EPA's Natural Gas STAR Program Overview

Production Technology Transfer Workshop
September 24, 2013
Philadelphia, PA

Why Methane?

- **Potent greenhouse gas**
  - 100 year GWP = 21
  - Lifetime = 12 years
  - Most important short-lived forcer— based on emissions, accounts for >1/3 of current anthropogenic forcing
- **Ozone precursor**
  - Affects ground-level ozone levels
- **Clean energy source – primary component of natural gas**
- **Many emission sources**
  - Oil & gas, agriculture & waste sectors
  - 50 - 70% of which are anthropogenic
- **Concentration of methane in the atmosphere has increased by 150% in the last 260 years**

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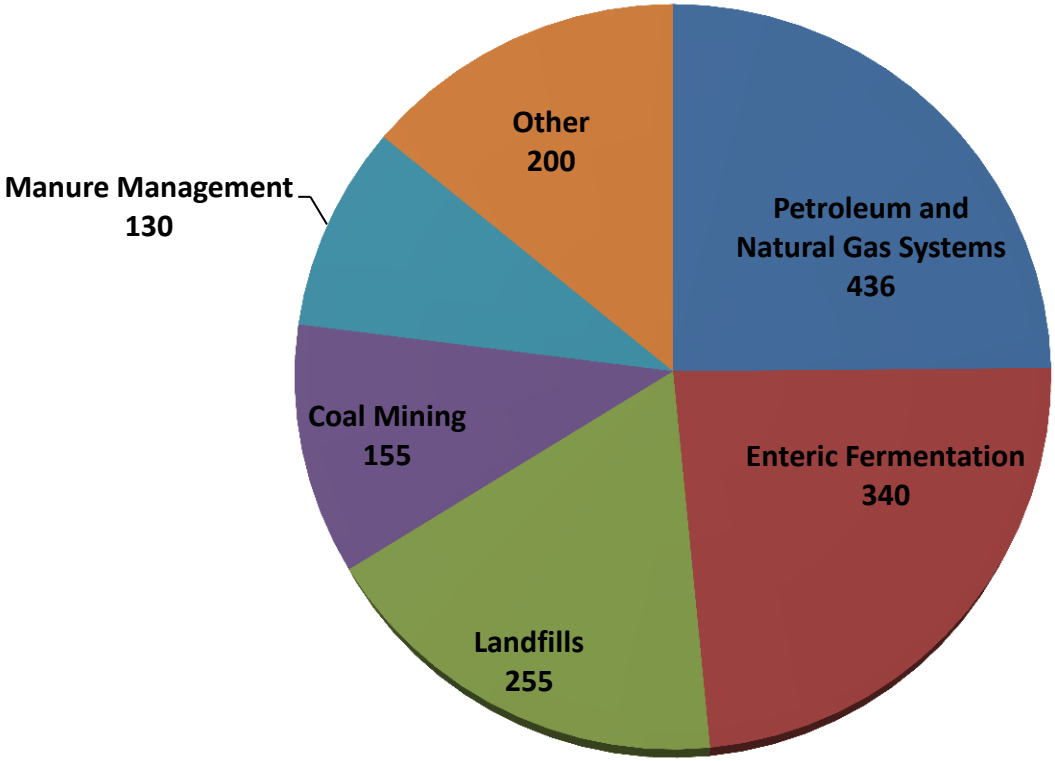
2011 U.S. Human-Made Methane Emissions



