



Methane to Markets



Reducing Methane Emissions from Pneumatic Devices

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

October 4, 2010, Moscow, Russia

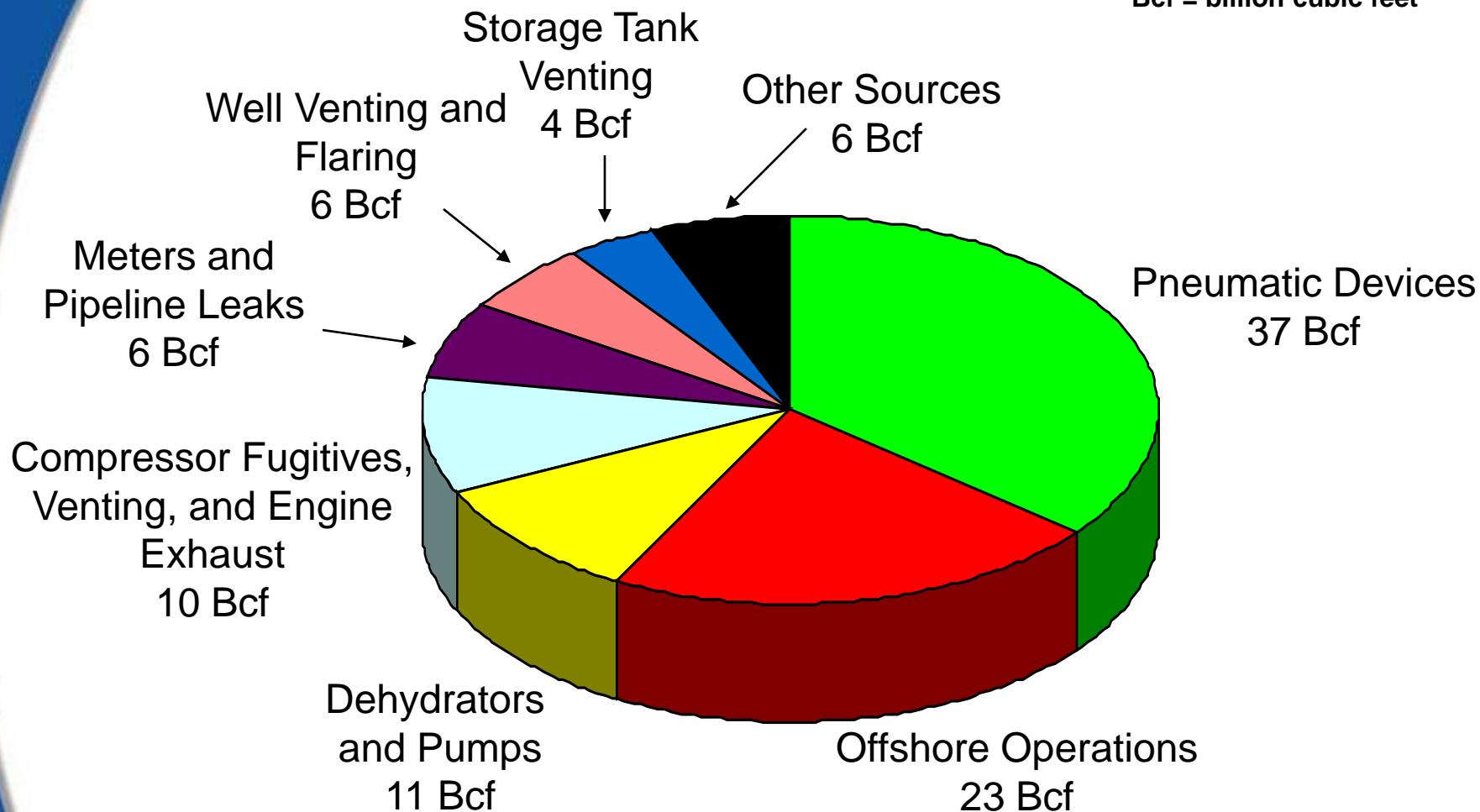
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Pneumatic Devices: Agenda

- Methane Losses
- Methane Recovery
- Is Recovery Profitable?
- Industry Experience
- Discussion

2008 Production Sector Methane Emissions (103 Bcf)

Bcf = billion cubic feet



What is the Problem?

