


OIL AND GAS METHANE DETECTION,

The background of the slide features a photograph of an oil pumpjack in a field. The pumpjack is a large, mechanical device used for extracting oil from the ground. It has a long, angled arm with a curved counterweight at the end. The structure is made of metal and is situated in a grassy field. The sky above is blue with scattered white clouds. The overall scene is a typical oil field landscape.

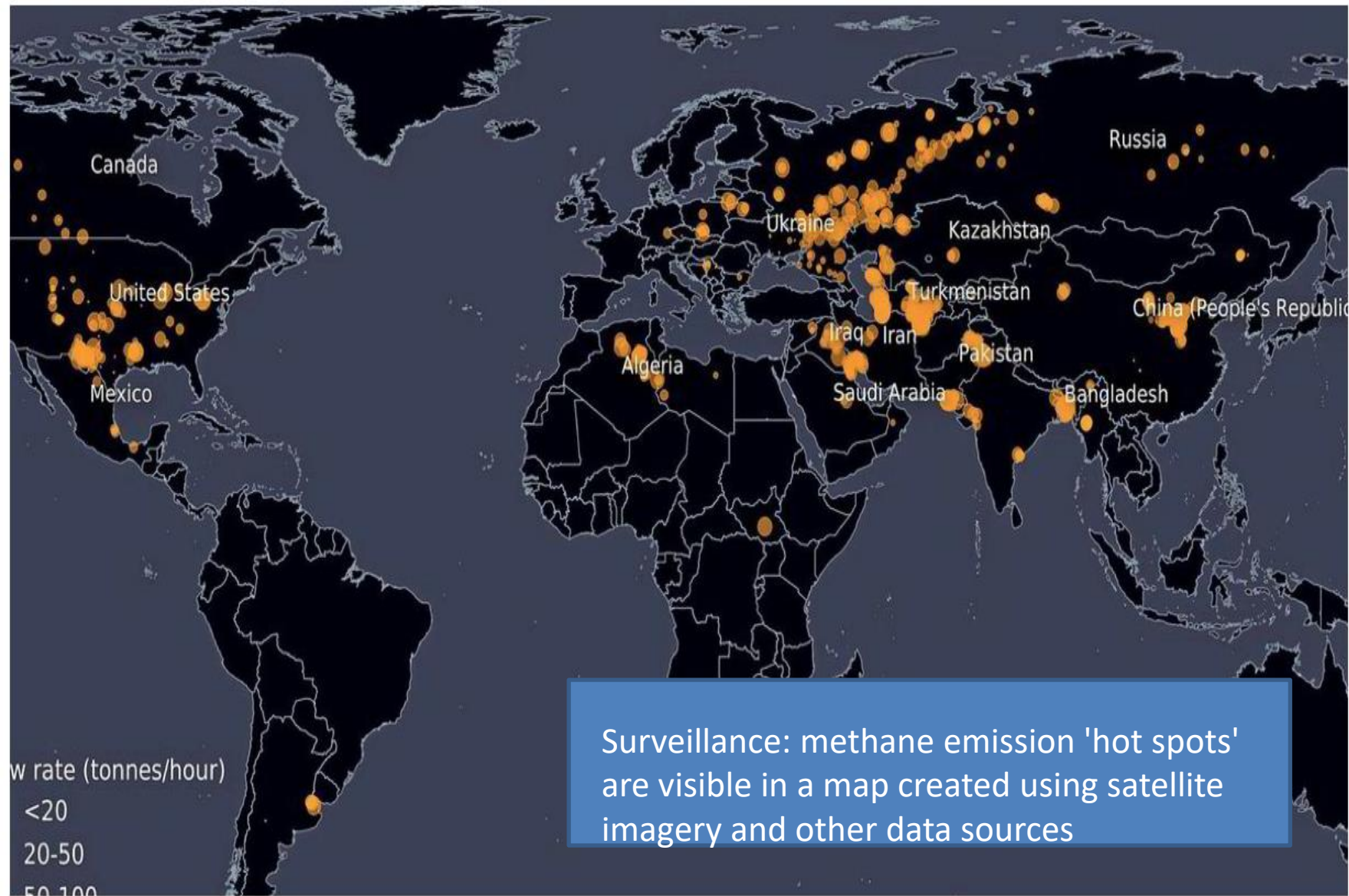
Soheil Asgarpour, Ph.D., FCAE, FCIM, FCSSE, P. Eng.
PTAC CEO & President

A solid red horizontal bar is located at the bottom of the slide, spanning most of the width. It is positioned below the text and above the bottom edge of the image.



Methane Technologies

1. Mass Spectrometer (Deep Carbon Observatory)	Deep Carbon Observatory
2. U10 Laser Methane Leakage Detector	Aeromotus
3. FTIR Spectrometer	Telops
4. Silicon Photonic Absorption Spectrometer	JWN Energy
5. Methane detection from drone	ArchAerial

