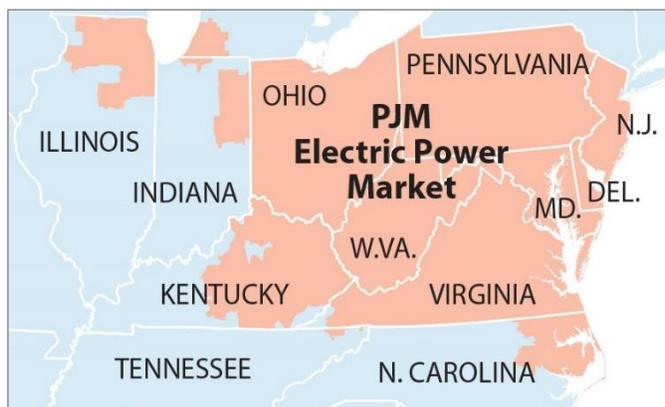


Risks Outweigh Rewards for Investors Considering PJM Natural Gas Projects

Executive Summary

Financial entities take heed: Investing in natural gas-fired power plant development in the Pennsylvania-New Jersey-Maryland (PJM) region—the largest independent power system operator (ISO) in the United States—entails substantial risk. Development has become increasingly perilous in the past several years, and there is rising uncertainty about the financial viability of new gas plant projects.

In this report, Applied Economics Clinic and the Institute for Energy Economics and Financial Analysis (IEEFA) have identified six overarching threats that pose growing risks for investors in new PJM gas-fired power plants. These threats are:



- **Increasing price competitiveness of clean solar, wind, demand response and battery storage alternatives.**

Renewable energy will grow in PJM as costs continue to fall, making it more economic than conventional fossil resources. Load flexibility resources like battery storage, demand response and energy efficiency also will become increasingly important, helping to integrate high levels of renewable generation.

- **Significant existing overcapacity, flat demand growth and market turmoil.**

PJM's summer reserve margin in 2018 was almost 33 percent, more than twice the ISO's target, undercutting the need for any new capacity. U.S. regulators ordered changes to PJM's capacity market that resulted in controversy; the dispute has delayed the ISO's capacity auction by almost a year, with no certainty about when or how it will be resolved.

- **High-impact, unpredictable global events such as COVID-19 that radically reshape markets and expectations of future demand.**

The pandemic cut daily peak load in PJM by roughly 13.5 gigawatts (GW), and the system operator says it may be 2023 before demand fully recovers.

- **Uncertainty over the future direction of gas prices, particularly given the substantial increase in U.S. liquefied natural gas (LNG) exports.**

U.S. gas prices are now increasingly tied to international markets, making long-term predictions increasingly uncertain and significantly raising risks for new gas plant development.

- **Actions by state governments within the PJM market to limit future fossil fuel generation and/or even withdraw from the market entirely.**

Illinois, New Jersey and Virginia already have aggressive clean energy goals that likely will limit future fossil fuel plant development; other states in the region are weighing similar actions. Illinois, Maryland and New Jersey are considering exiting PJM.

- **Public opposition that can delay project development and raise overall costs.**

Projects must overcome both local opposition, stemming from concerns about water and air quality impacts, as well as broader regional and national concerns about contributions to climate change. Delays are costly and raise the possibility of major changes in the marketplace before the project is completed.

The body of the report begins with an introduction to the PJM market. Next, AEC and IEEFA present an in-depth analysis of the threats outlined above and how they undercut the rationale for future gas-fired combined cycle power plant development in the PJM region.

Individually, each of these risks could perhaps be factored into a project's financing. Taken together, they pose virtually insurmountable hurdles for new gas-fired projects in the region. This is clearly a case of buyer (or financier) beware—the headwinds facing new PJM gas plants are growing stronger and stronger.

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Introduction

Investments made today in U.S. natural gas-fired power plants are at risk due to rapidly changing market conditions that force gas power onto the margin and increase the likelihood of these assets becoming stranded before the end of their useful life. This report examines how the landscape for gas-fired power plant development in the United States' PJM region has changed dramatically over the last five to 10 years: Gas projects are facing potentially crippling delays; peak electric demand growth has been almost flat since 2002; electric generating capacity is oversupplied; gas prices are volatile; renewable energy is increasingly cost-competitive; and existing and forthcoming state-level climate and clean energy policies are limiting the potential lifetime of new gas plants.

Pennsylvania-New Jersey-Maryland (PJM) is the largest independent power system operator (ISO) in the United States and is responsible for coordinating the flow of electric power to more than 65 million electric customers across 13 U.S. states and the District of Columbia. This report addresses risks for new gas plants in the PJM Interconnection. The sections that follow assess six substantial risks to 11 proposed gas-fired combined cycle plants in PJM (see Table 4.)

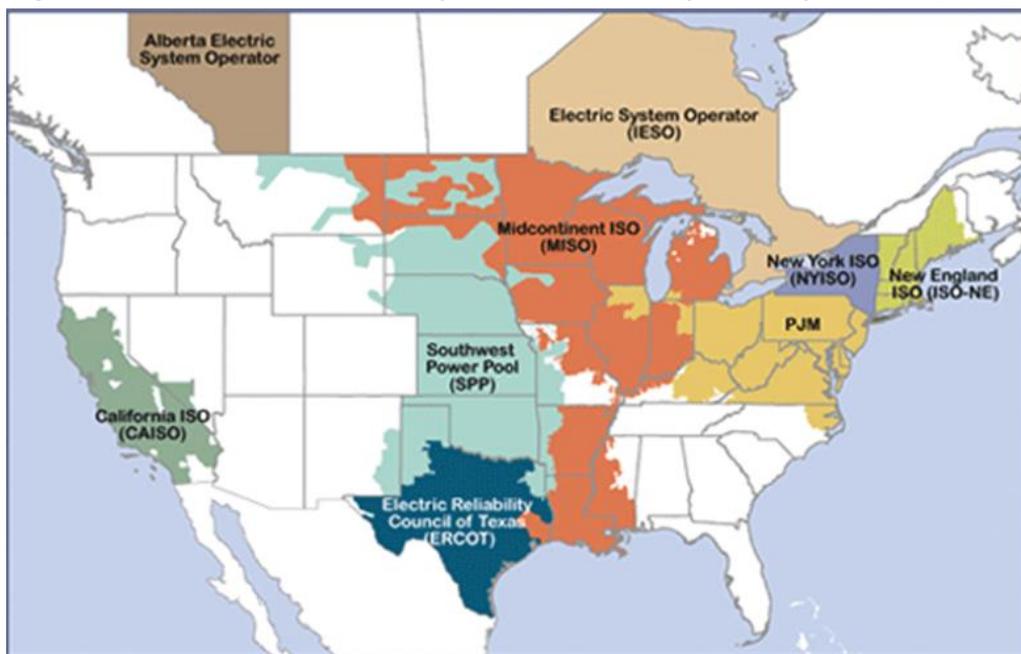
Table 1: Summary of Risks To New Natural Gas Plants in PJM

Risk	Summary
1 Renewable energy, battery storage and load flexibility resources: cost-competitive, reliable, resilient	PJM has fallen behind other U.S. grid operators in renewable energy development, even though renewables are cost-effective, reliable and resilient. There are signs that the conditions that have favored gas development in lieu of renewable development in PJM are shifting rapidly, and renewable energy will fare better in an uncertain energy future because it has no fuel cost and very low operations/maintenance costs relative to gas power.
2 Capacity oversupply: uncertainty and upheaval	Despite just 1 percent growth in peak demand since 2002, PJM's total generating capacity has grown disproportionately by 173 percent. In addition to finding itself in a position of overcapacity, PJM is also currently being ordered by FERC to overhaul its capacity market.
3 High-risk global events: unexpected consequences and conditions of uncertainty	World events like COVID-19 and/or extreme weather can and do have severe impacts on existing and proposed gas plants and their investors, including operational disruptions, financial losses and even legal liability.
4 Increasing and volatile gas prices: rapidly changing conditions and heavy reliance on LNG exports	Gas prices are projected to increase over the next two to three decades, particularly as demand rises for exports of LNG from the United States. LNG export terminals are expensive to build and difficult to guide through the U.S. permitting process, exacerbating natural gas price uncertainty. The future impact of COVID-19 on gas prices is uncertain, another source of risk for new gas plants.
5 State action impacting gas plants: clean energy and climate goals shorten the lifespan of new gas	Most states in PJM's service territory have some form of clean energy or climate legislation in place. Nevertheless, investors continue to finance new gas power plants and pipelines with expected lifetimes that exceed legal end-dates for fossil fuel generation, raising the risk of stranded assets.
6 Project delays: commonplace and potentially ruinous for new gas power plants	Gas project delays are common and often the result of higher than anticipated project costs, obstacles to project financing and/or grassroots opposition. In rapidly changing and uncertain conditions, project delays may lead to project cancellation.

What is PJM?

The Pennsylvania-New Jersey-Maryland (PJM) Interconnection is the largest independent power system operator (ISO) in the United States, serving more than 65 million electric customers.¹ Despite its name, PJM coordinates the power flow from generators to local utilities across all or parts of 13 states and the District of Columbia:² Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia and West Virginia.³

Figure 1: North American Independent Power System Operators (ISOs)



Source: Reproduced from *POWER Engineering*, April 7, 2020. “ERCOT: Load impact of COVID-19 minimal so far”.

PJM is divided into 21 transmission zones (see Figure 2) linked by an extensive network of transmission lines, allowing relatively unimpeded movement of electricity within the region. PJM’s transmission zones each have their own transmission facilities (i.e., poles, wires and electrical substations) and also buy and sell guarantees of electric capacity as needed in PJM’s capacity market.⁴ Each zone has its own energy prices based on the location and timing of its delivery, in a system known in the United States as locational marginal pricing (LMP).⁵ The goal of using an LMP system is to support the efficient and reliable operation of energy

¹ PJM. No date. “Who we are.”

² NRDC. No date. “PJM Explained.”

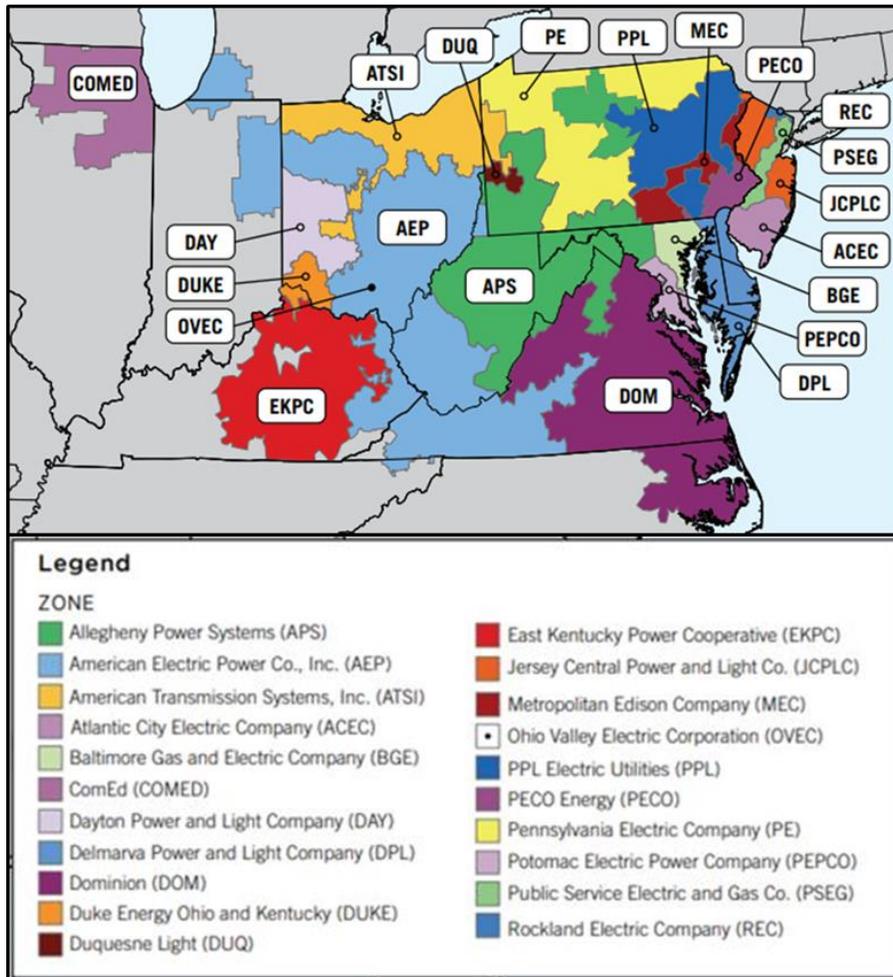
³ 1) Florence School of Regulation. February 11, 2019. “Zonal versus Nodal Electricity Pricing: the PJM experience.” European University Institute. 2) PJM. No date. “Who we are.”

⁴ PJM. No date. “Maps.”

⁵ PJM. February 23, 2017. “Locational Marginal Pricing.”

resources where prices successfully reflect energy purchases and sales, transmission congestion and losses within the power system.^{6,7}

Figure 2: Map of PJM Transmission Zones

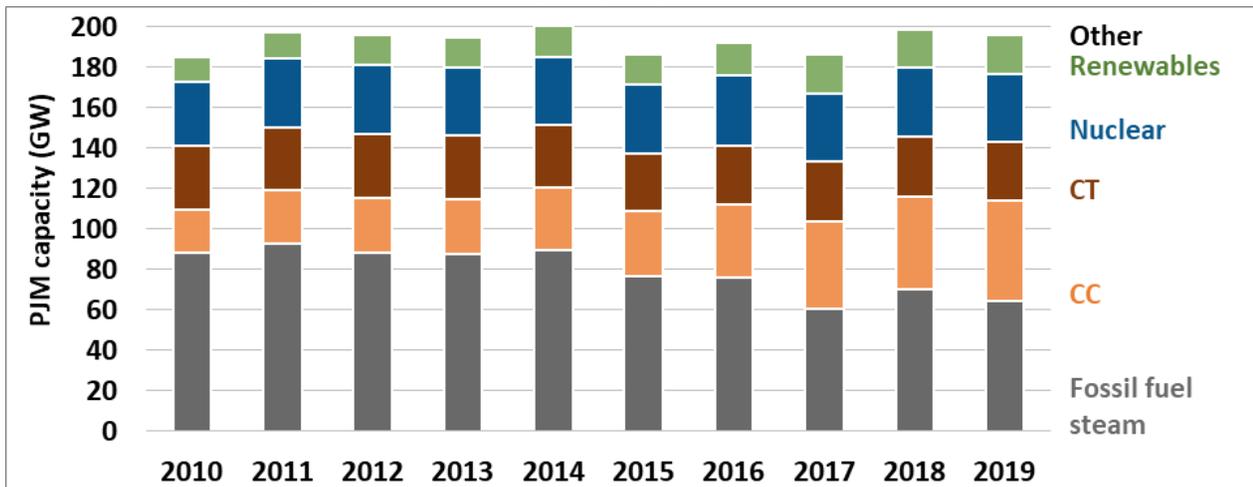


Source: Reproduced from PJM. 2020. "Territory Served". Map edited for size by AEC.

PJM currently coordinates electric capacity totaling nearly 200 gigawatts that generate more than 820 terawatt-hours (TWh) annually.⁸ Electric capacity and generation in PJM are dominated by fossil fuel steam resources (mostly coal-fired), natural gas-fired combined cycle plants (CC) and combustion turbines (CT), and nuclear units (see Figure 3 and Figure 4). These resources account for 89 percent of PJM's 2019 total capacity and 95 percent of its 2019 total generation.

⁶ PJM. April 16, 2019. *The benefits of the PJM interconnection system*. p.4.
⁷ PJM. July 13, 2017. "Locational Marginal Pricing Components." p.3.
⁸ PJM. May 2020. *PJM 2019 Financial Report*. p.3.

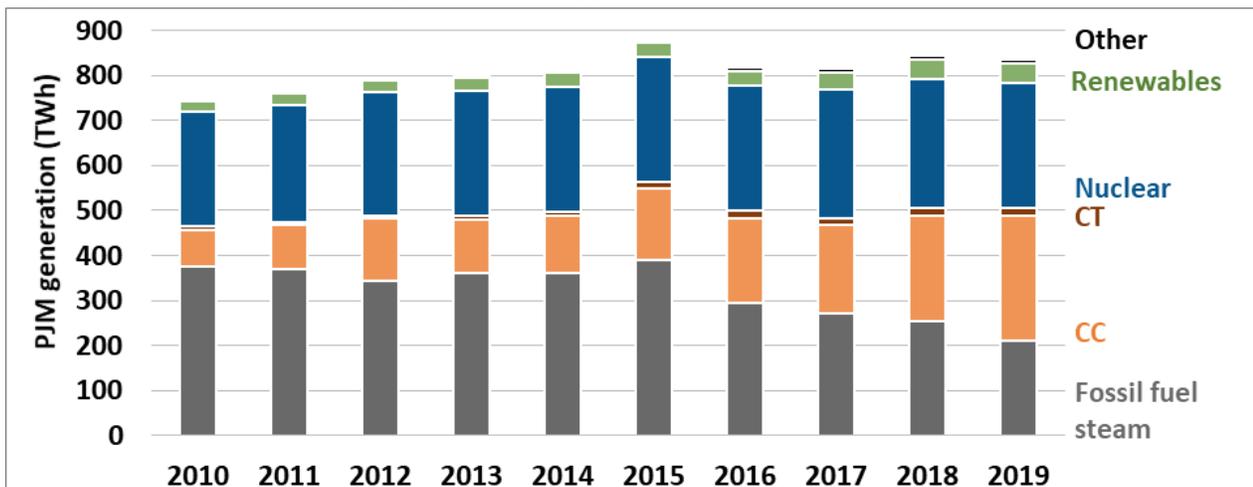
Figure 3: PJM Capacity by Resource Type (GW), 2010-2019



Note: Excluding storage, which totaled 0.351 GW of capacity in 2019.

Source: PJM. 2019. 2010-2019 State of the Market Report for PJM.

