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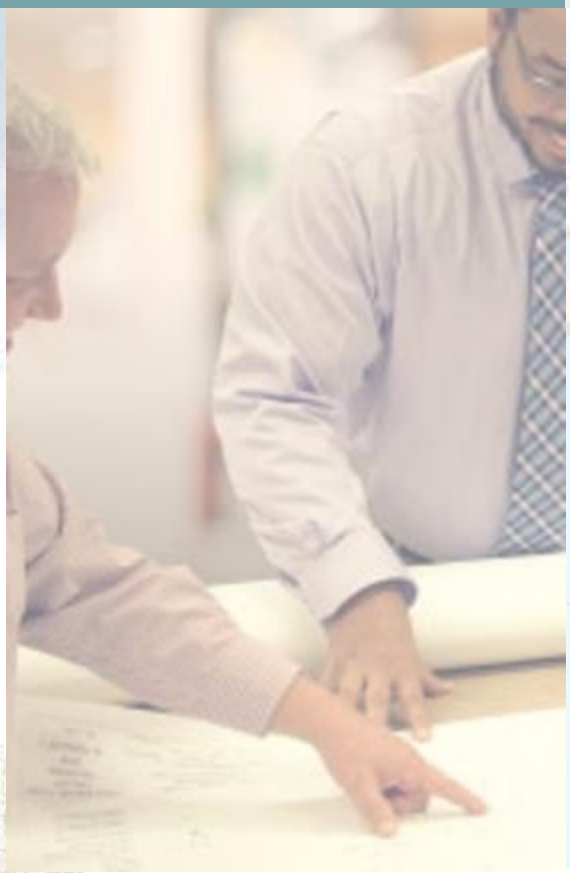
APPA

Prepared on behalf of the
American Public Power Association

The Importance of Natural Gas Fuel and Interstate Pipeline Infrastructure

Public Power Perspective

June 24, 2022



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Executive Summary

The electric and natural gas industries are intertwined, and several recent events including natural gas pipeline review changes contemplated by the Federal Energy Regulatory Commission (FERC), a rapid increase in natural gas commodity prices, and extreme winter weather events have brought a focus to the relationship between those industries. This paper provides an overview of natural gas as an electric generation fuel and highlights its ongoing importance to electric reliability and affordability to the nation's consumers. Looking forward, efficient regulatory review processes that provide required certainty will be necessary to ensure adequate infrastructure enables the needed supply to support reliability and affordability. Table 1 below summarizes key points discussed further throughout the paper.

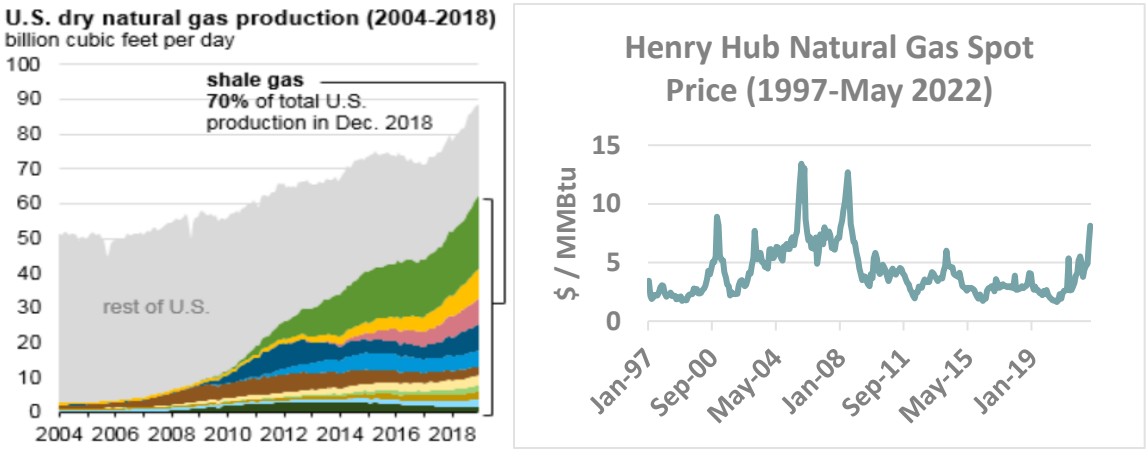
TABLE 1: SUMMARY OF KEY POINTS

#	
1	Natural gas has grown as an electric generation fuel and will continue to play several important roles in the electric system for the foreseeable future.
2	The natural gas and electric systems are interdependent, and the adequacy of each industry impacts the other.
3	Natural gas prices are an important driver of electricity affordability.
4	Regulatory processes should meet statutory requirements while maximizing efficiency and certainty. Cost and reliability may be exacerbated by poor infrastructure review processes.
5	Necessary infrastructure can address constraints on natural gas supply. Without adequate natural gas supply and the pipeline infrastructure to transport it, natural gas, power, and home heating customers are likely to experience elevated energy prices.

1 Electric / Natural Gas Nexus

In the last 15 years, the intersection between the electric and natural gas industries has expanded and intensified. Natural gas has grown significantly as an electric generation fuel source in that time, both as a replacement for retiring coal and as flexible generation, balancing growing intermittent resources like wind and solar. The prominence of natural gas-fueled generation has been propelled by the shale gas revolution, which significantly increased domestic natural gas production, resulting in sustained low prices for several years (see Figure 1) and a redefinition of how the natural gas pipeline network was utilized and expanded. Higher and higher intermittent generation penetration and the uncertainty / variability of electric output from these sources make quick-starting natural gas generation a critical reliability component on the grid.