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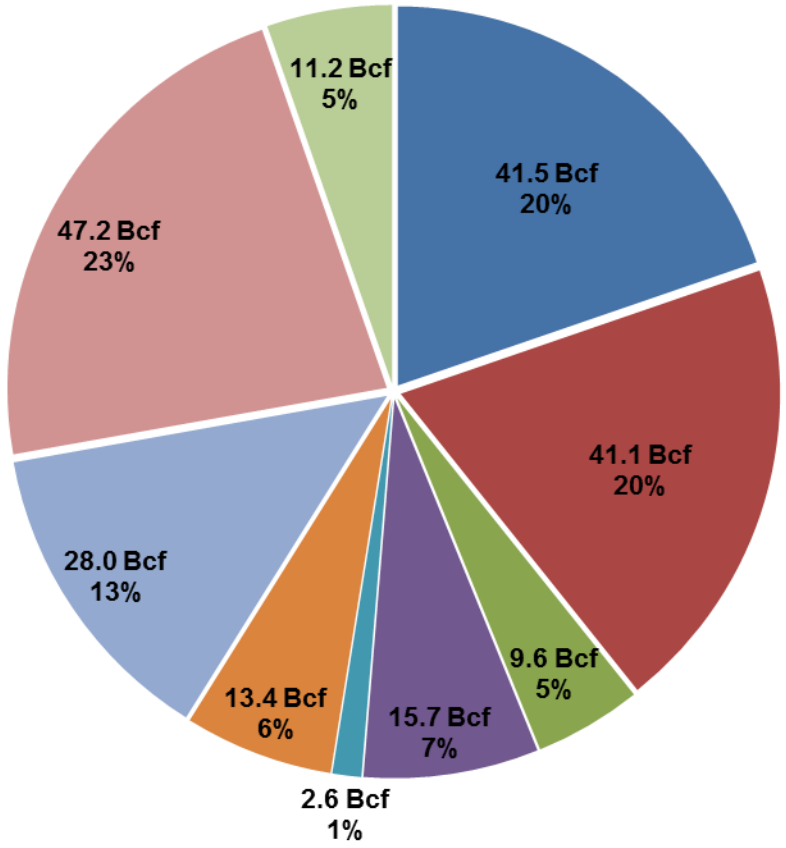
Production Sector Emissions



Production Sector Emissions 2011

Total Emissions 210.3 Bcf

- Completions/Workovers
- Pneumatic Device Vents
- Glycol and Chemical Pumps
- Gas Engines
- Compressors
- Liquids Unloading
- Tanks (condensate and oil)
- offshore (gross)
- Other Production

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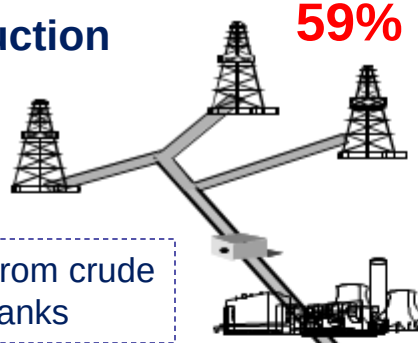
Sources of Methane Emissions from Oil and Gas Operations



Oil Production

59%

Venting of casinghead gas

Flash emissions from crude oil storage tanks

Natural Gas Production & Processing

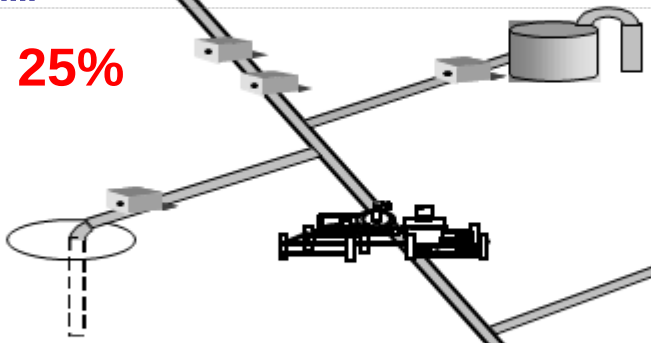
Well completions, blowdowns and workovers

Reciprocating compressor rod packing

Venting from glycol reboilers on dehydrators

Processing plant leaks

Gas-driven pneumatic devices



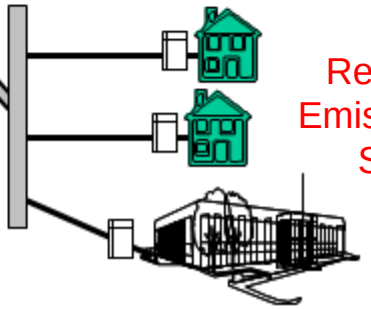
Gas Transmission

25%

Venting of gas for maintenance or repair of pipelines or compressors

Leaks from pipelines, compressor stations

Centrifugal compressor seal oil de-gassing



Gas Distribution

16%

Leaks from mains and service lines

Leaks at metering and regulating stations

Pipeline blowdowns

Red Numbers are Emissions from Each Sector in U.S.

