THE PEW CHARITABLE TRUSTS

Industry Trends in the U.S. Wind Energy Sector

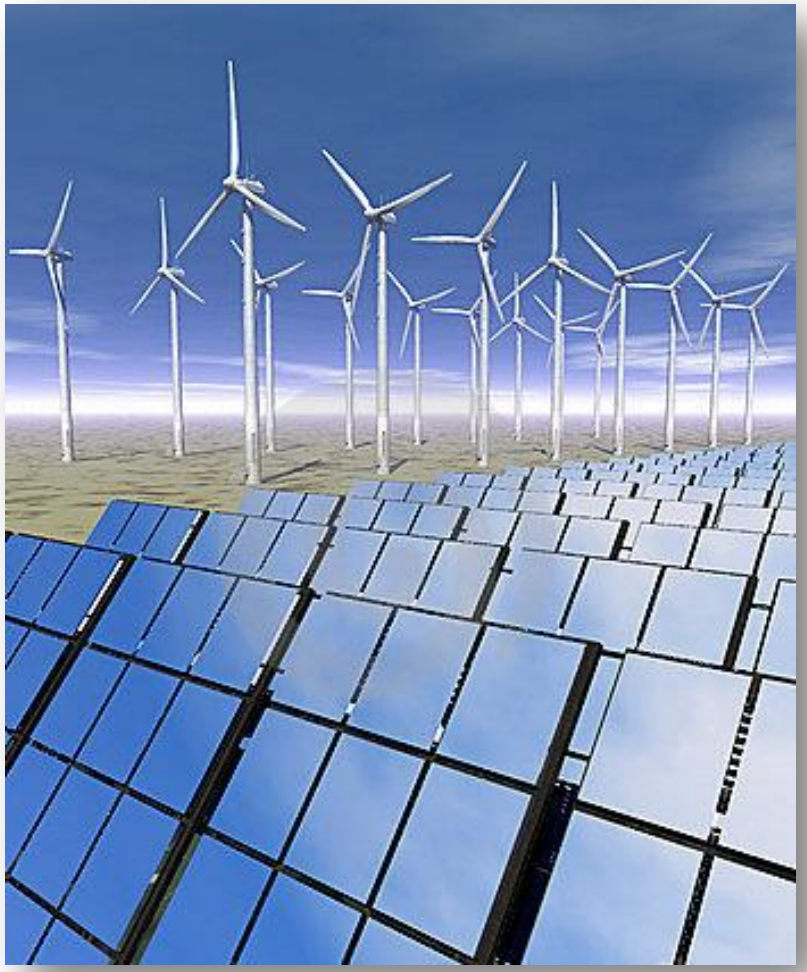
August 11th 1:30 to 2:30 p.m. eastern

Clean Energy Initiative

Our goal is to accelerate the clean energy economy for its national security, economic and environmental benefits.

The initiative promotes the adoption of key changes to U.S. energy policy in four sectors:

- Industry
- Utilities
- Transportation
- Research and development



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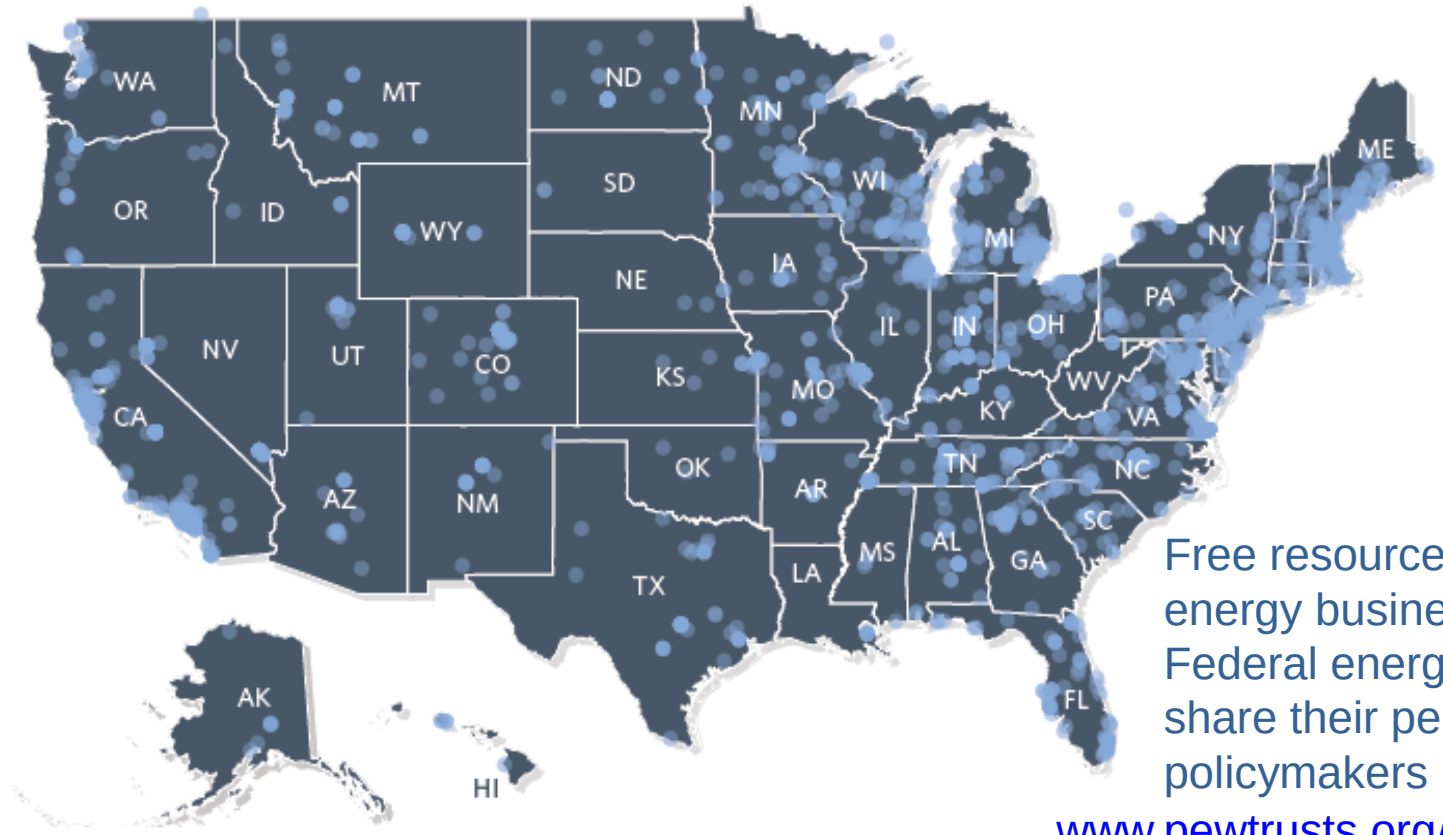
Pew Clean Energy Business Network Member Locations

More than 3,000 business leaders nationwide



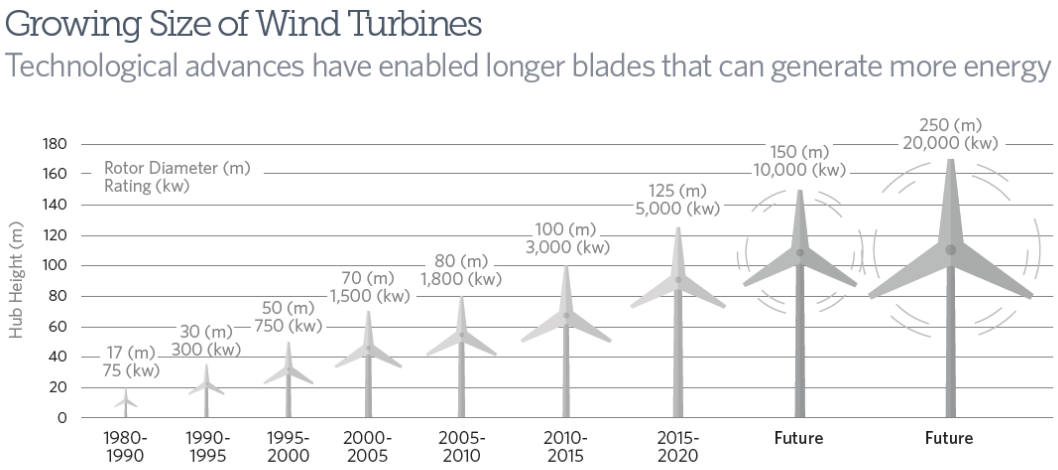
Free resource to inform clean energy business leaders about Federal energy policy and share their perspectives with policymakers

www.pewtrusts.org/businessnetwork

Growth in the U.S. Wind Industry

- 4.9% of electricity demand in 2014
- Average $13 billion investment per year (2008 - 2013)
- 73,000 jobs
- Over 500 domestic wind-related facilities

Growth in the U.S. Wind Industry



Source: European Wind Energy Association

- Increase in turbine size, greater energy capture
- $5.8 billion in new tax equity last year
- All-time PPA price lows in 2014
- Offshore wind industry taking hold

Today's Speakers

- **Jose Zayas**, director of the Wind and Water Power Technologies Office in the Office of Energy Efficiency and Renewable Energy at the U.S. Department of Energy

- **Michael Goggin**, senior director of research, American Wind Energy Association

- **Daniel Shurey**, analyst—North American Wind, Bloomberg New Energy Finance

The Wind Technologies Market Report, prepared by Lawrence Berkley National Laboratory and released each summer, summarizes key trends in the U.S. wind power market.

