



Methane to Markets

Methane to Markets Overview – Oil & Gas Sector

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Overview

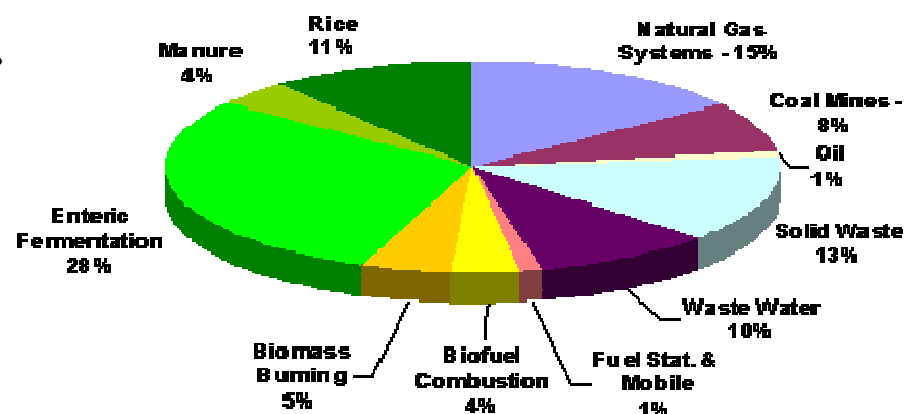
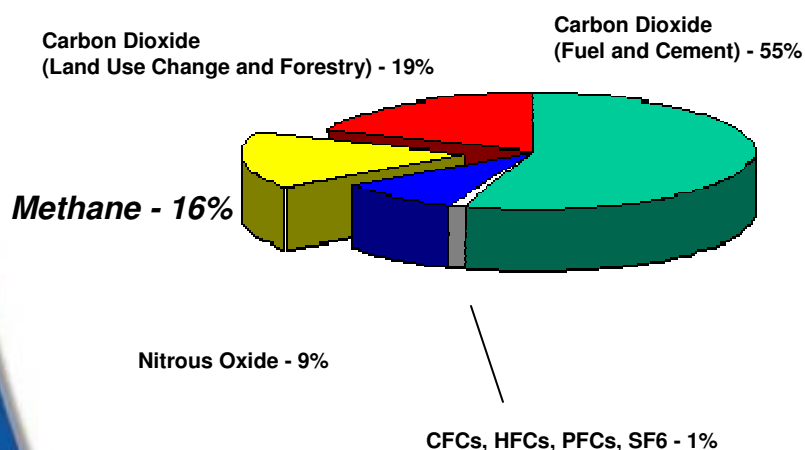
- Methane to Markets (M2M) & Natural Gas STAR Background
- Opportunities in the Oil & Gas Sector
- Resources to Promote Methane Mitigation Projects
- M2M 2008 Workshops & Conferences
- A Note on Project Economics
- Conclusion

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**

Global GHG Emissions in 2000

40,702 million tonnes carbon dioxide equivalent (MtCO₂e)

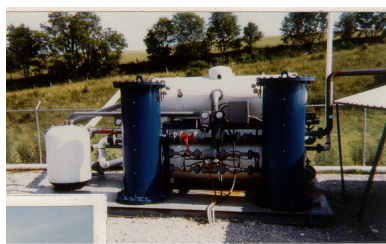


Methane to Markets Partnership

- The **Methane to Markets Partnership (M2M)** is an international initiative that advances cost-effective, near-term methane recovery and use as a clean energy source in four sectors:



Oil and Gas Systems



Coal Mines



Landfills



Agricultural Waste

- The goals of the Partnership are to reduce global methane emissions to
 - Enhance economic growth
 - Strengthen energy security
 - Improve air quality and industrial safety
 - Reduce emissions of greenhouse gases

