International Association of Oil & Gas Producers

50 Years 1974-2024

Industry aids to reduce flaring and methane

University of Brunel, London 17th SEEP Conference

Dr Faye Gerrard

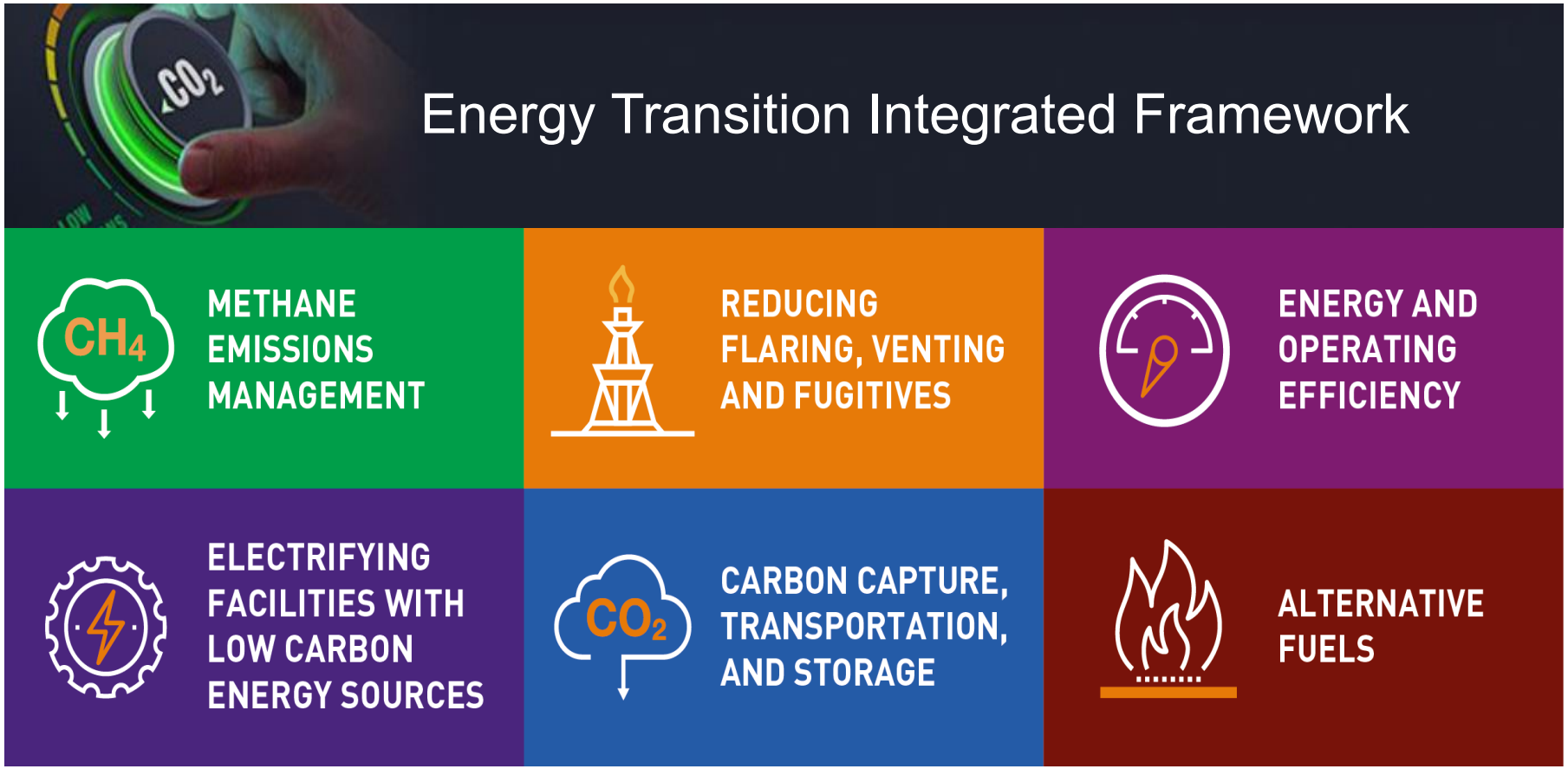
29 July 2025

Agenda

- Opening remarks/Introduction
- Energy Transition Integrated Framework toolkit
- Flaring & Venting publications
- Methane emissions detection and quantification technologies filtering tool
- Final Q&A
- Closing

Energy Transition Integrated Framework

IOGP Energy Transition Integrated Framework



Energy Transition Integrated Framework tool

Explore the different decarbonization solutions and approaches

Go to tool

IOGP Energy Transition Integrated Framework

METHANE EMISSIONS MANAGEMENT | REDUCING FLARING, VENTING AND FUGITIVES | ENERGY AND OPERATING EFFICIENCY

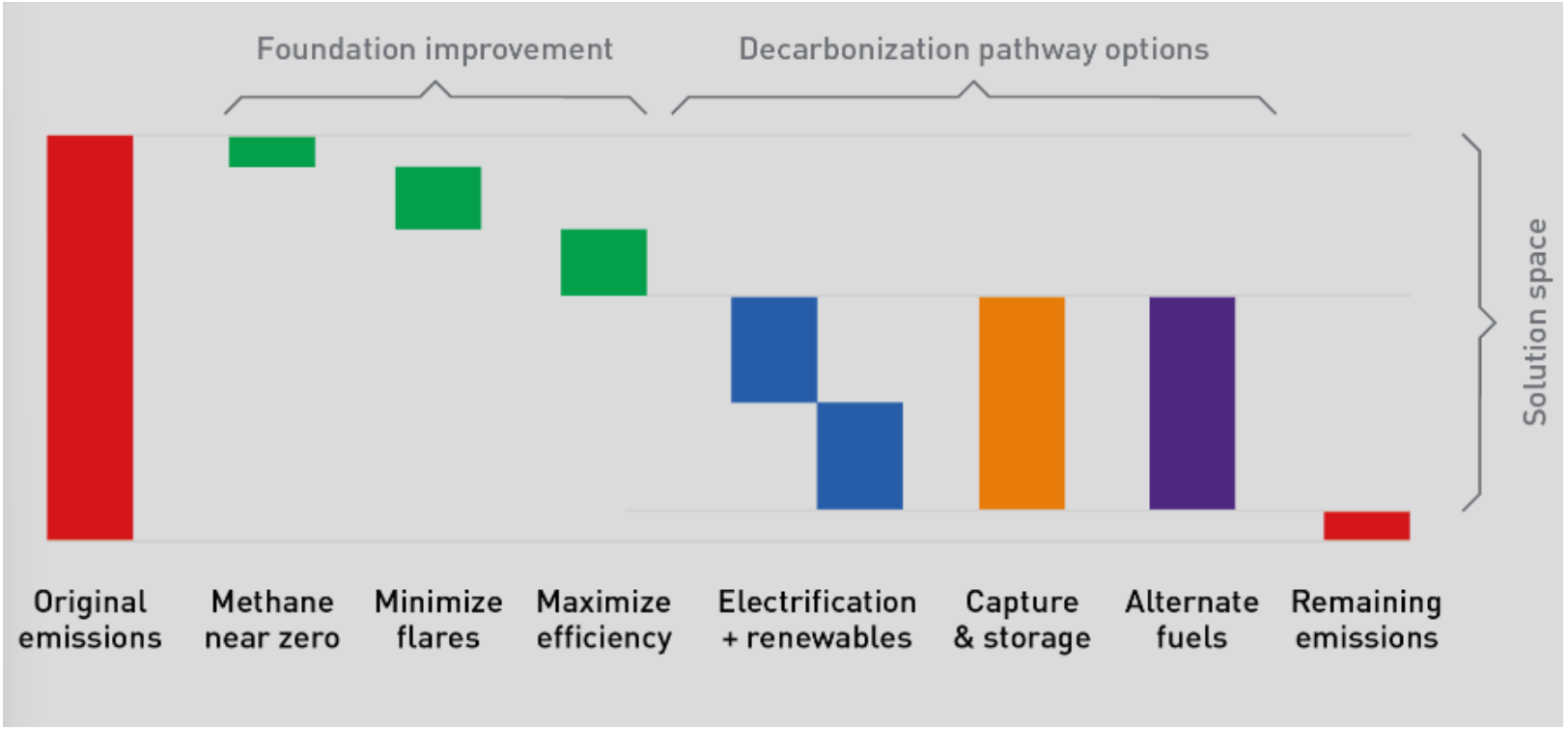
Foundation

Themes support sound operation of oil and gas production in terms of methane, flaring, venting and operating efficiency performance and link to specific aspirations outlined in various global forums and international organization commitments.

ELECTRIFYING FACILITIES WITH LOW CARBON ENERGY SOURCES | CARBON CAPTURE, TRANSPORTATION, AND STORAGE | ALTERNATIVE FUELS

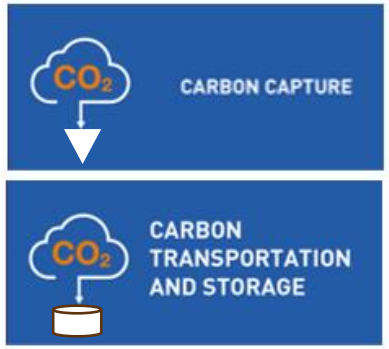
Decarbonization

Themes support decarbonization planning and operational performance with deep levers for reducing greenhouse gas emissions, encompassing electrification, carbon capture transportation and storage, and alternate fuels (e.g.: hydrogen)



Publications and Toolkit

Energy Transition Directorate

COMMITTEE	 38 Members	 38 Members
EXPERT GROUP	 160+ SMEs	 80+ SMEs

Energy Transition Integrated Framework - Tool

Welcome to the Energy Transition Integrated Framework

This comprehensive resource will guide upstream oil and gas organizations travelling the road to decarbonization, providing a holistic usage guide with different decarbonization solutions and approaches to the vast diversity of operational settings across the industry.

