Electricity Price Outlook for February 2019

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The Office of Technical and Regulatory Analysis presents the outlook for wholesale electricity prices each month. This assessment considers trends in electricity futures markets as ***well as forecasted weather, economic growth, and input fuel prices.***

Key Points in this Month's Outlook

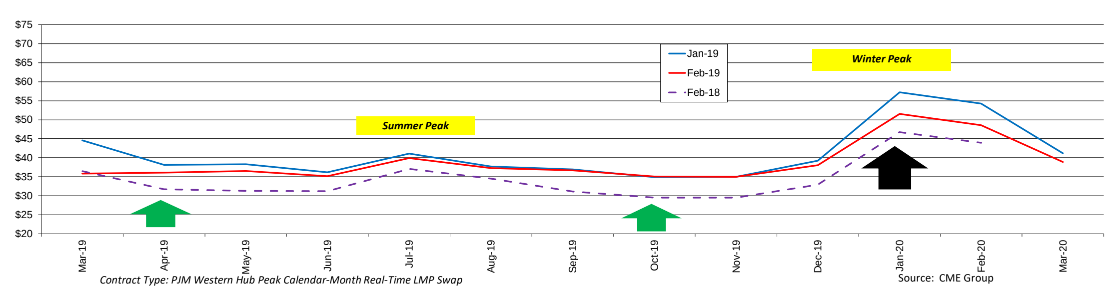
- On June 1st, new, lower Standard Offer Service ("SOS") electric rates took effect: A 5.3 percent average decrease for residential customers and 4.3 percent average decrease for small commercial customers.
- Plentiful natural gas in the PJM region is keeping wholesale electricity prices stable.
- Natural gas now exceeds coal as a generation fuel source in the PJM region.

Wholesale Electricity Futures Market

Contracts to deliver electricity in future months are traded for the multi-state region that is served by regional transmission operator PJM Interconnection and includes the District of Columbia. Figure 1 below shows the futures contract "price strips" through March 2020 as settled on January 17, 2019 (blue line), and on February 21, 2019 (red line).[1]

Because electricity cannot be easily stored, the effect of seasonal temperature changes on the price of future delivery contracts stands out sharply, with yearly peaks in the hot summer months and cold winter ones. Wholesale prices rise to incentivize high-cost generators to turn on their power plants to meet the high demand for electricity to run air conditioning on hot summer days and heating systems on cold winter days.

Figure 1: Wholesale Electricity Futures Prices ($/MWh)



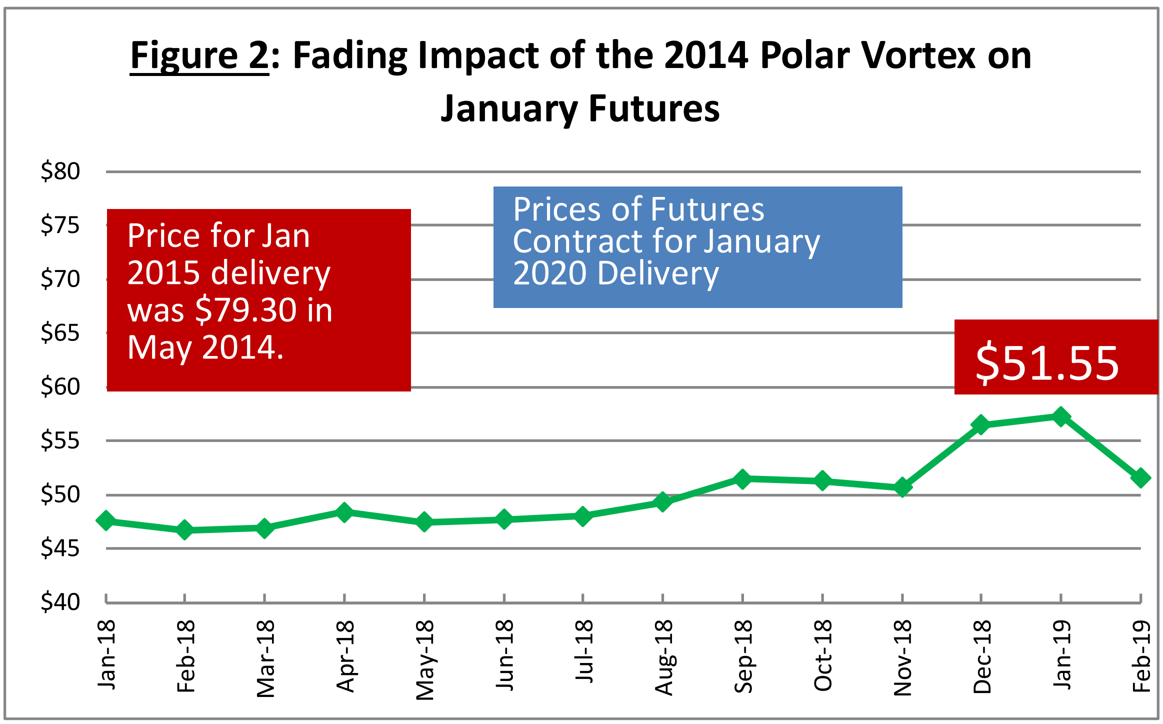
In Figure 1 above, the dashed purple line shows the trading values for the "price strip" from one year ago (February 15, 2018). Price expectations for all months are well

[1] See PJM Western Hub Peak Calendar-Month Real-Time LMP Swap Futures; CME Group.

above last year's levels. However, near-term investor expectations of future electricity prices are about the same as last year (red and purple lines). The futures price for January 2020 has decreased by 10 percent since last month (see black arrow). As can be seen in Figure 1, the trend of January (winter) prices exceeding July (summer) prices continues.

Price expectations during the "shoulder months" are above where they were a year ago. The green arrows (see Figure 1 above) point to the "shoulder months" of April 2019 and October 2019. During these months, temperatures are moderate and demand can be met from less expensive generation like nuclear and wind.