The Distributed Wind Market Report, prepared by the Pacific Northwest National Laboratory and also released each summer, summarizes key trends in small and distributed wind technologies.

Energy.gov/windreport

2014 Wind Technologies Market Report Highlights

In 2014, the United States was the world's number one producer of wind energy and ranks second in total installed capacity.

Throughout 2014, the United States installed 4,854 MW of new wind generating capacity, enough new capacity to power an additional 1.3 million average U.S. homes, bringing the country's total installed capacity to 65,877 MW (~17.5 million avg. homes).

The average price for Power Purchase Agreements signed in 2014 was 2.35 cents / kilowatt-hour, the lowest price ever recorded for new wind energy contracts.

Texas installed the most capacity in 2014 with 1,811 MW, while nine states exceed 12% wind energy penetration.

Iowa and South Dakota generated more than a fourth of their in-state electrical generation from wind energy in 2014.

2014 Wind Technologies Market Report Key Facts

The average hub height of turbines installed in 2014 was 82.7 meters. Additionally, the average rotor diameter for wind turbines installed in 2014 was 99.4 meters, a growth of 22% over the past five years.

The average nameplate capacity of newly installed turbines in 2014 was 1.9 MW, up 172% since 1999.

Roughly 2,000 miles of new transmission lines came into service in 2014, enabling wind energy curtailments to be at the lowest point since 2008.

The United States has a strong wind energy manufacturing capacity. At the end of 2014. As an example, the United States had the capacity to assemble 9 GW of nacelles and produce 7 GW of blades and towers annually.

Since 2010, the average cost for new wind energy installations has decreased 25%.

2014 Distributed Wind Market Report Highlights

Distributed wind is quickly reaching a cumulative capacity of 1 GW in the United States in 2014, reflecting nearly 74,000 wind turbines deployed across all 50 states, Puerto Rico, and the U.S. Virgin Islands

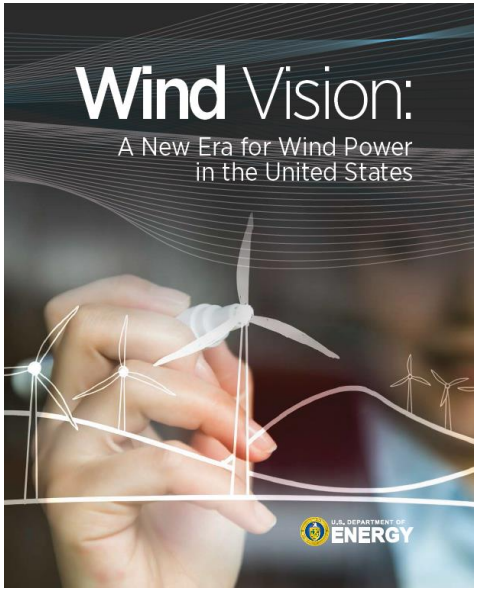
In total, 63.6 MW of new distributed wind capacity was added in 2014, representing nearly 1,700 turbines and $170 million in investment across 24 states.

With two large projects totaling 34.8 MW installed in 2014, New Mexico accounted for more than half of the total U.S. annual capacity additions in 2014.

New Mexico, Texas, and California were the top states in 2014 in terms of adding distributed wind capacity.

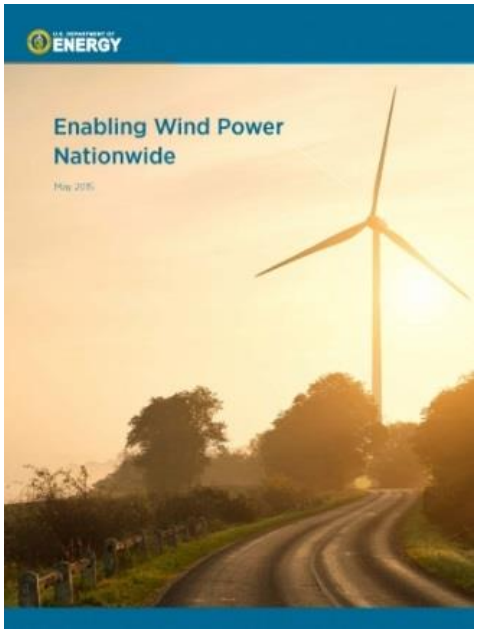
Exports remained an important source of revenue for U.S. manufacturers of small wind turbines. Seven U.S. manufacturers exported 11.2 MW in 2014, at a value of $60 million.

In 2015, Two New Reports Highlight the Potential Growth of Wind Energy in the United States



Released in March 2015, the *Wind Vision* report quantifies the economic, environmental, and social benefits of a robust wind energy future and the actions that wind stakeholders can take to make it a reality.

Energy.gov/windvision



Released in May 2015, *Enabling Wind Power Nationwide* shows how the United States can unlock the vast potential for wind energy deployment in all 50 states—made possible through the next-generation of larger wind turbines.

- The U.S. Department of Energy's Wind Program leads the nation's efforts to accelerate the deployment of wind power technologies through improved performance, lower costs, and reduced market barriers.

- By investing in improvements to wind plant design, technology development, and operation as well as developing tools to identify the highest quality wind resources, the Wind Program assists the industry in making wind energy technologies more competitive with traditional sources of energy and a larger part of our nation's renewable energy portfolio.

Thank You!

Policy to sustain the American wind success story

Michael Goggin, Senior Director of Research
American Wind Energy Association

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PTC has driven virtuous circle of deployment → cost reductions → more deployment

-New DOE data: 65% decline in average wind PPA price since 2009

-As 2007 LBNL analysis predicted, a stable PTC drives:

1.More-efficient labor deployment and greater investment in supply-chain capital, including lower risk premiums for manufacturing investment.

2.Enhanced private R&D expenditures that improve wind technology.

3.Cost savings from a de-linking of U.S. prices to the Euro-U.S. dollar exchange rate, due to increased domestic manufacturing.

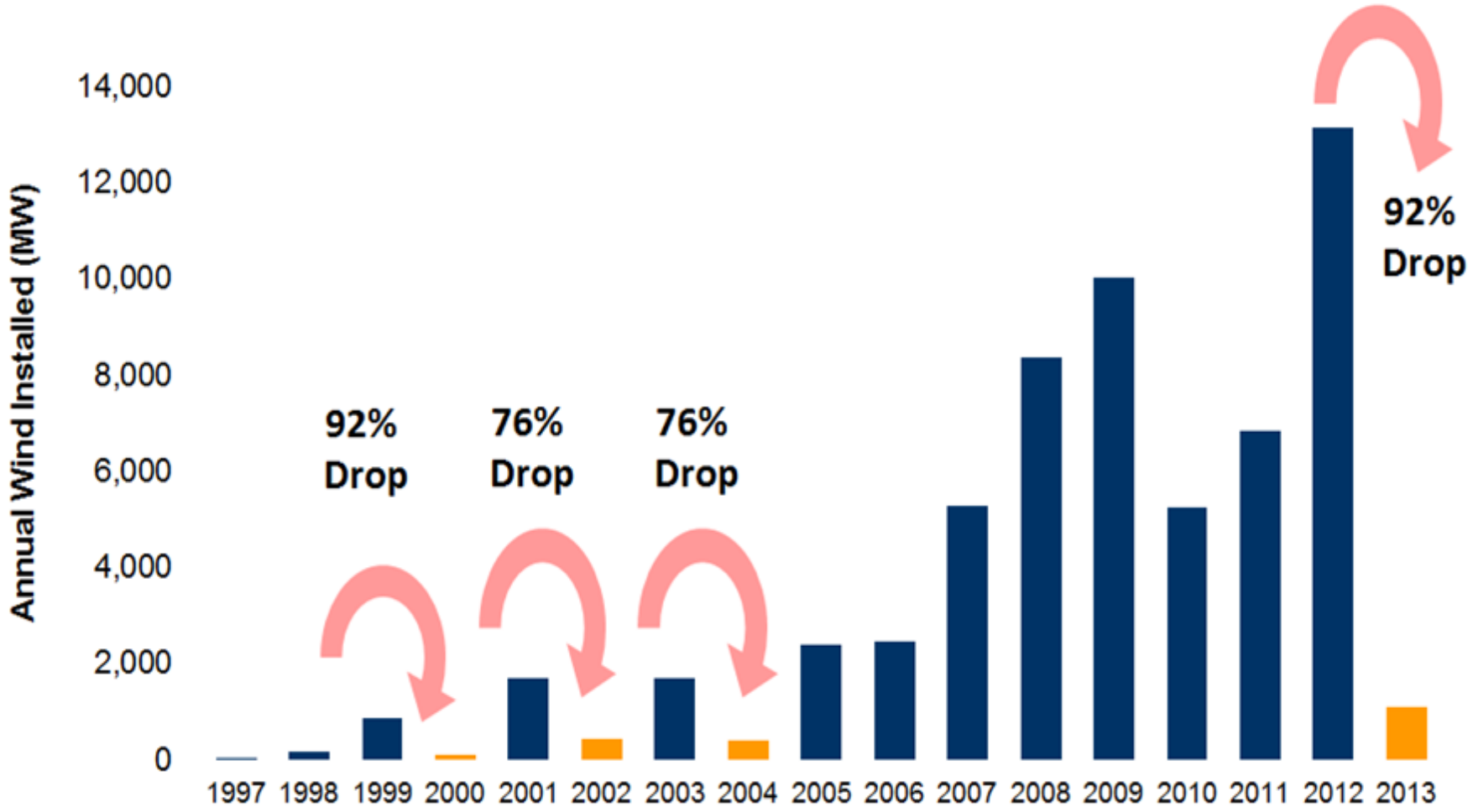
4.Transportation savings created by increased domestic manufacturing of turbines and components.