Methane to Markets Partnership

- 27 Partner Governments

North America

Canada
Mexico
United States

South America

Argentina
Brazil
Colombia
Ecuador

Africa

Nigeria

Europe & FSU

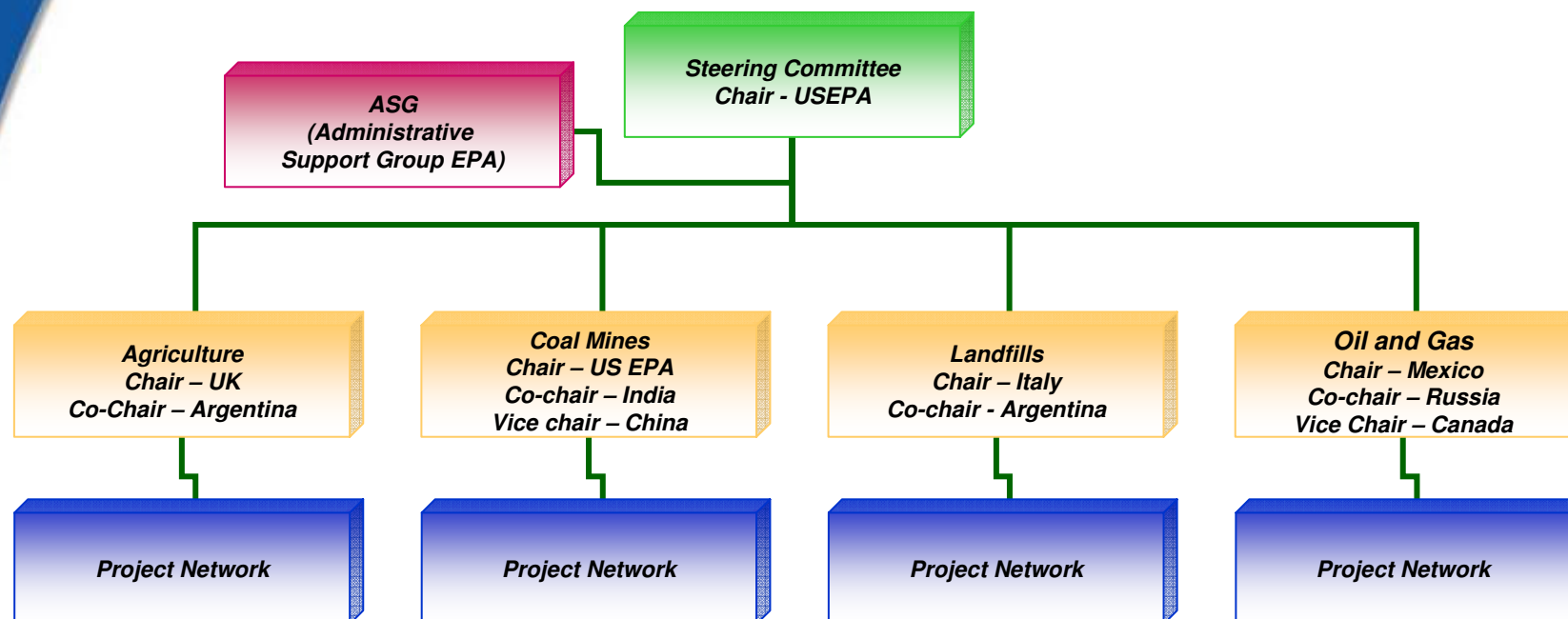
European Commission
Finland
Germany
Italy
Kazakhstan
Poland
Russia
Ukraine
United Kingdom

Asia Pacific

Australia
China
India
Japan
Korea
Mongolia
Pakistan
Philippines
Thailand
Vietnam

- Private companies, multilateral development banks and other relevant organizations participate by joining the ***Project Network – over 700 organizations now participating***

M2M Partnership Organization



Argentina involvement

- Secretariat of Environment and Sustainable Development
- Participation on the Steering Committee and Agriculture (Chair), Coal mines, Landfill (Chair) and Oil & Gas Subcommittees
- Active promotion of projects in Landfill

US Government commitment

- U.S. EPA coordinates efforts across the US Government
 - Other agencies participating are USTDA, USAID, Department of State, Department of Energy and USDA
- Pledge of \$53 million over five years to support technology transfer and project development

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 oil and natural gas operations.

