



September 2020

GAS TRANSMISSION PIPELINES

Interstate
Transportation of
Natural Gas Is
Generally Reliable, but
FERC Should Better
Identify and Assess
Emerging Risks

GAO Highlights

Highlights of [GAO-20-658](#), a report to congressional requesters

Why GAO Did This Study

The interstate transmission pipeline system transports natural gas from production areas to large-volume customers, such as gas distribution companies, which provide natural gas to millions of residential and commercial consumers. Interruptions in the service provided by transmission pipelines can have serious effects, such as when about 7,000 homes and businesses in Rhode Island went without heat for a week in January 2019.

GAO was asked to review federal oversight of service interruptions involving interstate natural gas transmission pipelines. This report examines: (1) service interruptions on these pipelines and (2) emerging risks and the extent to which FERC identifies and assesses these risks.

GAO analyzed data and interviewed officials from relevant federal agencies; interviewed states' public utility commissions, interstate transmission pipeline operators, natural gas and electric industry associations, and standards-setting associations and surveyed a random sample of gas distribution companies.

What GAO Recommends

GAO recommends that FERC: (1) use available information, such as reports by transmission pipeline operators on service interruptions, to identify and assess risks to the reliability of this service and (2) develop an approach to respond, as appropriate, to any identified risks. FERC agreed to establish a process to incorporate such information into its ongoing efforts to monitor and address reliability of interstate transmission pipeline service.

View [GAO-20-658](#). For more information, contact Elizabeth Repko at (202) 512-2834 or repkoe@gao.gov

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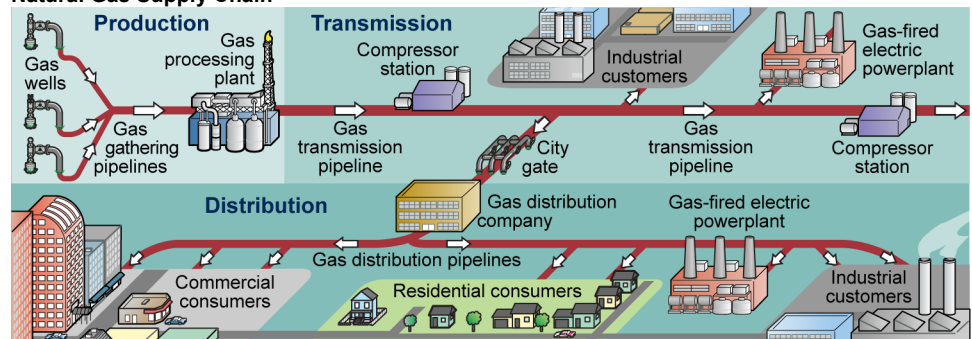
GAS TRANSMISSION PIPELINES

Interstate Transportation of Natural Gas Is Generally Reliable, but FERC Should Better Identify and Assess Emerging Risks

What GAO Found

Available information indicates that the transportation of natural gas by interstate transmission pipelines has been generally reliable. Using reports submitted to the Federal Energy Regulatory Commission (FERC), which oversees the reliability of service provided by interstate transmission pipelines, GAO found that interruptions in natural gas service without advance notice to customers occurred an average of 28 times a year from 2015 to 2019. In contrast, in a single year (2018), every electric power consumer in the United States, on average, went without power for 5.8 hours. However, gas interruptions usually did not result in a complete loss of service to affected consumers. Representatives of natural gas industry sectors—including gas distribution companies, which typically rely on interstate transmission pipelines for access to natural gas—agreed that the transportation of natural gas via pipelines is generally reliable.

Selected Elements in the Production, Transmission, and Distribution Sectors of the U.S. Natural Gas Supply Chain



Source: GAO analysis of Energy Information Administration and Natural Gas Council documents. | GAO-20-658

Industry representatives and state officials told GAO that risks to the reliability of natural gas service on interstate transmission pipelines could increase in the future due to more intensive use, driven by greater domestic gas production and use by electric power plants. However, because natural gas service has consistently been reliable, FERC does not routinely use all available information—including reports provided by natural gas transmission pipeline operators on the frequency and effects of service interruptions—to identify, assess, and respond to risks. Maintaining the reliable transportation of natural gas, which is integral to ensuring reliable energy service, involves understanding and being prepared to respond to risks as they emerge. By not routinely using all available information to identify and assess potential risks to the reliability of service on interstate transmission pipelines, FERC is not well positioned to respond, if necessary, to changes in the natural gas industry in order to ensure consumers continue to have reliable service.

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Abbreviations

DOE	Department of Energy
DOT	Department of Transportation
EIA	Energy Information Administration
FERC	Federal Energy Regulatory Commission
PHMSA	Pipeline and Hazardous Materials Safety Administration

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September 23, 2020

The Honorable Jack Reed
Ranking Member
Subcommittee on Transportation, Housing and Urban Development,
and Related Agencies
Committee on Appropriations
United States Senate

The Honorable Sheldon Whitehouse
United States Senate

A nationwide network of over 2.5 million miles of pipeline transports natural gas through a supply chain extending from production areas to residential, commercial, and other customers.¹ When natural gas service is interrupted, the effects on gas consumers can be severe. For example, in January 2019, over 7,000 homes and businesses in Rhode Island went without heat for days during a period of extremely cold weather due, in part, to operational issues with the transmission pipeline supplying that area.²

The production, transmission, and distribution of natural gas are carried out by different entities, each of which may answer to different regulators. For example, gas distribution companies—which operate over 2.2 million miles of low-pressure, intrastate pipelines that distribute gas to local communities—are generally subject to state regulation. Interstate transmission pipeline operators use nearly 195,000 miles of large, high-pressure pipelines to transport natural gas from production areas to customers like gas distribution companies and are regulated by federal agencies. The Federal Energy Regulatory Commission’s (FERC) stated mission is, in part, to assist consumers in obtaining reliable energy services—including natural gas service via interstate transmission

¹Pipeline and Hazardous Materials Safety Administration (PHMSA), *Gas Pipeline System Miles by System Type—2019*, accessed June 22, 2020. Total includes gas distribution, gas gathering, and gas transmission miles reported to PHMSA.

²Other factors that contributed to this outage include high demand for natural gas by gas distribution companies and other customers using the interstate transmission pipeline that serves this region, as well as equipment failures on the infrastructure operated by the gas distribution company serving Rhode Island. PHMSA, *Events Contributing to Natural Gas Outages on National Grid’s Distribution System in Newport, Rhode Island* (Aug. 13, 2019).

pipelines—at a reasonable cost through appropriate regulatory and market means.

We were asked to review federal oversight of natural gas service interruptions that involve interstate transmission pipelines. This report examines:

- service interruptions to the customers of natural gas transmission pipelines between 2015 and 2019, and
- emerging risks of pipeline service interruptions, if any, and the extent to which FERC identifies and assesses those risks.

To address these objectives, we reviewed laws and regulations related to the federal government’s role in overseeing interstate natural gas transmission pipelines, specifically the Natural Gas Act and Pipeline Safety Laws, as amended. We also reviewed industry documents on the structure and operation of the natural gas supply chain. We interviewed officials with relevant federal agencies, including the Department of Energy (DOE), Energy Information Administration (EIA), FERC, and the Pipeline and Hazardous Materials Safety Administration (PHMSA) to determine each agency’s authority and efforts related to overseeing the reliability of interstate transmission pipelines. We also interviewed academic researchers studying the interconnection of the natural gas and electric industries, representatives of natural gas and electric industry associations, regional transmission organizations that manage wholesale electricity markets, and organizations that set standards for electric power generators and interstate natural gas transmission operators.

To determine what is known about service interruptions on interstate transmission pipelines from 2015 to 2019 and emerging risks, we examined federal, state, and industry sources for relevant information. Specifically:

- Through interviews with officials at DOE, EIA, FERC, and PHMSA, we identified 11 federal data sources that could include information on service interruptions to customers of interstate transmission

pipelines.³ We reviewed data from these sources and determined that the reports of “serious interruptions of service,” which interstate transmission operators are required to submit to FERC under FERC’s regulations, contain data that, when aggregated and analyzed, would provide information on the frequency, scope, and causes of service interruptions.⁴ We analyzed the serious interruptions of service reports submitted to FERC from January 2015 to December 2019.⁵

- To understand states’ roles in overseeing reliability of natural gas transportation and distribution and to learn more about the frequency, scope, and causes of service interruptions on interstate transmission pipelines that have affected gas distribution companies, we conducted semi-structured interviews with officials from 42 states’ public utility commissions.⁶ We reached out to 49 public utility commissions in the lower 48 states and the District of Columbia; 42 responded and agreed to be interviewed.⁷ These interviews are not generalizable to all states.