5.Reductions in other project development and financing costs that are currently inflated due to rushed development schedules.

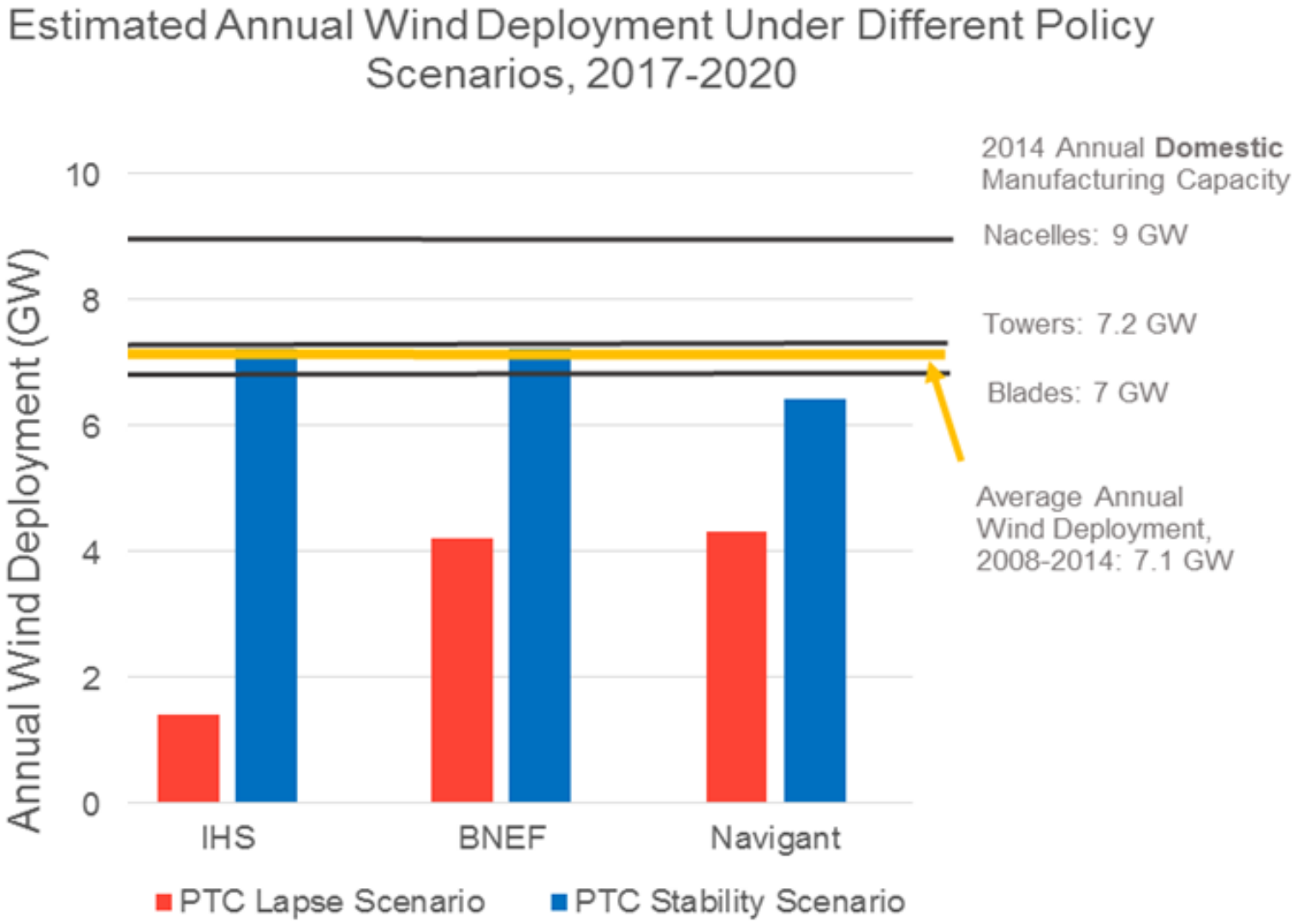
"Using the Federal Production Tax Credit to Build a Durable Market for Wind Power in the United States"

