

Methane Emissions Mitigation – Technology and Innovation

Oil & Gas Subcommittee Webinar

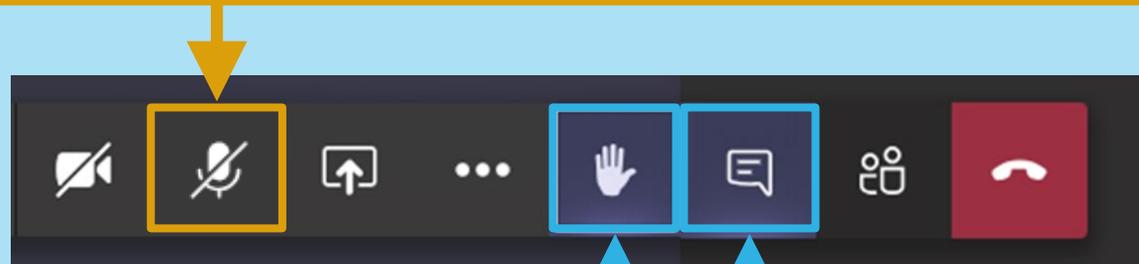
13 January 2021



Housekeeping – Tips for using Teams

Mute your microphone.

- Everyone should set the microphone to mute unless actively speaking.
- If participating by phone, press *6 to mute your phone.



If available, use the “Raise your hand” button to be called upon to speak.

Or, enter questions using the “Chat” pane. Type “Raise My Hand” to be called upon to speak.

Help!

Need Help?

If you need help, please send an email to asg@globalmethane.org

Agenda

- **Welcome**
 - James Diamond, GMI O&G Subcommittee Co-Chair, Environment and Climate Change Canada (ECCC)
- **Introduction to Webinar and Speakers**
 - Jonathan Banks, Clean Air Task Force
- **Presentation: Methane Capture/Recompression System for Gas Compression and Station Blowdown Systems**
 - Sean Garceau, Solar Turbines Incorporated
- **Presentation: Solar Mobile Turbomachinery (SMT) in Flare Gas Applications**
 - Jay Mistry, Solar Turbines Incorporated
- **Presentation: A Programmatic Approach to Recover Methane from Venting Operations, enabled by ZEVAC Technology**
 - Doug Sahm, TPE Midstream
- **Facilitated Discussion**
 - Jonathan Banks
- **Wrap up and Adjourn**

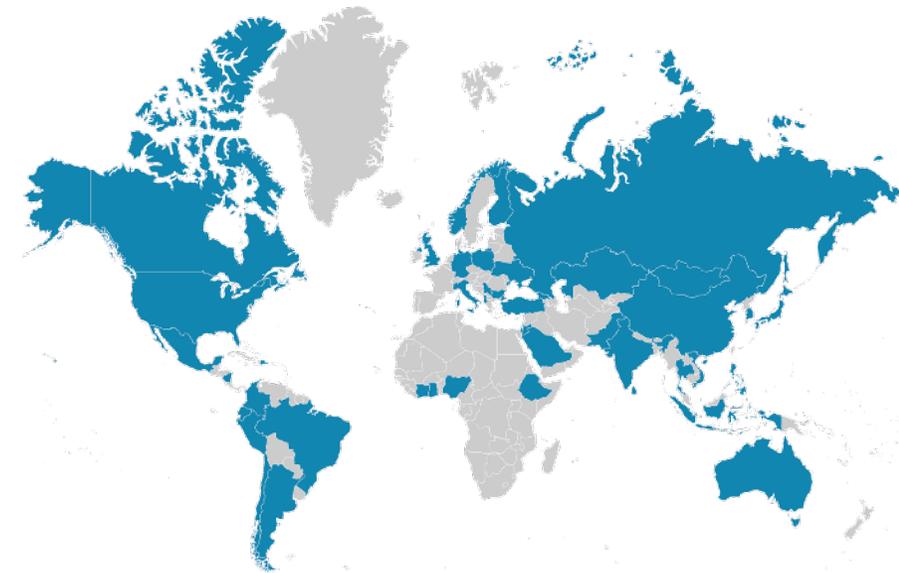
Global Methane Initiative (GMI)

GMI is an international public-private partnership focused on reducing barriers to the recovery and use of methane as a clean energy source.

- 45 Partner Countries
- 700+ Project Network members
- Strategic partnerships with international organizations focused on methane recovery and use



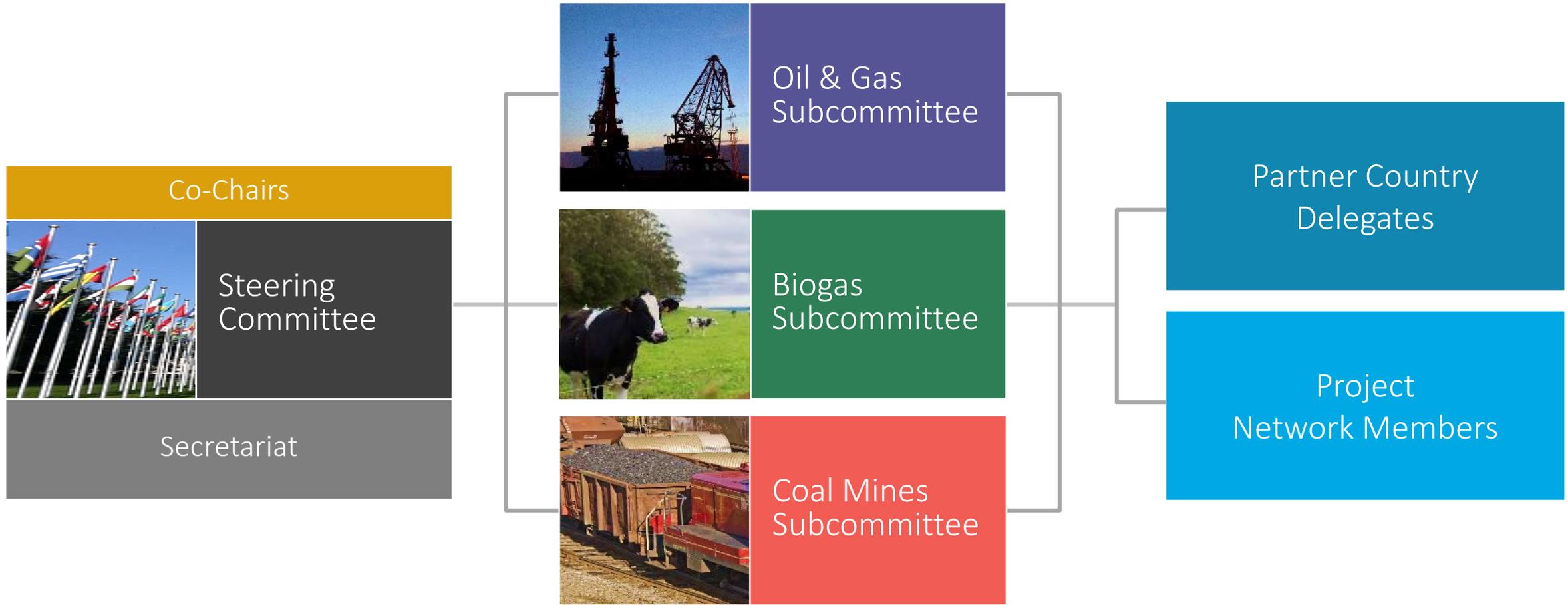
UNECE



GMI Partner Countries represent approximately 75% of the world's man-made methane emissions.



Organizational Structure



Recovering and Using Methane in Sectors Targeted by GMI



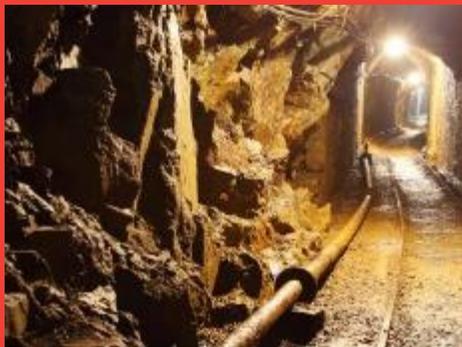
Oil & Gas Sector

Methane emissions from oil and natural gas systems result from both normal operations and system disruptions. These emissions can be cost-effectively reduced by upgrading technologies or equipment, and by improving operations.



Biogas Sector

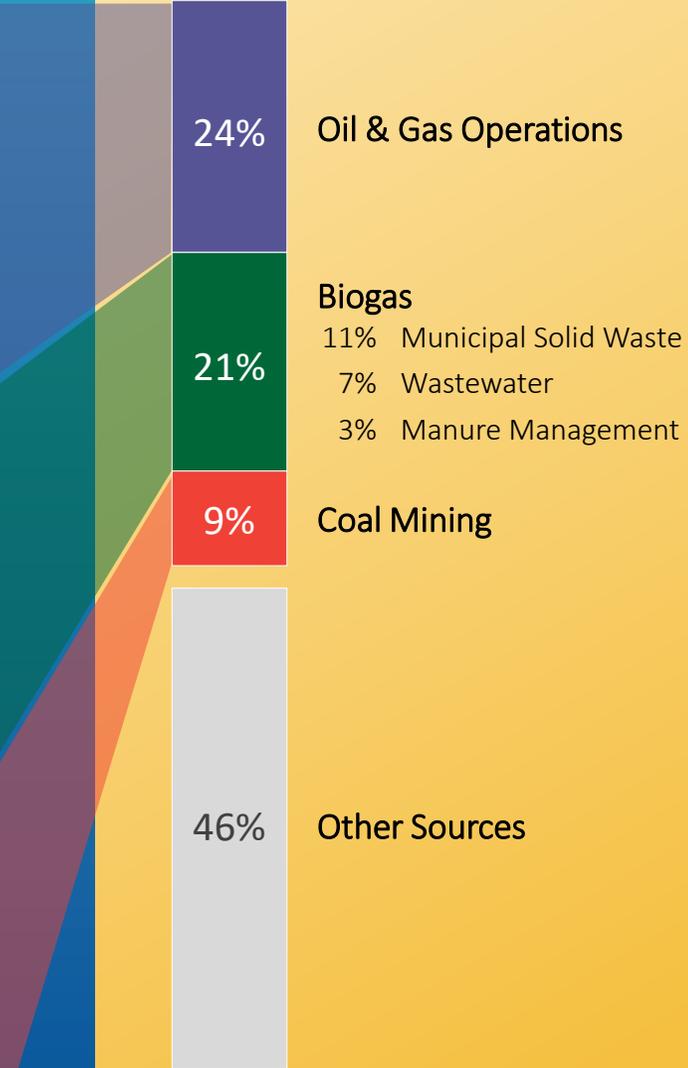
Biogas produced from the anaerobic digestion of organic material or emitted directly from landfills can be treated to create pipeline-quality natural gas, used as a cooking fuel, used to generate electricity, and captured on-site to provide heat and power.



Coal Mines Sector

Removing fugitive methane gas from underground coal mines and using it in profitable and practical ways can improve worker safety, enhance mine productivity, increase revenues, and reduce greenhouse gas emissions.

Estimated Global Man-made Methane Emissions by Source¹



¹ U.S. EPA, *Global Anthropogenic Emissions of Non-CO₂ Greenhouse Gases: 1990–2030*

Global Methane Challenge Promotion

A white submission form titled "Global Methane Challenge Submission Form" with the "Global Methane Initiative" logo in the top right. The form is divided into five steps, with Step 1 being the current focus. Step 1 is titled "Tell us about your organization." and includes fields for "Organization Name", "Location (Country)", "Organization Website", "Point of Contact Name", "Email address", and "Phone Number". A checkbox at the bottom of Step 1 reads "I agree to allow GMI to promote my story." The form also includes a progress indicator at the top showing steps 1 through 5.

