Wind Energy Potential and Integration: A National and Regional Perspective

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Interwest Energy Alliance

to DOE/NCSL/NASEO
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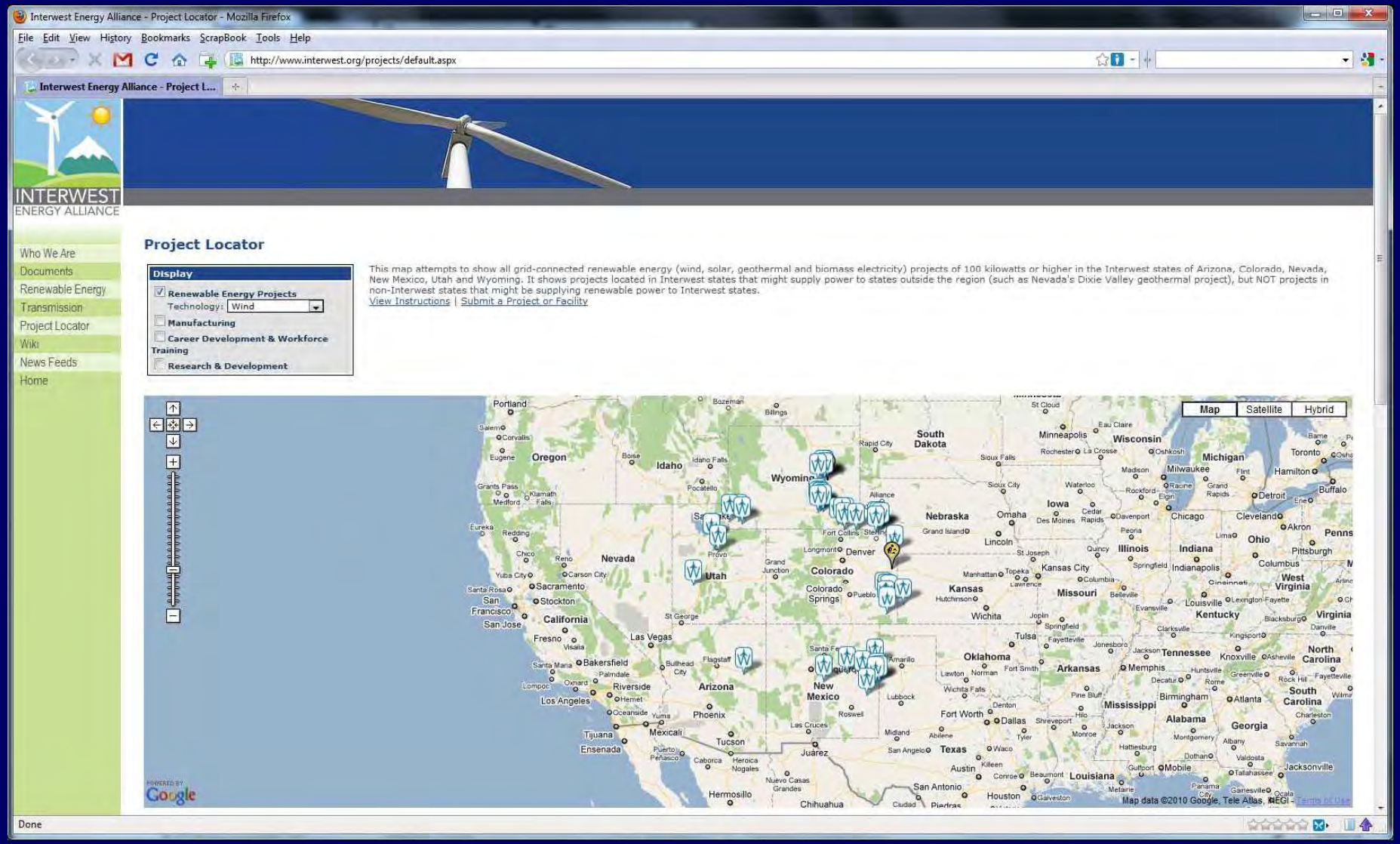
Harvesting the Power of the Wind℠

3,226 MW installed wind in five Interwest states



(Year-end 2009 capacity = Ariz., 63 MW; Colo., 1,241 MW; N.M., 598 MW; Utah 223 MW and Wyoming, 1,101 MW)

"Fast facts" from AWEA Annual Market Report

- Over 10,000 MW of wind was installed in 2009, the largest year in U.S. history, keeping the U.S. as the global leader in wind power.
- Current U.S. wind power capacity is over 35,000 MW. Wind provided 39% of all new generating capacity in 2009.
- 14 states are in the "Gigawatt Club" with more than 1,000 MW of capacity installed – 36 states now have utility-scale wind projects.
- Top Wind Power Owner: NextEra Energy Resources
- Utility With Most Wind Power on System: Xcel Energy
- Top U.S. Wind Turbine Supplier: GE Energy
- Wind energy provided 1.8% of U.S. power in 2009.
- The wind industry supported 85,000 jobs across all 50 states in 2009.
- There were 39 new, announced or expanded manufacturing facilities in 2009, and the total number of online facilities is well over 200.
- There are now nine different turbine manufacturers with manufacturing facilities in the U.S.