The Integrated Framework

GHG abatement solutions and low carbon workstreams have been integrated into an Energy Transition Integrated Framework to guide, prioritizes, and promote efficiency and mitigation efforts, aiming to reduce the carbon footprint of oil and gas facilities and operations.

The purpose of the framework is to create one source of information to aid the implementation of the IOGP Energy Transition Toolkit.

What the framework includes

- upstream scope 1 and 2 emissions (directly within industry control)
- scope 1 and 2 full range technical solutions
- IOGP ET Publications
- select external resources (OGCI, Ipieca, and others).
- best practices and best available technologies

What the framework excludes

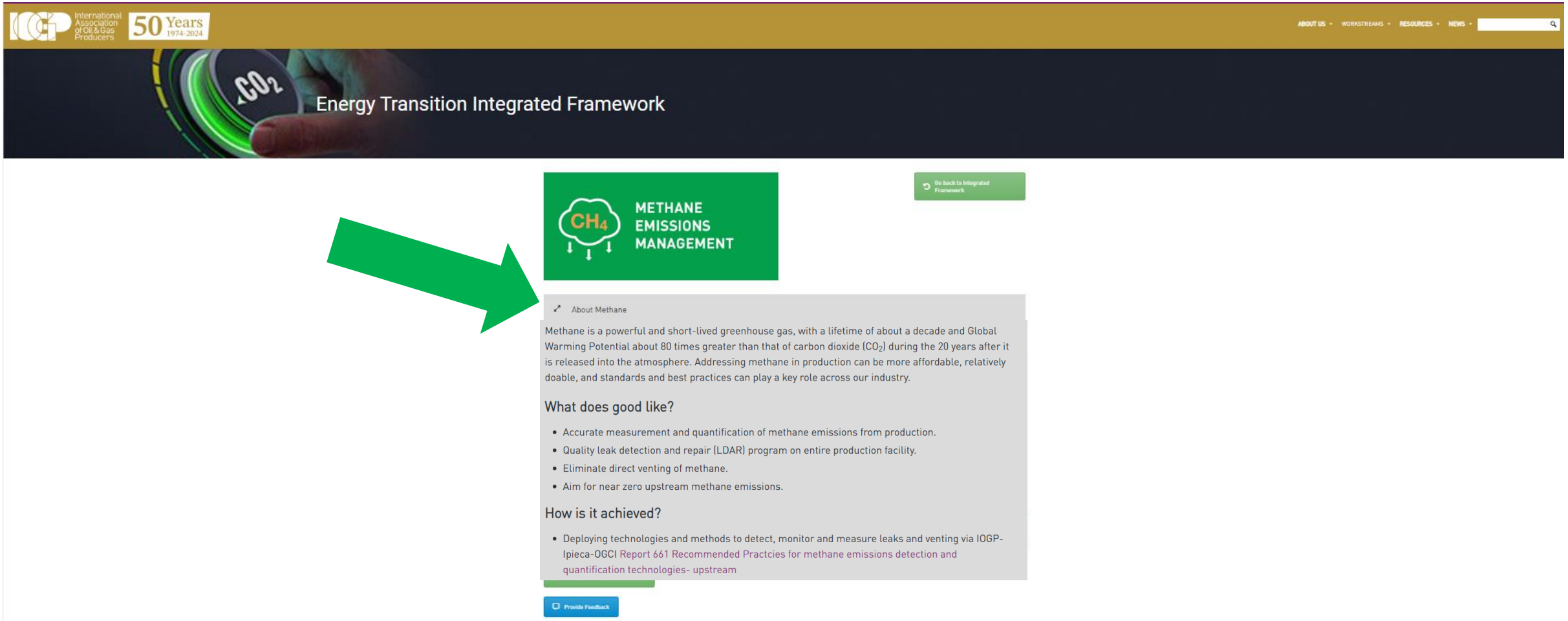
- economics, commercial, and decision criteria
- scope 3 emissions
- pure greenfield renewable energy projects connected to the grid (integrated "behind-the-meter" renewable projects within upstream facilities are still within scope)
- offset mechanisms (including nature-based solutions)

The Framework places technical focus areas into two main groupings: Foundation and Decarbonization.

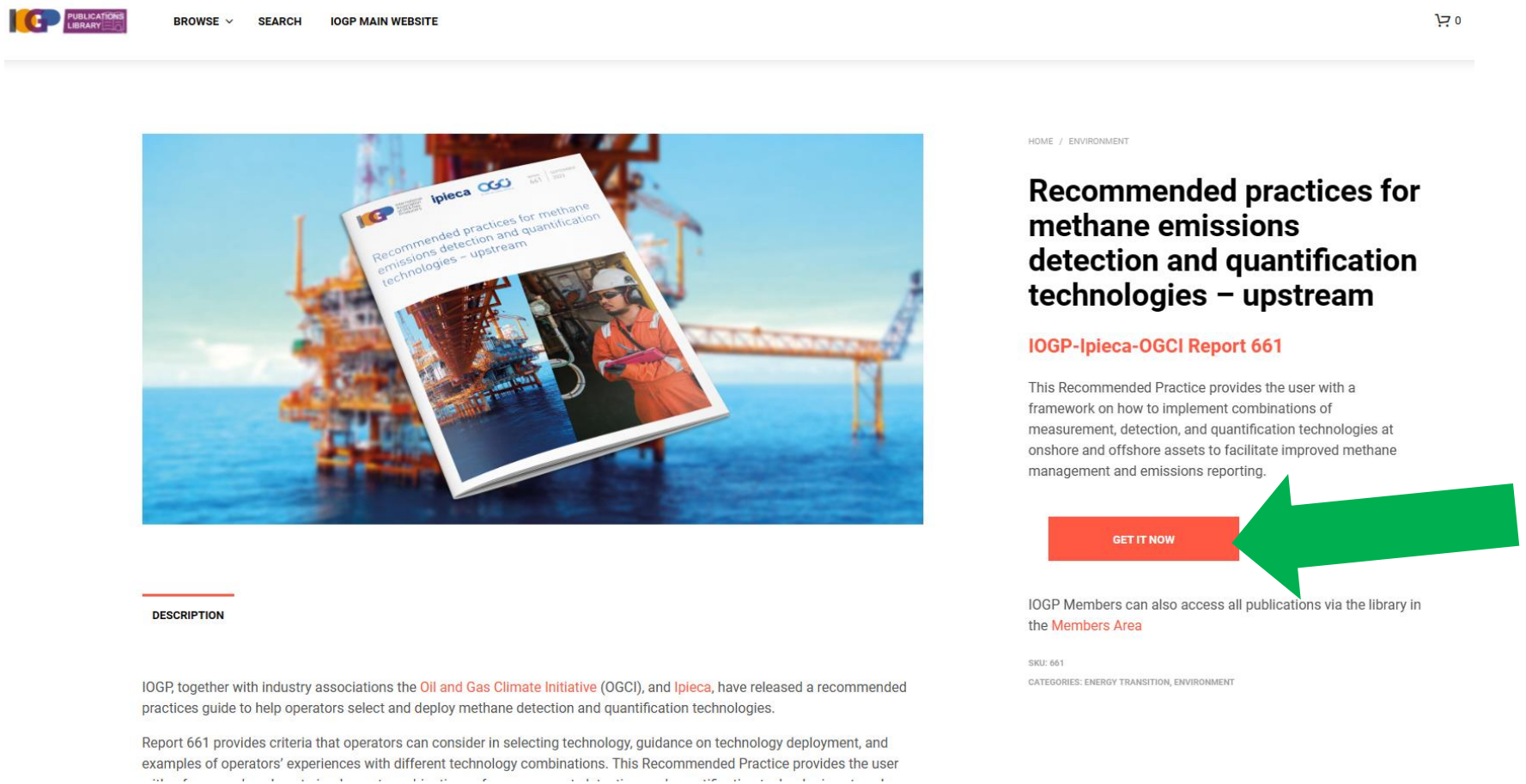
Foundation support sound operation of oil and gas production in terms of methane, flaring and venting, and operating efficiency performance and link to specific aspirations outlined in various global forums and international organization commitments.

publications from other organizations, including OGCI and Ipieca.