- Pneumatic devices are collectively a major source of methane emissions in the U.S. the natural gas industry
- Natural gas powered pneumatic devices are used throughout the U.S. oil and natural gas industry

	Number of Devices in Natural Gas Systems	Number of Devices in Petroleum Systems
Production and Gathering	443,000	396,000
Processing	11,000	-
Transmission and Storage	85,000	-

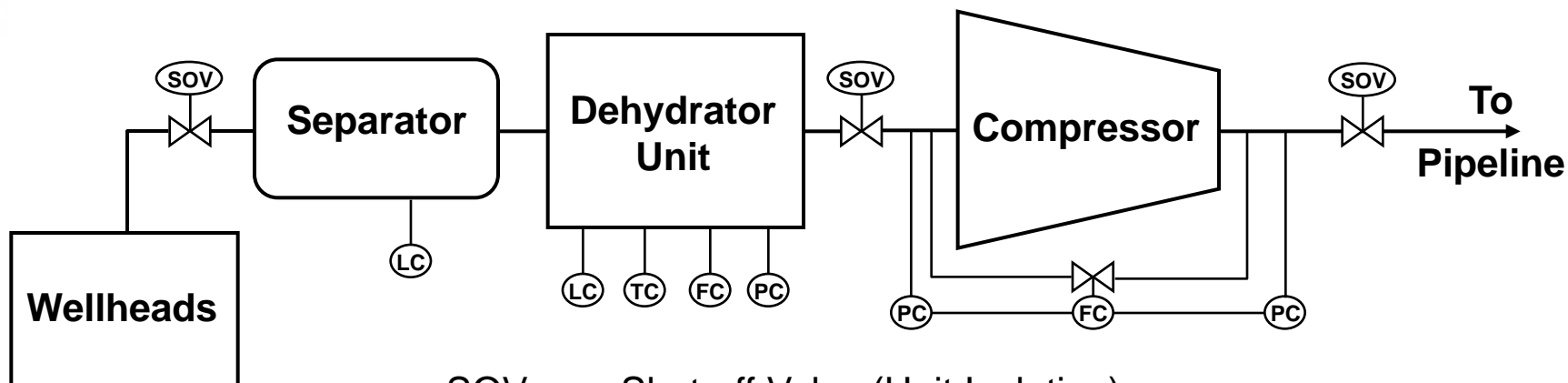
Pneumatic Devices: Methane Emissions

- As part of normal operations, pneumatic devices release natural gas to atmosphere
- High-bleed devices are defined as those that bleed in excess of 4 m³ per day¹
 - Aggregates to more than 1,416 m³/year¹ in the U.S.
 - Typical high-bleed pneumatic devices bleed an average of 3,965 m³/year¹
- Actual bleed rate is largely dependent on device's design and maintenance

1 – EPA. *Lessons Learned: Options for Reducing Methane Emissions from Pneumatic Devices in the Natural Gas Industry*. October 2006.