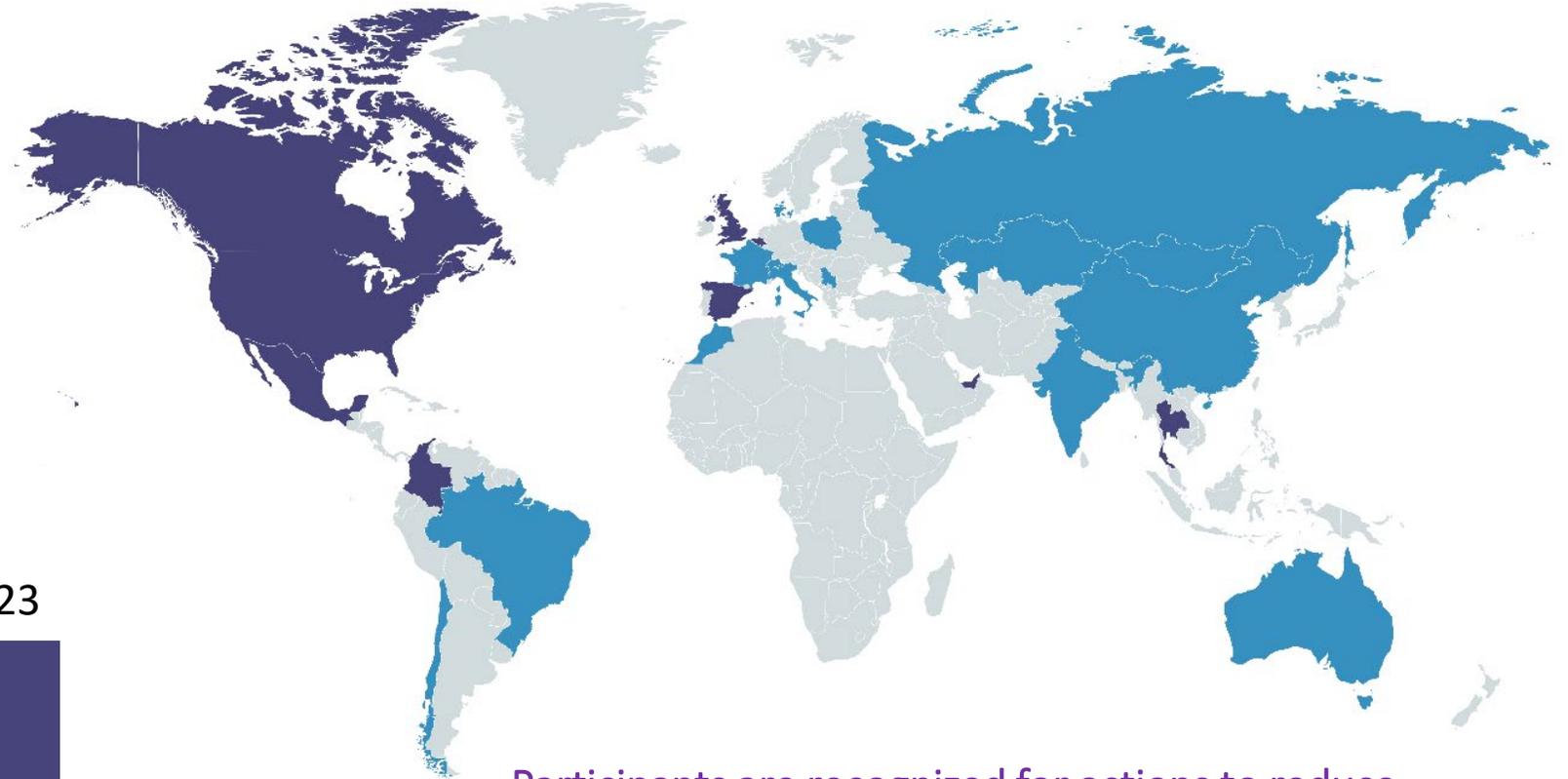
A YouTube video thumbnail for the Global Methane Challenge. It features a black background with white text that reads: "Here are just a few of the amazing projects from around the world that embrace the goal of the Global Methane Challenge". A red play button icon is overlaid on the text. Below the text, it says "The full list is available at www.globalmethane.org/challenge". The YouTube logo and video player interface are visible at the bottom.

Actions Showcase

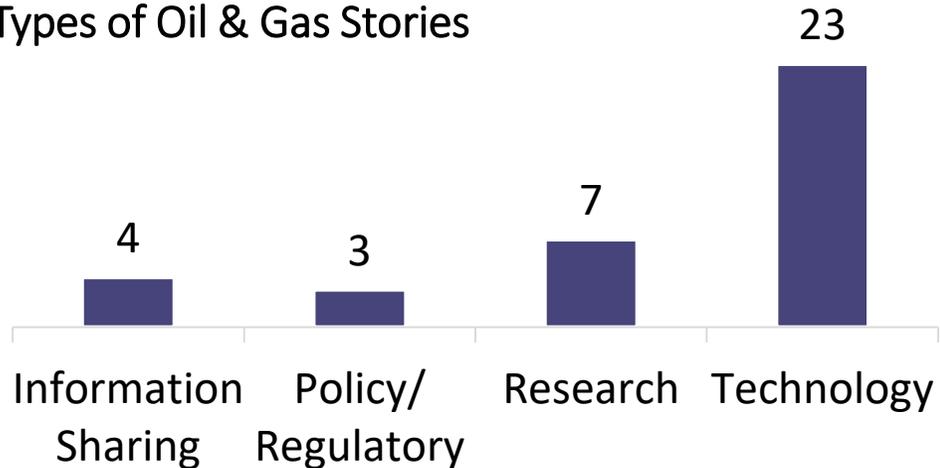


Oil and Gas Sector Stories

Sector	Stories
Oil & Gas	37
Biogas	33
Coal	9
Multiple	5
Total	84



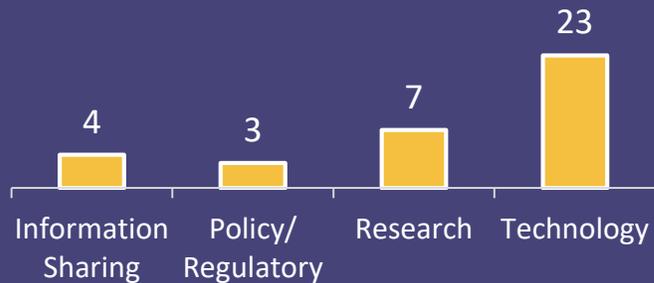
Types of Oil & Gas Stories



Participants are recognized for actions to reduce methane emissions and their stories are published online, promoted in social media, and featured in GMI outreach.

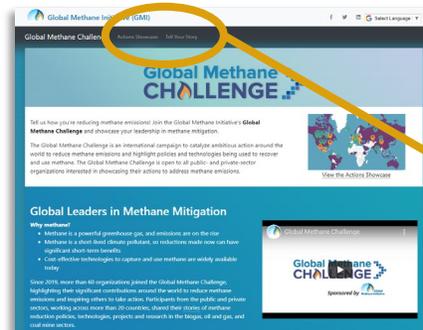
Global Methane Challenge

37 Oil & Gas Stories



Global Methane CHALLENGE

- The Global Methane Challenge is still open!
- Launched in 2019 to raise awareness and catalyze ambitious action to reduce methane emissions

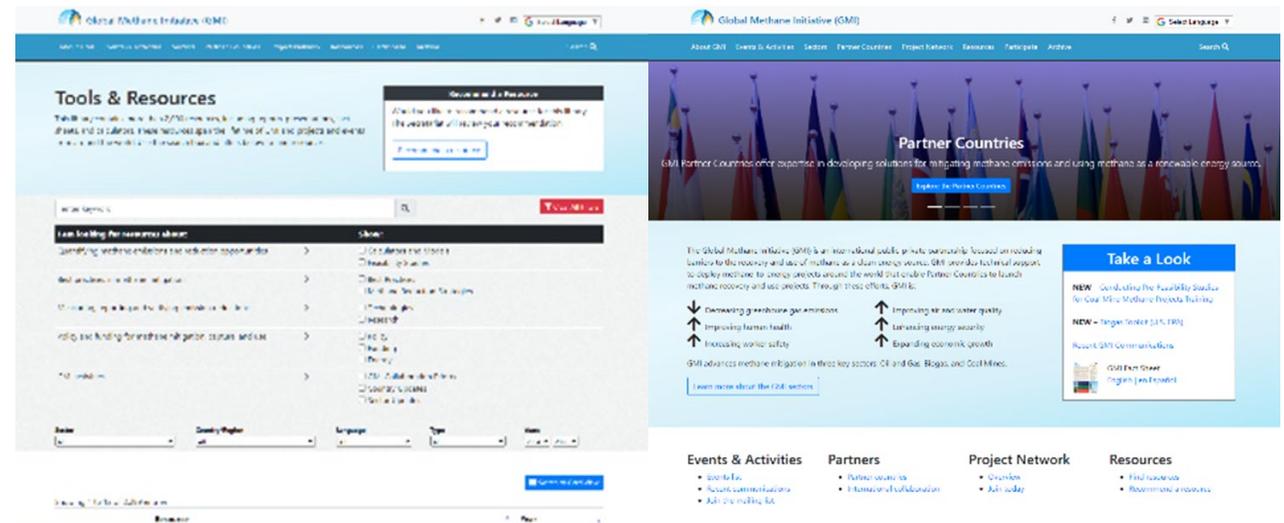


A screenshot of the Global Methane Challenge Submission Form. The form is titled 'Global Methane Challenge Submission Form' and includes a progress indicator with five steps. The first step, 'Tell us about your organization', is highlighted with a red box. The form fields include Organization Name, Location (Country), Organization Website, Point of Contact Name, Phone Number, and Email address.

Submit your story at globalmethane.org/challenge/

GMI Oil & Gas Subcommittee Updates

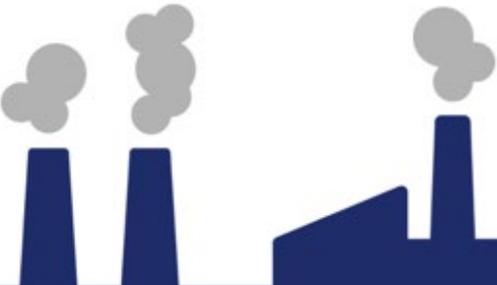
- Developing online training resources
 - Designing and Implementation of Leak Detection and Repair (LDAR) Program
 - Identification and Development of Methane Mitigation Projects
- Updated GMI website
 - Better navigation and organization
 - More direct outreach to stakeholders
 - Easier access to tools and resources
 - Faster load times



Introduction to Webinar and Speakers

Jonathan Banks, Clean Air Task Force

Why Methane Matters



REDUCTION POTENTIAL

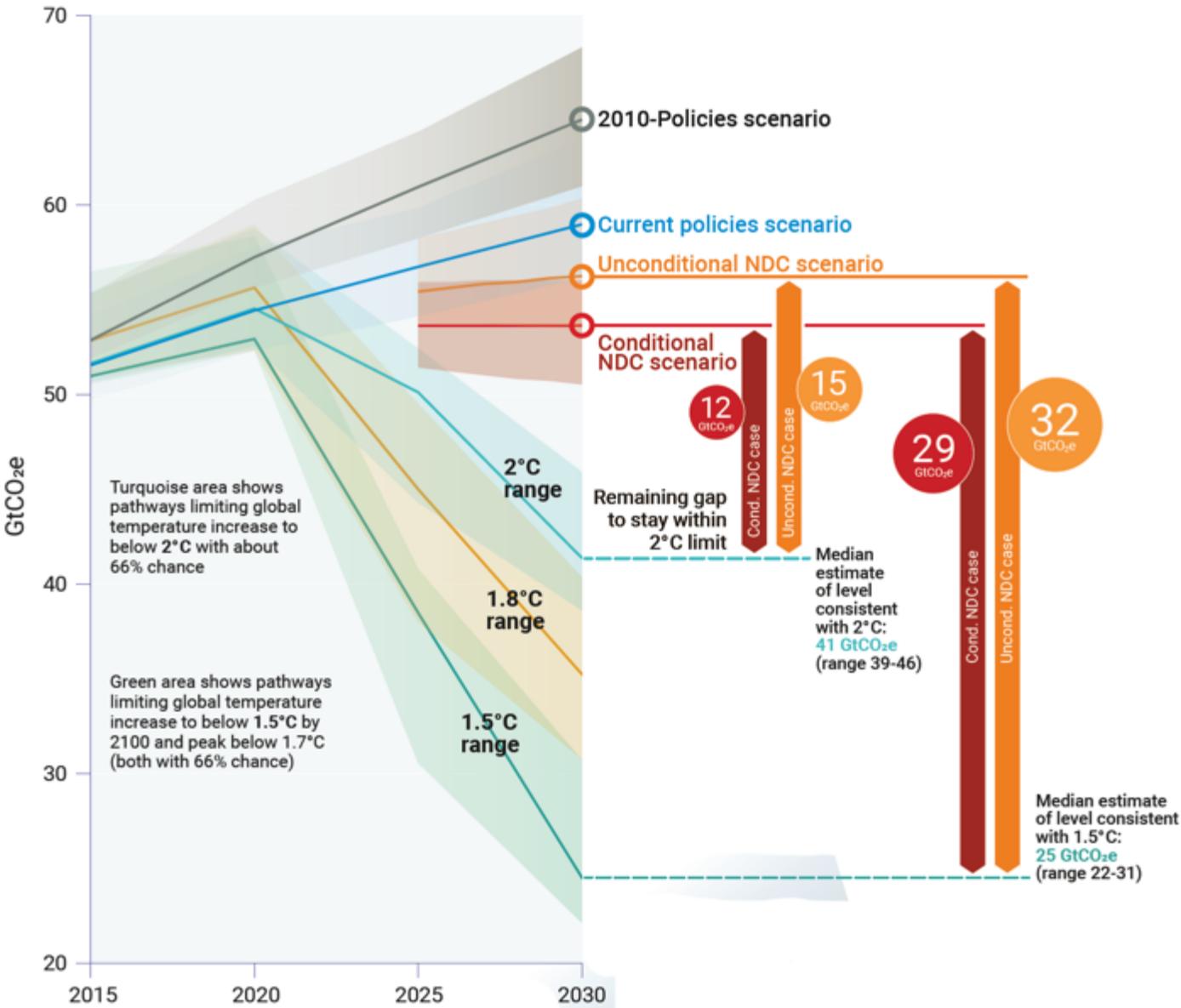
By 2030, CATF estimates we could reduce emissions by up to 76 million metric tonnes of methane annually. This is equivalent to closing

