

Producer Best Management Practices and Opportunities

Lessons Learned from Natural Gas STAR



Producers Technology Transfer Workshop

**Devon Energy Corporation
and
EPA's Natural Gas STAR Program**

April 20, 2005

Agenda

- ★ Production Sector Emissions
- ★ Top Partner Reported Opportunities (PROs)
- ★ Emissions Savings from Other PROs
- ★ Directed Inspection & Maintenance Overview
- ★ Discussion Questions



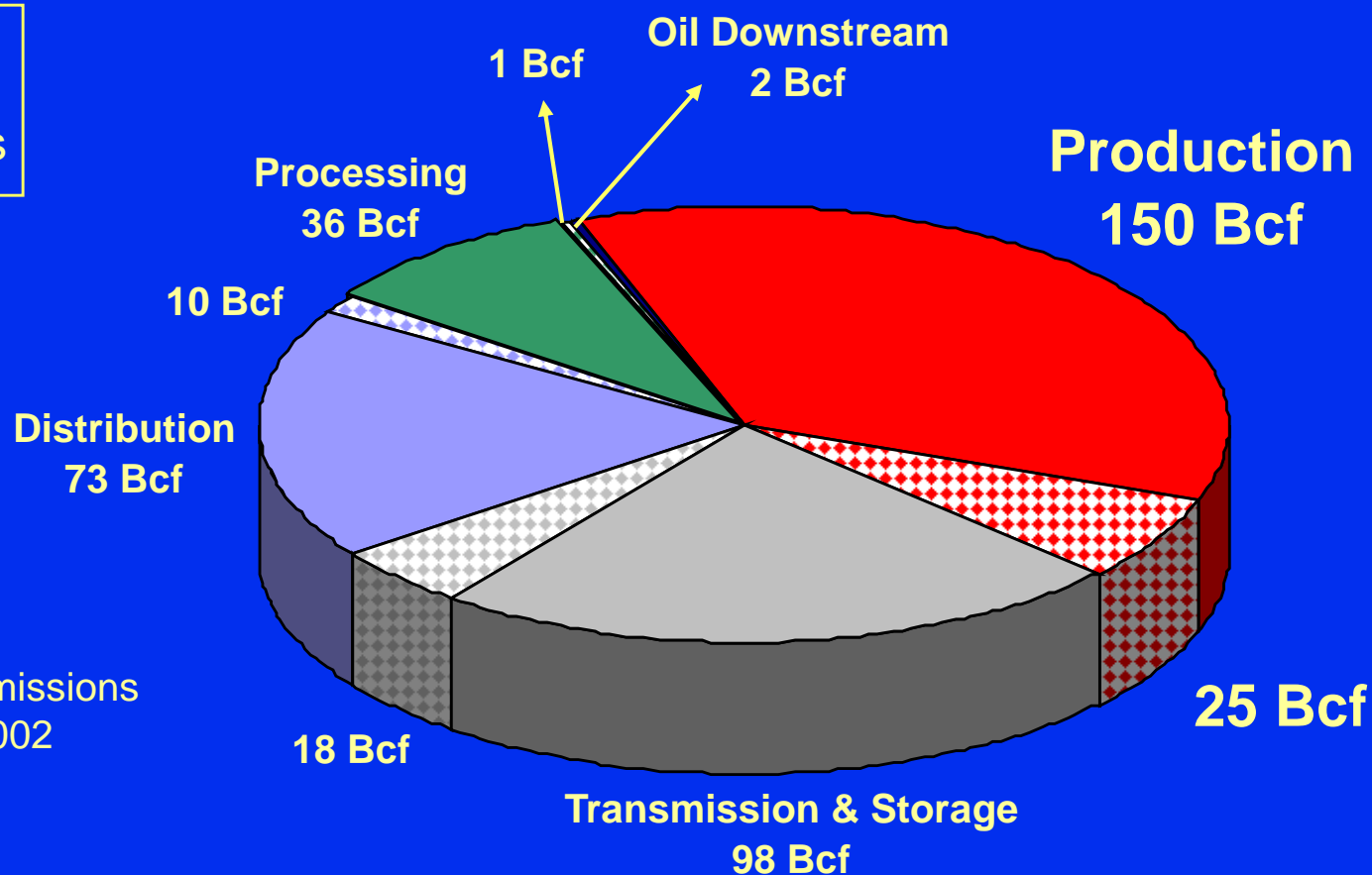
EPA POLLUTION PREVENTER

