20% Wind Energy by 2030 – Challenges and Opportunities for Utilities

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Manager of Utility Programs
American Wind Energy Association

March 12, 2009

Who is AWEA ?

- American Wind Energy Association
- National trade association for wind industry
  - Legislative / Lobbying
  - Education & Outreach
  - Member Services
- Currently >1800 business, utility, academic, and non-profit members

AWEA® AMERICAN WIND ENERGY ASSOCIATION

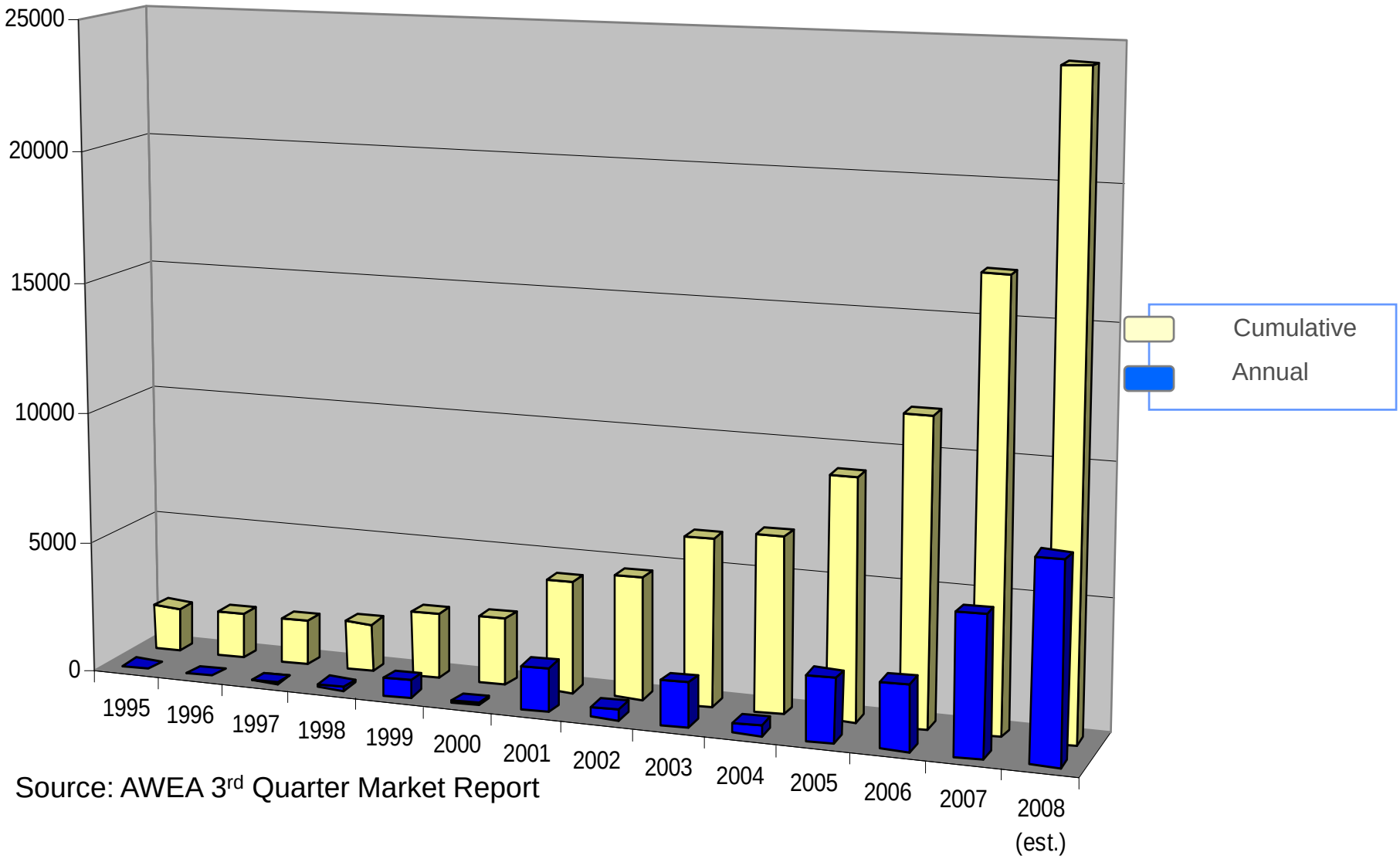
WIND: POWERING A CLEANER, STRONGER AMERICA | WWW.AWEA.ORG

Outline of Presentation

- Wind power market overview / trends
- Wind integration
  - where energy storage fits in the picture
- Utility numbers and trends
  - how utilities are bringing wind power to their customers today
  - strategies being used and new business models
- Economic development & wind power
  - opportunities for rural electric co-ops and munis
- Your Questions

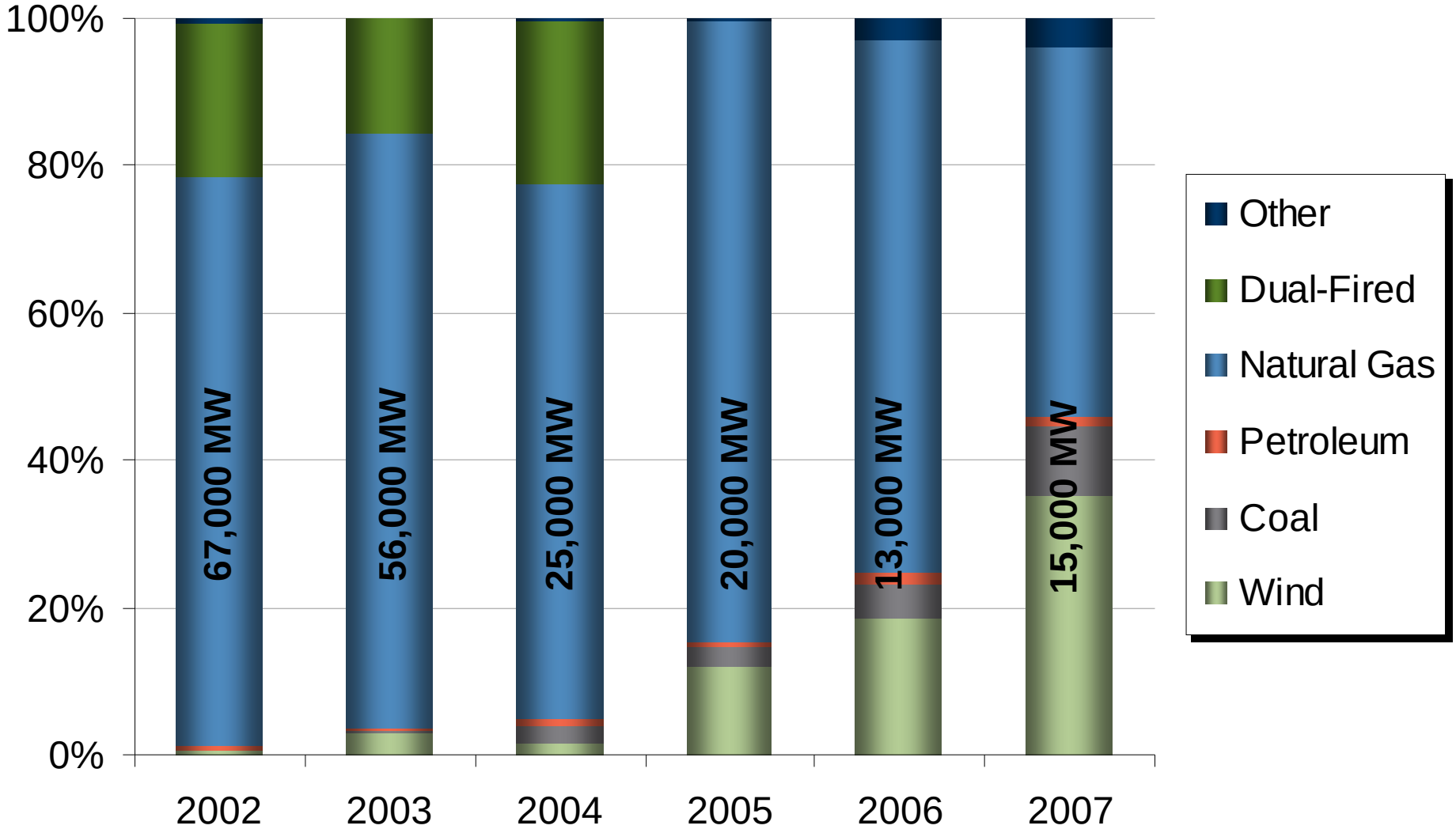
Wind Power Market Overview & Trends

Wind Power Taking Off in the U.S.



