

Presentation to the Senate Energy and Technology Committee
American Wind Energy Association
Deirdre K. Hirner, Midwest Policy Director

1. The U.S. was the number one country in the world in wind energy production in 2015.

The U.S. represents 17% of global installed wind capacity.

2. U.S. wind is a leader in the clean energy sector.

Last year, the wind industry installed 8,598 MW, the third-biggest year for installations ever, with an additional 520 MW of wind installed during the first quarter of 2016.

Wind power was the No. 1 source of new electric generation capacity additions in 2015.

Capturing 41% of new capacity additions, wind led both solar (28.5%) and natural gas (28.1%).

Note: Capacity is the maximum electric output an electricity generator can produce under specific conditions; it is the physical amount of generation power plants have available to serve load in MW; representing the plants' potential to generate electricity, and is related to peak demand. A power company must maintain a level of available capacity sufficient to meet the peak demand of its customers and have some in reserve.

Nameplate capacity is determined by the generator's manufacturer and indicates the maximum output of electricity a generator can produce without exceeding design thermal limits.

Generation is the amount of electricity a generator produces over a specific period of time. E.G., if a generator with 1 megawatt (MW) capacity operates at half that capacity for one hour, it will produce 0.5 MWh of electricity. A generator's output may vary according to conditions at the power plant, fuel costs, and/or as instructed by the electric power grid operator.

Energy is the amount of electricity (produced from capacity) customers consume over time.

3. We have developed nearly 75 gigawatts of wind power capacity in America, enough to power 20 million average American homes every year.

Utility scale wind turbines are now in 40 out of 50 states plus Puerto Rico and Guam.

More than 10,100 additional MW currently under construction, much of it in Texas.

In Michigan, there is 1,531 MW of installed wind capacity, with the state ranked 14th for installed wind capacity. Michigan has 887 wind turbines, ranking 15th in the nation for the number of wind turbines. And, Michigan has 23 wind projects online, and 279 MW of wind capacity under construction.

4. Wind is mainstream power that is *reliably* integrated into the grid.

Wind provided more than 30% of Iowa's in-state electricity generation in 2015, over 25% in South Dakota, over 20% in Kansas, and at times, supplied more than 65% of the electricity on the main utility system in Colorado, and above 43% on the main grid operator in Texas.

In Michigan, wind energy provided 4.19% of all in-state electricity production in 2015, powering the equivalent of 437,000 homes.

5. RPS laws generate demand for wind energy.

Michigan enacted a Renewable Portfolio Standard (RPS) in 2008, requiring state electricity providers to generate 10 percent of their sales from renewable energy sources by 2015. The state successfully reached its RPS target.

Wind energy has historically been the renewable resource chosen to meet renewable standards requirements, fulfilling 86% of RPS requirements through 2011 and driving economic development in the state as a result.

6. Wind power equals jobs!

Wind supported 88,000 jobs nationally in 2015, including over 21,000 manufacturing jobs nationwide.

In Michigan, wind supported between 1,000 and 2,000 direct and indirect jobs. \$3.0 billion total has been realized in capital investment; and annual land lease payments equal between \$1 and \$5 million.

There are more than 500 manufacturing facilities in the United States, producing products for the wind industry that range from blade, tower and turbine nacelle assembly facilities to raw component suppliers, including fiberglass and steel.

There are 32 active manufacturing facilities in the state of Michigan, among the highest number in the nation.

7. Wind energy costs decline is leading the clean energy sector by a wide margin because of advanced technology.

Wind-generated electricity is two-thirds cheaper than it was six years ago, because of

- Improved turbine technology, with increased rotor diameters and hub heights;
- Better computer analytics, so we know more about where to place the turbines and how to operate them as a unit;
- Networked sensors, and drones, so we can know more about when to maintain, before we have to repair or replace; and
- U.S. factories, which save on shipping large components from overseas.

NREL has wind and gas prices converging nationwide by the early 2020s.

- Wind has no fuel cost and a much lower marginal operating cost than other resources, so it's a preferred resource for utility system operators.

8. Wind also provides for environmental benefits: generating wind power creates no emissions and uses virtually no water.

Wind energy generation saves about 226 gallons of water for every American each year.

- In Michigan, wind generation saved 799.1 million gallons of water in 2014, the equivalent of **6.1 billion** water bottles.
- In 2014, it also avoided 1.3 million metric tons in annual state carbon dioxide (CO₂) emissions, the equivalent of 268,000 cars worth of carbon emissions.

9. New technology means more development in more regions.

The onshore wind resource is estimated at more than 9,000 GW with 80-meter hub height technology.

Increasing turbine hub heights and rotor diameters are opening new regions to development, with transportation and cost restraints.

The DOE Wind Vision Scenario projects that Michigan could produce enough wind energy by 2030 to power the equivalent of 710,000 average American homes.

- Land based technical wind potential at 80 m hub height: 8,677 MW
- Land based technical wind potential at 110 m hub height: 254,690 MW (Source: NREL)

10. The Clean Power Plan will drive wind demand.

Extension of the PTC is meant to be a "bridge" to the Clean Power Plan.

The Clean Power Plan will drive a lot of wind to be built in the United States, because wind is the biggest, fastest, cheapest way to comply.

Of all the new power needed for states to comply with the CPP, EIA says that 57% percent will come from wind, under the most cost-effective scenario.

Right now, there's enough wind power installed in the U.S. to power 19 million homes, which is expected to quadruple by 2030.

11. The DOE 2015 Wind Vision Report offers that achieving 20% wind by 2030, will create 380,000 jobs.

When the original 20% by 2030 report came out in 2008, the MW targets seemed aggressive, but the US wind industry has surpassed the target trajectory every year since.

The new Wind Vision report finds that we remain on track so far, and gives us a fresh road map to get to 35% by 2050.

Last year's results kept us on the path, with 8.6 GW of installations which led the clean energy sector.

The U.S. industry remains on track to double in the next five years, and double again in the following 10 years.

To remain on track, we must install six to eight GW each year.

12. Wind is deeply popular across political spectrum.

- 70% say U.S. should put more emphasis on producing more domestic energy from wind;
- 14% say the same emphasis as now;
- Among Republicans, 63% want more emphasis on wind.

13. Wind power is popular in rural communities – with good reason:

- The vast majority of land used to host turbines can continue to be used for its original purposes (ranching, farming, wildlife habitat, recreation).
- Only 2-5% of the land is needed for the turbines themselves
- The Department of Energy has found that the presence of a wind farm does not have a consistent or significant effect on property values.
- U.S. wind farms now pay \$222 million dollars a year to farming families and other rural landowners, with more than \$156 million dollars going to landowners in counties with below average incomes.