³As part of our review of federal data sources, we looked at (1) data collected by PHMSA from Annual Reports on Natural and Other Gas Transmission and Gathering Pipeline Systems, Incident Reports-Gas Transmission and Gathering Systems, Annual Reports: Gas Distribution System, and Incident Reports-Gas Distribution Systems; (2) data collected by EIA from Annual Reports of Natural and Supplemental Gas Supply and Disposition (Form EIA-176); and (3) data provided to FERC by natural gas pipeline companies on serious interruptions of service and damage to facilities (Form 576); Annual Report of Natural Gas Transactions (Form 552); Annual Report of System Flow Diagrams and Capacity (Form 567); Annual Report of Major Natural Gas Companies (Form 2); Supplemental Form 3-Q: Quarterly Financial Report; Index of Customers (Form 549B); and Capacity Reports. We assessed the relevance of these data sources by reviewing the data collection instrument or requirements and reviewing a selection of available data.

⁴See 18 C.F.R. § 260.9(a)(1)(ii),(b)(1).

⁵At our request, FERC officials provided serious interruptions of service reports that natural gas pipeline companies submitted to them between January 2015 and December 2019. Through interviews with FERC officials and review of the data, we determined that these data were reliable for the purposes of providing a minimum estimate of the frequency and scope of service interruptions to the customers of interstate transmission pipeline operators.

⁶State public utility commissions generally are the state agencies that regulate the rates and services of intrastate pipelines and gas distribution companies within their respective state. 15 U.S.C. § 717(c); 18 C.F.R. § 284.1(b).

⁷We reached out to staff at state public utility commissions using contact information on the National Association of Regulatory Utility Commissioners website. We were not able to make contact with or not able to schedule interviews with public utility commissions in seven states: Georgia, Idaho, Iowa, Minnesota, North Carolina, Oklahoma, and Oregon.

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- To obtain industry perspectives, we conducted semi-structured interviews with representatives of 15 interstate natural gas transmission pipeline operators to determine the extent to which they have had to interrupt service to their customers and how they handle or would handle interruptions. We selected interstate transmission operators that operate at least 250 miles of interstate natural gas transmission pipeline.⁸ These interviews are not generalizable, but altogether, the operators we spoke with manage over 180,000 miles of interstate natural gas transmission pipelines (nearly 94 percent of the total interstate natural gas transmission miles in the United States). In addition, from December 2019 to March 2020, we surveyed a stratified random sample of 152 gas distribution companies selected from a population of over 1,300 based on their ownership type and number of customers.⁹ The survey asked about gas distribution companies' natural gas resources, strategies for mitigating the effects of interruptions, and experience of interruptions over the last 5 years. We received responses from 61 gas distribution companies, for a response rate of 40 percent.¹⁰ The results of this survey are not generalizable to all gas distribution companies operating in the United States.

To analyze the extent to which FERC identifies and assesses the risk of pipeline service interruptions, we interviewed officials to understand how the agency uses data on serious interruptions of service reports and data

⁸Using data from PHMSA's *Annual Report for Calendar Year 2018 Natural and Other Gas Transmission and Gathering Pipeline Systems*, we identified interstate natural gas transmission pipelines with 250 or more miles of pipeline. Then, we identified the operators of these pipelines using their corporate websites. We reached out to 20 of these operators and 15 agreed to our request for interview through a phone call or by providing written responses.

⁹To create a random sample of gas distribution companies operating in the United States, we created a stratified sample of companies based on the number of services (an approximation of the number of consumers served) and ownership type. Using data from PHMSA's *Annual Report for Calendar Year 2018 Gas Distribution System*, we identified 1,373 gas distribution companies with at least one service distributing natural gas. We randomly selected companies and put them into five strata: 750,000 or more services; investor or privately owned with between 10,000 and 749,999 services; municipally owned or cooperatives with between 10,000 and 749,999 services; investor or privately owned with less than 10,000 services; and municipally owned or cooperatives with less than 10,000 services. We developed the survey questions through background research and preliminary interviews with three gas distribution companies. We pre-tested our survey with seven gas distribution companies and refined the questions to ensure clarity, validity, and reliability.

¹⁰See appendix I for the survey instrument and corresponding results.

from other sources, as well as actions the agency takes to act upon the information obtained from these data sources. We compared how FERC uses these data to identify and assess the risk of pipeline service interruptions to our enterprise risk management framework, which outlines how federal agencies should manage risks in complex systems.¹¹

We conducted this performance audit from July 2019 to September 2020 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

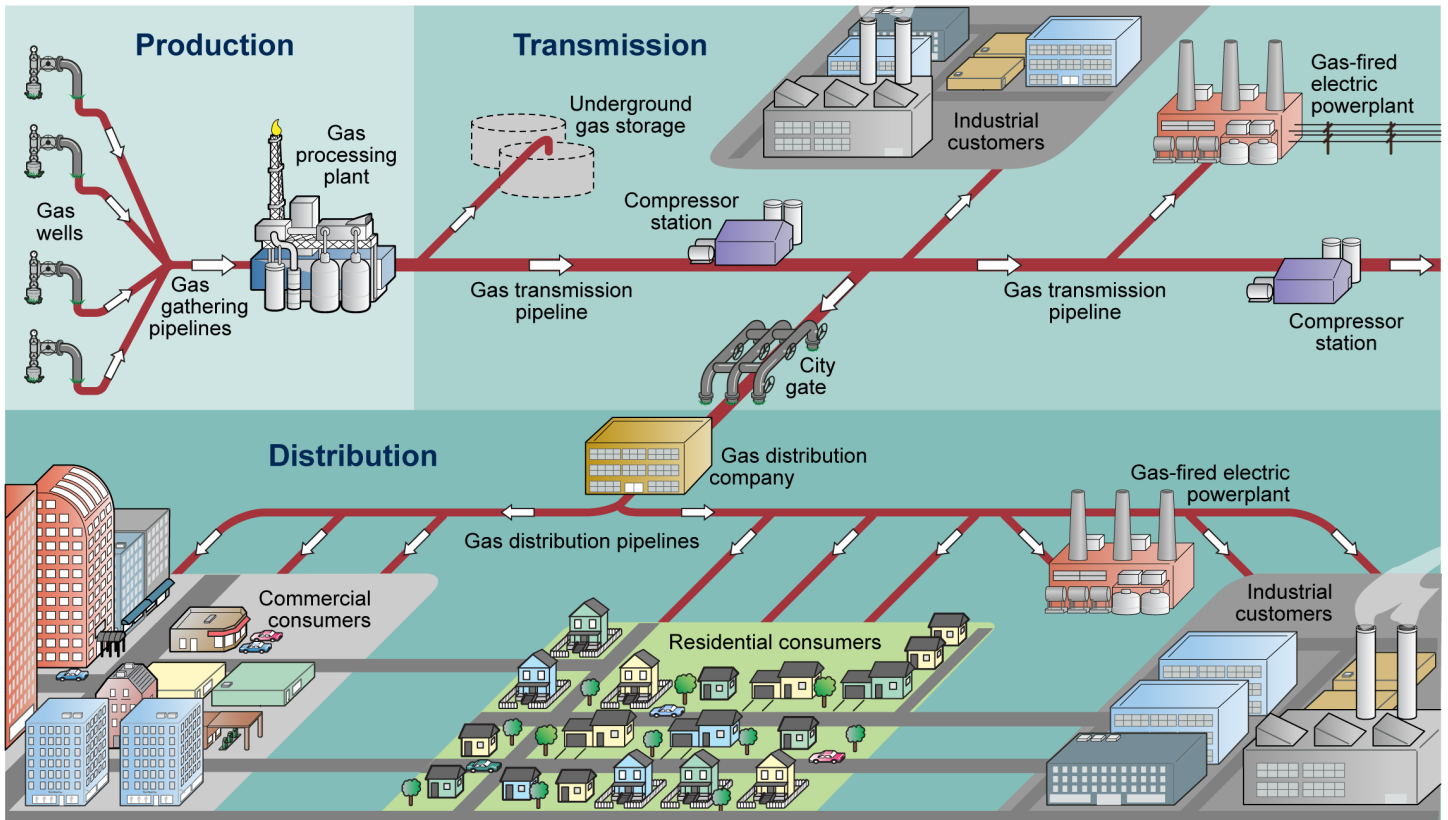
Natural Gas Supply Chain

The natural gas supply chain is composed of three major sectors: production, transmission, and distribution, as shown in figure 1. In 2019, 40 percent of the natural gas delivered by transmission and distribution pipelines went to electric power plants, 30 percent to industrial plants, and 30 percent to residential and commercial consumers.¹²

¹¹GAO. *Enterprise Risk Management: Selected Agencies' Experiences Illustrate Good Practices in Managing Risk*, [GAO-17-63](#) (Washington, D.C.: Dec. 1, 2016).

