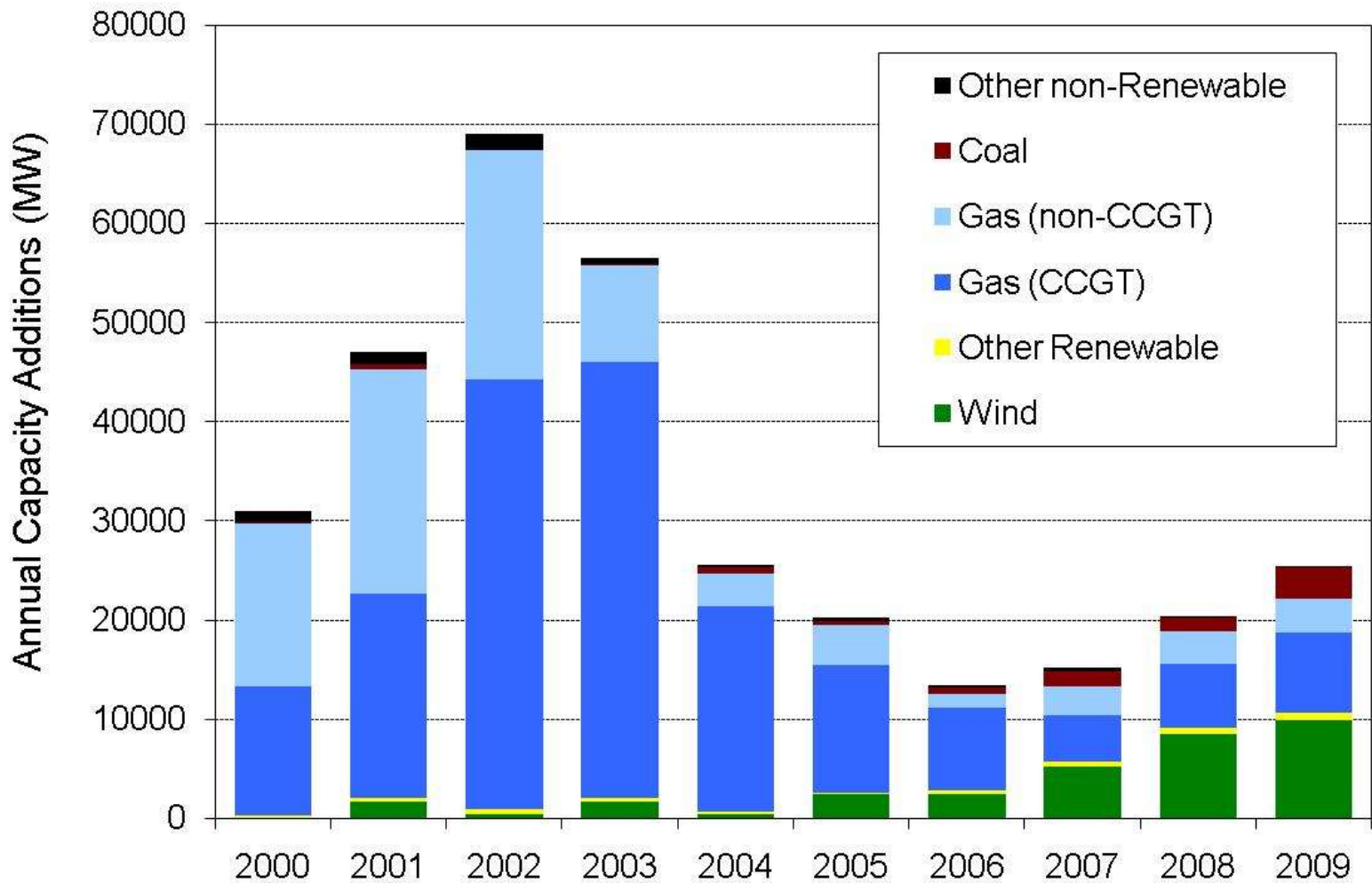


Wind Capacity at End of 2009 Could Deliver 2.4% of US Electricity Supply



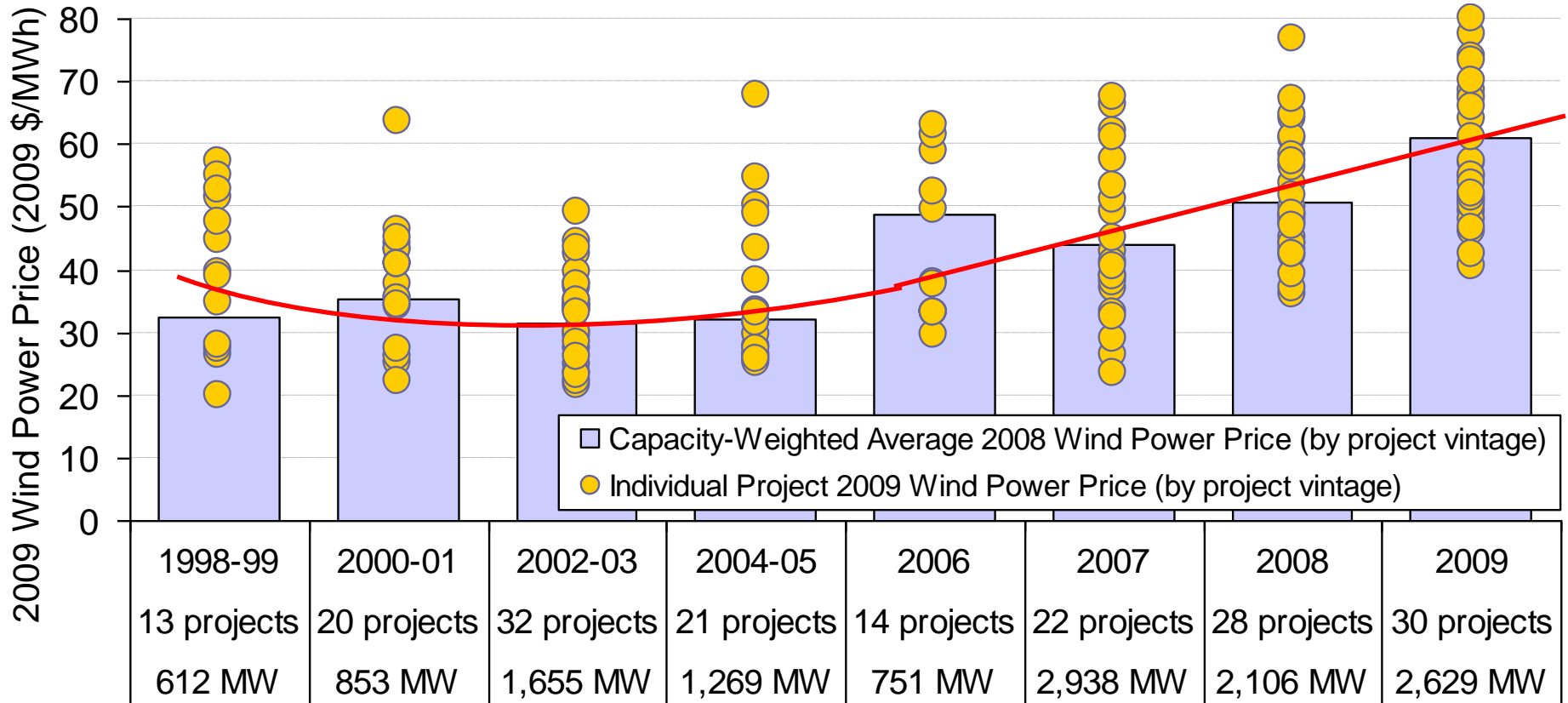
Note: Figure only includes the 20 countries with the most installed wind capacity at the end of 2009

