socrate
WORKING FOR SUSTAINABILITY

Integrated solutions for the industrial, oil & gas, and energy sectors

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Regulatory framework

- The Regulation of the European Parliament 2024/1787 lays down rules for accurately measuring, quantifying, monitoring, reporting, and verifying methane emissions in the European Union's energy sector, as well as for reducing them, including through leak detection and repair surveys, repair obligations, and restrictions on venting and flaring.

- This Regulation also establishes rules on instruments that ensure transparency regarding methane emissions.

The air monitoring solution used complies with all the regulatory parameters required by the regulation:

- It complies with TIER 3 of the IPCC (Intergovernmental Panel on Climate Change); The Tier 3 approach uses direct measurements on a mine-specific basis and, properly applied, has the lowest level of uncertainty.
- It complies with Level 5 of OGMP 2.0. For Level 4 (source-level) and Level 5 (site-level), companies should document and provide sufficient information to demonstrate that the sampling used to estimate emissions is representative of the population of sources and sites they are characterizing.
- It is capable of monitoring leaks (well) below 500 ppm (limit set for LDAR type 2);

In particular, through the use of laser technologies in the mid-infrared range, the Socrate solution allows the detection of very low concentrations of both methane and ethane to distinguish between anthropogenic and natural methane (which in some cases can reach significant concentrations) that could alter the quantification of emissions if it were

OGMP Reporting Level:

Levels 1–2: Use of standard emission factors (IPCC, EPA).

Levels 3–4: Direct measurements at sources and facilities.

Level 5: Reconciliation between bottom-up inventory and top-down observations (mandatory).

Discrepancies must be documented, and the differences explained.

Livello	Descrizione	Caratteristiche principali
Level 1	Basic inventory	Use of standard emission factors (IPCC, EPA) and activity data. No direct measurements.
Level 2	Improved inventory	Technology/process-specific emission factors. Greater granularity than Level 1.
Level 3	Direct measurements on sources	Direct measurements on equipment or components (e.g., leaks from flanges, valves). Input of real data.
Level 4	Plant-level measures	Quantification of a site's total emissions through measurement campaigns (e.g. drones, fixed sensors)
Level 5	Bottom-Up vs. Top-Down Reconciliation	Comparison between inventory (bottom-up) and atmospheric observations (top-down). Documentation of discrepancies and corrective actions.

OGMP
Oil And Gas Methane Partnership 2.0

LEVEL 3: Fugitive emission point level detection:

The first step is the leak detection and identification of the emission sources.

This activity can be developed using an Optical Gas Imager (OGI), which has a good capability to identify the emission sources, and the latest models available in the market have also a quantifications capability.

The RedLook OGI portable camera is an Optical Gas Imager (OGI) designed for the detection of fugitive gas emissions. The system consists of an infrared camera with an integrated processing unit, which supports embedded RedLook software.

The solution is based on a highly sensitive, uncooled detector optimized for the detection of methane (CH_4), sulfur dioxide (SO_2), and volatile organic compounds (VOCs). The system implements extensively tested gas detection algorithms, combined with advanced signal integration and data analysis technologies.

The embedded processing typical of OGI systems enables advanced analyses, including quantification of the observed gas flow rate. The RedLook OGI portable camera and all its components are packaged in a waterproof case for easy transport.

