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Before the

Committee on Energy and Natural Resources

United States Senate

Regarding

The Evolution of Energy Infrastructure in the United States

and How Lessons Learned from the Past Can Inform Future Opportunities

February 8, 2018

Good morning Chairman Murkowski, ranking member Cantwell, and members of the committee. My name is Donald F. Santa and I am the president and CEO of the Interstate Natural Gas Association of America, or INGAA. INGAA represents the vast majority of the owners and operators of interstate natural gas transmission pipeline in the United States. The pipeline systems operated by INGAA's 27 member companies are analogous to the interstate highway system, transporting natural gas across state and regional boundaries. As you can see from the map below, this is an extensive energy infrastructure.

The committee has asked that we address the evolution of energy infrastructure in the United States and how lessons learned from the past can inform future opportunities. This testimony will focus on natural gas transmission pipelines. My perspective on this subject is informed not only by my current

role as president and CEO of INGAA, but also by my experience as a member of the Federal Energy Regulatory Commission (1993-1997). During my tenure at FERC, the commission implemented the Order No. 636 gas restructuring rule that unbundled interstate natural gas pipeline services.[1]

The United States has a highly integrated pipeline network that can transport natural gas to and from nearly any point in the lower-48 states. This network of more than 210 natural gas pipeline systems includes approximately 300,000 miles of interstate and intrastate transmission pipelines, more than 1,400 compressor stations that maintain the pressure needed to transport natural gas supplies, and more than 400 underground natural gas facilities.[2] To put this into perspective, the mileage of domestic natural gas transmission pipelines is almost 6.5 times greater than the mileage of the U.S. interstate highway system. While my testimony will focus on natural gas transmission pipelines, it should be noted that there also are approximately 2.2 million miles of smaller diameter, lower pressure distribution pipelines used by local utilities to deliver natural gas to residential and commercial consumers.

Incremental additions of transmission pipeline capacity will continue to be needed as natural gas supply and consumption patterns continue to evolve. This conclusion was confirmed by a study performed in 2016 by ICF International for the INGAA Foundation.[3] While the study noted uncertainties about energy commodity prices, the global and domestic economic outlook, and the pace at which public policy will affect energy markets, even the low case scenario found a continued need for natural gas pipeline investment and expansion. Consequently, a legal framework and a public policy environment that supports the efficient, responsible and market-driven development of natural gas transmission pipeline infrastructure remains important.

This testimony will summarize: (1) the history of the U.S. natural gas transmission pipeline industry; (2) the legal framework for interstate natural gas pipeline regulation; (3) the role of private capital in the industry's development; (4) the evolution of policy for authorizing the construction of interstate natural gas pipelines; and (5) the safety and efficiency of natural gas transmission pipelines. I also will offer some lessons learned and recommendations.

A Brief History of the U.S. Natural Gas Transmission Pipeline Industry

The development of the nation's interstate natural gas transmission pipeline network is attributable to two factors. The first is the economic incentive to link major demand centers to distant supplies of

[1] I also served as a member of the staff of the Committee on Energy and Natural Resources during enactment of the Natural Gas Wellhead Decontrol Act of 1989.

[2] The interconnectedness of this pipeline network can be demonstrated with several additional statistics. The pipeline network includes more than 11,000 delivery points, 5,000 receipt points and 1,400 points of interconnection where natural gas can be transferred between pipeline systems. There are 49 locations where natural gas can be imported or exported via pipeline, 8 liquefied natural gas (LNG) import facilities and one operational LNG export facility in the lower-48 states. Energy Info. Admin., *About U.S. Natural Gas Pipelines*; available at https://www.eia.gov/naturalgas/archive/analysis_publications/ngpipeline/index.html. Other LNG export facilities are under development, one of which will soon enter operation.

[3] ICF International, North American Midstream Infrastructure Through 2035: Leaning into the Headwinds (April 12, 2016), available at http://www.ingaa.org/File.aspx?id=27961&v=db4fb0ca.

natural gas. The second is the technology that made it possible for high-capacity pipelines to transport natural gas safely and economically over long distances.[4]

The Beginnings of the Interstate Pipeline Network

The true birth of the U.S. natural gas pipeline industry was in the 1920s when advances in pipe rolling, metallurgy and welding combined to make the long-distance transmission of natural gas practical. Subsequent advances in technology have enabled the industry to use increasing pipe diameters and pressures, which resulted in greater pipeline capacity and economies of scale.[5] For example, in 1930 the maximum diameter and design pressure for a natural gas pipeline was 20 inches and 500 pounds per square inch gauge (psig), while by 1980 the utilization of pipe up to 56 inches and 2,000 psig was contemplated (although as a practical matter, the maximum diameter pipe used in commercial applications is in the 42 inch range).

