Topic Paper #3-3

GAS/ELECTRIC COORDINATION AND NATURAL GAS PIPELINE DEPLOYMENT

Prepared for the

Permitting, Siting, and Community Engagement for Infrastructure Development Task Group

On December 12, 2019 the National Petroleum Council (NPC) in approving its report, *Dynamic Delivery – America's Evolving Oil and Natural Gas Transportation Infrastructure*, also approved the making available of certain materials used in the study process, including detailed, specific subject matter papers prepared or used by the study's Permitting, Siting, and Community Engagement for Infrastructure Development Task Group. These Topic Papers were working documents that were part of the analyses that led to development of the summary results presented in the report's Executive Summary and Chapters.

These Topic Papers represent the views and conclusions of the authors. The National Petroleum Council has not endorsed or approved the statements and conclusions contained in these documents, but approved the publication of these materials as part of the study process.

The NPC believes that these papers will be of interest to the readers of the report and will help them better understand the results. These materials are being made available in the interest of transparency.

The attached paper is one of 26 such working documents used in the study analyses. Appendix C of the final NPC report provides a complete list of the 26 Topic Papers. The full papers can be viewed and downloaded from the report section of the NPC website (www.npc.org).

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Topic Paper

(Prepared for the National Petroleum Council Study on Oil and Natural Gas Transportation Infrastructure)

3-3	**Gas/Electric Coordination and Natural Gas Pipeline Deployment**
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SUMMARY

Federal energy regulators and energy market participants have identified the need to improve interoperability between the natural gas and electricity wholesale markets as critical to improving reliability and resiliency, and to foster infrastructure deployment. Due to incompatibility within the markets, the largest end-user of natural gas pipelines, natural gas-fired power generators, faces impediments to entering into contracts necessary for pipeline capacity expansion. Power plant takes from pipelines are highly variable; yet the market currently lacks an efficient and transparent pricing structure for the intraday volumetric variability upon which they rely. Conversely, the design of the competitive wholesale electricity markets does not provide competitive generators with sufficient incentives to commit capital needed for expansion to meet their requirements for gas transportation services. These impediments will become more pronounced as additional renewables are deployed, which will increase intraday variability. Thus, energy regulators and market participants should identify and implement market policy solutions for improving coordination and the means for electric generators to contract with pipeline operators to meet their evolving needs.

Introduction:

Natural gas pipelines are deployed based on market forces: to move gas from a source of supply and/or to an area of demand, based on the willingness of a shipper to pay. In the vast majority of circumstances, when proposed natural gas pipelines are subscribed by customers signing long term contracts for new pipeline capacity (anchor shippers), that capacity gets approved and constructed. By entering into a long term contract, and paying the demand charges by which daily transportation capacity is reserved over the contract term, such shippers are entitled to firm transportation service. For pipeline developers, interest from and signed contracts with firm shippers is the predicate for designing, obtaining regulatory approvals and ultimately putting into service new infrastructure.

Natural gas-fired power plants are now the largest users of the interstate pipeline system, and growing. Yet while comprising the largest segment of demand, power plants –particularly those in the regional competitive wholesale electricity markets that cover most of the country- are reluctant to contract for firm transportation, and comprise a disproportionately small percentage of the contract shippers needed to facilitate infrastructure expansion. This paper identifies areas of misalignment between the natural gas and electricity wholesale markets, and discusses market policy opportunities that have been identified by regulators and market participants to bridge existing contracting gaps in order to foster investment and natural gas pipeline deployment.

The Commercial Impetus for Natural Gas Pipeline Expansion:

Under current natural gas market policy, the Federal Energy Regulatory Commission (FERC) extensively relies on contracts between pipeline shippers and pipeline developers as the primary implement for determining whether there is "market need" for proposed pipeline capacity and as a threshold for its permitting reviews. Under the economic theory underpinning FERC's market-based needs assessment, a sizeable price differential between two points on the pipeline network "create[s] an incentive for shippers to support midstream pipeline development in order to capture the arbitrage opportunity across the network."[1]

In simple terms, "basis differential" is the difference between the spot market price of natural gas at a pricing point and the price at a different point. When the contract cost for shippers to fund new pipeline capacity is less than the aggregate basis differential over the prospective contract term, a shipper derives an economic benefit from making such a contract commitment so that new capacity is deployed. Once the new capacity is operational, basis is diminished and the arbitrage opportunity evaporates. Thus, natural gas pipeline capacity is generally added through an empirically demonstrable market impetus for investment by market participants, either on the supply or demand side, that would benefit from investment to reduce or eliminate basis.

