



Methane to Markets

Partnership Overview and Oil & Gas
Sector Opportunities in India

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Overview

- Why Methane?
- M2M Background
- US Efforts: Natural Gas STAR
- Opportunities in the Oil and Gas Sector
- Colombia Case Study
- Potential Cooperation in India
- Upcoming M2M Activities

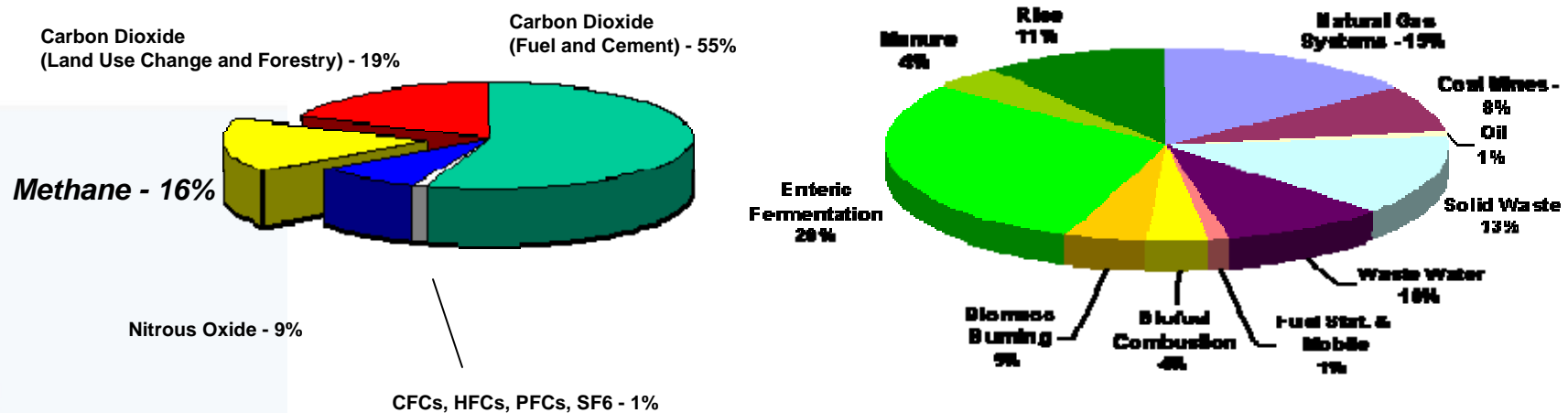


Why focus on Methane?

- 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 ~18% of total climate forcing
- A primary constituent of natural gas and a valuable, clean-burning energy source

Global GHG Emissions in 2000

40,702 million tonnes carbon dioxide equivalent (MtCO₂e)





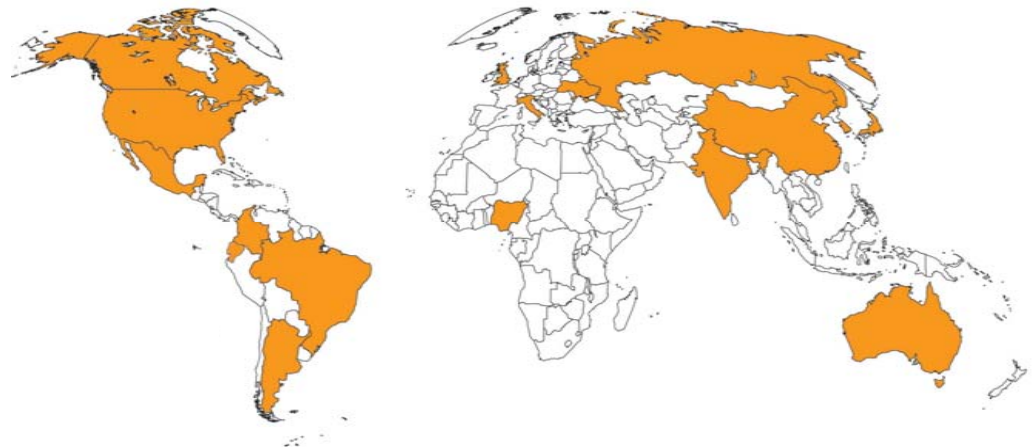
Methane to Markets Partnership Overview

- Advances recovery and use of methane as a valuable clean energy source
- Encourages development of **cost-effective** methane recovery and use opportunities in
 - coal mines
 - landfills
 - oil and gas systems and
 - agriculture (manure waste management)