Figure 4: PJM Generation by Resource Type (TWh), 2010-2019



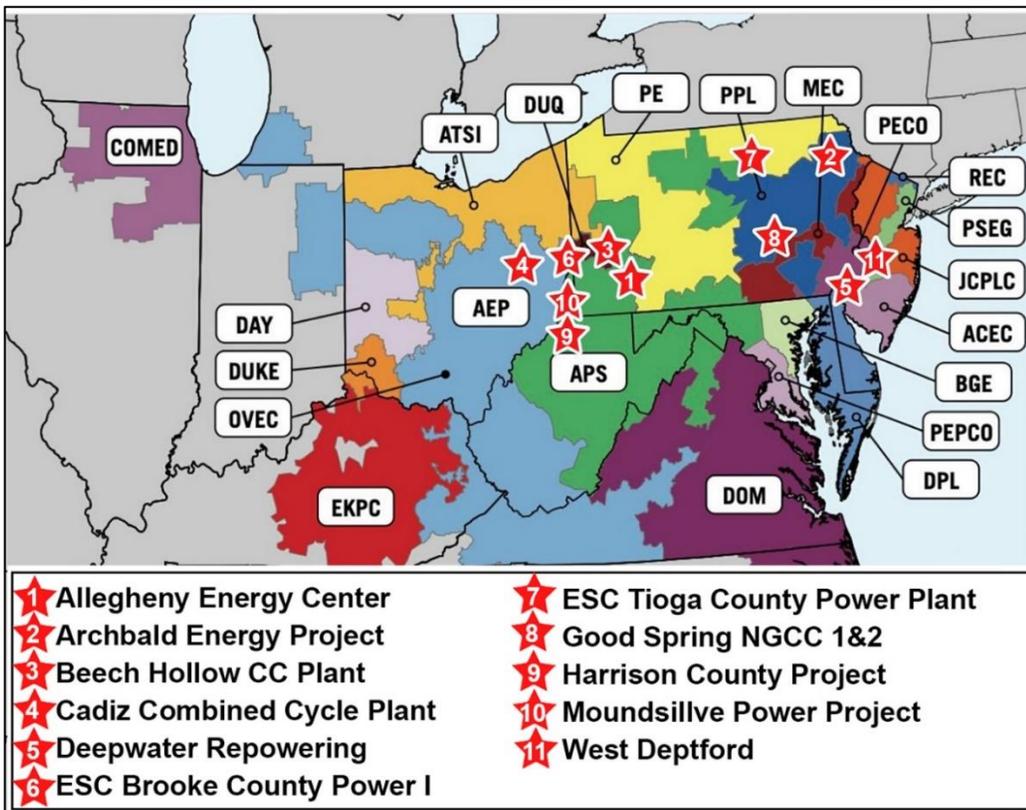
Note: Excluding storage and solar, for which generation totaled 19 GWh and 2.7 TWh, respectively, in 2019, according to PJM.

Source: 2010-2019 PJM State of the Market Report.

Between 2010 and 2019, the share of PJM’s total electric capacity fueled by fossil fuel steam has fallen from 47 percent to 33 percent—while generation from fossil fuel steam has been cut in half, falling from 50 percent to 25 percent of total generation. During the same period, the share of gas-fired capacity (including both gas-fired CCs and CTs) has grown from 29 percent to 40 percent, and its share of total generation has tripled, growing from 12 percent to 36 percent. Renewable wind, solar and battery storage resources have grown from 2 percent to 6 percent of total capacity—primarily due to large-scale investment in wind resources—and from 1 percent to 3 percent of total generation. (Section 5 of this report addresses the development of renewable energy resources in PJM in more detail.)

The landscape for gas development in PJM has changed dramatically since 2010. Installed gas combined cycle capacity has grown from 22 GW in 2010 to 50 GW in 2019, and gas combined-cycle generators alone account for 46 percent of new capacity added between 2010 and 2019. Between 2013 and 2017, PJM’s growth in gas-fired capacity was the largest of any U.S. grid operator.⁹ This report considers 11 gas-fired combined-cycle plants in early stages of development in PJM across four states: New Jersey, Ohio, Pennsylvania and West Virginia (see Figure 5—which shows PJM’s 21 transmission zones as well as the 11 proposed plants. This may not be an exhaustive list of currently proposed gas plants in PJM).

Figure 5: PJM Proposed Gas Plants in Early Development



Source: Reproduced from PJM. 2020. “Territory Served”. Map edited to include PJM’s proposed natural gas plants by AEC.

Project developers in PJM now face myriad challenges that affect new gas development, including flat demand growth, overcapacity and overhaul of its capacity market by the Federal Energy Regulatory Commission (FERC),^{10,11} all taking place in the context of the COVID-19 global pandemic. The remainder of this report

⁹ U.S. EIA. October 17, 2018. “Natural gas-fired power plants are being added and used more in PJM Interconnection.”

¹⁰ Tsao, S., Martin, R. December 3, 2019. “Overpowered: PJM market rules drive an era of oversupply.” S&P Global Market Intelligence.

¹¹ Morehouse, C. June 4, 2020. “PJM: MOPR compliance plan aims to avoid FERC’s ‘immense’ and ‘unreasonable’ burden.” Utility Dive.

presents six substantial risks to proposed PJM gas power plants: cost-competitive renewables, battery storage and load flexibility resources; PJM capacity oversupply; high impact global events; rising U.S. LNG exports; project delays; and state action affecting gas plants.

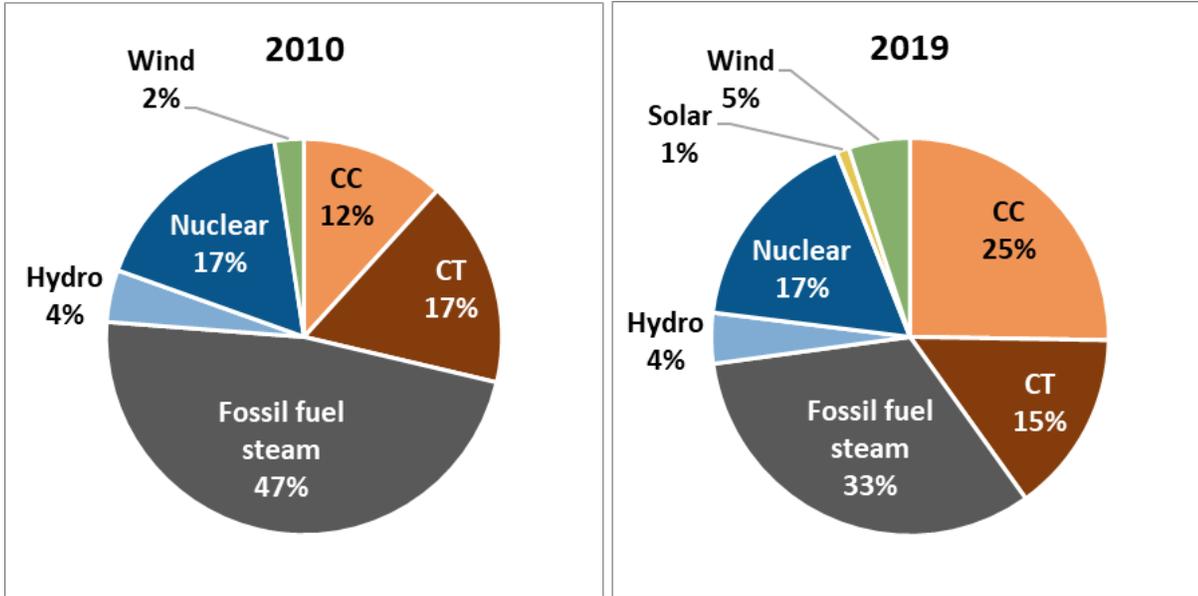
1. Renewable Energy and Other Zero-Carbon Resources: Cost-Competitive, Reliable, Resilient

During the past decade, substantial coal-fired capacity has been retired across PJM and replaced largely with natural gas-fired combined cycle plants and—to a much lesser extent—renewable wind and solar (see Figure 6). PJM is far behind other U.S. ISOs in its development of renewable generation resources, even though renewables have proven to be cost-competitive, reliable and resilient in other markets.

Between 2010 and 2019, PJM's electric capacity and generation shifted away from fossil fuel steam resources (mostly coal) toward gas-fired combined-cycle plants and renewable wind and solar (see Figure 6 and Figure 7). Over the same period, PJM's hydroelectric and nuclear capacity and generation have remained steady. Growth in PJM's renewable generation has been driven almost entirely by the development of wind power, which more than doubled its generation between 2010 and 2019 (from 9.6 GWh to 24.2 GWh). During the same period, the coal capacity in PJM was replaced almost entirely with gas-fired combined-cycle units rather than renewable resources, due largely to market designs that favored gas over renewable resources. This market design has had a predictable result: Since 2012, PJM is last in the share of renewable resources added to its grid compared to other U.S. transmission system operators.¹²

¹² Farmer, M., Levin, A. July 2, 2019. "Comparing America's grid operators on clean energy progress: PJM is headed for a climate disaster." Utility Dive.

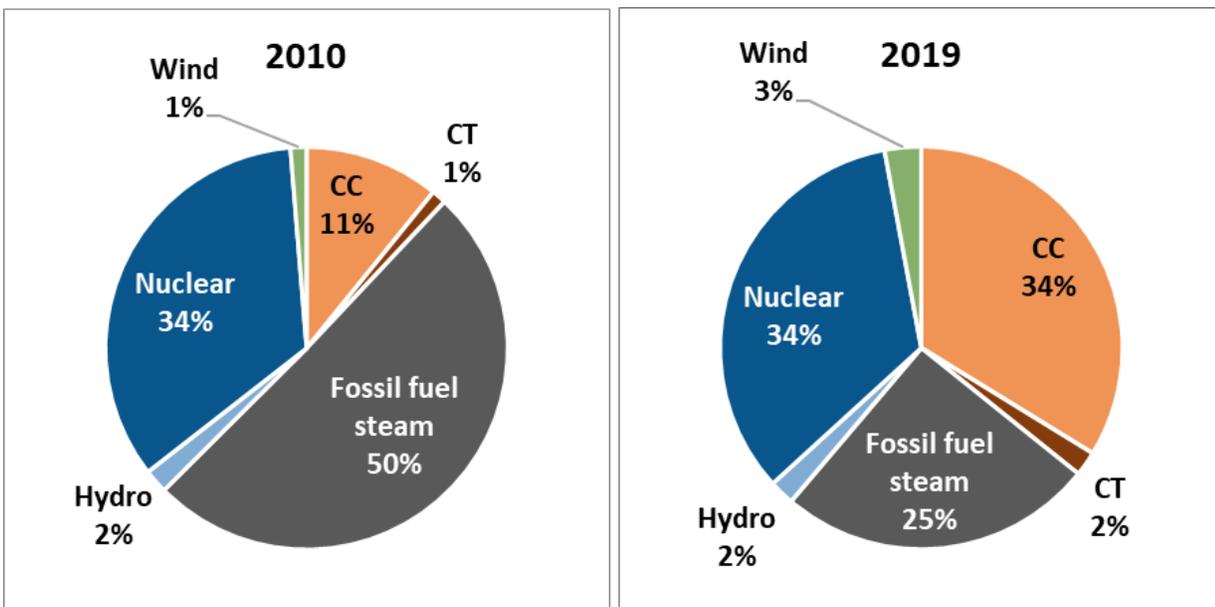
Figure 6: PJM Installed Capacity (GW) by Resource Type (Share of Total), 2010 vs. 2019



Note: Resource categories with less than 1 percent of total installed capacity are not shown in the Figure for ease of interpretation.

Source: 2010 and 2019 PJM State of the Market Report.

Figure 7: PJM Generation (GWh) by Resource Type (Share of Total), 2010 vs. 2019



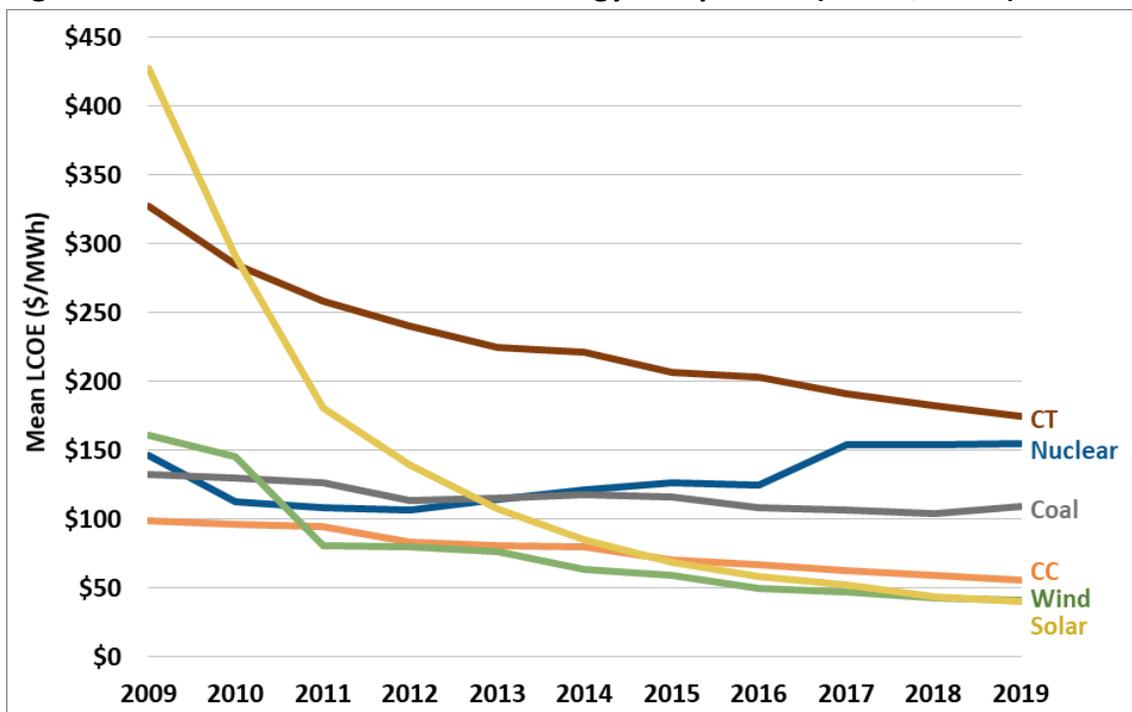
Note: Resource categories with less than 1 percent of total generation are not shown in the Figure for ease of interpretation.

Source: 2010 and 2019 PJM State of the Market Report.

Renewable energy is selected to replace retiring coal units in large part because it is currently available and cost competitive. (Load flexibility resources like battery storage, demand response and energy efficiency, facilitate high renewable integration while maintaining grid reliability and resilience). In its 2014 renewable integration study, PJM acknowledged that it “would not have any significant reliability issues operating with up to 30 percent of its energy (as distinct from capacity) provided by wind and solar generation” and that “PJM’s large geographic footprint also provides significant benefit for integrating wind and solar generation because it greatly reduces the magnitude of variability-related challenges.”¹³

The reason that PJM is far behind other ISOs regarding the amount of installed renewable energy does not appear to be cost; these resources are already highly competitive with fossil resources like natural gas. Lazard estimates show that prices for utility-scale solar are lower than those for new gas combined cycle plants, and utility-scale wind prices are competitive with new gas combined cycle units as well.¹⁴ Lazard also finds that prices for utility-scale solar with battery storage are lower than those for new gas combustion turbines and could, therefore, be a more cost-effective way to meet peak demand.¹⁵ While the levelized cost of gas combined-cycle plants has held relatively steady over the last 10 years, the levelized costs of renewable energy have fallen rapidly (see Figure 8).

Figure 8: Historical Levelized Cost of Energy Comparison (2019\$/MWh)



Source: Lazard. November 2019. *Levelized Cost of Energy Analysis—Version 13.0*. p.7.

¹³ GE Energy Consulting. March 31, 2014. *PJM Renewable Integration Study*.

¹⁴ Lazard. November 2019. *Lazard’s Levelized Cost of Energy Analysis*. Version 13.0. p. 2.

¹⁵ *Ibid* and Lazard. November 2019. *Lazard’s Levelized Cost of Storage Analysis*. Version 5.0. p. 14.

The cost of renewable resources will continue to drop. The U.S. National Renewable Energy Laboratory (NREL) projects that between 2017 and 2050, without accounting for government subsidies, the levelized costs of:

- Solar will decrease from \$33-59/megawatt hour (MWh) to \$18-31/MWh;
- Wind will decrease from \$30-143/MWh to \$17-69/MWh;
- Gas combined cycle will increase from \$33-38/MWh to \$43-48/MWh; and
- Gas combustion turbines will increase from \$64-148/MWh to \$76-151/MWh.¹⁶

Changing Conditions in PJM

While renewable energy development in PJM has lagged other U.S. regions, there are signs that the circumstances that facilitated the region's boom in natural gas development since the turn of the century are changing. In PJM's most recent capacity auction (2021-22), more new solar capacity cleared (68 MW) than in any of the four previous auctions, while no new gas-fired units cleared.¹⁷ The amount of new gas clearing the PJM capacity auction has fallen from approximately 6,000 MW in the 2017-2018 auction to zero in the 2021-22 auction.¹⁸ As gas resources compete primarily against one another in capacity auctions, investors in new merchant plants should be aware that there is no guarantee these plants will clear future auctions. Renewable resources' marginal costs (and capacity auction bids) are lower than those of gas plants, and more low-cost renewables entering the market has lowered PJM's energy market prices, or LMPs (see explanation of LMPs in the 'What is PJM' section above).¹⁹ Indeed, PJM's LMPs have been declining since 2008 (see Figure 9), putting gas plants' energy revenues at risk. Moreover, new state policies described in Section 5 and consumer preferences will attract new renewable investment and development in PJM in the coming years.