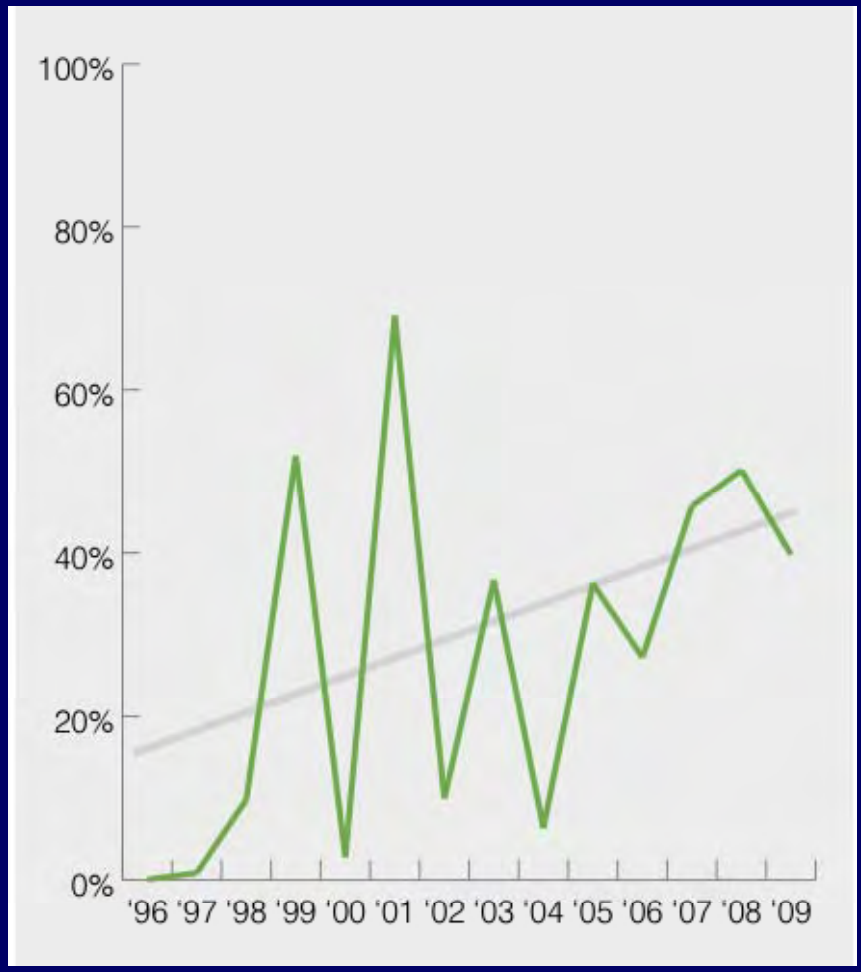
Growth of U.S. wind power capacity

The five-year average annual growth rate for the industry (2005-2009) is now 39%, up from 32% between 2004 and 2008.

As annual installations have doubled twice in the last three years, the five-year annual growth rate continues to increase.