- Launched domestically in 1993, internationally in 2006
 - Over 110 Program Partners across four sectors
 - Nine International Partners
 - 19 Endorser Associations

Natural Gas STAR International

- Natural Gas STAR International launched September 26, 2006 now has nine partners

ConocoPhillips

devon



ENBRIDGE™

COMGAS
Natural

ExxonMobil

 Marathon
Oil Company

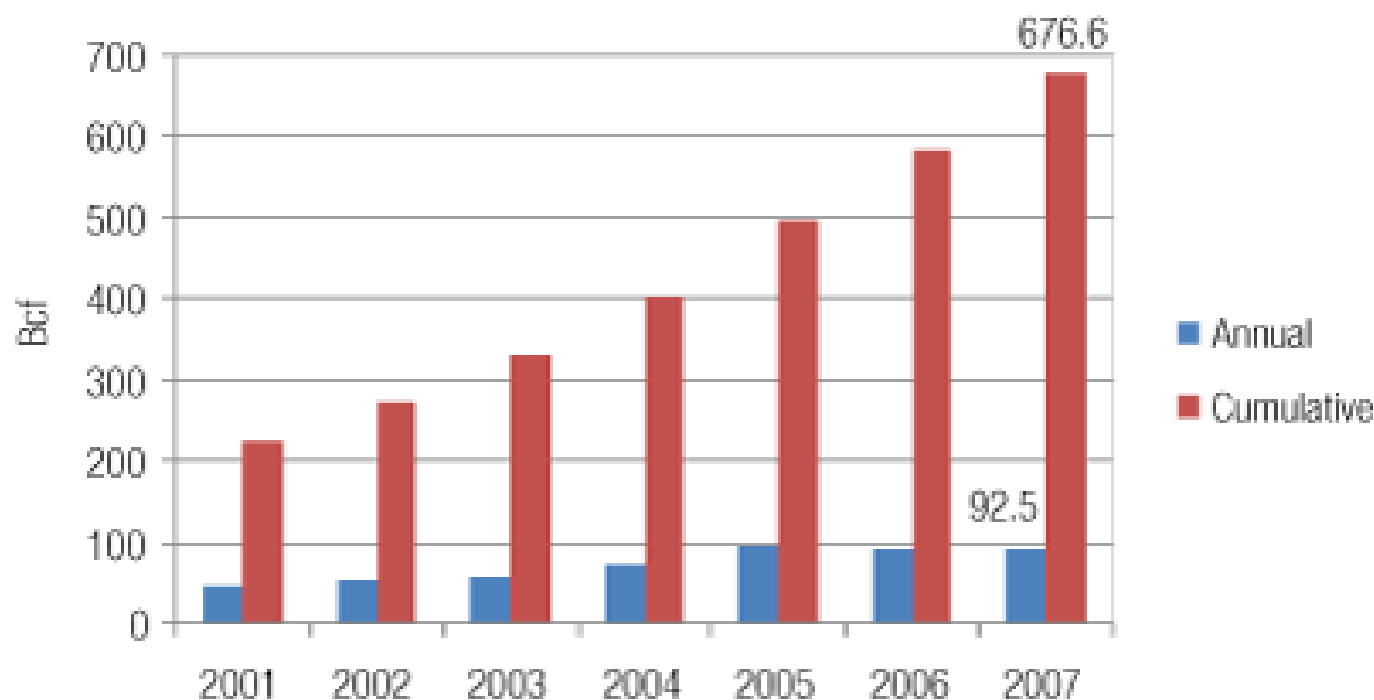
OXY

 TransCanada
In business to deliver

Gas STAR Partner Methane Emission Reductions

- Gas STAR Partners reduced methane emissions by 92.5 Bcf in 2007
 - 677 Bcf in cumulative reductions

Natural Gas STAR Emissions Reductions as of 2007



Methane Emissions from Oil and Gas Operations

- The majority of oil and gas methane emissions come from
 - Oil production
 - Natural gas
 - Production
 - Processing
 - Transmission
 - Distribution
- Methane emissions can be intentional or unintentional
 - Leaks
 - Process venting
 - System upsets



