Wind and Solar Pose Increasingly Serious Risks for Coal-Fired Generators

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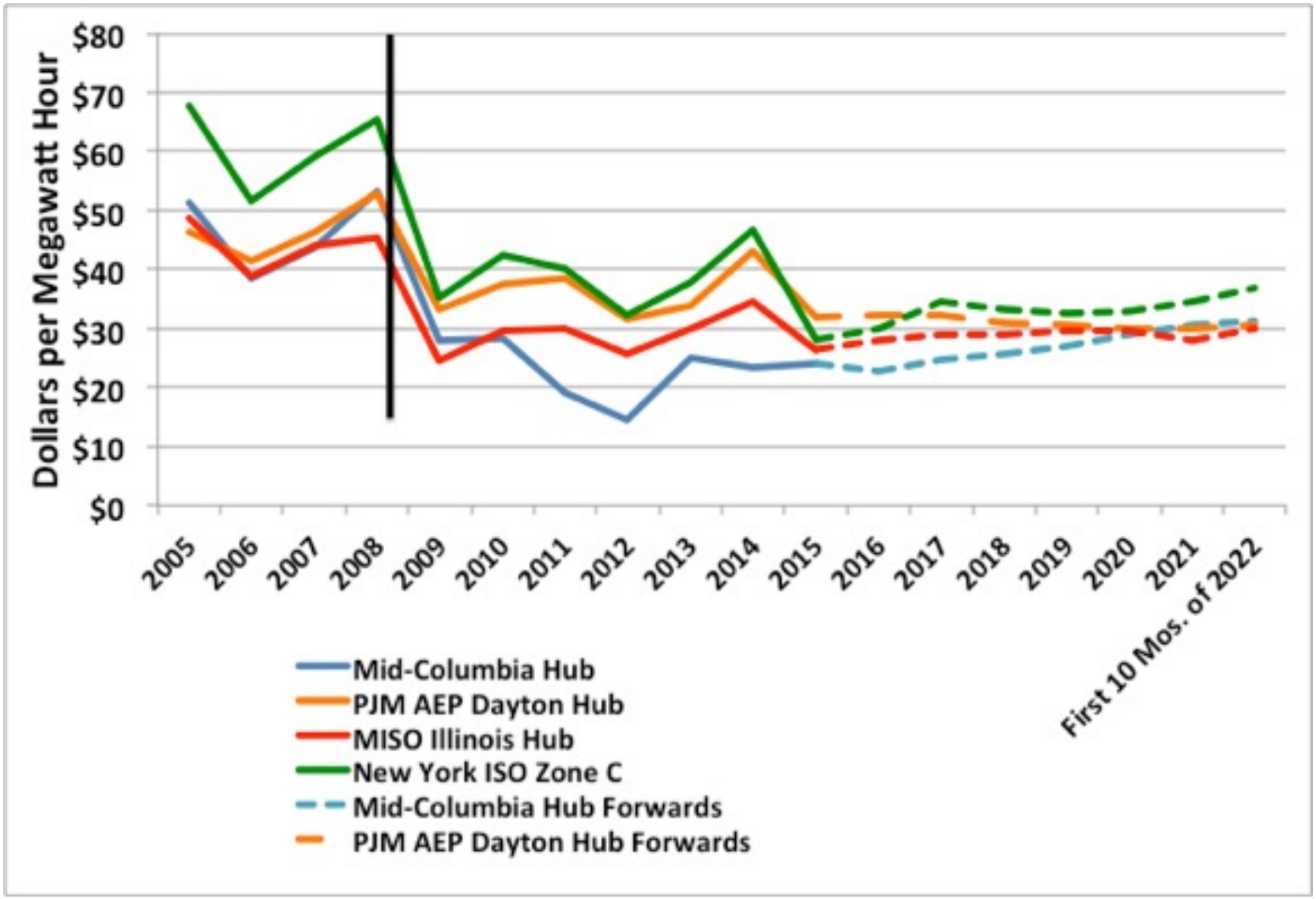
These are Troubled Times for the Coal Industry

- U.S. Generation from coal declined from a high of 2,016 million MWh in 2007 to 1,240 million MWh in 2016. As a result, coal's share of the U.S. electricity mix fell to 30.4% in 2016, down from 49% in 2006.
- Some 250 coal plants have been retired or have announced that they will be retired in coming years.
- Total U.S. installed wind capacity increased to 82,183 MW at the end of 2016, up from 11,450 MW in 2006.
- Total U.S. utility-scale solar rose over 20,000 MW in 2016, with another 17,503 MW in various stages of development.

Coal-Fired Generators Continue to Face Same Market Risks as Before January 2017

- Low natural gas and energy market prices.
- Growing competition from wind & solar.
- Low gas prices and increased competition from renewables means less generation from coal-fired plants and lower revenues from sales.
- Flat or nearly flat peak demands (MW) and energy loads (MWh) – *means increased competition to serve same sized loads.*
- Low and/or volatile capacity market prices.
- An aging coal fleet.
- Environmental Regulations.