SENSIA Mileva 33

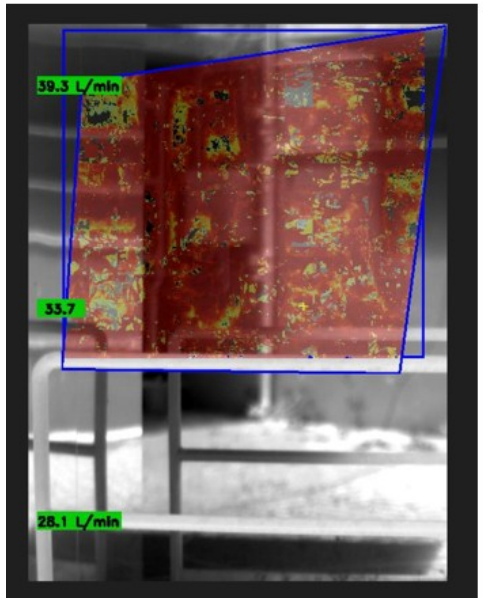
- Sensia's Mileva 33 thermal imaging camera is an advanced instrument for detecting and quantifying gases, particularly methane, ensuring high sensitivity and precision. The system enables the acquisition of high-resolution thermal images, with uncooled IR sensors and temperature variation detection up to ±0.05°C, ensuring rapid and reliable identification of emissions
- Thanks to the integrated digital interface, data can be transferred in real time and stored on internal memory or external devices for subsequent analysis. The thermal imaging camera's automatic calibration ensures maximum measurement accuracy. The acquired thermal images allow for the precise location of methane leaks, quantification of their concentration, and provision of detailed technical reports.
- The Mileva 33 thermal imaging camera can also be integrated with dedicated software for data processing and report generation compliant with safety and environmental standards, offering the customer a complete tool for monitoring and efficiently managing gas emissions.

SENSIA Mileva

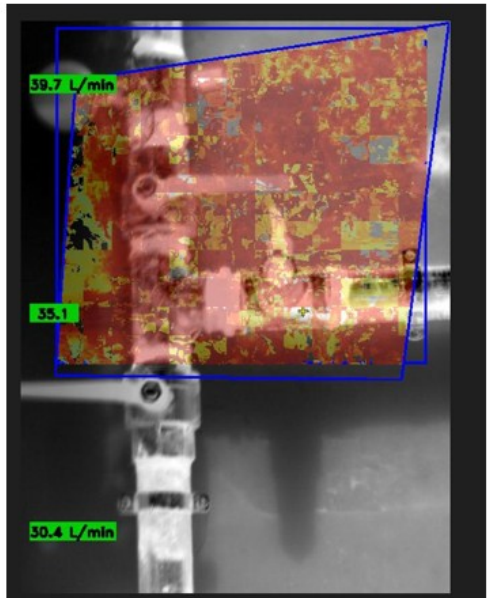
33

The detector and electronics integrated into the thermal imaging camera convert the infrared radiation conveyed by the optics into digital images. The acquired data is then processed and displayed on the instrument's screen and/or recorded for analysis and archiving. Below are examples of images acquired using a thermal imaging camera.

