# Methane Report 2024

# Mission

We are an energy company.

13 15 We concretely support a just energy transition,
with the objective of preserving our planet

7 12 and promoting an efficient and sustainable
access to energy for all.

9 Our work is based on passion and innovation,
on our unique strengths and skills.

5 10 On the equal dignity of each person, recognizing diversity
as a key value for human development,
On the responsibility, integrity and transparency of our actions.

17 We believe in the value of long-term partnerships with the Countries
and communities where we operate, bringing long-lasting prosperity for all.

## Global goals for a sustainable development

The 2030 Agenda for Sustainable Development, presented in September 2015, identifies the 17 Sustainable Development Goals (SDGs) which represent the common targets of sustainable development on the current complex social problems. These goals are an important reference for the international community and Eni in managing activities in those Countries in which it operates.


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# CEO Letter

This year, we decided to integrate our disclosure with a specialized report detailing Eni's commitment to reducing methane emissions.
Abating methane emissions in Oil&Gas operations is recognized as a meaningful near-term climate solution and a pivotal lever to decarbonize the use of natural gas, thus fostering an orderly and equitable transition.
This report delineates a trajectory initiated approximately ten years ago, wherein Eni has cultivated expertise and knowledge, instituted best practices, and developed technologies for the monitoring, verification and reporting of methane emissions. Consequently, Eni has emerged as a pioneer in implementing methane management plans across our operated assets.
I am proud to say that, today, with an upstream methane intensity of around 0.06%, significantly less than the 0.2% sector's best practice, we are among the industry leaders. Over the past six years (2018-2023), we have succeeded in more than halving the company's direct methane emissions, owing to the implementation of monitoring campaigns, such as the Leak Detection and Repair (LDAR) campaign, performed across all our operated assets. In 2023, thanks to an extensive worldwide methane measurement campaign conducted by a third party, conforming to the OGMP 2.0 recommendations.
Furthermore, our methane reduction strategy hinges upon the collaboration with other sector players and international organizations, seeking a cohesive and tangible commitment to methane emissions reduction throughout the oil and gas value chain.
As a member of the Oil and Gas Climate Initiative, we have contributed to piloting the Satellite Monitoring Campaigns, designed to detect methane emissions while also facilitating data access to operators for prompt remediation of any detected leak. Moreover, our support of the Aiming for Zero initiative underscores our ambition to achieve near-zero methane emissions by 2030.
Given the broader industry's embrace of the targets delineated in the Oil & Gas Decarbonization Charter signed at COP 28, we will continue to use the methodological and technological expertise acquired to enhance the performance of both our operated and non-operated assets, thereby aiding other operators in addressing the methane challenge. We already have agreements in place with several National Oil Companies (NOCs), collaborations that enable the dissemination of our methane reduction know-how.
Additionally, our participation in the World Bank Global Gas Flaring and Methane Reduction (GFMR) Partnership serves to bolster support to producing countries and NOCs on a global scale.
As we cast our gaze towards 2030, our commitment remains firmly fixed on progressively eliminating methane emissions and fostering the credibility, accessibility, and transparency of our methane data. This aligns with our key target of near-zero methane emissions by 2030.

# Highlights

## TARGETS AND GOALS

**Eni:**

*The pathway towards Eni's Carbon Neutrality by 2050 includes a series of intermediate objectives that first envisage Net Zero emissions (Scope 1+2) for the upstream business by 2030 and for the Eni group by 2035, then Net Zero emissions by 2050 for all Scope 1, 2 and 3 GHG emissions associated with Eni's entire value chain, both in absolute and intensity terms*

**Eni Upstream**

- ✓ Keeping methane emission intensity well below 0.2% by 2025 (0.06% in 2023)
- ✓ Achieved 80% reduction of Upstream fugitive emissions in 2019 vs. 2014 (-95% in 2023 vs 2014)[1]
- Zero routine flaring by 2025 (subject to execution of projects in Libya)
- Aiming for zero methane emissions by 2030

## 2023 MAIN RESULTS

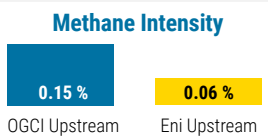
- Methane emissions are 4% of Eni's GHG operated Scope 1 and 2 Upstream emissions
- 20% reduction in methane emissions in the Upstream business from 2022 to 2023[2]
- The volumes of hydrocarbons sent for routine flaring in Upstream operated/cooperated assets decreased by around 8% compared to 2022

## OUTCOMES

86% of reduction in methane intensity since 2014


Fugitive campaigns covering 17 countries and over 80 sites (average of 10,000 components per site) - the LDAR campaigns performed in 2023 provided an average reduction of 40% in comparison with 2022 results

Eni's Upstream Methane Intensity vs the OGCI Collective Upstream Methane Intensity in 2023




About this report

- Targets and metrics reported in the document refer to Eni's operated activities except where explicitly stated that they are on an equity basis
- Information reported in this document refers to Eni's Upstream activities.
- Further information and data on Eni's performance can be found in Eni For 2023[3].

1 Reduction is due to LDAR campaigns implementation and improved accuracy of emission quantification.
2 2023 data comes mainly from direct measurement while 2022 data are mostly based on estimation of emissions.
3 https://www.eni.com/static/en-IT/infographics/eni-for-2023/home/



# Methane Background

Methane is the primary component of natural gas, a vital source of affordable, reliable, and less impactful energy than other fossil fuels. Natural gas is a versatile fuel that can be burned for electricity generation, heating, cooling and cooking. It is also used as a raw input in the manufacture of plastics, fertilizers and chemicals.
Still, after carbon dioxide, methane is the second most important greenhouse gas contributing to climate change. Compared to carbon dioxide, methane exists in the atmosphere for a shorter time but can trap more heat. The Intergovernmental Panel on Climate Change (IPCC) indicated a greater Global Warming Potential (GWP) for methane when considering its impact over a 100-year timeframe (GWP100) -commonly used in main reporting frameworks- and even more so, when considering its impacts over a 20-year timeframe (GWP20).

