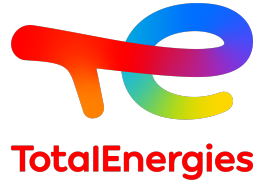




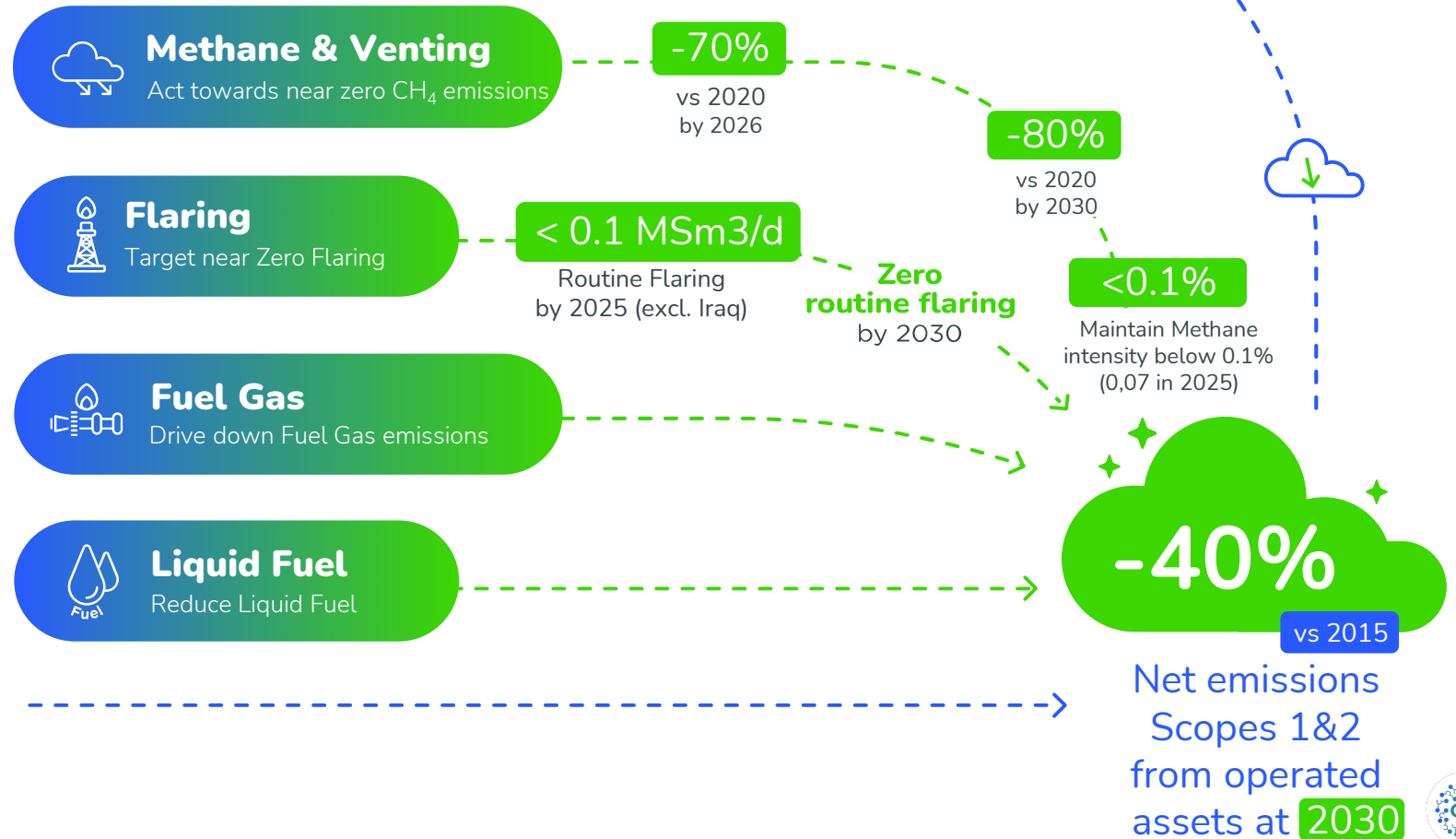
Rio Innovation Week

TotalEnergies Methane Strategy & Action Plan

TotalEnergies Emissions' commitments



- 1 Anchor & Spread a Low Carbon Culture & Performance
- 2 Collect & Share High-Quality CFR Data
- 3 Improve Support of Assets through Innovation, Technology Methods & Tools
- 4 Engage & Leverage External Stakeholders