1,700

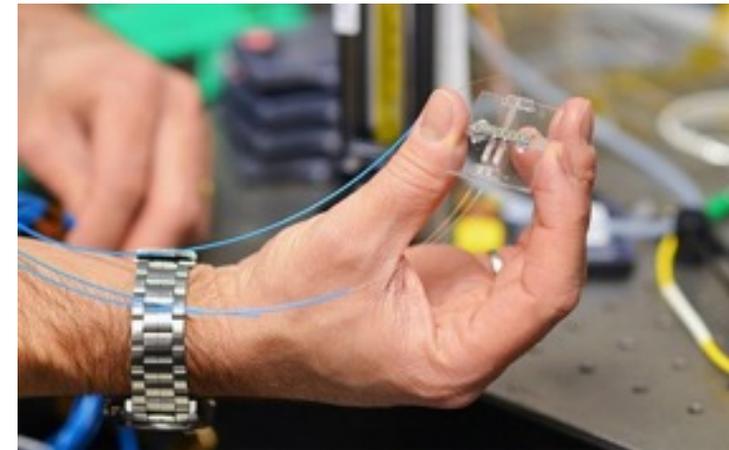
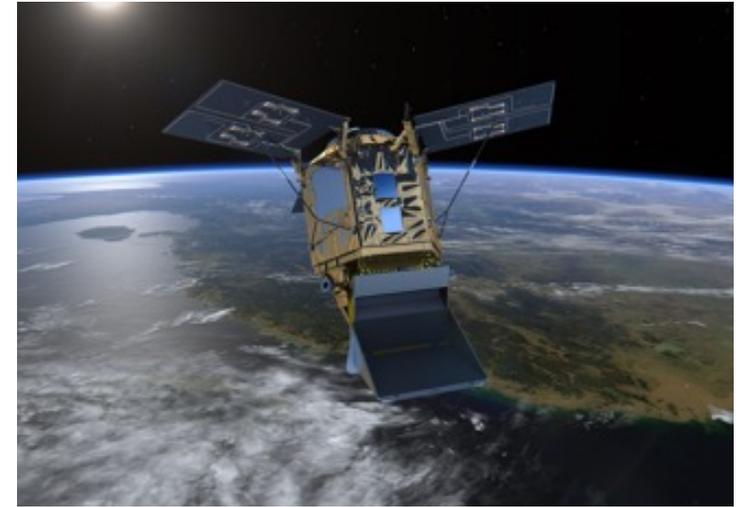
COAL POWER PLANTS

No other single action can slow the rate of global warming like reducing oil and gas methane pollution. **Methane is responsible for more than 25% of Earth's warming today, and the oil and gas sector is the largest industrial source.**

We are nowhere near on track to meet climate targets.



Methane Mitigation Technology has come a long way



Webinar Speakers

- Sean Garceau, Solar Turbines Incorporated
- Jay Mistry, Solar Turbines Incorporated
- Doug Sahm, TPE Midstream

Methane Capture/Recompression System for Gas Compression and Station Blowdown Systems

Sean Garceau, Solar Turbines Incorporated

Methane Emissions Reduction Solutions

Powering the Future

Solar Turbines

A Caterpillar Company

Global Methane Initiative

REDUCTION OF METHANE EMISSIONS

- Pipeline Blowdown Applications
 - In-Line Compression
 - **Mobile Compression**
 - **Low Pressure System**
 - Stopples
- Dry Seal Primary Vent Emission Applications
 - Not in UNNEC No 65 Report
 - Part of Canadian Methane Rule
- Economic Benefit
- Social Benefits



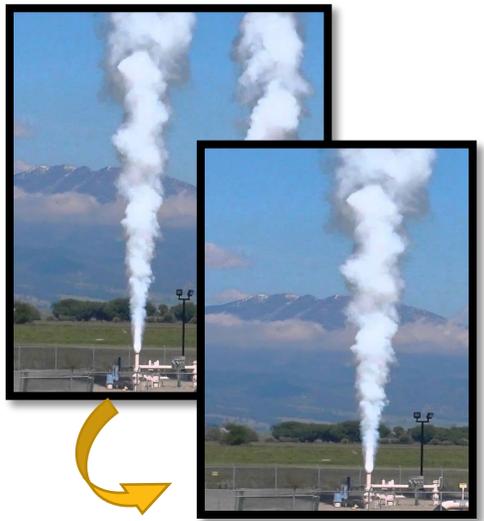
10. Equipment depressurization and blowdowns from pipelines and facilities	Use Isolation valves to minimize impact	Variable
	Re-direct gas into storage vessel (field), flare, or low-pressure header (fuel gas or gathering system)	
	Minimise the number of starts ups	
	Lower pressure in the pipeline prior to event through main line compressors and a mobile compressor stations (for pipeline repairs)	
	Install plugging equipment to shorten segment of pipeline involved in outage, use isolation valves to minimize impact	
	Rerouting the natural gas to a duct burner, thermal oxidizer or flares where possible (upstream) to recover a portion of all of the blowdown gas.	Variable

UNECE 65 Table 4.1: Best Practice Guidance for Effective Methane Management in the Oil and Gas Sector

Benefit to Our Customers



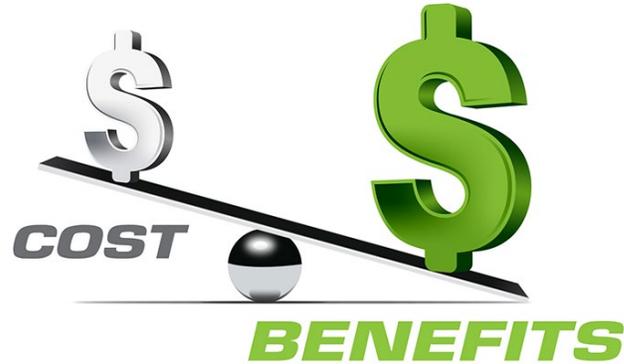
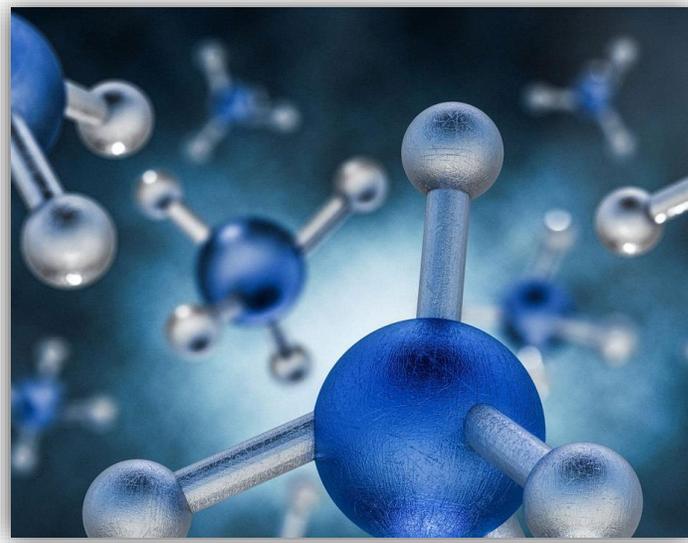
Decrease emissions to the atmosphere