These advances spurred the first pipeline building boom. Between 1927-1931, about a dozen major natural gas transmission pipelines were constructed with each spanning more than 200 miles. Three of these systems stretched more than 1,000 miles. These systems connected gas supply from the Mid-Continent (Texas, Oklahoma and Kansas) to demand centers in the Midwest and Rocky Mountain region, supply from Louisiana to demand centers in the Midwest and South, and supply in California to in-state markets.

While pipeline construction subsided during the Great Depression, the fuel needs created by World War II provided the impetus for greater pipeline capacity. The 1,275-mile Tennessee Gas Transmission System from the Gulf Coast to the Appalachian region was authorized and constructed during the war. In addition, the federal government constructed two pipelines, the 1,340-mile Big Inch pipeline and the 1,475-mile Little Inch pipeline, terminating in Philadelphia and New York City, respectively, to ensure the security of crude oil and refined products from the Gulf Coast. Following the war, the "inch" pipelines were converted to transport natural gas and were sold to the private sector in 1947. The Big Inch pipeline route remains the foundation of the Texas Eastern Transmission system, while the Little Inch pipeline was converted to refined product transportation in 1957.

Post-War Pipeline Expansion

The United States' post-war economic expansion included a pipeline construction boom that lasted until the mid-1960s. Much of the backbone of today's natural gas transmission network was constructed at this time. At least 15 major interstate natural gas pipelines were added during this period and the interstate pipeline network matured to reach every major consuming market in the lower-48 states. In addition to major new trunklines, spurs were added to reach new markets and the capacity along existing pipeline corridors was expanded with parallel pipelines (looping) and added compression. In addition, the first significant pipeline connections with Canada and Mexico were established between 1957-1960.

[4] The following summary of the evolution of the natural gas pipeline industry is based on Arlon Tussing and Bob Tippee, The Natural Gas Industry: Evolution, Structure and Economics 79-124, (2nd ed. 1995).
[5] Tussing and Tippee at 84.

Interstate Gas Shortages and Wellhead Decontrol

Pipeline construction waned during the late 1960s and for much of the 1970s. Federal wellhead price controls on natural gas dedicated to the interstate market, first imposed in the mid-1950s, created demand for natural gas among industrial consumers, because regulation constrained prices to artificially low levels. The Federal Power Commission (FERC's predecessor) discouraged new pipeline construction to preserve interstate gas for residential and commercial consumers. This situation worsened in the 1970s, as dwindling supplies of natural gas dedicated to the interstate market had to be rationed via end-use curtailment. The interstate natural gas shortages and overall pessimism about natural gas supply resulted in a significant contraction of the US natural gas market that finally bottomed out in the mid-1980s. It took until 1991 for the domestic natural gas market to grow back to the previous peak set in 1972.

Congress ultimately responded by enacting the Natural Gas Policy Act of 1978, a complicated statute that eliminated the distinction between the interstate and intrastate natural gas commodity (or "wellhead") markets, provided incentive pricing for multiple categories of new natural gas production, and began a phased wellhead decontrol that culminated in 1985 with the elimination of all remaining price caps on new (post-NGPA) natural gas production. The NGPA also encouraged linkage of the heretofore separate interstate and intrastate natural gas transmission pipeline systems by offering limited federal regulation for intrastate pipelines that established such interconnections.

Given the dim supply outlook, it was not surprising that few new natural gas transmission pipelines were constructed during this period. The significant exceptions were the "prebuild" legs of the Alaska Natural Gas Transportation system, a proposed and approved pipeline intended to transport natural gas from Alaska's North Slope to the lower-48 states. While ANGTS ultimately was not constructed, the eastern and western "prebuild" legs established important connections between natural gas supplies in Western Canada and consuming markets in the US Pacific Coast and Midwest regions.