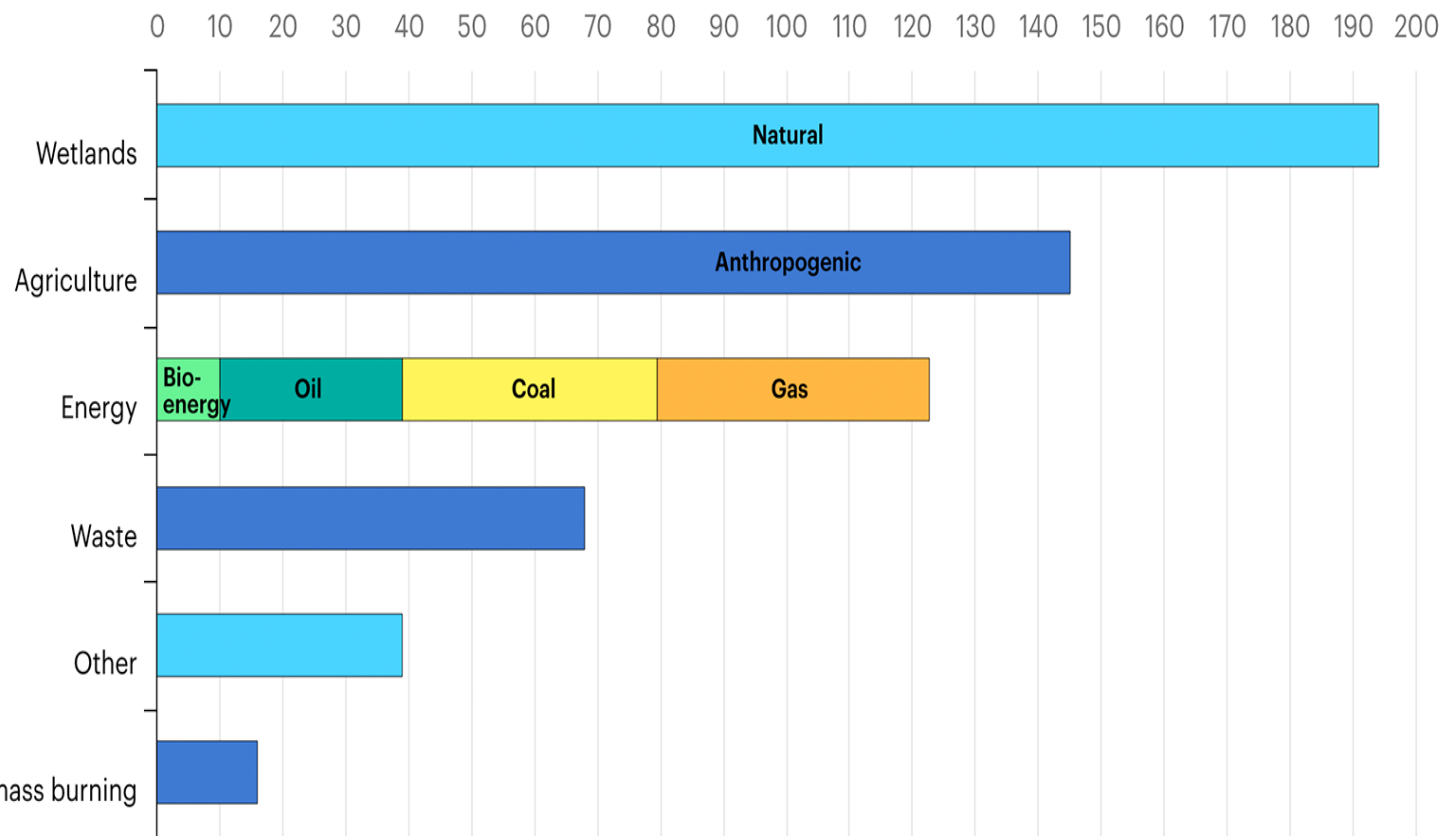


Sources of methane emissions

Methane Tracker 2021

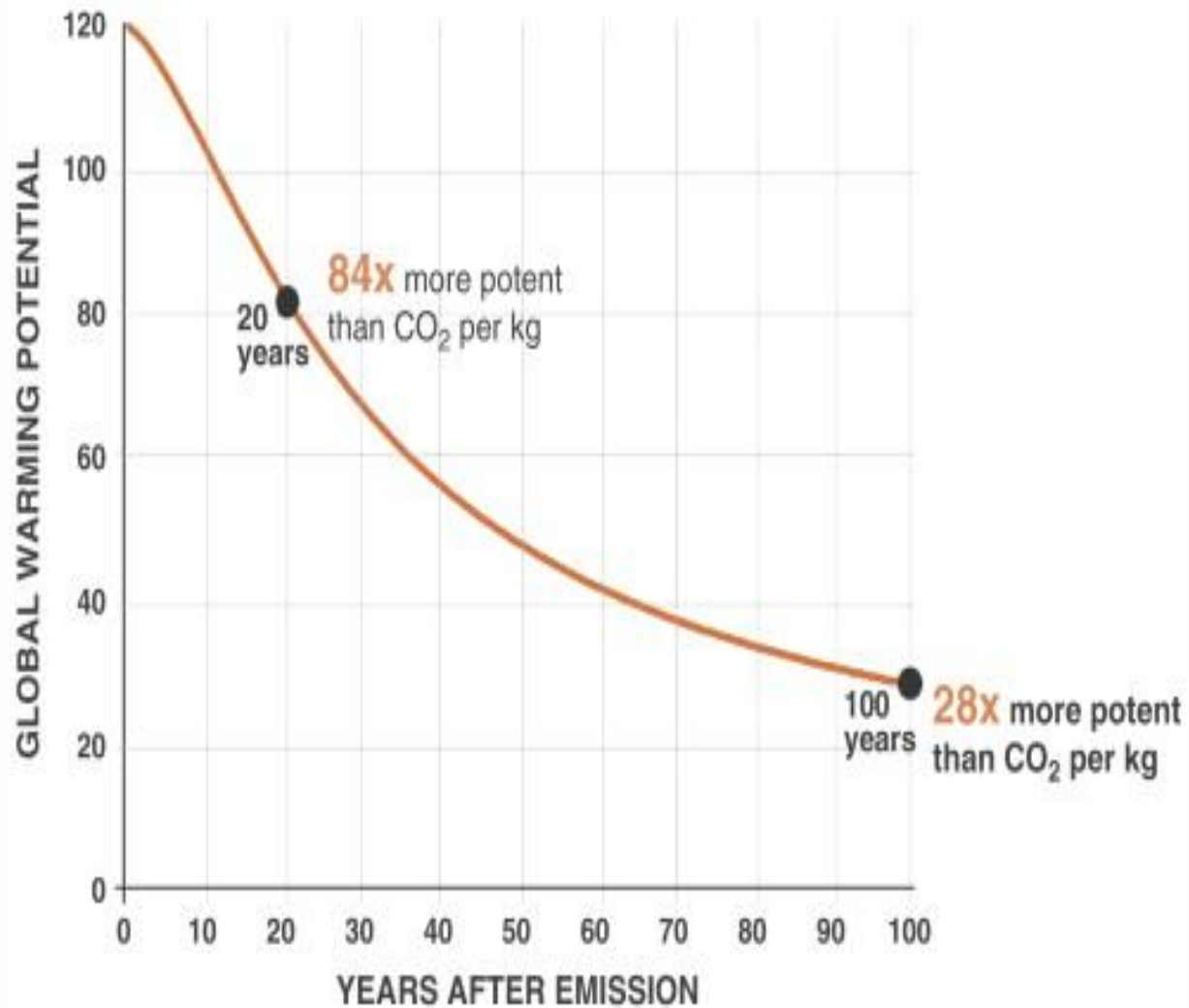
MT of methane

● Natural ● Anthropogenic ● Bioenergy ● Oil ● Coal ● Gas