Minimize the number of blow-down/venting events

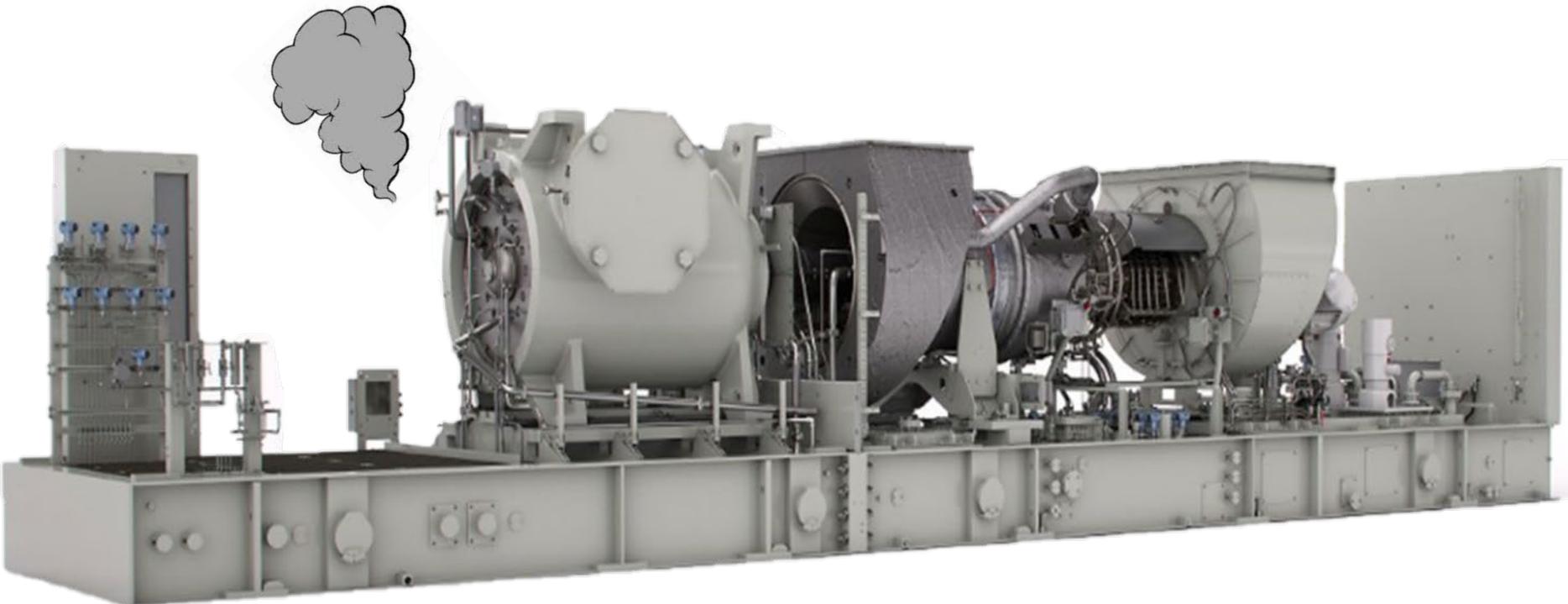


Solar supported equipment



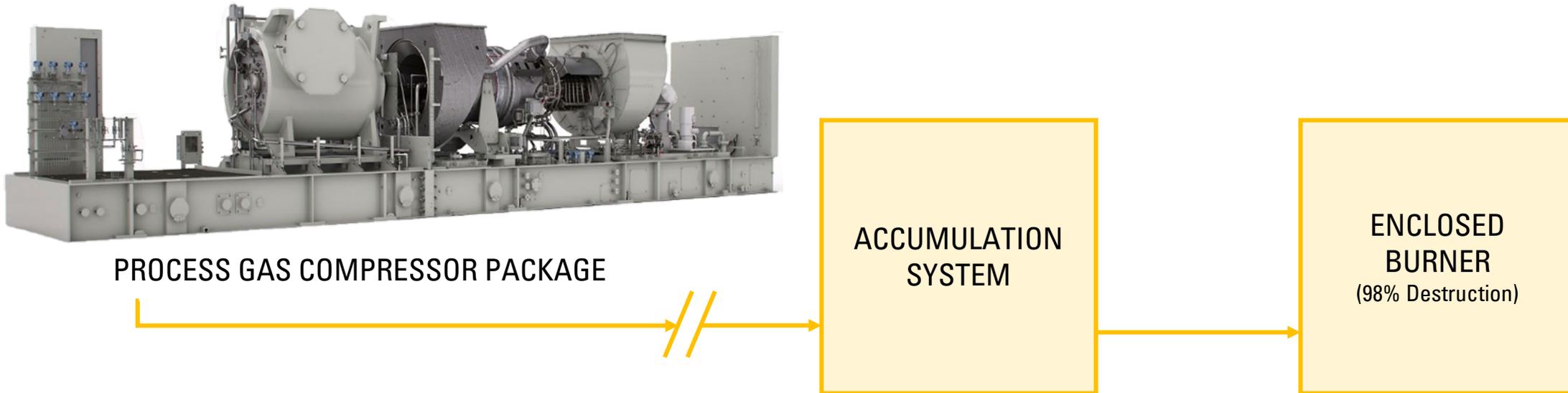
Savings from capturing fugitive methane

Gas Compressor Package with Dry Gas Seal System



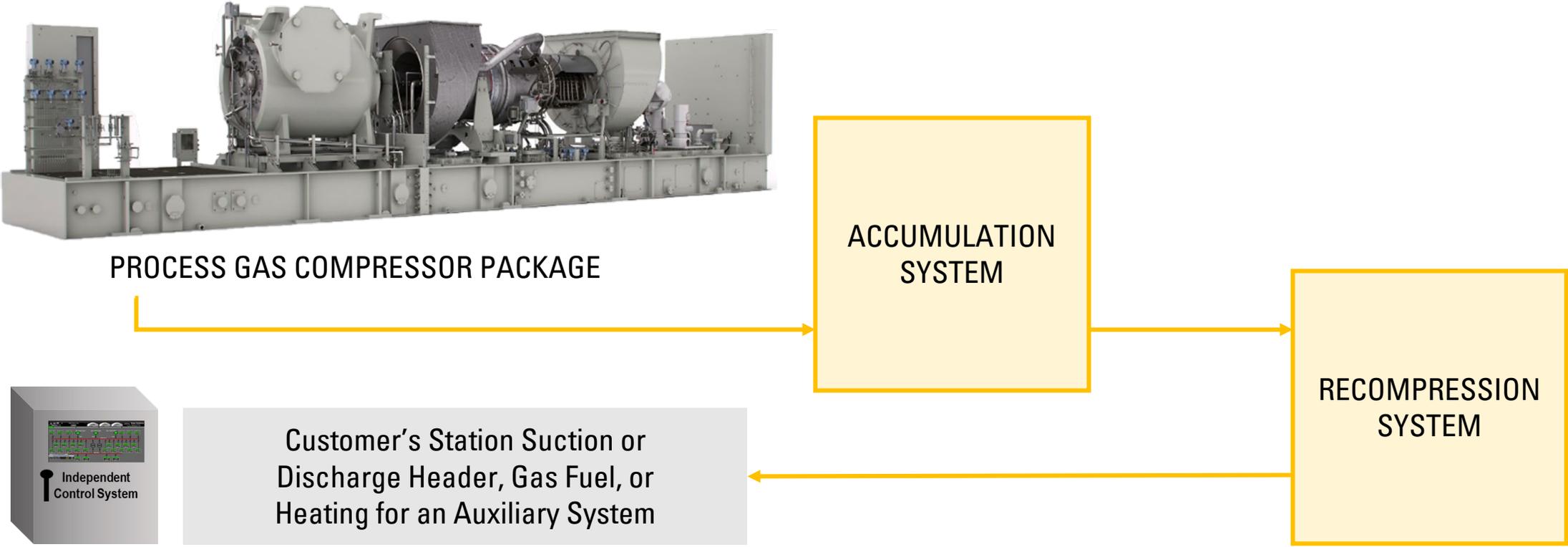
Enclosed Burner System (EBS)

- Primary vent pressure is increased above atmospheric pressure
- Methane is captured while process compressor is in operation



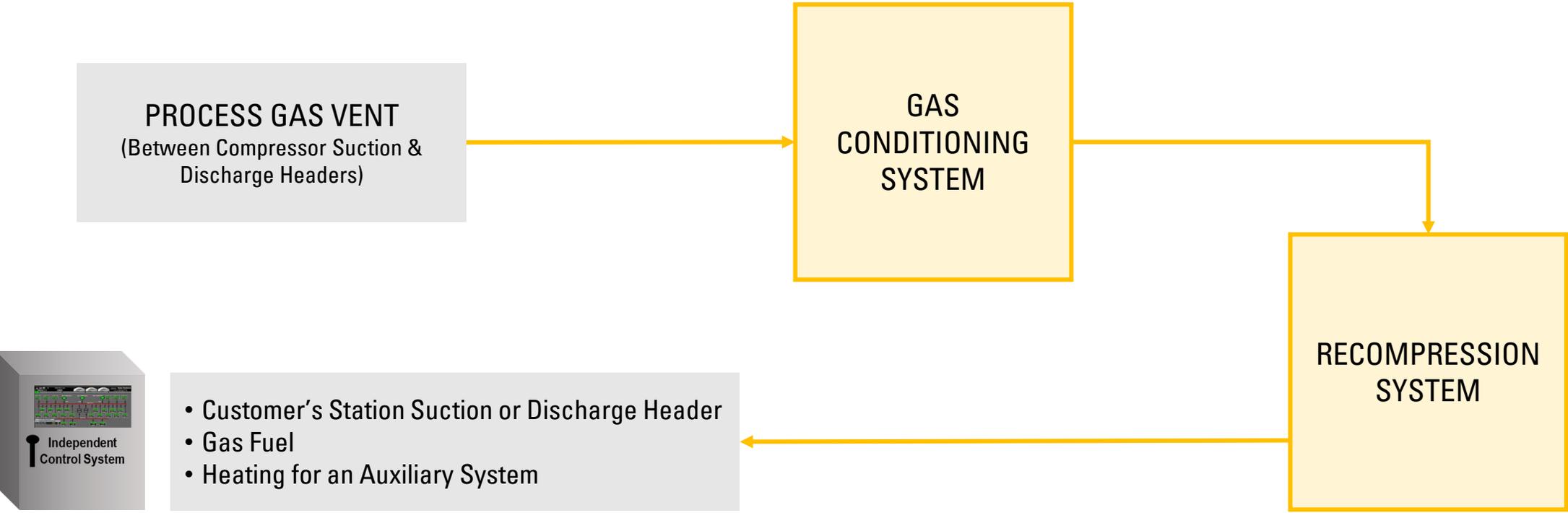
Dry Seal Recompression System

- Methane is captured while process compressor is in operation
- Near-zero emissions
- Two recompression sizes available based on process gas compressor size



Process Vent Recompression System

- Captures gas between suction and discharge valves
- Operational when depressurizing process gas compressor during a non-emergency shutdown
- Offer Full and Simplex Conditioning System



- Customer's Station Suction or Discharge Header
- Gas Fuel
- Heating for an Auxiliary System

Process Vent and Dry Seal Recompression System

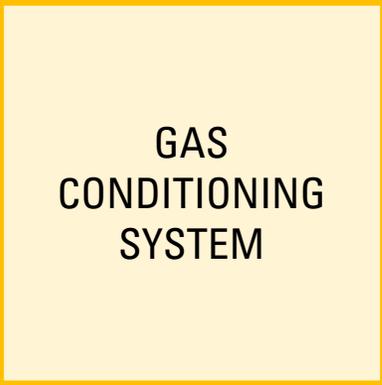
- Two recompression sizes available based on process gas compressor size



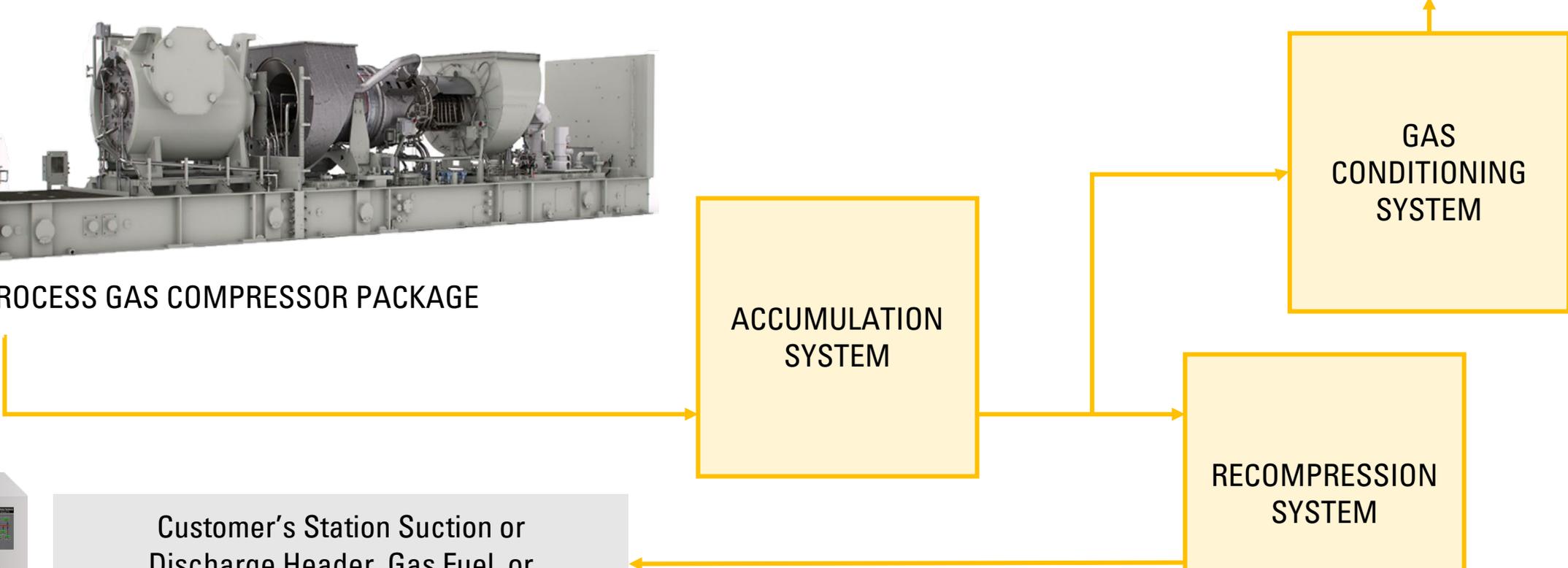
PROCESS GAS COMPRESSOR PACKAGE



Customer's Station Suction or Discharge Header, Gas Fuel, or Heating for an Auxiliary System



PROCESS GAS VENT



Additional Benefits

- System Diagnostics
 - Automatic operation with turbomachinery packages
 - HMI
 - Realtime system monitoring
 - Daily emissions totalizer with CO2e calculations
 - Data logging
- Uses similar components as Solar Turbines turbomachinery packages
- Integration into existing Solar Turbines package control system



Case Studies

BERKSHIRE HATHAWAY ENERGY COMPANY

Pennsylvania

- Dry Seal Recompression System
 - Connected to Solar C402 compressors operating at 800-1,000 psig
- Process Vent Recompression System
 - Depressurization from 1,000 psig to 30 psig



WILLIAMS PIPELINE

Virginia

- Process Vent Recompression System
 - Connected to two Turbomachinery packages
 - Depressurization from 600 psig to 30 psig
 - Outside Installation
 - Noise Level 76-78 dB(a) at 1 m



Product Snapshot

KEY FEATURES

- Reduce methane emissions to near-zero levels
- Designed to be installed in NEC and ATEX Class 1, Div. 2 and Zone 2 locations
- System monitoring, diagnostics, and daily methane capture totalizers

Solar Turbines
A Caterpillar Company

PIL 280
Product Information Letter

**Emissions Management
Methane Reduction Solutions
Process Gas Vent Recompression**

Solar Turbines
A Caterpillar Company

PIL 279
Product Information Letter

**Emissions Management
Methane Reduction Solutions
Primary Vent Dry Gas Seal Recompression**

Michella Thomas
Solar Turbines Incorporated

PURPOSE
The purpose of this Product Information Letter is to provide an overview of Solar Turbines' Dry Gas Seal Recompression System which has been developed to help customers achieve near-zero methane emissions targets, and to reduce the environmental impact of greenhouse gas (GHG) emissions.

THANK YOU

Solar Turbines
A Caterpillar Company

Solar Mobile Turbomachinery in Flare Gas Applications

Jay Mistry, Solar Turbines Incorporated



SMT 60

Solar Mobile Turbomachinery

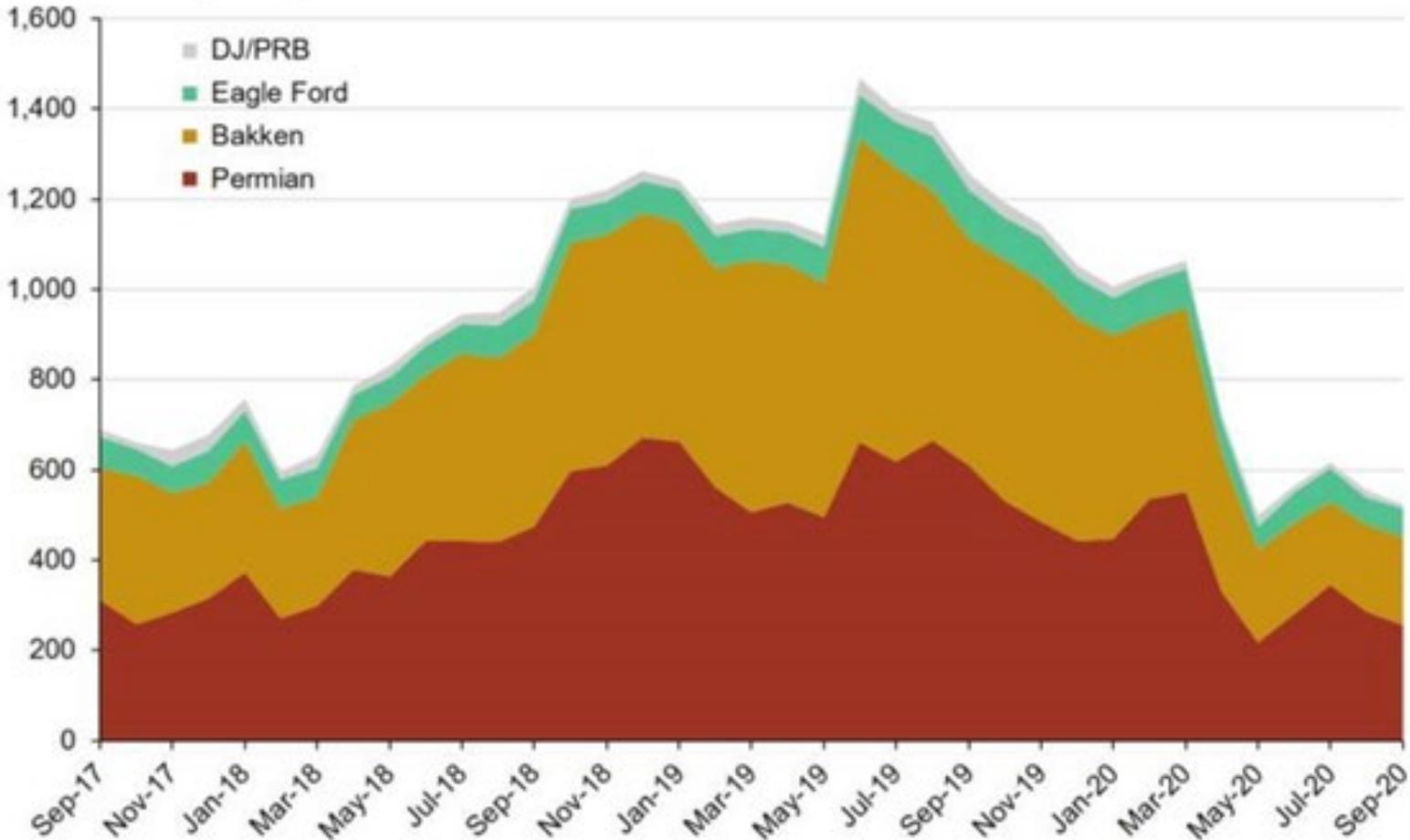
Using Associated Gas to Create Electrical Power

Jay Mistry
Mobile Turbomachinery Business Manager
January 13, 2021

Powering the

Wellhead Flaring – Wasted Energy

Figure 1: US Land natural gas wellhead flaring by oil basin and month
Million cubic feet per day



Source: Rystad Energy US Emission Dashboard Nov2020

What can be done with Associated Gas?