¹²EIA, "Natural Gas Consumption by End Use," *Natural Gas Monthly* (June 30, 2020), accessed on July 23, 2020.

Figure 1: Selected Elements in the Production, Transmission, and Distribution Sectors of the U.S. Natural Gas Supply Chain



Source: GAO analysis of Energy Information Administration and Natural Gas Council documents. | GAO-20-658

- Production.** Producers extract natural gas from the ground, move it to processing plants using gathering pipelines, and sell the gas to large-volume customers, such as gas distribution companies, electric power plants, and industrial plants.¹³ Producers also sell gas to

¹³About 17,500 miles of gas gathering pipelines are regulated by PHMSA based on annual report data from 2019; however, PHMSA estimates that only around 5 percent of gas gathering pipelines are subject to its pipeline safety regulations. Gathering pipelines tend to have a smaller diameter than transmission pipelines, and their operating pressure can range from low to high pressure.

marketers, which bundle natural gas from multiple producers and sell it to large-volume customers or transport it to facilities for export.¹⁴

- **Transmission.** Transmission pipelines—large-diameter and high-pressure—transport natural gas from production areas to large-volume customers and to storage areas for later use.¹⁵ Almost 195,000 miles of transmission pipelines are interstate and are therefore subject to federal regulation.¹⁶ Transmission pipeline operators do not buy or sell the gas they transport; rather, they sell the space or “capacity” on their pipelines through transportation contracts with producers, marketers, and large-volume customers.¹⁷
- **Distribution.** Gas distribution companies (also known as local distribution companies or gas utilities) operate more than 2.2 million miles of low-pressure pipelines that distribute natural gas to residential and commercial consumers in the states, cities, or communities they serve. In some cases, electric power plants and industrial plants may receive natural gas from a gas distribution company’s system, instead of a transmission pipeline. Distribution pipelines are subject to federal, state, and applicable local regulation.

Natural Gas Service

As defined by regulation, there are two main types of service contracts available to customers seeking to receive deliveries of natural gas through interstate transmission pipelines:

- **Firm.** Customers with “firm” contracts are entitled to receive up to a certain daily volume of gas for a specified period of time.¹⁸ Under FERC’s regulations, if a transmission pipeline needs to interrupt (reduce or eliminate) service to its customers, deliveries of gas to firm

¹⁴Marketers also sell natural gas to residential and commercial customers by means of customer choice programs that allow customers to purchase gas from entities other than their traditional gas distribution company.

¹⁵Transmission pipelines move gas by creating pressure within the pipelines using a series of compressor stations, usually every 50 to 100 miles.

¹⁶See Natural Gas Act of 1938 (NGA) §§ 1(b), 2(6)-(7), 15 U.S.C. §§ 717(b), 717a(6)-(7). In this report, we use the term “transmission pipelines” to refer to interstate transmission pipelines, unless otherwise noted. There are a little over 100,000 miles of intrastate natural gas transmission pipelines in the United States.

¹⁷Some large-volume customers purchase transportation service from marketers, which then ensure gas is delivered using the pipeline capacity for which they have contracted.

¹⁸See 18 C.F.R. § 2.78(c)(4).

customers are in a higher priority of service category and generally will not be subject to interruption until all lower priority of service customers have had their service eliminated.¹⁹ Firm service customers pay a fixed monthly fee to reserve space on the transmission pipeline and must pay this reservation charge whether or not they use the reserved space to receive gas they have scheduled for delivery on any given day.²⁰ Firm customers also must pay the rates charged by the pipeline operator for its transportation services.²¹ According to an industry report, gas distribution companies generally contract for the firm service transportation of natural gas to ensure they can serve their core customers, such as residential and commercial consumers, to comply with state requirements.²²

- **Interruptible.** Under FERC’s regulations, deliveries of gas to customers with “interruptible” contracts are in a lower priority of service category than firm customers.²³ Specifically, a customer with an interruptible contract is not entitled to receive a specific volume of gas within a given time period.²⁴ Firm customers have scheduling priority over interruptible customers, so that interruptible customers’ scheduled amounts of gas for delivery may be reduced if firm customers request to schedule gas deliveries before a certain time of day.²⁵ If a transmission pipeline operator cannot meet all of its scheduled delivery obligations, for example, due to a limited gas supply, interruptible service must be eliminated before firm service may be interrupted.²⁶ Rates for interruptible service are lower than for firm service, and interstate transmission pipeline operators are barred from charging reservation fees for this type of service.²⁷

¹⁹18 C.F.R. § 2.78(a).

²⁰See 18 C.F.R. § 284.7(e).

²¹18 C.F.R. § 284.10(c).

²²Natural Gas Council, *Natural Gas Systems: Reliable & Resilient* (2017).

²³18 C.F.R. §§ 2.78(a), 284.9(a)(3).

²⁴18 C.F.R. § 2.78(c)(5).

²⁵18 C.F.R. § 284.12(b)(1)(i).

²⁶18 C.F.R. § 2.78(a)(3).

²⁷18 C.F.R. § 284.9(c).

As mentioned in industry sources, one measure of the reliability of the transportation of natural gas is the percentage of gas reaching customers with firm service contracts without interruption.²⁸ Interruptions to natural gas transportation service fall into two categories:

- **Planned interruptions.** Expected reductions or interruptions in the transportation of natural gas to customers. These interruptions may result from planned maintenance or construction.
- **Unplanned interruptions.** Unexpected reductions or interruptions in the transportation of natural gas to customers. These interruptions can occur for a variety of reasons, including compressor station failures and weather-related damage.

When an outage occurs, for any reason, gas distribution companies must take several steps to ensure the safety of gas consumers and restore service.

- **Shut off gas service.** Gas distribution company personnel must go to each affected establishment (such as homes and businesses) and shut off gas service.
- **Restore gas to the distribution pipelines.** Once service is restored to the gas distribution company, the company repressurizes its system.
- **Restore service to consumers.** Gas distribution personnel must access the premises of each affected consumer, test each gas appliance to ensure it can operate safely, turn gas service back on, and make sure all gas appliances are working correctly.

Federal and State Oversight

FERC's stated mission is to assist consumers in obtaining economically efficient, safe, reliable, and secure energy services at a reasonable cost through appropriate regulatory and market means, and collaborative

²⁸A measure cited by industry reports is from an April 2017 survey of 51 interstate pipelines conducted by the Interstate Natural Gas Association of America, which found that over a 10-year period (2006 to 2016) pipelines delivered 99.79 percent of their firm delivery contractual commitments. See Natural Gas Council, *Natural Gas Systems: Reliable & Resilient* (2017). Customers with interruptible contracts are a lower priority for delivery during periods of curtailment and service interruptions are anticipated and permitted by contract. Thus, interruptions to these customers are not included when determining transmission pipeline reliability.

efforts.²⁹ To carry out this mission, FERC has issued regulations to ensure interstate pipelines provide open-access, non-discriminatory transportation service to all customers interested in contracting for service.³⁰ As such, FERC reviews the rates that interstate transmission pipeline operators charge their customers and the general terms and conditions under which they provide service.³¹ In addition, FERC reviews and approves interstate pipelines' applications to build new or expanded infrastructure and enforces anti-market manipulation laws and regulations.³²

FERC regulations also require interstate transmission operators to submit reports of "serious interruptions of service."³³ Under this reporting requirement, operators must file a report when the interruption of service to a firm customer is unplanned and lasts 3 or more hours. These interruptions specifically include, but are not limited to, service interruptions to communities, major government installations, and large industrial plants outside communities, or any other interruption deemed significant by the operator. However, even in those specific instances, operators are not required to submit a report if the service interruption is in accordance with an interruptible service contract, results from planned maintenance or construction, or lasts less than 3 hours. These reports are required to be submitted as soon as possible and must include information, such as the location and cause of an interruption, the customers affected by the interruption in service, and emergency actions taken to maintain service.³⁴

²⁹FERC is an independent regulatory commission established as part of DOE by the Department of Energy Organization Act of 1977. FERC carries out one of Congress's original, stated purposes for establishing DOE: "to promote the interests of consumers through the provision of an adequate and reliable supply of energy at the lowest reasonable cost." 42 U.S.C. § 7112(9).