Distanza 10m dal punto di emissione

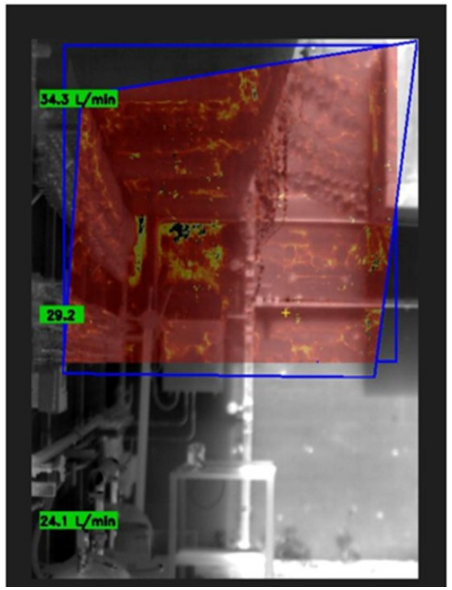


Distanza 3m dal punto di emissione

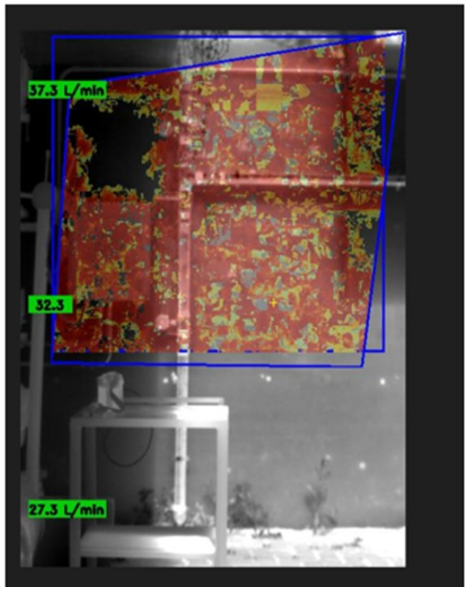


30 l/min of FLOWMETER SETUP with the following reading of the CAROLINE OGI Y Ex device.

Distanza 10m dal punto di emissione



Distanza 5m dal punto di emissione



24 l/min of FLOWMETER SETUP with the following reading of the CAROLINE OGI Y Ex device.

LEVEL 3: Fugitive emission point level quantification:

For more accurate and reliable quantification, a dedicated sniffer can be used for point-to-point measurements, providing the highest accuracy in emission quantification.

AddGlobe is the leading manufacturer of the Gas Flow Meter 2.0, with over 17 years of experience as the largest supplier of high-volume samplers.

The reception distance is up to 5 meters, and the battery capacity allows for uninterrupted measurements for approximately 14 hours. The protection rating is IP 67.

It is equipped with a high-performance ATEX IP 68 phone for use as the user interface. The electrochemical oxygen sensor used for measuring oxygen and methane has a lifespan of approximately 3 years.

It also uses an advanced ultrasonic sensor to provide accurate, real-time flow data even in the presence of humidity.

AddGlobe Gas Flow Meter 2.0

It is a portable, explosion-proof, battery-powered instrument designed to determine the volumetric leak rate from various fittings such as air compressors, wet/dry seals, suction valves, and many other sources of gas leaks in natural gas systems

The leak rate is measured by high velocity sampling to capture all gases escaping from the object as they are diluted with ambient air, thereby ensuring the accuracy of the leak rate calculation.

A small optical sensor with a wide temperature range from (-40 to 60 °C) is used to measure the concentration of natural gas and also has an additional sensor indicating the volumetric oxygen content.

To eliminate the influence of hydrocarbons, a high order leads to a significant increase in the optical sensor readings and exceeds the indicated measurement error limits, the GFM instrument corrects the detected leaks using the oxygen displacement method and the methane/natural gas coefficient, set to 1000

LEVEL 4: Total fugitive emission quantification:

To perform a level 4, and consequently a Data reconciliation (level 5), a top-down approach is required that monitors the atmospheric effect of the sum of leaks from the specific asset.

Aeris Strato model, equipped with a MID IR laser system, a Harriott cell, and a suction pump, allows accurate monitoring of concentrations of methane and ethane, allowing:

1- On-foot survey to identify critical points within the plant
2- Applying statistical methods determination source area.
3- Detect and quantify the plant's total emissions using dedicated software based on AI and statistical models.

Given its extremely low weight and compact size, it can be mounted on a drone to enable low- and medium-altitude monitoring, allowing for a more precise assessment of total emissions.