- One option is to use the associated gas to create required electricity for a production or fracking site
- Typically producers would use diesel powered generator units for field electricity
- Avoids 'double dip' of emissions – flaring and burning other fossil fuel to create electricity
- Emissions intensity is improved (emissions/unit output) compared to flaring

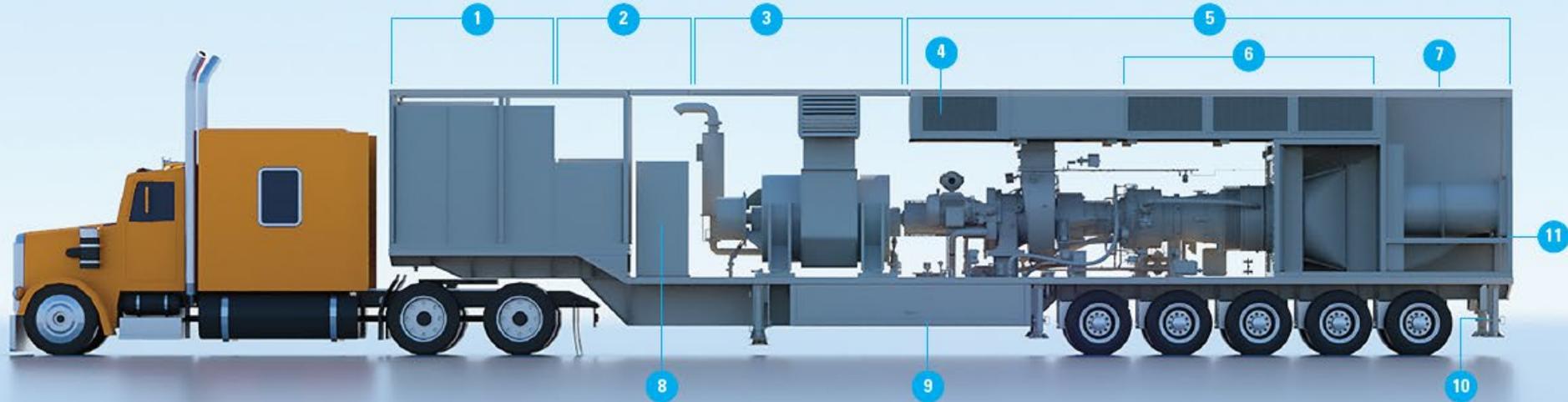
SMT60

Park | Plug | Play



- Single trailer with fully integrated design
- Hydraulic leveling system
- Only 3 main connections
 - Medium voltage, black start, gas fuel
- No alignment; no crane lifts; no feet off the ground

SMT60 – Equipment Layout within Trailer



1 | Electrical Equipment Compartment (EEC)

2 | Medium Voltage Compartment

3 | Generator Compartment

4 | Generator Ventilation Inlet Filter

5 | Turbine Compartment

6 | Integrated Air Inlet Duct and Filters

7 | Exhaust

8 | MV Connection Point

9 | SoLoNOx™ Gas Fuel System

10 | Auto-Leveling Jack

11 | Enclosure Ventilation Fans

SMT60 – Specifications and Dimensions

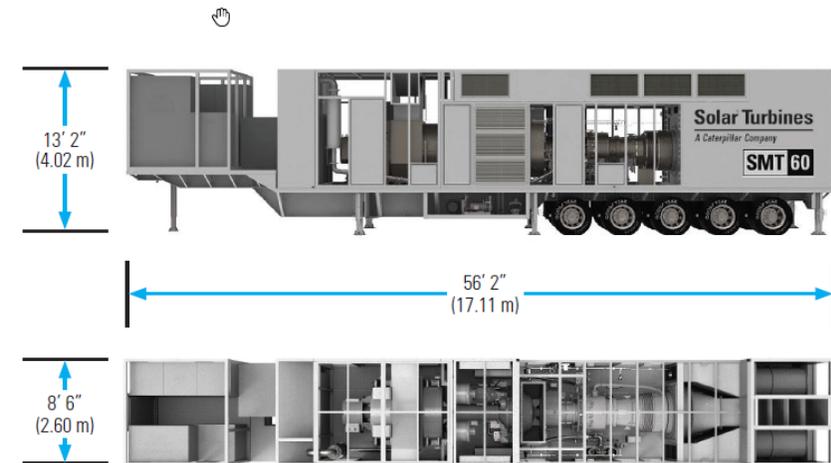
Solar Mobile Turbomachinery (SMT60)

Powered by the Taurus™ 60 engine from Solar, the SMT60 provides superior mobile technology:

- Widest well-head gas fuel flexibility in the industry
- World leader in dry low emissions
- Easy to relocate and DOT compliant
- Fully integrated modular power plant
- Robust, proven equipment with a global support network

SMT60 Specifications

- Dimensions: 56'2" l x 8'6" w x 13'2" h
- 7700 HP (5.7 MWe) ISO
- 13.8KV / 4160V generator
- Reduced noise emissions
- Single trailer design
- Dry low emissions
- Dual fuel capable
- Runs on wide range of well-head gas fuels
- DOT compliant; no escorts required





THANK YOU

Solar Turbines

A Caterpillar Company

A Programmatic Approach to Recover Methane from Venting Operations, enabled by ZEVAC Technology

Doug Sahm, TPE Midstream



PRESENTATION
for
Global Methane Initiative

A Programmatic Approach to Eliminating Methane Venting, supported by **ZEVAC** vent-gas recovery system.

Together, we want to empower gas operators to transform their culture to align with their ESG ambitions.

We envision a future without venting, where every employee is equipped to do their job without releasing gas.

Instant Impact. Sustainable Returns.

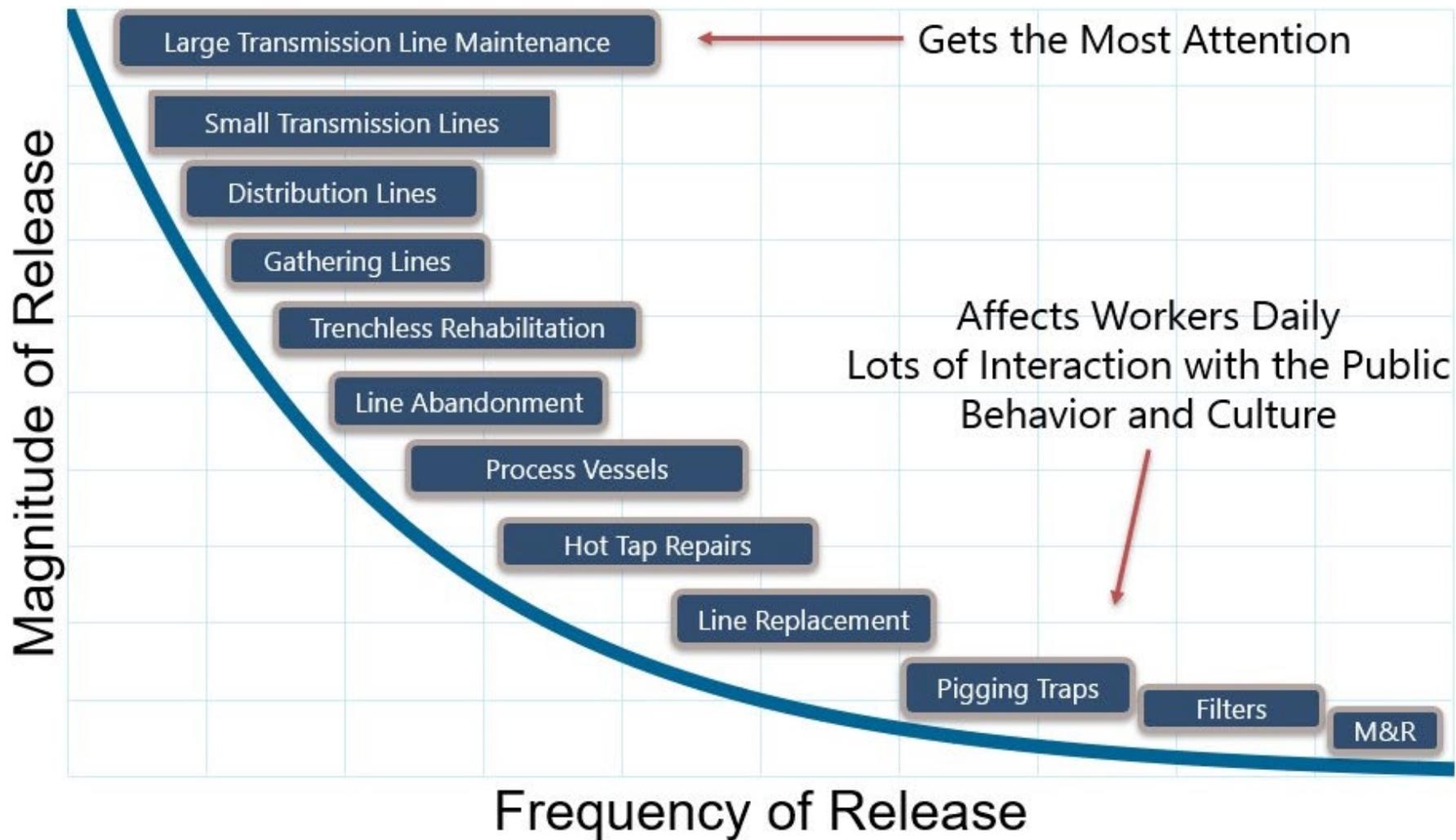
**What is
Venting?**

**Hand-On-Valve Emissions
“Blowdown”
Release on Purpose**

**What is
ZEVAC?**

**An alternative to venting
Capture & Re-inject vent-gas**

Everyday Venting Activity (on purpose)