Wind Is a Major Source of New Capacity Additions: 39% in 2009



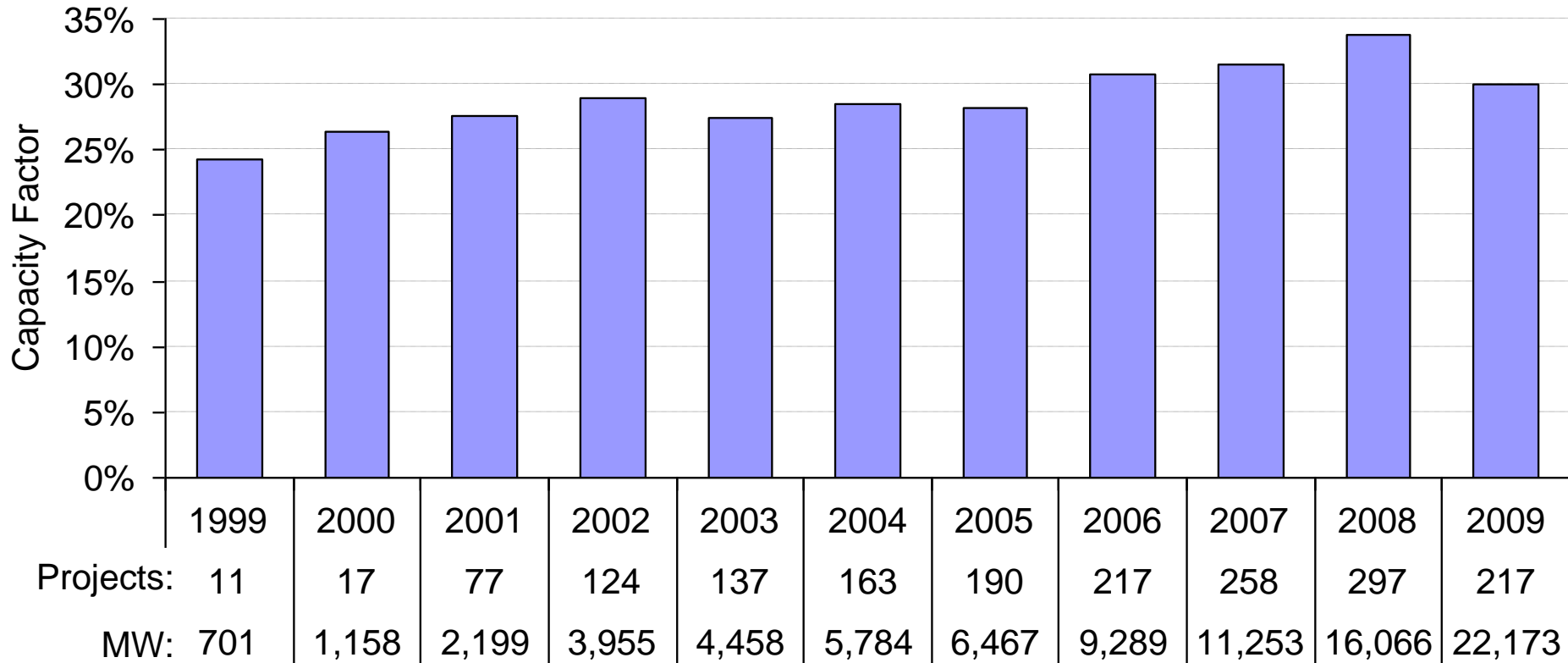
Source: EIA, Ventyx, AWEA, IREC, Berkeley Lab

Wind Power Sales Prices Have Been Rising



- Wind power prices bottomed out with projects built in 2002-03
- Projects built in 2009 are ~\$30/MWh higher on average

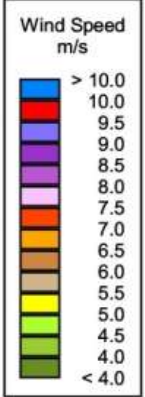
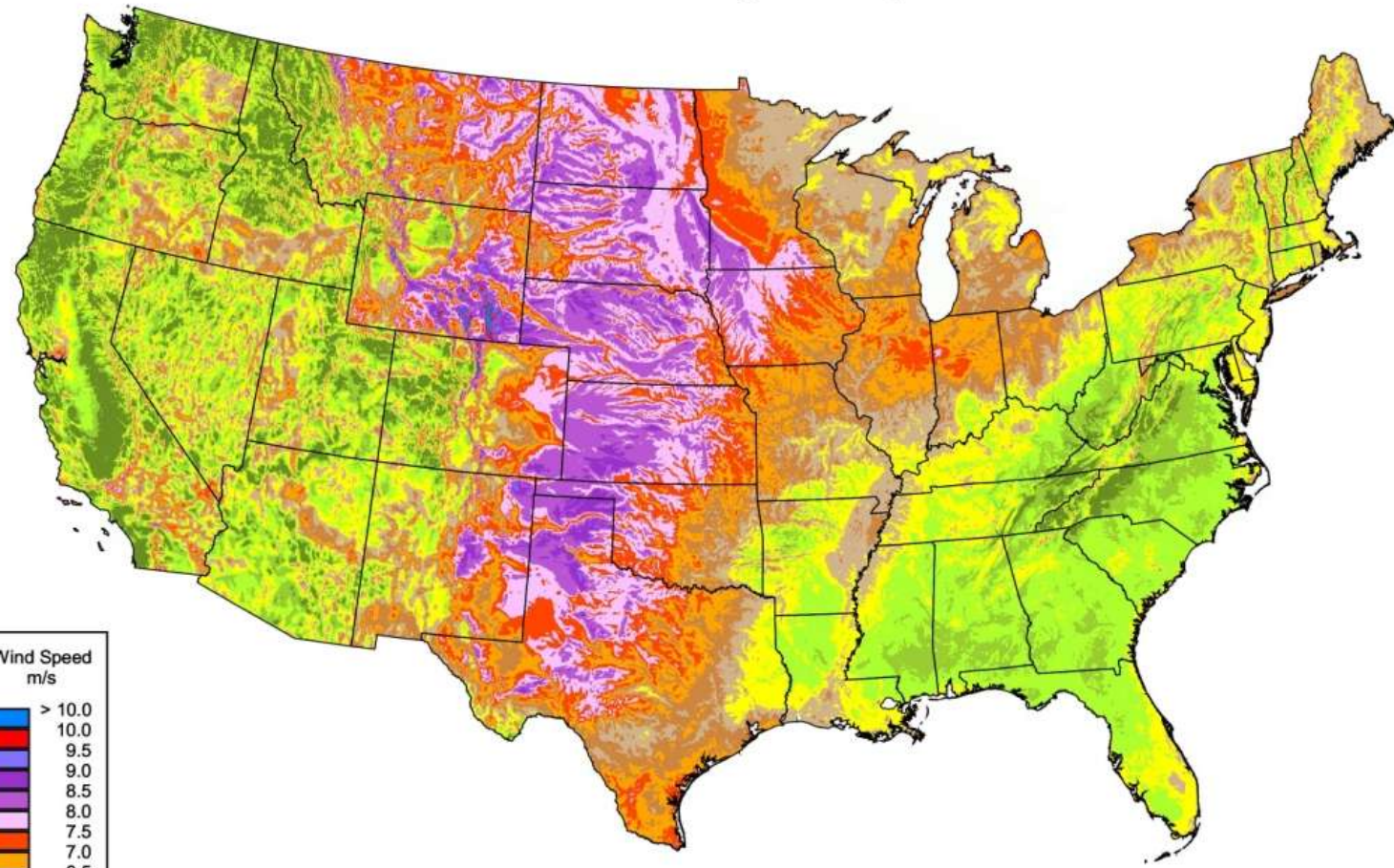
Fleet-Wide Average Capacity Factors Generally Increased Over Time



But... fleet-wide average capacity factor declined substantially in 2009 (30% in 2009 from 34% in 2008)

