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# RATS - ROTATING & TURBOMACHINERY SOCIETY

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MAINTENANCE  
RELIABILITY  
OPERATIONS

## TECHNICAL CONFERENCE & WORKSHOPS

Fugitive Emission Reduction  
Technologies for Recip compressors

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Wednesday October 25, 2023  
DOW Centennial Centre - Fort Saskatchewan



# Agenda

Some definitions on Greenhouse Gas (GHG) Emissions

Reducing Fugitive Emissions

Reducing Vented Emissions Sources

Reducing Emissions Resulting from Energy Consumed

Return On Investments (ROI) for Projects



# Greenhouse Gas (GHG) Emissions

2022 set a record of 58 gigatons of GHG Emissions and if current trends continue this will double by 2030

Methane (CH<sub>4</sub>) is the second most abundant anthropogenic GHG after carbon dioxide (CO<sub>2</sub>), accounting for about 20 percent of global emissions.

Methane is more than 25 times as potent as carbon dioxide at trapping heat in the atmosphere.

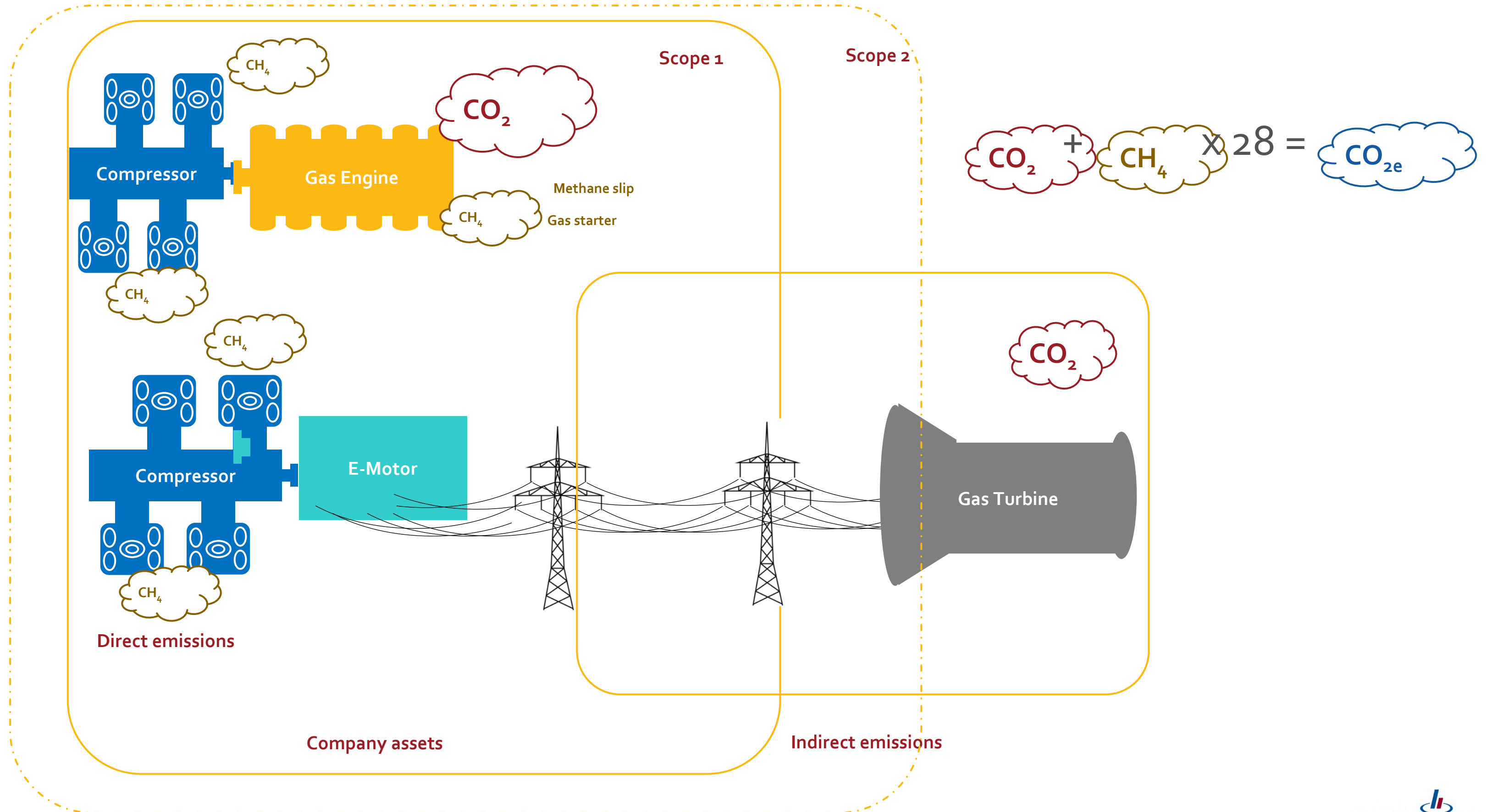
[The Paris Agreement | UNFCCC](#)

<https://www.epa.gov/gmi/importance-methane#:~:text=Methane%20is%20more%20than%2025,dueto%20human%2Drelated%20activities.>

