

Montana Energy Issues

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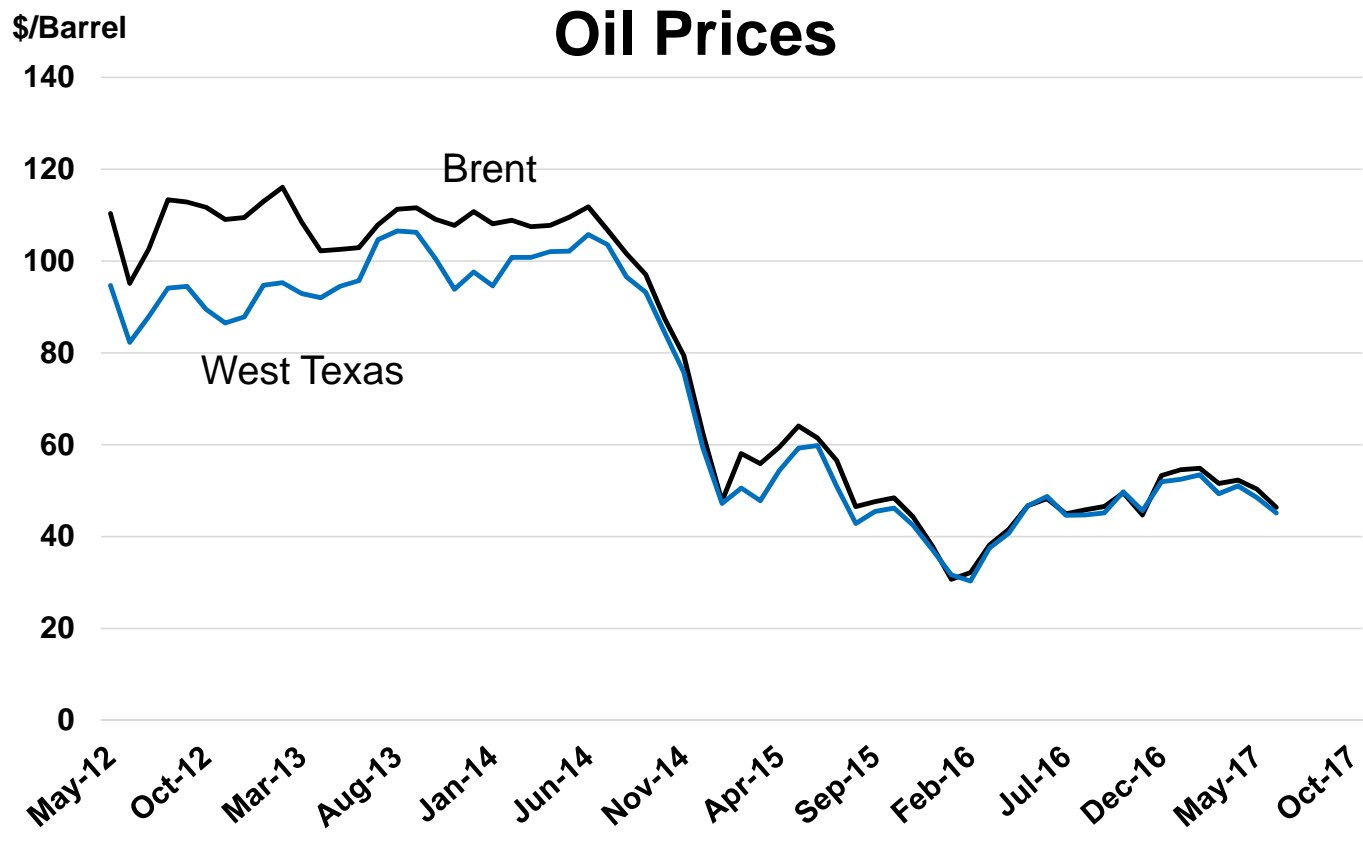
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What's New in the Bakken?



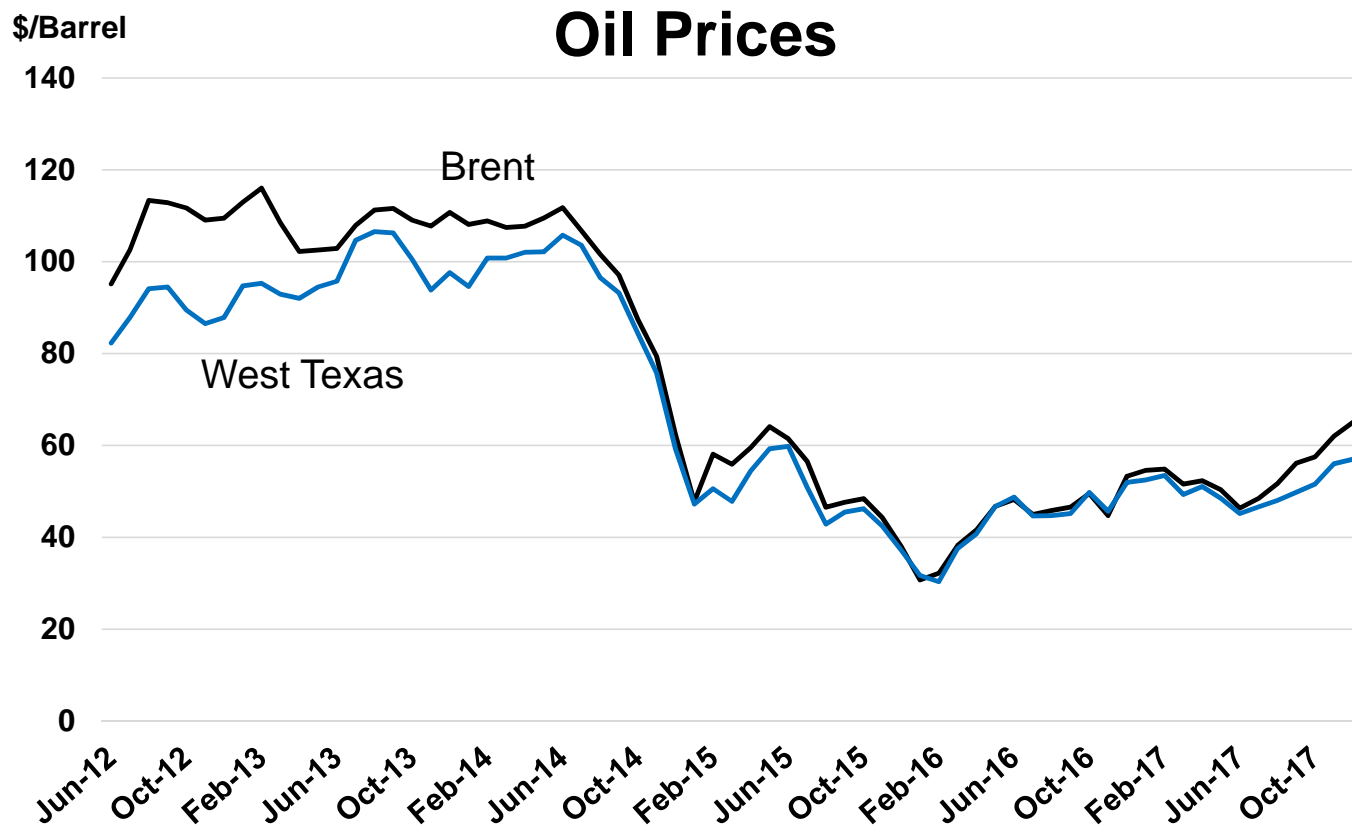
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Source: Federal Reserve Bank of St. Louis