Restructuring: A New Model

By the early 1980s, the US had entered a long period of natural gas oversupply.[6] This supply glut, known as the "gas bubble," lasted until the end of the next decade. Wellhead decontrol triggered a series of events that resulted in a profound restructuring of US natural gas markets, the natural gas pipeline industry, and the incentives for developing new natural gas pipelines. Beginning with Order No. 436 in 1985, a series of FERC orders transformed interstate natural gas pipelines from gas merchants into open access transporters that had completely exited the merchant function. As merchants, interstate pipelines were supply aggregators that purchased natural gas at the wellhead and resold it to downstream customers, typically local gas utilities, as a bundled product that included both the natural gas commodity and its transportation to the point of delivery. Now, as open access transporters, interstate pipelines sell natural gas transportation as an unbundled product on a non-unduly

[6] The glut was the product of several factors. On the supply side, increased production resulted from the NGPA incentive prices and the rush by interstate pipelines to add gas to their supply portfolios after years of shortage. This occurred, however, as natural gas demand was dampened by the economic recession of the early 1980s and the Powerplant and Industrial Fuel Use Act, a federal law intended to discourage the consumption of oil and natural gas for electric generation and industrial processes.

discriminatory basis. FERC's restructuring orders sought to ensure truly non-discriminatory access to pipeline transportation and to facilitate competition in the supply and transportation of natural gas. As part of this, FERC encouraged pipelines to exit the merchant function entirely and imposed strict rules to preclude pipelines from favoring their merchant affiliates.[7]

Restructuring affected the incentives for developing new natural gas pipeline capacity. Before restructuring, interstate pipelines' incentive for developing new pipeline infrastructure was tied directly to their bundled merchant function, i.e., attaching new purchased gas supplies upstream and attaching new resale markets downstream. After restructuring, interstate pipelines are agnostic as to the ultimate ownership or use of the natural gas that is transported. New pipeline infrastructure is developed to satisfy the needs of the sellers and purchasers of the natural gas to be transported.

Natural gas wellhead decontrol and pipeline restructuring unleashed new competition among both gas suppliers and pipelines. This resulted in intense competition to serve new market opportunities in the late 1980s and early 1990s. Multiple pipeline companies competed to deliver gas from the US Southwest to markets in California. By 1992, two new interstate pipelines had been built into California and an existing pipeline expanded its capacity to deliver Canadian gas to the state. The other market that benefitted from the new competition was New England. The region historically had been served by long-distance pipelines originating in Texas and the Gulf Coast and depended on imported liquefied natural gas to meet peak winter demand.[8] With an opportunity for market growth by displacing heating oil in the residential and commercial market and fueling new gas-fired electric generators, local gas utilities wanted access to abundant gas supplies from Western Canada as a supplement to domestic supply. They formed a partnership with two pipeline companies to build a 370-mile pipeline originating at the Ontario-New York border in 1991-1992.

The end of the natural gas bubble coincided with the beginning of the new millennium. The market-clearing price for natural gas rose significantly, and there was pessimism about future gas supply from the lower-48 states and Western Canada. This sparked renewed interest in importing LNG and constructing the pipeline infrastructure needed to tap natural gas from Alaska's North Slope. One of the few domestic production bright spots was the Rocky Mountain region. New pipelines were built to connect this supply, including the 1,679-mile Rockies Express pipeline to transport natural gas from the Powder River Basin, to higher priced East Coast markets.

The Shale Boom: Replumbing the System

The natural gas supply picture shifted dramatically in the latter half of the 2010s with the new ability of producers to access the nation's abundant shale gas resource. This new abundance rendered obsolete plans to supplement lower-48 gas supply with imported LNG and North Slope natural gas. The first significant shale development occurred within the traditional oil and gas supply region of Texas and Louisiana (e.g., the Barnett and Haynesville Shales). Shale development quickly spread to other areas, including North Dakota (the Bakken Shale) and, most surprisingly, the East (the Marcellus and Utica

[7] Richard G. Smead, *How the Natural Gas Industry Became What It Is Today*, 33 Nat. Gas and Electricity 29,31 (2017).

[8] Even today, New England depends on LNG imports to supplement pipeline gas during the winter peak.

Shales). Furthermore, the shale boom brought not only abundant natural gas, but also crude oil and natural gas liquids.

The abundant and affordable domestic energy made possible by the shale boom has had a profound effect on the US and global energy economy. It also has created the need for new pipeline infrastructure to link producers and consumers. The location and abundance of shale resources has compelled fundamental changes in how the natural gas transmission pipeline network operates. Much of that network had been constructed to transport natural gas from the Gulf Coast and Texas to demand centers in the Northeast. This changed with the prolific Marcellus Shale on the doorstep of those markets. Furthermore, the Marcellus abundance was so great that it could not only meet demand in the East, but also could supply markets outside the region. As a result, pipeline flows have changed significantly. In addition to building the pipeline connections needed to supply consumers in the East, existing pipelines have been modified and new pipelines have been constructed to transport Marcellus gas to markets in other regions.