Sources of Methane Emissions: Oil and Gas

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

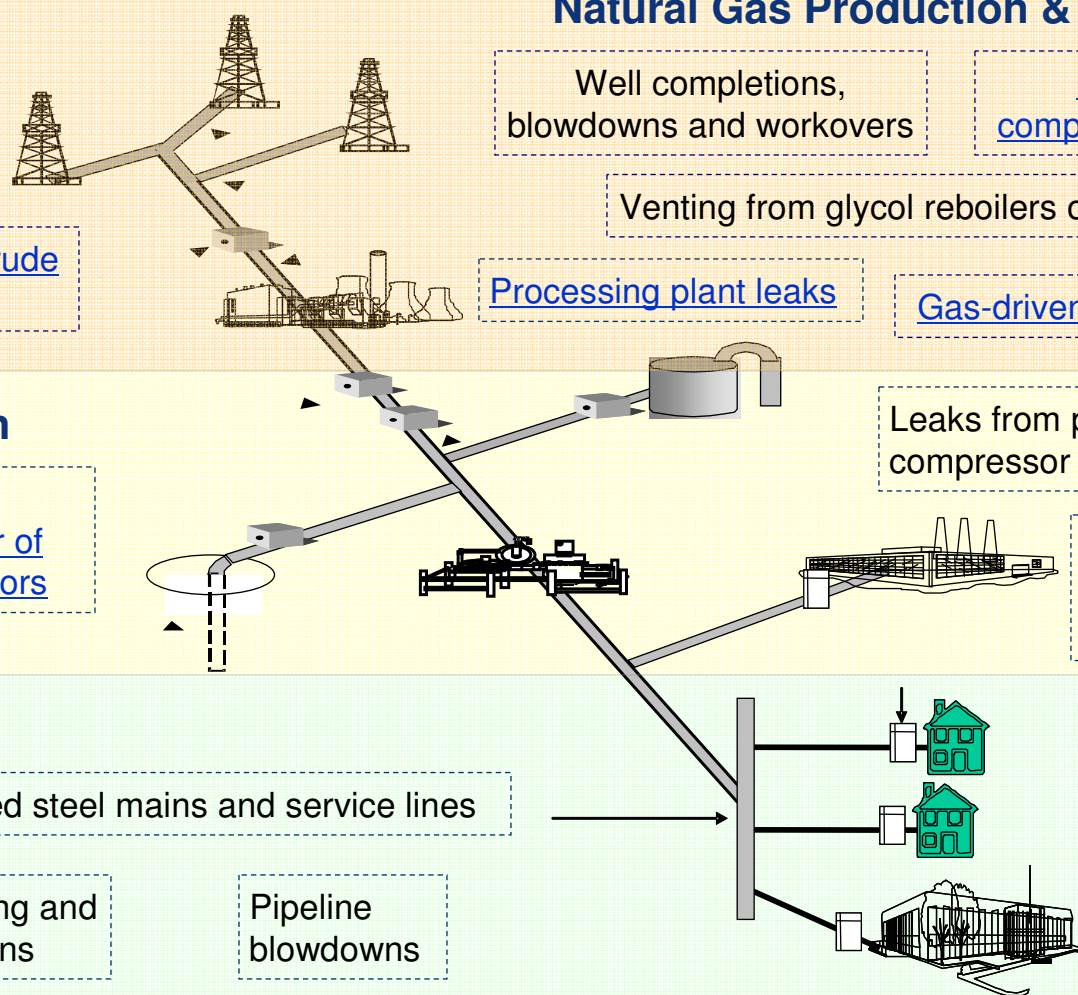
Centrifugal compressor seal oil de-gassing

