

# Reducing Emissions Through Retrofitting of High Bleed Devices



imagination at work

Presented By: Greg  
Giernoth

# Key Facts and Figures

- Every year, within a natural gas system, a single unit of pneumatic control valve instrumentation typically releases 500,000 scf of natural gas emissions into the atmosphere.
- 500,000 scf is equivalent to the annual greenhouse gas emissions from 5 passenger vehicles or carbon sequestered annually by over 5 acres of pine or fir forest.
- At a market price of \$5/Mcf, a single unit of pneumatic instrumentation can cost a pipeline operator \$2,500 of lost revenue.
- According to the EPA, “retrofit or complete replacement of worn units can provide better system-wide performance and reliability and improve monitoring of parameters such as gas flow, pressure,”
- Companies who have engaged in pneumatic instrumentation replacements or retrofits have saved over 20 billion cubic feet of natural gas collectively since 1993.

*\*Source: EPA Methane Emission for the Natural Gas Industry Volume 12: Pneumatic Devices*

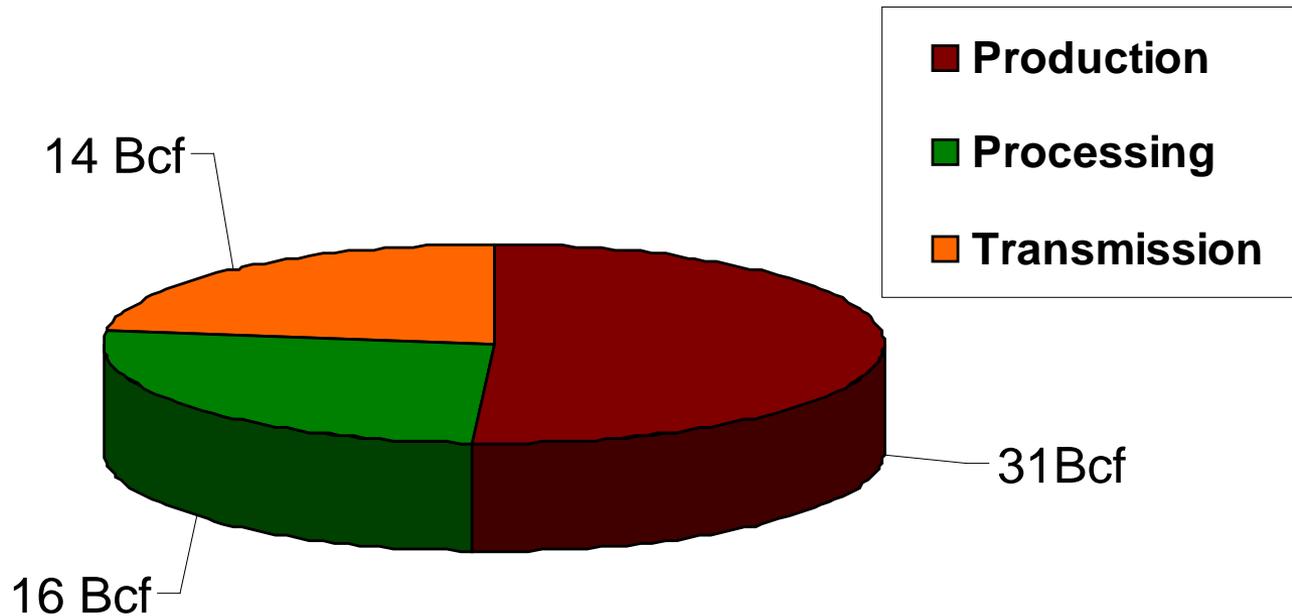
# Pneumatic Devices per Sector

	Number of Devices in Natural Gas Systems	Number of Devices in Petroleum Systems
<b>Production and Gathering</b>	478,000	399,000
<b>Transmission and Storage</b>	85,000	-

\*Source: EPA. *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990 – 2009*. April, 2011.  
[epa.gov/climatechange/emissions/usinventoryreport.html](http://epa.gov/climatechange/emissions/usinventoryreport.html).

# Pneumatic Device Emissions

## Methane Emissions (Bcf) from Pneumatic Devices Per Year



*One of The Largest Sources of Vented Methane Emissions in the Natural Gas Industry*

# Where Pneumatic Devices are Used

*Various Segments of the Gas Industry Have Different Equipment and Different Standard for Using Pneumatic Devices*

	Standard Uses of Pneumatic Devices			
	Production	Processing	Transmission	Distribution
Control Valves Operated by Gas?	Yes	Very Few	Yes	Yes
Isolation Valves Operated by Gas?	No	Some	Yes	Some

**Pneumatic Devices Linked to Control Valves Are the Largest Source of Pneumatic Emissions in the Natural Gas Industry\***

*\*Source: EPA Methane Emission for the Natural Gas Industry Volume 12: Pneumatic Devices*

# Average Bleed Rates for NG Sector

Canadian Petroleum Association (CPA) Study\*

	<b>Measured Emissions Rates for Continuous Bleed Devices</b>			
	<b>Production Onshore</b>	<b>Production Offshore</b>	<b>Total Production</b>	<b>Transmission</b>
<b>Number of Measurements</b>	9	9	18	23
<b>Minimum, (scfd/device)</b>	380	108	108	152
<b>Maximum, (scfd/device)</b>	2,334	962	2,334	4,215
<b>Average, scfd/device</b>	<b>1,189 ± 39%</b>	<b>556 ± 33%</b>	<b>872 ± 30%</b>	<b>1,363 ± 29%</b>