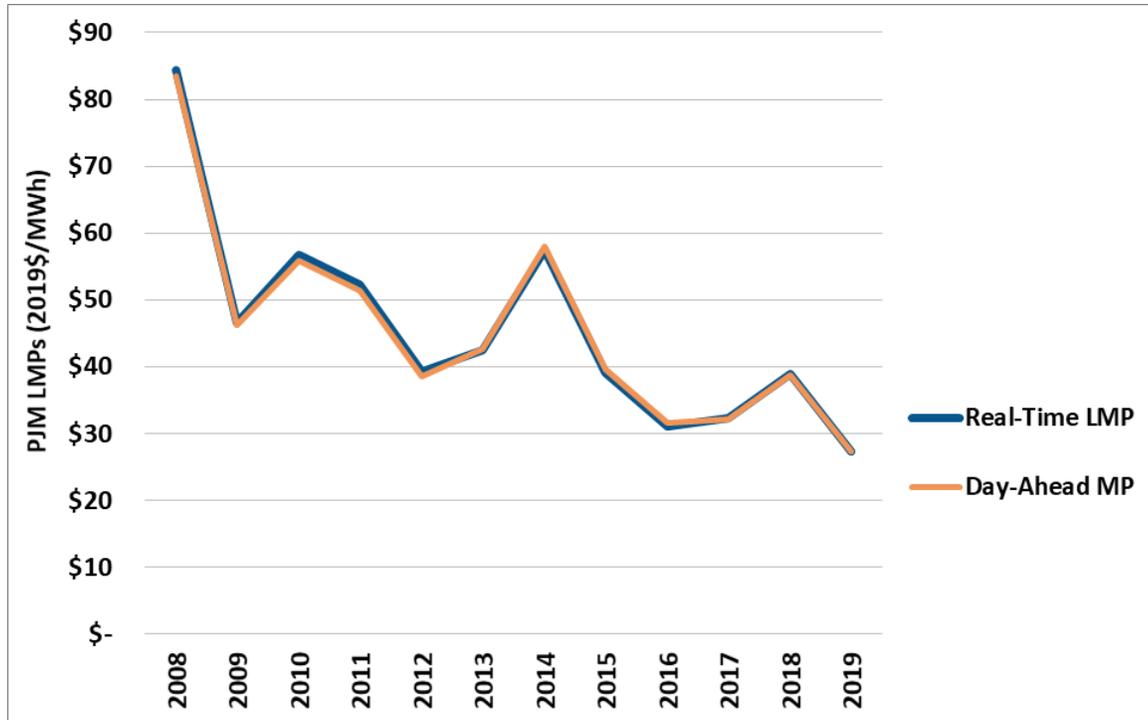
¹⁶ Vimmerstedt, L. 2019. *2019 ATB Cost and Performance Summary*.

¹⁷ PJM. May 23, 2018. *2021/2022 RPM Base Residual Auction Results*. Table 8.

¹⁸ 1) PJM. No date. *2020/2021 RPM Base Residual Auction Results*. PJM; 2) PJM. 2014. *2017/2018 RPM Base Residual Auction Results*. PJM.

¹⁹ PJM uses locational marginal pricing to set prices for energy purchases and sales in the PJM market and to price transmission congestion costs.

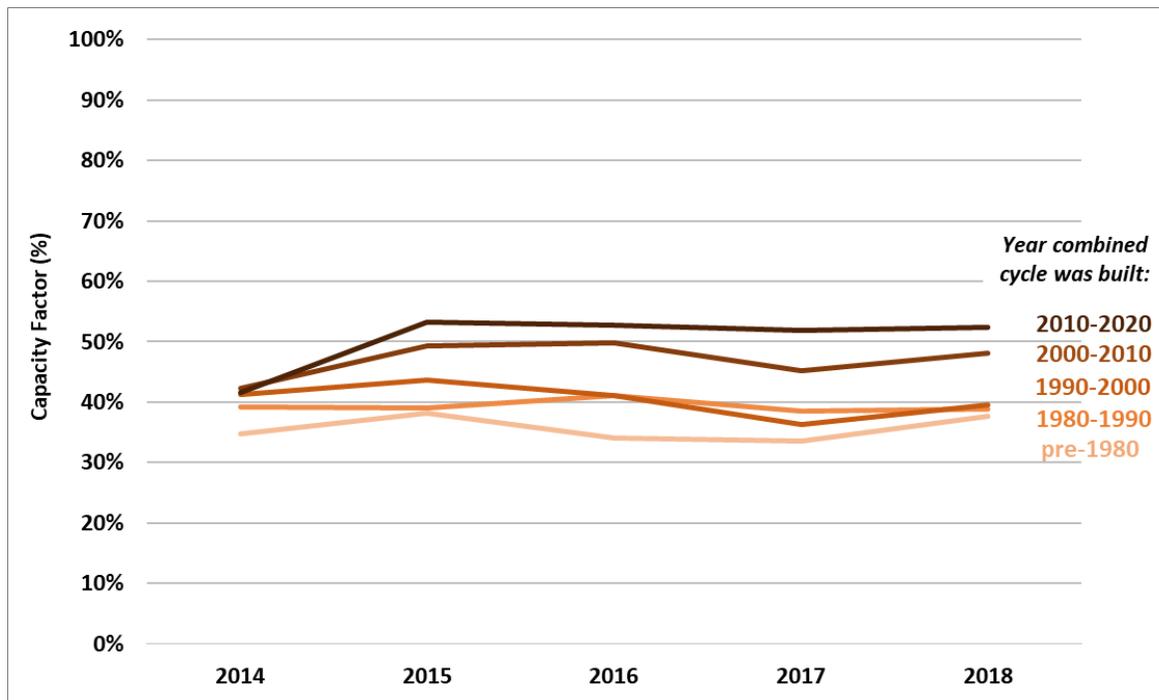
Figure 9: PJM Real-Time and Day-Ahead, Load-Weighted Average LMPs (2019\$/MWh)



Source: 2019 PJM State of the Market Report.

PJM's older gas combined-cycle plants generate less per unit of capacity (see Figure 10). The average PJM combined-cycle plant built after 2010 ran at 50 percent capacity between 2014 and 2018, but the average combined-cycle plant built before 1980 only ran at 36 percent capacity. As PJM's newer gas plants outcompete older ones, the financial viability of older plants is put at risk. Not only does this negatively affect owners of older plants, but today's new plants will become tomorrow's old plants—meaning this is a concern for investors in new gas power plants as well.

Figure 10: PJM Gas Combined Cycle Capacity Factors by Age of Plant



Source: AEC calculations using data from: 1) U.S. EIA. 2014-2018. Form EIA-860, Generator Data; 2) U.S. EIA. 2014-2018. Form EIA-923, Generator Data.

Conditions in PJM are changing such that renewable energy resources are increasingly competitive. Meanwhile, the impacts of COVID-19 have illuminated the limited resiliency of gas resources to unexpected shocks and uncertain future conditions, while renewable resources have fared much better.²⁰

2. Capacity Oversupply: Uncertainty and Upheaval

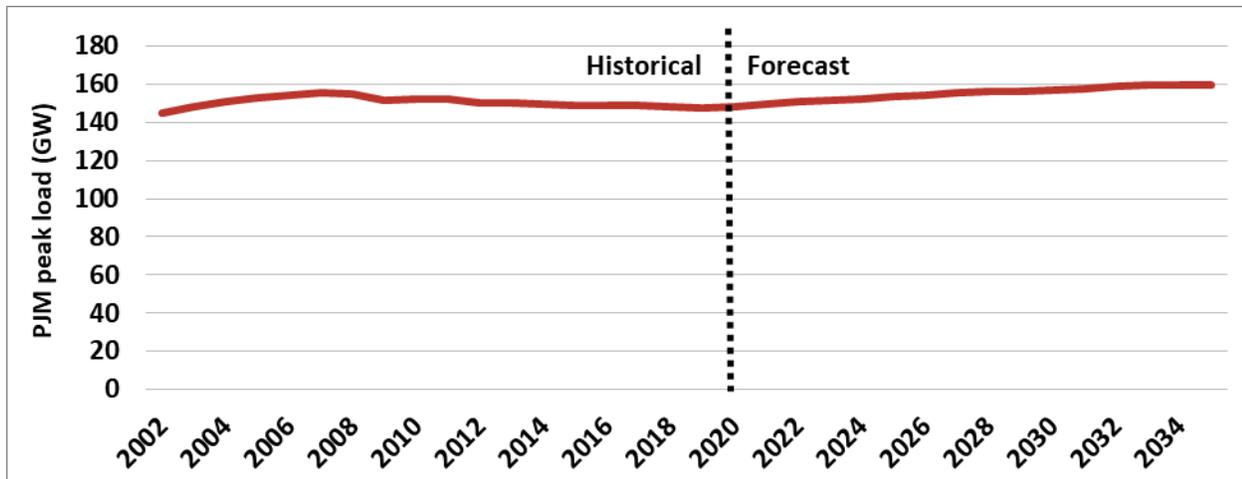
Since 2002, PJM’s total electric generating capacity nearly tripled while peak electric demand essentially remained unchanged. Unsurprisingly, this has resulted in capacity surplus—PJM has far more capacity than it requires to meet its electric load. In 2019, PJM’s peak load was approximately 150 GW while installed capacity totaled 198 GW. At the same time, PJM faces a nearly year-long delay in its latest capacity auction amid fundamental changes to its capacity market mandated by FERC. These changes have already created a large amount of uncertainty in PJM’s capacity market and will determine the role of the minimum offer price rule (MOPR) in preferencing renewables over other forms of generation in PJM.

Introduced in 2006, PJM’s capacity market was designed to protect consumers by letting a free market determine the correct level of investment in electric capacity resources. Since 2002, PJM’s total electric generating capacity has grown by 173

²⁰ Dunn, K. May 20, 2020. “COVID-19 is crippling the energy market, with one big exception: renewables.” Fortune.

percent (from approximately 72 GW in 2002 to 198 GW in 2019)²¹ while net energy usage only grew by 2.9 percent.²² Between 2010 and 2019, PJM’s gas-fired combined cycle capacity alone grew by more than 127 percent (or 28 GW).²³ Growing electric capacity was not matched by growth in peak customer demand—which has been relatively flat since 2002 (peak demand was 150.8 GW in 2002 and 151.3 GW in 2019, see Figure 11). Ultimately, this means that customers are paying for new generating capacity that is not required. In 2018, for example, PJM’s summer reserve margin (excess capacity above peak demand) was 32.8 percent compared to its target margin of 16.1 percent. That means reserve capacity in PJM is more than double what it needs to be—and that new power plants have been built that are not required to meet electric load.

Figure 11: Historical and Forecast PJM Peak Load (GW), 2002-2035



Source: PJM Resource Adequacy Planning Department. January 2020. *PJM Load Forecast Report*. Table B-10.

During the last nine years, PJM load demand forecasts have begun to better reflect actual demand growth, as shown in Figure 12, where the light blue bars show actual peak load, the dark blue bars show peak load predicted one year prior, and the yellow bars show peak load predicted 10 years prior. The respective bars become more similar over time, indicating that PJM’s forecasts of load are becoming more accurate.²⁴ PJM currently forecasts 0.51 percent average annual growth through 2034 (see Figure 11).

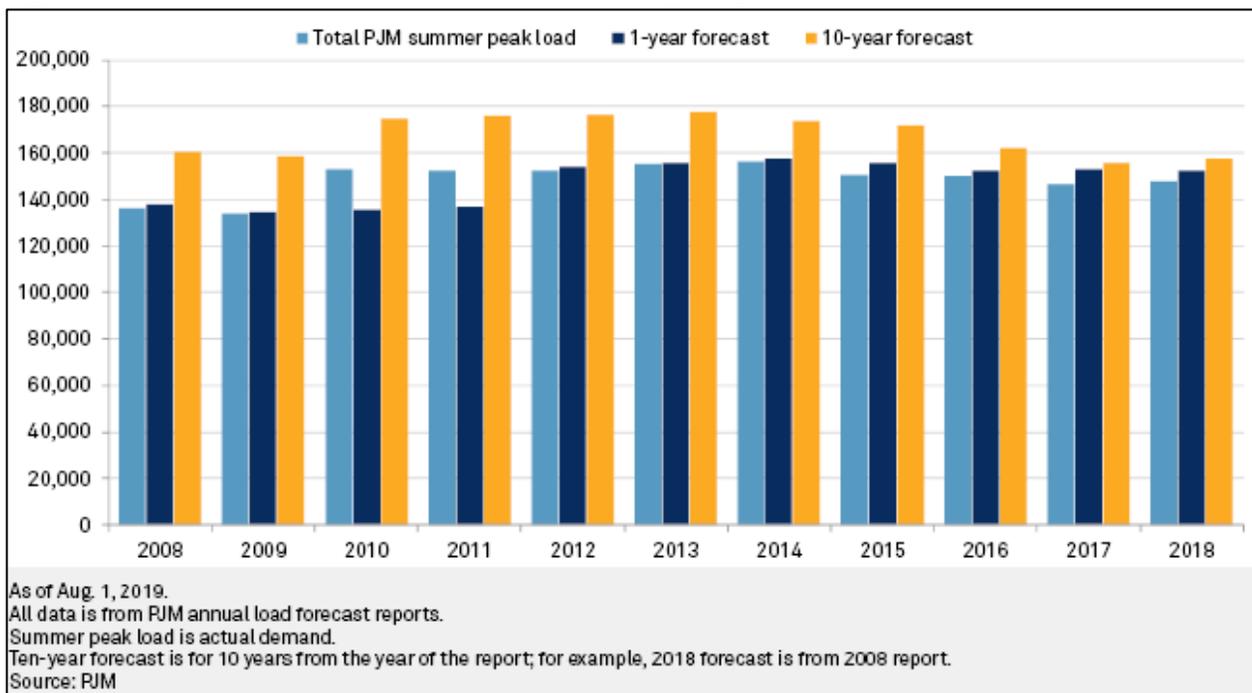
²¹ PJM Market Monitoring Unit. March 5, 2003. *2002 State of the Market*.

²² PJM Resource Adequacy Planning Department. January 2020. *PJM 2020 Load Forecast*. Table F-2.

²³ Tsao, S. and Martin, R. December 3, 2019. “Overpowered: PJM market rules drive an era of oversupply.” S&P Global Market Intelligence.

²⁴ PJM Resource Adequacy Planning Department. January 2020. *PJM Load Forecast Report*.

Figure 12: PJM Forecasted Versus Actual Load (MW), 2008-2018



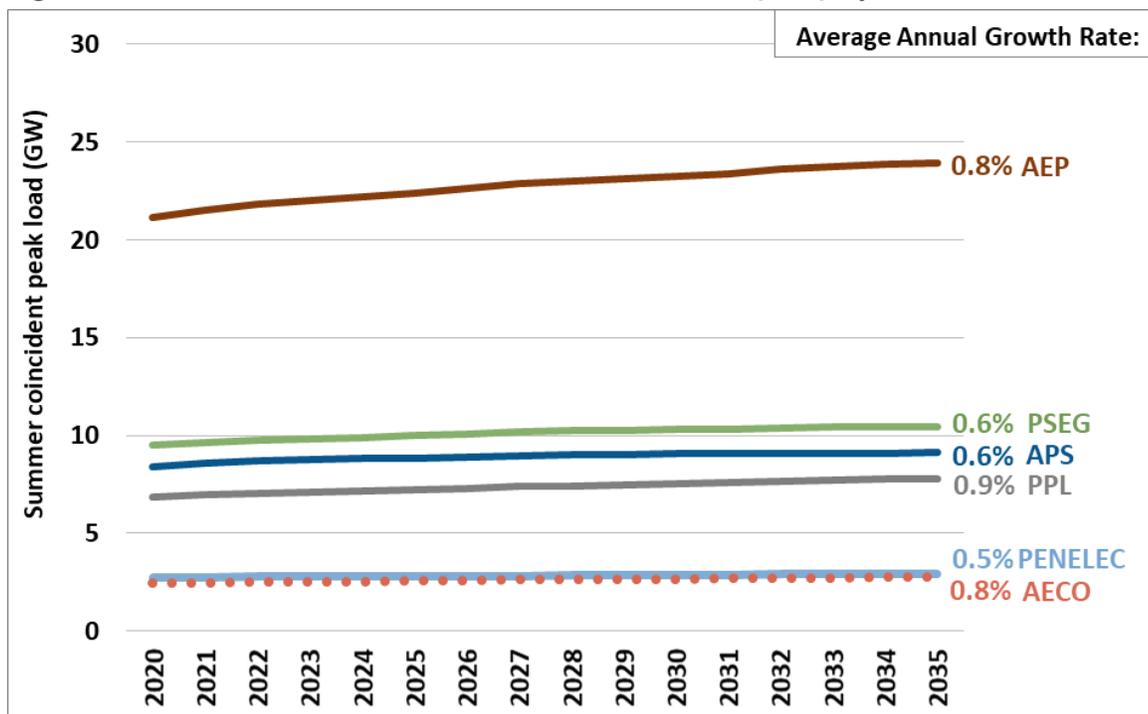
Source: Reproduced from Tsao, S. and Martin, R. December 3, 2019. *Overpowered: PJM market rules drive an era of oversupply*. S&P Global Market Intelligence.

Peak loads in some PJM zones are expected to grow more quickly than PJM as a whole—for example, PJM forecasts that peak load in PPL (located in eastern Pennsylvania) will grow by 0.9 percent annually over the next 15 years (see Figure 13). These forecasts are optimistic given PJM’s historical demand growth and recent events. PJM’s load forecasts were conducted and published in January 2020, before the COVID-19 pandemic, which has resulted in the largest absolute drop in global electric demand ever,²⁵ and is expected to have cascading effects across the global energy industry, according to the IEA.²⁶

²⁵ Broom, D. May 18, 2020. “5 things to know about how coronavirus has hit global energy.” World Economic Forum.

²⁶ International Energy Agency. April 2020. *Global Energy Review 2020*.

Figure 13: PJM Forecasted Summer Coincident Peak (GW) by Zone



Source: PJM Resource Adequacy Planning Department. January 2020. *PJM Load Forecast Report*. Table B-10.

PJM’s Capacity Market

PJM’s electricity supply for the next three years is secured via capacity market auctions.²⁷ Auction participants offer their generating resources into the market; these resources can provide electric supply on summer peak and/or reduce electric demand on summer peak.²⁸ Either way, market participants are paid to be available to meet electric demand when needed. If they cannot supply their promised capacity recourses when called, they face a steep penalty. PJM’s capacity auction procures three years of generating resources through a competitive market where participants bid the amount of capacity they can offer. PJM’s demand formula sets the price paid to the market participants that are selected (\$ per MW-day), where prices vary by transmission zone.²⁹

PJM’s capacity market prices are volatile, varying dramatically from auction to auction (see Table 2). PJM capacity prices are also locational, meaning that they vary from one transmission zone to the next. Historically, there have been wide variations in capacity prices across PJM zones (see Figure 14). As PJM continues to invest in enhancing its transmission infrastructure to move energy most efficiently from one zone to the next, capacity prices in zones where congestion has been eased as a result of those enhancements are likely to fall. Lower

²⁷ PJM. No date. “Capacity Market (RPM).”

