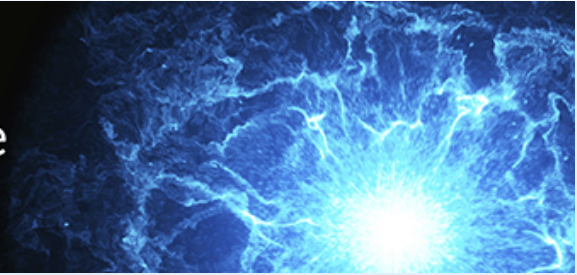




Wisconsin Public Utility Institute
UNIVERSITY OF WISCONSIN-MADISON



WPUI Members-Only Event with Professor Sheldon Du

February 21, 2020

Economic Overview Regarding Energy Industry

Sheldon Du

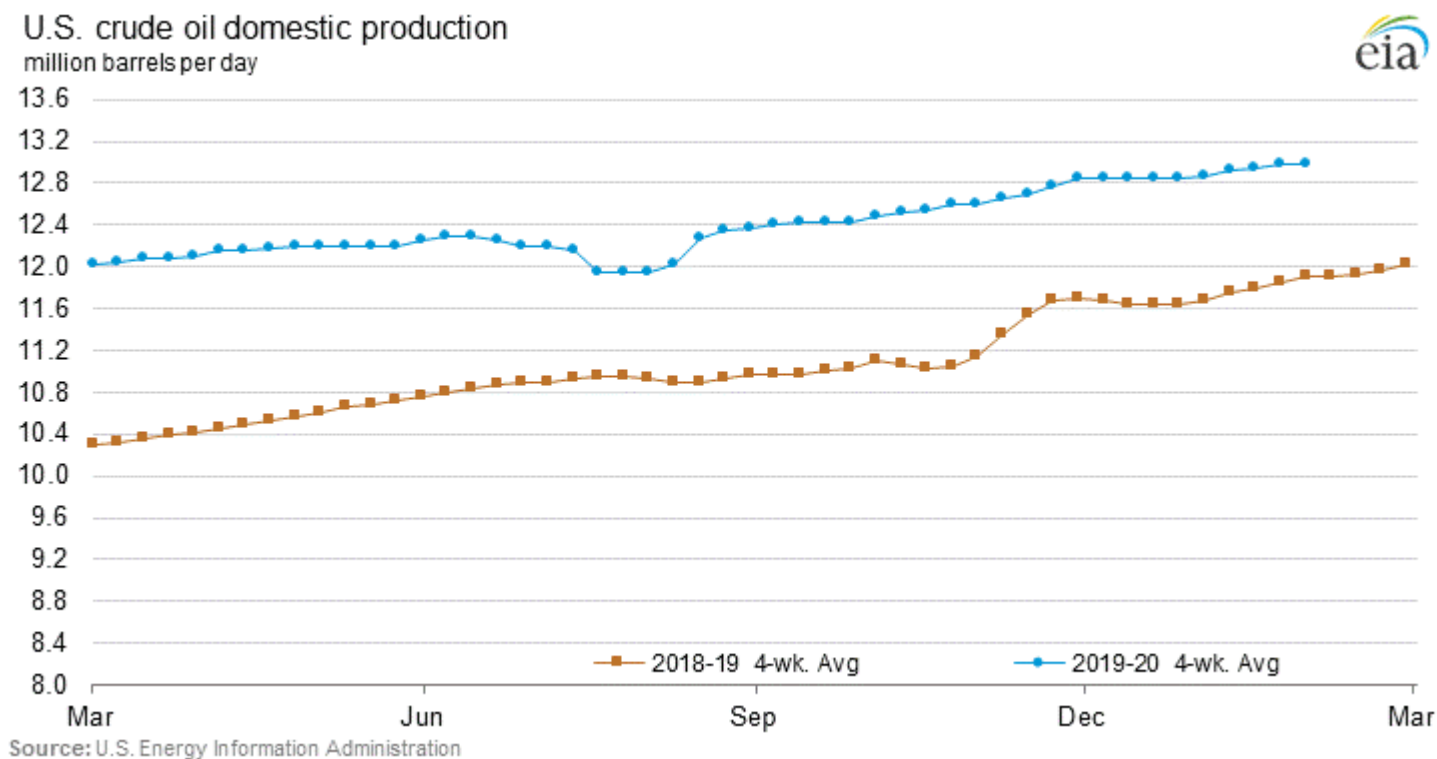
Agricultural & Applied Economics

University of Wisconsin-Madison

February 21st, 2020

The US Oil and Gas Boom

- US oil production: 12/13/14 million bpd in 2019/'20/'22