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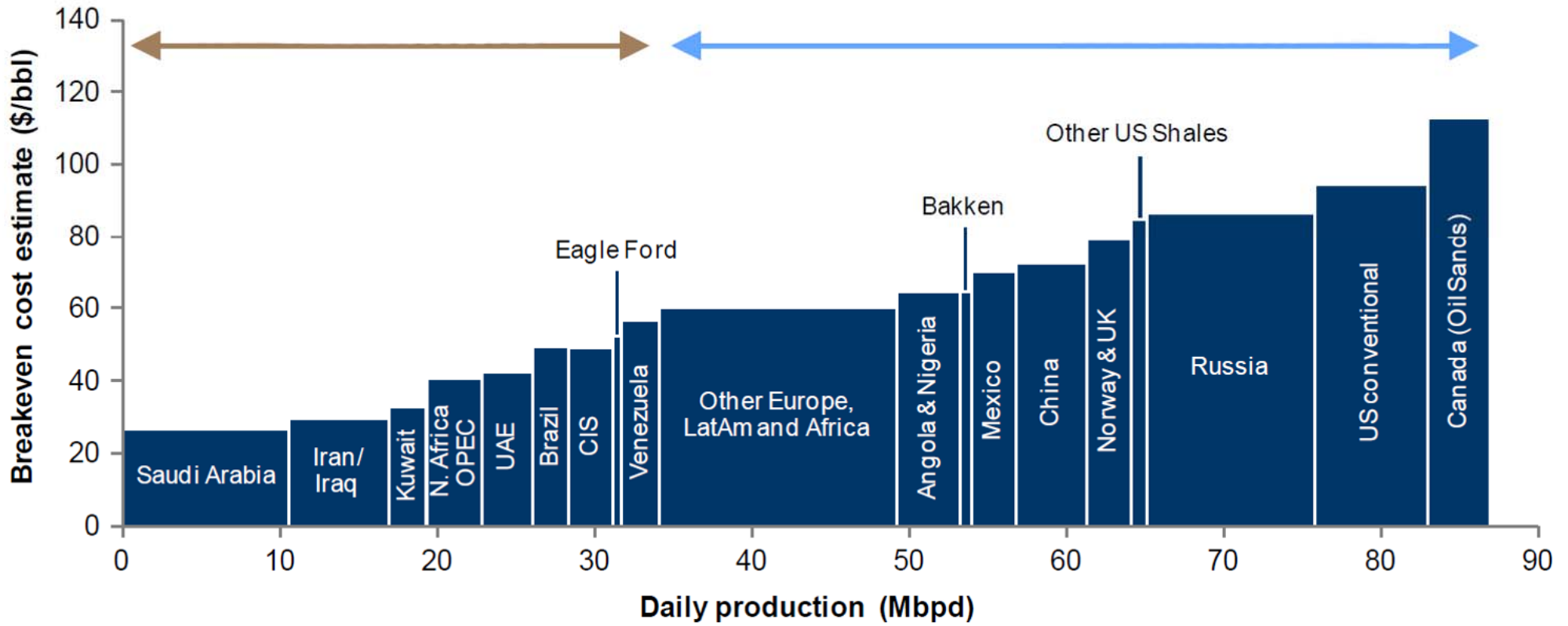


Future Oil Price Trends

- Synchronized Global Recovery
 - EU now growing
 - Japan Unemployment falling
 - China still uncertain, but improving
- Saudi-Russia supply cut agreement extended
- Mideast oil supply disruptions possible



Global breakeven prices (considering only technical extraction costs) versus production. Source: Alliance Bernstein, October 2014



Break-Even Oil Prices



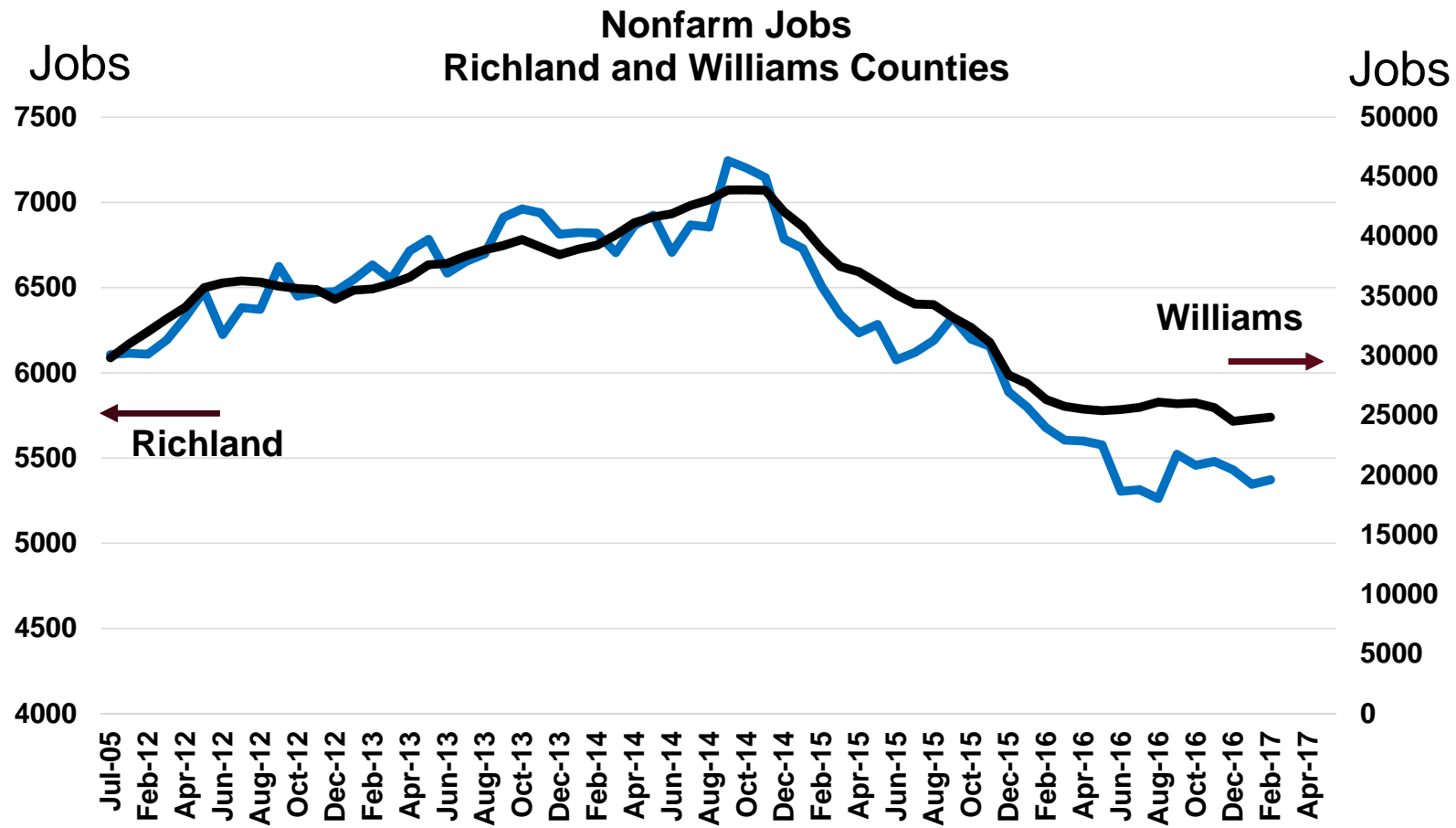
*Includes Saudi Arabia, Kuwait, UAE, Algeria and Iraq.
Source: PIRA Energy

