UNITED STATES OF AMERICA
BEFORE THE FEDERAL ENERGY REGULATORY COMMISSION

Grid Resilience in Regional Transmission Organizations and Independent System Operators	**)))**	**Docket No. AD18-7-000**

REPLY COMMENTS OF THE
ENVIRONMENTAL DEFENSE FUND

Pursuant to the Federal Energy Regulatory Commission's ("Commission" or "FERC") March 20, 2018 Order Extending Time for Comments,[1] the Environmental Defense Fund ("EDF") respectfully submits the following reply comments in the above-captioned proceeding. The Commission's January 8, 2018 Order[2] rightfully disposed of the Department of Energy's ("DOE") proposal, which would have imposed rules on select Regional Transmission Organizations ("RTOs") and Independent System Operators ("ISOs") to compensate certain electric generation resources for reliability and (undefined) resilience attributes. The proceeding has now pivoted to an inquiry of how RTOs and ISOs are evaluating and addressing resilience challenges. As evidenced by several RTO/ISO submittals in this docket, the Commission has an opportunity to further enhance resilience by taking the next step to advance gas-electric coordination: resolving the contract gap between pipelines and their new largest user, electric generators.

I. INTERESTS OF EDF

EDF is a membership organization, with over 2 million members, whose mission is to preserve the natural systems on which all life depends. Guided by science and economics, EDF seeks practical solutions to resolve environmental problems. EDF uses the power of markets to

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1 *Grid Resilience in Regional Transmission Organizations and Independent System Operators*, 162 FERC ¶ 61,256 at P 3 (2018).

2 *Grid Reliability and Resilience Pricing*, 162 FERC ¶ 61,012 (2018).

speed the transition to clean energy resources, and consistent with its organizational purpose is engaged in activities to facilitate cost-effective and efficient energy market designs that encourage investment to modernize the energy grid so that it can support the ongoing deployment of renewable energy resources and energy efficiency. EDF works collaboratively with market participants sharing these goals and is a member of the North American Energy Standards Board ("NAESB") and the New England Power Pool. Before this Commission, EDF has long recognized that fostering efficient market outcomes, optimized within the rubric of fair market competition, will safeguard energy customers, channel economic energy infrastructure investment and facilitate beneficial environmental outcomes.[3] EDF has also presented extensive analyses to the Commission to support its suggested market reforms—all of which have been aimed to increase efficiency and competition and provide customer benefit.[4]

II. COMMENTS

The Commission's January 8, 2018 Order detailed the significant evolution of the electric power industry in order to place the DOE's proposal into context and to explain the rationale for

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[3] *See, e.g.*, Technical Conference on Environmental Regulations and Electric Reliability, Wholesale Electricity Markets, and Energy Infrastructure, Prepared Statement of Environmental Defense Fund – N. Jonathan Peress, Docket No. AD15-4 at 2 (March 11, 2015) ("When markets provide clear and efficient price signals, participants are able to make investment decisions to determine the most cost-effective means to maintain reliability.").

[4] Comments of the Environmental Defense Fund, Conservation Law Foundation, the Sustainable FERC Project, and the Clean Energy Group, Docket No. RM14-2 (November 28, 2014) (recommending additional intraday nomination cycles for pipelines, the shifting of the nomination schedule to allow for electric generators to finalize their commitments before making gas purchase arrangements, and requiring pipelines to schedule and deliver non-ratable quantities and services all to "improve liquidity and flexibility of the gas market and…help ensure just and reasonable rates"); *see also* Comments of the Environmental Defense Fund, Docket No. RM17-3 (February 28, 2017) (citing a misalignment study in support of a new shaped flow hourly service to be provided by pipelines).

addressing that proposal.[5] The Commission chronicled the development of the competitive electricity markets and noted that "support for markets and market-based solutions has been a core tenet of Commission policy."[6] The Commission also found that innovation in the energy sector and change in the energy resource mix has compelled it to evaluate its current rules to ensure that rates remain just and reasonable.[7] This continual evaluation and updating of rules on the electric side has, for the most part, resulted in a robust framework to ensure just and reasonable rates through fair competition, price transparency and discovery, and protection against reliability and cybersecurity threats.

In contrast to its electric market efforts, the Commission's evaluation and updating of the gas market rules has been far less comprehensive. The Commission's pro-market regulatory model is evident in its foundational orders such as Order No. 436, Order No. 636, and Order No. 563, and to be clear, those orders have brought about significant benefits by enhancing transparency and competition. The Commission has also taken incremental steps to improve coordination between the gas and electric markets by increasing scheduling opportunities and promoting information sharing.[8] But unlike the Commission's actions on the electric side to continually reflect contemporaneous conditions, such as its efforts to remove barriers to the

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5 *Grid Reliability and Resilience Pricing*, 162 FERC ¶ 61,012 at PP 7-11 (2018).

6 *Id.* at P 9.

7 *Id.* at P 10.

8 *See Coordination of the Scheduling Processes of Interstate Natural Gas Pipelines and Public Utilities*, Order No. 809, FERC Stats. & Regs. ¶ 31,368 (2015); *Communication of Operational Information Between Natural Gas Pipelines and Transmission Operators*, Order No. 787, FERC Stats. & Regs. ¶ 31,350 (2013). Notably, however, the information sharing fostered by Order No. 787 did not promote transparent information sharing of the type that has been the hallmark of this Commission's efforts over the years and which has led to and promoted price formation in the markets overseen by this Commission.

integration of variable energy and demand response resources, the natural gas market rules have remained comparatively stagnant despite the unprecedented change of the last decade.

That unprecedented change includes significant growth in shale resource development,[9] which in turn has altered in dramatic ways the use of the existing interstate pipeline system. Due in part to the cost advantages created by the abundant shale gas supply, gas fired power plants are now expected to supply 33% of the electricity generated in 2018, compared to coal's 30%.[10] Electric generators were the smallest sector for natural gas demand in 1988, and they now have become the largest.[11] The pipeline network—originally designed and built to meet the needs of Local Distribution Companies ("LDCs") and large industrial users—is now the critical life line to a host of generators. But the current market design, which provides revenue to pipelines solely based on take-or-pay contracts requiring customers to pay reservation charges for years or decades, fosters incompatibility between the wholesale gas and wholesale electric sectors.[12] Other outmoded market elements remain such as ratable take provisions in pipeline tariffs based on maximum daily transportation quantities, specifying that customers must provide to the

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[9] U.S. Energy Information Administration, International Energy Outlook 2017 at 56 (September 14, 2017) ("Shale resource development accounts for 50% of U.S. natural gas production in 2015, increasing to nearly 70% in 2040…."), https://www.eia.gov/outlooks/ieo/pdf/0484(2017).pdf.

[10] U.S. Energy Information Administration, Short-Term Energy Outlook (February 6, 2018), https://www.eia.gov/outlooks/steo/.

[11] North American Electric Reliability Corporation, 2011 Special Reliability Assessment: A Primer of the Natural Gas and Electric Power Interdependency in the United States at 43 (December 2011), http://www.nerc.com/files/gas_electric_interdependencies_phase_i.pdf.

[12] *See, e.g.*, Algonquin Gas Transmission, LLC, Comments on ISO-NE Operational Fuel Security Analysis at 1, n.1 (February 15, 2018) ("To the extent the region needs or desires capacity dedicated to supporting the electric market, there has to be a paradigm change in terms of how that pipeline capacity for the electric market is funded.").

pipeline and take from the pipeline gas in equal amounts over the course of the day.[13] This requirement is in direct conflict with how generators actually consume gas over the day—in varying amounts over short periods of time.[14] In effect, a market design which is commercially premised on ratable takes aggregating up to a daily quantity has become a vestige, particularly for the emergent largest pipeline users.

In the absence of Commission action to ensure that the gas market rules evolve with contemporaneous conditions, the market has found opaque workarounds to provide the flexibility generators require. Pipelines provide non-ratable takes when operational conditions permit,[15] but have to date not delineated or priced this service. Thus, when non-ratable service is constrained or unavailable on days of high demand, the market lacks a clear price signal upon which to determine the value of the service. Consequently, this lack of price formation and price discovery for non-ratable service muddles investment signals, as there is theoretically unlimited demand for a valuable but unpriced service. Instead of pricing sub-day delivery services that are of most value to generators, the wholesale market commercial construct functionally seeks to

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13 This 1/24 of daily transportation quantity per hour is referred to as ratable service. Nearly every pipeline tariff provides that, absent service under a tariff (or contract) specifically providing variability, no-notice, or hourly service, the service under a firm transportation contract provides that the default condition is for ratable receipts and deliveries.

14 Quadrennial Energy Review, U.S. Department of Energy (April 2015), Appendix B: Natural Gas, p. 10 ("many gas-fired power plants use large amounts of natural gas over short periods of time throughout the day. A generator that is needed to meet daily peak demand may not be dispatched until early afternoon, consuming no gas at one moment then drawing very large volumes the next").

15 *Portland Natural Gas Transmission System*, 106 FERC ¶ 61,289 at P 52 (2004) ("Portland asserts that this 'flexibility' is not part of Portland's firm service obligations, but has been extended on a best-efforts basis as an accommodation to FT shippers. Portland maintains that it has made clear to the Generators, in written correspondence and otherwise, that this flexibility was provided by Portland as a 'courtesy' with the expectation that the Generators would endeavor to adhere to the tariff's uniform take provisions.").

compel generators to commit to firm service every day for years (10-20 years, in order to add new capacity). Given that organized electric markets limit the extent to which all-in gas acquisition costs can be reflected in power generator offers, it is not surprising that generators have declined to sign up for the premium firm services offered by pipelines.[16]

Because generators do not have a business case for transacting directly with pipelines, they rely on capacity released by LDCs and on LDC "off-system sales"[17] both of which operate in the secondary market.[18] Marketers and third parties also meet the variable hourly needs of generators on the secondary market but there is little to no transparency or price discovery around these transactions.[19] Because there is not an effective market basis for resolving supply and demand imbalances sub-day and peak day, RTOs are forced to intercede in the markets to mediate supply and demand between generators and pipelines.[20] This command and control workaround also creates challenges for competitive generators and RTOs in determining

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[16] Comments of the New England States Committee on Electricity, Docket No. AD12-12 at 8 (March 30, 2012) ("By contrast, in a competitive wholesale electric market such as New England, generators are not guaranteed recovery of their fixed costs, including any commitments to pipeline capacity, and therefore have minimal financial ability and/or risk tolerance to sign a contract for long-term pipeline capacity.").