14. Wind power is popular with business as well.

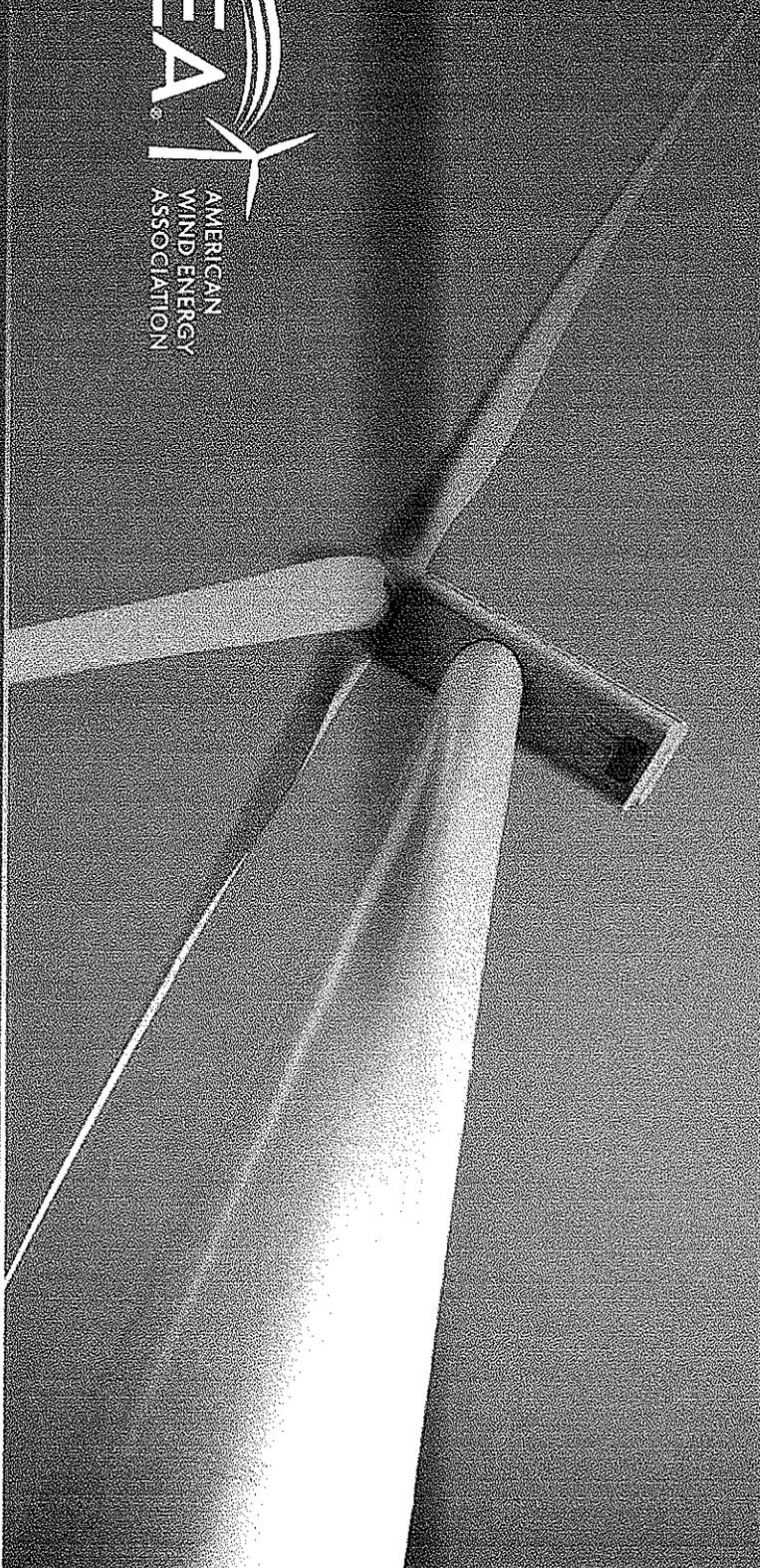
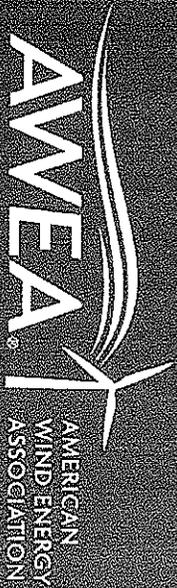
Major consumer brands and city governments buy wind on long-term contracts for fixed low prices.

- Fixed, low-cost long term contracts, along with carbon pollution savings, are encouraging major brands to purchase wind energy;
- In the fourth quarter of 2015, 75% of the megawatts (MW) contracted through power purchase agreements were through non-utility buyers.

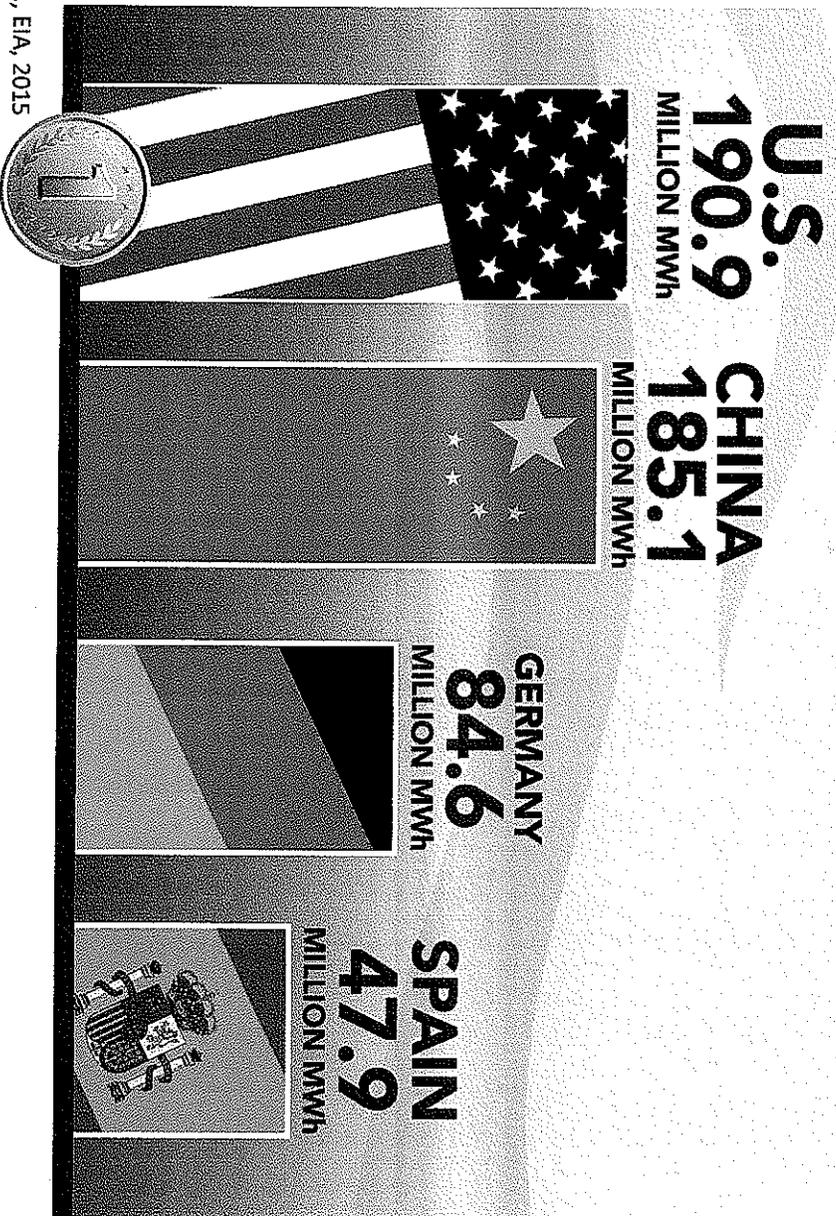
15. Wind power is good for the United States, wind power is good for Michigan.

Deirdre K. Hirner

Midwest Policy Director, American Wind Energy Association
Michigan Senate Energy & Technology Committee May 5, 2015