Source: Wall Street Journal



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Source: U.S. Bureau of Labor Statistics, QCEW



Jobs, by Place of Residence			
	2013	2014	2015
Richland Cty, MT			
Total Jobs	6,775	6,747	6,423
Live in Richland	3,953	4,265	4,957
Live Elsewhere	2,822	2,482	1,826
Williams Cty, ND			
Total Jobs	35,395	39,464	36,948
Live in Williams	15,732	17,369	18,507
Live Elsewhere	19,063	22,096	18,441
Source: U.S. Census Bureau			



The Long Road Ahead For Clean Energy in Montana



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EXPAND CLEAN ENERGY IN MONTANA

- “It’s time to shift the state’s energy recourses away from greenhouse gas-emitting fossil fuels toward renewable energy.”
- “We Montanans can transform ourselves from being the West’s leader in greenhouse-gas pollution to the first state that commits to 100 percent reliance on clean energy.”
- “Few states are blessed with Montana’s wind and solar resources.”
- **Missoulian 10/17/2017**



Wind Generation Potential

Rank	50 Meter		80 Meter		100 Meter	
	State	Capacity (MW)	State	Capacity (MW)	State	Capacity (MW)
1	North Dakota	480,000	Texas	1,901,530	Texas	2,320,792
2	Texas	470,000	Kansas	952,371	Montana	1,012,355
3	Kansas	420,000	Montana	944,004	Kansas	955,239
4	Montana	410,000	Nebraska	917,999	Nebraska	921,075
5	South Dakota	400,000	South Dakota	882,412	South Dakota	890,626

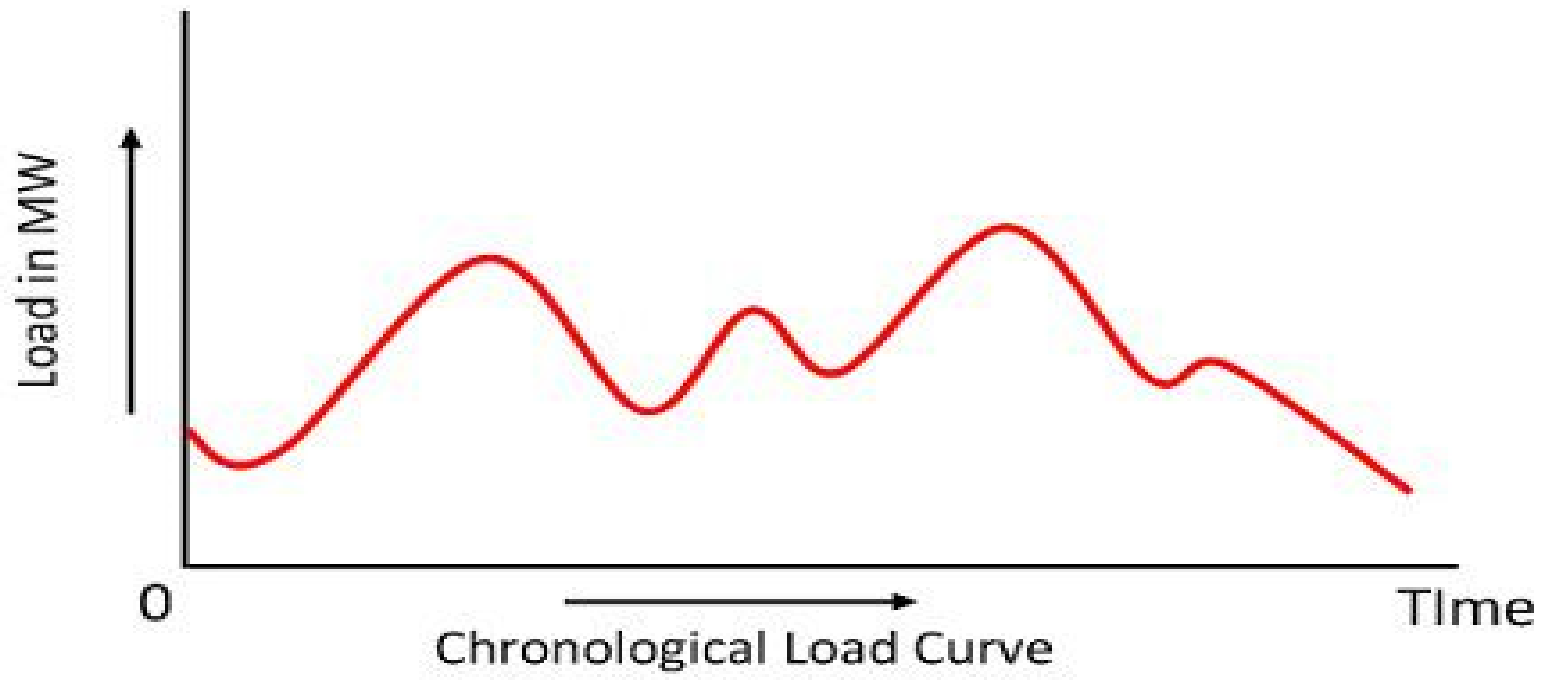
Source: American Wind Energy Association and U.S. Renewable Energy Laboratory