Much, but not all, of the recent natural pipeline buildout can be characterized as "supply push" whereby producers or marketers contract for firm transportation in order to obtain capacity for moving low cost production to supply areas. With power generation continuing to increase natural gas consumption, a growing commercial impetus for system expansion should be demand-serve, whereby large gas users seek pipeline service to meet the needs of gas fired generation, LNG exports and to access liquid supply locations. But for competitive electric generators, there is a lack of viable commercial constructs and transactional tools available for electric generators to foster new market-driven capacity.

Competitive power generators tend to rely on interruptible transportation, whereby they avoid take or pay reservation or demand charges to reserve capacity. Interruptible transportation, however, is unreliable on days when the pipelines are constrained, and more importantly, obscures the price signal that conveys the value of infrastructure investment to serve power generation load, the largest volumetric user of the interstate pipeline system. Thus, the

[1] US DOE, Quadrennial Energy Review, (April 2015), Appendix B at p. 29.

unwillingness or inability of merchant power generators to enter into long term contracts necessary to support pipeline capacity presents an obstacle to new infrastructure deployment.

Impediments to Pipeline Capacity Expansion for Serving Power Generation:

The commercial barriers for competitive power generators have two distinct facets. In the first instance, the design of the competitive wholesale electricity markets does not provide competitive generators with sufficient incentives to commit capital for pipeline capacity expansion. Secondly, the design of the natural gas wholesale market was premised on the commercial prerogatives of local gas distribution companies and large industrial gas users. Natural gas-fired power generation was essentially an afterthought, and the service and tariff offerings of the pipelines were not fundamentally designed with power generation takes in mind, especially as they are becoming more variable (i.e., non-ratable) on an hourly and sub-day basis. The incompatibility as among and between the wholesale natural gas and electricity markets presents challenges beyond the resulting obstacles to new infrastructure deployment; it also leads to otherwise avoidable costs and reliability challenges. Numerous credible entities have identified the need to enhance gas/electric interoperability as necessary to foster infrastructure deployment and as critical to improving reliability and resiliency:

- DOE: "[u]tilities, states, FERC, and DOE should support increased coordination between the electric and natural gas industries to address potential reliability and resilience concerns associated with organizational and infrastructure differences." [2]

- North American Electric Reliability Corporation: "However, regulatory and policy solutions that help expand pipeline access, reliability, and the needs of electric generation have not surfaced. The recent suspension of Kinder Morgan's AED and Algonquin's proposal to facilitate electric utility purchase of pipeline capacity demonstrates the need for regulatory solutions to facilitate electric generator commitments. This is particularly true for generation operating in wholesale electric markets." [3]

- National Academy of Sciences: "[t]he growing interdependence of natural gas and electricity infrastructures requires systematic study and targeted efforts to improve coordination and planning across the two industries," [4] and FERC and NAESB should address "the alignment of planning and operating practices across the two industries." [5]

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[2] Department of Energy Staff Report to the Secretary on Electricity Markets and Reliability at 127 (August 2017), https://energy.gov/sites/prod/files/2017/08/f36/Staff%20Report%20on%20Electricity%20Markets%20and%20Reliability_0.pdf

[3] NERC 2016 Reliability Assessment at 21, http://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/2016%20Long-Term%20Reliability%20Assessment.pdf.

[4] National Academies of Sciences, Engineering, and Medicine. 2017. *Enhancing the Resilience of the Nation's Electricity System*. Washington, DC: The National Academies Press. https://www.nap.edu/catalog/24836/enhancing-the-resilience-of-the-nations-electricity-system.

[5] *Id.* at 41.