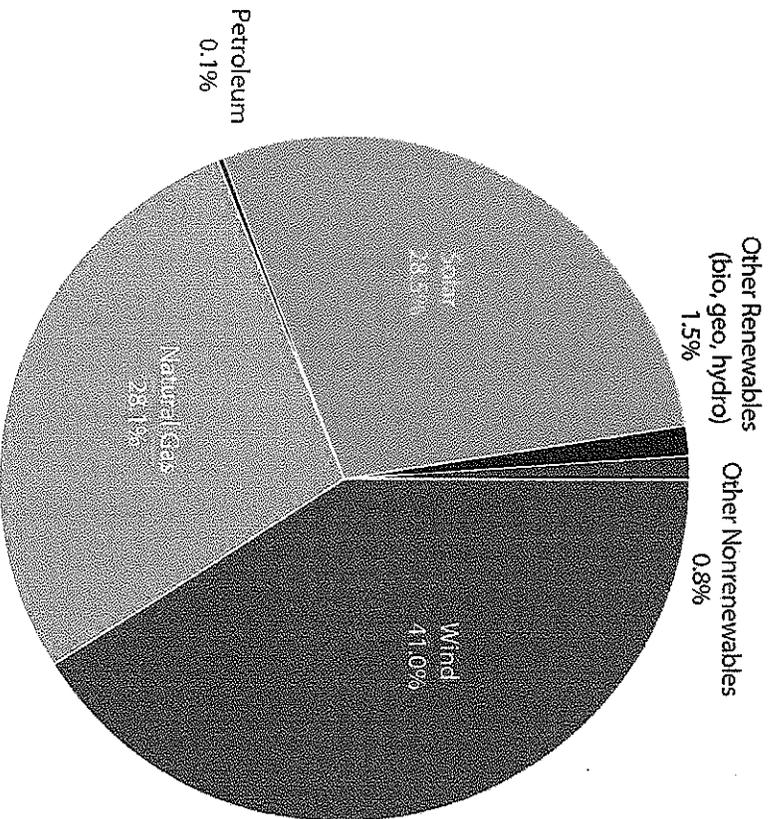
U.S. IS WORLD'S #1 WIND ENERGY PRODUCER



Source: China Electricity Council, EIA, 2015

Wind leads in new capacity additions

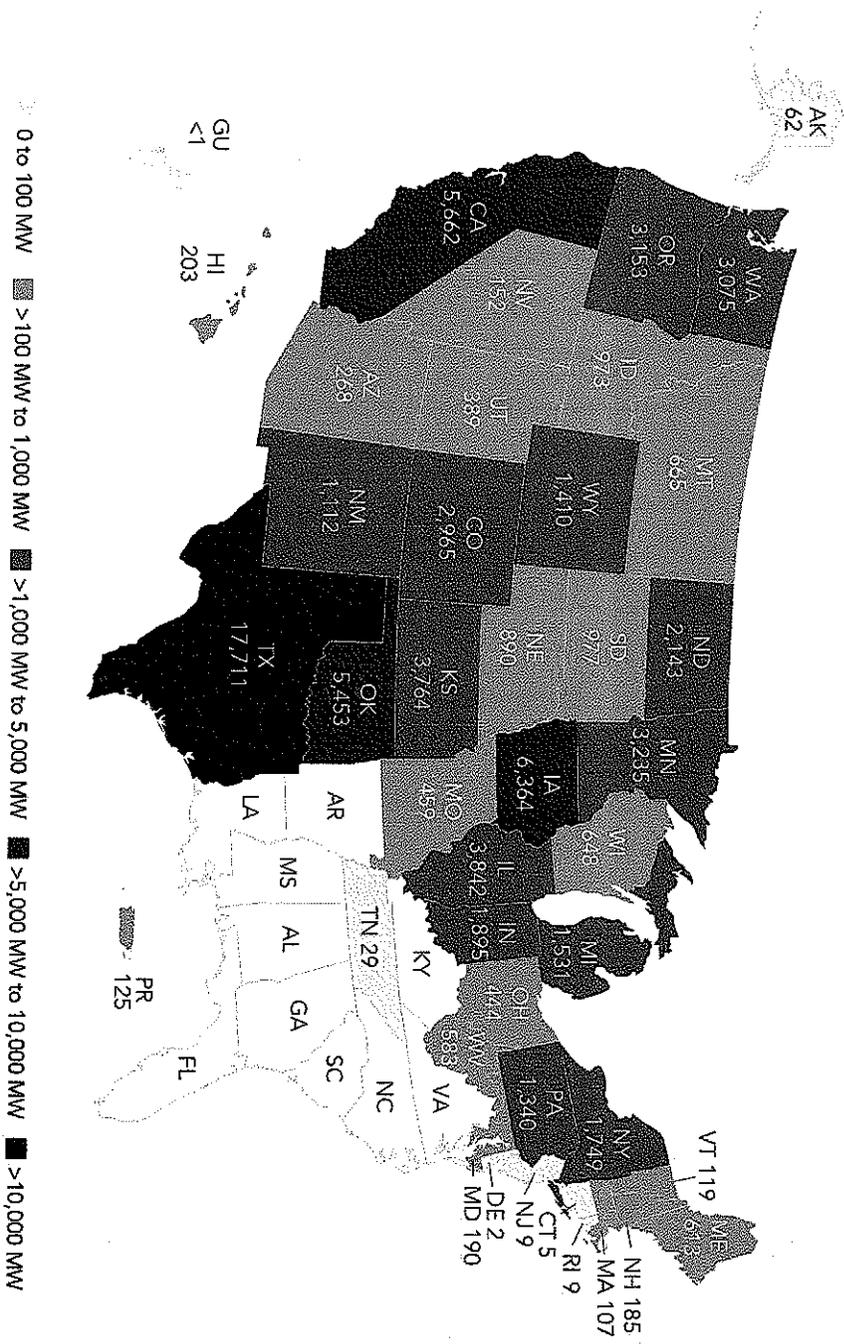
U.S. Percentage Share of Power Capacity Additions in 2015



Enough wind energy to power 20 million homes

Top states for wind power

1. Texas
2. Iowa
3. California
4. Oklahoma
5. Illinois

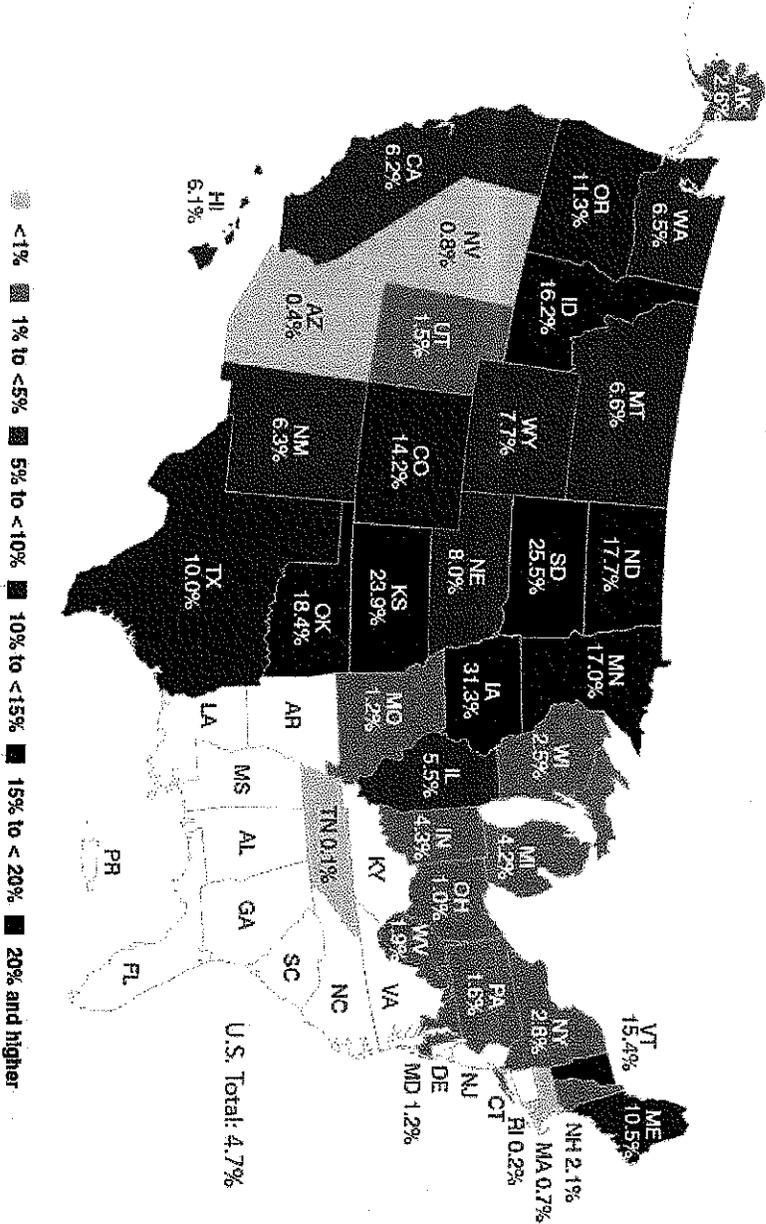


Source: AWEA U.S. Wind Industry First Quarter 2016 Market Report

Mainstream power, reliably integrated

- 12 states produced 10% or more of their electricity from wind
- Two states produced >25% of their electricity from wind