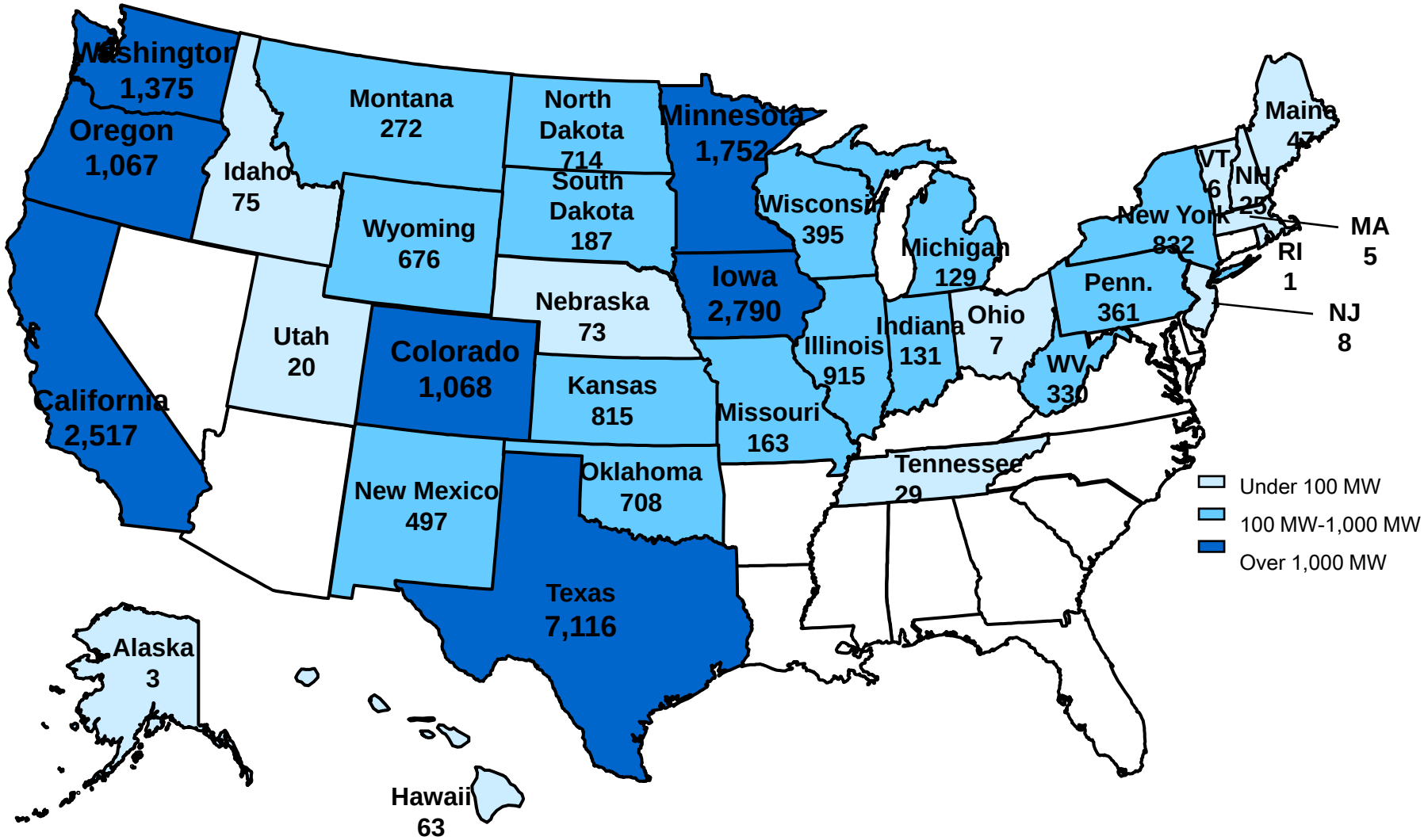
Source: AWEA 3rd Quarter Market Report

New U.S. Generating Capacity



Data Source: DOE EIA, *Electric Power Annual,* updated with Solar and Wind Industry Data

Wind Power Installed – 12/31/08



Some Key US Wind Facts

- 8,358 MW added in 2008 - 42% of the new power producing capacity in U.S. - enough to serve over 2 million homes
- Wind energy industry added > $17 billion in investment into the U.S. economy in 2008
- Price of wind energy now cost competitive with wholesale power costs in many regions of the U.S. (per U.S. DOE “Annual Report on U.S. Wind Power Installation, Cost, and Performance Trends”
- 55 new / expanded wind power manufacturing facilities in 2008
- 85,000 people employed in the wind industry today
- Share of domestically manufactured wind turbine components grew from < 30% in 2005 to ~ 50% in 2008

Wind Integration

The Variable Nature of Wind Energy

- **Wind is an energy resource, not a capacity resource**
  - Thus, not a “baseload” resource
- **Wind Power output is “variable” and not “dispatchable”**
  - Operators need tools to address variability
  - Wind Forecasting plays a key role today and will play an increasing important role
- **There is a cost to managing wind’s variability - which depends upon systems characteristics, but is generally low**
  - Many Wind Integration Studies have been performed in US, EU

Wind Energy Variability - UWIG

Because wind energy output adds almost no variability on the minute-to-minute time scale, very large amounts of wind energy can be added to the grid with virtually no impact on the use of spinning reserves.

Study	Wind Energy Level	1 minute	5 minute	1 hour
Texas 2008	15,000 MW	6.5 MW	30 MW	328 MW
California 2007	12,500 MW (plus 2,600 MW of Solar)	3.3 MW	14.2 MW	129 MW
New York 2005	3,300 MW	- - -	1.8 MW	152 MW

Sources:

1. http://www.uwig.org/Wind_Generation_Impact_on_Ancillary_Services_-_GE_Study.zip
2. http://www.uwig.org/CEC-500-2007-081-APB.pdf
3. http://www.uwig.org/nyserdaphase2appendices.pdf

Wind Integration Costs

Date	Study	Wind Capacity Penetra-tion (%)	Regula-tion Cost ($/MWh)	Load Following Cost ($/MWh)	Unit Commit-ment Cost ($/MWh)	Gas Supply Cost ($/MWh)	Total Operating Cost Impact ($/MWh)
2002	BPA	7	.19	.28	1.00-1.80	na	1.47-2.27
2003	GRE	16.6	na	na	na	na	4.53
May '03	Xcel-UWIG	3.5	0	0.41	1.44	na	1.85
Sep '04	Xcel-MNDOC	15	0.23	na	4.37	na	4.60
July '04	CA RPS Phase III	4	0.36	na	na	na	na
June '03	We Energies	4	1.12	0.09	0.69	na	1.90
June '03	We Energies	29	1.02	0.15	1.75	na	2.92
2005	PacifiCorp	20	0	1.6	3.0	na	4.6
April '06	Xcel-PSCo	10	0.20	na	2.26	1.26	3.72
April '06	Xcel-PSCo	15	0.20	na	3.32	1.45	4.97

Wind Integration Lessons Learned

- Wind forecasting can significantly reduce integration costs by reducing uncertainty
- Wind resources spread over larger areas are less variable
- Diverse wind has very little variability on the minute-to-minute time scale
- Wind is easier to integrate on more flexible power systems
- Market/system operation reforms, such as control area consolidation, can significantly reduce wind integration costs, as can coordinated regional operations
- A robust transmission grid can significantly reduce integration costs
- Integrating wind is a cost issue, not a reliability issue
- 2008 Xcel Energy analysis, wind integration costs are:
  - $3.51 per MWh in the 10% wind penetration scenario
  - $4.77 per MWh in the 15% scenario
  - $5.13 per MWh in the 20% wind scenario