FIGURE 1: US SHALE GAS PRODUCTION & PRICES[i1]

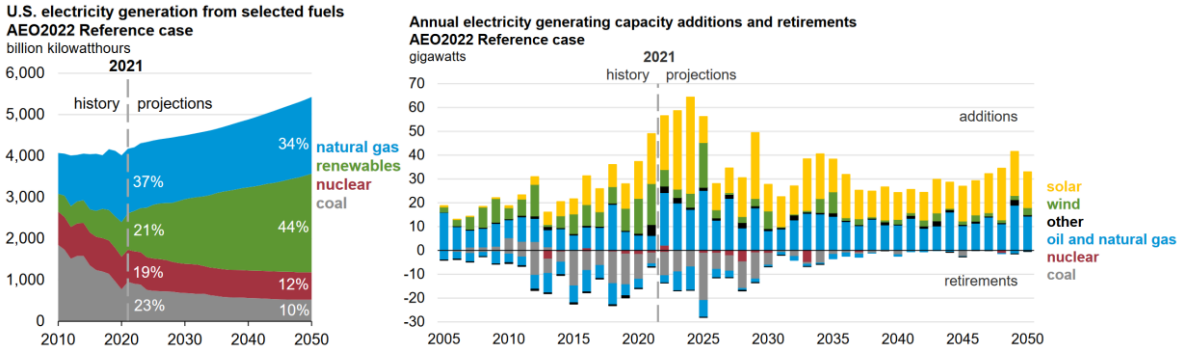


1.1 NATURAL GAS AS ELECTRIC GENERATION FUEL

Significant coal generation capacity retirements have occurred in the past 15 years, while natural gas and renewable capacity has been added. These trends are expected to continue, with natural gas and renewables projected to be the primary capacity additions through at least 2050 (see Figure 2). The relative share of generation output shown in Figure 2 reflects those capacity change dynamics, although natural gas generation output may decline relative to its capacity share due to displacement by renewables (i.e., declining capacity factor).

[1] The more recent increase in natural gas prices that began in 2021 is discussed later in the paper.

FIGURE 2: US ELECTRICITY GENERATION & CAPACITY BY FUEL[ii]



These are long-range projections, and resource trends may play out differently. An increased focus on nuclear energy, for example, may affect its relative contribution to the resource mix. There are also many factors that could impact natural gas's future role as an electric generation fuel, including growing competition from renewables, maturing battery storage, and emerging, novel technologies. Federal and state policies promoting non-emitting generation may also influence the proportion of natural gas-fired generation in the resource mix. There is also growing interest in, and experimentation planned for, using the existing natural gas system with cleaner options such as hydrogen.

Notwithstanding these uncertainties, natural gas-fired electric generation will remain critical to maintaining reliable electric service for the foreseeable future. Indeed, the U.S. Energy Information Administration (EIA) projects that natural gas resources will remain relatively constant as approximately one-third of the generation capacity mix through 2050, with some regions likely at a higher percentage.

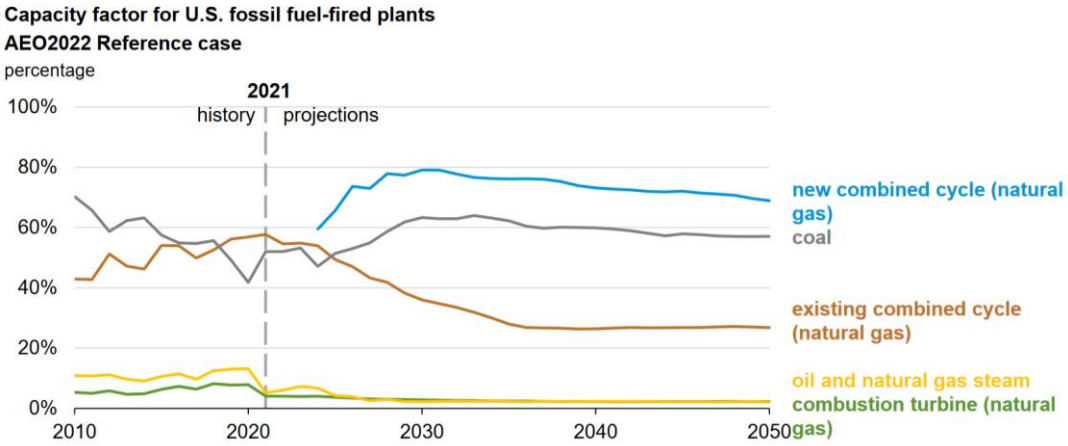
Natural gas remains an important fuel for generating plants owned by public power utilities to serve the customers in their communities. According to analyses by APPA, natural gas-fueled power plants accounted for 44.1% of generating capacity owned by public power utilities as of 2020, and 34.4% of the energy generated by public power-owned facilities.

1.2 ROLE OF NATURAL GAS POWER PLANTS IN RELIABLE ELECTRIC SERVICE

From quick-start, lower efficiency peaking plants such as combustion turbines and engines, to higher efficiency, more capital-intensive combined cycle plants, natural gas-fueled power plants serve a variety of important roles in maintaining reliable service on the electric grid. For example, combined cycle plants, based on their higher efficiencies, can operate at high levels of output for many hours of the year (often characterized as baseload), while combustion turbines might only operate a select handful of hours of the year when electricity demand is highest (often referred to as peaking), as illustrated by the EIA chart in Figure 3.[2]

[2] In regions with large amounts of intermittent generation, the traditional peak period has shifted from gross demand (when load is highest) to net demand (when load less intermittent generation is highest).