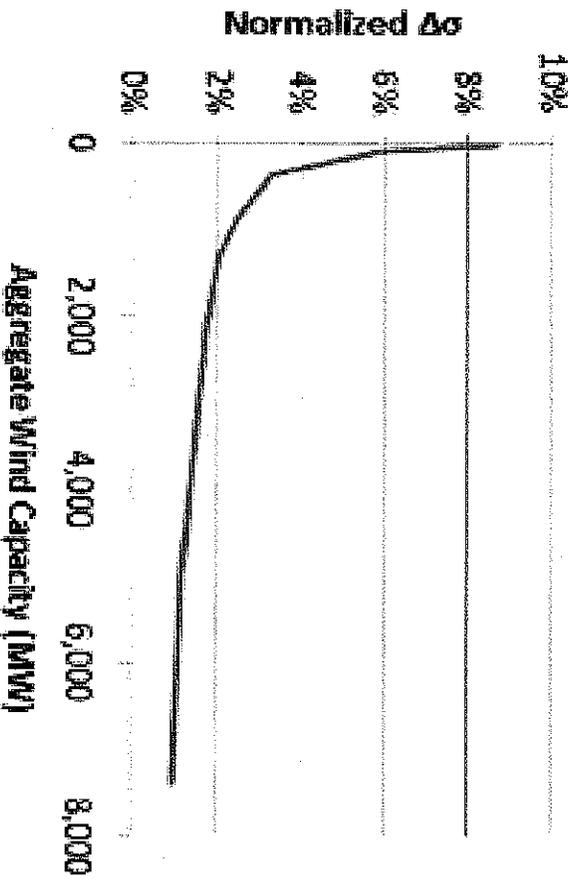
U.S. Wind Energy Share of Electricity Generation, by State



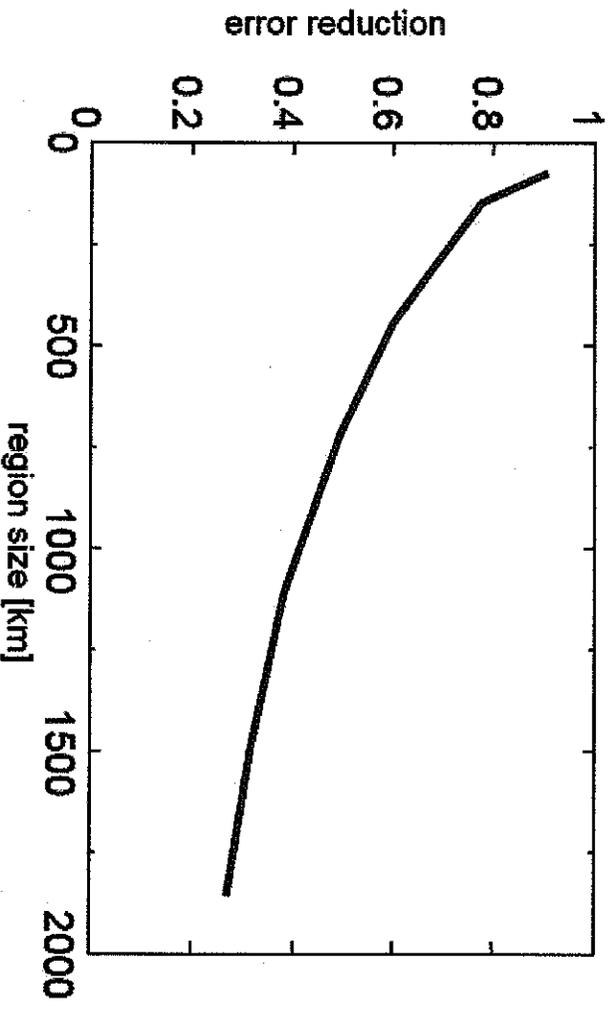
Source: AWEA U.S. Wind Industry Annual Market Report Year Ending 2015

Wind output changes smooth out over larger areas,
and can be forecast

Wind variability



Wind uncertainty

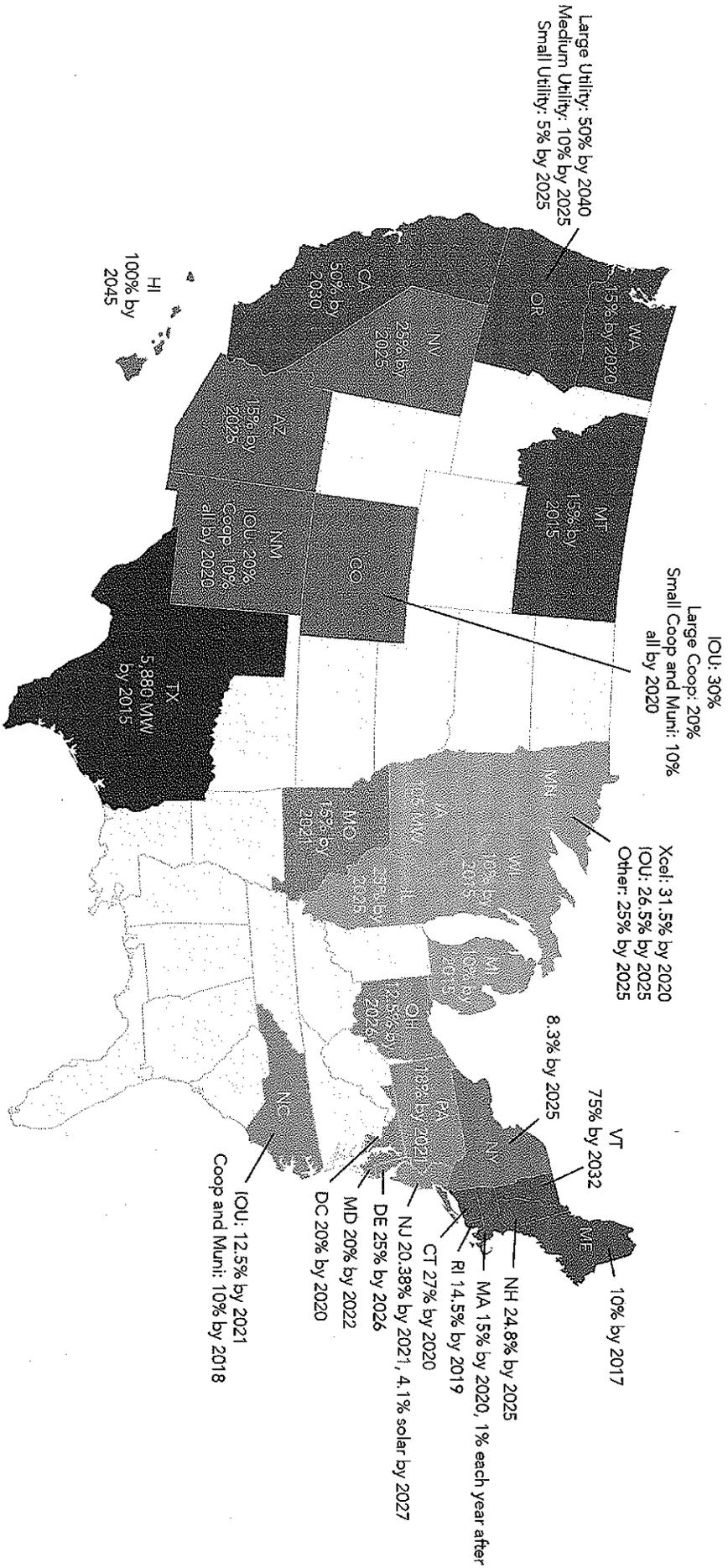


- Changes in total wind output occur gradually and can be forecast
- Outages at conventional plants occur instantaneously and without warning