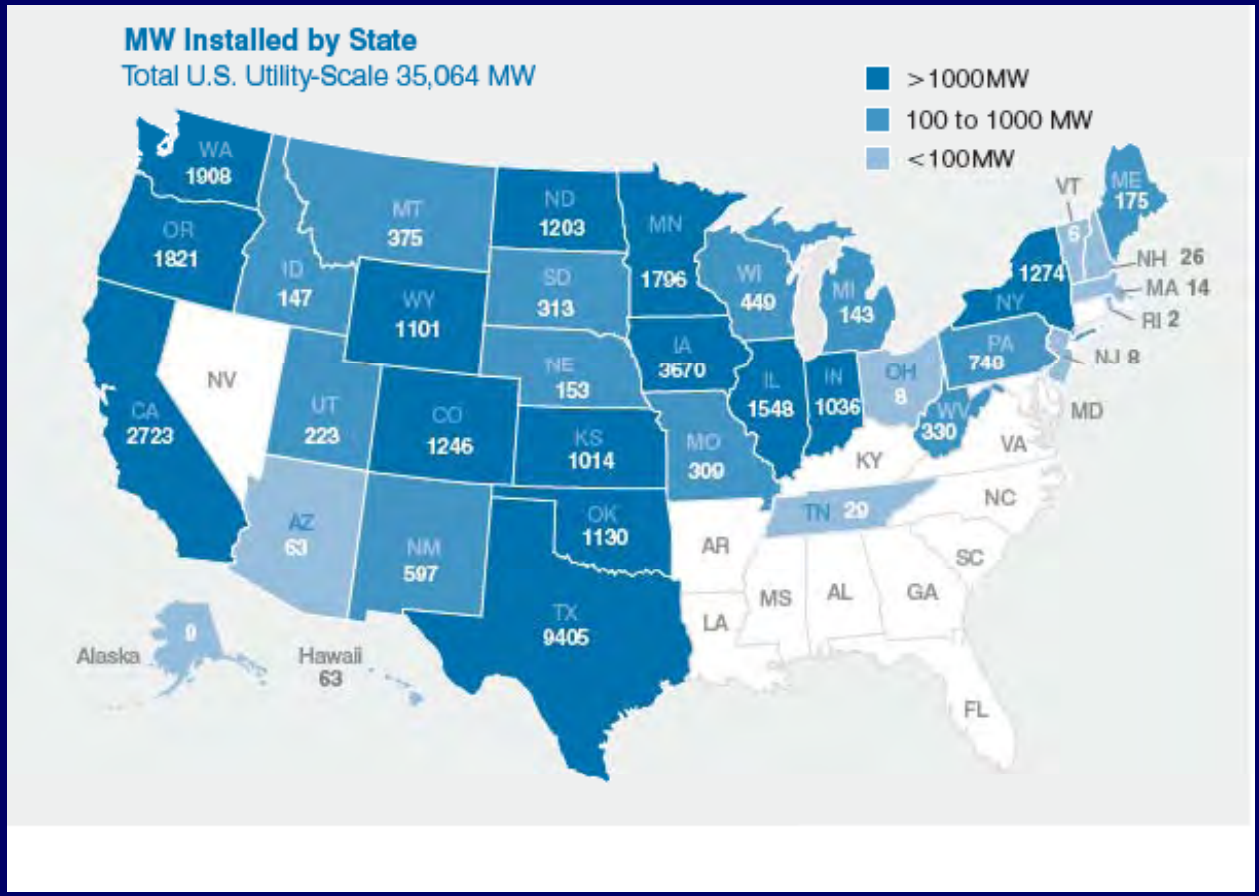
The volatility in this chart in the early 2000s reflects the strong effect that on-again, off-again tax policy had on the market.

From "U.S. Wind Industry Annual Market Report Year Ending 2009," Copyright © 2010 by the American Wind Energy Association



Wind power capacity installed by state

In 2009, there were fourteen states in the “Gigawatt Club” with more than 1,000 MW installed – 1 GW. In 2009, new club members included Illinois, Indiana, Kansas, New York, Oklahoma, North Dakota, and Wyoming.