The green line in Figure 2 (below) illustrates how investors have responded to the unusually cold winter weather experienced during the "Polar Vortex" of January 2014, the February 2015 cold snap, and January 2019 -- as they form expectations about the price of electricity in coming winter months. In May 2014, the price of a MWh for delivery in January 2015 closed at \$79.30. Investors' fears about the risk of January generation outages seem to be moderating and have returned to pre-Polar Vortex levels.[2] However, the near-term weather outlook (see below) seems to driving the January contract price upwards. The most recent price for January 2020 delivery is \$51.55 – a decrease of 10 percent from the previous month.



Behind these price movements for January futures contracts lie the extraordinary demands for electricity during January 2014 when five of the 10 highest winter demands for electricity ever recorded in the PJM region occurred. PJM set a new, all-time winter

[2] The Federal Energy Regulatory Commission held a hearing about the January 2014 cold snap. The FERC Staff presentation can be found at this link: http://ferc.gov/legal/staff-reports/2014/04-01-14.pdf.

peak demand during the evening of January 7, 2014.[3] PJM reports that these January 2014 cold-weather events resulted in an unusually high level of "forced outages" of generators serving the PJM system; this created a "shortage effect" that drove wholesale prices temporarily higher.[4]

Progress made by PJM in managing extreme winter peak demand was demonstrated during January 2018 when usage achieved levels within the "PJM Top Ten Winter Peaks" (see figure below). PJM President Andy Ott told the U.S. Senate Committee on Energy and Natural Resources on January 23, 2018, that "Preliminary data (Figure 5) shows that overall forced outages during the peak demand hour of the recent cold snap were about half what they were during the Polar Vortex."[5]

Jan. 5 Cold Weather Update

According to a preliminary report, on Thursday, January 31, 2019, at 8 a.m., PJM experienced a peak demand of 139,452 MW; this amounts to the fourth-highest recorded peak.[6] Forced outages by generators were only slightly greater than normal and large price swings were avoided, despite the shutdown of a generating unit at PSE&G's Salem nuclear plant in New Jersey early Thursday after ice formed on the screens protecting its water intake, limiting the flow needed to cool the reactor.[7]

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[3] PJM's previous, all-time winter peak demand was 136,675 MW, on February 5, 2007. PJM GRID MEETS MONTH-LONG CHALLENGES OF COLD JANUARY; January 31, 2014; http://pjm.com/~/media/about-pjm/newsroom/2014-releases/20140131-pjm-grid-meets-month-long-challenges.ashx.

[4] See PJM; "Generation Forced Outages for January 6-8, 2014"; http://www.pjm.com/~/media/documents/reports/20140109-january-2014-cold-weather-peaks-and-generator-outages.ashx.

[5] http://www.pjm.com/-/media/library/reports-notices/special-reports/2018/20180123-testimony-andrew-ott-to-us-senate.ashx.

[6] https://www.pjm.com/-/media/committees-groups/committees/oc/20190205/20190205-oc-cold-weather-ops-january-28-31-info-only.ashx.

[7] "Cold weather forces Salem nuclear unit offline as owner PSE&G presses for subsidies," *Utility Dive*, February 1, 2019.

Retail Residential Electricity Prices

The U.S. Energy Information Administration's (EIA) *Short-Term Energy Outlook (STEO)* reports that retail residential electricity prices are expected to increase by 2.6 percent in 2019 nationwide and a 1.5 percent increase is projected in 2020.[8] Factors other than generation costs are included in the prices reported by EIA, including the cost of continued investment in transmission and distribution infrastructure.

On March 7, 2018, the Public Service Commission of the District of Columbia approved the results of the annual competitive auction for new electric generation rates for default service, called Standard Offer Service or SOS, which went into effect on June 1, 2018. As a result of a competitive auction overseen by the Commission, on average, the rate for SOS (which consists of the generation and transmission price) for a residential SOS customer will decrease by about $2.74 per month for the average user of 644 kWh (kilowatt hour) per month. The residential SOS customer's rate during the summer will decrease from 7.7 cents per kWh to 7.2 cents per kWh, while the winter rate will decrease from 8.2 cents per kWh to 7.9 cents per kWh. On average, the rate for small commercial SOS customers will decrease about $5.59 per month for the average user of 1,763 kWh per month. Overall, residential customers will be subject to an average SOS rate decrease of 5.3 percent, while small commercial SOS customers will be subject to an average rate decrease of 4.3 percent.[9]

The following sections provide a brief discussion of some of the factors affecting this month's outlook, including the three-month weather forecast, the overall economic outlook, and the prices of fuels used in power generation.

Weather Outlook

Sea-surface temperatures in the equatorial Pacific Ocean influence weather patterns across North America; these so-called *La Niña/El Niño* conditions are the primary factor in the three-month temperature outlook which, in turn, impacts investor expectations about future electricity prices.

The National Oceanic and Atmospheric Administration's February 14th *El Niño* watch indicates that weak El Nino conditions are present and are expected to continue through the Northern Hemisphere spring 2019 (~55% chance).[10] NOAA notes that, with a potential *El Niño* condition, above-normal <u>average</u> temperatures are expected in the mid-Atlantic region through the March-April-May period.[11] The arrival of *El Niño* conditions means that greater-than-normal precipitation this winter is more likely. *El Niño* conditions

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8 *February 2019 Short-Term Energy Outlook (STEO)*; Table 7c; http://205.254.135.24/forecasts/steo/.

9 Formal Case No. 1017; Order No. 19290; March 7, 2018.

10 http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/ensodisc.html. "ENSO" means <u>*El Niño* Southern Oscillation</u>; "ENSO-neutral" means that neither *El Niño* nor *La Niña* conditions are present.

