OVERVIEW

- QER overview
- QER natural gas findings & recommendations
- DOE gas analysis and resources for states
An Unconventional Look at Energy Systems

- The United States has one of the most advanced energy systems in the world

- The energy transmission, storage, and distribution (TS&D) infrastructure is increasingly complex and interdependent

- It must handle demanding system requirements (e.g., 24/365, on-demand, highly-reliable energy)

- The longevity and high capital costs mean that TS&D infrastructure decisions today will affect the national energy system for decades to come
QER: SELECT NATURAL GAS SECTOR FINDINGS AND RECOMMENDATIONS
Importance of Gas Transmission Infrastructure

Wide differentials encouraged infrastructure investment

Divergence in NE suggests infrastructure constraints

Narrowing begs question: where will future investment come from?
GAS PIPELINE CAPACITY

Monthly Average Flows of Natural Gas into New England along the Algonquin Transmission Pipeline

Constraints in New England

Projected Pipeline Capacity Additions under Three Scenarios, 2015 - 2030

Nationally, needed yearly pipeline capacity expansion under two high-gas movement scenarios is commensurate with historical rates
Gas storage capacity increased dramatically between 2007 and 2012; is it leveling off?

Cumulative storage additions by volume since 2005

- **Depleted fields**
  - Initial value: 6700 Bcf (285% of demand in Dec 2005)
  - Final value: 7000 Bcf (240% of demand in Dec 2013)

- **Salt caverns**
  - Initial value: 250 Bcf (10% of demand in Dec 2005)
  - Final value: 650 Bcf (22% of demand in Dec 2013)
Steady Improvements in Pipeline Safety Requires Persistent Attention from Policy Makers

Total Incidents, Injuries, and Fatalities Associated with U.S. Natural Gas Pipelines (PHMSA, 2014)

- Most serious incidents involve distribution pipelines***
- Frequency of incidents is variable, but declining
- Excavation damage is the leading cause of serious incidents
- Other causes include corrosion, equipment failure, and incorrect operation

Federal Policy Efforts:
- In 2011, DOT issued a “Call to Action” on pipeline safety
- The Pipeline Safety, Regulatory Certainty, and Job Creation Act of 2011
- PHMSA is developing new safety rules, including a proposed transmission pipeline safety rule expected this year
- FERC has issued a policy statement allowing recovery for pipeline modernization expenditures

*** Note: most gathering pipelines are unregulated and not subject to PHMSA’s reporting requirements
GHG Emissions from Natural Gas Systems

Distribution systems accounted for 20% of methane emissions from the natural gas sector in 2012.

- Cast iron and uncoated steel pipes account for 30% of emissions from distribution systems.
- Leaks at city gate stations (from regulators and meters) account for roughly 40% of emissions from distribution systems.
- Replacement programs to date have contributed to an estimated 22 percent decline in methane emissions from distribution systems, from 1990 to 2012.

*Note: GHG emissions from end-use (not shown here) result in the large majority (80%) of GHG emissions from natural gas systems*

Data sources: EPA, 2014; EIA, 2014 (see QER for details)
Approximately 9% of distribution pipelines in the United States are leak-prone.

 Replacement costs nationally are estimated to be $270 billion.

 States with leak prone pipelines in need of replacement are from all regions of the country.

 At least a dozen utilities will require two decades or more to replace their leak-prone pipelines.

 39 states have trackers or surcharges to enable cost-recovery for pipeline replacement programs.

 Most state programs have cost caps or other limitations that slow the rates of investment.

### 10 states with the Most Leak-Prone Distribution Mains

<table>
<thead>
<tr>
<th>Rank</th>
<th>State</th>
<th>Leak Prone Iron Mains (mi)</th>
<th>Leak Prone Steel Mains (mi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PA</td>
<td>3,300</td>
<td>8,600</td>
</tr>
<tr>
<td>2</td>
<td>NY</td>
<td>4,200</td>
<td>7,500</td>
</tr>
<tr>
<td>3</td>
<td>OH</td>
<td>570</td>
<td>9,500</td>
</tr>
<tr>
<td>4</td>
<td>CA</td>
<td>29</td>
<td>8,200</td>
</tr>
<tr>
<td>5</td>
<td>NJ</td>
<td>4,900</td>
<td>2,200</td>
</tr>
<tr>
<td>6</td>
<td>MA</td>
<td>3,600</td>
<td>2,600</td>
</tr>
<tr>
<td>7</td>
<td>TX</td>
<td>820</td>
<td>5,000</td>
</tr>
<tr>
<td>8</td>
<td>MI</td>
<td>3,000</td>
<td>2,300</td>
</tr>
<tr>
<td>9</td>
<td>WV</td>
<td>13</td>
<td>3,000</td>
</tr>
<tr>
<td>10</td>
<td>AL</td>
<td>1,200</td>
<td>820</td>
</tr>
</tbody>
</table>

