

EPA Natural Gas STAR Program Overview and Best Management Practices for Transmission and Distribution Companies



SGA Environmental Round Table
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Agenda

🔥 Natural Gas STAR Program Overview

- 🔥 Background
- 🔥 Program Overview and Highlights
- 🔥 Program Resources and Tools
- 🔥 Brief Update on EPA Greenhouse Gas Reporting Rulemaking

🔥 Best Management Practices for Transmission and Distribution Companies



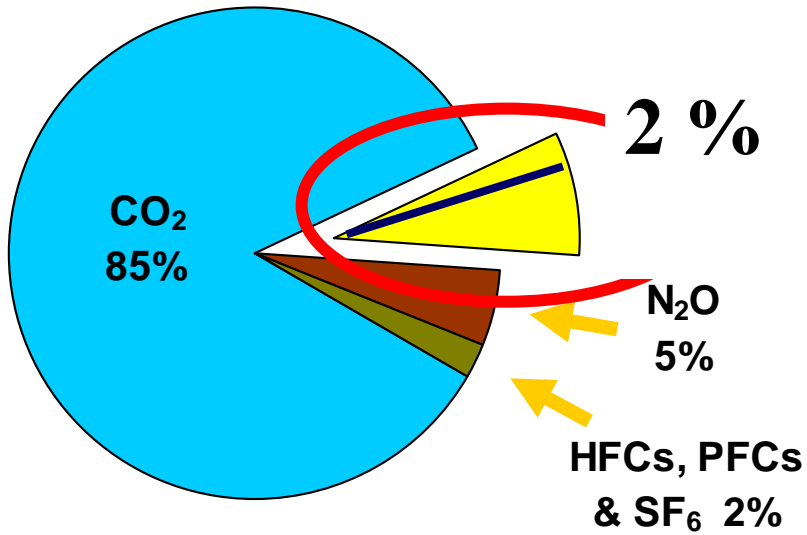
Background





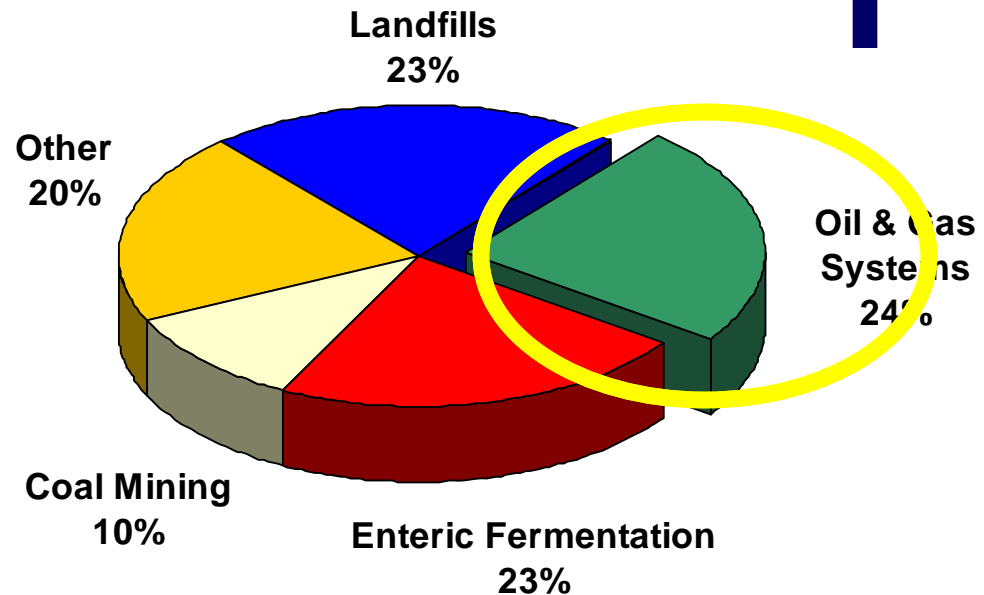
Current U.S. Greenhouse Gas Emissions Estimates

U.S. Greenhouse Gas Emissions All Sources



Methane emissions from Oil and gas systems make up 2% of total U.S. greenhouse gas emissions

U.S. Methane Emissions by Sector

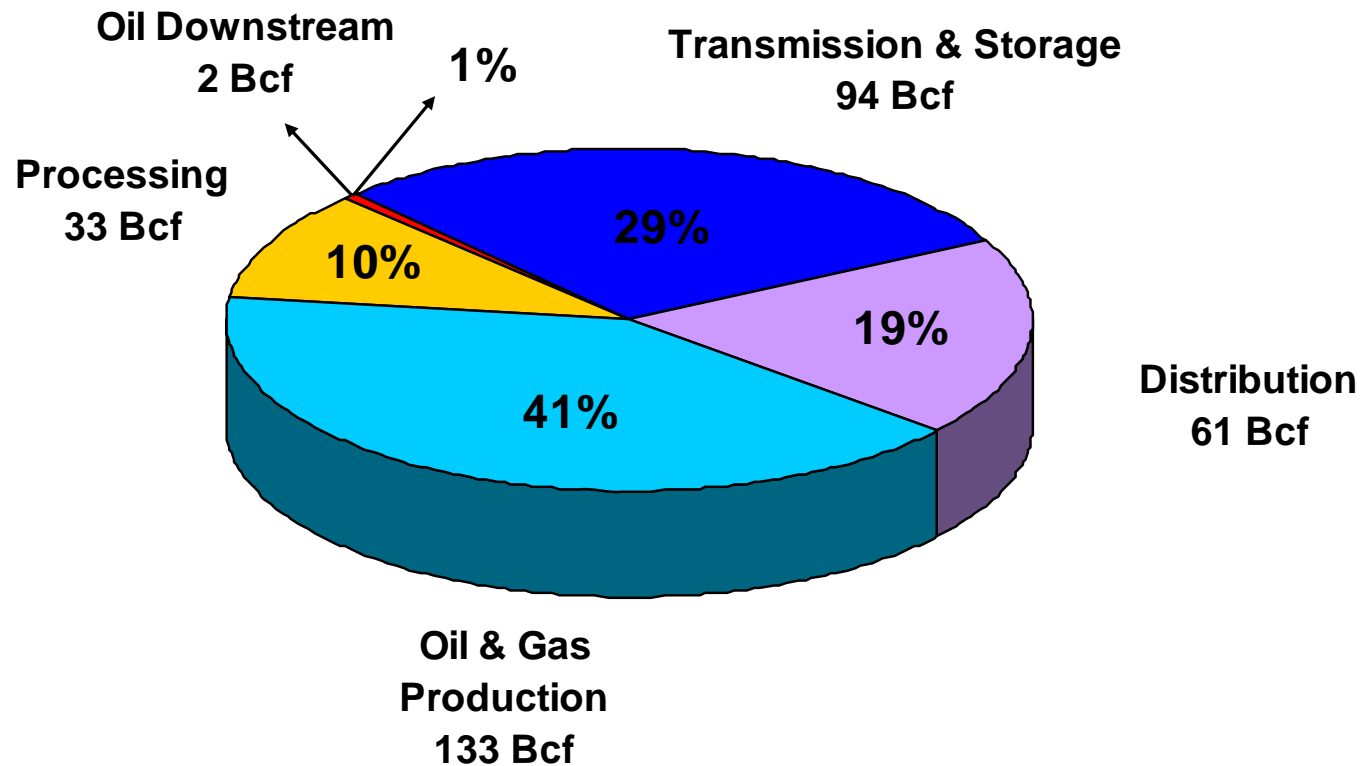


Oil and gas systems are the **largest** man-made source of methane emissions (**24%**)