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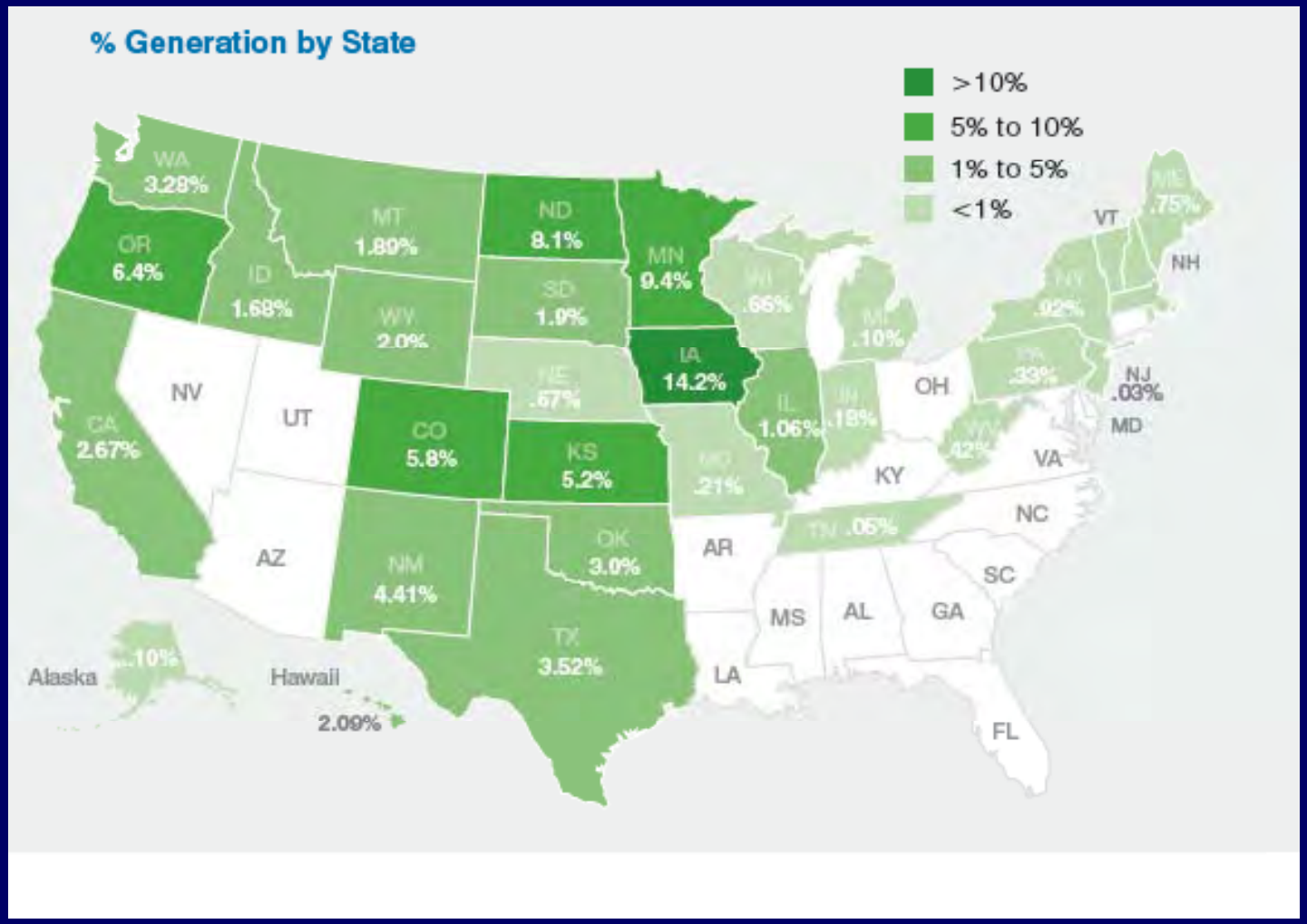
Wind as percentage of generation



Percentage of wind generation compared to all generation in state as reported in DOE EIA Electric Power Monthly

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All online wind manufacturing facilities

Over 200 facilities across the U.S. supply to the wind industry, not including the many additional facilities at the sub-supplier level. At the end of 2009, the wind industry employed 85,000 Americans directly and indirectly.

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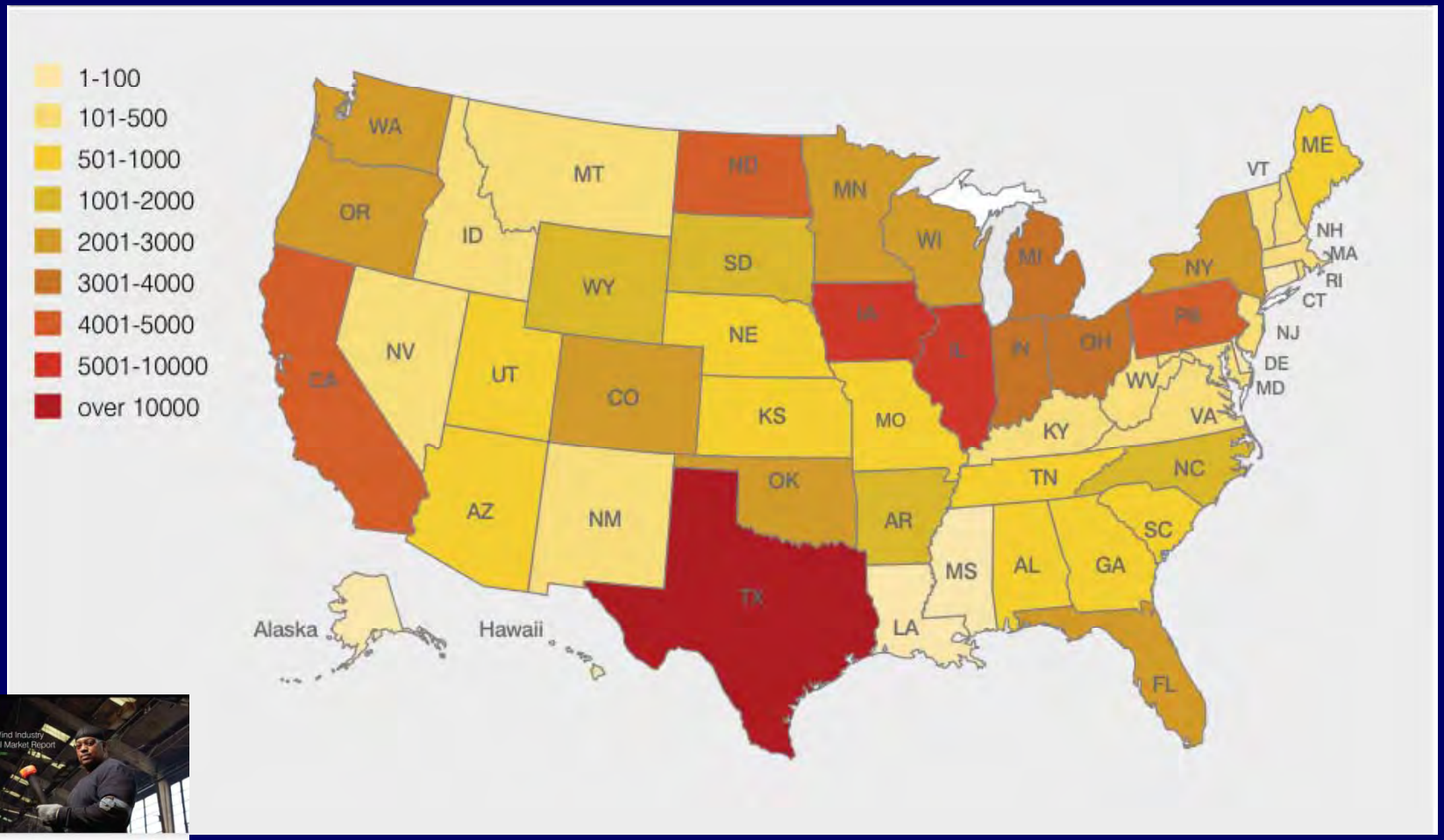
Wind industry jobs by state



