American Gas Association

SLC Energy & Environment Committee Virtual Program

Natural Gas Utility Cybersecurity & Pipeline Resilience
The American Gas Association (AGA) represents companies delivering natural gas safely, reliably, and in an environmentally responsible way to help improve the quality of life for their customers every day. AGA’s mission is to provide clear value to its membership and serve as the indispensable, leading voice and facilitator on its behalf in promoting the safe, reliable, and efficient delivery of natural gas to homes and businesses across the nation.

Committed to utilizing America’s abundant, domestic, affordable and clean natural gas to help meet the nation’s energy and environmental needs.
AGA Cybersecurity Action Plan Roadmap

Enhance Cyber Standards

- **Objective:** Coordination across natural gas industry and government stakeholders to develop a consensus-based pipeline cybersecurity standard for operational technology
- **Solution:** AGA and member utilities actively engage in the development of *API 1164 version 3.0 Industrial Cybersecurity for the Oil and Natural Gas Pipeline Industry (API 1164 v3)* and encourage TSA to incorporate API 1164 v3 by reference

Enhance Security Verification Tool

- **Objective:** Coordination across natural gas industry and government stakeholders to demonstrate operators effectively manage cybersecurity under the current TSA pipeline security oversight model
- **Solution:** AGA coordinates with U.S. Dept of Homeland Security (DHS) in development of the DHS Pipeline Cyber Security Evaluation Tool (CSET) to incorporate API 1164 v3; AGA member utility commitment to use the Pipeline CSET; encourage TSA to leverage CSET for metrics

Enhance Operator Accountability Mechanism

- **Objective:** Coordination among industry and government stakeholders to strengthen industry accountability for effective cybersecurity management
- **Solution:** AGA leads coordination of the development of verification mechanism that holds industry accountable
Building a Resilient Energy Future:
How the Gas System Contributes to
US Energy System Resilience

An American Gas Foundation Study
prepared by Guidehouse

January 2021
Key Questions Answered

What are the characteristics of the US gas system that contribute to its resilience?

How do those resilience characteristics allow the US gas system to contribute to the overall resilience of the US energy system?

How can the US gas system be leveraged more effectively to strengthen the US energy system?

What are the policy and regulatory changes that may help ensure that gas infrastructure can be maintained and developed to continue to support energy system resilience?

The project deliverables can be accessed at Gasfoundation.org
Energy System Resilience

Resilience is defined as a system’s ability to prevent, withstand, adapt to, and quickly recover from system damage or operational disruption. These abilities can be conceptualized into distinct phases along a resilience curve:

1. Preparation: The ability to prepare for and prevent initial system disruption leading up to disruption
2. Withstanding: The ability to withstand, mitigate, and manage system disruption during the disruption
3. Recovery: The ability to quickly recover normal operations and repair system damage following the disruption
4. Adaptation: The ability to adapt and take action to improve resilience to future disruption events throughout, but especially during and following recovery

RESILIENCE
Characterized by the energy system’s performance in response to high-impact, low-likelihood disruption events; such as extreme weather, cyber-attacks, and accidents.

RELIABILITY
Characterized by the energy system’s performance in response to low-impact, high-likelihood fluctuation events; such as power surges and routine changes to supply or demand.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Energy System Abilities</th>
<th>Timeframe</th>
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<tbody>
<tr>
<td>1. Preparation</td>
<td>The ability to prepare for and prevent initial system disruption</td>
<td>Leading up to disruption</td>
</tr>
<tr>
<td>2. Withstanding</td>
<td>The ability to withstand, mitigate, and manage system disruption</td>
<td>During the disruption</td>
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<td>3. Recovery</td>
<td>The ability to quickly recover normal operations and repair system damage</td>
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<td>4. Adaptation</td>
<td>The ability to adapt and take action to improve resilience to future disruption events</td>
<td>Throughout, but especially during and following recovery</td>
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Resilience of the Gas System
The gas system supports the overall resilience of the energy system through its inherent, physical and operational capabilities that enable it to meet the volatile demand profiles resulting from resilience events.

