# SPE Argentine Petroleum Section

# Measuring & Mitigating Methane Emissions

Presented by Darcy Spady, Feb 13, 2023

CARBON CONNECT INTERNATIONAL

SPE International
Society of Petroleum Engineers

# PRESENTER

## DARCY SPADY, P.ENG

2018 SPE International President

Managing Partner, Carbon Connect International


@SPE2018Pres

@Darcy Spady

You are welcome to live tweet and use social media, however:

- thoughts & opinions are mine, not necessarily representing SPE
- be mindful of where comments could end up
- **please include me in the feed**

# WE HAVE A PROBLEM.....

THERE IS A PERCEPTION PROBLEM, THE WORLD THINKS WE ARE BAD GUYS!!!!

# WE ARE THE SOLUTION!!!

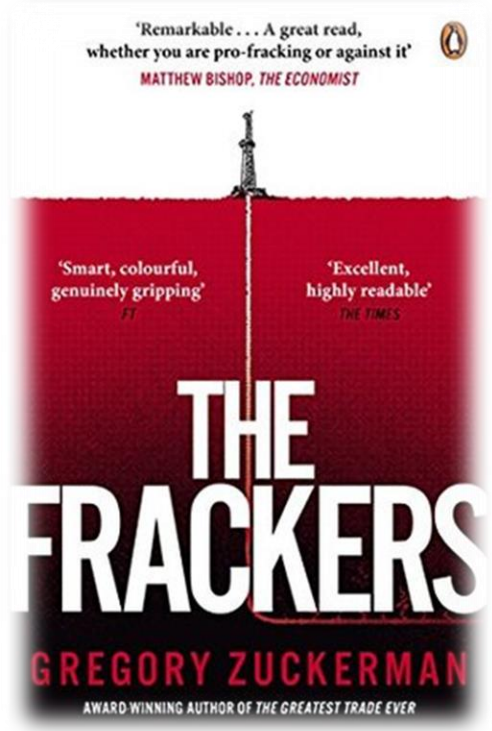
1. WE UNDERSTAND METHANE EMISSIONS AS SPE MEMBERS
2. ARGENTINA IS A KNOWN AND COMPETENT PRODUCER, AND CAN LEAD!!!

# OUTLINE

1. SPE – we are energy professionals
2. Emissions – why methane
3. Example from Alberta, Canada
4. Global targets and standards
5. SPE members – we can lead the way!

# SPE – We are Energy Professionals

# THE REALITY


'Remarkable . . . A great read, whether you are pro-fracking or against it'
MATTHEW BISHOP, THE ECONOMIST
'Smart, colourful, genuinely gripping'
FT
'Excellent, highly readable'
THE TIMES
THE FRACKERS
GREGORY ZUCKERMAN
AWARD-WINNING AUTHOR OF THE GREATEST TRADE EVER


CONFERENCE CHAIRED BY


РОСНЕФТЬ
НА БЛАГО РОССИИ

# GLOBAL LEADERSHIP

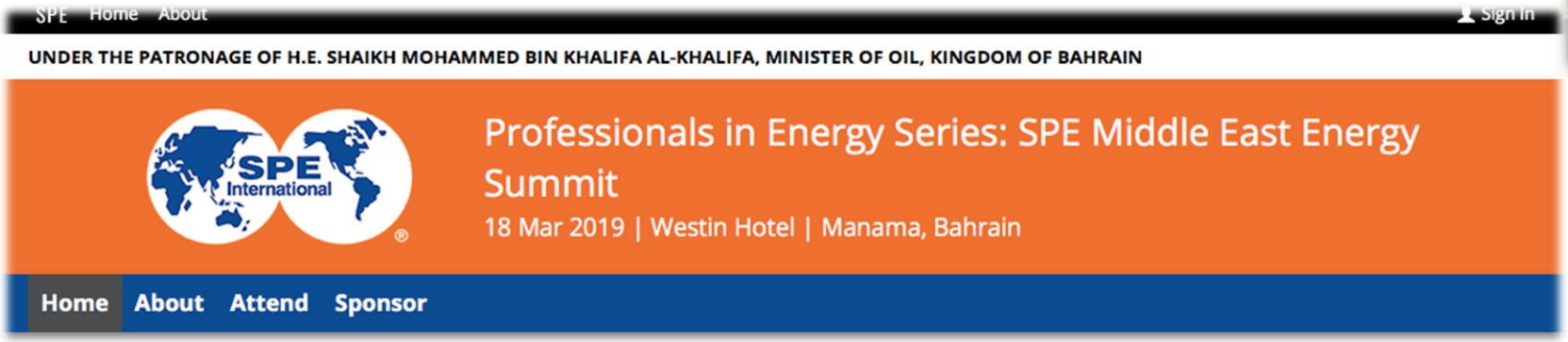
Society of Petroleum Engineers (SPE)

OR

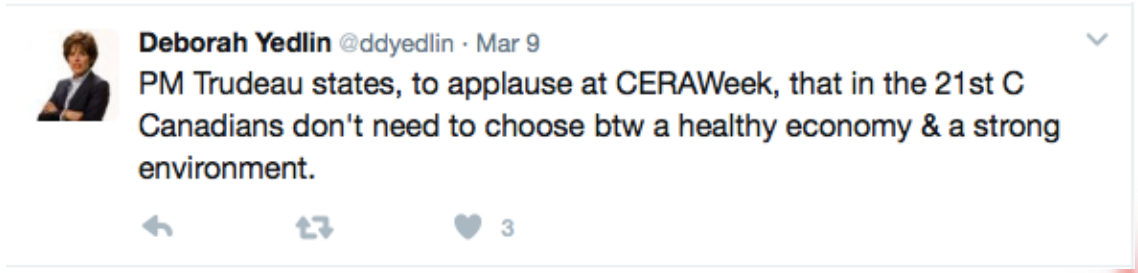
Society of Professionals in Energy (SPE)

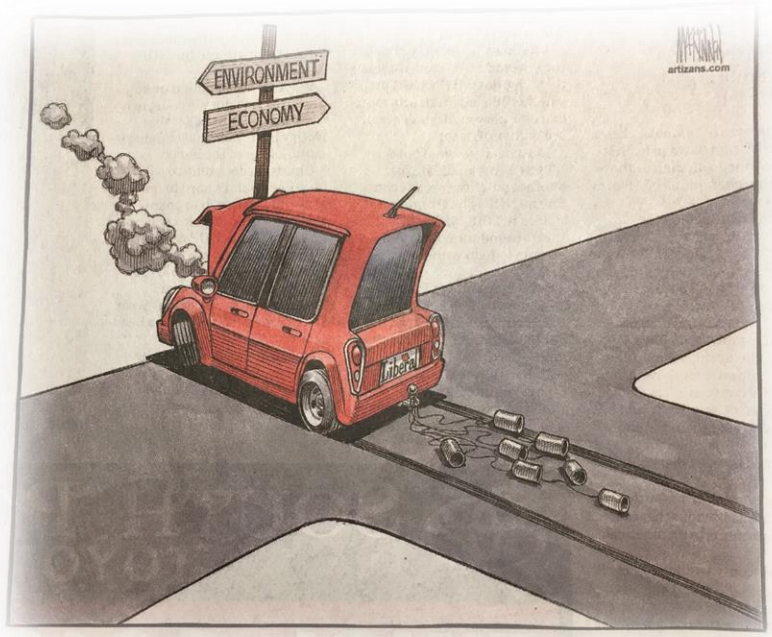
OR

Both!

# ECONOMY & ENVIRONMENT




From the Calgary Herald

# LET'S DO, NOT JUST TALK ABOUT IT!!

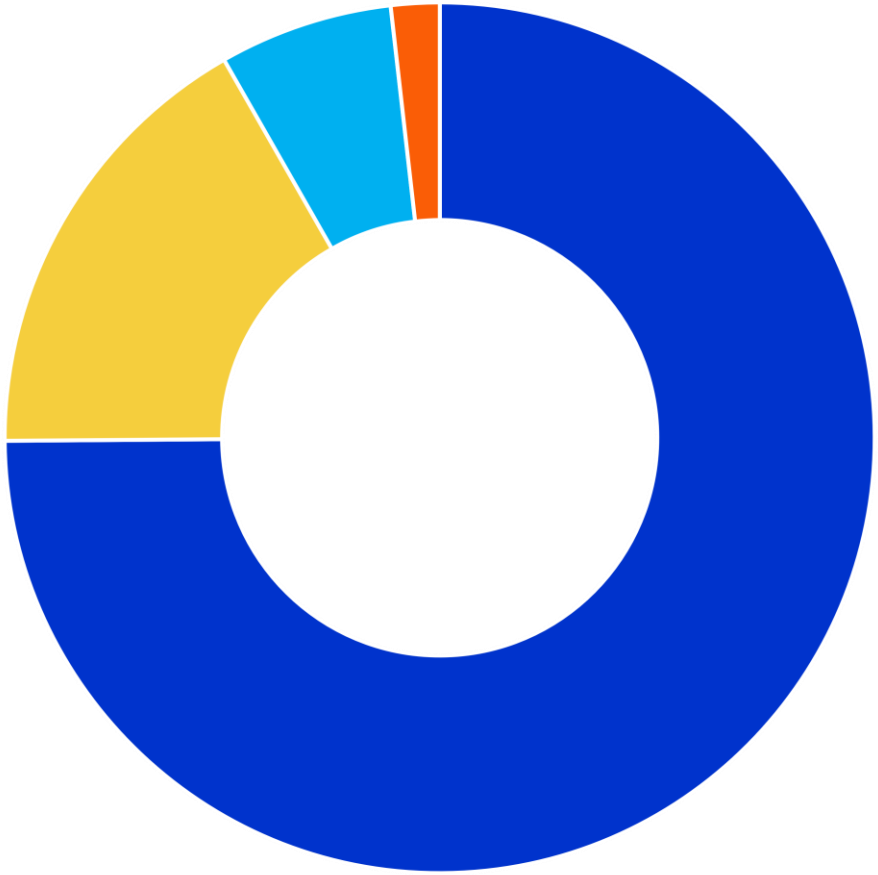
- INSTALLATION WAS BY US
- WE CAN BE THE SOLUTION
- PERCEPTION CAN CHANGE

# Emissions – Why Methane?

Or what is all the fuss about?