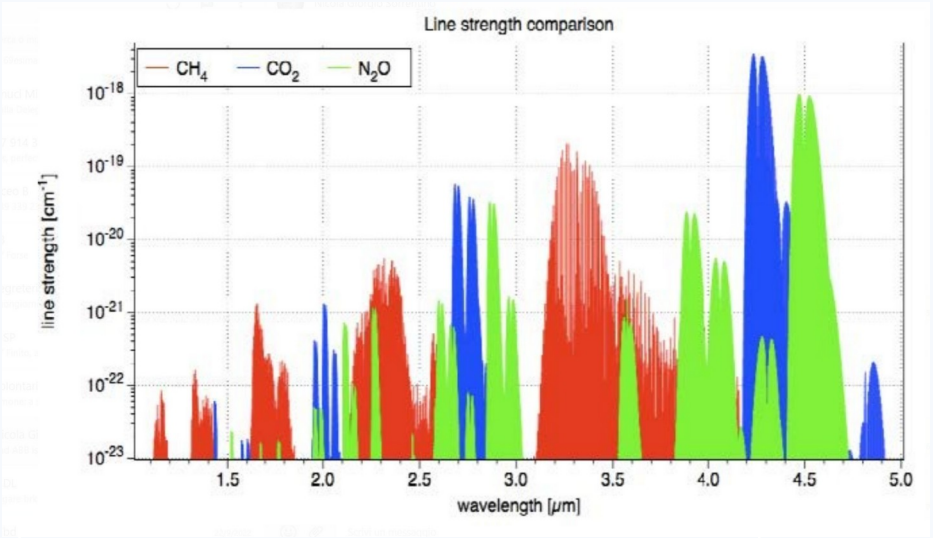
Device characterisation

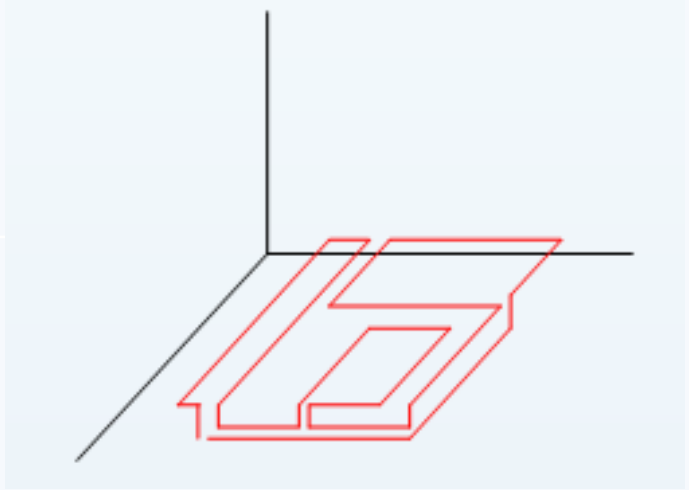
In summary, the use of TDLAS technology, combined with the spectral shape of absorption peaks in the mid-infrared (fundamental absorptions rather than higher-order harmonics), allows hydrocarbon peaks to be isolated, ensuring the following performance:

- CH_4 detection limit: < 1 ppb
- C_2H_6 detection limit: < 500 ppt

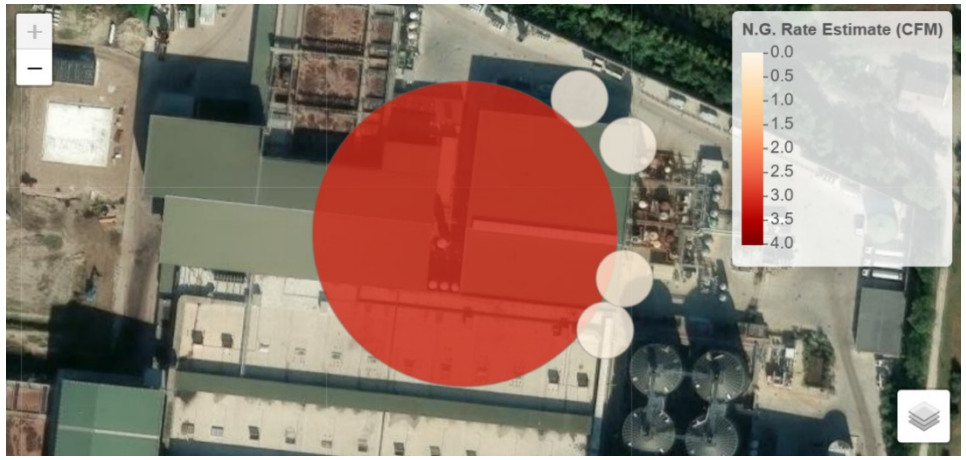
These characteristics make the product approximately 30 times more sensitive than standard devices typically used for this purpose.