²⁸ PJM. No date. “Capacity Market (RPM).” Learning Center.

²⁹ *Ibid.*

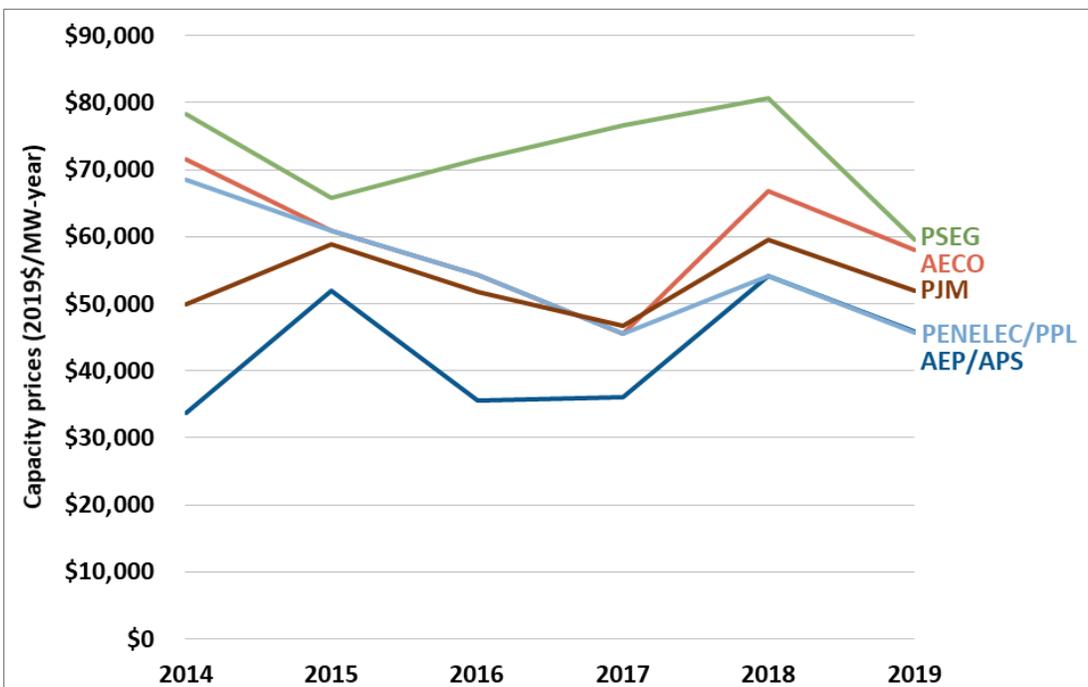
capacity prices mean less capacity revenue—a concern for investors in new gas-fired power plants.

Table 2: PJM Capacity Auction Clearing Price (2019\$/MW-day)

Year	Zonal Capacity Price (2019\$/MW-day)	
	In Zone With Lowest Price	In Zone With Highest Price
2017/18	\$125.16	\$224.24
2018/19	\$167.76	\$229.51
2019/20	\$100.00	\$202.77
2020/21	\$76.53	\$188.12
2021/22	\$140.00	\$204.29

Source: 1) All dollars in this report have been converted to 2019\$ using CPI-U: U.S. Bureau of Labor Statistics. July 10, 2020. “Databases, Tables & Calculators by Subject”; 2) PJM. 2017/2018 RPM Base Residual Auction Results. PJM. 3) PJM. 2018/2019 RPM Base Residual Auction Results. PJM; 4) PJM. 2019/2020 RPM Base Residual Auction Results. PJM; 5) PJM. 2020/2021 RPM Base Residual Auction Results. PJM; 6) PJM. 2020/2021 RPM Base Residual Auction Results. PJM.

Figure 14: Capacity Price (2019\$/MW-year) for PJM Zones With Gas Plants in Early Development, 2014-2019



Source: 2019 PJM State of the Market Report.

Uncertainty in PJM's Capacity Market Due To FERC's MOPR Order

PJM's capacity market is currently in a state of upheaval as the result of an ongoing oversight process at FERC to update PJM's minimum offer price rule (MOPR). The process has created a great deal of uncertainty in PJM's capacity market and delayed its capacity auction by about a year, which negatively affects proposed gas plants insofar as changes to the capacity market will alter financial outlooks in ways that cannot be known until the oversight process with FERC is complete.

Established in 1977, FERC oversees the gas, electricity, and oil industries by (1) regulating the transmission and sales of energy products across and between U.S. states and (2) regulating the construction of interstate fossil fuel pipelines, liquefied natural gas (LNG) terminals, and hydropower projects.³⁰ In doing so, FERC monitors energy markets to prevent price manipulation and has the authority to enforce regulatory requirements through civil penalties.³¹ FERC is not responsible for regulations relating to retail electricity sales to consumers, municipal power systems and electric cooperatives, developing energy resources within state boundaries, or addressing reliability issues from the shortcomings of local distribution companies.³²

PJM faces fundamental changes to its capacity market stemming from an ongoing oversight process at FERC to update PJM's MOPR, which will have the effect of raising the minimum price for would-be market participants to bid into the capacity market. The stated aim of FERC's order on the PJM MOPR was to address the "unjust and unreasonable" downward effect of state subsidized resources (largely renewable resources) on capacity prices to "protect [PJM's] competitive capacity market."^{33,34} Energy stakeholders like environmental organizations and business associations expect that FERC's order will instead unfairly benefit PJM's gas plants and unnecessarily raise consumer costs for electricity; therefore, they are advocating for changes to the rule.^{35,36,37}

The MOPR Order refers to FERC's December 2019 directive requiring PJM to establish resource-specific minimum price offers for renewables and other state-subsidized resources. The impact would be to raise the price of state-supported resources like renewables bidding into the PJM capacity market.³⁸ PJM's MOPR itself

³⁰ Federal Energy Regulatory Commission. June 16, 2020. "What FERC Does".

³¹ *Ibid.*

³² *Ibid.*

³³ Cleary, K. January 21, 2020. "Natural Gas Falls to 25-Year Low as Storage Builds." Resources.

³⁴ Federal Energy Regulatory Commission (FERC). December 19, 2019. "FERC Directs PJM to Expand Minimum Offer Price Rule."

³⁵ Cleary, K. January 21, 2020. "Natural Gas Falls to 25-Year Low as Storage Builds." RFF.

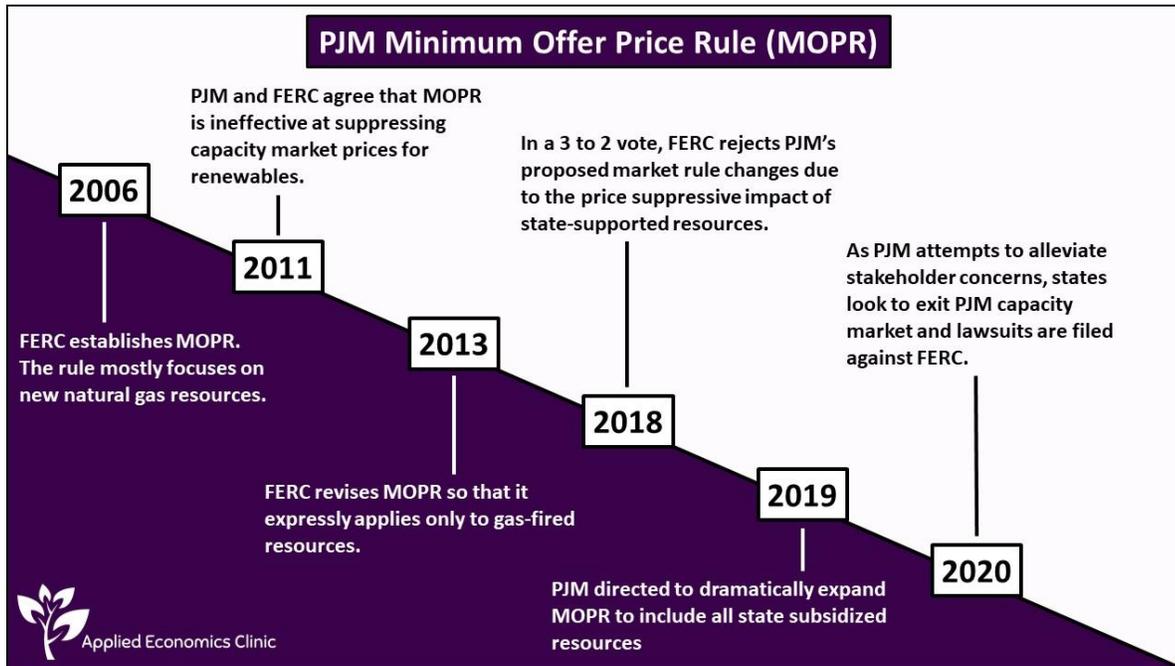
³⁶ Advanced Energy Economy, January 2020. *FERC expands minimum price rule, hurting advanced energy and consumers in nation's largest market.*

³⁷ Goggin, M. and R. Gramlich, May 2020, "A Moving Target: An Update on the Consumer Impacts of FERC interference with state policies in the PJM region." Grid Strategies.

³⁸ Cleary, K. January 21, 2020. "What the Minimum Offer Price Rule (MOPR) Means for Clean Energy in PJM." RFF.

dates back to 2006, when the region’s capacity market was introduced (see Figure 15 for a brief timeline of the PJM MOPR).

Figure 15: PJM MOPR Timeline



Sources: 2006: 1) PJM Interconnection LLC. April 12, 2011. *Order accepting proposed tariff revisions, subject to conditions, and addressing related complaint*. Docket No. ER11-2875-000. Submitted to FERC. p.5. 2) Patel, S. December 26, 2019. “The Significance of FERC’s Recent PJM MOPR Order Explained”. Power.

2011: PJM Interconnection LLC. April 12, 2011. *Order accepting proposed tariff revisions, subject to conditions, and addressing related complaint*. Docket No. ER11-2875-000. Submitted to FERC. p.47.

2013: Patel, S. December 26, 2019. “The Significance of FERC’s Recent PJM MOPR Order Explained”. Power.

2018: Advanced Energy Economy. January 2020. *Understanding FERC’s ‘minimum offer price rule’ order*.

2019: Patel, S. December 26, 2019. “The Significance of FERC’s Recent PJM MOPR Order Explained.”

2020: 1) Morehouse, C. March 19, 2020. “PJM MOPR compliance plan allays renewable sector concerns of being shut out of capacity auctions.” Utility Dive. 2) Morehouse, C. April 27, 2020. “Broad array of groups sue FERC over PJM MOPR decision as Chatterjee rejects cost, renewable concerns”. Utility Dive.

The original MOPR established conditions under which PJM capacity market participants could bid at prices below the level set in PJM’s capacity auctions. Since that time, PJM’s MOPR has been contested and revised on several occasions. FERC’s December 2019 order came after the commission rejected PJM’s proposed capacity market changes in 2018.³⁹ The 2019 order directed PJM to dramatically expand its

³⁹ Patel, S. December 26, 2019. “The Significance of FERC’s Recent PJM MOPR Order Explained.” Power Mag.

price rule to include not only new gas-fired units but also all new and existing resources that receive “state subsidies.”⁴⁰ A report by Grid Strategies estimated the cost impact of FERC’s order to be as high as \$2.6 billion annually, costing consumers almost \$24 billion over the next nine years,⁴¹ and making it more difficult for new renewable resources to clear PJM’s capacity market auction.⁴² For coastal Maryland, New Jersey and Virginia,⁴³ potential offshore wind projects are unlikely to clear the capacity market at the prices established by the FERC order.⁴⁴

Opposition to FERC’s order was sufficient to prompt PJM to focus much of its 536-page MOPR compliance document (drafted in March 2020) on how to alleviate concerns, noting it had heard from many affected groups over the course of nine formal stakeholder meetings.⁴⁵ PJM’s compliance filing proposed to:⁴⁶

- allow unit-specific reviews that would allow projects to submit evidence to support a lower clearing price and PJM’s proposal lowers the default floor prices for renewables;
- postpone its next capacity auction and future capacity auction schedule until such time as FERC has approved the rules that will govern its capacity auctions; and
- Waive tariff provisions to allow for implementation of PJM’s proposed auction schedule.

In April 2020, FERC voted to uphold its 2019 order and denied requests to rehear it, prompting Illinois, Maryland and New Jersey to file a petition for review with two federal courts.^{47,48}

The order has created a great deal of uncertainty in PJM’s capacity market, including an almost year-long delay in the latest auction and indications that (as of May 2020) Illinois, Maryland, and New Jersey are considering exiting the PJM capacity

⁴⁰ *Ibid.*

⁴¹ Goggin, M., Gramlich, R. May 2020. “A Moving Target: An Update on the Consumer Impacts of FERC Interference with State Policies in the PJM Region.” Grid Strategies, LLC.

⁴² St. John, J. December 19, 2020. “FERC Orders PJM to Restrict State-Backed Renewables in Its Capacity Market.” Greentech Media.

⁴³ *Ibid.*

⁴⁴ Morehouse, C. May 18, 2020. “Maryland lawmakers struggle to mitigate MOPR harm to offshore wind with shortened legislative session.” Utility Dive.

⁴⁵ Morehouse, C. March 19, 2020. “PJM MOPR compliance plan allays renewable sector concerns of being shut out of capacity auctions.” Utility Dive.

⁴⁶ PJM Interconnection, L.L.C. March 18, 2020. Compliance filing concerning the minimum offer price rule, request for waiver of rpm auction deadlines, and request for an extended comment period of at least 35 days. FERC. Docket Nos. EL16-49, ER18-1314, EL18-178 (Consolidated).

⁴⁷ Morehouse, C. April 16, 2020. “‘Just plain garbage,’ FERC’s Glick says as commission largely upholds its PJM MOPR decision.” Utility Dive.

⁴⁸ Morehouse, C. May 15, 2020. “Ditching PJM capacity market could cost New Jersey \$386M through 2022, market monitor finds.” Utility Dive.

market.^{49,50} Such a decision would radically alter the PJM capacity market; even the threat to do so creates a great deal of uncertainty. Delayed capacity auctions are a substantial financial risk, and broader conditions of uncertainty around the future of PJM's capacity market also negatively impact proposed gas plants since changes to the capacity market will affect regional financial outlooks. The upheaval and uncertainty created by FERC's order amplifies the existing risk of overcapacity for gas plants by creating a risky and uncertain financial environment for developers and investors in proposed new power plants.

3. High-Risk Global Events: Unexpected Consequences and Conditions of Uncertainty

High-risk global events include both the physical effects of climate change—heat waves, cold snaps, hurricanes, high tide flooding and other extreme weather events—and high impact global events, such as the current COVID-19 pandemic, wars and other geopolitical disruptions (for example, 9/11 or the 2011 Japan tsunami). Aging energy transmission and distribution infrastructure and older design and siting standards for the energy system leave even the newest power generating assets vulnerable to extreme weather events, power outages and geopolitical disruptions. These events can have severe impacts and expose gas plants and their owners to potential operational disruptions and financial losses. The remainder of this section outlines two types of high-risk global events for PJM: Global pandemics like COVID-19 and the impacts of climate change.

Global Pandemic: COVID-19

The COVID-19 pandemic has decreased demand for electric power, created greater exposure to global market risks and set off a worldwide economic recession that will undoubtedly result in long-lived repercussions and recovery efforts.

The International Energy Agency (IEA) has found—using data current through May 2020—that countries with full COVID-19 lockdown measures saw electricity demand reductions of 20 percent or more. The IEA also predicts that energy investment will fall by 20 percent in 2020 and expects that the COVID-19 pandemic will reduce 2020 global energy demand by 6 percent from 2019 levels, the largest ever drop in absolute terms, with the United States seeing a 10 percent reduction in energy demand.⁵¹ A drop that large would be double the impact of the 2008 global recession.⁵² Based on what we know about the impacts of the COVID-19 pandemic so far, we can expect that the impact of COVID-19 on gas resources will last at least as long as (and take at least as long to rebound) as the 2008 global recession.

⁴⁹ Morehouse, C. March 19, 2020. "PJM MOPR compliance plan allays renewable sector concerns of being shut out of capacity auctions." Utility Dive.

⁵⁰ Morehouse, C. May 22, 2020. "State-federal tension 'at an all time high' between MOPR, net metering attack, says head Maryland regulator." Utility Dive.

⁵¹ International Energy Agency. 2020. "COVID-19."

⁵² International Energy Agency. April 2020. *Global Energy Review 2020*.

Grid operators in the United States saw a decline in electricity demand within one week of states and major cities announcing quarantines and stay-at-home orders.⁵³ Data collected during the pandemic show that the decrease in demand depends on the duration and stringency of lockdowns (with more stringent lockdowns resulting in larger declines⁵⁴); fuel type (global coal and oil demand dropped by 8 percent and 5 percent respectively,⁵⁵ while renewables have seen a growth in demand⁵⁶); and region (colder climates have seen larger reductions in energy demand than warmer ones).⁵⁷ The extent of these drops in demand has varied across PJM's territory depending on the duration and stringency of each state's lockdown and reopening strategy, as well as each state's climatic conditions. Across PJM, the COVID-19 pandemic reduced average total weekday energy use by 7 percent, or roughly 140 GWh, in April 2020, compared to expected electric demand.⁵⁸ Daily peak loads have fallen by as much as 15 percent, or roughly 13.5 GW.⁵⁹ PJM's overall load curve has been flatter than usual, with smoother peaks than the load pattern typically seen in late winter and early spring.⁶⁰ In its "Update of COVID-19 Load Impacts" released in May, PJM predicted "potential full recovery" from COVID's impact by mid-2023.⁶¹

Oil prices have plummeted during COVID-19,⁶² even going negative in April 2020,⁶³ while natural gas prices have fallen to their lowest levels since 1995.⁶⁴ Utilities face differing impacts from COVID-19 depending on whether they rely on electric sales for revenue or not. Utilities that must compete in an open market—like those in PJM—are more exposed to the effects of plunging oil and gas prices. Electric distributors are also more exposed to COVID-19's impacts if they have a large share of commercial and industrial customers (that have seen larger reductions in demand than the residential sector).⁶⁵

While the full impact of COVID-19 on energy demand is uncertain, observed drops in oil and gas prices (see below for more detail) and energy demand have been larger than those witnessed during the global economic recession of 2008. In 2008, crude oil prices fell by more than \$140 to \$35 per barrel in only a few months.⁶⁶ Over this same period, in PJM, gas prices fell by more than 25 percent compared to the 15

⁵³ Walton, R. March 23, 2020. "Utilities beginning to see the load impacts of COVID-19 as economic shutdown widens." *Utility Dive*.