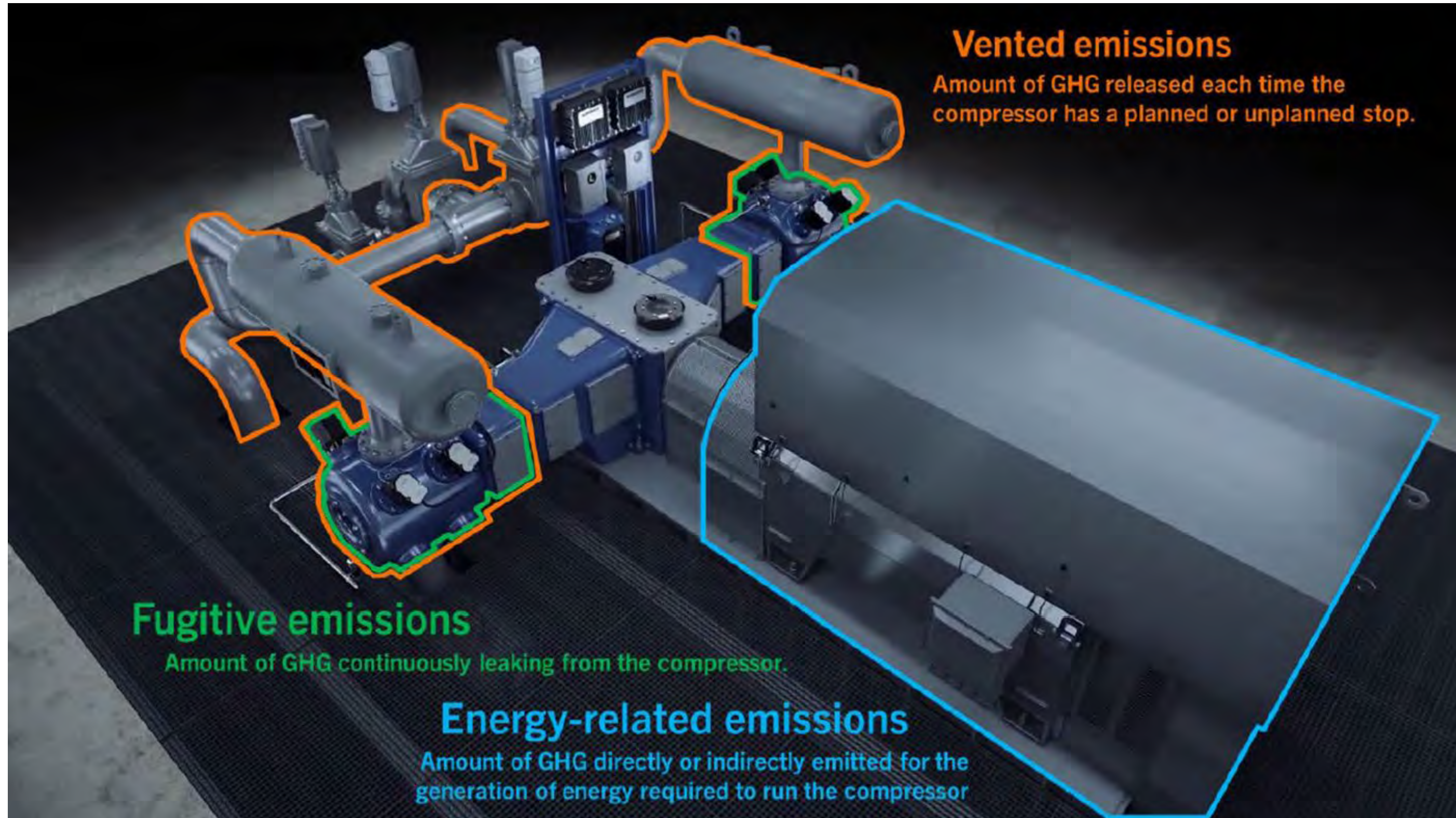




# Definitions



# Emission Sources





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Reducing Fugitive Emissions

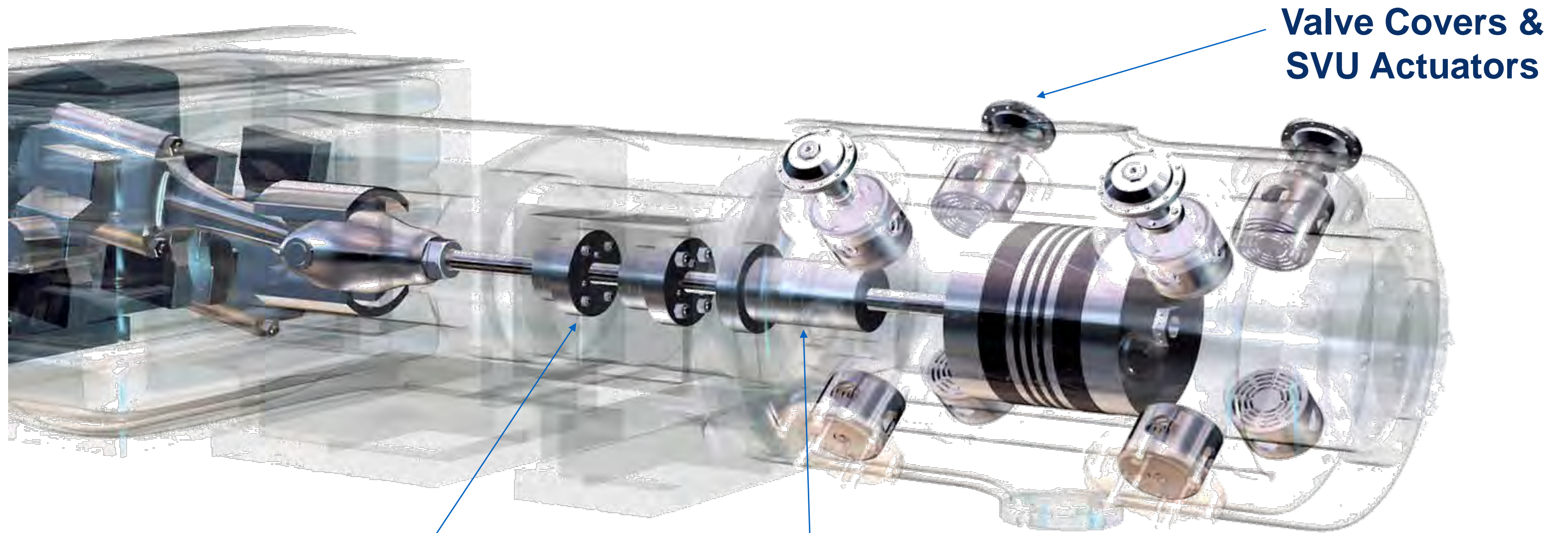
Reducing Vented Emissions Sources

Reducing Emissions Resulting from Energy Consumed

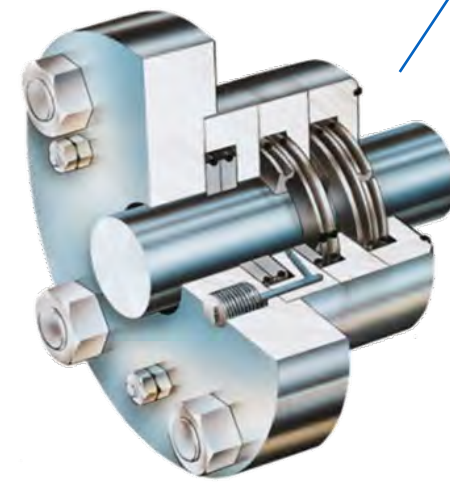
Return On Investments (ROI) for Projects