11 http://www.cpc.ncep.noaa.gov/products/predictions/90day/fxus05.html.

are also associated with greater variability in both temperature and precipitation which implies increased chances of extreme weather events in our region.

Heating-degree days measure the demand for heating during the winter. EIA reports that heating degree days in our region are projected to be lower in 2019 than in 2018. Projected heating degree days for 2019 are one percent below the ten-year average.[12]

Cooling-degree days measure the demand for air conditioning during the summer. EIA projects cooling-degree days in the Census region that includes the District of Columbia will be four percent fewer in 2019 compared to the ten-year average. The projection for summer 2019 is twelve percent lower than 2018.[13] The long-term warming trend continues.[14]

Economic Growth and Electricity Consumption

The outlook for economic activity in 2018 remains one of moderate growth. Real (inflation-adjusted) gross domestic product (GDP) is expected to increase and to continue bringing down the unemployment rate gradually. Real GDP grew by 2.9 percent in 2018 and is projected to grow by 2.6 percent in 2019 and by 2.1 percent in 2020.[15] Economic growth is unlikely to affect electricity price trends unless it is sustained above three percent.

EIA forecasts that nationwide residential electricity sales (measured in kWh) will decrease by three percent in 2019, followed by a one percent increase in in 2020. Nationwide electricity sales for all sectors will decrease by one percent in 2019 with little increase projected in 2020.[16]

Fuel Prices

In recent years, the cost of fuels for electricity generation has been restrained, with the exception of petroleum-based fuels where the market remains volatile in both directions. This moderate trend is driven by historically low natural gas prices and moderate economic growth. *The cost of natural gas for generation is projected to remain below the $4 level in 2019 and 2020.*[17]

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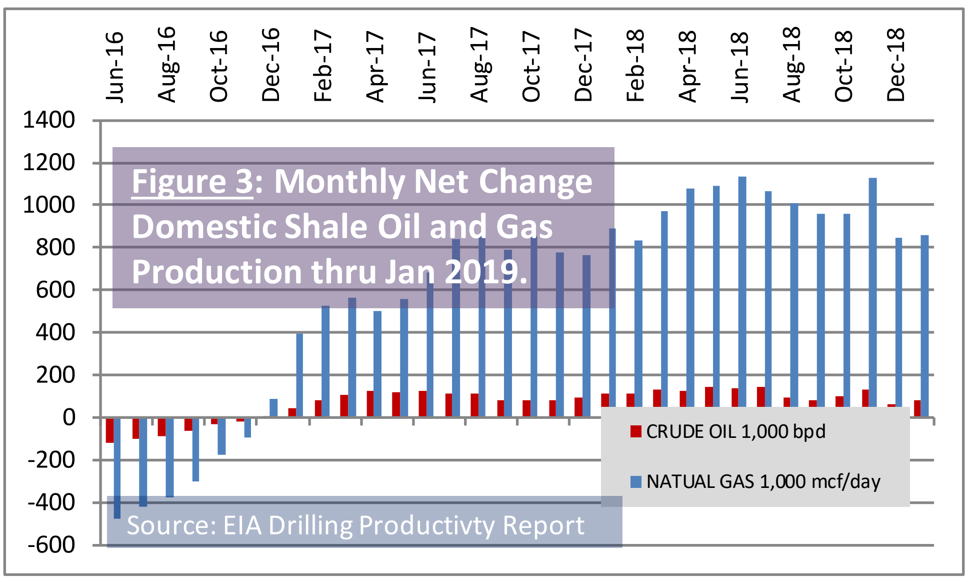
12 *STEO*, Table 9c.
13 *STEO*; Table 9c.
14 NOAA National Climatic Data Center; Contiguous U.S. Temperature 1896 – 2018.
15 *STEO*; Table 1.
16 *STEO*; Table 7b.
17 *STEO*, Table 7a.

Petroleum

OPEC output cuts took hold in January and are having an impact on oil prices.[18] North Sea Brent crude averaged $59 per barrel in January, an increase of $2/bbl since December, but $10/bbl lower than January 2018.[19] Brent crude is forecast to average $61 per barrel in 2019 and $62 per barrel in 2020, down from an average of $71 per barrel in 2018.[20] EIA expects retail gasoline to average $2.47 per gallon in 2019 and and $2.62 per gallon in 2020, compared to $2.73 per gallon in 2018.[21]

U.S. shale oil producers continue to raise their production, acting as a countervailing force to OPEC. EIA reports that domestic crude oil production averaged 12 million b/d in January, an increase of 90,000 b/d from December 2018. EIA projects an average of 12.4 million b/d in 2019 and 13.2 million b/d in 2020 – up from 8.9 million b/d in 2016 and surpassing the 1970 record of 9.6 million b/d. 2018 set an all-time record for total U.S. crude production as well as for a single-year increase.[22]

The latest Monthly *Drilling Productivity Report* from the EIA shows oil and natural gas output increasing in the U.S. shale-producing basins surveyed (see Figure 3 below).[23] Figure 3 illustrates the sensitivity of shale production to crude oil prices which fluctuated greatly in the last three months of 2018.



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18 “Oil Prices Reach Three-Month Highs on OPEC Cuts,” *Wall Street Journal*; February 20, 2019.

19 *STEO, page 7*.