[17] Here "off-system" means off of the LDC's system and at another location on the pipeline with which the LDC has the transportation contract.

[18] Response of ISO New England, Docket No. AD18-7 at 6 (March 9, 2018) ("ISO-NE Comments").

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

[20] ISO New England Inc. and New England Power Pool, Filings of Performance Incentives Market Rule Changes, Docket ER14-1050, Attachment I-1b (Testimony of Peter Brandien) at 3 (January 17, 2014) ("This has put the ISO in the position of monitoring the region's gas supply and, when the pipelines are constrained, managing the output of large portions of the generating fleet based on available fuel supply. This is not the appropriate role for the ISO; we should be focused on operating the power system, not the fuel supplies of the region's generating fleet.").

reasonably expected fuel supply[21] acquisition costs as a component of energy offers.[22] Without clear and transparent prices, during periods of stress (periods resiliency tools should address), it is very challenging, if not impossible, to reasonably determine fuel supply costs.

Meanwhile, LDCs have been foisted into the role of "gas RTO," explicitly taking into account the needs of generators in their long-term supply planning assessments[23] and managing the day-to-day reliability of the gas system within their given service territory. Unlike electric RTOs/ISOs, however, there are no formal federal rules governing LDC independence and transparency, and consequently, LDCs have significant discretion to determine whether, and if so to what extent, to release capacity to (or make off-system sales to) generators on the secondary market.[24] Their superior legacy no-notice rights on the system allow the LDCs to foster

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[21] With respect to the wholesale gas market, "fuel supply" encompasses the gas or methane commodity and the pipeline capacity to deliver the gas to the consumption point at the moment (i.e., time) of consumption. As used throughout these comments fuel supply always means gas plus capacity to deliver that gas at the time of needed consumption.

[22] *See, e.g.*, Testimony of Leslie Dedrickson on behalf of Exelon Corporation, Docket No. RM16-5 at page 26, lines 10-18 (April 4, 2016) ("Verifying" costs in such a manner is more challenging than it sounds. It is particularly difficult to verify costs prior to the offer being included in LMP, assuming "verification" requires a linear comparison of the cost estimates embedded in the offer and evidence to justify those specific costs, because actual costs are not clearly known day-ahead when the offers are made. In reality, the only cost information available on a day-ahead basis are estimates based on consideration of numerous factors, including fuel cost (including commodity price risk, transportation costs, balancing costs, and risks of dispatch and performance), heat rate, VOM, emissions costs, and opportunity costs.").

[23] Connecticut Natural Gas Corporation, Forecast of Natural Gas Demand and Supply 2017-2021 at page II-1 (October 1, 2016) ("The fact that the regional electric industry has yet to address [generators'] gas capacity shortcomings will result in a continued dependency by the power market on non-firm capacity for years into the future. This dependency on secondary capacity by generators creates a favorable mitigation tool for LDC growth capacity and supports an appropriately conservative capacity plan.").

[24] One of the key characteristics of ISOs/RTOs is that they must exhibit independence as market operators, rather than as market participants. *Regional Transmission Organizations*, Order No. 2000, FERC Stats. & Regs. ¶ 31,089 (1999), *order on reh'g*, Order No. 2000-A,

reliability by providing short term pipeline capacity and/or bundled supply to generators, but these actions are *not* occurring with the requisite amount of transparency to ensure sufficient price discovery—price formation and discovery that would foster efficient market outcomes and inform market participants of the value of new capacity (reliability/resiliency) investment. While divvying up LDC supply and transportation entitlements in the secondary market has worked thus far, it obscures investment signals and cost allocation.

This obfuscation of investment signals is particularly problematic as the gas system transitions from a "supply push" (or "supply serve") to a "demand pull" (or "demand serve") environment. The recent expansion of the natural gas pipeline system has largely been supported by producer and marketer capital seeking to relieve otherwise stranded supplies and gain access to liquid market locations.[25] Now the primary commercial impetus for new pipeline capacity appears to be demand-serve, whereby large gas users seek pipeline service to meet the needs of gas fired generation and access liquid supply locations.[26] Thus, as the electricity markets transition from less coal to more gas, there appears to be new gas users that would benefit from pipeline transportation and delivery capacity investment. With the exception of vertically

FERC Stats. & Regs. ¶ 31,092 (2000), *aff'd sub nom. Public Utility District No. 1 of Snohomish County, Washington v. FERC*, 272 F.3d 607 (D.C. Cir. 2001).

[25] *See, e.g.*, FERC Office of Enforcement, 2017 State of the Markets Report, at page 5 (April 2018), https://www.ferc.gov/market-oversight/reports-analyses/st-mkt-ovr/2017-som-A-3-full.pdf ("New pipeline capacity out of the Marcellus and Utica shale plays allowed producers to meet demand in previously inaccessible markets").

[26] Cohen & Steers, A Case for Midstream Energy (March 2014), http://www.efmidstream.com/sites/default/files/resources/resources_CaseForMidstreamEnergy.pdf (highlighting the shift from "supply push" to "demand pull," noting that the "most significant natural gas demand growth is expected from the power generation sector….").

integrated electricity markets, however, there is a lack of commercial constructs and tools for demand-serve to act as the impetus for new capacity.[27]

The current structure also has significant implications for the Commission's ability to address resilience. As acknowledged by PJM, the current framework governing cyber and physical security standards on the gas side is far from robust.[28] Unlike the electric side, the Commission has very little visibility into system conditions on the pipeline network. Furthermore, there is a significant lack of data on the interstices between fuel security and attacks, whether physical or cyber:

> [F]uel security is the ability of the system's supply portfolio, given its fuel supply dependencies, to continue serving electricity demand through credible disturbance events, such as coordinated physical or cyberattacks or extreme weather that could lead to disruptions in fuel delivery systems, which would impact the availability of generation over extended periods of time. To define potential fuel-security criteria, PJM needs to understand the fuel-supply risks in an environment trending towards greater reliance on natural gas supply and delivery.[29]

In order to fully gauge fuel supply risks, there needs to be a sufficient degree of transparency into the market.[30] Given that generators must rely on the secondary market in order to obtain the

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[27] Vertically integrated markets could also benefit from a shaped flow service offering for generators. Pipelines serving these areas have already observed that "obtaining hourly quantity profiles for gas-fired electric generation facilities . . . will assist . . . in planning system flows throughout the day and understanding system constraints in advance." Mountain Valley Pipeline, LLC, Responses to OEMR Data Requests Issued October 19, 2016, Docket No. CP16-10 at 1 (November 2, 2016). Taking the additional step of pricing this service would help pipelines prioritize service requests and ensure they are providing flexibility on a non-discriminatory basis, whether or not within the organized markets.

[28] PJM Comments at 62 ("Pipeline cyber standards and physical security standards (beyond specific pipeline standards promulgated by PHMSA) are overseen by TSA and largely voluntary in nature.").

[29] PJM Interconnection, L.L.C., Valuing Fuel Security, http://www.pjm.com/-/media/library/reports-notices/special-reports/2018/20180430-valuing-fuel-security.ashx.

[30] After the Blue Cut Fire in August 2016, the California Council on Science and Technology observed that "Operating data from SoCalGas' Envoy system show total gas system sendout on the day of the Blue Cut Fire of 3,438,000 Dth, with 410,000 Dth withdrawn from

flexibility (i.e., variable fuel supply) they require, that transparency does not exist today.[31] A lack of visibility as to fuel supply pricing[32] challenges the system's ability to recover from a physical or cyber attack.

In sum, the gas market rules are a generation behind the electric market, and the market regulatory paradigm needs to be updated to accommodate the new largest user of the gas system—electric generators. It is infeasible, in practice, to ensure fuel security (and, correspondingly, resilience) if the new largest users of the pipeline system are not contracting with those upon whom they rely to transport fuel supply. Without a viable transactional construct to foster meaningful and direct contractual relationships between merchant power plants and pipeline developers/operators, it is unreasonable, if not irrational, to conclude that a natural gas-reliant power system is optimized for reliability and resiliency. This proceeding provides the Commission with an opportunity to advance markets as the impetus for new capacity by helping pipelines and power generators to develop the transactional structures and market rules to support mutually compensatory contracting. Without that action to address the

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underground gas storage and system receipts of only 3,028,000 Dth. Envoy archives also show that SoCalGas had a low operational flow order (OFO) in place for this event asking shippers to bring their supplies within 5% of demand. If SoCalGas posted the archived hourly data one might be able to explain the apparent discrepancy by which total receipts plus withdrawals exceeded sendout for the day (as offset by individual hours in which sendout was higher than receipts)." California Council on Science & Technology, Long-Term Viability of Underground Natural Gas Storage in California at 524, n.68 (January 2018), http://ccst.us/publications/2018/Full%20Technical%20Report%20v2.pdf ("CCST Technical Report").

31 PJM Comments at 58 ("But such new flexible services, to the extent they have been offered, appear to have been confined to the secondary market in which available gas from LDCs or industrial customers is made available, for a price, on the non-transparent bilateral secondary market.").

32 Here, fuel supply pricing is a combination of two separate and distinct components. One is the price of the gas commodity inside the pipeline and the other is the value/price of the capacity able to deliver that gas to the consumption location at the rate of consumption and at the time of consumption.

fundamental disconnect between interdependent market participants across both the gas and electricity markets, RTOs and this Commission will be left with a constrained set of tools to address fuel security, reliability, and resilience.

A. Several RTO/ISO Comments Demonstrate the Need for Commission Action on Gas-Electric Coordination

The Comments submitted by PJM Interconnection, L.L.C. ("PJM"), ISO New England Inc. ("ISO-NE"), and the California Independent System Operator Corporation ("CAISO") foreshadow fuel security and resilience challenges to come, if the Commission does not advance opportunities to synchronize the natural gas market rules with the evolving needs of the electric market. Although these market operators manage their systems in unique geographic regions and under different operational constraints, the fundamental disconnect between the gas and electric markets remains unsolved in all three markets.

i. PJM Interconnection, L.L.C.