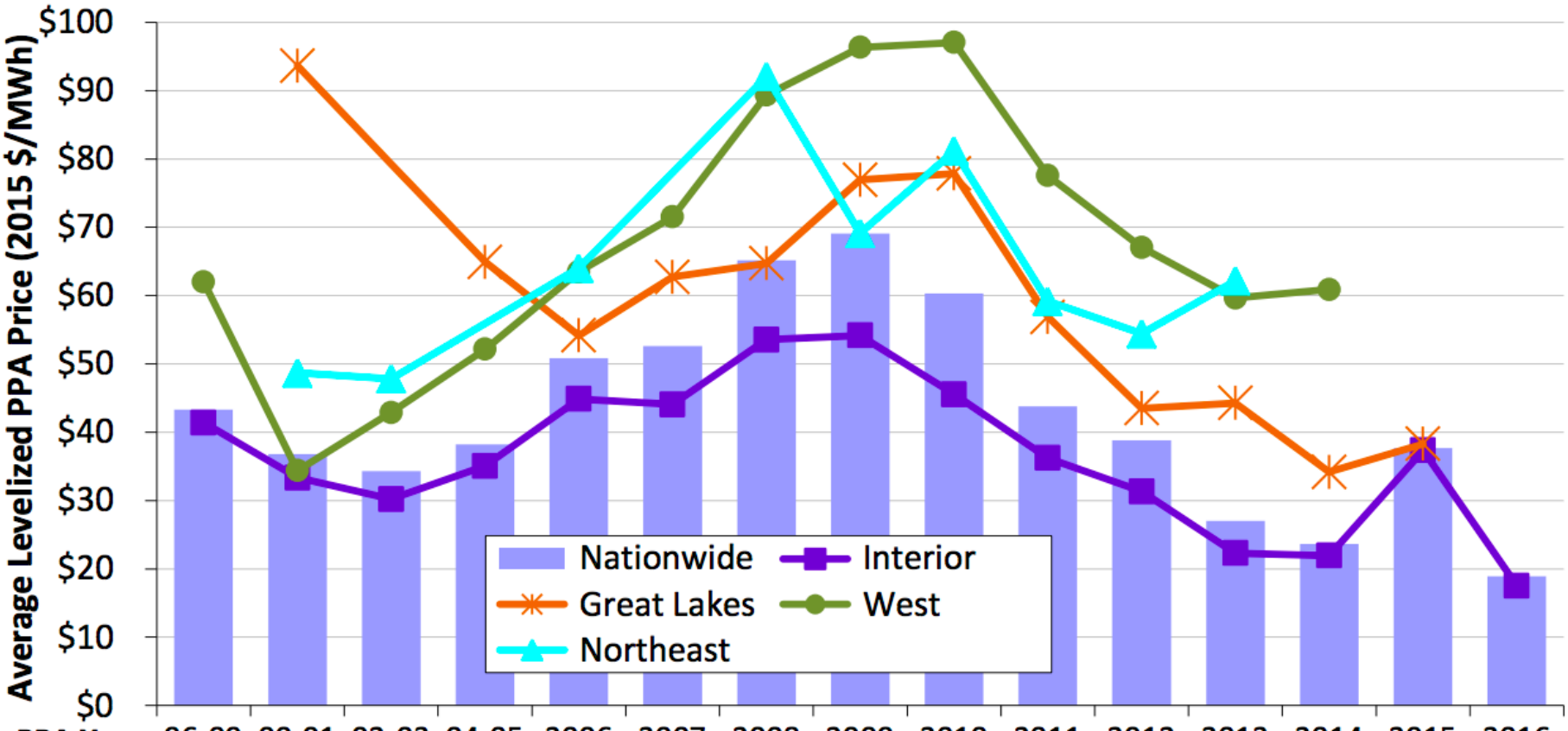
Low Energy Market Prices Pose Serious Threat to Financial Viability of Coal-Fired Generators



Solar and Wind Also Pose Serious Threats to Financial Viability of Coal Plants

- Solar and wind installation costs and power purchase agreement (PPA) prices have been declining dramatically in recent years.
- With no fuel costs, utility-scale solar and wind facilities are dispatched first in the competitive markets, displacing energy from coal- and gas-fired generators.
- Solar generation keeps energy market prices low during periods of peak demands. Wind generation does the same in both peak and off-peak hours.
- Distributed rooftop solar photovoltaic resources reduce loads on the electric grid and, therefore, reduce the need for generation from coal (and natural gas) plants.