# GLOBAL GREENHOUSE GAS EMISSIONS BY GAS

PIK data is up to 2017, and it was updated in Mar 2020.
Note: PIK **do not** include LULUCF
https://www.climatewatchdata.org/

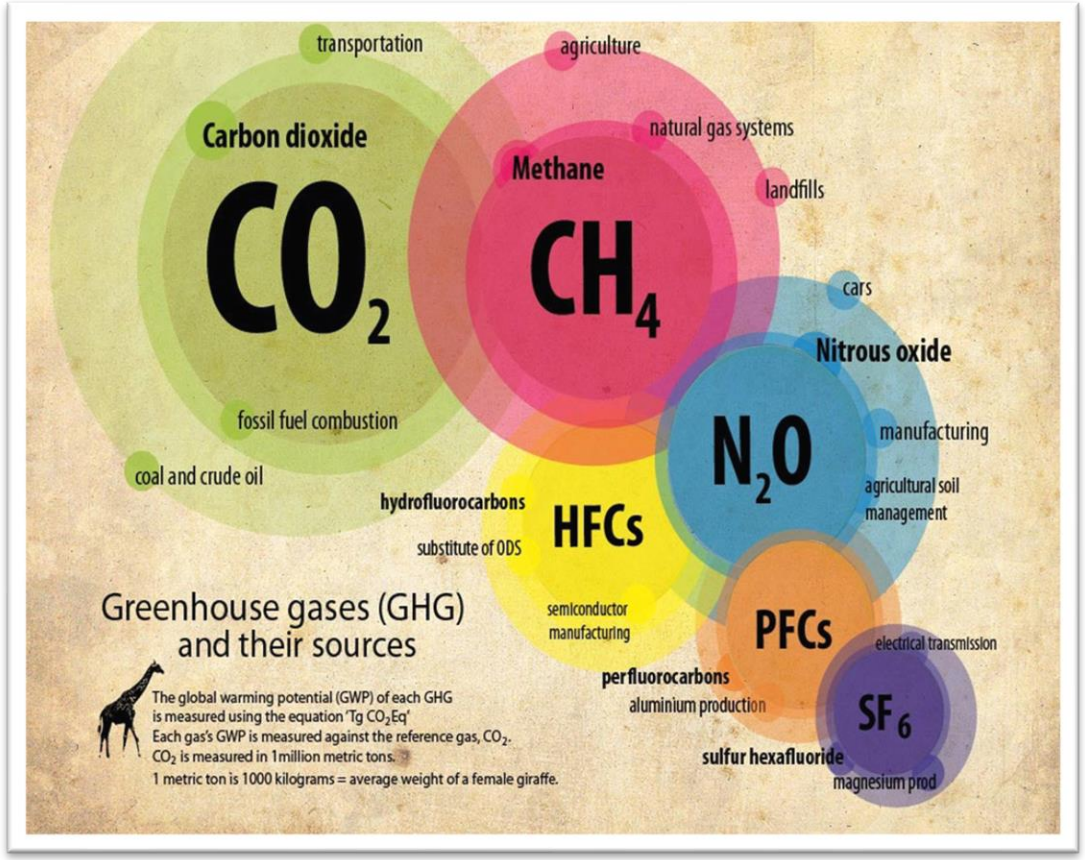


| 2017 | $CO_2e$ |
|---|---|
| CO2 | 36Gt |
| CH4 | 8.1Gt |
| N2O | 3.1Gt |
| F-Gas | 870Mt |

# GREENHOUSE GASES (GHGS) AND GLOBAL WARMING POTENTIAL

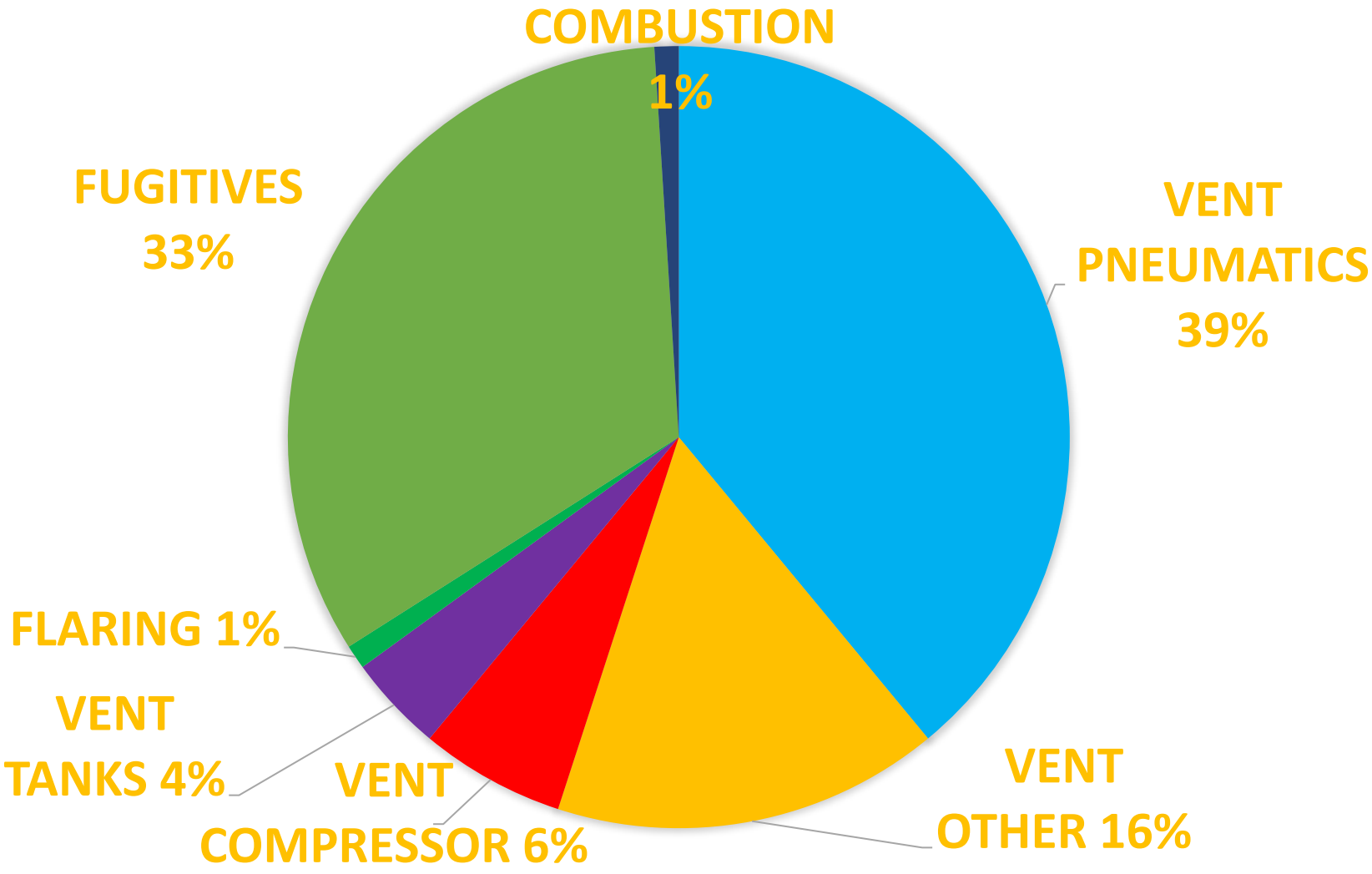
A **greenhouse gas (GHG)** is a gas that absorbs and emits radiant energy within the thermal infrared range. Greenhouse gases cause the greenhouse effect on planet, hence results in global warming or the climate to change.

**Global Warming Potential (GWP)** is a measure of how much heat a greenhouse gas traps in the atmosphere up to a specific time horizon, relative to carbon dioxide. **Methane GWP** over a 100 years time horizon is 25.