Energy Transition Integrated Framework - Tool



Energy Transition Integrated Framework - Tool



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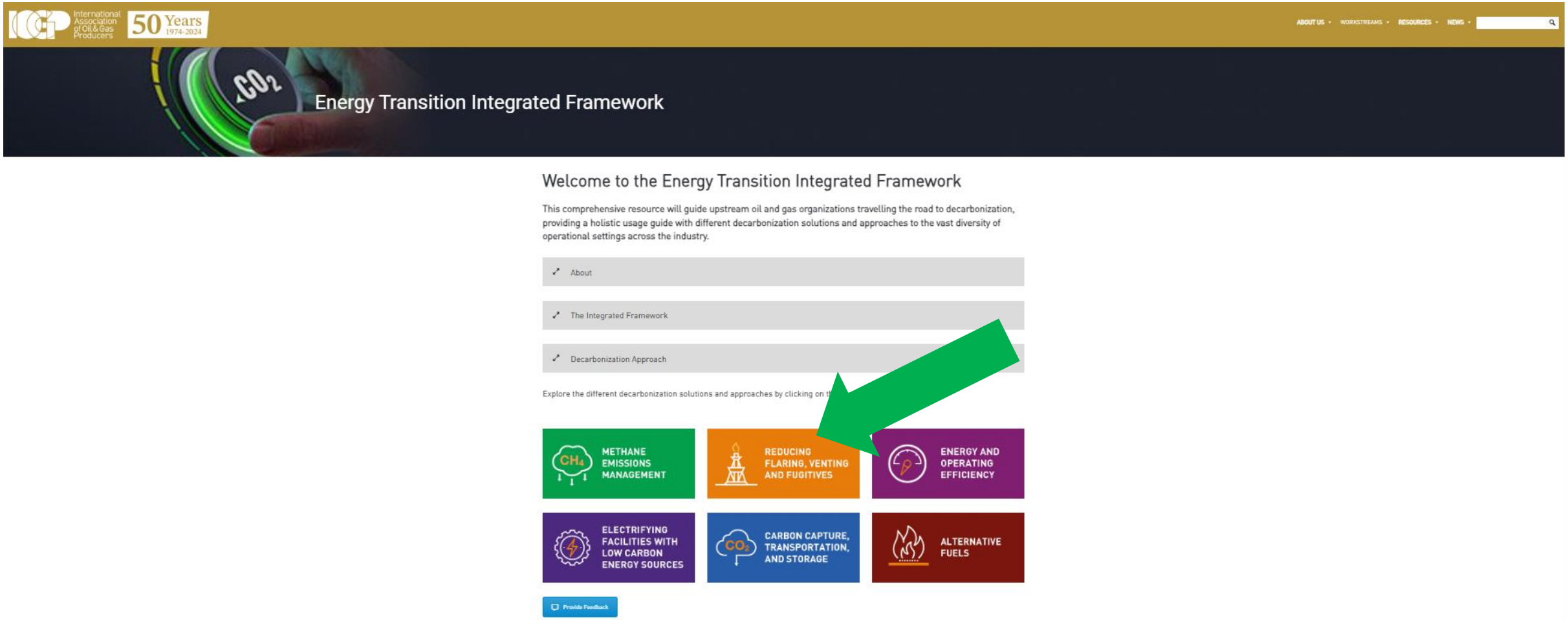

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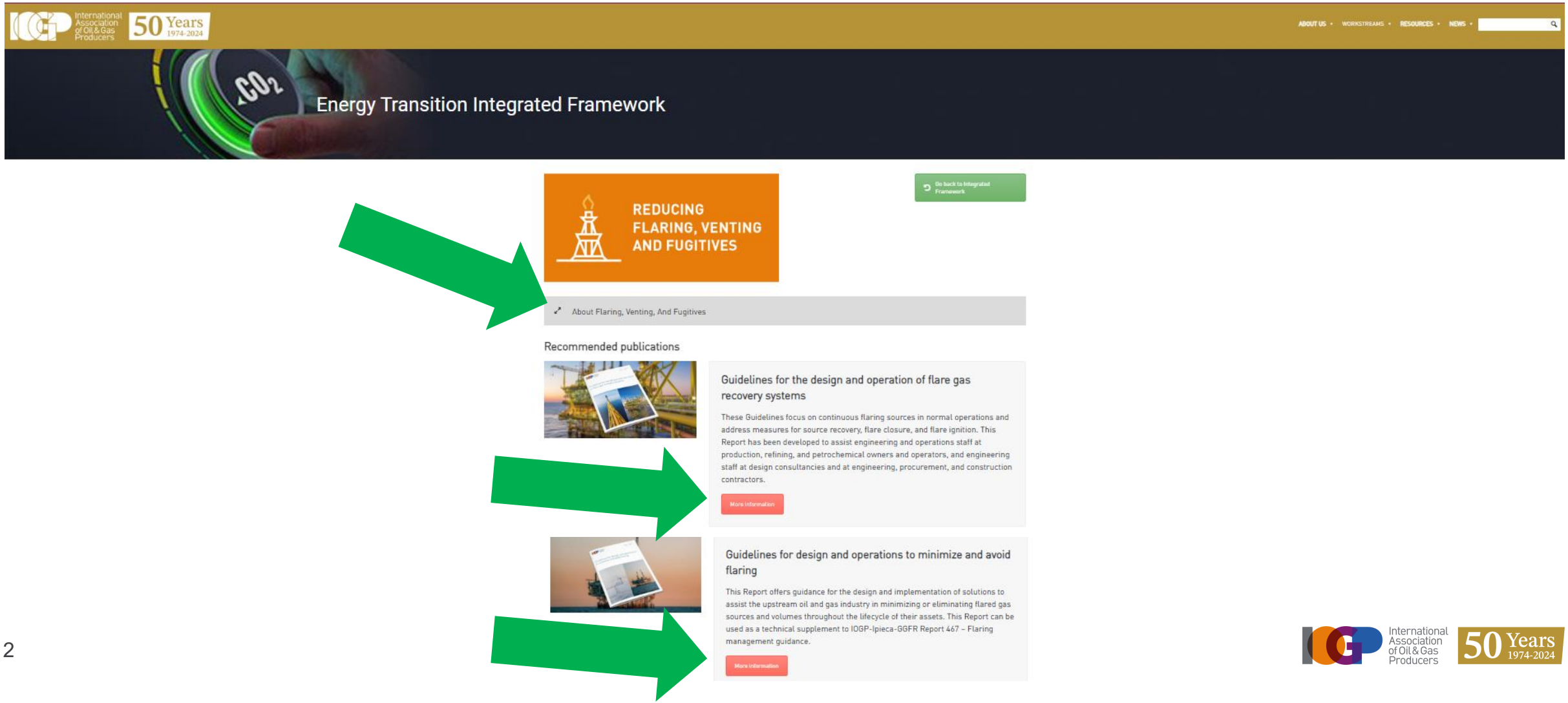
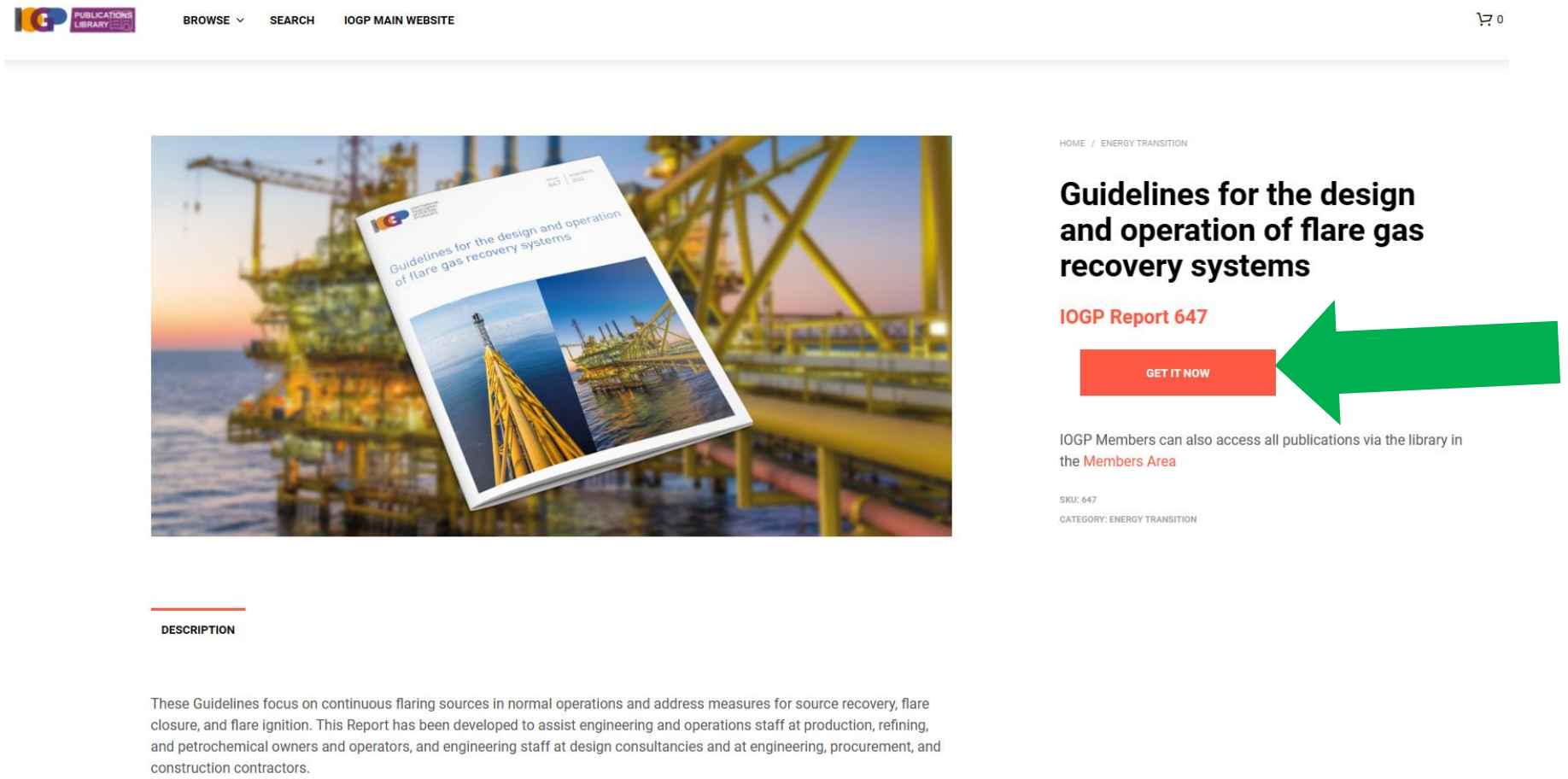


Energy Transition Integrated Framework - Tool



Energy Transition CCS Publications

Gap analysis of standards and guides for carbon capture, transport, and storage

Report 652
Recommended practices for measurement, monitoring, and verification plans associated with geologic storage of carbon dioxide