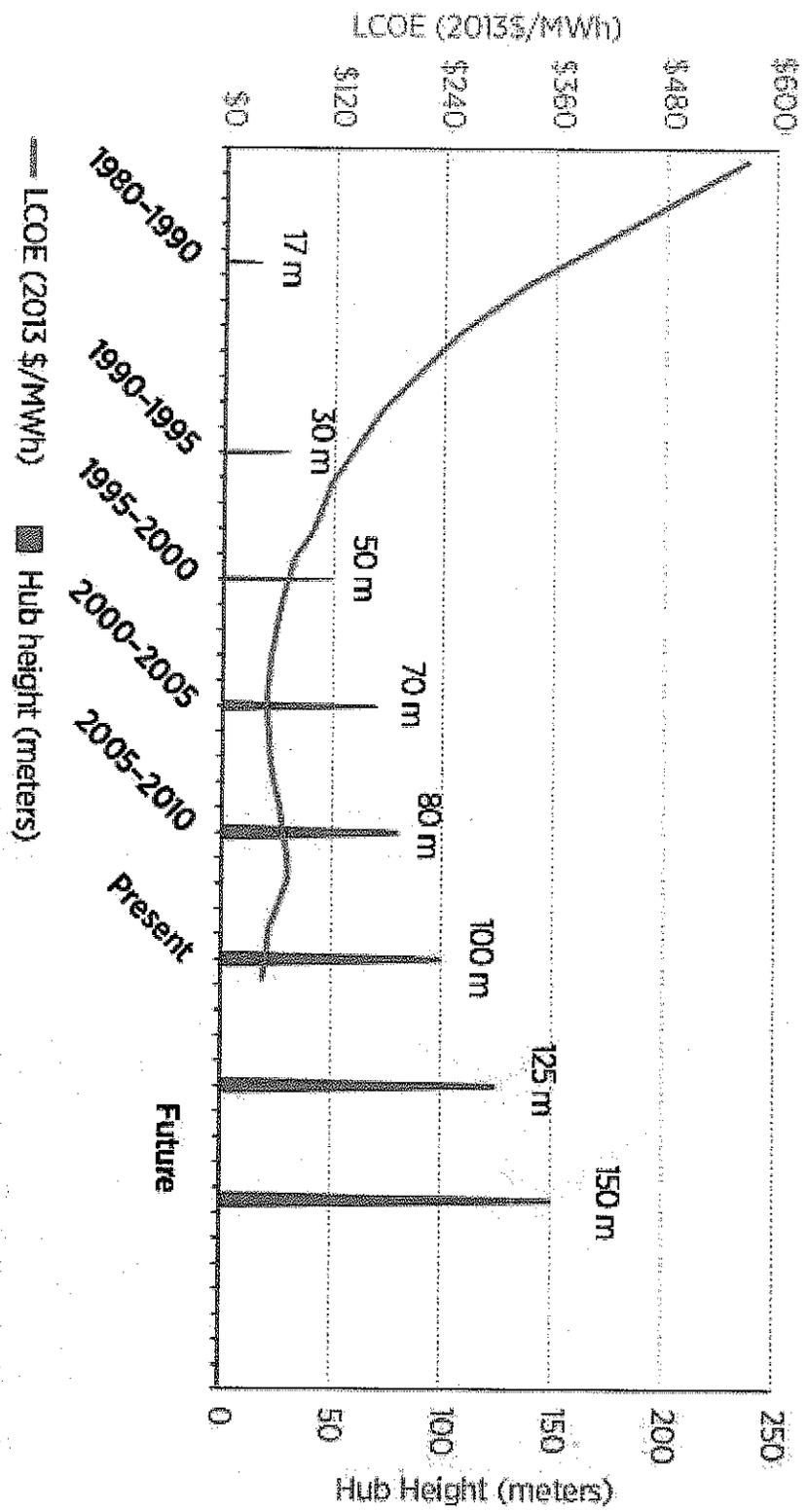
AWWEA

AMERICAN
WIND ENERGY
ASSOCIATION

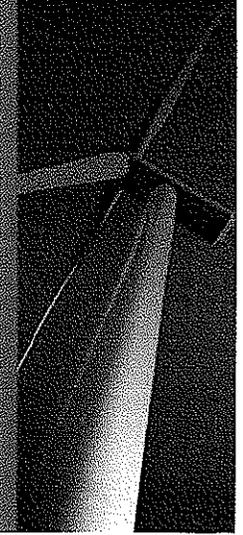
RPS laws generate demand for wind energy