Source: Green Growing, November 2016

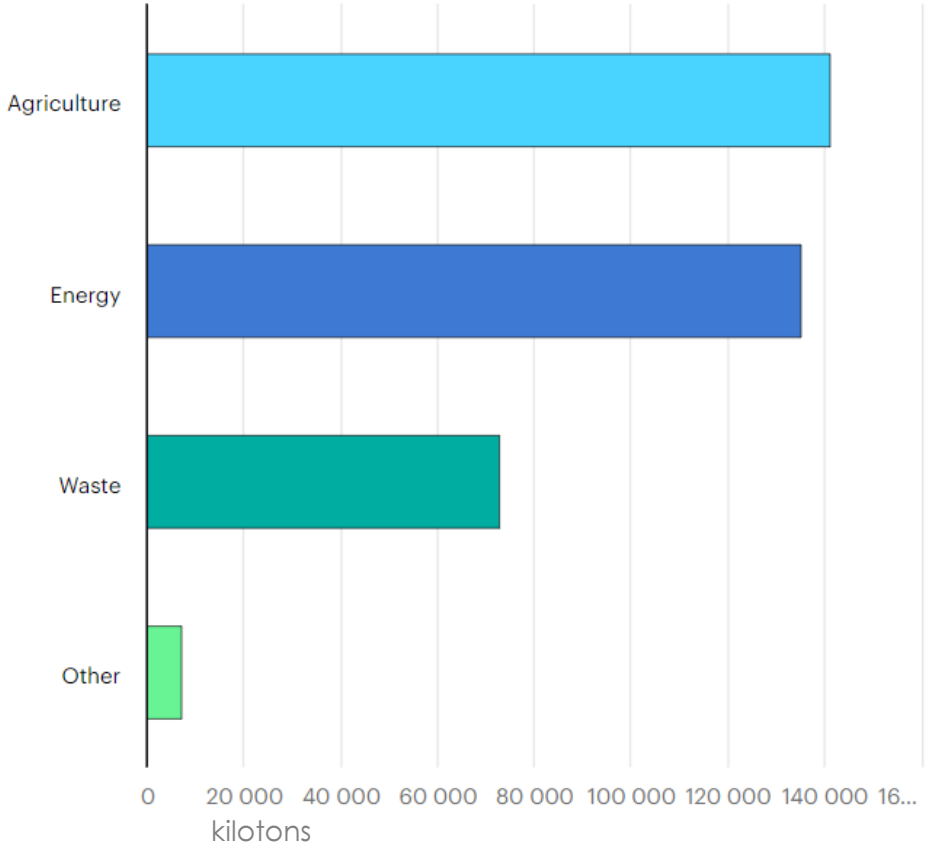
# SOURCES OF METHANE EMISSIONS IN O&G



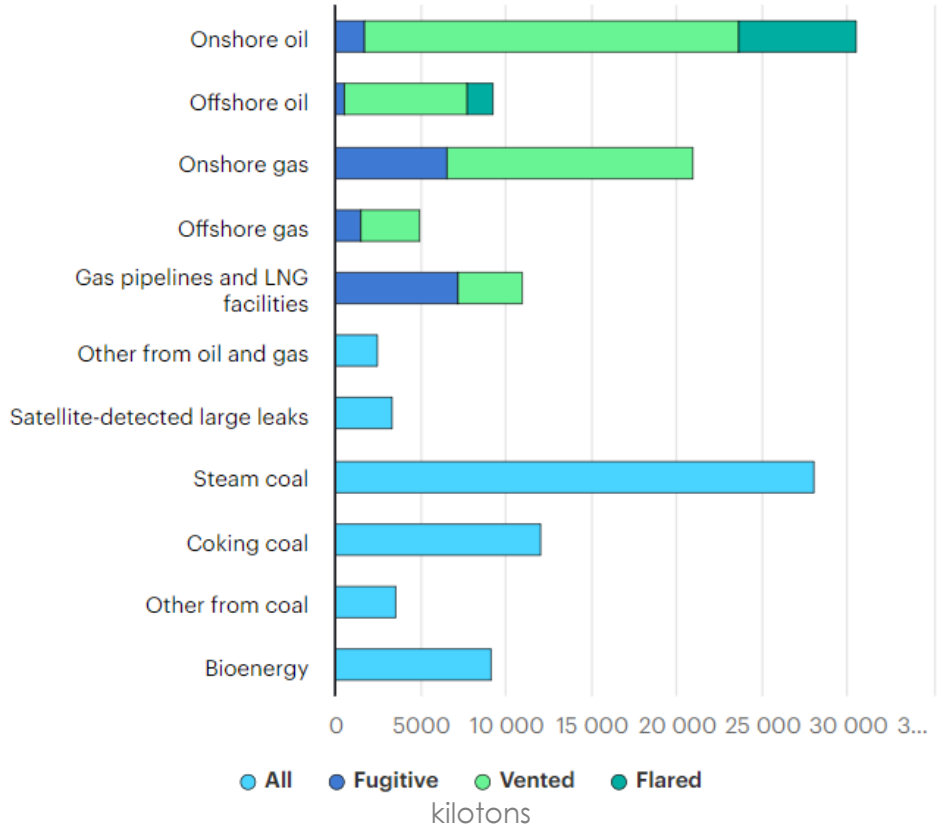

https://static.aer.ca/prd/documents/ab-uog-emissions-inventory-methodology.pdf

# GLOBAL METHANE EMISSIONS

## All Sources



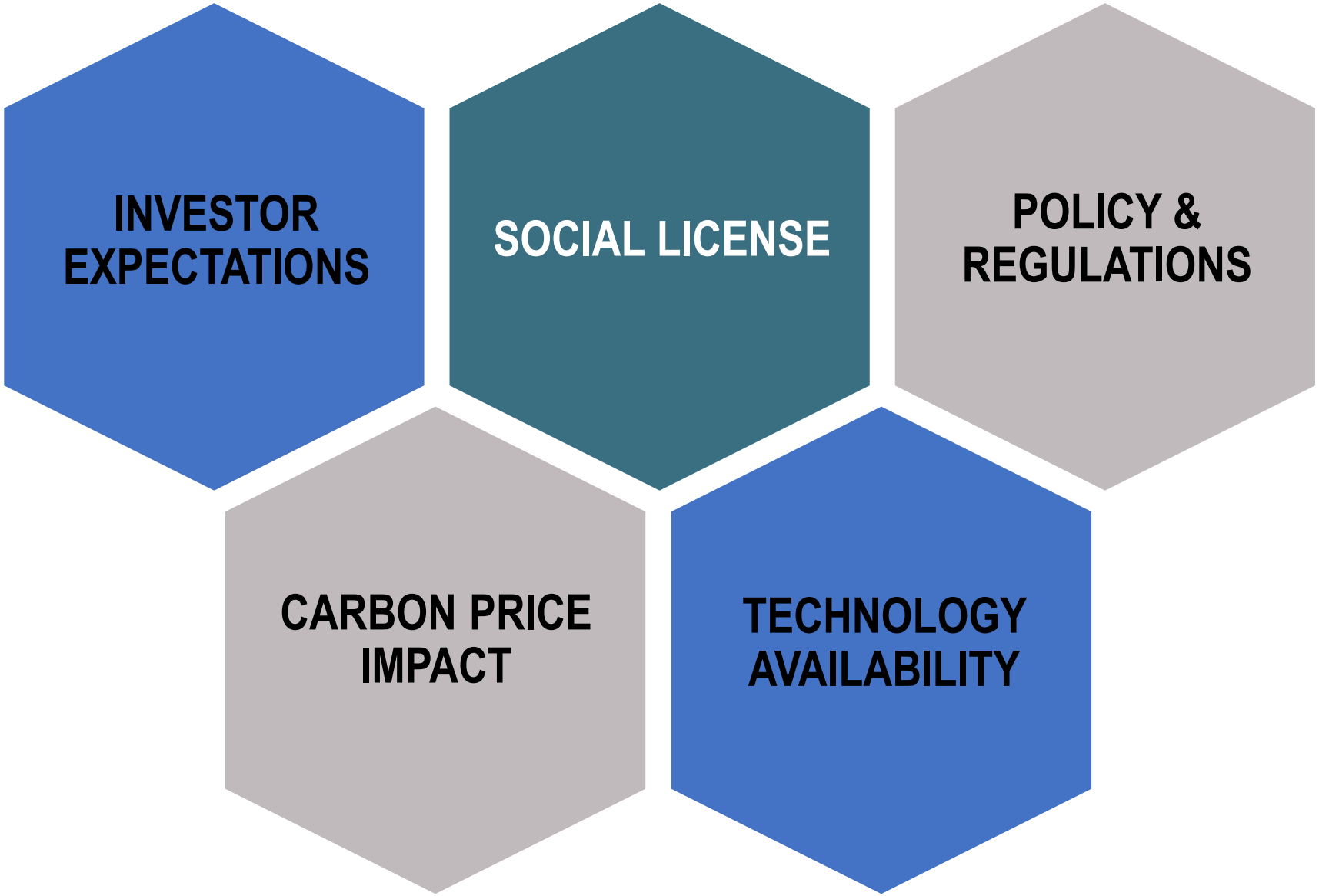

## From Energy






Source: IEA, Methane Tracker Data Explorer, Feb 23, 2022

# CONVERGING FACTORS INFLUENCING METHANE REDUCTION ACTIVITIES



# EMISSIONS SCOPE

## SCOPE 1

Direct emissions from operations

## SCOPE 2

Indirect emissions from purchased energy

## SCOPE 3

All other emissions associated with a company's activities

Source: Sustain.Life

# WHAT IS INCLUDED IN EACH SOURCE


**Indirect emissions from purchased energy**

- Purchased electricity
- Purchased heating / cooling
- Purchased steam

**All other emissions associated with a company's suppliers**

- Purchased good and services
- Capital goods
- Employee commuting
- Business travel
- Leased assets

**Direct emissions from operations**

- Company vehicles and equipment
- Company facilities
- Fugitive emissions

**All other emissions associated with a company's consumers**

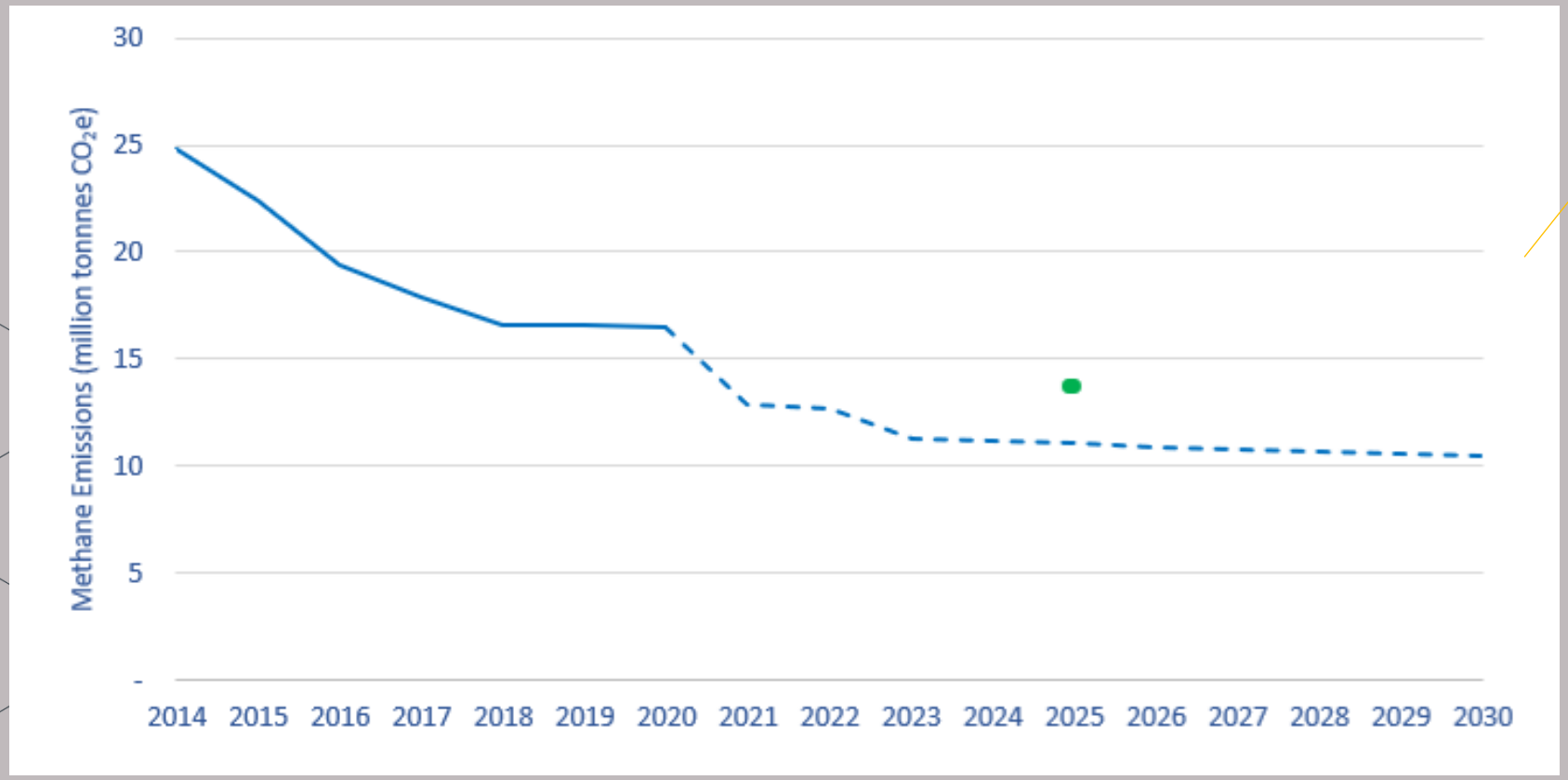
- Transportation and distribution
- Processing of goods sold
- Use of sold products
- End-of-life treatment of sold products
- Franchises

Source: US EPA

# Example from Alberta, Canada

Or, it's been done before!!