Report 657

Seabed and overburden integrity monitoring for offshore CO_2 storage

Report 665

Design guidance for subsea carbon capture and storage systems

Report 670

Risk and uncertainty assessments for geologic storage of CO_2

Report 671

Techno-economic methodology to assess carbon capture technologies

Report 672

Overview of lifecycle assessment for carbon capture and storage projects

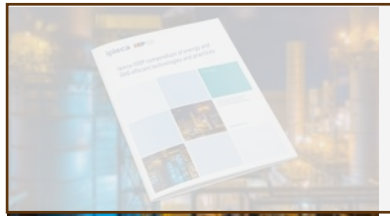
Energy Transition LCOE Publications

Report 647
Guidelines for the design and operation of flare gas recovery systems

Report 661
Recommended practices for methane emissions detection and quantification technologies – upstream

Report 653
Recommended practices for electrification of oil and gas facilities

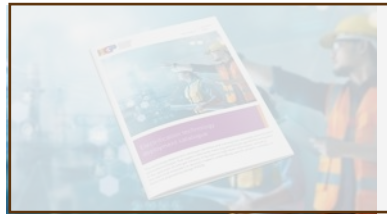
Electrification Projects Lessons Learned
(IOGP Member only)



Update of IOGP-Ipieca Energy Efficiency Compendium

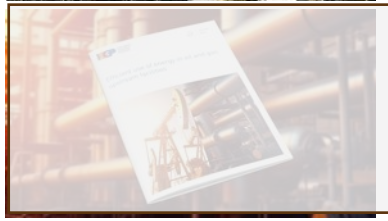
Report 673
Guidelines for design and operation to minimize/avoid flaring sources

Report 675
Guidelines for venting minimization and vent recovery systems



Technology Deployment Catalogue

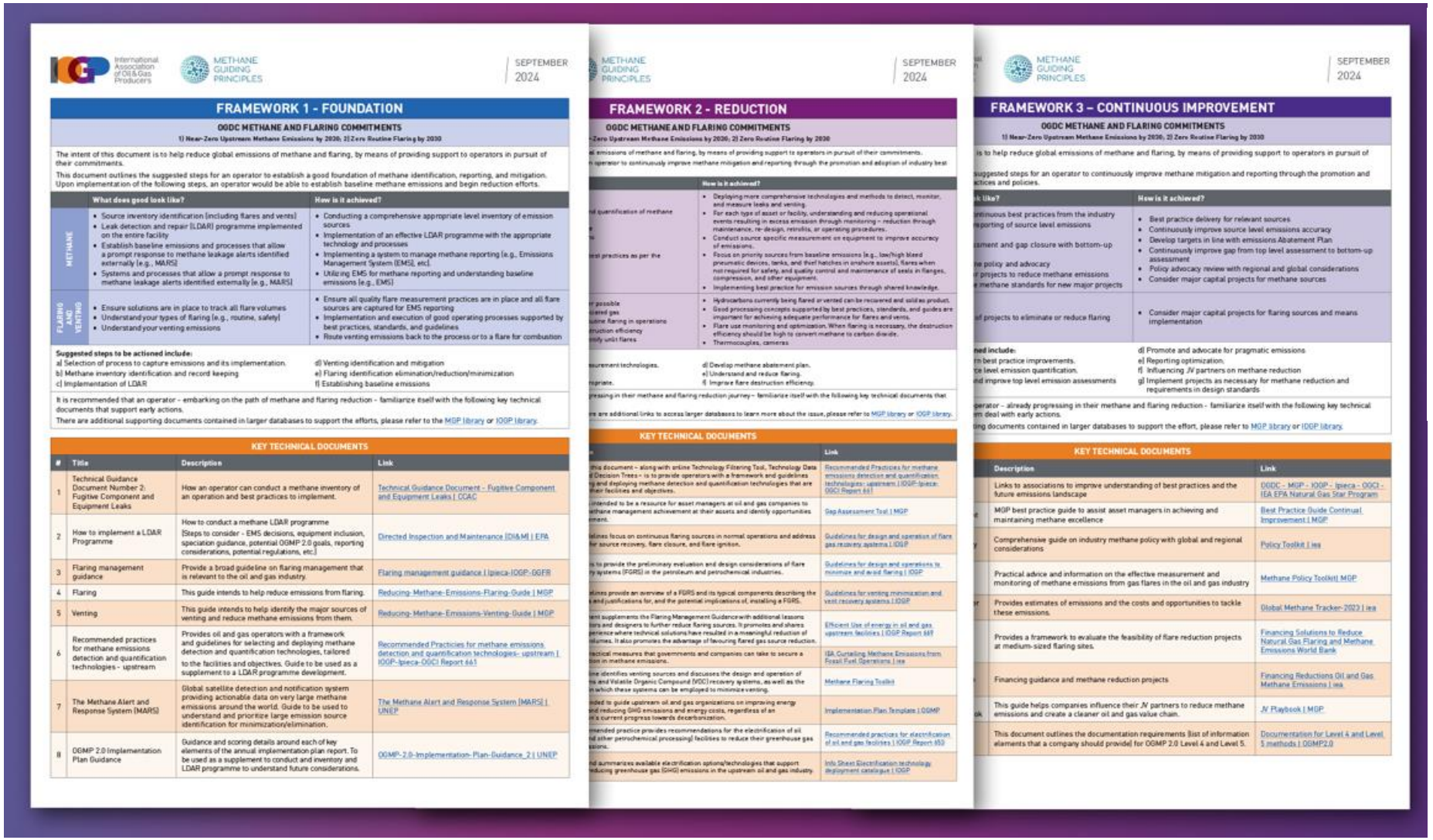
Energy Efficiency Projects Lessons Learned
(IOGP Member only)



Report 669
Efficient Use of energy in oil and gas upstream facilities

OGDC Framework

Eliminating routine flaring and reducing methane emissions



FRAMEWORK 1 - FOUNDATION

OGDC METHANE AND FLARING COMMITMENTS

1) Near-Zero Upstream Methane Emissions by 2030; 2) Zero Routine Flaring by 2030

The intent of this document is to help reduce global emissions of methane and flaring, by means of providing support to operators in pursuit of their commitments.

This document outlines the suggested steps for an operator to establish a good foundation of methane identification, reporting, and mitigation. Upon implementation of the following steps, an operator would be able to establish baseline methane emissions and begin reduction efforts.

	What does good look like?	How is it achieved?
METHANE	• Source inventory identification (including flares and vents) • Leak detection and repair (LDAR) programme implemented on the entire facility • Establish baseline emissions and processes that allow a prompt response to methane leakage alerts identified externally (e.g., MARS) • Systems and processes that allow a prompt response to methane leakage alerts identified externally (e.g., MARS)	• Conducting a comprehensive appropriate level inventory of emission sources • Implementation of an effective LDAR programme with the appropriate technology and processes • Implementing a system to manage methane reporting (e.g., Emissions Management System (EMS), etc). • Utilizing EMS for methane reporting and understanding baseline emissions (e.g., EMS)
FLARING AND VENTING	• Ensure solutions are in place to track all flare volumes • Understand your types of flaring (e.g., routine, safety) • Understand your venting emissions	• Ensure all quality flare measurement practices are in place and all flare sources are captured for EMS reporting • Implementation and execution of good operating processes supported by best practices, standards, and guidelines • Route venting emissions back to the process or to a flare for combustion

Suggested steps to be actioned include:

a) Selection of process to capture emissions and its implementation
b) Methane inventory identification and record keeping
c) Implementation of LDAR
d) Venting identification and mitigation
e) Flaring identification elimination/reduction/minimization
f) Establishing baseline emissions

It is recommended that an operator - embarking on the path of methane and flaring reduction - familiarize itself with the following key technical documents that support early actions.

There are additional supporting documents contained in larger databases to support the efforts, please refer to the MGP library or IOGP library.

KEY TECHNICAL DOCUMENTS

#	Title	Description	Link
1	Technical Guidance Document Number 2: Fugitive Component and Equipment Leaks	How an operator can conduct a methane inventory of an operation and best practices to implement.	Technical Guidance Document - Fugitive Component and Equipment Leaks | CCAC
2	How to implement a LDAR Programme	How to conduct a methane LDAR programme [Steps to consider - EMS decisions, equipment inclusion, speciation guidance, potential OGMP 2.0 goals, reporting considerations, potential regulations, etc.]	Directed Inspection and Maintenance (DI&M) | EPA
3	Flaring management guidance	Provide a broad guideline on flaring management that is relevant to the oil and gas industry.	Flaring management guidance | Ipieca-IOGP-GGFR
4	Flaring	This guide intends to help reduce emissions from flaring.	Reducing-Methane-Emissions-Flaring-Guide | MGP
5	Venting	This guide intends to help identify the major sources of venting and reduce methane emissions from them.	Reducing-Methane-Emissions-Venting-Guide | MGP
6	Recommended practices for methane emissions detection and quantification technologies - upstream	Provides oil and gas operators with a framework and guidelines for selecting and deploying methane detection and quantification technologies, tailored to the facilities and objectives. Guide to be used as a supplement to a LDAR programme development.	Recommended Practicies for methane emissions detection and quantification technologies- upstream | IOGP-Ipieca-OGCI Report 661
7	The Methane Alert and Response System (MARS)	Global satellite detection and notification system providing actionable data on very large methane emissions around the world. Guide to be used to understand and prioritize large emission source identification for minimization/elimination.	The Methane Alert and Response System (MARS) | UNEP
8	OGMP 2.0 Implementation Plan Guidance	Guidance and scoring details around each of key elements of the annual implementation plan report. To be used as a supplement to conduct and inventory and LDAR programme to understand future considerations.	OGMP-2.0-Implementation-Plan-Guidance_2 | UNEP

FRAMEWORK 2 - REDUCTION

OGDC METHANE AND FLARING COMMITMENTS

-Zero Upstream Methane Emissions by 2030; 2) Zero Routine Flaring by 2030

	How is it achieved?
	• Deploying more comprehensive technologies and methods to detect, monitor, and measure leaks and venting. • For each type of asset or facility, understanding and reducing operational events resulting in excess emission through monitoring – reduction through maintenance, re-design, retrofits, or operating procedures. • Conduct source specific measurement on equipment to improve accuracy of emissions. • Focus on priority sources from baseline emissions (e.g., low/high bleed pneumatic devices, tanks, and thief hatches in onshore assets), flares when not required for safety, and quality control and maintenance of seals in flanges, compressors, and other equipment. • Implementing best practice for emission sources through shared knowledge.
	• Hydrocarbons currently being flared or vented can be recovered and sold as product. • Good processing concepts supported by best practices, standards, and guides are important for achieving adequate performance for flares and vents. • Flare use monitoring and optimization. When flaring is necessary, the destruction efficiency should be high to convert methane to carbon dioxide. • Thermocouples, cameras
	d) Develop methane abatement plan. e) Understand and reduce flaring. f) Improve flare destruction efficiency.