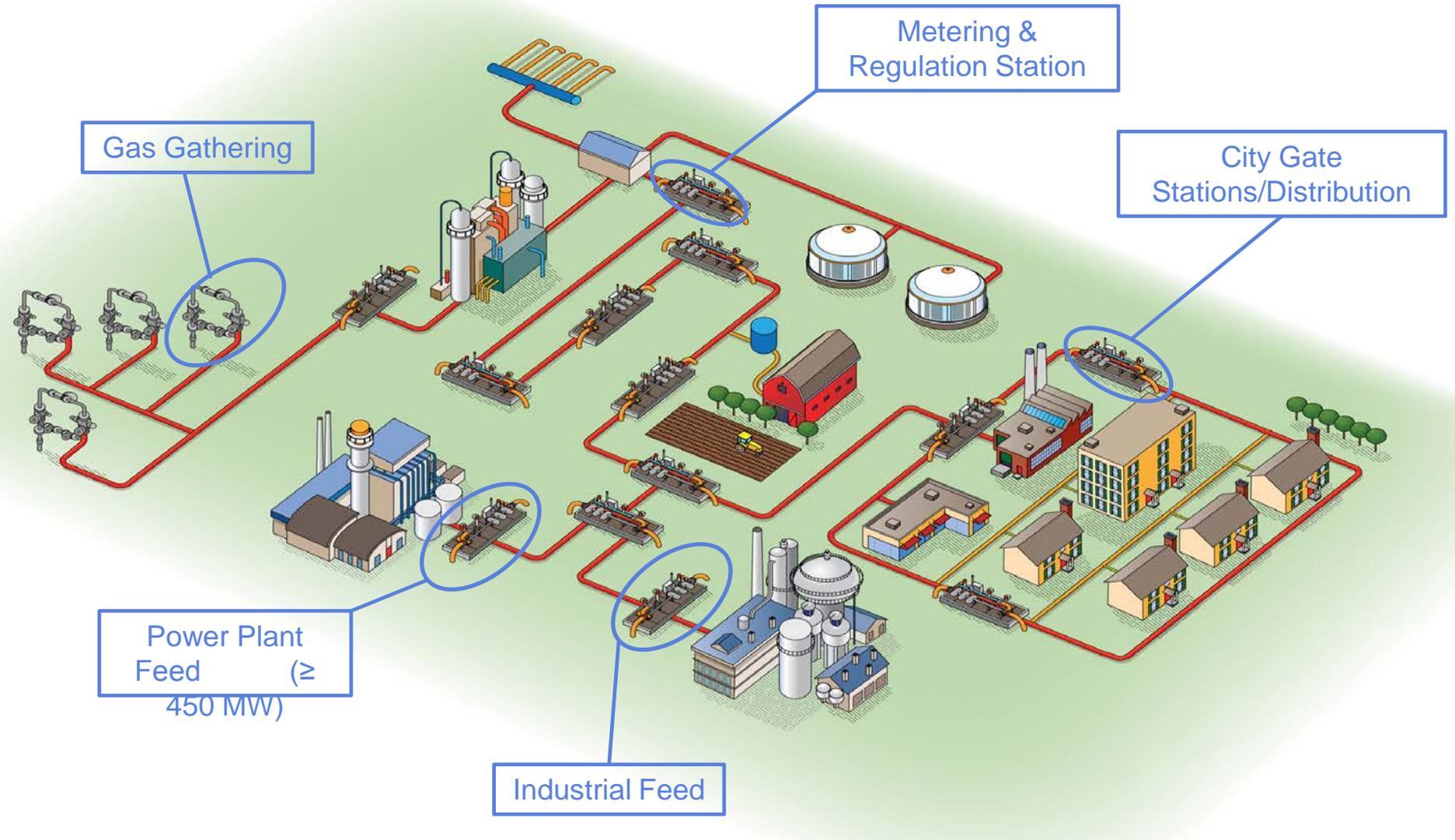
Minimum Production : 39.42 mscf/year per device

Minimum Transmission: 55.48 mscf/year per device

*\*"A Detailed Inventory of CH<sub>4</sub> and VOC Emissions From Upstream Oil and Gas Operation in Alberta" – Canadian Petroleum Association*

# Identifying Retrofit Opportunities

# Retrofit Opportunities



# Types of Devices

- **Continuous** bleed devices are used to modulate flow or pressure and will generally vent gas a steady state
- **Actuating or Intermittent** bleed devices perform snap-acting or control and release gas only when they stroke a valve open or close or as they throttle gas flow
- **Self-Contained** devices release gas into the downstream pipeline, not the atmosphere

# Why Retrofit?

Reduce or Eliminate emissions from high bleed instrumentation

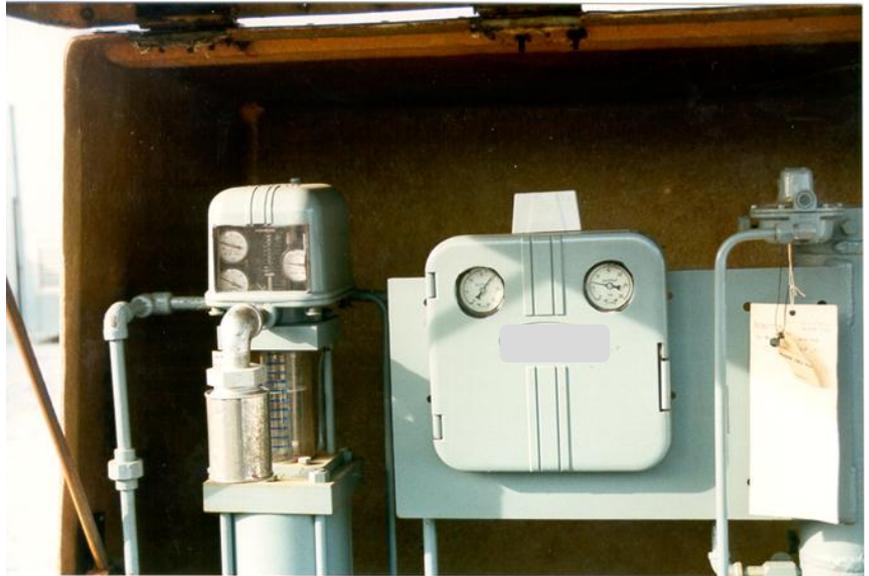
Minimize control instrumentation maintenance