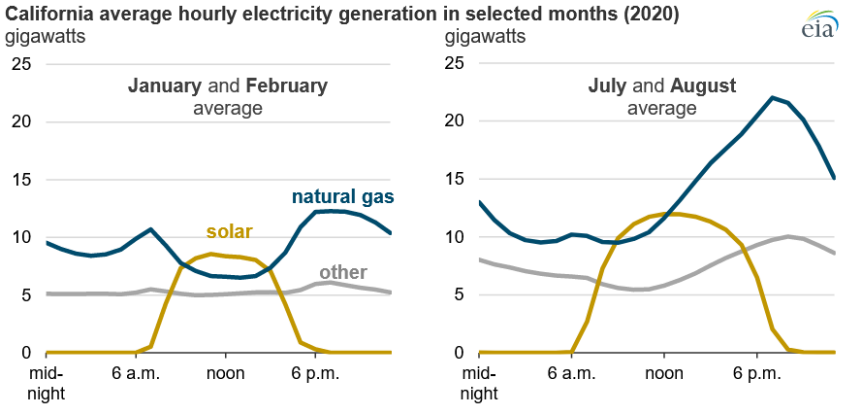
FIGURE 3: NATURAL GAS PLANT CAPACITY FACTORS



Natural gas power plants are also viewed as a primary technology choice for meeting marginal capacity requirements. For example, PJM Interconnection (PJM) has always used a natural gas combustion turbine as its 'reference resource' in its capacity market and may pursue switching to a natural gas combined cycle technology for its capacity auctions beginning with 2026 based on recent recommendations.[iii][3]

Another important and related aspect of natural gas power plants is their flexibility, meaning their ability to vary output rapidly (including stopping and starting) as needed. Natural gas power plants, across the relevant technologies (e.g., combustion turbine, engines, combined cycles) and especially newer plants, are typically highly flexible. From peaking plants that can be started very rapidly as needed, to other natural gas plants that can vary their output quickly, natural gas power plants can respond to the dynamic needs of the electric grid. For example, in the California Independent System Operator (CAISO) footprint, natural gas has been significant as a complement to increased output from solar resources (see Figure 4). The flexibility of natural gas power plants has been utilized to ramp down generation during the midday solar production period and then quickly ramp back up in the evening as solar output diminishes while load requirements are high.

FIGURE 4: HOURLY NATURAL GAS OUTPUT IN CALIFORNIA[iv]



[3] PJM utilizes its selected 'reference resource' technology as the basis for developing the Cost of New Entry (CONE), which is an important input into its capacity auction, determining in part the amount of capacity PJM procures (i.e., demand curve) as well as generation market offer allowances (i.e., ceiling prices on capacity offers from sellers).

The critical role of natural gas plants as marginal and flexible generation explains why the North American Electric Reliability Corporation (NERC) and others have increasingly emphasized the importance of natural gas-fueled generation in a resource mix with greater variable resources. NERC's 2021 Long-Term Reliability Assessment (LTRA), for example, bluntly states that "[n]atural gas is the reliability 'fuel that keeps the lights on,' and natural gas policy must reflect this reality." NERC goes on to explain that "[s]ufficient flexible resources are needed to support increasing levels of variable generation uncertainty," and that "[u]ntil storage technology is fully developed and deployed at scale (which cannot be presumed to occur within the time horizon of this LTRA), natural-gas-fired generation will remain a necessary balancing resource to provide increasing flexibility needs."[v] NERC's CEO has echoed this theme, emphasizing that "as variable resources continue to replace other generation sources, natural gas will remain essential to reliability."[vi]

Grid operators with responsibility for keeping the lights on in large regions of the country have made similar points. In joint comments to FERC, for example, PJM and the Midcontinent Independent System Operator (MISO) stressed "that the continued availability of natural gas and associated infrastructure is a key component in ensuring long-term resource adequacy, and by extension, in meeting PJM and MISO's significant reliability responsibilities . . . ."[vii]

1.3 INTERDEPENDENCY OF ELECTRIC AND NATURAL GAS INDUSTRIES

The importance of natural gas-fueled generation to reliable electric service creates significant interdependencies between the electric and natural gas industries. These interdependencies have been areas of particular focus for years, often highlighted by severe winter weather events when peak electricity and natural gas usage coincide. As far back as 2011, FERC and NERC noted that:

> *"Utilities are becoming increasingly reliant on gas-fired generation, in large part because shale production has dramatically reduced the cost of gas. Likewise, compressors used in the gas industry are more likely than in the past to be powered with electricity, rather than gas. As a result, deficiencies in the supply of either electricity or natural gas affect not only consumers of that commodity, but of the other commodity as well."*[1]

In 2015, FERC issued Order No. 809 which improved the coordination of the wholesale natural gas and electricity markets by shifting the interstate natural gas nomination timeline to better align with electricity market timelines. This order was prompted by severe cold weather in the winter of 2013/14.

