

A Tale of Two Polar Vortices

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Matthew Hong
Director of Research, Power and Gas
+1 312 244-7649
matthew.hong@morningstar.com

Data Sources Used in This Publication
PJM
EIA
PointLogic
NGI
NOAA

Polar Vortex

Last week, over 100 million people in the United States experienced some of the coldest temperatures seen in some time. Temperatures in the Midwest hit historic lows with some areas breaking decades-long records for cold. Temperatures in Chicago hit negative 23 degrees Fahrenheit, with wind chills making it feel 30 degrees colder. The last polar vortex was in 2014, and structural changes to the generation portfolio in PJM created a significantly different environment this time around. This piece looks at how this recent polar vortex differed from the one seen in 2014.

Comparing the Two Polar Vortices

The last polar vortex occurred in January 2014, with U.S. heating degree days that month hitting 957. Although January 2019 started on the moderate side, it definitely ended much colder (Exhibit 1) with 854 heating degree days. The National Oceanic and Atmospheric Administration's December 2018 forecast predicted 885 heating degree days for January, which ended up overshooting actuals by 31 heating degree days.

Exhibit 1 CONUS Heating Degree Days in January (Degree Days)

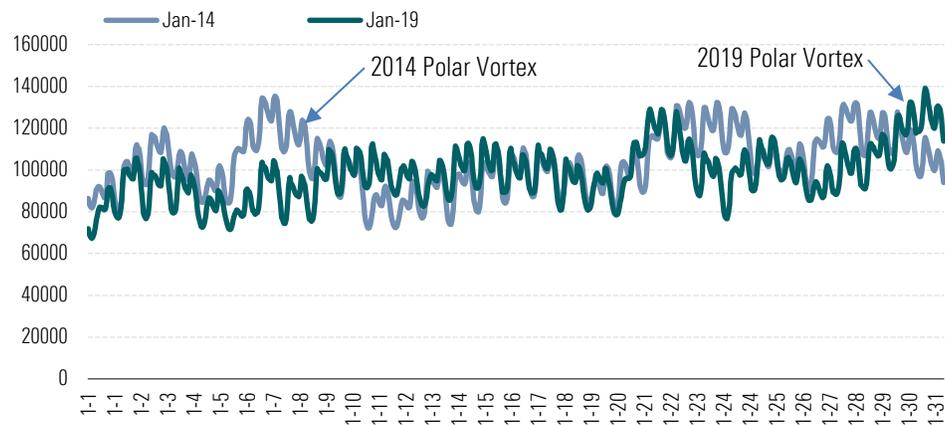


Source: NOAA

The monthly PJM peak load this January actually exceeded 2014 by a little over 3,800 MW (Exhibit 2). January 2014 peak load hit 135,000 MW compared with 139,000 MW seen last week. The historic cold also generated an uptick in natural gas demand, with lower-48 res/com consumption slightly above what was seen in January 2014 by 0.10 Bcf/d with January 2019 estimates coming in at 52 Bcf/d.

Although some areas along PJM's periphery in the Midwest experienced considerable challenges, the PJM region itself performed pretty well during last week's cold snap. Despite operational challenges from freeze-offs and pipeline disruptions, natural gas prices showed considerable resiliency.

Exhibit 2 January Daily Load (MWh)