The US Oil and Gas Boom

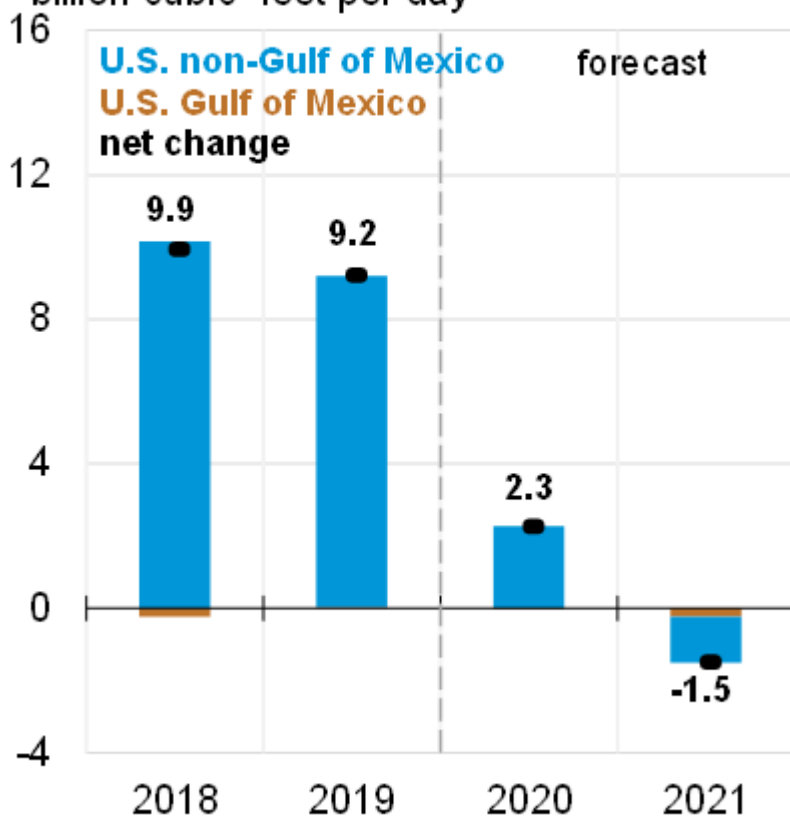
- Volatile oil prices



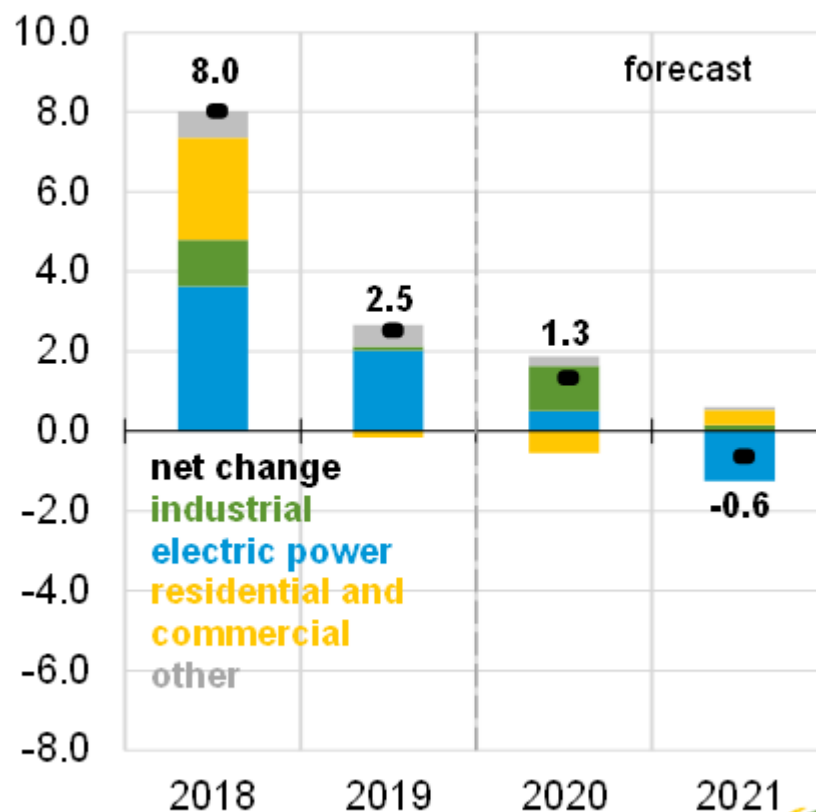
Source: Barchart.com

The US Oil and Gas Boom

U.S. marketed natural gas production
Components of annual change
 billion cubic feet per day



U.S. natural gas consumption
Components of annual change
 billion cubic feet per day



The US Oil and Gas Boom

- Natural gas prices fall to lowest level

Natural gas spot prices (Henry Hub)