Anthropogenic activities are responsible for 60% of the global methane emissions[4], and the remaining 40% comes from natural sources. Methane from fossil fuels is emitted during coal, oil, and natural gas production and distribution. Other anthropogenic sources of methane emissions originate from livestock and agricultural practices, land use, and the decay of organic waste in municipal solid waste landfills.

## KEY FIGURES ON METHANE

**2nd**
most important GHG contributor to climate change

**60%**
of global methane emissions results from human activity

**40%**
of this comes from the energy sector

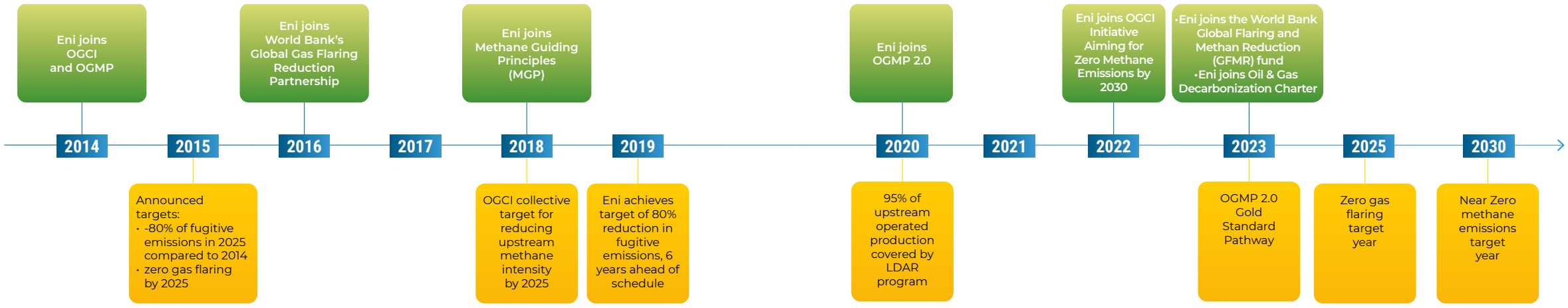
According to the International Energy Agency, reducing methane emissions from the energy sector is one of the best and most affordable ways to limit global warming in the near term. Estimates reported by the UNEP's Climate and Clean Air Coalition show that the possible methane emissions reductions from the fossil fuels sector could avoid 0.14°C of additional warming – an important contribution to limiting warming to within 1.5°C.

## METHANE EMISSIONS FROM THE OIL & GAS SECTOR COME FROM 4 CATEGORIES OF SOURCES:

| | |
|---|---|
| **FUGITIVES** | Emissions resulting from unintentional loss of gas phase from equipment containing over-pressurized fluid, namely, leakages from tubing, valves, connections, flanges, packing, open-ended lines, and other process and operation components. |
| **VENTING** | Emissions related to the controlled release of gases directly into the atmosphere resulting from process design and from operational requirements, most typically released through a vent pipe, seal, or duct. |
| **FLARING** | Emissions related to the unburnt fraction of methane from flaring activities. The combustion efficiency is the main factor influencing this contribution. |
| **STATIONARY COMBUSTION** | Component of uncombusted methane generated through fuel gas or diesel/oil consumption in the assets such as emissions from turbines, internal combustion engines, heaters, and boilers. |

4 https://www.iea.org/reports/global-methane-tracker-2024/understanding-methane-emissions

# 10 years of commitment to methane management

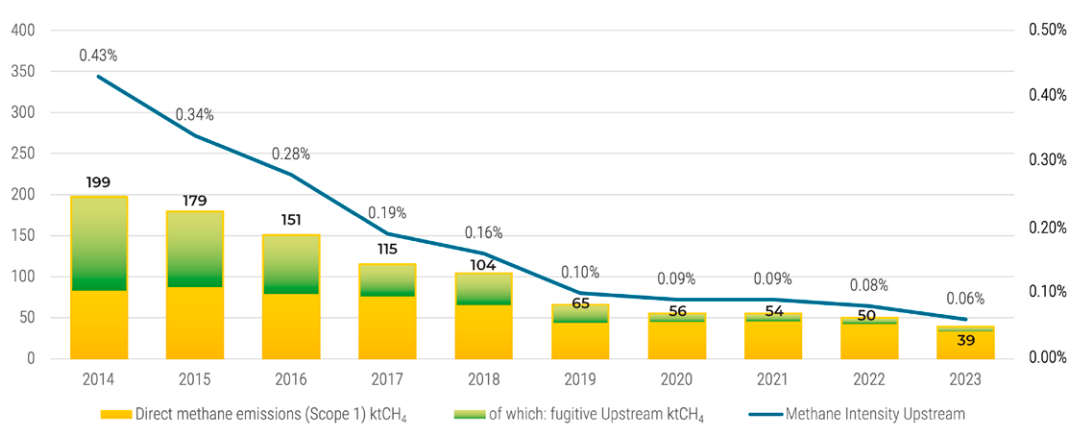



Eni believes that natural gas has a role in the energy transition pathway to 2050 because of its affordability, reliability, versatility, and low carbon content compared to other fossil fuels. However, global action is needed to eliminate methane leakage throughout the natural gas value chain.

Driven by a strong internal focus, Eni has been committed to reducing methane emissions in its operations for more than a decade. Understanding the urgency to act and the need for in-depth knowledge of its assets has resulted in developing monitoring and mitigation technologies, using them in the field, and implementing an increasingly reliable reporting system aligned with international best practices. Eni's actions have focused on a responsible upstream value chain, particularly on fugitive emissions, accounting for 60% of Eni's methane emissions in 2014. In 2015, as part of a broader commitment to reduce GHG emissions from its operations, Eni announced a reduction target of -80% fugitive methane emissions (compared to 2014 - base year) by 2025. This announcement represented the first absolute methane emission reduction target disclosed by a Major. Eni reached this target in 2019 thanks to implementing LDAR campaigns that are now carried out yearly in Eni's operated assets.