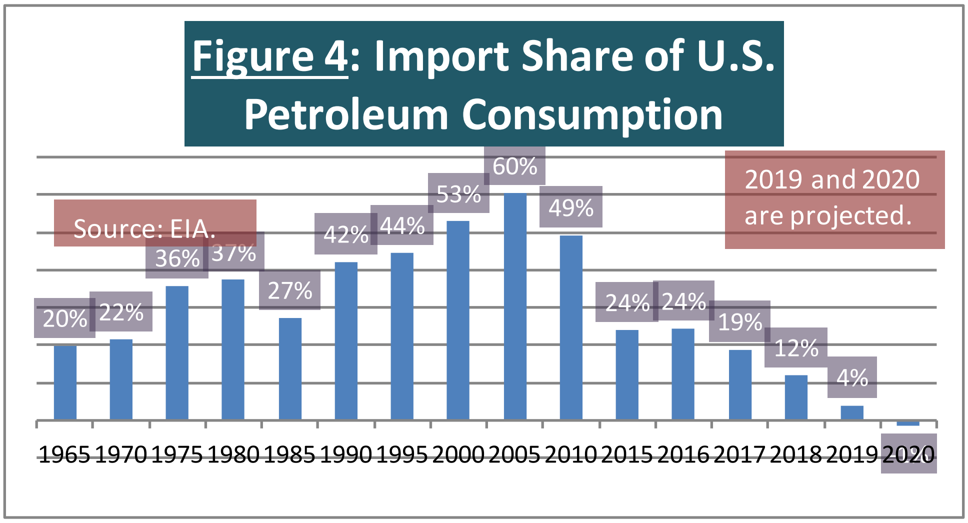
20 *STEO*, page 1. The “North Sea Brent Crude” is the key contract for setting the price of crude oil in international markets.

21 *STEO*, Table 2.

22 *STEO*, pages 1 and Table 4a.

23 See EIA’s monthly *Drilling Productivity Report*; http://www.eia.gov/petroleum/drilling/pdf/dpr-full.pdf.

Net liquid fuel imports to the United States peaked at over 60 percent of domestic supply in 2005 and then fell to 19 percent in 2017 – the lowest level since 1970; this represents a major shift in the structure of world oil markets.[24] EIA projects the net import share to fall even further -- to 12 percent in 2018 and five percent in 2019. The United States is projected to be a net exporter in 2020.[25] See Figure 4 below.



Only time will tell whether the recent increase in domestic output will continue to moderate the price of crude oil. Russia produced 11.4 million barrels a day of crude in 2018, a level unseen since the Soviet Union, while Saudi Arabia reached 10.4 million barrels a day.[26]

Petroleum fuels made up 0.2 percent of the PJM fuel mix during the twelve months ending in December 2018.[27] (See Figure 6 on page 10 below.)

Natural Gas

Natural gas prices are significantly below 2008 levels when the Henry Hub price averaged $8.94 per one million British Thermal Units (MMBtu).[28] Recently, the spot price has recovered from the lows reached in early 2012 when it briefly touched $2 per MMBtu.

Natural gas prices in the spot market result from the interaction of trends in domestic production, growing gas-fired generation, and expected winter heating needs; growing natural gas exports may impact prices in the future. Record domestic production offset rising exports and above-average usage. EIA expects Henry Hub spot prices to

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24 *STEO*; Table 4a. *EIA Monthly Energy Report*; July 2018; Table 3.1; http://www.eia.gov/totalenergy/data/monthly/pdf/mer.pdf.

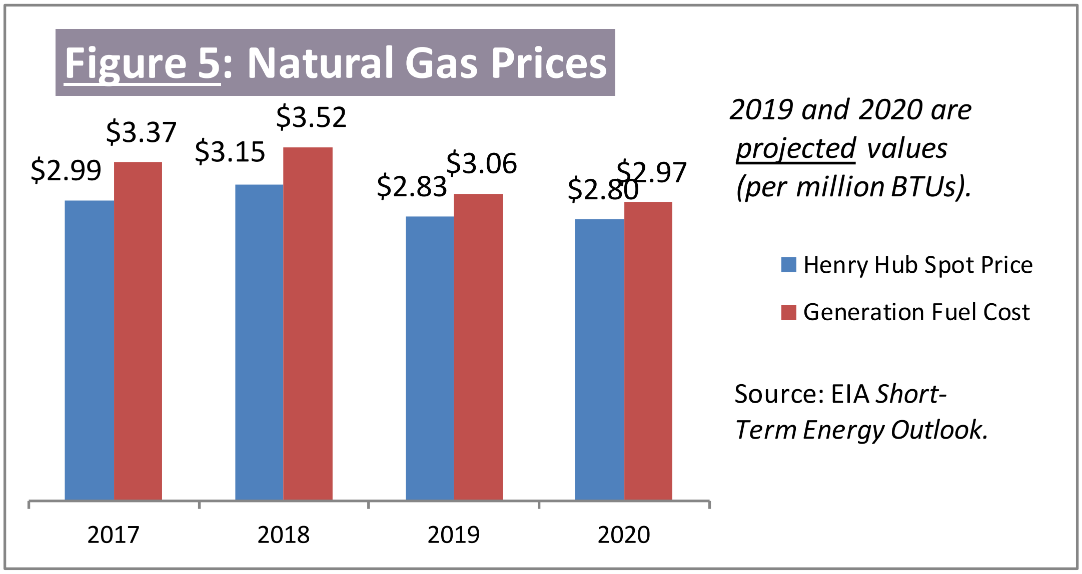
25 *STEO*, Table 4a.

26 *STEO*, Tables 3b and 3c.