The shale abundance also triggered a demand response as natural gas became more affordable and as confidence grew that natural gas prices would remain stable. This included price-sensitive industrial consumers, natural gas-fired generators, residential and commercial markets still using fuel oil, and the opportunity to export US natural gas via pipeline to Mexico and in the form of LNG to global markets. The demand response to the shale abundance also created the need for pipeline infrastructure.

The shale revolution has compelled a significant "replumbing" of the US natural gas transmission pipeline network. This has involved both new "greenfield" pipeline infrastructure and repurposed existing infrastructure. For example, many of the pipelines that historically served the Northeast have been made bi-directional so that, depending on the season, natural gas can be delivered either to or from these markets. These modifications typically involve new compressors and some incremental pipeline facilities. The almost new Rockies Express is one of the pipelines that has been made bi-directional.

Legal Framework for Pipeline Regulation

The Natural Gas Act provides FERC with the exclusive authority to authorize the construction and operation of interstate natural gas pipelines that it finds to be in the "public convenience and necessity."[9] The NGA also provides that a pipeline found to be in the public convenience and necessity may exercise a federal right of eminent domain to acquire the land along its right of way.

The federal siting authority conferred by the NGA is unique among the statutes administered by FERC. For example, the Federal Power Act does not authorize FERC to site interstate electric transmission lines nor do the surviving portions of the Interstate Commerce Act authorize FERC to site oil pipelines. The uniqueness of natural gas transportation was acknowledged in the legislative history of the NGA, enacted in 1938. It recognized (1) that pipelines were the only practical means to transport natural gas long distances, (2) that the principal markets for natural gas were long distances and often multiple

[9] 15 U.S.C. § 717f.

states away from the sources of natural gas supply, and (3) that the states lacked the authority to deal with the need for interstate natural gas transportation.[10]

Interstate natural gas pipelines also are subject to the ratemaking sections of the NGA.[11] Under these provisions, the rates, terms and conditions for the interstate transportation of natural gas must be "just and reasonable" and "not unduly discriminatory".

The NGA does not define key terms, such as "public convenience and necessity," "just and reasonable," and "not unduly discriminatory." This has provided FERC the latitude to adapt its regulation to evolving imperatives provided it engages in reasoned decision making and remains within the bounds of its jurisdiction. For example, FERC's authority to act in response to "undue discrimination" was the basis for its sweeping natural gas restructuring orders, even though the statute nowhere mentions open access natural gas transportation. Similarly, the prerequisites for meeting the "public convenience and necessity" standard for obtaining authority to construct and operate an interstate natural gas pipeline have evolved to keep pace with market conditions and public policy priorities.

While FERC has exclusive authority under the NGA to find a proposed interstate natural gas pipeline to be in the public convenience and necessity, a pipeline operator also must comply with a host of other federal and, in some cases, state laws to obtain all permits required to proceed with construction.[12] FERC certificate orders are conditioned on obtaining all such authorizations.

Private Capital

The U.S. natural gas transmission pipeline industry has been funded entirely with private capital.[13] Unlike the electric power industry, there is no analog to the federal power marketing authorities or public power in the natural gas transmission pipeline industry.

In The Political Economy of Pipelines, Jeff Makholm describes the significance of this aspect of the US pipeline industry as follows:

> The most defining characteristic of US oil or gas pipelines is that they all have been financed by investor-owners under the assumption that each pipeline would pay for itself. Having a payment scheme in place from creditworthy parties for a new pipeline is a very big deal. It is the capital market's independent check on the wisdom of the line, its route, and size.[14]

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[10] Robert Christin, Paul Korman & Michael Pincus, *Considering The Public Convenience and Necessity in Pipeline Certificate Cases Under the Natural Gas Act*, 38 Energy L. J.,115, 117-120 (2017) (discussing the legislative history of the Natural Gas Act).

[11] 15 U.S.C. §§ 717c-717d.

[12] Examples of these permits and authorizations include consultation requirements under section 106 of the National Historic Preservation Act and section 7 of the Endangered Species Act, Coastal Zone Management Act consistency determinations, Bureau of Land Management right-of-way grants, and U.S. Fish and Wildlife Service special use permits. In addition, as discussed below, certain federal laws, such as the Clean Water Act and the Clean Air Act, assign permitting responsibilities to the states.

[13] Perhaps the only exception to this blanket statement would be the World War II "inch" pipelines that later were converted to transport natural gas. The federal presence in the pipeline industry was short lived, as these assets were sold to private, investor-owned pipeline companies over seven decades ago.