Eni has progressively implemented a monitoring system to measure the extent of methane emissions in its assets. This system has made possible to define, with increasing reliability, the contribution of other methane sources (e.g., flaring, venting, and stationary combustion) to evaluate and implement reduction plans in line with Eni's most recent targets. The methane reductions achieved by Eni by 2023 (-28% versus 2020) and the pathway Eni is following confirm its commitment to the ultimate target of near zero methane emissions in 2030.

## METHANE EMISSIONS (SCOPE 1) AND METHANE INTENSITY UPSTREAM




**FOCUS ON**

### ENI'S METHANE DISCLOSURE EVOLUTION

Since 2014, Eni's institutional reporting has included data on methane emissions for all segments of Eni's operating activities. Eni's reporting has evolved over the past ten years, particularly for upstream activities, to include all sources responsible for emissions and in line with international best practices (e.g., IOGP/IPIECA/OGCI review of detection & quantification recommended practices). The commitment to transparency in reporting is related to quantifying direct methane emissions and measuring the effectiveness of mitigation actions implemented at operated and non-operated sites. In 2020, by adhering to OGMP 2.0, Eni committed to setting reduction targets and progressively increasing the transparency and accuracy of methane reporting, gradually extending to non-operated assets. "Reasonable assurance"[5] from third parties currently covers direct (Scope 1) and indirect (Scope 2) GHG emissions, including the direct methane emissions data from operated assets.

5 https://www.eni.com/content/dam/enicom/documents/eng/sustainability/2023/sustainability-performance/eni-for-2023-sustainability-performance-eng-print.pdf#page=76

# Collaboration in methane initiatives

A key lever of Eni's methane strategy is collaboration with other sector players and international organizations that look for a common and concrete commitment to controlling methane emissions in the oil and gas value chain. Eni was a founding member of the Oil & Gas Methane Partnership (OGMP), Oil and Gas Climate Initiative (OGCI), and Methane Guiding Principles (MGP) and actively participates in industry associations, such as IPIECA and IOGP. These collaborations have helped define the magnitude of the issue with increasing accuracy, develop methane emissions monitoring, reporting, and verification best practices, and fostered the deployment of new technologies for monitoring/abatement of emissions.
Joint efforts have also taken the form of awareness-raising actions aimed at other industry players to promote the adoption of advanced management practices and at producing countries' governments to support the implementation of national strategies and regulations in line with international commitments. For example, the Global Methane Pledge, launched by the European Union and the United States at the Glasgow Conference in 2021, commits the 155 member countries to contribute to at least 30% of global methane emission reduction by 2030 compared to 2020.

FOCUS ON

## OIL AND GAS CLIMATE INITIATIVE (OGCI)

OGCI aims to be an "industry leader in responding to climate change and accelerating action toward a net-zero future in line with the 2015 Paris Agreement." Eni was among the founding members (which included Saudi Aramco and TotalEnergies vs. 12 partner companies today) that launched OGCI in 2014 at the United Nations Secretary-General's Climate Summit.

In 2017, Eni led the OGCI team that helped define and launch the "Global Methane Studies" project, co-funded by Environmental Defense Fund (EDF) and the European Commission and coordinated by the United Nations Environment Programme (UNEP). The project aimed to fill knowledge gaps in measuring methane emissions for different types of gas assets and regional contexts, helping companies and governments prioritize actions and policies to reduce methane emissions. Independent scientific teams conducted the studies to ensure transparency and credibility and published more than ten studies in various scientific journals.

In 2018, Eni, with the other OGCI partner companies, committed to a collective intensity reduction target by 2025 of <0.2 % methane emissions of the total gas sold (compared to OGCI baseline of 0.3% in 2017). Eni achieved this target five years ahead of schedule. In 2022, OGCI spearheaded the Aiming for Zero initiative, committing partner companies to eliminate methane emissions from their assets by 2030. In addition to adhering, Eni, along with other OCGI partner companies, has encouraged different industry players to join the initiative. To date, 22 Oil and Gas companies and 63 supporters have announced their commitments.

Also, in 2022, OGCI, in collaboration with the GHGSAT /Carbon Limits team, initiated the Satellite Monitoring Program after successfully conducting satellite monitoring tests in assets operated by OGCI partner companies (including Eni-operated assets). The actual program was approved and implemented in assets not operated by OGCI partner companies. OGCI selected the assets based on transparent screening criteria, including the potential presence of emission points and the lack of reliable data. The program aims to support operators in analyzing the data and identifying mitigation actions for detected emission sources. The effective collaboration between OGCI teams, technicians, and asset operators made it possible to eliminate substantial methane leaks (e.g. the Iraq case study, mentioned in the OGCI report)[6].

6 https://www.ogci.com/wp-content/uploads/2023/04/OGCI_Iraq_Whitepaper_jan23.pdf

FOCUS ON

## METHANE GUIDING PRINCIPLES (MGP)

MGP drives efforts in five core principles to reduce methane emissions from natural gas:

1. Continually Reduce Methane Emissions
2. Advance Strong Performance across the Gas Supply Chain
3. Improve Accuracy of Methane Emissions Data
4. Advocate Sound Policy and Regulations on Methane Emissions
5. Increase Transparency.

Eni was among the eight founding partner companies (vs. 50 partner companies today) that launched MGP in 2018. The partners commit to the five core principles and share practical tools and guidance to help others (including MGP partner companies and other industry stakeholders) learn from their experiences and put those lessons into practice.
Through MGP, Eni has contributed to several projects, including developing a web toolkit for managing methane emissions from flares and best practices to ensure the inclusion of clauses aimed at a commitment to reduce methane emissions within the Non-Operated Joint Venture (NOJV) agreements. In 2020, Eni, in collaboration with Snam, hosted an MGP training course, "Course of Global Outreach Program for Italy," with the participation of about 15 leading Oil & Gas operators in Italy and Europe.