³⁰18 C.F.R. §§ 284.7(b), 284.9(b).

³¹NGA § 4, 15 U.S.C. § 717c; 18 C.F.R. §§ 154.1, 154.3, 154.109.

³²NGA § 7(c), 15 U.S.C. § 717f(c) (applications for construction); 15 U.S.C. §§ 717c-1, 717m, 717t, 717t-1 (anti-market manipulation laws); 18 C.F.R. § 1c.1 (anti-market manipulation regulations).

³³18 C.F.R. § 260.9(a)(1)(ii).

³⁴18 C.F.R. § 260.9(b)(1).

While FERC regulates the market in which interstate natural gas is transported, several other federal agencies—DOE, EIA, and PHMSA—conduct activities that help contribute to the reliability of interstate natural gas transportation, such as coordinating emergency response, providing critical information on pipeline operations, and ensuring that pipeline operators meet minimum safety standards for pipeline design, construction, and operation.

- **DOE.** DOE’s stated mission is to ensure the country’s security and prosperity by addressing its energy, environmental, and nuclear challenges through transformative science and technology solutions. DOE oversees multiple efforts related to the security and emergency preparedness of the country’s energy infrastructure.³⁵
- **EIA.** EIA is an independent agency within DOE. EIA’s stated mission is to collect, analyze, and disseminate independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding of energy and its interaction with the economy and environment.
- **PHMSA.** PHMSA is an agency within the Department of Transportation (DOT). PHMSA’s stated mission is to protect people and the environment by advancing the safe transportation of energy and other hazardous materials. PHMSA sets and enforces safety standards for interstate gas pipelines and pipeline facilities.³⁶ Its regulatory programs are focused on ensuring safety in the design, construction, operation, and maintenance of pipelines. For example, under PHMSA’s pipeline integrity management programs, pipeline operators take primary responsibility for the integrity of their pipelines, including systematically identifying threats and mitigating risks to pipelines in certain areas. PHMSA conducts inspections to ensure operator compliance with federal regulations. Federal law also gives PHMSA the authority to set safety standards for intrastate pipelines; state pipeline safety offices may assume regulatory, inspection, and enforcement responsibilities for intrastate pipelines after certifying to

³⁵According to DOE, the Office of Cybersecurity, Energy Security, and Emergency Response facilitates coordination across the government and with the energy sector when an incident occurs to enhance response and recovery. The Office of Electricity is developing a model—the North American Energy Resilience Model—that will simulate the effect of certain events, including natural gas service interruptions, on the electric power system.

³⁶49 U.S.C. § 60102(a).

PHMSA that they have adopted and are enforcing applicable federal standards.³⁷

In addition, states, through public utility commissions or other state agencies, typically oversee and enforce safety requirements for all operators of intrastate natural gas pipelines, including gas distribution companies. State public utility commissions also may set reliability requirements for gas distribution companies within their jurisdiction, such as requiring these companies to ensure they can serve their customers on the coldest days of the year.

Available Information Indicates Transportation of Natural Gas by Interstate Transmission Pipelines Has Been Generally Reliable

Reports of serious interruptions of service that interstate transmission pipeline operators submitted to FERC from 2015 to 2019 show that unplanned service interruptions were generally infrequent and limited in scope. These interruptions did not usually result in outages to residential and commercial consumers that received gas through gas distribution companies. Representatives of natural gas industry sectors—including gas distribution companies, which typically rely on interstate transmission pipelines for access to natural gas—agreed that the transportation of natural gas via pipelines is generally reliable.

Frequency of Unplanned Interruptions

Based on our analysis of serious interruptions of service reports submitted to FERC from 2015 to 2019, interstate transmission pipeline operators interrupted service to customers with firm contracts 140 times.³⁸ The number of reported interruptions each year ranged from 15 to 35, with an average of 28 per year. The geographical distribution of reported interruptions varied, with 29 percent of reported interruptions occurring in Kansas and Texas.

³⁷49 U.S.C. §§ 60102(a), 60105. States with current certifications may adopt additional or more stringent safety standards as long as they are compatible with federal standards. *Id.* § 60104(c).

³⁸The January 2019 service interruption in Aquidneck, Rhode Island is not included in these reports. According to FERC officials, they learned about that incident from news reports and contacted the pipeline operator to learn more, so did not deem it necessary for the operator to file a report.

Causes of Unplanned Service Interruptions

Serious interruptions of service to customers of interstate natural gas transmission pipelines reported to FERC from 2015 to 2019 were generally attributed to one of five causes (due to rounding the percentages do not add to 100 percent):

- **Physical failure** (64 percent). Pipelines and other transmission system components may fail due to mechanical or physical problems, such as compressor station failures or pipeline corrosion.
- **Third-party damage to pipeline infrastructure** (11 percent). Natural gas pipeline infrastructure is vulnerable to third-party damage, such as being struck by vehicles or construction equipment.
- **Operator error** (5 percent). Pipeline personnel may fail to follow correct procedures, such as re-opening a valve after maintenance work.
- **Other causes** (14 percent). Other causes, such as weather-related events and supply issues, can also result in a service interruption.
- **Unknown/Not specified** (7 percent). Some reports either did not specify the cause of an interruption or stated the cause was unknown at the time of reporting.

Source: GAO Analysis of Federal Energy Regulatory Commission (FERC) Serious Interruptions of Service Reports from 2015 to 2019. | GAO-20-658

According to FERC officials, the annual number of reported service interruptions should be treated as a minimum. For example, estimates based on these reports do not include interruptions lasting less than 3 hours or interruptions on pipelines that lie outside of FERC’s jurisdiction, such as intrastate gas transmission pipelines. FERC officials also told us that while they have the authority to penalize operators that do not submit a report, they have not done so. According to FERC officials, they would not impose penalties on operators, as they consider these reports as being submitted only for informational purposes. If operators do not submit an interruption report, FERC officials can request information about the event. They can also require operators to submit clarifications or additional details on reports that have been made.³⁹

Representatives of natural gas industry trade associations representing different sectors of the industry, including producers, transmission pipeline operators, and gas distribution companies told us the transportation of natural gas on interstate transmission pipelines is reliable and that interruptions in firm service to the customers of these pipelines are rare. Most of the 15 interstate transmission operators we spoke with said that between 2015 and 2019, they had not interrupted service to their customers with firm transportation contracts on an unplanned basis, or they described such interruptions as “rare” or “infrequent.” Similarly, representatives of an electric industry trade association, electric regional transmission organizations, an electric standard-setting organization, and state public utility commissions told us they view the transportation of natural gas by transmission pipelines as a reliable method of moving natural gas to large-volume customers, especially those with firm service contracts.

Transmission pipeline operators told us that when service is interrupted to customers, they use a combination of notifications through their electronic

³⁹18 C.F.R. § 260.9(c).

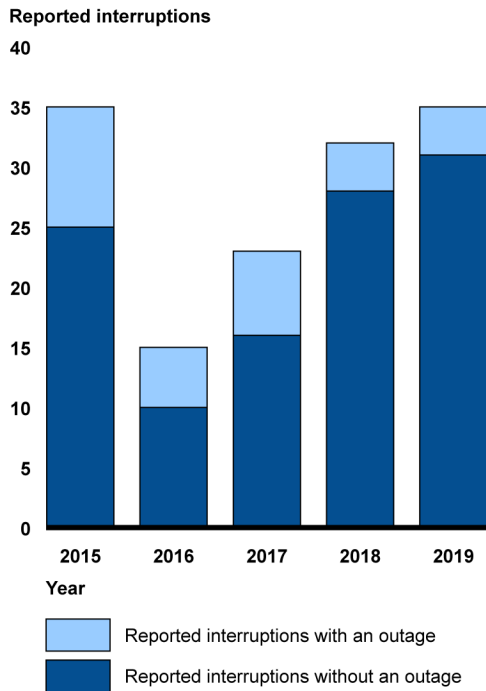
bulletin boards and communications through meetings, phone calls, and emails to ensure their customers are prepared.⁴⁰

Scope of Unplanned Interruptions

Based on reports to FERC from 2015 to 2019, service interruptions to the customers of interstate transmission pipelines did not usually result in outages to large-volume customers that use natural gas, such as electric power plants and industrial plants or in the case of gas distribution companies, to the residential and commercial consumers they serve (see fig. 2).