Wind PPA Prices Have Declined Significantly

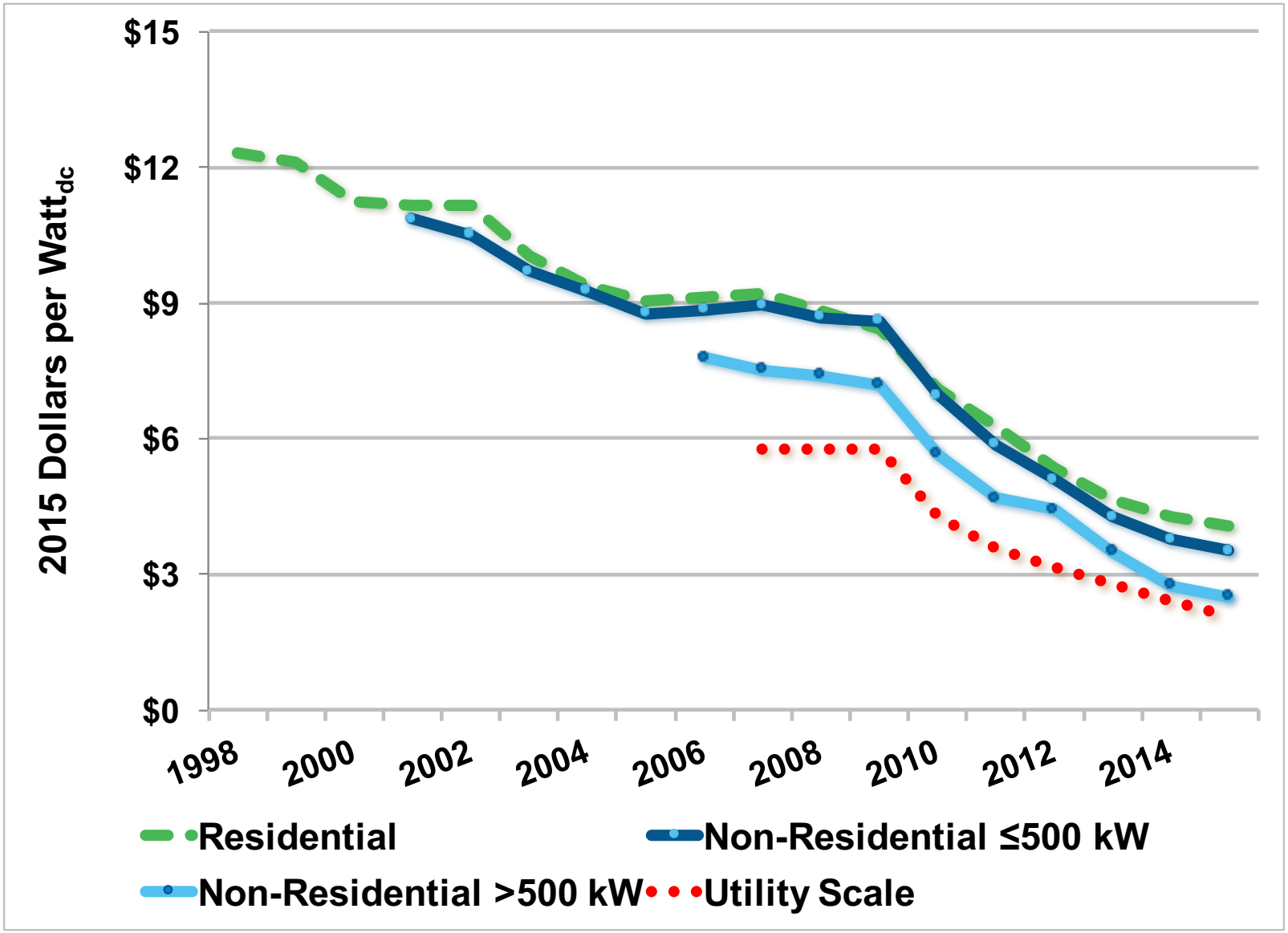


PPA Year:	96-99	00-01	02-03	04-05	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Contracts:	10	17	24	30	31	26	39	49	49	43	13	32	16	6	2
MW:	553	1,249	1,382	2,190	2,436	1,781	3,465	4,048	4,790	4,727	970	4,374	1,985	401	207