27 See PJM System Mix by Fuel; https://gats.pjm-eis.com/gats2/PublicReports/PJMSystemMix/Filter.

28 EIA; *2011 Annual Energy Outlook*; page 115.

average \$2.83/MMBtu for all of 2019 and \$2.80 in 2020.[29] *Natural gas prices now display a <u>downward</u> trend for the short term.*



The Henry Hub spot price is more volatile than the cost of natural gas actually paid by electricity generators where long-term contracts and hedging are typically involved. EIA projects that the cost of natural gas for power generation will fall in 2019 and 2020.[30]

U.S. liquefied natural gas (LNG) export capcity is growing. Sabine Pass LNG (Texas) began export operations in February 2016; and commercial exports from Dominion Energy's Cove Point LNG in Maryland have begun.[31] EIA reports that Cove Point utilized 94 percent of its capacity in May. EIA expects exports to grow faster than domestic production, possibly putting modest upward pressure on natural-gas prices; EIA expects LNG export capacity to more than double by the end of 2019.[32]

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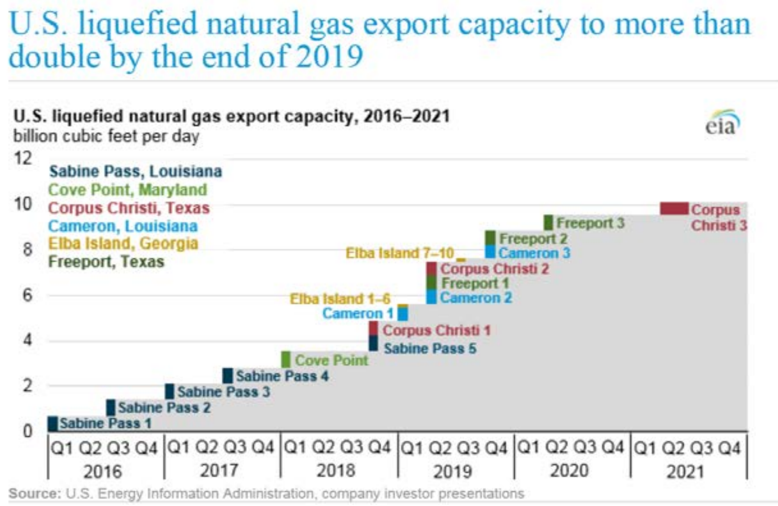
29 *STEO*; page 2.

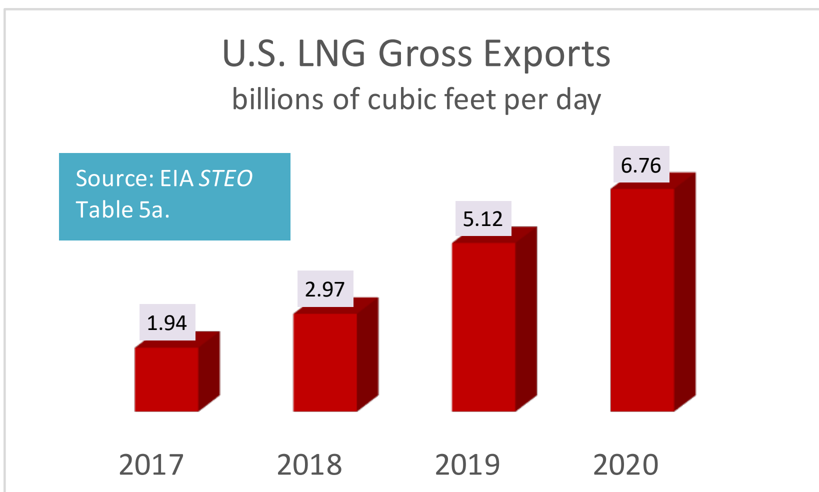
30 *STEO*; Table 7a.

31 U.S. Cove Point LNG terminal begins commercial LNG deliveries; *Reuters*; April 16, 2018. https://www.reuters.com/article/us-dominion-covepoint-lng/u-s-cove-point-lng-terminal-begins-commercial-lng-deliveries-data-idUSKBN1HN1JX.

32 See Table 5a and https://www.eia.gov/todayinenergy/detail.php?id=37732. "Bcf/d" is billion cubic feet per day.



The gap between projections for LNG export capacity (above) and projected amounts (below) suggests that not all of the new capacity under construction is committed by supply contracts.



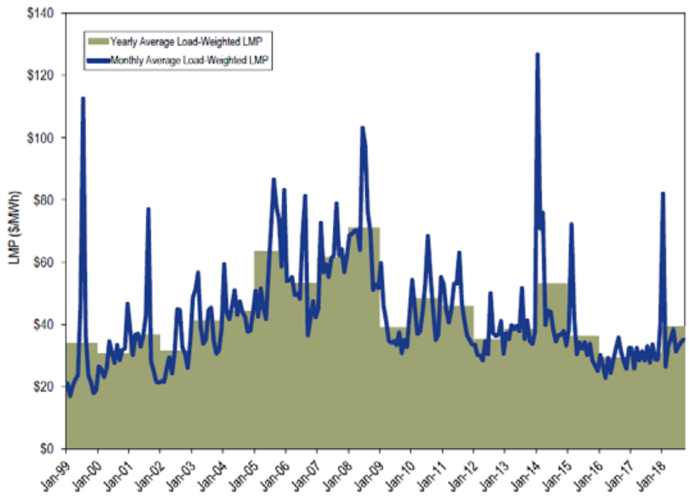
Regional variations in natural-gas prices also impact regional wholesale electricity markets like PJM – influenced by local gas production and the availability of gas pipeline transportation capacity. The *Wall Street Journal* reports that plentiful natural gas in the Appalachian region has fueled an expansion of gas-fired generation and depressed electricity prices in the PJM wholesale market.[33] This is confirmed in a brief analysis from EIA: *Natural-gas fired plants are being added and used more often within the region served by PJM Interconnection.* EIA explains that gas-fired capacity has being growing in the region

33 "Power Plants Bloom Even as Electricity Prices Wilt," *Wall Street Journal*, December 28, 2017.

and that gas-fired generation has a rising "capacity factor" which combine to increase megawatthours generated by natural gas.[34]

The long-term impact of inexpensive natural gas can be seen easily in PJM price trends. "Figure 3.47" (below) shows the monthly and annual average load-weighted LMP for 1999 through September 2018.[35] Annual average LMP has declined since natural-gas prices peaked in 2008. Note the January price spike in 2018, the result of extreme winter cold.

Figure 3-47 Real-time, monthly and annual, load-weighted, average LMP: January 1999 through September 2018



Natural gas accounted for 31.1 percent of the PJM fuel mix during the twelve months ending in December 2018, a significant increase from 16.4 percent in June 2014.[36] (See Figure 6 below.)