http://emp.lbl.gov/sites/all/files/REPORT%20lbnl%20-%2063583_0.pdf

PTC uncertainty has at times broken that circle



Policy stability essential going forward



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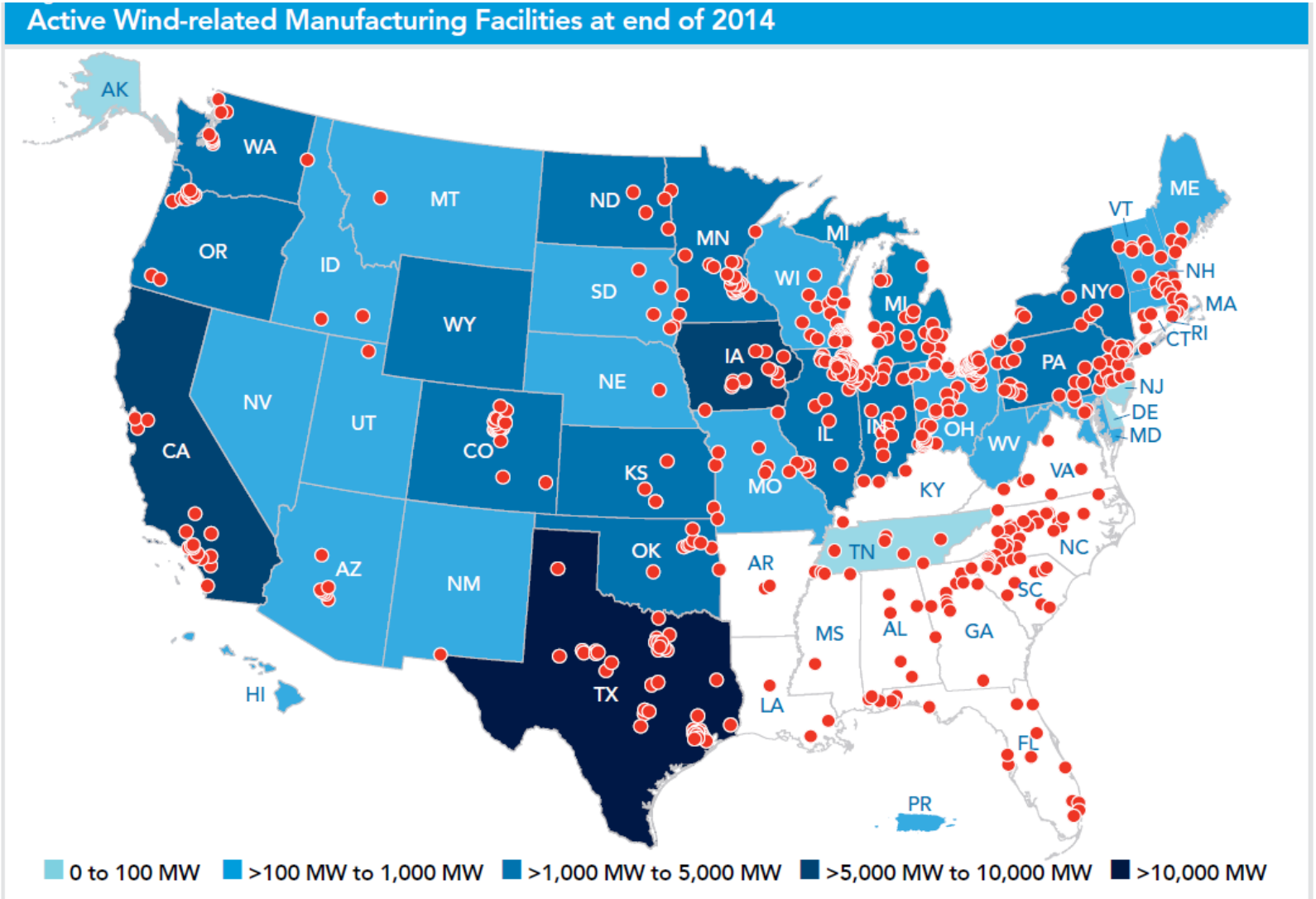
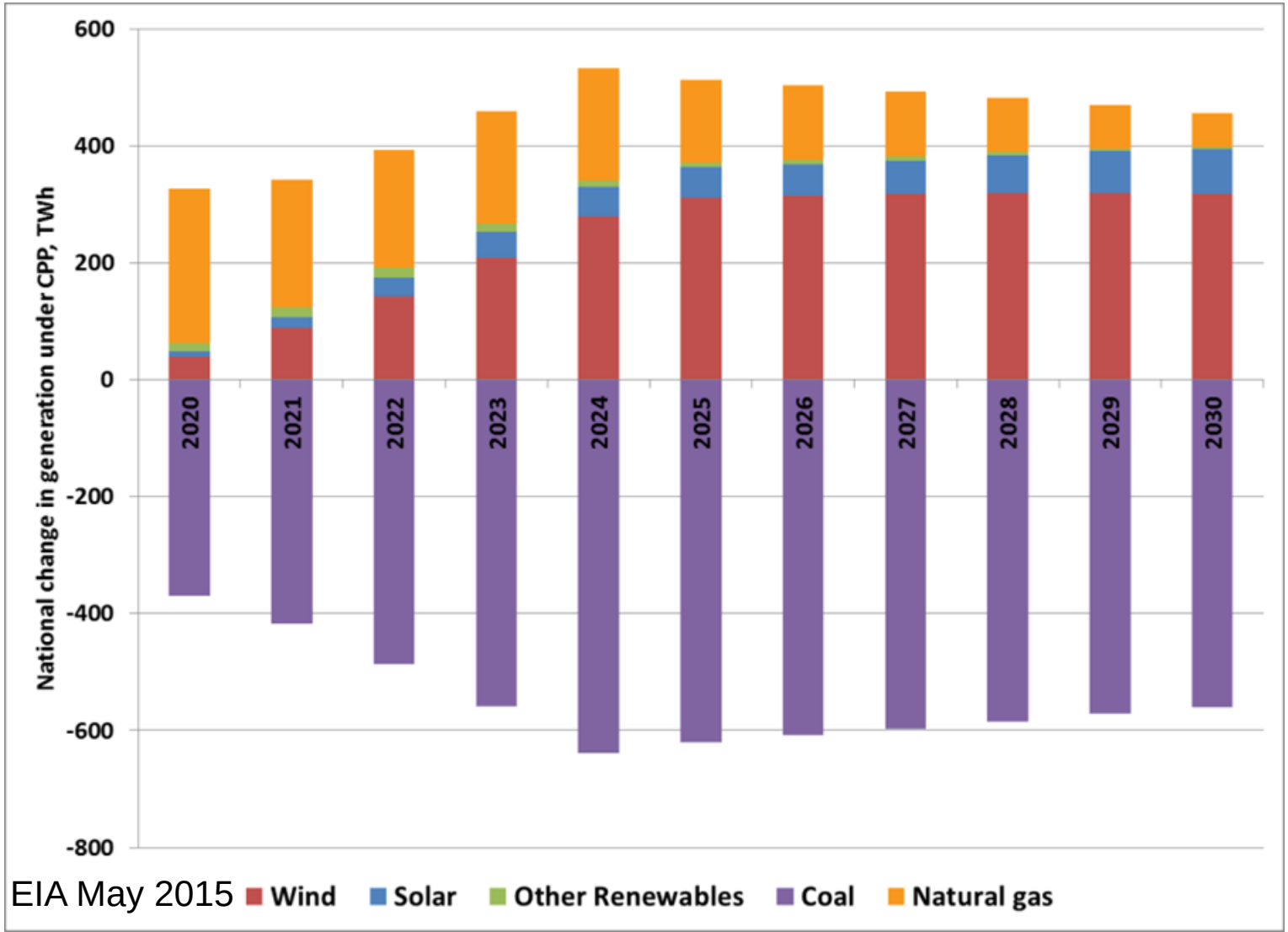
500+ manufacturing facilities at stake



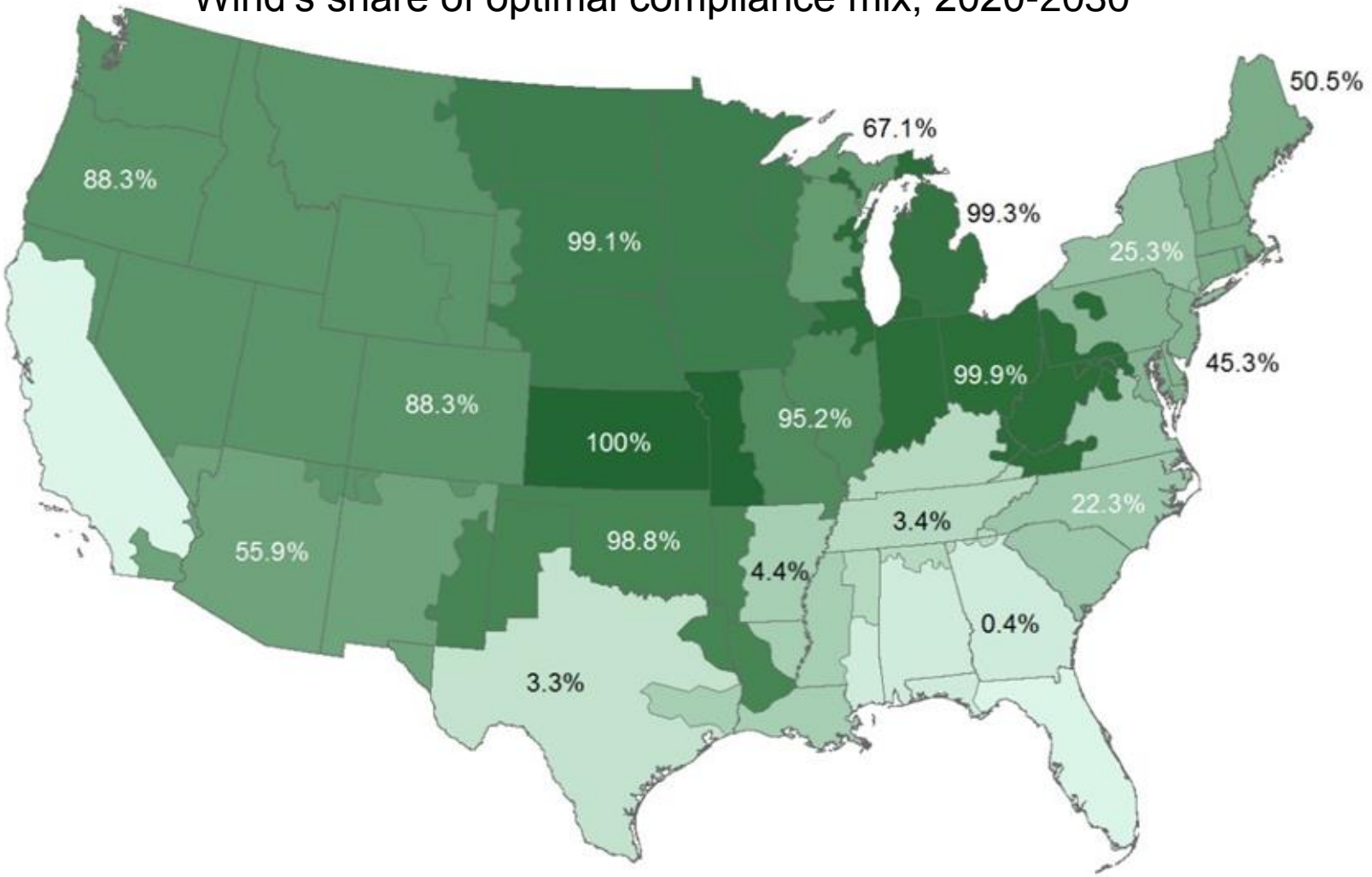
EIA: Wind grows rapidly in 2020s under optimal CPP compliance