VENTING IS HAPPENING EVERY DAY

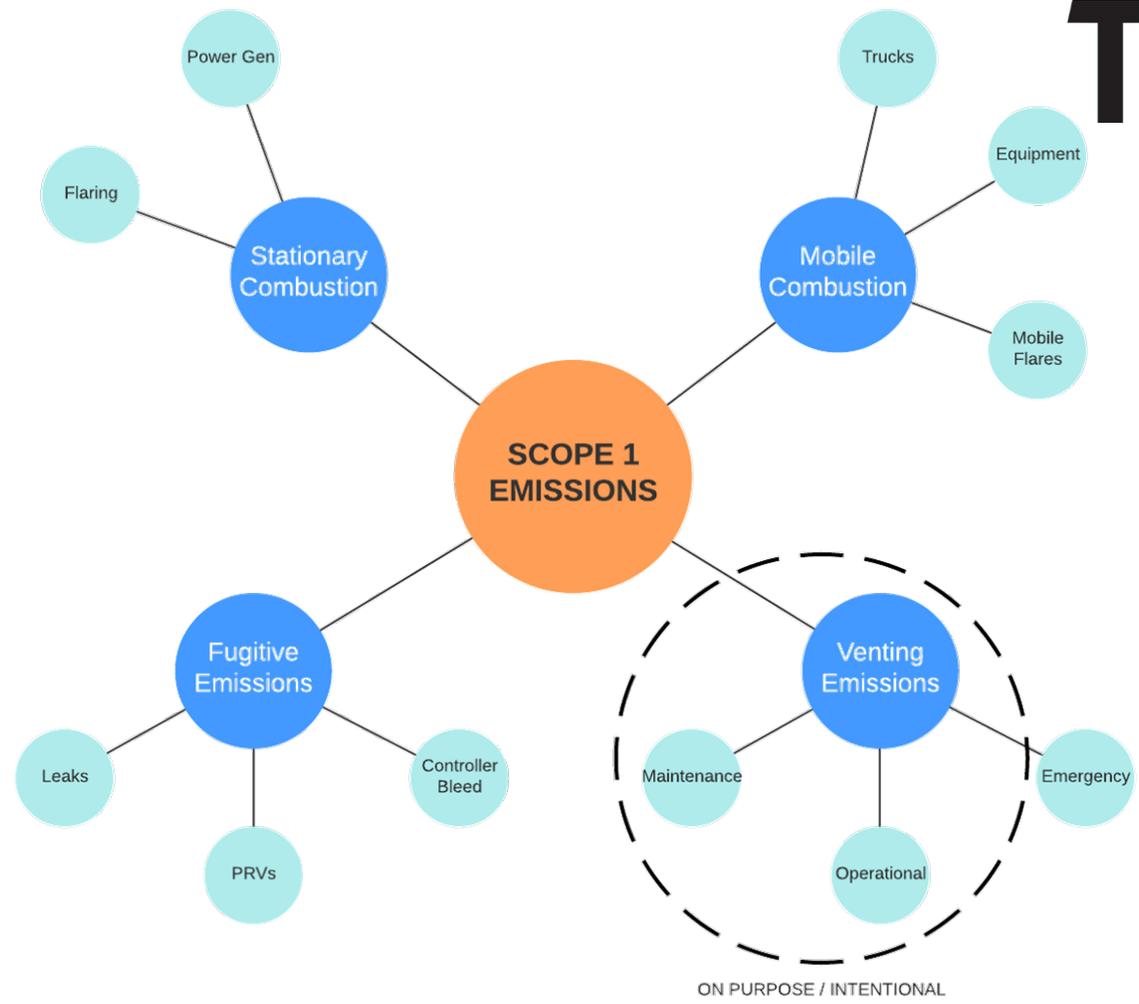
All these emissions are intentional. You don't have to search for them.

Why Focus on Venting?

Impact-Based Approach

ZEVAC

Proven ROI



Look at Montreal →

REGULATION WILL HIT INTENTIONAL EMISSIONS - HARD

- R-11 = Intentional Release BANNED
- R-12 = Intentional Release BANNED
- R-22 = Intentional Release BANNED
- R-134 = Intentional Release BANNED
- R-143 = Intentional Release BANNED
- R-410 = Intentional Release BANNED
- R-600a (isobutane) = Intentional Release BANNED (then exempted)
- R-290 (propane) = Intentional Release BANNED (then exempted)

Why Focus on Venting?



ACTIONABLE

NO NEED TO SEARCH

IMMEDIATE ACTION



LOW COST

TIME AND MONEY TO
ADDRESS VENTING
ARE NEGLIGIBLE



SAFETY

PREVENT FUEL+AIR
MIXTURE AROUND
WORKERS



REGULATION

EASY TO REGULATE /
RESTRICT / BAN
INTENTIONAL
VENTING



PUBLIC RELATIONS

SHOW REAL ACTION
IN THE FIELD



COMPANY CULTURE

ALIGN OPERATING
PRACTICES WITH ESG
CLAIMS

Why Focus on Venting?

Impact-Based Approach

ZEVAC

Proven ROI



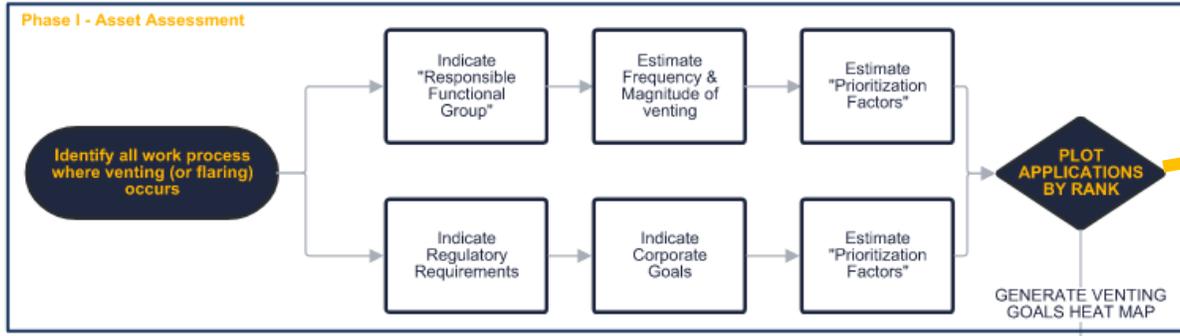
Application	Funct. Grp in Charge	Frequency*	Magnitude*	Public*	Culture*	Safety*	SCORE/100
New Pipe Gas-In	Construction	7	5	5	5	2	17.5
New Station Gas-In	Engineering	5	5	5	5	2	12.5
New Vessel/Skid Gas-In	Operations	2	5	2	5	2	2
New Customer/Meter Gas-In	Operations	10	2	5	2	2	4
Pipe Retirement (whole line) Gas-Out	Engineering	7	7	5	5	5	61.25
Pipe Retirement (section) Gas-Out	Operations	7	5	5	5	2	17.5
Pipe Repair (section) Gas-Out	Integrity						
Pipe Repair (section) Gas-In	Integrity						
Station Maintenance Gas-Out	Facilities Ops						
Station Maintenance Gas-In	Facilities Ops						
Vessel/Skid Maintenance Gas-Out	Operations						
Vessel/Skid Maintenance Gas-In	Operations						
Meter & Regulator Maintenance	M&R Ops	10	2	5	2	2	4
Pigging Operations	Integrity	10	2	2	5	5	10
Odorizer Operations	Operations	10	1	7	2	2	2.8
Valve Maintenance & Repair/Replace	Integrity						
Hot-Tapping & Tie-Ins	Construction						
Up-rating Projects	Engineering						
High-Bleed Replacement Programs	Environmental						
LDAR Repair Projects	Environmental						
Double-Block & Bleed Operations	Operations						
...							
Your company list continues...							
We recommend running a search on various keywords within your operations manual:							
"Blowdown, vent, venting, depressurize, purge, sweep, release, flare, flaring, burn, combust, de-inventory, commission, decommission, etc."							

*	Frequency	Magnitude	Public	Company Culture	Safety
10	Daily Activity for Multiple People/Groups	Environmental Permit	Permits Required	Direct Opposition of Leadership Message	Unacceptable Risk w/ Venting
7	Regular Activity for Multiple People/Groups	Environmental Reporting Required	Notifications Required / Complaints Expected	Counter Intuitive to Leadership Message	High Risk w/ Venting
5	Occasional for 1 or more people/groups	Courtesy Reporting (LUAF gas, etc.)	Courtesy Notifications	Counterproductive to HSE Goals	LowxMed or MedxLow
2	Seldom Activity for 1 or more people/groups	No Calculation of Volume	No Notifications	SOP Indirect to HSE Goals	LowxLow Risk
1	Rare (<6 events /year)	No Release	Not Noticeable	SOP supports HSE & Leadership Goals	No Risk w/ Venting

METHANE VENTING PROGRAM - A PATH FROM NOW to ZERO TPE MIDSTREAM LLC & Campos EPC | November 30, 2020



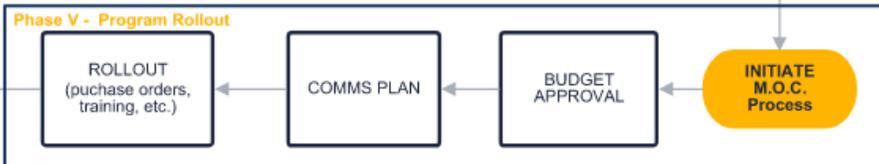
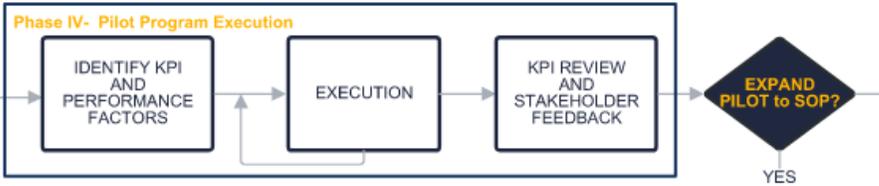
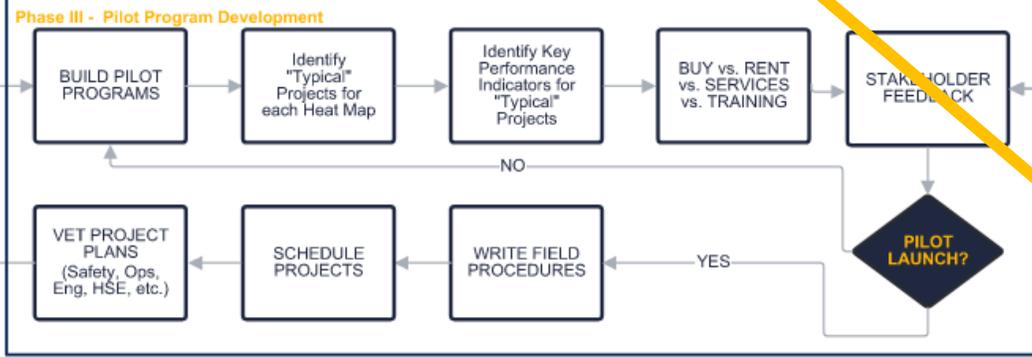
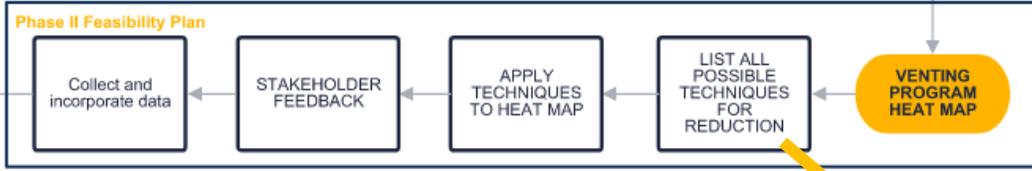
IMPACT-BASED APPROACH



METHANE VENTING PROGRAM - A PATH FROM NOW to ZERO
TPE MIDSTREAM LLC | November 18, 2020

Application	Func. Grp in Charge	Frequency*	Magnitude*	Public	Company Culture	Safety	SCORE/100
New Pipe Gas-In	Construction	7	5	5	5	2	17.5
New Station Gas-In	Engineering	5	5	5	5	2	12.5
New Vessel/Skid Gas-In	Operations	2	5	2	5	2	2
New Customer/Meter Gas-In	Operations	10	2	5	2	2	4
Pipe Retirement (whole line) Gas-Out	Engineering	7	7	5	5	5	61.25
Pipe Retirement (section) Gas-Out	Operations	7	5	5	5	2	17.5
Pipe Repair (section) Gas-Out	Integrity						
Pipe Repair (section) Gas-In	Integrity						
Station Maintenance Gas-Out	Facilities Ops						
Station Maintenance Gas-In	Facilities Ops						
Vessel/Skid Maintenance Gas-Out	Operations						
Vessel/Skid Maintenance Gas-In	Operations						
Meter & Regulator Maintenance	M&R Ops	10	2	5	2	2	4
Pigging Operations	Integrity	10	7	2	5	5	18
Odorizer Operations	Operations	10	1	7	2	2	2.8
Valve Maintenance & Repair/Replace	Integrity						
Hot-Tapping & Tie-Ins	Construction						
Up-rating Projects	Engineering						
High-Bleed Replacement Programs	Environmental						
LDAR Repair Projects	Environmental						
Double-Block & Bleed Operations	Operations						

Frequency	Magnitude	Public	Company Culture	Safety	
10	Daily Activity for Multiple Assets/Groups	Environmental Permit	Permits Required	Direct Opposition of Leadership Message	Unacceptable Risk of Venting
7	Regular Activity for Multiple Assets/Groups	Environmental Reporting Required	Compliance Critical	Customer Walk-in to Leadership Message	High Risk w/ training
5	Occasional for 2 or more assets/groups	Country Reporting (LDAR, etc.)	Country Notifications	Contribution to HSE Goals	Limited/Low Risk
2	Sublim Activity for 1 or more assets/groups	No Calculation of volume	No Notifications	SOP Inherent to HSE Goals	Lowest/Low Risk
1	Rare (not events level)	No Release	Not Notifiable	SOP Supports HSE & Leadership Goals	No Risk w/ training



After Year 5 Any remaining venting will be budgeted for offset

ANNOUNCEMENT
"We are eliminating venting & flaring from applications"