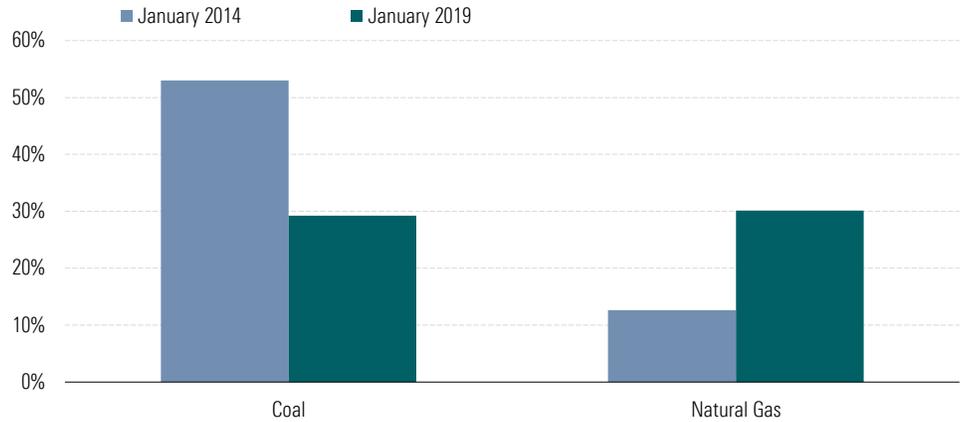
Source: PJM

Changing Landscape

While there are some similarities between the 2014 and 2019 polar vortices, one of the largest differences lies in changes to the electricity generation stack and the supply of natural gas. Natural gas production grew over the past five years with lower-48 output increasing by 16 Bcf/d, from 70 Bcf/d in January 2014 to 86 Bcf/d in January 2019. Easy access to cheap natural gas from the Marcellus/Utica basin over the past five years has expanded the natural gas generating fleet in PJM as well as the pipeline transport network, which has helped keep power prices generally low.

Changes to the generation stack came primarily from coal to natural gas switching. In January 2014, coal represented slightly over 50% of electricity generation in PJM, while natural gas only accounted for 13% (Exhibit 3). Fast forward to January 2019, and we see a significantly different picture. Coal generation accounted for 29% of PJM's generation, falling slightly behind the 30% generated by natural gas during the same month. During the peak cold last week, coal generation as a percent of total generation only hit 37%. One interesting thing to note is that coal generation peaked briefly at 40% on Jan. 21, likely a result of the TETCO pipeline explosion in Noble County, Ohio. Despite the pipeline disruptions, the natural gas system was able to adjust pretty well. While coal was still leaned on to ensure reliability during the recent vortex, the trend toward greater reliance on natural gas continues.

Exhibit 3 Monthly Average Coal and Natural Gas Generation (% of Total Generation)



Source: PJM, EIA

The Result of Natural Gas

Power prices remained relatively stable this time around when compared with the last polar vortex. PJM day-ahead on-peak prices in January 2014 settled at \$168.89/MW compared with \$37.37/MW for January 2019. Natural gas prices also settled at lower levels over the course of the month. The NGI daily Appalachian average for January came slightly above \$3.00/mmbtu compared with a little over \$2.00/mmbtu in January 2014. Interestingly, heat rates stayed in a much tighter range during the 2014 polar vortex, peaking at 15.9 mmbtu/MWh. That compares with a wider 24.4 mmbtu/MWh seen on Jan. 31, 2019 (Exhibit 4). The tighter range in 2014 probably reflected the larger coal fleet and tighter natural gas supply compared with today. Although coal generation moved up in response to greater demand this time around, the natural gas sector showed immense flexibility in the face of the latest weather event, which may spell lower prices in the years to come.

Exhibit 4 January 2014 and January 2019 Heat Rate (Mmbtu/MWh)



Source: NGI, PJM, Morningstar

Conclusion

The recent polar vortex highlighted just how much the northeast and the PJM system have changed over the last five years. Increased natural gas supply, greater flexibility on the pipeline system, and changes to the generation fleet created a totally different environment than the one seen five years ago. PJM's fuel security analysis touted the reliability of its system in the face of fundamental changes to the power generation portfolio, and last week provided the first test case of those assumptions in several years. Power and natural gas prices stayed relatively subdued in the face of higher demand and operational challenges on the pipeline system, highlighting the improvements to the grid and PJM's ability to reliably meet demand in spite of generational weather systems. ■■

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For More Information

+1 800 546-9646 North America

+44 20 3194 1455 Europe

commoditydata-sales@morningstar.com



22 West Washington Street
Chicago, IL 60602 USA

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