TotalEnergies Emissions' commitments



Act towards near zero

Methane & Venting

2023

OGMP 2.0 Gold Standard
Operated Material Assets: L4 (all) & L5 (1/3)

2025

OGMP 2.0 Gold Standard
Operated Material Assets: L5 (all)
Support OBO OGMP L5
-60% vs 2020

2030

Monitoring

Deploy CH₄ site monitoring technologies



Drones



Satellites



Planes



LDAR



PEMS



Camera



Sensor & Microsensor

Reporting

- **Comply** with OGMP 2.0 reporting
- **Determine flare** specific emission factors
- **Reconciliation** with site-level measurements – Reach Level 5 reporting



Accelerating

- **Maintain R&D** 'technological watch
- **Industrialize reconciliation**
- **Industrialize monitoring data visualization tools**

1 Monitor, Report & Verify

1.1

1.2

1.3

2 Eliminate systematically all sources

Venting continuous & non-continuous

- Vent mapping
- Study residual venting
- Assess Oil Tanker emission

2.1

Flaring

Interface with Flaring roadmap

2.2

Rotating Equipment

- Interface with Fuel Gas roadmap
- Deploy PEMS for stationary combustion

2.3

Fugitives

Yearly QLDAR

2.4

3 Advocate & collaborate

Foster a zero CH₄ culture

- Promote collaboration

3.1

Support to OBO

- Implement OGMP 2.0 requirements in OBO



3.2

Contribute to external Partnerships

- IOGP Methane expert group
- GFMR Technical Advisory Group



3.3

Regulatory watch

- Follow-up updates on CH₄ EU regulation implementing acts

3.4

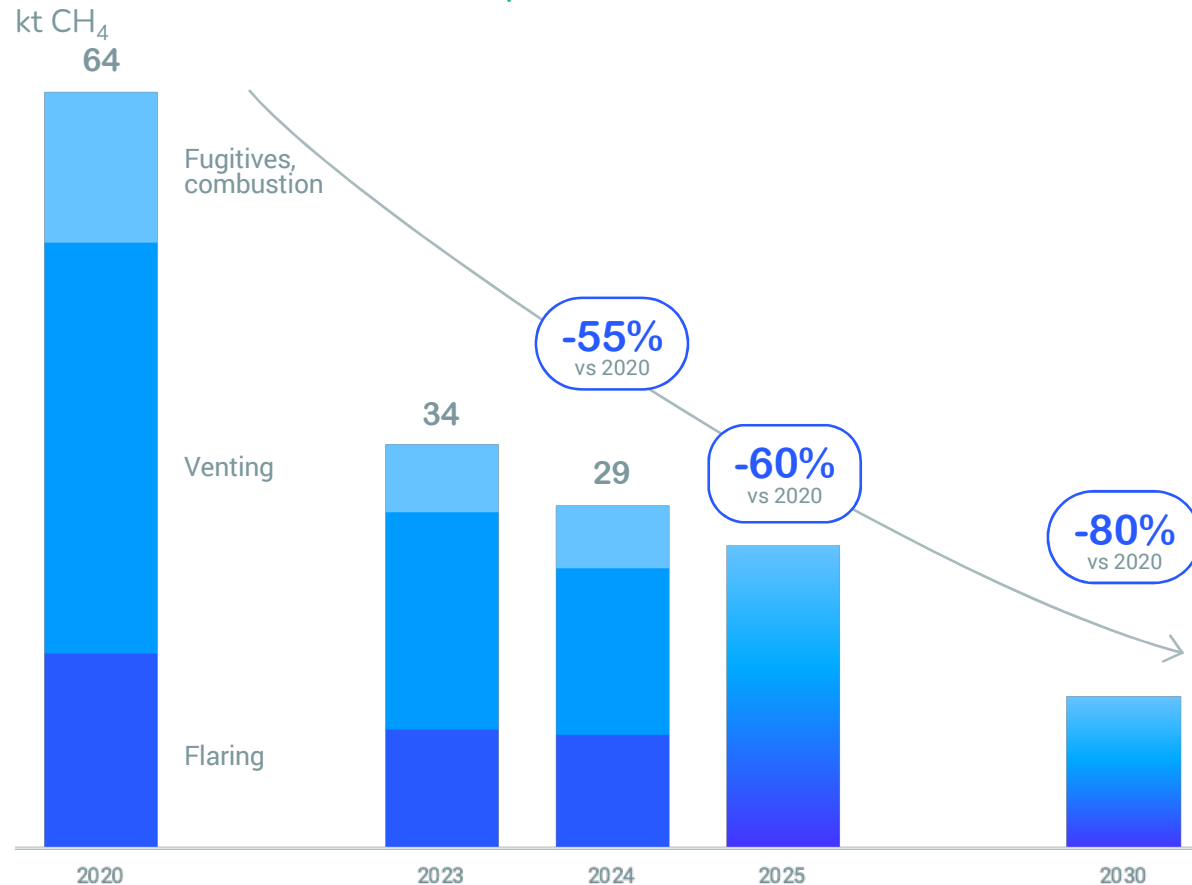