- Private companies, multilateral development banks and other relevant organizations participate by joining the **Project Network** – *over 500 organizations now participating*

- 19 Partner Countries

Argentina	Japan
Australia	Korea
Brazil	Mexico
Canada	Nigeria
Colombia	Poland
China	Russia
Ecuador	Ukraine
Germany	United Kingdom
India	United States
Italy	



Methane Emissions from the Oil and Gas Industry

- M2M countries contribute 56% of global methane emissions from oil and gas systems
- India currently emits approx. 64 Bcf (1.81 Bcm) of CH₄
 - This volume is anticipated to increase to **89 Bcf (2.52 Bcm)** in 2010 and **153 Bcf (4.33 Bcm)** in 2020

2005 Methane Emissions from Natural Gas and Oil Systems (MMtCO₂e)

Russia	172.7
US	127.6
Ukraine	90.8
Mexico	77.2
Nigeria	51.3
Canada	38.3
India	26.0
Argentina	15.1
UK	8.0
Germany	7.7

Australia	7.6
China	6.3
Poland	5.8
Italy	5.4
South Korea	4.1
Brazil	3.7
Colombia	1.9
Ecuador	0.7
Japan	0.4

Total M2M Countries: 650.6

Total World: 1,165.0

U.S. Domestic Efforts: 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.

Natural Gas STAR International

- Under the Methane to Markets Partnership, U.S. EPA is expanding Natural Gas STAR internationally
- Launched in September 2006 with seven founding partner companies
- Companies world-wide are welcome to join Gas STAR International



■ Oil and Gas Subcommittee





Methane to Markets

2006 Natural Gas STAR International Partners

**ConocoPhillips**

devon[®]

 **ENBRIDGE**[™]

ExxonMobil

 **Marathon
Oil Company**

OXY

 **TransCanada**
In business to deliver



Significant Benefits of Methane Recovery and Use Projects

BENEFITS OF METHANE PROJECTS

- Increases energy efficiency at oil and gas facilities
- Reduced waste of a valuable fuel and important local energy source and
- Improved industrial safety and productivity
- Improved air quality, water quality and reduced odors
- Reduced greenhouse gas emissions
- Progress toward sustainable development goals
- Economic growth and energy security

BUT BARRIERS EXIST...

- Lack of awareness of emission levels and value of lost fuel
- Lack of information on and training in available technologies and management practices
- Traditional industry practices
- Regulatory and legal issues
- Limited methane markets and infrastructure
- Uncertain investment climate

Methane to Markets and the Oil and Gas Sector

- Advance project development in the oil and gas sector:
 - Identify and assess project opportunities
 - Pre-feasibility and Feasibility studies
 - Support technology transfer, training, and capacity building
 - Workshops and Conferences
 - Study tours
 - Develop Reports, Databases, Clearinghouses
 - Technical documents detailing Partner Reported Opportunities (PROs), Lessons Learned studies, and Partner Updates
 - Technology demonstration and deployment



Lessons Learned
From Natural Gas STAR Partners

INSTALLING VAPOR RECOVERY UNITS ON CRUDE OIL STORAGE TANKS

Executive Summary

There are about 17,000 crude oil storage tanks in the United States. These tanks are used to hold oil until it can be refined or otherwise processed. The tanks are subject to evaporation losses, which can be reduced by installing vapor recovery units (VRUs) on the tanks. This document provides information on the benefits of VRUs, the types of VRUs available, and the costs of installation. It also includes a table of VRU types and their characteristics.