### Key Takeaway

**Fundamental Resilience Characteristics of the Gas System**

<table>
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<tr>
<th>Inherent Resilience of Gas</th>
<th>Physical Resilience of System Assets</th>
<th>Operational Resilience of the Gas System</th>
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<tr>
<td>A molecular form of energy storage; the natural gas molecule is an abundant energy form with long-duration and seasonal storage capabilities.</td>
<td>Most gas system assets are underground and shielded from major disruptions. In most cases, the system is self-reliant, reducing its exposure to disruption.</td>
<td>Operational flexibility is designed into the gas system within a set of system standards that ensure the system’s safety and security.</td>
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</table>
| • Compressibility  
  o Storage  
  o Linepack  
  • Abundance and Diversity of Supply | • Underground infrastructure  
  • Looped and Parallel T&D Network  
  • Self-Repliant Gas-Fired Equipment  
  • Distributed Customer Generation  
  • System Storage Capacity | • Robust Management Practices  
  • Flexible Delivery  
  • Demand Side Management  
  • Large Customer Contract Design |
Recent climate events have revealed the US energy system’s potential vulnerabilities. However, the multitude and diversity of resilience assets that already exist as part of the energy system have made the difference — facilitating energy flows to critical services and customers.

North Atlantic Hurricanes have increased in intensity, frequency and duration since the 1980s.

Storm surges reach farther inland as they ride on top of sea levels that are higher due to warming.

Heavy snow falls during winter storms affect transportation systems and other infrastructure.
## Proving It – Case Studies of Gas System Resilience

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
<th>Description</th>
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</table>
| 2019 | Polar Vortex | In 2019, the Midwest experienced record-breaking cold temperatures, which led to an increased demand on the energy system to meet heating needs.  
- CenterPoint Energy curtailed gas service to interruptible customers and pulled gas from every possible storage resource to maintain service to homes and businesses. In total, CenterPoint delivered almost 50% more than a standard January day.  
- On January 30, 2019, Peoples Gas, North Shore Gas, and Nicor Gas together delivered gas in an amount equivalent to more than 3.5 times the amount of energy that ComEd, the electric utility serving an overlapping territory has ever delivered in a single day.  
- The Consumers Energy’s Ray Compressor Station fire on January 30 took a primary storage supply resource offline. Consumers leveraged several gas resilience characteristics (linepack, backup storage, and their highly networked system) to ensure that no critical, priority, or residential customers lost service. |
| 2014 | Polar Vortex | During early February 2014, a polar vortex brought extreme cold temperatures, snowfall, and high winds to Oregon. On February 6, during the system peak, Northwest Natural set a company record for natural gas sendouts, which still stands today, of 900,000 Dekatherms. Nearly 50% of this peak demand was met by natural gas storage capacity, including on-system liquified natural gas, off-system underground storage, and mobile compressed natural gas deliveries. In combination with diligent planning and dedicated employees, this case study highlights the critical role that natural gas storage, in all its forms, plays in meeting demand during extreme weather events. |
| 2020 | Hurricane Isaias | On August 4, 2020, Hurricane Isaias made landfall in North Carolina. It caused significant destruction as it moved north, triggering outages that affected more than 1 million New Jersey homes and businesses. Many customers experiencing electric outages turned on their natural gas backup generators, resulting in a massive increase in demand for New Jersey Natural Gas (NJNG). In 24 hours, NJNG experienced a 60% increase in daily demand on its system—the daily demand for this one day was higher than any other August day for the previous 10 years. Because of the built-in storage capacity (compressibility and on-system storage) and flexibility of the gas system, NJNG was able to ramp up service to customers with disrupted electricity supply. |
Gas System Contributions to Overall Energy System Resilience
Driven by changes in the cost and availability of new technologies and increasing political and social pressure to decarbonize, our energy system is undergoing a transformation. This transformation exposes an issue of energy system resilience related to the interaction of the gas and electric systems.

Key Takeaway

Interdependencies Between the Gas and Electric Systems
Key Takeaway

- The gas system was built to serve the relatively predictable load profiles of the residential, commercial, and industrial sectors.

