



November 2022

Enhancing and Maintaining Gas and Energy System Resiliency

Areas of Focus and Change

Executive Summary

An American Gas Foundation Study Prepared by:



Background and Methodology

This study was conducted to investigate the resilience of the US gas system and the necessary changes required to the regulatory framework to support gas resilience investments. It builds off the prior report published by the American Gas Foundation and Guidehouse in January 2021: [*Building a Resilient Energy Future: How the Gas System Contributes to US Energy System Resilience*](#). This work was directed to ask and answer four key questions:

- What characteristics of the current regulatory framework enable or disable gas resilience?
- How can resilience be valued and measured to better qualify gas infrastructure investments?
- What recommended changes are needed to fully enable gas system resilience?
- Through what modified regulatory frameworks can the recommended changes be implemented?

These questions were explored through a qualitative assessment conducted by Guidehouse, including discussions and interviews with many energy industry subject matter experts and Commissioners across the US and Canada. Case studies and examples of resilience were identified as a part of these discussions. Guidehouse used these studies and examples to develop methods to properly value resilience infrastructure and implement gas resilience within the energy system, including through proposed regulatory changes. The findings presented in this work identify issues that merit consideration and further exploration when developing future energy policy and regulation to ensure a resilient, reliable, and clean future energy system in all regions and jurisdictions.

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Abbreviations

Abbreviation	Definition
AGF	American Gas Foundation
BERF	Building a Resilient Energy Future report
CAIDI	Customer Average Interruption Duration Index
CCUS	Carbon Capture Utilization and Storage
CDP	Carbon Disclosure Project
CDF	Customer Damage Function
DER	Distributed Energy Resource
DOE	US Department of Energy
EU	European Union
FERC	Federal Energy Regulatory Commission
IJA	Infrastructure Investment and Jobs Act (2021)
ICE	Interruption Cost Estimator
IPCC	Intergovernmental Panel on Climate Change
ISO	Independent Service Operator
LDC	Local Distribution Company
LNG	Liquified Natural Gas
LMI	Low and Middle Income
MEA	Maryland Energy Administration
NARUC	National Association of Regulatory Utility Commissioners
NERC	North American Electric Reliability Corporation
NIAC	National Infrastructure Advisory Council
NGO	Non-Governmental Organization
POET	Power Outage Economics Tool
PSC	Public Service Commission
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
STRIDE	Maryland Strategic Infrastructure Development and Enhancement Plan
UK	United Kingdom
US	United States

Executive Summary

Resilience is an inherent and crucial component of a dependable energy system, which is obtained through diverse and redundant energy sources. The ability of the gas system to meet seasonal and peak day demands represents an important and valuable resource that must be considered when designing future energy systems and building pathways to a low-carbon future. This report examines gas system resilience attributes, focusing on how it enables overall energy system resilience, changes to the regulatory framework to support gas resilience investments, and the infrastructure improvements necessary to support broader energy system resilience. This report also examines opportunities to enhance the resilience of the entire “energy system” and how future investments in the gas system that support the resilience of other parts of the energy system can also support a low-carbon future and the increased integration of renewables in both the gas and electric grids. A focus on the evolution of electric and gas grids as a complete energy system which includes additions of renewable supply is needed.

As recent significant weather events have increased in severity, those events illustrate the need for enhanced energy system resilience has become demonstrable. The resilience of the overall energy system rests upon gas system resilience since natural gas accounts for one-third of primary energy consumption across all principal sectors of the economy and is the primary fuel for the generation of electric power in the US. There is broad recognition that gas system resilience is critical to overall energy system resilience. As the use of natural gas has become the primary fuel for the generation of electric power, the importance of natural gas has increased beyond its role as a fuel for homes and businesses. Recent weather events have shown the value and necessity of a resilient gas system and the inextricable linkage between fuel delivery, the supply of electricity, and peak energy management across the gas and electric system.

This report provides the technical, commercial, and regulatory analysis associated with the resilience of the US gas system with the goal of identifying the necessary changes to the policy and regulatory framework for the energy industry to support gas resilience investments. It builds off the prior report published by the American Gas Foundation and Guidehouse in January 2021: *Building a Resilient Energy Future: How the Gas System Contributes to US Energy System Resilience*.

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The study set out to address the following four key questions:

- What characteristics of the current regulatory framework enable or hinder gas resilience?

- What recommended changes are needed to fully enable gas system resilience?
- How can resilience be valued and measured to better qualify gas infrastructure investments?
- Through what modified regulatory frameworks can the recommended changes be implemented?

Resilience attributes of the gas system are examined in this study focusing on how it enables overall energy system resilience, the changes to the regulatory framework which may support future gas resilience investments, and the infrastructure improvements necessary to support broader energy system resilience into the future. This report was developed and assembled using data and inputs from a diverse array of sources including interviews with industry recognized state regulators, detailed review of available studies and assessments of the impact of severe weather events upon energy infrastructure and broader regional economies, regulatory initiatives to address resiliency implemented in the US and overseas, reliability studies and analyses performed by the University of California at San Diego (UCSD). Also, discussions with representatives of local distribution companies (LDCs) active in addressing issues associated with resiliency and independent analytics of key features of the energy system including the deployment of distributed energy resources was undertaken.