VRU Type	Capacity (gallons per hour)	Installation Cost (\$)	Operating Cost (\$/year)	Efficiency (%)	Notes
Pressure-Swing	100 - 10,000	\$10,000 - \$50,000	\$1,000 - \$5,000	90 - 95	Most common type
Thermal	100 - 10,000	\$10,000 - \$50,000	\$1,000 - \$5,000	90 - 95	Requires heat source
Flare	100 - 10,000	\$10,000 - \$50,000	\$1,000 - \$5,000	90 - 95	Requires flare system



EPA PARTNER UPDATE
FALL 2004

In the News
Natural Gas STAR Program to Play Key Role in White House Methane to Markets Initiative

Partner Profile
Superior Implementation of Natural Gas STAR - Devon Energy Corporation



Install Electronic Flare Ignition Devices

PRO Fact Sheet No. 303

Technology Practice Overview

This document provides information on the benefits of electronic flare ignition devices, the types of devices available, and the costs of installation. It also includes a table of device types and their characteristics.

Device Type	Capacity (gallons per hour)	Installation Cost (\$)	Operating Cost (\$/year)	Efficiency (%)	Notes
Electronic Ignition	100 - 10,000	\$10,000 - \$50,000	\$1,000 - \$5,000	90 - 95	Most common type



Reducing Methane Emissions from Oil and Gas Systems



- Methane from leaks, system upsets, and process venting.
- Reduce fugitives through enhanced inspection and maintenance, capture/prevent vented emissions.
- Key emission reduction technologies/options
 - *Technology upgrades* - instrument air systems, replacing high-bleed pneumatic devices, vapor recovery units, flash tank separators
 - *Operational improvements* - directed inspection and maintenance programs, reduced emission completions, pipeline pump-downs



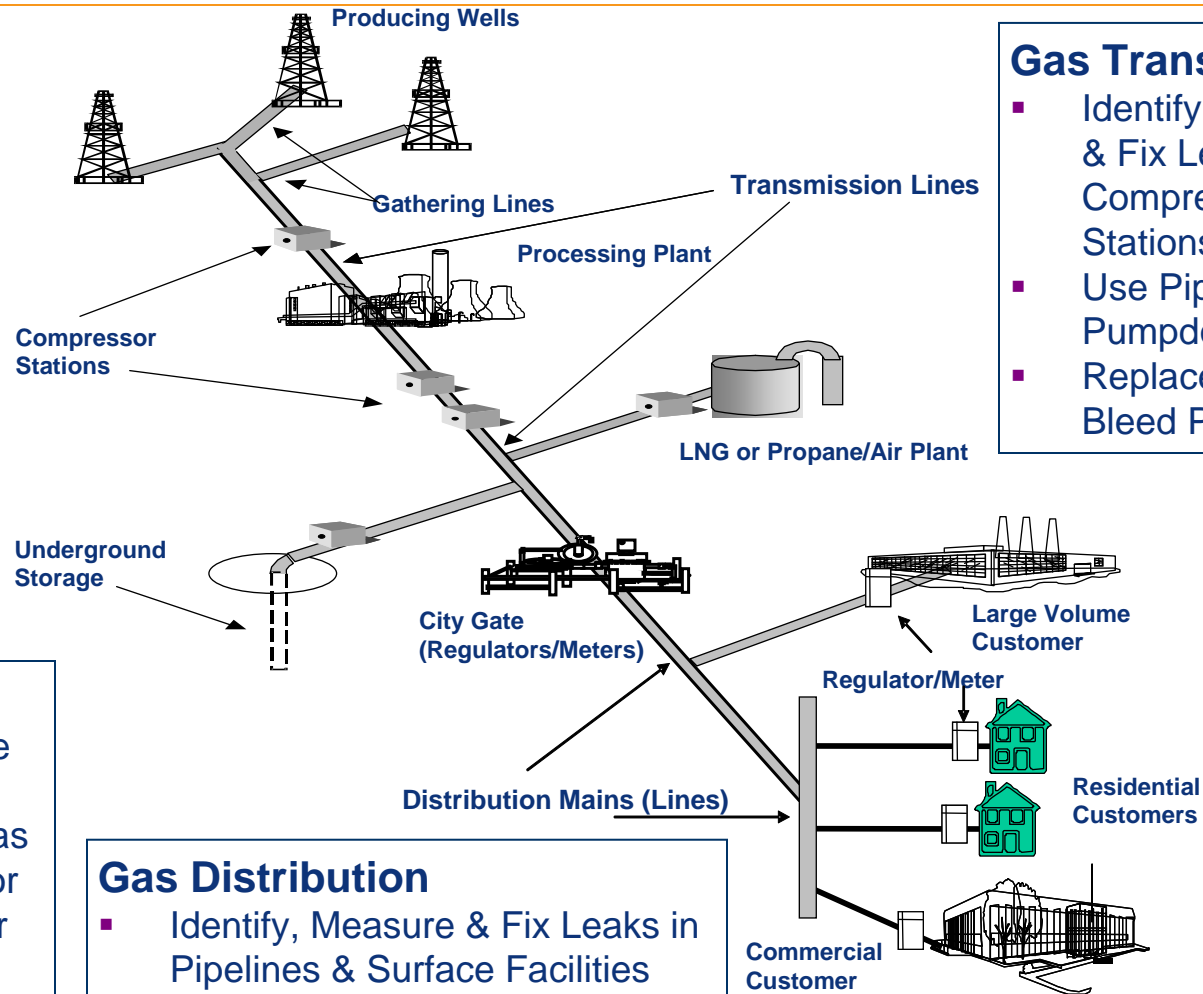
Oil & Gas Methane Emission Reduction Opportunities