<u>Coal</u>

Coal has been displaced by natural gas, wind, and nuclear in electricity generation. Nationwide, coal consumption in electric power generation has not returned to the peak level of 2007. EIA estimates that coal production was 774 million short tons (MMst) in 2017, six percent higher than in 2016. EIA expects that coal production will decline by 4.2 percent in 2019 followed by a further 5.6 percent decrease in 2020.[37]

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[34] U.S. EIA; *Natural-gas fired plants are being added and used more in PJM Interconnection*; October 17, 2018. https://www.eia.gov/todayinenergy/detail.php?id=37293.

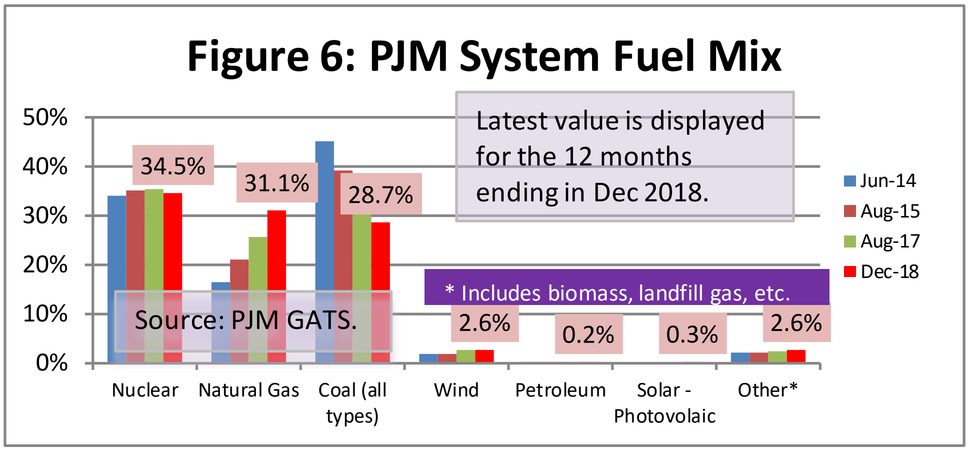
[35] Independent Market Monitor*; Q3 2018 State of the Market Report for PJM January through September (November 8, 2018);* page 179. LMP means "locational marginal price" which refers to the price-setting methodology used in PJM's wholsesale electricity market.

[36] See PJM.

[37] *STEO*; Table 6. Historical data can be found at http://www.eia.gov/totalenergy/data/annual/pdf/sec7_9.pdf. See also The Brattle Group; Coal Plant

EIA reports that the delivered price of coal for power generation peaked at $2.39 in 2011. EIA estimates the delivered price of coal averaged $2.06 per MMBtu in 2018, and forecasts $2.07 per MMBtu in 2019 and $2.08 in 2020.[38]

In the PJM wholesale market that serves the District of Columbia, the cost of natural gas is a more important factor than coal in setting the overall level of wholesale market prices for electricity.[39] Coal represented 28.7 percent of the PJM fuel mix during the twelve months ending in December 2018, down from a recent high of 45.2 percent in June 2014.[40] As noted above, the natural gas share of PJM generation is rising, in line with national trends. Coal has fallen to third place behind nuclear and natural gas a share of the PJM fuel mix. (See Figure 6 below.)



Across the United States, coal generation plants are being retired and new natural gas-fired generation plants are being built, mirroring trends in the PJM region. EIA projects that the natural gas share of electricity generation nationwide will rise from 35 percent in 2018 to 37 percent in 2020. Coal's share of generation will fall to 26 percent in 2019 and will fall to 24 percent in 2020, down from 28% in 2018.[41] EIA's forecasted generation shares for coal and natural gas are very sensitive to the natural-gas price forecast.

<u>Renewables</u>

EIA reports that solar capacity is growing rapidly nationwide, with utility-scale solar expected to grow by 99 percent from 2016 to 2020. At that rate, utility-scale solar will be

Retirements: Feedback Effects on Wholesale Electricity Prices; November 2013; http://www.brattle.com/system/news/pdfs/000/000/584/original/Coal_Plant_Retirements_-_Feedback_Effects_on_Wholesale_Electricity_Prices.pdf.

38 *STEO*; Table 7a.

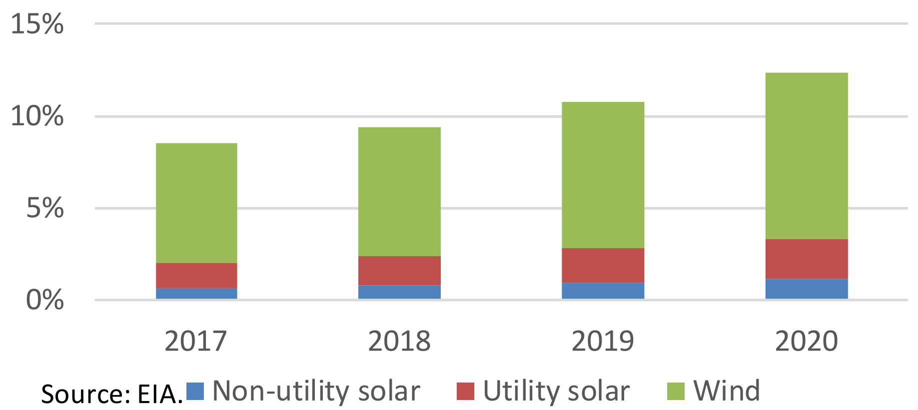
39 EIA reports prices for coal as delivered under long-term contracts that are less volatile than the spot prices reported for other fossil fuels. See Table 6, *STEO*.