Lower 48 Wind Resources

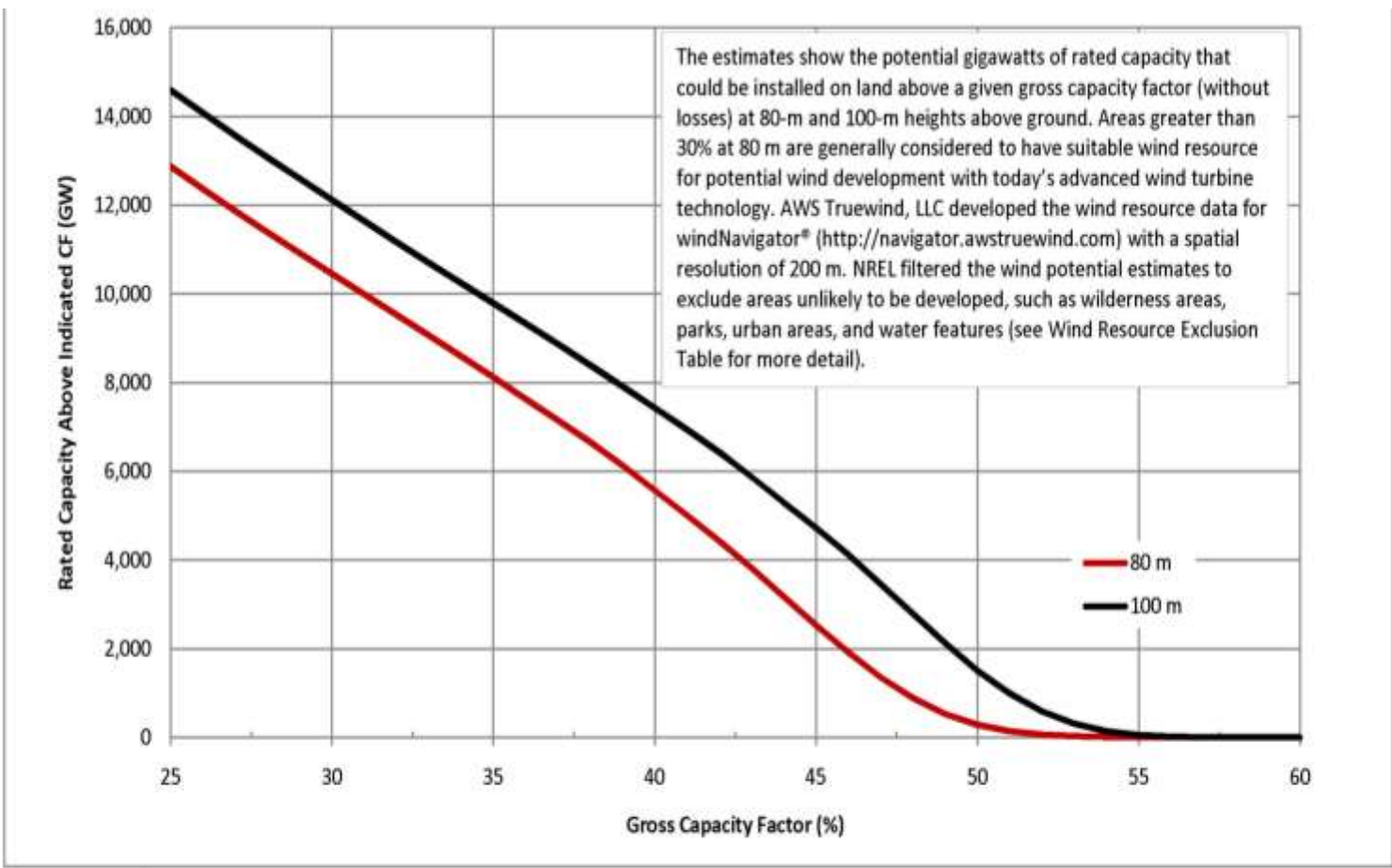
United States - Annual Average Wind Speed at 80 m



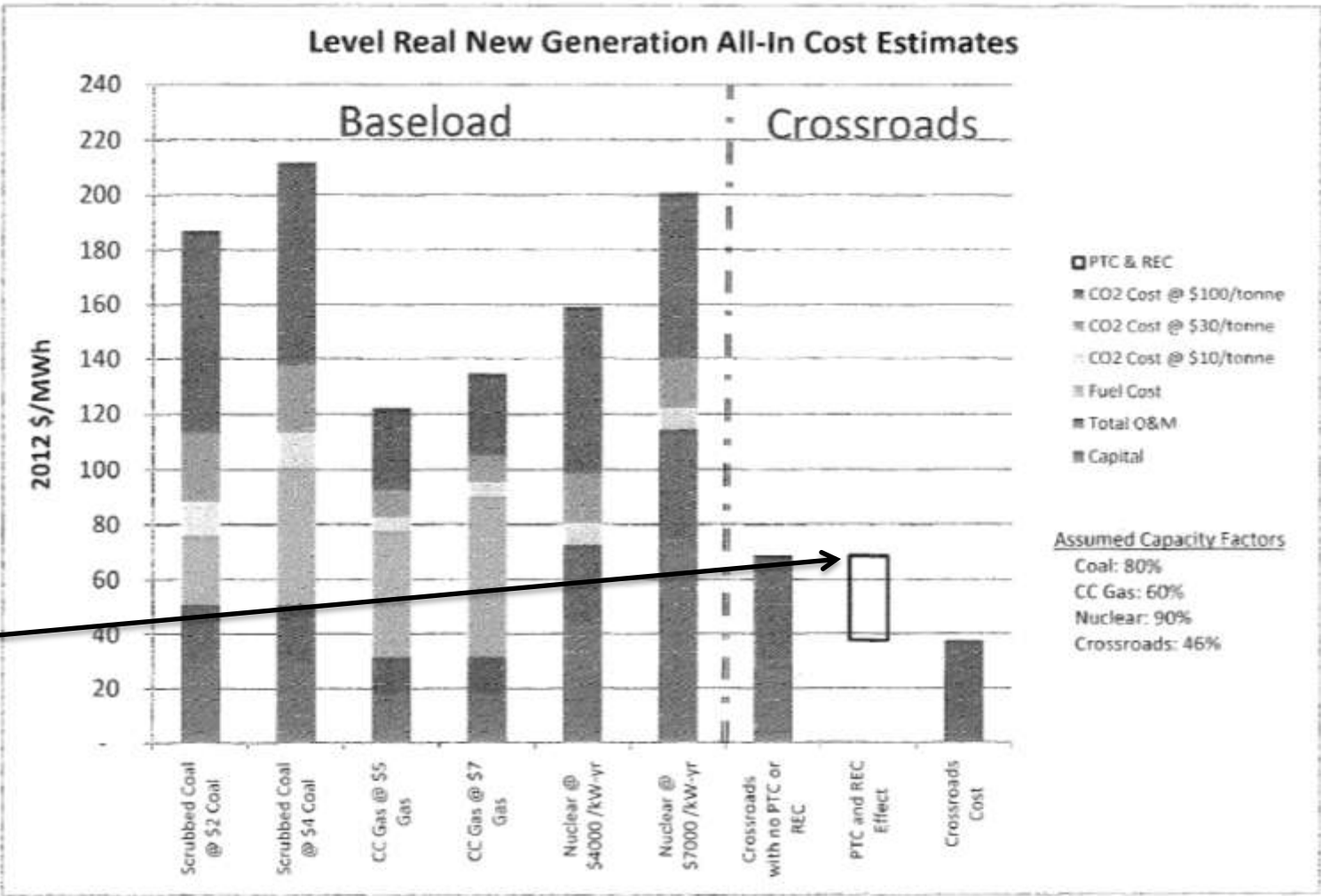
Source: Wind resource estimates developed by AWS Truewind, LLC for windNavigator®. Web: <http://navigator.awstruewind.com> | www.awstruewind.com. Spatial resolution of wind resource data: 2.5 km. Projection: Albers Equal Area WGS84.