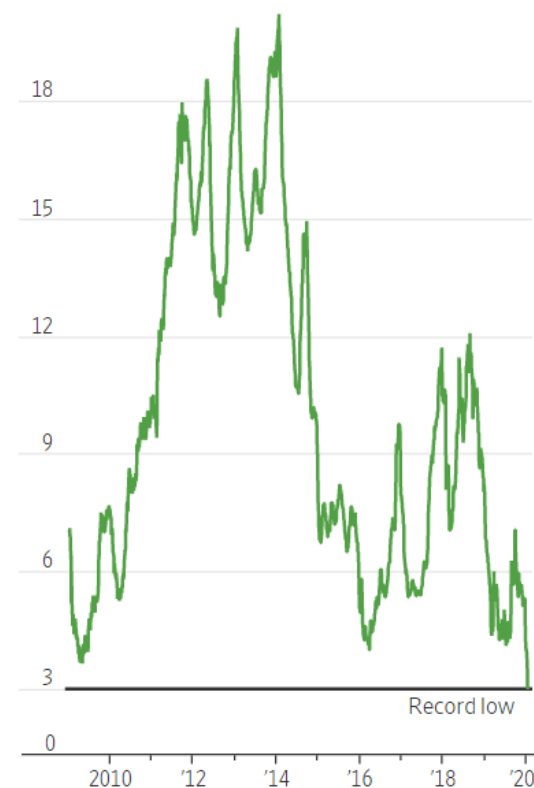
dollars per million British thermal units



 Source: Natural Gas Intelligence

Liquefied natural gas price in Asia

\$21 per million British thermal units



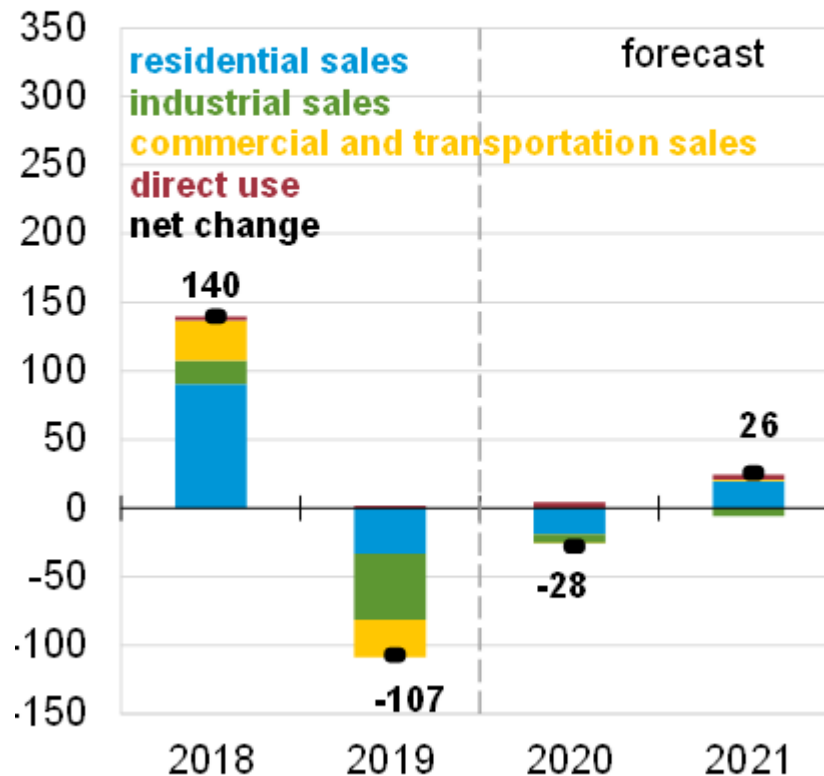
Source: WSJ (2/6/2020)

Implications for Electricity

- Slightly lower electricity consumption (-0.4%) in 2020

U.S. electricity consumption
billion kilowatthours

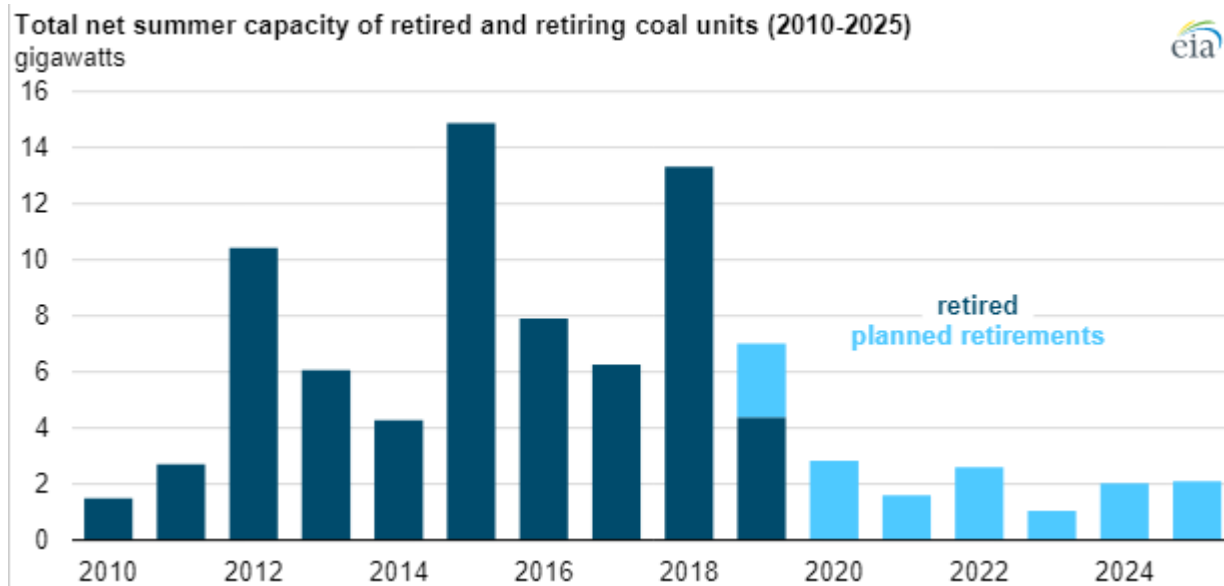
Components of annual change
billion kilowatthours