# CCI PROGRAMS ARE PART OF ALBERTA'S STRATEGIC FOCUS ON METHANE REDUCTIONS




Represents a 45% reduction (2025 vs 2014)

# OUR FOCUS

- Company formed in 2019
  - Member of Methane Emission Leadership Alliance (MELA)
  - Major contract with Alberta Environment and Protected Areas (AEPA)
- Emissions baseline program (BROA) – 20,000+ sites
- Technology implementation program (MTIP) – 100+ projects
- Methane focused oil & gas experts

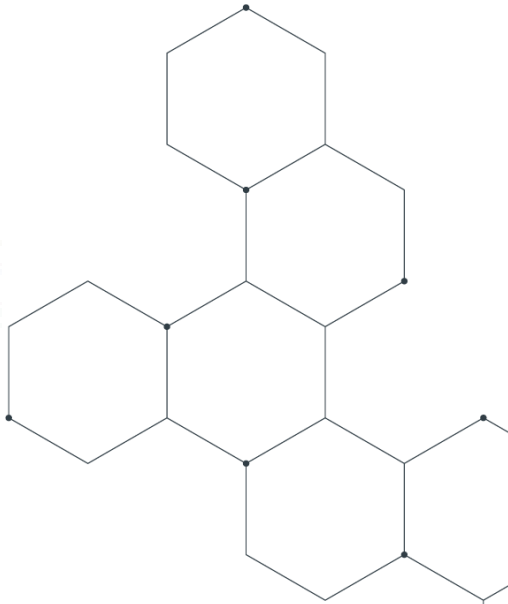
Alberta

mela

AIMING FOR ZERO
Methane Emissions Initiative

SPE International

APEGA



# CARBON CONNECT BACKGROUND

**Local**

## *Management of Carbon Tax (TIER) funded programs*

- ✓ Program Design and Management

  Completely sold out

- ✓ Start Date: February 2020

- ❑ Actively developing business in Middle East, Latin America and Europe

**Local & Global**

## *Education in Methane Reduction Space*

- ✓ Methane Emission Measurement & Mitigation courses delivered through Society of Petroleum Engineers (SPE) Globally: Canada, USA, Indonesia, Colombia, Croatia
- ✓ Energy Transition Courses delivered via NExT, a division of SLB (Schlumberger): Japan, Russia, USA, Ecuador, UAE, France, UK
- ✓ Various methane mitigation courses delivered to Global Affairs Canada (Trade Commissioner Service)

# CCI ALBERTA AEPA PROGRAMS
## (100% SOLD OUT W. WAITING LIST)

### BROA

***Baseline and Reduction Opportunity Assessment Program***

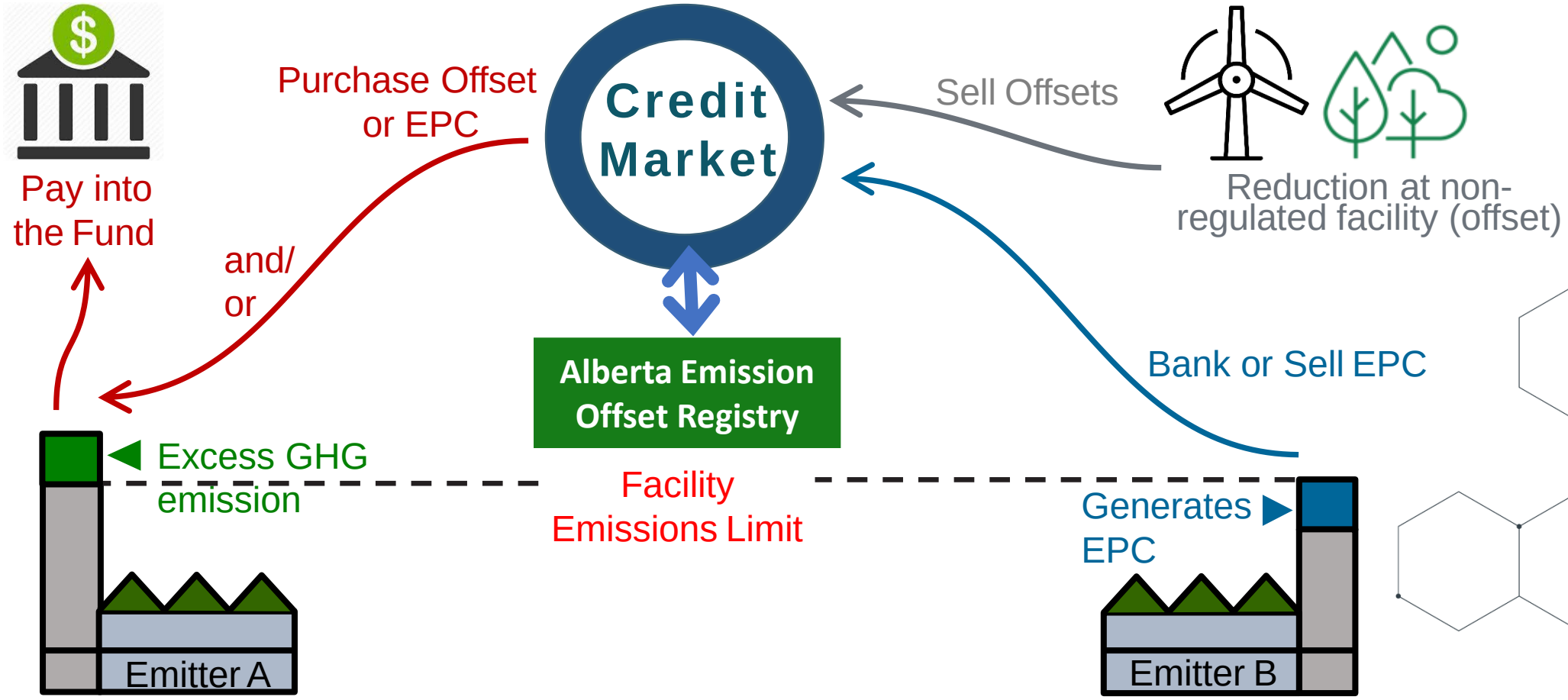
- ❑ Inventory of all facility equipment
- ❑ Quantify methane emission sources, vents, and leaks
- ❑ Demonstrate economic value of emission reductions
- ❑ Identify next steps to support project implementation

### MTIP

***Methane Technology Implementation Program***

- ❑ Implementation of commercially available methane reduction technology to meet or exceed provincial reduction targets
- ❑ Reduce operating cost and future cost of compliance
- ❑ Accelerate export capacity and support the growth of Canada's technology sector

# ALBERTA'S CARBON PRICING SYSTEM




**EPC – Emission Performance Credit*

# DE–CARBONIZATION

**METHANE REDUCTION**
Very Economic

**CCUS/CCS**
Subsidized

**HYDROGEN**
Subsidized

- Three Key solutions to De–Carbonization and the Energy Transition

# COSTS OF DE-CARBONIZATION

**METHANE REDUCTION**

US $53 million

(53,000,000)

=

17.4 MTCO2E

**CCUS/CCS**

US $1.3 billion

(1,300,000,000)

=

20 MTCO2E

**HYDROGEN**

? $

=

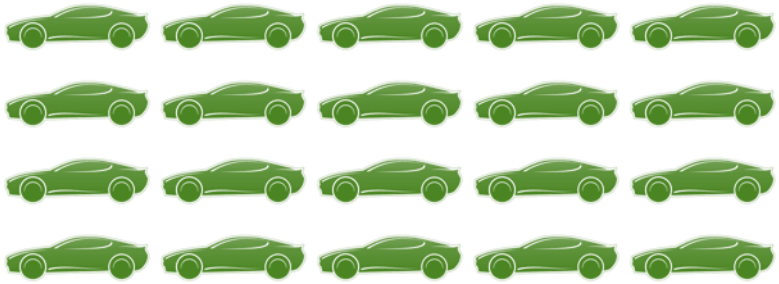
??