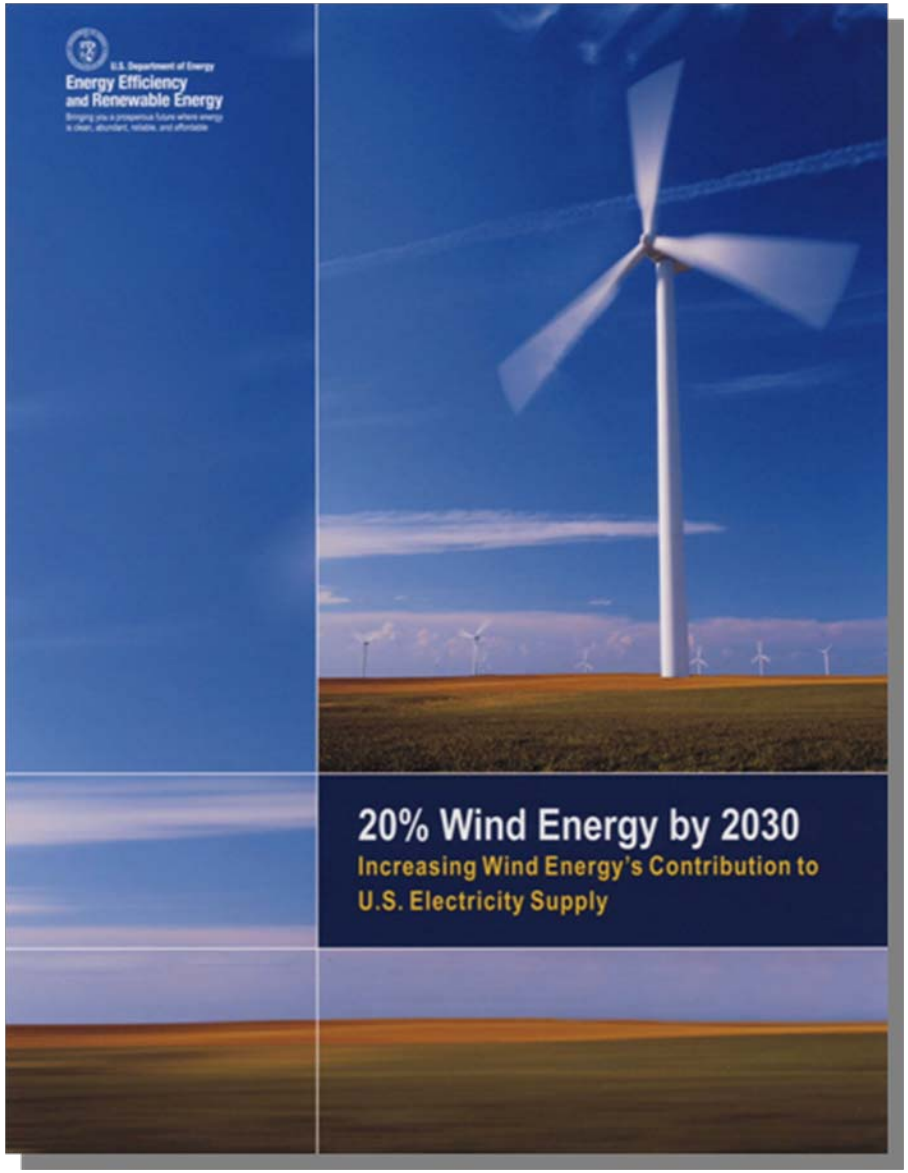
Wind Power and Energy Storage

- **Where does Energy Storage show up in these Wind Integration studies ? What about experience in Europe ?**
- **Neither have indicated the need for energy storage to integrate large amounts of wind energy (up to 20% typically)**
  - Wind Integration Studies in NY, MN, CA
  - Results: minimal impacts, costs
  - Best when robust markets exist
  - Wind Forecasting importance increasing
  - Major studies underway in Western and Eastern Interconnects in the U.S.
- **So is Energy Storage needed to make wind energy "reliable" ? <u>No</u>**
- **Is Energy Storage really "the holy grail" for wind power ? <u>No</u>**

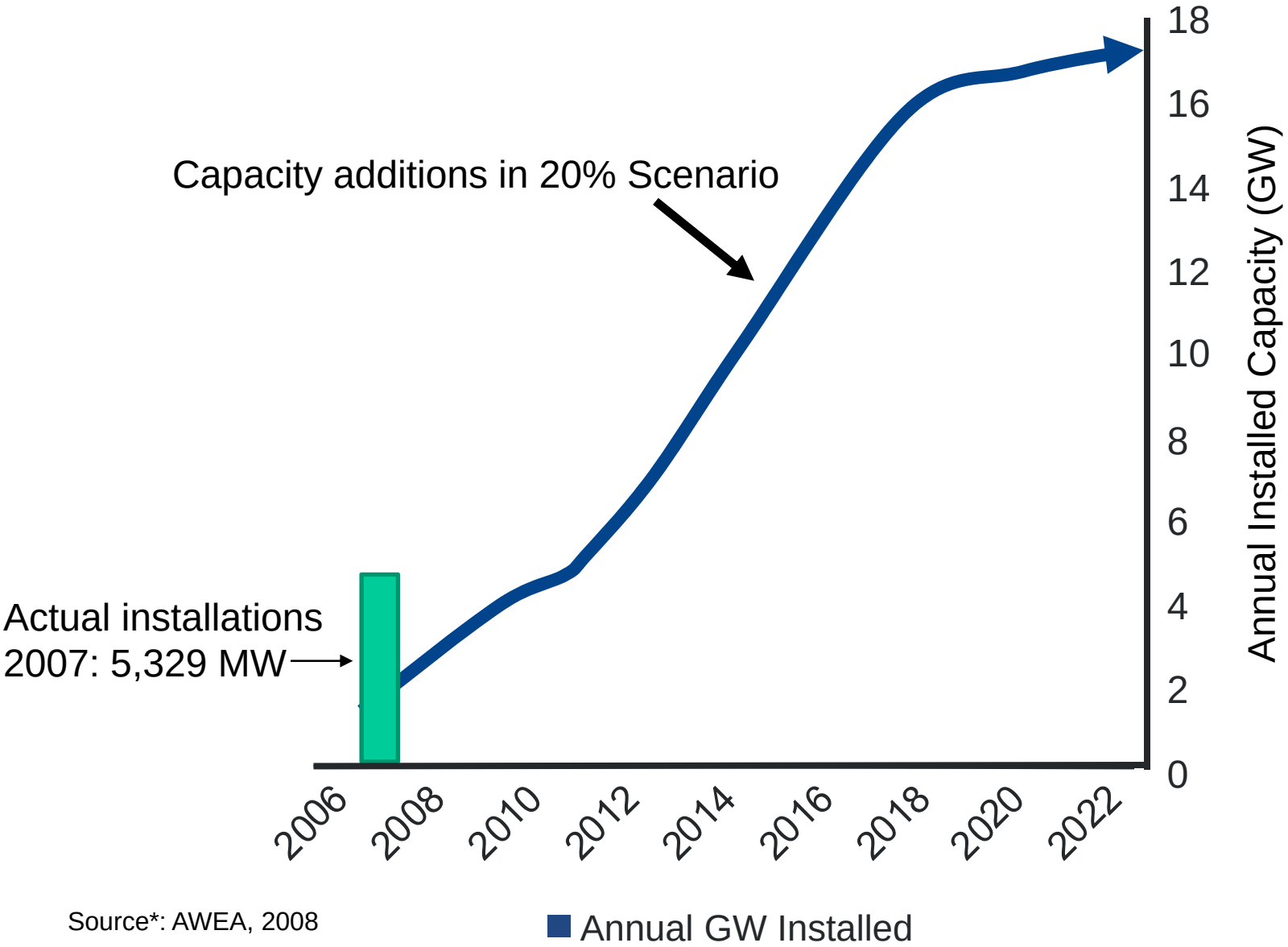
20% Wind
Energy by
2030

20% Wind Energy by 2030 Report

- Explores one scenario for reaching 20% wind energy by 2030 and contrasts it to a scenario in which no new U.S. wind power capacity is installed
- Is not a prediction, but an analysis based on one scenario
- Does not assume specific policy support for wind



Projected Installations vs. Actual



Source*: AWEA, 2008

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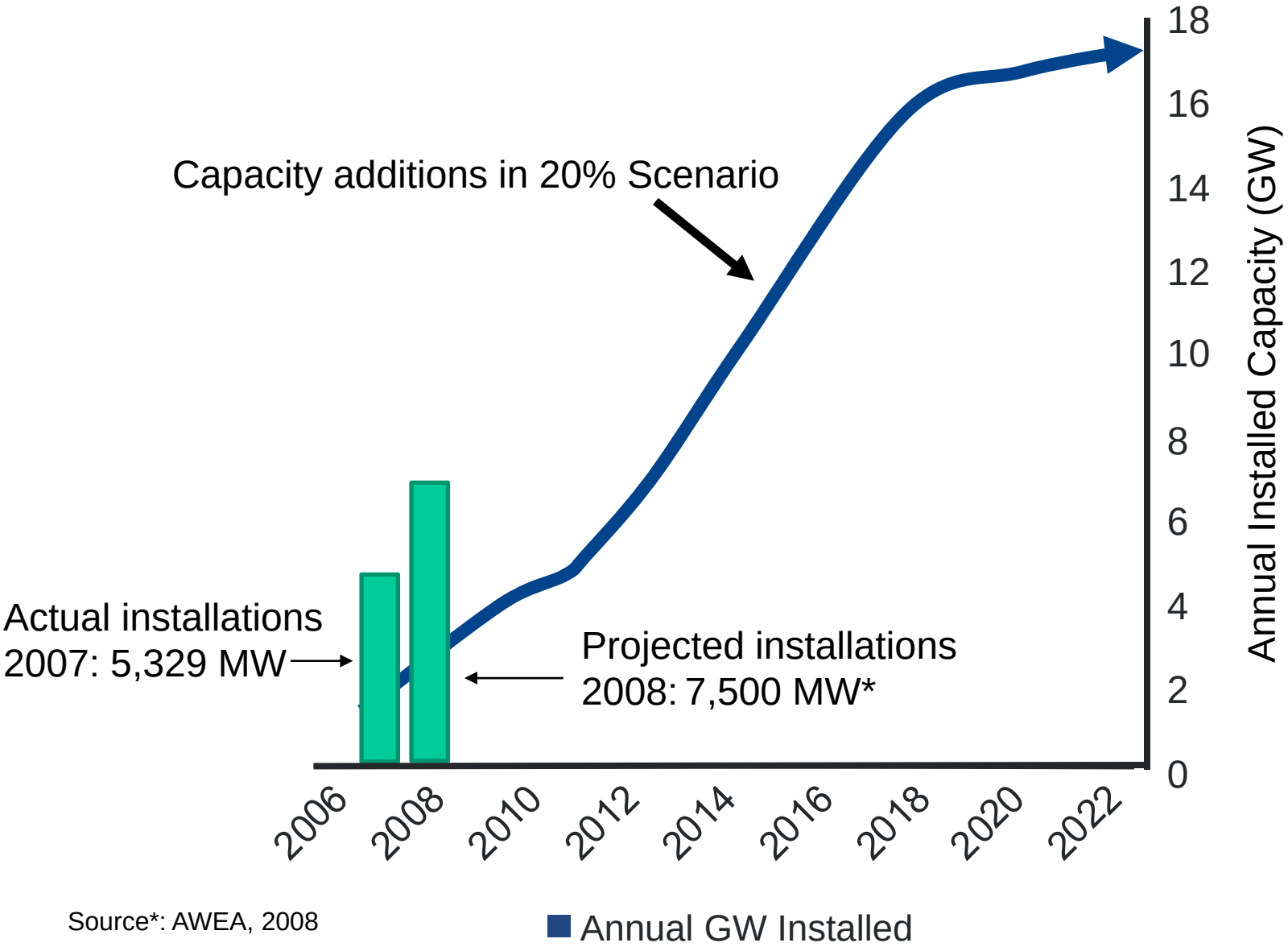