FOCUS ON

## OIL & GAS METHANE PARTNERSHIP (OGMP)

OGMP began as a voluntary initiative in which governments, international organizations, non-governmental organizations, and the Oil & Gas industry work together to raise awareness and responsibly address methane emissions. Eni was among the founding partner companies (along with BP, Ecopetrol, Equinor, Neptune Energy International SA, Pemex, PTT, Repsol, Shell, and TotalEnergies) that launched OGMP in 2014 at the United Nations Secretary General's Climate Summit.
OGMP aims to establish a protocol to help companies systematically manage their methane emissions from upstream oil and gas operations. It also provides a credible platform to help member companies demonstrate actual reductions to stakeholders. Eni has played a key role as steering committee co-chair for several years. Commitment to transparency in methane emissions reporting and adherence to technical protocols developed in collaboration with other participants in the initiative for significant emission sources have enabled Eni to progress in disclosing methane data and mitigation achievements.
In 2020, Eni supported the evolution of OGMP to the OGMP 2.0 framework with the aim of increasing the level of accuracy and granularity of methane measurements both on operated and non-operated assets. It also encourages undertaking proper and effective mitigation actions, simultaneously ensuring the delivery of higher transparency in reporting and credible progress in reducing methane emissions.

# Supporting policy development and National Oil Companies (NOCs)

Eni has welcomed international and regional strategies and commitments to reduce methane emissions, such as the declared support for the European Methane Strategy presented in 2020 and for the Global Methane Pledge launched at the Glasgow Conference in 2021. Most recently, Eni has been a strong supporter of the COP28 Presidency's objective to lead the broad Oil & Gas sector to make inclusive commitments on reducing their activities' greenhouse gas emissions impact. Eni is a signatory of the **Oil & Gas Decarbonization Charter**, a milestone initiative launched at COP28, that will help align the sector towards transparent and concrete actions to reduce emissions, including methane and flaring.
Eni has contributed on several fronts, participating, on the one hand, in awareness-raising actions aimed at other players in the industry and governments of producing countries to stimulate the adoption of advanced management practices, on the other, in the implementation of national strategies and regulations in line with commitments declared at an international level.
Eni considers collaboration with governments and organizations such as UNEP/IMEO essential to define policies and regulations at a regional level, with reduction objectives supported by accurate data and clear guidance/standards for operators. In this context, Eni shared its experience in capacity building training organized by UNEP/IMEO for governments and NOC officials in producing countries, such as the Ivory Coast, Libya, and Mozambique.

**FOCUS ON**

### EU REGULATION ON METHANE

Eni supported the first-ever EU Regulation on methane emissions reduction as a necessary tool to reduce methane emissions in the energy sector in Europe and in the global supply chains, with the goal of achieving climate neutrality by 2050. Eni, both individually and jointly with other players, developed short, medium, and long-term recommendations in various phases of the policy-making process leading to the adoption of the EU framework on methane emission reduction. Eni participated in a number of public consultations, putting forward constructive feedback and technical knowledge to the benefit of policy makers and supporting the adoption of sound policies that can help the O&G sector mitigate methane emissions, and supporting the introduction of mechanisms that favor the import of natural gas with lower emission intensity of methane based on viable limits and practicable criteria for the concerned operators.
In Italy Eni is part of a multistakeholder working group that includes other companies and NGOs in order to facilitate the implementation of the EU Regulation at national level.

**FOCUS ON**

### COLLABORATION WITH EGYPTIAN NATURAL GAS HOLDING COMPANY (EGAS)

As part of the joint agreement to identify opportunities for the reduction of greenhouse gas emissions, in 2023, a data collection initiative has been collectively launched by Eni and the Egyptian Natural Gas Holding Company (EGAS) for EGAS subsidiaries to evaluate methane emissions.
A pre-assessment has been carried out to identify potential mitigation actions to reduce the emissions of 21 EGAS subsidiary sites. A further and detailed energy assessment shall be performed in 2024 to confirm the initiatives and develop the implementation plan.
Moreover, in 2023 a fugitive and venting emission monitoring campaign has been implemented in the Egyptian Natural Gas Company (GASCO) Western Desert Gas Complex.
The activities have been executed with Eni's support, and training provided on the methodology, best practice and tools for leakage detection in the plant. The complete training program will allow GASCO and EGAS personnel to replicate Western Desert Gas Complex campaign on other plants.

**FOCUS ON**

### MOZAMBIQUE NATIONAL TRAINING ON REDUCING O&G SECTOR'S METHANE EMISSIONS (SEPTEMBER 2023)

Training was organized for senior decision-makers in the Government of Mozambique to increase awareness of the potential opportunities and build capacities for methane emissions reduction from Mozambique's offshore oil and gas operations.
Eni shared its experience and approach in developing a methane mitigation plan, demonstrating the efficient design of Coral Sul FLNG installation in terms of energy efficiency, zero routine flaring policy, and fugitive emissions monitoring program.
Eni will continue to support these initiatives and contribute to capacity building.

Eni's support of the **Global Flaring and Methane Reduction (GFMR) Partnership Multi-Donor Standalone Trust Fund** launched by the World Bank at COP28 continues to demonstrate the concrete willingness of Eni to support low-income producing countries and small operators in the implementation of national policies and emissions reduction projects, contributing not only financially but also providing necessary technical support.
**Eni has also initiated collaboration agreements with NOCs**, sharing experience on methane management gained directly in the field to overcome barriers to overcome barriers such as accessibility between geographical areas and operators. For example, Eni is working with Sonatrach and EGAS in Algeria and Egypt to identify opportunities for reducing greenhouse gas emissions with a focus on methane and energy efficiency initiatives. Similar agreements are in place in Libya and the UAE.
Eni's ongoing support to Sonatrach to build and present its first Emission Baseline by 2024 is an excellent example of these collaborations. Eni is sharing its experience on monitoring and accounting methodologies and has provided training to Sonatrach staff by executing the Zcina Plant Energy Assessment as part of the strategic agreement signed in January 2023. The collaboration aims to identify opportunities to reduce flaring with the goal of achieving Zero Routine Flaring.