⁵⁴ International Energy Agency. April 2020. *Global Energy Review 2020*. p.3.

⁵⁵ *Ibid.*

⁵⁶ *Ibid.*

⁵⁷ EIA. May 7, 2020. "Daily electricity demand impacts from COVID-19 mitigation efforts differ by region."

⁵⁸ PJM Interconnection LLC. April 15, 2020. "PJM Details COVID-19 Impacts to Electricity Demand." *PJM Inside Lines*.

⁵⁹ Gledhill, A. May 12, 2020. "Update of COVID-19 Load Impacts." PJM.

⁶⁰ *Ibid.*

⁶¹ *Ibid.*

⁶² Galdieri, D. June 25, 2020. "Oil dips on rise in coronavirus cases, posts second negative week in three." CNBC.

⁶³ Kubursi, A. April 21, 2020. "Oil crash explained: How are negative oil prices even possible?" World Economic Forum.

⁶⁴ Salzman, A. June 25, 2020. "Natural Gas Falls to 25-Year Low as Storage Builds." Barron's.

⁶⁵ *Ibid.*

⁶⁶ Conca, J. May 23, 2020. "How Will the Coronavirus Affect Energy Use in America?" Forbes.

months before the recession.⁶⁷ The impact of COVID-19 on the energy sector is already more extreme than the impacts of the 2008 recession by some measures.

COVID-19 has sent crude oil prices below zero and U.S. natural gas demand has dropped by 4.5 percent in 2020 from 2019 levels—which the IEA called “a huge shock to a gas industry that is used to robust growth in consumption.”^{68,69} The U.S. Energy Information Administration anticipates that 2020 gas consumption will be 3.9 percent lower than in 2019, gas production will fall, and gas exports will decline.⁷⁰ Ultimately, while the duration and depth of the COVID-19 crisis is still uncertain, the scale of its observed impacts so far suggest that the gas industry faces unprecedented challenges. In a May research article, McKinsey & Company concluded that “without fundamental change, it will be difficult to return to the attractive [oil and gas] industry performance that has historically prevailed.”⁷¹ Falling prices pose a risk to investors in gas power plants: Lower prices lead to reduced gas production, affecting the bottom line, viability and financial outlook of new gas power plants.

Climate Change

Climate change has already had observable effects in the United States, such as sea-level rise, more intense heat waves and droughts, and changing precipitation patterns.⁷² Federal climate assessments predict that these kinds of impacts will continue and worsen into the future—though impacts will vary by region.⁷³ PJM’s service territory spans parts of the U.S. Mid-Atlantic, Midwest and Southeast (see Figure 16).

⁶⁷ *Ibid.*

⁶⁸ Heath, T. April 21, 2020. “Oil prices extend slide one day after U.S. crude drops below zero; Dow plunges more than 600 points.” The Washington Post.

⁶⁹ International Energy Agency. April 2020. *Global Energy Review 2020*.

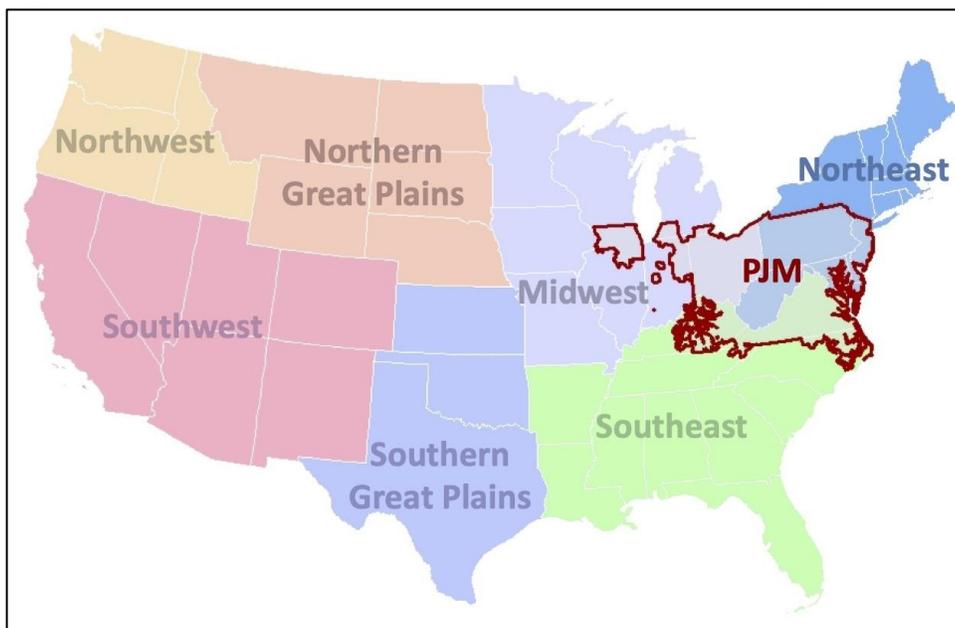
⁷⁰ Rapier, R. May 17, 2020. “Short Term Energy Outlook Shows Impact Of COVID-19 On Energy Sector.” Forbes.

⁷¹ Barbosa, F., et al. May 15, 2020. “Oil and gas after COVID-19: The day of reckoning or a new age of opportunity?” McKinsey & Company.

⁷² Global Climate Change. No date. “Facts.” NASA.

⁷³ U.S. Global Change Research Program. 2018. *Fourth National Climate Assessment*. Volume II.

Figure 16: PJM and U.S. National Climate Assessment Regions



Source: U.S. Global Change Research Program. 2018. *Fourth National Climate Assessment*. Volume II. Map edited to include PJM service territory by AEC.

In its *Fourth National Climate Assessment* (released in 2018),⁷⁴ the U.S. Global Change Research Program presented observed and anticipated climate impacts across the United States.

Across PJM’s service territory, average temperatures have been increasing and are projected to continue rising; precipitation levels have been increasing and are projected to continue this trend; and occurrences of extreme heat and precipitation events have increased and are projected to occur more frequently over the next few decades.⁷⁵ Higher temperatures and more frequent extreme heat episodes are expected to increase human morbidity, amplify economic vulnerabilities and disrupt the ecological resources on which people and industries depend. More frequent, higher precipitation events have resulted in increased flooding risk—which can displace human communities, disrupt ecosystems, damage existing energy infrastructure and affect the useful life of new infrastructure and disrupt business operations in the energy sector.⁷⁶

Leading scientific organizations including the U.S. Environmental Protection Agency,⁷⁷ the Center for Climate and Energy Solutions and the Union of Concerned Scientists expect that warmer average temperatures and increased occurrence of heat waves will lead to an increased need for indoor cooling and, consequently,

⁷⁴ *Ibid.*

⁷⁵ U.S. Global Change Research Program. 2018. *Fourth National Climate Assessment*. Chapter 18: [Northeast](#); Chapter 19: [Southeast](#); Chapter 21: [Midwest](#).

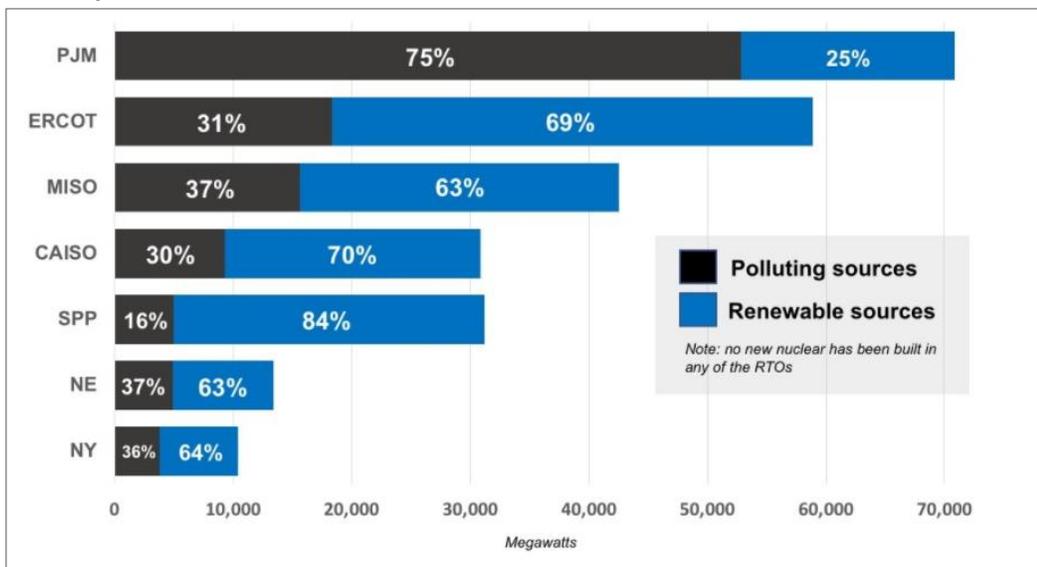
⁷⁶ *Ibid.*

⁷⁷ U.S. E.P.A. No date. “[Heat Island Impacts](#).”

higher electric demand.^{78,79,80} Researchers at Arizona State University have found that because PJM already experiences maximum demand in the summer, these peaks will increase more than average electric demand as temperatures climb, heat waves become more common and demand for electric cooling increases.⁸¹

Of the seven major grid operators in the United States (see Figure 1 above), PJM has, by far, the greatest share of new greenhouse gas-emitting electric generation. Figure 17 presents research from *Utility Dive* on the share of polluting and renewable electric generating resources added (and planned for addition) from 2012 through 2022.

Figure 17: Electric Generation Capacity Added Between 2012 and 2022 by Grid Operator



Source: Reproduced from *Utility Dive*. Farmer, M., Levin, A. July 2, 2019. “Comparing America’s grid operators on clean energy progress: PJM is headed for a climate disaster”. *Utility Dive*.

4. The Impact of Rising U.S. LNG Exports—Likely Increases in Gas Prices and More Volatility

During the past four years, U.S. liquefied natural gas (LNG) exports have surged more than 68-fold. This development has served to tie the U.S. natural gas market to the international gas market, which is likely to increase domestic gas price volatility

⁷⁸ C2ES. No date. “Heat Waves and Climate Change.”

⁷⁹ Union of Concerned Scientists. August 2018. *Heat waves and climate change*.

⁸⁰ Rhodium Group. April 2019. *Clear, Present and Underpriced: The Physical Risks of Climate Change*. p.9.

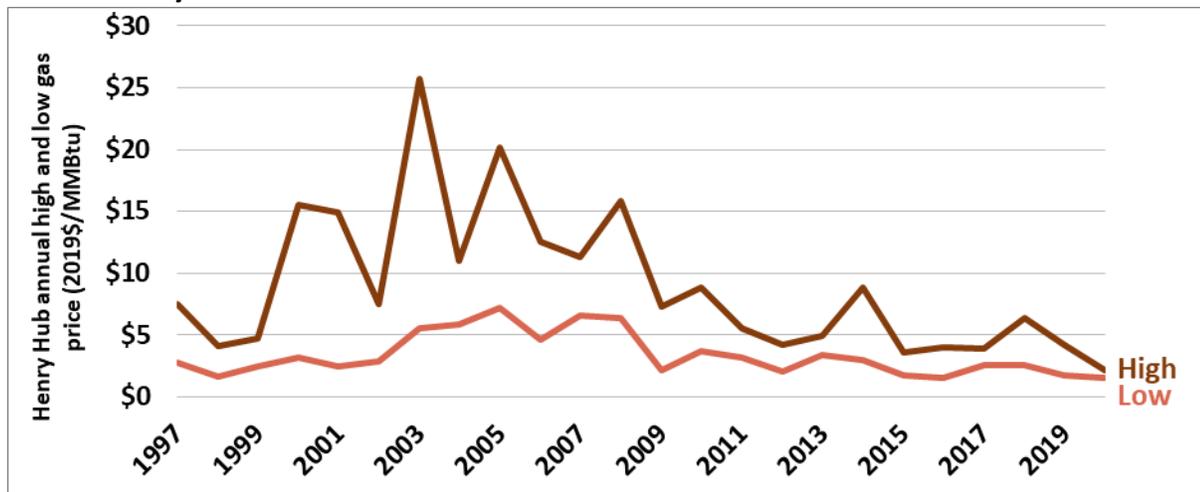
⁸¹ Auffhammer, M., Baylis, P. and Hausman, C.H. 2017. Climate change is projected to have severe impacts on the frequency and intensity of peak electricity demand across the United States. *Proceedings of the National Academy of Sciences of the United States of America*, 114(8), 1886-1891.

and create more risk for gas-fired power plants and their owners in PJM.

Historic Uncertainty in PJM Gas Prices

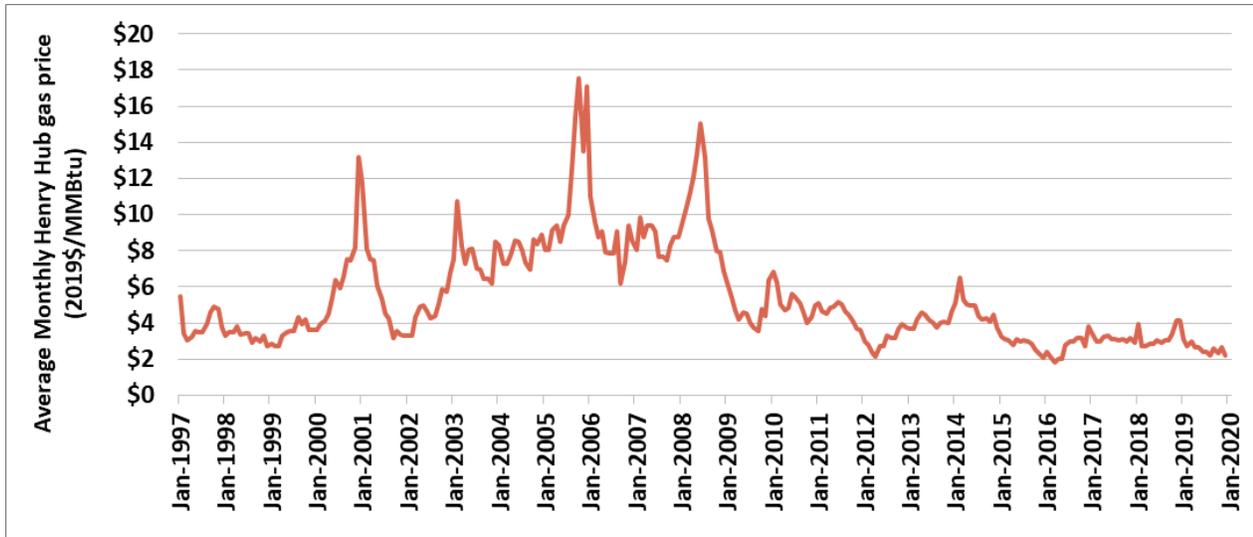
Historically, U.S. gas prices have been volatile. Daily gas prices since the late 1990s have fallen as low as \$1.50 per million British thermal units (MMBtu) and risen as high as \$25.68/MMBtu (see Figure 18). Month-to-month, gas prices have experienced similar dramatic swings during this period (see Figure 19). This volatility poses significant risks for investors considering new power plant investments in PJM since long-term fuel prices play a major role in project profitability. Now, the U.S. gas sector's increased exposure to global market dynamics due to the significant recent rise in its LNG exports, coupled with predictions of continued increases in the future, threatens to exacerbate this price volatility, adding yet another risk that investors must consider in deciding whether to finance new PJM gas plants.

Figure 18: Henry Hub Natural Gas Prices (2019\$/MMBtu), Highest and Lowest Daily Gas Prices in Each Year



Source: U.S. EIA. July 24, 2020. "Natural Gas". *Henry Hub Natural Gas Spot Price*.

**Figure 19: Monthly Average Henry Hub Natural Gas Prices
(2019\$/MMBtu)**



Source: U.S. EIA. July 24, 2020. "Natural Gas". *Henry Hub Natural Gas Spot Price*.

The World Bank,⁸² the U.S. Commodity Futures Trading Commission (CFTC),⁸³ and the U.S. Energy Information Administration (EIA)⁸⁴ all project that U.S. natural gas prices will rise over the next few decades, particularly as U.S. LNG exports increase.⁸⁵ EIA predicts that between 2019 and 2050, natural gas prices will rise 44 percent in a reference-case scenario and 155 percent in a scenario with low oil and gas supply. (Note that gas prices in 2050 are forecast to be 1 percent lower than 2019 in a scenario with high domestic supply of oil and gas; see Figure 20).

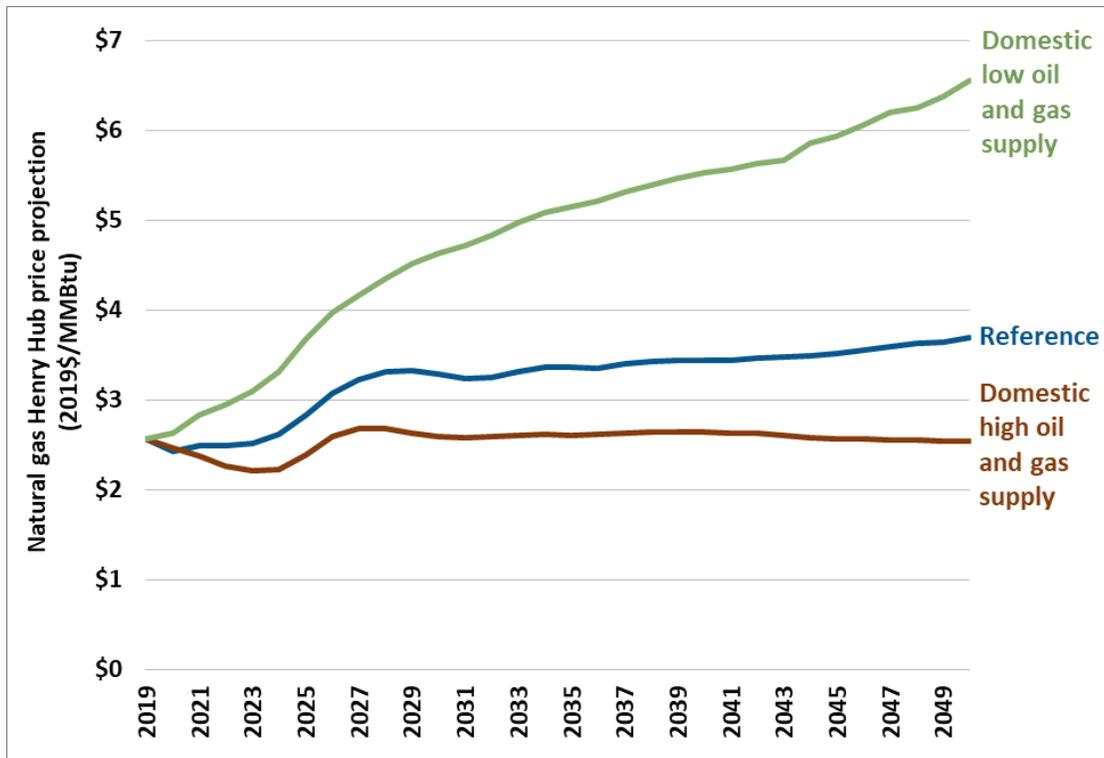
⁸² World Bank. April 23, 2020. "World Bank Commodities Price Forecast."