Reducing Emissions, Increasing Efficiency, Maximizing Profits

Page 2

Natural Gas and Petroleum Industry Emissions

☆ Production responsible for largest portion of emissions



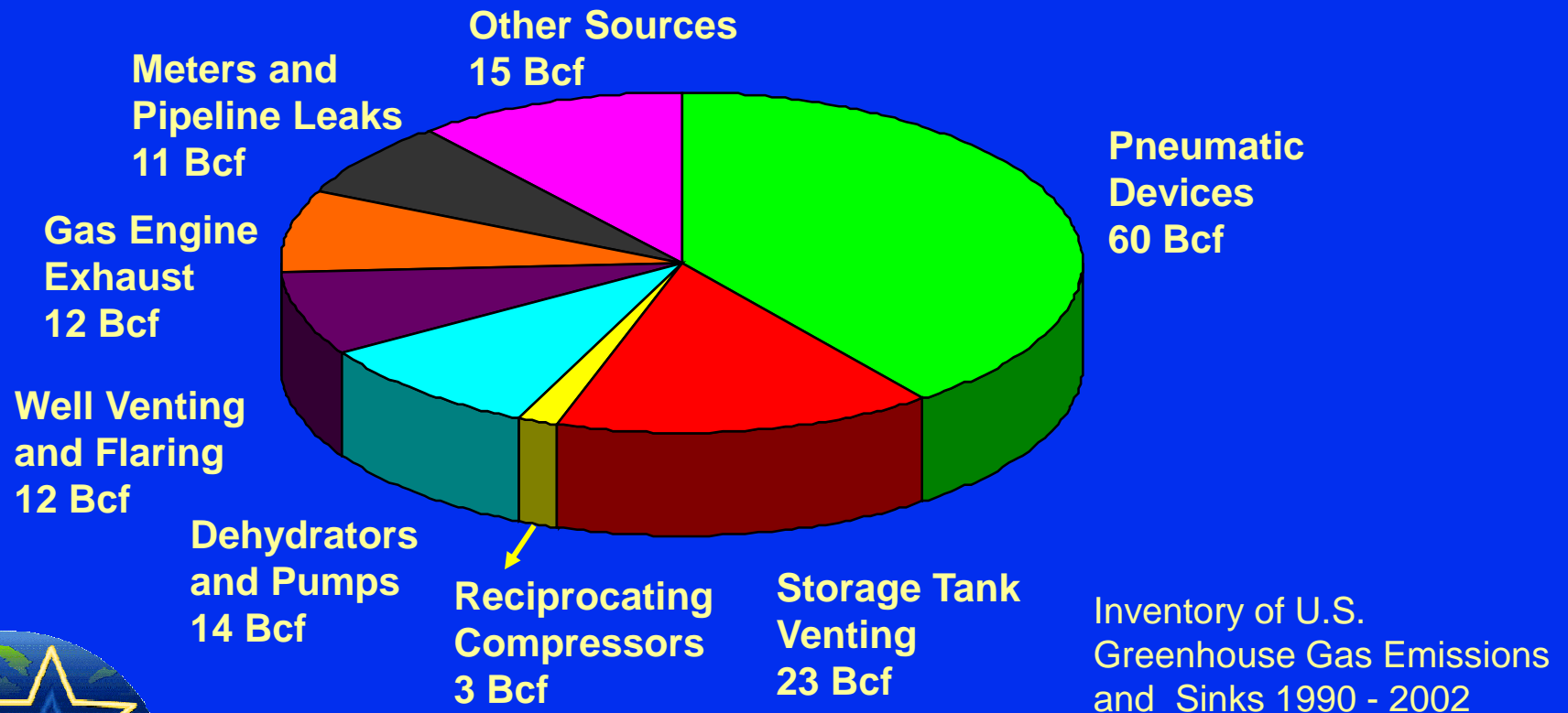
Inventory of U.S.
Greenhouse Gas Emissions
and Sinks 1990 - 2002



Reducing Emissions, Increasing Efficiency, Maximizing Profits

Oil and Gas Production Sector Emissions

- ★ The production sector has several large methane emission sources that can be targeted for reductions