Source: Short-Term Energy Outlook, February 2020

Implications for Electricity

- 5% (13%) coal-fired capacity was retired in 2019 (2020)
- 1.4 GW of natural gas combined-cycle will be added
- In Midwest, coal generation is expected to fall by 33 billion kWh, part of which is offset by natural gas generation (12 billion kWh)

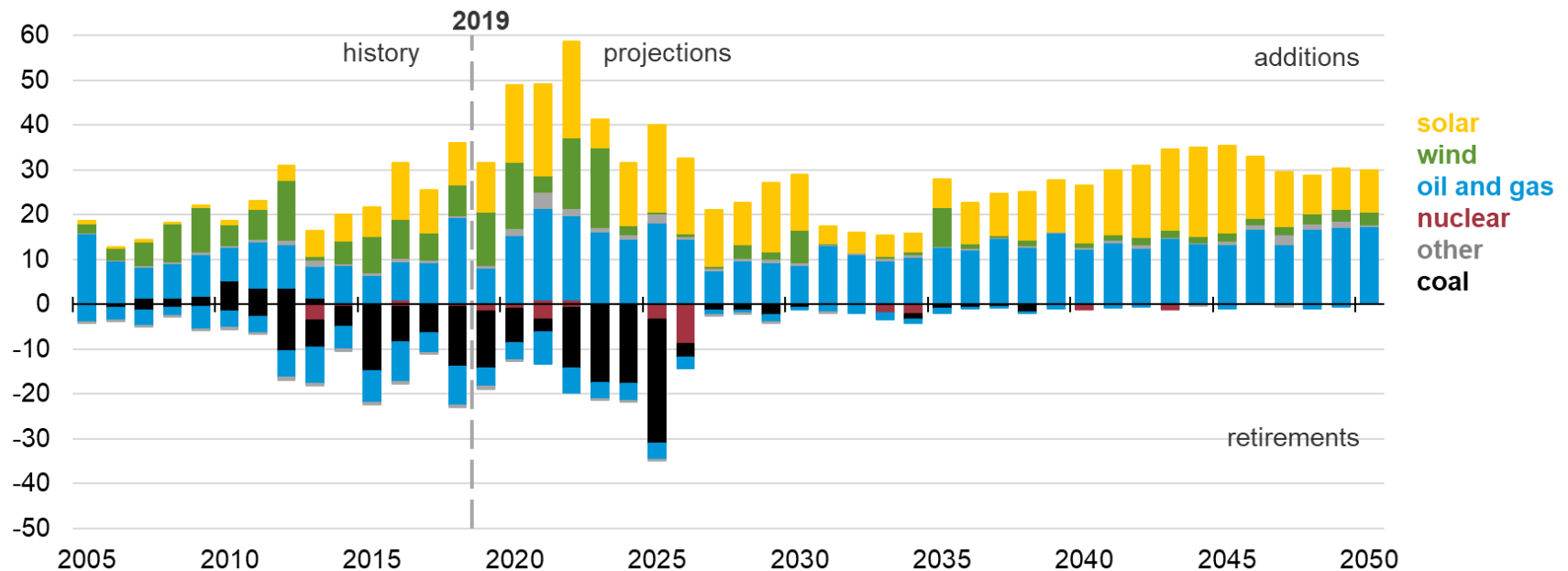


Source: EIA (2020)