Electric Generation in Montana 2015

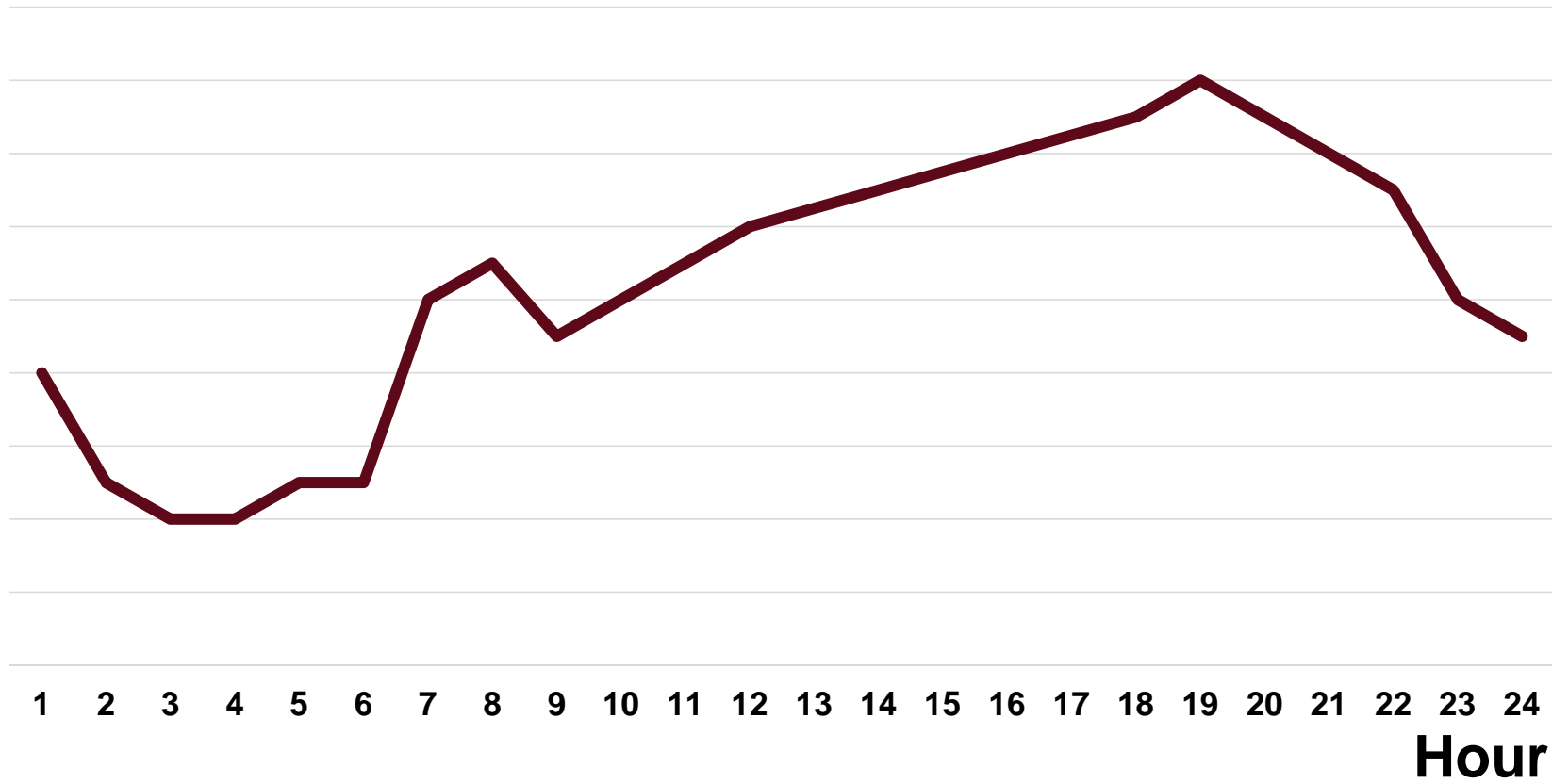
	Capacity		Generation	
	MW	Percent	MHW	Percent
Total	6,367	100	29,302,000	100
Coal Generation	2,488	39.1	16,013,000	54.6
Hydro Generation	2,628	41.3	9,887,000	33.7
Gas Generation	456	7.2	599,206	2.0
Wind Generation	662	10.4	1,964,726	6.7
All Other Generation	133	2.1	838,0687	2.9
Source: U.S. Energy Information Agency				