United States (48 Contiguous States) – Wind Resource Potential Cumulative Rated vs. Gross Capacity Factor (CF)

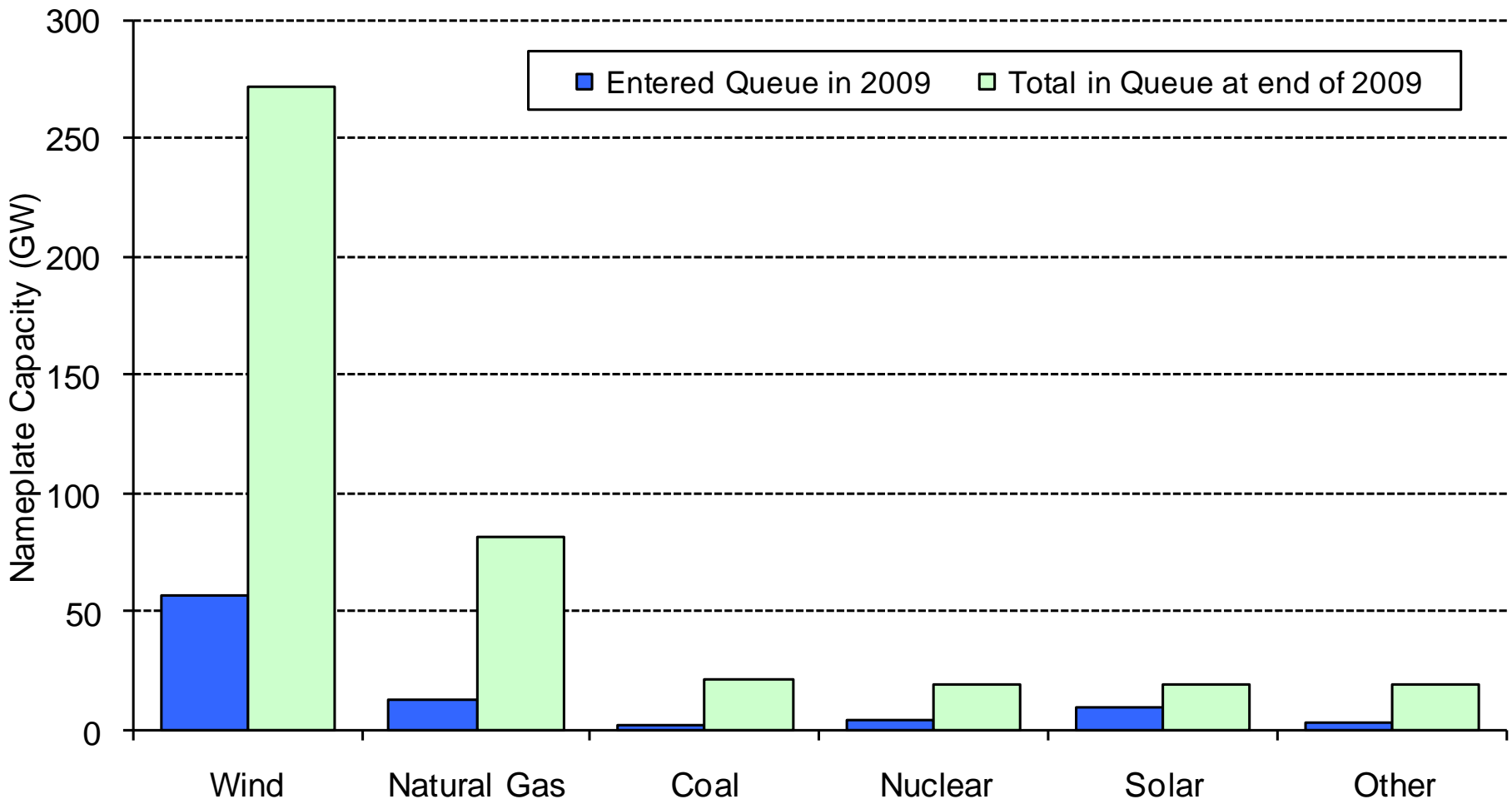


Oklahoma Gas & Electric's View of Costs of New Generation

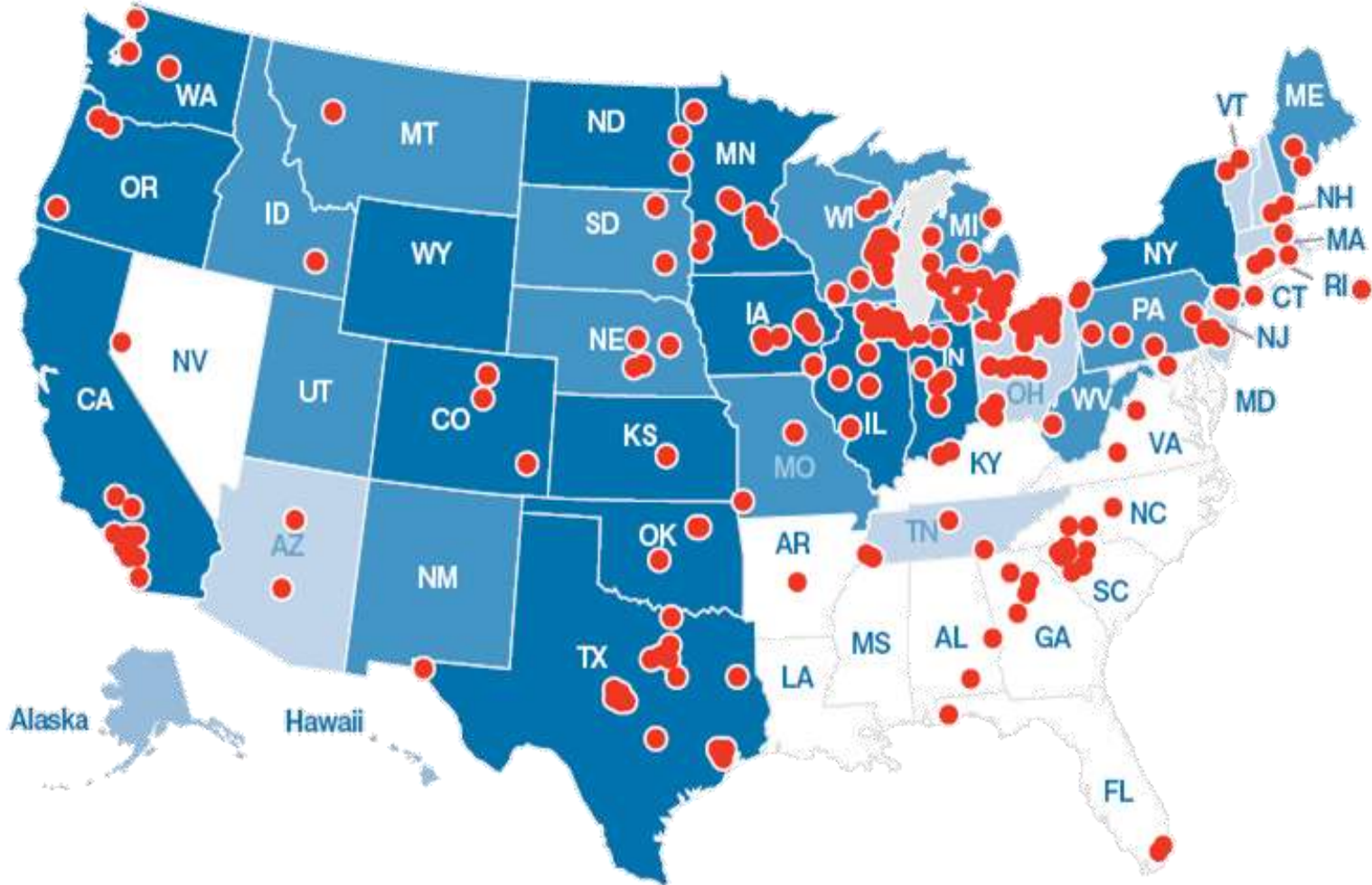


New wind is cheaper than new gas, coal or nuclear

Interconnection Queues Are Clogged with Wind Projects: Nearly 300 GW



US Wind Manufacturing Facilities



Over 200 facilities across the U.S. supply to the wind industry, and this figure does not capture the many additional facilities at the sub-supplier level.