U.S. Oil and Gas Methane Emissions Breakdown by Sector

2006 U.S. methane emissions from oil and natural gas industry: 323 Bcf (2% of total U.S. greenhouse gas emissions)

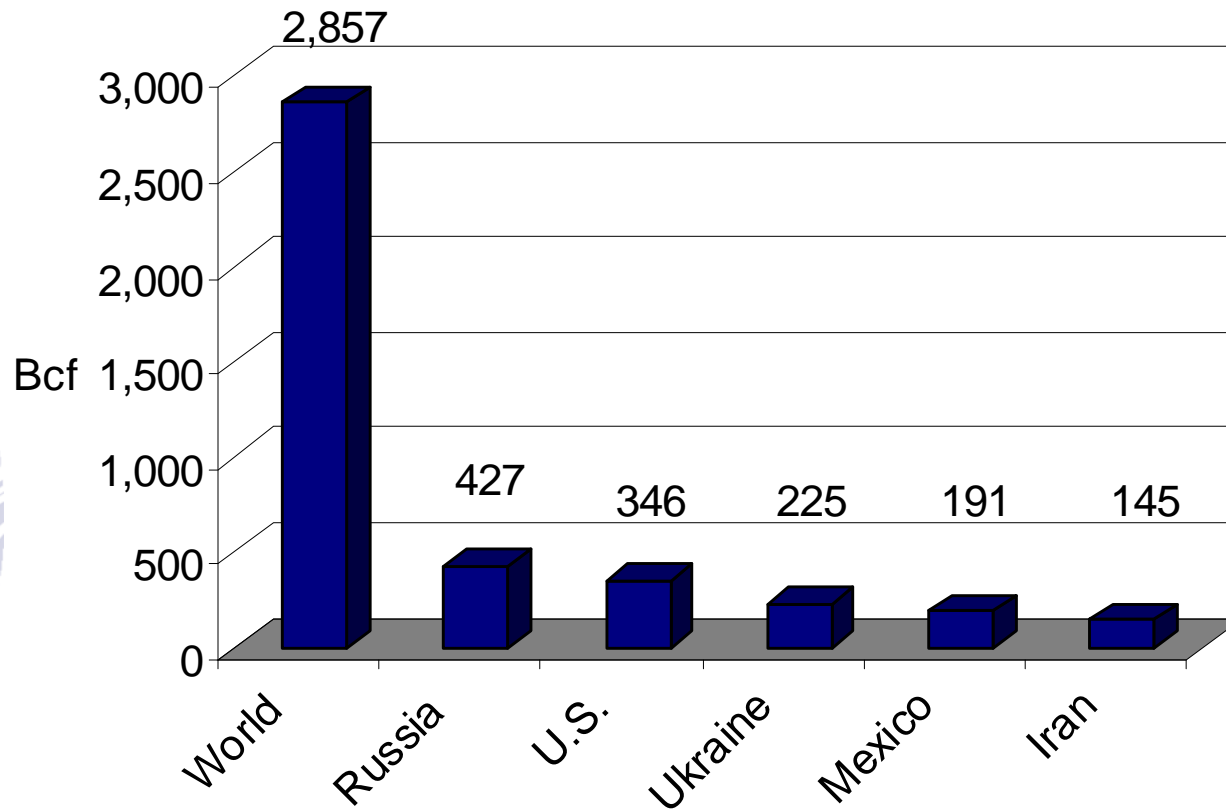


Source: EPA. *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990 – 2006*. April, 2008.
Note: Natural Gas STAR reductions from gathering and boosting operations are reflected in the production sector.



Oil and Gas Industry Methane Emissions: U.S. & International

U.S. contributes 12% of worldwide methane emissions from oil and gas systems



Source: Global Anthropogenic Non-CO₂ Greenhouse Gas Emissions: 1990 – 2020, USEPA, June 2006



U.S. Oil & Natural Gas Opportunities: Why Gas STAR?

- ❖ **323 Bcf of methane emissions per year amounts to:**
 - ❖ \$2.26B worth of gas lost (at \$7/Mcf)
 - ❖ CO₂ emissions from the electricity use of 17.3 million homes for one year
 - ❖ Annual greenhouse gas emissions from 23.9 million passenger vehicles

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





Overview & Natural Gas STAR 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 120 Program Partners across four sectors

- 🔥 Eight International Partners
- 🔥 19 Endorser Associations

Complete partner listing- www.epa.gov/gasstar/partner.htm



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 Gas STAR Recommended Technologies and practices (over 80 total) at each payback level

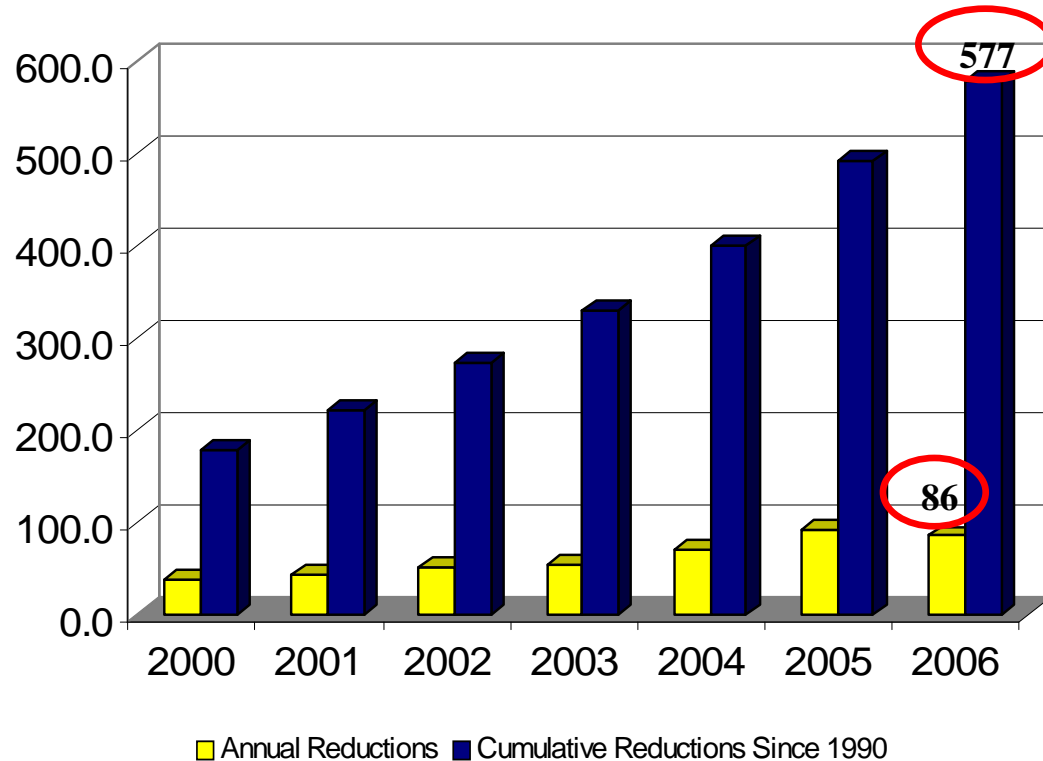
Depends on company specific circumstances.