Aiming for

Near
Zero Methane
emissions



TotalEnergies Emissions' commitments

Methane emissions on operated facilities



Our actions to move toward near-zero methane



Methane
Permanent
Monitoring



Annual
leak detection &
repair campaign



Reducing
flaring & venting

→ 2030 reduction targets in line with external references:

- EU gas markets framework -80%
- IEA NZE scenario -75%

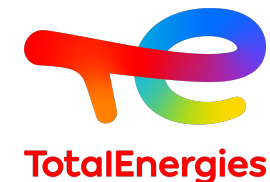
→ Highest level of reporting for operated and non operated assets
Gold standard OGMP 2.0

OGMP 2.0 Reporting Framework

OGMP 2.0 is a **reporting framework** aiming to improve reporting accuracy and transparency of CH₄ emissions in O&G sector for **operated & non-operated** ventures.

The **Gold Standard** is attributed on an annual basis.

To get the **Gold Standard**, a company must achieve Level 4/5 reporting for **operated** assets within **three years** and for **non-operated assets** within **five years**



Sources Categories

1 - Stationary combustion

2 - Flaring

3 - Fugitives

4 - Venting

- 4.1 Nat gas driven equip
- 4.2 Centrifugal compressor
- 4.3 Reciprocating compressor
- 4.4 Glycol dehydrator
- 4.5 Tanks
- 4.6 Gas Well liquid unloading
- 4.7 Oil Well casinghead vent
- 4.8 Hydraulic fracture completion
- 4.9 Venting other

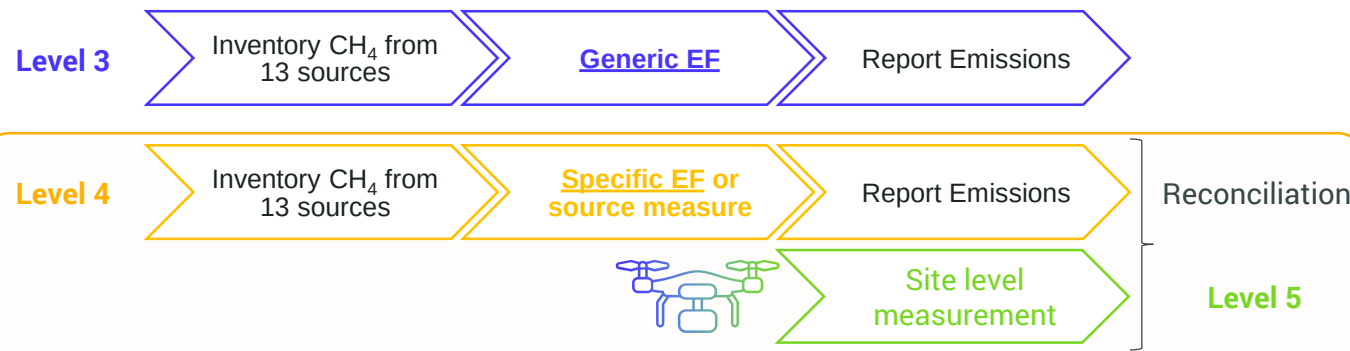
Venting sources

5 - Other sources

Reporting Levels key points: Methane to be reported through measures and for 13 sources