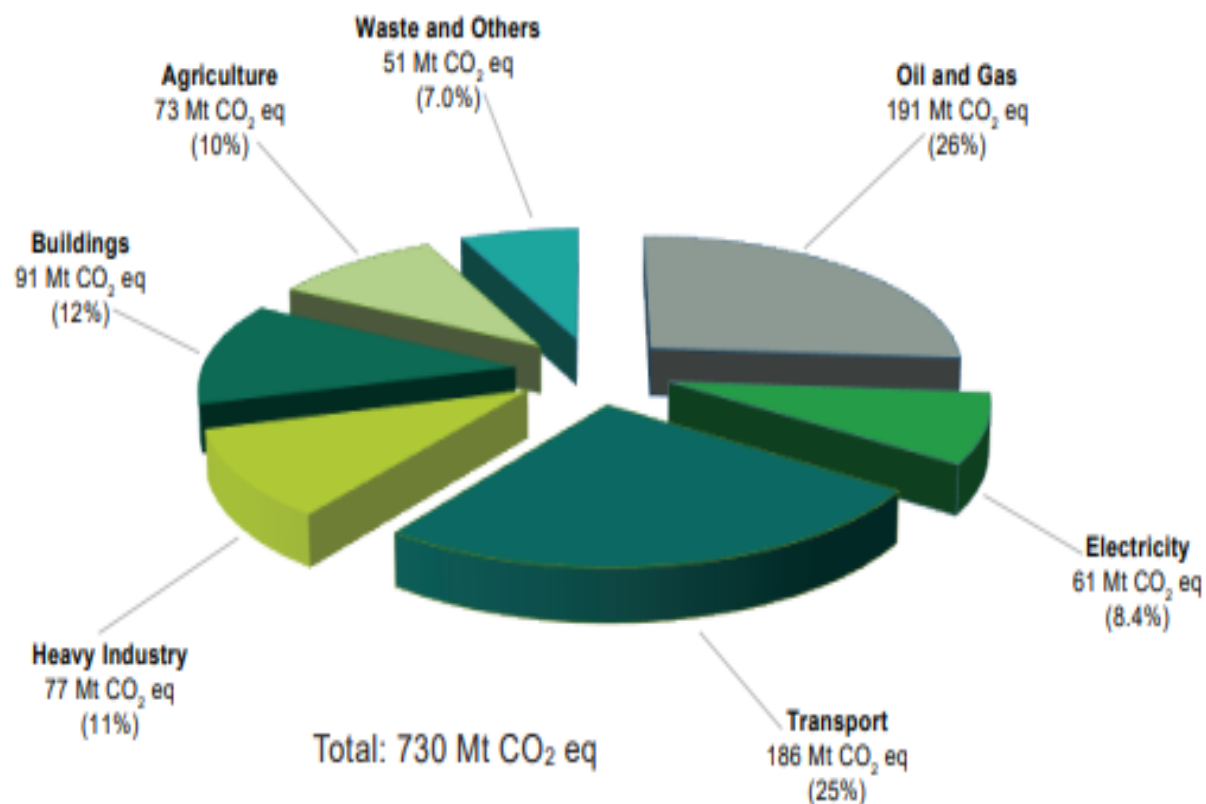
International
Energy Agency

DIRECT AND INDIRECT WARMING COMBINED OVER TIME



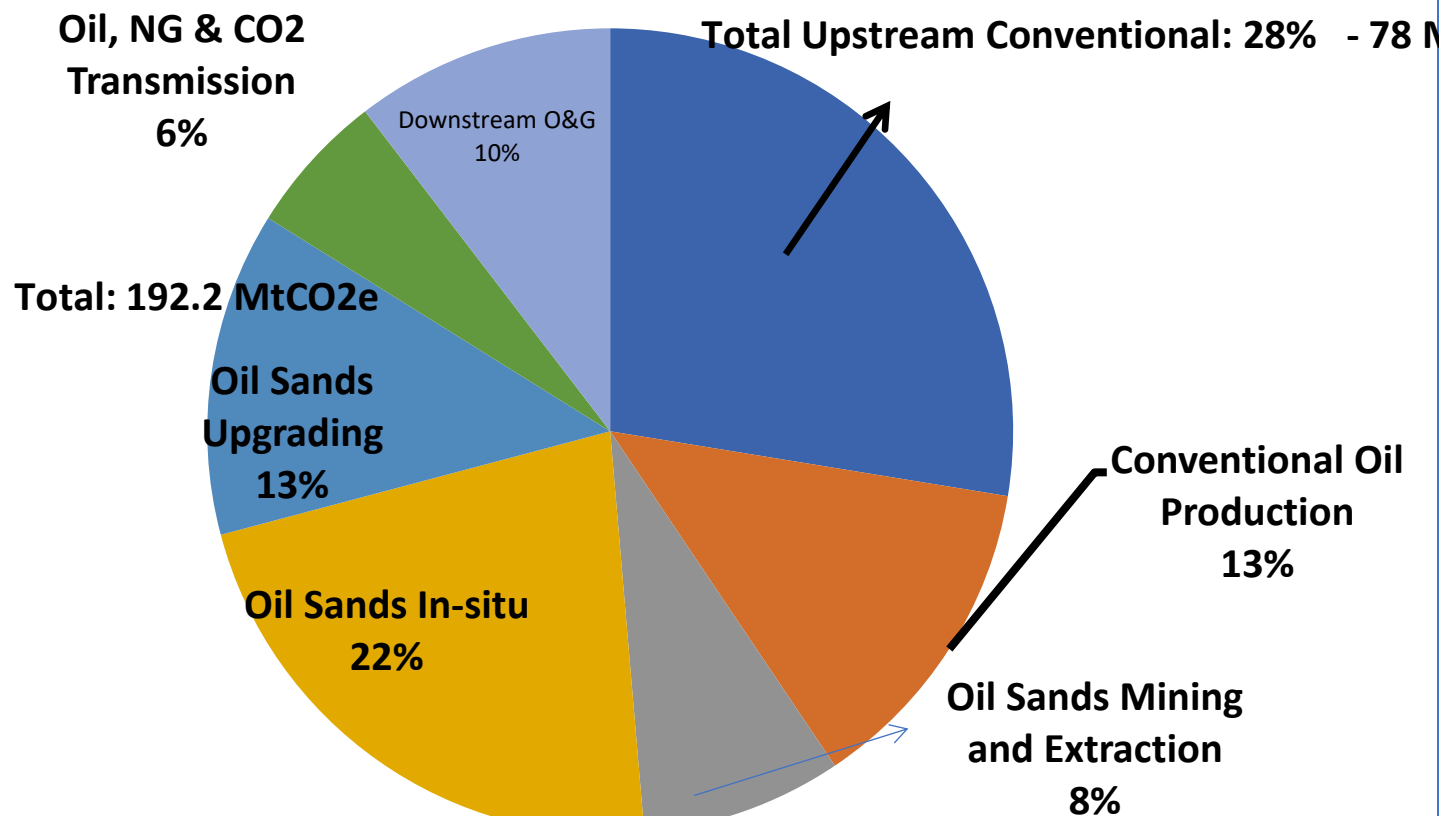
Current Opinion in Chemical Engineering