2006 Another Successful Year for Methane Emission Reductions

Gas STAR Partners reduced methane emissions by 86 Bcf in 2006

577 Bcf in cumulative reductions since 1990





Participation Matters

In a time of heightened interest in greenhouse gases such as methane, the Natural Gas STAR Program only works if our Partners participate. Participation means:

- 🔥 **Don't just check the box:** expand on your existing and future efforts to identify and implement new ways to reduce gas losses, save money, and make an impact on the environment
- 🔥 **Implement robust methods for quantifying leaks and vented emissions:** this will only increase in importance over time
- 🔥 **Report successes to Gas STAR:** which is currently the main knowledge base for the industry's efforts to reduce methane emissions



How Do Companies Participate?

🔥 **Joining Natural Gas STAR involves:**

- 🔥 Signing a voluntary one page Memorandum of Understanding;
- 🔥 Evaluating and implementing current and future voluntary activities that reduce methane emissions;
- 🔥 Submit an Implementation Plan within one year of joining and report activities to EPA on an annual basis.

🔥 **Benefits include:**

- 🔥 Partner companies are automatically eligible for all of the services Natural Gas STAR has available
- 🔥 Build a strong network with and learn from direct experience of others in the industry.
- 🔥 Flexible participation and reporting formats; companies can participate at the level they choose, evaluating company-wide, site-specific or pilot projects.



Natural Gas STAR International

Under the Methane to Markets (M2M) International Initiative, EPA expanded Natural Gas STAR Internationally

- 🔥 Builds on success of the domestic Natural Gas STAR Program.
- 🔥 Creates a framework for global application of the Program's principals.
- 🔥 Increases opportunities to reduce methane emissions from oil and gas operations worldwide.
- 🔥 EPA is encouraging existing partners to engage their international operations to voluntarily reduce methane emissions



James Connaughton, Chairman, White House Council on Environmental Quality speaking before the signing ceremony for the seven Natural Gas STAR International charter members



Natural Gas STAR International

🔥 Natural Gas STAR International launched September 26, 2006 now has eight partners


ConocoPhillips

devon




ENBRIDGE™

ExxonMobil


**Marathon
Oil Company**




TransCanada
In business to deliver



Natural Gas STAR Program Resources and Tools





Natural Gas STAR Resources

- ❖ **Guidance on new technologies & practices**
 - ❖ Technical documents on over 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**

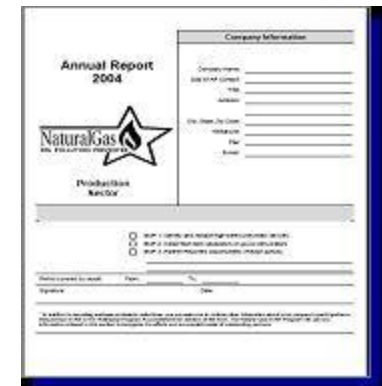


Technical Information



Project Demonstrations

Workshops

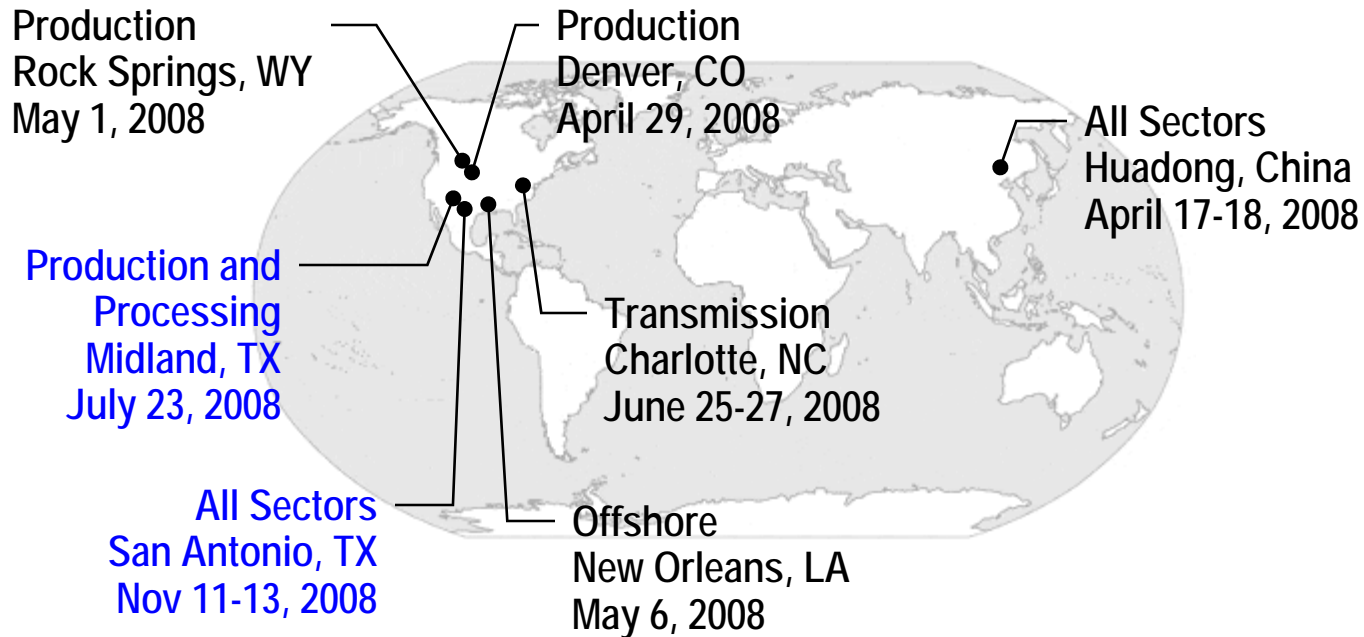


Annual Reports



2008 Technology Transfer Workshops

🔥 Natural Gas STAR will host, with partner organizations, the following Technology Transfer workshops in 2008



🔥 **Upcoming Distribution Technology Transfer Webcast, July 16, 2008**

For more information, visit <http://www.epa.gov/gasstar/workshops.htm>



Emission Reduction Calculation Guidance

Guidance for quantifying methane emission reductions from recommended technologies and practices

http://www.epa.gov/gasstar/docs/quantifying_ngs_methane_reductions.xls - Microsoft Internet Explorer

http://www.epa.gov/gasstar/docs/quantifying_ngs_methane_reductions.xls

| Technology/Practice Sector(s) | Quantification Method 1 | Quantification Method 2 |
|---|--|--|
| Composite wrap for non-leaking pipeline defects Processing Transmission Distribution | <p><u>Engineering Calculation</u></p> <p>Installing composite wrap opposed to replacing pipelines with defects saves the methane that would otherwise be vented to the atmosphere during replacement.</p> <p>Calculate emissions reductions by summing over all pipeline diameters and pressures: $ER = \sum \{ (D^2 \cdot P \cdot [L/1,000] \cdot 0.372) / 1,000 \} \cdot XCH4$</p> <p>Where, ER = Emissions Reductions (Mcf/year) D = Inside diameter of pipeline (inches) L = Length of pipeline between shutoff valves (feet) P = Pipeline pressure (psia for less than 50psi, psig for more than 50psi) XCH4 = Mole fraction of methane in the gas (decimal) - default is 0.87 (Processing), 0.934 (Transmission/Distribution)</p> <p><u>References:</u> Composite Wrap for Non-Leaking Pipeline Defects Lessons Learned http://www.epa.gov/gasstar/pdf/lessons/ll_compwrap.pdf</p> | <p><u>Emissions Factor</u></p> <p>The volume of methane emissions saved by composite wrap is very sensitive of the operation - pipeline length, pipeline diameter, and system pressure. I know it is suggested to use the engineering calculation for better accuracy report composite wrap can save 3,960 Mcf/installment.</p> <p>Calculate emissions reductions using the following equation: $ER = AF \cdot 3,960 \text{ Mcf/installment}$</p> <p>Where, ER = Emissions Reductions (Mcf/year) AF = Activity Factor (number of installments/year) (EF assumed repair of a 6" defect on a 24" diameter pipeline at 350psig with shutoff valves.)</p> <p><u>References:</u> Composite Wrap for Non-Leaking Pipeline Defects Lessons Learned http://www.epa.gov/gasstar/pdf/lessons/ll_compwrap.pdf</p> |
| Identify and | <u>Engineering Calculation</u> | <u>Emissions Factor</u> |