Drivers for Wind Power

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



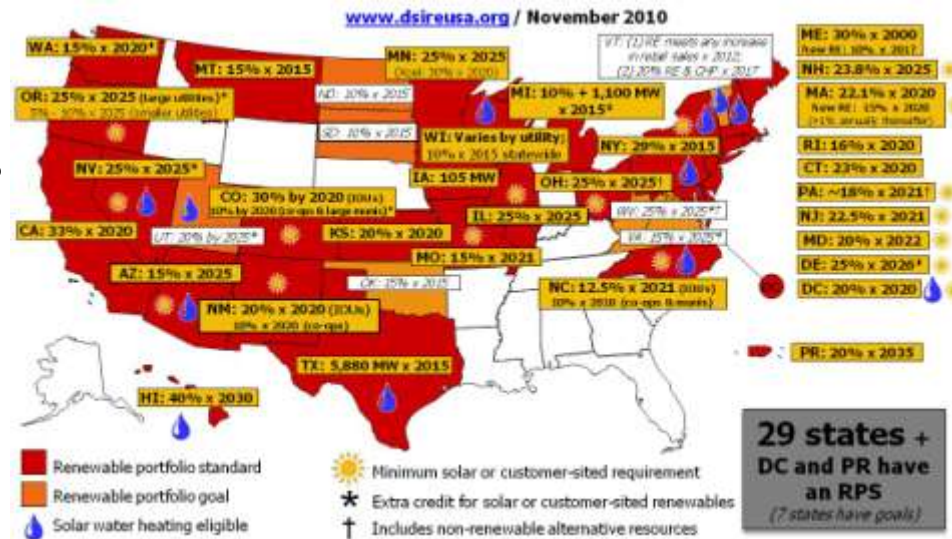
Key Issues for Wind Power



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

Near Term Outlook

- Wind industry has matured, giving it the standing to be a major contributor to the U.S. supply mix
- Wind has been competitive in wholesale power markets in many regions in recent years,
- Recent escalation in wind prices and reduction in natural gas/wholesale market prices, puts more dramatic wind growth at some risk
- Expanding deployment causing social acceptance issues in some markets
- Federal policy likely at a standstill though general drivers exist
- States under increasing pressures so consolidation is more likely
- Wind will come out strong in any regard due to the many factors driving the market
- Transmission, especially in some markets, limit wind development



Policy Support is Strong

- State Policies
 - 37 states and DC with some renewables portfolio standards
 - Growing interest in carbon reduction policies
 - Increased state/regional efforts to address transmission barriers
- Federal Policies
 - 2.5 centUS/kWh Production Tax Credit extended through 2012
 - 30% Investment Tax Credit or Grant option extended through 2011 - Treasury 1603
 - 5-year accelerated depreciation
 - More-proactive transmission build-out supported by FERC
 - More-proactive efforts on siting by Federal authorities
 - Expansion and extension of loan guarantee program
 - New CREB funding, manufacturing tax incentives, transmission funds, bonus depreciation extension, etc. (Pending)

Offshore Wind – Strong Push

Challenges

- Higher risk and cost
- technical challenges
- untested permitting requirements for siting wind projects – 10 years plus

DOE Research & Deployment plan

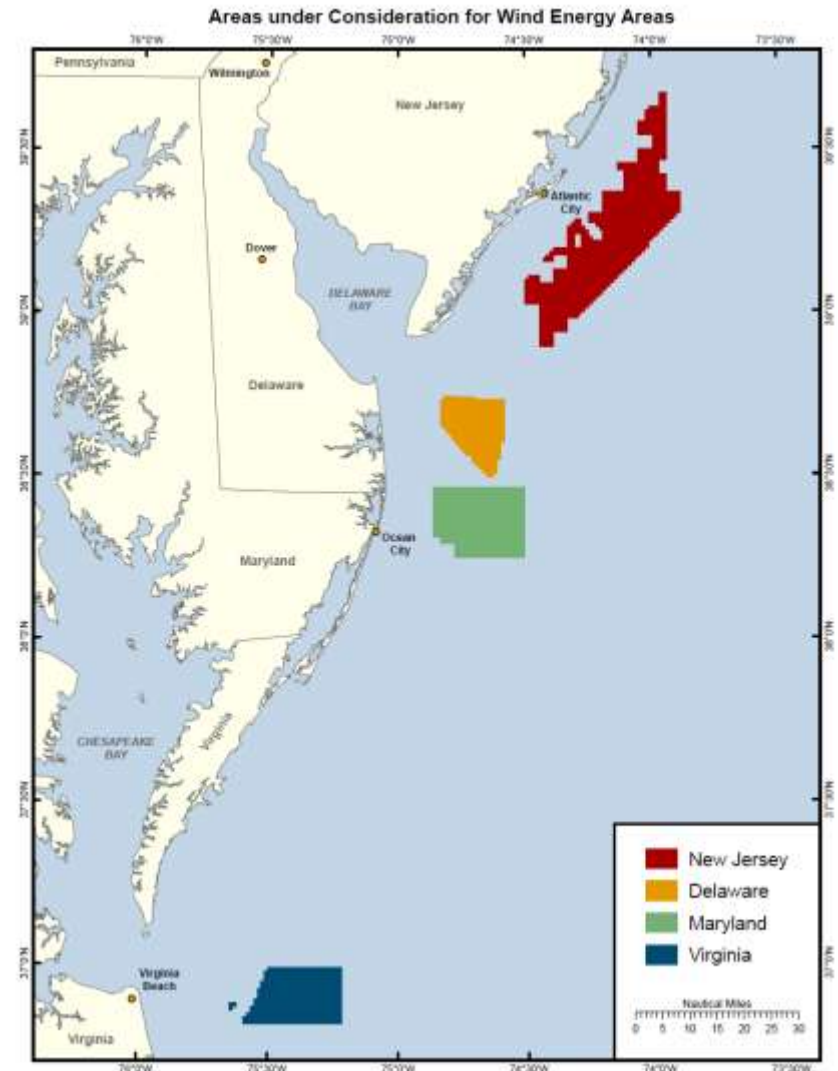
- Competitive solicitation \$50.5M/5 years
 - Technology Development (\$25M/5 years)
 - Removing Market Barriers (\$18M/3 years)
 - Next Generation Drivetrain Development (\$7.5M/3 years)

<http://www1.eere.energy.gov/windandhydro>

- Direct R&D and deployment efforts

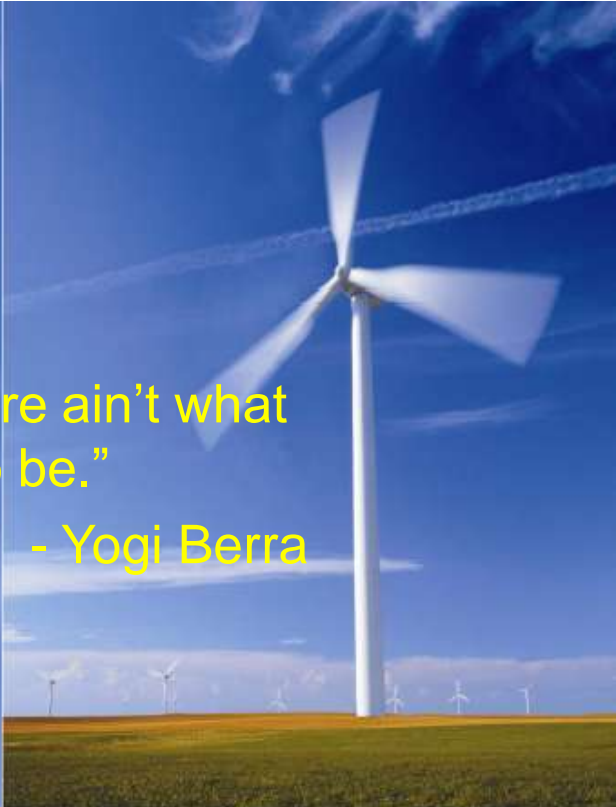
DOI Deployment Activities

- Identification of wind energy deployment areas in four mid-Atlantic states
- More announcements expected for the North and south Atlantic States expected
- Development in the Great Lakes also being investigated