Figure ES-7 Breakdown of Canada's GHG Emissions by Economic Sector (2019)



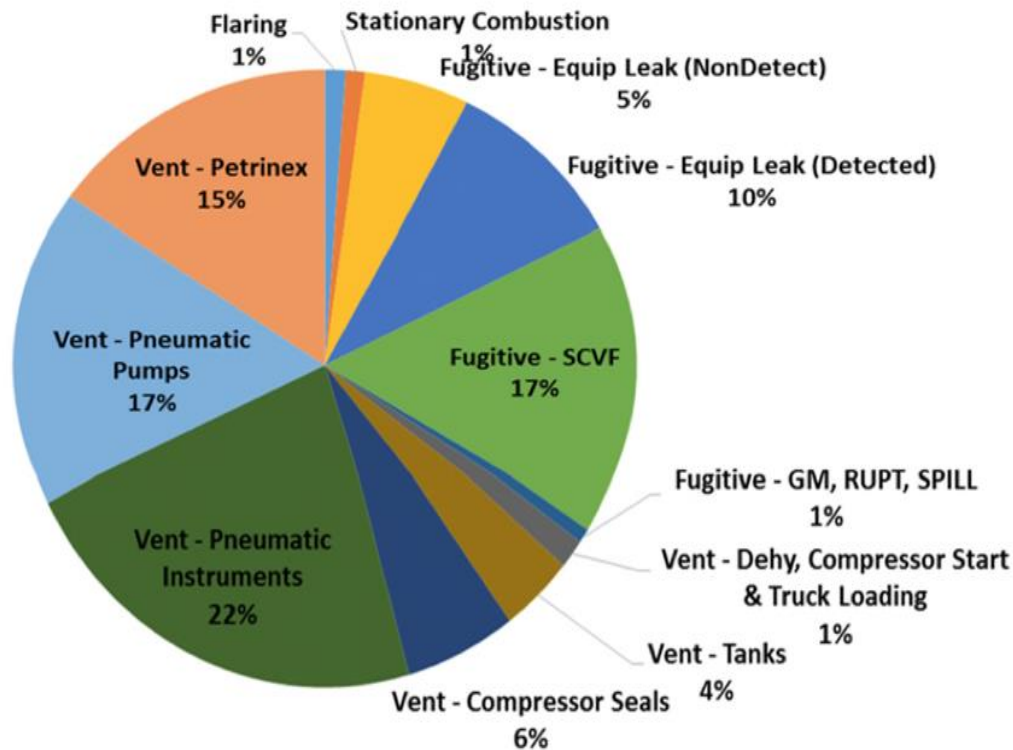
Note: Totals may not add up due to rounding.

Breakdown of Canada's GHG Emission Contribution by Oil & Gas (2019)