Source: EIA May 2015

EIA: Wind lowest-cost solution for Clean Power Plan

Wind's share of optimal compliance mix, 2020-2030



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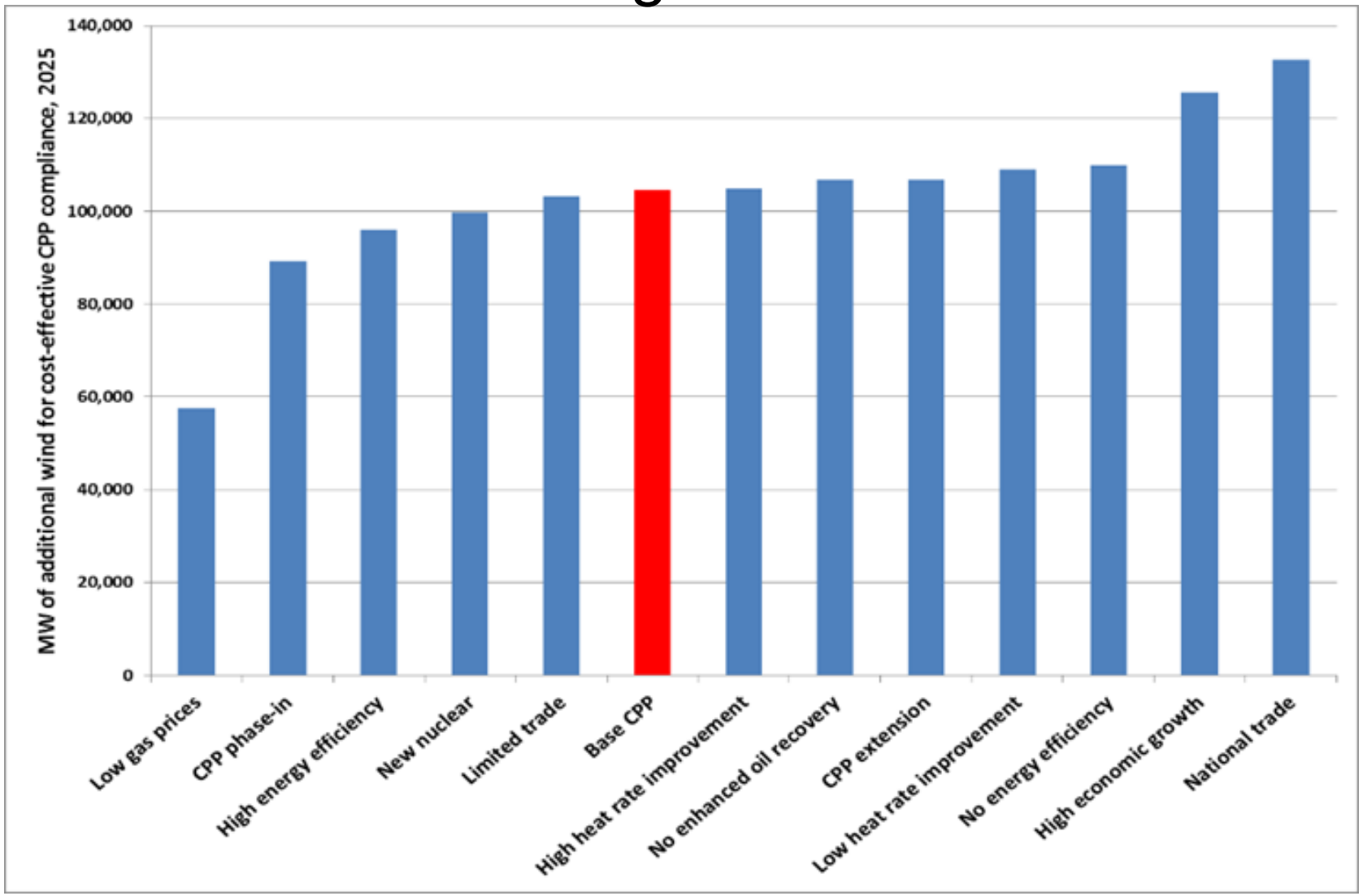
Wind is a “no-regrets” CPP solution



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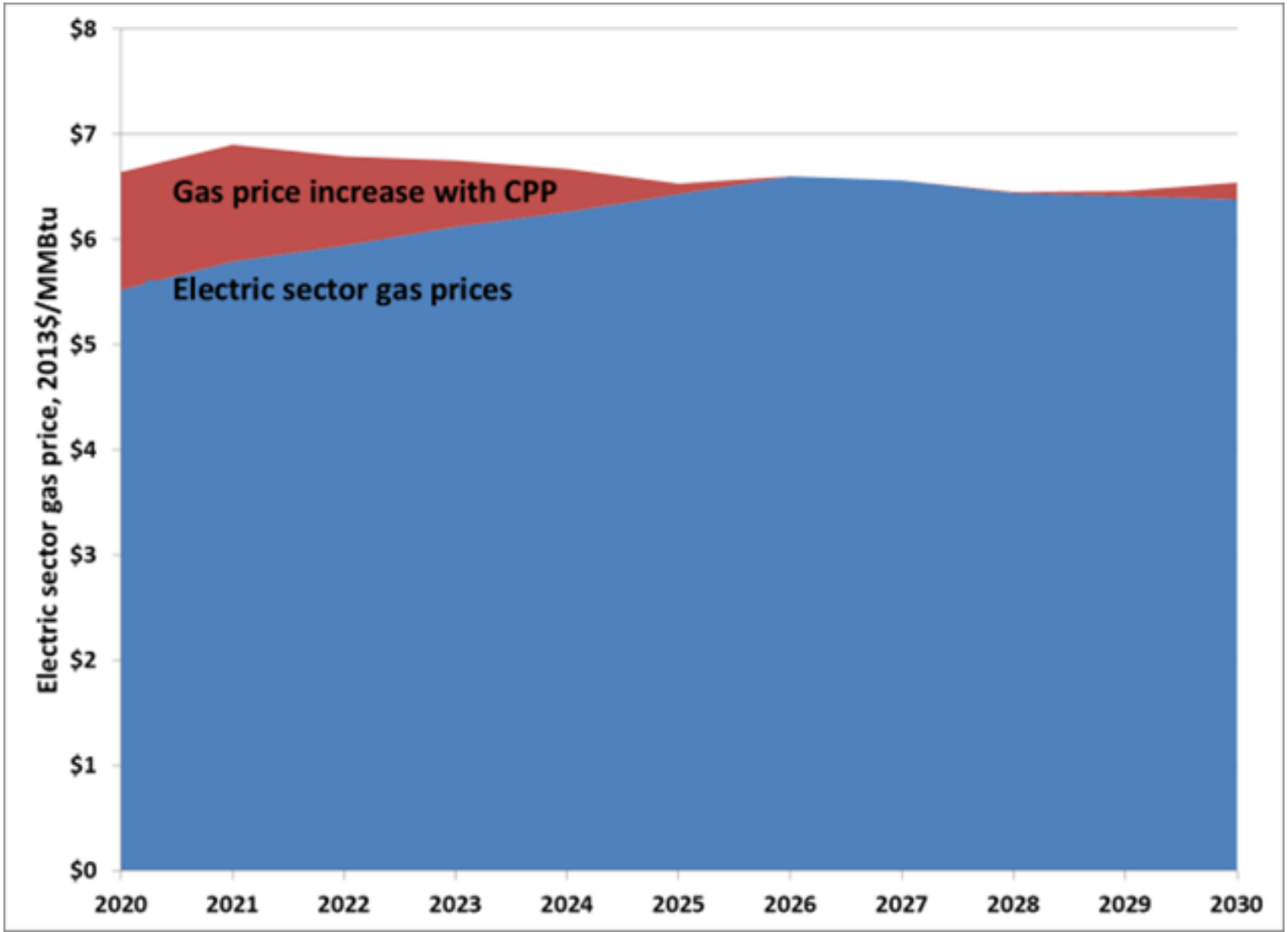
Wind moderates spike in gas prices from CPP demand