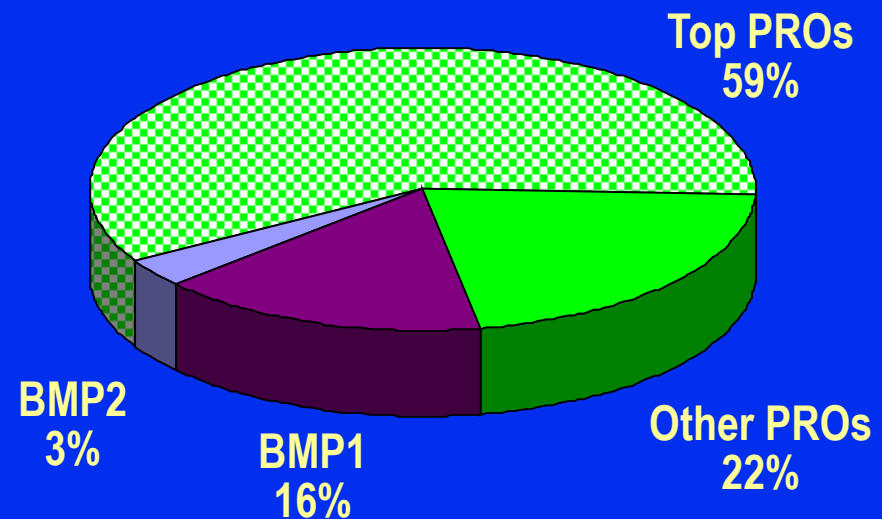


Reducing Emissions, Increasing Efficiency, Maximizing Profits

Best Management Practices (BMPs)

- ☆ BMP 1: Identify and replace high bleed pneumatic devices
- ☆ BMP 2: Install flash tank separators on glycol dehydrators
- ☆ BMP 3: Partner Reported Opportunities (PROs)

◆ **81% of production sector reductions came from PROs**



Frequently Implemented PROs

★ The Gas STAR program has documented 42 PROs that are applicable to the production sector

★ Nine “top” PROs:

- ◆ PROs most reported by production Gas STAR partners
- ◆ Target major emissions sources
- ◆ Responsible for over 2/3 of PRO emissions reductions

The image displays three overlapping Natural Gas PRO Fact Sheets. The top sheet is titled 'Nitrogen Rejection Unit Optimization'. The middle sheet is titled 'Zero Emissions Dehydrators'. The bottom sheet is titled 'Convert Engine Starting to Nitrogen' and includes a 'PRO Fact Sheet No. 101' label. Each sheet contains sections for 'Applicable sectors', 'Description', 'Technology/Practice Overview', 'Operating Requirements', 'Applicability', and 'Methane Emissions Reductions'. The bottom sheet also includes a 'Methane Savings' table with columns for 'Costs' and 'Payback (Years)'.

Methane Savings: 1,200 Mscf per year	
Capital Costs (including installation)	\$10,000 - \$15,000 - \$20,000 - \$25,000
Operating and Maintenance Costs (annual)	\$1,000 - \$2,000 - \$3,000 - \$4,000
Payback (Years)	1-2 2-3 3-4 4-5



EPA POLLUTION PREVENTER

Reducing Emissions, Increasing Efficiency, Maximizing Profits

Top PROs

Rank	Top PROs	Payback	Methane Savings
1	Install Instrument Air Systems	<1 yr	20,000 Mcf/yr
2	Install Plunger Lifts	<1 yr	>4,700 Mcf/yr
3	Pipe Glycol Dehydrator to Vapor Recovery Unit	<1 yr	3,300 Mcf/yr
4	Convert Gas-Driven Chemical Pumps to Instrument Air	<1 yr	2,500 Mcf/yr
5	Eliminate Unnecessary Equipment and/or Systems	<1 yr	2,000 Mcf/yr
6	Install Vapor Recovery Units	1-3 yr	>4,900 Mcf/yr
7	Consolidate Crude Oil Production and Water Tank Storage	1-3 yr	4,200 Mcf/yr
8	Install Electric Compressors	>10 yr	6,440 Mcf/yr
9	Install Flares	None	2,000 Mcf/yr

- ★ Determine which top PROs are not currently implemented at your company
- ★ Revisit economics of top PROs using current gas price



Top PROs Currently Reported

Partner Reported Opportunities	ExxonMobil Corp.	ChevronTexaco	Burlington Resources Inc.	Marathon	Kerr-McGee Corp.	Devon	Methane Savings per Application
<u>Compressors/Engines</u>							
Install Electric Compressors	x				x		6,440 Mcf/yr
<u>Dehydrators</u>							
Convert Gas-Driven Chemical Pumps to Instrument Air	x	x		x	x		2,500 Mcf/yr
Pipe Glycol Dehydrator to Vapor Recovery Unit		x	x		x		3,300 Mcf/yr
<u>Wells</u>							
Install Plunger Lifts	x		x	x	x		4,700 Mcf/yr



Top PROs Currently Reported, Cont.