DATA SOURCE: PHMSA, 2014 (data collected for 2013)
$2.5 to 3.5 Billion competitive funding program to help LDC’s achieve the *dual goals of enhanced safety and lower emissions* through pipeline replacement, DI&M and other innovative approaches to improving the performance of natural gas distribution systems.

- Federal funding would provide rate-relief for low-income households to help leverage broader, accelerated investments in infrastructure modernization.
- To expedite projects and reduce costs, State governments would be encouraged to coordinate permitting processes between agencies.
- Goal is to support a “portfolio approach” to investments that are most cost-effective within each individual context. Quantifiable benefits could include a combination of gas conservation, avoided fatalities and injuries and reduced GHG emissions (accounting for Social Cost of Carbon).
Other Recommendations to Help Reduce Methane Emissions

- **Improve quantification of emissions from natural gas infrastructure.** $10 million requested in the FY 2016 Budget to help update Greenhouse Gas Inventory estimates of methane emissions from natural gas systems. DOE and EPA should undertake a coordinated approach.

- **Expand DOE research and development (R&D) programs** on cost-effective technologies to detect and reduce losses from natural gas TS&D systems. $15 million requested in the FY 2016 Budget for DOE’s midstream natural gas infrastructure program.

- **Demonstrate and Deploy continuous emissions monitoring equipment.** Continuous emissions monitoring can be a valuable component of leak detection and repair programs. DOE should provide the additional funding needed to ensure that the most successful MONITOR projects are field tested and deployed.
DOE’s Natural Gas Modernization Initiative

- ARPA-E announced funding for 11 new projects developing low-cost methane sensing for the oil and gas sector (December, 2014).
  - Formal kick-off event was held in Denver, May, 2015
  - Quarterly reviews begin in July, 2015
- FERC issued a Policy Statement on cost recovery for midstream natural gas infrastructure upgrades (April, 2015)
- DOE-NARUC partnership for technical assistance was just formally launched
  – (July 14, 2015 – NYC)
- DOE just launched the Natural Gas Modernization Clearinghouse website
- DOE is engaging with stakeholders to advance a DOE-wide RD&D strategy:
  - “Natural Gas Infrastructure R&D and Methane Emissions Mitigation Workshop” (November 12-13, 2014 – Pittsburgh PA)
- Stakeholder action is also key. We are following up with stakeholders who announced commitments to action at the Methane Roundtable Capstone. E.g.,
  - DOE receives regular briefings from EDF on methane measurement studies
  - Regular meetings with ONE Future and the Downstream Initiative
  - INGAA Board approved industry guidelines for directed inspection & maintenance programs (May 9, 2015)
Based on QER Findings and Recommendations, EPSA is launching six gas analysis projects

**Gas-Electricity Coordination Issues**
- Natural Gas Systems Operational Analysis
- Gas System Vulnerability Analysis
- Natural Gas Storage Analysis

**Gas Production**
- High-Reliability Organizational Principles for Gas Production

**Gas Markets**
- Ethane/NGL Disposition Study
- Monitoring and Assessment of U.S. LNG Exports, Regional Markets, and International Trade, including with Mexico (in conjunction with DOE Office of Fossil Energy)
**Interconnection Gas-Electric Interface Studies**

Each of the three interconnect studies examined the interdependency between electric and natural gas systems, identifying potential challenges.

**Key Questions**
- Will existing and planned natural gas infrastructure meet the needs of the electric industry?
- Will the natural gas system have adequate short-term operational flexibility to meet electric industry requirements?