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Hindrances to wind energy growth

- Inconsistent federal and state policies
- Duplicative/overlapping layers of permitting (e.g., county and state)
- **Transmission constraints**

Critical transmission issues

How do we PLAN for transmission?

- "Single-utility" planning, e.g., 1991 Colorado Ute agreement
- Long term—10, 20 years, life of equipment
- Systematic and comprehensive
  - System benefits, least total G&T costs
- How do we PAY for transmission?
- How do we PERMIT transmission?

"PLAN – PAY – PERMIT"

Proposed Transmission Projects in the Western Interconnection

Note: This plot includes selected projects from Table 3.2 of 2008 TEPPC Study Plan(v7) Projects have been grouped to simplify coding.

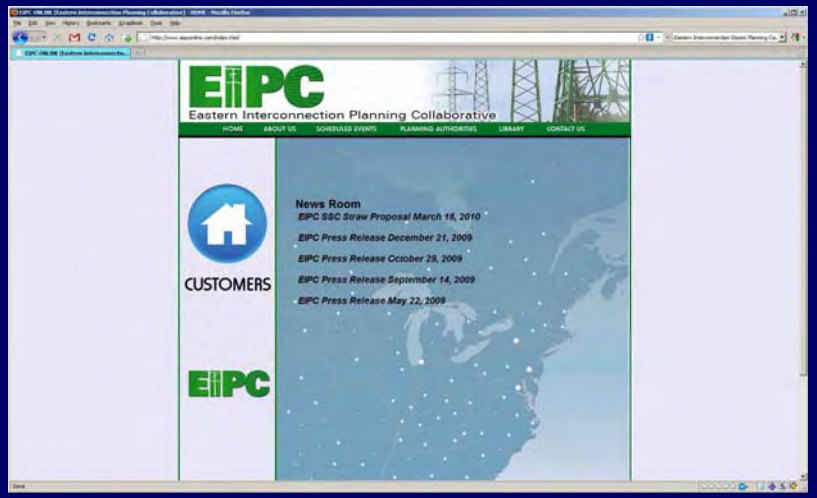
- Sea Breeze Projects
- TransCanada Projects
- Gateway & Other NTTG Projects
- Columbia Grid Projects
- TransWest Express
- LS Power & Great Basin Projects
- WY-CO Intertie Project
- High Plains Express
- Sun-ZIA
- Canada/PacNW-NoCalif
- Central CA Clean Energy (C3ET)
- Green Path North
- Devers-Palo Verde 2
- Navajo Transmission Project