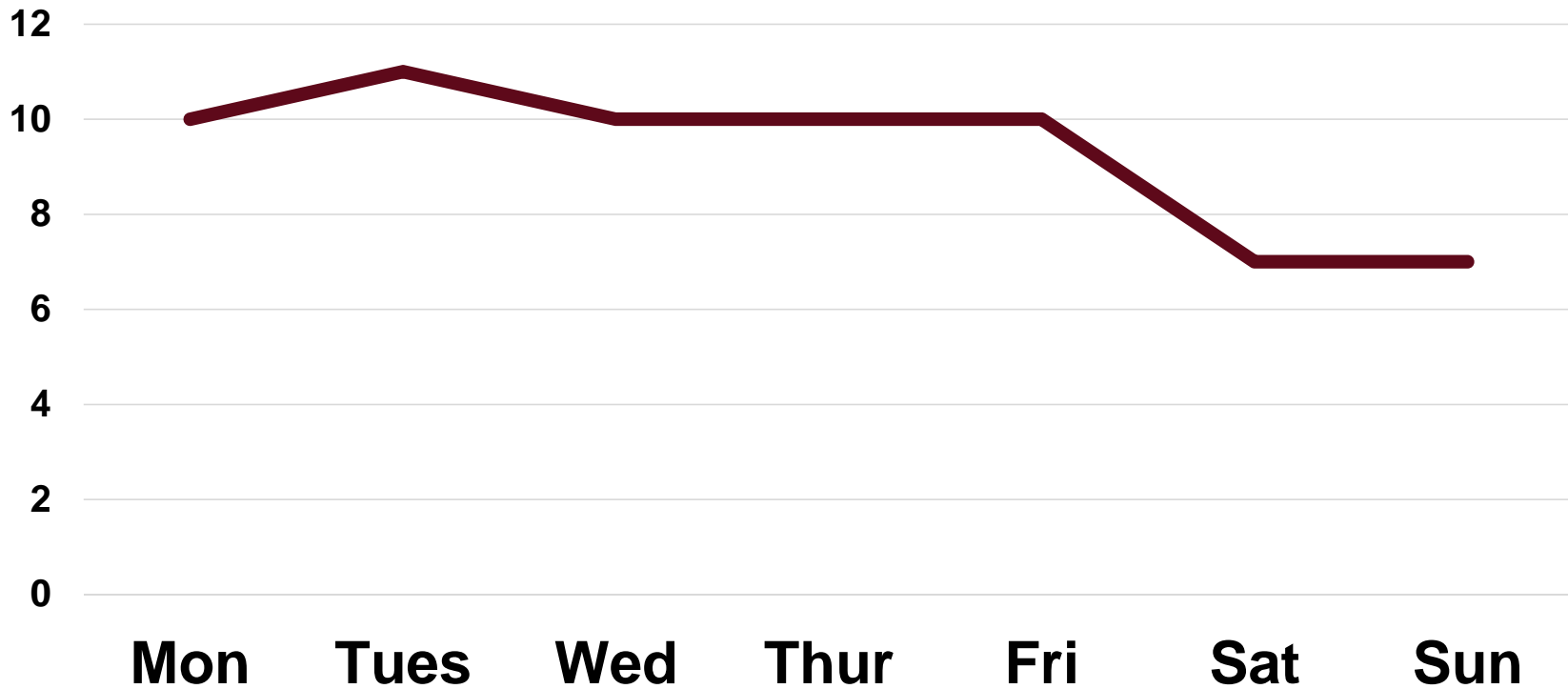
KW

Daily Load



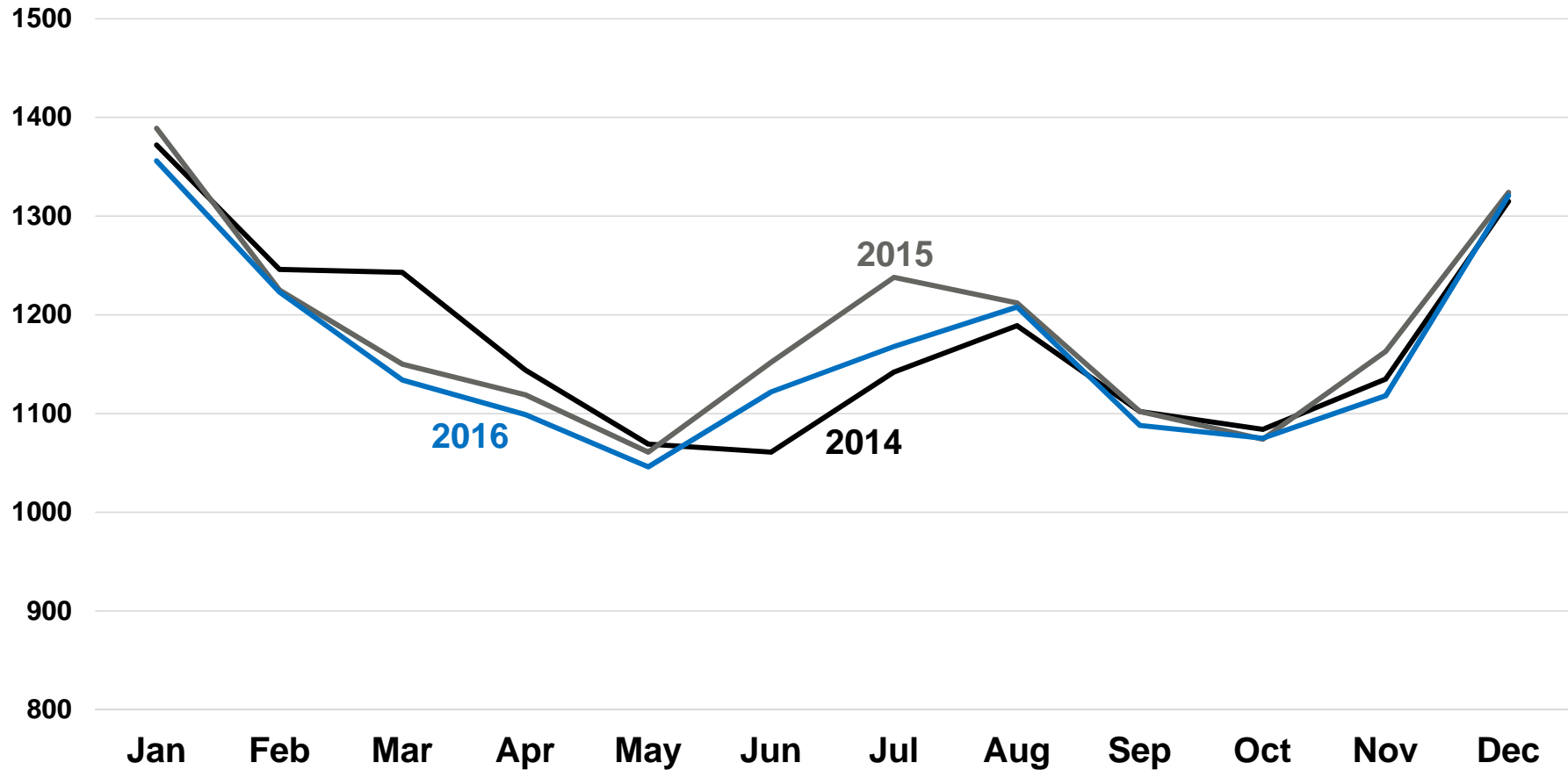
KWH

Weekly Load



Montana Monthly Electric Sales

KHW in Millions



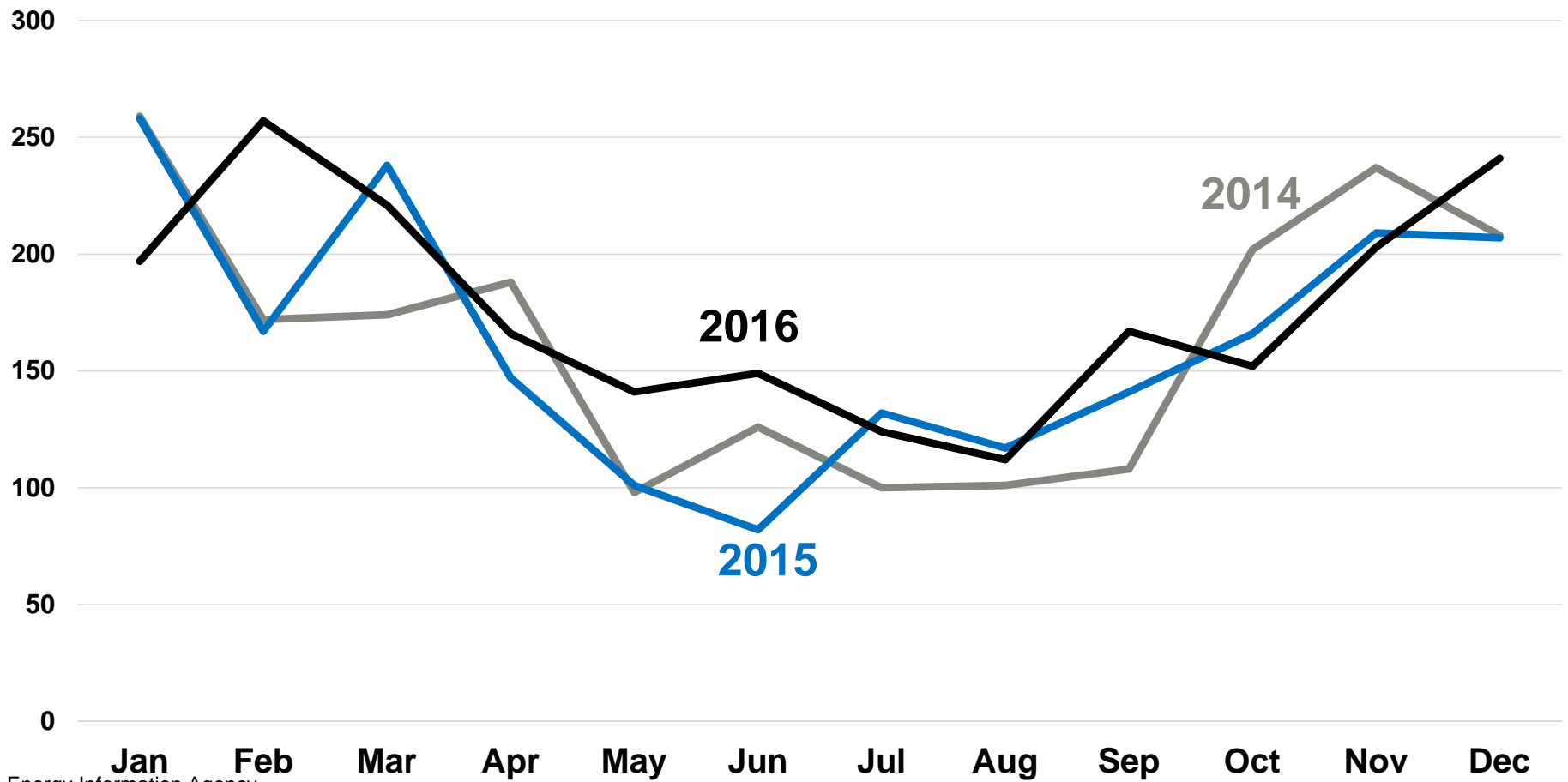
Source: U.S. Energy Information Agency



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MHW Thousand Montana Monthly Wind Generation