Introduction / Compressors / Dehydrators / Other / **Pipelines** / Pneumatics-Controls / Tanks / Valves / We



Post-Reporting Feedback to Partners

2005 Reporting Summary & Benchmarking Report

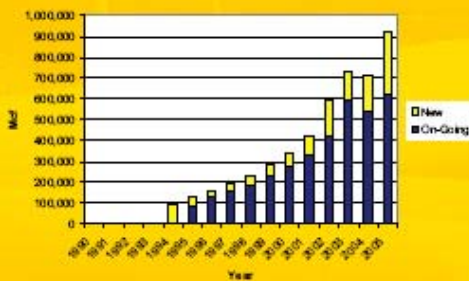
Report Summary

Joined Natural Gas STAR

Annual

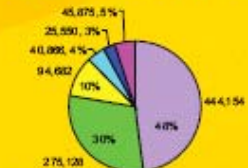
2005 Annual methane emissions reductions

Since joining the Natural Gas STAR Program in 2001, [redacted] has achieved cumulative emission reductions of [redacted].



To achieve these reductions, [redacted] employed the following Natural Gas STAR methane emission reduction technologies and practices:

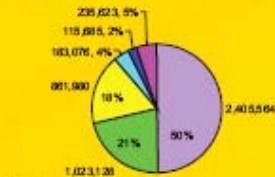
2005 Reductions:



- Eliminate unnecessary equipment or systems
- Reduce gas pipeline leaks
- Replace gas pipeline pumps with electric pumps
- Other

* Other includes: Use IR camera/optical imaging for leak detection, Replace gas pipeline pumps with electric pumps, Replace gas pipeline valves with electric valves, Use inert gases and pigs to perform pipeline purges.

Cumulative Reductions:



- Eliminate unnecessary equipment or systems
- Reduce gas pipeline leaks
- Replace gas pipeline pumps with electric pumps
- Other

* Other includes: Use IR camera/optical imaging for leak detection, Replace gas pipeline pumps with electric pumps, Replace gas pipeline valves with electric valves, Use inert gases and pigs to perform pipeline purges.

* Annual emissions reductions include new reductions plus ongoing reductions.

EMISSIONS REDUCTIONS ARE APPROXIMATELY EQUIVALENT TO:



The carbon offset equivalent of planting this many acres of trees:

585,000 (cumulative)
112,430 (annual)



Enough natural gas to heat this many homes for one year:

70,000 (cumulative)
13,425 (annual)



Removing this many cars from the road for one year:

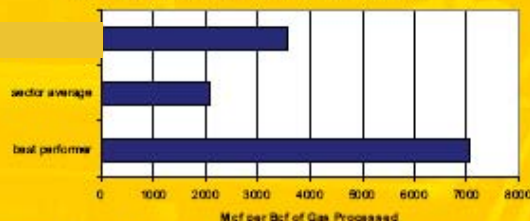
430,000 (cumulative)
82,450 (annual)

Benchmarking

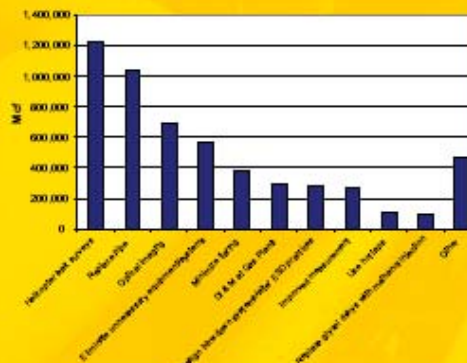
The Natural Gas STAR Program endeavors to assist partners in achieving full benefit of participation by raising awareness about activities that other partners have undertaken to achieve cost-effective emission reductions.

The following show [redacted] reductions versus the Sector Average and Best Performer in the Processing Sector. Emission reductions were normalized based on each partner's annual gas processing capacity.

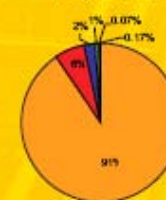
2005 Methane Emissions Reductions



Top 10 technologies and practices employed in the Processing Sector in 2005. Sector reductions totaled 5,424,568 in 2005.



The Best Performer for the Processing Sector achieved emission reductions through the following activities in 2005.



- Helicopter Leak Surveys
- Use IR camera/optical imaging for leak detection
- Replace gas pipeline pumps with electric pumps
- Replace gas pipeline valves with electric valves
- Replace gas pipeline flares with methane injection
- Eliminate unnecessary equipment or systems
- Other

Based on top technologies and practices employed in the Processing Sector, other activities [redacted] might want to consider include:

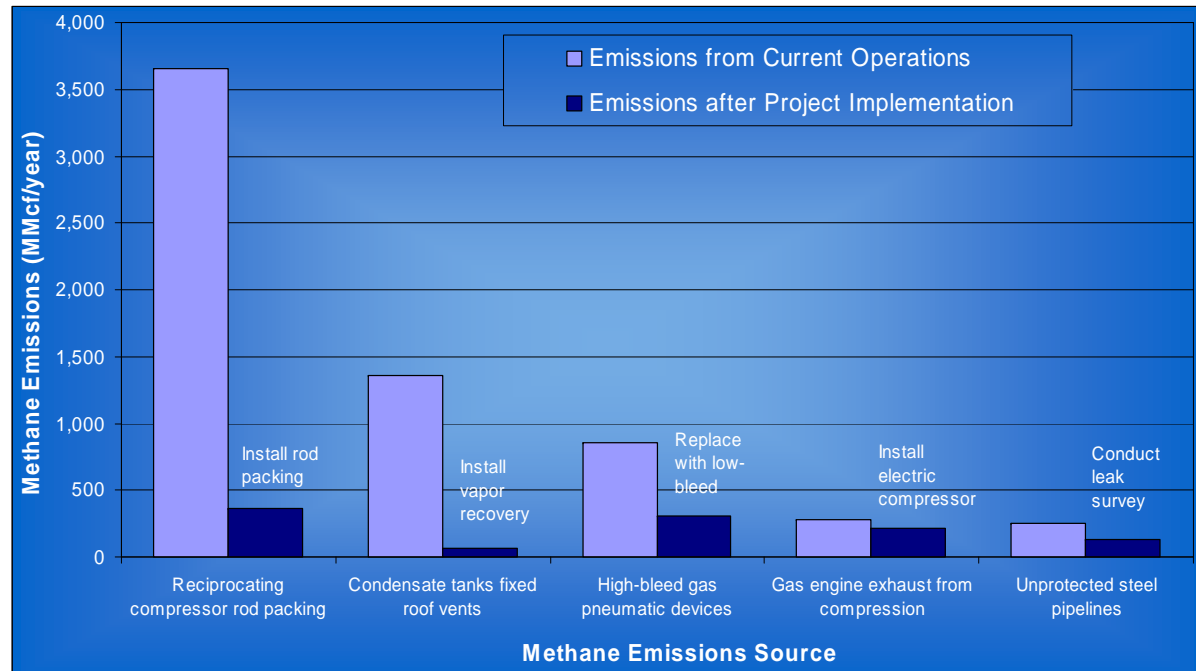
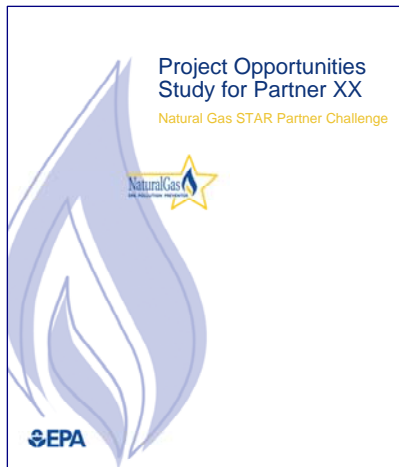
- Helicopter leak surveys
- Replace pipe
- Optical imaging
- Minimize flaring
- D&M at gas processing stations