Transmission decisions: Gaining public support

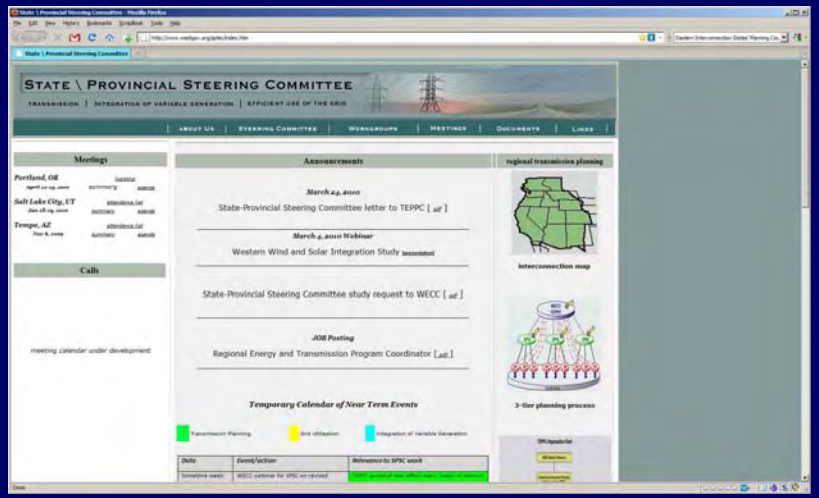
- **Public understanding and support**
  - Saving money on generation costs justifies transmission
  - Even though transmission dollars are large, they are tiny compared with generation costs and potential savings
  - Economic development opportunities are quantifiable, and significant

Grid-wide transmission planning

http://www.wecc.biz/committees/BOD/TEPPC/SPSG/default.aspx



http://www.eipconline.com/index.html



http://www.westgov.org/sptsc/index.htm

http://www.ercot.com/

Signs of progress

renewGRID™

www.renewgridmag.com Volume 1, Number 3 April 2010

Progress Being Made In Western Interconnection

Transmission professionals and regulators in the West must contend with a number of moving parts.

By Nora Caley

Transmission development in the western U.S. has seen some success lately, and the experts say more progress is ahead. At the American Wind Energy Association's recent Wind and Transmission Workshop in Denver, speakers representing various Western states' boards, commissions and groups said they were moving projects for-

Energy-First Planning

Today: planning focuses on capacity

- Capacity resources supply most energy

Carbon constraints focus on energy

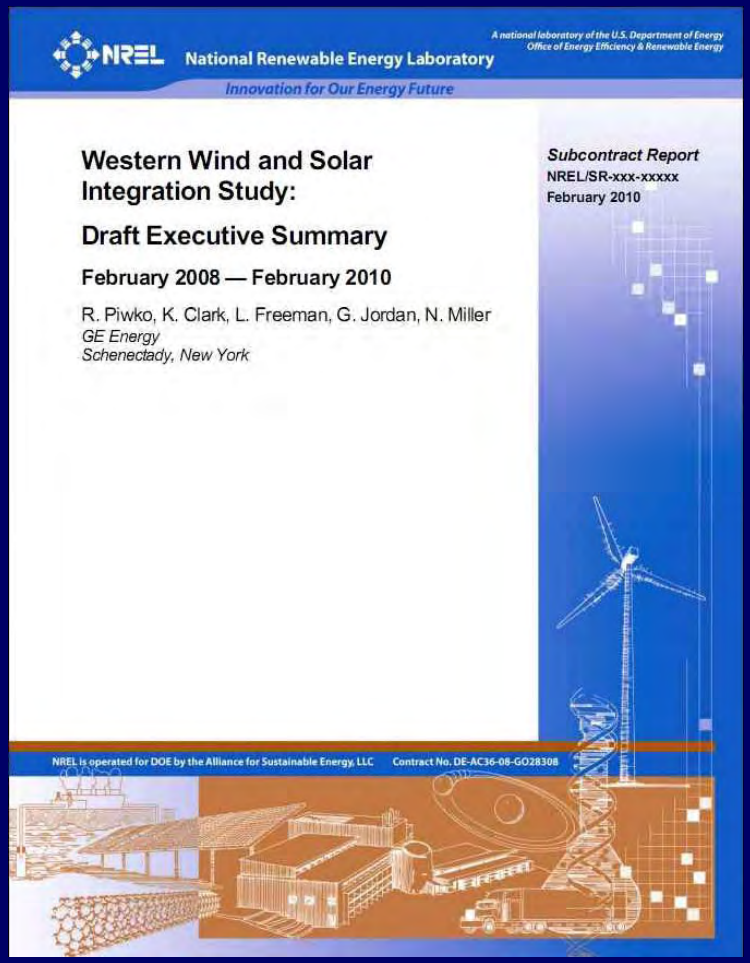
- Emissions a function of energy, not capacity