KEY TECHNICAL DOCUMENTS

	Link
	Recommended Practices for methane emissions detection and quantification technologies- upstream | IOGP-Ipieca-OGCI Report 661
	Gap Assessment Tool | MGP
	Guidelines for design and operation of flare gas recovery systems | IOGP
	Guidelines for design and operations to minimize and avoid flaring | IOGP
	Guidelines for venting minimization and vent recovery systems | IOGP
	Efficient Use of energy in oil and gas upstream facilities | IOGP Report 667
	IEA Curtailing Methane Emissions from Fossil Fuel Operations | iea
	Methane Flaring Toolkit
	Implementation Plan Template | OGMP
	Recommended practices for electrification of oil and gas facilities | IOGP Report 650
	Info Sheet Electrification technology deployment catalogue | IOGP

FRAMEWORK 3 – CONTINUOUS IMPROVEMENT

OGDC METHANE AND FLARING COMMITMENTS

1) Near-Zero Upstream Methane Emissions by 2030; 2) Zero Routine Flaring by 2030

is to help reduce global emissions of methane and flaring, by means of providing support to operators in pursuit of

suggested steps for an operator to continuously improve methane mitigation and reporting through the promotion and actices and policies.

k Like?	How is it achieved?
ntinuous best practices from the industry reporting of source level emissions sment and gap closure with bottom-up he policy and advocacy f projects to reduce methane emissions e methane standards for new major projects	• Best practice delivery for relevant sources • Continuously improve source level emissions accuracy • Develop targets in line with emissions Abatement Plan • Continuously improve gap from top level assessment to bottom-up assessment • Policy advocacy review with regional and global considerations • Consider major capital projects for methane sources
f projects to eliminate or reduce flaring	• Consider major capital projects for flaring sources and means implementation
ned include: m best practice improvements. ce level emission quantification. nd improve top level emission assessments	d) Promote and advocate for pragmatic emissions e) Reporting optimization. f) Influencing JV partners on methane reduction g) Implement projects as necessary for methane reduction and requirements in design standards

perator - already progressing in their methane and flaring reduction - familiarize itself with the following key technical m deal with early actions.

ng documents contained in larger databases to support the effort, please refer to MGP library or IOGP library.

KEY TECHNICAL DOCUMENTS

Description	Link
Links to associations to improve understanding of best practices and the future emissions landscape	OGDC - MGP - IOGP - Ipieca - OGCI - IEA EPA Natural Gas Star Program
MGP best practice guide to assist asset managers in achieving and maintaining methane excellence	Best Practice Guide Continual Improvement | MGP
Comprehensive guide on industry methane policy with global and regional considerations	Policy Toolkit | iea
Practical advice and information on the effective measurement and monitoring of methane emissions from gas flares in the oil and gas industry	Methane Policy Toolkit| MGP
Provides estimates of emissions and the costs and opportunities to tackle these emissions.	Global Methane Tracker-2023 | iea
Provides a framework to evaluate the feasibility of flare reduction projects at medium-sized flaring sites.	Financing Solutions to Reduce Natural Gas Flaring and Methane Emissions World Bank
Financing guidance and methane reduction projects	Financing Reductions Oil and Gas Methane Emissions | iea
This guide helps companies influence their JV partners to reduce methane emissions and create a cleaner oil and gas value chain.	JV Playbook | MGP
This document outlines the documentation requirements (list of information elements that a company should provide) for OGMP 2.0 Level 4 and Level 5.	Documentation for Level 4 and Level 5 methods | OGMP2.0

Flaring and Venting publications

Flaring and Venting Publications

Access all our Energy Transition Reports

IOGP Report 647
Guidelines for the design and operation of flare gas recovery system.

IOGP Report 673
Guidelines for design and operations to minimize and avoid flaring.

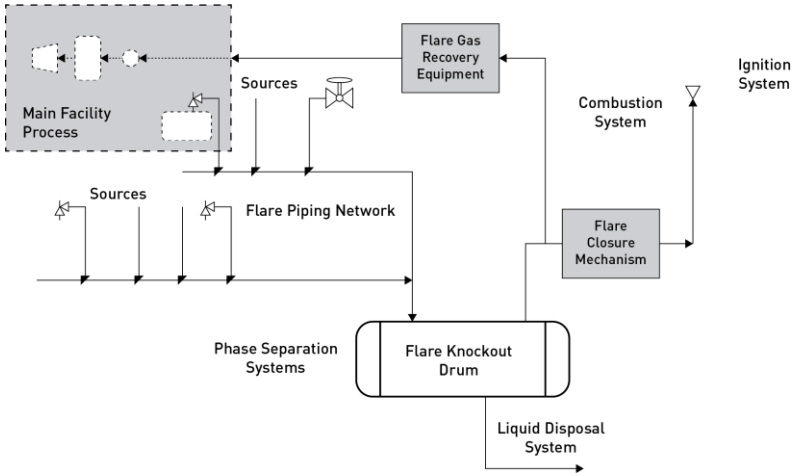
IOGP Report 675
Guidelines for venting minimization and vent recovery systems

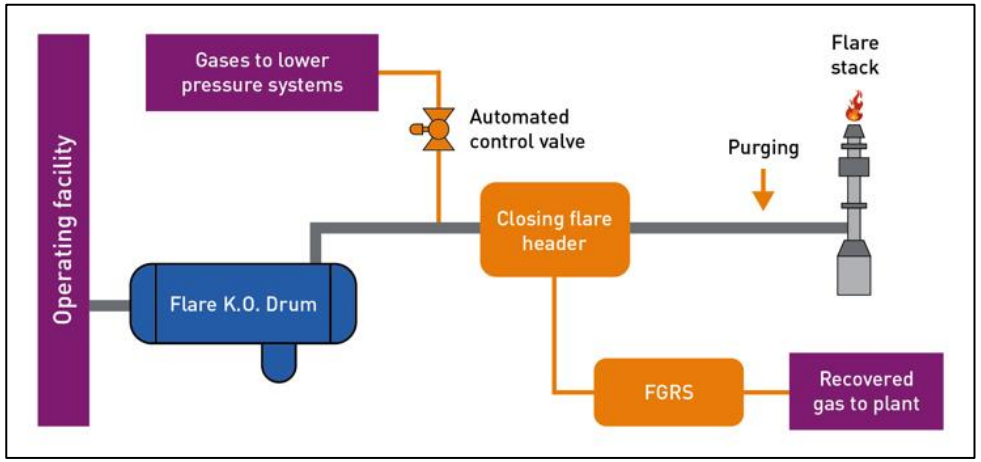
All documents can be downloaded from IOGP Bookstore - https://www.iogp.org/bookstore/

Report 647 - Flare Gas Recovery System (FGRS)

- Focus on continuous flaring sources in normal operations
- Address measures for source recovery, flare isolation and flare ignition
- Aims to assist
  - engineering and operations staff at production, refining and petrochemical
  - engineering staff at design consultancies and EPC contractors.

- FGRS capture and compression of flare gas for other uses/recycle
- Guide for initial evaluation, justification, design and operational considerations of FGRS
- Overview of FGRS Components
  - Flare isolation (e.g. liquid seal, valve closure)
  - Flare ignition (pilots, kinetic ignition)
  - Recovery systems (compressors, ejectors)





IOGP Report 673 - Minimize and avoid flaring

- Guidance for design and implementation of solutions to assist upstream oil and gas industry in minimizing or eliminating flared gas sources and volumes throughout the lifecycle of their assets
- Implementation of solutions are subjected to:
  - regulations, laws, and permits in the operating region
  - individual company requirements and guidance

- Supplements the Flaring Management Guidance (IOGP-Ipieca-GGFR Report 647)
- Industry experience
- Flare gas source reduction
- Focus on upstream

Design

- concept development phase
- engineering development phase

Operation – Commissioning and startup

Operation – Production

IOGP Report 675 - Venting minimization and vent recovery systems

- General guidance on vent minimization, VRU design considerations and HC Blanketing systems for cargo tanks on FPSOs.
- Focus on upstream
- Assist engineering and operations

- Preliminary evaluation and design considerations for vapor recovery units (VRUs)
- Overview of methane and other hydrocarbon
- Industry experiences
- HC Blanketing systems for cargo tanks on FPSOs
- VRU design

- Sources of venting
- Vent source minimization and elimination
- Vent source recovery