**Process**
- Develop scenarios modeling future gas needs for electric and other end uses with high level of stakeholder involvement to project electricity demands and gas demands through 2023 (10 year horizon)
- Sensitivities modeled to factor in a variety of alternate conditions, *e.g.* LNG exports, increased coal retirements, higher degree of renewable deployment, etc.
- Contingencies modeling system response to adverse events (low probability, high impact events; extreme weather)

**Results**
- Determine areas where natural gas supply for power generation may be constrained
- Identify potential resiliency planning or mitigation strategies to prevent or minimize impacts of contingency events
Highlight Key Findings of Interconnection Studies

- Constraints were identified in several regions, for example:
  - Eastern Interconnection: ISO-NE, NYISO are likely to face constraints in the winter during times of peak demand
  - Western Interconnection: WECC-wide cold weather would cause constraints in CA and the Desert Southwest
  - ERCOT: widespread freezing and tropical cyclones represented the highest risk of curtailment

- Regional level coordination (improved communication and cooperative resource planning) between the gas and bulk electric system operators and regulators could prevent short-term curtailments and long-term constraints.

- Adjustments to contracting structure and nomination cycles could help alleviate curtailments.
FOR MORE INFORMATION

**Eastern Interconnection (PJM, MISO, NYISO, ISO-NE, TVA, IESO)**

Eastern Interconnection Planning Collaborative (EIPC)

Eastern Interconnection States Planning Council (EISPC) and National Association of Regulatory Utility Commissioners

**Western Interconnection**

Western Interstate Energy Board (WIEB) and State-Provincial Steering Committee (SPSC)
- http://westernenergyboard.org/natural-gas/study

**ERCOT**

Texas Clean Energy Coalition
DOE TECHNICAL ASSISTANCE PORTAL

http://energy.gov/technicalassistance

• Provides access to DOE’s existing technical assistance offerings on one page
• Requests for technical assistance can still be submitted directly through the programs
• Suggests additional resources within and outside of DOE, including TA related to greenhouse gas emissions reductions
• Responds to Secretary Moniz’s call to “up the game” with states, localities and tribes
• Each program office is represented on the TA team, which meets regularly
• Cross-cutting requests for technical assistance are handled through coordination across the TA team
QUESTIONS?

Lara Pierpoint (Natural Gas Analysis)
Lara.pierpoint@hq.doe.gov

James Bradbury (Climate/Methane Analysis)
James.Bradbury@hq.doe.gov

Office of Energy Policy and Systems Analysis
U.S. Department of Energy

http://www.energy.gov/qer
40% of methane emissions from distribution systems are from leaks at meters and regulators at city gate stations.

Directed inspection and maintenance (DI&M) programs can reduce survey costs and enhance profitable leak repair (Targeting problem stations and components saves time and money by prioritizing equipment to focus on with future surveys)

Quarterly leak detection and repair, could reduce emissions from city gate stations by 60%.

Recent study confirmed that facility upgrades substantially reduce these leaks.

In general: new technologies and approaches to using methane sensing technologies can help prioritize investment, yielding improved safety and greater emission reductions
The National Transportation Safety Board found in 2015 that many types of basic data necessary for comprehensive probabilistic risk modeling of natural gas pipelines are not currently available.

The Board’s recommendations included the development of better-quality spatial data on pipelines that can be more easily accessed by regulators and operators.

QER Recommendation

Improve environmental data collection, analysis, and coordination:

- DOE should work with other Federal agencies to improve data and analysis on the environmental characteristics and impacts of TS&D infrastructures. This work should be designed to fill the host of data gaps on environment, safety, and public health issues with respect to TS&D infrastructure.
Curbing emissions of methane is critical to our overall effort to address global climate change. … To achieve additional progress, the Administration will:

- Develop a comprehensive Interagency Methane Strategy (completed March 2014)
- Take a collaborative approach with state governments and the private sector to cover all methane emitting sectors
- UPDATE: Set a 2025 target for the O&G sector to reduce methane emissions by 40 to 45% below 2012 levels, plus additional actions (January 2015)

Three Pillars

<table>
<thead>
<tr>
<th>Assessing current emissions data and addressing data gaps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifying Technologies and Best Practices for Reducing Emissions</td>
</tr>
<tr>
<td>Identifying Existing Authorities and Incentive-based Opportunities for Reducing Emissions</td>
</tr>
</tbody>
</table>
Secretary’s Methane Stakeholder Roundtables

Convened broad range of stakeholders, discussing opportunities to *modernize natural gas infrastructure & reduce mid- and downstream methane emissions*

Key lessons learned:

- *There is broad stakeholder support for taking action*
- *The drivers for action vary by stakeholder group*
  - Improve safety
  - Conserve energy and save money
  - promote efficiency
  - protect the climate
  - create jobs

A capstone roundtable took place at the White House on July 29, 2014. Afterward, Secretary of Energy Ernest Moniz announced several new initiatives as DOE’s part of the larger Administration Strategy to Reduce Methane Emissions.