**FOCUS ON**

### COLLABORATION WITH SONATRACH

Eni and Sonatrach signed a strategic agreement in January 2023 to accelerate emissions reduction and strengthen energy security.
Eni is supporting Sonatrach in its ambition to build and present its first Emission Baseline by 2024, including stationary, fugitives, and venting methane emissions, as well as flaring emissions. The activity started in 2023 and covered four geographical areas, with the remaining assets scheduled in 2024.
Regarding methane emissions reduction, in 2023, Sonatrach started implementing LDAR campaigns on both gas lines and plants. The first campaign covered 4x200 km of gas pipelines, and out of 7500 potential leaking points, 32 leaks have been identified, and mitigation activities are ongoing. A long-term LDAR campaign plan has been set up to cover 100% of upstream assets in the next 3-5 years.
Sonatrach is also working on identifying potential leaks through satellite data provided by the Algerian Space Agency (ASAL) and the OGCI Satellite Monitoring Campaign, which supports monitoring campaigns for the Hassi Messaoud and Hassi R'Mel areas.
On flaring, Eni is supporting Sonatrach in identifying further flaring down opportunities, in addition to projects already launched by the company.

# Detecting and measuring methane emissions

Eni strongly believes methane must be kept in the pipes, achieved through detection and maintenance to prevent methane emissions. Options to detect and measure methane emissions are advancing, allowing Eni to incorporate innovative solutions into its methane management programs over time. But how do we detect and quantify what is invisible?

Current detection technologies provide wide-ranging levels of specificity. As technology improves, Eni increasingly uses detection information to validate and quantify its emission.
Identifying and monitoring methane emissions requires deploying a combination of technologies adopting a so called 'Top-Down' and 'Bottom-Up' approach to validate the measurements.

It is common for industrial businesses to adopt more than one technology to cover the different emission sources at various sites. At Eni sites, we are developing and deploying several methodologies and technology solutions to detect, quantify, and ultimately reduce our methane emissions through the implementation of specific mitigation actions.

- The **bottom-up approach** provides on-site quantification and estimation of emissions from single sources. It can involve using ground-based mobile, fixed-position sensors, portable monitoring devices such as Optical Gas Imaging (OGI) cameras, or continuous monitoring devices. These instruments provide the most precise information on emission sources at the specific equipment level. Quantification through a bottom-up approach is based on the facilities' site-specific data and utilizes either generic or specific emission factors.

- The **top-down approach** measures methane concentrations at the site level or covers a broader area through drones, airplanes, or satellite-based methane detection. These technologies provide emission quantification and allow the identification of "super emitters." However, they do not allow the attribution of the emissions to the specific sources.



## TECHNOLOGIES USED FOR THE DETECTION OF METHANE EMISSIONS

Eni uses a dual approach to innovation for methane detection: on one side, innovative technologies available on the market are scouted and tested in the field to validate their capabilities; on the other side, Eni covers the gap between needs and market-available technologies through internal development in collaboration with external partners.
Multiple innovative technologies for methane monitoring are emerging in the market. Most of these technologies exploit methane optical characteristics (light absorption in the infrared spectrum) to assess the concentration of $CH_4$ in the air and to compute the emitted flow rate using local weather data. Innovative technologies mainly differentiate in terms of sensor carriers. Methane sensors can be installed on satellite platforms, aircraft, helicopters, drones, ground robots, and vehicles or fixed on the ground for continuous monitoring.

| TECHNOLOGY TYPE | CAPABILITY | BENEFITS | CURRENT CHALLENGES | DEPLOYMENT SCENARIO | FIELD TESTING |
|---|---|---|---|---|---|
| **SATELLITE PLATFORM** | • Infrared spectroscopy<br>• Monitored area 12x12 km<br>• Detection threshold 100 kg/h<br>• Ground resolution 25 m | • Site level monitoring<br>• Methane concentration mapping<br>• Methane flowrate calculation with proprietary algorithm<br>• Weekly coverage | • High detection threshold<br>• First stages of offshore monitoring<br>• Limited ground resolution and hard to allocate emissions | • Site level monitoring for high emitters<br>• Source level and site level reconciliation<br>• Monitoring activities to verify | • 1-year activities on 2 sites (Italy and Turkmenistan) concluded<br>• Ongoing monitoring activities on 4 onshore sites (Algeria) and 1 offshore site (Ghana) |
| **AERIAL PLATFORM** | • Infrared spectroscopy<br>• detection threshold 35 kg/h<br>• wide monitored area in contained amount of time | • on demand monitoring<br>• methane concentration mapping<br>• methane flowrate calculation using proprietary algorithm | • difficulties in emission allocation in highly congested areas<br>• quite high detection threshold | • site level monitoring for remote wells and not congested sites | • field test on multiple sites in Northern Italy with a single flight |
| **AERIAL DRONE** | • IR laser sensor for local concentration measurement<br>• Detection threshold 0.1 kg/h (validated in field) | • Site level monitoring with analysis of an operational unit area<br>• On-demand monitoring<br>• Flowrate calculation using local wind data and proprietary algorithm | • Not-ATEX system<br>• Necessity to have at least 1 m/s wind, not higher than 15 m/s<br>• Wind direction and intensity shall be stable<br>• Flight permits not easy to be obtained in certain countries | • Site level monitoring for medium emitting sites | • Site level monitoring 3 onshore sites (Italy, Ghana) and 1 FPSO (Ghana) |
| **FIXED SENSORS** | • Fixed solutions for continuous monitoring<br>• Multiple solutions available on the market, based on optical sensors or metal oxides<br>• Detection threshold 1-5 kg/h | • Site level monitoring<br>• possibility to account for methane flowrate on an operational unit basis for ATEX certified devices<br>• continuous coverage allows to quantify intermittency | • necessity to optimize the installation points<br>• emission quantification depends on local wind data and anemometer position optimization | • site level monitoring on low emitting sites | • field tests planned in Italy |
| **FIXED CAMERA** | • thermal camera for methane monitoring<br>• detection threshold 2 kg/h at 150 m from the leak<br>• continuous monitoring | • source level monitoring for big emitters (e.g. vents, blowdown)<br>• site level monitoring using pan&tilt<br>• possibility to install ATEX certified instruments | • necessity to optimize position considering other emission of gas/vapor | • source level monitoring for intermittent sources | • field test to monitor intermittent vents in Italy |

## EXAMPLES OF METHANE DETECTION TECHNOLOGIES

Among the different innovative technologies for methane detection, Eni has tested satellite platforms, aircraft, aerial drones, and thermal cameras, while fixed sensors and ground robot testing are ongoing

A field test of a satellite platform in Turkmenistan performed over 12 months, allowed the identification of emission variation in time, validated technology reliability by comparing satellite emission data with operational records and identified the areas of intervention.