⁴⁰An electronic bulletin board is an online communication system maintained by a transmission pipeline operator. Transmission operators post a variety of information to their electronic bulletin boards, including routine operating information such as available capacity and lists of customers, and notices related to abnormal operating conditions such as pipeline damage and maintenance. The North American Energy Standards Board sets requirements for the kinds of information transmission pipeline operators must share on their electronic bulletin boards. These standards are incorporated by reference into FERC regulations. 18 C.F.R. § 284.12.

Figure 2: Number of Serious Interruptions of Service and Outages Reported by Interstate Natural Gas Transmission Pipeline Operators to the Federal Energy Regulatory Commission (FERC), by Year



Source: GAO Analysis of FERC Serious Interruptions of Service Reports from 2015 to 2019. | GAO-20-658

Twenty-one percent of serious interruptions of service reports to FERC during this period (30 reports) indicated that the interruption caused an outage. However, because FERC’s reporting regulation does not expressly require transmission pipeline operators to disclose whether an outage to natural gas consumers (i.e., residential and commercial consumers) occurred, it is possible that additional outages were not reported.⁴¹ According to representatives of transmission pipeline operators and gas distribution companies, the effect of interruptions on operations depends on several factors, including the amount of the reduction in available gas, demand for gas by residential and commercial consumers, and the availability of alternative sources of gas supply.

In contrast to the 2019 gas outage in Rhode Island, which affected over 7,000 consumers for 7 days, most outages due to service interruptions

⁴¹Therefore, we treat the number of outages identified in serious interruptions of service reports as a minimum.

that were reported to FERC affected a smaller number of consumers for 1 day or less. According to reports, the total number of consumers affected from 2015 to 2019 ranged from 3 to 5,400. Overall, only three reports mentioned that natural gas outages to consumers affected more than 1,000 consumers; most (20 of 30 reports) affected 500 or fewer consumers. Because FERC's regulation does not require transmission pipeline operators to report whether an outage occurred at all, it accordingly does not require them to report the duration of any outage. However, when operators included this information in reports to FERC, none lasted longer than 24 hours.

Compared to electric power outages, the frequency and scope of outages to natural gas consumers appears relatively limited. According to an EIA analysis based on data from 2018, power outages for electricity customers averaged 5.8 hours per customer during the year.⁴² In the case of major weather events, the scope of electric power outages can be extensive, affecting millions of consumers for days at a time.⁴³

According to industry reports, transmission pipelines are designed to ensure reliable service. Transmission pipeline operators cited the following system features as critical to ensuring that gas can be delivered even in the event of a problem, such as a service interruption:

- **Two or more pipelines sharing a right-of-way.** If a portion of one of these pipelines is damaged, there is often enough capacity in the parallel segment to continue to serve customers.
- **Reticulated system design.** A “web-like” design, with multiple paths to any given point, may allow gas to be rerouted in the event of problems on certain pipeline segments.
- **Interconnections to other pipelines.** If there is a failure on one pipeline, gas can often be brought into the system upstream or downstream from the problem, as necessary.

⁴²EIA, *Today in Energy*, “U.S. customers experienced an average of nearly six hours of power interruptions in 2018” (June 1, 2020), <https://www.eia.gov/todayinenergy/detail.php?id=43915>, accessed on Sept. 9, 2020.

⁴³For example, Hurricane Irma left as many as 6 million customers in Florida without electric power for multiple days; EIA, *Today in Energy*, “Hurricane Irma cut power to nearly two thirds of Florida’s electricity customers” (Dec. 21, 2017), <https://www.eia.gov/todayinenergy/detail.php?id=34232>, accessed on July 27, 2020.

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- **Automated monitoring and control systems.** These systems allow problems to be identified early and initiate a quick response, such as opening or closing valves to control pressure.
 - **24/7 staffing of gas control rooms.** Having staff physically located in gas control rooms at all times also facilitates a quick response to problems.
 - **Access to storage.** In the event of an interruption, operators can draw gas from storage areas to ensure gas delivery to customers.
 - **Bidirectional gas flow on pipelines.** If a disruption in the flow of gas occurs at a given point on the system, changing the direction in which gas flows can ensure gas reaches affected customers.

Moreover, the physical properties of natural gas help mitigate the effects of service interruptions. Natural gas moves slowly (at an average speed of 15 to 20 miles per hour) through pipelines, giving pipeline operators time to isolate damaged infrastructure and reroute gas to customers in case a problem occurs.

Risk of Service Interruptions Could Increase with Greater Use of Natural Gas Transmission Pipelines, but FERC Does Not Fully Identify or Assess Risks

While service interruptions to the customers of interstate transmission pipelines are generally infrequent and limited in scope, the risk of such interruptions may be increasing. Industry representatives and state officials told us that greater use of interstate transmission pipelines, primarily due to increased production of natural gas and increased use by electric power generators could make service interruptions more likely. Although FERC is responsible for assisting consumers in obtaining reliable natural gas service, it does not use the data it collects to identify or assess trends in the frequency or scope of service interruptions on interstate transmission pipelines. Without this analysis, FERC is not well positioned to take action, if necessary, to fulfill its mission of working to ensure reliable natural gas transportation.

Greater Domestic Gas Production and Use of Natural Gas by Electric Power Plants Could Lead to Increased Risks

Although interruptions in the transportation of gas were generally limited between 2015 and 2019, greater use of interstate transmission pipelines could potentially increase the frequency and scope of interruptions, according to industry representatives and state officials. Transmission pipelines are, overall, running closer to their total capacity more frequently throughout the year as a result of changes in the supply of and demand for natural gas in the United States over the last decade, including:

-
- **Increased domestic production of natural gas.** Driven largely by growth in natural gas extracted from shale deposits, natural gas production grew by 5.1 percent on average each year from 2015 to 2020.⁴⁴ Five transmission pipeline operators told us gas production is driving greater use of their pipelines. EIA projects that growth in domestic shale gas production will continue at least through 2050, albeit at a slower rate.⁴⁵
 - **Growth in use of natural gas for electric power generation.** The share of electricity generated by natural gas has increased from 27 percent in 2014 to 37 percent in 2019, as older, coal-fired power plants have been replaced by natural gas-fired power plants. EIA forecasts that natural gas will continue to fuel over one-third of U.S. electricity generation over the next 30 years.⁴⁶ According to seven transmission pipeline operators we spoke to, this increase has meant new customers for gas transportation services and greater use of their pipelines.

Further, seven interstate transmission operators told us that at least one of their pipelines operates at or near 100 percent of its capacity for most of the year. Officials with 10 state public utility commissions described increased demand for capacity on interstate transmission pipelines or increased use of these pipelines in their states. Trends in natural gas use and the expansion of pipeline infrastructure vary by region, but most transmission pipeline operators we spoke with said they expected use of their pipelines to remain the same or increase over the next 5 years.

State officials and gas and electric industry representatives told us that more intensive use of interstate transmission pipelines could increase the risk of service interruptions. State officials who said there is an increased demand for capacity or use of transmission pipelines in their states also told us that greater use could place stress on transmission pipelines or affect their ability to serve current or future customers reliably. Representatives from one electric industry association also told us that a lack of available capacity and lack of flexibility in interstate transmission

⁴⁴EIA, *Annual Energy Outlook 2020*, (Washington, D.C.: Jan. 2020), slides 46 and 52. EIA projects continued growth in domestic shale gas production through 2050, except in the event of higher production costs. In this scenario, growth in domestic shale gas production would remain flat.

⁴⁵EIA, *Annual Energy Outlook 2020*, slides 49 and 50.