Source: NATIONAL INVENTORY REPORT 1990 –2019: GREENHOUSE GAS SOURCES AND SINKS IN CANADA

- 2018 DATA BY SUBCATEGORY

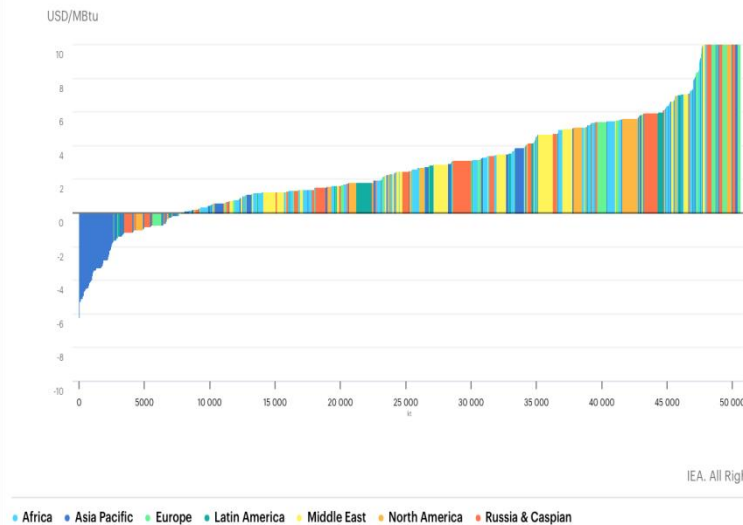


Methane Emissions Challenges

Methane and Climate Change

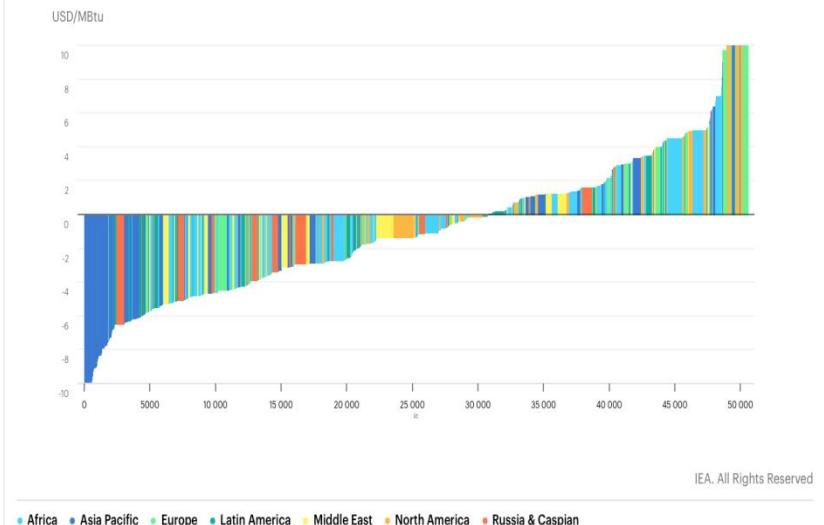
Marginal abatement cost curve for oil- and gas-related methane emissions by region, 2020

Open



Marginal abatement cost curve for oil- and gas-related methane emissions by region at higher natural gas prices

Open





DID YOU KNOW ...

Canada's Oil & Gas Industry
is ALSO Canada's Largest Cleantech Industry?

AIM
LAND

Electricity generation from selected fuels (AEO2020 Reference case)

billion kilowatthours

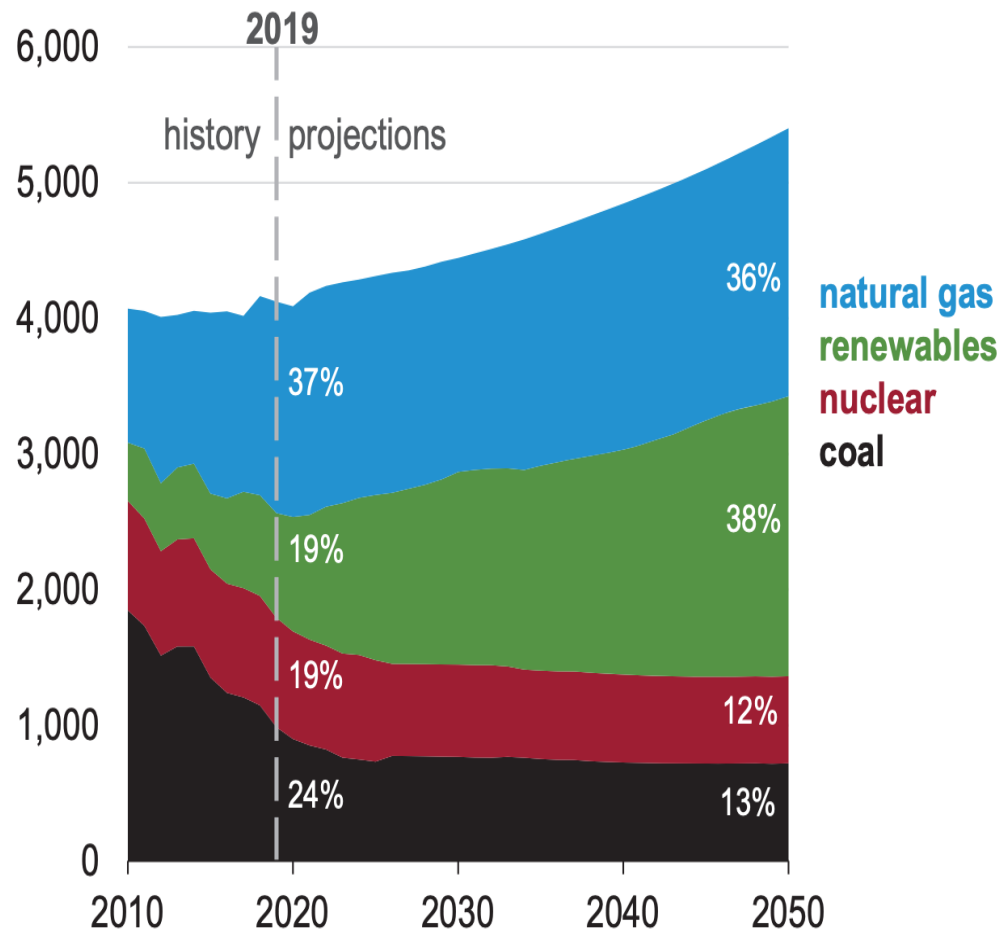


Image credit: EIA

PTAC's Methane detection and mitigation Grand Vision

Methane Mitigation:

- To increase methane mitigation technology capacity by 45% by 2022 at a cost of less than \$5 per tonne of carbon dioxide equivalent (CO_{2e}). This increased capacity will equip producers to meet the 2025 target.
- Long-term vision is to increase technology capacity by 90% by 2030.

Methane Detection:

- To foster cost-effective accurate technologies that detect methane emissions.

Best Management Practices

Development of best practices using past AUPRF research projects targeting PTAC focus areas
Plug/annular cement integrity analysis and fault diagnosis of mechanical plugs

Development of a Model to Predict Benzene Emissions from Glycol Dehydrators with
Condensation Tanks (2015)

Improved Flare Source Parameters for CALPUFF and AERMOD Dispersion Models (2015)

Leak Detection and Repair Baseline (2016)