- EPRI: "Understanding the reliability impacts of increased reliance on gas and the opportunities its operational flexibility provides are important in the near-term…"[6] and including the recommendation to "assess key interfaces between the gas and electric systems and markets…to achieve efficiency." [7]

- Interagency Task Force on Natural Gas Storage Safety: The gas and electric industries "should work together to develop flexible pipeline services to accommodate the changing needs of the electricity industry."[8]

While New England provides the most pronounced example of misalignment between the gas and electric industries constraining infrastructure deployment, the problem permeates the day to day interaction of the two markets throughout most of the country. Both markets need to adapt to each other's respective needs for the contract gap to be closed.

A. Misaligned Incentives for Investment in Fuel Supply Arrangements within the Wholesale Electricity Markets

Natural gas-fired electric generators rely on "just-in-time" delivery of fuel across either the interstate pipeline system or from local gas distribution utilities. When natural gas pipelines are constrained, just-in-time power generators are often challenged in the ability of the system to provide them with fuel, which should be a signal for generators to make contractual arrangements for additional fuel supply arrangements with natural gas pipeline developers or operators. In practice, however, it has become increasingly clear that competitive merchant power plants do not derive commercial benefits from making reliability-enhancing supply investments that would foster additional pipeline capacity.

As ISO-NE recently observed, "making these discrete investments, if they meaningfully reduce the risk of electricity supply shortages (and therefore the risk of high prices), entails up-front costs to the generator – yet reduce the energy market price the generators receives." [9] With respect specifically to pipeline capacity, merchant generators lack the ability to recover from the competitive wholesale energy markets the fixed demand charges or reservation costs, upon which pipeline developers rely to commit capital and expand. Because making such contract commitments actually results in lower energy market revenues for competitive generators, they are neither financially viable nor within a generator's commercial interests. Consequently, competitive gas-fired generators do not provide impetus for pipeline capacity expansion, notwithstanding that electric generators are the largest users of the pipeline system. In effect, the rational commercial incentives for natural gas-fired power generators in the competitive

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6 Electric Power Research Institute, A Preview of the U.S. National Electrification Assessment at 60 (February 2018), https://www.epri.com/#/pages/product/000000003002013582/.

7 *Id.* at 55.

8 Final Report of the Interagency Task Force on Natural Gas Storage Safety, Ensuring Safe and Reliable Underground Natural Gas Storage at 80 (October 20, 2016), https://www.energy.gov/sites/prod/files/2016/10/f33/Ensuring%20Safe%20and%20Reliable%20Underground%20Natural%20Gas%20Storage%20-%20Final%20Report.pdf.

9 ISONE Discussion Paper, *Energy Security Improvements,* (April 2019) p.3.

wholesale electricity markets are misaligned with the financial model by which natural gas pipeline capacity is deployed.

The issues posed by the current misalignment between the natural gas and electricity markets will become more pronounced and problematic as more renewables are integrated into the electric grid. Renewables tend to increase sub-day variability in the electric grid and create more intraday volumetric variability to gas takes by generators on the pipeline system. Thus a more renewable electric grid will change shipper requirements for natural gas pipeline services and capacity. A recent report prepared by the INGAA Foundation details the expected changes.

> If natural gas fired generators are expected to serve as backup when renewable generation is unavailable, these shippers may require pipeline services to allow them to nominate on the pipeline with little to no notice and the ability to consume gas non-ratably. In such cases, pipelines must have the capacity to offer such services, and if not, pipelines must be sized to do so. In cases where existing capacity is insufficient to support such services, the shippers demanding such services must be willing to pay for the needed capacity.