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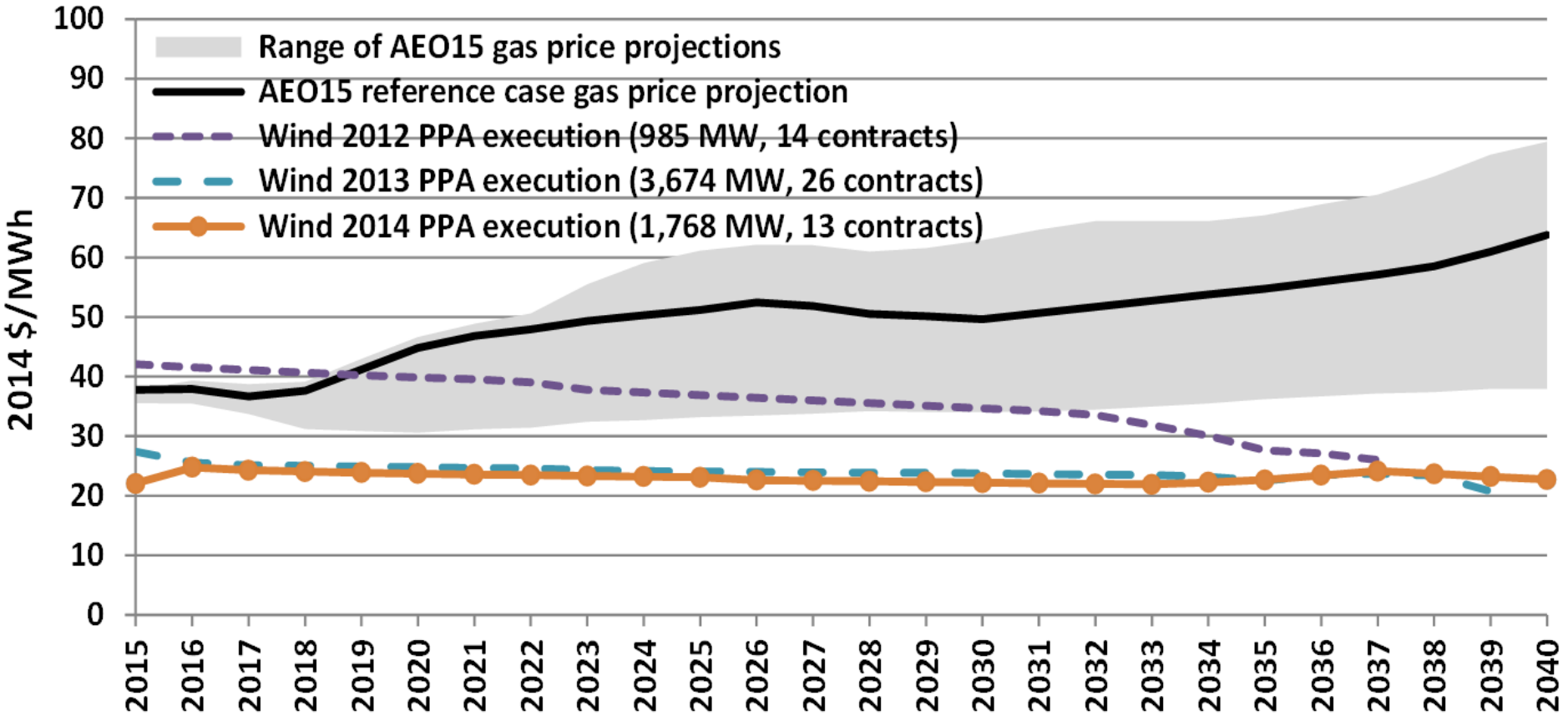
Wind protects against fuel price increases



11 August 2015

BNEF COMMENTARY ON 2014 WIND TECHNOLOGIES MARKET REPORT

Webinar

Dan Shurey

Bloomberg
NEW ENERGY FINANCE

NORTH AMERICA TURBINE PRICE BY DELIVERY DATE, H1 2008-H1 2017, $M/MW

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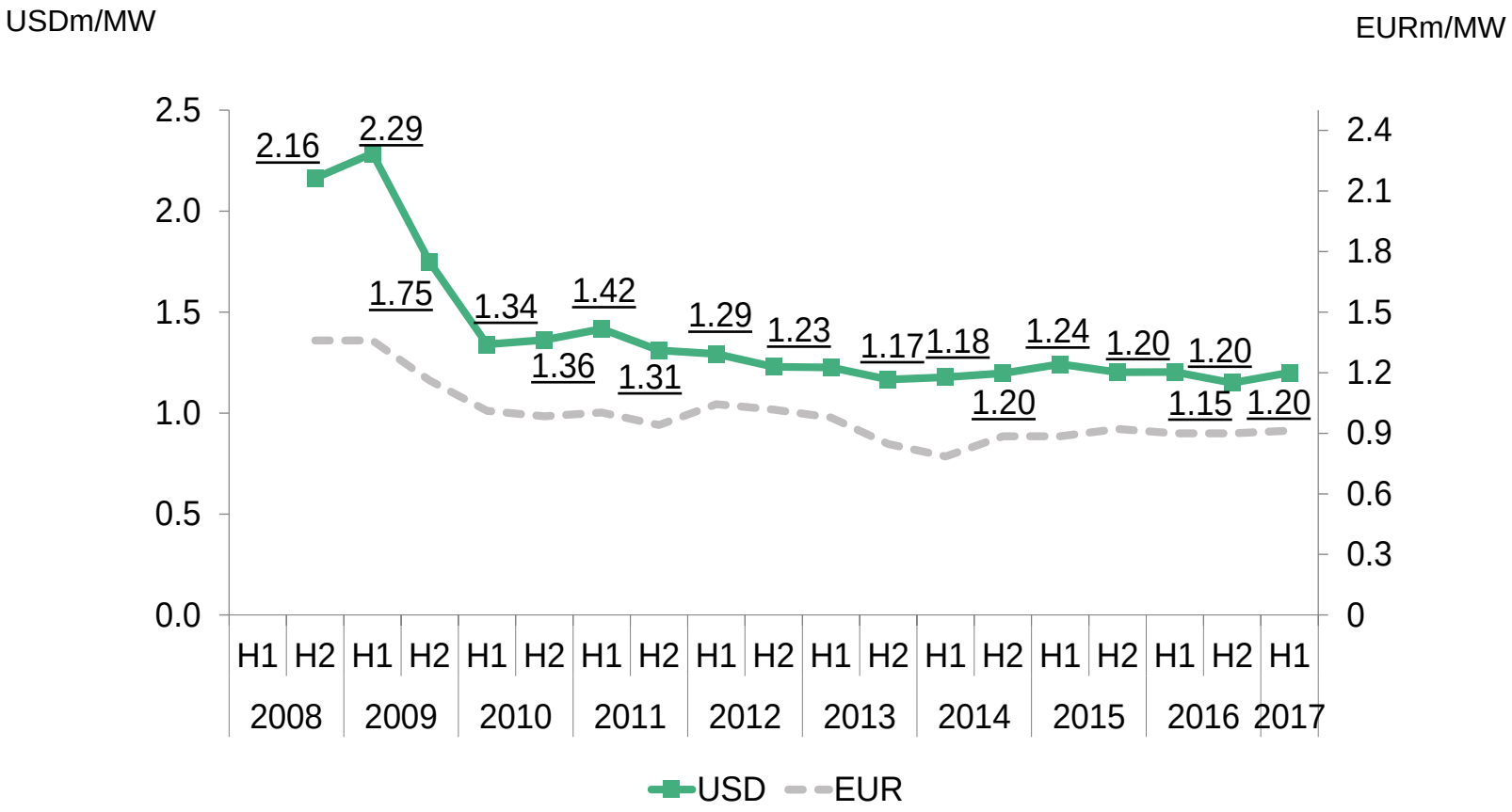

Based on 50 real, undisclosed turbine contracts from the US from the Bloomberg New Energy Finance Wind Turbine Price Index