Simplify Control Logic

Maintain System consistency

Retrofit will pay for itself

Increase durability and ruggedness



# The Replacements

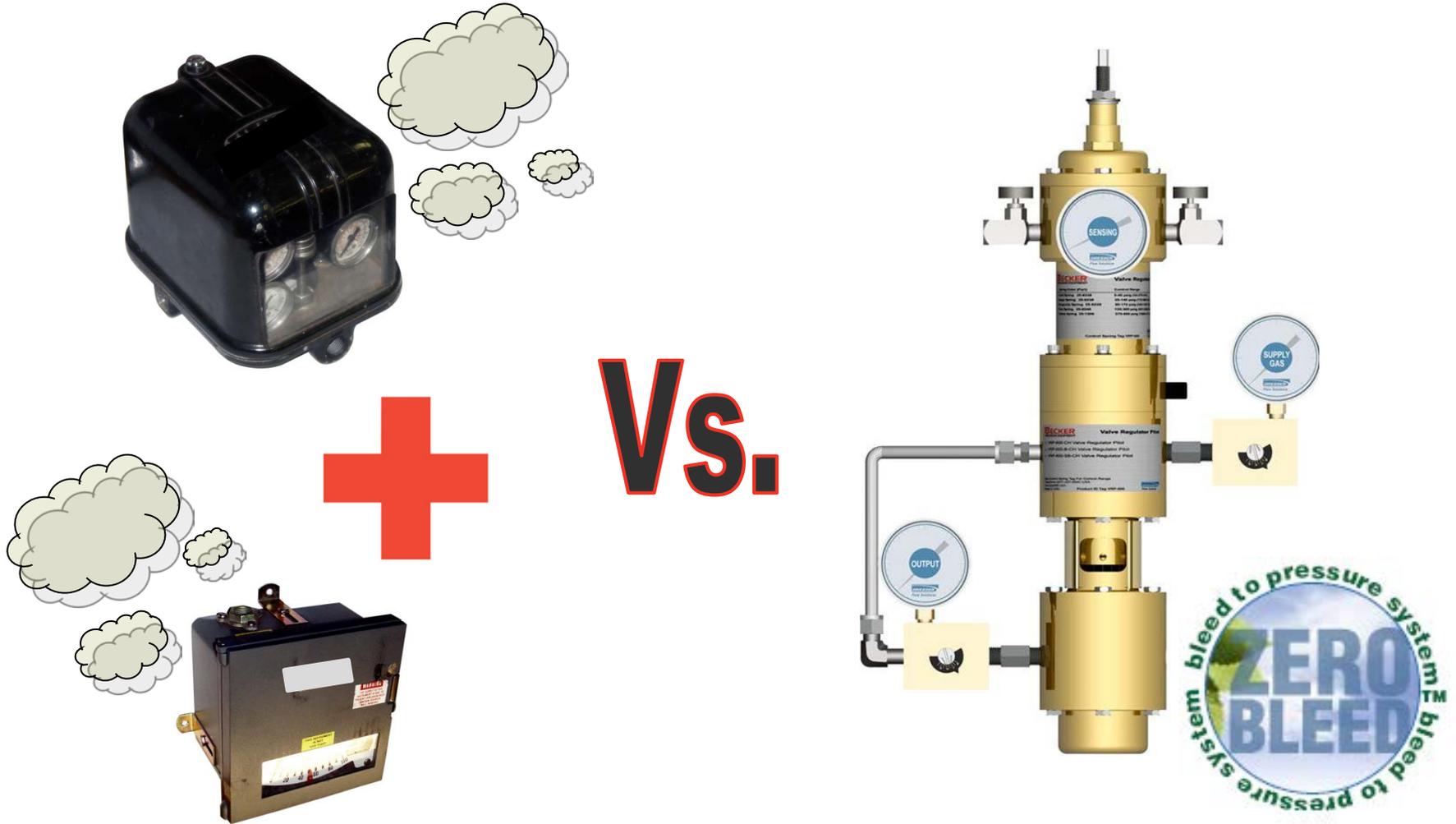
## Lower Bleed Pressure Controllers



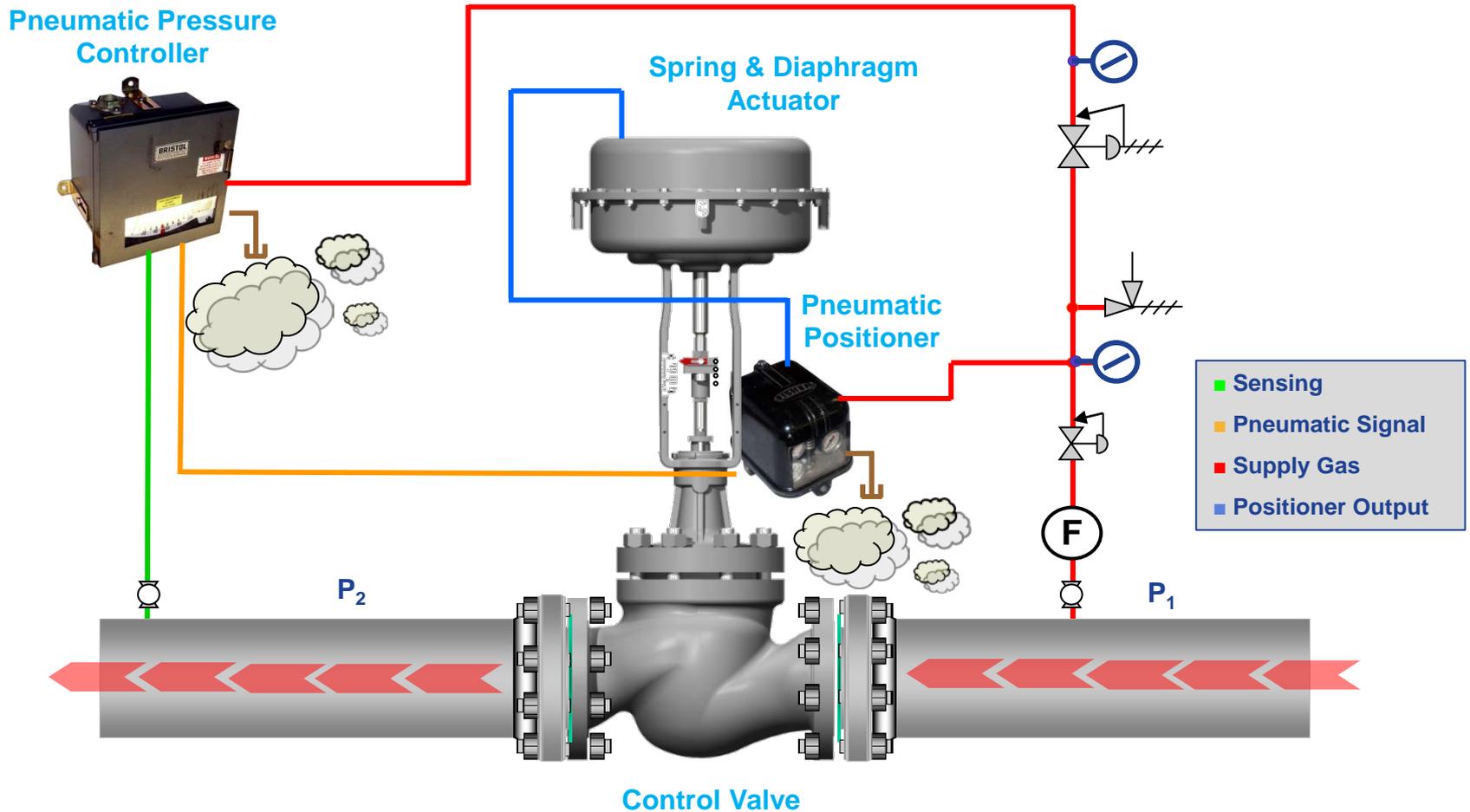
## ZERO Bleed Pilot Controllers



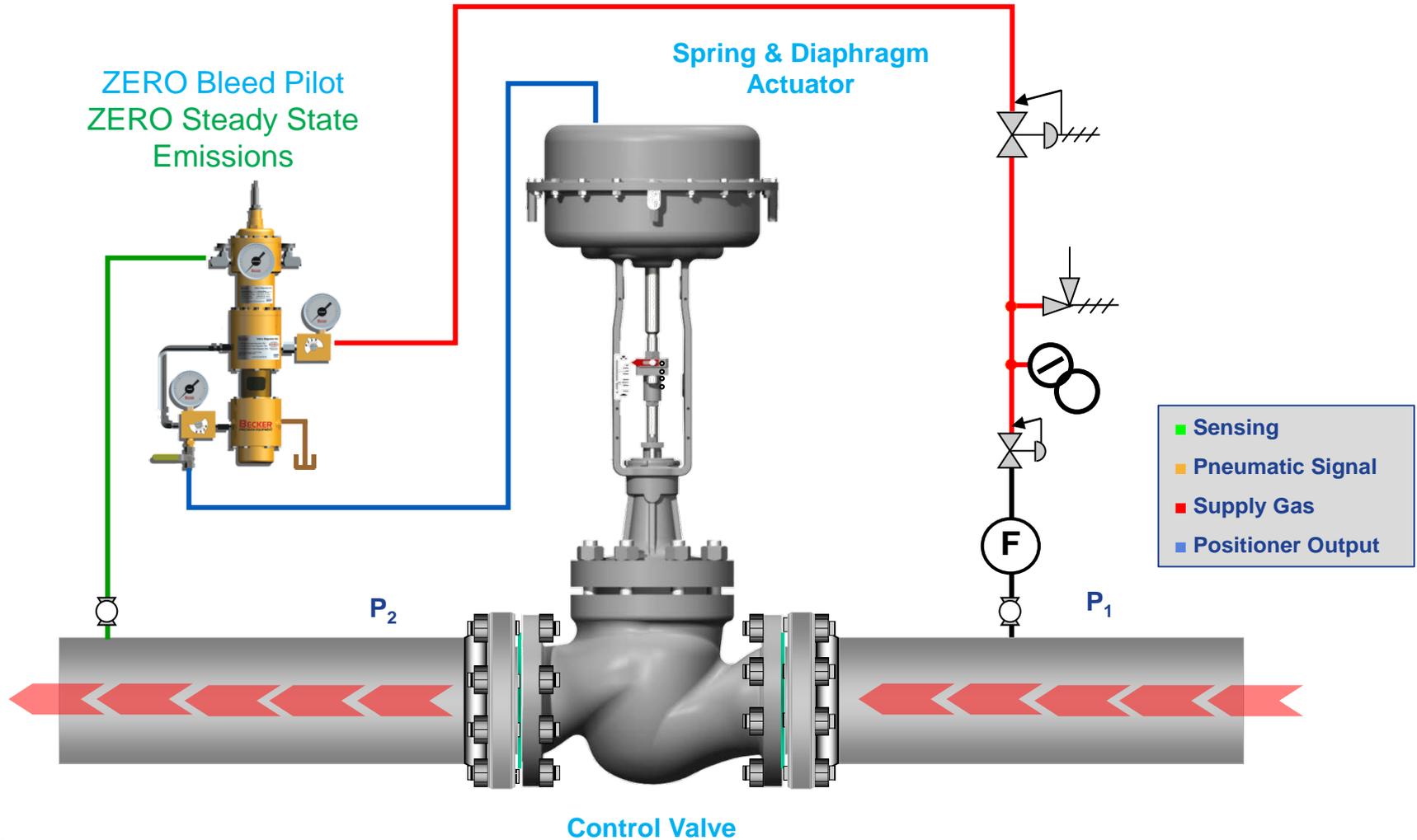