Natural Gas STAR “Partner Challenge”

- ❖ EPA offers assistance to partners in identifying and prioritizing new opportunities to cost-effectively reduce methane emissions
 - ❖ Uses customized data
 - ❖ Estimates emissions sources and recommends technologies and practices
 - ❖ Details economic and operational benefits of reduction opportunities

Example Analysis: Project Recommendations based on Estimated Methane Emissions Sources





Update: Greenhouse Gas Reporting Rulemaking





GHG Reporting Rulemaking

What is the 2008 Omnibus Appropriations Bill (HR 2764)?

The 2008 Omnibus Appropriations Bill (HR 2764) was signed into law in December 2007. The legislation signed by President Bush authorizes EPA to develop and publish a draft rule to **require mandatory reporting of greenhouse gas emissions above appropriate thresholds in all sectors of the economy**



Appropriations Language and Legal Authority

FY2008 Consolidated Appropriations Amendment:

- “... not less than \$3,500,000 shall be provided for activities to develop and publish a draft rule not later than 9 months after the date of enactment of this Act, and a final rule not later than 18 months after the date of enactment of this Act, to require mandatory reporting of greenhouse gas emissions above appropriate thresholds in all sectors of the economy...”

Legal Authority:

- Sections 114 and 208 of the CAA allow for data collection and measurement and recordkeeping from stationary or mobile related sources
- Appropriations language provides EPA with \$3.5 million in FY 2008 to develop proposed & final rules



Purpose and Scope

🔥 **Objective(s) of the Program – to provide data that will inform and support development of national climate policy**

🔥 **Scope of Coverage**

- 🔥 Define gases- “...to require mandatory reporting of greenhouse gas emissions”
 - 🔥 CO₂, CH₄, N₂O, HFC, PFC, SF₆
- 🔥 Both upstream and downstream sources- “The Agency is further directed to include in its rule reporting of emissions resulting from upstream production and downstream sources...”
 - 🔥 Upstream: Fuel and Chemical producers/importers (e.g., oil refineries, natural gas processors, HFC producers)
 - 🔥 Downstream: GHG emitters (e.g., power plants, iron and steel plants, cement manufacturers)



Purpose and Scope cont.

🔥 Areas of flexibility:

- 🔥 Emissions threshold: “The Administrator shall determine appropriate thresholds of emissions above which reporting is required...”
- 🔥 Frequency of Reporting: “...and how frequently reports shall be submitted to EPA”

🔥 Methods:

- 🔥 “The Administrator shall have discretion to use existing reporting requirements....”
- 🔥 Build on methods from existing mandatory and voluntary reporting systems
 - 🔥 Federal reporting programs- e.g., Title IV, Climate Leaders, 1605(b)
 - 🔥 State Programs- e.g., California, The Climate Registry, RGGI, other state programs
 - 🔥 Corporate Programs- e.g., WRI/WBCSD
 - 🔥 Industry Protocols- e.g., API Compendium, CSI Protocol (cement), International Aluminum Institute



Timing and Process

- ⚡ Proposed rule by September 2008, final rule by June 2009
 - ⚡ An ambitious timetable but are working towards these deadlines
- ⚡ EPA is involving agency and interagency expertise
 - ⚡ Have already worked extensively with interagency counterparts on measurement and reporting issues (e.g., US GHG inventory, IPCC guidelines)
- ⚡ EPA welcomes stakeholder input and has been reaching out to stakeholders
- ⚡ No final decisions have been made to date concerning affected sources, thresholds, frequency of reporting, etc.
- ⚡ There will be an official public comment period in September or October, 2008 (following the issuance of the proposed rule).



Best Management Practices for Transmission and Distribution Companies





Best Management Practices Agenda

🔥 Methane Losses

- 🔥 What are the sources of emissions?
- 🔥 How much methane is emitted?

🔥 Methane Recovery

🔥 Is Recovery Profitable?

🔥 Discussion



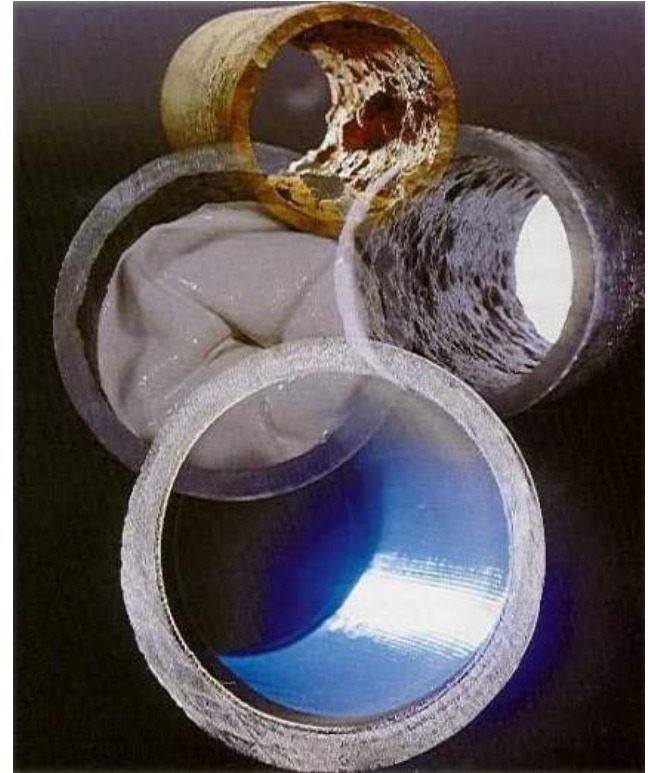
Methane Losses

Transmission sector

- ♦ Fugitive and venting emissions at compressor stations
 - ♦ Vibration and heat cycling of equipment
- ♦ Distributed pipeline leaks
 - ♦ Pipelines span long distances