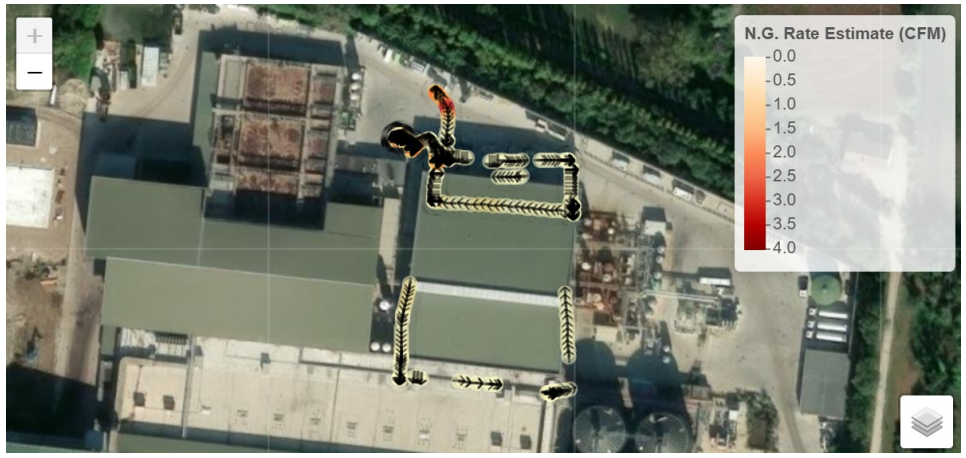
The circuit method along the perimeters of the various plant sections is used as the primary operational approach for detecting and quantifying emissions.
This methodology allows for real-time compensation of measurements based on wind speed and direction, ensuring the reliability of results even in conditions of weak, absent, or rapidly changing winds, conditions that significantly reduce the effectiveness of planar approaches.





LEVEL 4: Total fugitive emission quantification:





LEVEL 5: Data reconciliation

The OGMP framework requires companies aiming for the highest level of transparency to progress to **Level 5**. At this stage, **reconciliation** is performed by identifying and explaining discrepancies between measured and estimated emissions and by updating emission factors and methodologies as needed to improve the accuracy of future inventories.

It is therefore necessary to determine the gap (gap) between the environmental measurement (Level 4) and the emissions determined by the LDAR campaign (Level 3). Similarly, the scaling factor must be determined, defined as the ratio between the two aforementioned values (top-down/bottom-up).

However, these data (like all physical quantities) carry with them the uncertainty of the measurements themselves; therefore, it is also necessary to determine the uncertainty of the gap and the scaling factor and perform a statistical consistency assessment to determine whether an investigation into the presence of other sources not detected during the calculation or measurement of individual emissions is necessary.

Scenario

Bottom-Up (Level 3):

Valves: 500 pieces × 0,0005 kg/h = 0,25 kg/h

Compressors: 10 pieces × 0,12 kg/h = 1,2 kg/h

Total: 1,45 kg/h

Top-Down (Level 4):

Drone campaign → **3,0 kg/h** total emissions detected.

Reconciliation steps once consistency has been verified

Gap calculation:

$$\text{Gap} = \text{Top-Down} - \text{Bottom-Up} = 3{,}0 - 1{,}45 = 1{,}55 \text{ kg/h}$$

→ Inventory underestimated by ~**107%.**

Root cause analysis:

Are emission factors too low?

Unrecorded leaks (e.g., flanges, tanks)?

Different operating conditions?

Application scaling factor:

$$\text{Scaling Factor} = \frac{\text{Top-Down}}{\text{Bottom-Up}} = \frac{3{,}0}{1{,}45} \approx 2{,}07$$

→ Update inventory by multiplying by 2,07.

Inventory Update:

New Total: 1,45 × 2,07 ≈ 3,0 kg/h

Document in OGMP Level 5 report.

Result: The gap is explained and corrected. The Bottom-Up model is updated to reflect the actual measurements.

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