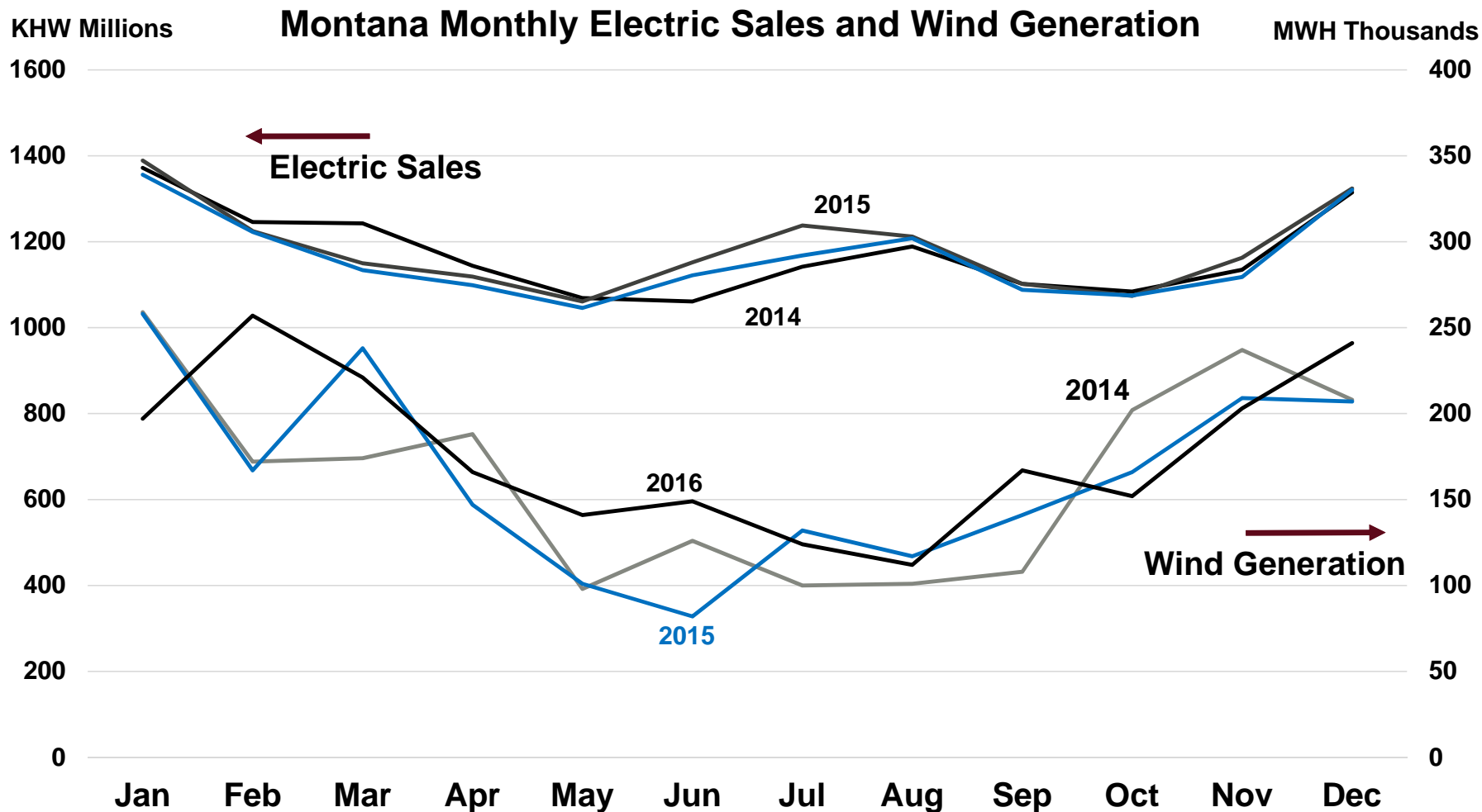


Source: U.S. Energy Information Agency



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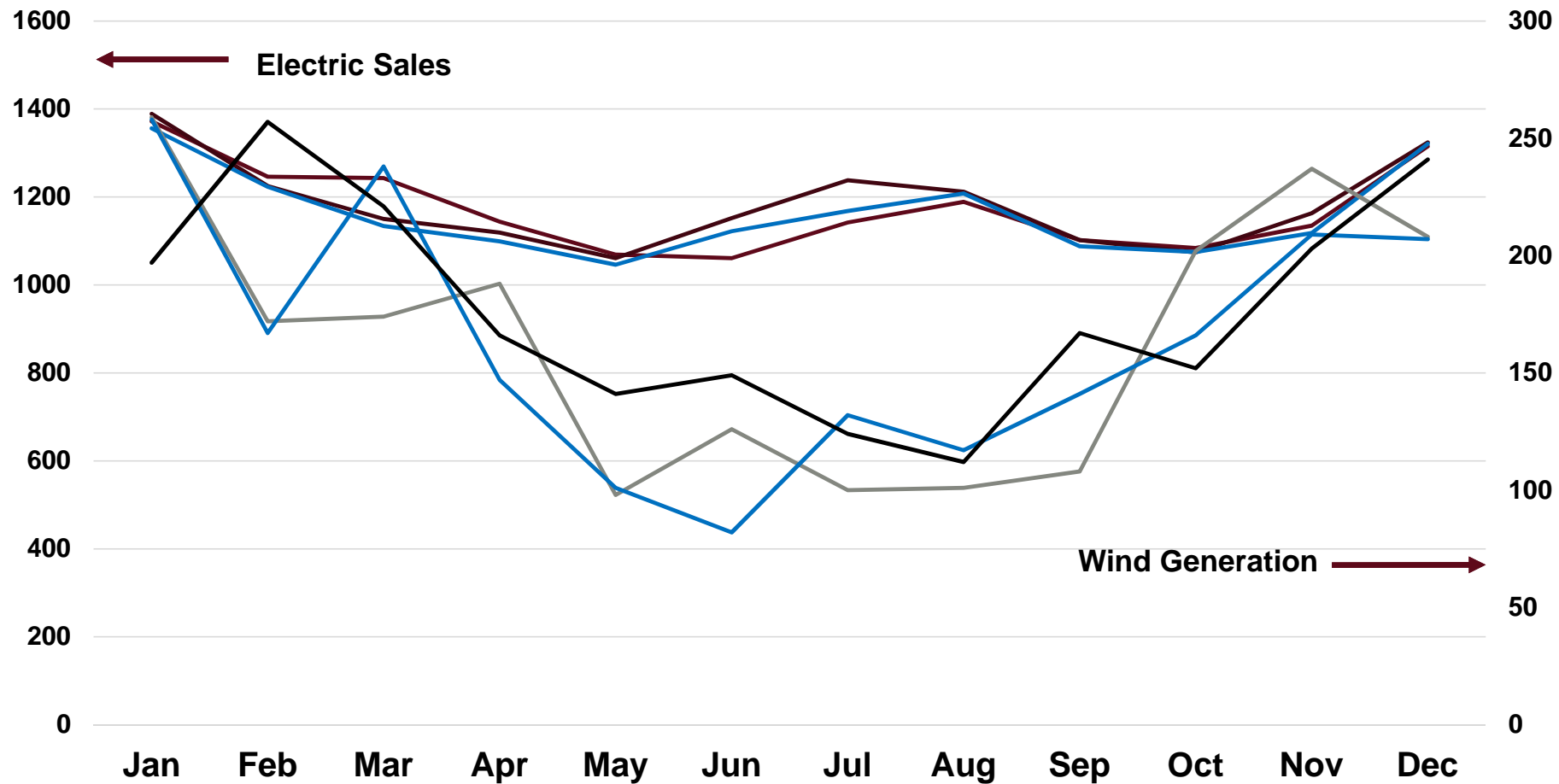
Source: U.S. Energy Information Agency