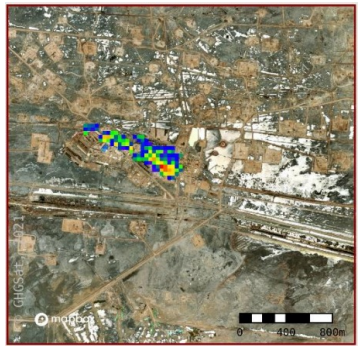



Figure 1 - Satellite platform monitoring - Turkmenistan

Another deployment with a positive outcome is related to a miniaturized laser sensor mounted on commercial drones for methane monitoring at the operational unit level. This instrument monitors emissions by flying downwind of the survey area and assessing methane concentration. This technology was used to acquire site level emission data for OGMP 2.0 reconciliation on an onshore gas site in Northern Italy. Methane emissions were monitored for multiple days, capturing different operational conditions. Despite the emission variation, reconciliation between source and site level measures was successful.


Figure 2 - Source level vs. site level reconciliation

A third testing activity was executed in an onshore site in Northern Italy with a fixed thermal camera to detect and quantify methane emissions from intermittent sources continuously. Specifically, this instrument monitors compressor vents, storage tanks, breathing valves, and blowdown from cold vent. Data acquired by this instrument have been used for emission data reconciliation between source and site level monitoring.

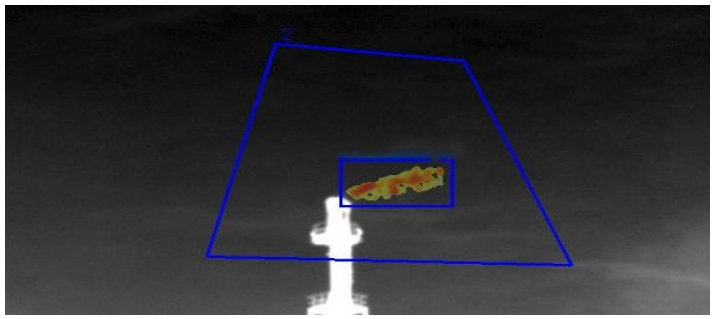


Figure 3 - Cold vent blowdown monitoring



## DEVELOPMENT OF NEW TECHNOLOGIES

Eni also launches initiatives related to technology development through Joint Development Agreements (JDA) or Collaboration Agreements (CA) with third parties or by leveraging internal know-how.
The deployment of innovative robotic technologies seeks to conduct monitoring activities automatically and remotely, allowing the repeatability of the results and reducing operators' exposure to harsh and dangerous environments. This multiplatform robotic framework includes fixed sensors and movable ones, installed on aerial drones or legged robots.

One breakthrough example relates to the development of an autonomous aerial drone concluded in November 2022. The prototype was certified for operation in ATEX classified areas, becoming the first drone with the possibility to operate in potentially explosive atmospheres. Eni and an Italian drone manufacturer developed this drone, within a JDA, to operate autonomously in complex environments, such as upstream sites not covered by GPS signal. It can take off from its docking station, follow pre-defined routes inside the plant, hover near the items of interest, acquire data with its laser sensor, return to the docking station to recharge batteries, and share the acquired data with the site control room for implementation action. This technology has been field tested in an onshore site in Northern Italy and applied in an emission campaign in Congo.
Another innovative technology, a terrestrial robot, certified for operation in ATEX classified areas, was tested within a CA. Eni is particularly interested in this technology because it can execute autonomous missions following pre-programmed routes in ATEX-certified and GNSS-denied environments. Field validation of the robotic technology was completed in September 2023, while future development includes integrating methane sensing elements on the robot.

**FOCUS ON**

### CASE STUDY

In 2019, while performing the LDAR campaign at one of the plants in Egypt, the OGI camera detected sources of fugitive emissions at the top part of a de-ethanizer tower, and the leaks seemed to be huge volumes. Subsequently, this part of the plant was shut down, and major maintenance activities were carried out to replace all the leaking sources. The following LDAR verification campaign confirmed a significant reduction in methane emissions (about 10 ton $CH_4$/y).

In 2014, fugitive emissions represented over 60% of Eni Upstream's methane emissions; in 2023, they account for only 17%. This reduction has been achieved, in large part, due to the implementation of monitoring campaigns, such as Leak Detection and Repair programs, performed across Eni's operated assets. The methodology currently adopted for monitoring fugitive emissions envisages, in line with the international CCAC-OGMP and US EPA guidelines, a first phase of detailed technical studies of individual plants to map all potential sources of fugitive emissions (average over 10,000 points per site across flanges, valves and other components) and provides a more realistic and site-specific estimate of fugitive emissions. Then we proceed with field monitoring through LDAR campaigns, which allow, through specific instruments such as sniffer devices and OGI cameras to identify all possible leaks and methane losses, and proceed with the repair/maintenance of the source in the minimum technical time (most effective method in terms of cost/benefit).

To date, desktop studies and LDAR campaigns cover more than 99.7% of Eni's operated assets, and we plan full coverage by 2024. Since 2021, the frequency of implementing LDAR campaigns has been set annually, in line with the Oil & Gas Methane Partnership guidelines.

This process is now applied to all Eni Upstream sites and subsidiaries/districts. With the Business Units (BUs) commitment to perform annual LDARs, the BUs have purchased their OGI cameras and trained their local personnel/teams on equipment use and quantification process of fugitive emissions. Now, many operational sites at the BUs are performing LDAR campaigns autonomously.