- Total cost estimates assume a 20 year life
- Examples used for methane reduction are Alberta BROA & MTIP, and Quest CCUS (Alberta)

# METHANE'S ROLE IN ACCELERATING DECARBONIZATION

= 10,000 / year
= 1 year
$ = $50 million

## Carbon Connect Methane Reduction Projects



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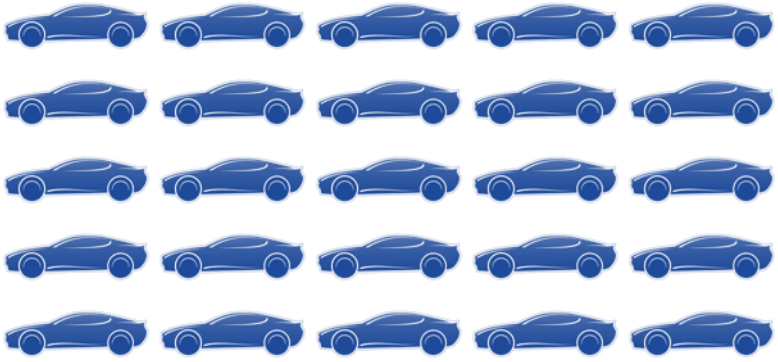
## Carbon Capture, Utilization and Storage



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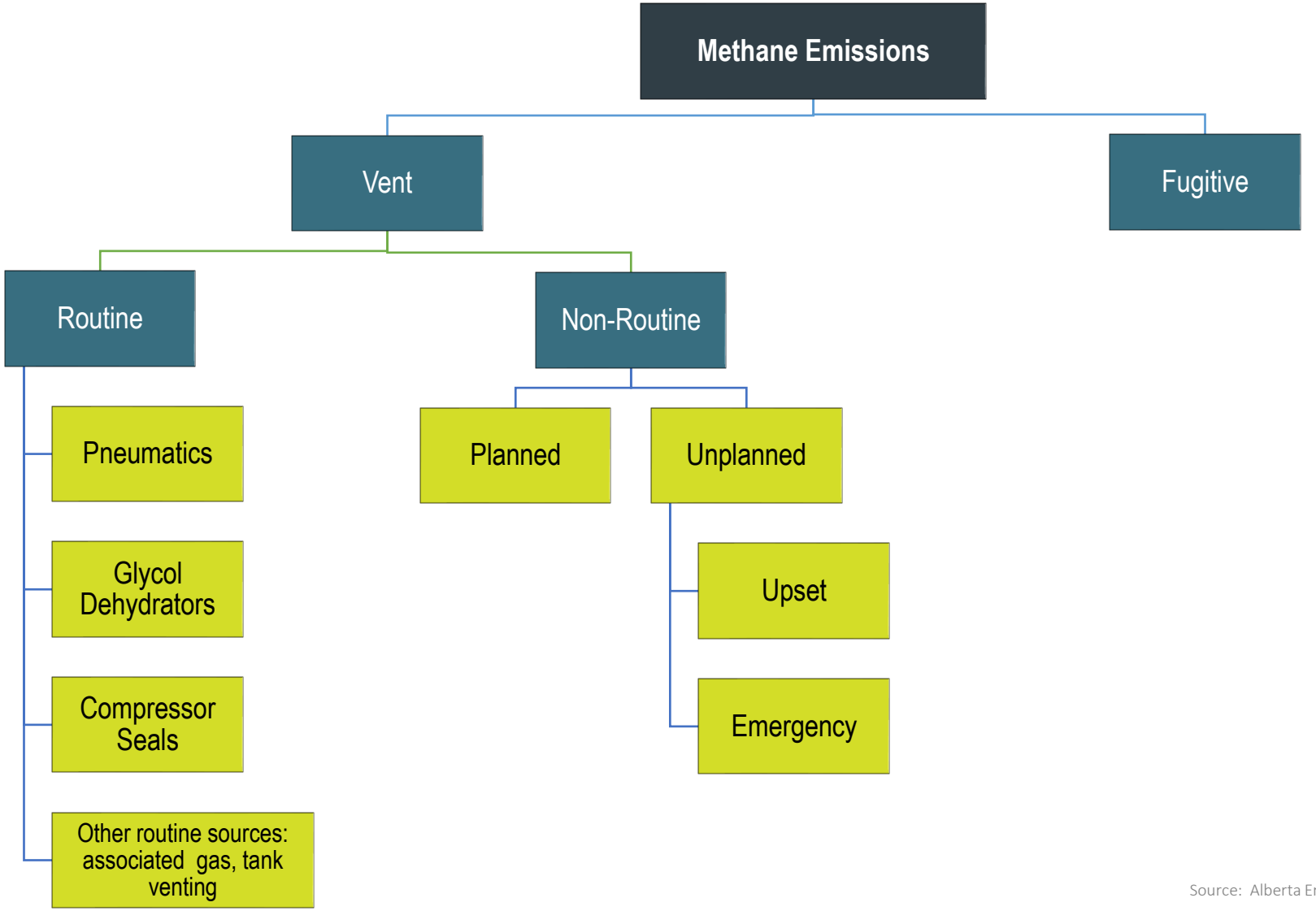
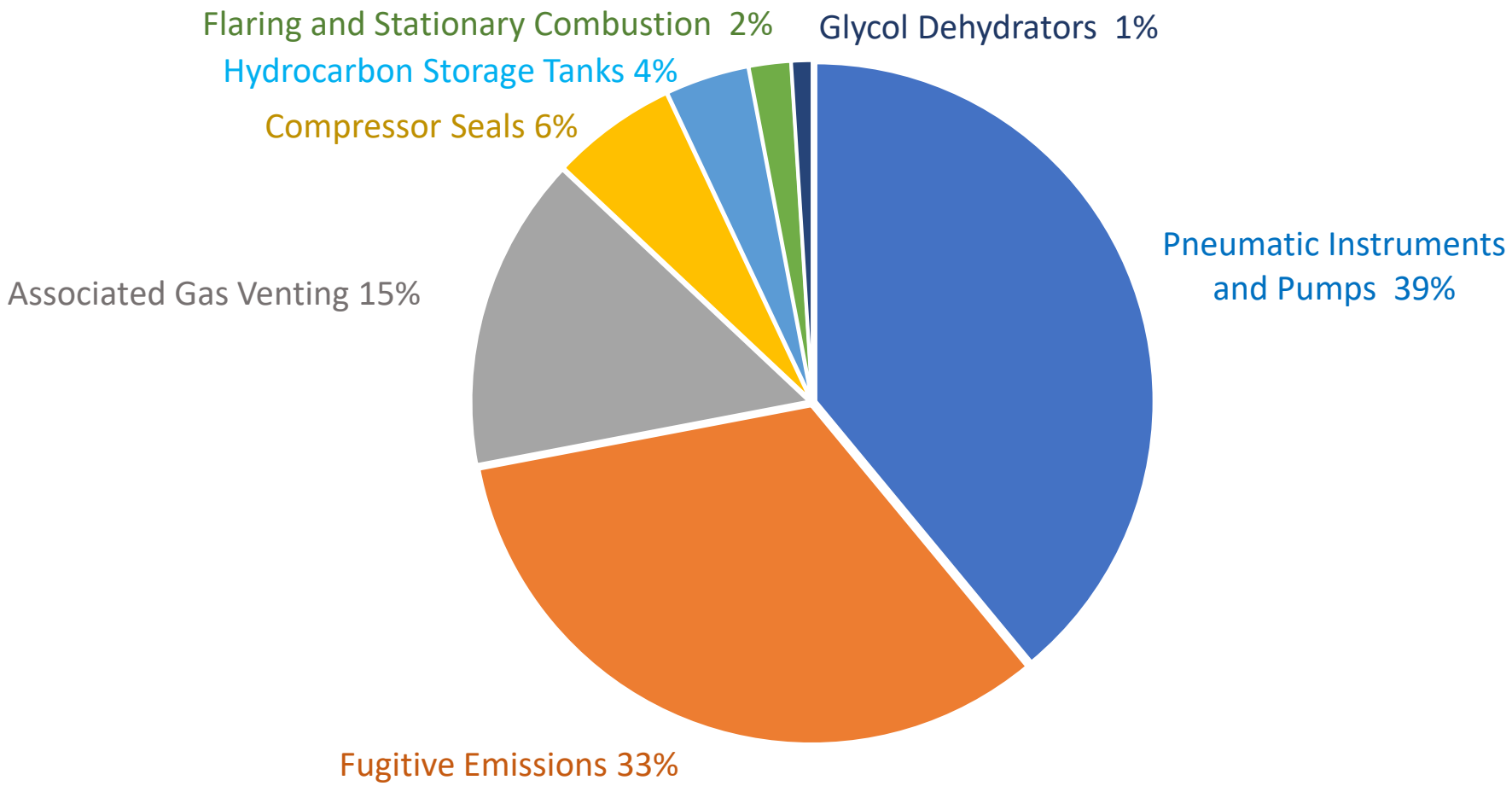
# CATEGORIZING METHANE EMISSIONS