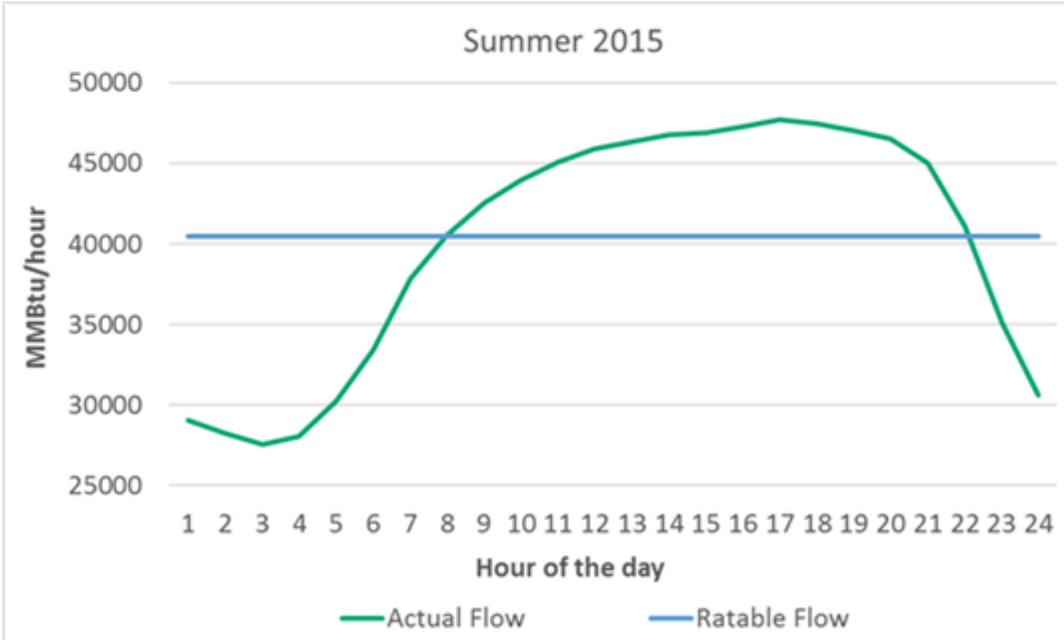
It is axiomatic, however, that market design barriers which preclude natural gas-fired generators from undertaking the contractual arrangements necessary for additional responsive pipeline capacity also present a barrier to the role of gas and the infrastructure needed for balancing renewables. It is therefore necessary for appropriate updates to the market designs in the various competitive wholesale markets to foster contracting by generators for the fuel transportation services upon which they increasingly rely.

B. Misaligned Pricing Structures for Non-ratable (Variable) Transportation Services within the Wholesale Natural Gas Markets

While changes to the wholesale electricity markets are appropriate to foster contracting between competitive gas-fired generators and pipeline operators, updates to the design of the wholesale gas markets and, in particular, predominant pricing structures for transportation services, are also needed. In general, natural gas pipeline tariff services are not delineated and priced around the needs of gas-fired generators. As the PJM Interconnect has observed, "the traditional world of long term contracts for pipeline transportation capacity and relatively predictable and steady demands placed by LDCs on the pipeline system throughout an entire season is rapidly changing as we see increased interconnection by gas-fired electric generation on the pipeline system.[10]

The gas market design generally assumes uniform hourly flow for the average day, despite the fact that the flow used by generators is far more shaped over the course of the day in order to match electrical output with load:

[10] Comments and Responses of PJM Interconnection, L.L.C., FERC Docket No. AD18-7 at 57 (March 9, 2018).



Yet under the natural gas market design, power generators have limited opportunities to adjust the scheduled volume of pipeline gas to conform to their varying needs over the course of the day. Current FERC regulations *require* only three "intraday" nominating opportunities, whereby shippers can modify scheduled quantities. FERC, in its policy docket seeking to improve gas/electric coordination, expressed concern that the limited standard, nationwide intraday nomination opportunities do not provide shippers – especially natural gas-fired generators – with sufficient flexibility.[11] While pipelines strive to provide the delivery services power plants require, the lack of commercially standardized scheduling opportunities over the course of the day diminishes the willingness of power generators to contract with pipelines for firm transportation because they cannot be certain that they will receive the needed responsive delivery services –especially when a pipeline system is constrained due to high demand.

Deliverability was a major problem during the polar vortex event in January 2014 when it is widely believed that the interstate pipelines serving the northeast were totally full. In fact, analysis of pipeline flows demonstrates that several large pipeline systems within the zone of constraint along the mid-Atlantic seaboard had large amounts of unused capacity, even on the coldest days when gas and electricity spot market prices were at their highest. On the flip side, pipelines that provide enhanced around-the- clock scheduling flexibility were fully utilized and managed to deliver amounts of gas that exceeded their firm contracted capacity. More flexible and responsive pipeline scheduling, with transparent pricing structures that foster cost recovery for power generators in the electricity market (see below), would provide commercial impetus for power plant operators to contract for firm capacity.