# A simple way of adding simplicity



# Typical Control Valve Configuration



# ZERO Steady State Bleed Solution

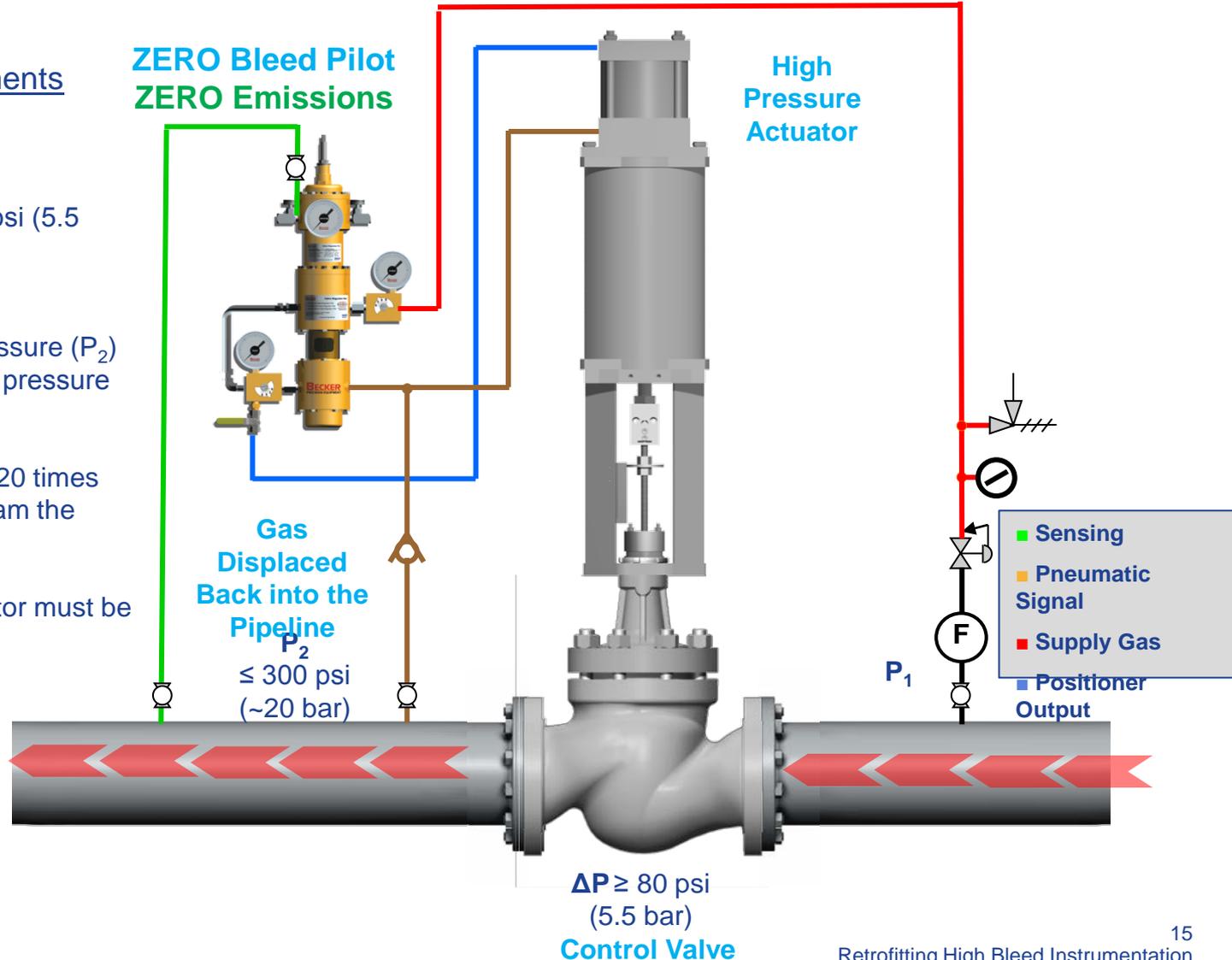


# Bleed To Pressure System

Completely Eliminates Emissions

## Application Requirements

- ✓ Sweet (Clean) Natural Gas
- ✓ Pressure Differential  $\geq 80$  psi (5.5 bar)
- ✓ Maximum downstream pressure ( $P_2$ )  $\leq 300$  psi ( $\sim 20$  bar) or a low pressure system (i.e. heater)
- ✓ Sensing line should be 10-20 times the pipe diameter downstream the valve flange
- ✓ Spring & Diaphragm actuator must be replaced