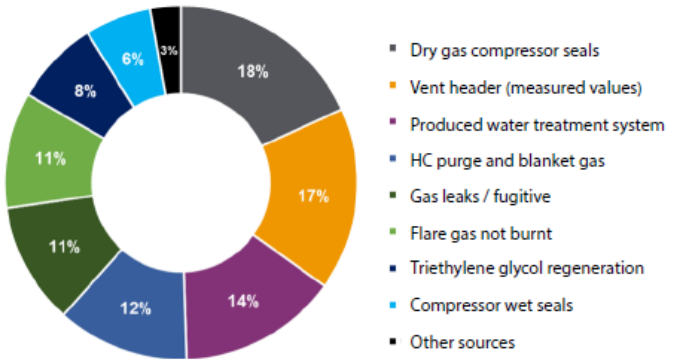


Figure 2 - Major methane emissions sources in the Norwegian offshore sector by percentage of contribution

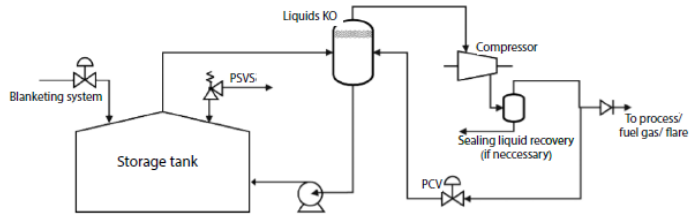


Figure 20 – Basic schematic showing VRU for a storage tank

IOGP Report 661

Recommended practices for methane emissions detection and quantification technologies

IOGP Report 661

Recommended practices for methane emissions detection and quantification technologies

Provides the user with a framework for:

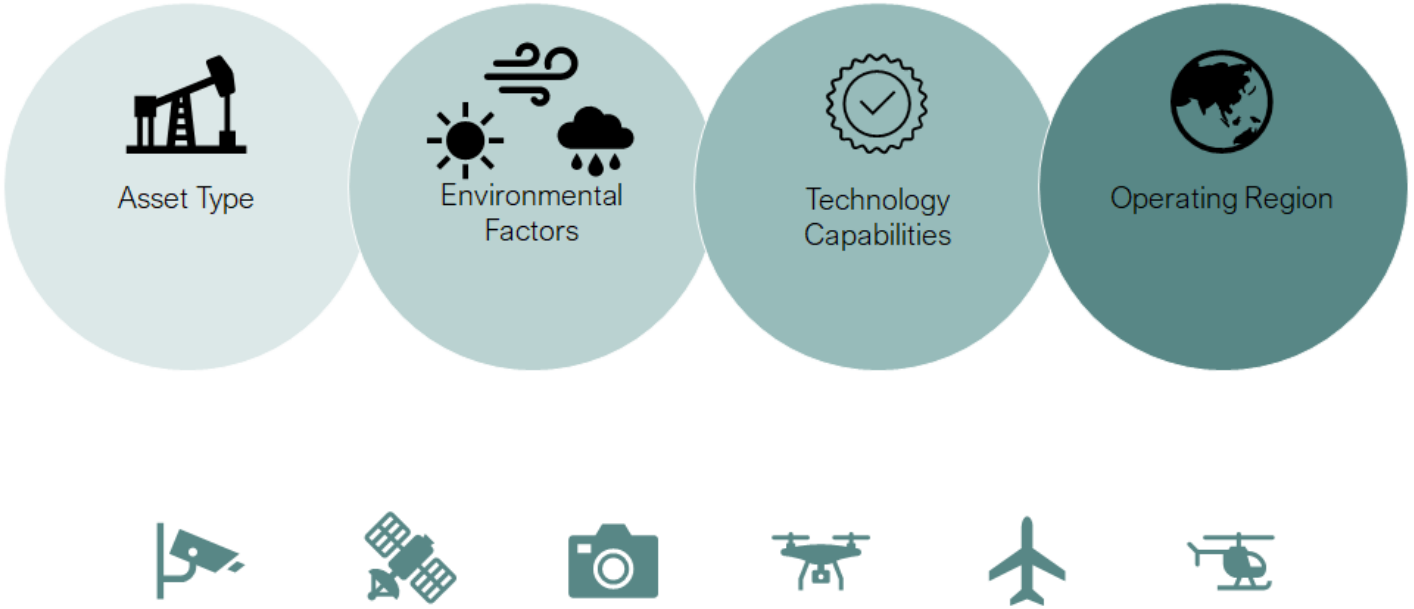
- Criteria operators can consider in selecting technology
- Guidance on technology deployment
- Measurement, detection, quantification technology combinations
- Facilitate improved methane management/emissions reporting.

- https://www.iogp.org/bookstore/product/recommended-practices-for-methane-emissions-detection-and-quantification-technologies-upstream/

International Association of Oil & Gas Producers 50 Years 1974-2024

No magic answer for the detection/quantification of Methane!!

- Detection and Quantification varies based on multiple factors:



Recommended Practices Document – Project Structure

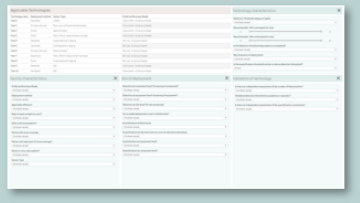
- Carbon Limits Analysis
- Technology Providers
- Industry/Researcher Input
- Project Task Force
- Scientific Publications

Decision trees

Allow the users to navigate the different objectives and situations Help them narrow down the purpose of technology deployment

Technology Filtering Tool

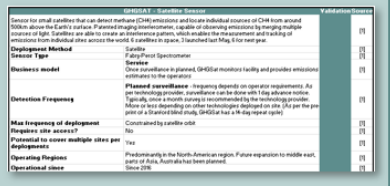
Operators can narrow down suitable technologies for their purpose and given their site conditions



Technologies Datasheets

Factsheet for each technology to provide more details on the technology and validation of results for the operator's reference

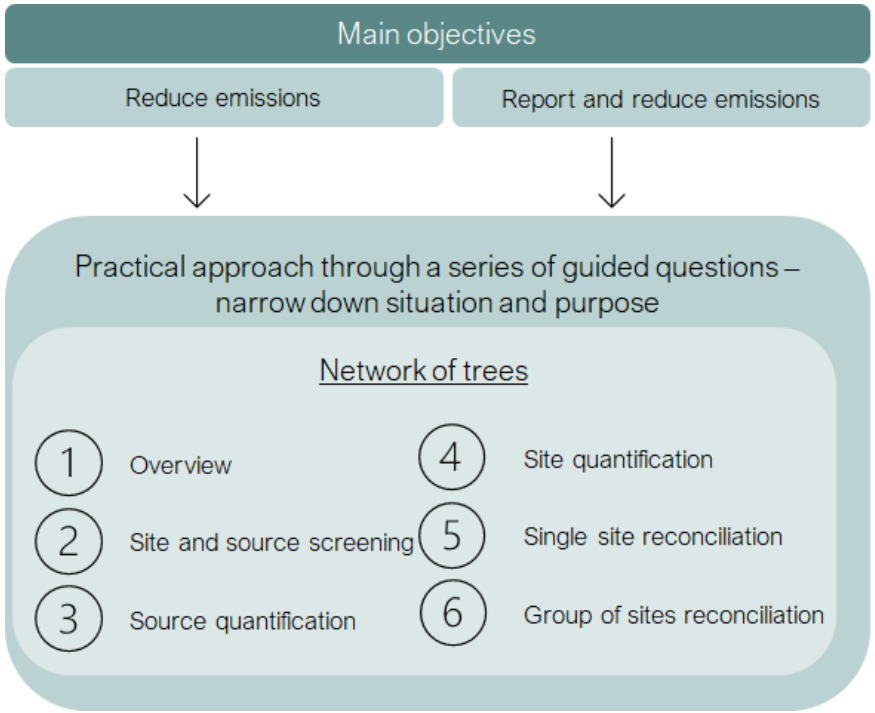
Technologies
60+

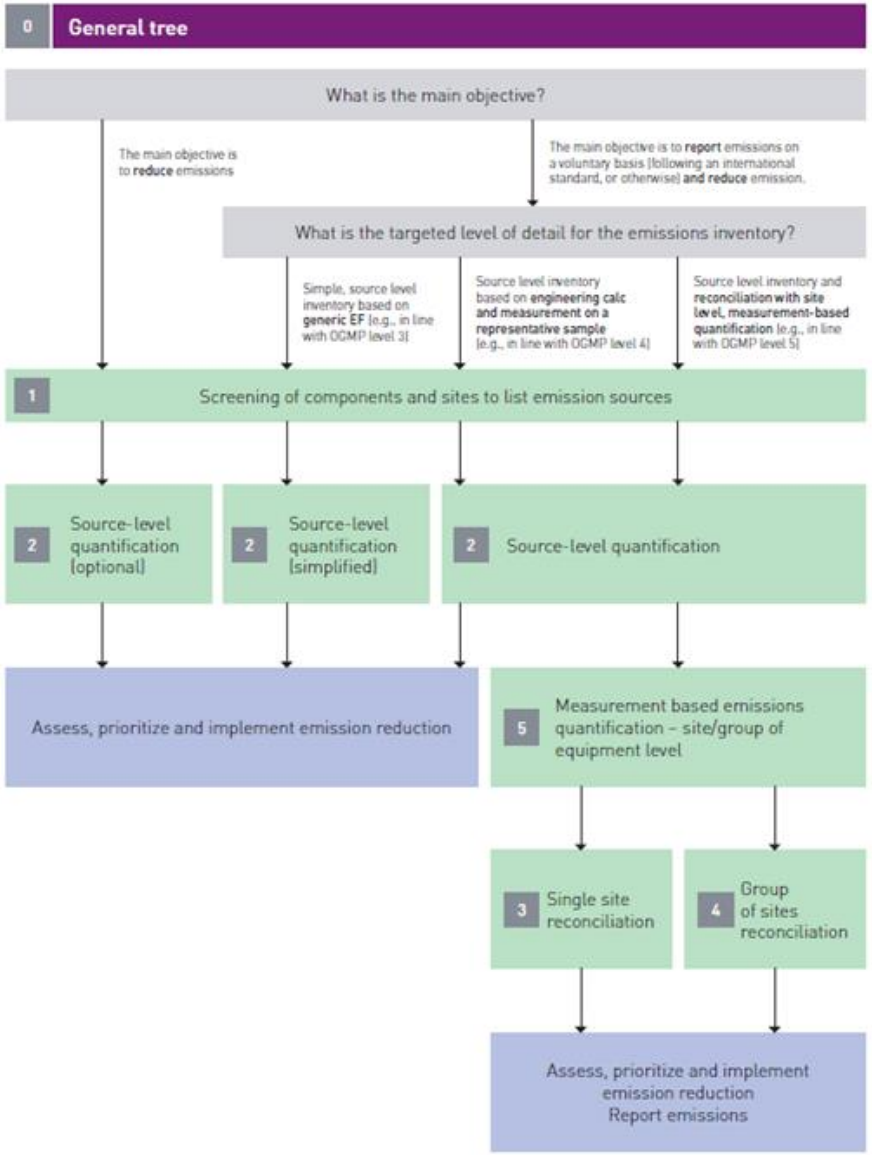


Recommendations for operators

Decision Trees

- How can technologies be deployed to meet the objectives?





