National Fuel Gas – Fully Integrated Business Model

Upstream – Seneca Resources
- ~ 0.6 Billion cubic feet gas per day
- > 9,200 Barrels of oil equivalent per day

Midstream – 3 companies
- NFG Midstream, Supply, Empire Pipeline
- ~2,600 miles of pipeline
- 31 Gas storage fields

Downstream Business
- 742,000 customers
- 1.7 million people
Natural Gas Pipeline Infrastructure

Legend
- Interstate Pipelines
- Intrastate Pipelines

Source:
Energy Information Administration, Office of Oil & Gas, Natural Gas Division, Gas Transportation Information System
Role of Natural Gas Storage

• 20% of Seasonal Gas Supply

• Physical Reliability for Natural Gas Customers

• Providing Supply Flexibility and Ensuring Pipeline Grid Integrity during Winter and Summer seasons

• Serving Market for Growing Peak-Day Demand and Production Increases

• Hedging Mechanism within Utility Supply Portfolio
Peaking Role of Natural Gas Storage

• Up to 70% Gas On Peak Days From Storage
Role of Natural Gas in Electricity Generation

Annual share of U.S. electricity generation by energy source

Source: U.S. Energy Information Administration, Short-Term Energy Outlook
US Storage Operator Statistics

- 415 Gas Storage Facilities
  - 330 depleted fields
  - 46 aquifers
  - 39 salt caverns

- 17,500 Wells (estimated)

- 4,800 Bcf Working Gas Capacity

- 4,433 Bcf Base Gas

*sources: 2016 PHMSA OpID/EIA 191 & 2016 AGA Storage Statistics*
Natural Gas Storage 101

- Depleted Fields
- Salt Caverns
- Aquifers

Source: Modified from AGA
Impermeable rock formations surrounding the reservoir provide barriers for reservoir integrity.

Porous & Permeable “Reservoir” Rock
Rock Properties – Gas Stored in Pore Spaces

Scanning Electron Photomicrograph

Pore Spaces

Sidewall Core

Magnification 151 X
Present Day Example – Potential Stratigraphic Traps
Casings, cement, wellhead seals, master valve, and impermeable rock formations provide multiple barriers for wellbore integrity.
Safety Focus

▪ Protect Public, Personnel & Environment

▪ Contain Gas
  • Pipeline and Surface Systems
  • Wellbore
  • Reservoir

▪ Federal Regulation
  • US Department of Transportation (DOT)
  • Pipeline and Hazardous Materials Safety Administration (PHMSA)
  • Federal Energy Regulatory Commission (FERC)
Recent Gas Storage Regulatory Chronology

- April 2010 – CIG v Wright
- August 2011 – Storage safety in Pipeline Safety Mega NOPR
- March 2012 – API Recommended Practice (RP) development
- September 2015 – API RP1171 published
- October 2015 – Aliso Canyon failure
- January & February 2016 – JITF formed & PHMSA Advisory issued
- PHMSA Interim Final Rule Issued December 19, 2016 (IFR)
API Recommended Practice Development

- **RP1170** – Salt Caverns
- **RP1171** – Depleted Reservoirs and Aquifers
- Referenced by PHMSA Storage IFR

**Development Team Stakeholder Representation**
- FERC
- PHMSA
- State Oil & Gas Regulators
- Industry
- Consultants

**Review Group – Increased Scope of Stakeholders**

**Every Comment Addressed Prior To Voting and Publication**
API Recommended Practice 1171

▪ Team Studied Past Events

▪ Reviewed European and Canadian Standards

▪ Key Parameters Addressed
  • Risk Management
  • Storage Well and Reservoir Design
  • Storage Well Construction
  • Reservoir Integrity
  • Integrity in Ongoing Operations
  • Site Security
  • Emergency Preparedness
  • Training & Documentation
Risk Assessment Basis

▪ Identification of Site Specific Threats

▪ Establish Mitigative Measures and Monitoring

▪ Life Cycle Approach

▪ Continuous Improvement Process
Joint Industry Task Force (JITF)

• AGA, INGAA, API
• 15 operators
• Developed 3 communication pieces providing general background information on underground storage of natural gas: https://www.aga.org/factsheets/natural-gas-storage