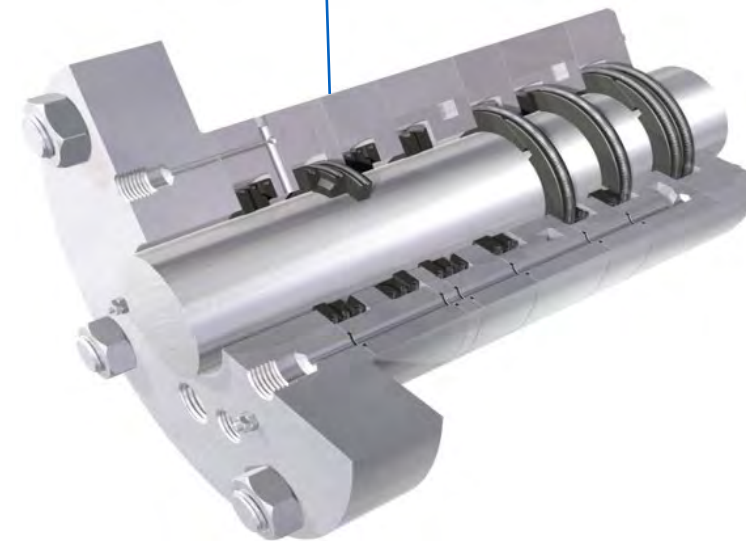
# Fugitive Emission Sources



**Valve Covers & SVU Actuators**



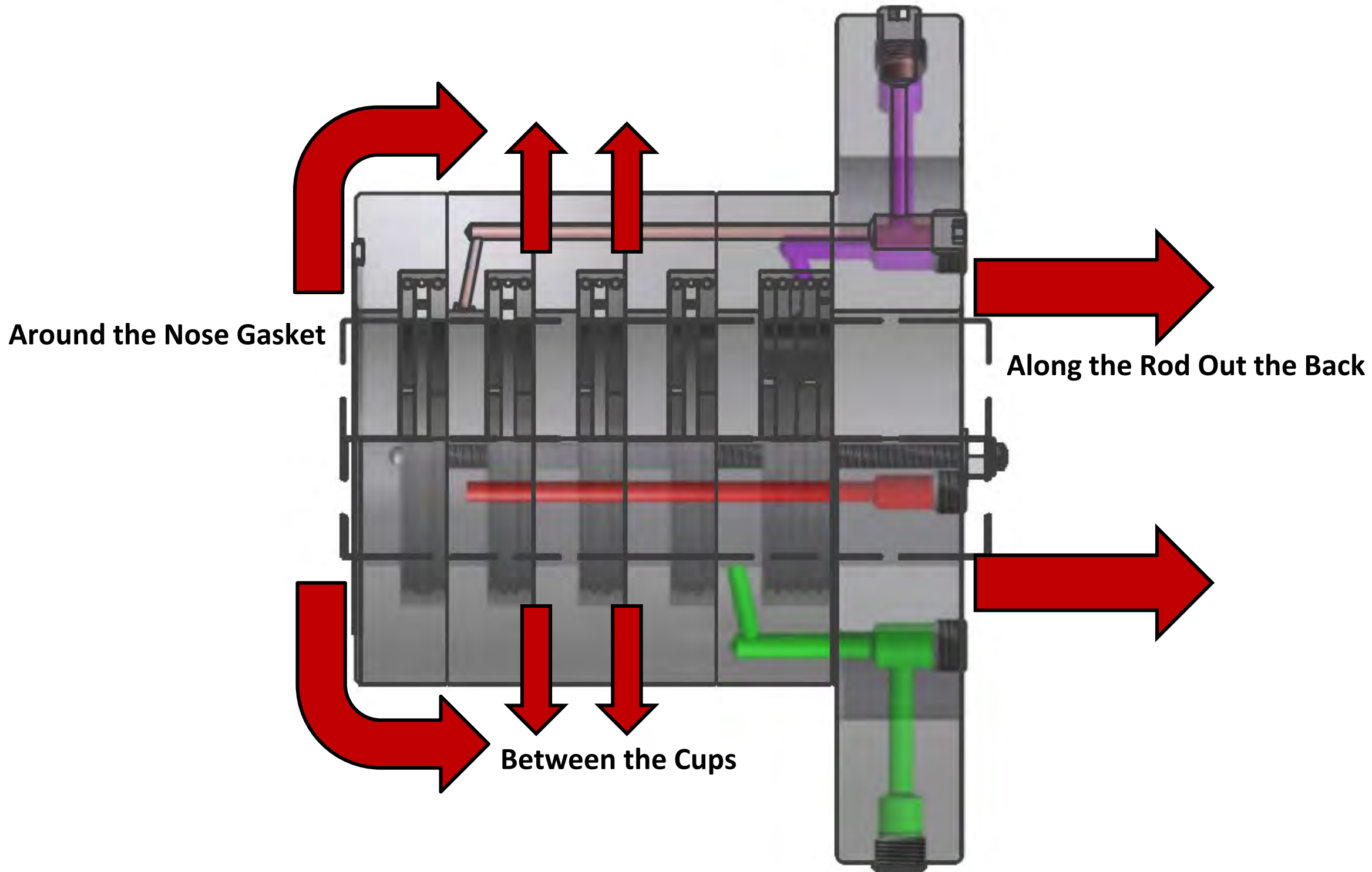
**Intermediate Packing**



**Pressure Packing**

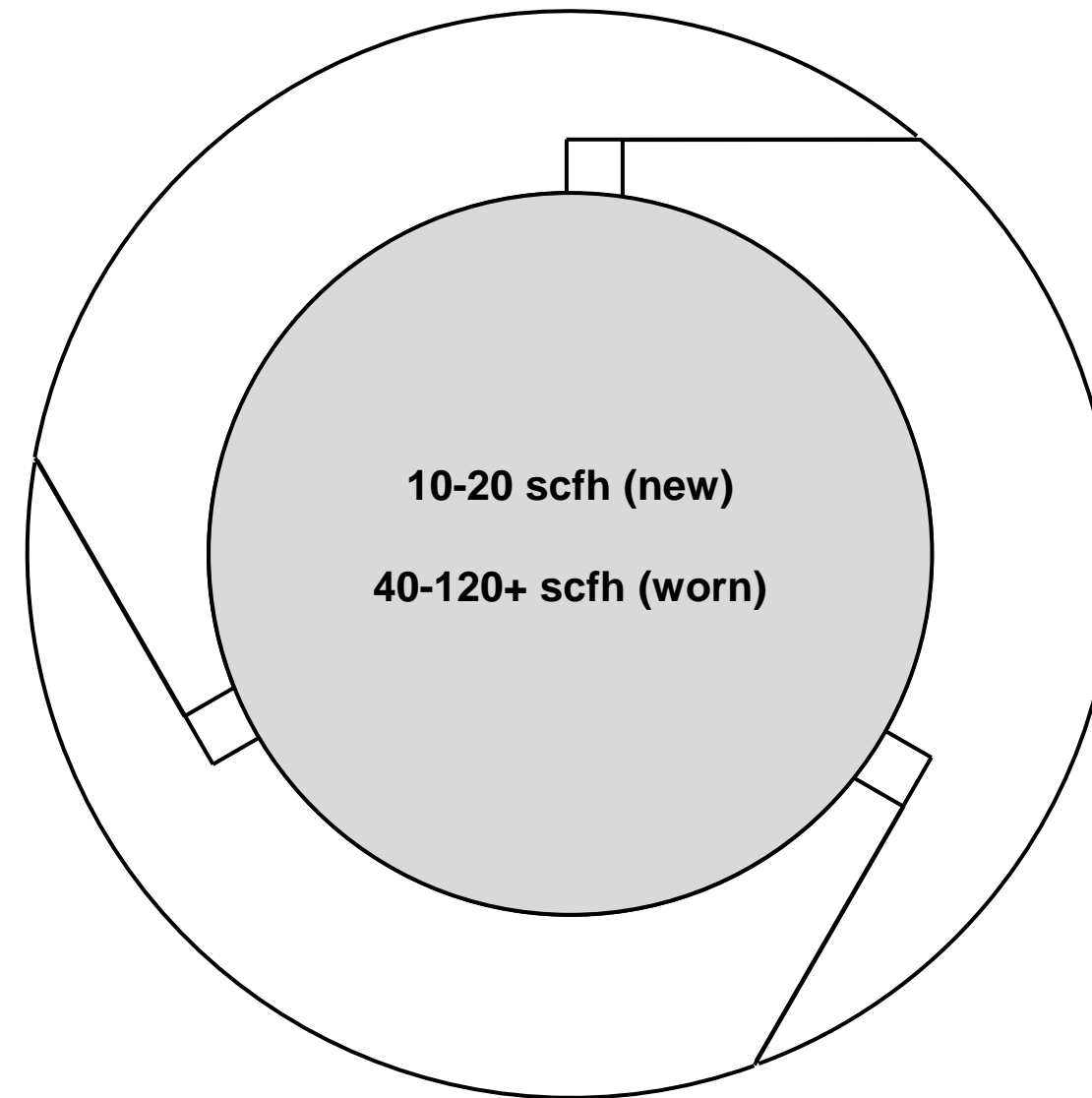


# Packing Case Emission Paths





# All Pressure Packing Rings Leak



## During operation

- Conformance between rod & ring geometry
- All gaps are sealed
- Leak rates increase with ring wear
- California requires packing replacment at 120 SCFH