Partner Reported Opportunities	ExxonMobil Corp.	ChevronTexaco	Burlington Resources Inc.	Marathon	Kerr-McGee Corp.	Devon	Methane Savings per Application
<u>Pneumatics/Controls</u>							
Install Instrument Air Systems	x	x		x	x		20,000 Mcf/yr
<u>Tanks</u>							
Consolidate Crude Oil Production and Water Tank Storage	x			x			4,200 Mcf/yr
Install Vapor Recovery Units	x	x	x	x	x	x	4,900 Mcf/yr
<u>Other</u>							
Install Flares	x	x	x	x	x	x	2,000 Mcf/yr
Eliminate Unnecessary Equipment and/or Systems	x	x		x	x	x	2,000 Mcf/yr



Emissions Targeted by Top PROs

- ☆ BMPs and top PROs target over 75% of production sector emissions but have only reduced emissions by 20%
- ☆ This means:
 - ◆ Partners that report PROs recognize major emissions sources and are taking steps to mitigate emissions
 - ◆ Partners not practicing all BMPs and top PROs may have further opportunities for methane savings



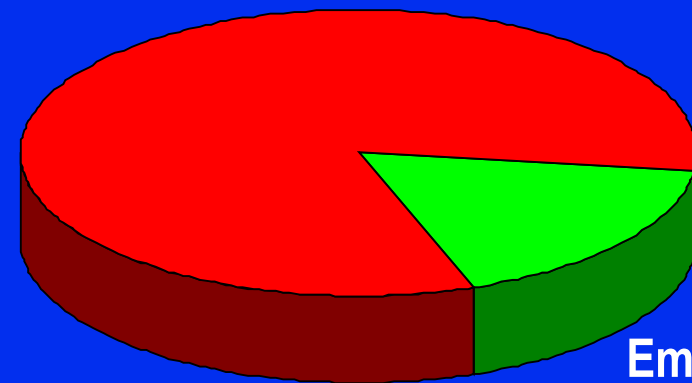
EPA POLLUTION PREVENTER

Reducing Emissions, Increasing Efficiency, Maximizing Profits

Installing Vapor Recovery Units

- ☆ Only 18% of emissions from crude oil storage tanks were recovered in 2002
- ☆ Lessons Learned studies show that vapor recovery units save 5,000 to 100,000 Mcf/yr per application
- ☆ Installing vapor recovery units still has much potential for methane and money savings

Storage Tank Emissions
23 Bcf

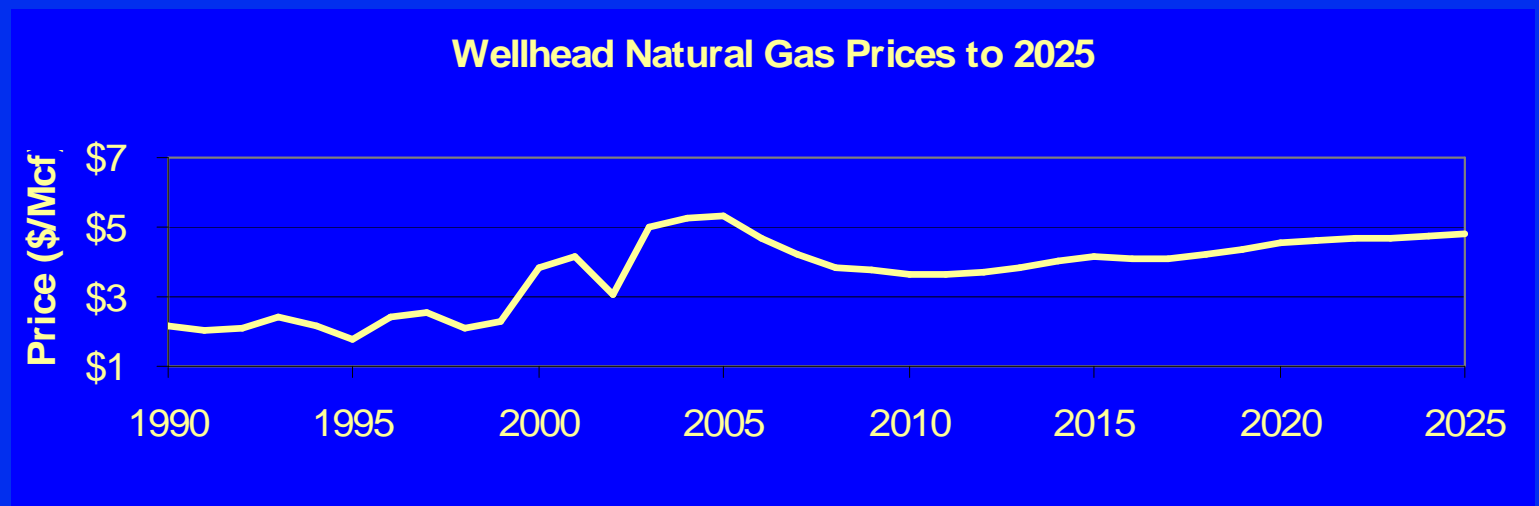


Emissions
Recovered
4.7 Bcf



Gas Price and Methane Savings

- ☆ Economics of implementing new PROs change with gas price
- ☆ PRO fact sheets use nominal gas price of \$3/Mcf
- ☆ Many PROs were reported when gas price <\$2