Source: Alberta Energy Regulator, Directive 060

# MAJOR METHANE EMISSIONS SOURCES IN UPSTREAM OIL AND GAS (ALBERTA)




Source: https://www.aer.ca/documents/ab-uog-emissions-inventory-methodology.pdf

# CCI ALBERTA PROGRAMS

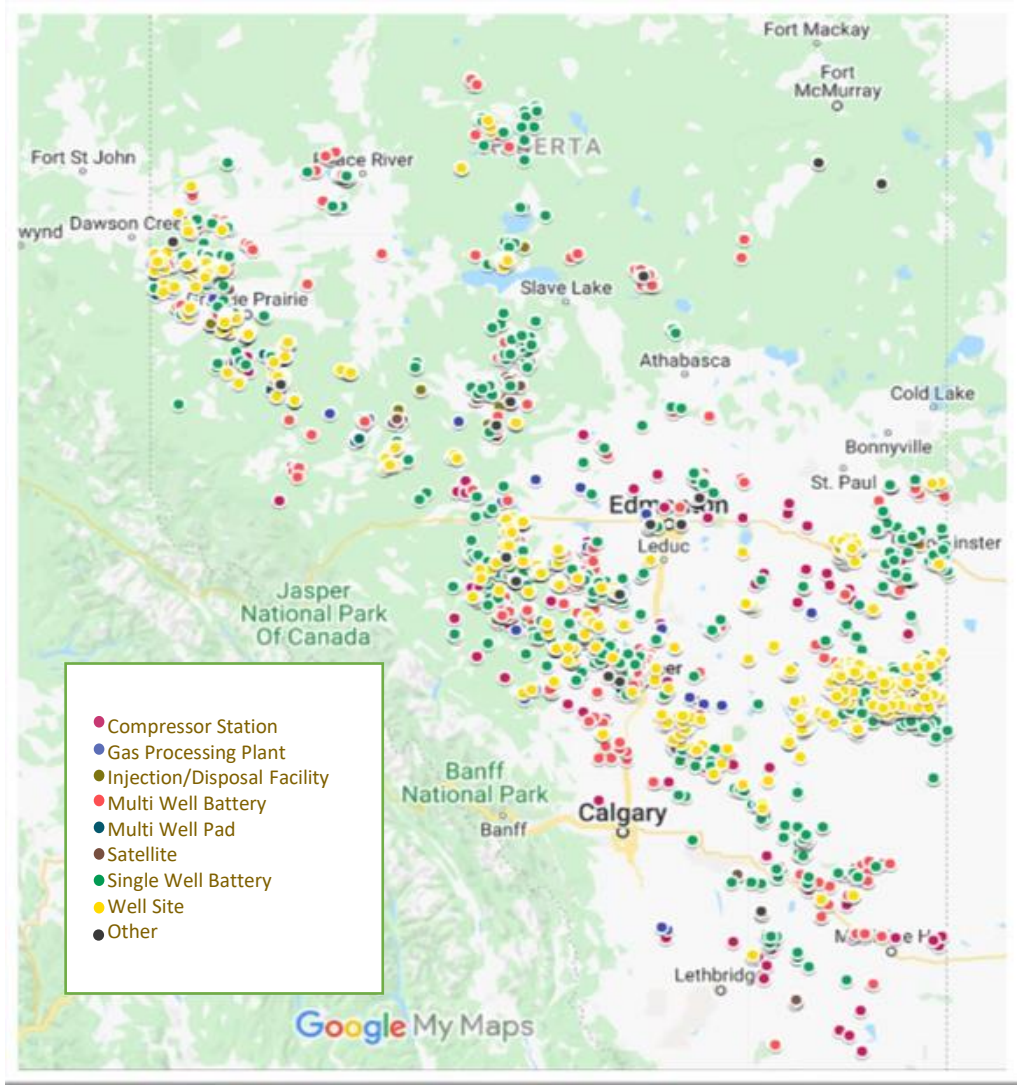
**$C40M**
Total government investment for incentives

**20,000**
Facility level emissions measurement and inventory surveys

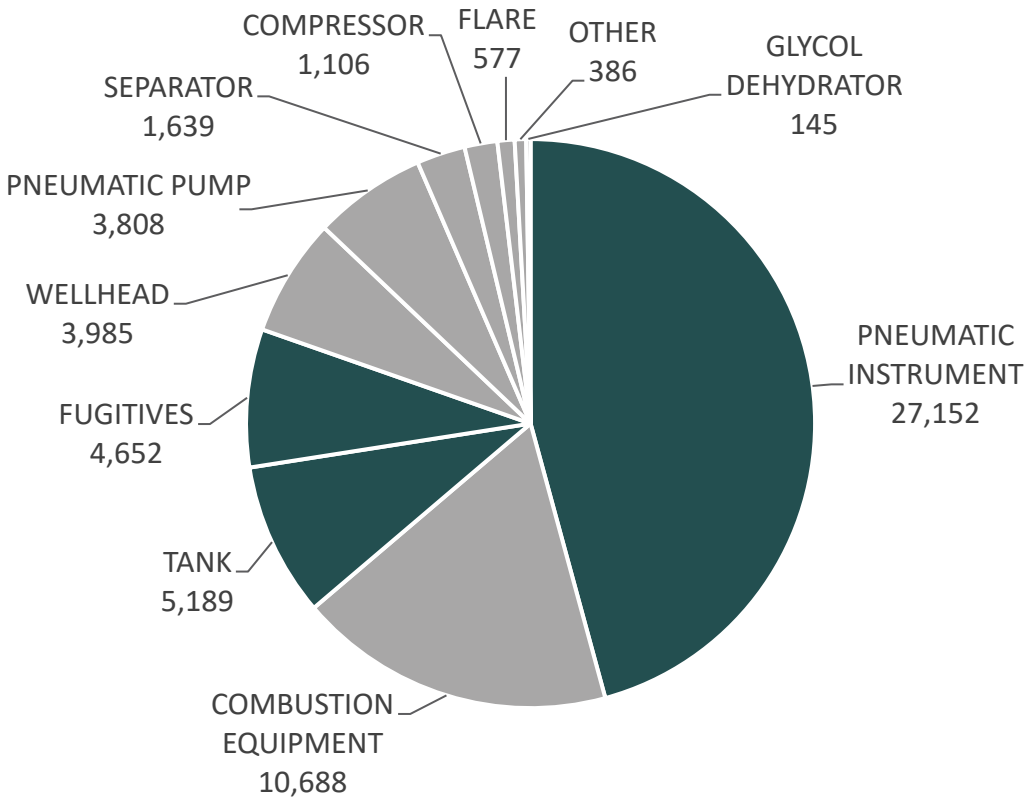
**17 MTCO2E**
Lifetime methane reduction

- Baseline quantification program (BROA) managed $C15 million funding to industry
- Methane reduction technology implementation (MTIP) managed $C25 million funding to industry
- After 1.5 years in market, our Alberta programs closed September 30, 2022 and were SOLD OUT!

# EMISSIONS QUANTIFICATION SURVEYS




## Source Count by Category




Alberta ~ 662,000km$^2$

# TYPES OF TECHNOLOGY IMPLEMENTED IN ALBERTA, CANADA (MTIP)

**Pneumatic Devices**

1a - Pneumatic Devices Electrification (including instruments, actuators, VFDs, motors, chemical injection pumps)

1b - High Bleed Pneumatic Instruments Conversion to Low Bleed Pneumatic Instruments

1c - Instrument Gas to Instrument Air Conversion

1d - Vent Gas Capture from Pneumatic Devices

**Hydrocarbon Storage Tanks**

2a - Hydrocarbon Storage Tank Vapour Destruction in Clean Combustor

2b - Hydrocarbon Storage Tank Vapour Recovery Unit

**Compressors**

3a - Compressor Vent Gas Utilization and Destruction

3b - Compressor Vent Gas Conservation

**Other & Non Routine**

4a - Vent Gas Reduction from Desanders

4b - Surface Casing Vent Gas Flow and Gas Migration

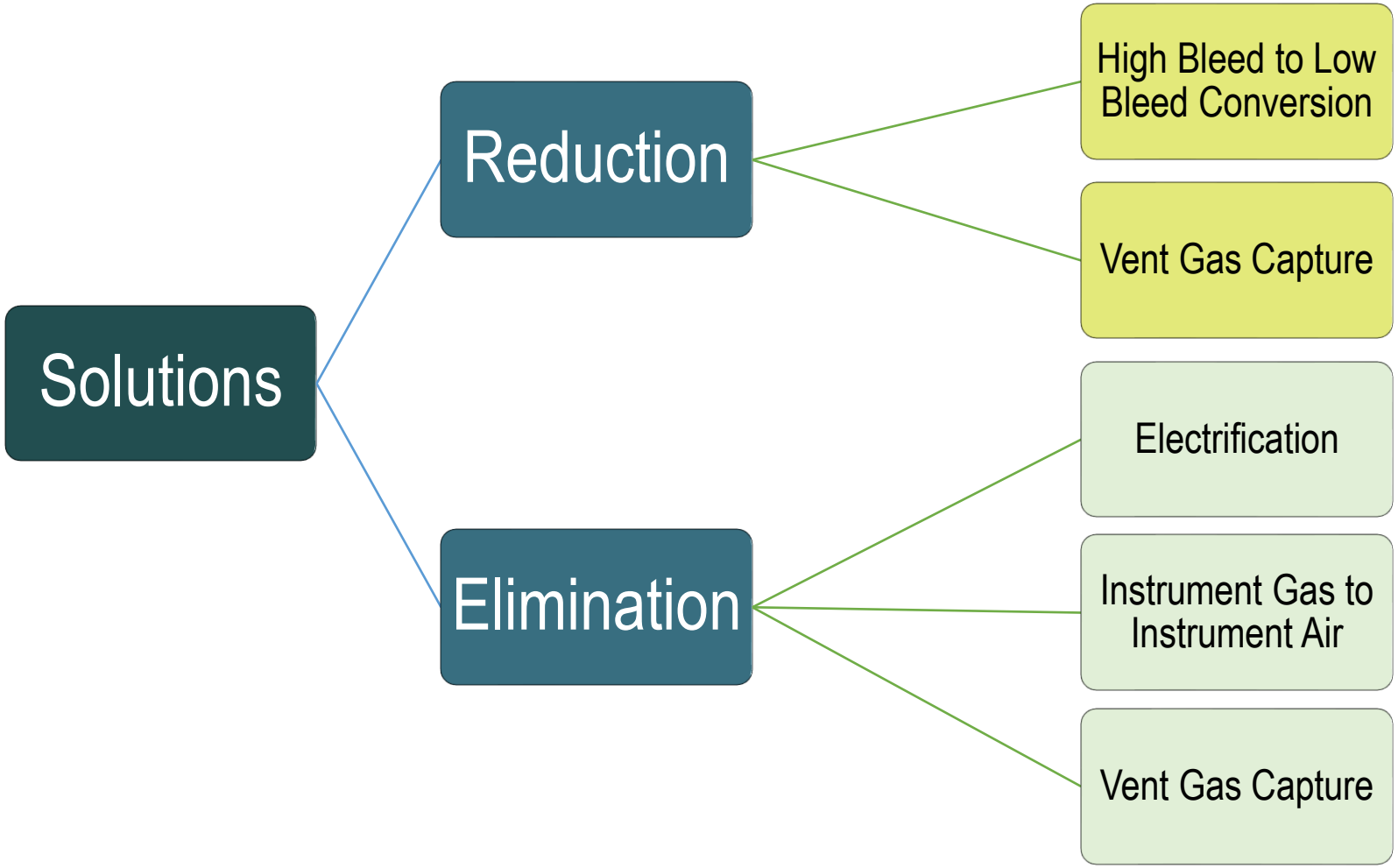
**Casing Gas**

5a - Casing Gas Capture and Destruction in a Clean Combustor

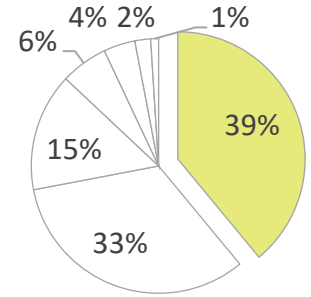
5b - Casing Gas Conservation

5c - Casing Gas Capture with Separation Process and Destruction

# MITIGATION SOLUTIONS FOR PNEUMATIC INSTRUMENTS AND PUMPS



# PNEUMATIC INSTRUMENTS AND PUMPS




**Pneumatic Instrument**
Pneumatic device that uses pressurized gas to maintain a process condition such as liquid level, pressure or temperature