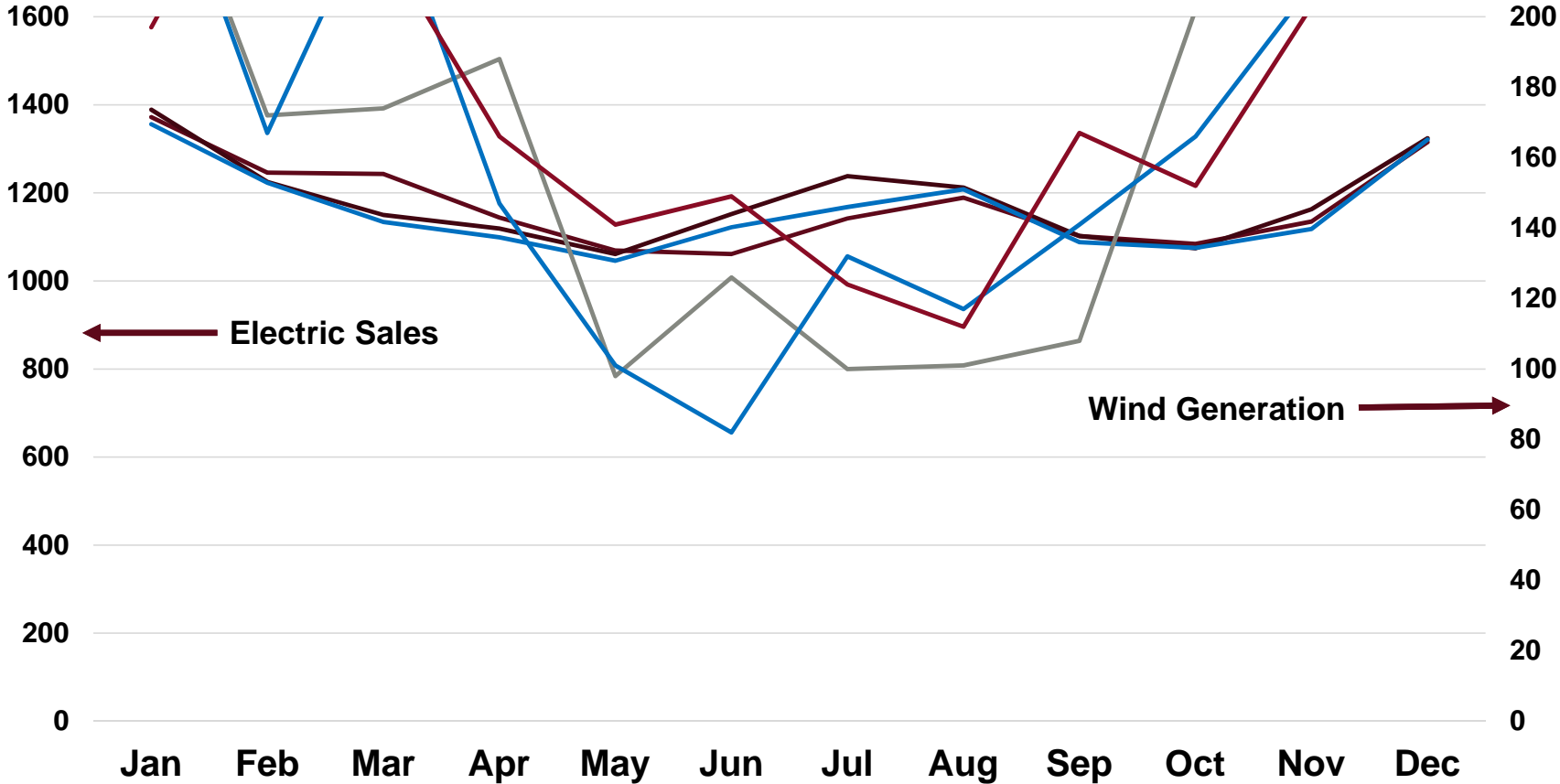
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Montana Electric Sales and Wind Generation 2014 to 2016