Source*: AWEA, 2008

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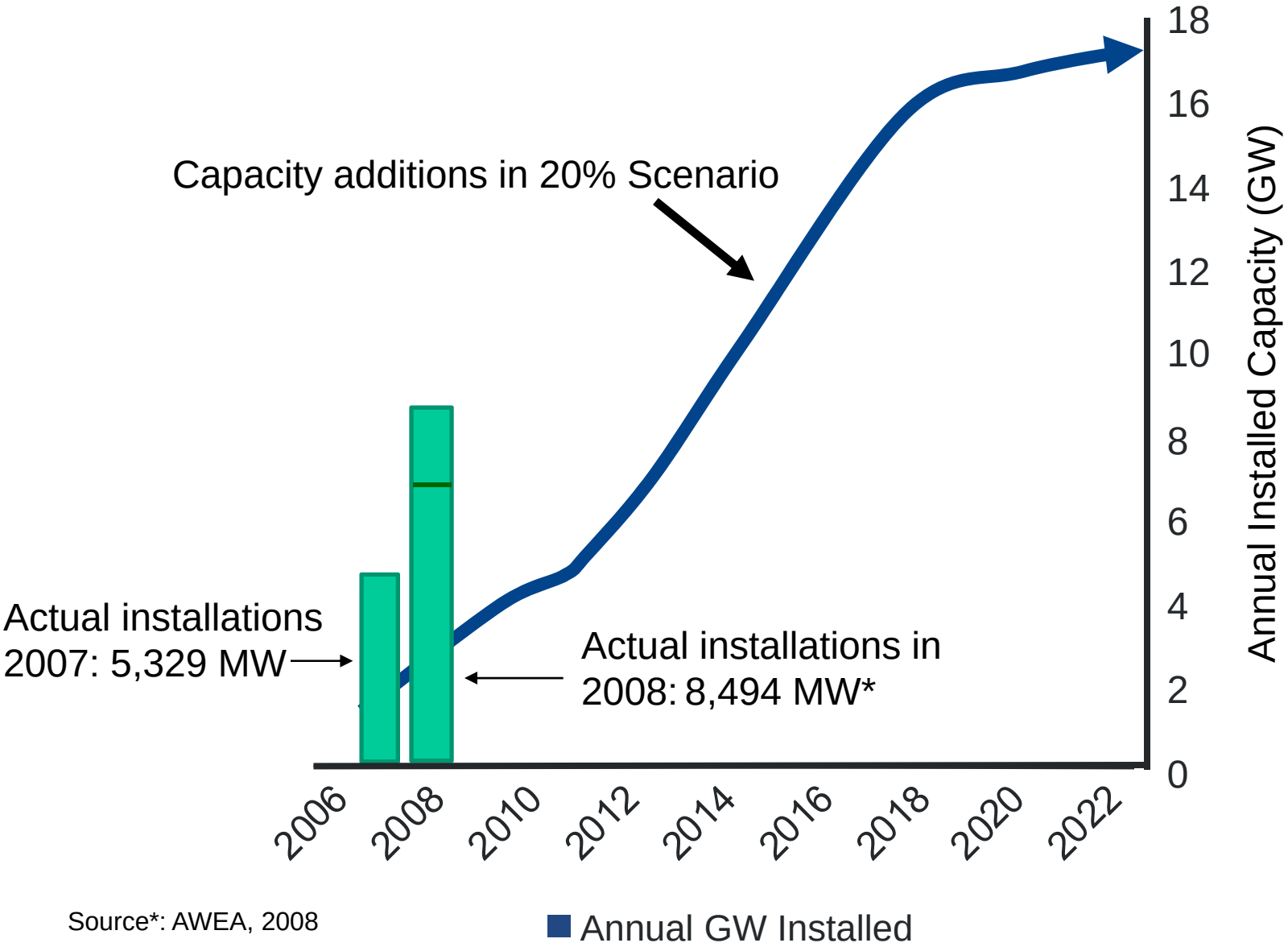
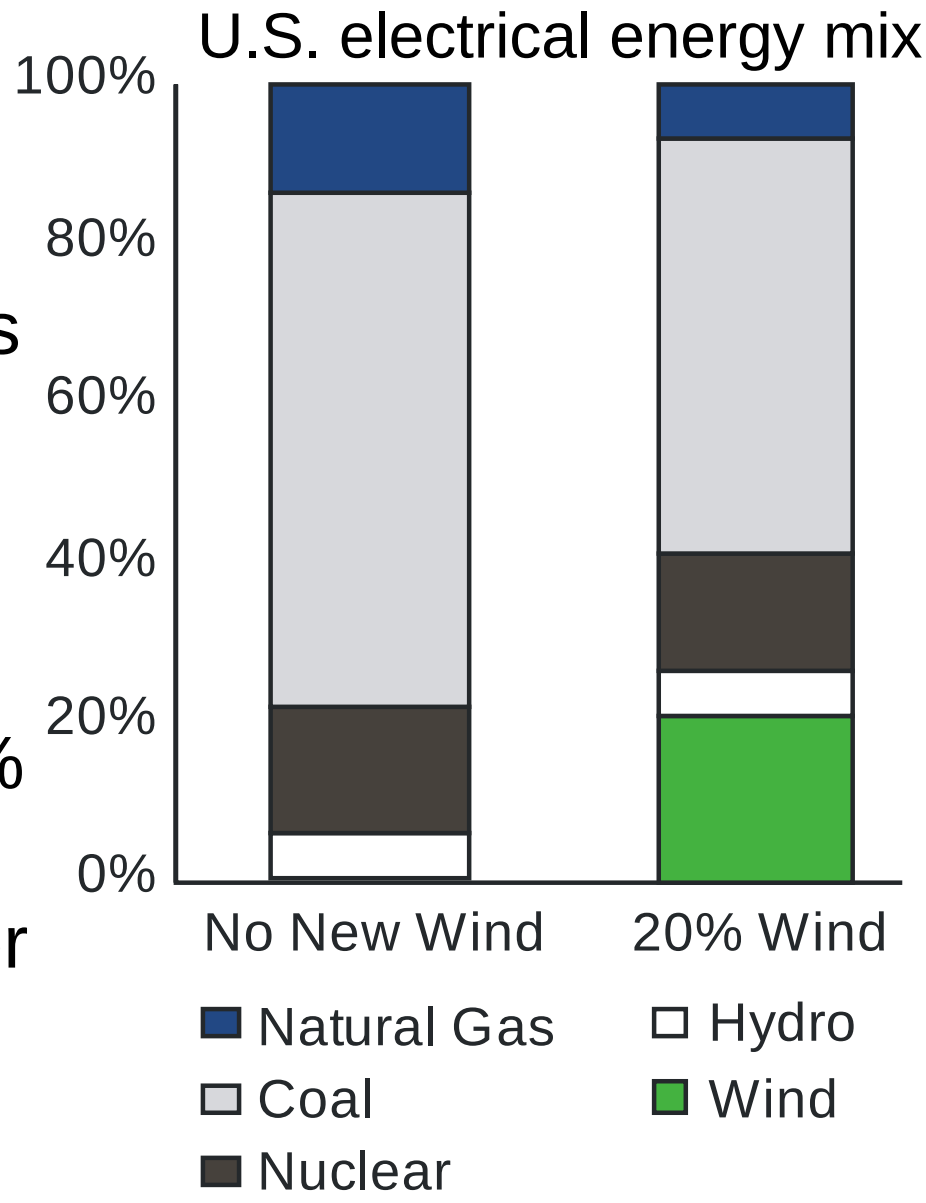