Distribution sector

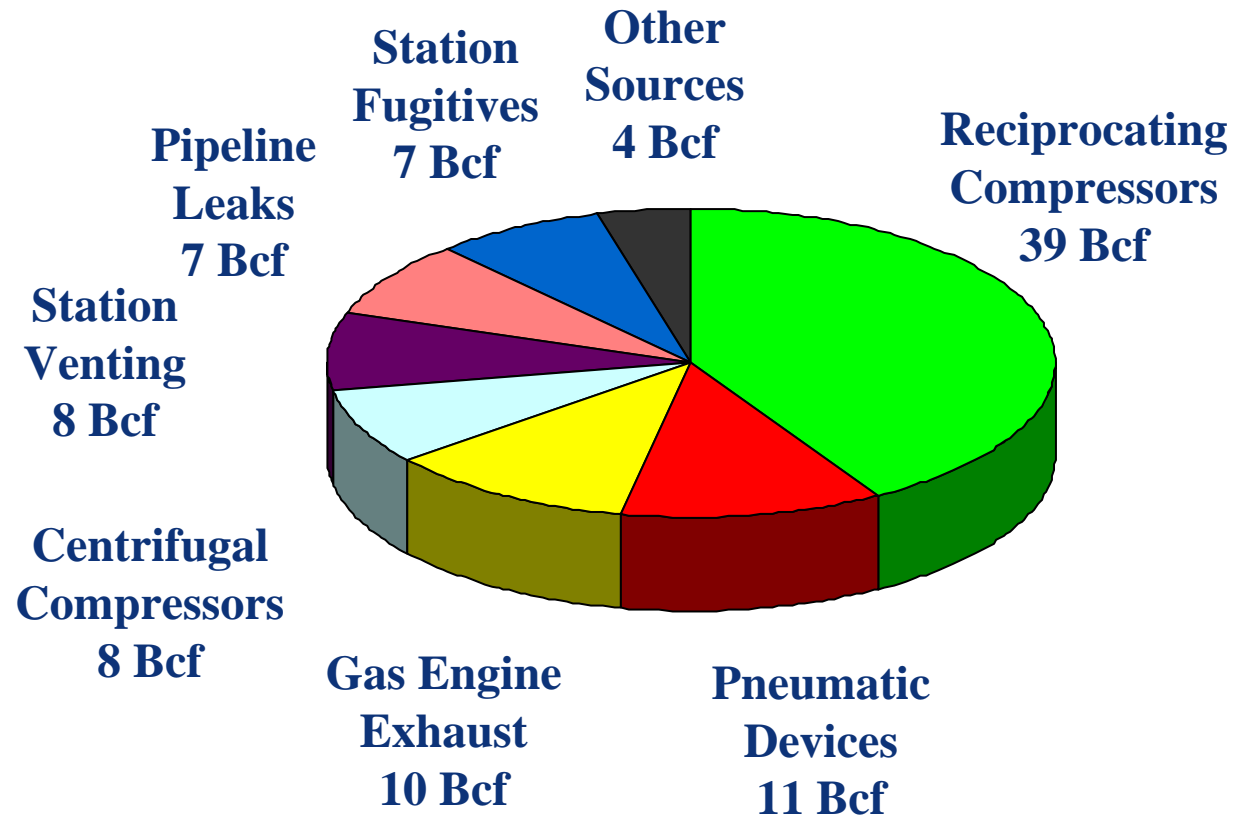
- ♦ Large number of small leak sources
- ♦ Fugitives at gate stations
- ♦ Distributed pipeline leaks
 - ♦ Pipeline material and age



Source: ConEd



2006 Transmission Sector Methane Emissions

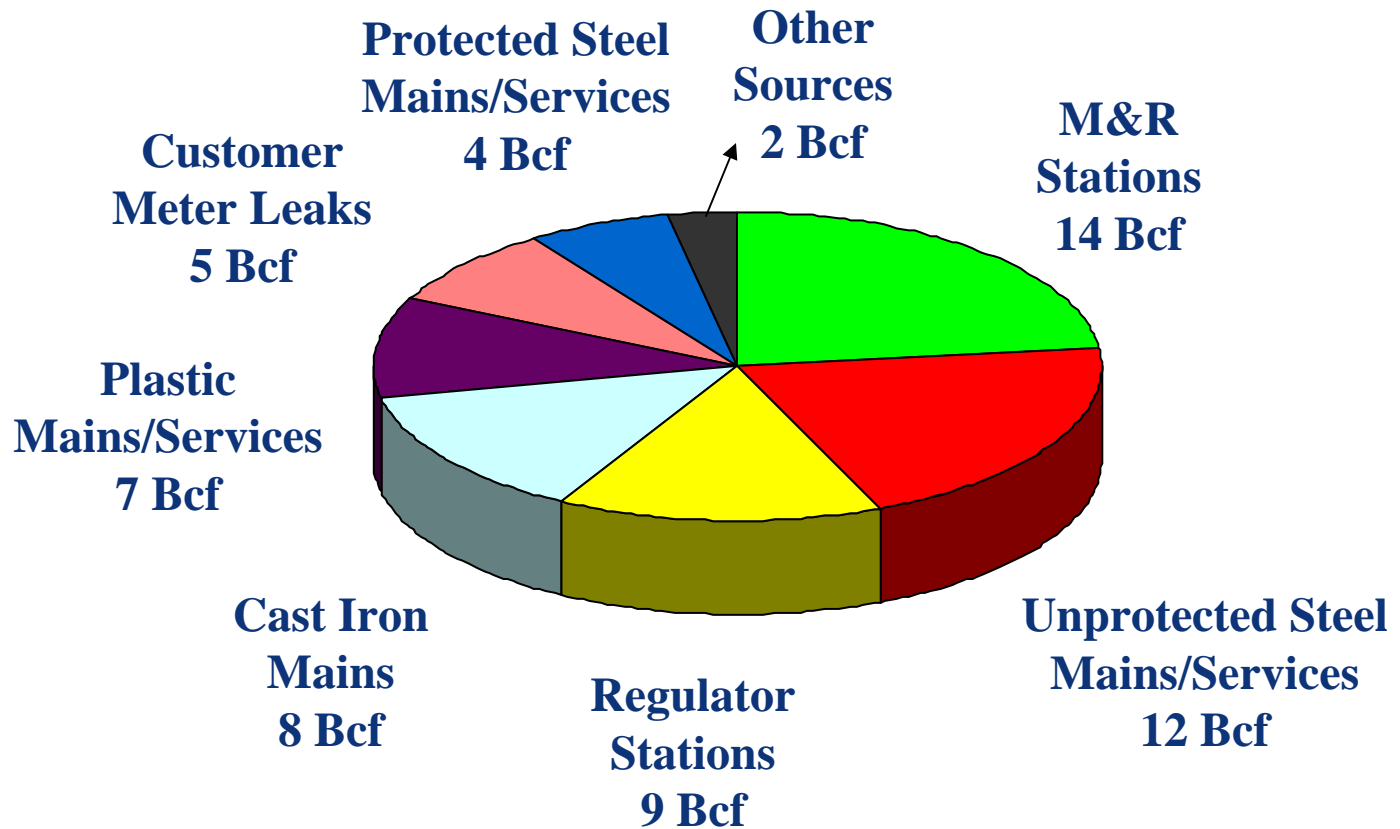


EPA. *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990 – 2006*. April, 2008. Available on the web at: <http://www.epa.gov/climatechange/emissions/usinventoryreport.html>

Natural Gas STAR reductions data shown as published in the inventory.