[14] Jeff D. Makholm, The Political Economy of Pipelines at 22 (2012).

FERC rate regulation under the NGA complements and reinforces the discipline imposed by private capital markets. Investors must accept that an interstate natural gas pipeline will be subject to cost-based rates and non-discriminatory open access conditions. In other words, even if there is great demand for natural gas transportation, a pipeline investor cannot extract economic rents greater than the FERC-approved rates nor can it limit access to the pipeline for its benefit.

Evolution of the FERC Certificate Process

As noted, Congress left FERC with significant discretion to interpret the phrase "public convenience and necessity." This has been recognized by the courts, which has allowed FERC considerable freedom in establishing the circumstances in which it will issue a certificate authorizing pipeline construction.[15]

The criteria for establishing that a proposed natural gas pipeline satisfied the "public convenience and necessity" were first articulated in the context of pipelines as aggregators of natural gas supply to fulfill their bundled merchant obligations. The inquiry focused on the sufficiency of the gas reserves that would support the proposed pipeline. In addition, FERC for many years consolidated competing applications for a single consolidated hearing. Under the *Ashbacker* doctrine, FERC held hearings to determine how much pipeline capacity would be needed in a defined area and then decided which of the competing projects would best be able to fulfill those needs.[16]

The Boundary Gas proceeding illustrates the insufficiency of this prior model. Boundary Gas, Inc. filed an application in 1980 for authority to import natural gas from Canada and resell that gas to distribution companies in the US Northeast. A year later, Tennessee Gas Pipeline Company filed an application to do the same. In addition, Tennessee filed an application to construct pipeline facilities with sufficient capacity to transport both its and Boundary's natural gas. Two other companies then filed applications to serve the same markets. In 1982, FERC consolidated the applications for evaluation in a single hearing. Certificates were finally issued by in 1987 – *seven years* after the need for additional gas was identified.[17]

FERC ultimately stopped setting competing applications for hearing, having concluded that "allowing market forces to determine the success or failure of the projects is the most efficient mechanism to assure the maximum use of facilities."[18] FERC realized that the public convenience and necessity criteria and the comparative hearing procedures designed for bundled merchant pipelines no longer fit the new market dynamic it had created. It recognized that "market forces could be relied on to determine the ultimate need for the facilities so long as the consumer was protected."[19]

This last point highlights an important shift in FERC's regulatory philosophy as it restructured the natural gas market to ensure that consumers benefitted from the wellhead decontrol enacted by Congress. Its regulation of natural gas transportation has evolved into a hybrid model with elements of both

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[15] *FPC v. Transcontinental Gas Pipeline Co.*, 365 US 1, 7 (1961).
[16] *Ashbacker Radio Corp. v. FCC*, 326 U.S. 327 (1945).
[17] *Boundary Gas, Inc.*, 40 FERC ¶ 61,088 (1987). Boundary is not an isolated example. It took more than five years (1985-1990) for FERC to sort through competing applications for new pipelines to serve California. During these proceedings, FERC policy evolved to the position that project sponsors' assumption of risk eliminated the need for comparative hearings.
[18] *Islander East Pipeline Co.*, 100 FERC ¶ 61,275, at P 51 (2002).
[19] *Regulation of Natural Gas Pipelines After Partial Wellhead* Decontrol, 33 FERC ¶ 61,007 (1985).

traditional regulation where appropriate and much lighter-handed regulation where competition is evident. Incumbent customers pay cost-based tariff rates and are shielded from the cost of new facilities from which they do not benefit. Meanwhile, the market drives the development of new and expanded pipeline infrastructure, as pipeline developers compete for shipper commitments and negotiate rates subject to the availability of a cost-based default rate.

The market for existing pipeline capacity also is robust, as parties can freely buy and sell point-to-point transportation capacity rights in a highly transparent secondary market. The pipeline capacity market both facilitates the competitive natural gas commodity market and sends important price signals about the value of pipeline capacity and the need for additional pipeline capacity.[20]

FERC's refocusing of the criteria for determining public convenience and necessity culminated in the 1999 FERC Policy Statement, Certification of New Interstate Natural Gas Pipeline Facilities.[21] The policy statement identifies the specific goals to be achieved by an effective policy and outlines a mechanism for achieving those goals in specific cases. FERC specifically stated that an effective policy "should be designed to foster competitive markets, protect captive customers, and avoid unnecessary environmental and community impacts while serving increasing demands for natural gas. It should also provide appropriate incentives for the optimal level of construction and efficient customer choices."[22]

By requiring that new pipeline projects be independently viable, the policy statement both protects existing customers and establishes a powerful incentive against overbuilding. Incremental pricing (i.e., rates must recover the full cost of the new pipeline) ensures that new projects will not be subsidized by customers who do not benefit. Consequently, the project developer takes the economic risk and must weigh the impact of potential changes in market conditions over the life of pipeline.