Source: Bloomberg New Energy Finance

NATIONAL WIND TURBINE MANUFACTURING SUPPLY AND DEMAND

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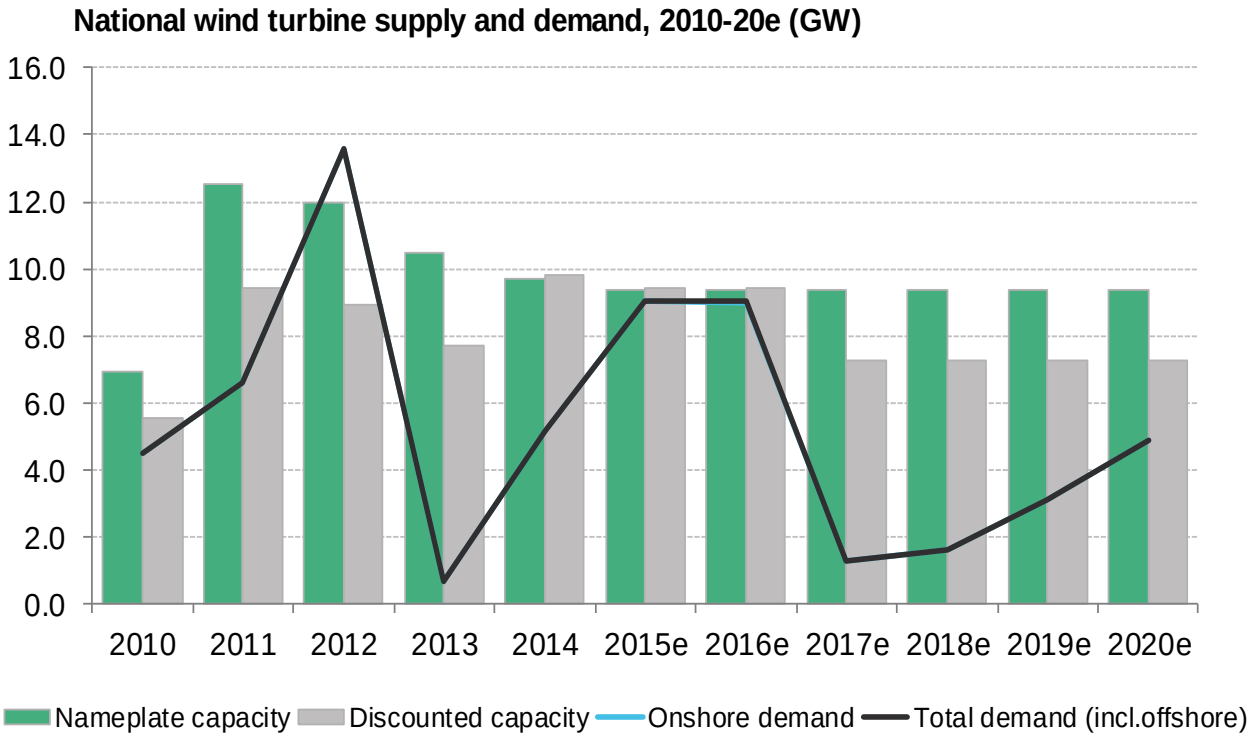
Total capacity by country	United States
Nameplate capacity (GW)	☑
Discounted capacity (GW)	☑



Source: Bloomberg New Energy Finance

Note: Nameplate capacity represents the announced capacity, discounted capacity represents our best estimation of actual capacity

Source: Bloomberg New Energy Finance.

IEC CLASS MARKET SHARE BY YEAR OF COMMISSION, US, %

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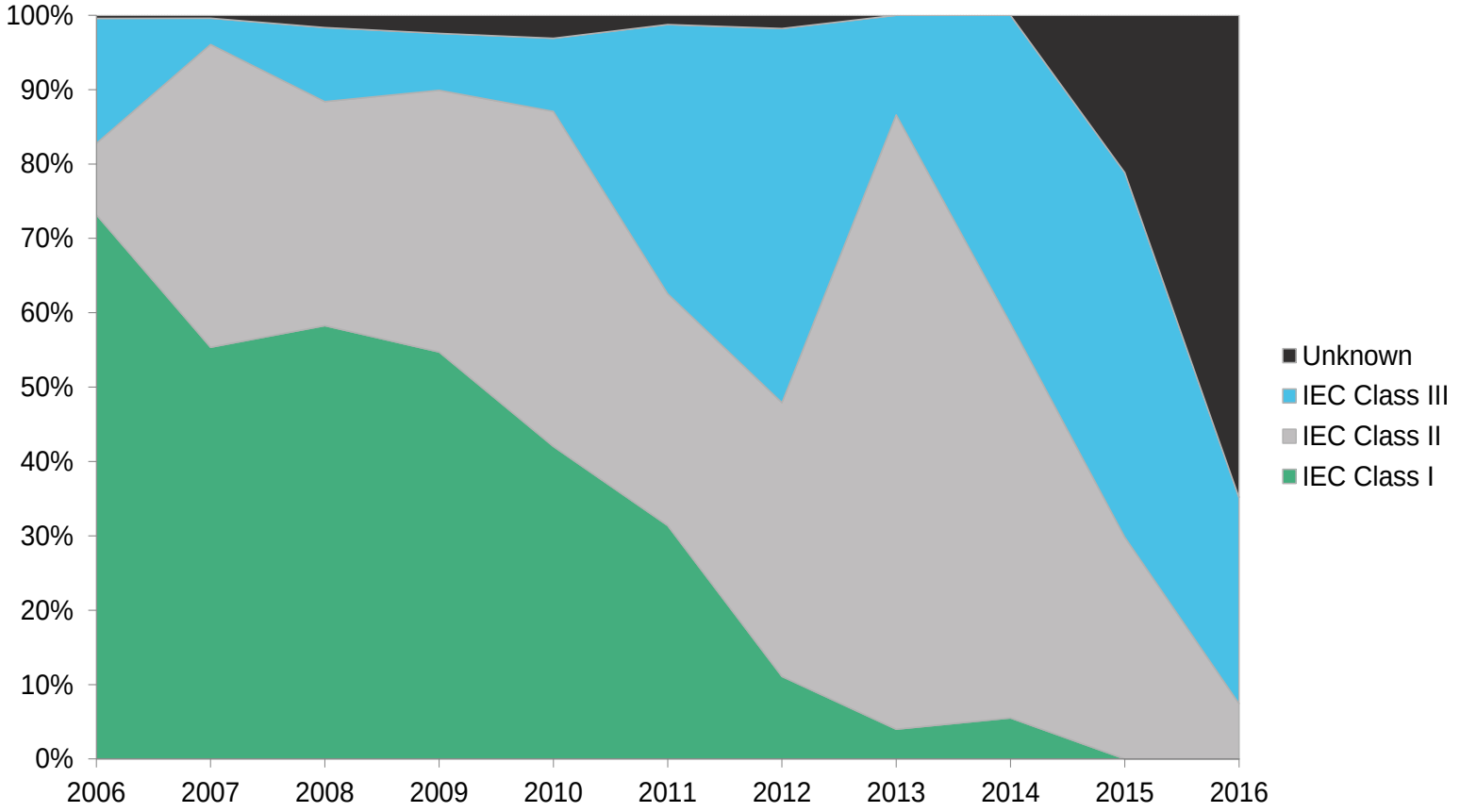

Source: Bloomberg New Energy Finance

AVERAGE PPA PRICE BY TECHNOLOGY, BY ORIGINATION YEAR, 2008-H1 2015 ($/MWH)

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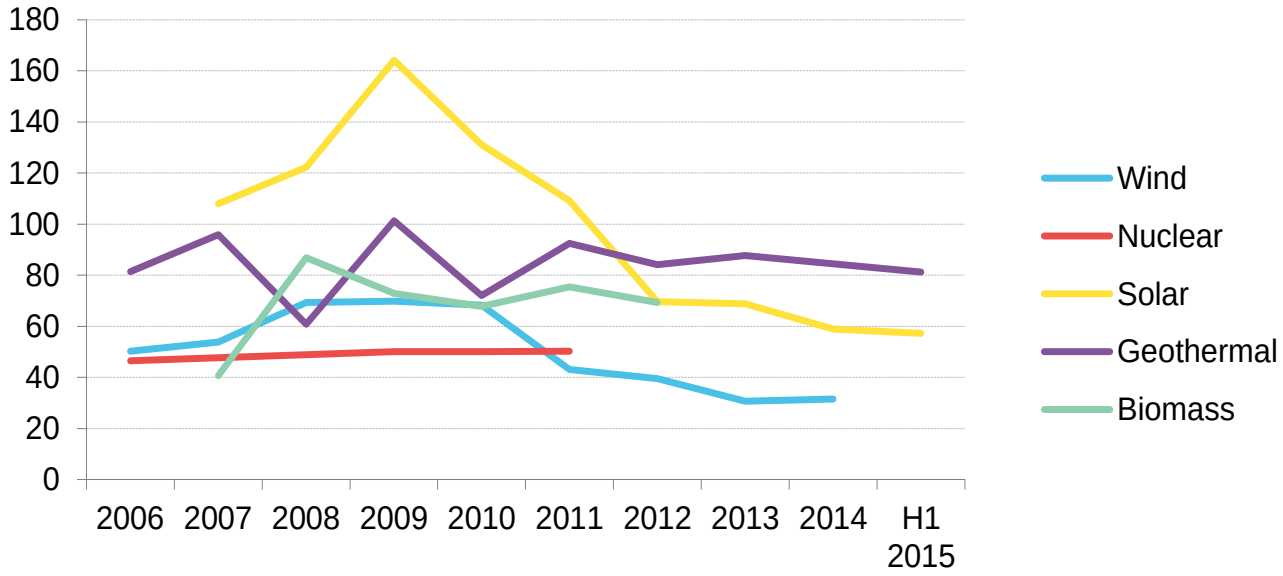

See Appendix A: of accompanying report for definition of 'origination' and additional details on sources and methodology.

Source: Bloomberg New Energy Finance, FERC EQR, public disclosures and analyst estimates.