PJM recounts the evolution of the Commission's gas-electric coordination efforts, detailing back to the roundtable meetings sponsored by then-Commissioner Phillip Moeller.[33] PJM also highlights the efforts it has taken to encourage and foster coordination with the nine pipelines that serve generators within its footprint, which most notably includes execution of a 2015 Memorandum of Understanding to enhance information sharing, outage planning, and situational awareness.[34] Despite this progress, PJM calls the Commission to "move gas-electric

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[33] PJM Comments at 55. As part of that proceeding, EDF and others presented analysis demonstrating shortcomings in the gas market design, including with respect to transparency, price formation, and service offerings. EDF also offered several proposed solutions, including to "require pipelines to schedule non-ratable flows for durations as short as one hour . . . ." Comments of Environmental Defense Fund, Skipping Stone, Conservation Law Foundation, and the Sustainable FERC Project in Support of Enhancing Transparency and Liquidity in the Gas Markets, Docket No. AD14-19 (October 1, 2014).

[34] PJM Comments at 55-56.

coordination to the next level," proposing a host of reforms ranging from increased information sharing to enhanced pipeline services to greater LDC coordination.[35]

PJM's Comments detail the crux of the increasing misalignment between the operation of the gas market and electric market: "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.[36] PJM also observes that the use of ratable take provisions is simply not compatible with generators' variable demands.[37] EDF's misalignment analysis of New England gas-fired generators bears this out.[38] EDF analyzed daily gas usage patterns by natural gas-fired power plants and the relationship between their gas usage, hourly electricity prices and revenues. A key observation from the analysis[39] is

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[35] *Id.* at 7-8.

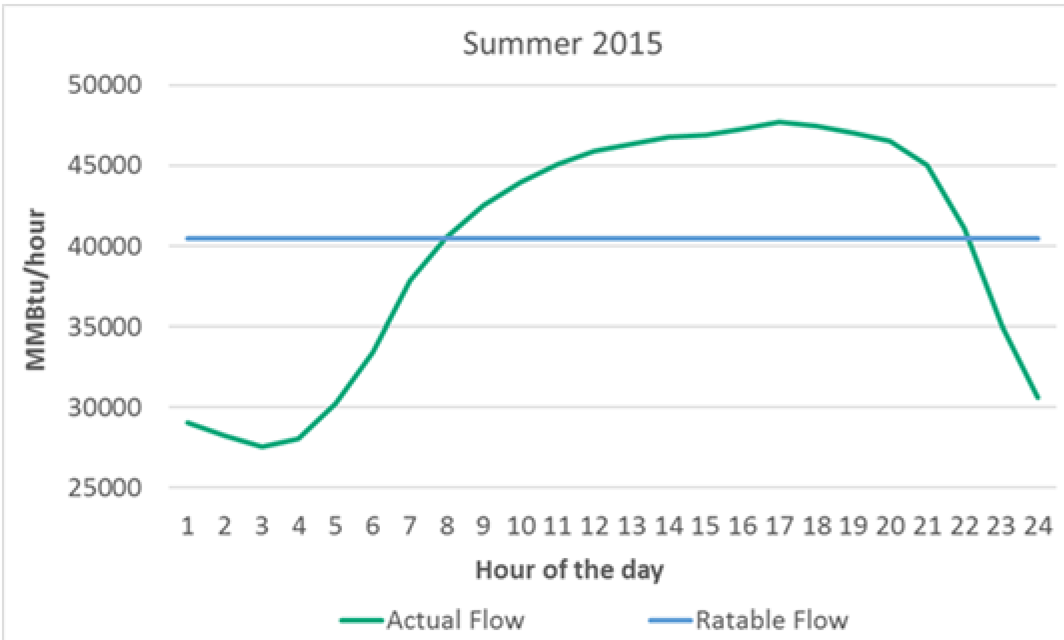
[36] *Id.* at 57.

[37] *Id.* at 56.

[38] EDF analyzed gas generators located in Massachusetts, Connecticut, and Rhode Island. The publicly available data relied upon includes EPA Air Markets Program Data, ISO-NE real time hourly aggregated electricity prices, and the SNL Daily Algonquin Citygate price.

[39] A second key 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. Certainly, the value of (and possibly 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 variation in the organized markets. *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). Limitations on the ability of generators to reflect sub-day fuel supply costs undercuts price formation and price signals for the value of deliverability. *See, e.g.*, Motion to Intervene and Comments of the American Petroleum Institute, Docket No. ER16-372 at 4 (September 16, 2016) ("Fuel cost policies need to provide generators some degree of flexibility to procure fuel in the lowest cost manner. If PJM, the IMM, or the Commission prescribe specific means and terms of fuel procurement, this may restrict generators in a way that could lead to higher

that 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:



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 flow, 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.[40]

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consumer costs as more flexible and cost-effective means to obtain fuel in real-time may be "locked out" by the proscribed fuel procurement formula.").

[40] N. Jonathan Peress and Natalie Karas, Aligning U.S. Natural Gas Markets to Reduce Costs, Enhance Market Efficiency and Reliability (September, 2017), https://www.edf.org/sites/default/files/aligning-us-natural-gas-and-electricity-markets.pdf.

PJM similarly observes that the market has found short-term work arounds to provide the needed flexibility but 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."[41]

Many of the suggestions proposed by PJM would improve, but not fully address, this disconnect. For example, PJM "supports additional reforms to Order No. 787 to avoid the variable levels of information sharing provided by different pipelines in the PJM Region that resulted from the strictly voluntary nature of Order No. 787."[42] EDF does not dispute the value of consistent information sharing between RTOs and pipelines. The exchange of data, however, is not a substitute for a robust market that mediates supply and demand, through market mechanisms, without intervention by an independent third party who has no commercial stake in the outcome. While additional information sharing requirements could enhance gas-electric coordination and permit the continued resolution of day-to-day issues, this command and control based problem resolution will neither support nor promote improvements that eliminate current let alone future resilience issues. Only by a combination of Commission-specified market objectives and the development over time of actionable price signals can the broad goal of resilience be addressed in a sustainable, self-correcting manner. In short, the Commission should not prioritize these reforms and improvements around the edges and neglect to address the more fundamental inefficiencies of the gas market.

PJM also suggests that greater communication and coordination is needed with the LDCs that supply wholesale generation, and "the Commission should support such efforts including evaluating whether communication and coordination obligations should be imposed on

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[41] PJM Comments at 58.

[42] *Id.* at 7.

LDCs that supply jurisdictional wholesale generation."[43] LDCs have significant discretion in determining whether, and if so to what extent, they release capacity to generators on the secondary market:

> The appropriate amount of capacity to reserve (for the current day and the next day and thereafter) is evaluated each day to assess risks. Such evaluation is performed by highly experienced personnel based upon the then current circumstances of weather conditions and pipeline operations, forecasts and other operational circumstances and experiences. When making this evaluation, [Southern Connecticut Gas] is aware that actual weather conditions can vary significantly from forecasted weather conditions; temperature forecasts could vary by as much as 15 degrees from actual temperatures each day, and that larger differences between forecasted and actual temperatures occur during colder weather conditions as compared to warmer weather conditions. The gas supply department examines weather conditions and forecasts including weather fronts and regional conditions and other factors, such as Supplier of Last Resort ("SOLR") obligations, pipeline conditions, contract availability, routes available to the city gates, market conditions and other factors. As a matter of practice, the Company employs a conservative approach in its purchasing and dispatch to mitigate risk, while also appropriately balancing cost impact.[44]

These decisions ultimately have implications for whether the system is being used in an efficient manner, and accordingly, whether the Commission's goals of allocative efficiency have been satisfied.[45] Moreover, this framework results in opaque price formation; a lack of price transparency that not only diminishes regulatory oversight, but obscures if not completely eliminates both competitive innovation and investment signals. While enhancing LDC coordination and communication may be necessary to achieve greater transparency into the markets, it is not sufficient to resolve fuel security concerns.

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43 *Id.* at 8.

44 Southern Connecticut Gas Company Response to Data Request EN-009, Docket No. 17-10-31 (January 4, 2018), http://www.dpuc.state.ct.us/dockcurr.nsf/8e6fc37a54110e3e852576190052b64d/f3bfe847f15d33cc8525820f0057b06b?OpenDocument.

45 *See Algonquin Gas Transmission, LLC*, 156 FERC ¶ 61,151 at P 27 (2016) (explaining that allocative efficiency is enhanced by ensuring the capacity is used for its highest valued use).

The most critical suggestion 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."[46] PJM is correct to characterize this proposal as a paradigm shift. 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, however, it is unsurprising that "few generators even wanted to discuss the options presented in this open season on a non-binding basis with Texas Eastern."[47] At present, there is no transparent market information by which to establish the value of shaped flow service[48] to generators, and consequently, generators are challenged to express the marginal cost of such a service in their hourly offers. The resulting diminished price signals likewise fail to inform pipelines (let alone other market participants like marketers and asset managers) what investments are economically justified to serve power generation load. As detailed below, 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

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[46] PJM Comments at 7.

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

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

appropriate right-sized investments are made and to ensure reliability and resilience are maintained.

PJM's suggestion for improved pipeline offerings is particularly germane to the pricing of fast-start resources within its footprint.[49] In the Commission's pending docket to assess whether PJM's current pricing rules are just and reasonable, PJM states that "it has very few resources that meet the Commission's definition of fast-start resources," and therefore "the fast-start definition as applied to the PJM footprint [should] consist of resources with a start-up and minimum run times of two hours or less."[50] Analysis submitted by the Electric Power Supply Association in that proceeding indicates that this two-hour definition "will include approximately an additional 17,000 MWs of resources eligible to set LMP…."[51] As PJM refines its fast start pricing rules in this docket, and if additional gas units become eligible to set the LMP, there remains a critical question of whether these units will have access to two-hour fast start fuel supply. This market development underscores the importance of ensuring that pipeline offerings meet the needs of generators, particularly in light of these additional units that could become eligible to set the LMP.[52]

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49 *PJM Interconnection, L.L.C.*, 161 FERC ¶ 61,295 (2017).

50 Initial Brief of PJM Interconnection, L.L.C., Docket No. EL18-34 at 3 (February 13, 2018).

51 Reply Brief of the Electric Power Supply Association, Docket No. EL18-34 at 8 (March 14, 2018).

52 PJM recently initiated a process to assess and value fuel security. PJM Interconnection, L.L.C., Valuing Fuel Security, http://www.pjm.com/-/media/library/reports-notices/special-reports/2018/20180430-valuing-fuel-security.ashx. As part of that process, PJM intends to use market signals as "one data point to assist in valuing various alternatives such as the benefits of new pipelines, the benefits of resources with on-site fuel and the value of new technologies that promote an array of fuel-secure resources." This market-based approach will be difficult to achieve without ensuring the requisite amount of transparency in the gas market to understand how pipeline capacity is allocated. PJM has observed that gas transactions often occur on a non-transparent basis on the secondary market and has stated that "the Commission should make sure that it is first ensuring that existing pipelines are

ii. ISO New England Inc.

