

# ***Pipeline Research Council International***

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## ***Greenhouse Gas Emissions Reduction: PRCI Strategic Research Priority Program***



**LEADING PIPELINE RESEARCH**

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PHMSA R&D Forum  
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Pipeline Research  
Council International  
LEADING PIPELINE RESEARCH

# Our Mission

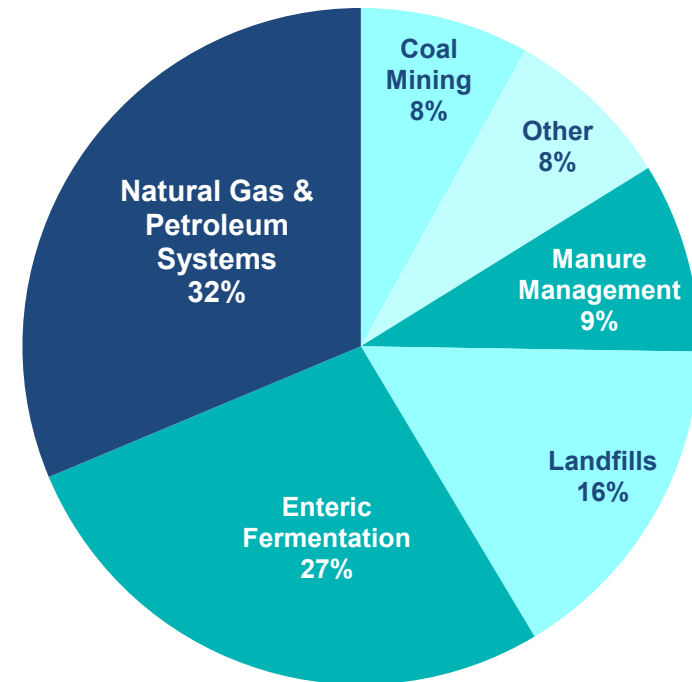
To collaboratively deliver relevant and innovative applied research to continually improve the global energy pipeline systems.



# Background

- **Increased focus on reducing greenhouse gas (GHG) emissions is increasingly becoming a social and, in turn, a business driver.**
- **Direct combustion of hydrocarbons is by far the highest source of greenhouse gases**
- **Methane emissions is the second highest source**
  - Relatively small reductions in methane have a larger net impact in greenhouse emissions as it is a more potent GHG than CO<sub>2</sub>

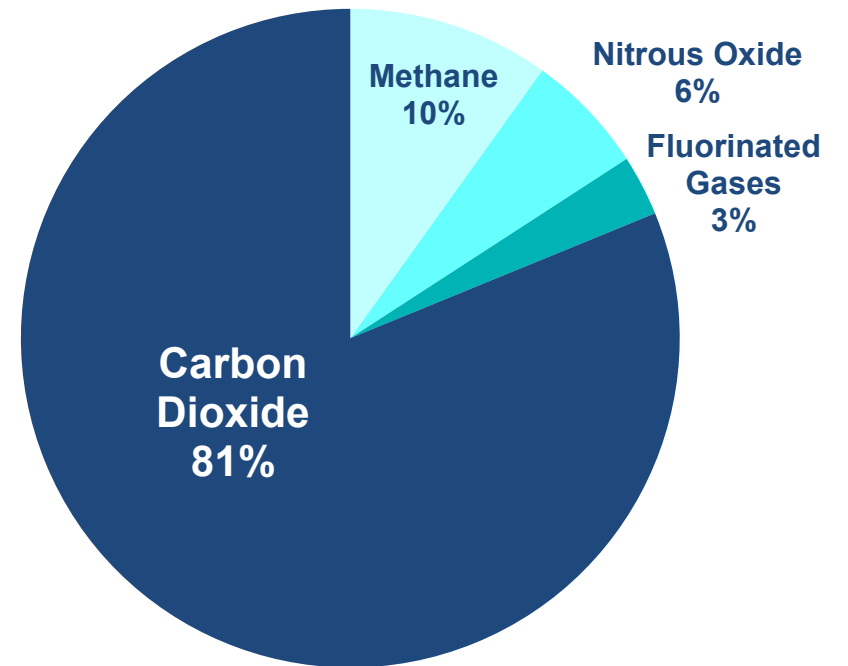
2017 US Methane Emissions, By Source



# Background

- **The pipeline industry should tackle reduction in GHG emissions through**
  - Reduced combustion/efficiency optimization
  - Reduced methane emissions

**US Greenhouse Gas Emissions in 2017**



## Impact to the industry

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- **GHG is a global issue**
- **Impacts both gas and liquid operators but has a larger impact to the gas industry as the equipment used to compress gas utilizes natural gas as a fuel and has methane emissions.**
- **The entire pipeline infrastructure is at risk if the social drive is to eliminate all fossil fuels**
  - Exception if there is a transition to renewable methane and/or hydrogen
  - Even if the impact is limited to just methane slip on two-stroke compressor engines, the replacement costs are estimated to be > \$5B
- **Increasingly, companies are required to show to their stockholders how they are reducing their GHG emissions**
- **Regulatory drivers to reduce methane emissions**

# GHG Strategic Research Priority

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- **What will it do & accomplish?**
  - Provide PRCI members and the energy pipeline industry with GHG solutions to implement and reduce their carbon footprint
  - Provide a roadmap of research projects to significantly reduce GHG emissions from pipeline transmission

# CO2e Economic Analysis Tool

A standardized basis to evaluate multiple technical approaches to assess relative cost (\$/CO2e) on a NPV basis was created.