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
- Use Pipeline Pumpdown Techniques to Minimize Venting

Picture courtesy of American Gas Association

U.S. Involvement: Accomplishments to Date

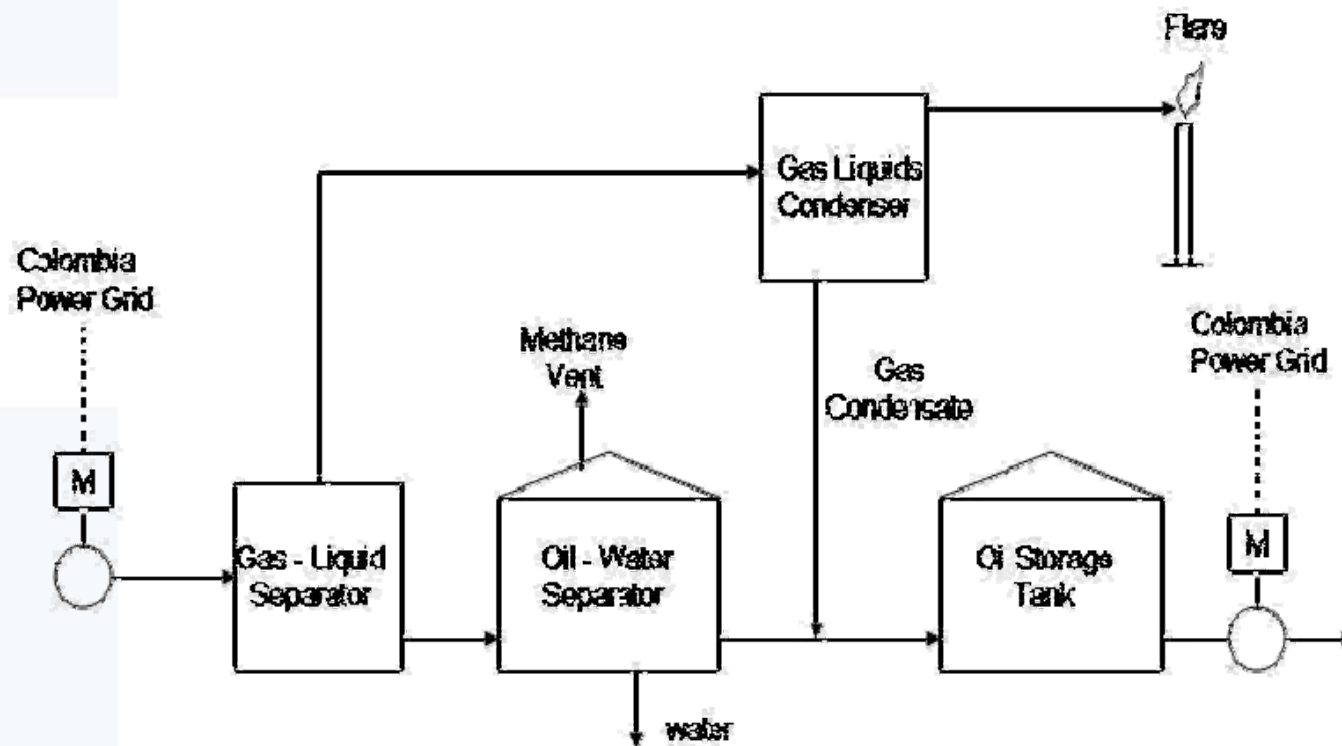
- **Oil and gas systems**
 - Funding two pilot projects at PEMEX facilities.
 - Estimated annual emission reductions of just over 120,000 MTCO₂E.
 - Developing two pre-feasibility analyses for gas capture and use for electricity generation at a Colombia crude oil facility
 - Held workshops in Columbia, Mexico, Russia, Calgary and Washington, DC. Will have a workshop in New Delhi this winter.
 - Funding two major natural gas compression directed inspection and maintenance projects in Ukraine.



Case Study: Colombia Current Practice

One partner company has oil production facilities in Colombia that currently operate with the process diagrammed below

- Flashed gas is vented from the water knockout tank
- Associated gas from the gas-liquid separator and condenser is