Issues of fuel security have been building in ISO-NE for years, culminating with the release of ISO-NE's Operational Fuel Security Analysis ("OFSA"). EDF concurs with ISO-NE's suggestion that the region should be allowed sufficient time to develop a solution through the established stakeholder process[53] and intends to offer its continued input in that process. EDF has taken issue with several potentially faulty assumptions underpinning the OFSA and has noted that any solutions that do not also entail enhancement of price formation and transparency in the gas market will exacerbate suboptimal future outcomes.[54] Although EDF will continue to advocate in that stakeholder process, provided below are some observations regarding fuel security in the region.

ISO-NE observes that its "fuel security problem is particularly acute with natural gas, on which the regional power system is increasingly dependent for natural gas-fired generation, but the corresponding investments in natural gas-fuel infrastructure to meet the increasing power sector demand for gas have not been made."[55] The common narrative in New England is that pipeline opponents are obstructing these projects, preventing any new infrastructure from being

being utilized most efficiently and in a manner which meets the needs not only of its seasonal load customers, such as LDCs, but also the needs of more short term and variable needs of the generation community." PJM Comments at 58-59. As EDF has advocated before ISO-NE, any solutions that do not also involve enhancement of price formation and transparency in the gas market will exacerbate suboptimal future outcomes.

[53] ISO-NE Comments at 2.

[54] *See* Environmental Defense Fund, Comments, Request for Modifications to ISO New England Operational Fuel Security Analysis Assumptions and Additional Data Clarification Requests (February 15, 2018), https://www.iso-ne.com/static-assets/documents/2018/03/a2_stakeholder_analysis_assumption_request_submissions.zip

[55] ISO-NE Comments at 20.

built in the region.[56] The reality is that those proposed projects which did not move forward, failed due to the lack of viable underpinning commercial terms. The first project proposed by Tennessee Gas Pipeline Company, L.L.C. ("Tennessee"), Northeast Energy Direct, sought to bring an approximate 1 Bcf/day greenfield pipeline into New England. While Tennessee was able to secure a certain number of precedent agreements, it ultimately abandoned work on the project due to "inadequate capacity commitments from prospective customers and a determination that the Project is uneconomic."[57] Despite its claims that the proposed pipeline would depress both gas and electric prices, these purported benefits were not enough to drive market support for the project.

The second project—Access Northeast—was aimed at having electric distribution companies both invest in, and pay for, the cost of a 1 Bcf/day pipeline expansion. This socialized cost sharing approach would have obligated electric distribution companies to execute agreements, sending pipeline costs to captive electric distribution ratepayers. Again, the commercial terms of the transaction were the ultimate downfall of the project, and the proposal was found to be inconsistent with state law.[58] For its part, Algonquin proposed to construct a

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[56] Boston Globe Editorial Board, "Our Russian 'pipeline,' and its ugly toll" (February 13, 2018), https://www.bostonglobe.com/opinion/editorials/2018/02/12/our-russian-pipeline-and-its-ugly-toll/K0wQ7FBTGR756DqorYkwxN/story.html.

[57] Tennessee Gas Pipeline Company, L.L.C., Notice of Withdrawal of Certificate Application, Docket No. CP16-21 (May 23, 2016).

[58] *ENGIE Gas & LNG LLC v. Dep't of Pub. Util*., 475 Mass. 191, 192 (Mass. Aug. 17, 2016) (concluding that the Massachusetts Department of Public Utilities' order approving ratepayer-backed, long-term contracts entered into by electric distribution companies for additional natural gas pipeline capacity in the Commonwealth to be invalid); New Hampshire Public Utilities Commission, Petition for Approval of a Gas Capacity Contract with Algonquin Gas Transmission, LLC, Gas Capacity Program Details, and Distribution Rate Tariff for Cost Recovery, Order No. 25,950 (October 6, 2016) (dismissing Eversource's petition requesting approval of a contract to purchase capacity on the proposed Access

Liquefied Natural Gas ("LNG") storage facility that would deliver on peak days up to 925,000 dekatherms per day.[59] This aspect of the proposal would have been particularly valuable to electric generators. As noted by Algonquin, "the service envisions several creative features including non-ratable takes from the LNG facility, as well as basically the ability to take deliveries without nominating a source of supply."[60] However, none of these LNG-related services were priced on a stand-alone basis. The failure of these two projects demonstrates the real crux of the fuel security concern in New England: until one of the most valuable services pipelines provide (i.e., non-ratable just-in-time delivery service) is delineated and priced, and a transactional structure is in place between pipelines and generators for providing it, the infrastructure question will not be resolved (absent approval of at least one, followed inevitably by a continuing series of, out-of-market actions).

A review of the constraint notices posted by Algonquin, within operational flow orders, demonstrates the value of non-ratable takes and the reliability risk posed if that valuable service is not allocated efficiently:

> AGT requests that customers/point operators on AGT be aware of the impact non-ratable hourly takes from the system may have in causing delivery pressures reaching lower than desired levels. As a reminder, AGT's system is not designed to sustain delivery pressures above contract levels while making non-ratable/accelerated deliveries above scheduled quantities for more than 6 consecutive hours, to be followed by flows below scheduled quantity for the balance of any 24 hour period. Furthermore, if customers/point operators don't manage hourly takes from the system, 1) delivery pressures will be impacted and /or 2) AGT may be required to impose further restrictions or courses of action in order to maintain the operational integrity of the system. Additionally, AGT requires all Power Plant Operators to provide information mandated by FERC

Northeast gas pipeline, and associated program details and distribution tariff, finding that the program "is inconsistent with New Hampshire law").

[59] Algonquin Gas Transmission, LLC, Request for Approval of Pre-Filing Review – Access Northeast Project, Docket No. PF16-1 at 1 (November 3, 2015).

[60] Algonquin Gas Transmission, Technical Conference Transcript, Docket No. RP16-618 at page 38, lines 2-5 (May 9, 2016) ("RP16-618 Transcript").

> Order No. 698. Information required includes the hourly consumption profile of directly connected power generation facilities.[61]

Algonquin has observed that generators rely on "the flexibility that Algonquin provides" (i.e., non-ratable takes) in order to match electrical output with load.[62] But during constrained hours, the secondary market is not efficiently allocating pipeline capacity. The reference to Order No. 698 implies the problem: capacity is being allocated by ISO-NE outside of any market mechanism. ISO-NE is forced to intercede to balance power plant fuel needs with pipeline supply primarily by exchanging data (such as pipeline pressures and expected power generation hourly takes) as between pipelines and power plants.[63] Rather than having a market that efficiently transacts to match hourly pipeline capacity with generators' fuel supply needs by establishing prices and value, a party lacking a commercial relationship with either is forced to mediate as between the pipelines and their largest customers in order to maintain reliability. Both ISO-NE and the pipelines have recognized the limitations to such an approach. ISO-NE has stated that "[t]his is not the appropriate role for the ISO; we should be focused on operating the power system, not the fuel supplies of the region's generating fleet."[64] Algonquin's perspective is that the "low hanging fruit" of improved communication has already been

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[61] https://infopost.spectraenergy.com/infopost/AGHome.asp?Pipe=AG

[62] RP16-618 Transcript at page 13, line 18 to page 14, line 4 (generators are "also taking advantage . . . of the flexibility that Algonquin provides. But it also is creating hourly concerns in terms of hourly flows both for the overall system and also on a generator basis. Essentially, we are using pipeline capacity that is committed to serve local distribution companies, designed to serve local distribution companies, to serve a vast and growing demand for gas-fired generators. The reliability risk, in our view, is clear, the price concerns that the pipeline constraints create is clear.").

[63] *See* section 3.0(b) of Attachment D ("Information Policy") to ISO New England's tariff, as accepted in *ISO New England, Inc.*, 146 FERC ¶ 61,159 (2014).

[64] ISO New England Inc. and New England Power Pool, Filings of Performance Incentives Market Rule Changes, Docket ER14-1050, Attachment I-1b (Testimony of Peter Brandien) at 3 (January 17, 2014).

achieved.[65] ISO-NE's current data exchange and redispatch activities are suboptimal in comparison to transactional structures that mediate supply and demand through prices. In sum, data exchange is not a substitute for an efficient market. Before considering suggestions for "out-of-market" solutions,[66] the Commission should address the inefficiencies within the current market and ensure that sufficient transactional structures are in place between pipelines and competitive generators.

iii. California Independent System Operator Corporation

Questions of gas-electric coordination in CAISO are certainly distinct from the challenges posed in PJM and ISO-NE. Aliso Canyon and other gas storage facilities have allowed power generators to pay for interruptible transportation services, while receiving transportation and storage service equivalent to far more expensive firm transportation and storage services—meaning that the cost reflected in the electricity market for generators to avoid gas delivery curtailment was minimal, if not obscured, in hourly offers and clearing prices. California's historically robust gas storage capacity has, in significant measure, concealed the

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[65] RP16-618 Transcript at page 14, line 14 to page 15, line 12 ("And we have focused on communication, and I think Algonquin has done everything possible to improve and enhance and have real-time information postings so that the status of our system is instantly known by the ISO New England to the extent possible. We meet with them frequently, we compare outages, we talk to them weekly, the communication is good. We have worked on scheduling and coordination. We do 42 nomination cycles for any given 24-hour gas day. We do that far in excess of any other pipeline, and increasingly 41 of those nominations, our scheduling response is no….So we think that the low-hanging fruit has been fully addressed by Algonquin….").

[66] ISO-NE Comments at 12 ("ISO-NE may need to take steps to prevent key energy resources with on-site fuel from retiring, to refrain from dispatching certain resources economically during adverse weather conditions to preserve critical fuel stocks, or to utilize other targeted (yet to be identified) out-of-market actions.").

cost and value of firm pipeline transportation services and sub-day (e.g., hourly) non-ratable supply.[67]

Power plant fuel supply needs are becoming more intermittent and uncertain on both daily and sub-day levels.[68] Consequently the need for, and the system value of, just in time fuel delivery and varying, non-ratable takes by generators is increasing, at the same time that overall gas use is decreasing.[69] Moreover, the limited operability of Aliso Canyon underscores the need for enhanced gas-electric coordination, including tariff changes to increase supplier bid flexibility such as those being explored in the Commitment Cost Enhancements and Default Energy Bid stakeholder process.