Source*: AWEA, 2008

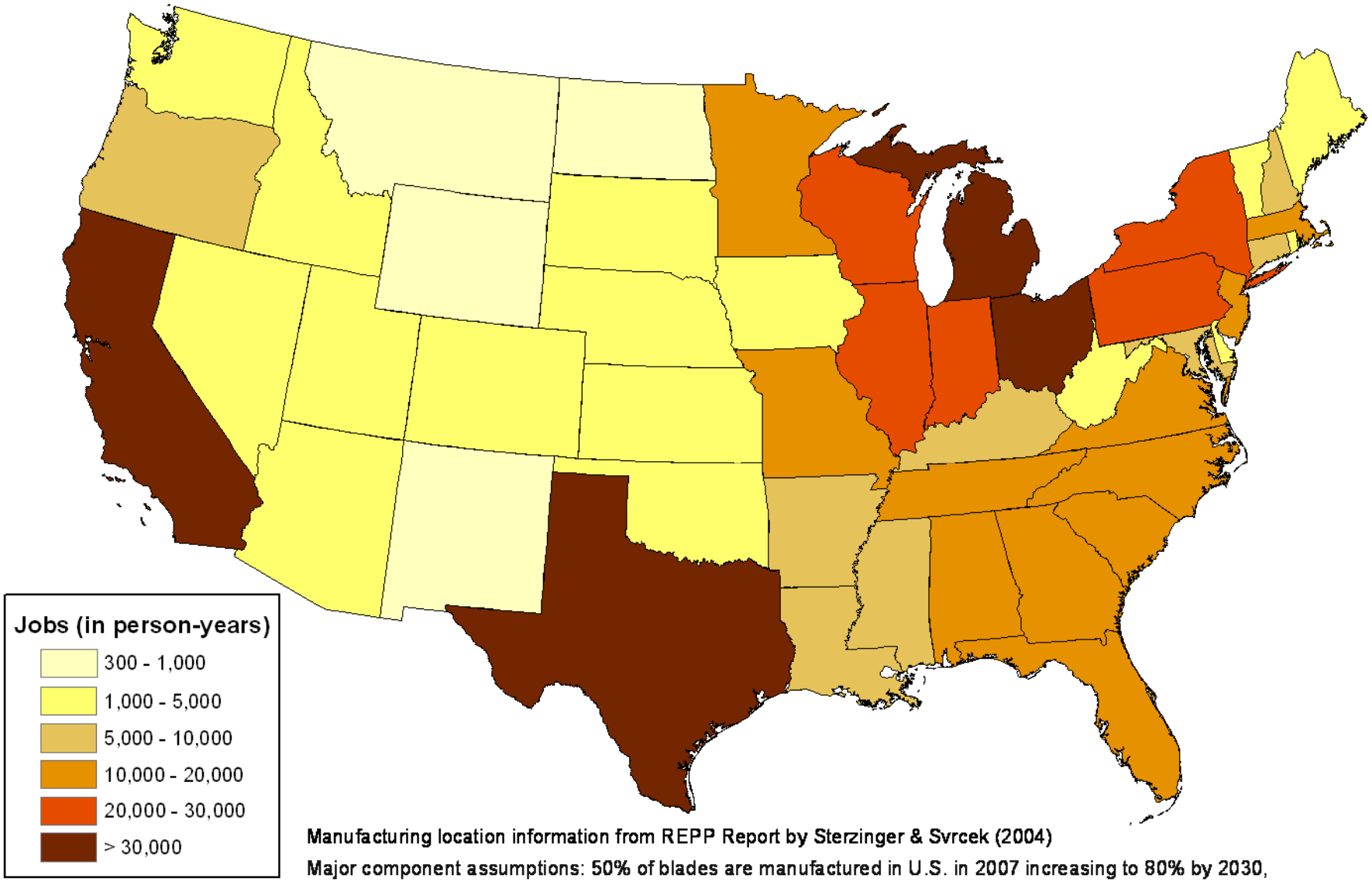
20% Wind Scenario Generation Mix

- Reduces electric utility natural gas consumption by 50%
- Reduces total natural gas consumption by 11%
- Natural gas consumer benefits: $86-214 billion*
- Reduces electric utility coal consumption by 18%
- Avoids construction of 80 GW of new coal power plants



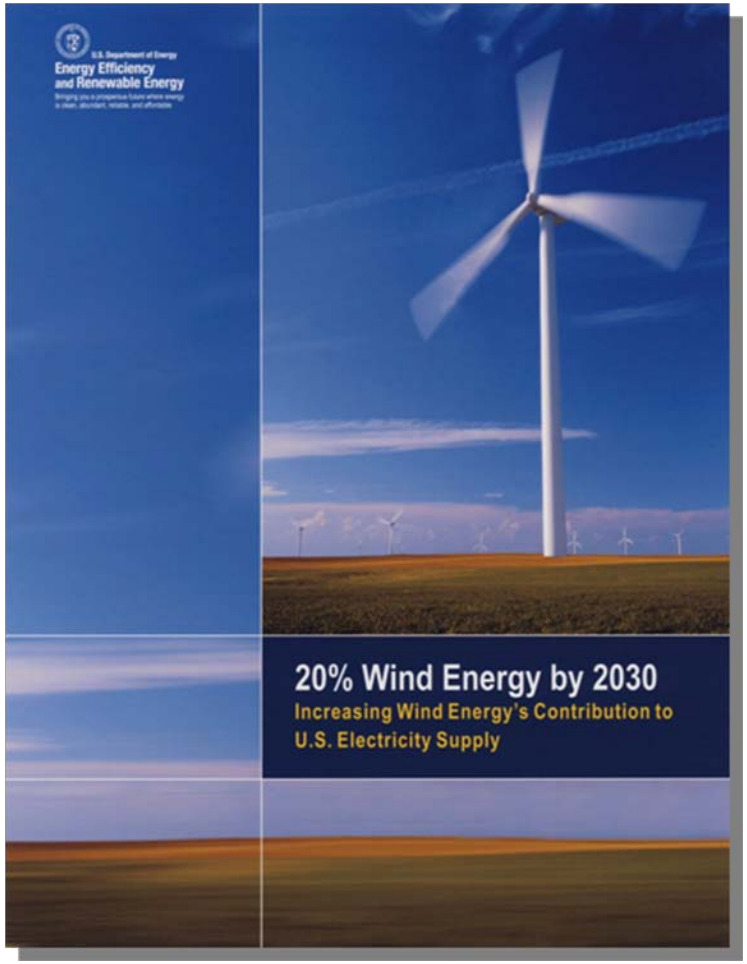
Source *: Hand et al., 2008

Manufacturing Jobs Supported



Manufacturing location information from REPP Report by Sterzinger & Svrcek (2004)

Major component assumptions: 50% of blades are manufactured in U.S. in 2007 increasing to 80% by 2030, 26% of towers are from the U.S. in 2007 increasing to 50% by 2030 and 20% of turbines are made in the U.S. increasing to 42% by 2030.



20% Wind Energy by 2030:

Increasing Wind Energy's Contribution to U.S. Electricity Supply

www.20percentwind.org

20% Wind Energy by 2030

Utility Numbers and Trends

Benefits of Wind Power for Utilities

Wind Power is the only large-scale, widely-available, readily-deployable clean energy source of electricity generation.

Cost Stability

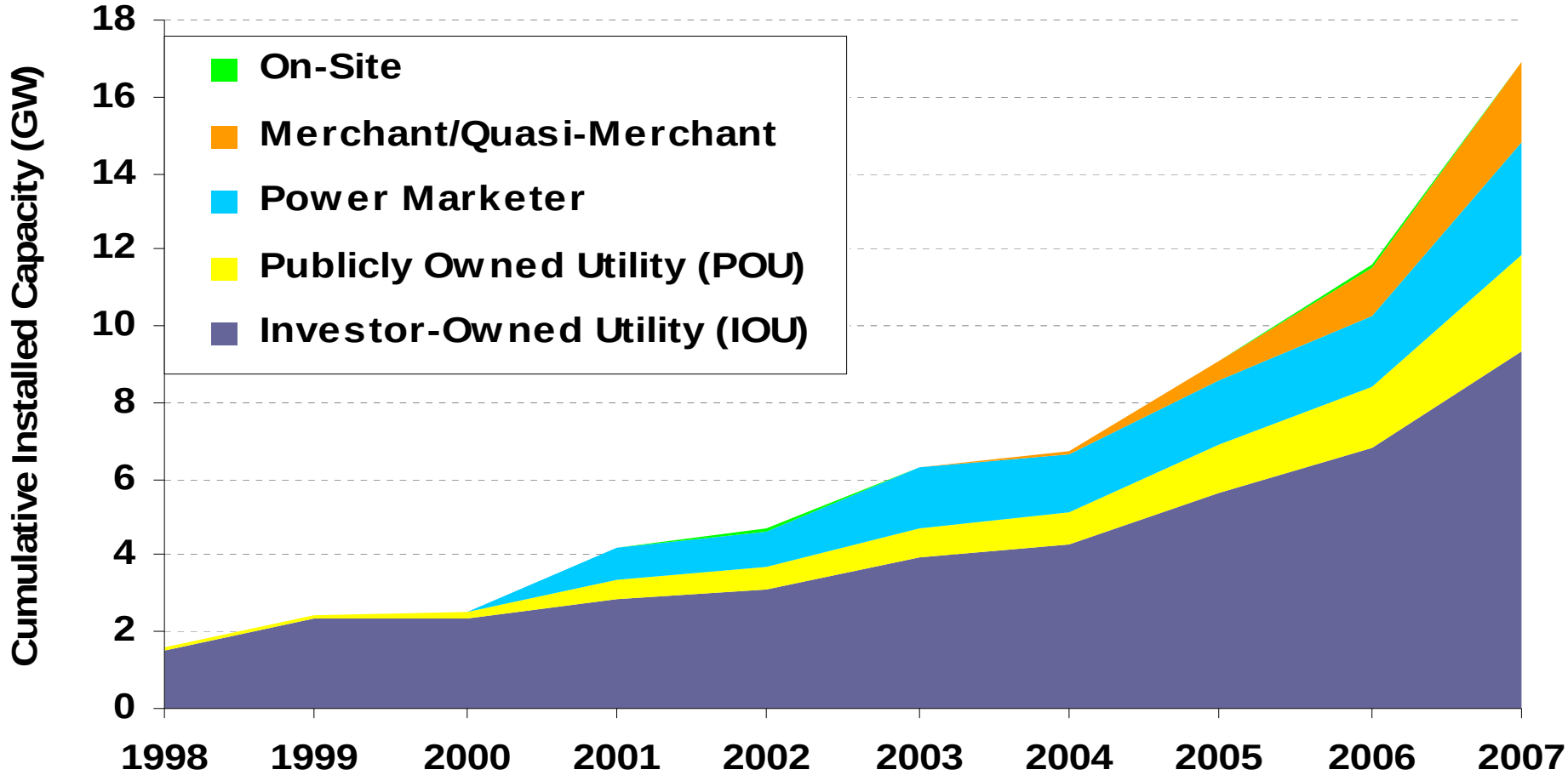
- Known pricing can offer hedge against fuel price volatility risk
- Electricity from the wind is inflation-proof once a wind farm is installed
- Utilities starting to value this “price hedge”