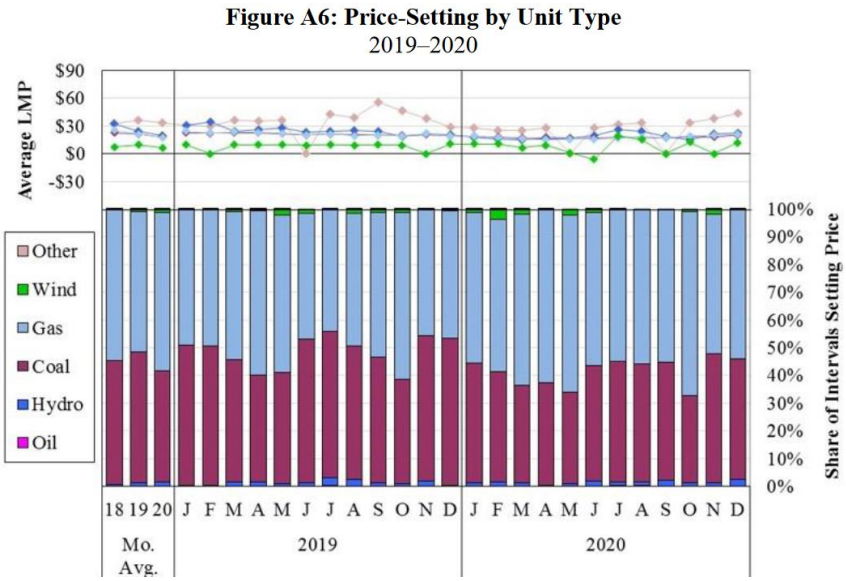
More recently, FERC and NERC analyzed the causes of the February 2021 arctic weather event, finding that natural gas fuel supply issues were a major contributor to the unavailability of electric generation resources, while at the same time concluding that electricity outages (including load shed directives) unfortunately included production and other critical natural gas facilities.

These severe winter weather events and their fallout starkly illustrate the growing relationship between electric and natural gas over the past 15 years. They underscore that these industries are interconnected and the adequacy of one affects the other.

1.4 IMPACT OF NATURAL GAS PRICE ON COST OF POWER

Given the critical role that natural gas power plants play in providing reliable generation to the grid, the price of fuel for these plants can significantly impact the price of electricity ultimately paid by consumers. There is a strong, well-established connection between wholesale natural gas and power prices. In the FERC-regulated organized markets, the relationship between natural gas prices and wholesale electric prices is particularly evident. Because natural gas power plants are often on the margin, they frequently set the price in structured wholesale electricity markets, where the cleared offer price of the marginal unit sets the overall market price. In MISO, for example, natural gas sets the price more than any other fuel, in over half of all instances (see Figure 5).

FIGURE 5: MARGINAL, PRICE SETTING FUEL IN MISO[viii]



Southwest Power Pool's (SPP) Market Monitoring Unit reports on wholesale power prices alongside natural gas prices, and there is a clear, strong correlation (see Figure 6). One of FERC's key findings from its 2021 State of the Markets report, moreover, was that "higher natural gas prices caused higher electricity prices with increases at all major electric pricing hubs."[ix] Even more recently, FERC Staff's 2022 Summer Energy Market and Reliability Assessment notes that, driven by higher natural gas prices and other factors, "futures prices for some major U.S. electric price points are up over last year's settled prices by between 77% to 233%."[x] As wholesale natural gas prices have markedly increased over the past two years (see Figure 7), wholesale power prices have responded in turn. These impacts are by no means limited to organized markets. APPA member data show that, in Florida, natural gas generation is on the margin in the vast majority of hours.

Electric utilities incur the cost of the natural gas commodity (along with pipeline transportation costs) either directly as purchases for use as fuel in power plants or indirectly through wholesale power market prices. In either case, the affordability of electric power bills is driven in no small part by natural gas prices.

FIGURE 6: SPP 2021 ENERGY VS NATURAL GAS PRICING[xi4]

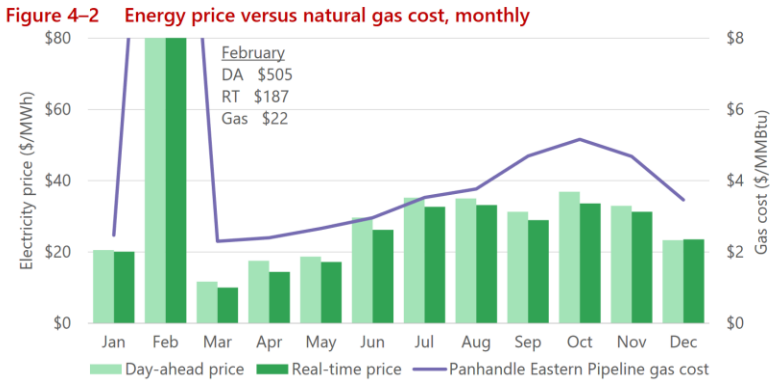
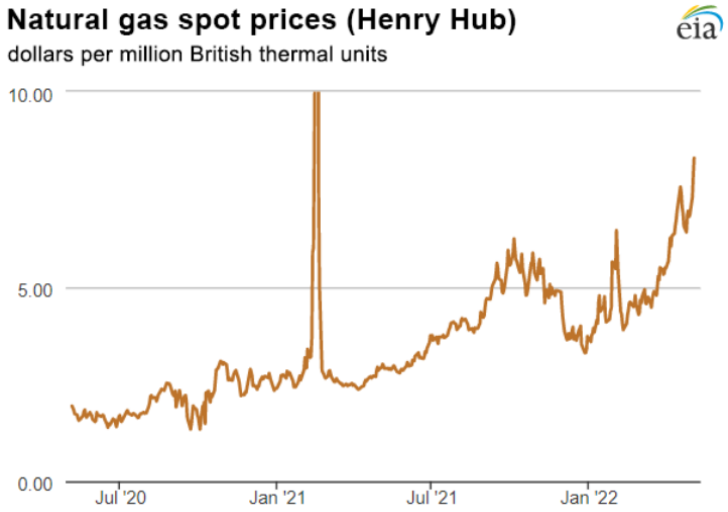


