



Methane to Markets

Overview of Technology Options in the Russian Oil and gas Sector

Seminar with Russian Independent Oil and Gas Producers on Methane Mitigation Technologies and Strategies

October 4, 2010 Moscow, Russia

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Why focus on Methane?

- **A potent greenhouse gas (GHG) with 100-year global warming potential of 23; atmospheric lifetime of ~12 years**
- **The 2nd most important GHG accounting for ~16% 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 (16%) of total global man-made methane emissions.**
 - EPA estimates that methane emissions are projected to grow globally by more than 33% from 2005 to 2015.

Overview: Methane Emissions from Oil and Gas Operations

- The majority of oil and gas methane emissions come from
 - Natural gas
 - Production
 - Processing
 - Transmission
 - Distribution
 - Oil production

- Methane emissions can be intentional or unintentional
 - Leaks
 - Process venting
 - System malfunctions

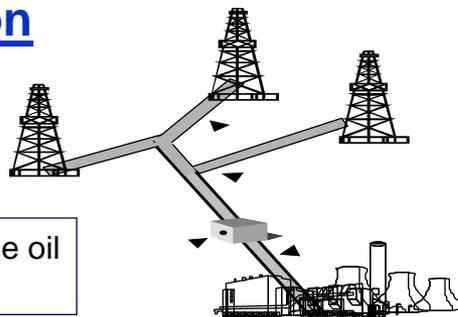


Methane Emissions from Oil and Gas Operations

Oil Production

Venting of casinghead gas

Flash emissions from crude oil storage tanks



Natural Gas Production & Processing

Well completions, blowdowns and workovers

Reciprocating compressor rod packing

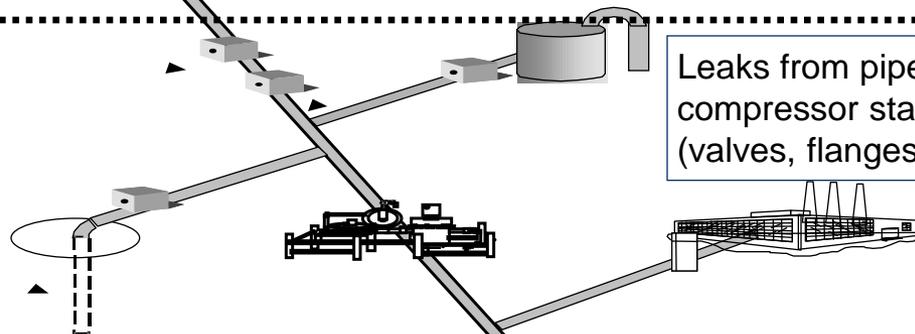
Venting from glycol reboilers on dehydrators

Processing plant leaks

Gas-driven pneumatic devices

Gas Transmission

Venting of gas for maintenance or repair of pipelines or compressors



Leaks from pipelines, compressor stations (valves, flanges, etc.)

Compressor blowdown venting

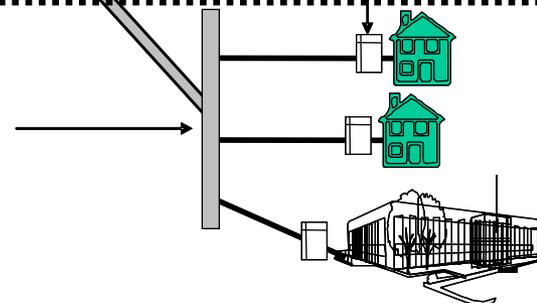
Centrifugal compressor seal oil de-gassing