Source: Berkeley Lab

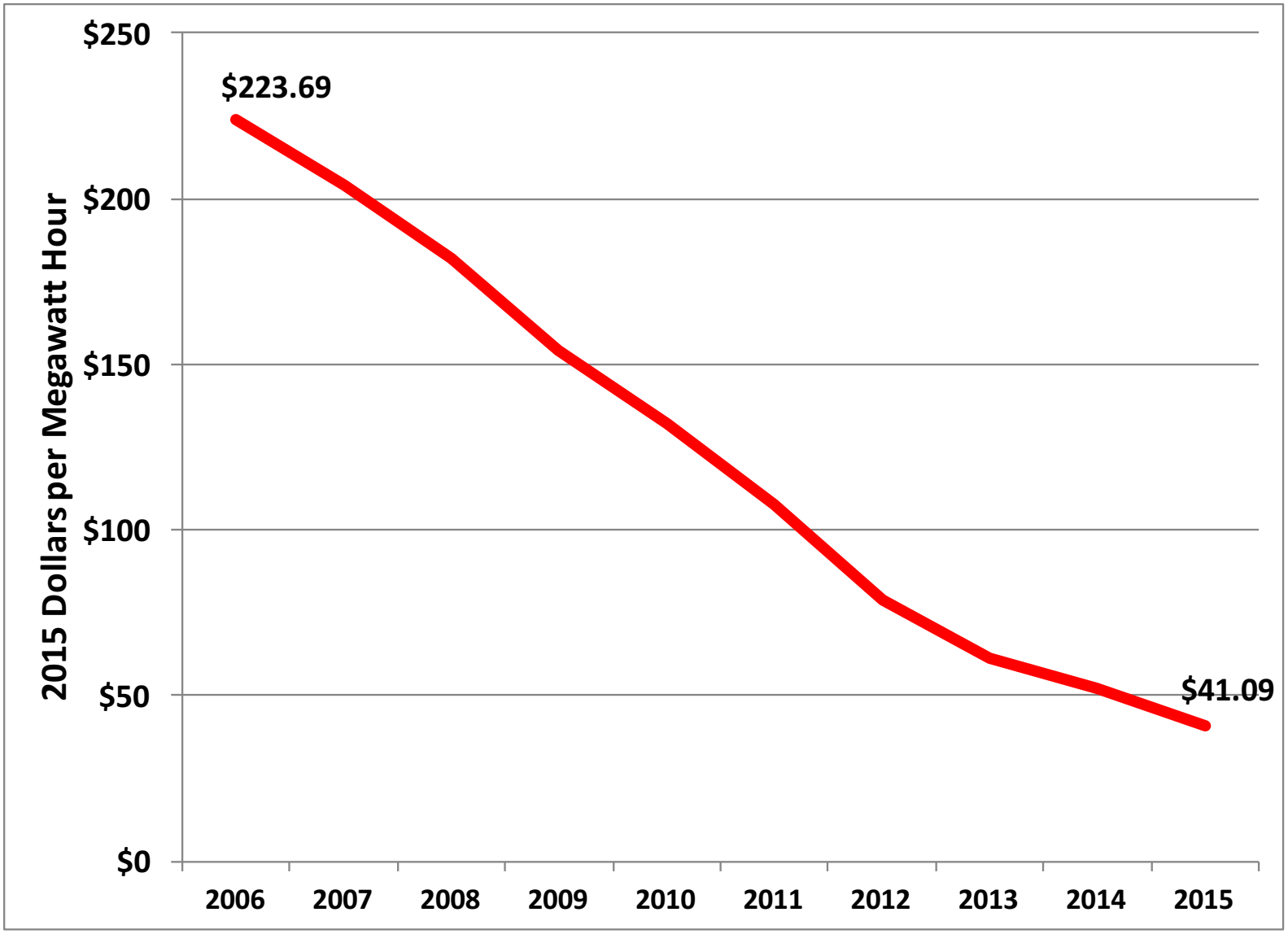
Figure 48. Generation-weighted average levelized wind PPA prices by PPA execution date and region

Declining Solar Installation Prices



[LBNL – *Utility-Scale Solar 2015: An Empirical Analysis of Project Cost, Performance and Pricing Trends in the United States*]

Solar PPA Prices Have Been "Dropping Like They're Hot"