The policy statement calls on project developers to eliminate or minimize the adverse effects on other pipelines and their customers and on the economic interests of landowners and communities along the proposed route. Pipeline applicants are expected to shape their proposals to achieve these goals before an application is filed, and FERC may impose additional conditions in the certificate to minimize adverse impacts.

The policy statement states that FERC will accept "any relevant evidence" of public benefits to demonstrate need for the project. Examples of such evidence include "meeting unserved demand, eliminating bottlenecks, access to new supplies, lower costs to consumers, new interconnects that improve the interstate grid, providing competitive alternatives, increasing electric reliability, or advancing clean air objectives." FERC added, however, that precedent agreements (customer contracts) still "constitute significant evidence of demand." In practice, pipeline applicants and FERC continue to rely heavily on precedent agreements as an objective demonstration of need; applicants nonetheless frequently include supplementary evidence along the lines suggested by the policy statement.

Finally, the policy statement provides that FERC will balance the "evidence of public benefits to be achieved against the residual adverse effects." To receive a certificate, an applicant must demonstrate that the public benefits of the project are proportional to any adverse impacts.

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[20] Makholm at 118-119.
[21] *Certification of New Interstate Nat. Gas Pipeline* Facilities, 88 FERC ¶ 61,277 (1999).
[22] 88 FERC ¶ 61,277 at p. 61,743.

FERC Chairman Kevin McIntyre has announced that the commission this year will take a "fresh look" at the 1999 policy statement. Various parties have asserted that subsequent changes in energy markets and energy policy call into question whether the policy statement remains appropriate for reviewing applications for new natural gas pipelines. While there have no doubt been significant changes since 1999, I strongly suspect that the "fresh look" will conclude that the policy statement remains an efficient framework for FERC to determine whether a proposed pipeline is required by the public convenience and necessity. The issues raised by parties in current pipeline certificate proceedings are all capable of being addressed by the policy statement as it now exists.

Pipeline Efficiency

Transporting natural gas via pipeline is an effective and efficient means of delivering energy over long distances. Viewed in equivalent energy terms and equivalent transport distances, natural gas pipelines consume an average of two to three percent of throughput to overcome frictional losses compared to electric transmission lines, which lose six to seven percent of the energy they carry due to electric resistance.[23]

The "efficiency" of interstate natural gas pipelines can be viewed from two principal perspectives: economic efficiency and transportation efficiency. Economic efficiency measures the delivered cost to customers compared to the cost of the natural gas, accounting for both fuel cost and transportation rates. The overall system transportation efficiency is a measure of the fuel and/or electric energy used to transport natural gas and is a function of the overall system design (the hydraulic efficiency), how the system is operated, and the efficiency of individual components (such as the compressor units).[24]

Economic efficiency sometimes limits a pipeline company's ability to improve transportation efficiency. This occurs when the end-use market will not tolerate the price increase necessary to recover the cost of a measure that would improve transportation efficiency.

Pipeline companies strive to be as efficient as possible, yet must balance efficiency with the need to provide reliable and flexible service to customers. For example, pipeline companies often guarantee a sufficiently high delivery pressure so that local distribution company customers do not need to install additional compression behind their city gates. While this may reduce the transportation efficiency of the interstate pipeline, it increases the overall efficiency of the wellhead-to-burnertip value chain. Also, the increasing use of natural gas to generate electricity, both as part of the overall fleet of electric generators and as a back-up to intermittent sources of renewable power, means that pipelines do not operate as efficiently as they could if demand were constant and predictable. This reduced efficiency, however, is more than offset by the overall environmental and public health benefits gained by the increased use of natural gas to power generation. The interstate natural gas pipeline industry provides a flexible transportation service that accommodates wide variations in the demand for delivery of natural gas to a diverse market of end-use consumers, and thereby enhances the efficiency of the entire U.S. energy value chain.

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[23] Energy Information Administration, Frequently Asked Questions (national-level losses were 6.5 percent of total electricity disposition in 2007), available at http://tonto.eia.doe.gov/ask/electricity_faqs.asp#electric_rates2.

[24] The attached INGAA white paper, Interstate Natural Gas Pipeline Efficiency (October 2010), provides background on pipeline and compressor station design and technology and the factors that affect the efficiency of a pipeline system.