Fuel Diversity

- **Domestic energy source**
- **Inexhaustible supply**
- **Small, dispersed design reduces supply risk**
- **Reduced natural gas consumption**

Utility Adoption of Wind Power

Top 20 utilities own / have contracted for two-thirds of U.S. wind capacity (Top 10 ~ 50%)



Source: Berkeley Lab estimates based on AWEA project database

Current Leading Munis for Wind Power

Top five municipally-operated utilities with wind power on system, end of 2007:

- **CPS Energy** (San Antonio, TX) – 501 MW
- **Austin Energy** (Austin, TX) – 274 MW
- **MSR Public Power Agency** (CA) – 200 MW
- **Seattle City Light** (WA) – 176 MW
- **Sacramento Municipal Utility District (SMUD)** (CA) – 106 MW
- **Los Angeles Department of Water and Power (LADWP)** – (various)

Current Leading Co-ops for Wind Power

Top five rural electric cooperative utilities with wind power on system, end of 2007:

- **Great River Energy** (MN) – 218 MW
- **Last Mile Electric Cooperative** (WA) – 205 MW
- **Basin Electric** – 137 MW
- **Lower Colorado River Authority *** (TX) – 106 MW
- **Minnkota Power Cooperative** (MN) – 101 MW

* Not a co-operative utility per se

Utility options and experiences

AWEA study: issues, strategies & business models related to utilities & wind power

- Wind Energy acquisition options are proliferating, with some utilities gradually transitioning to ownership; some sticking with PPAs; hybrid models being developed
- Federal and state level drivers (RPS) and incentives (PTC, REPI, CREBs) continue to be a great importance, but some utilities looking beyond to other benefits
- Utilities starting to focus on O&M Issues as ownership considerations expand; workforce issues as well
- Transmission seen a huge challenge – as well as a potential opportunity
- Wind siting and wind integration continue to be challenging, but manageable

Utility Case Studies – Best Practices

Investor owned utilities

- **Alliant Energy**
- **Minnesota Power**
- **Portland General Electric**
- **Puget Sound Energy**
- **San Diego Gas & Electric**
- **Xcel Energy**

Public power

- **Austin Energy**
- **Basin Electric**
- **Great River Energy**
- **Iowa Lakes Electric Co-op**
- **Lakewood Light & Power**
- **Nebraska Public Power District**
- **Sacramento Municipal Utility District**
- **Seattle City Light**

Pros / cons: PPAs vs. Ownership

Power Purchase Agreement

- Developer responsible for most project development & operational risks
- Frees up capital for utility to invest in other projects
- Constrains utility's operational flexibility
- Price predictability / transparency
- Can be less cost effective than ownership
- Potential impact for PPA imputed debt on credit ratings
- Low (perceived) risk

Ownership

- Greater upfront capital investment
- Greater risk placed on utility management
- Known rates-of-return can recoup investment in ~2/3 of facility lifetime
- Avoids PPA curtailment penalties
- More control on siting project
- PTC can be tapped (per rules)
- Lower administrative costs
- Higher (perceived) return

Wind Turbine O&M

Real and perceived risk of ownership partly due to Ooperations & Maintenance (O&M) exposure

- Most utilities don't yet have enough experience to take it on

Experience to date with utility O&M is mixed bag, but challenges remain, including

- Keeping turbine availability at expected rates
- Obtaining spare part inventories
- Delivery of power to load / market
- Staffing O&M functions

Most utilities still relying on turbine vendor or independent company to maintain wind asset

- Lots of learning taking place, and confidence being built up

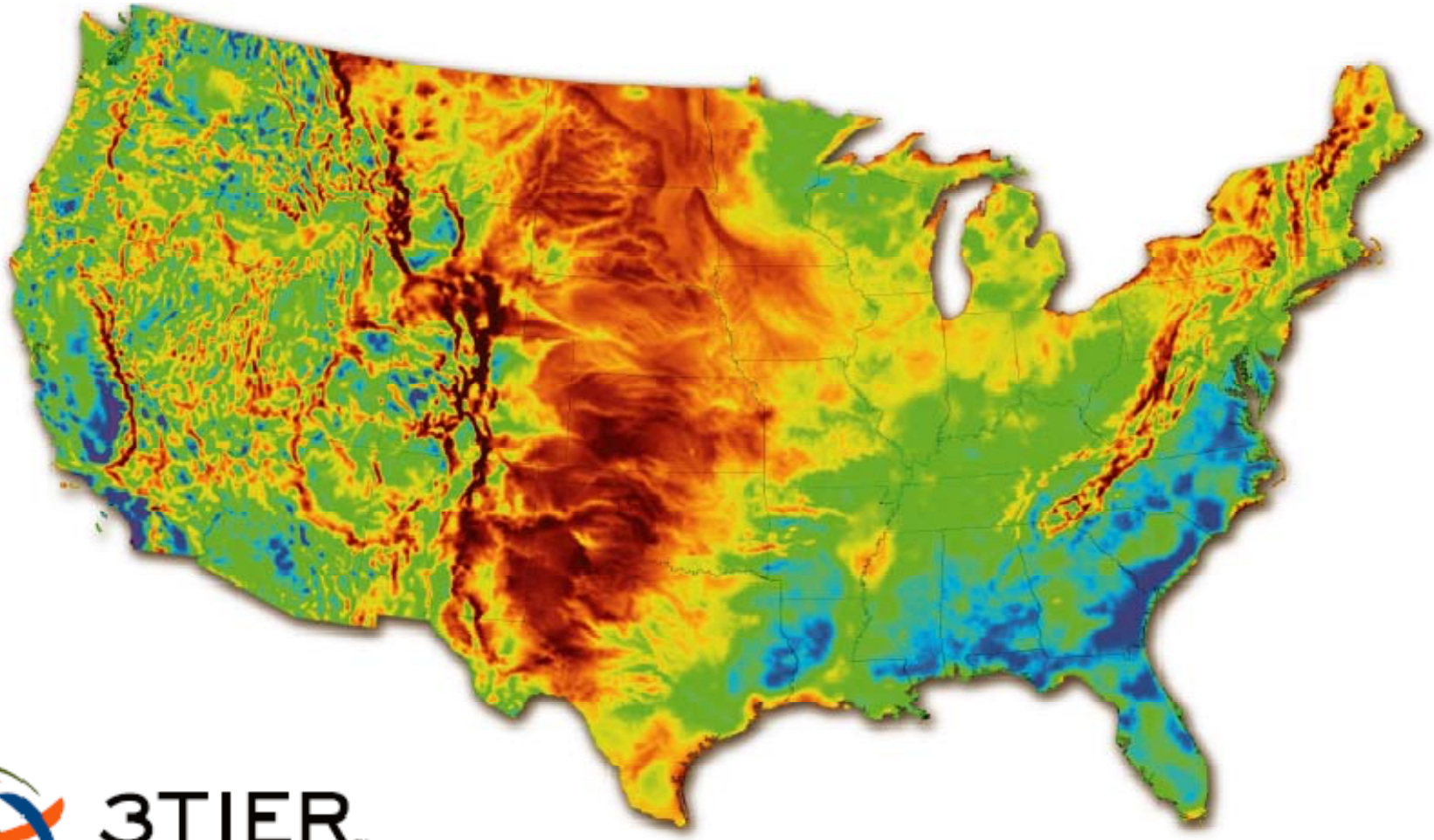
With time, utilities could see wind turbines as just another generator

Major challenges for utilities

- Transmission rules / market structure, availability, tariffs, queues
  - Transmission availability already an issue
  - Changing rules (e.g. ERCOT) create uncertainty
  - PPA language on delivery crucial, but owners not exempt
- Incentives
  - PTC uncertainty
  - REPI and CREBs: annually rewarded and competitive, not proven as safe bets
  - Public power would prefer tradable PTC for owned projects, but unclear how likely that is
- Turbine availability and pricing
  - How long will the suppliers' market last?