Huge amounts of low marginal cost, no-carbon energy resources available

- Plan electric system to maximize their use

Need to build capacity strategically, to keep system balanced, fill in around energy resources

Integrating 30% wind and 5% solar in the West: needed steps

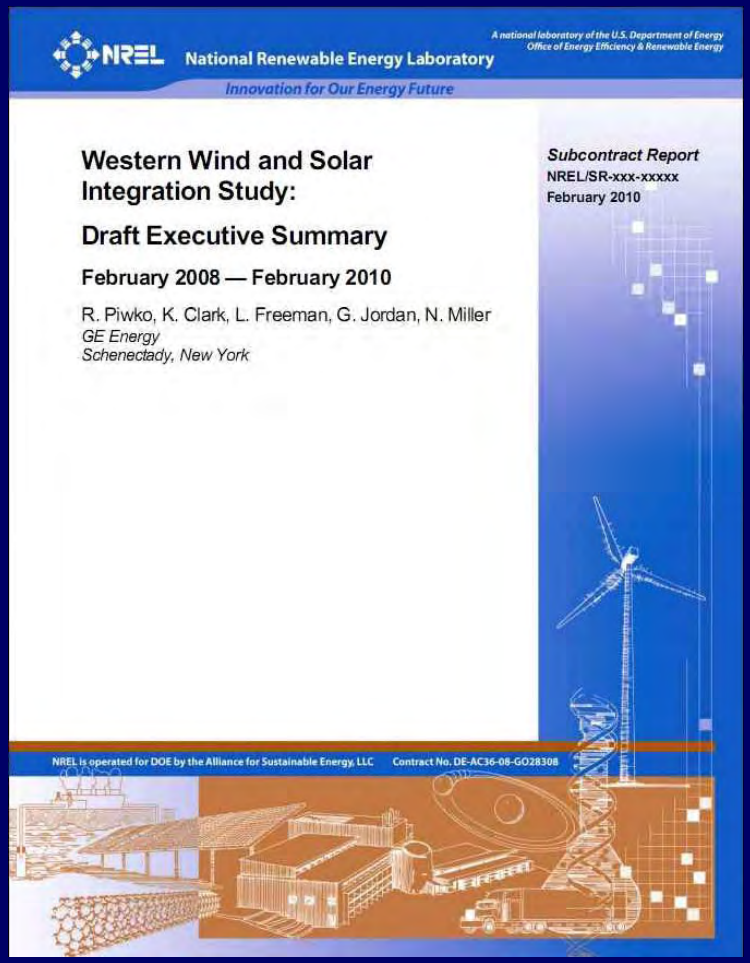


- **"The technical analysis performed in this study shows that it is feasible for the WestConnect region to accommodate 30% wind and 5% solar energy penetration."**

- "To do so successfully requires changes to current practice including the following:
  - Control area cooperation or consolidation
  - Open access to all transmission resources
  - Economically rational commitment and dispatch process
  - Use of state of the art wind and solar Forecasts
  - Flexible fleet generation (e.g., lower turn down, faster ramp rates, reduced start/stop costs or minimum down time)
  - Additional operating reserves
  - Sufficient intra-state transmission
  - Inter-state transmission expansion
  - Sub-hourly scheduling of both generation and inter-area exchanges
  - Load participation
  - Implementation of down reserve in wind plant"