Proliferation of Renewables

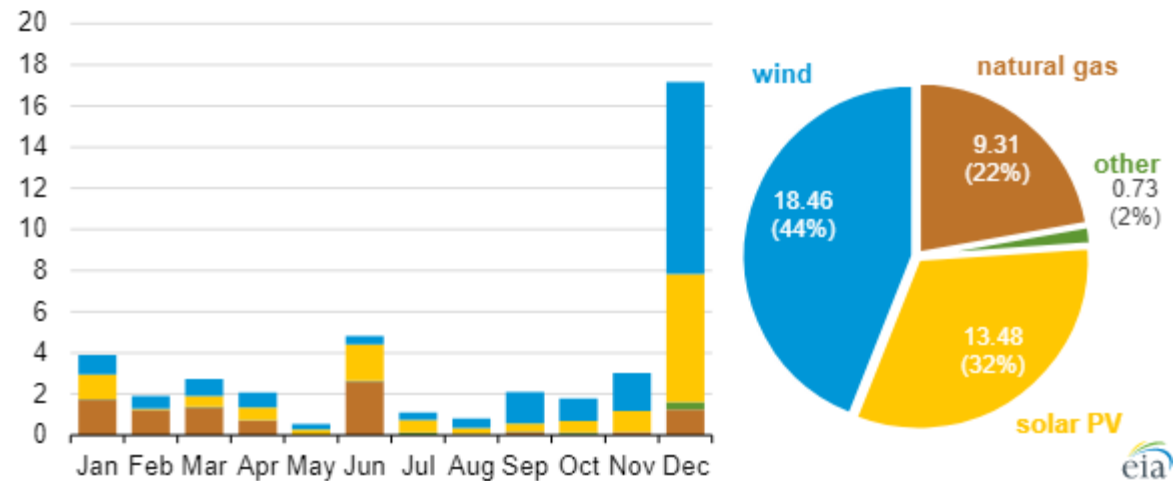
- 13 GW utility-scale solar PV will be added in 2020
- Wind capacity will increase from 106 GW in 2019 to 125 GW in 2020

Annual electricity generating capacity additions and retirements (Reference case)
gigawatts