AVERAGE PPA PRICE FOR RENEWABLES (SHORT-RUN MARGINAL COST FOR COAL AND GAS) BY TECHNOLOGY, 2014-H1 2015 ($/MWH)

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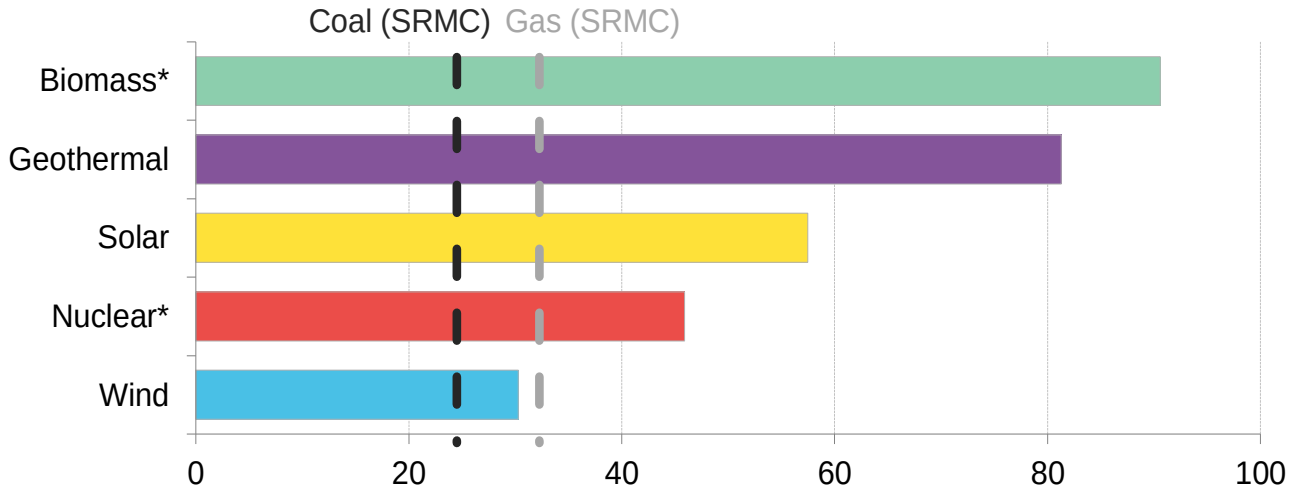

Notes: (*) Biomass and nuclear reflect older contracts. 'Coal SRMC' and 'Gas SRMC' refer to the short-run marginal cost of generation both technologies, according to current fuel prices.

Source: Bloomberg New Energy Finance, FERC EQR, public disclosures and analyst estimates.

LCOE EXPERIENCE CURVE(EXCLUDING CHINA) ($/MWH)

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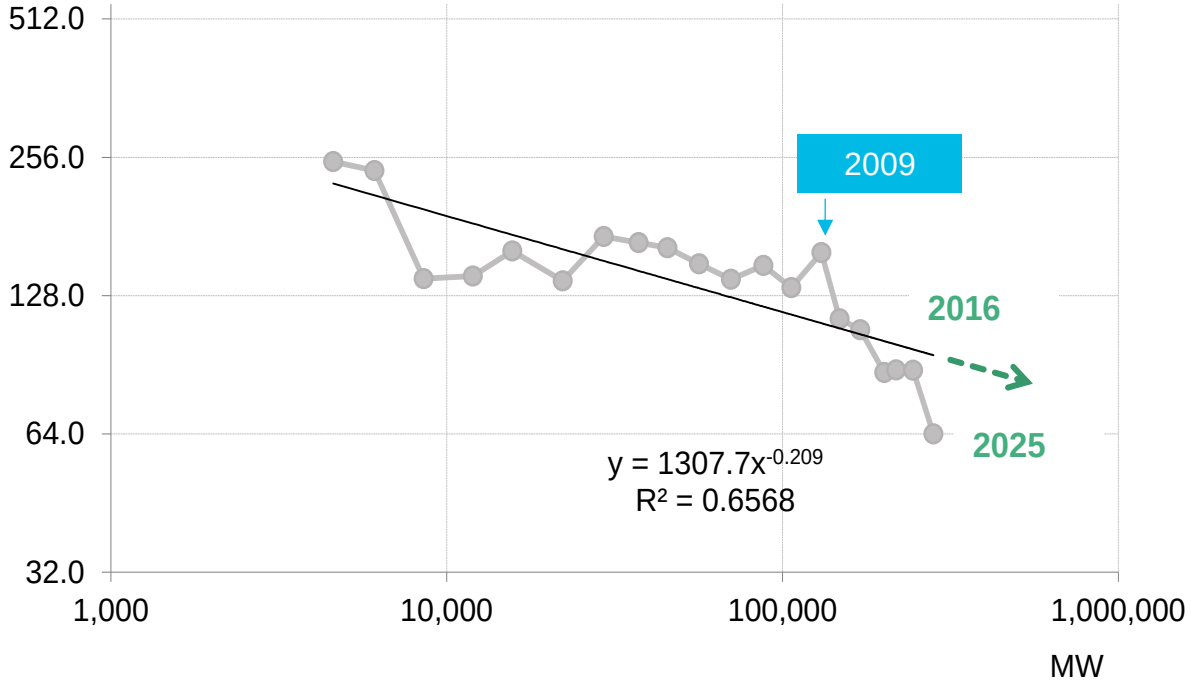

- Learning rate =13%
- Wind turbine price in 2025 is likely to drop to 89% of that in 2015

Source: Bloomberg New Energy Finance

ONSHORE WIND LCOE COMPARED WITH NATURAL GAS AND COAL WITH CARBON PRICE, 2015-40 ($/MWH, NOMINAL)

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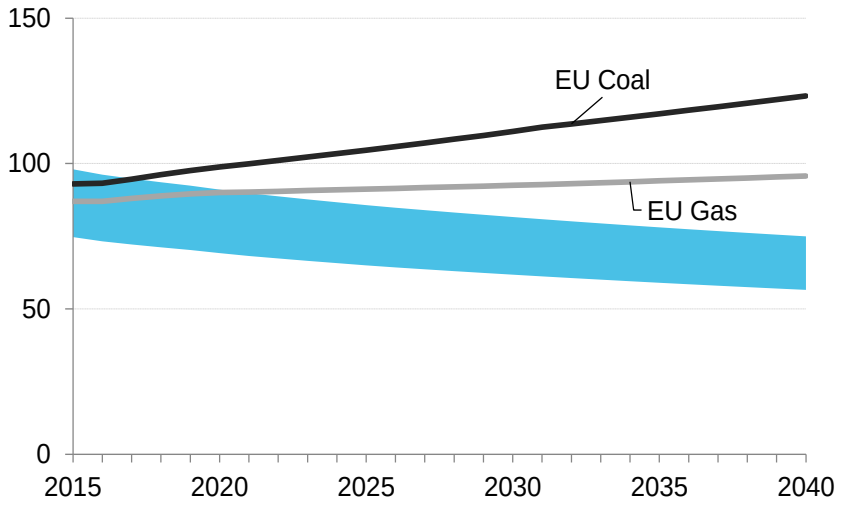
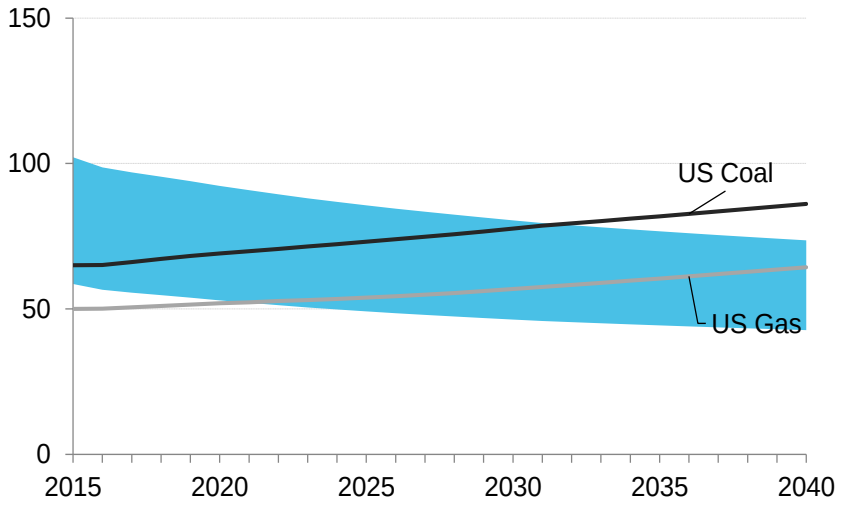
EUROPE



Source: Bloomberg New Energy Finance: Capacity factors – Europe: 24-32%.Natural gas LCOE projections are for a combined-cycle gas turbine. Both gas and coal LCOEs include a carbon price

US



Source: Bloomberg New Energy Finance: Capacity factors – US:27-45%. Natural gas LCOE projections are for a combined-cycle gas turbine. Both gas and coal LCOEs include a carbon price

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