⁸³ Commodity Futures Trading Commission. May 2018. *Liquefied Natural Gas Developments and Market Impacts*.

⁸⁴ Annual Energy Outlook. 2020. *Natural Gas*. U.S. EIA.

⁸⁵ Szybist, M. May 2019. "Pennsylvania's Gas Power Problem, Part II: Cost and Risk." NRDC.

Figure 20: EIA 2020 Annual Energy Outlook Henry Hub Natural Gas Price Forecast (2019\$/MMBtu)



Source: U.S. EIA. 2020. *Natural Gas Henry Hub Spot Price*. Annual Energy Outlook.

Since the beginning of 2016, U.S. LNG exports have soared, climbing from essentially zero to a record 9.8 billion cubic feet per day (bcf/d) in March 2020.⁸⁶ (See also Figure 21 below). The COVID-19 pandemic brought this surge to a halt, at least temporarily, pushing U.S. LNG exports down to less than 4 bcf/d in June.⁸⁷

The U.S. natural gas sector produces more than needed to meet domestic demand, as highlighted by the rapid increase in LNG exports. The result is that domestic gas prices are now tied much more closely to the international market, making them vulnerable to changes in demand outside U.S. borders. For example, the pandemic-induced decline in demand also pushed international LNG prices to near-record lows and highlighted a point made in a May 2018 report by the U.S. Commodity Futures Trading Commission (CFTC): “Given the magnitude of U.S. exports, there is also the potential that domestic natural gas markets could become subject to global supply-demand dynamics with the potential for increased volatility.”⁸⁸

In addition to raising the prospect of additional volatility, the CFTC report concluded

⁸⁶ Today in Energy, June 23, 2020. “U.S. liquefied natural gas exports have declined by more than half so far in 2020.” U.S. EIA.

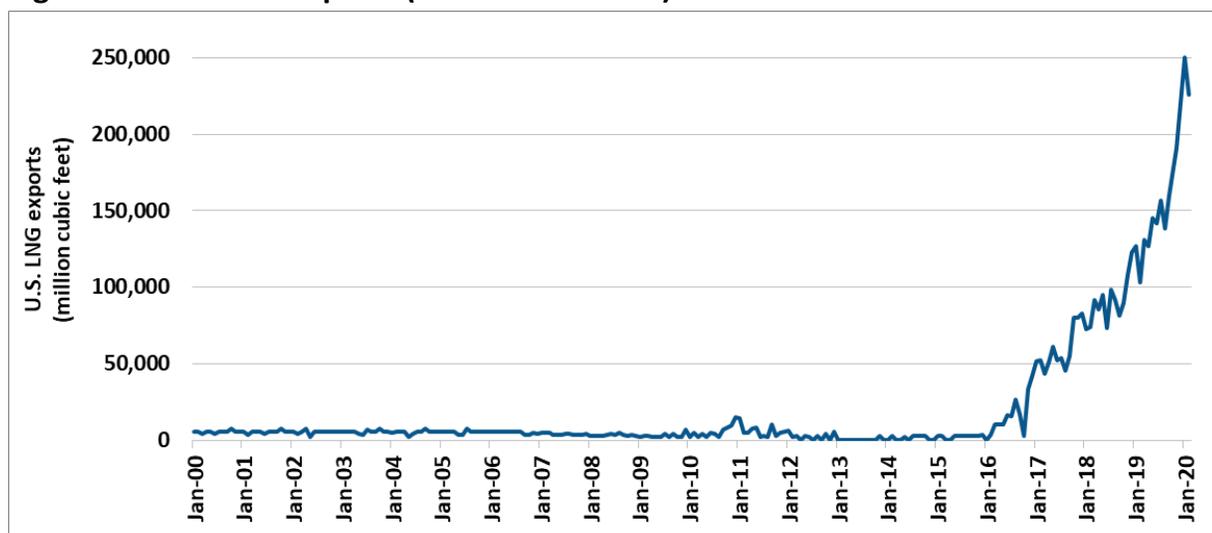
⁸⁷ *Ibid.*

⁸⁸ Commodity Futures Trading Commission. May 2018. *Liquefied Natural Gas Developments and Market Impacts*.

that rise in U.S. LNG exports “may put upward pressure on domestic natural gas prices.”⁸⁹

In other words, a market already fraught with price volatility is now likely to see even more frequent price swings, as well as a likely upward price trend in the long term. Both developments should be clear cautionary flags for investors in new PJM gas-fired power plants.

Figure 21: U.S. LNG Exports (million cubic feet)



Source: U.S. EIA. 2020. “Liquefied U.S. Natural Gas Exports”.

The U.S. LNG Infrastructure

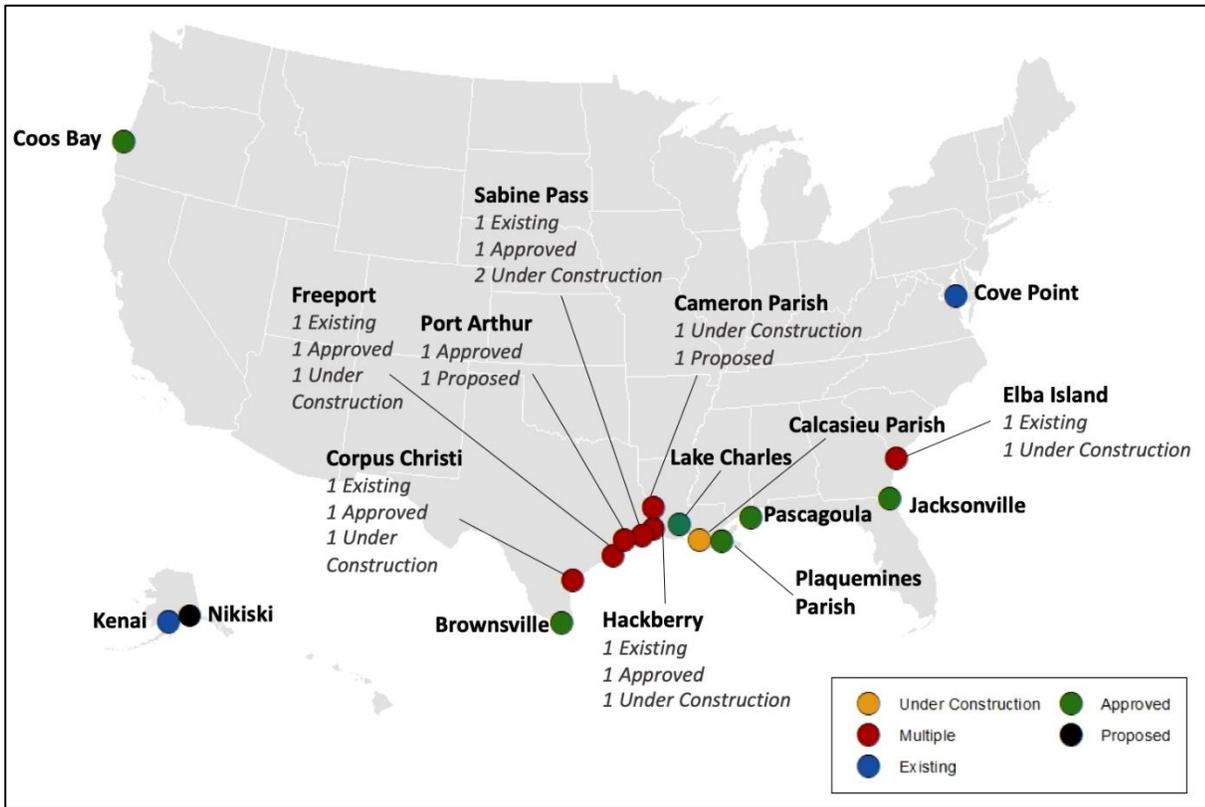
The volatility of gas prices—and the likelihood that this volatility will grow in real terms over time—is exacerbated by the state of LNG export terminal development in the United States. Currently, there are:

- 7 operational LNG export terminals;
- 8 LNG export terminals under construction;
- 14 LNG export terminals approved but not under construction; and
- 7 proposed LNG export terminals (see Figure 22).⁹⁰

⁸⁹ *Ibid.*

⁹⁰ Federal Energy Regulatory Commission. No date. “LNG.”

Figure 22: U.S. Existing, Under Construction, Approved and Proposed LNG Export Terminals



Source: Federal Energy Regulatory Commission. No date. "LNG".

Of the seven operational LNG export terminals, four came into service in 2019 (see Figure 22 and Table 3). Currently, the United States has more LNG export capacity in development (more than 50 bcf/d) than was consumed globally in 2019 (46.3 bcf/d).⁹¹ By developing more LNG export capacity than is currently demanded in the market, the U.S. LNG sector is betting on increasing global demand—a gamble that looks much riskier today than it did before the 2020 pandemic.

⁹¹ Bousso, R. March 30, 2020. "Shell drops out of major U.S. LNG project, Energy Transfer delays decision." Reuters.

Table 3: Operational U.S. LNG Export Terminals

Export Location	State	In-Service	Capacity (Bcfd)
Kenai	AK	1969	0.2
Sabine	LA	2008	3.5
Cove Point	MD	2018	0.82
Corpus Christi	TX	2019	1.44
Hackberry	LA	2019	1.4
Elba Island	GA	2019	0.21
Freeport	TX	2019	2.13

Source: 1) FERC. March 19, 2020. *North American LNG Export Terminals Existing*; 2) U.S. EIA. April 2020. *Form EIA-860M Monthly Update to Annual Electric Generator Report*. [Planned tab].

LNG export projects that are still in development began the permitting process when gas prices were higher—between 2012 and 2016. For the four projects that came online in 2019, an average of six years transpired between the project’s original FERC filing and the in-service date.⁹² Even if pending LNG export facilities obtain all required permits, it is no longer certain they can be financed since gas prices (which were already dropping before the COVID-19 pandemic) have plummeted, causing LNG storage facilities to remain at full capacity and ships carrying LNG to sit idle in the ocean.⁹³ LNG importers are canceling shipments from the United States, and U.S. gas companies are delaying LNG projects.⁹⁴ For example:

- **Cheniere LNG, Texas:** In May 2020, Cheniere pushed back its final decision (from 2020 to 2021) on a major expansion of the LNG export facility in Corpus Christi, Texas, stating that it depends on securing sufficient foreign investment;⁹⁵
- **Sempra Energy, California:** Also in May 2020, Sempra delayed its final decision on a new LNG export terminal in Port Arthur, Texas, from 2020 until 2021;⁹⁶

⁹² 1) Cheniere. No date. *“Second Largest LNG Operator in the World.”* 2) NS Energy. No date. *“Cameron LNG Project, Louisiana.”* 3) Kinder Morgan. No date. *“FERC Documents/Links.”* 4) Federal Energy Regulatory Commission. No date. *“LNG.”*

⁹³ 1) Krauss, C. May 11, 2020. *“Natural Gas Exports Slow as Pandemic Reduces Global Demand.”* *New York Times*. 2) Shiryayevskaya, A. and Stapczynski, S. February 12, 2020. *“Empty LNG Ships at Biggest Producer Show How Virus Grips Market.”* *Bloomberg*. 3) Toscano, N. June 15, 2020. *“Australia’s LNG tankers sitting idle as global supply glut, COVID start to bite.”* *The Sydney Morning Herald*. 4) Wallace, J. and Faucon, B. March 4, 2020. *“Ships Turn into Floating Storage Units for Oil and Gas as Chinese Buyers Back Out.”* *The Wall Street Journal*.

⁹⁴ Krauss, C. May 11, 2020. *“Natural Gas Exports Slow as Pandemic Reduces Global Demand.”* *New York Times*.

⁹⁵ 1) *Ibid*; 2) Financial Times. February 25, 2020. *Cheniere faces buyer reluctance over long-term LNG contracts*. 3) S&P Global Market Intelligence. June 11, 2020. *“Essential Energy Insights - June 11, 2020.”*

⁹⁶ 1) *Ibid*; 2) Nikolewski, R. May 5, 2020. *“Sempra delays decision on Texas LNG project to next year.”* *The San Diego Union Tribune*. 3) Chapa, S. May 4, 2020. *“Sempra Energy delays financial investment decision on Port Arthur LNG.”* *Houston Chronicle*.

- **Texas LNG, Texas:** In May 2020, Texas LNG delayed a final decision on a proposed LNG terminal in Brownsville, Texas, from 2020 until 2021;⁹⁷ and
- **Royal Dutch Shell, Louisiana:** In March 2020, Royal Dutch Shell withdrew from a joint venture with Energy Transfer in Lake Charles, Louisiana.⁹⁸

Growth in global LNG demand is still likely in the long term, but a recalibration will certainly be needed in the wake of the current global economic downturn. What is clear, however, is that the recent surge in U.S. LNG exports and associated infrastructure has linked the U.S. gas market much more closely to broader international developments. In turn, this is likely to increase domestic gas price volatility, injecting additional risk into gas-fired power plant financing decisions in PJM.

5. State Actions Impact Gas Plants: Clean Energy and Climate Goals Shorten the Lifespan of New Gas Plants

In the United States, much of the climate and clean energy legislation affecting gas plants is set at the state level rather than by the federal government. The primary federal environmental policy regulating gas plants is the 1963 Clean Air Act which, among other things, gives the U.S. Environmental Protection Agency (EPA) the authority to limit dangerous air pollutants, including greenhouse gases like carbon dioxide and methane.⁹⁹ These limitations are termed the National Ambient Air Quality Standards (NAAQS).¹⁰⁰ Among the environmental protections authorized by the Clean Air Act are the New Source Performance Standards (NSPS),¹⁰¹ which establish air and water pollution standards for power plants as well as industrial facilities such as glass, cement and rubber.¹⁰² Major sources of air pollution are also subject to the Title V Operating Permit program, and new or modified plants are subject to the New Source Review (NSR) permitting program.^{103,104} In 2015, the Obama administration released the Clean Power Plan (CPP),¹⁰⁵ which aimed to reduce emissions from existing power plants by 30 percent and would have given EPA authority to enforce these limits. In June 2019, however, the Trump

⁹⁷ 1) *Ibid*; 2) Weber, H. May 18, 2020. "NextDecade's Rio Grande LNG is latest US export project to delay FID until 2021." S&P Global Platts.

⁹⁸ 1) *Ibid*; 2) Pulsinelli, O. March 30, 2020. "Energy Transfer to move forward with Louisiana LNG project without Shell." Houston Business Journal. 3) Bouso, R. March 30, 2020. "Shell drops out of major U.S. LNG project, Energy Transfer delays decision." Reuters.

⁹⁹ U.S. EPA. No date. "Summary of the Clean Air Act."

¹⁰⁰ U.S. EPA. No date. "NAAQS Table."

¹⁰¹ U.S. EPA. No date. "Demonstrating Compliance with New Source Performance Standards and State Implementation Plans."

¹⁰² *Ibid*.

¹⁰³ U.S. EPA. No date. "Operating Permits Issues under Title V of the Clean Air Act."

¹⁰⁴ U.S. EPA. No date. "New Source Review (NSR)."

¹⁰⁵ U.S. EPA. No date. "FACT SHEET: Overview of the Clean Power Plan."

administration repealed the Clean Power Plan and replaced it with the Affordable Clean Energy (ACE) rule,¹⁰⁶ allowing each power plant owner to decide how much to cut emissions. The repeal of the CPP and its replacement by the ACE continues to face legal challenges.¹⁰⁷ Ultimately, the stringency of federal regulation of emissions from fossil-fueled power plants, including gas power plants, is likely to depend on the 2020 presidential election.

Clean Energy and Climate Goals

At a state level, climate and energy policies vary substantially. Pennsylvania aims to reduce greenhouse gas emissions by 80 percent from 2005 levels by 2050, achieve 18 percent renewable generation by 2021, and is considering joining the Regional Greenhouse Gas Initiative (RGGI, see more information about RGGI below).¹⁰⁸ West Virginia has no greenhouse gas emission reduction or renewable energy goals (Figure 23).¹⁰⁹ Currently, 39 U.S. states have a renewable portfolio standard, clean energy target or emissions reduction goal. Of those, 16 states aim to achieve 100 percent clean energy or 100 percent emissions reduction. PJM's 13 member states and the District of Columbia have adopted a variety of clean energy and climate goals (see Figure 23).