Bringing transparency and price discovery to natural gas transportation service has implications for the competitiveness of the electric grid and those resources which can compete with natural gas to provide flexibility services. As CAISO observes, "[c]ompensation for

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[67] CCST Technical Report at 475 ("California's pipeline capacity and underground gas storage facilities give California consumers diverse options for supply and operational flexibility that most states do not have"); *id.* at 504 ("Gas storage provides crucial hourly balancing for the gas system in all seasons. Without gas storage, California would be unable to accommodate the electricity generation ramping that now occurs nearly every day and that may increase as more renewables are added to the grid.").

[68] California Energy Commission 2016 Integrated Policy Report at 6 (February 28, 2017), http://docketpublic.energy.ca.gov/PublicDocuments/16-IEPR-01/TN216281_20170228T131538_Final_2016_Integrated_Energy_Policy_Report_Update_Complete_Repo.pdf ("[f]lexibility is necessary to compensate for hourly changes in variable renewable generation and energy demand, as well as outages for power plant maintenance and seasonal variations in hydropower generation. Natural gas-fired power plants offer the most flexibility for quickly, reliably, and cost-effectively ramping up or down to balance supply and demand.").

[69] 2016 California Gas Report, Prepared by the California Gas and Electric Utilities at 4, *available at* https://www.socalgas.com/regulatory/documents/cgr/2016-cgr.pdf ("For the purpose of load-following as well as backstopping intermittent renewable resource generation, gas-fired generation will continue to be the primary technology to meet the ever-growing demand for electric power.").

providing flexibility services can also be uncertain, with the gas-fired generation fleet facing competition from other sources."[70] Various types of resources can provide flexibility services, as shown in the Electric Power Research Institute ("EPRI") chart below:[71]

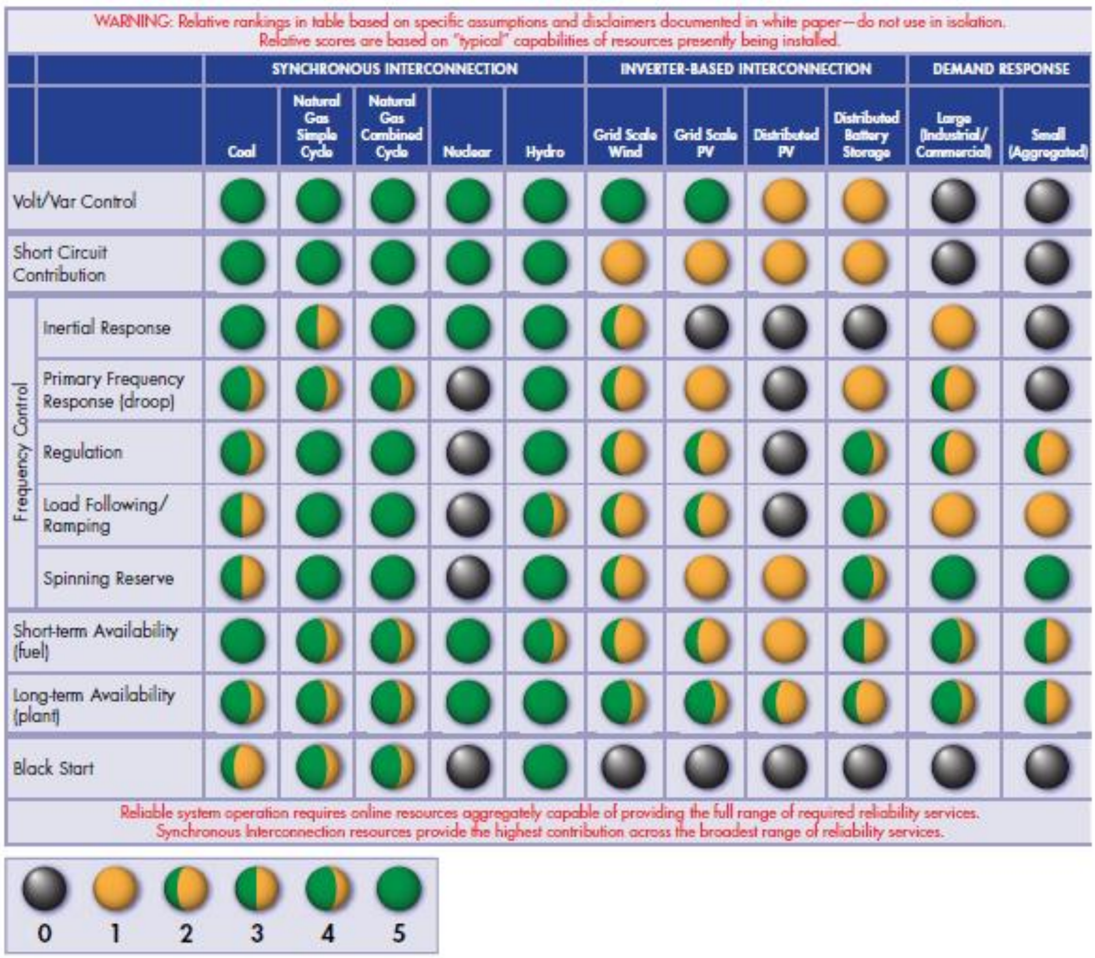

Table 1. Relative Comparison of Reliability Contributions of Resource Groups

70 Comments of the California Independent System Operator Corporation In Response to the Commission's Request for Comments About System Resiliency and Threats to Resilience, Docket No. AD18-7 at 35 (March 9, 2018).

71 Electric Power Research Institute, Contributions of Supply and Demand Resources to Required Power System Reliability Services at 21 (May 2015), https://www.epri.com/#/pages/product/3002006400/; *see also* Alison Silverstein *et al.*, A Customer-focused Framework for Electric System Resilience at Appendix B, GRID STRATEGIES, LLC (May 2018), https://gridprogress.files.wordpress.com/2018/05/customer-focused-resilience-final-050118.pdf (detailing reliability services capabilities for major energy sources).

But because the gas market does not delineate and price the flexibility that natural gas provides (*i.e.*, sub-day non-ratable flows), the markets do not effectively spur competition, innovation, or investment. In effect, the "unpriced" flexibility from the natural gas supply chain (embedded within the price for long-term pipeline capacity), muddles the market for participation by more dynamic, data-driven resources like batteries and demand response. Enhanced price transparency and discovery in the gas market—if ultimately flowed through to the electric market—will better incentivize flexible resources during periods of tight fuel supply[72] and will ensure that the products and services in both the electric and gas markets will generate effective price signals in and across the two markets so that appropriate right-sized investments will be made.

B. Resilience Can Be Enhanced by Establishing a Standardized Means to Transact for and Reflect the Value of Non-Ratable Pipeline Flows in the Electric Market

The key attribute of our future energy system is flexibility.[73] FERC has recognized the importance of this attribute on the electric side by approving various ramping products and refining fast-start pricing rules.[74] As the grid becomes more dynamic, the role of natural gas as a

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72 *See* CAISO, Commitment Cost and Default Energy Bid Enhancements Second Revised Draft Final Proposal at 13 (March 2, 2018) ("By increasing the accuracy of its reference level calculations, the California ISO can better: support integration of renewable resources through improving its valuation of resources under uncompetitive conditions in a manner that will incentivize flexible resources participation during tight fuel supply; account for costs of flexible resources (gas and non-gas) to reduce risk of insufficient cost recovery; and encourage participation of non-resource adequacy and Energy Imbalance Market resources.").

73 Flexibility is also at the heart of resilience. *See* Miriam-Webster Dictionary – Resilient Synonyms, https://www.merriam-webster.com/dictionary/resilient (listing "flexible" as a synonym for "resilient").

74 *See, e.g.*, *Cal. Indep. Sys. Operator Corp.*, 156 FERC ¶ 61,226 (2016) (approving CAISO's tariff revisions to replace its existing flexible ramping constraint with its new flexible ramping product); *ISO New England Inc. and New England Power Pool Participants*

grid reliability service provider will become all the more important.[75] The suite of pipeline services should complement and facilitate the variable needs of generators, and the value of this flexibility should be reflected in the electric, gas supply, storage and transportation markets.[76] Today, outmoded market structures hinder this. At a minimum, a shaped nomination service—allowing generators to explicitly specify the quantity of gas they need each hour, with an accompanying transportation pricing structure—can unleash market-based solutions of value to pipelines, storage operators, gas suppliers, and generators. This action will enhance reliability and resilience and consequently improve the efficacy of existing market mechanisms on the electric side.

The market today has managed to provide the necessary flexibility but only in an opaque way. Pipelines should be commended for their management of assets and capabilities to enable generators to take varying quantities over the course of the day. Beyond the "best efforts" of these pipelines, however, there are too few regulatory structures in place to ensure reliability will

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Committee, Docket No. ER15-2716-000 (Oct. 19, 2015) (delegated letter order approving ISO-NE's revisions to its process for dispatching and pricing fast start units).

75 Diversity of Reliability Attributes – A Key Component of the Modern Grid, Prepared for American Petroleum Institute by The Brattle Group at page 21, table 1 (May 17, 2017), http://www.api.org/~/media/Files/Policy/Natural-Gas-Solutions/20170517-API-Diversity-of-Attributes.pdf (summarizing the relative advantages that different technologies have in providing the attributes needed for system reliability).

76 While it is true that pipelines have offered enhanced services, such services have, for the most part, not been successful in organized markets because: (1) they are of fixed duration, usually at least a season; (2) they require demand charges for the full period of the subscription; and (3) generators (especially intermediate dispatch generators) have little if any economic mechanism in organized markets to recover such costs.

be maintained.[77] This challenge will only become magnified with increasing numbers of quick-start plants on the system.[78]

Commission precedent establishes that shippers do not have a firm right to flow gas on a non-ratable basis under existing ratable firm service.[79] Although pipelines accommodate non-uniform hourly takes when possible, they are left without any mechanism to enforce uniform hourly takes except when system integrity is threatened.[80] The Commission has previously recognized the reliability implications of this issue, noting that "[w]hen shippers take gas at non-uniform rates, system reliability may be impacted."[81] On the El Paso system, the Commission observed that "when shippers fail…to take gas ratably from the pipeline, additional line pack

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77 ICF International, Firming Renewable Electric Power Generators: Opportunities and Challenges for Natural Gas Pipelines – Submitted to the INGAA Foundation at 82 (March 16, 2011), http://www.ingaa.org/File.aspx?id=12761&v=692649a6 ("Pipelines will need to be prepared for the quick ramp-up of a firming generation plant and this typically would be done by increasing the pressure in the vicinity of the power plant in anticipation of the plant coming on-line. Absent this high pressure line pack in the vicinity of the generating plant the gas turbine can trip and drop off the electric grid. If the pressure on the pipeline is compromised by gas requirements from a firming generator that have not been scheduled and confirmed, the pipeline may have to restrict flow to the generator in order to maintain the scheduled and confirmed volumes to other shippers or to protect the integrity of the pipeline system. In either case, the result is the same. The smooth operations and reliability of the electric and gas systems are compromised. In such an instance, the loss of pressure harms all of the shippers in the vicinity, including those that are operating in compliance with the nomination, scheduling and imbalance norms.").