## 6 throw comprssor with 40 scfh per throw of leakage

- 5800 scf per day
- 180,000 scf per month
- 2,150,000 scf per year
- 64 Metric tons of CO<sub>2e</sub>



# “Low Emissions” Pressure Packing Rings



BCD



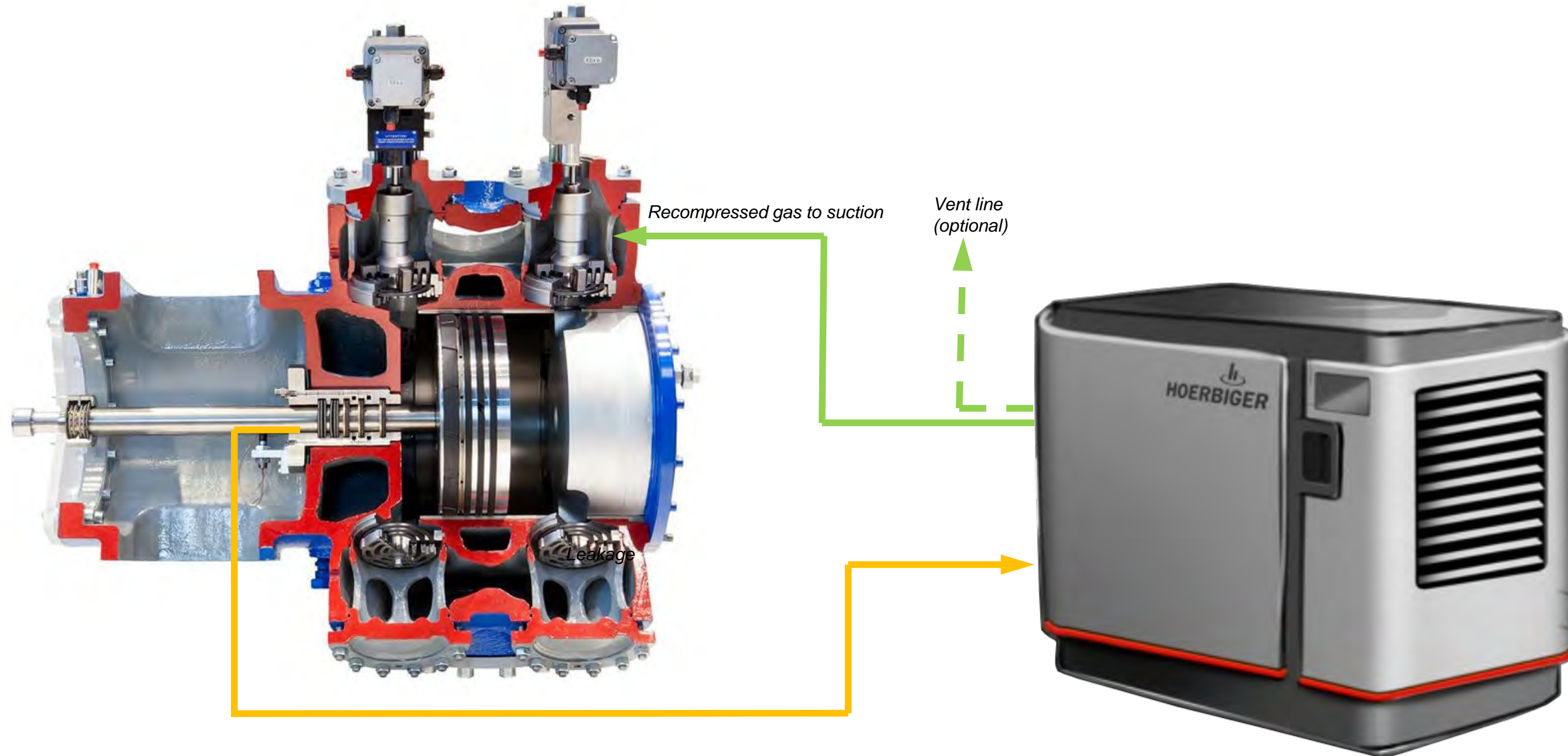
BTUU





# Recompression Systems

Capture and Recompress leakage during operation



50:1 Compression ratio



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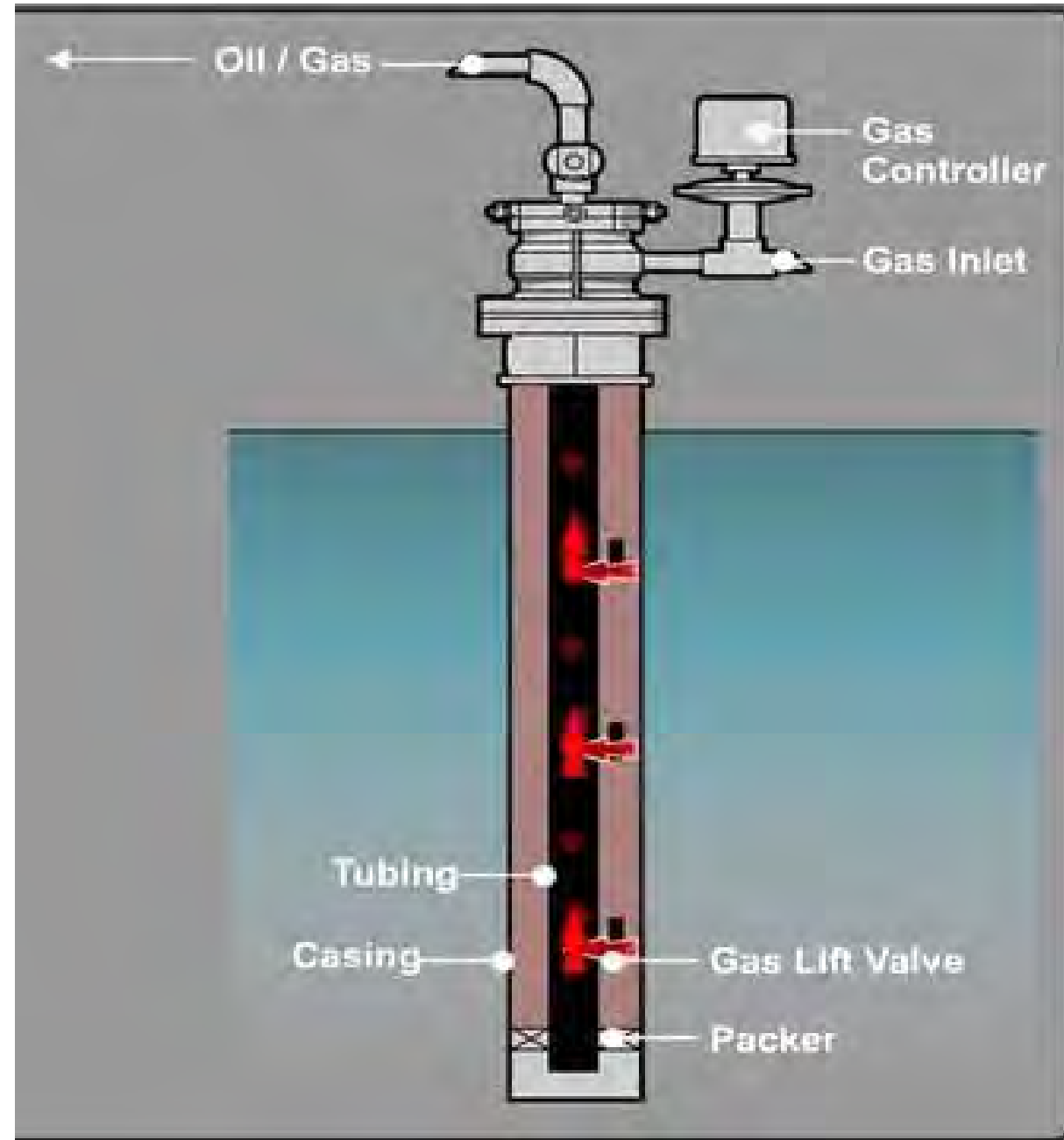