Level 1 – CH₄ reported globally for a venture at asset or country

Level 2 – CH₄ reported in consolidated, simplified main sources categories



2020

Y0



joins OGMP2.0

2021

Y1



Gold Status
Based on Y0

2022

Y2



Gold Status
Based on Y1

2023

Y3



Gold Status
Based on Y2

2024

Y4



Gold Status
Based on Y3

2025

Y5



Gold Status
Based on Y4

2026

Y6



Gold Status
Based on Y4

2027

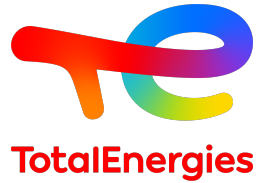
Y7

Next target

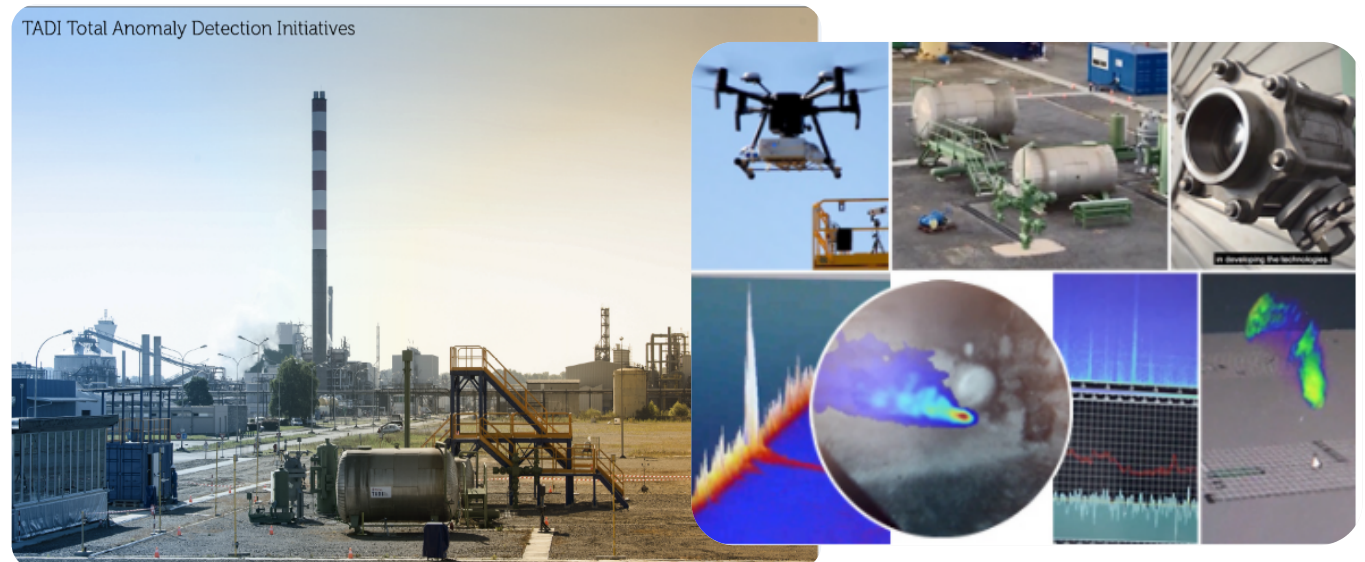


TADI Platform

TotalEnergies Anomaly Detection Initiatives



- **Testing Hub:** Operational since 2018 near Pau, France, TADI tests and qualifies promising technologies
 - **R&D Essential:** Key for GHG detection and quantification in a secure industrial setting.
 - **Innovation Support:** Facilitates techno scouting and the development of new technologies
-
- Although there are several guidance documents available, today **there is no standard** to validate CH₄ detection or quantification technologies
 - **Not all technologies** available on the market are efficient!
 - Hence it is important to select technologies that have been validated against **controlled releases** in testing facilities.



TotalEnergies qualifies all technologies before deployment
by means of blind tests on TADI facilities

MRV – Technologies deployment

TotalEnergies scouts technologies for CH₄ quantification and assess them on dedicated test site (blind tests on TADI)

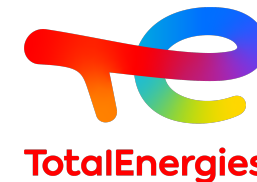
Satellite	Threshold > 100 Kg/h		ONS
Airplane	Threshold > 10 Kg/h		ONS
Drones	Threshold > 1 Kg/h		ONS / OFF
Cameras	Threshold > 0.3 Kg/h		ONS
Fixed sensors	Threshold > 0.3 Kg/h		ONS

	Quantify CH ₄	Quantify CO ₂	Track fugitives	Combustion efficiency
	✓	✗	✗	✗
	✓	✗	✓	✗
	✓	✗	✓	✗
	✓	✓	✓	✓
	✓	✗	✓	✗
	✓	✓	✓	✗
	✓	✗	✓	✗
	✓	✗	✓	✗

Combining CO₂ and CH₄ sensors helps better understanding the breakdown of emission (combustion source or venting).