78 CCST Technical Report at 528 (in addressing a 50% renewable penetration case, SoCalGas observed that more quick-start gas-fired generators "could cause dramatic pressure drops that would look much more like a system failure to gas system operations control staff").

79 *Southwest Gas Corp.*, 111 FERC ¶ 61,511 at P 13 (2005) ("the applicability of uniform hourly flow requirements is controlled by the individual pipeline's tariff. Here, the tariff language provides that the shipper will "endeavor" to take gas in uniform hourly quantities and will keep variations to the minimum "feasible." While this language suggests that there is some flexibility in hourly flow requirements, the Commission has made clear that this type of language does not give the shipper a firm right to hourly variations in service.").

80 *Id.* at P 14.

81 *El Paso Natural Gas Co.*, 114 FERC ¶ 61,305 at P 38 (2006).

must be utilized which can result in decreased pressure on both laterals and the mainline system."[82] One customer on El Paso's system "stated they have been harmed and have been unable to obtain pressure guarantees from El Paso as a direct result of overuse on the system."[83] The Commission ultimately concluded that "the implementation of new hourly and daily services…should enhance reliability."[84]

The foundations for a shaped nomination service have already taken hold in the market. As noted by Mountain Valley Pipeline, LLC, "it is common industry practice for a gas-fired electric generation facility to cooperatively share its burn profile with the pipeline so the pipeline can manage its system to provide the volumes needed by the facility."[85] MVP has also observed that "obtaining hourly quantity profiles for gas-fired electric generation facilities . . . will assist Mountain Valley in planning system flows throughout the day and understanding system constraints in advance."[86] Recent pipeline tariffs incorporate exceptions to the uniform hourly flow rate, proposing a process whereby customers communicate anticipate hourly flow variations in advance to the pipeline.[87] Other pipelines have offered a shaped flow service to provide

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[82] *Id.* at P 39.

[83] *Id.*

[84] *Id.*

[85] Mountain Valley Pipeline, LLC, Responses to OEMR Data Requests Issued October 19, 2016, Docket No. CP16-10 at 1 (November 2, 2016).

[86] *Id.*

[87] Atlantic Coast Pipeline, LLC, FERC Gas Tariff, *pro forma* Original Volume No. 1 at Section 5.4B ("Hourly Flow Rate") ("on any Gas Day that Pipeline has operational capability, Pipeline may grant Customer the flexibility, for that Gas Day, to vary its hourly Tenders and/or Takes. Pipeline shall endeavor to give priority in granting such hourly variations to any Customer under this Rate Schedule that submits a written request to Pipeline, on a first-in-time basis. Such requests shall be submitted to Pipeline's Transportation Services Department on the form provided on the Website, shall be submitted no more than 48 hours and no less than four hours in advance of flow, and shall set forth Customer's anticipated hourly flow variations, by hour, for the time period requested. As soon as practicable, but no

shippers with enhanced flexibility, simultaneously noting such service will make more complete use of the capacity and operational capabilities of its system.[88] But there is not a standardized method in the market for nominating and scheduling shaped flows.

The NAESB Gas Electric Harmonization forum, initiated at the request of the Commission,[89] sought to standardize these efforts. EDF and others proposed a definition for a "Shaped Nomination," which would allow a customer to provide to a pipeline the specific quantities of gas it will use in each hour over the course of a day, and suggested a standard for how a customer should communicate this information to the pipeline.[90] Several representatives of the pipeline segment cited their intention and/or willingness to offer such services and the benefits of standardizing commercial and operational protocols for Shaped Nomination or

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later than within two hours of the receipt of a request, Pipeline shall respond and inform Customer whether the requested flexibility will be granted. In evaluating Customer's request for hourly variations, Pipeline may consider any relevant factors, including but not limited to Pipeline's current operating conditions, the level of variation requested by all customers, the level of other scheduled services, and Customer's demonstrated ability to Tender and/or Take Gas in a timely fashion").

[88] Dominion Energy Questar Pipeline LLC, Tariff Filing on Firm Peaking Deliverability Service, Docket No. RP17-900 (July 14, 2017).

[89] *Coordination of the Scheduling Processes of Interstate Natural Gas Pipelines and Public Utilities*, Order No. 809, FERC Stats. & Regs. ¶ 31,368 at P 107 (2015).

[90] North American Energy Standards Board Status Report for Submittal to the Commission Concerning FERC Order No. 809 Coordination of the Scheduling Processes of Interstate Natural Gas Pipelines and Public Utilities, Docket No. RM14-2 at 5, n.10 (March 30, 2017) ("NAESB WGQ Proposed Definition 1.2.[z1]: A Shaped Nomination is a nomination in which a Service Requester provides both a daily quantity and a quantity for each hour of the Gas Day, with each hour beginning at the start of the hour (e.g. 10:00 AM)"); *see also id.* at 5, n.11 ("NAESB WGQ Proposed Standard 1.3.[z1]: Where a Transportation Service Provider offers a service under its tariff, general terms and conditions, and/or contract provisions which expressly provides for a Service Requester (SR) to submit a Shaped Nomination, the SR should submit its nomination for that service as a Shaped Nomination using NAESB WGQ Standard No. 1.4.1 (Nomination). Receipt of service expressly providing for the use of a Shaped Nomination may require additional coordination with interconnected parties.").

similar services.[91] Although the Standards ultimately did not pass because of a segment block, the favorable voting record demonstrates the industry's interest and the benefits such a structure could provide.[92]

Standardizing shaped flows would lay the groundwork for valuing this service in pipeline tariffs. As detailed in the term sheet provided in Exhibit A, EDF has developed a tool and construct to transact for and reflect the value of nonratable flows in the electric market.[93] Exhibit B provides further details and examples of how this service would work in practice. Under the proposal, the pipeline would charge requesting parties an amount per Dth per hour for each Dth that is greater or less than the daily nominated and scheduled quantity divided by 24 (i.e., that varies from ratable). Consistent with prior Commission findings,[94] the proposal asserts that the right to non-ratable flows is not explicit.[95] On the electric side, subscribing generators would get

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[91] *Id.* at 5.

[92] *See also* CCST Technical Report at 571 (noting that Canadian producers might be able to use the natural gas storage hub in Alberta to support shaped nominations on the GTN pipeline and Kern River might be able to allow shaped nominations if the Magnum storage project proceeds).

[93] Further support for pricing deviations from ratable flow is set forth in a recent paper entitled *Market Based Intraday Coordination and Natural Gas System Operation*. The focus of the paper is a mechanism to relieve pipeline constraints and better inform investment decisions. The paper explicitly illuminates the challenges to gas-electric coordination and risks to electric reliability that result due to the lack of efficient price formation. The solution proposed is the timely exchange of physical and pricing data in the natural gas secondary market. Rudkevich *et al.*, Market Based Intraday Coordination of Electric and Natural Gas System Operation, Proceedings of the 51st Hawaii International Conference on System Sciences 2018, https://scholarspace.manoa.hawaii.edu/bitstream/10125/50215/1/paper0328.pdf.

[94] *Southwest Gas Corp.*, 111 FERC ¶ 61,511 at P 13 (2005).

[95] Understanding that shippers/operators have come to rely on this un-tariffed service, tariffs would remain unchanged and/or continue to be silent on non-ratable flows and non-ratable scheduling at locations served by Primary FT. At those operated locations where operators are receiving service under other than Primary FT, however, non-ratable flow and scheduling would be explicitly available (at a price).

next day, predictable, hourly flows that can be "bid to the grid" as hourly electricity production and can embed the variable cost of such non-ratable flows into their energy bids. In short, the proposal ascribes a potentially actionable "value" to the service (today, a valuable but unpriced service assures scarcity).

This proposal has numerous benefits. By pricing non-uniform flow, pipelines will be able to confirm that they are providing the service to those who value the service the most, consistent with the goals of allocative efficiency.[96] Pricing and delineating the service also ensures that pipelines are providing the service on a non-discriminatory basis and eliminates uncertainty on behalf of both pipelines and customers regarding what services are provided pursuant to the tariff as opposed to on a "courtesy" basis.[97] In addition, the command and control aspects of current practices that resolve day-to-day issues can be reduced and, over time, be replaced, with self-correcting market mechanisms. As FERC observes, this has a corresponding reliability and operational benefit.[98] Once a market develops for the valuable service of providing shaped nominations and flows, the appropriate price signals will inform pipelines as to what investments should be made to their system. Proposing right-sized investments will attract sufficient shipper commitments, eliminating the investment challenges faced by pipelines in the recent past, and increasingly so in the future. Furthermore, the proposal

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96 *See Algonquin Gas Transmission, LLC*, 156 FERC ¶ 61,151 at P 27 (2016) (explaining that allocative efficiency is enhanced by ensuring the capacity is used for its highest valued use).

97 *Portland Natural Gas Transmission System*, 106 FERC ¶ 61,289 at P 52 (2004) ("Portland asserts that this 'flexibility' is not part of Portland's firm service obligations, but has been extended on a best-efforts basis as an accommodation to FT shippers. Portland maintains that it has made clear to the Generators, in written correspondence and otherwise, that this flexibility was provided by Portland as a 'courtesy' with the expectation that the Generators would endeavor to adhere to the tariff's uniform take provisions.").