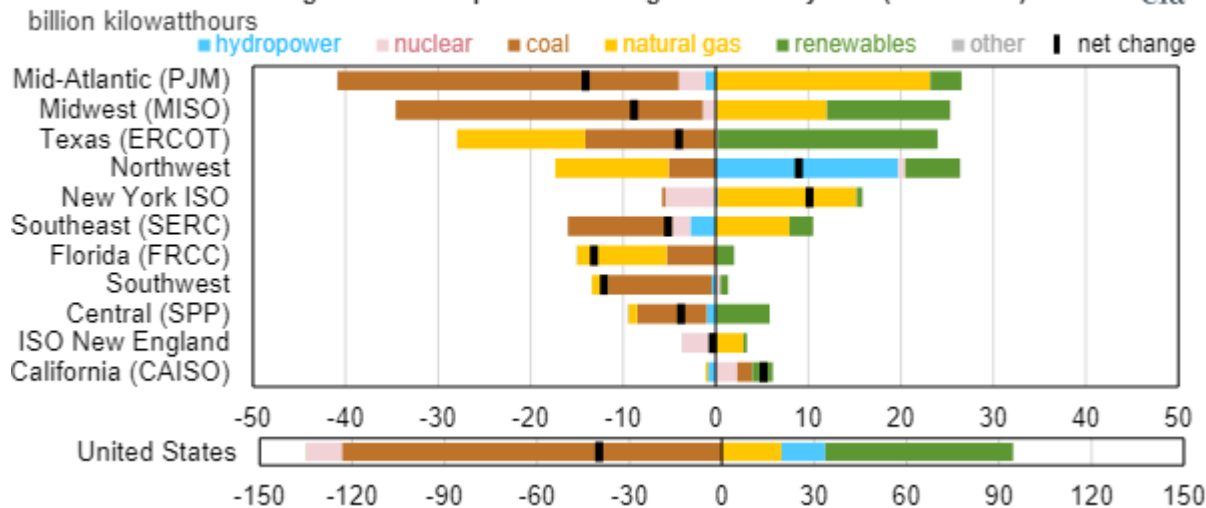


Proliferation of Renewables

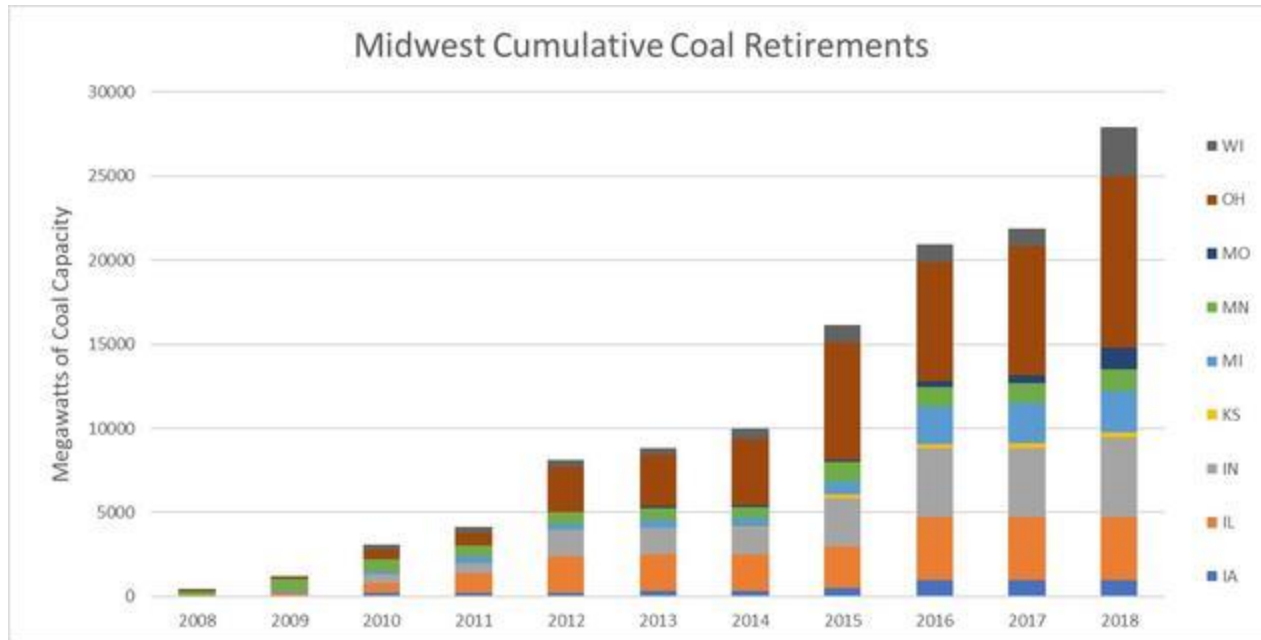
Planned U.S. electric generating capacity additions (2020)
gigawatts (GW)



Forecast annual change in electric power sector generation by fuel (2019-2020)

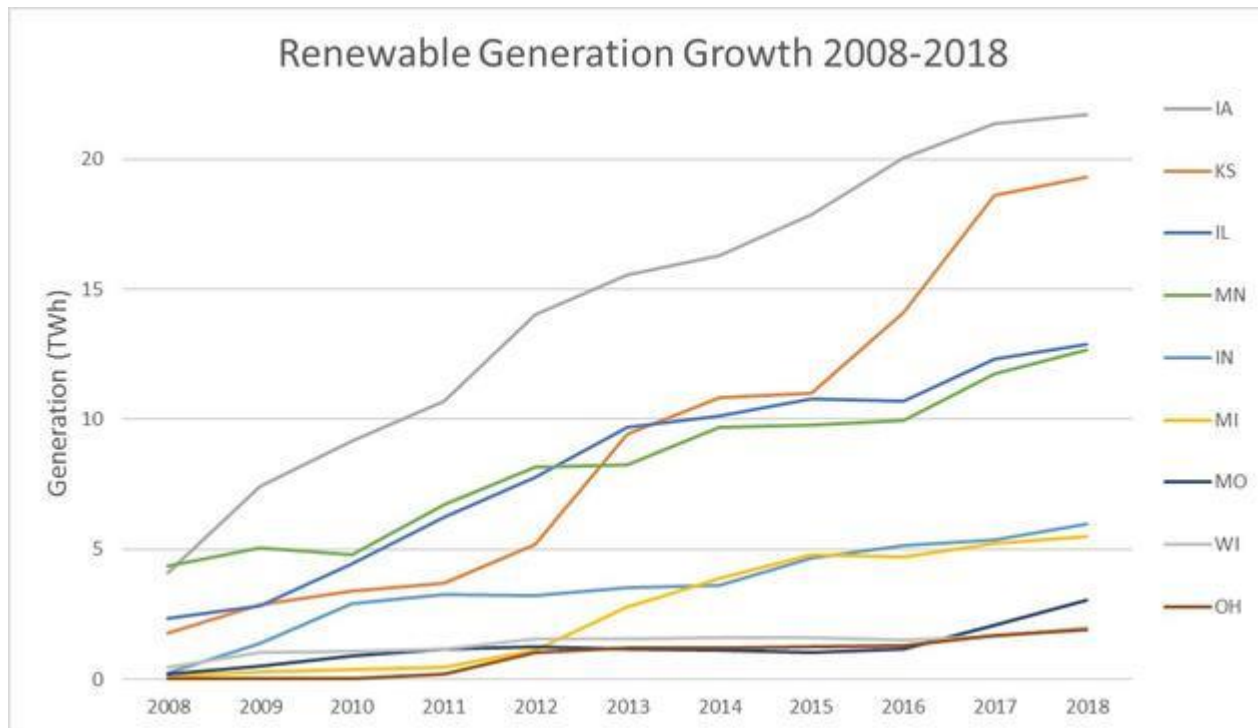


Renewable Energy in Midwest



Source: NRDC (2019)