It is important to recognize the impact of natural gas wellhead decontrol and pipeline restructuring. Both were about competition and choice, and interstate pipelines are the conduit for physically delivering the benefits of competition and choice to customers. A network of competitive, open access pipelines makes the overall market more efficient, providing natural gas sellers with access to multiple markets and natural gas consumers, with supply options previously unattainable.

The competitive market for natural gas transportation services also influences decisions by natural gas pipeline companies about investing in pipeline system efficiency improvements. Before investing, pipeline companies want assurance that the capital expenditures will reduce the cost to operate the pipeline, increase business for the pipeline company, or are needed to provide safe and reliable service.

Pipeline Safety

Pipelines are the safest mode of energy transportation. The gas transmission pipeline industry's commitment to improving its safety performance continuously is evidenced by the record. Data from the Pipeline and Hazardous Materials Safety Administration indicates an approximately 90 percent decrease in pipeline leaks over the past three decades. Furthermore, advances in inline inspection technology since the early 2000s have revolutionized pipeline safety by enabling more accurate and expansive assessments of pipeline system integrity. Operators have leveraged these technologies to attack challenging pipeline integrity threats. Over the last decade, manufacturing-related incidents have decreased approximately 80 percent and external corrosion-related incidents have decreased approximately 50 percent. Pursuant to a National Transportation Safety Board recommendation, operators and regulators are working now to implement structured, risk-based pipeline safety management systems. Safety management systems are being used to strengthen safety culture, identify innovative strategies for reducing incidents and sustain the continuous improvement.

Lessons Learned

Enhancements to the natural gas pipeline network will continue to be needed

There is no doubt that the U.S. has a robust, well-developed natural gas pipeline network. Nonetheless, sources of natural gas supply and consumption patterns will continue to evolve. Consequently, a flexible and responsive natural gas pipeline network that can adapt to meet the public interest still will be needed.

This evolving situation is illustrated by the recent emergence of the Permian Basin as a significant source of associated gas[25] that is close to markets on the Gulf Coast and in Mexico. Additional pipeline capacity will be needed to bring this gas to market or the nearest liquid trading point. The 2016 report by ICF International referenced earlier found that between 44 and 59 billion cubic feet per day of natural gas transportation capacity would need to be added in the US and Canada by 2035.[26]

[25] Associated gas is natural gas produced in conjunction with petroleum, either dissolved in the oil or as a "gas cap" above the oil in the reservoir.

[26] ICF International, North American Midstream Infrastructure Through 2035: Leaning into the Headwinds (April 12, 2016) at 7.

As noted in this testimony, both the capital markets and FERC's policy statement ensure that pipelines will not be constructed unless there is a demonstrated need. FERC's policies will continue to protect consumers and the resources and interests potentially affected by the pipeline.

Value the Natural Gas Act framework

The Natural Gas Act framework has been remarkably durable and should not be upset. The choice by Congress in 1938, and in early amendments to the NGA, to provide FERC with latitude to interpret statutory terms such as "just and reasonable," "unduly discriminatory" and "public convenience and necessity" has enabled the commission to adapt efficiently to an evolving market and contemporary public policy.

Congress vested FERC with exclusive authority to authorize the construction and operation of an interstate natural gas pipeline found to meet the public convenience and necessity. This exclusive authority is important in two respects. First, FERC exercises its authority in the national interest. While FERC may consider the effect of a proposed pipeline on the parochial interests of an individual state, its decisions ultimately are made to promote the national interest.[27] Second, while multiple federal agencies have mandates to issue impact-specific permits in connection with a proposed pipeline, FERC is the only agency that has been vested with a project-approval mandate.

The temptation to dictate FERC's agenda via prescriptive tweaks to the NGA should be resisted. Statutes drafted with the level of detail seen in some other statutory schemes that are not administered by an independent agency like FERC are destined to be overtaken by events and ultimately will hamstring the regulatory as it attempts to adapt policy and regulation to new conditions. This can be true even with statutory changes intended to "help" the regulator.[28]

Coordinate the Permitting Process

While FERC has overall responsibility for reviewing applications to construct new interstate natural gas pipelines, other federal agencies have impact-specific mandates that are fulfilled by reviewing and permitting discrete activities associated with pipeline construction. In addition, in certain cases, the states have been assigned authority for fulfilling responsibilities under federal law. Experience demonstrates that the implementation of these other mandates can delay and frustrate the timely and predictable approval of pipeline projects.