Wind Power & Economic Development

The Great Plains Wind Resource



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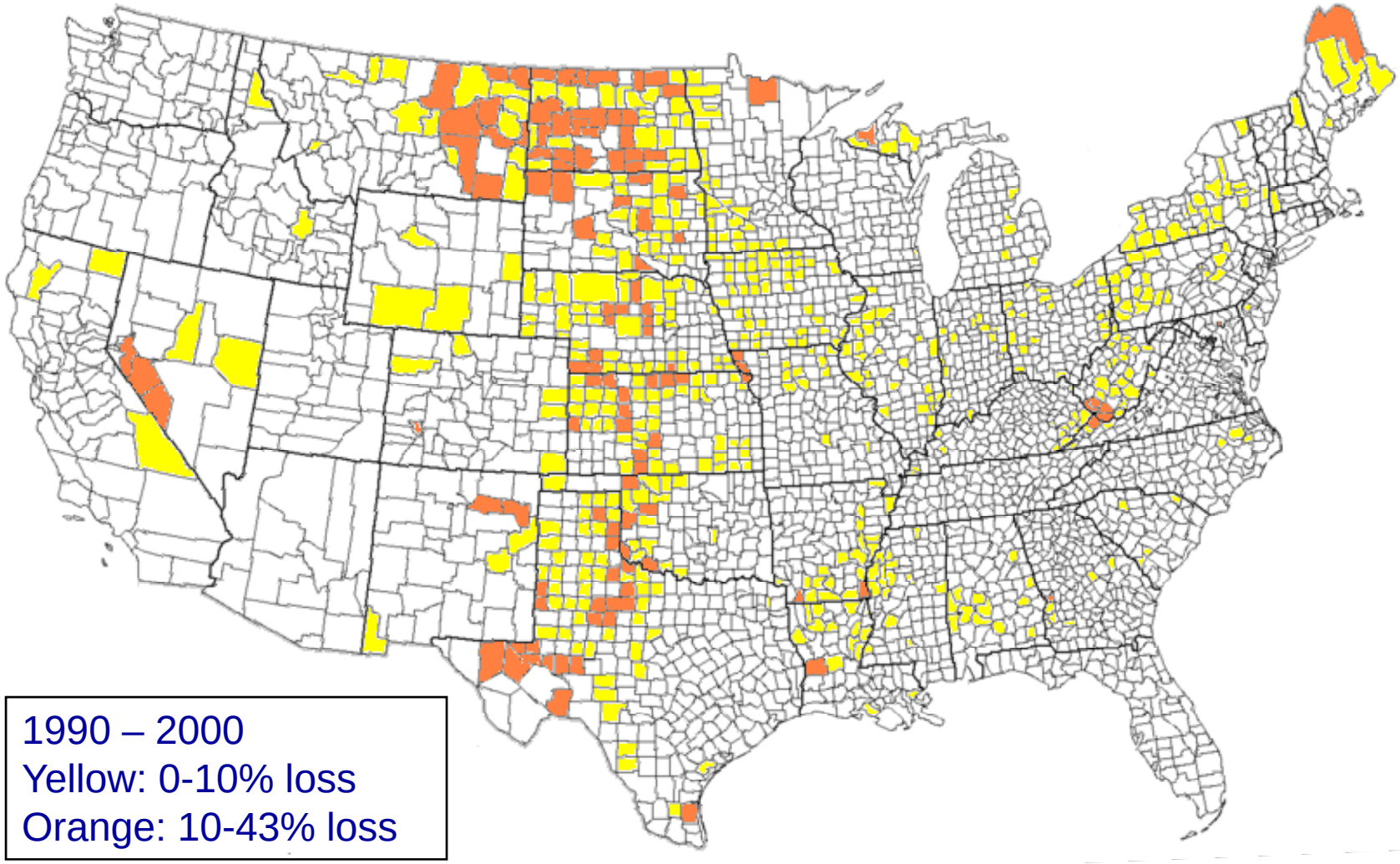
An Economic Opportunity

- The Great Plains wind resource is a huge economic resource
- The resource exceeds load in the region, and must be exported if anything close to its potential is to be achieved
- Long-term trends support continued strong growth of wind
- Economic benefits to the region include:
  - Revenue to local governments
  - Revenue to land owners
  - Jobs in construction, operations, manufacturing and a variety of support capacities such as transportation

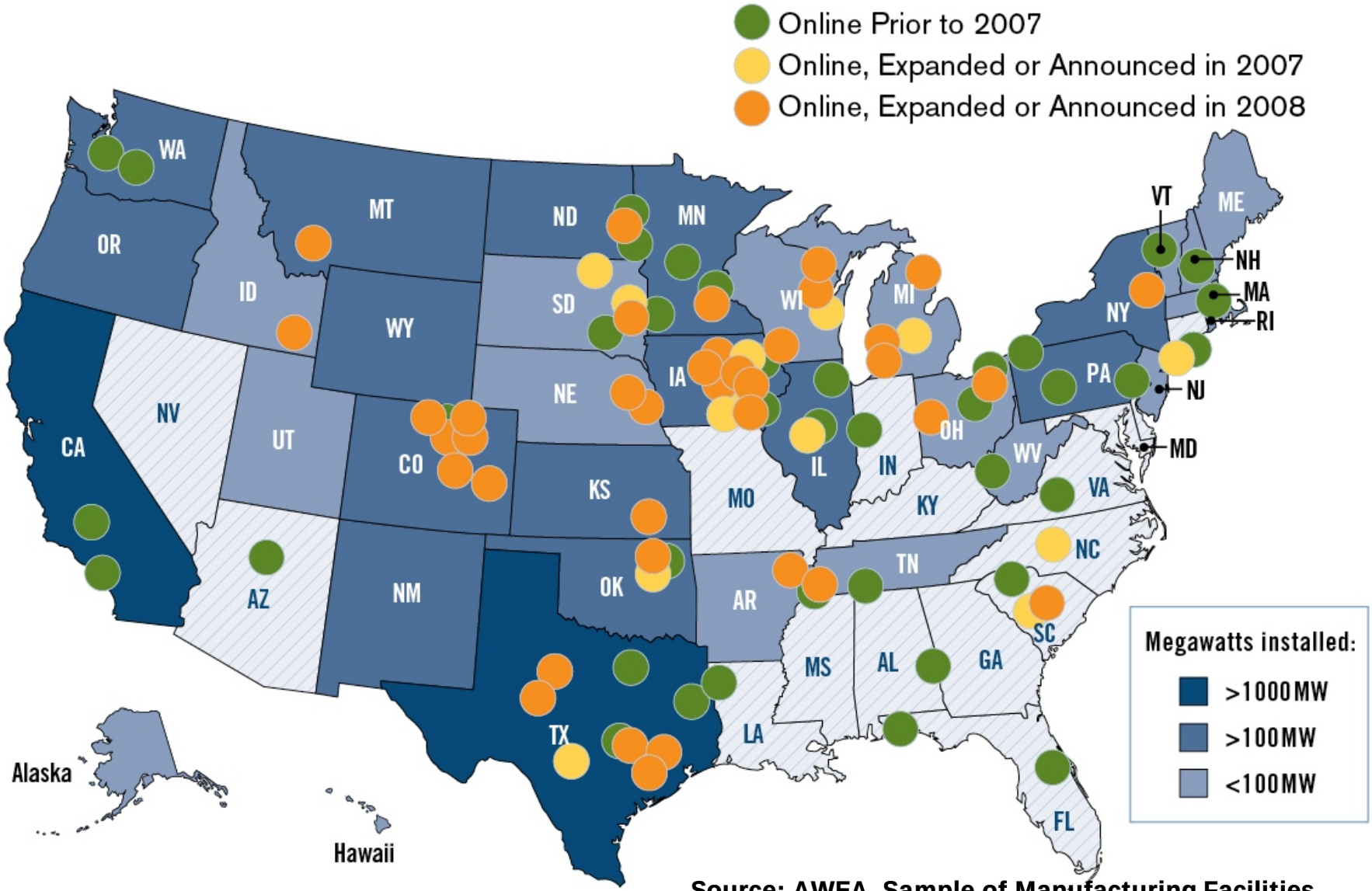
Counties with Population Decline



1990 – 2000
Yellow: 0-10% loss
Orange: 10-43% loss

The Great Plains has struggled to maintain economic opportunity for its young people

U.S. Wind Manufacturing Facilities



Source: AWEA, Sample of Manufacturing Facilities

Opportunities: Public Power Utilities

- What steps can rural cooperatives take to ensure wind's value for their consumer-owners is maximized?
  - Be pro-active – help shape the future of the wind industry in the Great Plains, and the economic development that will flow from it
  - Redefining the role of WAPA, BPA, TVA
  - NRCO: www.renewable.coop
  - Expand / create new incentives: refundable/transferable PTC

Conclusions / Wrap-Up

- **Questions ? Jeff Anthony, janthony@awea.org**

  www.awea.org/utility

- **Learn more at WINDPOWER 2009 – Chicago, Illinois - May 4-7 www.windpowerexpo.com**
  - > 1000 exhibitors; > 13,000 attendees; 54 sessions
  - Supply Chain workshop on May 4th

20% Wind Energy by 2030

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Increasing Wind Energy's Contribution to U.S. Electricity Supply