20% Wind Energy by 2030

U.S. Department of Energy
Energy Efficiency and Renewable Energy
 Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

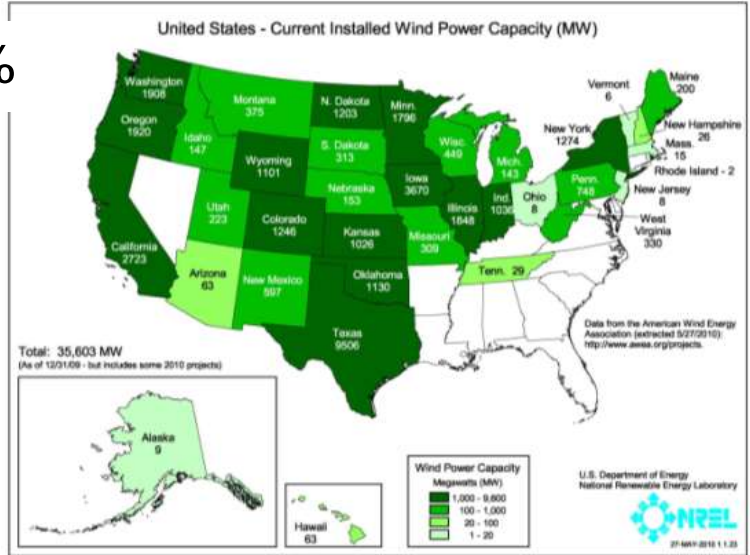


“The future ain’t what it used to be.”
 - Yogi Berra

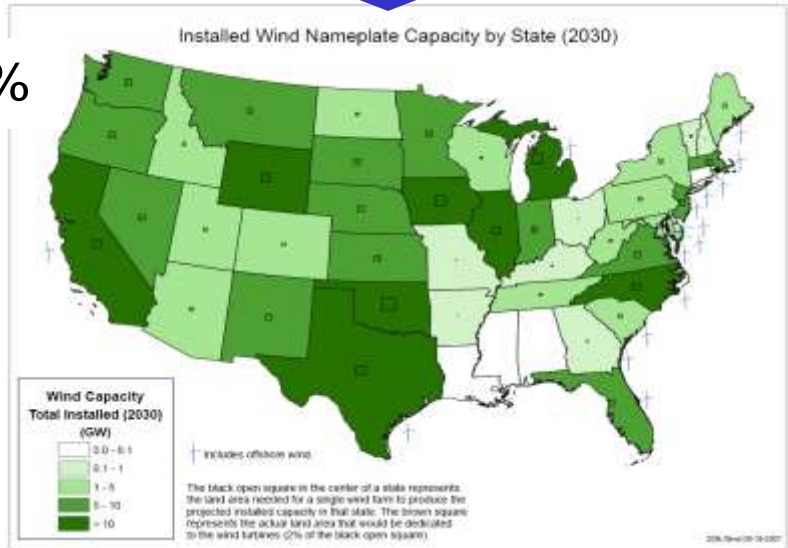
20% Wind Energy by 2030
 Increasing Wind Energy’s Contribution to U.S. Electricity Supply

July 2008

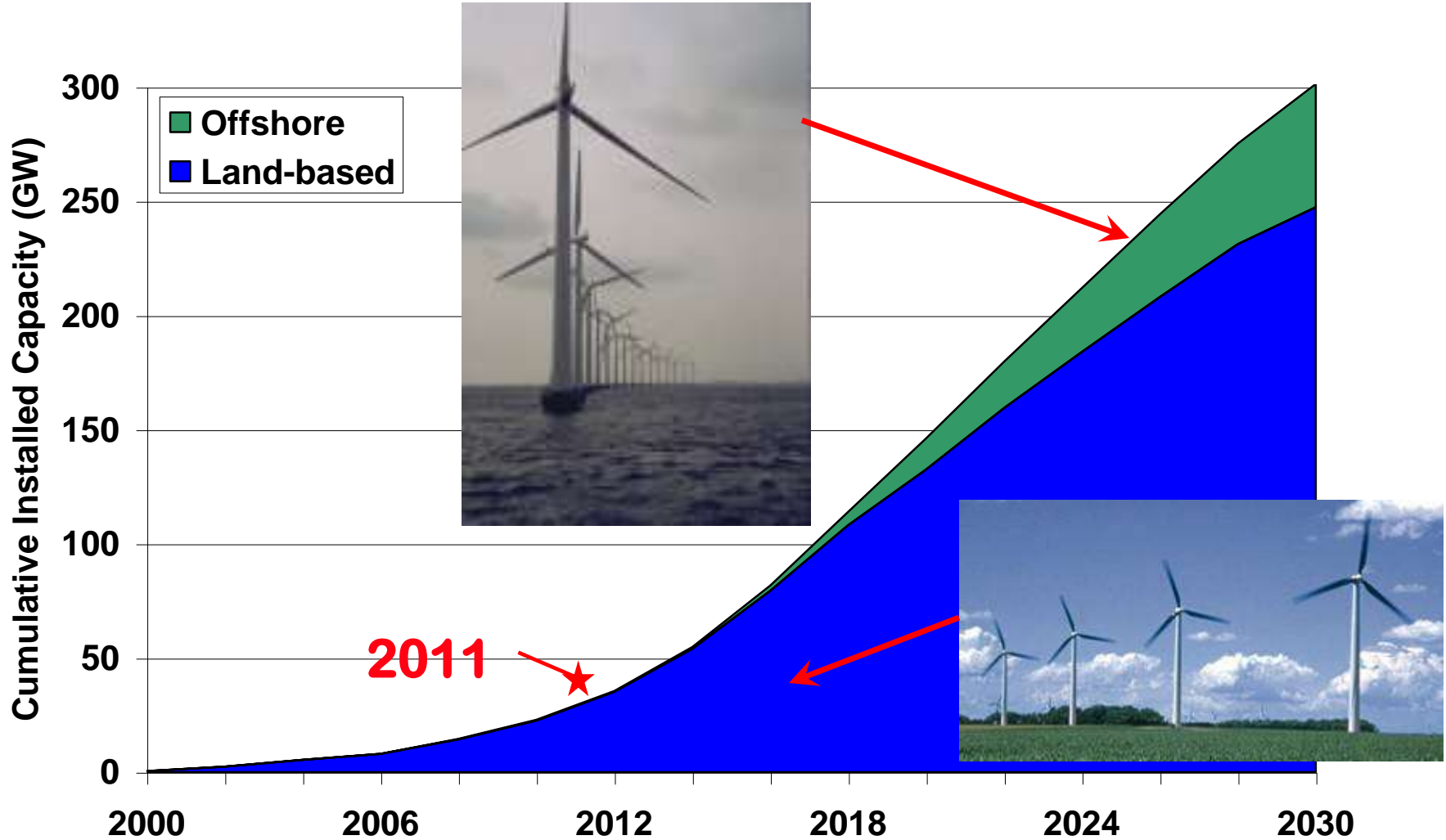
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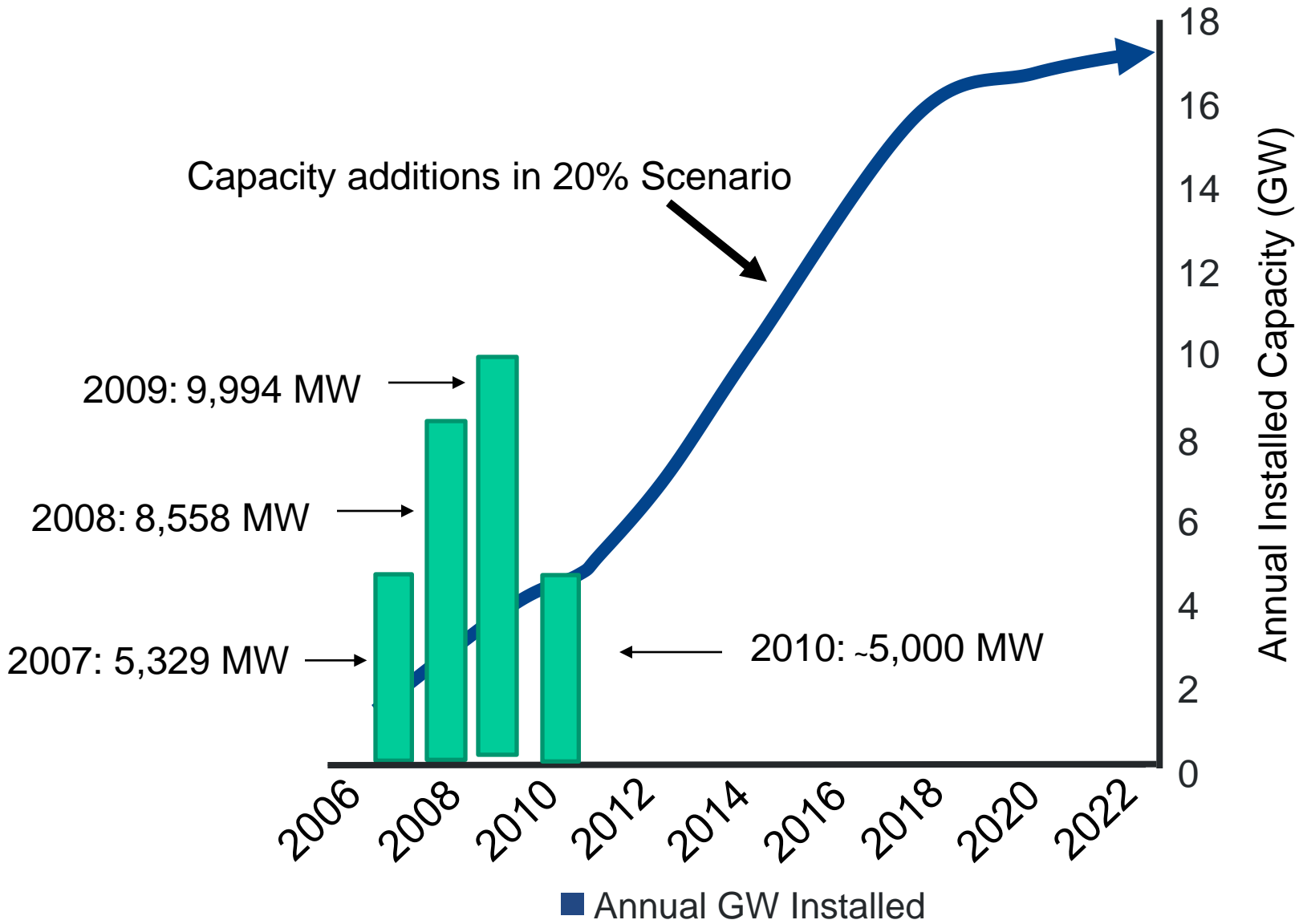
20 %