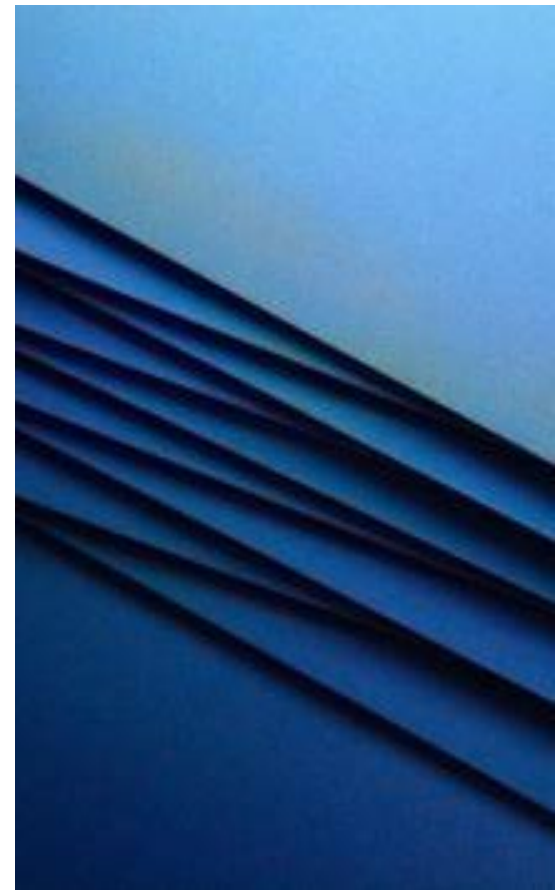
Vehicle-based Fugitive Emission Detection and Attribution within Albert Energy Developments
(2016)

Mitigating Low Volume Methane Emissions (2016)

Pneumatic Vent Gas Measurement (2017)

Verification of Quantitative Optical Gas Imaging System (2017)

Pilot Measurements Study for Quantifying Methane Emissions at Upstream and Midstream Oil
and Gas Facilities (2017)



Methane Applied Research and Studies

- Identification and Evaluation of GHG Reduction & Energy Efficiency Improvement Opportunities at Oil and Gas Facilities (2008)
- Emissions Reduction opportunities in Dehydration Facilities
- Validation of Reduced Spacing from Residences for Enclosed Combustors
- Mitigating low volume methane emissions - Erica Emery, Saskatchewan Research Council
- Field Data Collection Study to Investigate Abnormal Tank Venting - Yori Jamin, Clearstone Engineering Ltd.
- Stationary Engines Air Emissions Research (2012)
- Petroleum Emissions Management Accelerator (PEMA) – Study of the Potential for Emissions Reductions in Conventional Oil and Gas (2013)
- Conceptual Engineering Study of Technologies for Reducing Methane Venting in Cold Heavy Oil Production (2015)
- Glycol Dehydration Pump Optimization Review (2016)
- Eco-efficiency Handbook (2016-2017)
- REMVue Slipstream Industry Impact Assessment



Fugitive Emissions Management Program Effectiveness Assessment (FEMP EA)

- A world class methane detection, quantification and verification applied research project.
 - Study area = 2500 Square Kms
 - 200 facilities (a total of 30 operators).
 - 100% voluntary participation from operators.
 - 200 sites selected for leak detection and repair surveys using optical gas imaging, Hi-Flow sampler, and QOGI

Field Challenges

Alberta Methane Field Challenge

- Sought to understand the real-world performance of alternative methane leak detection technologies in comparison to conventional camera-based surveys..
 - 2500 square kilometer in the Rocky Mountain House Region



Field Challenges

Alt-FEMP Project

- This project focused on Methane emissions detection, attribution, and quantification at upstream oil and gas facilities – a comparison of two truck systems and optical gas imaging.
- *Results indicate strong agreement among the methods for facility-level detections*



List of Methane Detection Technologies developed through PTAC

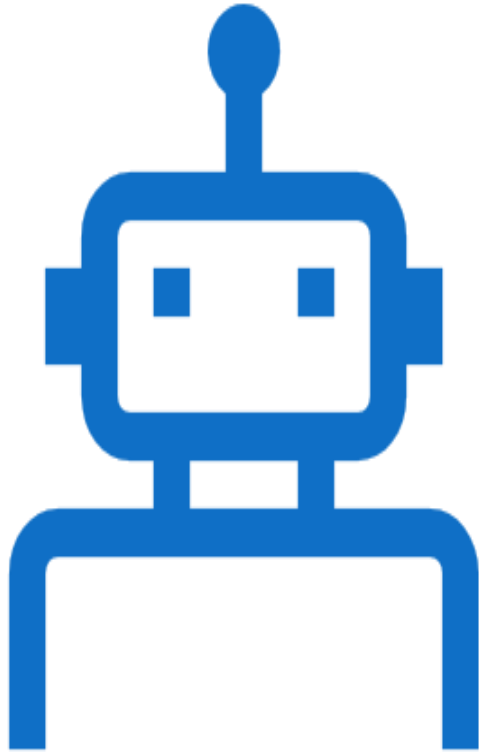
mAIRsure

LDAR SIMS

Intelligent Methane Measurement, Monitoring and Mitigation system (IM3S)


Distributed Energy Efficiency Project Platform (DEEPP) – DEEPP,

Methane Abatement Platform Phase 1 - Engagement Plan (2017)



List of Methane Detection Technologies Deployed/ Demonstrated through PTAC

- SeekOps, (Drone)
- Heath Consultants Inc. (Drone)
- Aerometrix (Drone)
- Altus Technologies (Truck)
- Heath Consultants Inc. (Truck)
- University of Calgary (Truck)
- Bridger Photonics (Aerial)
- Sander Geophysics Ltd. (Aerial)
- FLIR (Handheld)
- Tecvalco (Handheld)
- Luxmux (Ground-based)
- NitroTech (Controlled release)



2021/2022 Detection Projects

Understanding Routine and non-Routine Venting from Tanks

- Methods for Estimating Emissions from Tank
- Quantification of Transient Methane Venting through Fixed Roof Liquid Storage Tanks
- Measurement of Associated Gas and Venting Volumes at CHOPS Sites in Alberta and Saskatchewan

Evaluation of Alternative Detection and Quantification Technologies, and assess their 'Equivalence' to prescribed OGI LDAR:

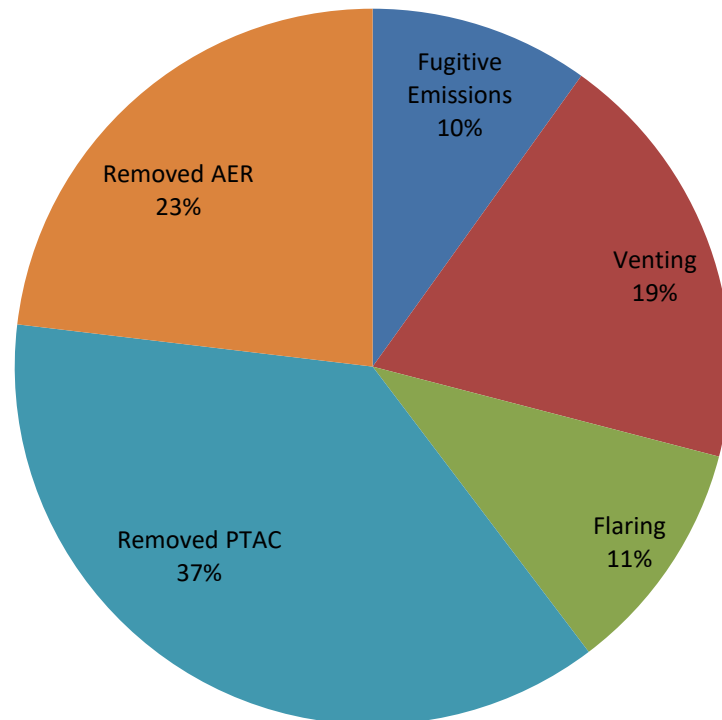
- Evaluation of Current & Emerging Emission Quantification

Evaluation of Surface Casing Vent Flows at Inactive Wells: Database Analysis and Field Measurements in Alberta

State of Science on Emission Rate Thresholds for Upstream Petroleum Industry Leaks Corresponding to a Range of ppm Concentration Thresholds.

Methane Mitigation Technologies Developed through PTAC

PTAC Developed Case In Technology Abatement,
%age Contribution



Source: NATIONAL INVENTORY REPORT 1990 –2019: GREENHOUSE GAS SOURCES AND SINKS IN CANADA

- LCO Chemical Pump
- LCO Instrument Air
- PureJet Combustor
- Electric Dump Valve Actuator (EDVA)
- Calscan Electric Wellsite
- Trido Chemical Pump
- Multilateral Junction by Modern Wellbore
- 2 technologies through CanERIC

One example of many new PTAC technologies successfully delivering results.

REMVue Slipstream m

Current Benefits

- 130,000/year cars off road
- \$15 Million/year value creation

Full Industry Uptake

- 1.6 Million/year cars off the road
- \$160 Million/year value creation



Consortium of Methane Emission & Abatement Test Facilities



Locations of Field Facilities, Labs & Organizations

Alberta

Calgary & Rural Alberta
ATCO
CAPP
Cenovus Energy
CMC Research Institutes
CRIN
Encana
Inter Pipeline
NAL Resources
Orphan Well Association
PTAC
SAIT
Seven Generations
TC Energy
TEREE
Total EP Canada
University of Calgary