98 *El Paso Natural Gas Co.*, 114 FERC ¶ 61,305 at P 38 (2006).

provides an additional source of revenue to pipelines. As basis continues to diminish, if not collapse,[99] recovering revenue for providing receipt and delivery services, as opposed to ratable point-to-point throughput capacity, will become a critical component of a pipeline's revenue stream.[100]

Confirmed, shaped flows (i.e., scheduled shaped deliveries) will allow generators to schedule quantities of gas for delivery the next day in the shape that correlates to their anticipated output levels.[101] This variability is crucial, as these generators increasingly become the provider of flexible services to balance and facilitate deployment of intermittent and variable output renewable energy capacity. EDF's proposal also allows generators to essentially recoup the costs of the reservation charge, assuming sufficient volumes are used, which will likely make the service a more economical choice than firm service priced under the straight fixed variable rate design. The proposal will also lead to more certainty for generators and potentially lower

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[99] Federal Energy Regulatory Commission, State of the Markets Report 2015 at 4 (March 17, 2016), https://www.ferc.gov/market-oversight/reports-analyses/st-mkt-ovr/2015-som.pdf ("[w]ith the exception of the Northeast, including New England, regional price differences across the country were not large, a sign that midstream investments over the past 10 years have largely relieved natural gas transportation constraints.").

[100] Allison Good, US Gas Pipelines Face Rising Revenue Risk from Expiring Contracts, S&P Global Market Intelligence Data Dispatch (January 29, 2018), https://platform.mi.spglobal.com/web/client?auth=inherit#news/article?id=43337110&KeyProductLinkType=4 ("With many interstate energy pipelines' initial long-term firm transportation contracts scheduled to end during the current calendar year, Barclays Capital Inc. analysts said operators should expect recontracting risk to be a prominent midstream theme in 2018.").

[101] Use of the term confirmed shaped flow is an explicit reference intended to convey that this service could be provided and charged to the actual generator as "point operator" interconnected with the pipeline. This structure may enable better price conveyance to RTOs as well as be the distinct transaction that pipelines would report as part of their transactional reporting under Order 563 *et seq*.

fuel supply costs.[102] Finally, the proposal will lessen the administrative burden of verifying cost-based bids to the RTO/market monitor. Particularly on constrained days, securing intraday gas poses a host of verification concerns for generators, as have been detailed before FERC.[103] The ability to secure and document day-ahead transportation costs will help address the uncertainty of transacting solely in the intra-day market and create sufficient documentation for market monitors/RTOs to verify the fuel cost for electric bids.[104]

C. Commission Leadership is Needed to Facilitate Action

The Commission has an opportunity in this proceeding to enhance resiliency by taking action on gas-electric coordination. In terms of value to customers, a recent study authored by Alison Silverstein, Rob Gramlich, and Michael Goggin identifies "schedule coordination" and "fuel coordination" as high value resilience measures.[105] A litany of entities have also identified this area as critical to improving reliability and resiliency:

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[102] Today, operators generally pay intraday gas prices to meet their day-of needs. The proposal allows operators to schedule gas a day in advance and therefore incorporate the day-ahead price. This will lead to increased certainty regarding the transportation of gas and likely lower fuel costs given that intra-day gas prices usually exceed next-day gas prices.

[103] *See, e.g.*, Testimony of Leslie Dedrickson on behalf of Exelon Corporation, Docket No. RM16-5 (April 4, 2016).

[104] June 29, 2017 Technical Conference Transcript, Docket No. AD 17-8 at 163 ("[On] January 17th of 2014 the price of gas was $6.50. So that's what we are using the next day going into the day ahead market. The price that traded on that next day was actually $18.00. So it was about three times what the value of gas we had in New England for a reference level. So right there we could be mitigating somewhat to a price that doesn't reflect what their marginal cost is, that's a big concern for us.").

[105] Alison Silverstein *et al.*, A Customer-focused Framework for Electric System Resilience at 63, GRID STRATEGIES, LLC (May 2018), https://gridprogress.files.wordpress.com/2018/05/customer-focused-resilience-final-050118.pdf.

- 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."[106]

- 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."[107]

- 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,"[108] and FERC and NAESB should address "the alignment of planning and operating practices across the two industries."[109]

- EPRI: "Understanding the reliability impacts of increased reliance on gas and the opportunities its operational flexibility provides are important in the near-term…"[110] and including the recommendation to "assess key interfaces between the gas and electric systems and markets…to achieve efficiency."[111]

- 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."[112]

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[106] 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.

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

[108] 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.

[109] *Id.* at 41.

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

[111] *Id.* at 55.

[112] 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),

Taking action in this area is a logical extension of the Commission's past efforts to bring increased competition and transparency to the gas market. The Commission's shift from a monopolistic structure to a market structure has brought significant benefits to customers, the economy, and geopolitics.[113] In Order No. 636, FERC found that "this rule will establish an efficient gas market in which all participants are able to fashion the contractual arrangements—both long and short term—best suited to their needs. In short, they will be able to respond to their financial and commercial situation through the contracting process in an efficient gas market."[114] Just as Order No. 636 eliminated barriers to market efficiency in the 1990s, a new impetus is needed to help resolve the pressing challenges posed by the nexus between today's gas and electric markets.

The NAESB process and outcome described above is indicative of a stalemate, demonstrating the need for the Commission to create an impetus to overcome it. To date, the market has not been able to resolve this issue on its own, leading to non-transparent workarounds and a lack of price transparency and discovery. This is despite the fact that multiple entities have identified new service offerings, tailored specifically for the needs of generators, as viable means

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https://www.energy.gov/sites/prod/files/2016/10/f33/Ensuring%20Safe%20and%20Reliable%20Underground%20Natural%20Gas%20Storage%20-%20Final%20Report.pdf.

113 *See* Agnia Grigas, The New Geopolitics of Natural Gas, Harvard University Press, 2017, at page 2 ("Gas is no longer a scarce, localized, difficult-to-transport resource doled out by energy monopolists…."); *see also id.* at page 5 ("These newfound energy resources will bring many domestic benefits and economic opportunities as well as improve America's energy security, or the availability of sufficient supplies at affordable prices").

114 *Pipeline Service Obligations and Revisions to Regulations Governing Self-Implementing Transportation; and Regulation of Natural Gas Pipelines After Partial Wellhead Decontrol*, FERC Stats. & Regs. ¶ 30,939 (1992).

of enhancing gas-electric coordination.[115] Moreover, as observed by PJM, "many of the next steps in gas/electric coordination are beyond the authority of any one RTO (or any one pipeline) to effectuate in any kind of uniform manner."[116] A "paradigm" shift[117] cannot occur in the absence of a policy impetus driven by the Commission.

The Commission should continue to advance markets as the impetus for new capacity by prompting pipelines and power generators to develop the transactional tools to support contracting. This action could take various forms:

- FERC could resolve the segment block at NAESB that prevented the Shaped Nomination standard and communication protocol from moving forward. FERC has resolved disputes at NAESB and adopted its own standards when "the standards are sufficiently important to warrant such intervention."[118]

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[115] Comments of ISO-NE, Docket No. AD12-12 at 4-5 (March 30, 2012) ("With respect to natural gas pipelines, it is important that pipeline tariffs provide the most flexibility possible to accommodate the variable needs of gas-fired generators. ISO-NE is working with the gas industry and other stakeholders to identify pipeline service enhancements such as hourly, no-notice and non-rateable takes so that generators can meet the net hourly load following and contingency responses needed for reliable electric operations. Construction of new pipeline infrastructure is expensive, especially if it is only fully utilized a limited number of days a year. There may be opportunities to accommodate some of the demands of the electric sector through new services offered through existing pipeline facilities."); *see also* PJM Comments at 7.

[116] PJM Comments at 57.

[117] *See, e.g.,* Algonquin Gas Transmission, LLC, Comments on ISO-NE Operational Fuel Security Analysis at 1, n.1 (February 15, 2018) ("To the extent the region needs or desires capacity dedicated to supporting the electric market, there has to be a paradigm change in terms of how that pipeline capacity for the electric market is funded."); PJM Comments at 7 (FERC should "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.").

[118] *Standards for Business Practices for Interstate Natural Gas Pipelines*, Order 587-U, FERC Stats. & Regs. ¶ 31,307 at P 32 (2010); *see also Standards for Business Practices for Interstate Natural Gas Pipelines*, 117 FERC ¶ 61,095 at P 23 (2006) ("Any standards that would allow better coordination between scheduling of gas and electric markets would be of benefit to both industries, and we encourage NAESB to continue its efforts to develop such standards.").

- FERC could open a new docket, through a Notice of Inquiry or Notice of Proposed Rulemaking, to evaluate the need for gas market updates to reflect contemporaneous market conditions, assessing the value of a voluntary shaped flow service. As part of its data gathering in that docket, FERC could request pipelines to provide all physical receipts and deliveries by hour for the time period January 2017-January 2018.[119]

- FERC could invite participation in a voluntary pilot program and create a framework for pipelines to charge for shaped flow transactions.[120] The pilot program would provide an additional informational benefit—pipelines would report transactions, including a log of unfulfilled requests along with the reasons for denial, and report such logs to the Commission on a quarterly basis.[121]

- As suggested by PJM, FERC could examine these issues "on an individual pipeline basis, through targeted proceedings at the Commission." PJM Comments at 59.

It is practically impossible to ensure fuel security if the new largest users are not contracting with those upon whom they rely to transport fuel. To achieve grid resilience, FERC must provide an impetus and the transactional structure to ensure gas market rules reflect contemporaneous market conditions.

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[119] The data should be provided at the same levels and locations with the same indicators as the pipelines publish Scheduled Quantities by means of the NAESB Operationally Available data set. Quantities by hour by receipt location and by delivery location (including receipts from and delivery to storage locations) should be requested as a minimum. In addition, pipelines should provide separately, by day, an hourly sum of all receipts and an hourly sum of all deliveries.

[120] *See, e.g., Tennessee Gas Pipeline Co*., 75 FERC ¶ 61,352 (1996) (approving a pilot program for Tennessee Gas Pipeline Company to offer a downstream storage swing option service, targeted for a limited set of customers that ultimately was offered on a system wide basis).

[121] *See Pacific Gas and Elec. Co*., 38 FERC ¶ 61,242 at p. 61,796 (1987) ("The WSPP is an experiment of limited two-year duration with no precedential value regarding the particular trades within that period…Rather, its primary purpose is to provide information to be used by the Commission to reevaluate its regulatory policy toward bulk marketing."); *see also Public Service Company of New Mexico*, Opinion No. 203, 25 FERC ¶ 61,469 at p. 62,040 (1983), *reh. denied*, 27 FERC ¶ 61,154 (1984) ("such experiments permit an analysis of the effects of a particular modification of regulation without, at the same time, subjecting the entire electric utility industry to the regulatory 'treatment'").