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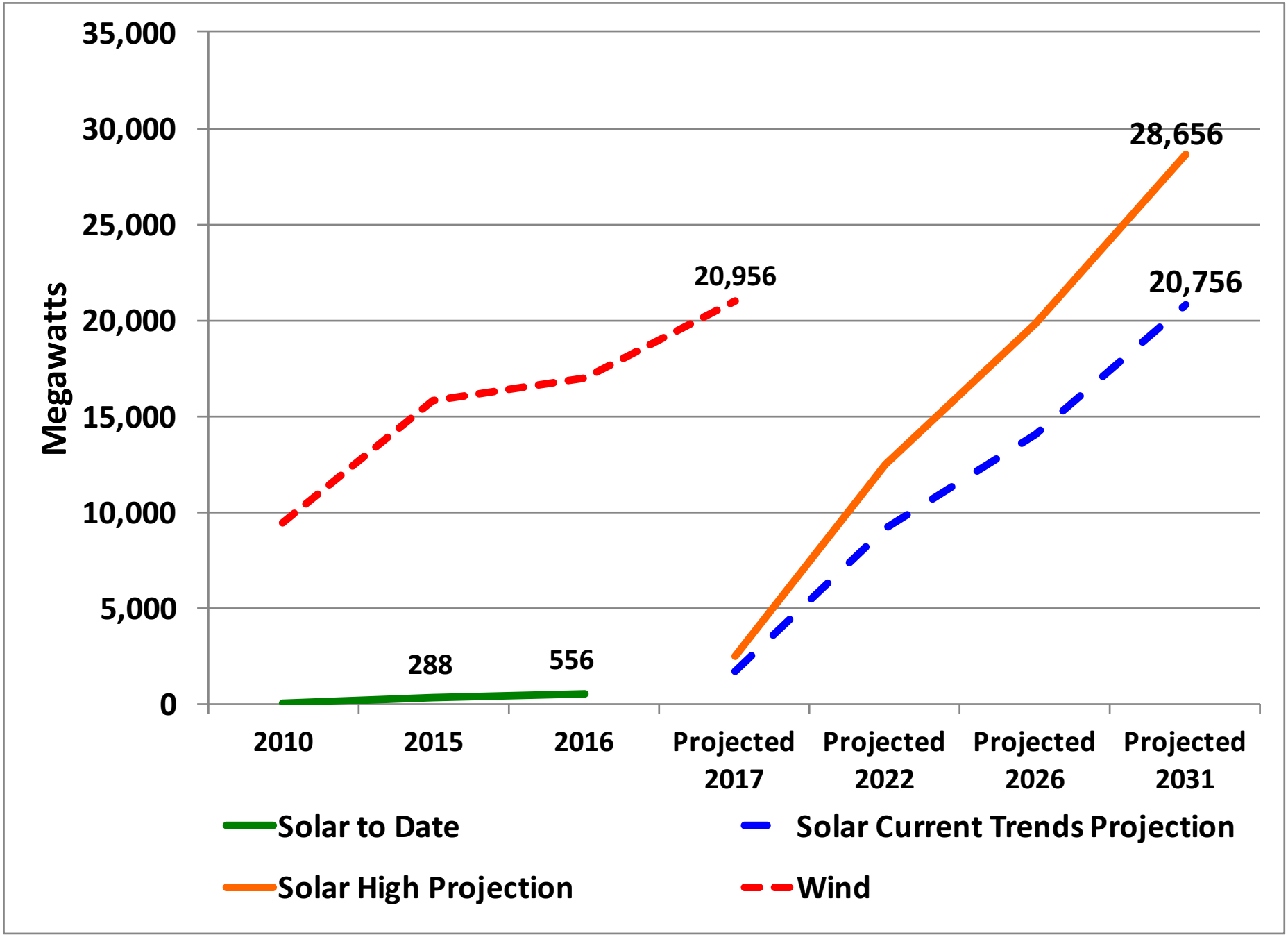
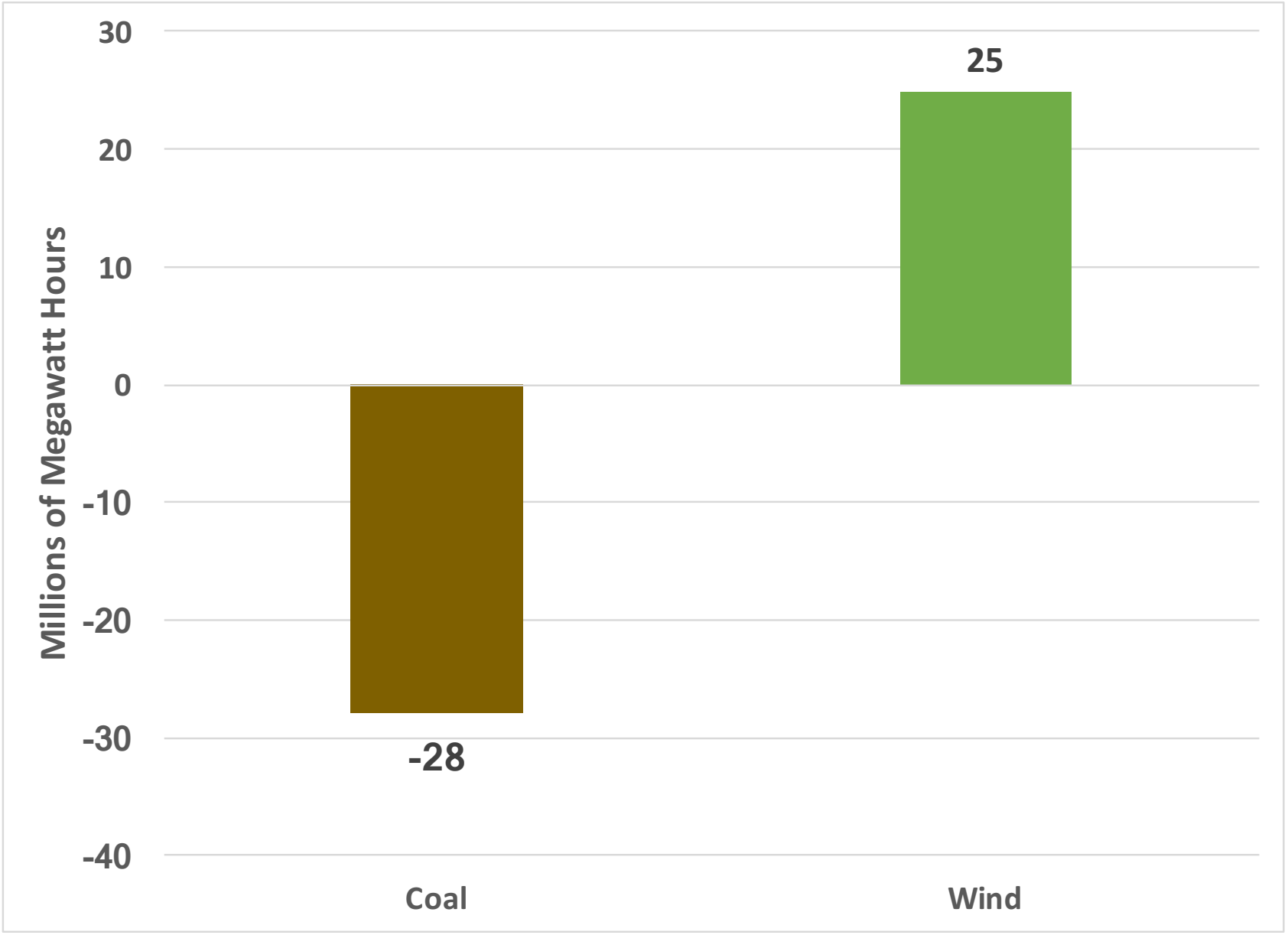
Alberta Electric System Operator
Ontario Independent Electric System Operator
ISO New England
New York ISO
Midcontinent ISO
PJM Interconnection
California ISO
Southwest Power Pool
Electric Reliability Council of Texas