Available in the report: https://www.iogp.org/bookstore/product/recommended-practices-for-methane-emissions-detection-and-quantification-technologies-upstream/,

Technology Datasheets

Structured compilation of data

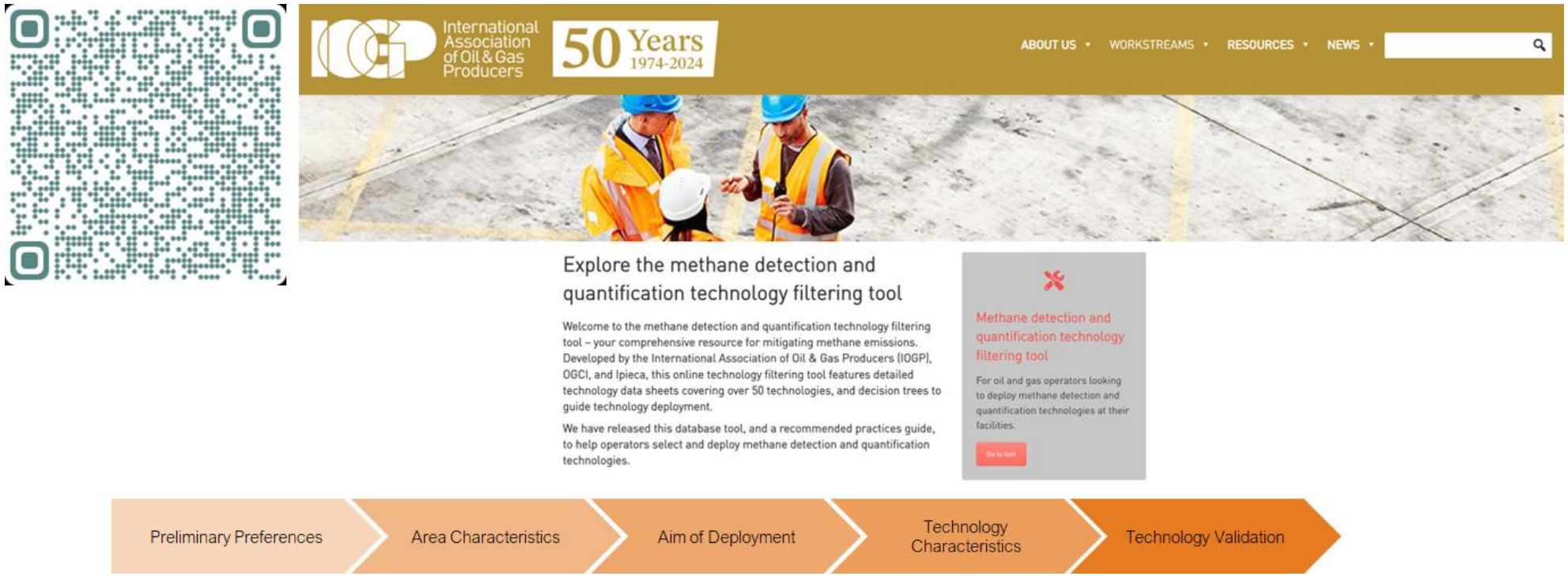
- General Information
- Tech. Specifications
- Environmental Conditions
- Location Conditions
- Deployment Information
- Links to Additional information

GHGSAT - Satellite Sensor		Validation	Source
Sensor for small satellites that can detect CH_4 emissions and locate individual sources of CH_4 from around 500 km above the Earth's surface. Patented imaging interferometer, capable of observing emissions by merging multiple sources of light. Satellites can create an interference pattern, which enables the measurement and tracking of emissions from individual sites across the world. 6 satellites in space, 3 launched last May, 6 for next year.			[3]
Deployment Method	Satellite		[3]
Sensor Classification and Type	Visual Product, Remote sensor type Fabry-Perot Spectrometer		[3]
Business model *(Instrument or data to be purchased?)*	Data Product – Once surveillance in planned, GHGSat monitors facility and provides emissions estimates to the operators.		[3]
Frequency – *for technology deployment*	Periodic Monitoring Planned surveillance: frequency depends on operator requirements. As per technology provider, surveillance can be done with 1-day advance notice. Typically, once a month survey is recommended by the technology provider: more or less depending on other technologies deployed on site. As per Sherwin et al (2022) [pre-print], GHGSat has a 14-day repeat cycle.		[3]
Sampling frequency during operation	1 image per visit. Revisit time is 14 days for a single satellite, or 1 to 7 days when considering the satellite constellation.		[1] [5]
Requires access to site?	No		[3]
Potential to cover multiple sites per deployments	Yes		[3]
Operating Regions	Worldwide		[3]
Operational since	>5 years (2016)		[3]
Detection			
Detection Level	At Site level - Yes At equipment level - No At component level - No An independent test performed stated that GHGSat can narrow down key zones of emissions, with no individual source identification		[2], [3]

Kuva Systems – Kuva camera		Validation	Source
Kuva Systems provides a camera based, stationary, continuous monitoring system for methane (can alse be tuned for other VOC emissions). It includes a cloud platform that provides emissions data and image-based alerts via web portal, email or API.			[3]
Deployment Method	Stationary		[3]
Sensor Classification and Type	Visual Product, Remote sensor type Shortwave infrared (SWIR)		[3]
Business model *(Instrument or data to be purchased?)*	Instrument can be purchased or rented Data Product – cloud monitoring services are offered		[5]
Frequency – *for technology deployment*	Continuous monitoring Technology measures during daylight hours. Currently testing a system for day and night-operation (under development).		[5]
Sampling frequency during operation	Not specified		[5]
Requires access to site?	Yes		[5]
Potential to cover multiple sites per deployments	No		[5]
Operating Regions	North America as of November 2022, deployments planned in other continents		[3]
Operational since	>5 years (founded in 2015)		[5]
Detection			
Detection Level	At Site level - Yes At equipment level - Yes At component level - Maybe		[3] [5]
Detection Threshold / Precision	1-10 kg/h In field conditions (METEC ADED testing), lower under lab conditions		[3]
Detection Threshold validation	Validated by fully blinded tests performed with third party By METEC, ADED, Alt-FEMP approved	(b), (d)	[1], [2], [3]

Use of the Technology Filtering Tool

Link to Technology Filtering Tool

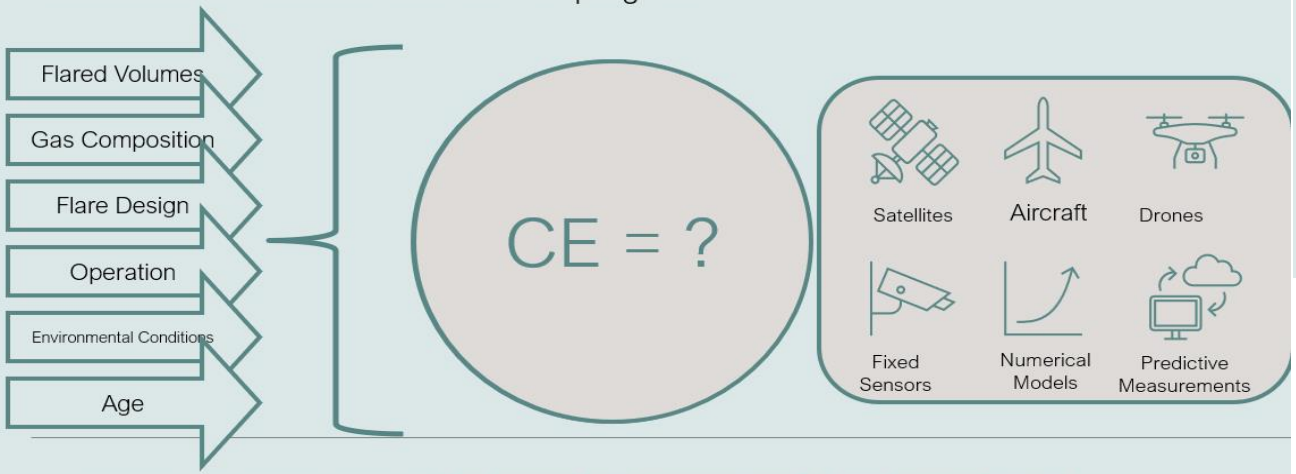


Recommended Practices for flares

Recommended Practices for flares

Background

- Flaring: burning undesirable or surplus gas in an open-atmosphere flame
- Flaring converts flared gases (including methane) into carbon dioxide.
- GWP of CH_4 82.5/29.8 times greater than CO_2 over a 20/100 year period
- 139 billion m^3 of gas was flared in 2022
- Motivation for initiatives such as ZRF program