III. CONCLUSION

This proceeding has made clear that the grid is evolving at a fast pace, while certain market rules and structures continue to lag behind. The gas market is a generation behind the electric market and has not meaningfully been updated to reflect geographically-dispersed supply abundance, and the fact that natural gas generators are now the new largest users of the pipeline network. The Commission has an opportunity to further enhance gas-electric coordination in a focused and targeted manner by creating the impetus for generators and pipelines to meaningfully transact. Without a signal from the Commission that the industry should take the first step (i.e., communicating shaped flow intent among interconnected parties), the foundation upon which further progress can be made will not be present. As detailed in these Comments, this proposal will bring numerous operational benefits, in addition to enhancing resilience, reliability, and transparency. This action would represent substantial progress towards the elimination of outmoded rules, requirements, and processes and would be an important step to a more robust, economical, and equitable energy system.

Dated: May 9, 2018

Respectfully submitted,

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Exhibit A

Shaped Flow Service Proposed Term Sheet

As the output of natural gas-fired generators increasingly varies over the course of a day, generators require more flexible transportation services from pipelines. Below are core commercial elements envisioned for a volumetric, shaped-flow service:

1. Current pipeline ratable take rules under standard Firm Transportation (FT) and Interruptible Transportation (IT) service agreements require generators to take gas on a steady hourly rate over the course of a day. Shaped flows will allow generators to schedule varying flow quantities of gas for delivery the next day that correlate to their anticipated output levels. A "Shaped Nomination" is a nomination in which a Service Requester provides both a daily quantity and a quantity for each hour of the Gas Day, with each hour beginning at the start of the hour (e.g. 10:00 AM).

2. Pricing and delineating the shaped flow service ensures that pipelines are providing the service on a non-discriminatory basis and eliminates uncertainty on behalf of both pipelines and customers regarding what services are provided pursuant to the tariff as opposed to on a "courtesy" basis. Shaped flow service would allow the generator to only request the service when needed on a daily basis.

3. The pipeline would make available, on a first-come first-served basis, every day, a volumetric service to either or both of: 1) firm shippers whose firm service agreement does not have primary delivery rights at the location seeking non-uniform (i.e., shaped) hourly service; and/or 2) those other operators (e.g., power plants) operating locations off of the pipeline's mainline that are not covered by a primary firm service agreement (encompassing the pipeline's mainline) with a contracted maximum daily quantity at least as great as the daily requested deliveries seeking non-uniform (i.e., shaped) hourly service. The pipeline would charge requesting parties an amount per Dth per hour for each Dth that is greater or less than the daily nominated and scheduled quantity divided by 24 (i.e., that varies from ratable). Note that because the service can be purchased by the power plant operator, the price paid for the non-ratable service is paid by the power plant operator and not bundled into a shipper's price. The power plant operator can show that delineated charge to the ISO/RTO as needed.

4. There would be a two-part charge: (1) a maximum reservation charge per Dth/hour of max hourly variance (positive or negative) from ratable; and (2) a maximum usage charge for all daily scheduled Dth that are (or are not) delivered ratably. The usage charge would be credited against the reservation charge. Shaped flow service would allow generators to essentially recoup the costs of the reservation charge, assuming sufficient volumes are used.

5. For those subscribing to the service on days when all binding requests for service can be granted, the usage charge per Dth paid by the point operator will be the pipeline's Park

and Loan (PAL) charge per Dth and at the end of the billing month, the pipeline will then credit the usage rate dollars against the reservation rate dollars in the monthly invoice. For those subscribing to the service on days when all binding requests for service requiring forward haul capacity cannot be granted, the Maximum Usage Charge will be a charge (not to exceed the 100% load factor of its rate for the pipeline's highest incremental service project in the past five years) and the pipeline will then likewise credit the usage dollars against the reservation dollars in the monthly invoice.

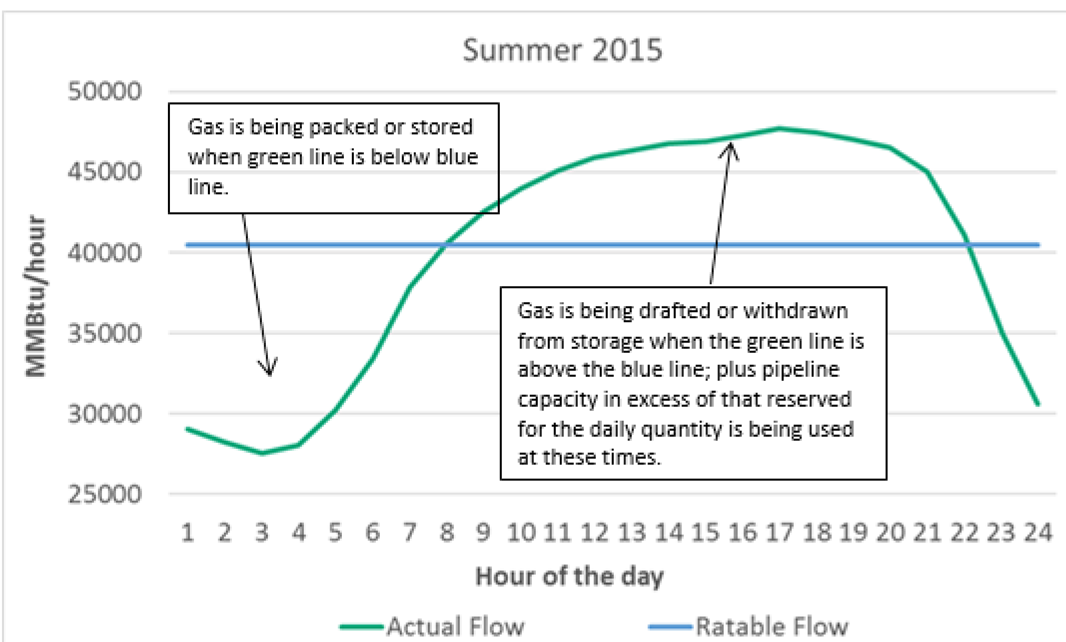
6. Because shaped flow service will be priced volumetrically, it is conducive for fuel supply pricing in generator hourly offers. Particularly on constrained days, securing intraday gas poses a host of verification concerns for generators, as have been detailed before FERC. The ability to secure and document day-ahead transportation costs will help address the uncertainty of transacting solely in the intra-day market and create sufficient documentation for market monitors/RTOs to verify the fuel cost for electric bids.

Exhibit B

<u>Comparison of Ratable Hourly Service to Non-Ratable Shaped Flow Service</u>

<u>Description of Ratable Hourly Service</u>:
The existing Gas Day for interstate natural gas pipelines begins at 9:00 a.m. (Central) and ends at 9:00 a.m. (Central) the following day. All nominations for interstate natural gas pipeline transportation service are for a daily quantity to be transported over the 24-hour Gas Day. The rate at which a shipper may use its contracted quantity on a given interstate pipeline, also known as a flow rate, is determined by the individual pipeline's tariff and the flexibility of that pipeline to permit shippers to use gas on other than a uniform hourly basis over the 24-hour Gas Day (i.e., non-ratable flows). Except for special services, pipeline services are generally based on the assumption of uniform hourly flows over the Gas Day. *See Coordination of the Scheduling Processes of Interstate Natural Gas Pipelines and Public Utilities*, Order No. 809, FERC Stats. & Regs. ¶ 31,368 at P 5 (2015).

<u>Descriptions/Examples of Non-Ratable Shaped Flow Hourly Service</u>:
When a daily quantity of gas is nominated and scheduled and the quantity taken in several hours is less than 1/24th of the daily quantity and in other hours exceeds 1/24th of the daily quantity, the service of delivering the gas is non-ratable or "shaped." Pipelines generally receive gas from producers, gatherers, processing plants and other pipelines on a ratable basis. The essence of non-ratable service is that pipelines have to find a place (i.e., linepack or storage) to put gas that is being received ratably across the day but taken below rate in several hours. Likewise, when pipelines are delivering gas in hours at rates in excess of 1/24th of the daily quantity, they not only have to find a place to get that gas from (i.e., linepack or storage) but they are using capacity in that hour that has not been reserved by the shipper that scheduled the daily quantity.



In-Path Non-ratable Flow Example (Current Operations)
Assume for this example that the power generator is being served under a contract held by a Marketer, Asset Manager, or LDC (Seller). Also assume for these purposes that the Seller is also delivering gas to another location in the reserved contract path. The Seller nominates the daily quantity that will be delivered to the generator as well as to the other location. Under current practice, once the gas is scheduled, the pipeline communicates with the point operator of the power plant to identify the likely shape of its takes. If the pipeline thinks it can meet that shape, the non-ratable service is provided. The gas gets delivered, but the value/price of that shaped delivery is opaque. The pipeline is paid the typical usage rate under the FT contract (usually pennies or less).

In-Path Non-ratable Flow Example (Proposed Operations)
As with the above example, assume that the power generator is being served under a contract held by a Marketer, Asset Manager, or LDC (Seller). Also assume for these purposes that the Seller is also delivering gas to another location in the reserved contract path. In this example, assume that the power plant point operator has purchased the service described in Exhibit A. The Seller nominates the daily quantity that will be delivered to the generator as well as to the other location. The point operator nominates the shape to the pipeline and has the shape scheduled. The power plant operator pays the Seller for ratable gas purchased in the day-ahead market and pays the pipeline the fee for the shaped flow. Because the pipeline service is a "transaction" under the Commission's regulations, the pipeline would report the price, quantity, date, and location(s) of the service.

LNG Innovation Example
Assume the plant operator is going to run all hours of the day, but in a shaped flow manner. Here the power plant operator, instead of paying the pipeline of the seller for a shaped flow, it schedules a daily quantity which is 24 times the plant's lowest hourly burn (a ratable nomination). Then, for the hours in which it is going to burn greater than the ratable amount, it schedules LNG to be delivered by back-haul (most LNG facilities are located downstream of power plants, and most power plants are located upstream of LNG facilities) to meet the higher than ratable burns. This innovation would be economical for those periods when the pipeline's charge for the shaped service would be such that it is less expensive to purchase the LNG than pay either the Seller or the pipeline the charges for the non-ratable service. Also note that the gas purchased from the Seller in the day-ahead market does not have any charges for intraday quantities or non-ratable service charges bundled into the Seller's price.

CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document upon each person designated on the service list compiled by the Secretary in this proceeding either by U.S. Mail or electronic service, as appropriate. Dated at Washington, DC, this 9th day of May, 2018.

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