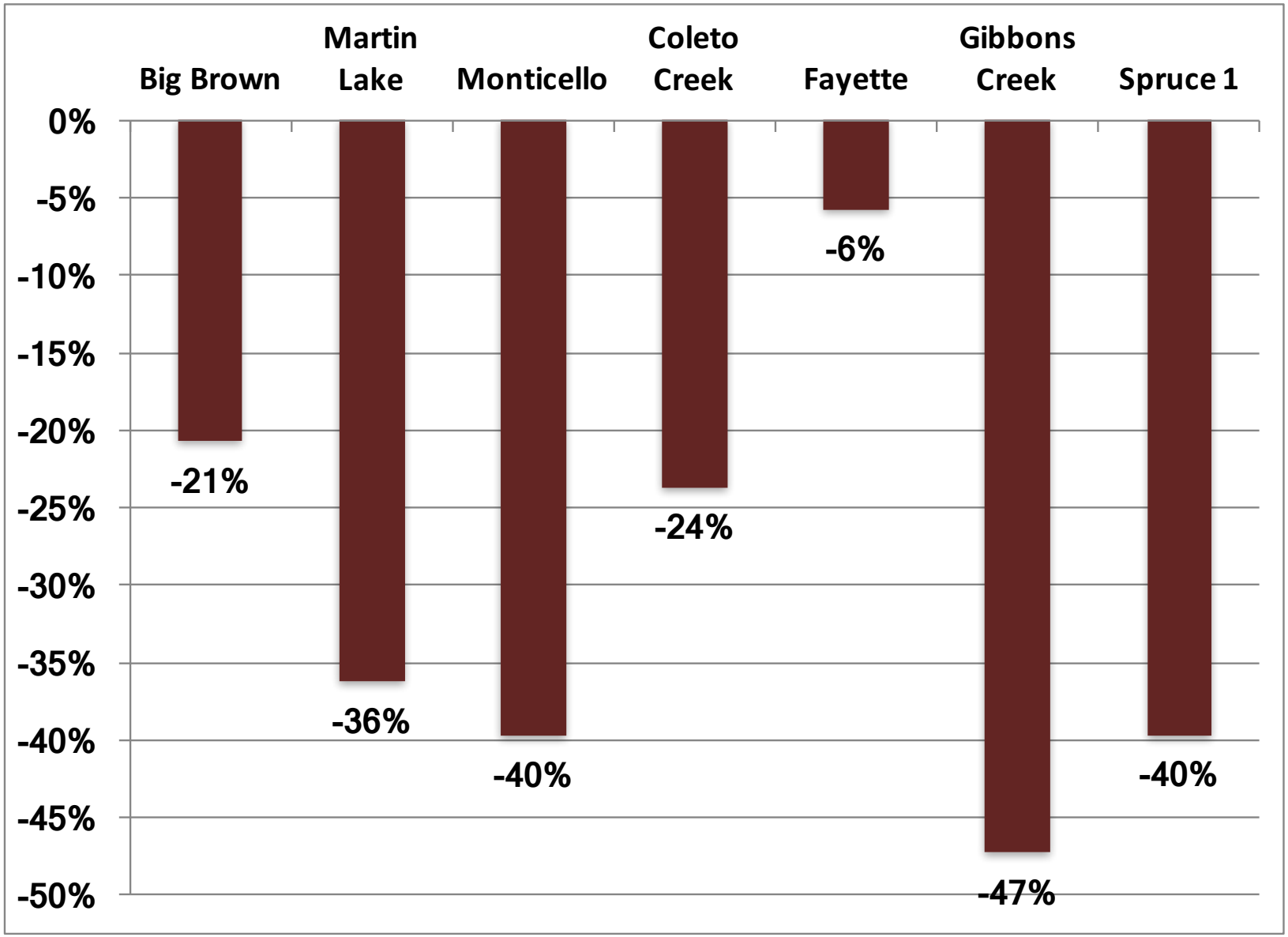
Growth in Wind and Solar Resources in ERCOT