Montana Electric Sales and Wind Generation 2014 to 2016

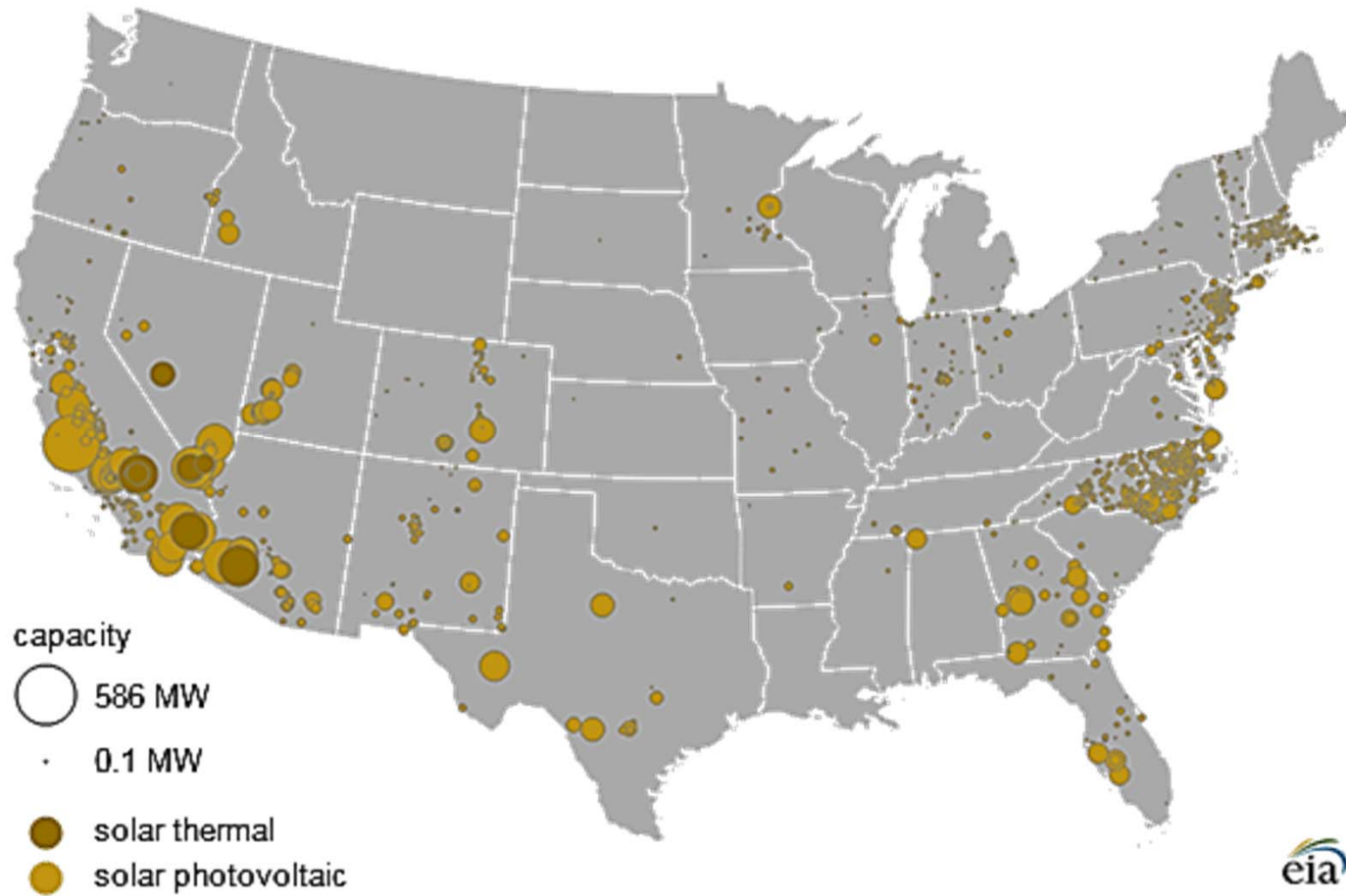


Types of Solar Generation

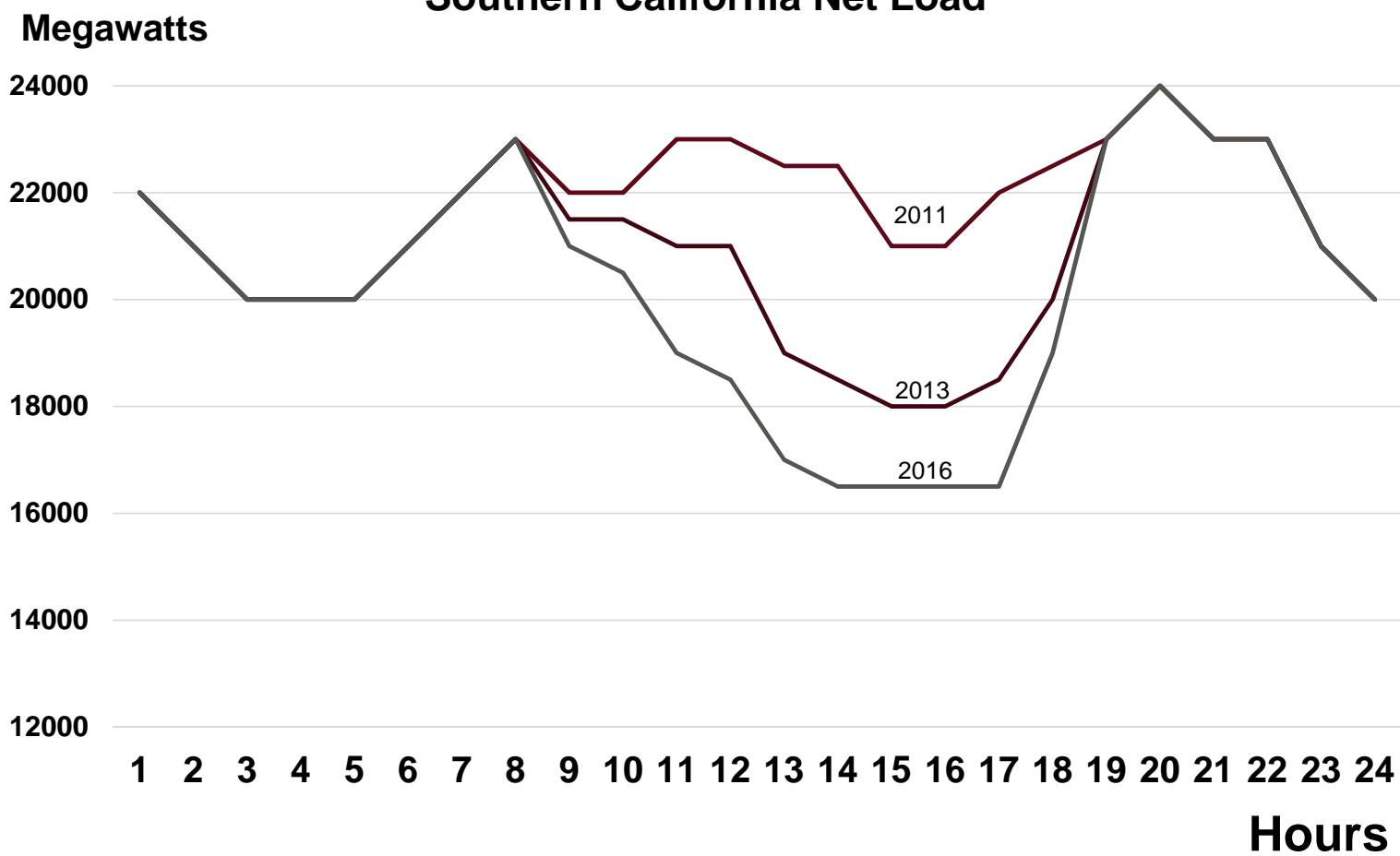
- Utility-scale solar generation. Large solar generation facilities that sell electricity to wholesale utility buyers.
- Distributed solar generation. Relatively small (e.g. rooftop, residential) electric generation serving end-use consumers. May sell excess generation back to utility.



Distribution of solar power plants in the Lower 48 states (as of December 2016)



Southern California Net Load



Source: SCIOS



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Dispatchable Generation (easy on-off)

- Gas Generation
- Pumped Storage
- Hydro (sometimes)



European Proposal

Cost \$ + \$ = \$\$

Renewable
Sources

Dispatchable
Sources



Questions?



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