These multiple statutory mandates need to be reconciled, with further direction from Congress, to give proper effect to each. This is not about preempting or limiting the ability of any agency to perform the

[27] For example, during the early development of the natural gas pipeline network, FERC's predecessor routinely acted to authorize proposed interstate pipelines notwithstanding the objections of states that sought to husband natural gas for their own benefit. See Tussing and Tippee at 96 (Texas and Louisiana objections to the proposed Tennessee Gas Transmission Co. pipeline). *See also* Tussing and Tippee at 102 (eastern consuming states objection to proposals to expand the Tennessee Gas Transmission Co. and Texas Eastern Corp. systems into New England).

[28] For example, in the Energy Policy Act of 2005, Congress enacted a new NGA section 4(f) intended to assist FERC in encouraging the development of underground natural gas storage in markets lacking such facilities. Because section 4(f) imposed so many conditions on FERC's ability to authorize such facilities, next to no applicants have taken advantage of this provision. In hindsight, Congress would have been better to leave FERC to work through the problem using the latitude provided by the existing statute.

role given to it by the Congress. Rather, it is about establishing governing principles to ensure that no federal agency prevents another from fulfilling its statutory mandate.

Congress attempted to address this situation by enacting the new NGA section 15 (a)-(d) on process coordination and section 19(d) on judicial review as part of the Energy Policy Act of 2005. This legislation was intended to strengthen FERC's role as the lead permitting agency for interstate natural gas pipelines. Unfortunately, these provisions have not been entirely successful in accomplishing their intended purpose. Legislation now pending before Congress, the House-passed H.R. 2910 and the Senate-introduced S. 1844, proposes incremental improvements to advance the goals of the EPAct 2005 amendments. We encourage enactment of these provisions as part of an infrastructure bill or via another suitable legislative vehicle.

These goals also are being advanced through executive branch reform initiatives. For example, implementation of Executive Order 13807, Establishing Discipline and Accountability in the Environmental Review and Permitting Process for Infrastructure, has the potential to achieve the harmonization in the permitting process that we believe is needed.

Restoring Cooperative Federalism

As noted, federal law assigns certain permitting responsibilities to the states. For many years, this worked smoothly as states reviewed applications for permits required by federal law and imposed reasonable conditions to protect their resources. Now, however, states are using this authority to dictate national energy policy. Specifically, the State of New York is doing so in connection with its authority to grant a certification pursuant to section 401 of the Clean Water Act that a discharge into navigable waters will comply with applicable water quality standards. New York is attempting to use this authority effectively to veto the determination by FERC that a project is in the public convenience and necessity.

We respect the rights of states in protecting the resources within their borders and support the "cooperative federalism" framework upon which many of these environmental statutes are built. This, however, is more than just a discussion about the respective roles of federal and state authority, because one state's abuse of its role in this relationship can affect the ability of other states and their citizens to enjoy the benefits of interstate commerce. For example, the State of New York's actions to thwart the construction of an interstate pipeline that FERC has found to be in the public convenience and necessity frustrates the ability of neighboring states to enjoy the benefits associated with that pipeline. The Commonwealth of Pennsylvania and its citizens are denied the benefits of a downstream market for their natural gas production and the downstream New England states and their consumers are denied the benefits of the lower energy costs made possible by additional natural gas supplies. That is not cooperative federalism.

We do not believe that this result is what was intended by Congress when it enacted this statute. While we believe that steps can be taken administratively to circumscribe a state's ability to overstep the bounds of its authority under section 401, support and relief from Congress is needed to achieve clarity. We encourage Congress to provide oversight to ensure that section 401 is implemented as intended and to remedy the situation by providing guidance as to the appropriate role of a state under section 401 and by providing meaningful recourse should a state abuse its authority.

Conclusion

The United States has a natural gas transmission pipeline network unlike any other in the world.[29] The combination of the robust physical infrastructure and the "open architecture" model for gas transportation provide the foundation for the most competitive natural gas market in the world.[30] The ability to expand and modify this network quickly and efficiently in response to evolving market imperatives has enabled the United States to benefit rapidly from the shale abundance. These benefits include lower energy prices for consumers and industry, cleaner air through the displacement of less benign fuels, and greater energy security. This would be impossible without the pipelines that link the suppliers and consumers of natural gas.

[29] Central Intelligence Agency, *World Factbook Field Listing: Pipelines*; available at https://www.cia.gov/library/publications/the-world-factbook/fields/2117.html.

[30] The U.S. is the only competitive natural gas commodity market in the world to exhibit competitive spot and futures trading. Makholm at 118.