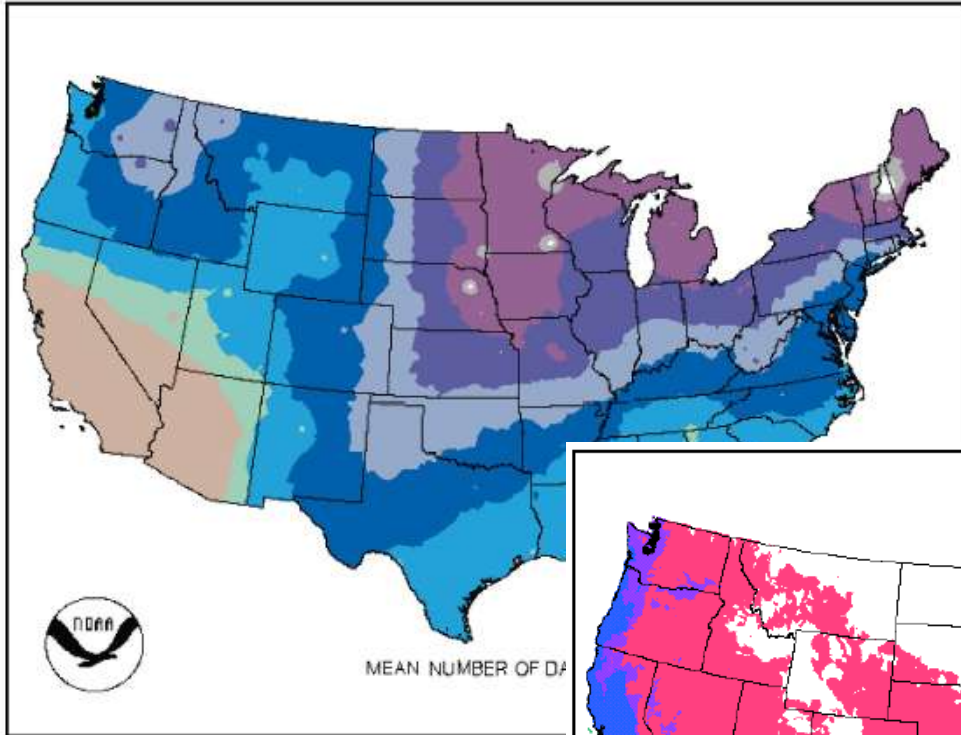
Vision: 20% Wind by 2030



Annual Installed Capacity vs. Current Installed Capacity

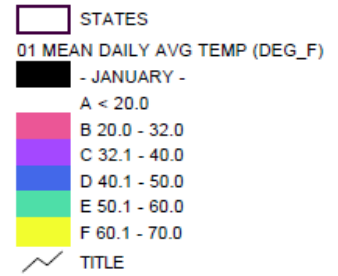
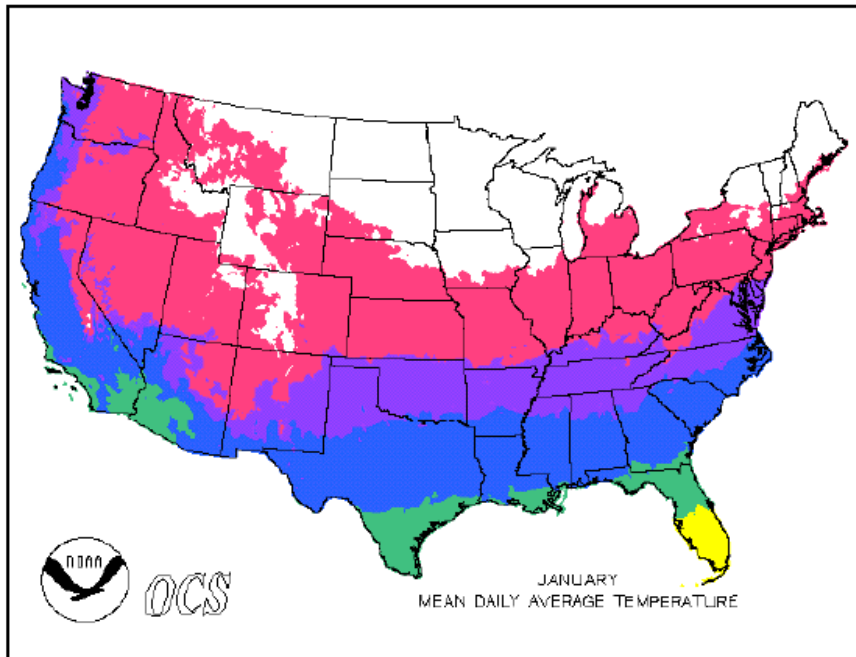