40 See PJM.

41 *STEO;* page 14.

more than one percent of electricity generation capacity in 2018. Wind capacity is growing rapidly across the country as well, increasing by 40 percent during 2016-2020.[42]

Figure 7: Wind and Solar are a Growing Share of U.S. Electricity Generation



Source: EIA.

Nationwide, EIA projects that generation of electricity from all nonhydropower renewables will provide more than 10 percent in 2019 and may reach 13 percent in 2020.[43] Wind will generate more electricity than hydropower for the first time in 2019. Generation from utility-scale solar is projected to rise by 65 percent between 2017 and 2020.[44]

Renewable Portfolio Standards ("RPS") enacted by many states are stimulating the rapid growth of solar in the PJM market. This stimulus will intensify as scheduled increases will raise the RPS for solar in coming years, as shown in "Table 8-6" below.[45]

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42 *STEO*; Table 8b.

43 *STEO* at page 2.

44 *STEO* at Table 8b.

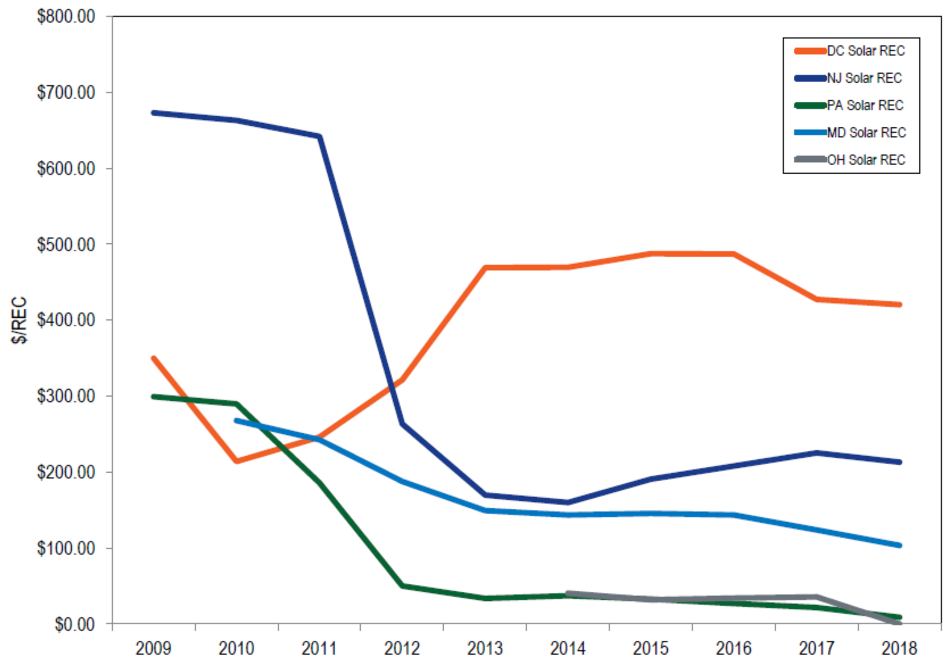
45 Independent Market Monitor; *Q3 2018 State of the Market Report for PJM* (November 8, 2018); page 351.

Table 8-6 Solar renewable standards by percent of electric load for PJM jurisdictions: 2018 to 2030

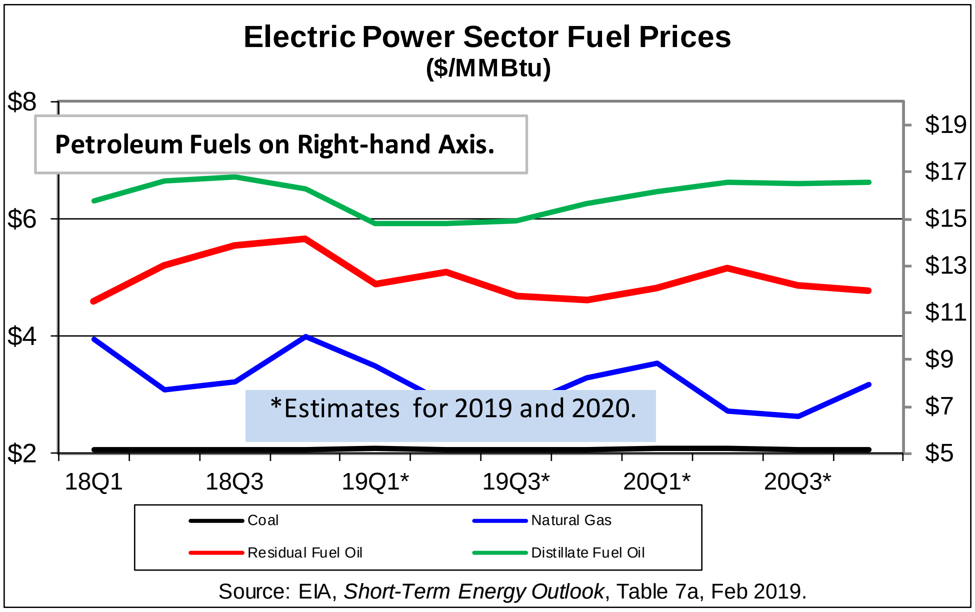
Jurisdiction with RPS	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Delaware	1.75%	2.00%	2.25%	2.50%	2.75%	3.00%	3.25%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%
Illinois	0.78%	0.87%	0.96%	1.05%	1.14%	1.23%	1.32%	1.41%	1.50%	1.50%	1.50%	1.50%	1.50%
Maryland	1.50%	1.95%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%
Michigan	No Minimum Solar Requirement												
New Jersey	4.30%	4.90%	5.10%	5.10%	5.10%	4.90%	4.80%	4.50%	4.35%	3.74%	3.07%	2.21%	1.58%
North Carolina	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%	0.20%
Ohio	0.18%	0.22%	0.26%	0.30%	0.34%	0.38%	0.42%	0.46%	0.50%	0.50%	0.50%	0.50%	0.50%
Pennsylvania	0.34%	0.39%	0.44%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
Washington, D.C.	1.15%	1.35%	1.58%	1.85%	2.18%	2.50%	2.60%	2.85%	3.15%	3.45%	3.75%	4.10%	4.50%
Jurisdiction with Voluntary Standard													
Indiana	No Minimum Solar Requirement												
Virginia	No Minimum Solar Requirement												
Jurisdiction with No Standard													
Kentucky	No Renewable Portfolio Standard												
Tennessee	No Renewable Portfolio Standard												
West Virginia	No Renewable Portfolio Standard												