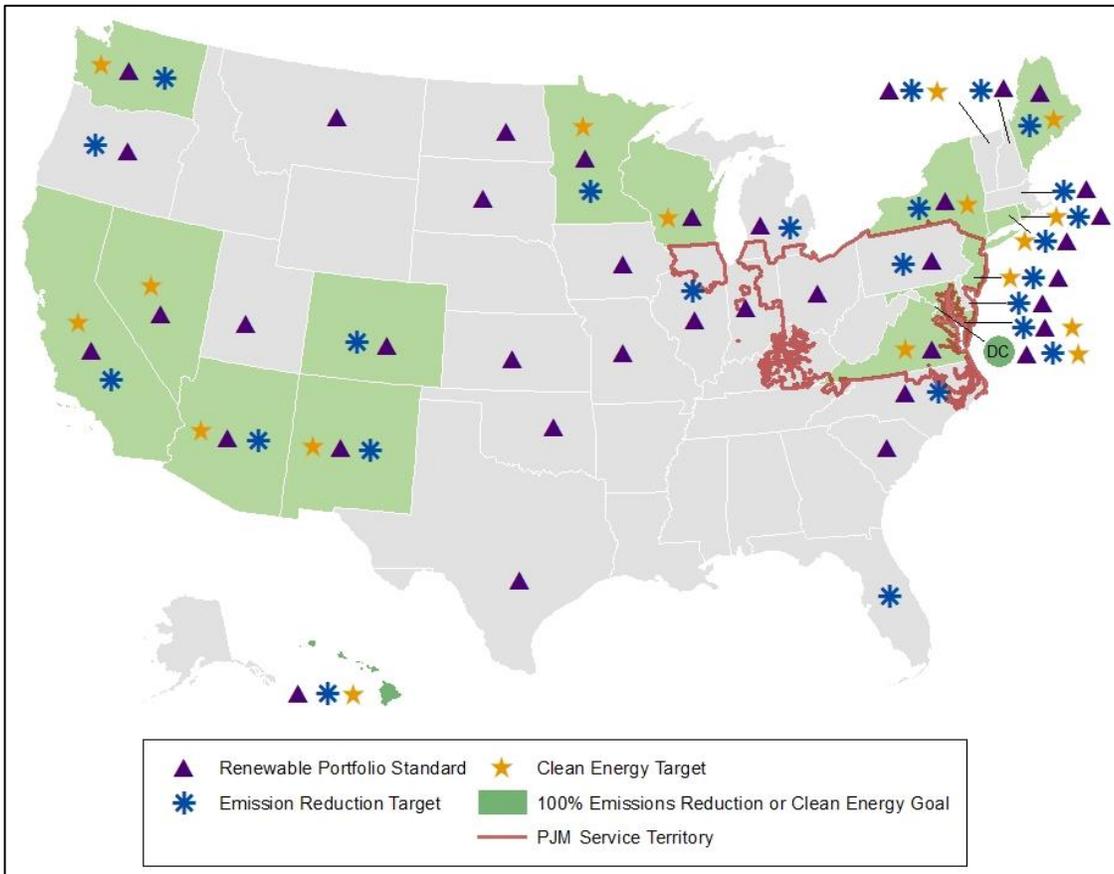
¹⁰⁶ U.S. EPA. No date. "Affordable Clean Energy Rule."

¹⁰⁷ Burtraw, D., Keyes, A. July 2019. *10 Big Little Flaws in EPA's Affordable Clean Energy Rule*. Resources for the Future. Issue Brief 19-05.

¹⁰⁸ 1) Wolf, T. 2019. *Executive Order No. 2019-01: Commonwealth Leadership in Addressing Climate Change and Promoting Energy Conservation and Sustainable Governance*. Commonwealth of Pennsylvania Governor's Office. 2) Pennsylvania Public Utility Commission. June 2015. *Energy Efficiency and Conservation Program IMPLEMENTATION ORDER*. Pennsylvania Public Utility Commission. Prepared for the Pennsylvania General Assembly. 3) Pennsylvania Public Utility Commission. September 2008. *FINAL RULEMAKING ORDER*. Pennsylvania Public Utility Commission.

¹⁰⁹ American Council for an Energy-Efficient Economy (ACEEE). July 2019. "Energy Efficiency Resource Standards."

Figure 23: Renewable Energy and Emission Reduction Goals Across the United States



Eleven U.S. states currently have carbon pricing mechanisms in place: California and the 10 Northeast states that are members of the Regional Greenhouse Gas Initiative (RGGI)—Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island and Vermont.¹¹⁰ California’s program was launched in 2013 and is the first cap-and-trade program in the United States that limits emissions economy-wide. The program applies to large electric power plants, large industrial plants, and fuel distributors. As of 2017, Massachusetts implemented regulations to establish an additional cap-and-trade program for its power sector that runs parallel to RGGI but extends to 2050. Washington state also passed a market-based climate policy, but the program is currently suspended while a challenge is pending in court.

RGGI, established in 2009, was the first carbon pricing program in the United States to limit emissions from the power sector via a cap-and-trade system.¹¹¹ RGGI aims to reduce electric sector emissions in its participating states by 45 percent below 2005 levels by 2020 and by 75 percent by 2030.¹¹² RGGI’s most recent progress report—

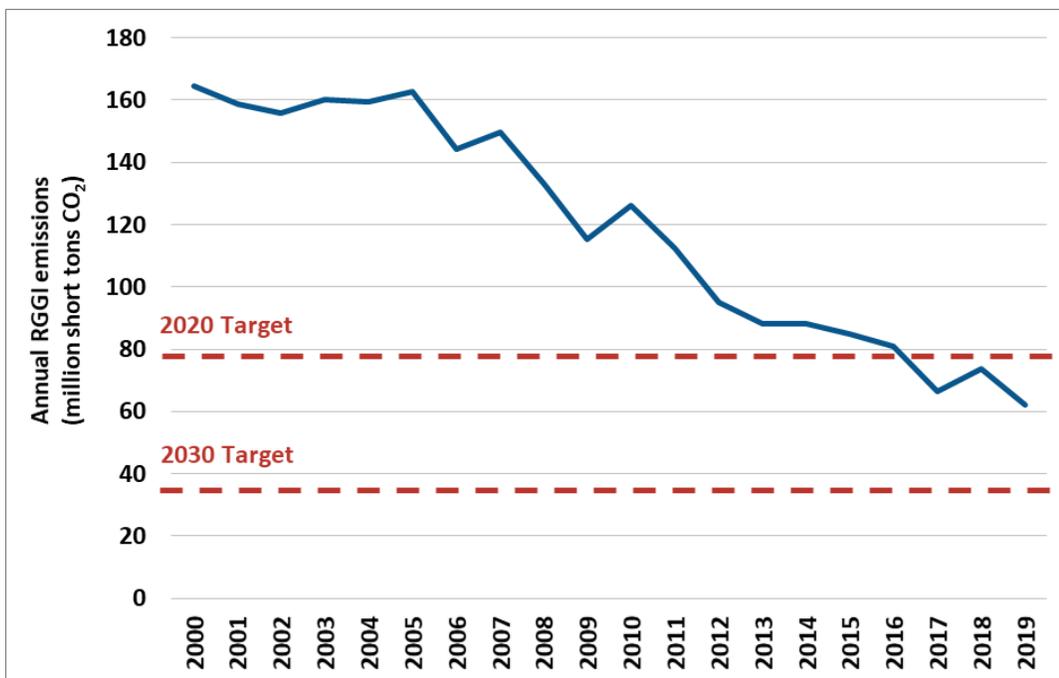
¹¹⁰ Center for Climate and Energy Solutions. June 2020. “U.S. State Carbon Pricing Policies.”

¹¹¹ The Regional Greenhouse Gas Initiative. July 8, 2020. “Welcome.”

¹¹² Center for Climate and Energy Solutions. No date. “Regional Greenhouse Gas Initiative (RGGI).”

released in November 2019—shows that average annual emissions between 2015 and 2017 fell by 45 percent compared to “the base period of 2006 to 2008,”¹¹³ meaning that RGGI reached its 2020 goal ahead of schedule (see Figure 24). The 11 currently proposed gas-fired combined cycle plants in PJM are in four states: New Jersey, Ohio, Pennsylvania and West Virginia. After formally leaving RGGI on January 1, 2012, New Jersey rejoined the emissions compact on January 1, 2020¹¹⁴—becoming the second largest state emitter of greenhouse gases currently participating in the program.¹¹⁵ If Pennsylvania were to join RGGI, as it is considering,¹¹⁶ it would constitute the largest expansion of the program since its formation and would make Pennsylvania RGGI’s largest greenhouse gas emitter by far.¹¹⁷

Figure 24: Historical RGGI Emissions (million short tons CO₂)



Note: Emissions from New Jersey are not included.

Source: 1) 2009-2019 data from—RGGI CO₂ Allowance Tracking System. 2020. Annual Emissions data. 2) 2000-2008 data from—RGGI. 2020. “Emissions”.

U.S. state and regional environmental regulations can directly affect the types of electric capacity investments pursued. For example, in April 2020, the Virginia Electric and Power Company filed a motion with Virginia’s State Corporation Commission regarding its integrated resource plan filing; the motion acknowledged

¹¹³ The Regional Greenhouse Gas Initiative. November 8, 2019. *CO₂ Emissions from Electricity Generation and Imports in the Regional Greenhouse Gas Initiative: 2017 Monitoring Report*.

¹¹⁴ RGGI Inc. June 17, 2019. *RGGI States Welcome New Jersey as Its CO₂ Regulation Is Finalized*.

¹¹⁵ MJB&A Issue Brief. January 19, 2018. *Potential Impacts of New Jersey Rejoining RGGI*.

¹¹⁶ Lavelle, M. October 3, 2019. “A Major Fossil Fuel State Is Joining RGGI, the Northeast’s Carbon Market.” Inside Climate News.

¹¹⁷ *Ibid.*

that because of the Virginia’s Clean Economy Act of 2020 (which aims for 100 percent clean energy by 2045), “significant build-out of gas generation facilities is not currently viable.”¹¹⁸ In its 2019 IRP, Appalachian Power did not pursue any new gas resources and presented plans to retire two gas steam units to comply with emission reduction legislation passed in April 2019 by the Virginia Air Pollution Control Board that mandates a 30 percent emissions reduction from electric generators.¹¹⁹

Nonetheless, some investors continue to finance new gas power plants and pipelines with expected lifetimes that exceed end-dates for gas generation allowable under climate and energy legislation, raising the risk of stranded assets. There also is the risk that states with no current climate legislation may adopt such policies in the future, and those with existing legislation may strengthen their policies. Stringent emissions reduction and/or renewable energy laws are incompatible with new gas development and may even render existing gas resources’ inoperable before the end of their economic lives.

While federal action on climate or clean energy is unlikely under the current administration, 2020 is a presidential election year. Should former Vice President Joe Biden win the election, his climate platform includes a pledge to sign a series of executive orders that would put the country on track to achieve 100 percent clean energy and net-zero emissions by 2050.¹²⁰ Biden also promises action against fossil fuel companies that “knowingly harm our environment” by directing federal agencies including the Environmental Protection Agency and the Justice Department to “pursue these cases to the fullest extent permitted by law.”¹²¹

6. Project Delays: Commonplace and Potentially Ruinous for New Gas Power Plants

Project delays for power plants in the United States are exceedingly common. All 11 of the gas-fired plants currently in the early stages of development in PJM have experienced delays (see Table 4).

¹¹⁸ Virginia State Corporation Commission. March 24, 2020. *Commonwealth of Virginia, ex rel. State Corporation Commission In re: Virginia Electric and Power Company's Integrated Resource Plan filing pursuant to Va. Code § 56-597 et seq.* Case No. PUR-2020-00035.

¹¹⁹ Appalachian Power Company. November 5, 2019. *Integrated Resource Plan.* Case No. PUR-2019-00058. Part 2 of 4. p.38.

¹²⁰ Joe Biden. No date. “Climate.”

¹²¹ *Ibid.*

Table 4: PJM Proposed Combined Cycle Gas Plants in Early Development

Plant Name	PJM Zone	State	Capacity (MW)	Status
Deepwater Repowering	AECO	NJ	547	Delayed
West Deptford Energy Project	PSEG	NJ	762	Delayed
Cadiz Combined Cycle Plant	AEP	OH	1050	Delayed
Allegheny Energy Center	APS	PA	541	Delayed
Archbald Energy Project	PPL	PA	485	Delayed
Beech Hollow Combined Cycle Plant	APS	PA	1025	Delayed
ESC Tioga County Power Plant	PENELEC	PA	892.5	Delayed
Good Spring Natural Gas Combined Cycle 1 & 2	PPL	PA	695	Delayed
ESC Brooke County Power I	APS	WV	830	Delayed
Harrison County Project	APS	WV	578.9	Delayed
Moundsville Power Project	AEP	WV	673	Delayed

Source: S&P Global Market Intelligence.

Sometimes, the reason for these delays is made known to the public (i.e. lapsed permits, regulatory setbacks, grassroots opposition) but sometimes it is not. For example:

- **Deepwater Repowering, New Jersey:** An upgrade to Deepwater Repowering was planned to be in-service by June 1, 2019, but is not currently operational, and no further information is publicly available.¹²²
- **West Deptford Energy Project, New Jersey:** Proposed in 2007, the first phase of the West Deptford Energy Project was planned to be in service in 2011, but commercial operation did not begin until November 2014.¹²³ The second phase—currently under development—began in 2014,¹²⁴ and no public information is available regarding its status.¹²⁵
- **Cadiz Combined Cycle Plant, Ohio:** Approved in 2018 by the Ohio Power Siting Board,¹²⁶ Cadiz Combined Cycle Plant was originally proposed to break ground during the fall of 2018 and begin operations by June 2021.¹²⁷ After facing substantial delays due to regulatory hurdles, the plant is now expected to break ground in 2020 and begin operation in 2023.¹²⁸

¹²² Cassell, B. May 2016. "Calpine files with DOE for up-to-456-MW project in New Jersey." Transmission Hub.

¹²³ 1) LSPOWER. August 2007. "Natural Gas to Fuel West Deptford Power Project." 2) Cassell, B. April 2014. "LS Power permits second, 427-MW phase of West Deptford plant." Transmission Hub.

¹²⁴ Cassell, B. April 2014. "LS Power permits second, 427-MW phase of West Deptford plant." Transmission Hub.

¹²⁵ *Ibid.*

¹²⁶ Kallanish Energy. June 2018. "Ohio approves 1,050 MW, gas-fired power plant in Cadiz."

¹²⁷ *Ibid.*

¹²⁸ Graham, C. January 2020. "Cadiz power plant will be \$1 billion investment." Herald-Star.

- **Good Spring NGCC, Pennsylvania:** Originally planned to begin construction in 2010,¹²⁹ Good Spring's construction faced its first delay when the start-date was pushed back to late 2011.¹³⁰ In 2014, the plant's developer announced that the units were in the final stages of development and ready for construction.¹³¹ In September of 2017, the plant was put on hold with no reason made public.¹³² No information has been made publicly available about the project's status since.
- **Harrison County Project, West Virginia:** Originally planned to be fully operational by fall 2021,¹³³ construction on the Harrison County Project is expected to begin at some point in 2020 and take two to three years to complete,¹³⁴ pushing back its operational date until 2022 or 2023.¹³⁵ Owners of nearby properties have expressed concerns over the facility's aesthetics, noise levels and impact on traffic; the facility's developers claim to have allayed those concerns.¹³⁶

Quickly Changing Conditions

Rapidly shifting market conditions can add to unforeseen project delays for gas power plants. The recent decision by Dominion and Duke, two of the United States' largest electric utilities, to pull the plug on the long-delayed and over-budget Atlantic Coast Pipeline underscores the risks of delays to power sector developers, even those with deep pockets. The pipeline, which was proposed in 2015, was initially projected to cost \$5.1 billion and be operational by late 2018. By the time the two utilities canceled the controversial project, its total cost had ballooned to more than \$8 billion and it was not projected to be completed until early 2022.

For smaller developers, particularly many of the firms looking to bring new gas-fired combined-cycle facilities online in PJM's wholesale service territory, the risks from rapidly changing market conditions are even more pronounced. The Ohio experience of Clean Energy Future, a privately held Massachusetts-based gas plant developer active in PJM since the early 2000s, is indicative of these risks. One of the company's projects, a planned combined cycle gas plant near Lordstown, Ohio, was cancelled by Clean Energy Future less than a month after the state enacted new legislation (HB 6) in July 2019. That legislation provides a \$150 million annual bailout for the state's two operating nuclear reactors (Davis-Besse and Perry), significantly lowers the state's renewable energy portfolio standard, and essentially

¹²⁹ Energy Justice Network. No date. "Good Spring IGCC &/or NGCC." Energy Justice Network.

¹³⁰ *Ibid.*

¹³¹ EmberClear Corp. March 2014. "EmberClear Announces Partnership with Tyr Energy on Good Spring Power Projects." CNW Group Ltd.

¹³² Terwilliger, V. September 2017. "Good Spring power plant put on hold." Republican Herald.

¹³³ Snoderly, J. February 2019. "Natural gas power plant to provide economic catalyst to Harrison County & WV, officials say." WVNews.

¹³⁴ Nelson, A. January 2020. "Harrison Energy Center is under contract." WTRF.

¹³⁵ *Ibid.*

¹³⁶ Snoderly, J. February 2019. "Natural gas power plant to provide economic catalyst to Harrison County & WV, officials say." WVNews.

ended future statewide utility energy efficiency mandates.¹³⁷ The two nuclear reactors have a combined capacity of 2,162 MW, so their continued operation—when they otherwise would have been retired—represents a fundamental shift in the outlook for new power projects in the region. In announcing Clean Energy Future’s decision to cancel the Lordstown gas plant, Bill Siderewicz, the company’s president, said: “There’s sheer disappointment that this is a project we know should be built and there’s demand. But because of artificial legislation efforts, we’re basically going nowhere. We’ll take all our information, including our filings with the EPA and PJM, into cardboard boxes.”¹³⁸

The changed circumstances could further delay another project that Clean Energy Future is developing in Ohio, dubbed the Trumbull Energy Center. The Trumbull project is described as a 940 MW gas-fired combined cycle plant that would also be located in the Lordstown area. The project first came into the public eye in November 2016, with the announcement that Clean Energy Future had signed a contract with Fluor (an engineering and construction company) to begin work on initial permitting and development. At the time, Clean Energy Future and Fluor expected construction to begin in 2018 and commercial operations to start in 2020.¹³⁹ At a January 2017 briefing to unveil the project publicly, Clean Energy Future’s Siderewicz told residents and local officials that he expected financing for the project to be secured by the end of 2017, with construction on the project beginning in early 2018, just as the company wrapped up work on an earlier, adjacent project, the 940 MW Lordstown combined cycle plant.¹⁴⁰ Even as late as October 2017, when Ohio’s Power Siting Board approved the project, Clean Energy Future was still saying it expected the plant to be finished by 2020.¹⁴¹

A dispute between Clean Energy Future and Macquarie Group, the company that bought a 70 percent stake in the Lordstown plant, stalled progress at Trumbull. The disagreement was over the land transfer needed for Clean Energy Future to begin construction on the second plant, but according to published reports, Macquarie—which owned the land and the Lordstown facility—raised concerns regarding “potential losses that it would incur should a second plant be built.”¹⁴² The delay added \$12 million to the project’s cost and effectively put it on hold until 2019, when Siderewicz again touted the project’s potential benefits: “We think because the plant is favorably located and has great characteristics, we could be in a position to break ground and have a financial closing by summer of this year.”^{143,144} At that time, Siderewicz said the company’s financial advisor, Whitehall & Co., was working

¹³⁷ Vox, July 27, 2019. “Ohio just passed the worst energy bill of the 21st century.”