EIA Annual Energy Outlook <http://www.eia.doe.gov/oiaf/petgas.html>



Reducing Emissions, Increasing Efficiency, Maximizing Profits

Emissions Savings from Other PROs

☆ Fact Sheets for the 42 PROs applicable to the production sector are posted on the Gas STAR website

- ◆ 8 Compressor/Engine related
- ◆ 6 Dehydrator related
- ◆ 2 Pneumatics/Controls related
- ◆ 3 Pipeline related
- ◆ 5 Tank related
- ◆ 6 Valve related
- ◆ 9 Well related
- ◆ 3 Miscellaneous



Other PROs with High Potential Savings

Rank	PROs	Payback	Methane Savings
1	Install Compressors to Capture Casinghead Gas	<1 yr	32850 Mcf/yr
2	Rerouting of Glycol Skimmer Gas	<1 yr	7600 Mcf/yr
3	Connect Casing to Vapor Recovery Unit	<1 yr	7300 Mcf/yr
4	Inspect & Repair Compressor Station Blowdown Valves	<1 yr	2000 Mcf/yr
5	Use Ultrasound to Identify Leaks	<1 yr	2000 Mcf/yr

- ★ Fewer partners have reported other PROs with niche applications and high savings
- ★ These PROs may have broader application and better payback at today's higher gas prices



New PRO: Portable Desiccant Dehydrators

- ☆ Desiccant dehydrator transported to low pressure gas well sites
 - ◆ Use desiccant dehydrator during glycol dehydrator maintenance rather than venting gas
 - ◆ Use desiccant dehydrator during green completions rather than venting gas

Gas Price (\$/Mcf)	\$ 2.00	\$ 3.00	\$ 4.00
Gas Saved (Mcf/yr)	2,400	2,400	2,400
Annual Savings (\$/yr)	\$ 4,800	\$ 7,200	\$ 9,600
Installed Cost	\$ 4,275	\$ 4,275	\$ 4,275
Operating Cost	\$ 5,239	\$ 5,239	\$ 5,239
Payback Period (years)	-	2.2	1.0



New PRO: Zero Emissions Dehydrators

- ☆ Zero emissions dehydrators are designed to save emissions from still column exhaust and glycol circulation pumps
 - ◆ Non-condensable still column vapor used to fire glycol reboiler saving emissions and fuel
 - ◆ Electric glycol circulation pumps instead of gas-driven pumps

Gas Price (\$/Mcf)	\$ 2.00	\$ 3.00	\$ 4.00
Gas Saved (Mcf/yr)	31,415	31,415	31,415
Annual Savings (\$/yr)	\$ 62,830	\$ 94,246	\$ 125,661
Installed Cost	\$ 75,000	\$ 75,000	\$ 75,000
Operating Cost	\$ 8,988	\$ 8,988	\$ 8,988
Payback Period (years)	1.4	0.9	0.6



Directed Inspection and Maintenance (DI&M) by Leak Imaging

- ☆ Real-time visual image of gas leaks
 - ◆ Quicker identification & repair of leaks
 - ◆ Screen hundreds of components an hour
 - ◆ Screen inaccessible areas simply by viewing them
 - ◆ Aerial surveillance of flow lines



Reducing Emissions, Increasing Efficiency, Maximizing Profits

Infrared Gas Imaging Technology

- ☆ Active and passive IR technologies
- ☆ Shoulder- and/or tripod- mounted
 - ◆ Hand-held prototype 2005
- ☆ Aerial surveillance applications
- ☆ Require battery and/or power cord
- ☆ Most very large leaks ($> 3\text{cf/hr}$) clearly seen



Infrared Gas Imaging

- ☆ Video recording of fugitive leak found by infrared camera



Discussion Questions

- ★ Have you found any of the top PROs to be economically unattractive?
- ★ How do you take into account the price of gas when examining which PROs to implement?
- ★ What are some of the other issues that are preventing you from implementing these technologies and practices?