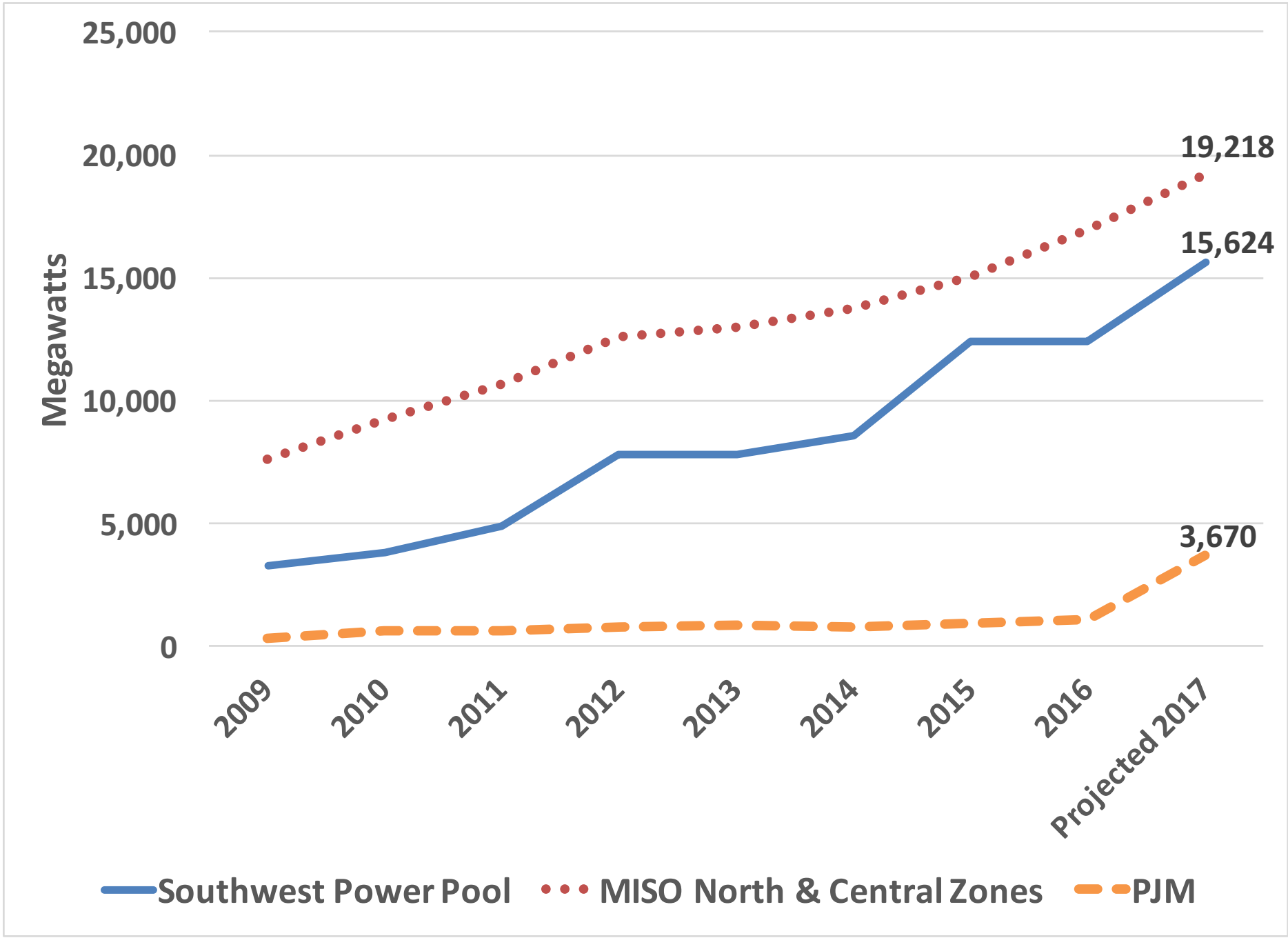
Wind Replaced Coal-Fired Generation in ERCOT – 20011 to 2016