FIGURE 7: NATURAL GAS SPOT PRICES (2020-22)[xii]



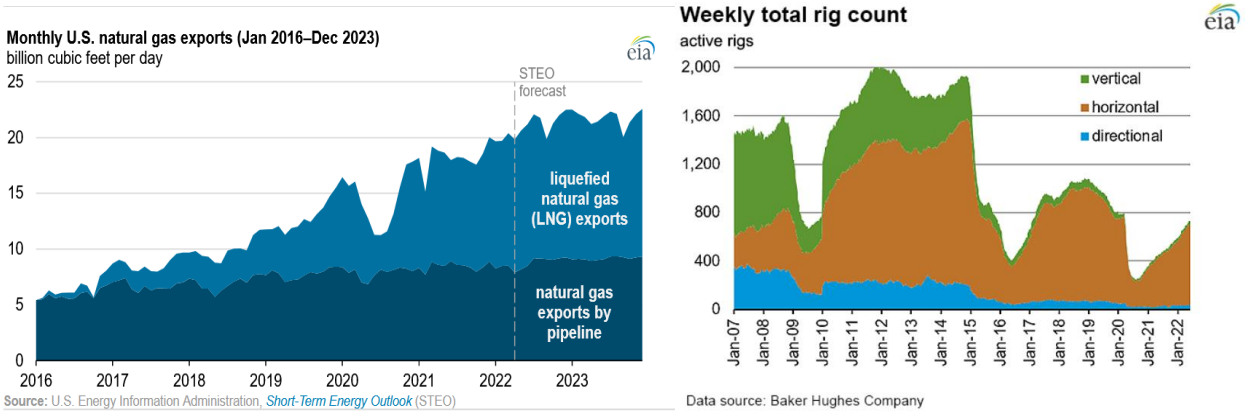
Since the effective deregulation of natural gas commodity prices in the 1990s, natural gas prices have been the product of supply and demand market factors. This can leave electric utilities and their customers exposed to significantly increased costs for essential natural gas fuel when supply constraints and / or other factors lead to higher natural gas prices, as has been the case in 2022. The recent increase in natural gas prices has been attributed to reduced exploration due to the COVID pandemic and environmental policy, fallout of the February 2021 arctic weather event, increased difficulty financing exploration, and increased liquefied natural gas (LNG) export activity, among other factors.

Indeed, over the past seven years, the amount of LNG exports from the U.S. has consistently risen and is expected to continue to rise. This trend has only been accelerated and intensified due to the war in Ukraine, and domestic users of natural gas are increasingly competing with global users (see Figure 8). As demand increases, new supply is often tracked using rig count as an indicator of exploration and

[4] The average for February 2021 displays the impact of the arctic weather event that occurred in the middle of that month. Although the event only lasted for several days, the impact on natural gas and electric energy prices was so profound, the monthly average is heavily impacted.

development. Although the number of rigs has been steadily increasing since a sharp slump that occurred in 2020, it has still not returned to 2019 levels (see Figure 8).[5]

FIGURE 8: NATURAL GAS EXPORTS AND EXPLORATION[xiii,xiv]



As natural gas electric generation has proliferated and played a large part in replacing coal generation, the U.S. electric system is more heavily impacted by the price of natural gas. Coal continues to compete with natural gas resources – and is relatively advantaged because of the recent increase in natural gas prices – but large amounts of coal generation have retired so its role as a substitute for natural gas fuel has diminished. Renewables can also compete and substitute for natural gas generation, but their variable output, as discussed above, means that natural gas generation also serves a complementary role with renewables. Both coal and renewables have been challenged with supply chain disruptions which also reduce their capability to compete with natural gas.

The importance of natural gas to reliable and affordable electric service highlights the need to ensure an adequate and reliable natural gas supply chain, including sufficient natural gas transportation infrastructure. To provide additional context for this important point, the following section provides a brief overview of the natural gas industry segments.

[5] The shift to horizontal drilling and other changes has continually improved productivity. After more than two years (including several months of higher prices) from its large move downward, exploration and production have not returned to their pre-pandemic levels.

2 Natural Gas Industry Overview

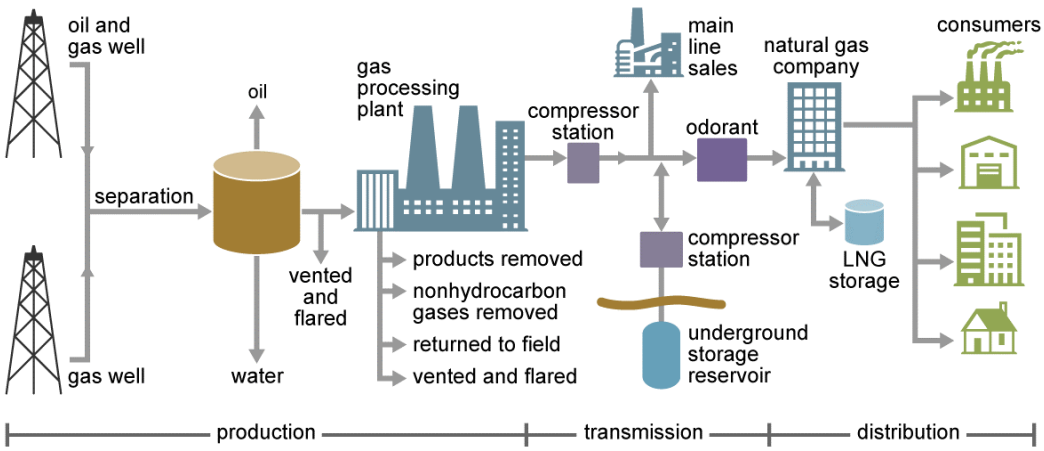
The natural gas industry is divided into separate segments, each of which involves different actors and industry activities. Regulation also varies between those segments, with federal regulators overseeing the interstate pipeline system and state regulators overseeing local gas utilities.