# Compressor Blowdowns

“On Average, a single blowdown results in the release of approximately 15Mcf of gas to the atmosphere”



# Reducing Unscheduled Maintenance Blowdowns



H302 Compressor in Gas Lift Application



Retainer and valve with paraffin wax buildup



Valve Seat before & after hand clean up

1 year (8K hours) Valve Inspection





# Reducing Unscheduled Maintenance Blowdowns

Unit	Start Date	End Date	Operating Hours
90177	11/19/2013	9/19/2021	56210
90171	12/3/2013	8/13/2021	47851
90143	12/3/2013	4/23/2019	42624
90142	11/19/2013	4/23/2019	36585
90216	1/14/2014	3/28/2017	14260
90167	12/3/2013	7/30/2017	18770
90219	12/4/2013	8/2/2016	22088
90133	1/17/2014	8/2/2016	12539
90221	1/16/2014	10/15/2015	24431
90196	1/15/2014	10/14/2015	11600

H302 Compressors



9 years (56K hours)



# Reducing Unscheduled Maintenance Blowdowns



JGC/4 Compressor valve inspection after 5 years (approximately 40K hours)



# EmmisionShield Packing System

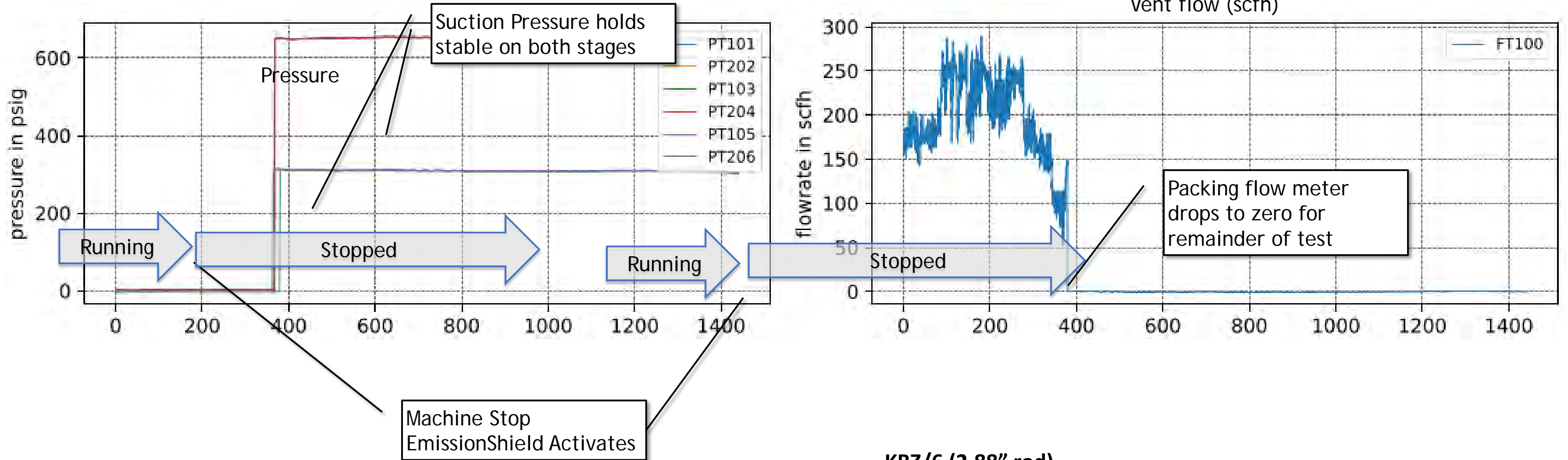


**Patent Pending Compressor Rod Packing Ring**





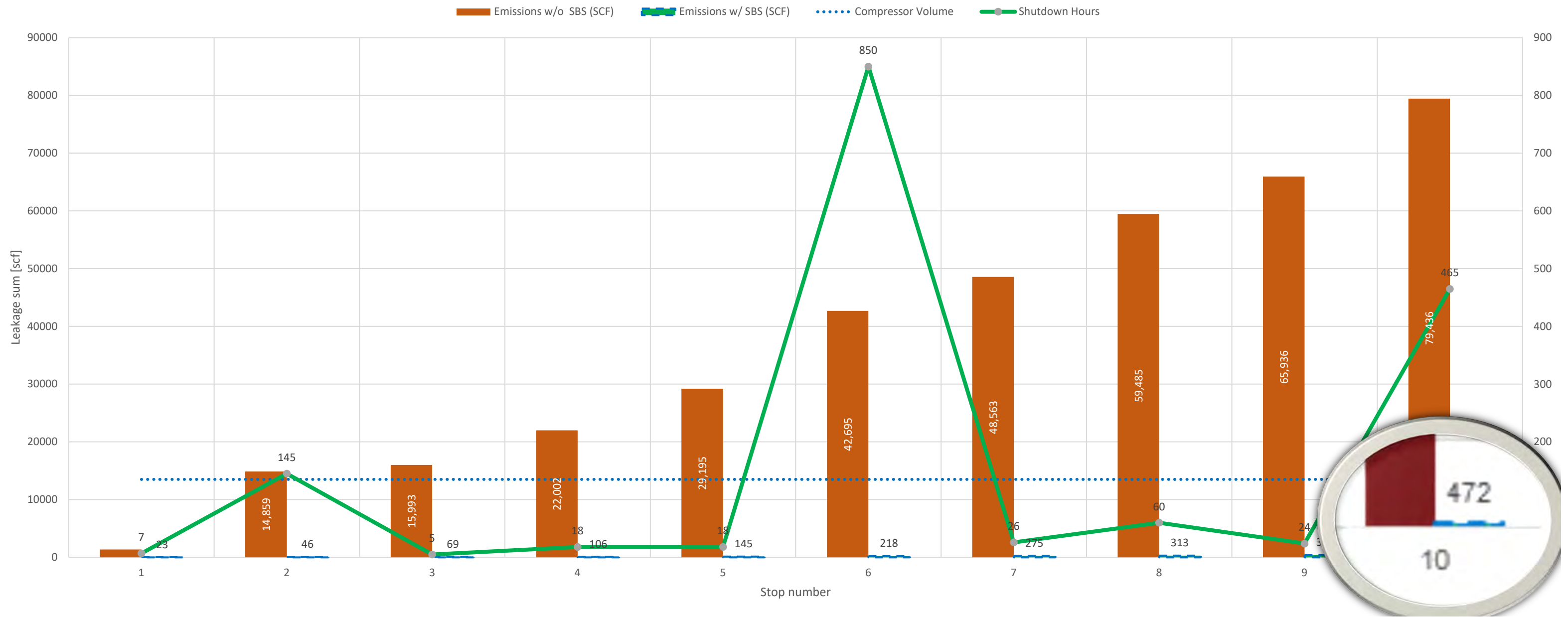
# EmissionShield Case Study



**KBZ/6 (2.88" rod)**  
**Natural Gas**  
**12,000+ run hours**  
**1,600+ pressurized stand by hours**  
**10 stops**



# EmissionShield Case Study



1600+ shutdown hours with less than 500 SCF vented during pressurized unit standby



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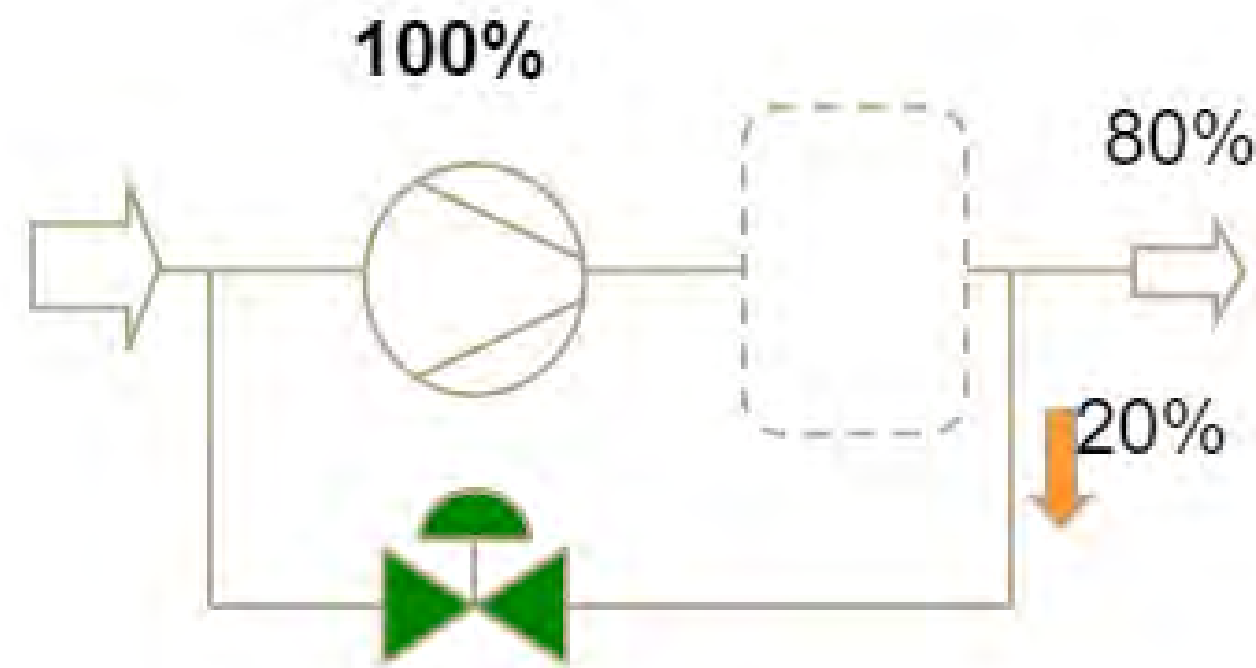
Reducing Emissions Resulting from Energy Consumed

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# Process Flow Maintained by Utilizing By-Pass Control Valve