Gas Distribution

Leaks from unprotected steel mains and service lines

Leaks at metering and regulating stations

Pipeline blowdowns

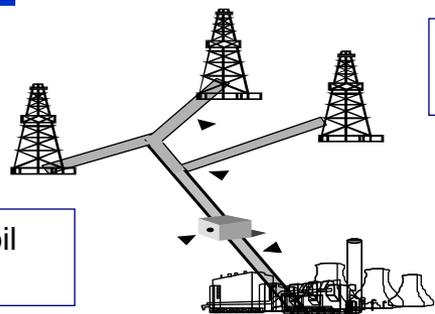


Cost-Effective Methane Mitigation Opportunities

Oil Production

Route casinghead gas to VRU or compressor for Recovery & Use or Sale

Install VRUs on crude oil storage tanks



Natural Gas Production & Processing

Reduced emission well completions

Economic replacement of reciprocating compressor rod packing

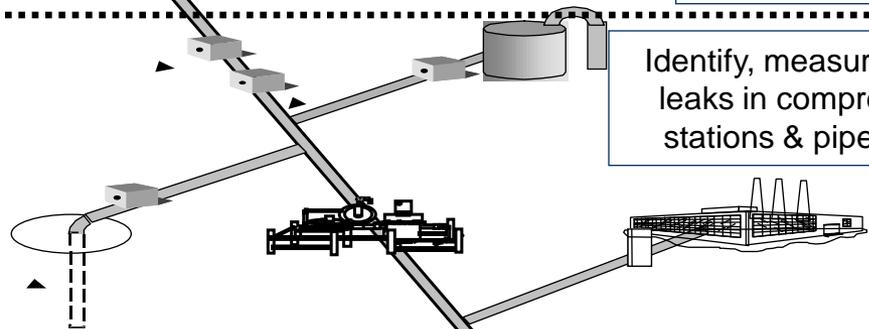
Install flash tank separators on dehydrators

Identify, measure & fix leaks in processing plants

Gas Transmission

Use pipeline pumpdown

Composite Wrap for Non-Leaking Pipeline Defects



Identify, measure & fix leaks in compressor stations & pipelines

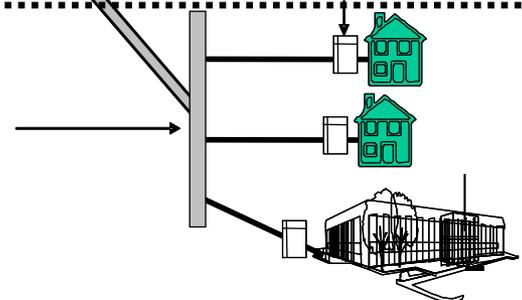
Re-route gas to fuel system or sales line or flare

Replace wet seals with dry in centrifugal compressors

Gas Distribution

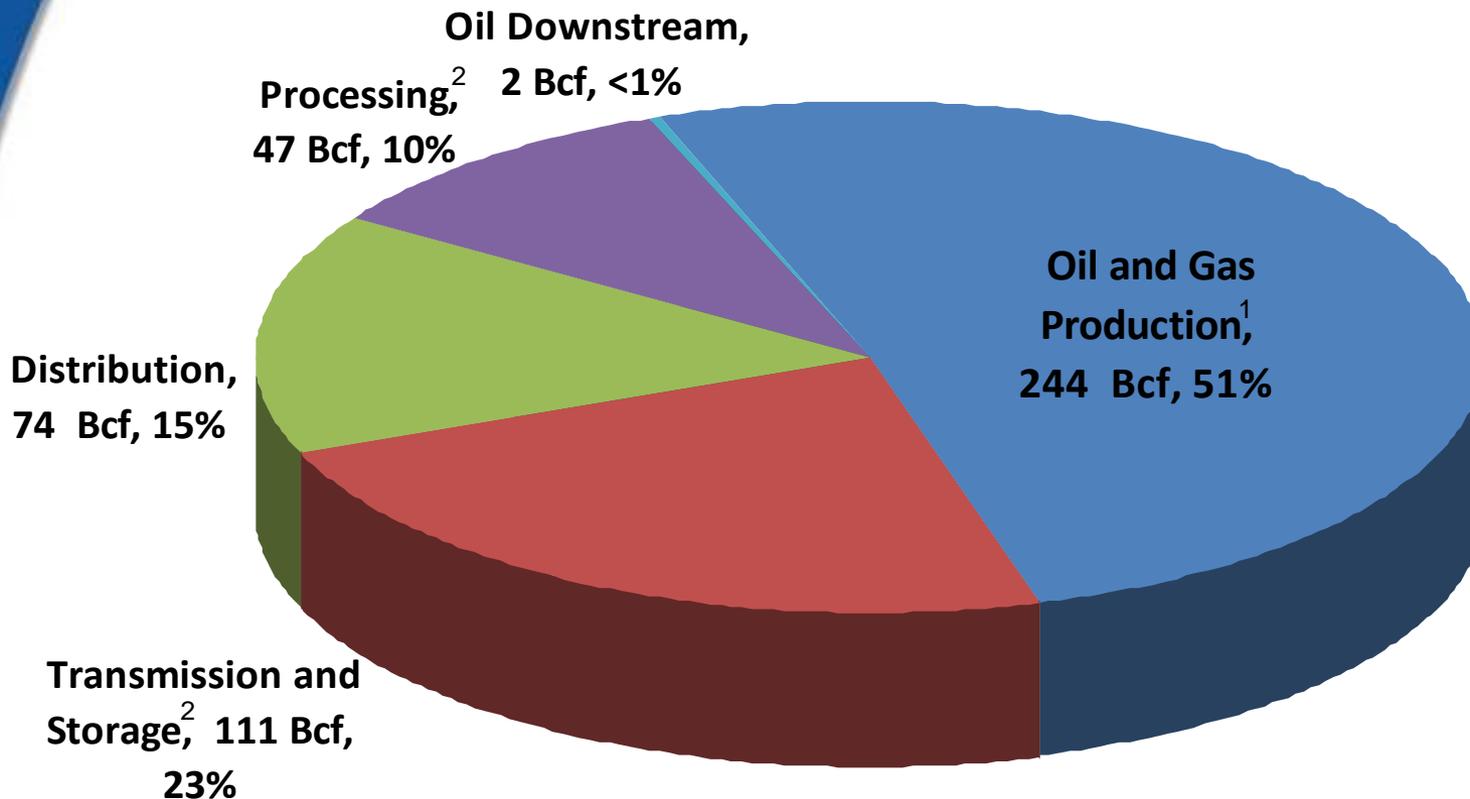
Identify, measure & fix leaks in pipelines & metering and regulating stations