2006 Distribution Sector Methane Emissions



EPA. *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990 – 2006*. April, 2008. Available on the web at: <http://www.epa.gov/climatechange/emissions/usinventoryreport.html>

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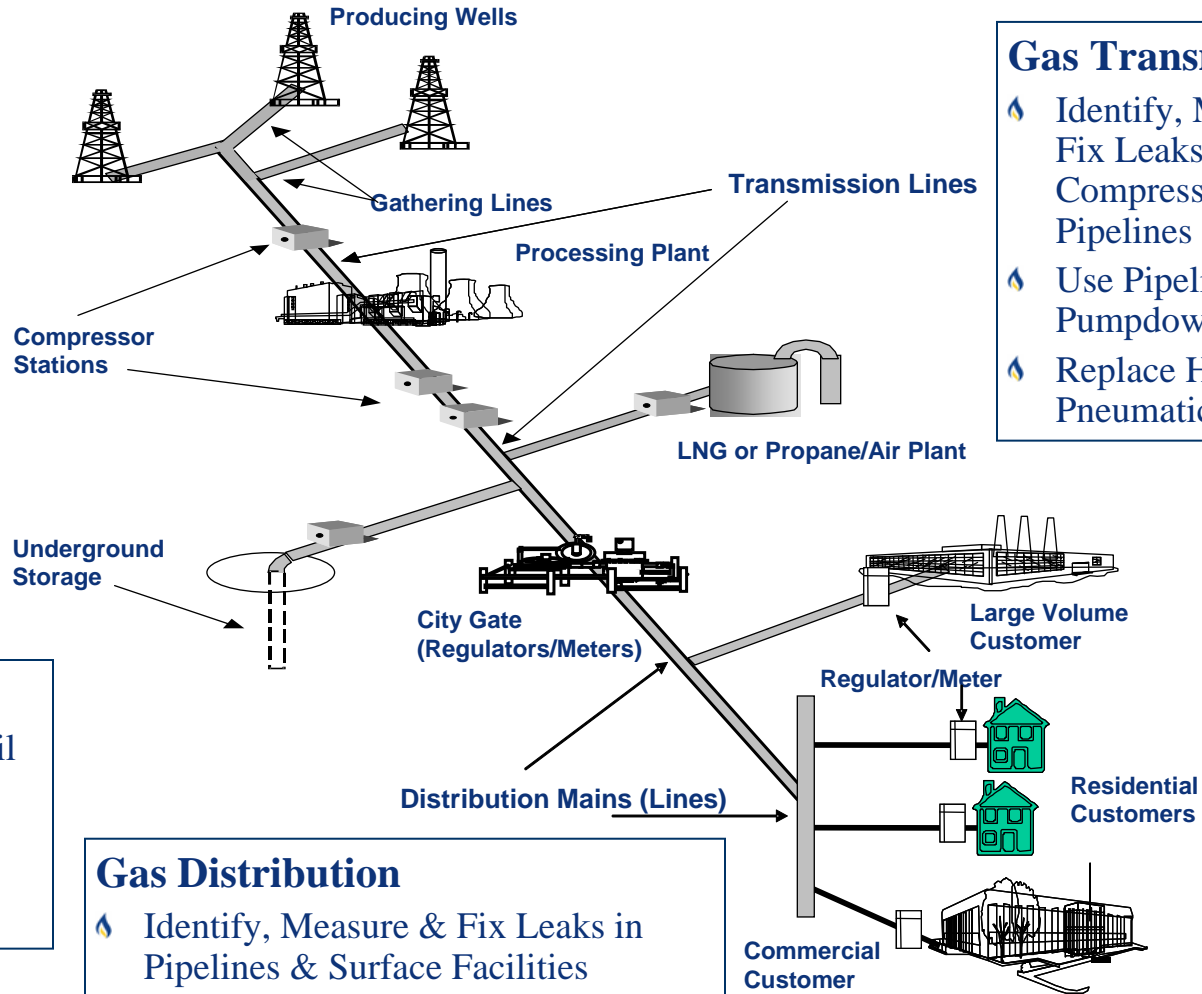
Methane Recovery

Gas Production & Processing

- 🔥 Reduced Emission Well Completions
- 🔥 Install Plunger Lifts on Gas Wells
- 🔥 Identify, Measure & Fix Leaks in Processing Plants
- 🔥 Install Flash Tank Separators on Dehydrators

Oil Production

- 🔥 Install VRUs on Crude Oil Storage Tanks
- 🔥 Route Casinghead Gas to VRU or Compressor for Recovery & Use or Sale



Gas Transmission

- 🔥 Identify, Measure & Fix Leaks in Compressor Stations, Pipelines
- 🔥 Use Pipeline Pumpdown
- 🔥 Replace High-Bleed Pneumatics

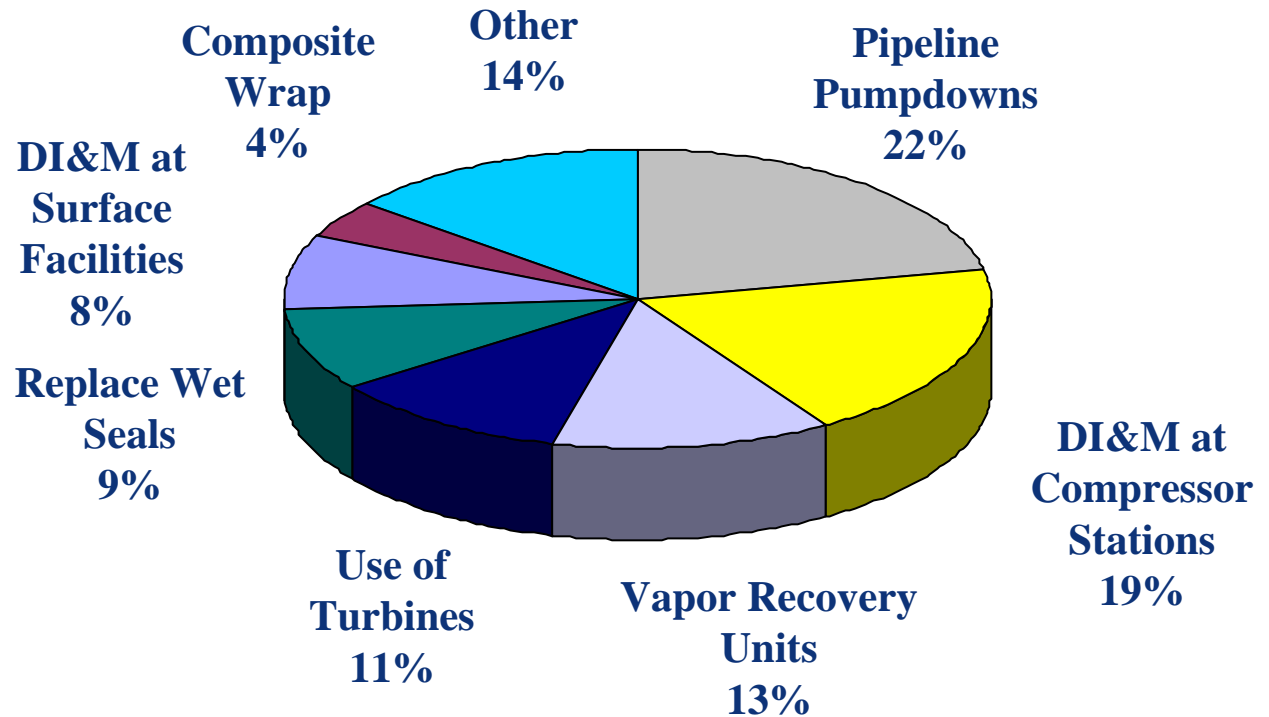
Gas Distribution

- 🔥 Identify, Measure & Fix Leaks in Pipelines & Surface Facilities
- 🔥 Inject Blowdown Gas into Low Pressure Mains



What are Partners Reporting?