**Pneumatic Pump**
Pneumatic device that uses pressurized gas to move a piston or diaphragm, which pumps liquids to the opposite side of the piston or diaphragm

# PNEUMATICS VERSUS PASSENGER VEHICLES

| Pneumatic Device | Vent Rate ($m^3$ gas/hr) | Annual GHG Emissions (Tonne $CO_2e$/Year) |
|---|---|---|
| Level Controller | 0.35 | 41.76 |
| Positioner | 0.26 | 31.27 |
| Pressure Controller | 0.32 | 38.29 |
| Transducer | 0.23 | 27.79 |
| Generic Diaphragm Pump | 1.05 | 125.49 |
| Generic Piston Pump | 0.59 | 70.43 |

***Assumptions:*
*80% $CH_4$ in gas*
*1% $CO_2$ in gas*
*24/7 operating hours*


https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references

# CASE STUDY: INSTRUMENT GAS TO INSTRUMENT AIR CONVERSION

https://www.appliedcompression.com/product/instrument-air-compressor-packages/

**130 tCO2e/year**
Annual GHG Reduction

**$30k USD**
Project cost

**10 Years**
Effective Useful Lifetime

**$23.08**
Lifetime Abatement Cost per tCO2e

GHG equivalent of **removing 28 cars** off the road

# IMPLEMENTATION OF THE ALBERTA PROGRAMS

| Design | | | Verification | | | |
|---|---|---|---|---|---|---|
| Planned and designed the program flow for inventories, leak detection program, specific measurement collection and reduction project implementation | Created a **standardized inventory template** based on stakeholder feedback | Created **GHG emission quantification protocols** for baseline and project emission estimation for 13 project types aligned with the Alberta Emission Offset Protocols | Certified 20+ field services providers | Reviewed over 100 emission reduction project plans and results | Verified over 7,500 (of about 20,000) facility inventories (and leak detection) | Team experienced in GHG emissions program management and emissions quantification |

# EMISSIONS QUANTIFICATION APPROACHES

## ESTIMATION

- Based on expert opinion, best guess, high-level calculations

## CALCULATION

- Derived directly from physical data of the assets
  - e.g. in the case of venting, the emission could be derived from the volume of the pipe section and the pressure in that section
- Based on emission factors taken from academic publications, gas industry R&D research, or equipment supplier data

## MODELLING

- Based on a combination of physical data of the assets and (semi-) empirical physical correlation
  - e.g. in case of pipe rupture, the emission could be derived from physical data combined with flow resistance factors or even more sophisticated numerical fluid dynamic calculations

## MEASUREMENT (not including continuous monitoring)

- Based on (in-)direct measurement of emissions
  - e.g. flowrate, concentration measurement, correlation techniques
- Based on emissions factors derived from field measurements
  - e.g. measurements for an estimate of a population samples of pneumatic controllers

*Source: OMGP Implementation Guide*

# METHANE EMISSIONS FOCUS AREAS

**LEAK DETECTION**

Identify fugitive leaks and vents using optical gas imaging cameras and other emerging sensor technologies.

**PNEUMATIC DEVICES**

Level controllers, pressure controllers, transducers, and chemical injection pumps.

**CASING / ANNULUS VENTS**

Fugitive gas in the annular spaces surrounding the casings that builds up and is vented to atmosphere.

**COMPRESSOR VENTS**

Vent gas capture back to sales or used for on-site fuel or sent to flare. Vent measurements important.

**TANK VENTS**

Difficult to measure & capture but a large known source particularly at oil facilities.

**DATA MANAGEMENT**

Internal data management systems generate accurate inventories & baseline quantification.

# BIGGEST CHALLENGES IN METHANE RIGHT NOW

Methane slip from engines

Unlit or inefficient flares

Underestimated and poorly understood tanks

# FUNDING

## Carbon Levy / Carbon Tax

- Legislation and policy to match
- Transparency

## External Funding

- IFIs (International Financial Institutions) such as IDB (Inter-American Development Bank)
- Other lenders
- Carbon Credits (COP26 Article 6)

# COST STRUCTURE

## De-Carbonization

- Canada is high priced, higher than US, partly due to climate, regs
- US is more cost effective, but has not delivered
- Argentina ? = great opportunity to deliver results

## Opportunity

- Argentina can be the GLOBAL LEADER!!
- Capacity Building for Argentina – Alberta can partner at the onset.

# Global Targets and Standards

It's already all laid out....

# GLASGOW COP26 - THE GLOBAL METHANE PLEDGE

"Participants joining the Pledge agree to take **voluntary actions** to contribute to a collective effort to reduce global methane emissions **at least 30 percent from 2020 levels by 2030**, which could eliminate over 0.2˚C warming by 2050.

This is a global, not a national reduction target. Participants also commit to moving towards using the **highest tier IPCC good practice inventory methodologies**, as well as working to continuously improve the **accuracy, transparency, consistency, comparability, and completeness** of national greenhouse gas inventory reporting under the UNFCCC and Paris Agreement, and to provide greater transparency in key sectors."

Global Methane Pledge

**112 Participants** | **Voluntary Actions**

Source: Global Methane Pledge

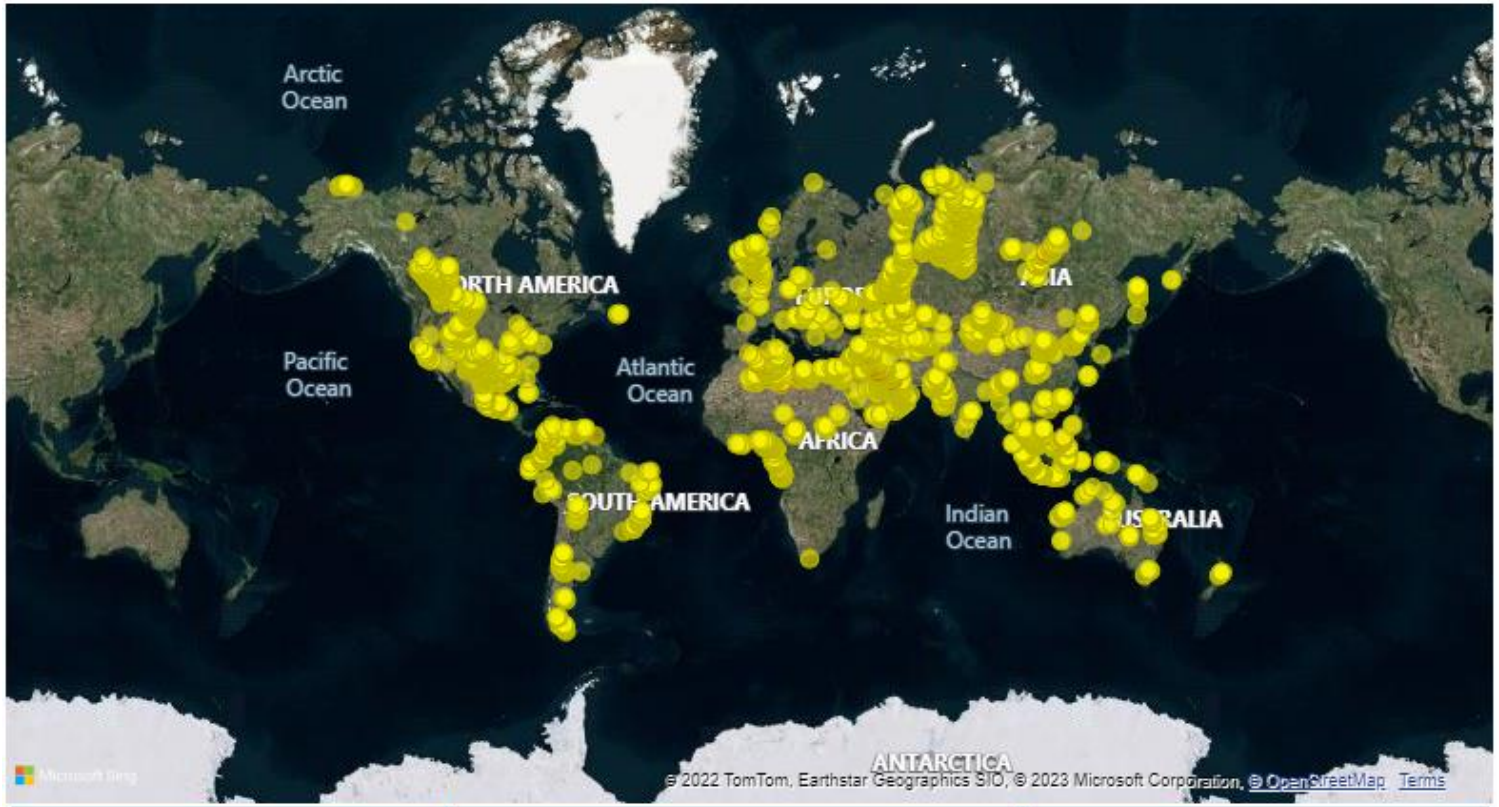
# FLARING AND STATIONARY FUEL COMBUSTION METHANE EMISSIONS

- Due to incomplete combustion of fuels, some methane emissions are released to atmosphere
- Combustion efficiency of flares and enclosed combustors are better than 99.7% (under ideal conditions)