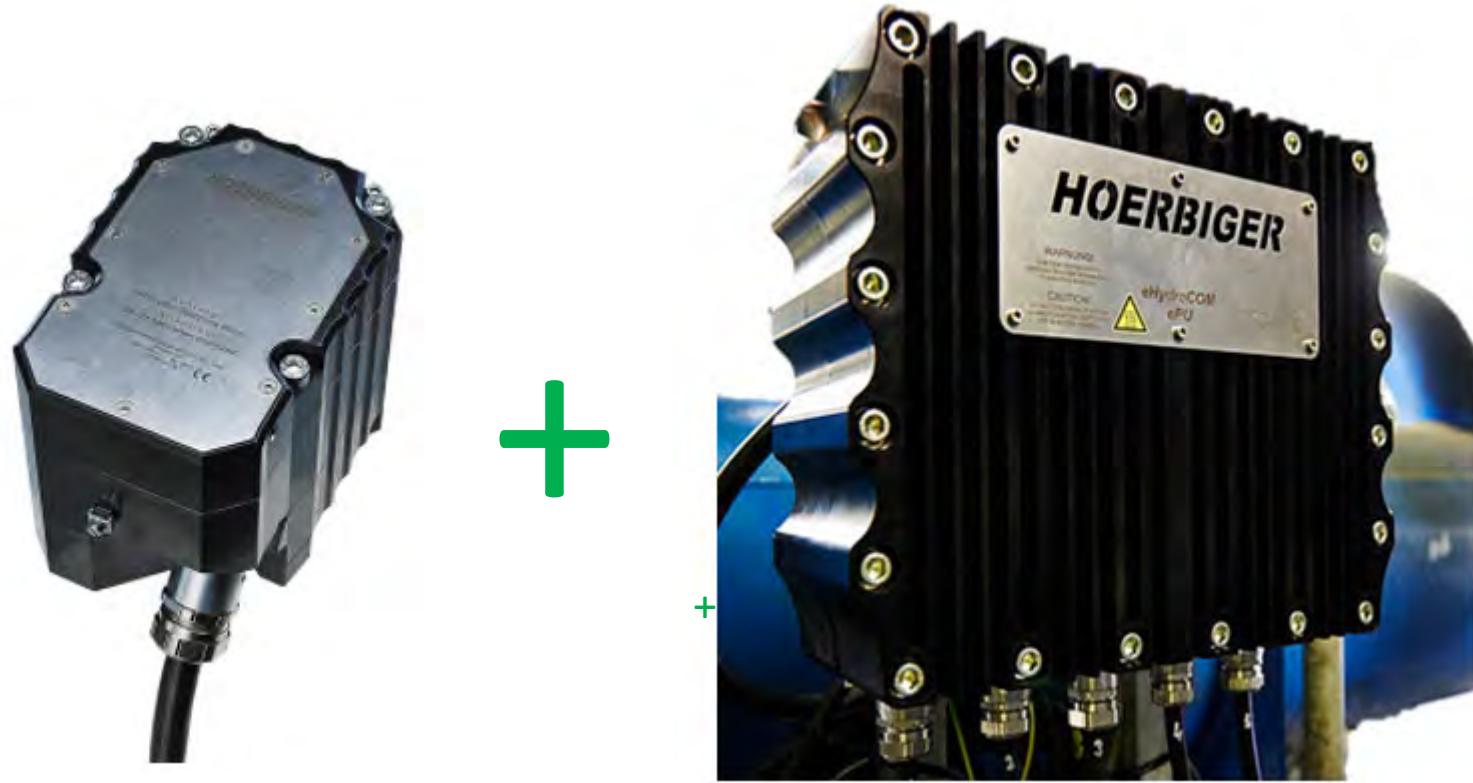
1300kW Motor with Bypass 20% open

$$1300 * 0.2 = 260\text{kW}$$

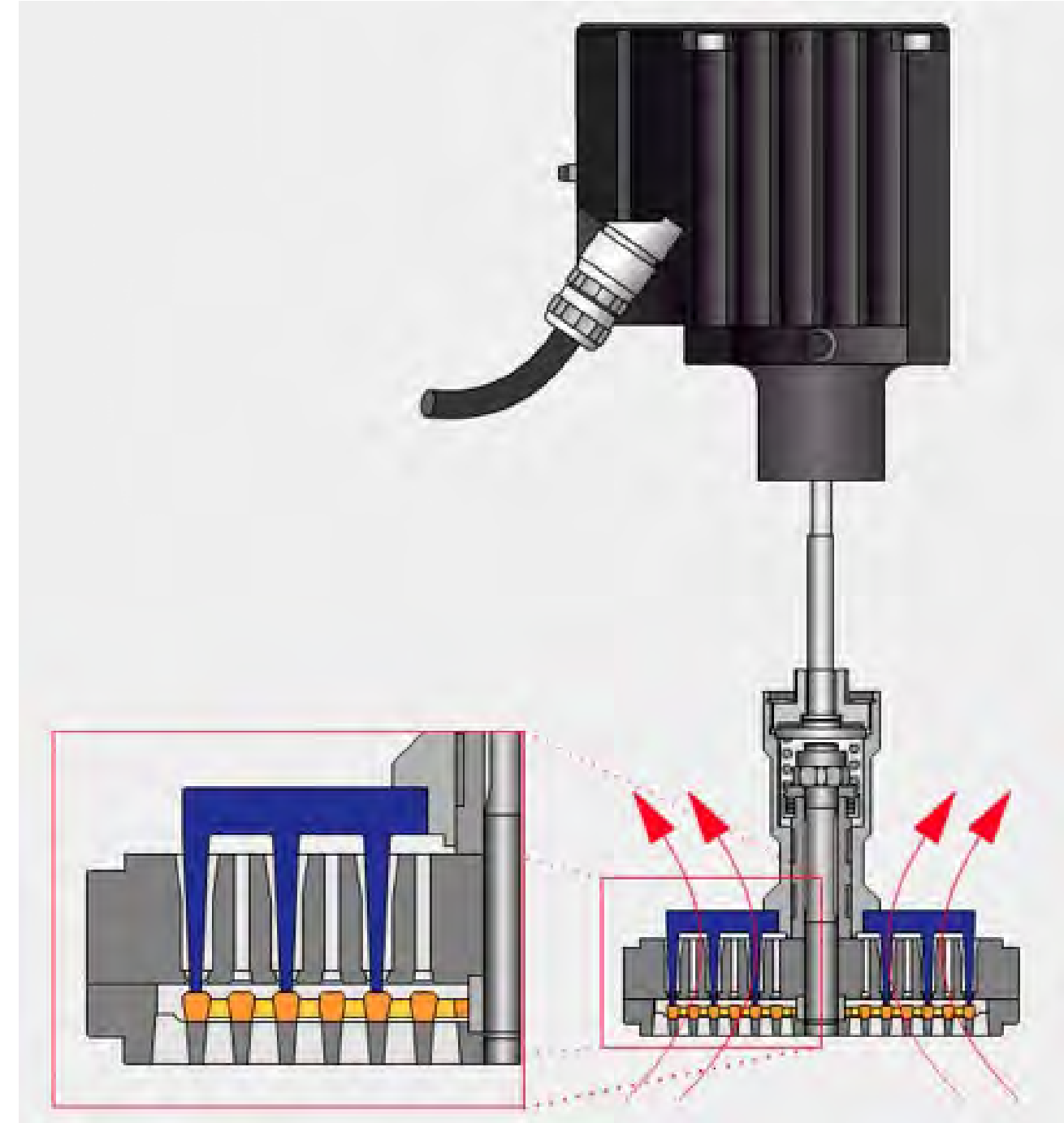
~2 million kWh/year



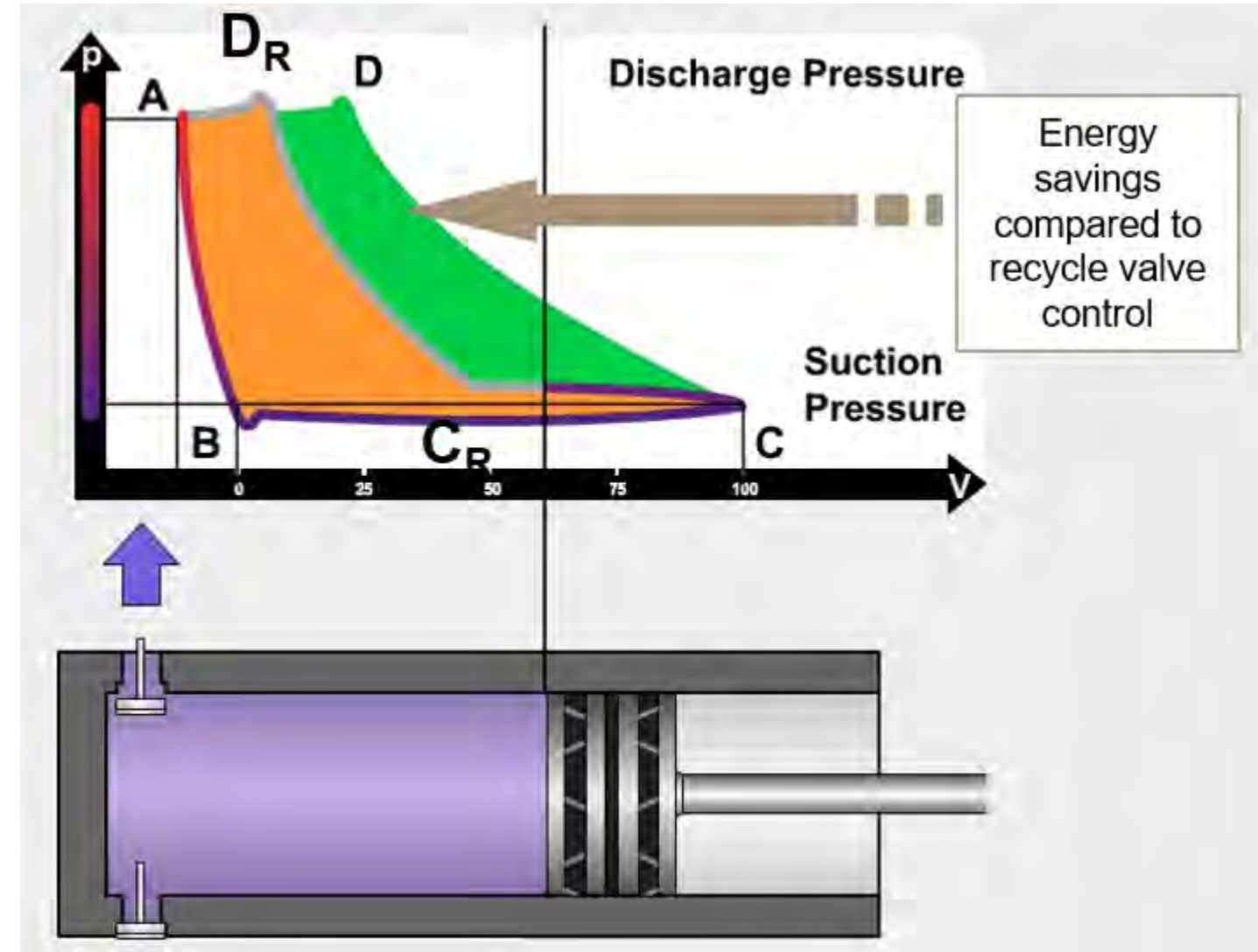
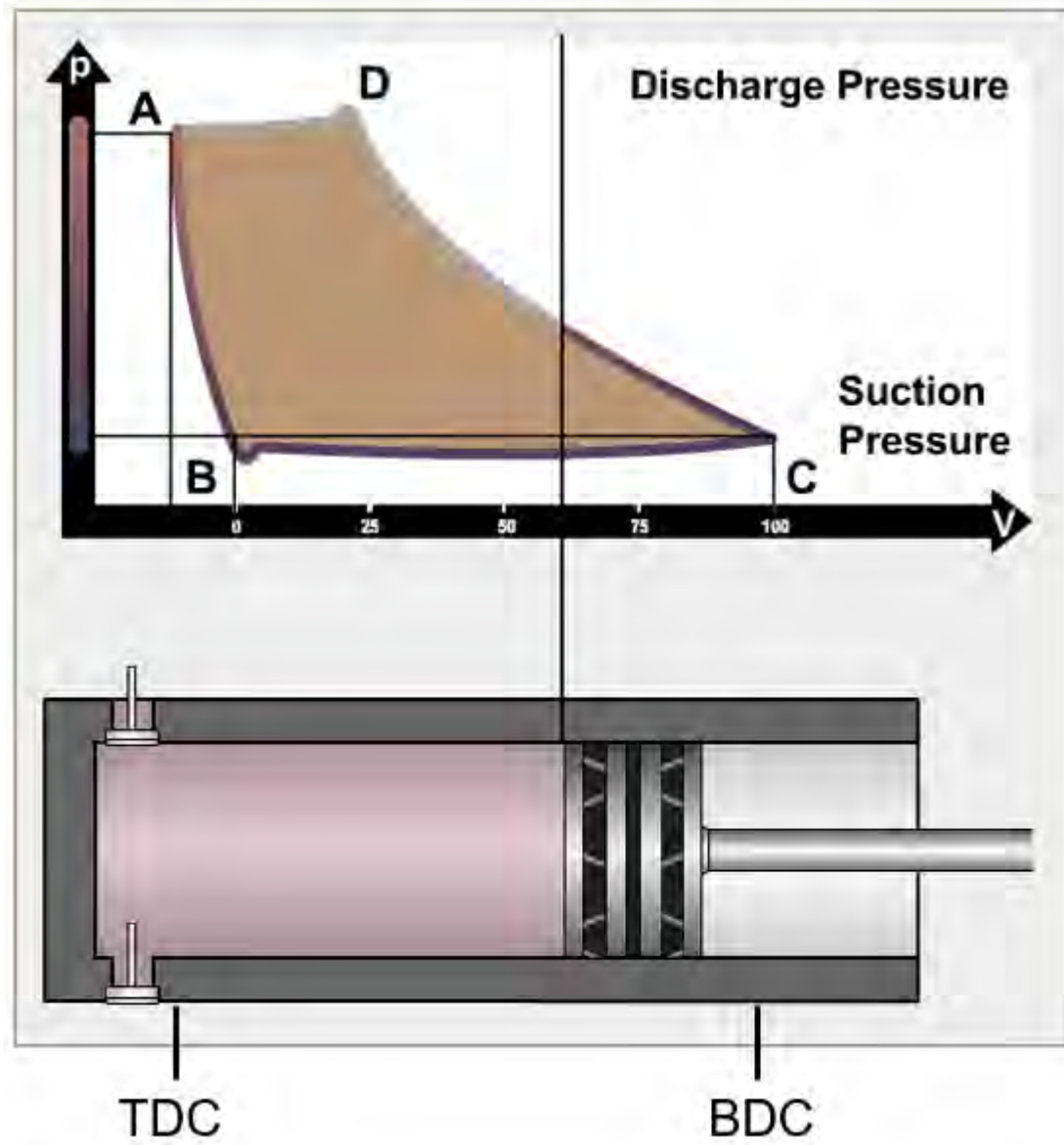
# Process Flow Maintained by Reverse Flow Control