METHANE VENTING PROGRAM - A PATH FROM NOW to ZERO

TPE MIDSTREAM LLC | November 18, 2020

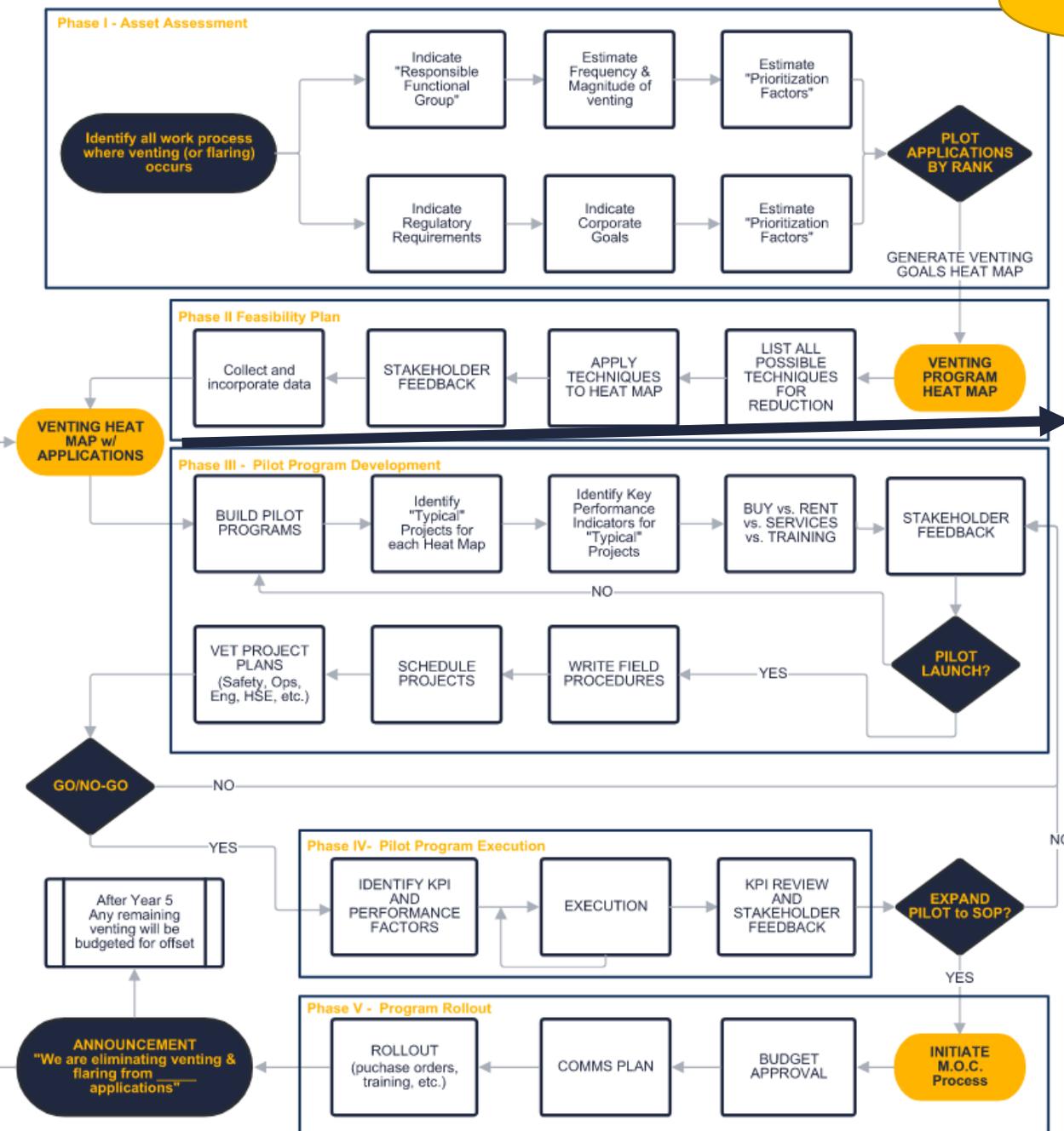
Application	Func. Grp in Charge	A	B	C	D	E	F
		Less Occurances	Less Volume	Less Pressure	Flaring	ZEVAC	Silencer / Deodorizer
New Pipe Gas-In	Construction					✓	
New Station Gas-In	Engineering					✓	
New Vessel/Skid Gas-In	Operations					✓	
New Customer/Meter Gas-In	Operations			✓		✓	
Pipe Retirement (whole line) Gas-Out	Engineering		✓	✓	✓	✓	
Pipe Retirement (section) Gas-Out	Operations			✓	✓	✓	
Pipe Repair (section) Gas-Out	Integrity		✓	✓	✓	✓	
Pipe Repair (section) Gas-In	Integrity				✓	✓	
Station Maintenance Gas-Out	Facilities Ops		✓	✓	✓	✓	
Station Maintenance Gas-In	Facilities Ops				✓	✓	
Vessel/Skid Maintenance Gas-Out	Operations			✓	✓	✓	
Vessel/Skid Maintenance Gas-In	Operations				✓	✓	
Meter & Regulator Maintenance	M&R Ops					✓	✓
Pigging Operations	Integrity					✓	✓
Odorizer Operations	Operations					✓	✓
Valve Maintenance & Repair/Replace	Integrity					✓	✓
Hot-Tapping & Tie-Ins	Construction	✓			✓	✓	
Up-rating Projects	Engineering	✓		✓	✓	✓	
High-Bleed Replacement Programs	Environmental	✓				✓	
LDAR Repair Projects	Environmental	✓				✓	✓
Double-Block & Bleed Operations	Operations					✓	✓



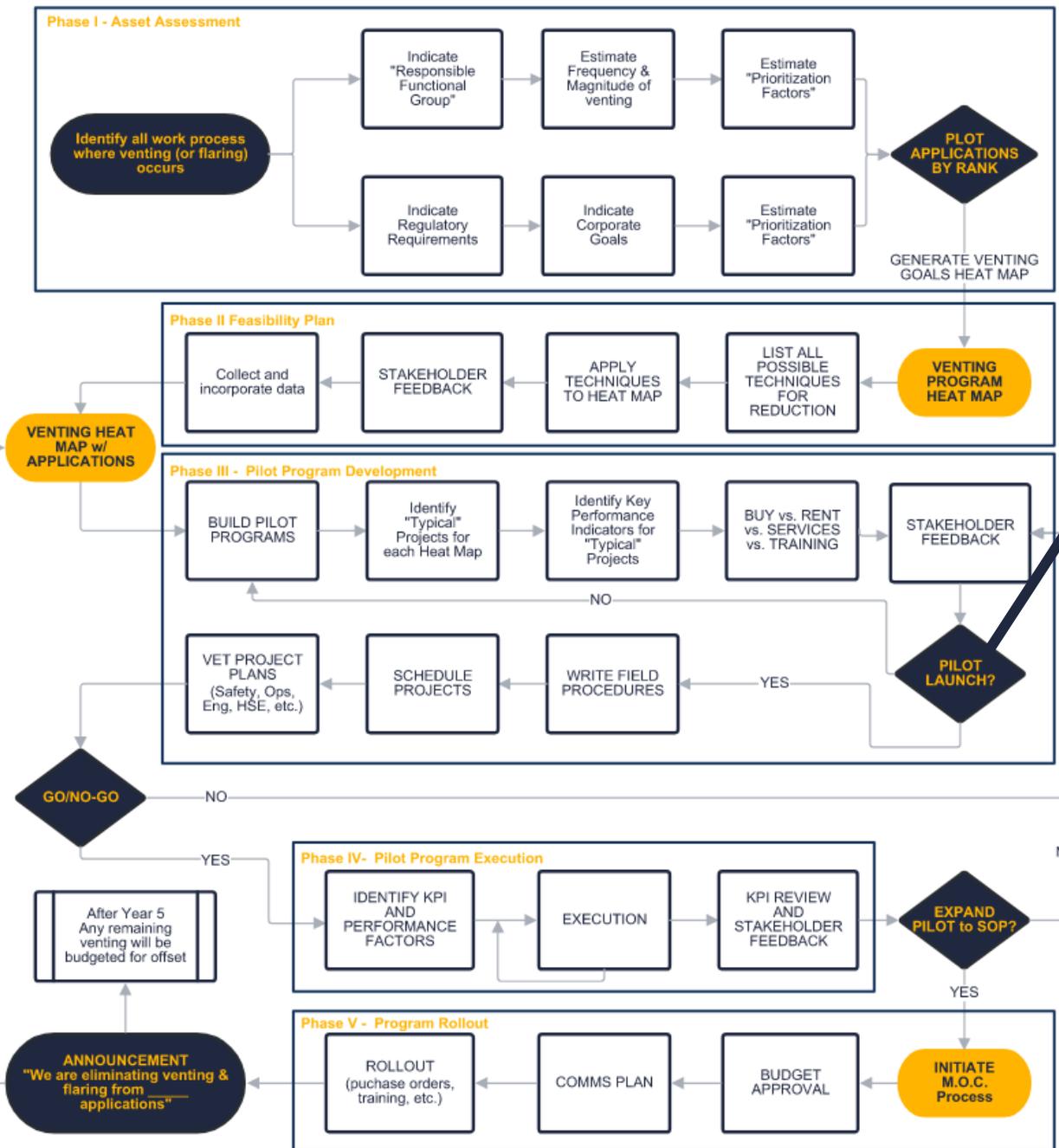
PILOT PROGRAM GOALS

FULL PROGRAMS

IMPACT-BASED APPROACH



GROUP	1 Year Impact Goal	2 Year Impact Goal	3 Year Impact Goal	4 Year Impact Goal	5 Year Impact Goal
Top 20% of Scores	50% Score Reduction	75%	90%	95%	99%+
60-80th Percentile	25%	50%	75%	90%	95%+
40-60th Percentile	10%	25%	50%	75%	90%+
20-40th Percentile	5%	10%	25%	50%	75%
Bottom 20% of Scores	5%	10%	25%	50%	75%



❑ Select Case-Study Projects:

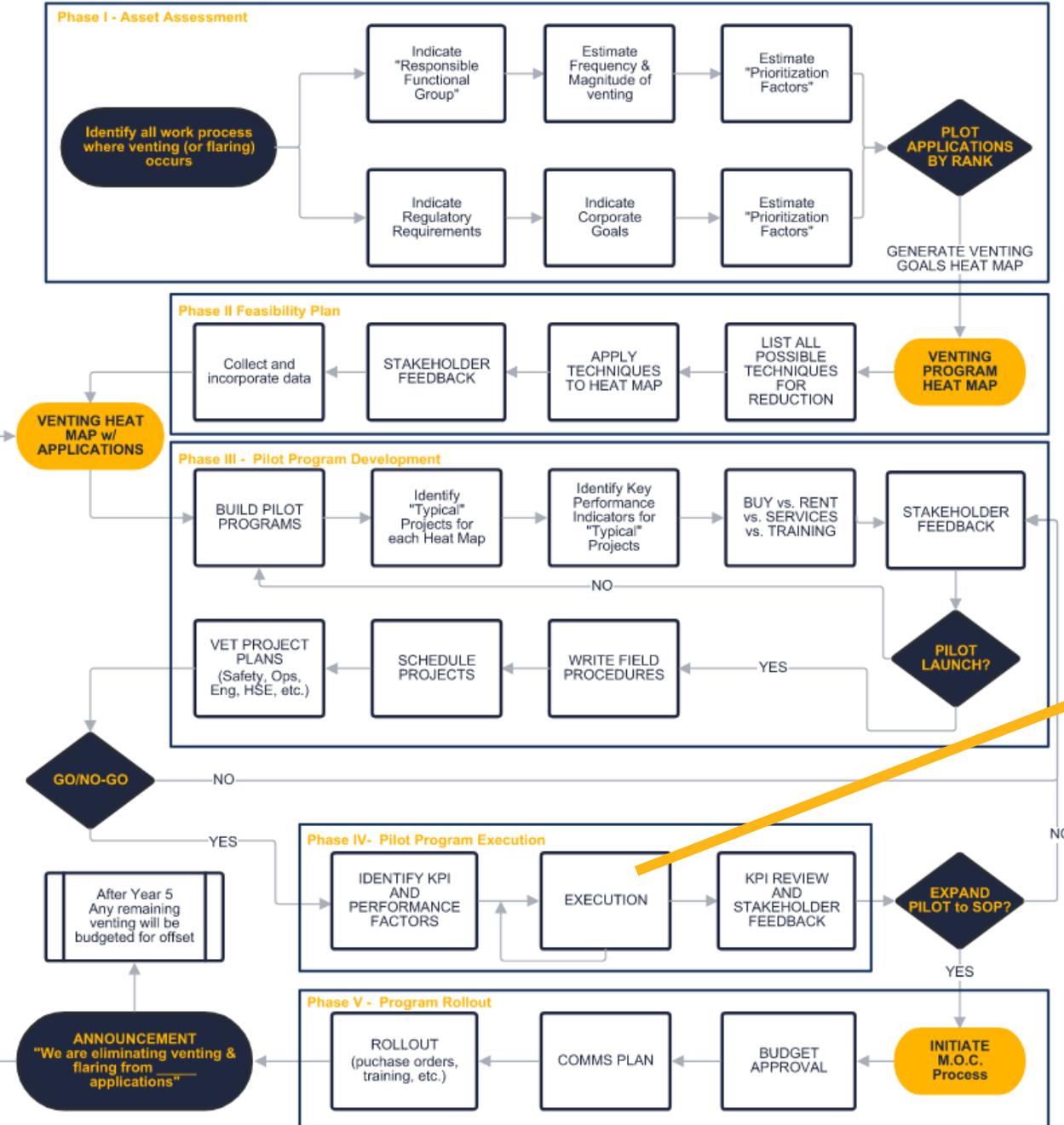
- Pipeline Cleaning & Inline Inspection
- Line Tap & Stop Cutout Repair
- Blowdowns
- Gas Plant / Compressor Station Maintenance Blowdown
- Gas-Out Abandonment / Gas-In New Construction
- Valve Replacements

- ❑ Identify KPI's
- ❑ Procedure Development
- ❑ Operation & Procedures Training
- ❑ Guided Procurement of Equipment
- ❑ In-Field Data Collection
- ❑ Compile Impact Reports and ROI & Benefits
- ❑ Provide Recommended Action Plan
- ❑ Alignment with ESG / SMS Goals
- ❑ Full Programmatic Implementation

METHANE VENTING PROGRAM - A PATH FROM NOW to ZERO
TPE MIDSTREAM LLC & Campos EPC | November 30, 2020



IMPACT-BASED APPROACH



Why Focus on Venting?