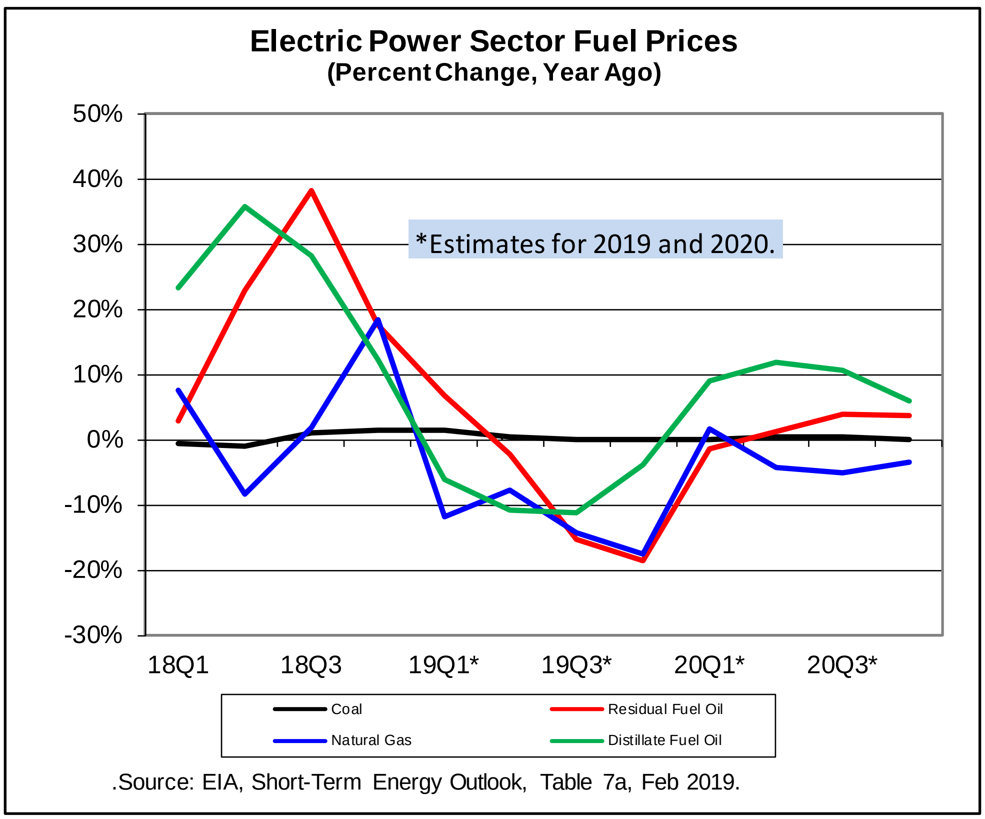
Prices for Solar Renewable Energy Credits ("SRECs") are much higher in the District of Columbia than in neighboring jurisdictions, as can be seen in "Figure 8-7" below.[46]

Figure 8-7 Average SREC price by jurisdiction: January 2009 through September 2018



46 Independent Market Monitor; *Q3 2018 State of the Market Report for PJM* (November 8, 2018); page 352.


Electric Power Sector Fuel Prices
($/MMBtu)
Petroleum Fuels on Right-hand Axis.
*Estimates for 2019 and 2020.
$8
$6
$4
$2
$19
$17
$15
$13
$11
$9
$7
$5
18Q1
18Q3
19Q1*
19Q3*
20Q1*
20Q3*
Coal
Natural Gas
Residual Fuel Oil
Distillate Fuel Oil
Source: EIA, Short-Term Energy Outlook, Table 7a, Feb 2019.


Electric Power Sector Fuel Prices
(Percent Change, Year Ago)
*Estimates for 2019 and 2020.
50%
40%
30%
20%
10%
0%
-10%
-20%
-30%
18Q1
18Q3
19Q1*
19Q3*
20Q1*
20Q3*
Coal
Residual Fuel Oil
Natural Gas
Distillate Fuel Oil
.Source: EIA, Short-Term Energy Outlook, Table 7a, Feb 2019.

Wholesale Electric Market Assessment Information

Price of Electricity Futures Contracts for January 17, 2019 and February 21, 2019

Twelve Month NYMEX Strip Components[47]

$/MWh (for $/kWh, divide by 1000)

	Jan-19	Feb-19
Mar-19	$ 44.55	$ 35.85
Apr-19	$ 38.10	$ 36.05
May-19	$ 38.30	$ 36.50
Jun-19	$ 36.15	$ 35.15
Jul-19	$ 41.10	$ 39.90
Aug-19	$ 37.70	$ 37.30
Sep-19	$ 36.95	$ 36.70
Oct-19	$ 34.90	$ 35.05
Nov-19	$ 35.00	$ 35.00
Dec-19	$ 39.20	$ 38.00
Jan-20	$ 57.25	$ 51.55
Feb-20	$ 54.25	$ 48.60
Mar-20	$ 41.15	$ 38.90

PEPCO DC Zone Locational Marginal Price (Hourly Integrated LMP for the hour ending 1000)[48]

February 21, 2019: **$27.40**

The above are wholesale energy prices only. Transmission and distribution rates are not included.

Weather Forecast

1. Current for next few days to one week:

   http://www.cnn.com/Weather/

   http://home.accuweather.com/

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