–From WWSIS draft executive summary, Section 1, page 1

Integrating 30% wind and 5% solar in the West: Feasibility

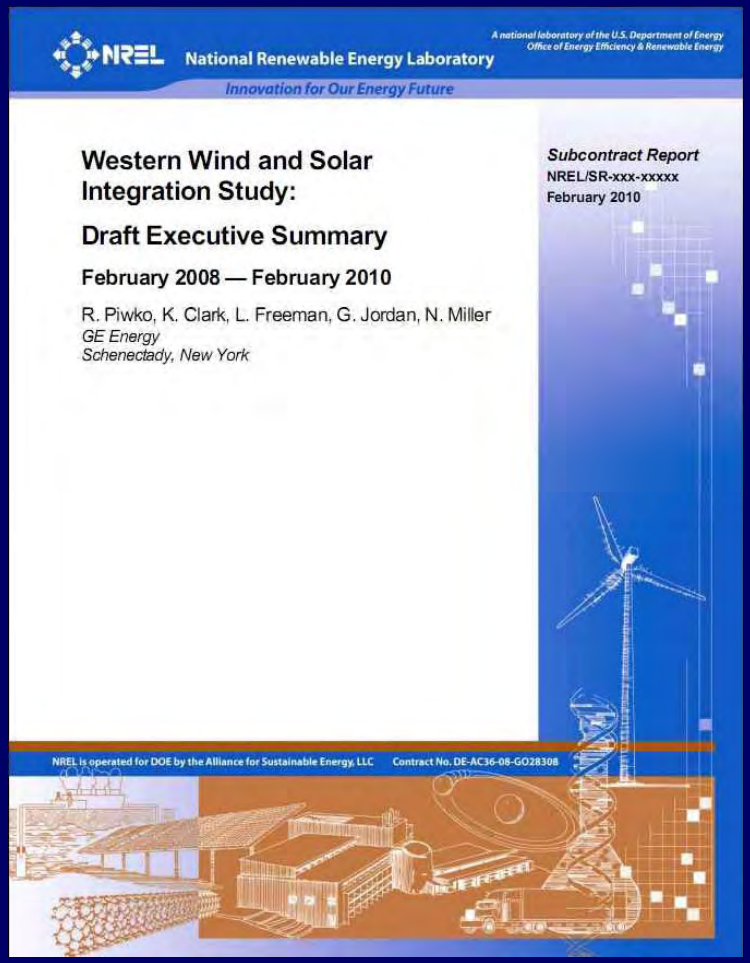


- **"Is it Feasible to Accommodate 30% Wind and 5% Solar?"**

- "The technical analysis performed in this study shows that it is feasible for the WestConnect region to accommodate 30% wind and 5% solar energy penetration, but it would require extensive control area cooperation or consolidation…"

–From WWSIS draft executive summary, Section 1.5.1, page 8

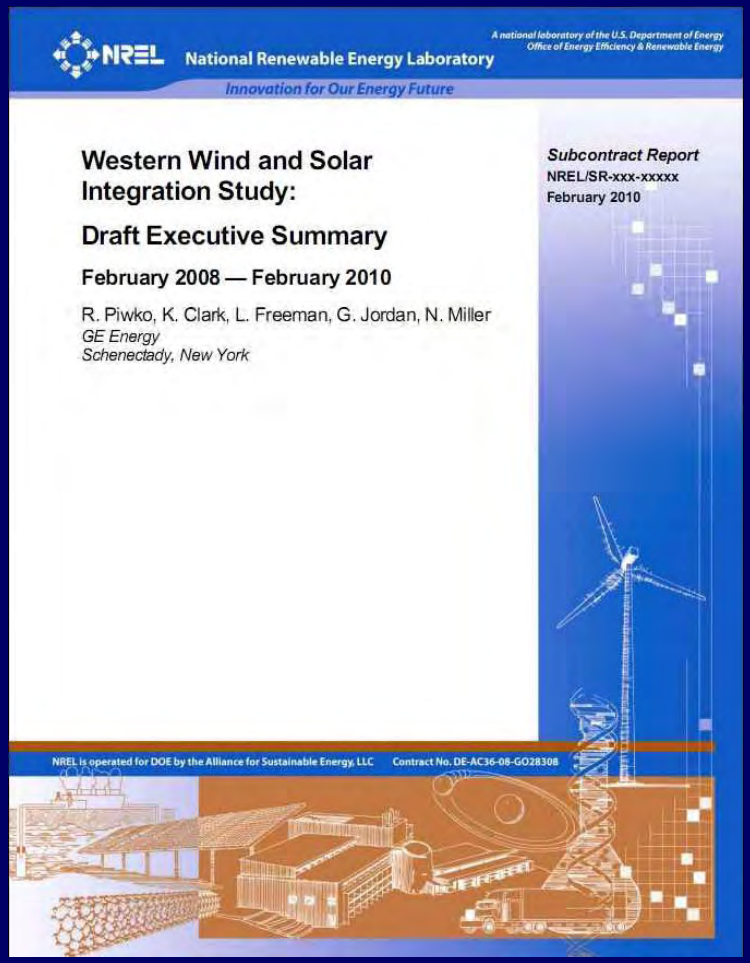
Integrating 30% wind and 5% solar in the West: is storage needed?



- **"Are Increased Reserves or Storage Required?"**
- "Increased penetrations of renewables did increase the utilization of the existing energy storage facilities slightly, but there were no indications that construction of additional storage was justified…"

–From WWSIS draft executive summary, Section 1.5.4, page 18

Integrating 30% wind and 5% solar in the West: value of renewables



- **"What Are Some of the Benefits?"**

- "The 30% wind penetration scenarios show WECC operating cost savings of $20 billion per year due to the wind and solar generation resources. This equates to $80/MWh of wind and solar energy produced. Lower penetrations of renewables showed values up to $88/MWh …"

–From WWSIS draft executive summary, Section 1.5.3, page 15

Thank you

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