Picture courtesy of American Gas Association

Values Source: 2013 Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011

Methane Projects Deliver Significant Co-Benefits

- **New Sources of Clean Energy**
  - Emission capture makes methane available for local energy generation
- **Air Quality Improvement**
  - Decrease in ground-level ozone
  - Reduction of local emissions of VOCs and HAPs
- **Industrial Safety**
  - Methane is explosive – improved worker safety

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Natural Gas STAR Program

- **Started in U.S. in 1993 to increase awareness of methane emission sources and share innovative means of reducing them**
  - Expanded internationally in 2006 as part of GMI
- **Over 120 domestic and international partners have**
  - Identified over 50 cost-effective technologies and practices to reduce methane emissions
  - Reduced methane emissions by nearly 1 trillion cubic fee (Tcf), saving more U.S. $3 billion

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Natural Gas STAR 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 50 mitigation options, including analyses of economic, environmental and operational benefits
- **Workshops** and **Conferences**
- **Individual assistance** to identify and assess project opportunities
  - Estimated methane **emission inventories**
  - **Measurement studies**
  - **Mitigation project feasibility studies**
- **Services and resources provided free of charge and at no obligation**

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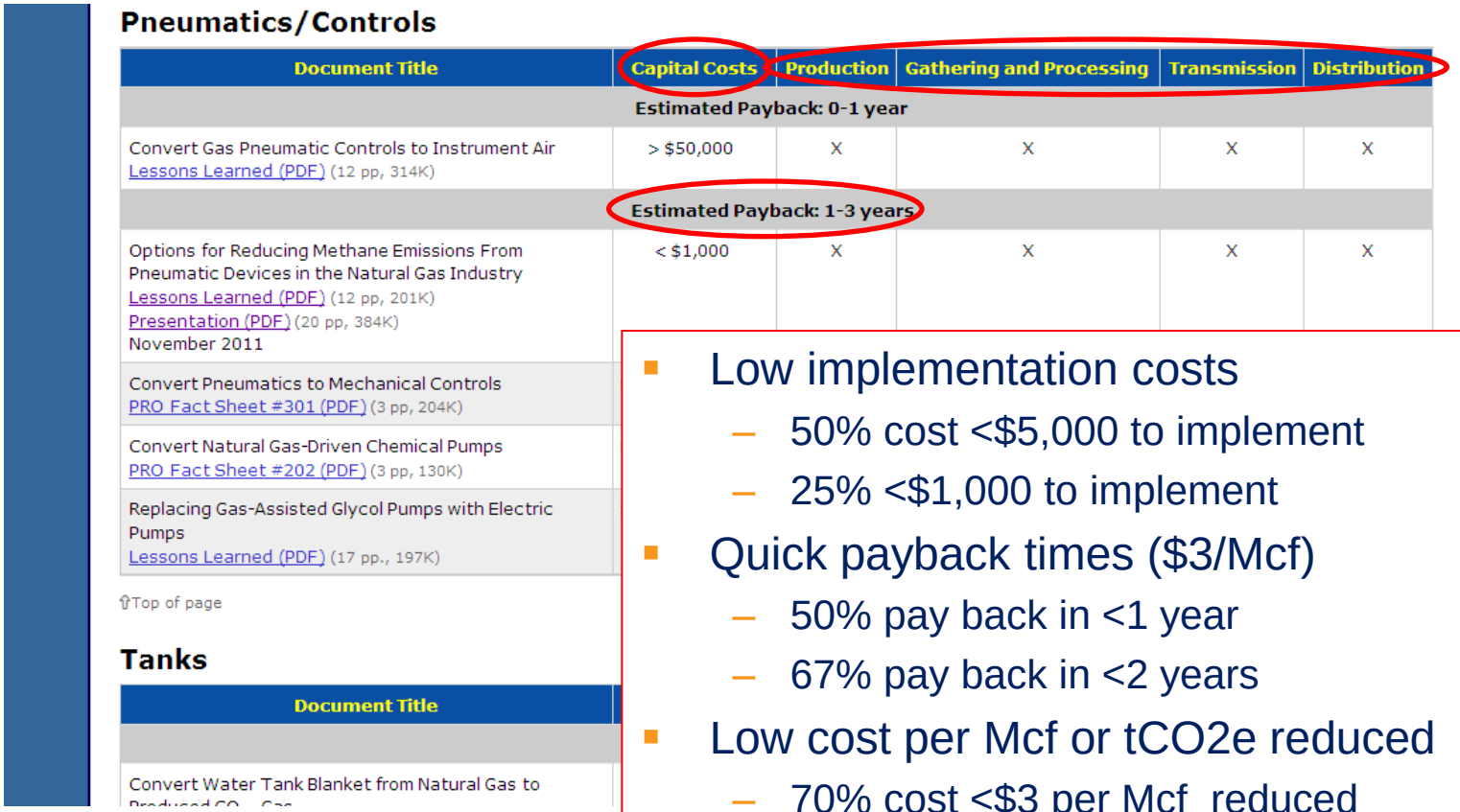
Over 50 Cost-Effective Methane Reduction Opportunities