- Predictable load profiles enabled LDCs to design, construct, and operate the gas system with a high degree of confidence in how the gas system would be used to serve demand.

- The load profiles of gas-fired power generation exhibit much higher variability and intraday swings. This is especially true for intermittent generation that serve as dispatchable resources for electric system operators (see examples 1 & 3 in the graph on right).

The Gas System is Designed to Serve Fairly Steady Demand

Variable demand of the power sector poses unique challenges

Example Gas System Load Profiles

Hourly Gas Consumption as Percent of Ratable Take Equivalent

- Average Res/Comm/Ind
- Power Example 1
- Power Example 2
- Power Example 3

Time of Day (Hourly)
KEY TAKEAWAY: Seasonal / long-term storage capacity, such as provided by the gas system, is critical to support the resilience of the energy system.

- In 2020, California experienced the hottest August on record, a severe drought, and its worst wildfire season in modern history, resulting in concurrent impacts:
  - Increased cooling loads = increased electric demand
  - Decrease in renewable output due to smoke from fires
  - Lower power inputs than expected

System operators turned to gas-fired generation to fill the gap between abnormally high electric demand and low renewable energy generation.

- All of SoCalGas' system storage assets were employed to fill the gap during the week of August 11.

- If the gas system was not able to fill the gap southern California would likely have experienced severe power outages

Gas storage provided 34% of the gas for power generation between 2pm and 9pm
Considerations for Future Resilience Planning
A New Framework is Needed to Appropriately Consider Resilience within the Regulatory Context

Key Takeaway

• The current model for maintaining the resilience of our energy system was built to support a legacy view of how the energy system operates.

• Ensuring future energy system resilience will require careful assessments of all available solutions, maximizing the fundamental benefits of a diversity of assets.

• Resilience needs to be considered as another dimension of energy system planning, like how reliability is considered today.

• Utilities, system operators, regulators, and policymakers need new frameworks to consider resilience impacts as part of the energy system transformation.

<table>
<thead>
<tr>
<th>Resilience Investments</th>
<th>Reliability Investments</th>
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<tbody>
<tr>
<td>Driven by increased threats from resilience events.</td>
<td>Driven by customer growth and need for system integrity.</td>
</tr>
<tr>
<td>Avoided Cost of Disruption</td>
<td>Cost Effectiveness</td>
</tr>
<tr>
<td>The value of resilience is measured by avoided repair costs, productivity losses, and negative human impacts.</td>
<td>The value of reliability is measured by cost per customer and/or cost per delivered unit of energy.</td>
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<tr>
<td>No Specific Regulatory Framework</td>
<td>Clear Obligation to Serve</td>
</tr>
<tr>
<td>LDCs are not often required to build resilience assets because societal value is often not recognized.</td>
<td>LDCs have contractual obligation to meet quantity and with the quality demanded by end-users.</td>
</tr>
<tr>
<td>Lack of Recovery Mechanisms</td>
<td>Existing Market Mechanisms</td>
</tr>
<tr>
<td>LDCs not often required to build resilience assets.</td>
<td>LDCs have long-term contracts for firm service deliveries.</td>
</tr>
<tr>
<td>Few Investments</td>
<td>Many Investments</td>
</tr>
<tr>
<td>Low utilization assets designed for low-frequency, high impact disruption events (i.e., extreme weather and cyber threats).</td>
<td>High utilization assets designed for high-frequency, low impact supply and demand fluctuations.</td>
</tr>
</tbody>
</table>
Implications for Policymakers and Regulators

- Energy system resilience needs to be defined as a measurable and observable set of metrics, similar to how reliability is considered.

- Resilience solutions must be considered from a fuel-neutral perspective and across utility jurisdictions, requiring electric, gas, and dual-fuel utilities to work together to determine optimal solutions.

- Methodologies need to be built for valuing resilience, such that it can be integrated into a standard cost-benefit analysis. Value must consider the avoided direct and indirect costs to the service provider, customers, and society.
QUESTIONS?