# Retrofit Examples

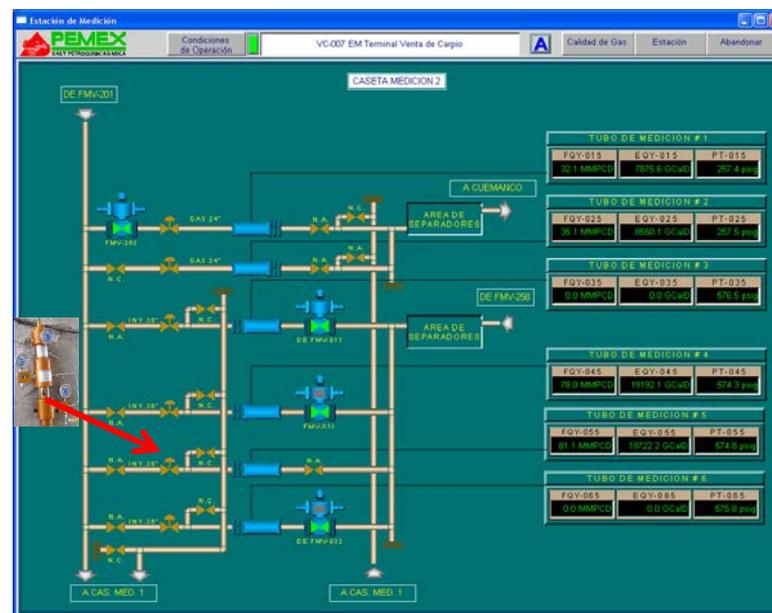
# Newer Trial Site: PEMEX

## Venta de Carpio Gas Station



### Application: Sales & Metering Regulation Station

- Existing Equipment: Fisher 4150
- Retrofit: VRP-SB-CH



# Bleed to Pressure Example

## Before

Company: National Grid UK

Problem: Frequent Gas Call Outs and Station in Enclosed Building

Previous Equipment:

- Four (4) Moore 750 Pneumatic Valve Positioners
- Eight (8) Bristol 624 – II Pneumatic Pressure Controllers
- Four (4) Actuators on Axial Style Valves



Bristol 624 Controllers Constantly Venting Gas



Axial Style Valve Equipped with Moore 750 pneumatic positioner, two inch (50mm) diameter piping used to vent gas to atmosphere

# Bleed to Pressure Example

After

Company: National Grid UK

Problem: Frequent Gas Call Outs and Station in Enclosed Building



Becker Solution:

- Replaced Moore 750 Positioners with Becker HPP and Bristol 624 -II Controllers with Becker VRP
- Implemented Becker Bleed to Pressure System with Becker LPDA actuator
- Eliminated natural gas emissions from station with Becker ZERO BLEED™ instrumentation



**Becker VRP ZERO BLEED™ feature eliminated Steady State Emissions**



**Becker High Pressure Positioner (HPP) and LPDA actuator allows gas to be discharged into a downstream Bleed to Pressure system—eliminating ALL emissions**

# Bleed to Pressure

ROI



Station Control Valve Emissions - Before			
Original Instrumentation	Quantity	Approximate Annual Vent (scf)	Approximate Lost Gas Value*
Bristol 624 – II Controller	8	633,310	\$4,433.00
Moore 750 Positioner	4	1,945,167	\$13,616.00
<b>Total Gas Lost</b>		<b>2,578,477</b>	<b>\$18,049.00</b>

\*Assumed European NG price of \$7/MCF

Emissions Reduced Summary - After	
<b>Total Annual Emissions Reduced</b>	<b>2,578,000 scf*</b>
<b>Equivalent to the Annual CO<sub>2</sub> Emissions From:</b>	26 Passenger Vehicles
<b>Equivalent to the Carbon Sequestered Annually by:</b>	28 Acres of Pine Forest
<b>Total Annual Savings</b>	<b>\$18,049.00</b>
<b>Approximate Payback Period</b>	<b>&lt; 2 years</b>

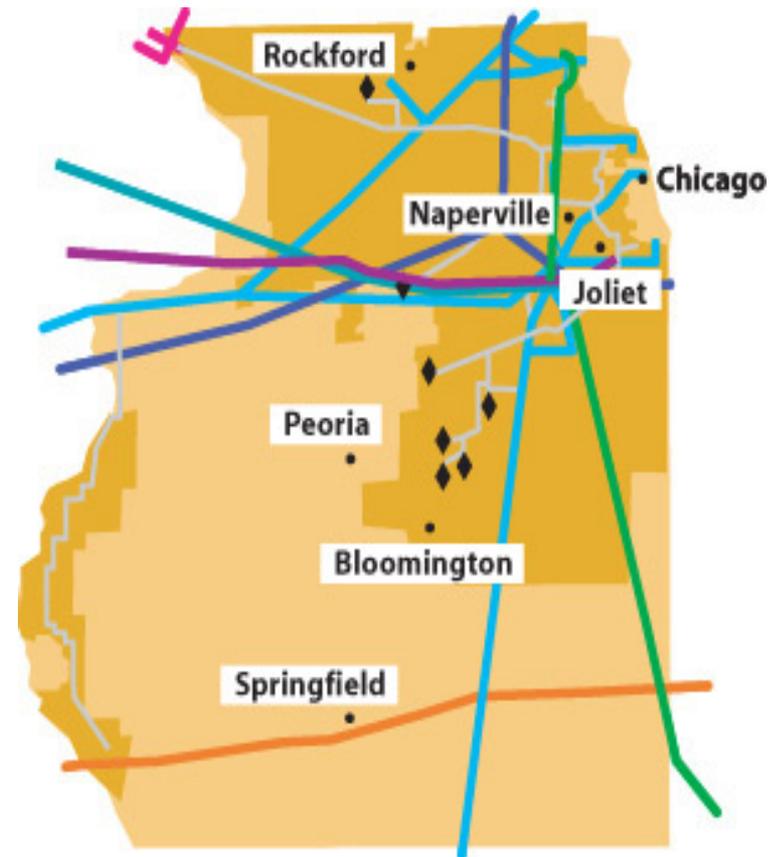
\*Equivalent to 142.2 Metric Tons of CO<sub>2</sub>