Pneumatics/Controls

Document Title	Capital Costs	Production	Gathering and Processing	Transmission	Distribution
Estimated Payback: 0-1 year					
Convert Gas Pneumatic Controls to Instrument Air Lessons Learned (PDF) (12 pp, 314K)	> $50,000	X	X	X	X
Estimated Payback: 1-3 years					
Options for Reducing Methane Emissions From Pneumatic Devices in the Natural Gas Industry Lessons Learned (PDF) (12 pp, 201K) Presentation (PDF) (20 pp, 384K) November 2011	< $1,000	X	X	X	X
Convert Pneumatics to Mechanical Controls PRO Fact Sheet #301 (PDF) (3 pp, 204K)					
Convert Natural Gas-Driven Chemical Pumps PRO Fact Sheet #202 (PDF) (3 pp, 130K)					
Replacing Gas-Assisted Glycol Pumps with Electric Pumps Lessons Learned (PDF) (17 pp., 197K)					

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Tanks

Document Title
Convert Water Tank Blanket from Natural Gas to

Screenshot from EPA Gas STAR website

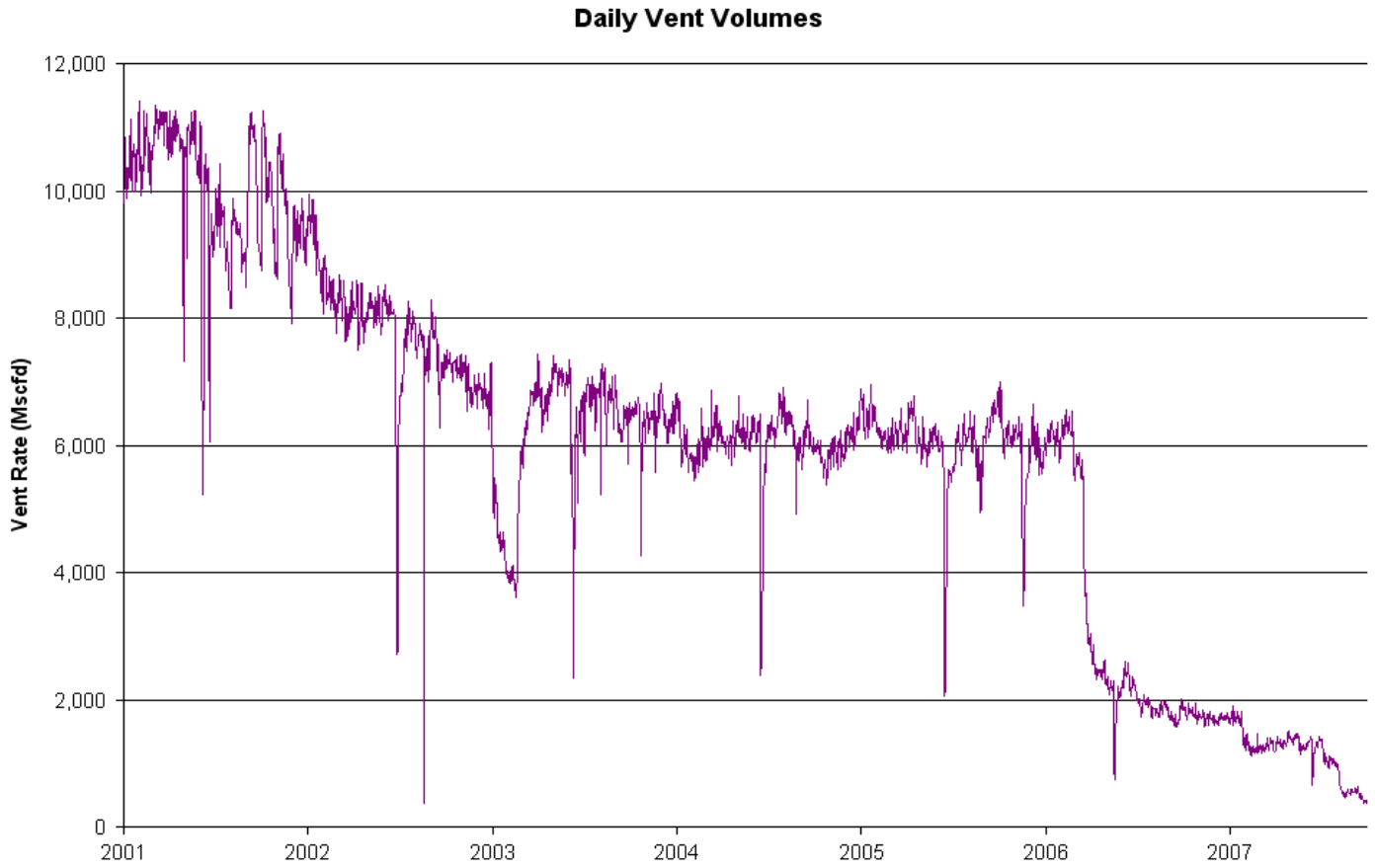
- Low implementation costs
  - 50% cost <$5,000 to implement
  - 25% <$1,000 to implement
- Quick payback times ($3/Mcf)
  - 50% pay back in <1 year
  - 67% pay back in <2 years
- Low cost per Mcf or tCO2e reduced
  - 70% cost <$3 per Mcf reduced
  - 70% cost <$10 per tCO2e reduced