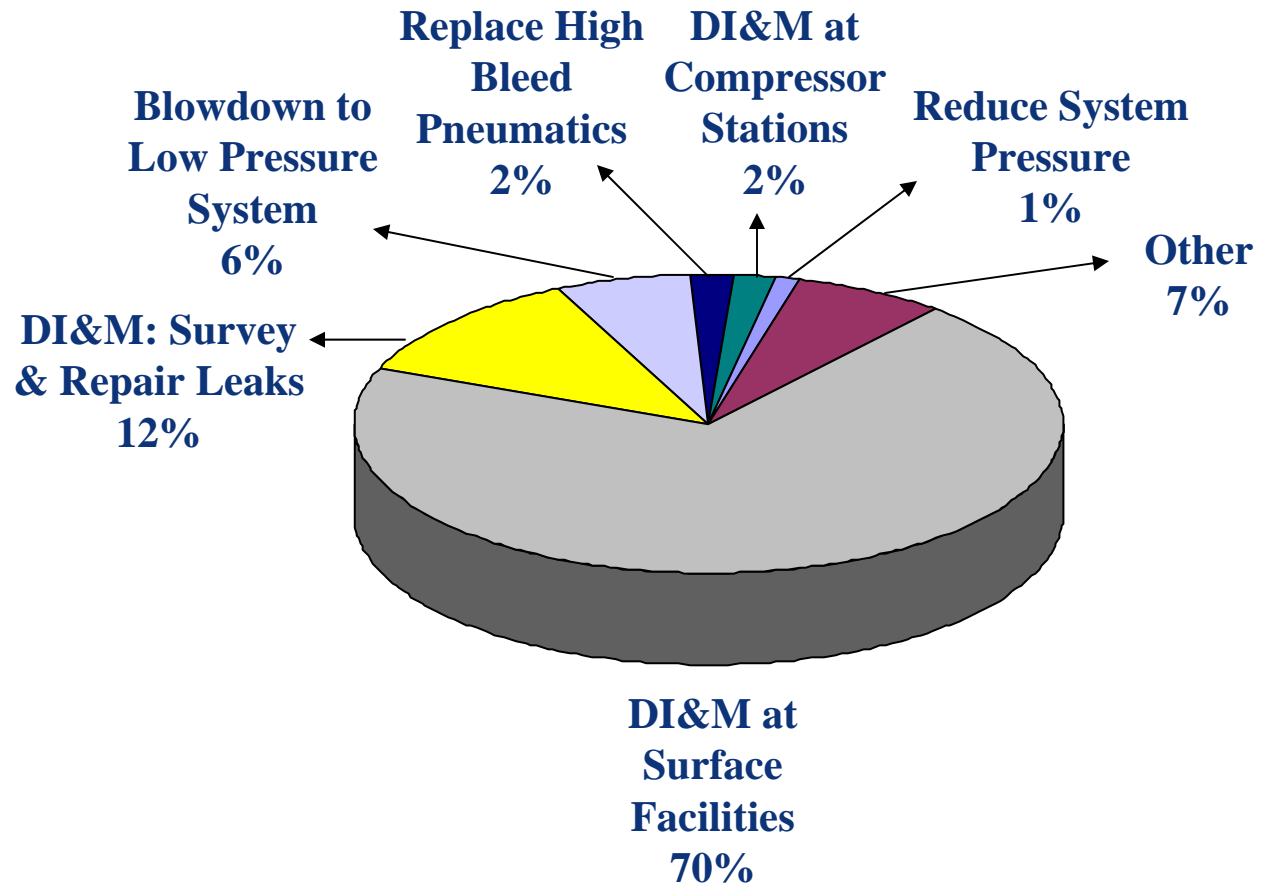
🔥 Transmission Partners reported 20.5 Bcf of reductions in 2006





What are Partners Reporting?

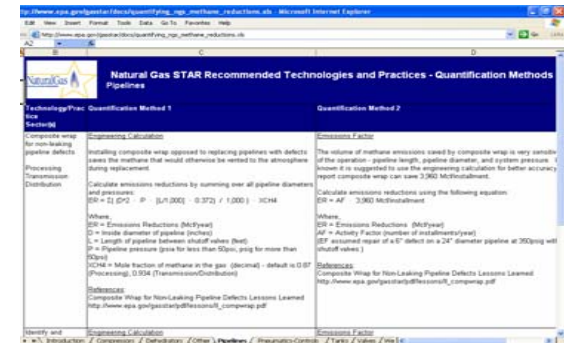
🔥 Distribution Partners reported 5.7 Bcf in reductions in 2006





Is Recovery Profitable?

- Transmission and distribution Partners have reported over 55 different technologies and practices for cost effectively reducing methane emissions
- Evaluate opportunities by examining projected economics versus company specific measures of cost effectiveness





Install Vapor Recovery Units on Condensate Tanks

What is the Problem?

- Liquids collected from pigging and scrubbers flash methane when transferred to atmospheric storage tanks

Partner Solution

- Install vapor recovery units on condensate tanks

Methane Savings

- Based on a condensate tank collecting around 100 Mbbbl/yr of liquids

Applicability

- The first compressor station in the transmission line or other stations collecting liquids from pigging

| |
|-------------------------------|
| Methane Savings |
| 21,400 Mcf/yr |
| Project Economics |
| Project Cost > \$10,000 |
| Annual O&M > \$1,000 Costs |
| Payback 1 – 3 yr |



Inject Blowdown Gas into Low Pressure Mains

What is the Problem?

- Gas within compressors and piping is depressurized and vented when taken out of service

Partner Solution

- Re-routing blowdown gas into low pressure mains will reduce losses

Methane Savings

- Based on ten depressurizing events at one station using one new piping connection

Applicability

- Wherever low pressure gas systems remain in service near shut down system

Methane Savings

150 Mcf/yr

Project Economics

Project Cost < \$1,000

Annual O&M < \$100
Costs

Payback < 1 yr



Methane Emission Reduction Technologies & Practices

- 💧 Topics covered in greater detail during the Air breakout
 - 💧 Methane savings from compressors
 - 💧 Reciprocating rod packing
 - 💧 Centrifugal compressor seals
 - 💧 Compressors offline
 - 💧 Pipeline maintenance
 - 💧 Hot taps
 - 💧 Pipeline pumpdowns
 - 💧 Composite wrap
 - 💧 Plastic main liners
 - 💧 Directed inspection and maintenance
 - 💧 Compressor stations
 - 💧 Pipelines
 - 💧 Gate stations and surface facilities



Discussion

- 🔥 How does your organization identify potential emission reduction projects? (e.g., by maintaining a greenhouse gas inventory, initiation by EHS staff, efforts to collaborate with field operators, etc.)
- 🔥 What qualifications must a potential emission reduction project meet before it can be implemented? (economic criteria, magnitude of reductions, etc.)
- 🔥 What technologies and practices are you currently implementing to reduce methane emissions?



Contact Information

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