World Bank GMFR. Global Gas Flaring Data: https://www.worldbank.org/en/programs/gasflaringreduction/global-flaring-data

- Ongoing Industry Effort
- Great to measure, but also important to remember to focus on mitigation
- Work is complementary to OGCI, IOGP and Ipieca RP, Methane Flaring Toolkit, World Bank ZRF Initiative

Project and report ongoing and expected to be made available later this year

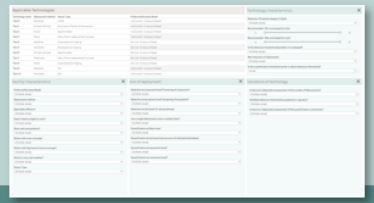
Recommended Practices Document: Integration of Flare Technologies

Decision trees

Allow the users to navigate the different objectives and situations Help them narrow down the purpose of technology deployment

CH_4 Technology Filtering Tool

Operators can narrow down suitable CH_4 technologies for their purpose and given their site conditions

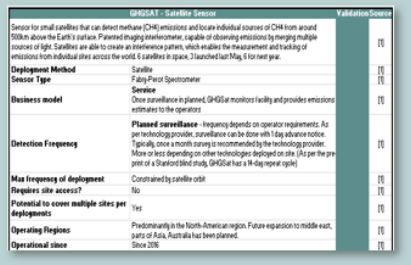


Flare Technology Filtering Tool

Operators can narrow down suitable flare technologies for their purpose and given their site conditions

Technologies Datasheets

Datasheet for each technology to provide more details on the technology and validation of results for the operator's reference

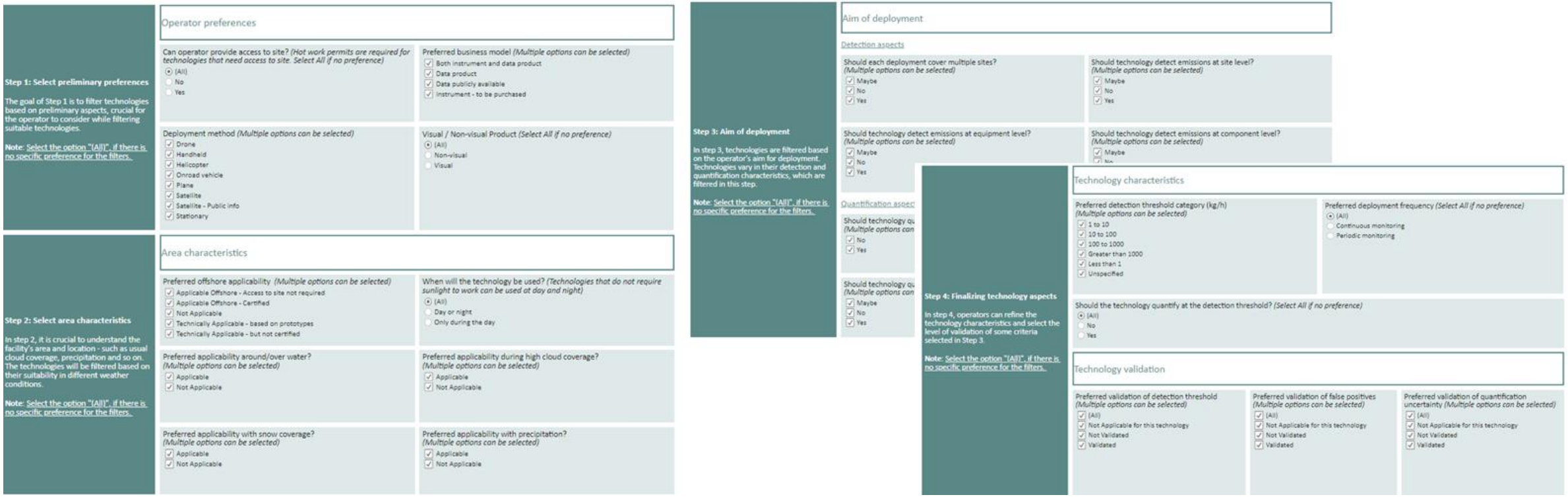


CH_4 Technologies **53**

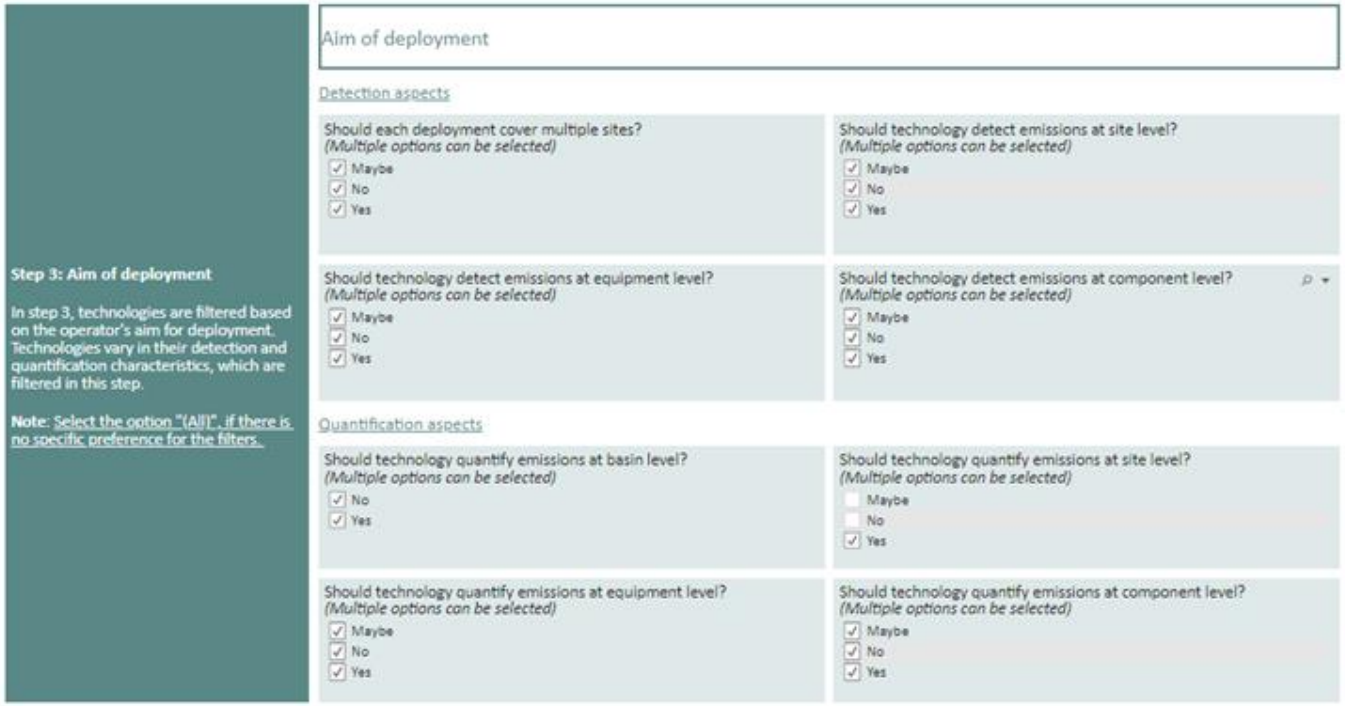
Flare Technologies **15**

Recommendations for operators

Technology Filtering Tool Options



Technology Filtering Tool Options – Filter to narrow down further



Provider Name	Technology name	Deployme..	Operating regions
AddGlobe	GFM 2.0	Handheld	Europe, Canada and United States. Plans for Middle East exist
Adlares	Charm	Helicopter	Europe
ASI	PRISMA	Satellite - Pub..	Worldwide
Atmosfir	D-fenceline	Stationary	North America currently. Open to selling to other regions.
Bridger	Gas Mapping Lidar (GML)	Plane	North America
Carbon Mapper - Planet	Carbon Mapper	Satellite	Northa America currently. Worldwide from 2023.
Clean Connect	Autonomous 365	Stationary	USA
DigitalGlobe	Worldview3	Satellite - Pub..	Worldwide
ESA	Sentinel-2	Satellite - Pub..	Worldwide
	TROPOMI	Satellite - Pub..	Worldwide
GHGSat	GHGSat Constellation	Satellite	Worldwide
Heath Consultants	Detecto-Pak Infrared+ ..	Handheld	Worldwide
	DISCOVER Advanced Mobile Leak Dete..	Onroad vehicle	Worldwide
	Remote Methane Leak Detector (RMLD..	Handheld	Worldwide
HETEK	HETEK Flow Sampler	Handheld	US, Canada, Europe
Kairos	LeaksSurveyor	Plane	North America, South America, and Europe
Kuva	Kuva Daylight	Stationary	North America. Deployments planned in other continents
Longpath Technologies	Longpath Laser System	Stationary	North America. Deployment in more regions in the foreseeable future.
MFE Instruments	SPOT Robotic Dog	Drone	North America
Mirico	ORION	Stationary	Worldwide
NASA/USGS	Landsat-8	Satellite - Pub..	Worldwide
NevadaNano	MPS Methane Gas Sensor	Stationary	North America, Europe, Middle East, Africa currently
Opgal	EyeCgas 2.0	Handheld	Worldwide
Orbital Sidekick	Hyperspectral monitoring solutions	Satellite	Worldwide
Pergam-Suisse	ALMA	Plane	Worldwide
	Laser Falcon	Plane	Worldwide
	LMm (Laser Methane mini)	Handheld	Worldwide
	LMS (Laser Methane Scanner)	Stationary	Worldwide
	SELMA Duo	Onroad vehicle	Worldwide
	SELMA Roof-Dome	Onroad vehicle	Worldwide

Q&A

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