EPA’s Natural Gas STAR Program
Overview

Production Technology Transfer Workshop
September 24, 2013
Philadelphia, PA
Why Methane?

- **Potent greenhouse gas**
  - 100 year GWP = 21
  - Lifetime = 12 years
  - Most important short-lived forcer—based on emissions, accounts for >1/3 of current anthropogenic forcing

- **Ozone precursor**
  - Affects ground-level ozone levels

- **Clean energy source** — primary component of natural gas

- **Many emission sources**
  - Oil & gas, agriculture & waste sectors
  - 50 - 70% of which are anthropogenic

- **Concentration of methane in the atmosphere has increased by 150% in the last 260 years**
2011 U.S. Human-Made Methane Emissions

- Petroleum and Natural Gas Systems: 436
- Enteric Fermentation: 340
- Landfills: 255
- Coal Mining: 155
- Manure Management: 130
- Other: 200
Production Sector Emissions

Production Sector Emissions 2011
Total Emissions 210.3 Bcf

- Completions/Workovers
- Pneumatic Device Vents
- Glycol and Chemical Pumps
- Gas Engines
- Compressors
- Liquids Unloading
- Tanks (condensate and oil)
- offshore (gross)
- Other Production
Sources of Methane Emissions from Oil and Gas Operations

Oil Production 59%
- Venting of casinghead gas
- Flash emissions from crude oil storage tanks

Natural Gas Production & Processing
- Well completions, blowdowns and workovers
- Reciprocating compressor rod packing
- Venting from glycol reboilers on dehydrators
- Processing plant leaks
- Gas-driven pneumatic devices

Gas Transmission 25%
- Venting of gas for maintenance or repair of pipelines or compressors
- Leaks from pipelines, compressor stations
- Centrifugal compressor seal oil de-gassing

Gas Distribution 16%
- Leaks from mains and service lines
- Leaks at metering and regulating stations
- Pipeline blowdowns

Picture courtesy of American Gas Association
Red Numbers are Emissions from Each Sector in U.S.
Methane Projects Deliver Significant Co-Benefits

- **New Sources of Clean Energy**
  - Emission capture makes methane available for local energy generation

- **Air Quality Improvement**
  - Decrease in ground-level ozone
  - Reduction of local emissions of VOCs and HAPs

- **Industrial Safety**
  - Methane is explosive – improved worker safety
Natural Gas STAR Program

- Started in U.S. in 1993 to increase awareness of methane emission sources and share innovative means of reducing them
  - Expanded internationally in 2006 as part of GMI

- Over 120 domestic and international partners have
  - Identified over 50 cost-effective technologies and practices to reduce methane emissions
  - Reduced methane emissions by nearly 1 trillion cubic feet (Tcf), saving more U.S. $3 billion
Natural Gas STAR Resources

- **Resources to advance cost-effective oil & gas sector methane emission reductions:**
  - General technology transfer, training, and capacity building

- **Technical documents and research** outlining over 50 mitigation options, including analyses of economic, environmental and operational benefits

- **Workshops and Conferences**

- **Individual assistance** to identify and assess project opportunities
  - Estimated methane emission inventories
  - Measurement studies
  - Mitigation project feasibility studies

- **Services and resources provided free of charge and at no obligation**
Over 50 Cost-Effective Methane Reduction Opportunities

- Low implementation costs
  - 50% cost <$5,000 to implement
  - 25% <$1,000 to implement

- Quick payback times ($3/Mcf)
  - 50% pay back in <1 year
  - 67% pay back in <2 years

- Low cost per Mcf or tCO2e reduced
  - 70% cost <$3 per Mcf reduced
  - 70% cost <$10 per tCO2e reduced

Screenshot from EPA Gas STAR website
Strategy for Addressing Methane Emissions

Develop Emissions BASELINE
- Develop source- and process-specific methane inventory.
- Use emission factors, engineering calculations, software tools, direct measurement.

Evaluate Best REDUCTION OPPORTUNITIES
- Prioritize largest sources and most cost-effective reduction projects.
- Conduct measurement studies and detailed analyses to confirm volumes and scope reduction projects.

IMPLEMENT Reduction PROJECTS
- Implement top reduction projects.
- Pilot projects or company-wide.
- Document and share lessons learned.

Document and SHARE SUCCESSES
- Quantify operational, economic, and environmental results.
- Publicize results to stakeholders.
Industry Experience – Well Unloading

Well Venting Reduction Using Plunger Lifts and Smart Automation

Daily Vent Volumes

Vent Rate (Mscfd)

0 2,000 4,000 6,000 8,000 10,000 12,000

2001 2002 2003 2004 2005 2006 2007

Natural Gas

bp

Global Methane Initiative
Industry Experience – Pneumatics

- Chesapeake retrofitted controllers with Mizer low bleed components
- Total 2,670 retrofits done through March 31, 2009
  - Cost: U.S.$1,447,140
  - Methane Reductions: **18 million m³**
  - **7 month simple payback** reported using Chesapeake’s gas value of ~$3.50/MMBtu

Fisher 2500, 2506
Retrofit w/ Mizer, bracket, tubing & relay plug

Cemco/WellMark 6900
Retrofit w/ Mizer Valve
## Industry Experience – Pneumatics

<table>
<thead>
<tr>
<th>U.S. District</th>
<th>Retrofits Done Thru 31-Mar-09</th>
<th>Daily Reduction (thousand m³)</th>
<th>Annual Reduction (million m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anadarko</td>
<td>1,264</td>
<td>25.1</td>
<td>9.2</td>
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<tr>
<td>Arkansas</td>
<td>100</td>
<td>2.0</td>
<td>0.7</td>
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<td>North Mid-Continent</td>
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<td>2.8</td>
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<td>Southern Oklahoma</td>
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<tr>
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<td>0.9</td>
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<td>Gulf Coast</td>
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<td>3.2</td>
<td>1.2</td>
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<tr>
<td>Louisiana</td>
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<td>0.3</td>
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<tr>
<td>North Permian</td>
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<tr>
<td>South Permian</td>
<td>149</td>
<td>2.9</td>
<td>0.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,670</strong></td>
<td><strong>52.9</strong></td>
<td><strong>18.4</strong></td>
</tr>
</tbody>
</table>

*Using $3.50/MMBtu, the simple payback is 7 months.*
Industry Experience – VRUs

- Payback economics – project for 9 tank batteries
  - Purchase price for 9 VRUs: U.S.$475,000
  - Estimate install cost: U.S.$237,500
  - Total capital costs: U.S.$712,500

- Approximate Gas Revenue
  - 29.7 Mcm/day x $100/Mcm* x 30 days = U.S.$89,100/month
  - Payback on capital investment < 8 months
  - Installed in 2005 & early 2006 – all locations continue to generate incremental revenue and meet environmental compliance goals today

*U.S.$100/Mcm ≈ U.S.$3/Mcf
SAVE THE DATE!

Natural Gas STAR
Annual Implementation Workshop
October 28-30, 2013
Grand Hyatt San Antonio
San Antonio, TX

Learn more at:
www.epa.gov/gasstar/workshops/annualimplementation/2013.html
Contact

Roger Fernandez
fernandez.roger@epa.gov
202-343-9386
epa.gov/gasstar