US Cold Climate Wind Deployment

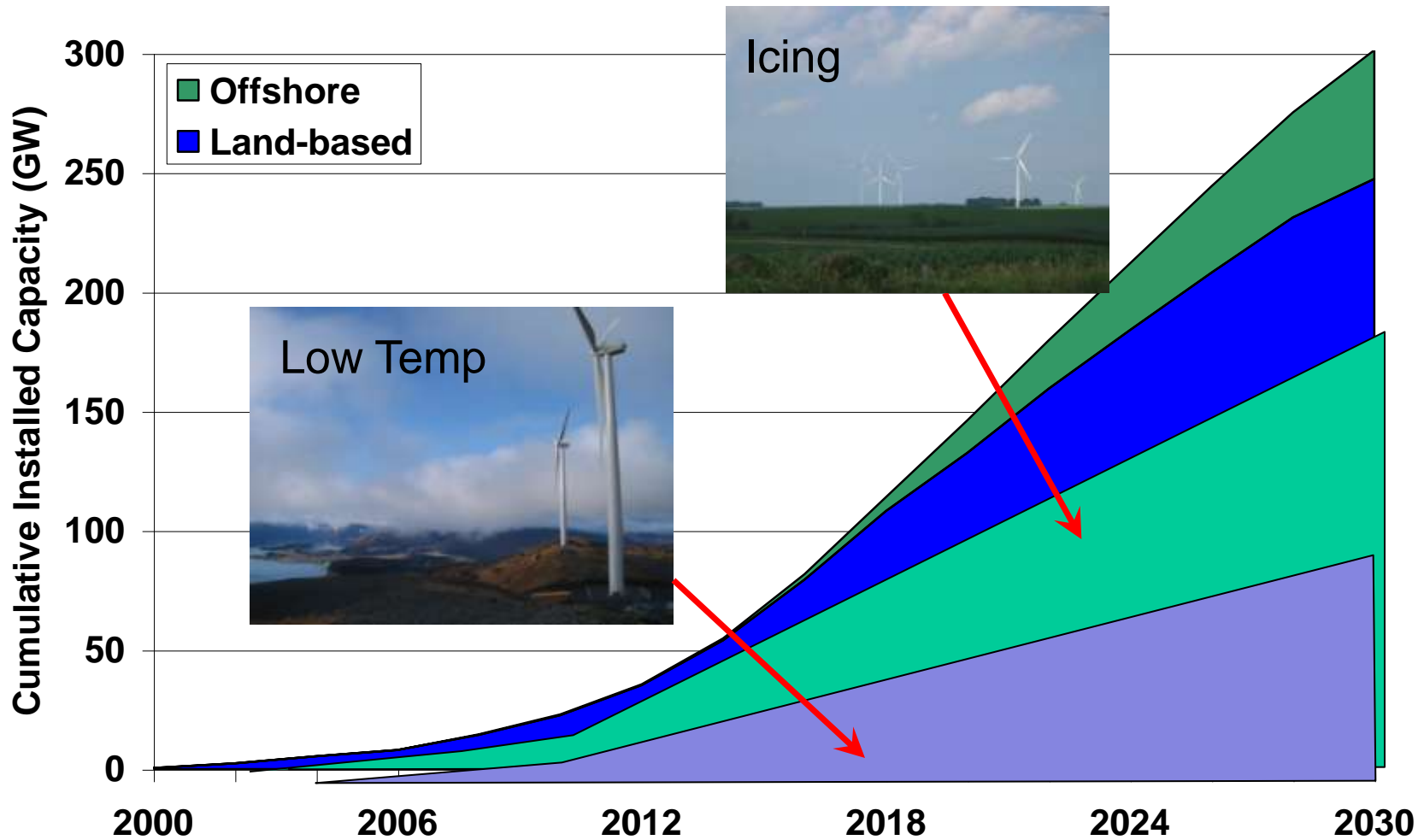


Areas in the U.S. with potential icing ...

... and cold temperature impacts

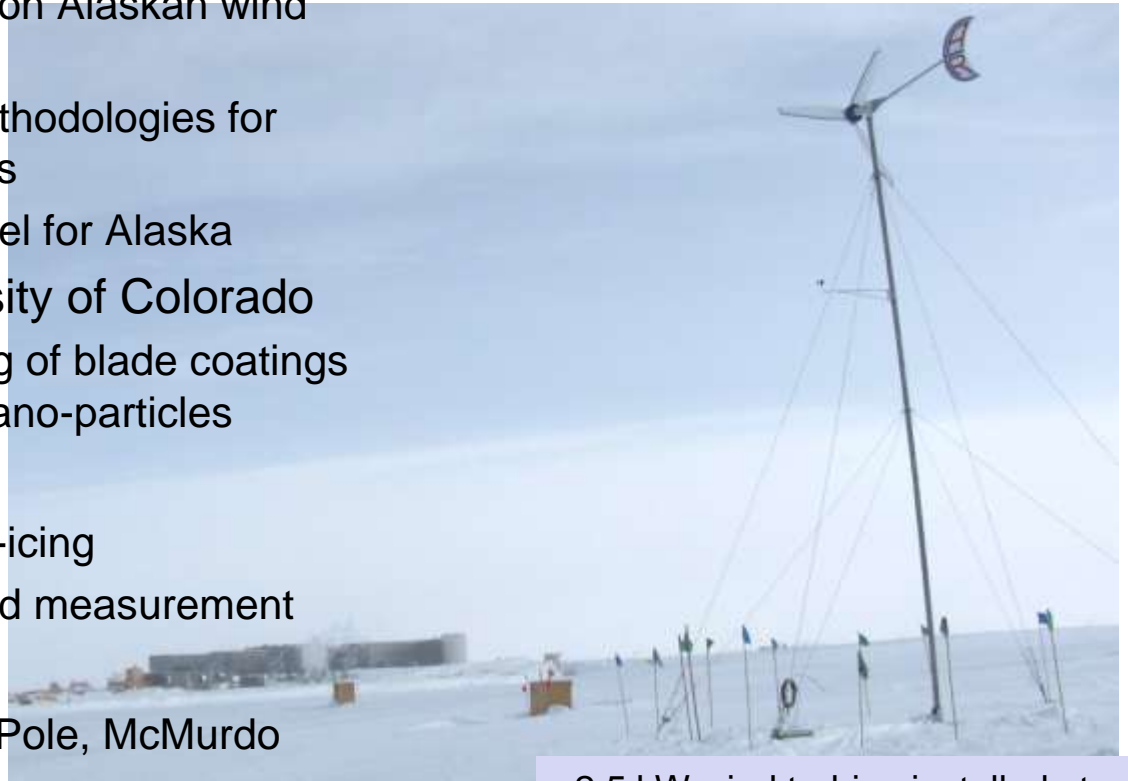


Cold Climate Impacts on Potential US Wind Fleet



US Cold Climate R&D Work

- DOE EPSCoR Grant – Univ. of Alaska – Fairbanks
 - Wind turbine foundation design for permafrost conditions (including extra ice loading)
 - Review and data collection on Alaskan wind turbines
 - Development of verified methodologies for estimating production losses
 - Development of an ice model for Alaska
- CREW Seed grant – University of Colorado
 - Investigate localized heating of blade coatings embedded with magnetic nano-particles
- Industry Development
 - Kelly Aerospace - Blade de-icing
 - NRG Systems – Wind speed measurement
- Deployment Support
 - Wind turbines at the South Pole, McMurdo and Greenland



2.5 kW wind turbine installed at the South Pole

Alaska Off Grid Applications

Over 20 wind-diesel power systems installed in remote Alaska to provide power to rural communities



Kasigluk and Toksook Bay Alaska





Carpe Ventem

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