Natural Gas STAR Program

Overview and Accomplishments

Producers and Processors Technology Transfer Workshop
Billings, MT
August 31, 2009

Outline

♦ Background

♦ Natural Gas STAR Program Overview & Highlights

♦ Program Resources and Tools
Oil and natural gas systems are the second largest man-made source of methane emissions in the U.S. (23%)
U.S. Natural Gas Industry GHG Emissions: 20 year Global Warming Potential Basis

- Methane emissions comprise 72% of total U.S. Natural Gas industry GHG emissions

![Pie chart showing CO₂ and CH₄ emissions]

N₂O Emissions are negligible

Background: U.S. Oil and Gas Methane Emissions by Sector

- 2007 U.S. methane emissions from oil and natural gas industry:
  - 331 Bcf (2% of total U.S. greenhouse gas emissions)

![Pie chart showing emissions by sector]

Note: Natural Gas STAR reductions from gathering and boosting operations are reflected in the production sector.
Oil and Gas Industry Methane Emissions: U.S. & International

- U.S. contributes 11% of worldwide methane emissions from oil and natural gas systems

![Graph showing methane emissions from various sources worldwide, with the U.S. contributing 2,834 Bcf.](image)


Background: U.S. Production Sector Methane Emissions

- Storage Tank Venting: 5 Bcf
- Well Venting and Flaring: 7 Bcf
- Other Sources: 7 Bcf
- Offshore Operations: 29 Bcf
- Pneumatic Devices: 43 Bcf
- Meters and Pipeline Leaks: 8 Bcf
- Compressor Fugitives, Venting, and Engine Exhaust: 12 Bcf
- Dehydrators and Pumps: 12 Bcf

Note: Natural Gas STAR reductions from gathering and boosting operations are reflected in the production sector.*
Background: U.S. Gathering and Processing Sector Methane Emissions

Note: Natural Gas STAR reductions from gathering and boosting operations are reflected in the production sector.

Why Focus on Methane?

- A potent greenhouse gas (GHG) with 100-year global warming potential of 25; atmospheric lifetime of ~12 years
- The 2nd most important GHG accounting for ~18% of total climate forcing
- A primary component of natural gas and a valuable, clean-burning energy source
  - Proven, viable technologies and practices exist to reduce methane emissions cost-effectively
- Oil and natural gas operations are a significant source of total U.S. (23%) and global (18%) human-made methane emissions.
U.S. Oil & Natural Gas Opportunities: Why Gas STAR?

- **331 Bcf of methane emissions per year amounts to:**
  - $2.32B worth of gas lost (at $7/Mcf)
  - CO₂ emissions from the electricity use of 17.7 million homes for one year
  - Annual greenhouse gas emissions from 24.5 million passenger vehicles

- **U.S. oil and natural gas industry has an opportunity to cost-effectively reduce methane emissions resulting in:**
  - Increased operational efficiency
  - Increased profits
  - Increased domestic natural gas supply
  - Improved safety
  - Improved environmental performance
  - Better public relations

Overview & Program Highlights
Natural Gas STAR Program

The Natural Gas STAR Program is a flexible, voluntary partnership between EPA and the oil and natural gas industry designed to cost-effectively reduce methane emissions from natural gas operations.

- Over 130 Program Partners across four sectors
  - 10 International Partners
  - 20 Endorser Associations

For a complete listing of Natural Gas STAR partner companies and industry association endorsers, visit epa.gov/gasstar/partners/index.html

Accomplishments

- Through participation in the Natural Gas STAR Program, partners reduced methane emissions by 92.5 Bcf in 2007
- 677 Bcf in cumulative reductions since 1993

Domestic Natural Gas STAR Methane Emission Reductions as of 2007
Natural Gas STAR International launched September 26, 2006 now has 12 partners

Comgas
ConocoPhillips Canada Ltd.
Devon Energy Corporation
Empresa Nacional del Petroleo (ENAP)
ENAP Sipetrol S.A.
Enbridge
ExxonMobil Corporation
GAZ-SYSTEM S.A.
Marathon Oil Corporation
Occidental Oil and Gas Corporation
Oil and Natural Gas Corporation Ltd. (ONGC)
TransCanada

Program Resources and Tools
Natural Gas STAR Key Components

- Guidance on new technologies and practices
  - Technical documents on more than 80 cost-effective technologies and practices
  - Free Technology Transfer workshops
  - One-on-one technical assistance to identify and prioritize cost-effective methane emission reduction opportunities

- Annual record of partner voluntary actions and methane savings

What is Cost Effective?

The simple payback is the number of years it takes to pay back the capital cost of a project (based on $3/Mcf)

- Payback within 10 years 87%
- Payback within 3 years 77%
- Payback within 12 months 47%
- Immediate payback 1%

Percentage of over 80 Gas STAR Recommended Technologies and practices at each payback level
Cost-Effective Methane Mitigation Opportunities

Oil Production
- Route casinghead gas to VRU or compressor for Recovery & Use or Sale
- Install VRUs on crude oil storage tanks

Gas Transmission
- Use pipeline pumpdown
- Composite Wrap for Non-Leaking Pipeline Defects
- Identify, measure & fix leaks in pipelines & metering and regulating stations

Natural Gas Production & Processing
- Reduced emission well completions
- Economic replacement of reciprocating compressor rod packing
- Install flash tank separators on dehydrators
- Identify, measure & fix leaks in processing plants
- Re-route gas to fuel system or sales line or flare

Gas Distribution
- Inject blowdown gas into low pressure mains
- Inject blowdown gas into low pressure mains
- Identify, measure & fix leaks in pipelines & metering and regulating stations

Emission Reduction Quantification Guidance

Guidance for quantifying methane emission reductions from recommended technologies and practices

Natural Gas STAR Recommended Technologies and Practices - Quantification Methods

http://www.epa.gov/gasstar/docs/quantifying_ngs_methane_reductions.xls
Natural Gas STAR “Partner Challenge”

- EPA offers one-on-one technical assistance to partners in identifying and prioritizing cost-effective methane emission reduction opportunities
- Uses customized data
- Quantifies partners’ methane emissions and identifies corresponding emission reduction opportunities
- Details economic and operational benefits of reduction technologies & practices

http://www.epa.gov/gasstar/tools/partner-challenge.html

2009 Technology Transfer Workshops

Production and Processing
Billings, MT
Aug 31, 2009

Production
Oklahoma City, OK
May 14, 2009

Annual Implementation Workshop
San Antonio, TX
Oct 19 to 21, 2009

Oil and Gas Subcommittee Meeting
Lake Louise, Alberta, Canada
Sept 14 to 17, 2009

For more information, visit www.epa.gov/gasstar/workshops

Comparison of Estimated Methane Emissions Before and After Project Implementation

Methane Emissions Source
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www.epa.gov/gasstar