Strategy for Addressing Methane Emissions

Develop Emissions BASELINE	▪ Develop source- and process-specific methane inventory. ▪ Use emission factors, engineering calculations, software tools, direct measurement.
Evaluate Best REDUCTION OPPORTUNITIES	▪ Prioritize largest sources and most cost-effective reduction projects. ▪ Conduct measurement studies and detailed analyses to confirm volumes and scope reduction projects.
IMPLEMENT Reduction PROJECTS	▪ Implement top reduction projects. ▪ Pilot projects or company-wide. ▪ Document and share lessons learned.
Document and SHARE SUCCESSES	▪ Quantify operational, economic, and environmental results. ▪ Publicize results to stakeholders.

Industry Experience – Well Unloading

Well Venting Reduction Using Plunger Lifts and Smart Automation



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Industry Experience – Pneumatics

- Chesapeake retrofitted controllers with Mizer low bleed components
- Total 2,670 retrofits done through March 31, 2009
  - Cost: U.S.$1,447,140
  - Methane Reductions: **18 million m^3**
  - **7 month simple payback** reported using Chesapeake's gas value of ~$3.50/MMBtu

Fisher 2500, 2506
Retrofit w/ Mizer, bracket, tubing & relay plug

Cemco/WellMark 6900
Retrofit w/ Mizer Valve

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Chesapeake ENERGY

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Industry Experience – Pneumatics

U.S. District	Retrofits Done Thru 31-Mar-09	Daily Reduction (thousand m^3)	Annual Reduction (million m^3)
Anadarko	1,264	25.1	9.2
Arkansas	100	2.0	0.7
North Mid-Continent	467	9.3	2.8
Southern Oklahoma	372	7.4	2.8
West Mid-Continent	47	0.9	0.4
Gulf Coast	161	3.2	1.2
Louisiana	17	0.3	0.1
North Permian	93	1.8	0.7
South Permian	149	2.9	0.6
Total	**2,670**	**52.9**	**18.4**

Using $3.50/MMBtu, the simple payback is 7 months.

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Chesapeake ENERGY

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Industry Experience – VRUs

- Payback economics – project for 9 tank batteries
  - Purchase price for 9 VRUs U.S.$475,000
  - Estimate install cost U.S.$237,500
  - Total capital costs U.S.$712,500

- Approximate Gas Revenue
  - 29.7 Mcm/day x $100/Mcm* x 30 days = U.S.$89,100/ month
  - Payback on capital investment < 8 months
  - Installed in 2005 & early 2006 – all locations continue to generate incremental revenue and meet environmental compliance goals today

*U.S.$100/Mcm ≈ U.S.$3/Mcf

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ConocoPhillips

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SAVE THE DATE!

Natural Gas STAR

Annual Implementation Workshop

October 28-30, 2013

Grand Hyatt San Antonio

San Antonio, TX

Learn more at:

www.epa.gov/gasstar/workshops/annualimplementation/2013.html

Contact

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