Utilizing Natural Gas Infrastructure for Reliable and Resilient Energy Supply

William Liss, Managing Director
Gas Technology Institute
Introduction: Natural Gas Energy Supply
Reliability as a Positioning Strategy

- Natural gas delivery systems are viewed as cost-effective, **safe**, and **reliable**
- Traditional and appropriate priority emphasis on safety
  - Will review example efforts
- **Can reliability have an elevated role** – internally and externally?
Safety: Excavation Encroachment Notification

- GPS/GIS-based system for monitoring the geographical positioning and operating status of heavy equipment (e.g., excavators, ag tillers, etc) near natural gas pipelines.
- In-cab system monitoring system that ties into GIS pipeline information. In-cab device has annunciator alerts vehicle operator of danger.
- Over 150 units in pre-commercial testing.
Safety: Damage Prevention from Vehicles & Other Outside Forces

- Engineered Meter Breakaway Device (OPW)
  - Positive gas shutoff in case of damage from vehicle, falling ice, etc
- Distribution Line Safety System (Lorax Systems)
  - Annular two-pipe system
  - Detect major failures (like an EFV) but also very small natural gas leaks
Safety: Risk Modeling and Management

- GTI developing series of topical risk models
- One example is a major program on life expectancy and slow crack growth prediction for vintage plastic pipe
- GTI risk modeling in other areas, including iron/steel pipe, gas storage, etc
Energy Delivery Reliability & Resilience

- Energy delivery system reliability and resilience gaining attention.
- Electric distribution utility service reliability often tracked (per IEEE methods), but natural gas service reliability not often available.
- Energy service reliability can be a useful internal tracking metric for continuous improvement – and congruent with safety focus.
- Service reliability can also be used for external for differentiation (e.g., when compared to electricity) and positioning.
  - Including new markets such as distributed generation and standby generators.
## Methods: Energy Delivery Reliability

### IEEE 1366 Electric Distribution Reliability Indices

<table>
<thead>
<tr>
<th>IEEE Reliability Metric</th>
<th>Determination</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System Average Interruption Duration Index (SAIDI)</strong></td>
<td>Total time all customers were without service / total number of customers</td>
</tr>
<tr>
<td><strong>System Average Interruption Frequency Index (SAIFI)</strong></td>
<td>Number of sustained customer service outages / total number customers</td>
</tr>
<tr>
<td><strong>Customer Average Interruption Duration Index (CAIDI)</strong></td>
<td>SAIDI / SAIFI</td>
</tr>
<tr>
<td><strong>Reliability (derived from SAIDI)</strong></td>
<td>1- (total customer outage hours/total customer hours)</td>
</tr>
</tbody>
</table>
Electric and Natural Gas Energy Distribution
Reliability Case Study

Example annual results for major California electric utility (SCE) and North American gas utility (over 15 billion customer hours/year)

- 6-Sigma System Availability
- 5-Sigma System Availability

Annual Outage Rates (per customer)

Electricity service outages over 300 times more likely than interruptions in natural gas service

Average = 1.00

Average = 0.0033
Natural Gas Distribution Generation

- Growing interest by residential, commercial, and industrial customers to use natural gas for distributed generation
  - Including standby and emergency generators
- Natural gas service reliability can provide advantages over liquid diesel fuel – coupled with lifecycle cost benefits

WWW.GENERAC.COM/INDUSTRIAL/ALL-ABOUT/NATURAL-GAS-FUEL/NATURAL-GAS-PERFORMANCE
Conclusions

• Natural gas energy delivery systems generally viewed as cost-effective, safe, and reliable – but reliability not often quantified
• Fusing together safety and reliability can be mutually reinforcing framework for pipeline planning and operations
• Reliability can support natural gas positioning and branding
  • Pursuing distributed generation business opportunities
  • Importance and value of natural gas service reliability can inform policy discussions pertaining to implications of electric fuel switching