¹³⁸ The Business Journal, Aug. 20, 2019. “Clean Energy Future kills plans for 3rd power plant.”

¹³⁹ Power Grid International. November 22, 2016. “Fluor signs with Clean Energy Future for Ohio gas-fired power plants.”

¹⁴⁰ Shank, V. January 12, 2017. “It’s official: Lordstown will get second energy plant.” Tribune Chronicle.

¹⁴¹ Utility Dive, October 10, 2017, “Ohio siting board approves 2 gas-fired projects.”

¹⁴² O’Brien, D. August 24, 2018. “Clean Energy, Macquarie Told to Mediate Dispute.” The Business Journal.

¹⁴³ Energy Central. February 26, 2019. “Second power plant to be built in Lordstown.”

¹⁴⁴ Construction Equipment Guide. April 2, 2019. “Energy Company Expects to Break Ground on Plant.”

to secure the necessary financing for the project, which he estimated at \$925 million—\$425 million in equity investment and \$500 million in debt.

The passage of HB 6 seems to be slowing progress on securing the financing needed for the Trumbull project. The same day Clean Energy Future announced it was cancelling the planned Lordstown gas plant, Siderewicz also said: “We’re talking with investors and lenders right now. It’ll be about a \$900 million project. The question is what is going on in Ohio. In that process, we should probably have completed by this time already, but there’s hesitation to invest in Ohio because they keep changing the rules of engagement.”¹⁴⁵ Despite the delay, Siderewicz said he was hopeful construction would begin at Trumbull by the end of 2019.¹⁴⁶ The latest official development in the Trumbull saga came in December 2019, when the company filed with the Environmental Protection Agency to renew its expired New Source Review permit. (For a discussion of these greenhouse-gas-emissions related permits, see Section 5 above.) Now, in late 2020, there is still no indication that the company has been able to secure financing for the project. The Standard & Poor’s database that tracks power plant project developments across the United States lists the project as being in “advanced development” with a tentative commercial startup date of June 2023.¹⁴⁷

Even without the upheaval caused by the HB 6 legislation in Ohio, the problem for Clean Energy Future and potential investors is that the energy situation in Ohio and throughout the PJM service territory has changed dramatically since the Trumbull project was first proposed. This transition has been fueled by efficient natural-gas combined-cycle units, increasing the competition for future entrants. Over-investment in capacity resources in PJM (see discussion in Section 2 above) and a resulting reserve margin of 33 percent has meant plenty of competition among existing resources, a trend that is not likely to change anytime soon. New entrants rely on being the lowest-cost supplier, a risky proposition when investing hundreds of millions of dollars in each given project.

Another new reality facing developers of gas-fired projects is the fading image of gas as a bridge to a low-carbon energy future. The past six months have changed that outlook completely, with utilities and state governments alike moving forward with transitions from coal to clean renewables, without an interim gas-fueled stopover. For example, it is almost certain that Virginia’s recent adoption of clean energy legislation played a role in Dominion’s decision to cancel the Atlantic Coast Pipeline.^{148,149} That legislation, signed by Gov. Ralph Northam in April, requires Dominion, the state’s largest utility, to be carbon-free by 2045. The legislation also calls for the construction of 5,200 MW of offshore wind and 16,100 MW of solar and onshore wind, deeming those projects “in the public interest.”¹⁵⁰ In other words, this

¹⁴⁵ The Business Journal. Aug. 20, 2019. “Clean Energy Future kills plans for 3rd power plant.”

¹⁴⁶ *Ibid.*

¹⁴⁷ S&P Global Market Intelligence. No date. “Power Plant Units.”

¹⁴⁸ Dominion Energy press release, July 5, 2020.

¹⁴⁹ Dominion filing in Virginia docket: PUR-2020-00035, p. 5.

¹⁵⁰ Virginia Senate Bill 851. “The Virginia Clean Economy Act.”

tells Dominion that investments in these resources almost certainly will be approved by regulators, allowing the utility to recover its costs and then some.¹⁵¹

Elsewhere in the United States, several utilities recently have announced plans to skip gas as they transition to a cleaner, lower-carbon future. Among the most recent are Tucson Electric Power, Colorado Springs Utilities and Florida Power & Light, which have all crafted plans to enable them to retire existing coal plants without building any new gas generation, instead relying on new solar, wind and battery storage.¹⁵² While investment in renewable generation was growing when the Trumbull plant was first proposed in 2016, there has been a clear increase in utility interest and uptake in the past four years. That, too, points to the risks inherent in project delays for gas developers.

Clean Energy Future has repeatedly touted the benefits that would accrue to the local community from the expected 50-year operating life of the Trumbull plant, but the plant is unlikely to operate that long. A much more realistic expected closure date would be 2050, when an increasing number of U.S. states aim to reach clean energy and emission reduction goals that are often incompatible with new gas power plants (see Section 5 above for a more detailed discussion). Even that date may be optimistic, given Virginia's 2045 carbon-free mandate and other state-led initiatives to push for lower-carbon resources. Potential investors in Trumbull and other proposed gas power plants cannot expect to have much more than two decades to recover their investment—and even then, they should be aware that their investment recovery window could close even sooner.

Grassroots Opposition

Around the United States, developers seeking to build new gas plants and the infrastructure needed to operate them—like pipelines and import/export terminals—often face opposition from successful, and growing, grassroots campaigns. For example, mass protests against the Keystone XL Pipeline garnered national attention, which ultimately resulted in then-President Obama's rejection of the project in 2015.¹⁵³ In July, the U.S. Supreme Court refused to let construction begin on the pipeline, meaning that pipeline is delayed until at least 2021.¹⁵⁴ Within PJM, more than six years of organizing and more than 600 activists successfully pushed the state of Maryland to issue a ban on fracked gas in March 2017.¹⁵⁵

Grassroots mobilization and activism have delayed and derailed numerous projects. For example, strong public opposition ultimately prompted state regulators to deny a key permit for the proposed 900MW Clear River Energy Center in Burrillville,

¹⁵¹ Yarmosky, A. April 12, 2020. "Governor Northam Signs Clean Energy Legislation." Office of the Governor of Virginia.

¹⁵² Wamsted, D. July 1, 2020, "Utilities are now skipping the gas 'bridge' in transition from coal to renewables."

¹⁵³ Schor, E. November 11, 2015. "Obama rejects Keystone XL pipeline." Politico.

¹⁵⁴ Stohr, G. July 6, 2020. "Keystone XL Pipeline Stays Blocked in U.S. Supreme Court Order." Bloomberg Green.

¹⁵⁵ Chesapeake Climate Action Network. March 2017. "We Banned Fracking in Maryland."

Rhode Island leading to its cancellation.¹⁵⁶ The Invenergy project was first proposed in 2015 and originally was projected to enter commercial service in 2019; permitting delays and grassroots opposition ultimately forced the company to push that date back to 2023 before the plant was cancelled.¹⁵⁷

In the case of the ET Rover gas pipeline in Michigan, six counties' township boards and commissions passed resolutions opposing the project, and local activists held rallies and wrote letters in opposition to lawmakers. Ultimately, Energy Transfer Partners (the parent company of the pipeline development firm) decided to re-route the portions of the pipeline away from the six counties that had opposed it.¹⁵⁸ In New Jersey,¹⁵⁹ activists opposing the PennEast pipeline successfully called on the state to deny the project's permits, even after they were approved by FERC. The developer reapplied after a year of additional land surveys, and was denied again in October 2019.¹⁶⁰ In February, the Constitution Pipeline—backed by Williams, Duke Energy, Cabot and AltaGas—was canceled after eight years of legal and regulatory battles.¹⁶¹ The developers of the project said that the expected return on investment had “diminished in such a way that further development is no longer supported.”¹⁶²

At least six of the 11 currently proposed gas-fired plants in PJM (see Figure 5 above) have encountered grassroots opposition to their development:

- **Archbald Energy Project, Pennsylvania:** Invenergy received approval for construction of the Archbald Energy Project in 2017. The project quickly faced opposition from local elected officials and citizens in Lackawanna County.¹⁶³ Because Archbald's proposed site sits half a mile from homes, local residents protested and presented a plan for a smaller plant that could be constructed elsewhere.¹⁶⁴ Nonetheless, the town council voted in favor of the full plant construction.¹⁶⁵ A year later, the nearby LEC plant experienced a gas release incident, causing further

¹⁵⁶ Proctor, D. June 21, 2019. “Rhode Island Rejects Burrillville Gas-Fired Plant.” Power.

¹⁵⁷ Walton, R. June 21, 2019. “Rhode Island Siting Board Rejects Invenergy’s 900 MW Gas Plant.” Utility Dive.

¹⁵⁸ Hasemyer, D. February 10, 2015. “Natural Gas Pipeline Battle in Michigan Moves South.” Inside Climate News.

¹⁵⁹ Harrison, A. October 25, 2019. “PennEast pipeline suffers another setback as DEP denies permits.” Hopewell Valley News.

¹⁶⁰ *Ibid.*

¹⁶¹ North American Oil & Gas Pipelines. February 25, 2020. “Williams, Partners Abandon Constitution Pipeline Project.”

¹⁶² Blanchard, S. February 25, 2020. “Constitution Pipeline project ends as builder cites ‘diminished’ return on investment.” *State Impact Pennsylvania*.

¹⁶³ 1) Cocklin, J. May 2017. “NatGas-Fired Power Plant in Northeast Pennsylvania Advances.” Natural Gas Intelligence (NGI). 2) O’Connell, J. December 2018. “Release of natural gas at power plant rattles Midvalley residents.” The Citizens’ Voice.

¹⁶⁴ Hopkins, S.H. November 2017. “Big power plant ignites political fight in small Pennsylvania town.” National Public Radio.

¹⁶⁵ *Ibid.*

public outcry by local residents who had already expressed concerns over the plant.¹⁶⁶

- **ESC Tioga County Power Plant, Pennsylvania:** Proposed in 2016, operations at ESC Tioga were scheduled to begin June,¹⁶⁷ but its full operation date has been pushed back to 2021.¹⁶⁸ Neighbors expressed concern over the possible sound and sight disruptions.¹⁶⁹ There were also concerns about the plant's water usage, and the Tioga County Planning Commission is currently considering requiring a dedicated water pipeline from external water resources to alleviate this issue.
- **The Allegheny Energy Center, Pennsylvania:** Allegheny was proposed in 2016 to be constructed on a remediated hazardous waste landfill.¹⁷⁰ The proposed plant faced local opposition and had its zoning variance application denied by the Elizabeth Township Zoning Hearing Board, a decision that the plant's developer, Invenergy, has appealed. In 2017, Invenergy suggested that a new site was under consideration for the project on the Allegheny/Westmoreland County border.¹⁷¹
- **ESC Brooke County Power I, West Virginia:** After years of legal challenges, ESC Brooke County received its final permits in February 2019.¹⁷² The plant has faced opposition since public comments began in 2017.¹⁷³ In 2018, a request was made for the state Supreme Court of Appeals to overturn the West Virginia Public Service Commission's decision to build this plant, but that request was overturned, which cleared the way for construction to begin.¹⁷⁴
- **Beech Hollow CC Plant, Pennsylvania:** Construction began in 2006, but due to construction lapses, the plant's air permits expired before completion. This delay resulted in lawsuits filed by the Environmental Integrity Project and the Sierra Club in 2008 demanding that the plant meet federal and state air pollution standards.¹⁷⁵ The plant's application

¹⁶⁶ O'Connell, J. December 2018. "Release of natural gas at power plant rattles Midvalley residents." The Citizens' Voice.

¹⁶⁷ Cassell, B. April 2016. "ESC Tioga pursues gas-fired project in Pa., 250 MW of which will be in PJM." Transmission Hub.

¹⁶⁸ Del Rosario, K.D. August 2018. "Shale-heavy regions continue to attract most US gas plant development." S&P Global Market Intelligence.

¹⁶⁹ Clarke, C.A. November 2017. "Gas-fired electric plant proposed - Supervisors to question developer at next meeting." Tioga Publishing.

¹⁷⁰ Mountain Watershed Association. No date. "Proposed Allegheny Energy Center."

¹⁷¹ 1) *Ibid*; 2) Kasserman, K. Mar 2, 2017. "Allegheny Energy Center Suggests New Location for Gas Plant."

¹⁷² Long, T. February 2019. "Natural gas power plant in Brooke County receives final permits." Nexstar Broadcasting.

¹⁷³ Eiler, S. August 2017. "Meeting held about proposed natural gas-powered electric plant in Brooke County." Sinclair Broadcast Group.

¹⁷⁴ Editorial Board. November 2018. "Editorial: Ruling clears way for gas-fired power plants in WV." Williamson Daily News.

¹⁷⁵ Energy Justice Network. No date. "Beech Hollow Energy Project."

for an air permit was resubmitted in March 2016, and in 2017 the plant's updated air quality plan was approved by state environmental regulators.¹⁷⁶ The project was delayed again in 2019 when two members of the Robinson Township Board (who must vote to approve the plant's land-use permits) declared a conflict of interest.¹⁷⁷ Locals have created an organization called Residents Against the Power Plant, that is opposed to any vote being held on the plant.¹⁷⁸ The plant's 2017 environmental approval was scheduled to expire in April 2018 if construction had not begun, but the plant's owner (Robinson Power) has been granted an extension that pushes the expiration date to October 27, 2020.¹⁷⁹

- **Moundsville Power Project, West Virginia:** Moundsville faced heavy opposition from local coal-affiliated interest groups,¹⁸⁰ which led to a lawsuit over one of the project's permits that was ultimately decided in favor of allowing the project.¹⁸¹ On their website, the plant developer, Quantum Utility Generation LLC, still lists this project as active, but news reports suggest that the lengthy litigation process has resulted in nervous investors.¹⁸²

Conclusion

The landscape for gas-fired power plant development in PJM has changed dramatically. Over the last decade:

- Electric demand has remained flat, resulting in significant regional overcapacity.
- Renewable energy has become increasingly cost competitive.
- Wind and solar generators have become underrepresented in PJM relative to other ISOs.
- States in PJM have acted to limit future gas generation development.
- Public resistance to large energy infrastructure projects has increased.

¹⁷⁶ Observer-Reporter. June 2017. "[Plans again in the works for Beech Hollow electric generation plant.](#)"

¹⁷⁷ Templeton, D. October 2019. "[Vote delayed on controversial Beech Hollow Energy plant in Washington County.](#)" Pittsburgh Post-Gazette.

¹⁷⁸ *Ibid.*

¹⁷⁹ *Ibid.*

¹⁸⁰ Ward Jr., K. November 2018. "[Jobs Alliance Backed by Coal Giant Loses Bid to Stop West Virginia Natural Gas Plant.](#)" ProPublica.

¹⁸¹ Junkins, C. February 2018. "[WV Natural Gas Power Plant Approved.](#)" The Intelligencer.

¹⁸² Ward Jr., K. September 2018. "[WV's largest coal operator fighting back against growing natural gas industry.](#)" Charleston Gazette-Mail.

Over the last year:

- FERC's MOPR Order has eroded certainty in PJM's capacity market.
- PJM's most recent capacity auction has been delayed by about a year.
- All 11 of the currently proposed gas-fired plants in PJM have remained delayed.
- Uncertainty over the future direction of U.S. gas prices has increased due to the rise in LNG exports and the resulting linkage between U.S. and international markets.

Over the last six months:

- Illinois, Maryland and New Jersey indicated they are considering exiting the PJM capacity market.
- The COVID-19 pandemic has driven down energy demand and gas prices, domestically and globally.
- The global economy has entered the worst recession since World War II.¹⁸³

Taken together, these changes have significantly increased the financial risks for investors considering new gas-fired power plants in the PJM region.

¹⁸³ The World Bank. June 8, 2020. "COVID-19 to Plunge Global Economy into Worst Recession since World War II."

About AEC

The Applied Economics Clinic (AEC) is an independent, 501(c)(3) non-profit consulting group that provides expert testimony, analysis, modelling, policy briefs, and reports for public interest groups on the topics of energy, environment, consumer protection, and equity, while providing on-the-job training to a new generation of technical experts. www.aeclinic.org

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About the Authors

Bryndis Woods, PhD

Bryndis Woods, PhD, Researcher at the Applied Economics Clinic, has more than seven years of experience in research and analysis, with a focus on climate and energy issues. Dr. Woods has authored more than fifty-five publications on a variety of topics, including: renewable energy; energy efficiency; environmental justice; climate policy and climate adaptation. She has presented her work at international conferences around the world, including the European Climate Change Adaptation Conference and the Annual Conference of the European Association of Environmental and Resource Economists.

Elizabeth Stanton, PhD

Elizabeth Stanton, PhD, Director and Senior Economist at the Applied Economics Clinic, has more than 19 years of experience in the field. Dr. Stanton has an extensive publication record, including more than 140 reports, journal articles, books and book chapters as well as more than 40 expert comments and oral and written testimony in public proceedings on topics related to energy, the economy, the environment, and equity. She has submitted expert testimony and comments in Minnesota, Louisiana, Indiana, Illinois, Vermont, New Hampshire, Massachusetts, and several federal dockets. Her recent work includes testimony and comments on IRP and efficiency plans, alternatives to fossil fuel infrastructure, proposed pipelines, energy storage, state climate plans, and the equitable implementation of a new green economy.

Dennis Wamsted

IEEFA Analyst/Editor Dennis Wamsted has covered energy and environmental policy and technology issues for 30 years. He is the former editor of The Energy Daily, a Washington, D.C.-based newsletter.

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