11 Docket No. RM14-2-000, Coordination of the Scheduling Processes of Interstate Natural Gas Pipelines and Public Utilities, (March 20, 2014)

A corollary observation is that the value of natural gas supply fluctuates over the course of the day, but the natural gas market primarily relies on a single daily "index" price that is established assuming that end users and power plants use a steady, non-varying (i.e., "ratable") quantity of gas each hour. The value of (and often the cost for) fuel supply obtained by generators over the course of the day varies, yet generators often face structural challenges and are sometimes impeded in accurately reflecting that cost variation in the competitive electricity markets.[12]

Limitations on the ability of generators to reflect sub-day fuel supply costs undercuts price formation and price signals for the value of new transportation capacity. The American Petroleum Institute has pointed out that current transportation pricing structures are an impediment to contracting noting that "[f]uel cost policies need to provide generators some degree of flexibility to procure fuel in the lowest cost manner."[13]

To date, the market has developed workarounds in order to provide generators with the required variability. Because the market does not create published or discoverable hourly fuel supply prices, and assumes ratable flows, power generators are compelled to develop creative methods such as having their gas traders divvy up ratable capacity into hourly chunks that correlate to generators fluctuating needs over the day. Although such transactions are occurring by the hundreds every day, the price for obtaining hourly gas supply is opaque at best, and there is not an organized structure to formulate prices as necessary for market participants to understand and transact based on a common understanding of the value of hourly flows. PJM similarly observes that while market participants have developed short-term work arounds to obtain the needed flexibility, such solutions "cannot, in the long run, serve as the sole means to meet the ever-growing demand for gas transportation by the generation sector."[14]

The most significant recommendation put forth by PJM is for FERC "to encourage the development of additional pipeline services tailored to the flexibility needs of natural gas-fired generation so as to encourage appropriate tailoring and pricing of services beyond today's traditional firm/interruptible paradigm."[15] The key is "pricing." Simply offering proposed new flexible services—but continuing to price those services using the straight fixed variable rate design—will not resolve the market disconnect. For example, Texas Eastern Transmission, LP's Enhanced Electric Reliability Project offered to provide non-ratable firm natural gas deliveries that could be tailored to the needs of electric generators, local distribution companies, and any other delivery points within the PJM region. Given the requirement to sign up for firm service without the means to recover costs in the electricity markets, however, it is unsurprising that

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12 *See, e.g.*, *Exelon Generation Company, LLC*, 160 FERC ¶ 61,076 (2017) (detailing challenges Exelon faced in reflecting the new incremental cost of re-gasified LNG purchased under its Shoulder Period Agreement for Mystic Units 8 and 9).

13 *See, e.g.*, Motion to Intervene and Comments of the American Petroleum Institute, FERC Docket No. ER16-372 at 4 (September 16, 2016)

14 Comments and Responses of PJM Interconnection, L.L.C., FERC Docket No. AD18-7 at 58 (March 9, 2018) ("PJM Comments).

15 PJM Comments at 7.

"few generators even wanted to discuss the options presented in this open season on a non-binding basis with Texas Eastern."[16]

At present, there is no transparent market information by which to establish the value of shaped flow service[17] to generators, and consequently, generators are challenged to express the marginal cost of such a service in their hourly offers in the electricity markets. The resulting diminished price signals likewise fail to inform pipelines (let alone other market participants like marketers and asset managers) what infrastructure investments are economically justified to serve power generation load. Pricing regimes that optimize hourly energy supply offers with the sub-day cost of flexible natural gas fuel supply are necessary to ensure that the appropriate investments are made and to ensure reliability and resilience are maintained.

Conclusion, Finding and Recommendation:

Electric generators (the new largest users of the pipeline network) are generally not contracting with those upon whom they rely to transport natural gas, and this disconnect diminishes infrastructure investment, as well as reliability. For the most part, there is no partial-day non-ratable take "market" for gas. Therefore there are inadequate price signals to inform exactly what natural gas infrastructure investments and services are required to meet the variable demands of natural gas-fired generation – demands that will only increase as the electric grid integrates more renewables and relies more heavily on natural gas generation to meet electricity demand.