Inject blowdown gas into low pressure mains



2008 U.S. Oil and Gas Industry Methane Emissions (492 Bcf)

Bca = billion cubic feet



Source: EPA. *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990 – 2008*. April, 2010.

1- Production updated with revised emissions estimates for well completions and workovers, well blowdowns, glycol dehydrators, storage tanks, and pneumatic devices.

2- Processing and transmission updated with revised emissions estimates for centrifugal compressors.

Evaluating Methane Emission Sources and Opportunities

Approaches to identifying methane emission sources and reduction opportunities:

- Top Down: Some companies develop emissions inventories at the company level using emissions and activity factors
 - Benefits: Can help identify general project areas and inform mitigation programs at the company level
 - Limitations: Too general for project-based investment; uncertainty in factors and system diversity can lead to poor data

- Bottom Up: Project based equipment level analysis (desktop pre-feasibility assessments and onsite measurement studies)
 - Benefits: Produces high quality, process-specific information
 - Limitations: Covers discreet parts of the system; onsite measurement studies can be more expensive

Overview of Mitigation Technologies: Production

- Storage tank vapor recovery units
- Low-bleed pneumatics
- Reducing emissions from well completions and venting
- Dehydrator technologies

Processing Sector Technologies

- Reciprocating compressors
- Dehydrators
- Low-bleed pneumatics
- Directed inspection and maintenance
- Elimination of unnecessary equipment

Methane Savings at Compressor Stations

- Compressor Opportunities
 - Economic rod packing replacement in reciprocating compressors
 - Replacing wet seals with dry seals in centrifugal compressors
 - Scrubber dump valves
 - Reducing emissions when taking compressors offline
- Pneumatic Devices

Methane Savings from Transmission Pipelines

- Transmission Pipeline Opportunities for Methane Recovery:
 - Pipeline pumpdowns
 - Composite wrap
 - Hot taps
 - Pipeline pigging
 - Aerial leak detection



Source: Armor Plate

Case Study: KyrKazGas Leak Detection and Quantification

Project: leak detection and quantification of KyrKazGas (of the Kyrgyz Republic) natural gas transmission system

- Previous methane leak inspection and repair practices resulted in overlooked product loss
- Field Study (February 2008) demonstrated state-of-the-art leak detection and measurement technologies and assessed methane emissions, product loss, and operating practices
- Resulted in expanded capacity and experience at KyrKazGas in leak detection and quantification and ability to demonstrate the viability of capital investment in methane emission reduction projects

Conclusions

- Many cost-effective opportunities exist
- EPA has developed detailed information on proven technologies based on industry experience
- We are open to cooperation
 - Joint seminars
 - Technical analysis of options and measures
 - Information and networking

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