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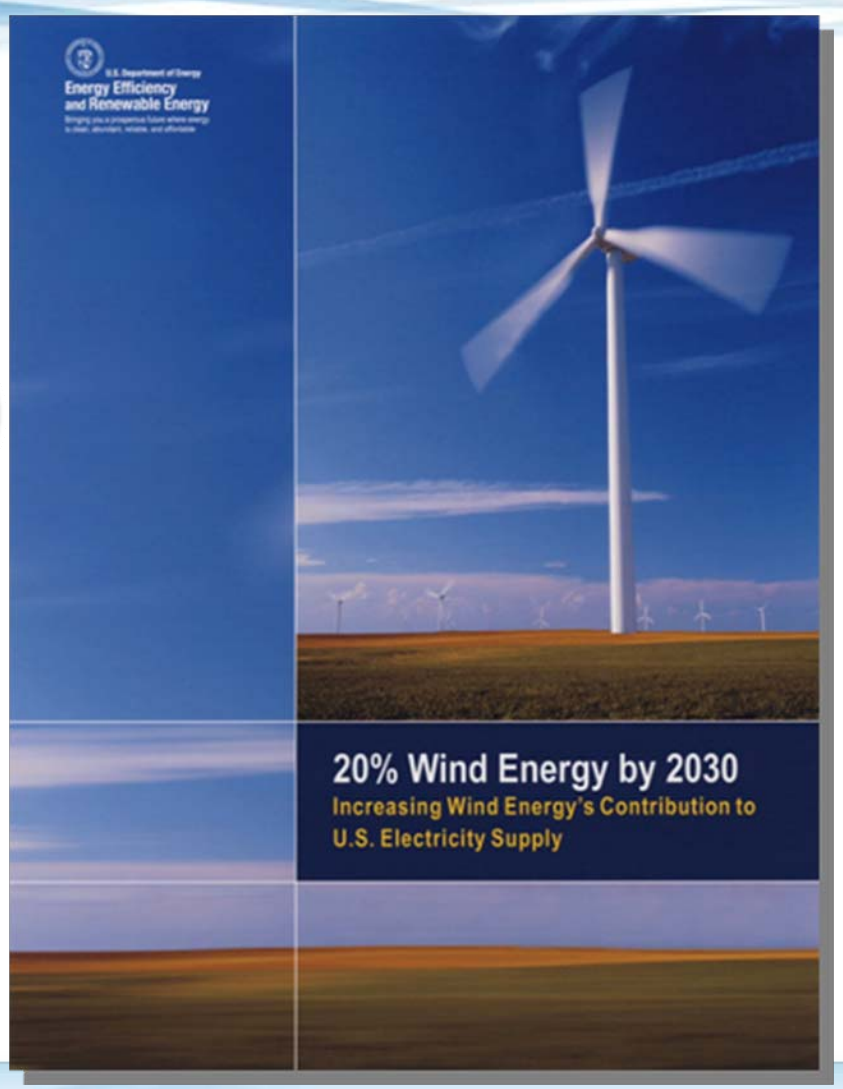
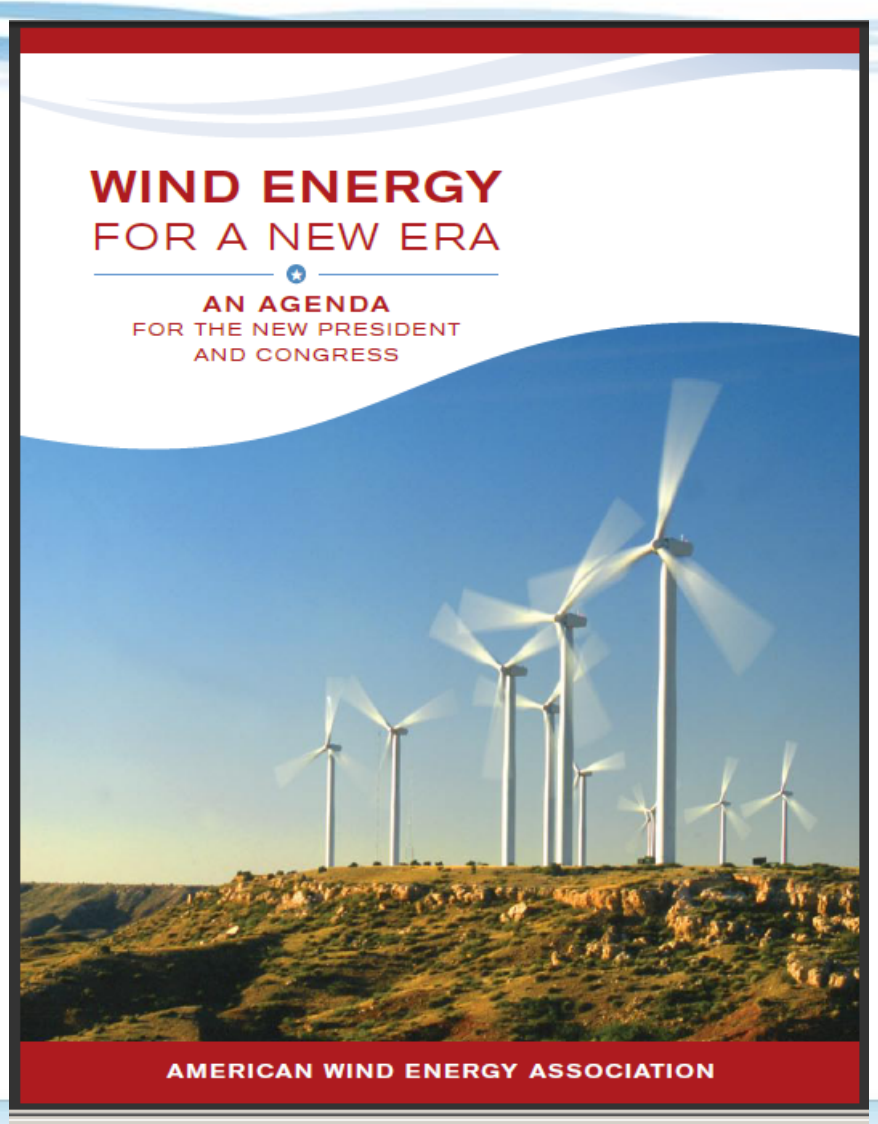


20% Wind Energy by 2030

Wind Energy for a New Era

An Agenda for the New President and Congress

www.newwindagenda.org

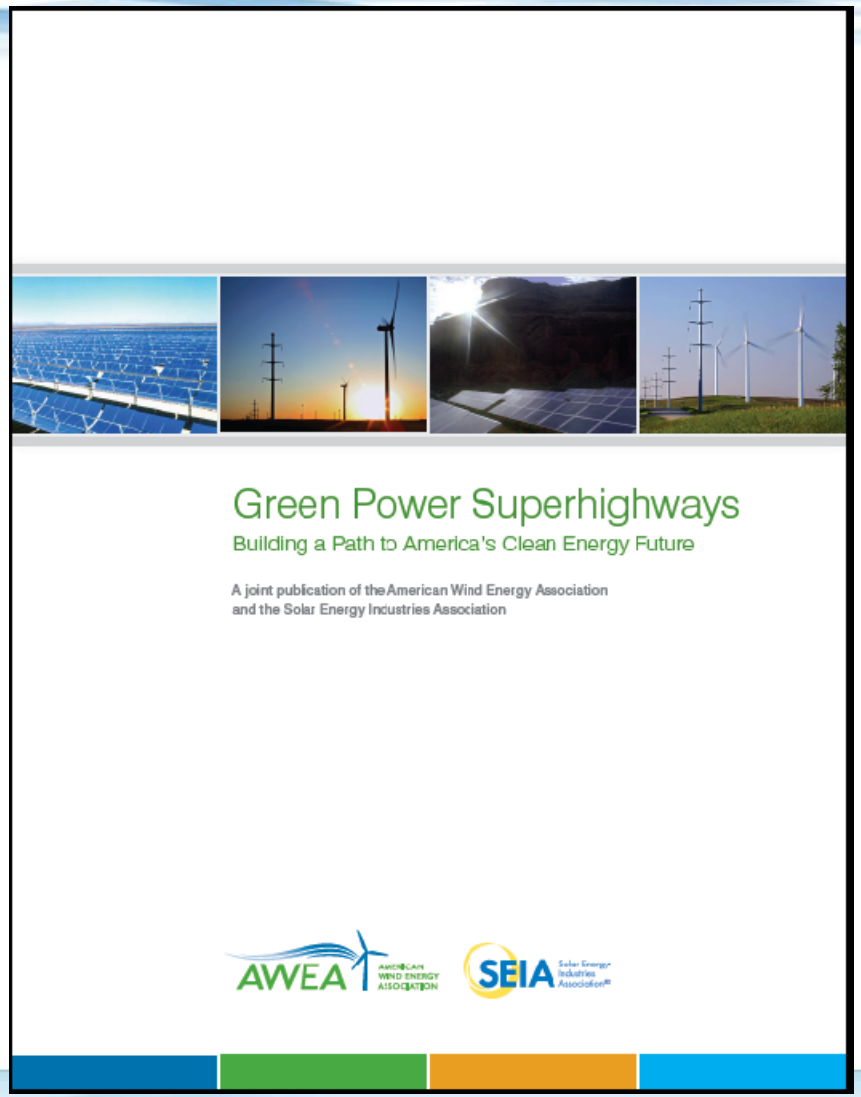


20% Wind Energy by 2030

Green Power Superhighways

Building a Path to America's Clean Energy Future

www.awea.org/GreenPowerSuperhighways.pdf



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