- A tool to help operators prioritize their efforts to reduce GHG emissions to target the most cost-effective issues first.
- Will also be used by the GHG SRP program to help prioritize research efforts to reduce GHG emissions.

**Summary**
Forecast for the period ending 10 years after initial cash flow.
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**Overview of Emissions and Levies After 1 Year**

Baseline	generates theoretical emissions of	161533 tonnes/year	of CO2e and attracts	\$6,461,329	in expenses.	?
Alternative 1	changes CO2e emissions by	-2.6%	and changing levies by	-2.6%		?
Alternative 2	changes CO2e emissions by	-5.1%	and changing levies by	-5.1%		?

**Overview After 10 Year Period**

	Alternative 1	Alternative 2
Net Present Value	\$ 620,525	\$1,657,848
Internal Rate of Return	15%	22%
Levy & Commodity \$ Reduction	\$ 2,140,192	\$4,170,503
CO2e Reduction	tonne 42539	82894
Cost Effectiveness \$ <sub>lev</sub> /per tonne	\$15	\$20

Template # 1

Sunday, August 8, 2021

Applying load profiles for gas turbine engines.

**Net Present Value**

**Energy and Emissions Per Source, Per Period**

- Applies the configured fuel rate, period, population, efficiency and combustion
- For Natural Gas and NGL, 'Energy In' is based on  in the

Baseline						CO2 tor
Source	Period	Energy In	Energy Out			
Engine A	day	3770.6	MMBTU	403.3	MWh	
Engine B	day	3670.0	MMBTU	403.3	MWh	
-	day	0.0	MMBTU	0.0	MWh	
-	day	0.0	MMBTU	0.0	MWh	
-	day	0.0	MMBTU	0.0	MWh	
-	hour	0.0	MMBTU	0.0	MWh	
-	hour	0.0	MMBTU	0.0	kWh	
-	hour	0.0	MMBTU	0.0	MWh	
-	hour	0.0	MMBTU	0.0	MWh	
-	hour	0.0	MMBTU	0.0	MWh	
not applicable						
total						

Alternative 1						CO2 tor
Source	Period	Energy In	Energy Out			
Engine A	day	3670.0	MMBTU	403.3	MWh	
Engine B	day	3574.7	MMBTU	403.3	MWh	
-	day	0.0	MMBTU	0.0	MWh	
-	day	0.0	MMBTU	0.0	MWh	
-	day	0.0	MMBTU	0.0	MWh	
-	hour	0.0	MMBTU	0.0	MWh	
-	hour	0.0	MMBTU	0.0	MWh	
-	hour	0.0	MMBTU	0.0	MWh	
-	hour	0.0	MMBTU	0.0	MWh	
not applicable						

## Active GHG Projects

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### **Fuel Reforming and Segregation as an Alternative for Compressor Fuel (CPS-14-07)**

- Develop technologies to facilitate reforming natural gas to produce hydrogen and other components.
- This would eliminate all CO<sub>2</sub>e emissions from these engines.

### **Improvements in Facility Efficiency (CPS-17-07)**

- White paper study to identify technologies that could minimize emissions through facility efficiency enhancements.

### **Reciprocating Engine Exhaust Methane Slip Reduction (CPS-17-08)**

- This multi-year effort will evaluate retrofittable hardware and control methods to reduce misfire/late combustion and minimize fuel trapped in portions of the engine where flame quenching is likely.
- The effort will also evaluate hardware and controls that enhance combustion to help assure complete combustion of the engine fuel.



## Active GHG Projects, cont.

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### **Continuous Monitoring and Diagnostics for Facility Efficiency (CPS-14-06 )**

- Project to determine near real-time identification of equipment that has undergone mechanical degradation such that it is operating below its expected efficiency.

### **Methods to reduce pipeline blowdowns to effectuate repairs/inspections (MATR-3-15)**

- White paper study to assess technologies that would facilitate pipeline repairs without the need to blowdown the pipeline.

### **Methane Leak Detection and Quantification (PL-1-08)**

- White paper study to provide research guidance on technologies that can be used to detect and quantify the rate of natural gas leaks.

### **Flow Sensors for Continuous Monitoring and Diagnostics for Equipment Efficiency Monitoring (MEAS-5-28)**

- An assessment of flow sensors that can be retrofitted to gas compressors and liquid pumps.

# New Projects Planned for 2022

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## **Alternate Pipeline Repair Methods**

- Initial development and enhancement of in situ pipeline repair methods.

## **Evaluate In Situ Valve Repair Techniques**

- Paper study to evaluate options to repair leaky isolation valves without removal from service and/or detection/monitoring methods.

## **Low-cost Instruments to Detect/Quantify Leaking Seals, Packing, or Dump Valves**

- White paper to assess the feasibility/reliability of low-cost instruments to detect leaking components.

## **High Flow Sampler Replacement**

- Assist in the development and testing of a high flow sampler (or alternate technology) for the quantification of moderate to large leaks.