Devon

CanMET Energy
Edmonton
ATCO
University of Alberta

Fort McMurray

Suncor
Cenovus Energy
Imperial Oil

Grand Prairie

Seven Generations

Rainier

CMC Research Institutes

Vegreville

InnoTech Alberta

British Columbia

Fort St. John
PETRONAS Canada

Northeast BC

CNRL
Encana
Husky
Imperial
Suncor
TC Energy

Northwest Territories

Norman Wells
Imperial Oil

Newfoundland and Labrador

St. John's
Husky Energy
Suncor

Nova Scotia

Antigonish
St. Francis Xavier University

Quebec

Montréal
TC Energy
Université de Montréal

Ontario

Ottawa
Carleton University

Rural Ontario

TC Energy

Waterloo

University of Waterloo

Manitoba

Rural Manitoba
CNRL
TC Energy

Saskatchewan

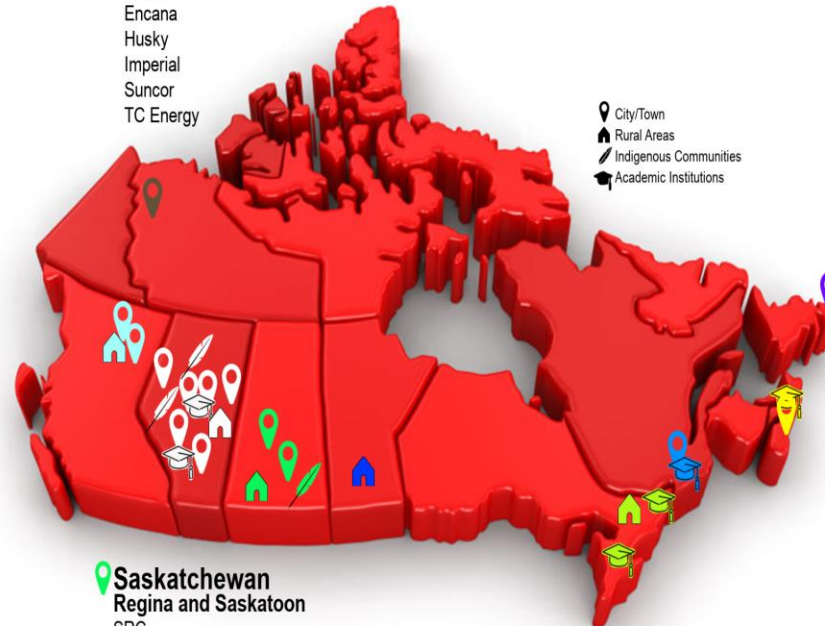
Regina and Saskatoon
SRC

Rural Saskatchewan

CNRL
Husky
Inter Pipeline
NAL Resources
TC Energy
Whitecap

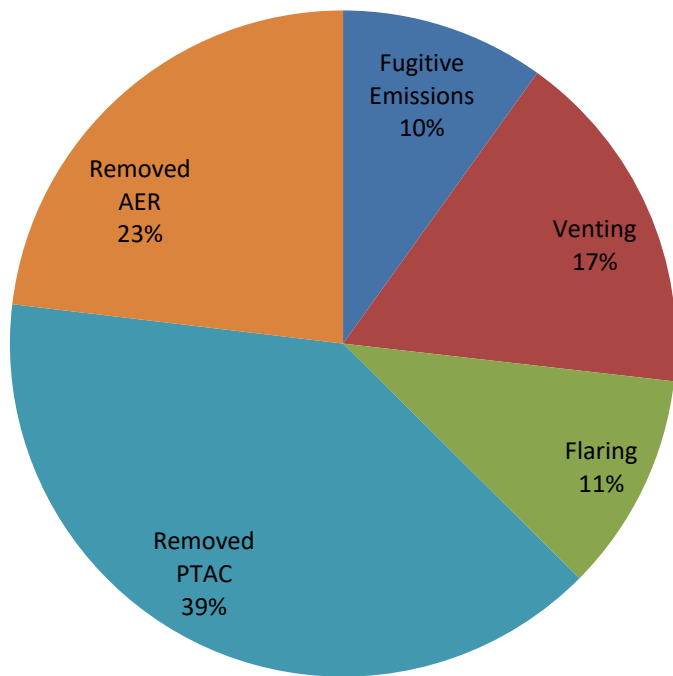
USA

Colorado State University
Harrisburg University
METEC
TC Energy
Total SA



Methane Mitigation Technologies Field Tested through PTAC

PTAC Field Tested Case In Technology Abatement, %age Contribution



Source: NATIONAL INVENTORY REPORT 1990 –2019: GREENHOUSE GAS SOURCES AND SINKS

- 8 technologies through CanERIC
- LCO Chemical Pump
- LCO Instrument Air
- PureJet Combustor
- Electric Dump Valve Actuator (EDVA)
- Calscan Electric Wellsite
- Trido Chemical Pump
- Trido Instrument Air
- Zero Emissions Wellsite – Demonstration of New Technology by Trido Industries for Eliminating Emissions at Remote Well Sites
- Blue Source low bleed chemical pump
- REMVue
- Analysis and Report of SlipStream® GTS-DeHy Auxiliary Burner System in Glycol Dehydration Units (2016)
- Gas Pro Vapour Recovery Unit Evaluation Study (2016-2017)
- Heavy Oil Emissions EcoFill

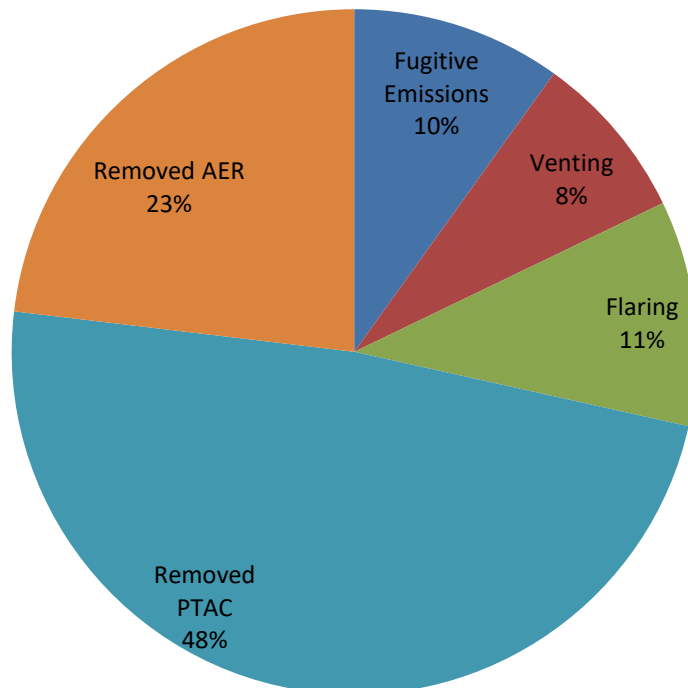
**Methane
Consortia
Program
Project
Suite
(2020/2021)**

Project Lead	Project	Total Mitigated CO2e	Number of Installations	Total GHG Reductions (tonne CO2e)*	Potential for installation
		(tCO2e)			
CalScan	Site Electrification	1216	10	18240	5000
Cenovus	Facility of the Future including : electric instruments & pumps, instrument air, and remote on-site power generation.	8658	1	8658	
Ember	Compressor Engines	2080	1	20800	500
Spartan	Instrument Air Compressor	635	12	5078	5000
Spartan LCO	Smart Pumps	2738.6	26	21902	10000
BlueSource	Pumps Optimization	674	37	6738	5000
NAL	STD Electric	817	14	8169	10000
Total		16819	101	89586	

Methane Mitigation Technologies/ Projects Deployed/Demonstrated through

PTAC

PTAC Deployed/Demonstrated Case In
Technology Abatement, %age Contribution



Source: NATIONAL INVENTORY REPORT 1990 –2019: GREENHOUSE GAS SOURCES AND SINKS IN C

- LCO Chemical Pump
- LCO Instrument Air
- Trido Chemical Pump
- Trido Instrument Air
- Air Teck Systems
- Ironline
- Texsteam Chemical Pump
- MCI Chemical Pumps
- Sirius Chemical Pump
- Eagle Power Supply
- Clear Rush Combustor
- The REMVue® AFR and SlipStream® Technology – By Spartan Controls
- The LP Vapour Combustor – By Black Gold Rush Industries Ltd
- Zero Emissions Wellsite by Cenovus
- Zero Emissions Wellsite – BP Canada Validation of Sun Pumper versus Tex Steam Units
- Field Evaluation of the REMVue Low Horsepower (LHP) Technology

Canadian Capabilities

Products	Description
Combustion	99.9% efficient at converting methane
Compress Methane	Compress methane back into sales
Instrument Air	Compress air to deliver power to pneumatics
Chemical Pumps	Electrically powered pumps
Electric Devices	Replace pneumatically operated devices
Electricity Generation	Create electricity by burning

Services	Description
Detection, Measurement, Quantification, Monitoring	Supply services to detect and monitor emissions
Research	Research labs to validate equipment for service
Reporting	Generating reports for companies and government
Management	Overall management from measurement and reporting, to strategic methods of optimizing money spent on this challenge
New	Typically engineering

Thank You!



**For more Information please contact Soheil Asgarpour at
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