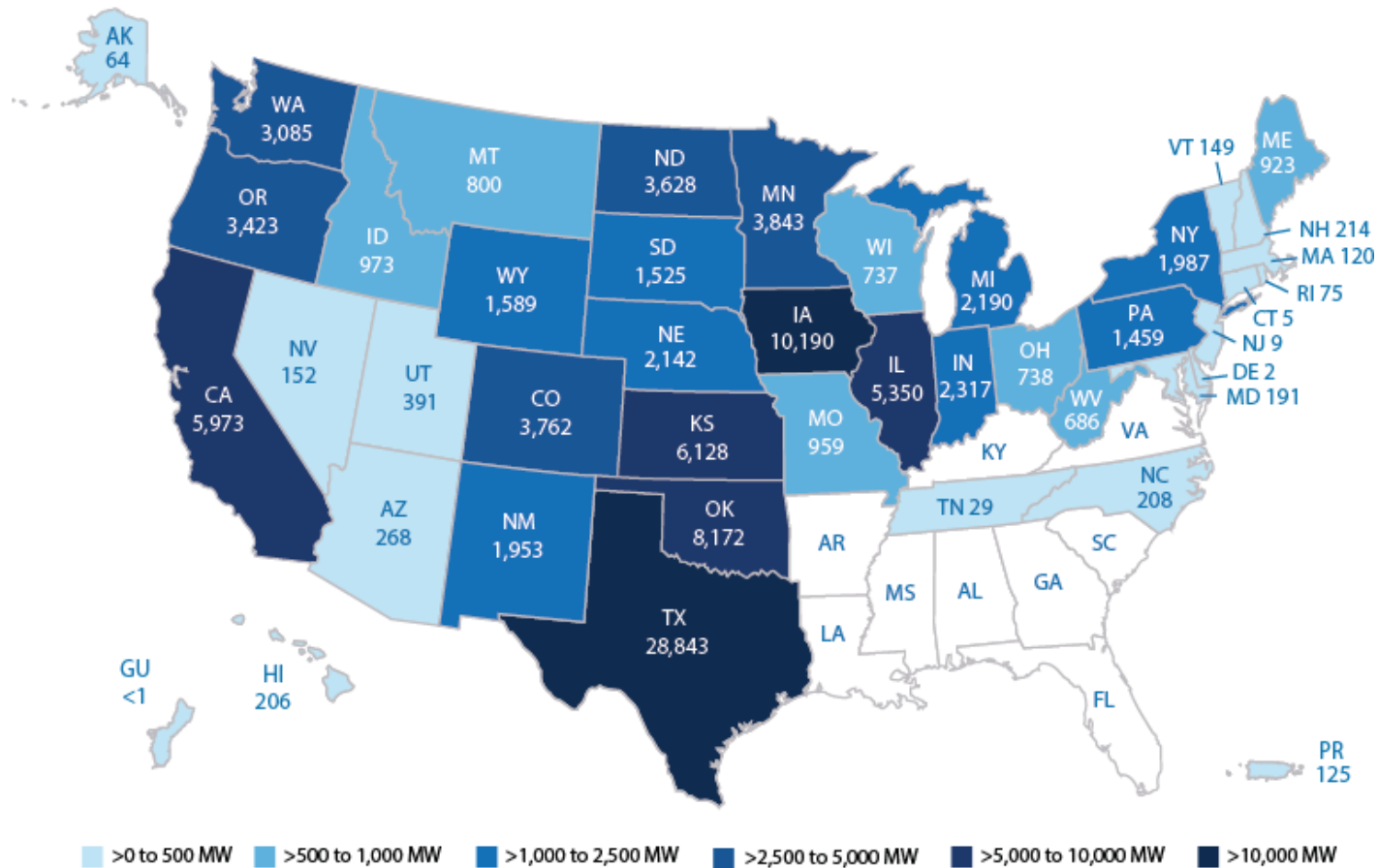
Renewable Energy in Midwest



Source: NRDC (2019)

Renewable Energy in Wisconsin

- Operational Wind Power Capacity



Source: AWEA (2020)

Renewable Energy in Wisconsin

Total Solar Installed

100.84 MW

15.86 MW in 2018

National Ranking

39th

38th in 2018

Solar Jobs¹

3,007

24th in 2018

Growth Projection

1,386.23 MW over the next 5 years

Ranks 22nd



Enough solar installed to power:

15,660 homes



Percentage of state's electricity from solar:²

0.14%



Price decline over the last five years:

36%

Source: SEIA (2020)

Renewable Energy in Wisconsin

- Xcel Energy committed to 100% carbon-free electricity by 2050
- Alliant Energy and WEC Energy Group pledged to cut carbon emission 80% by 2050
- Plans of Utility level solar: Xcel: 3,000 MWs; WEC: 485 MWs; Alliant: 1,000 MWs
- Coal retirement:
 - Alliant: 30% coal plants are retired; West Riverside natural gas plant will be online soon
 - WEC: 2,800 MWs of coal generation were retired
 - Xcel: to retire 50% of coal capacity by 2027