Source: Wikipedia, September 1999

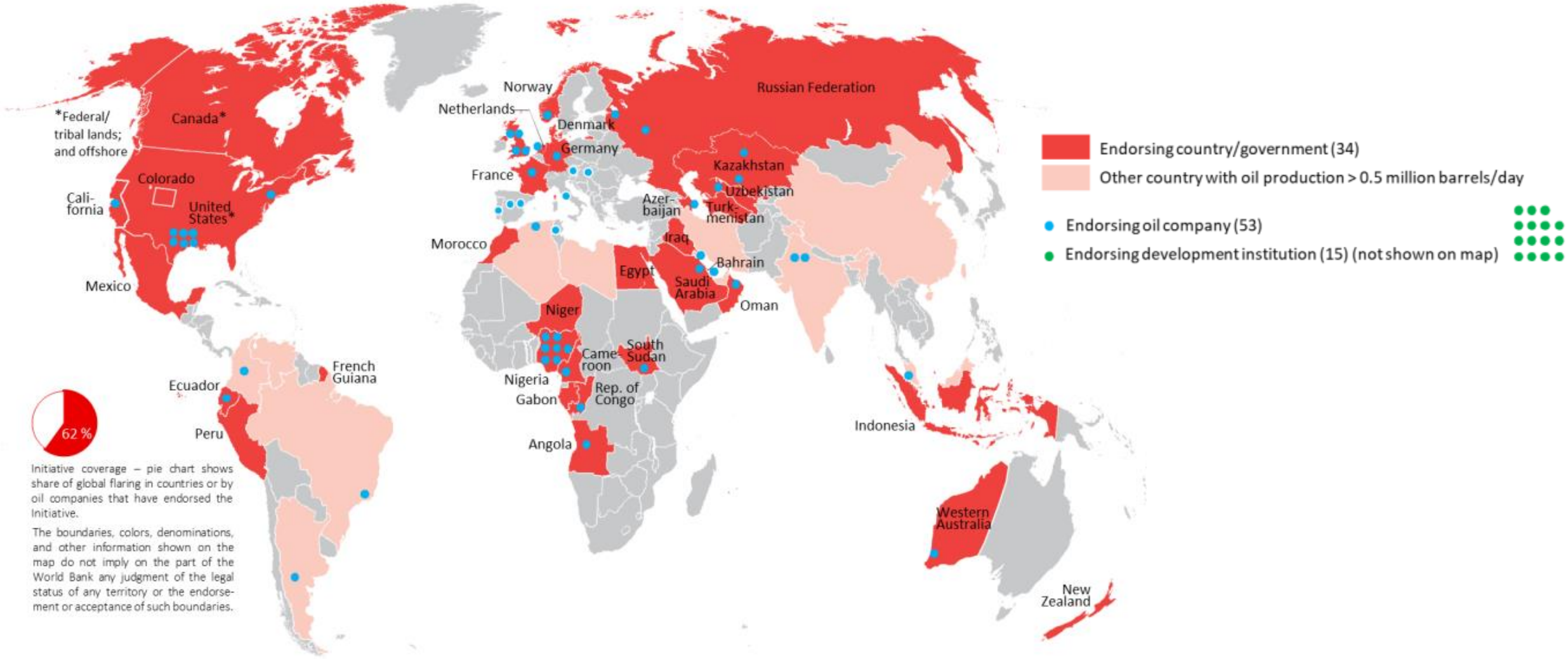
Source: AEREON, 2020

# FLARING AS A GLOBAL PROBLEM




| CO2 emission (million tonnes)[a] | Flare Volume (million $m^3$) | Eq. Sales Value (million USD)[a] |
|---|---|---|
| 382.68 | 143,474.92 | 16,470.43 |

# ZERO ROUTINE FLARING BY 2030




Source: www.worldbank.org/zeroroutinrflaring

# OIL & GAS METHANE PARTNERSHIP

- Launched by UNEP and the Climate and Clean Air Coalition (CACC)
- Comprehensive, measurement-based reporting framework for the oil and gas industry
- Improves the accuracy and transparency of methane emissions reporting in the oil and gas sector.
  - Methane is one of the most prolific & potent greenhouse gases and as such best practices can be extended to all GHGs
- Quantification framework includes a simplistic scoring mechanism by which to assess accuracy and progress
- Member companies are expected to work toward OGMP Level 4 - 5 within 3 years
- An OGMP 2.0 plan must indicate staged milestones, detail approach, measurement distribution and technical details to demonstrate an understanding of the challenges and plans to achieve targets
- Performance target options:
  - 45% reduction, 2015 vs 2025, or
  - 60-75% reduction by 2030, or
  - “near zero” emission intensity

# OIL & GAS METHANE PARTNERSHIP MEMBERS

# OGMP2.0 REPORTING LEVELS

**The five OGMP 2.0 reporting levels:**

- Level 1 – Emissions reported for a venture at asset or country level (i.e. one methane emissions figure for all operations in an asset or all assets within a region or country)

- Level 2 - Emissions reported in consolidated, simplified sources categories (based on IOGP's 5 emissions categories for upstream, and MARCOGAZ' 3 emissions categories for mid and downstream), using a variety of quantification methodologies, progressively up to the asset level, when available.

- Level 3 – Emissions reported by detailed source type and using generic emission factors (EFs)

- Level 4 – Emissions reported by detailed source type and using specific EFs and activity factors (AFs)

  Source-level measurement and sampling may be used as the basis for establishing these specific Efs and AFs, though other source specific quantification methodologies such as simulation tools and detailed engineering calculations (e.g. as referenced in existing OGMP TGDs) may be used where appropriate.

- Level 5 – Emissions reported similarly to Level 4, but with the addition of site-level measurements (measurements that characterize site-level emissions distribution for a statistically representative population).

from OGMP 2.0 Reporting Frameworkhttps://www.ccacoalition.org/en/resources/oil-and-gas-methane-partnership-ogmp-20-framework

# OGMP IMPLEMENTATION GUIDANCE*

- **Simplistic scoring mechanism**
- **Member companies are expected to work toward OGMP Level 4 or Level 5 within 3 years**
- **Performance target options:**
  - 45% reduction, 2015 vs 2025, or
  - 60-75% reduction by 2030, or
  - "near zero" emission intensity
- **Indicate staged milestones, detail approach, measurement distribution and technical details to demonstrate an understanding of the challenges and plans achieve the targets**
- **Revised plans and annual reporting May 31st, each year**

## Technical Guidance Documents (TGD)

- Centrifugal Compressors
- Flare Efficiency
- Glycol Dehydrators
- Incomplete Combustion
- Unstabilized Liquid Storage Tanks
- Level 1 & Level 2 Estimated Emissions TGD

*OGMP 2.0 Implementation Plan Guidance | OGM Partnership, December 2021

# BQI PROGRAM & OGMP 2.0 ALIGNMENT

| | |
|---|---|
| **Project Governance** | ▪ Project Steering Committee and communication protocol<br>▪ Scope of reporting and business unit readiness<br>▪ **Asset inventory and data warehouse assessment; Operated, non-operated and excluded assets.** |
| **Diagnosis, Calibration & Reporting** | ▪ Operational readiness and location for **pilot project (optional)**<br>▪ Project plan for site and source level emissions data<br>▪ Asset taxonomy and pilot project emitter inventory (source, site, asset, and facility)<br>▪ Level 1/2 pilot project “site” level emission estimate<br>▪ Level 3/4/5 direct “source” measurement of emissions<br>▪ Reconcile top-down (“site”) and bottom-up (“source”) measurements within OGMP 2.0 reporting framework<br>▪ **Verifiable Methane Baseline** |
| **Emissions Reductions Potential** | ▪ Best Available Technology (BAT) Analysis and peer benchmarking for pilot asset and emitter categories<br>▪ **Cost-Benefit & Economic Analysis including “level of ambition” scenarios** |
| **Target Setting** | ▪ Prioritized Emissions Reduction Plan including Methane Intensity vs Absolute Reduction target scenarios for operated assets.<br>▪ Technology implementation plan including monitoring and performance tracking protocols.<br>▪ **Align and approve targets with other GHG commitments taken by the organization** |
| **Performance Monitoring & Reporting** | ▪ Annual program reporting and audit plan.<br>▪ Regular monitoring of emissions. |

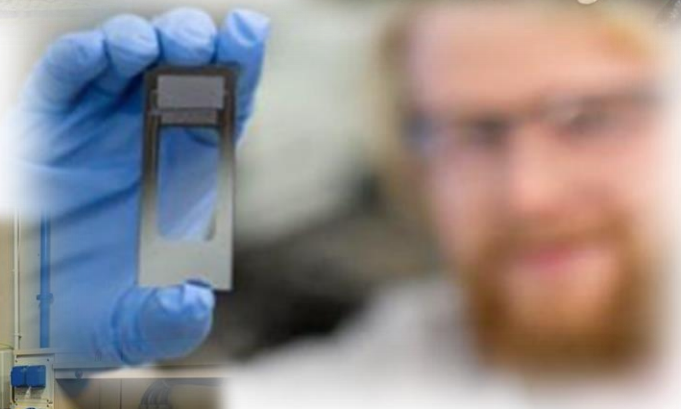
# SPE Members: We can lead the way!

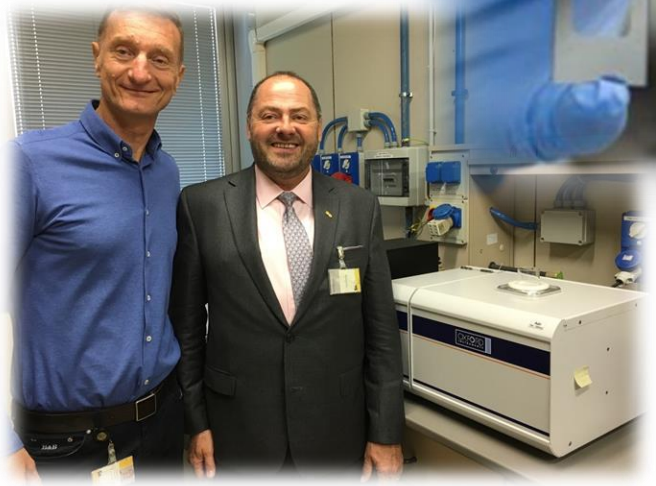
Argentina can be the best at football…and methane reduction


BERGEN?
Comfort Hotell Bergen Airport
Hotel & Conference Center

Are we lost?

# SPE MEMBERS – A CULTURE OF INNOVATION



# DO, DON'T TALK…..

- Alberta: were 5 years from talking to doing
  - NOW IT IS POPULAR
- Pledges being made all over the world – x reductions by date.


Thinking Like Activists, Acting Like Engineers

# DO, DON'T TALK.....

- OMGP 2.0 will provide a discipline to get started
  - BASELINE is first
  - Can't mitigate what you haven't measured

SPE Gaia, build a cathedral, not a circus tent!

# THANK YOU!

SPE International

Society of Petroleum Engineers

CARBON CONNECT INTERNATIONAL