Gas Distribution

Leaks from unprotected steel mains and service lines

Leaks at metering and regulating stations

Pipeline blowdowns



Natural Gas STAR/Methane to Markets Resources

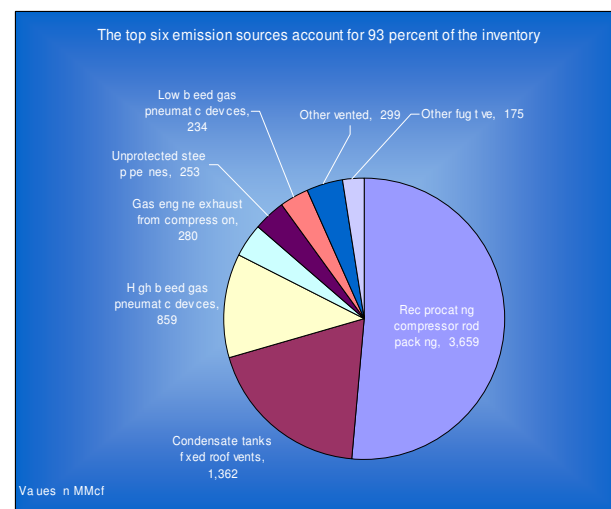
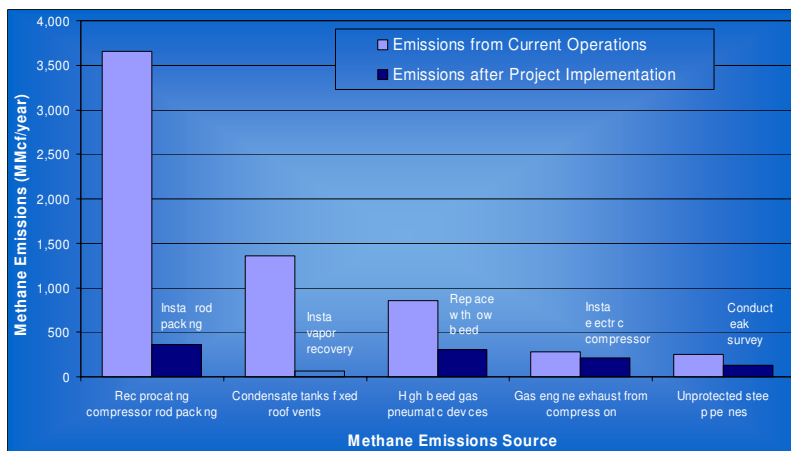
- Resources to advance cost-effective oil & gas sector methane emission reductions:
 - General technology transfer, training, and capacity building
 - Technical documents and research outlining over 80 mitigation options, including analyses of economic, environmental and operational benefits
 - Workshops and Conferences
 - Individual assistance to help companies identify and assess project opportunities
 - Estimated methane emission inventories
 - Pre-feasibility and feasibility studies
 - Measurement studies
- All services and resources provided free of charge and at no obligation



EPA Services for Natural Gas STAR Partner Companies

1. Develop Estimated Methane Emissions Inventory

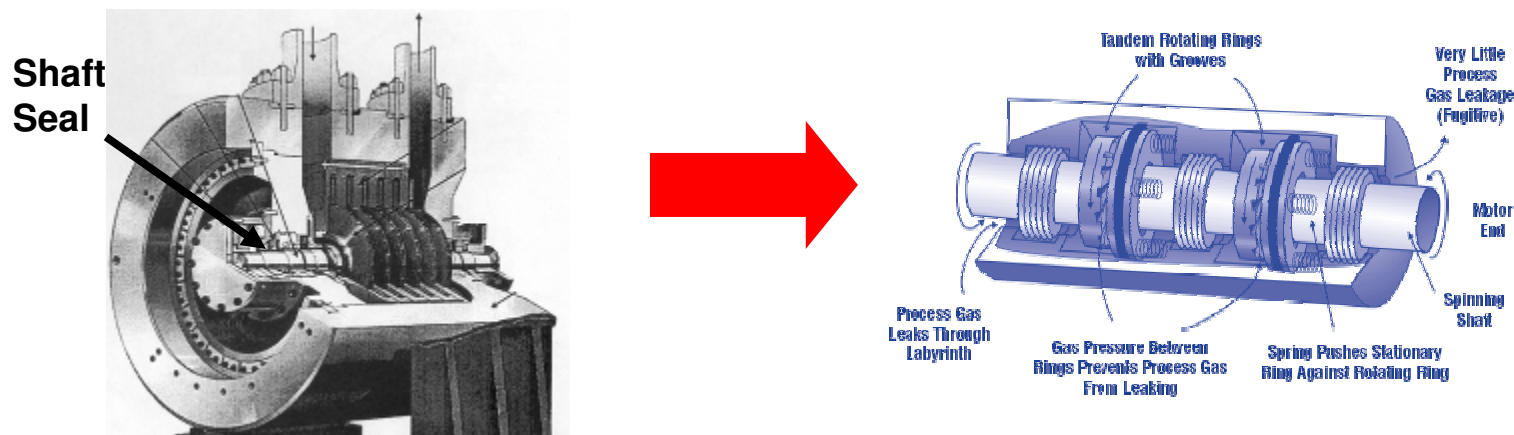
- Companies provide operational data that EPA uses to estimate methane emissions & propose emission reduction opportunities
- EPA delivers report to company detailing
 - Equipment-level emission estimations
 - Recommended mitigation options, including economic and operational benefits and anticipated emission reductions
- Helps prioritize opportunities