⁴⁶EIA, *Annual Energy Outlook 2020*, slide 62. In addition to electric power generation, EIA also expects industrial consumption and exports of natural gas and liquefied natural gas to contribute to greater use of natural gas.

pipeline systems raised reliability concerns for electric power generation. Two transmission pipeline operators also noted that greater use of their systems makes their systems less flexible, a situation that could lead to more service interruptions.

Interstate transmission pipeline operators also stated that greater use of their pipeline capacity has resulted in changes to the type of transportation service available to customers. Especially during winter months, little to no capacity on interstate transmission pipelines may be available to interruptible customers.⁴⁷ To prevent a service interruption to firm customers, interstate transmission operators typically interrupt (i.e., reduce or eliminate) service to customers with interruptible service contracts. If all or almost all of a pipeline's capacity is being used by customers with firm service, the operator cannot rely on reducing or eliminating service to interruptible customers to continue serving firm customers in an emergency.

Vulnerability to the occurrence and effects of service interruptions varies regionally, depending on climate, pipeline infrastructure, and use of natural gas for electric power generation. According to an analysis by the North American Electric Reliability Corporation, New England and the Southwest regions are particularly vulnerable to unplanned service interruptions due to limited storage facilities and greater demand for natural gas than can be transported by transmission pipelines during periods of peak demand.⁴⁸ Representatives of some gas industry associations noted that gas distribution companies with a single connection to an interstate transmission pipeline—more common in rural areas—are more vulnerable to service interruptions. Of the 42 state public utility commissions we interviewed, officials from 21 commissions

⁴⁷Transmission pipeline operators told us that customers with interruptible contracts, such as electric power plants and industrial plants, choose the service level that best matches their fuel needs and back-up options. For example, customers with interruptible contracts on one transmission pipeline may contract for transportation service on other transmission pipelines or have back-up fuel options, such as oil.

⁴⁸North American Electric Reliability Corporation, *Special Reliability Assessment: Potential Bulk Power System Impacts Due to Severe Disruptions on the Natural Gas System* (Atlanta, Georgia: 2017). The North American Electric Reliability Corporation is a non-profit international regulatory authority which is certified by FERC as the electric reliability organization for the United States. *North American Electric Reliability Corp.*, 116 FERC ¶ 61,062 (2006). Subject to FERC's approval and review, the North American Electric Reliability Corporation develops and enforces the mandatory reliability standards for the generation and transmission of electric energy throughout the country. 16 U.S.C. § 824o(b), (d)-(e). FERC also has the authority to enforce these standards independent of the North American Electric Reliability Corporation. *Id.* § 824o(e)(3).

said that they had concerns about current or future interstate transmission capacity. Some state officials had concerns specific to the circumstances in their region. For example:

- Officials from three Western states told us that growth in the use of renewable energy, such as solar energy, to fuel electric power generators could add stress to natural gas transmission pipelines. Specifically, natural gas is often used to meet shortfalls in electric generation when renewables are not producing enough power, causing rapid changes in the use of interstate transmission pipelines.
- Officials from four Midwestern states told us it is difficult for small gas distribution companies in their states to get access to capacity on interstate transmission pipelines.
- Officials from two Southern states said capacity constraints on interstate transmission pipelines make it difficult, if not impossible, for large-volume customers to obtain new capacity.
- Officials in five Northeastern states were concerned about constrained transmission pipeline capacity, especially during winter months, and its potential effects on gas distribution companies and gas consumers in their states.

FERC Does Not Use Data Collected on Pipeline Service Interruptions to Identify or Assess Risks

FERC's stated mission, in part, is to assist consumers in obtaining reliable energy services at reasonable costs through appropriate regulatory and market means. Ensuring the reliable transportation of natural gas, a process that is integral to reliable energy service, involves understanding and being prepared to respond to risks as they emerge. As outlined by our enterprise risk management framework, federal agencies should take a series of steps to manage risks in complex systems; key steps include identifying, assessing, and, as appropriate, responding to risks.⁴⁹

However, FERC does not use data from serious interruptions of service reports or other information sources it collects to identify or assess trends in the frequency or scope of pipeline service interruptions. According to FERC officials, they use the serious interruptions of service reports for

⁴⁹GAO-17-63. Enterprise Risk Management allows federal agencies to assess threats and opportunities that could affect the achievement of its goals. In 2016, we reported on essential elements and good practices when implementing an Enterprise Risk Management approach. To identify these essential elements and good practices, we reviewed academic and industry literature, validated the identified elements with subject matter experts, and compared them to practices at 24 federal agencies.

situational awareness but do not organize the reports for easy access, such as in a database, or analyze the reports to identify trends or potential risks. Additionally, FERC officials told us that the agency also purchases and uses data sourced from interstate transmission pipelines' electronic bulletin boards, which include daily information on any changes to the scheduling of gas transportation due to planned or unplanned service interruptions.⁵⁰ FERC officials said they analyze market trends and operations in the electronic bulletin board data to inform decision-making on interstate transmission operators' petitions for new infrastructure or changes in rates; the officials also use these data to identify sections of pipeline that may have reliability concerns and to analyze system conditions when interruptions occur. However, unlike serious interruptions of service reports, electronic bulletin board data do not contain information on the scope of unplanned service interruptions; specifically, the customers affected, how they were affected, and whether the interruption resulted in an outage to natural gas consumers. Without this information, FERC is not able to fully understand potential risks to the overall reliability of the gas transportation system.

FERC officials told us they do not use serious interruptions of service reports to identify or assess risks because interstate pipeline operators' contractual obligations have historically resulted in the reliable transportation of natural gas with a low risk of service interruptions. FERC officials view these reports as a hold-over from before the deregulation of the natural gas industry, when FERC had a greater regulatory role. In addition, FERC officials told us the agency is "reactive" and accordingly sets the regulatory framework within which the industry operates and contracts for natural gas transportation services. FERC does not, according to officials, look for problems, such as risks to reliability, but rather responds to problems as they arise. Thus, the agency does not have an approach to respond to potential risks, such as more frequent or severe service interruptions. Moreover, according to FERC officials, the agency does not have the authority to compel interstate pipeline operators to take actions to address interruptions, such as building new pipeline infrastructure. While FERC cannot compel interstate transmission

⁵⁰Reporting requirements for interstate pipelines require operators to use electronic bulletin boards to post information including but not limited to, gas flow and planned and actual service interruptions. 18 C.F.R. § 284.13(d). These data are procured from third-party vendors that collect and aggregate data from pipelines' electronic bulletin boards. Electronic bulletin boards are only required to keep an online archive of data for 90 days. *Id.* § 284.13(b). However, pipeline operators must maintain, for a period of 3 years, all information displayed and transactions conducted electronically and be able to recover and regenerate all such electronic information and documents. *Id.* § 284.12(b)(3).

operators to build new pipeline infrastructure, there are other actions—within its legal authority—that the agency could take. For example, FERC staff could analyze available information on service interruptions for trends or common causes and use this information to identify and assess potential risks. This information could inform market assessments performed by FERC as well as decisions concerning rates and applications for new infrastructure.

Without routinely identifying and assessing potential risks to the reliability of natural gas transportation, the agency is not well positioned to respond to risks, if necessary, to fulfill its mission of assisting customers to obtain reliable natural gas transportation service. Officials in 10 states said that improved federal oversight of the overall reliability of interstate transmission pipelines is needed. This action could help, for example, to ensure reliable natural gas service to large-volume customers—and ultimately residential and commercial gas consumers—in their states. In addition, FERC may be missing an opportunity to use available information to assess the status of the nation’s natural gas pipeline infrastructure and then share this information with other agencies, including DOE and PHMSA, which is FERC’s stated reason for requiring transmission pipeline operators to report serious interruptions of service and certain damage to interstate pipeline infrastructure.⁵¹ Sharing information on service interruptions could improve DOE’s and PHMSA’s own efforts to understand how frequently service interruptions occur and the effects of the interruptions.

Conclusions

Currently, interruptions of service to customers of interstate transmission pipelines are relatively infrequent, and industry, state, and federal stakeholders view the transportation of natural gas as reliable. However, the U.S. natural gas industry is changing. The growth in domestic natural gas production is contributing to the increased use of natural gas, particularly as a fuel for electric power generation. As a result, in many areas of the country, interstate transmission pipelines are being used more intensively than in the past. Without using all available data to routinely identify and assess emerging risks to the reliability of the natural gas pipeline system, such as service interruptions, FERC is not optimally positioned to anticipate and respond to these risks and thus to ensure that the energy needs of customers are met in the future.