Suction valve is held open for a portion of the compressor piston stroke

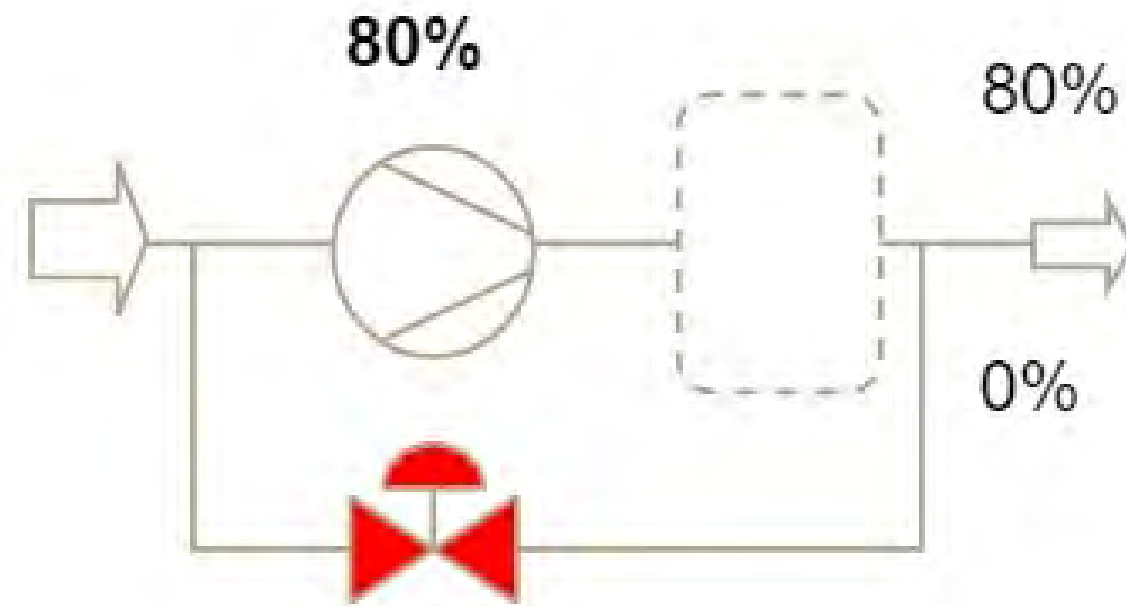


# Process Flow Maintained by Reverse Flow Control





# Process Flow Maintained by Utilizing By-Pass Control Valve



Bypass remains close

Process control range is wider and much more responsive

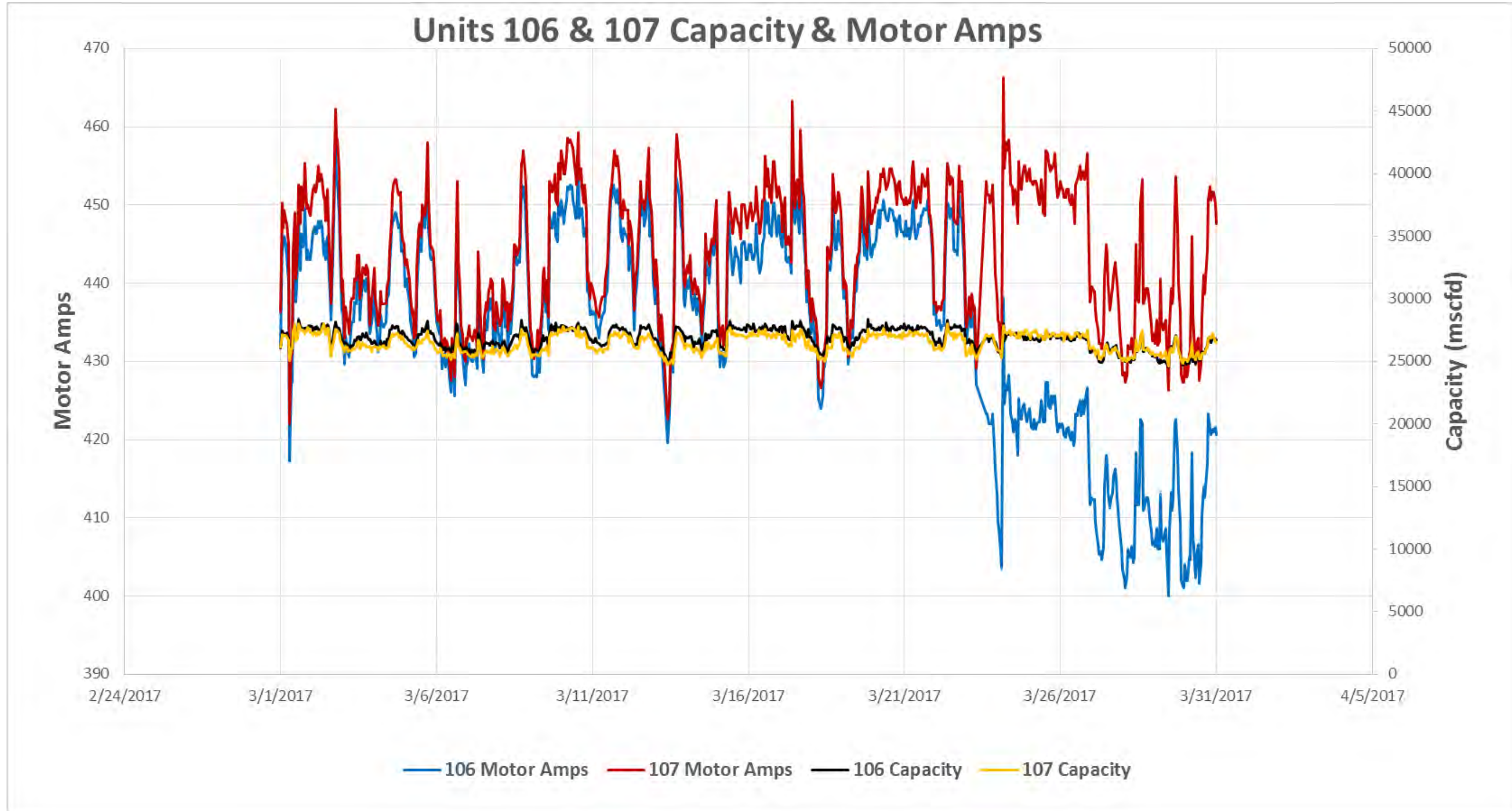
Energy costs of \$0.08/kWh

Total savings of **\$160,000** per year

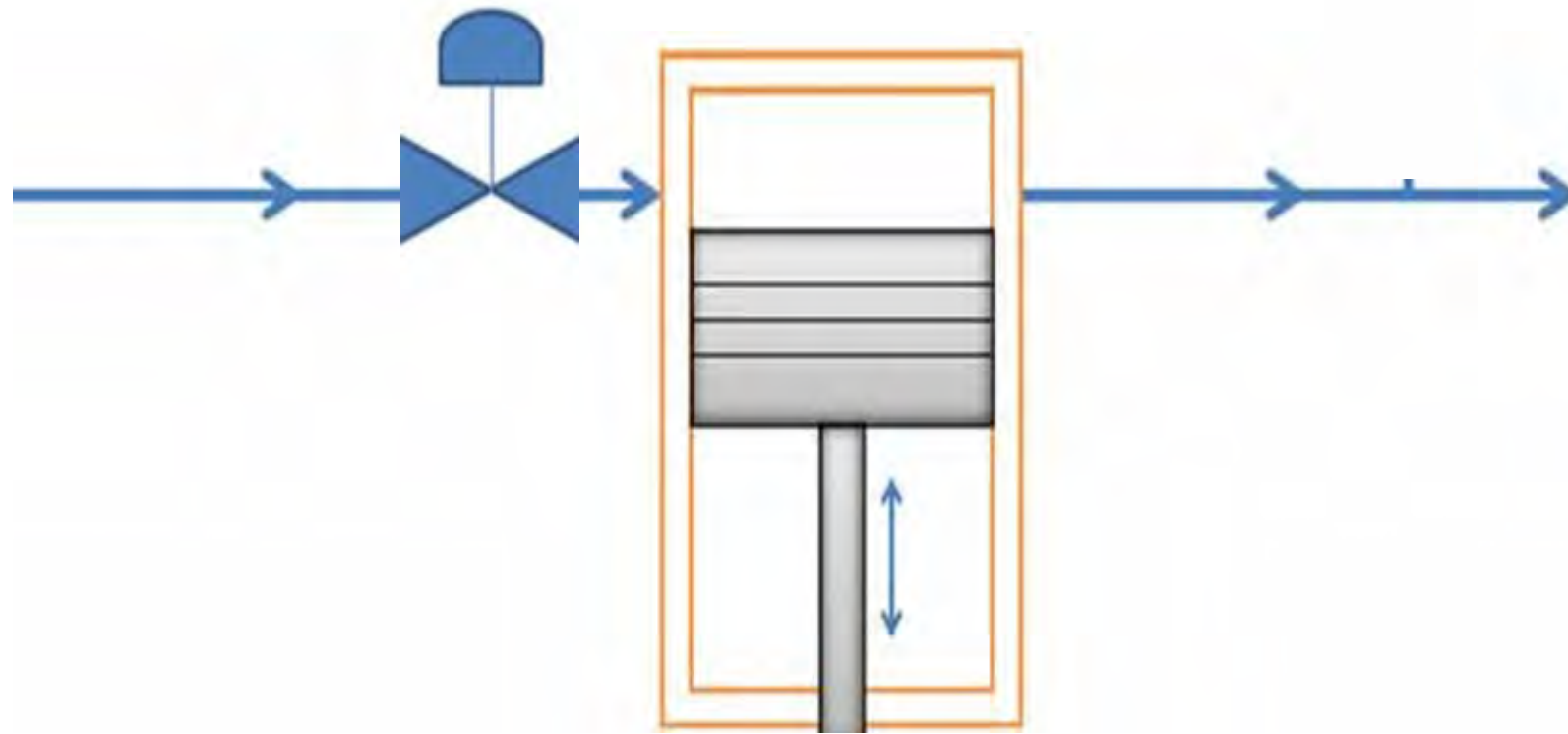
Potential carbon tax savings & credits



# Efficient Compressor Valves provide Horsepower Savings



# Additional Capacity



Control system monitoring the motor load increase suction pressure to the unit by opening further the suction control valve.

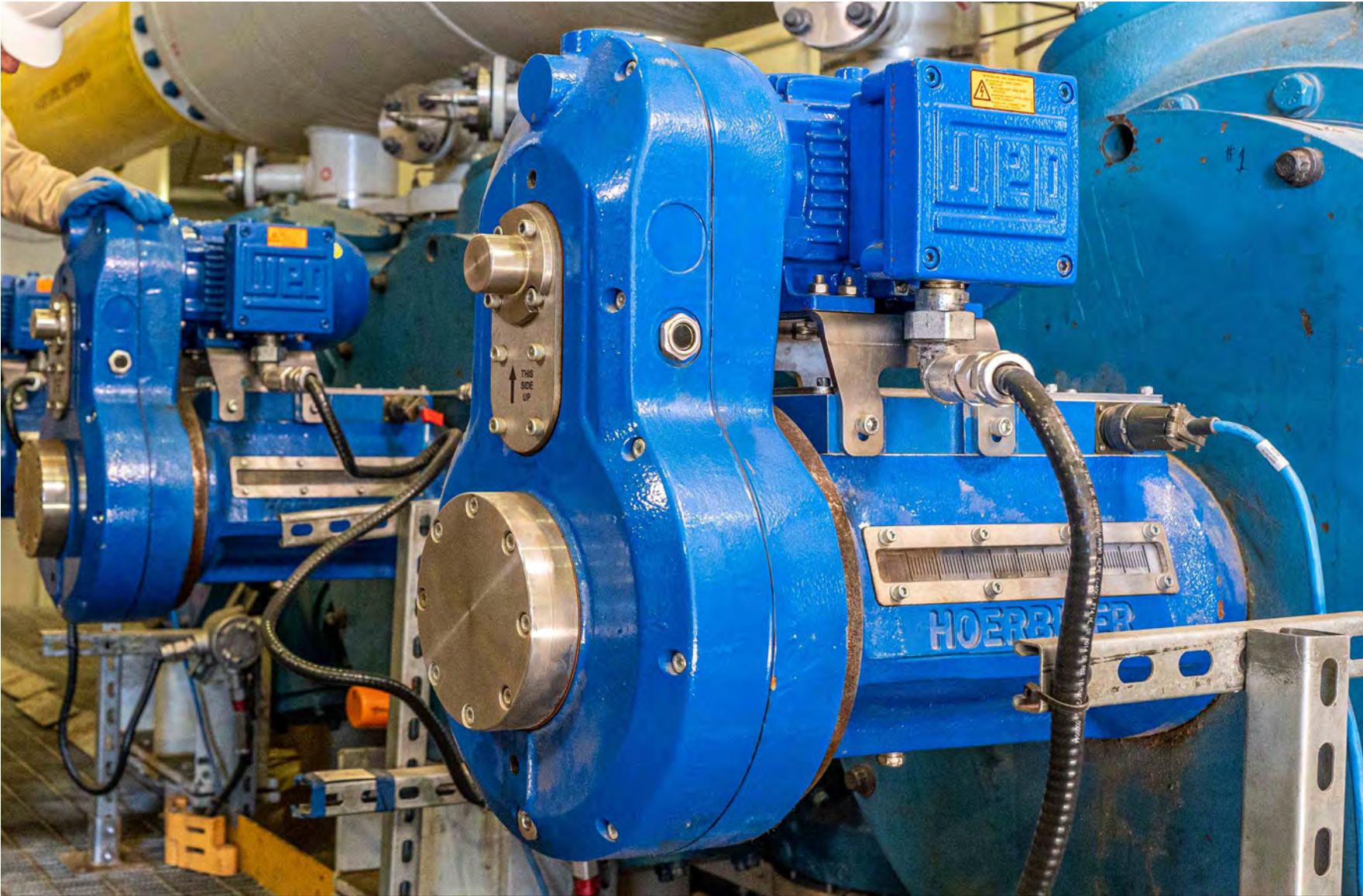
The higher suction pressure resulted in a lower compression ration adding approximately 1MMSCF/D of capacity.

Additional \$500K per year in revenue.