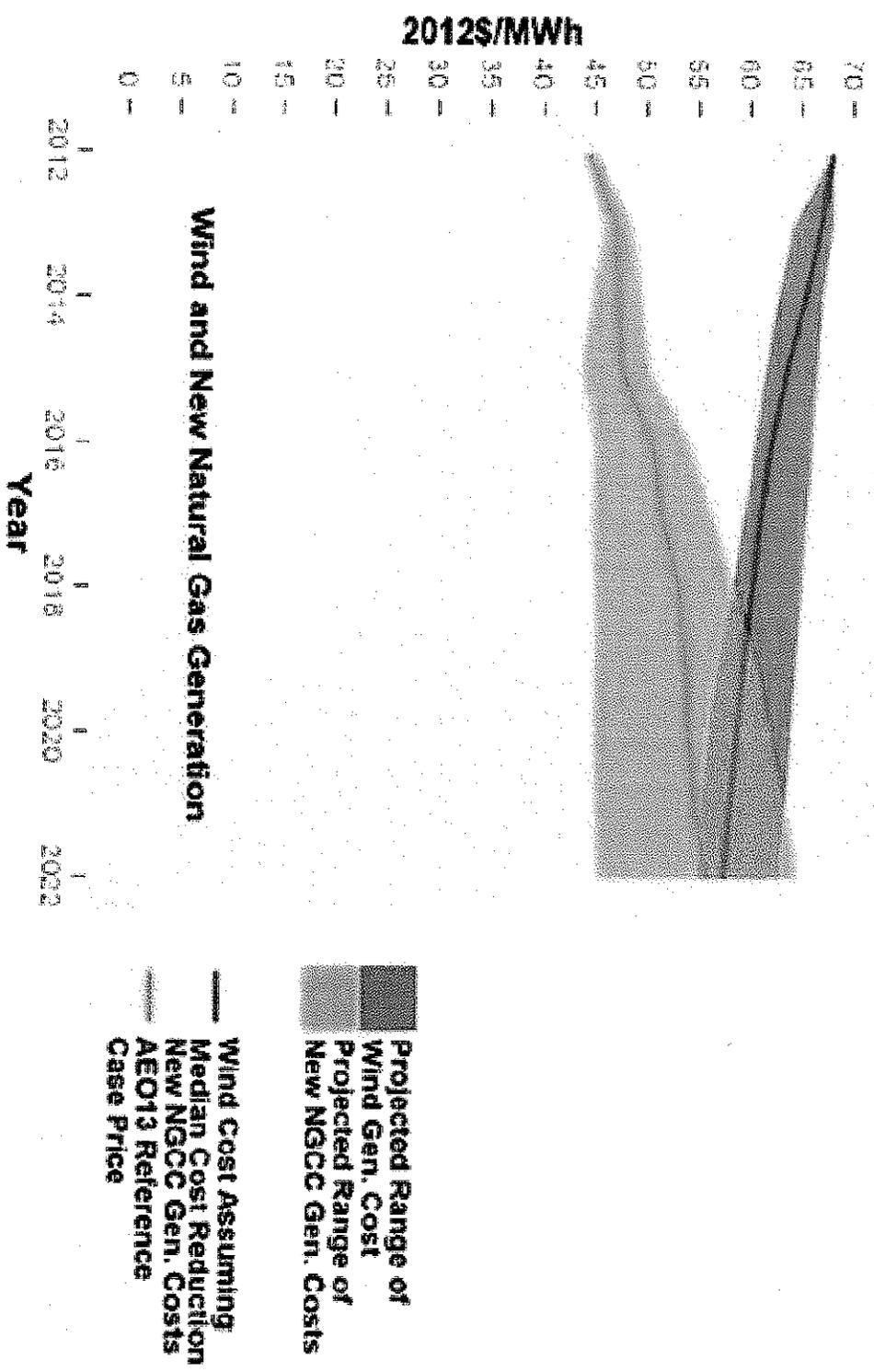
Falling costs of wind energy



Source: LBNL



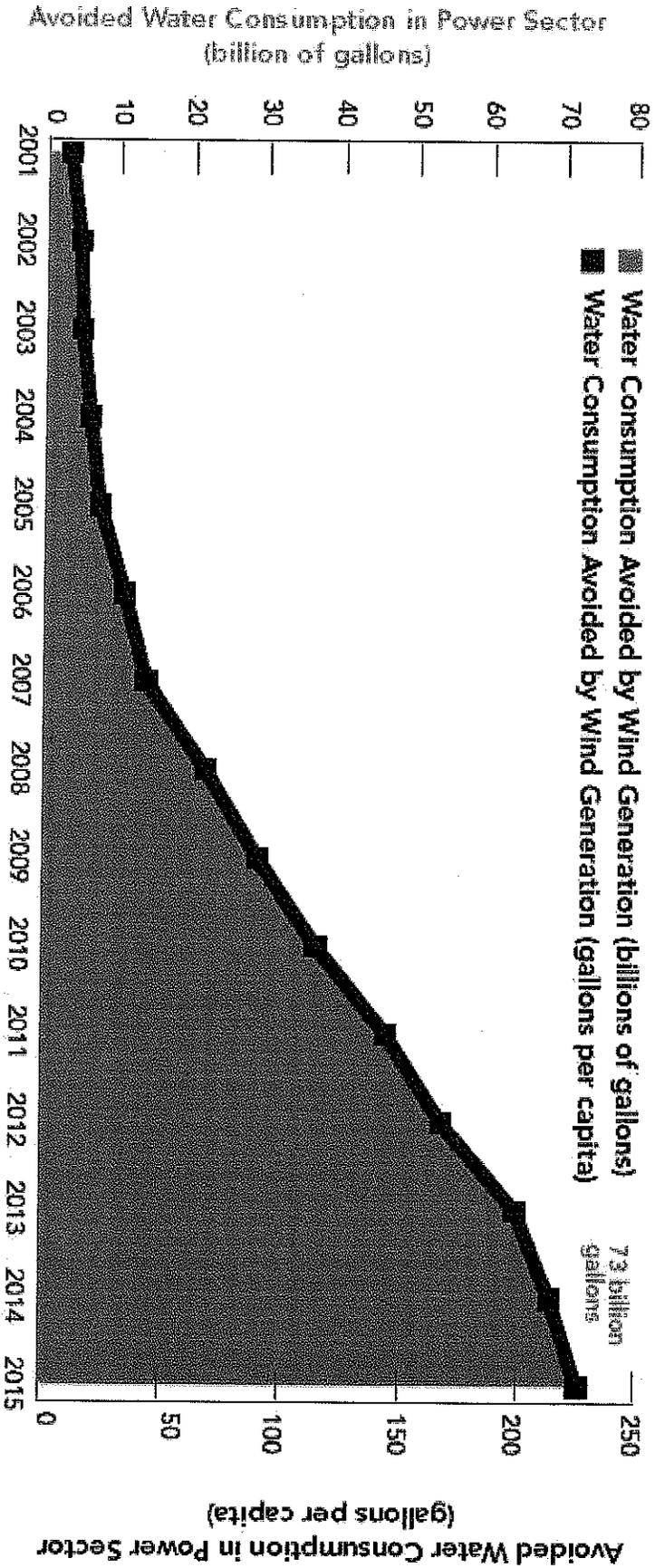
Wind cost vs. gas cost, 2012-2022



Source: NREL

Water savings rising sharply

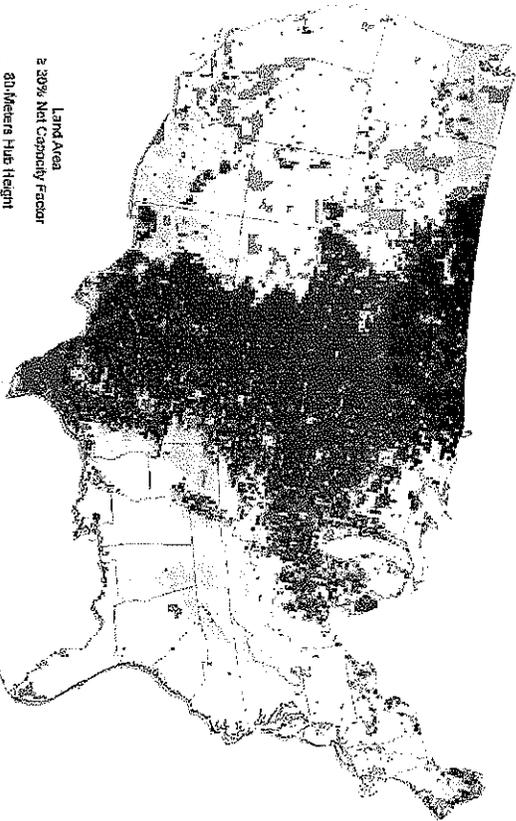
Wind Energy Impact on Avoiding Water Consumption from Thermal Power Plants



Source: AWEA U.S. Wind Industry Annual Market Report Year Ending 2015

New technology means more development in more regions

Wind Resource Potential at
Turbine Hub Height of 80m



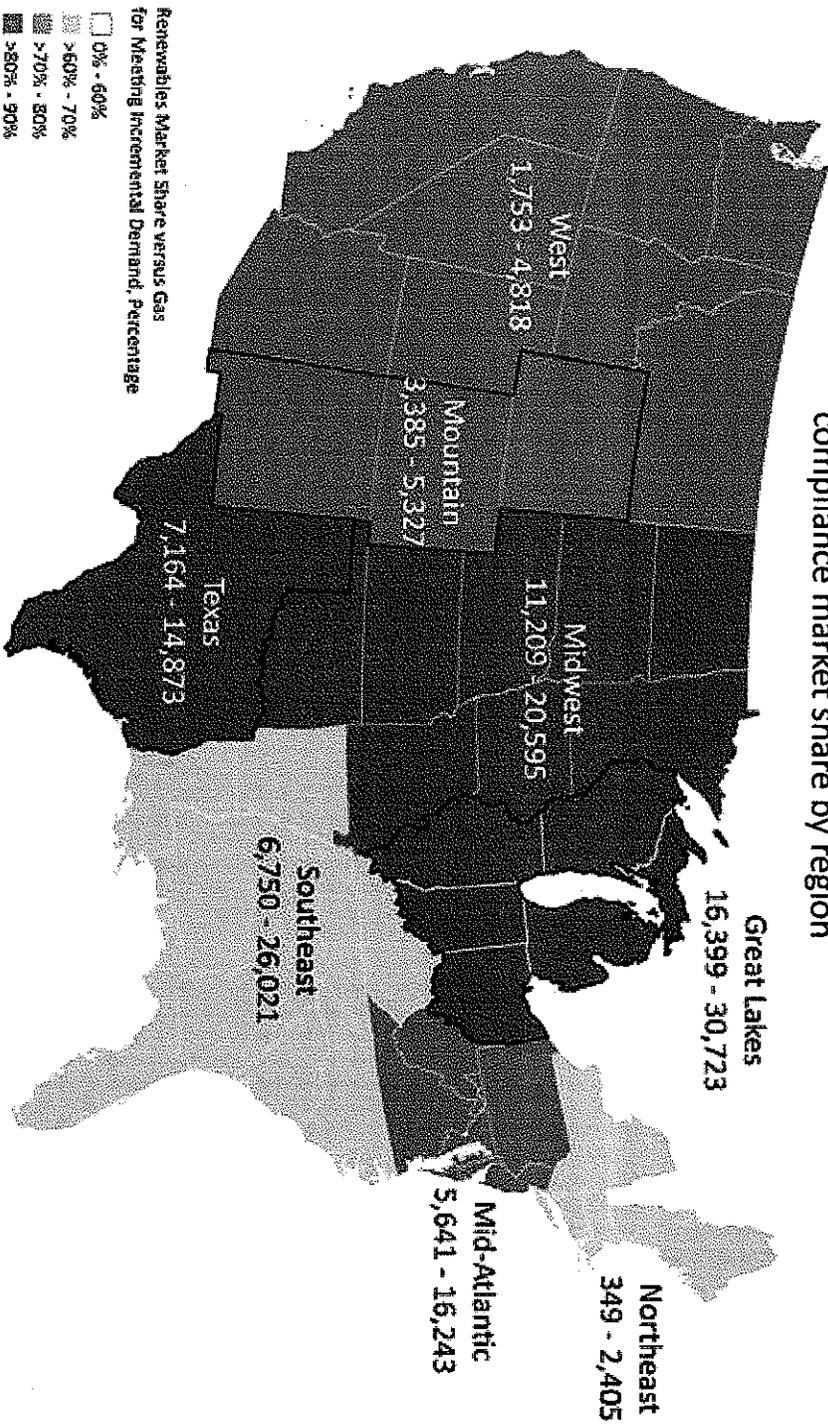
Wind Resource Potential at
Turbine Hub Height of 110m