High-Level Recommendations

There are a number of recommendations that should be considered to achieve enhanced energy system resiliency:

Recommendation: State Commission Analysis into Value of Gas Infrastructure

Commissions may explore methodologies that look beyond used and useful analysis to understand the true value gas infrastructure provides to the resilience of the entire energy system - relying on traditional regulatory criteria may not cover the future benefits of resiliency or weather-related system improvements.

Recommendation: Emphasize Safety and Renewable Integration When Seeking Approval

When seeking approval for resilience infrastructure investments and stakeholder support, gas companies should emphasize the investment's value to ensure safety and the future integration of renewables in both the gas and electric systems.

Recommendation: Focus on Enabling Mechanisms Emphasizing Resiliency and a Low-Carbon Future

To achieve current and future resilience, regulatory and financial supportive mechanisms should be considered that emphasize the gas system's long-term role in a low-carbon energy system

Downstream and Upstream of the City Gate Recommendations

Investments downstream of the city gate address the risk of upstream supply chain disruptions today, but greater investment may provide greater contingency planning.

Key **downstream** investment recommendations include:

- Increase investments in the weatherization of pipelines and storage distribution infrastructure.
- Continue improving downstream of city gate pipeline interconnections.
- Develop additional storage facilities on the gas distribution system to enhance the resilience of the overall pipeline distribution system.
- Introduce and expand the integration of alternative fuels (e.g., hydrogen or RNG) or LNG produced and stored behind the city gate.
- Continue to modernize infrastructure, including distribution pipelines to help enhance safety, reliability, resiliency, and affordability while in turn driving down emissions and delivering ever more low-carbon gas supply solutions over time.

Key **upstream** investment recommendations include:

- Increase investments in the weatherization of well-heads, gathering, and processing systems, gas transmission networks, and storage facilities to ensure they are prepared for extreme weather events and potential duration changes.
- Continue to modernize aging pipelines and interconnections with long lived assets that support broader energy system resilience.
- Design systems to accommodate low-carbon fuels such that future system operations can continue to provide resilience benefits while supporting mid-century decarbonization emission reduction goals.

Federal and State Recommendations

Recommendations: Federal and state intervention and approval to implement resilience measures

At both the federal (e.g., US House of Representatives, Senate, and federal agencies) and the state (e.g., state legislative or regulatory commission) levels hearings may be held on the impacts and consequences of extreme weather events on the US or state, including the risks of prolonged outages to customers, utilities, and state economies.

Federal

From the findings, Congress may consider issuing formal documentation notating the critical importance of enhancing energy system resilience, including the pipeline network and electric grid, to meet the challenges associated with climate change.

State

At the state level, legislators may request utilities to develop plans that describe the resilience investments necessary to mitigate against the impacts of extreme weather events. Resilience is important for forward looking plans required by regulatory agencies or submitted to reduce carbon going forward. For example, New York recently passed

legislation which allows utilities to recover their climate resilience plan costs through a specific cost recovery clause.¹

Recommendations: Implement resilience regulatory requirements

Both state and federal regulators may incorporate resilience into updated regulatory frameworks that govern the broader energy system.

Federal

By the means of legislation or other federal directives, the Federal Energy Regulatory Commission (FERC) can address this issue by establishing baseline resilience requirements for jurisdictional energy systems, possibly via the North American Electric Reliability Corporation (NERC). In addition, they can develop rules that require electric generators operating in regulated power markets in FERC's jurisdiction to engage with fuel suppliers that adhere to resilience requirements.

State

While FERC resiliency requirements or related rules may be adopted by some states and utilities, supportive policies in the state and regulatory arenas should recognize regional differences and state-specific requirements. State regulators will also need legislative support to expand the principle of "used and useful" to include the approval of resilience asset investments that may have very low utilization through their targeted response to high-impact, low-probability events.

Recommendations: Enable federal and state funding support for resilience investments for all energy sources.

Federal

Federal legislation could provide federal funding avenues for resilience investments, including both upstream and downstream of the city gate. Congress can also consider either amending the Infrastructure Investment and Jobs Act (IIJA) or producing new legislation to provide energy system infrastructure resilience investment avenues.

State

A template tariff for natural gas distributed energy resources may be developed to compensate LDCs for resilience investments. This would help address supply during peak demand periods (e.g., winter heating season) and help allocate a portion of the revenues earned by distributed energy resources (DERs) from participation in wholesale capacity markets and demand response programs.

States can also consider innovative regulatory constructs to manage the costs from energy system resilience investments and extreme weather impacts.

¹ New York State Senate. January 26, 2021. "[Assembly Bill A3360A.](#)" New York State.

Recommendations: Improve the interdependencies and coordination between the electric and natural gas industries

Federal

FERC and the Department of Energy (DOE) may consider policy and rules that recognize the importance and interdependencies and coordination of the natural gas and electric energy systems to ensure the points raised above are recognized and implemented at the federal level.

State

In parallel, state commissions can establish workshops and/or dockets that (i) establish policy and rules that recognize the importance and interdependencies of the natural gas and electric energy systems to ensure the points raised above are recognized and implemented at the federal level, (ii) recognize electric service to pipeline and distribution infrastructure as critical load so they are excluded from load shedding by utilities during extreme weather events; and (iii) establish broader state energy system dockets which review electric and natural gas initiatives that support overall energy system resilience.