# Partial System Upgrade

Nicor Gas - One of the nation's largest distribution companies

Largest natural gas distributor in Illinois

Network of more than 29,000 miles of pipeline



# Partial System Upgrade cont.

Recognized benefits from ZERO Bleed pressure control system

Implemented system-wide retrofit

- Replaced 25 “high-bleed” pneumatic controls
- 15 locations
- Mechanical controls used for all new installations

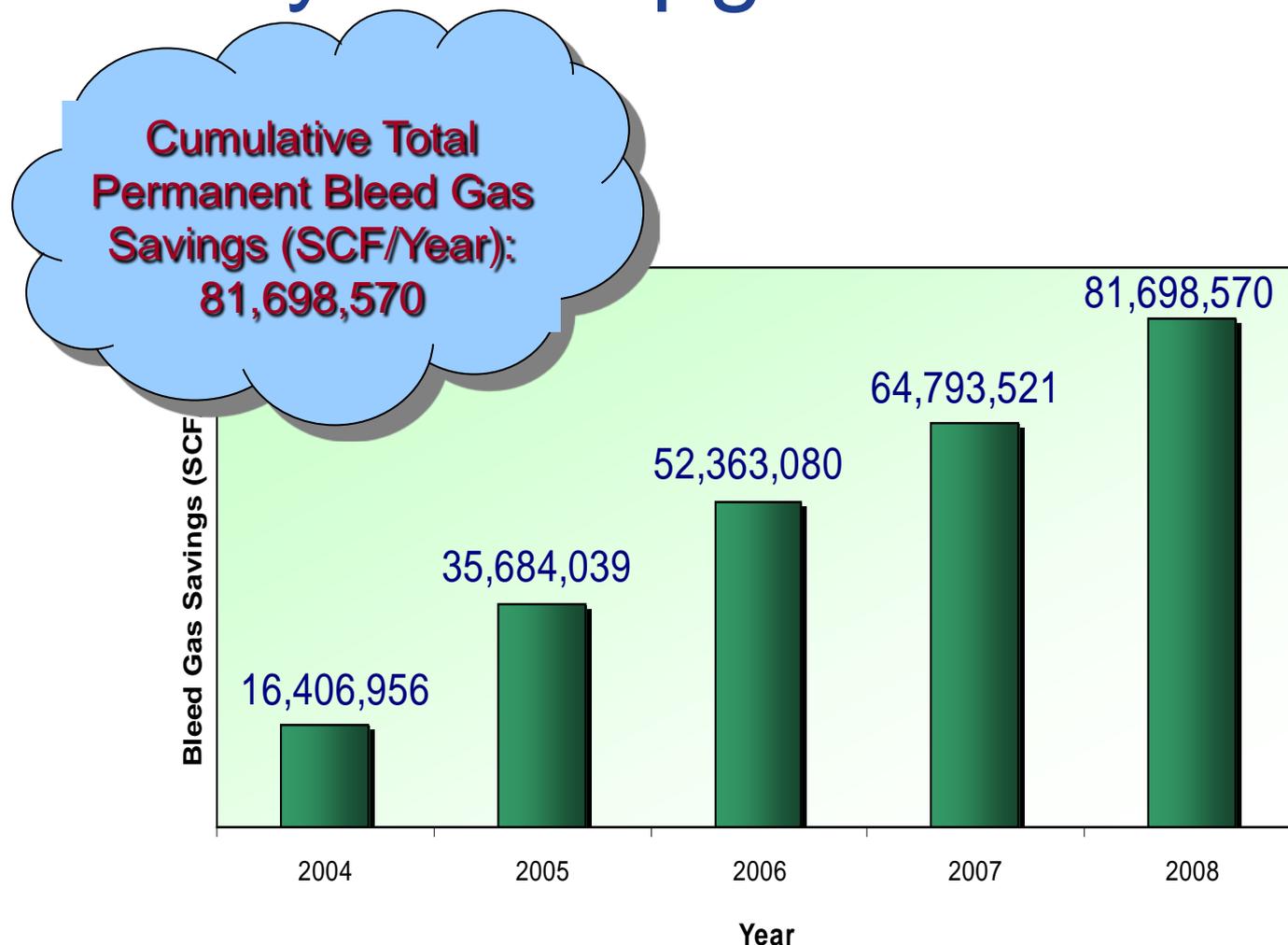


Before



After

# Partial System Upgrade cont.



\*Source: EPA Methane Emission for the Natural Gas Industry Volume 12: Pneumatic Devices

# Partial System Upgrade cont.

Total emissions reduced from this project equivalent to:

- 89,200 passenger cars not driven for a year
- 2,540 railcars of coal not burned
- 1,132,700 barrels of oil not used
- 12,489,100 tree seedlings carbon sequestered
- 110,700 acres pine acres carbon sequestered

Eliminated emissions equivalent to the gas use of over 1,850 homes

*\*Source: EPA Methane Emission for the Natural Gas Industry Volume 12: Pneumatic Devices*

# Tools For Retrofitting

# The EPA Website

More detail is available on these practices:

[epa.gov/gasstar/tools/recommended.html](http://epa.gov/gasstar/tools/recommended.html)

The screenshot shows the EPA website's "Natural Gas STAR Program" page. The header includes the EPA logo and the text "U.S. ENVIRONMENTAL PROTECTION AGENCY". A search bar is present with "All EPA" selected. The main heading is "Recommended Technologies and Practices". Below this, there is a paragraph explaining that partners share information on cost-effective methane emission reduction technologies and practices. A note states that EPA does not advocate any particular vendor's equipment or technology. A list of links for "Compressors/Engines" is provided, including "Dehydrators", "Directed Inspection and Maintenance", "Pipelines", "Pneumatics/Controls", "Tanks", "Valves", "Wells", and "Other". A table titled "Compressors/Engines" lists six practices with columns for Document Title, Capital Costs, Production, Gathering and Processing, Transmission, and Distribution. A "Quick Finder" sidebar on the right lists "Recommended Technologies and Practices", "Technical Document Translations", "Program Forms", "Technology Transfer Workshops", "Service Provider Directory", and "Natural Gas STAR Contacts". A note at the bottom right of the table area states: "You will need Adobe Reader to view some of the files on this page. See EPA's PDF page to learn more."