EPA Services for Natural Gas STAR Partner Companies

2. Conduct “Desktop” Project Analysis

- Using results from estimated inventory, EPA and company can further evaluate priority projects with high economic and environmental potential
- EPA will do deeper analysis to provide more specific project recommendation (detailed technical, economic, information, equipment specifications)



EPA Services for Natural Gas STAR Partner Companies

3. On-Site Measurement Study

- For companies seriously considering implementing emission reduction project, EPA can conduct on-site measurement studies
- EPA team uses methane emission identification and measurement equipment to quantify methane emissions
 - Infrared camera
 - Turbine meter
 - Hi-flow sampler
 - Calibrated bags
- EPA delivers to report detailing findings and corresponding mitigation recommendations

Infrared Leak Detection



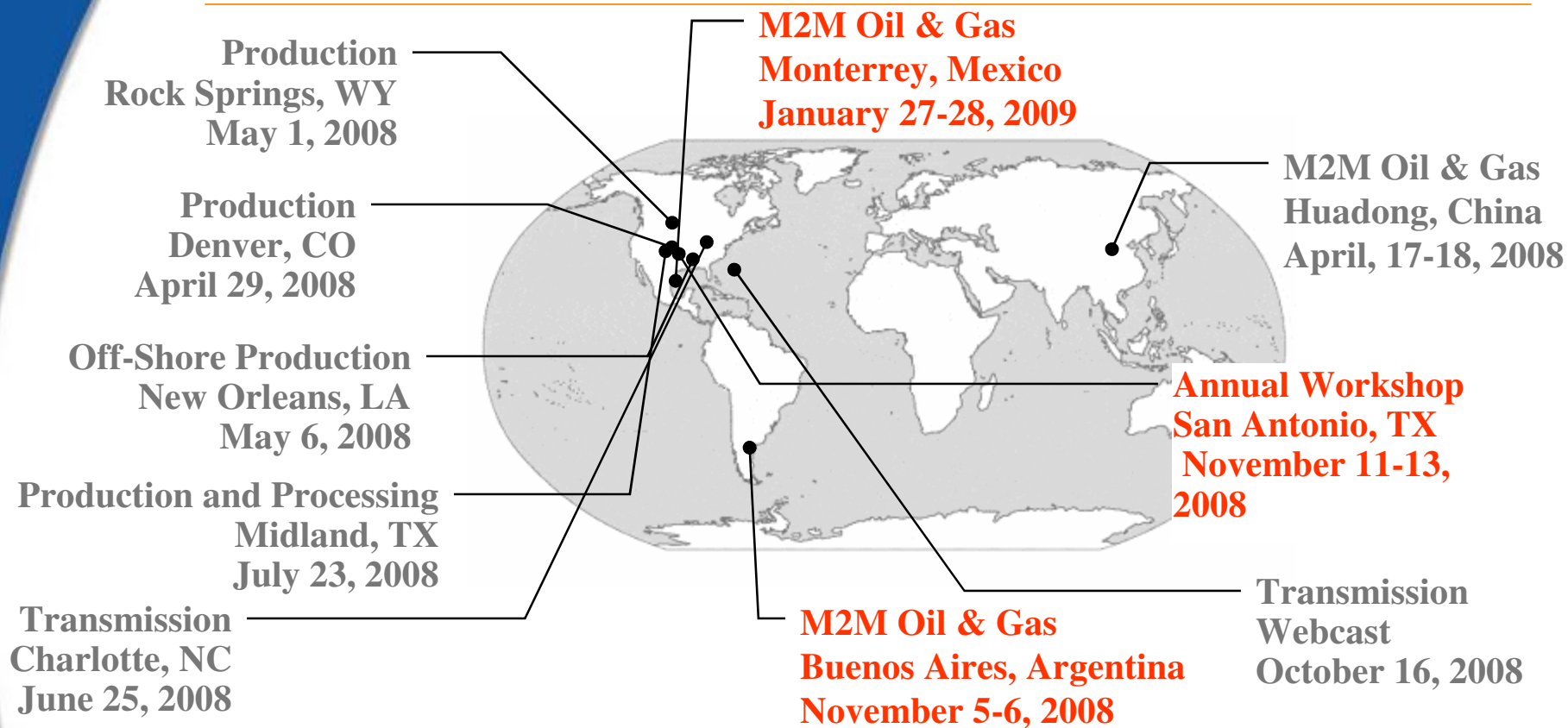
Source: Leak Surveys Inc.