In a recent report, INGAA suggested potential market design updates for development of an "hourly rate structure that will allow pipelines to allocate costs based on when customers need gas supply the most and to the customers who need it the most" and that "pipelines should be permitted to price based on the value of the service instead of the cost to provide the service."[18] Likewise, Kinder Morgan similarly acknowledged that hourly variability of natural gas demand will continue to increase, and concluded that "[s]hippers needing enhanced deliverability may be satisfied by changing their contract structure toward more hourly services."[19]

FERC has the authority and tools at its disposal to resolve current interoperability challenges between the natural gas and electric markets, challenges which presently constrain investment in infrastructure and deployment of natural gas pipeline capacity. In its 1996 Incentive Ratemaking Policy Statement, the Commission stated that it would allow utilities to

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16 Comments of Algonquin Gas Transmission, LLC, FERC Docket No. RM18-1 at 13 (October 23, 2017).

17 Shaped flow involves the explicit request for and confirmation of differing hourly quantities of gas across a gas day (i.e., a shape).

18 Black & Veatch Management Consulting, LLC for the INGAA Foundation, Inc., The Role of Natural Gas in the Transition to a Lower-Carbon Economy at page 54 (May 2019) ("INGAA Report"), https://www.ourenergypolicy.org/wp-content/uploads/2019/05/INGAAFlagshipReport_RoleofNaturalGas2020-2040.pdf ("[t]he continued evolution of the gas transmission industry to support a lower-carbon economy over the next two decades will alter shippers' requirements for natural gas pipeline services.").

19 Aaron Purdy and George Wayne, Intermittent Renewable Generation – Challenges for Integrating Natural Gas Infrastructure and Services, RMEL Issue 2 at page 29 (Summer 2018), http://www.nxtbook.com/naylor/RMET/RMET0218/index.php?startid=24#/24.

propose incentive rate mechanisms as alternatives to traditional cost-of-service regulation, noting that such proposals "should result in lower rates to consumers and provide utilities the opportunity to earn higher returns."[20] Its observation that "ratemaking flexibility would permit pipelines to tailor natural gas transportation rates for electric generators to meet the swings in gas consumption often experienced by such generators"[21] still rings true today.

The need for fast ramping electric generation resources will continue to grow with the transition to a lower-carbon economy. Developing no-notice or short-notice transportation rates that reflect the time of use element of the delivered gas volumes will be an important step to allocate the appropriate level of costs to each shipper on the system. A shipper that can avoid using gas deliveries on those specific hours, like LDCs or industrial customers, can capture some cost savings by allowing the pipeline to offer no-notice services to these electric resources and sharing the incremental revenue with its existing shippers.[22]

FERC can increase the frequency of intraday scheduling cycles and should use its ratemaking authority to provide incentive rates of return to pipelines who provide greater system value through more responsive gas transportation services (while maintaining its foundational rate of return market design).

Finding: Longstanding market policies, which predate the growing role of power generation as the largest user of the natural gas pipeline system, constrain competitive electricity generators from contracting with pipelines and fostering infrastructure investment and growth. The lack of such contract relationships leads to electricity reliability/resiliency challenges and inefficient allocation of capital for natural gas infrastructure expansion.

Recommendation:

- **Market updates which foster contracting between competitive power generators and pipelines are needed to enable infrastructure investment. Such updates should increase the frequency of intraday gas transportation scheduling and facilitate pricing of the variable transportation services relied upon by power generators to balance the electricity system, while maintaining the foundational rate of return natural gas interstate transportation market design. In addition, FERC should continue to advance mechanisms for power generators to bid in and recoup natural gas transportation costs within the competitive wholesale electricity markets.**

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20 *Alternatives to Traditional Cost-of-Service Ratemaking for Natural Gas Pipelines (1996 Incentive Ratemaking Policy Statement)*, 74 FERC ¶ 61,076 at p. 61,237 (1996).

21 *Id.* at p. 61,226.

22 Black & Veatch Management Consulting, LLC for the INGAA Foundation, Inc., The Role of Natural Gas in the Transition to a Lower-Carbon Economy at page 56 (May 2019).