**Natural Gas STAR Program**

U.S. ENVIRONMENTAL PROTECTION AGENCY

Contact Us Search: All EPA This Area Go

You are here: EPA Home » Climate Change » Methane » Natural Gas STAR Program » Documents, Tools and Resources » Recommended Technologies and Practices

### Recommended Technologies and Practices

Natural Gas STAR partners share information on cost-effective methane emission reduction technologies and practices via submission of [annual progress reports](#) detailing their emissions reduction activities. To promote technology transfer and share industry best practices, the Natural Gas STAR Program provides information on cost-effective methane emission reduction opportunities through a variety of documents including *Lessons Learned Studies*, *Partner Reported Opportunities (PRO) Fact Sheets*, Technical Presentations, and *Partner Update* articles (to learn more, see descriptions of [Natural Gas STAR technical resources below](#)). *Lessons Learned Studies* and *PRO Fact Sheets* are also available in [Arabic, Chinese, Russian, and Spanish translations](#).

Please note that EPA does not advocate any particular vendor's equipment or technology. The intent of the information presented below is to provide partner companies and others in industry with information for evaluating the applicability of these technologies and practices to their operations.

[Compressors/Engines](#) | [Dehydrators](#) | [Directed Inspection and Maintenance](#) | [Pipelines](#) | [Pneumatics/Controls](#) | [Tanks](#) | [Valves](#) | [Wells](#) | [Other](#)

Each technical document on this page shows economic payback values at a natural gas price of \$3, \$5, and \$7. However, the table on this page is arranged by economic payback based on a natural gas value of \$5/Mcf. This is considered a conservative natural gas value and some individual documents may reflect calculations assuming higher natural gas values. Actual payback may vary depending on individual partner operating circumstances.

**Compressors/Engines**

Document Title	Capital Costs	Production	Gathering and Processing	Transmission	Distribution
Estimated Payback: 0-1 year					
Replace Gas Starters with Air or Nitrogen <a href="#">PRO Fact Sheet #101 (PDF)</a> (2 pp., 71K)	< \$1,000	X	X	X	
Reduce Natural Gas Venting with Fewer Compressor Engine Startups and Improved Engine Ignition <a href="#">PRO Fact Sheet #102 (PDF)</a> (3 pp., 75K)	< \$1,000	X	X	X	X
Reducing Methane Emissions from Compressor Rod Packing Systems <a href="#">Lessons Learned (PDF)</a> (8 pp., 271K) <a href="#">Presentation (PDF)</a> (15 pp., 875K) June 2006	< \$1,000	X	X	X	
Test and Repair Pressure Safety Valves <a href="#">PRO Fact Sheet #602 (PDF)</a> (3 pp., 107K)	< \$1,000	X	X	X	X
Reducing Emissions When Taking Compressors Off-Line <a href="#">Lessons Learned (PDF)</a> (11 pp., 248K) <a href="#">Presentation (PPT)</a> (19 pp., 590K, <a href="#">About PPT</a> ) <a href="#">EXIT Disclaimer</a> September 2004	\$1,000-\$10,000	X	X	X	X

**Quick Finder**

- Recommended Technologies and Practices
- Technical Document Translations
- Program Forms
- Technology Transfer Workshops
- Service Provider Directory
- Natural Gas STAR Contacts

You will need Adobe Reader to view some of the files on this page. See [EPA's PDF page](#) to learn more.

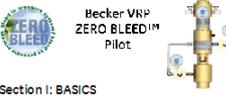
# How to quantify savings

## Questions

**Your Impact Emissions Calculator**

Ever wonder how much your company could save by replacing those old, inefficient high-emissions pneumatic devices? Now you can find out for yourself.

Did you know that replacing each high-bleed pneumatic device with a Becker VRP is equivalent to **planting 5 acres of trees?**



**Color Key**

This color box for an answer indicates a drop-down box.

Numbers are typed in this color box.

**Section I: BASICS**  
general picture of what type of company you are, how you operate, and what basic things you deal with.

Questions	Answers
1. Please enter your company's name.	
2. Please enter your name.	
3. Please enter your email address.	
4. In which of the following regions is most of your relevant infrastructure located?	Select a Region

Did you know that emissions from an average control valve's instrumentation is equivalent to **emissions from 5 cars?**

Below is specific information to be filled out if possible.

IMP1: Please give this data set a project or reference name:

\*Dollars will be used until the summary, when you can convert them to your chosen currency.

When finished, click off the last entry, and click button to the right.

## Results

**Your Impact by switching to the Becker VRP**

(Print first page of this section for your records)

Company Profile: [REDACTED]

By replacing old instrumentation with the Becker VRP, **every year your company can save:**

500 Mcf of Natural Gas / Yr.

Which is equivalent to:

28 Tons CO<sub>2</sub> / Yr.

5 Acres of Forest / Yr.

5 Cars off the Road / Yr.




0.9 years

Approx. Payback Timetable

\$3,501 TOTAL SAVINGS / Yr.

@ \$7.00 per MCF



Currency Conversion: (Select Currency)

\$3,501 to N/A = N/A N/A

Used Exch. Rate:\*\* N/A per dollar

\*\*Below you may enter your own currency exchange rate if the one above is incorrect.



imagination at work