Case Study: ONGC & Natural Gas STAR International

- State-owned company produces 78% of India's oil & gas
- Signed Gas STAR International MOU August 2007
- First non-U.S. based, state-owned company to join
- Leveraged EPA services to kick off Program in first year
 - 4 technology transfer workshops December 2007
 - 7 pre-feasibility studies
 - 4 measurement studies
- Presented measurement study findings & recommended mitigation projects to Board of Directors September 2008



2008-2009 Technology Transfer Workshops



For more information on 2008 Gas STAR workshops:
<http://www.epa.gov/gasstar/workshops/index.html>

A Note on Project Economics

- At \$3/Mcf, 77% of the 80 recommended technologies and practices pay back within 3 years and 47% pay back within 1 year
- Economics based on gas value alone may not always drive projects
- Gas value can be augmented if
 - Gas used to replace more expensive fuel (eg. for electricity generation)
 - Natural gas liquids value included
 - Carbon credit is leveraged
- Four Clean Development Mechanism (CDM) methodologies approved or under review
 - Leak reduction at natural gas compressor and distribution stations
 - Flare reduction and gas utilization at oil wells and gas processing plants
 - Gas distribution pipeline replacement
 - Recovery and Use of Gas from Oil Wells – Reduction of Gas Flaring by the Compression of Low Pressure Gas for Productive Use



Beyond Project Economics

- Companies have reported many reasons for reducing methane emissions
 - Safety concerns
 - Utilization of local energy source
 - Operational and efficiency improvements such as reduced maintenance and fuel costs
 - Reduced loss of a valuable domestic non-renewable fuel
 - Corporate mandate to operate in environmentally responsible manner
 - Internal greenhouse gas emission reduction goals
 - Addressing shareholder concerns about mitigating future climate risk



Beyond Monetary Incentives

- What happens when a transmission company does not directly benefit from the methane reductions?
- Due to GPL's tariff, there is no monetary incentive for the reduction of methane emissions.
- ONEOK Partner's Strategic Plan states that we will provide reliable energy-related services in a safe and *environmentally responsible* manner.
- Environmental Stewardship

Methane to Markets Activities: In Summary

- Reducing methane emissions can be profitable in a variety of ways:
 - Sales value of recovered methane and other hydrocarbons
 - Lower costs
 - Operations & Maintenance
 - Fuel savings
 - Capital / replacement
 - Potential carbon market value
- EPA provides free services to help Partner organizations benefit from these revenue sources with assistance in:
 - Identification of applicable technologies and practices
 - Methane emission estimated inventories and project feasibility studies
 - Measurement studies
 - Technical training or assistance
- EPA encourages oil and gas companies, government agencies and other stakeholders to inform EPA of interest in working together

Contact Information

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<http://www.epa.gov/gasstar/>