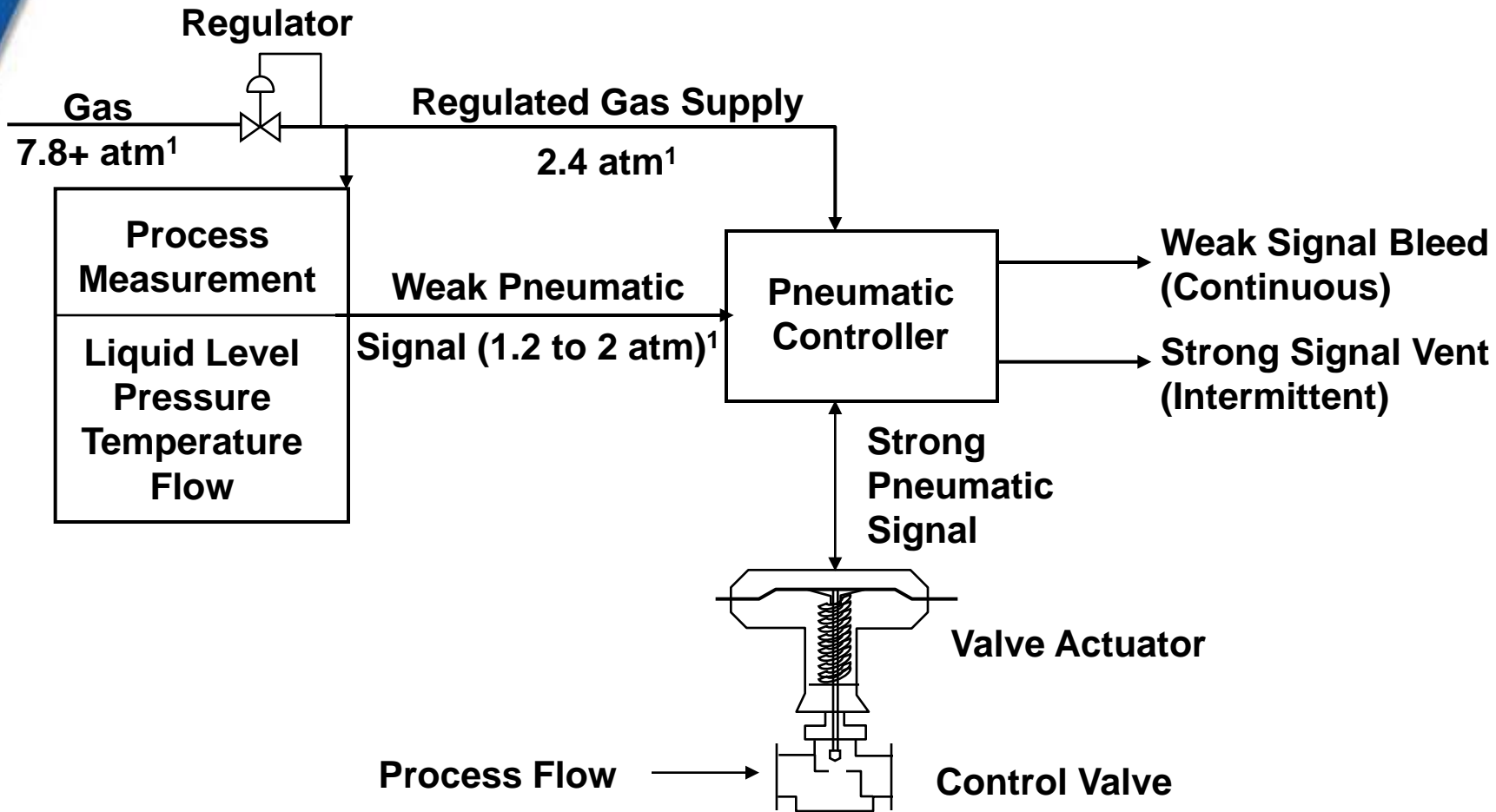
Methane Losses from Pneumatic Devices

- Pneumatic devices are used to actuate process controls on equipment throughout the natural gas industry



- SOV = Shut-off Valve (Unit Isolation)
 LC = Level Control (Separator, Contactor, Glycol Regenerator)
 TC = Temperature Control (Regenerator Fuel Gas)
 FC = Flow Control (Glycol Circulation, Compressor Bypass)
 PC = Pressure Control (Flash Tank Pressure, Compressor Suction/Discharge)

How Gas Pneumatic Devices Work



¹ 1 atmosphere (atm) = 0 pounds per square inch gauge (psig) and 14.7 pounds per square inch atmospheric (psia)

1 atm = 1.013 bar and 101.3 kilopascals (kPa)

Methane Recovery from Pneumatic Devices

- Option 1: Replace high-bleed devices with low-bleed devices
 - Replace at end of device's economic life
 - Typical cost range from RUB 21,500 to RUB 92,200 per device
- Option 2: Retrofit controller with bleed reduction kits
 - Retrofit kit costs approximately RUB 20,700
 - Payback time approximately 6 months
- Option 3: Maintenance aimed at reducing losses
 - Field survey of controllers
 - Re-evaluate the need for pneumatic positioners
 - Cost is low
- Field experience shows that up to 80% of all high-bleed devices can be replaced or retrofitted with low-bleed equipment