2.1 INDUSTRY SEGMENTS

The natural gas industry is typically broken down into the three segments shown in Figure 9. The first segment is **production**, also referred to as supply or upstream, in which natural gas is extracted from wells, gathered through small pipelines, and processed. The second industry segment is **transmission**, also referred to as transportation or midstream, in which natural gas is moved through large diameter pipelines, assisted by compressor stations. Finally, there is **distribution**, also referred to as consumption or downstream, in which natural gas is received from larger pipelines by wholesale purchasers such as Local Distribution Companies (LDCs) which distribute the natural gas through smaller pipelines to their retail customers which ultimately consume the gas. Natural gas power plants can either be customers of a LDC or they can receive their gas directly from the pipeline transmission system.

Storage is another critical component of the natural gas industry and is typically interconnected to the transmission pipeline system. Storage is important because natural gas production is fairly constant throughout the year, but demand is seasonally weighted in the winter heating months and also can vary considerably day by day. As discussed above, the operations of natural gas power plants vary to serve the needs of the electric system, so they are a source of variable demand for the natural gas system. The availability of storage can help to balance supply and demand quantities on the natural gas system, including for electric generation.

FIGURE 9: NATURAL GAS INDUSTRY[xv]



Source: U.S. Energy Information Administration

2.2 REGULATION OF THE NATURAL GAS INDUSTRY

While a detailed overview of natural gas regulation is beyond the scope of this paper, a few key elements of this regulatory framework are germane to this discussion. First, the production and processing of natural gas is generally a matter of state regulation. Second, as discussed above, the price of the natural gas commodity sold at wholesale (i.e., sales for resale) is generally deregulated and not subject to price controls. Third, the rates, terms, and conditions of interstate pipeline service (including storage) are regulated by FERC, generally on a cost-of-service basis. Under FERC's regulations, interstate pipelines must offer transportation service on a nondiscriminatory basis at just and reasonable rates regulated by FERC. Finally, in addition to regulating pipeline rates, FERC has jurisdiction over review of applications for construction of new interstate pipeline facilities under the Natural Gas Act. FERC must certify new pipeline projects and provide regulatory approval for those projects to move forward.

3 Pipeline Infrastructure Needs

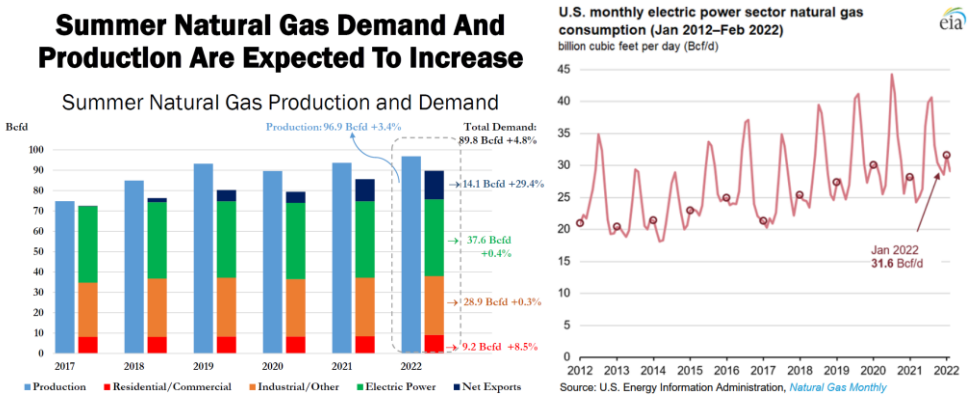
As the lead regulator with authority to approve new interstate natural gas pipeline facilities, FERC plays a significant role in ensuring adequate infrastructure exists to meet demand for natural gas, including that for electricity generation. In the past few years, FERC has been undertaking an overhaul of its processes for reviewing new pipeline applications, with potentially significant implications for natural gas supply and price reliability.

3.1 THE IMPORTANCE OF NATURAL GAS PIPELINE INFRASTRUCTURE

Energy (power and natural gas) are infrastructure-intensive industries. The U.S. natural gas pipeline system consists of over 300,000 miles of pipelines that has been built and expanded for decades. This system continues to grow and expand to meet increasing demand. Indeed, FERC approved 2,965 MMcf/d of pipeline capacity in 2021.[xvi]

The need for natural gas supply will continue to place demands on transportation infrastructure. Figure 10 shows that summer 2022 demand is expected to surpass recent history (driven by electric generation and exports), after January 2022 recorded the highest ever use of natural gas for electric generation.