⁵¹Revision to Regulations to Require Reporting of Damage to Natural Gas Pipeline Facilities, 71 Fed. Reg. 51,098, 51,098 (Aug. 29, 2006).

Recommendations for Executive Action

We are making the following two recommendations to FERC:

- FERC should use available information, such as reports by transmission pipeline operators on service interruptions, to identify and assess risks to the reliability of natural gas transmission service. (Recommendation 1)
- FERC should develop and document an approach to respond, as appropriate, to risks it identifies to the reliability of natural gas transmission service. (Recommendation 2)

Agency Comments

We provided a draft of this report to the Federal Energy Regulatory Commission (FERC), Department of Energy (DOE); Department of Transportation (DOT); and Energy Information Administration (EIA) for review and comment. In its comments, reproduced in appendix II, FERC outlined the agency's ongoing efforts to:

- identify and monitor reliability risks to the natural gas pipeline system,
- consider issues related to emerging risks to this system, and
- respond through actions, such as rulemakings and policies, when risks are identified.

In response to our recommendations, FERC plans to establish a process to incorporate serious interruption of service reports into its ongoing efforts to monitor and address the reliability of the interstate natural gas pipeline grid. We found that using serious interruption of service reports to, for example, identify trends and common causes of interruptions may provide a more comprehensive status of the natural gas pipeline service and allow for a more robust assessment of potential risks. DOE and DOT did not have comments on the draft report. EIA provided technical comments, which we incorporated as appropriate.

We are sending copies of this report to the appropriate congressional committees, the Secretaries of the Department of Energy and Transportation, the Administrator of the Energy Information Administration, the Executive Director of the Federal Energy Regulatory Commission and other interested parties. In addition, the report is available at no charge on the GAO website at <https://www.gao.gov>.

If you or your staff have any questions about this report, please contact me at (202) 512-2834 or repkoe@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix III.

A handwritten signature in black ink, reading "Elizabeth Repko", followed by a long horizontal line extending to the right.

Elizabeth Repko
Acting Director, Physical Infrastructure Issues

Appendix I: Survey of Gas Distribution Companies on Gas Supply Issues

To obtain information on gas distribution companies' experience with gas supply issues, in December 2019, we emailed a link to an online survey to a stratified random sample of 152 gas distribution companies.¹ We asked a series of closed- and open-ended questions about the communities and customers gas distribution companies serve, these companies' natural gas resources to meet demand, the availability of capacity on the natural gas transmission pipelines serving these companies, the extent to which these companies have experienced an unplanned interruption in gas service due to a problem on a transmission pipeline—and if an unplanned interruption occurred—how the company managed the event, among other things. The questions we asked and the aggregate results of the responses to the closed-ended questions are shown below. We do not provide results for the open-ended questions. We received 61 completed survey responses—a response rate of 40 percent. We examined the response patterns and found that smaller gas distribution companies were more likely to respond when compared to the larger companies. As a result, we determined that the results of the survey are not generalizable, and survey results should not be extrapolated to the full population of gas distribution companies.

Respondent Information

1. What is your name? (Written responses not included)
2. What is your job title? (Written responses not included)

Company Description

3. What is your local distribution company's (LDC) name? (Written responses not included)

¹In the survey we used the term local distribution company (LDC) when referring to the companies that purchase capacity on interstate transmission pipelines to move natural gas and then distribute that natural gas to users (such as residences, commercial, and industrial) in the communities they serve. We use the term "gas distribution company" in this report to refer to LDCs.

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4. Which of the following describes your LDC's ownership type? N=61

Response	Number of Responses
Municipally owned	30
Investor owned	18
Privately owned	6
Cooperative	1
Other	5
Did not answer	1

4a. What is the other ownership type? (Written responses not included)

5. What jurisdiction(s) does your LDC serve (i.e., city, county, region, and/or state)? (Written responses not included)

6. Approximately how many natural gas customers are served by your distribution system? (Written responses not included)

7. Are the following types of natural gas customers served by your distribution system?

7a. Residential n=61

Response	Number of Responses
Yes	61
No	0
Don't know	0
Did Not Answer	0

7b. Commercial n=61

Response	Number of Responses
Yes	60
No	0
Don't know	0
Did Not Answer	1

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7c. Industrial n=61

Response	Number of Responses
Yes	44
No	9
Don't know	0
Did Not Answer	8

7d. Electric Power Plants n=61

Response	Number of Responses
Yes	12
No	35
Don't know	0
Did Not Answer	14

7e. Other n=61

Response	Number of Responses
Yes	10
No	23
Don't know	5
Did Not Answer	23

7f. What other types of customers do you serve? (Written responses not included)

8. What resources does your LDC use to ensure it has sufficient capacity to meet total system load during periods of peak demand?

8a. Firm Transportation Capacity to City Gate(s) n=61

Response	Number of Responses
Yes	52
No	3
Don't know	3
Did Not Answer	3

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8b. Secondary Transportation Capacity n=61

Response	Number of Responses
Yes	23
No	23
Don't know	5
Did Not Answer	10

8c. Interruptible Transportation Capacity n=61

Response	Number of Responses
Yes	14
No	22
Don't know	6
Did Not Answer	19

8d. Underground Storage Capacity n=61

Response	Number of Responses
Yes	31
No	17
Don't know	3
Did Not Answer	10

8e. Peak Shaving Facilities with On-site Liquefaction n=61

Response	Number of Responses
Yes	4
No	36
Don't know	4
Did Not Answer	17

8f. Peak Shaving Facilities without On-site Liquefaction n=61

Response	Number of Responses
Yes	6
No	33
Don't know	4
Did Not Answer	18

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8g. Delivered Gas n=61

Response	Number of Responses
Yes	29
No	16
Don't know	3
Did Not Answer	13

8h. Other n=61

Response	Number of Responses
Yes	4
No	25
Don't know	8
Did Not Answer	24

8i. What other resource(s)? (Written responses not included)

9. Is your LDC's future forecasted peak day load increasing, remaining the same, or decreasing? N=61

Response	Number of Responses
Increasing	27
Remaining the Same	25
Decreasing	5
Don't Know	4
Did not answer	0

**Transportation Capacity on Transmission Pipelines Directly
Connected to Your System**

10. What are the name(s) of the natural gas transmission pipeline(s) directly connected to your LDC's system? Please list up to 10 (Written responses not included)

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11. Currently, are any of the natural gas transmission pipeline(s) directly connected to your LDC's system fully subscribed? N=61

Response	Number of Responses
Yes	17
No	5
Don't Know	39
Did not answer	0

12. Why do you think these transmission pipelines are fully subscribed?
(Written responses not included)

13. Of those transmission pipeline(s) directly connected to your system, please name the ones that are fully subscribed. (Written responses not included)

14. Why do you think these transmission pipelines are not fully subscribed? (Written responses not included)

15. In the last five years, has your LDC attempted to increase its firm transportation capacity on any of the transmission pipeline(s) directly connected to its system? N=61

Response	Number of Responses
Yes	20
No	27
Don't Know	14
Did not answer	0

15a. Why has your LDC attempted to increase its firm transportation capacity?
(Written responses not included)

15b. How often was your LDC successful in obtaining additional firm transportation capacity? n=20

Response	Number of Responses
Never	0
Almost never	1
Sometimes	5
Almost every time	7
Every time	7

15c. To what do you attribute your LDC's success or lack of success in obtaining additional firm transportation capacity? (Written responses not included)

15d. Why hasn't your LDC attempted to increase its firm transportation capacity? (Written responses not included)

Overall Transmission Pipeline Capacity

16. Over the next five years, is your LDC concerned that transmission pipeline capacity could impact its ability to distribute natural gas to current customers during periods of peak demand? N=61

Response	Number of Responses
Yes	14
No	44
Don't Know	3
Did not answer	0

16a. Why or why not? (Written responses not included)

17. Over the next five years, is your LDC concerned that transmission pipeline capacity could impact its ability to distribute natural gas to new customers? N=61

Response	Number of Responses
Yes	19
No	38
Don't Know	4
Did not answer	0

17a. Why or why not? (Written responses not included)

Unplanned Service Interruptions

18. Over the last five years, has your LDC experienced one or more unplanned episodes where an upstream natural gas transmission pipeline was not able to deliver the nominated amount of gas under a firm transportation contract? N=61

Response	Number of Responses
Yes	9
No	52
Don't Know	0
Did not answer	0

19. Over the last five years, about how many times has your LDC experienced such an episode? (Written responses not included)

20. In any of these episodes over the last five years, did the nominated amount of gas delivered to one or more of your city gates fall to zero (i.e., none of the nominated amount of gas was delivered to one or more of your city gates)? N= 9

Response	Number of Responses
Yes	3
No	6
Don't Know	0
Did not answer	0

20a. When did this complete interruption in natural gas reaching any of your city gate(s) occur (Month/Year)? (Written responses not included)

20b. Which transmission pipeline was not able to deliver natural gas to your system? (Written responses not included)

20c. Were you satisfied with the information you received from this transmission pipeline operator about this complete interruption? (Written responses not included)

20d. How long did the complete interruption last? (Written responses not included)

20e. To your knowledge, what caused the interruption? (Written responses not included)

For the remaining questions, please answer about the most recent unplanned episode where an upstream natural gas transmission pipeline was not able to deliver the nominated amount of gas under a firm transportation contract.