- New technology can reach higher and steadier winds, making wind energy development possible in new regions of the country
- Longer blades can capture more wind energy

How much wind demand the Clean Power Plan will drive

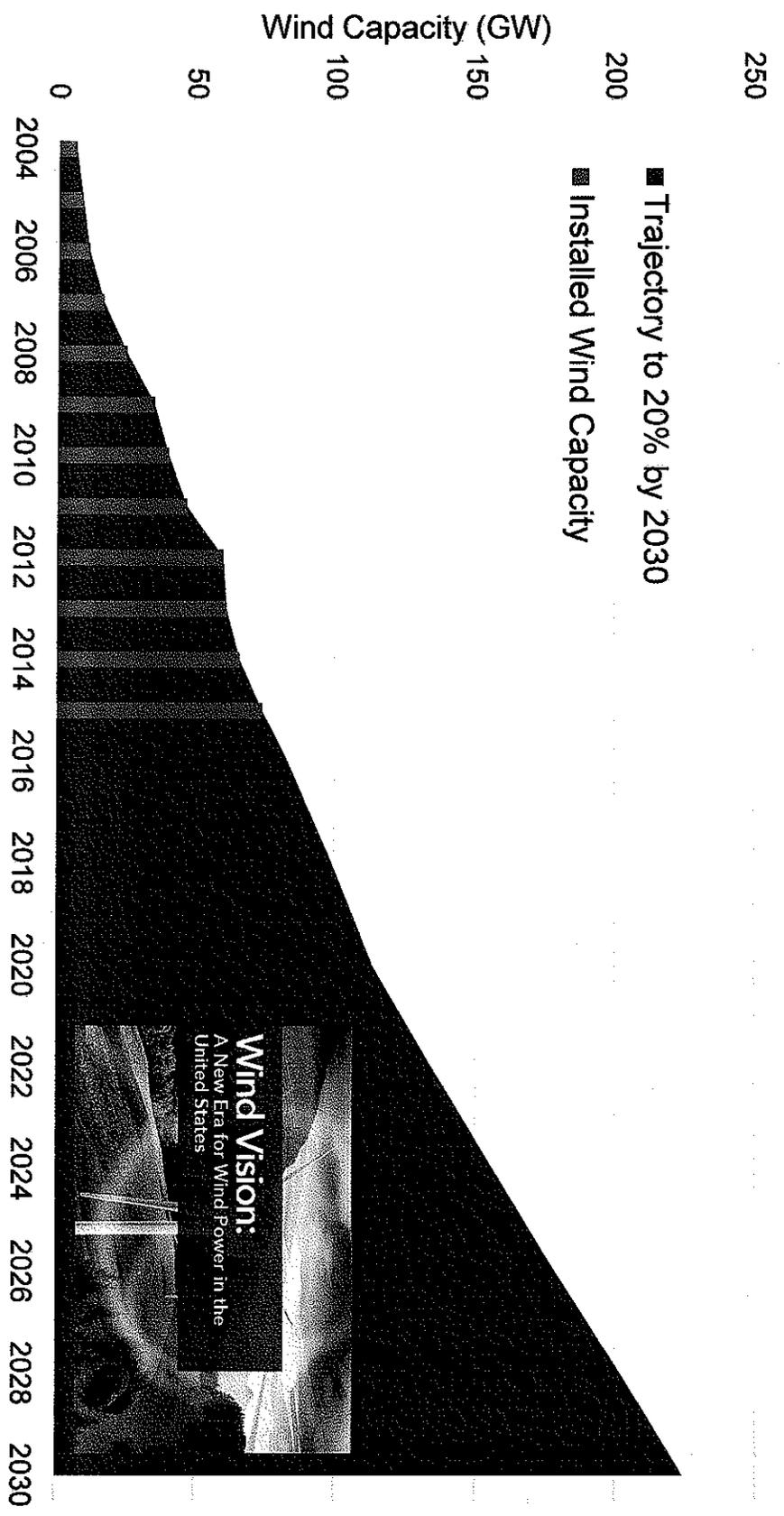
Additional wind needed by 2030 for lowest-cost compliance, and renewable compliance market share by region



Note: The total additional wind power capacity required to meet the compliance requirements of the Clean Power Plan is approximately 115,000 MW. The distribution of renewable energy by region is shown.

Wind demand shown in state with the demand for CPP and load growth, which is not necessarily the state where wind will be built

DOE: Wind installations on track to meet 20% by 2030



Source: DOE Wind Vision and AWEA Market Data

Wind is deeply popular across political spectrum

Gallup, *Annual Environment Poll*, March 5-8, 2015:

- **70%** say U.S. should put more emphasis on producing more domestic energy from wind; 14% say the same emphasis as now
- Among Republicans, **63%** want more emphasis on wind

Zogby, *U.S. Homeowners on Clean Energy*, March 2015

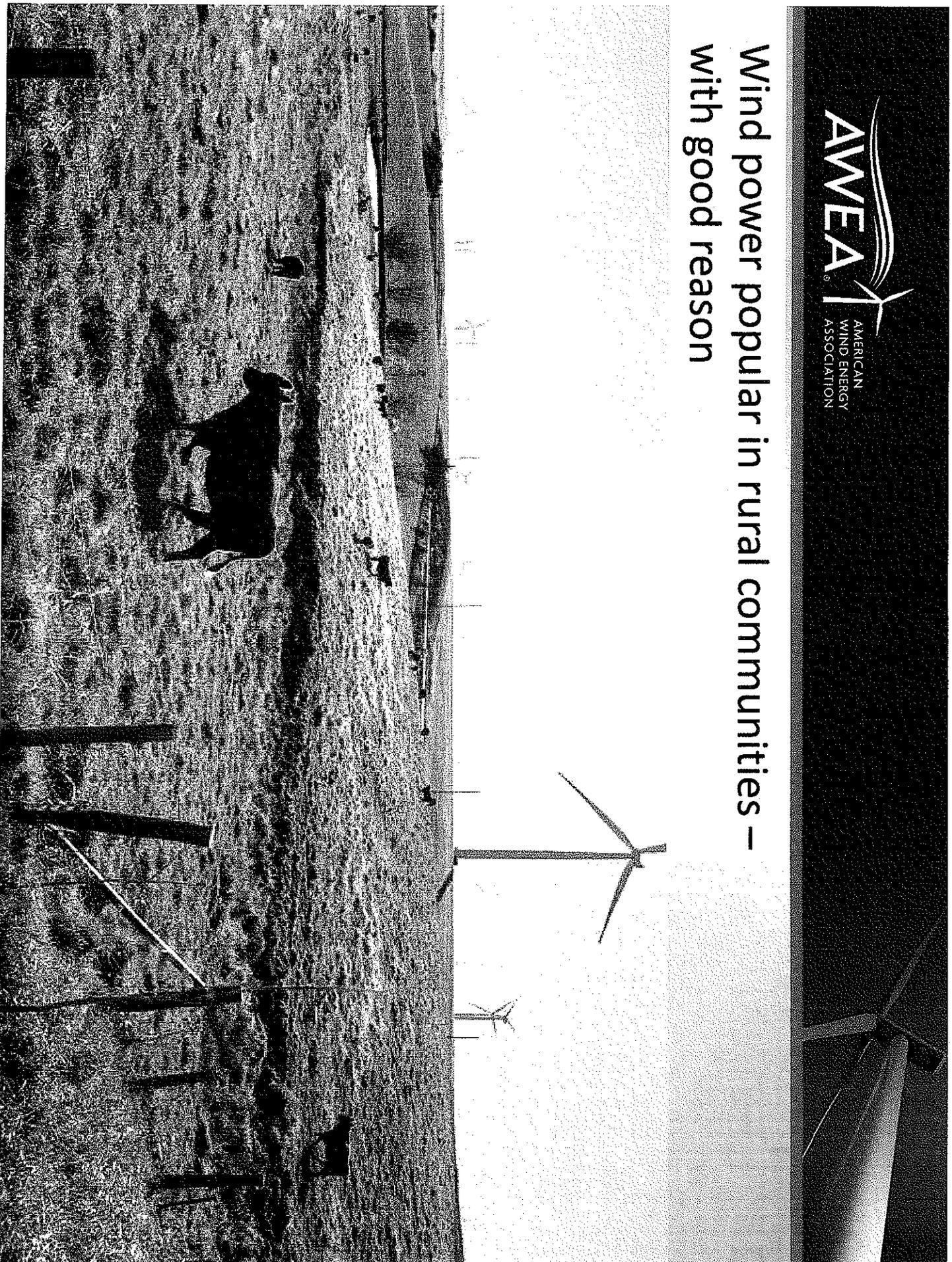
- **74%** support extending federal tax incentives for wind and solar
- **87%** think renewable energy is important to the country's future