All data are based on Partners' experiences and represented in U.S. economics converted to Russian currency

Five Steps for Reducing Methane Emissions from Pneumatic Devices

LOCATE and INVENTORY high-bleed devices



ESTABLISH the technical feasibility and costs of alternatives



ESTIMATE the savings



EVALUATE economics of alternatives



DEVELOP an implementation plan

Suggested Analysis for Replacement

- Replacing high-bleed controllers at end of economic life
 - Determine incremental cost of low-bleed device over high-bleed equivalent
 - Determine gas saved with low-bleed device using manufacturer specifications
 - Compare savings and cost
- Early replacement of high-bleed controllers
 - Compare gas savings of low-bleed device with full cost of replacement

Implementation ^a	Replace at End of Life	Early Replacements	
		Level Control	Pressure Control
Cost (RUB)	4,600 to 7,700 ^b	15,760	55,580
Annual Gas Savings (m ³)	1,400 to 5,660	4,700	6,460
Annual Gas Savings (Mcf)	50 to 200	166	228
Annual Value of Saved Gas (RUB) ^c	15,900 to 64,300	53,400	73,400
IRR (%)	345 to 835	339	130
Payback (months)	2 to 6	4	9

^a All data based are based on Partners' experiences and **represented in U.S. economics converted to Russian currency.**

^b Range of incremental costs of low-bleed over high bleed equipment

^c 2008 Russian gas sales price for European Market at \$370/Mcm (RUB 11,360/Mcm) - eia.doe.gov/cabs/Russia/NaturalGas.html

Suggested Analysis for Retrofit

- Retrofit of low-bleed kit
 - Compare savings of low-bleed device with cost of conversion kit
 - Retrofitting reduces emissions by average of 90%

	Retrofit^a
Implementation Costs^b	RUB 20,700
Bleed rate reduction (m ³ /device/year)	6,200
Bleed rate reduction (Mcf/device/year)	219
Value of gas saved (RUB/year) ^c	RUB 70,400
Payback (months)	4
Internal Rate of Return	340%

^a On high-bleed controllers

^b All data based on Partners' experiences and represented in U.S. economics converted to Russian currency.

^c Gas price is assumed to be RUB 11,360/Mcm

Suggested Analysis for Maintenance

- For maintenance aimed at reducing gas losses
 - Measure gas loss before and after procedure
 - Compare savings with labor (and parts) required for activity

	Reduce supply pressure	Repair & retune	Change settings	Remove valve positioners
Implementation Cost (RUB)^a	6,360	955	0	0
Gas savings (m³/year)	4,960	1,250	2,500	4,470
Gas savings (Mcf/year)	175	44	88	158
Value of gas saved (RUB/year)^b	56,350	14,200	28,400	50,780
Payback (months)	2	1	<1	<1
IRR	886%	1487%	--	--

^a All data based on Partners' experiences and represented in U.S. economics converted to Russian currency.

^b Gas price is assumed to be RUB 11,360/Mcm

Industry Experience: Marathon Oil (U.S. Production Company)

- Marathon surveyed 158 pneumatic devices at 50 production sites in the U.S.
- Half of the controllers were low-bleed
- High-bleed devices included
 - 35 of 67 level controllers
 - 5 of 76 pressure controllers
 - 1 of 15 temperature controllers



Marathon Oil: Industry Experience

- Marathon measured gas losses total 145 thousand m³/year
- Level controllers account for 86% of losses
 - Losses averaged 0.2 m³/hour/device
 - Losses ranged up to 1.4 m³/hour/device (11.9 thousand m³/year)
- Concluded that excessive losses can be heard or felt

Lessons Learned

- Most high-bleed pneumatics can be replaced with lower bleed models
- Replacement options save the most gas and are often economic
- Retrofit kits are available and can be highly cost-effective
- Maintenance is low-cost and reduces gas loss

Discussion

- Industry experience applying these technologies and practices
- Limitations on application of these technologies and practices
- Actual costs and benefits

Contact Information and Further Information

- More detail is available on these practices and over 80 others online at:
epa.gov/gasstar/tools/recommended.html
- For further assistance, direct questions to:

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