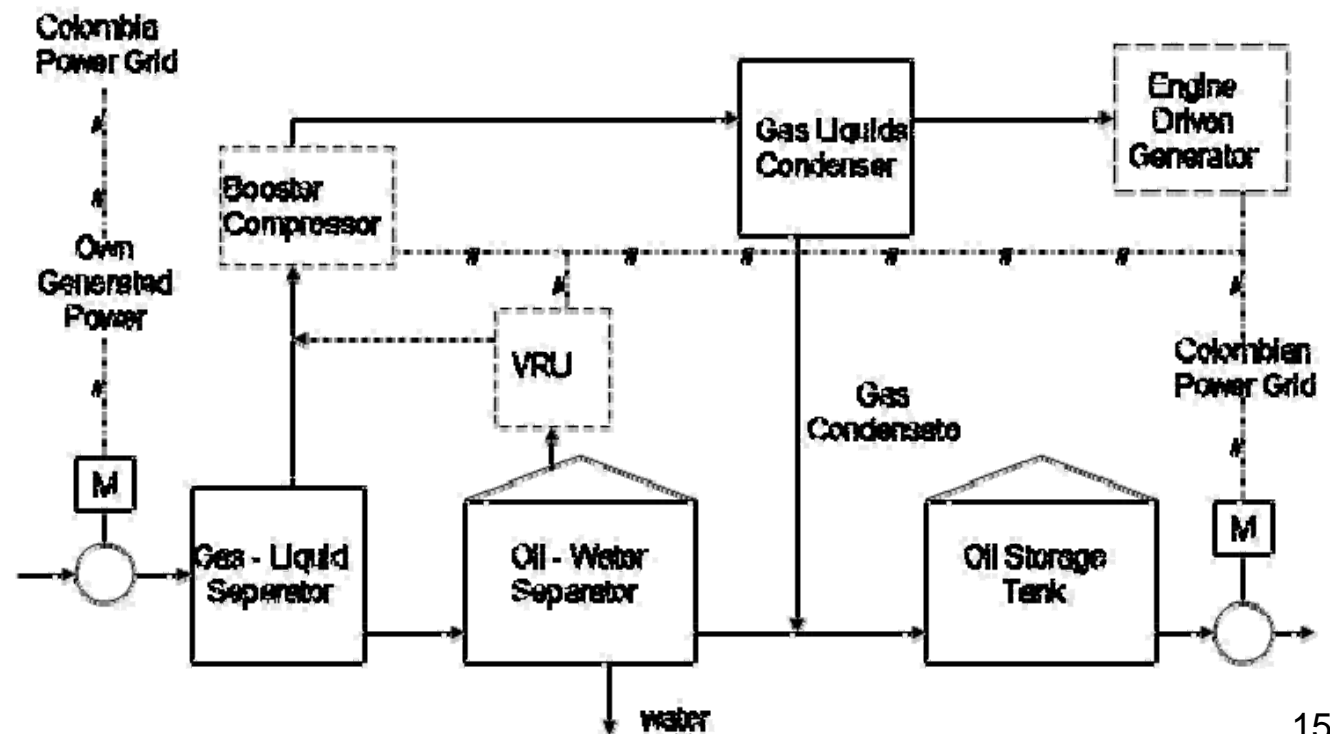
Case Study: Colombia Proposed Project

EPA proposed the process diagrammed below to turn methane emissions and gas waste into electrical energy.

- Install VRU to capture vented emissions off water knockout tank
- Install Reciprocating Engine/Generator to burn previously flared gas for electricity
- Compressor is used as part of a gas treatment to increase gas condensate to sales while keeping the fuel gas useable in the engines.

In this Case

- Flaring avoided
- Venting avoided
- Less power purchased



Case Study: Colombia Preliminary Economics

Flare and Vent Gas Recovery

- 3,100,000 m³ per year flared/vented hydrocarbons

Power Generated

- 8 Mega Watts (MW)

Economics

- 14 months simple payback
- 87% internal rate of return

Carbon emissions reduction

- 283,000 m³ per year methane
- 80,000 TCO₂e per year



How Methane to Markets Can Serve Indian Oil & Gas Companies

- M2M focuses on profitable **projects**
- Projects identify sources, quantify emissions, and implement reductions
- Verifiable projects that
 - Route methane to sales or local fuel
 - Reduce operating and equipment costs
 - Attain carbon credits
 - Increase safety
- Projects that meet **your** economic criteria, such as
 - Carbon market value
 - Return on investment
 - Value of intangible benefits
 - Stakeholder
 - Public relations
 - Sustainability

Potential M2M Activities with Indian Oil and Gas Industry

- Technology transfer
 - Technical documents
 - Workshops
 - One-on-one assistance

- Project Promotion
 - Project pre-feasibility analysis
 - Demonstrations
 - Technical support
 - Technical training

- Public recognition for increased focus on sustainability

2007 Methane to Markets Activities



- **Canadian / U.S. Methane to Markets Gas Processing Efficiency and Methane Emissions Reduction Workshop.** Hosted by CETAC-West, Environment Canada. Calgary, Alberta, January 2007

- **Advancing Project Development in India through Public Private Partnerships.**

Sponsored by FICCI, US Environmental Protection Agency (USEPA), U.S. Agency for International Development (USAID), US Trade and Development Agency (USTDA), Government of India Ministry of Petroleum and Natural Gas and Ministry of Power. New Delhi, February 22-23, 2007

- **Methane to Markets Oil & Gas Subcommittee Meeting.** Aberdeen, Scotland. April 30-May 2, 2007
- **Methane to Markets Partnership Expo: A Forum for Projects, Technology, Financing and Policy.** Beijing, China October 30 – November 1, 2007





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