In 2023, Eni performed onsite measurements to quantify fugitive emissions using the OGI cameras for leak detection and a high-flow sampler for emissions quantification.

## OGMP GOLD STANDARD PATHWAY ACKNOWLEDGMENT

Through its participation in the Oil and Gas Methane Partnership 2.0 (OGMP 2.0), Eni continues to enhance methane management practices and improve the quality and transparency of methane emissions reporting while reinforcing its commitment to reduce methane emissions along its value chain.

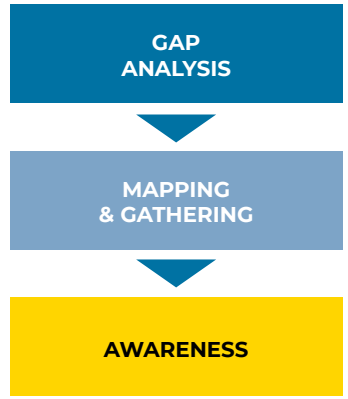
In December 2023, Eni received Gold Standard Pathway status under the OGMP 2.0 program, as reported in the International Methane Emissions Observatory 2023 Report (IMEO), published by the United Nations Environment Programme (UNEP), on the basis of a credible plan to achieve the highest levels of reporting within the set timelines.

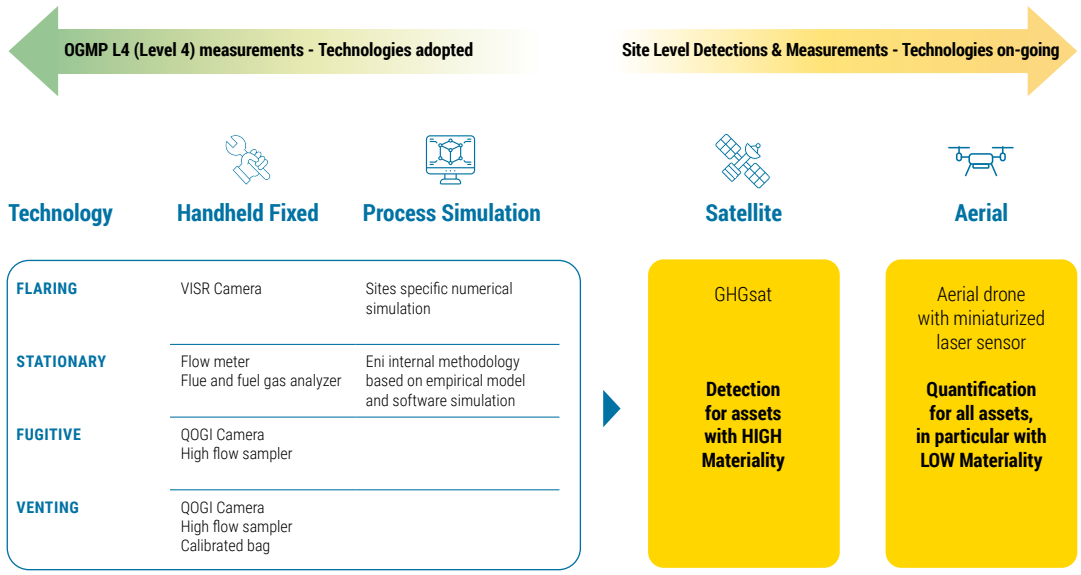
This acknowledgment marks Eni's decarbonization strategy's effectiveness in measuring methane emissions with the final target of reducing and mitigating them. Throughout 2023, Eni conducted an extensive worldwide methane measurement campaign.

A dedicated multidisciplinary task force oversaw the activities, with strong commitment and significant support from all Eni geographical areas, joint venture companies, and partners.

Eni's internal procedures, in alignment with OGMP best practices, have been applied to all methane emissions sources, including process venting, unintentional leaks (e.g., fugitive emissions), and emissions due to incomplete combustion (e.g., heating, power generation, flaring). The onsite measurement activities during the OGMP campaigns involved equipment and technologies specific to each emission source category. According to 2024 implementation plan, site measurements together with source measurements will be deployed. As part of such plan, Eni is working with its partners/operators of the assets in which it has a share, providing support to the operators from the technical view point where needed, raising awareness, and in some cases performing activities on their behalf contributing to data reliability.

*The path ahead for gold standard achievement*



Additionally, where considered more effective, process modeling and engineering analysis were employed to address scenarios, particularly for stationary combustion. The development of an in-house engineering calculation tool facilitated this approach.
A significant multidisciplinary coordination effort, precise logistical planning, and continuous interface with the operational side of the 14 affiliates were the winning ingredients to achieving an ambitious target by 2023.

### KEY DATA AT A GLANCE

- Analysis conducted on a **100%** of the sites (about **80** assets/facilities).
- Executive phase implemented across **12** countries and **14** Business Units.
- Measurement campaign conducted at **34** selected representative facilities.

**FOCUS ON**

### OGMP L4 CAMPAIGN ADDITIONAL BENEFIT:

- Identification of emission (unintentional leak) from sources not previously mapped, replaced during the upcoming major turnaround activity
- Enhanced comprehension of methane emission sources, categorized by types across various geographical regions and types of upstream facilities
- Mapping of specific operational plant conditions required for immediate implementation to reduce methane emission releases into the atmosphere
- Interface with different stakeholders within the jointly operated company (including national oil companies), promoting awareness of the methane mitigation program

One example of unexpected methane being detected and corrective action taken, was during a site survey, where we discovered the seals of some tank hatches were leaking. Subsequently, during a major turnaround scheduled one month later, maintenance activities resolved the loss of methane. The previous LDAR campaigns did not map this leak, which represents an example of improvement we shall take forward for future campaigns.