Economic Benefits of Renewables

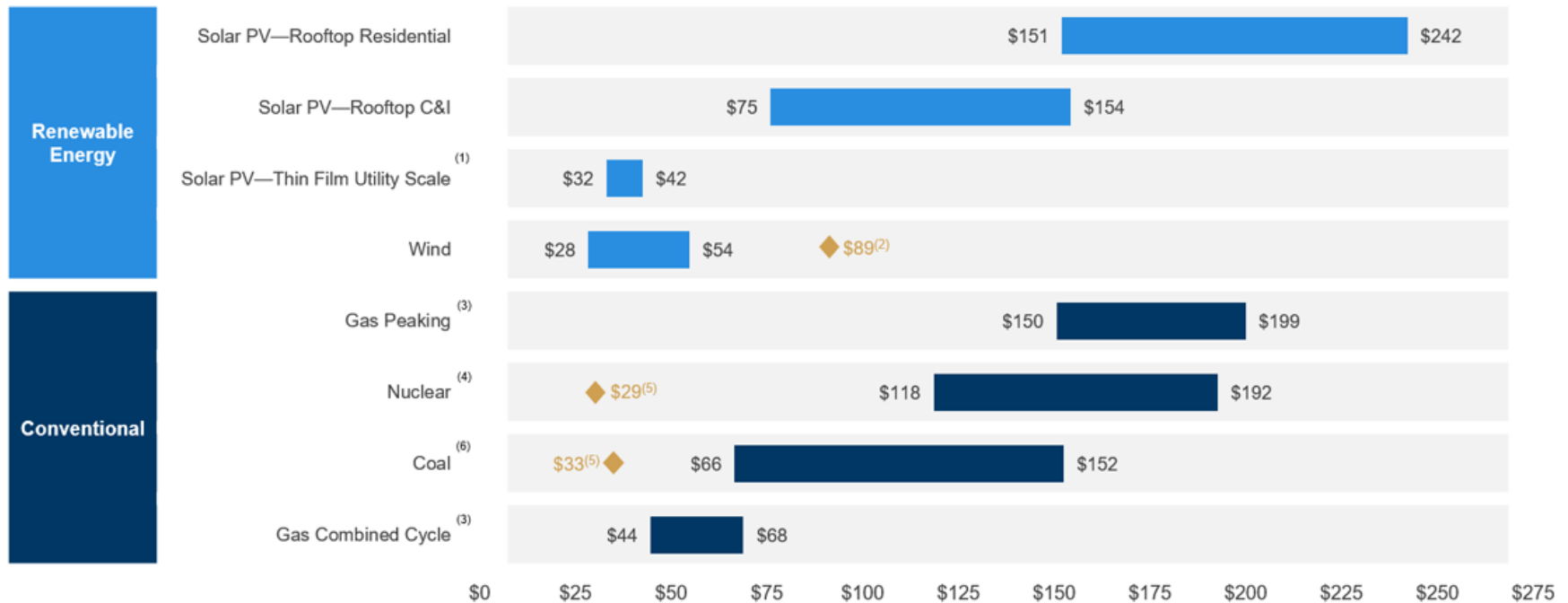
- Renewable energy jobs for Q2, 2018

Sector	Direct Jobs (U.S.)	Growth compared to 2017 (percent change)
Solar	242,343	-3.2%
Wind	111,166	3.5%
Renewable Fuels (Corn ethanol, other ethanols including biodiesel, woody biomass, and other biofuels)	106,709	2.2%
Hydropower	66,448	-0.6%
Biomass (Electrical generation)	12,976	4.8%
Geothermal	8,526	7.6%
Waste-to-Energy*	7,000	---
Total	555,168	-0.2%^

Source: USEER (2019)

Economic Benefits of Renewables

- Unsubsidized LCOE, 2009-2019 (\$/MWh)



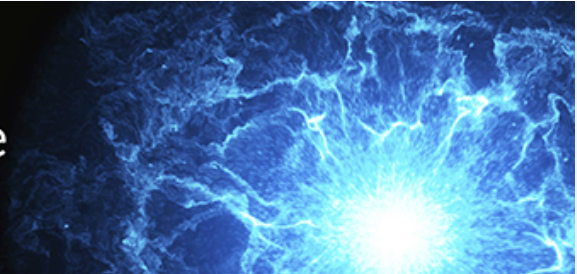
Source: LAZARD (2020)

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- LAZARD. 2020. Levelized Cost of Energy 2019.



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- **March 25** Natural Gas
- **April 20-22** RTO Fundamentals: Background, Purpose, Future
- **June 29** Technologies and Strategies to Mitigate Utility Climate Risk
- **September 8** Emerging Technologies
- **October 5-9** Energy Utility Basics
- **October 22** Water Affordability