FIGURE 10: GROWING NATURAL GAS DEMAND[xvii][xviii]

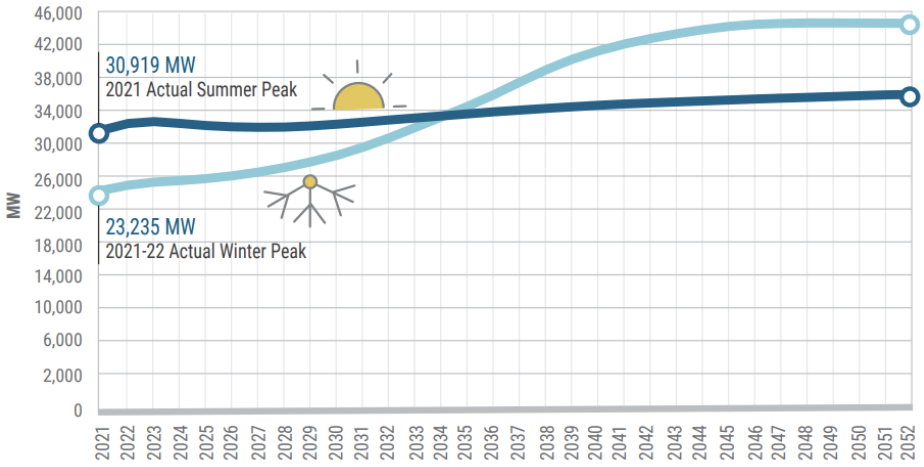


A reliable and affordable supply of natural gas depends on adequate transportation infrastructure. NERC has asserted that "additional pipeline infrastructure is needed to reliably serve load."[xix] FERC is reporting 13,353 MMcf/d of major pipeline projects pending as of June 1, 2022.[xx]

The New England Independent System Operator (ISO-NE) highlights the reliability concern in describing natural gas infrastructure constraints that exist in that region where natural gas infrastructure is less robust. ISO-NE states that inadequate natural gas infrastructure is an "energy-security risk [that] has become a pressing concern in New England, considering the major role natural-gas-fired generation plays in keeping the lights on and setting prices for wholesale electricity."[xxi] Similarly, NERC described that "high reliance on natural gas-fired generation and limited natural gas infrastructure elevates reliability risk in these areas" (referring to New England, California, and the southwestern United States).[xxii] Many areas of the electric system currently experience peak usage in the summer, but there are growing expectations that winter peaks may come to transcend summer peaks in the coming years (see

Figure 11). Although the drivers of this shift such as electrification are nascent and heating fuel switching may offset increased electricity use with decreased natural gas use, growing winter electric peaks can coincide with traditional natural gas heating peaks, leading to increased stress and peak usage of the natural gas system.

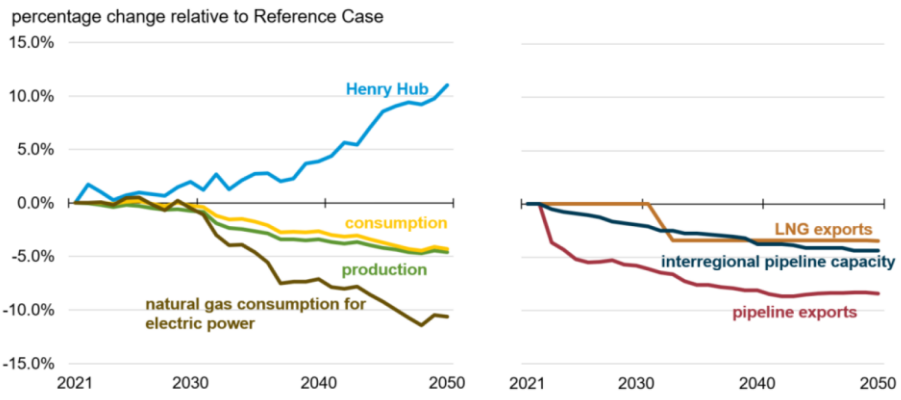
FIGURE 11: NYISO PROJECTED SUMMER / WINTER PEAKS[xxiii]



EIA highlighted the affordability concerns associated with inadequate gas pipeline capacity by specifically studying a scenario assuming no interstate pipeline expansion as a part of its 2022 Annual Energy Outlook (AEO). As compared to its 'Reference Case,' EIA noted several changes in the no pipeline addition case by mid-century including approximately 2 Tcf less gas production and 11% higher wholesale natural gas prices.[xxiv]

FIGURE 12: EIA NO PIPELINE EXPANSION MODELING

Figure 1. Percentage change between the Reference case and the No Interstate Pipeline Builds case, AEO2022



Source: U.S. Energy Information Administration, *Annual Energy Outlook 2022* (AEO2022)
Note: The percentage change represents the No Interstate Pipeline Builds case minus the Reference case.

3.2 FERC POLICY CHANGES

In 2018, FERC began exploring whether it should revise its gas pipeline certification policy statement that was originally issued in 1999. In February 2022, FERC issued a revised certificate policy statement along

with an interim policy statement outlining how FERC would consider Greenhouse Gas (GHG) emissions in evaluating applications for new interstate gas pipeline facilities.[xxv] FERC updated its policies in a number of key areas, including substantiation of project need, consideration of impacts on existing customers and pipelines, assessment of environmental impacts including GHG emissions, evaluation of the impacts on landowners, and consideration of environmental justice impacts. After considerable criticism, FERC withdrew its updated policies pending further input from stakeholders.[xxvi]

In proposing to revisit its gas pipeline certificate policy, FERC was motivated, at least in part, by several judicial decisions that overruled FERC pipeline approvals. As one particularly notable example, the Spire STL Pipeline had its certificate vacated by the U.S. Court of Appeals for the D.C. Circuit in 2021, two years after the pipeline had begun operations.[xxvii] A number of other rulings found fault with FERC's consideration of GHG emissions in assessing the potential environmental impacts of new pipeline infrastructure pursuant to the National Environmental Policy Act. Several of the FERC commissioners cited the need for a more "legally durable" policy in response to these court reversals.