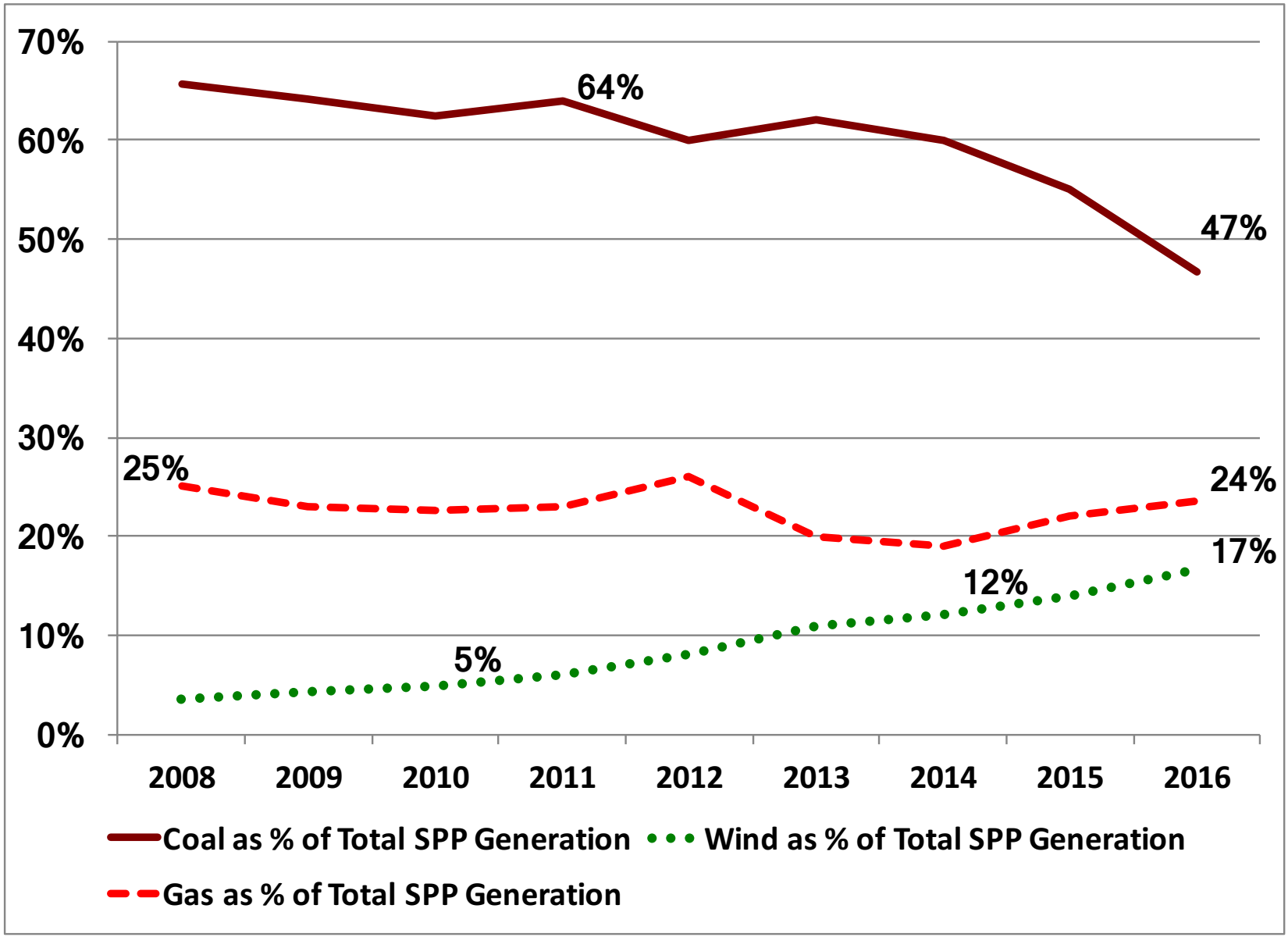
Declines in Generation at Texas Coal-Fired Generators Between 2011 and 2016



Growth in Wind Capacity in SPP, MISO & PJM



Wind Displacing Coal in the Southwest Power Pool



Coal Plants Are Caught in Death Spiral (Or At Least Near-Death Experience)

- Many coal-fired plants generating much less power than before and/or not operating as base load generators.
- Plus, because energy market prices are so low, owners getting less for each MWh of power their plants generate.
- This means significantly lower revenues from power sales.
- But production costs at many plants are increasing. Capex, some expensive, also necessary.
- Generating at high cost and selling at low cost is never good!
- Coal is in serious trouble even without the EPA!

Key Takeaways

- Market forces working against coal are inexorable – the coal industry and its allies in Washington and the states *maybe* can slow down but cannot reverse industry's long-term decline.
- Increases in renewable resources also can't be stopped. – costs have declined too much for that.
- Vital to oppose attempts to bailout fossil-fuel industry.
- It is important to continue to stress to decision-makers that individual (and groups of) coal plants remain exposed to significant economic and financial risks. Therefore, it is prudent to plan for a transition away from coal.

For More Information

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