# Methane reduction projects and initiatives

### FLARING DOWN THROUGH GAS VALORIZATION

Flared gas is a significant source of $CO_2$ and methane emissions due to incomplete combustion. If gas is recovered, it could be used to partially replace more carbon-intensive fuels, helping to improve energy access and security.
Eni has dedicated increasing efforts over the past years to identify and implement initiatives to mitigate gas flaring. To date, examples of these projects can be found in Africa - mainly, Congo, Libya, and Egypt - where greater logistical, operational, and market barriers have so far limited the valorization of the associated gas.
In principle, Eni works on the different opportunities based on the following pillars:

- Gas valorization through gas export or via LNG
- Gas valorization through Power (Gas-to-Power) or through computational capacity
- Gas reinjection for production enhancement
- Gas reinjection for disposal.

Among the initiatives for reducing flared gas, Eni has successfully implemented various gas valorization projects aimed at increasing power generation for the local communities where it operates, for example:

- CEC (Congo), with an installed power of 484 MW in operation since 2010
- OKPAI (Nigeria), with an installed power of 480 MW for the first phase, operating since 2005, and a second phase with 320 MW already installed, seeks to reach approximately 1 GW of total power in the coming years.

**ENI IS IMPLEMENTING FLARING REDUCTION PROJECTS TO VALORIZE THE GAS. EXAMPLES OF DIFFERENT MAGNITUDES ARE LISTED BELOW**

**EGYPT:** gas valorization projects in desert areas where the produced gas is recovered for the company's fuel use.

**LIBYA:** approximately 160 km offshore from Tripoli, the flared gas will be recovered and transported with a new pipeline for treatment and valorization on the market.

**CONGO:** LNG Project: the development project is based on the opportunity to satisfy a very competitive and attractive time-to-market with small and medium-sized LNG plants.

# Methane Emissions Reduction: Energy efficiency and New Projects Design

Each new development initiative undergoes an energy efficiency and GHG emission baselining (Scope 1 and 2) through all projects' phases from the beginning of the design, aiming at minimizing climate impacts and pursuing Carbon Neutrality in the long term. The project design should implement appropriate measures customized to the specific project characteristics, including a multiple effort to reach objectives, such as on overall GHG intensity reduction (Scope 1 and 2), zero routine flaring policy compliance, and near zero methane emission target.
Energy efficiency is a key element of Eni's **decarbonization strategy**[7] as it facilitates the reduction of energy consumption and cuts consequently down $CH_4$ and $CO_2$ emissions.
In the coming years, in addition to conducting intensive analysis of consumption through energy audits, which now cover almost all operated assets, Eni Upstream plans to progressively extend ISO 50001 certification to all its most energy-intensive companies and plants.
Adoption of the **Best Available Technologies** from the initial design phases, integration of **renewable energy**, **digitalization of processes** and **optimization of operations** are the main pillars of this process, which aims to continuously improve the energy performance of the assets and reduce their **carbon footprint**.

In its 4 Year Plan (2024-2027), Eni Upstream will have in place more than 90 of active energy saving initiatives worldwide. The main interventions include gas compression revamping, equipment adjustment to new operating conditions, the optimization of production network and thermal integration between adjacent plants. Other saving contributions come from initiatives related to electrification and renewable energy integration. At this regard, Eni has extensively assessed opportunities to:

- Electrify totally/partially its operated assets. This option is particularly interesting in countries where the power national grid is stable, reliable, and generated with a good fuel mix
- Integrate renewable energy plants into its operated assets, in order to displace totally or partially its own fuel/imported energy consumption.

One example is the Photovoltaic (PV) plant installation in Algeria at the Bir Rebaa North Plant: a 10 MWp PV plant was installed (start-up in 2019) to partially displace power imported from the national grid and an additional 10 MWp PV are currently under construction in the same area. Another example is the Rubicone compression (electrification) project, realized in Italy (Eni DICS; start up in 2020), which consisted of shutting off the offshore compression station fed by gas turbines and installing two electric compressors in the onshore receiving gas plant with a more suitable size.

| | |
|---|---|
| **MITIGATION OF METHANE EMISSIONS FROM STATIONARY COMBUSTION** | These emissions are proportional to fuel consumption and combustion efficiency. An approach that evaluates the electricity to the local electric grid by assessing grid availability and reliability and the electric energy carbon footprint assessment. Right-sizing of fired equipment enables it to operate throughout its entire life at optimized working points, maximizing overall system energy efficiency, reducing Fuel Gas burnt volumes, and with an optimal combustion efficiency enabling further reduction of unburnt hydrocarbons, methane, and other pollutants |
| **MITIGATION OF METHANE EMISSIONS FROM FLARING** | Zero routine flaring policy is applied to all new facility projects (both for revamping brownfield and greenfield initiatives), and non-routine flaring (except for flaring related to safety reasons) is minimized by deploying operative optimizations and maintenance best practices. Flaring is usually minimized during the start-up and commissioning phases and through schedule optimization of commissioning activities. Along with the improvement of flaring equipment and hydrocarbon destruction efficiency to reduce methane emissions, the following measures are always evaluated:<br>- Use of nitrogen instead of fuel gas as a purge gas<br>- Flare gas recovery systems (including closed flare deployment opportunities) |
| **MITIGATION ON METHANE VENTING** | Methane venting is avoided through process design; each venting source is recovered, or where unfeasible, the streams are burnt, releasing the unburnt component into the atmosphere. The mitigation is achieved by using localized or centralized vapor recovery units. |
| **MITIGATION OF METHANE FUGITIVE EMISSIONS** | Fugitive methane emissions occur due to unintentional releases into the atmosphere resulting from leaking equipment. A desktop study on fugitives can be run after the Front-End Engineering Design phase to identify and classify potential fugitive sources and set up LDAR campaigns from the time of the plant start-up. Operating, Inspection, Testing, and Maintenance procedures are planned for a comprehensive monitoring program. Specific testing against fugitives can also be run before installing critical equipment, such as valves. |

7 Information and data on Eni's performance on energy efficiency can be found in Eni For Performance 2023.
https://www.eni.com/content/dam/enicom/documents/eng/sustainability/2023/sustainability-performance/eni-for-2023-sustainability-performance-eng-print.pdf#page=16

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