3.3 IMPORTANCE OF REGULATORY EFFICIENCY AND CERTAINTY

As the need for natural gas to address critical needs persists, including ensuring electric reliability, regulatory processes for review and approval of gas pipeline infrastructure must be efficient and provide regulatory certainty and predictability to applicants and other stakeholders. Efficiency is achieved by having decision processes that are as streamlined and expeditious as possible, given statutory requirements, to provide reasonable outcomes while avoiding unnecessary delays or effort. Certainty is achieved with concrete and clear approval requirements. There should be a clear path to approval if required conditions are met. Efficiency and certainty are critical pillars of regulatory approval processes that should harmonize with the extent of statutory requirements of review.

FERC's goal to have legally durable pipeline approvals is entirely consistent with the need for regulatory certainty and efficiency. A regulatory approval process can and should meet statutory requirements (avoiding judicial reversals) while also providing efficiency and certainty for applicants.

3.4 RISKS OF REGULATORY INEFFICIENCY AND UNCERTAINTY

If regulatory approval processes are inefficient or create uncertainty, then needed infrastructure investment can be adversely affected. An inefficient regulatory approval process can delay investment and add costs to a project, including financing costs. If the process is characterized by uncertain standards or outcomes, the risk of rejection will either deter otherwise willing applicants or add costs. In either case, poor regulatory processes can stifle or delay needed infrastructure investment, leading to negative impacts on affordability and potentially diminished reliability.

In his written testimony before the Senate Energy and Natural Resources Committee, FERC Commissioner Mark Christie, who dissented on FERC's revised policy statements, articulated these risks:

> *By raising costs and uncertainty, it will undeniably act as a deterrent to building the facilities this country will need to keep our electric grid reliable, to heat people's homes in the winter, to provide manufacturers with the energy supply they need to keep manufacturing jobs here in the United States, and even to serve our national security, as current events in Europe and Ukraine graphically illustrate.*[1]

Measuring regulatory uncertainty and its economic impacts in a precise way is an intrinsically difficult endeavor. FERC's proposed policy changes invited strong concerns from interested parties, and the ultimate impact of any changes will depend on FERC's final policy actions and how those are implemented. Although the exact magnitude of impact may be difficult to assess, the negative impact of regulatory uncertainty on investment is clear. General research into policy uncertainty has found that "policy uncertainty is associated with greater stock price volatility and reduced investment and employment in policy-sensitive sectors like defense, healthcare, finance, and infrastructure constructions."[xxviii]

In the energy space specifically, policy uncertainty has had demonstrable, large impacts on renewable energy recently. The Production Tax Credit (PTC) for wind was originally authorized in 1992 and then went through several cycles of expiration and later renewal. The result was a boom-and-bust relationship for wind investment and development, as buyers sought to rush projects to garner the PTC before expiration, only for the PTC to later be extended. More recently, the Department of Commerce's solar tariff investigation has imposed major uncertainty on the solar industry, and the response has been massive with projects being delayed, canceled, and prices rising considerably. Whether renewable energy or natural gas, regulatory uncertainty has the same negative impact of dampening investment and raising costs.

4 Conclusion

Natural gas is and will continue to be an important driver of electric reliability and cost. The nexus between the electric and natural gas industries has intensified and will continue to be critical for the foreseeable future. The availability of adequate natural gas supply and the infrastructure to deliver it will impact the electric sector, including public power, as U.S. policy develops and changes. As an element of that policy, regulatory review of necessary energy investment should harmonize legally robust decisions with concrete approval conditions and streamlined processes. Otherwise, the reliability and affordability of the mutually dependent natural gas and electric systems will be harmed. The table below repeats the key points as provided in the Executive Summary.

#	Executive Summary Key Points
1	Natural gas has grown as an electric generation fuel and will continue to play several important roles in the electric system for the foreseeable future.
2	The natural gas and electric systems are interdependent, and the adequacy of each industry impacts the other.
3	Natural gas prices are an important driver of electricity affordability.
4	Regulatory processes should meet statutory requirements while maximizing efficiency and certainty. Cost and reliability may be exacerbated by poor infrastructure review processes.
5	Necessary infrastructure can address constraints on natural gas supply. Without adequate natural gas supply and the pipeline infrastructure to transport it, natural gas, power, and home heating customers are likely to experience elevated energy prices.

Endnotes

[i] Energy Information Administration, Today in Energy, https://www.eia.gov/todayinenergy/detail.php?id=38372

[ii] Energy Information Administration, Annual Energy Outlook 2022, available at https://www.eia.gov/outlooks/aeo/

[iii] PJM CONE 2026/2027 Report, prepared by the Brattle Group, https://www.pjm.com/-/media/library/reports-notices/special-reports/2022/20220422-brattle-final-cone-report.ashx

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[v] NERC 2021 Long-Term Reliability Assessment, available at: https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_LTRA_2021.pdf

[vi] Reliability, Resiliency, and Affordability of Electric Service in the United States Amid the Changing Energy Mix and Extreme Weather Events, Testimony of James B. Robb, President and CEO NERC, https://www.nerc.com/news/Headlines%20DL/NERC%20Reliability%20Hearing%20Testimony%203-11-21%20-%20Final.pdf

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