Public Opinion Strategies, for *Pew Charitable Trusts*, March 2015

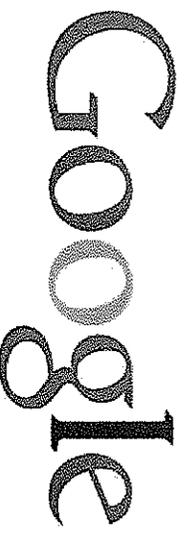
- **77%** support increasing the use of wind energy
- **75%** describe renewable energy as reliable
- **68%** support restoring wind energy PTC, 47% "strongly support"



Wind power popular in rural communities –
with good reason



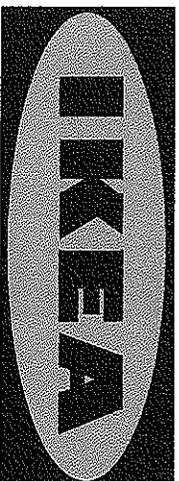
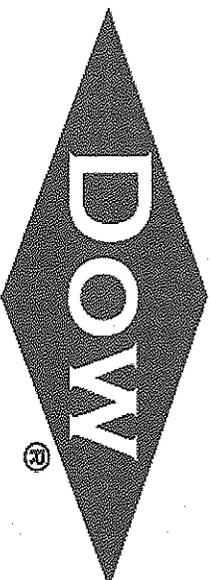
Big trend: Major corporate brands buying wind power to cut costs and pollution



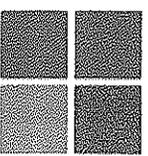
Google



Procter & Gamble



YAHOO![®]



Microsoft

Walmart[®]

WHY COMPANIES ARE TURNING TO WIND POWER

GOOGLE

"Because energy is a large operating expense at Google, it is beneficial to power the data centers with low-cost wind power."

DOW CHEMICAL

"Dow is always looking for win-win solutions – good for the environment and good for business. By entering into this agreement, Dow is taking a serious approach to our future energy needs in Texas and cost-competitive wind energy is a great opportunity."

IKEA

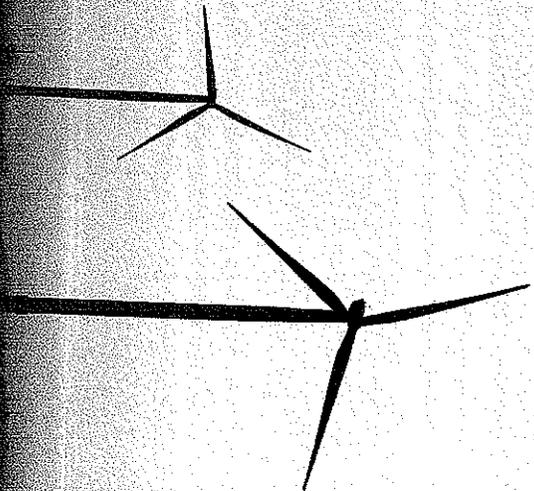
"The US has amazing wind and sun resources that will never run out. We are delighted to make this investment – it is great for jobs, great for energy security, and great for our business. Importantly, it's great for the future of our climate."

YAHOO!

"At Yahoo, we're committed to being an environmentally responsible company...Driving the development of cleaner and renewable sources of power is an important piece of our sustainability strategy."

MICROSOFT

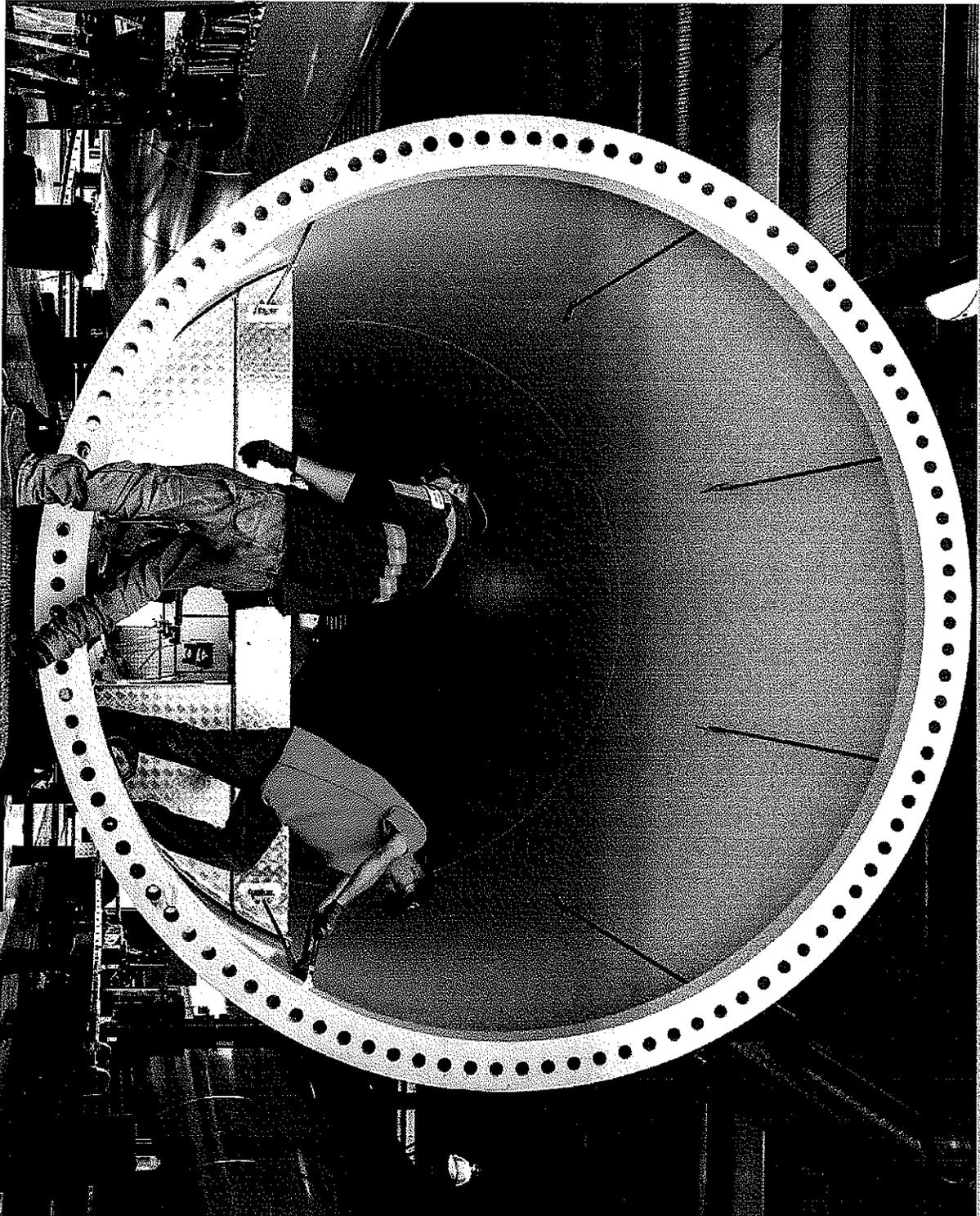
"The Pilot Hill Wind Project is important to Microsoft because it helps solidify our commitment to taking significant action to shape our energy future by developing clean, low-cost sources to meet our energy needs."





Wind is good
for the U.S.

Wind is good
for Michigan.





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