21. For the most recent episode where an upstream natural gas transmission pipeline was not able to deliver the nominated amount of gas under a firm transportation contract, what was the approximate size of the reduction? N= 9

Response	Number of Responses
Reduction of less than 10 percent	4
Reduction of 10 to 25 percent	2
Reduction of 26 to 50 percent	1
Reduction of greater than 50 percent	2
Did not answer	0

21a. When did this most recent interruption in natural gas reaching your LDC occur? (Written responses not included)

21b. Which transmission pipeline was not able to deliver your company's nominated amount of gas under a firm transportation contract? (Written responses not included)

21c. Were you satisfied with the information you received from this transmission pipeline operator about this reduction in service? (Written responses not included)

21d. How long did this episode last? (Written responses not included)

21e. To your knowledge, what caused the interruption? (Written responses not included)

22. In this most recent interruption, did your LDC ask any customers to voluntarily conserve natural gas? N= 9

Response	Number of Responses
Yes	0
No	9
Don't Know	0
Did not answer	0

22a. Why or why not? (Written responses not included)

23. In this most recent episode, did your LDC interrupt service to customers with interruptible contracts? N= 9

Response	Number of Responses
Yes	1
No	6
Not applicable because no customers have interruptible contracts	2
Don't Know	0
Did not answer	0

23a. About what proportion of interruptible customers had their service interrupted? (Written responses not included)

24. In this most recent episode, did your LDC interrupt service to any firm customers? N=9

Response	Number of Responses
Yes	0
No	8
Don't Know	1
Did not answer	0

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24a. About what proportion of firm customers had their service interrupted (Written responses not included)

24b. About how long did it take to restore service to these firm customers? (Written responses not included)

25. During this most recent episode, did your LDC use any of the following resources to maintain service to its customers?

25a. Firm Transportation Capacity on Alternate Pipeline n=9

Response	Number of Responses
Yes	3
No	4
Not Available	1
Don't know	0
Did not answer	1

25b. Secondary Transportation Capacity n=9

Response	Number of Responses
Yes	1
No	4
Not Available	1
Don't know	1
Did not answer	2

25c. Interruptible Transportation Capacity n=9

Response	Number of Responses
Yes	0
No	5
Not Available	1
Don't know	1
Did not answer	2

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25d. Underground Storage Capacity n=9

Response	Number of Responses
Yes	6
No	1
Not Available	1
Don't know	0
Did not answer	1

25e. Peak Shaving Facilities n=9

Response	Number of Responses
Yes	3
No	4
Not Available	0
Don't know	0
Did not answer	2

**25f. Gas—such as compressed natural gas (CNG) or liquid natural gas (LNG)—
brought in by truck n=9**

Response	Number of Responses
Yes	1
No	6
Not Available	0
Don't know	0
Did not answer	2

25g. Delivered Gas n=9

Response	Number of Responses
Yes	2
No	5
Not Available	0
Don't know	0
Did not answer	2

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25h. Mutual aid from other area companies (e.g., voluntary reductions in their natural gas usage) n=9

Response	Number of Responses
Yes	0
No	7
Not Available	0
Don't know	0
Did not answer	2

25i. Other n=9

Response	Number of Responses
Yes	0
No	6
Not Available	1
Don't know	0
Did not answer	2

25j. What other resource(s)? (Written responses not included)

26. During this most recent episode, did your LDC communicate information or instructions to its customers in any of the following ways?

26a. Direct Customer Contact by Phone or Email n=9

Response	Number of Responses
Yes	2
No	6
Don't know	1
Did not answer	0

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26b. Reverse 911 n=9

Response	Number of Responses
Yes	0
No	8
Don't know	0
Did not answer	1

26c. Public Service Announcements (i.e., local television or radio channels) n=9

Response	Number of Responses
Yes	0
No	9
Don't know	0
Did not answer	0

26d. Automated emergency notification system (e.g., Everbridge) n=9

Response	Number of Responses
Yes	0
No	9
Don't know	0
Did not answer	0

26e. Social Media n=9

Response	Number of Responses
Yes	1
No	7
Don't know	1
Did not answer	0

26f. Company website or mobile application n=9

Response	Number of Responses
Yes	1
No	7
Don't know	1
Did not answer	0

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26g. Other n=9

Response	Number of Responses
Yes	1
No	5
Don't know	1
Did not answer	2

26h. What other way(s)? (Written responses not included)

Federal Action

27. What actions, if any, could federal agencies take to offer more support to your LDC in maintaining reliable natural gas service to your customers? (Written responses not included)

Appendix II: Comments from the Federal Energy Regulatory Commission



Federal Energy Regulatory Commission Office of the Chairman

September 1, 2020

Elizabeth Repko, Acting Director
United States Government Accountability Office Physical Infrastructure Issues
442 G Street, NW
Washington, DC 20548

Dear Ms. Repko:

Thank you for the opportunity to provide comments on behalf of the Federal Energy Regulatory Commission with respect to the Government Accountability Office's draft report entitled, "Gas Transmission Pipelines: Interstate Transportation of Natural Gas is Generally Reliable but FERC Should Better Identify and Assess Emerging Risks (GAO-20-658)" (Report). GAO has made the following two recommendations related to the Commission:

- 1) FERC should use available information to identify and assess risks to the reliability of natural gas transmission service.
- 2) FERC should develop and document an approach to respond, as appropriate, to risks it identifies to the reliability of natural gas transmission service.

The Commission identifies and monitors reliability risks to the natural gas pipeline system and actively considers issues related to emerging risks to natural gas interstate transportation reliability. Once issues are identified, the Commission responds through actions available under its statutory authorities, such as rulemakings and policies to incent and promote just and reasonable rates, economic efficiency, and reliable operations. To this end, Commission staff monitor and report on the structure and operation of natural gas markets and interstate transportation through public reports such as the State of Markets reports and the Winter and Summer Energy Market Assessments. In these reports, Commission staff leverages public and non-public data sources to assess how well the interstate natural gas pipeline grid is functioning. Many of these data sources provide daily information on natural gas system operations, and include natural gas production levels, pipeline utilization and constraints, pipeline outages, and capacity expansions. Staff also periodically conducts outreach to industry members, market participants, and other regulators to inform analyses and policy recommendations.

With respect to the recommendations set forth in the Report, we will establish a process to incorporate the serious interruption of service reports into the Commission's ongoing efforts in monitoring and addressing the reliability of the interstate natural gas pipeline grid. If I can be of further assistance in this or any other Commission matter, please let me know.

Sincerely,

A handwritten signature in black ink, appearing to read "Neil Chatterjee".

Neil Chatterjee, Chairman

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Appendix III: GAO Contact and Staff Acknowledgments

GAO Contact

Elizabeth Repko, Acting Director, (202) 512-2834 or repkoe@gao.gov

Staff

Acknowledgments

In addition to the contact named above, Sara Vermillion (Assistant Director); Sarah Arnett (Analyst-in-Charge); James Ashley; Karen (Maggie) Bryson; Terence Lam; Yoki Moody-Wong; Joshua Ormond; Mary-Catherine P. Overcash; Kelly Rubin; Janet Temko-Blinder; Frances Tirado; and Laurel Voloder made key contributions to this report.

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