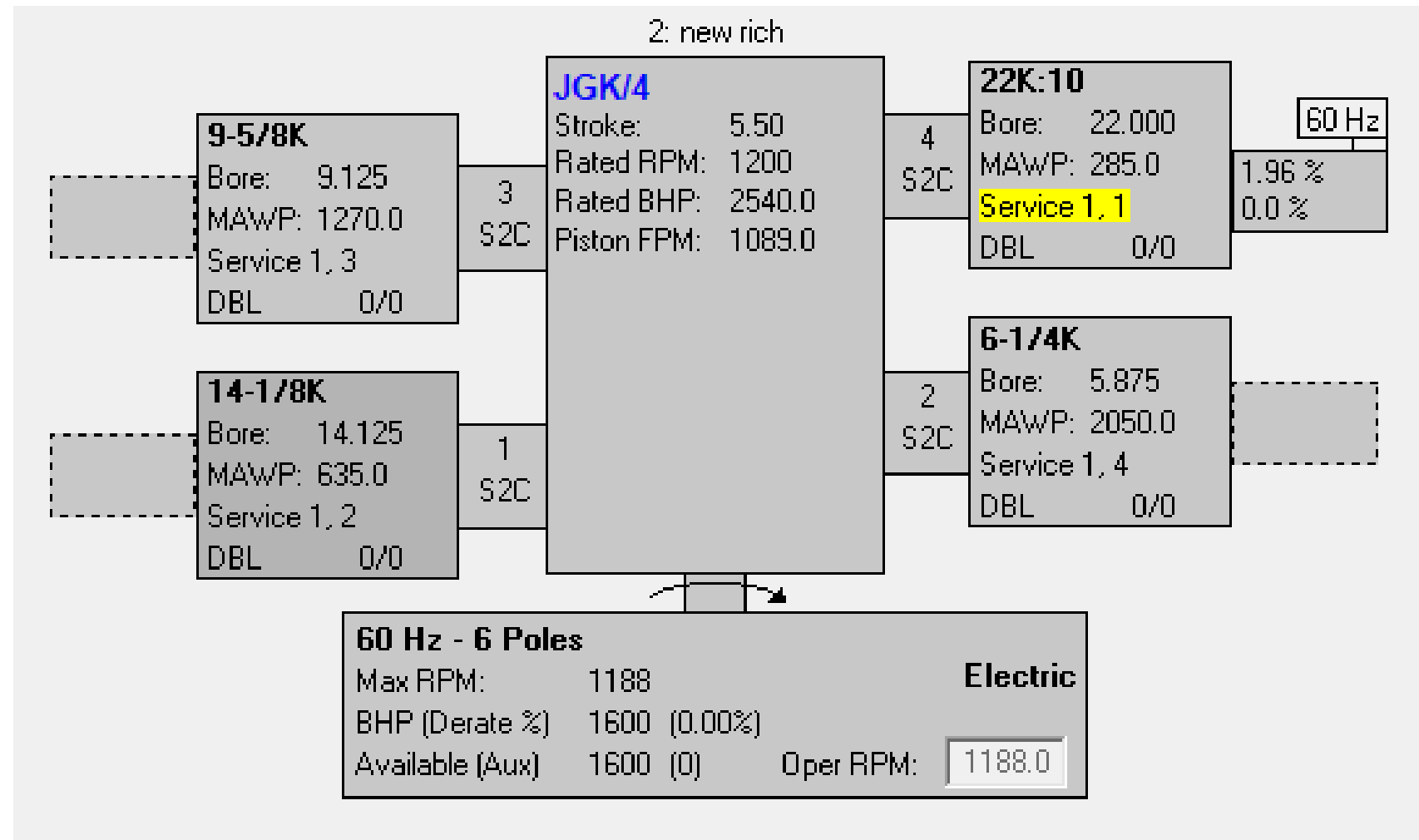


# CP Valve & Automated VVCP Control





# Valve & Automated VVCP Control – Case Study



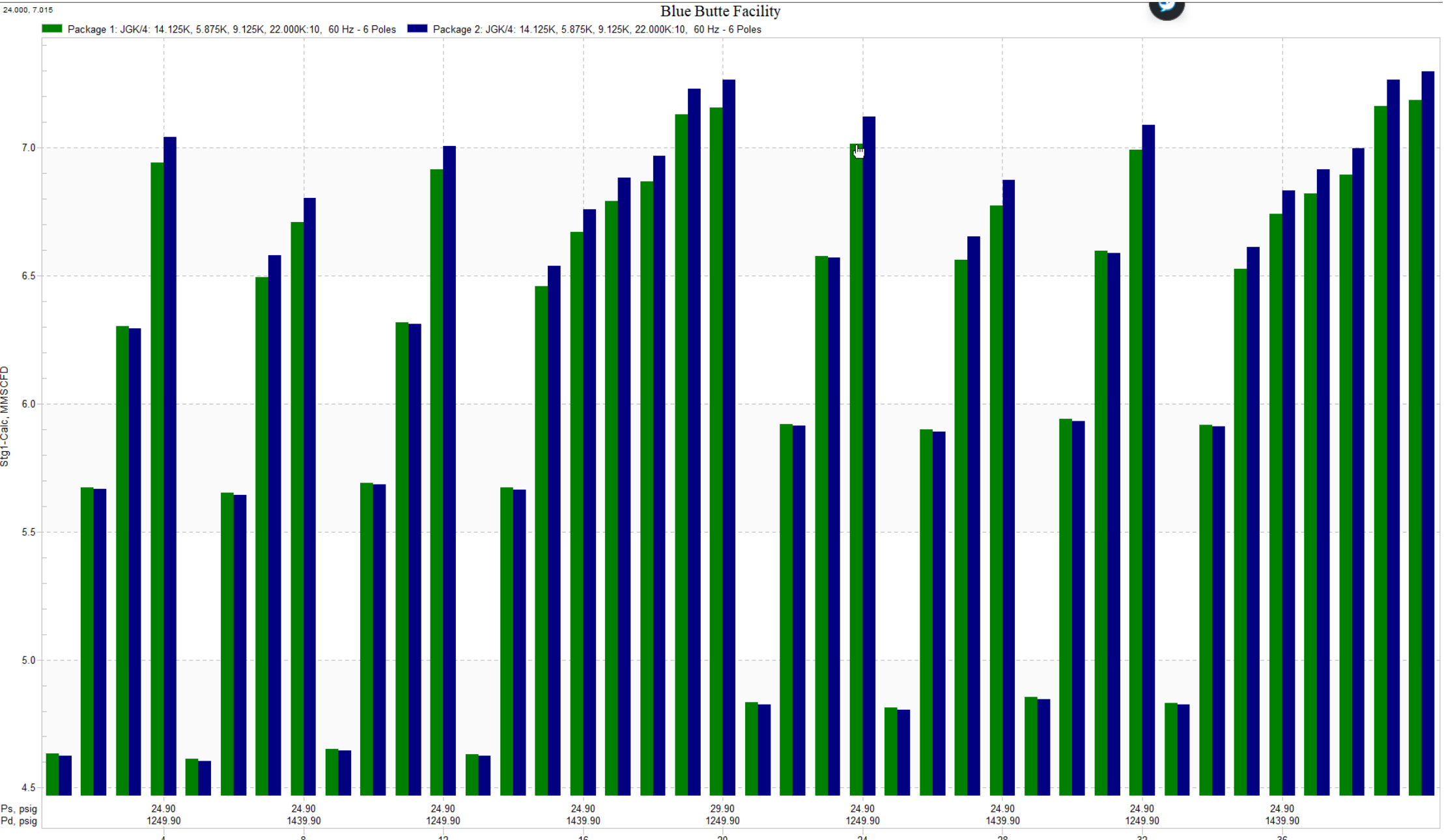
Compressor: **Ariel JGK/4 1600HP Electric 60HZ 1200 RPM**  
 Suction: **9.9 – 28.9 psig**  
 Discharge: **1249-1439 psig**

**Solution applied:**

eVCP system installed on the 1<sup>st</sup> stage cylinder  
 1<sup>st</sup> stage 184CP valves installed vs 190CT  
 2nd Stage 155CP valves installed vs 158CT



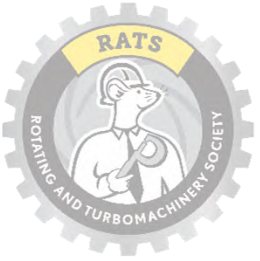
# Valve & Automated VVCP Control – Case Study



Flow prior and after CP& eVCP upgrade

CP valves resulted in a **1.5%** decrease in horsepower shown in decrease in motor amps for the same conditions. The eVCP fully loads the compressor resulting in a **1-1.5%** increase in flow or **0.1MMSCFD**.

This results in around **\$1,500** in increased production per day. Over the course of the year this upgrade has resulted in **\$550,000** in production. Applied to the **10** compressors at this station has seen an increase in **\$5.5million** in production per year.





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# Tracking Emissions & Emissions Savings

Legislation will likely soon require the monitoring and tracking of emission sources with penalties applied if limits are exceeded

Many corporate “Green” initiatives to reduce emissions

Governmental carbon taxes already being applied to energy consumed



# Energy Rebates and Potential Government Funding

Paper towel manufacturer (1888 Mills) receives rebate from 80K per year rebate from power company

[https://www.airbestpractices.com/technology/air-compressors/1888-mills-saves-140000-energy-savings-and-maintenance-costs?oly\\_enc\\_id=2359D6902023A9L](https://www.airbestpractices.com/technology/air-compressors/1888-mills-saves-140000-energy-savings-and-maintenance-costs?oly_enc_id=2359D6902023A9L)

Ovintiv Canada ULC received 1.8million to reduce 39K tonnes of CO2e from BC Government by upgrading their compressor valve technology

<https://news.gov.bc.ca/releases/2022ENV0059-001377>





# Summary

Methane emissions will play role in GHG legislation going forward

Technologies exist for reducing and even eliminating fugitive emissions from reciprocating compressors

Reduce vented emissions via improved component reliability and keeping the compressor pressurized during stand-by periods

Reducing emissions from energy consumed by improving efficiency and energy utilization

Legislation, Corporate Policy, and ROI will drive your emissions decision making





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