Impact-Based Approach

ZEVAC

Proven ROI

Zero Emission Vacuum And Compressor



ZEVAC is a **TOOL** that transfers **GAS & LIQUIDS** (that would otherwise be vented).

Learn More
www.TPEMidstream.com/ZEVAC

How ZEVAC works.

- Pigging**
Launching and receiving pigs, for integrity management or wet gas gathering, involves venting methane twice, for every pig run.
- Butane & NGLs**
Venting VOC products is heavily regulated and at times illegal. Flaring is slow, dangerous, wasteful and attracts negative publicity. ZEVAC-Q can help.
- Hot Tapping**
Hot tapping and stopping for line repairs, tie-ins, and maintenance involves venting methane, a powerful greenhouse gas. ZEVAC can eliminate these emissions.

UPSTREAM (Production)

Flowback Temporary Equipment Vessel Maintenance Separator Maintenance

GAS GATHERING & NGLs

Launcher & Receiver Operations Valve Maintenance Timing Meter Maintenance

STORAGE

Injection Compressor Maintenance

GAS TREATMENT & PRO

Vessel Maintenance Valve Maintenance

TRANSMISSION

Compressor Units Vessel Maintenance Station Maintenance Integrity Inspections

METERING & REGULATION

Meter Blowdowns Filter Changes Separator Inspections

DISTRIBUTION

Line Replacement Purge-less Vacuum Commissioning Line Abandonment Odorizing

The % cost added for zero venting is negligible



ZEVAC

Instant Impact. Sustainable Returns.

TPE



“Our field crews embraced ZEVAC for the ease of operation and fit with our main stop-off procedures. ZEVAC is a must have for the natural gas industry to reduce methane emissions associated with main replacement and ensure a sustainable future.”



Rick Trieste, Manager Research,
Development & Demonstration;
Consolidated Edison of NY



2,000,000 scf natural gas / year

	Potential Emissions (tons CO2e)	Carbon Offset (\$40/mTCO2e)	ZEVAC	
1	1196	\$ 47,840	\$ 54,600	
2	1196	\$ 47,840	\$ 54,600	
3	1196	\$ 47,840	\$ 54,600	
4	1196	\$ 47,840	\$ 54,600	
5	1196	\$ 47,840	\$ 54,600	
6	1196	\$ 47,840	\$ 54,600	
7	1196	\$ 47,840	\$ 54,600	
8	1196	\$ 47,840	\$ 19,600	
9	1196	\$ 47,840	\$ 19,600	
10	1196	\$ 47,840	\$ 19,600	
TOTAL	11960	\$ 478,400	\$441,000	10 year total abatement cost
		\$ 40.00	\$ 36.87	Abatement cost / mTCO2e
	13 miles of 12" pipe @ 500 psi		\$ (5.02)	Value of Product Saved (\$3/mscf)
	or		\$ 31.86	NET abatement cost / mTCO2e
	9 miles of 30" pipe @ 100 psi			Value of Safety
	or			Value of Culture Alignment
	175x 40' pieces of 18" pipe @ 1250 psi			Value of Positive PR
			\$ 25-30	NET-NET abatement cost / mTCO2e

Why Focus on Venting?

Impact-Based Approach

ZEVAC

Proven ROI

10,000,000 scf natural gas / year

	Potential Emissions (tons CO2e)	Carbon Offset (\$40/mTCO2e)	2x ZEVAC	
1	5980	\$ 239,200	\$ 109,200	
2	5980	\$ 239,200	\$ 109,200	
3	5980	\$ 239,200	\$ 109,200	
4	5980	\$ 239,200	\$ 109,200	
5	5980	\$ 239,200	\$ 109,200	
6	5980	\$ 239,200	\$ 109,200	
7	5980	\$ 239,200	\$ 109,200	
8	5980	\$ 239,200	\$ 39,200	
9	5980	\$ 239,200	\$ 39,200	
10	5980	\$ 239,200	\$ 39,200	
TOTAL	59,800	\$ 2,239,200	\$ 882,000	10 year total abatement cost
		\$ 40.00	\$ 14.75	Abatement cost / mTCO2e
	65 miles of 12" pipe @ 500 psi		\$ (5.02)	Value of Product Saved (\$3/mscf)
	or		\$ 9.73	NET abatement cost / mTCO2e
	45 miles of 30" pipe @ 100 psi			Value of Safety
	or			Value of Culture Alignment
	875x 40' pieces of 18" pipe @ 1250 psi			Value of Positive PR
			\$ 8 - 9	NET - NET abatement cost / mTCO2e

Why Focus on Venting?

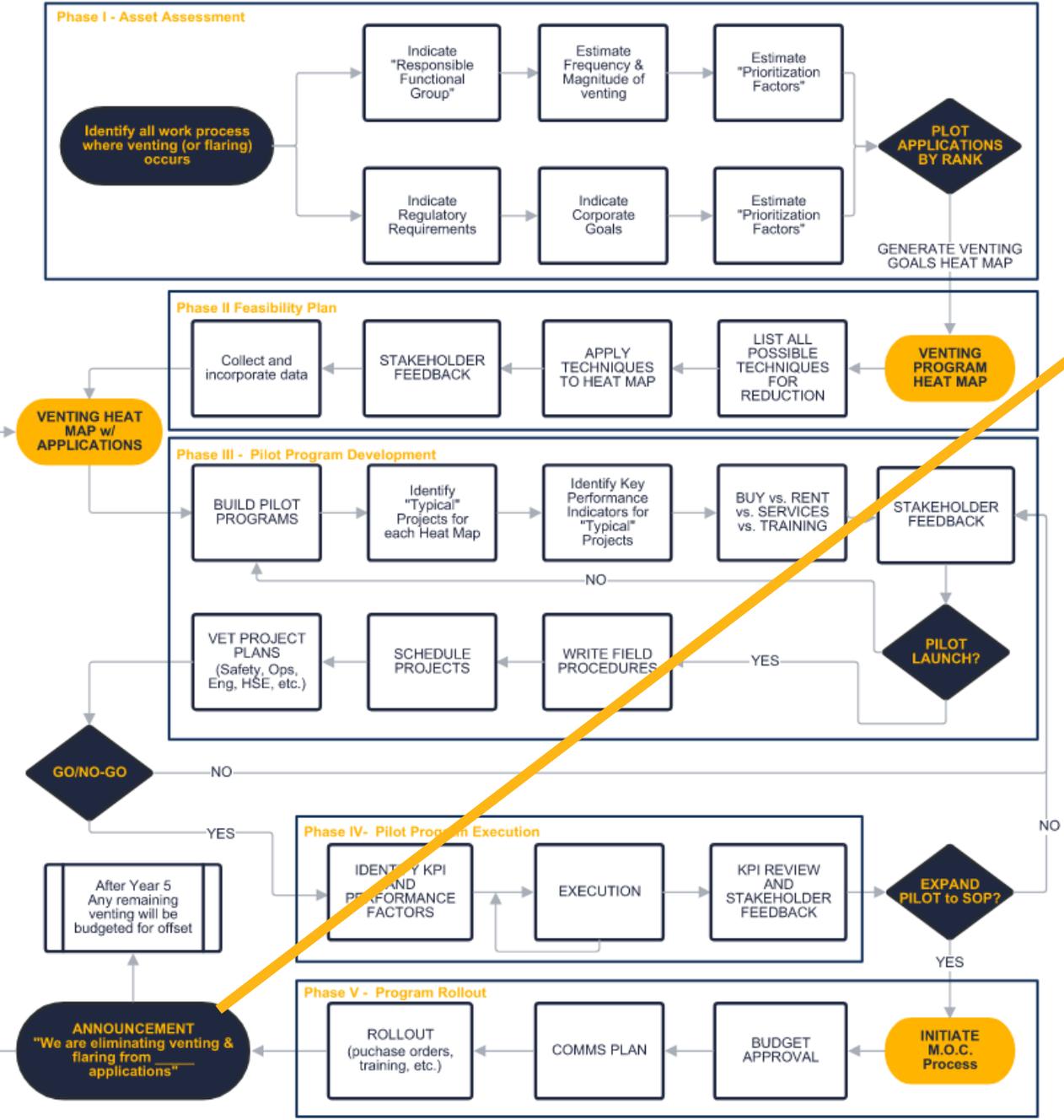
Impact-Based Approach

ZEVAC

Proven ROI

VERY LOW ABATEMENT COSTS CAN BE ACHIEVED BY USING MOBILE TOOLS TO CAPTURE VENT GAS AT THE SOURCE

KEY DRIVERS ARE:
High Tool Utilization, Limited # Assets (mobile vs per-facility)



INSTANT IMPACT

- PROVEN SOLUTION
- AVAILABLE EQUIPMENT
- SHORT LEAD TIMES (2 weeks plus shipping)
- FAST USER TRAINING & RAMP-UP
- TURNKEY MAINTENANCE & SUPPORT
- ZEVAC Services, Sales, Rental, Leasing
- **1st Use Public Relations Opportunity**
- **1st Use ESG Report Opportunity**



- Capital Recovered with Emissions Abatement
- O&M Recovered with Product Savings
- Improved Jobsite Safety
- **Avoid Carbon Pricing Uncertainty**
- **Avoid Legal/Regulatory Uncertainty**
- Align Operations and Operations Culture

SUSTAINABLE RETURNS

About ZEVAC & TPE

- Founded in 2014, Privately Owned
- Headquarters in **Tulsa, OK** with 5 offices across the USA
- Pipeline Equipment Rental
- Continuous **innovation in our DNA**
- ZEVAC for blowdown abatement, invented in 2017
- ZEVAC now supports an estimated **10,000 blowdowns annually**
- Manufacturing, Training, and Maintenance across US and Canada
- ZEVAC is the trusted equipment for methane blowdowns in gathering, transmission, facilities, storage, and distribution.
- **ZEVAC Services, Sales, Rental**

Learn More
www.TPEMidstream.com/ZEVAC



How ZEVAC works.

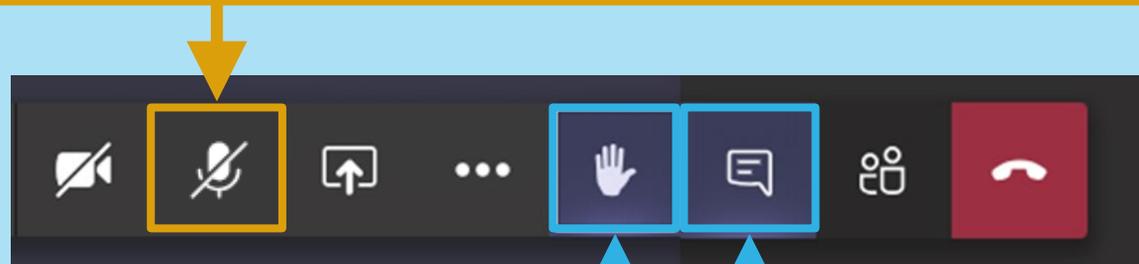
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Question and Answer

Mute your microphone.

- Everyone should set the microphone to mute unless actively speaking.
- If participating by phone, press *6 to mute your phone.



If available, use the “Raise your hand” button to be called upon to speak.

Or, enter questions using the “Chat” pane. Type “Raise My Hand” to be called upon to speak.

Help!

Need Help?

If you need help, please send an email to asg@globalmethane.org

Wrap Up

Oil & Gas Subcommittee Webinar: Methane Emissions Mitigation – Technology and Innovation



13 January 2021

- A recording of today's Subcommittee meeting and this presentation will be posted on the GMI website soon

Reminder



We welcome your feedback!
We encourage you to share suggestions by email to asg@globalmethane.org.

Stay Tuned - Upcoming Webinars

- Based on the feedback during the October 28 O&G Subcommittee meeting, we are planning additional webinars for February and March 2021 to cover the following topics:
 1. Marginal abatement cost (MAC) curves for methane emission abatement technologies
 2. Cost-effective leak detection and repair programs
 3. Emerging policies for reducing methane emissions
 4. Global carbon offset programs

Thank you for participating today



See you at the next webinar!