AUSEA campaign – Process

Technology developed by TotalEnergies and French National Research Center



Sensor

CH₄ & CO₂
Concentration Calculation
Ultra Light (1,2 kg)



DRONE

Standard Drone
Non ATEX
Light: < 10kg category



Weather station

Standard LIDAR Station
Advanced Wind Measurements



Operators

1 qualified gas analyzer operator
(superuser)
1 Professional drone pilot



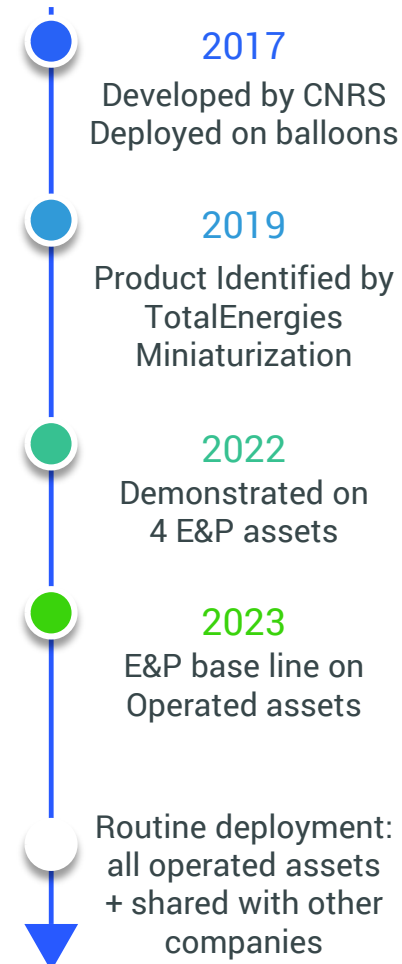
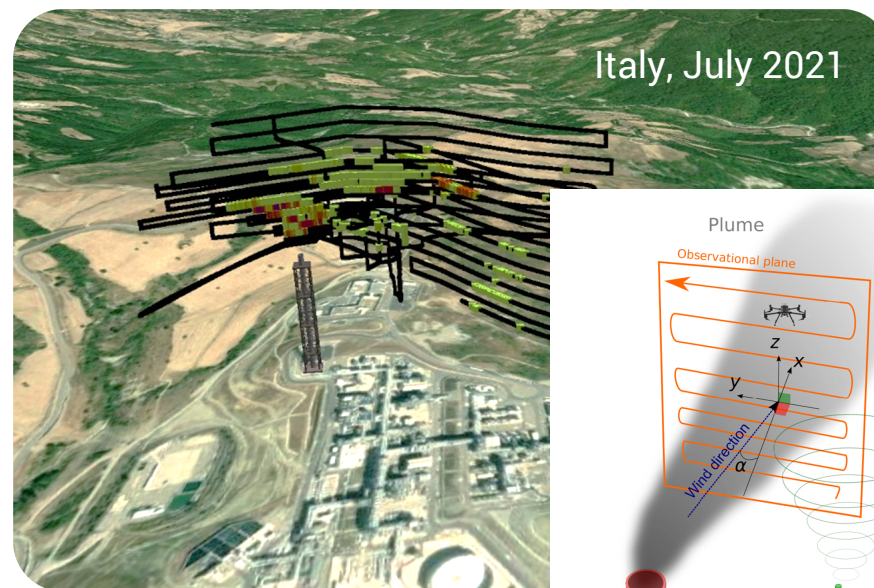
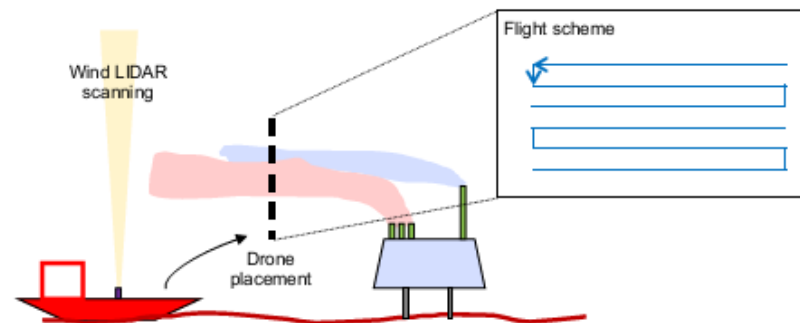
Post processing

Flow Calculations

- CO₂ & CH₄ quantification
- Inventory exhaustivity confirmation
- Fugitives tracking
- Combustion efficiency

Days of operation

2022 **180**
2023 **250**
2024 **>500**



CH₄ monitoring overall strategy

SITE LEVEL – Regular monitoring

SATELLITES SURVEILLANCE

- Track super emitters using public satellites
- Spot survey, using private network



DRONE SURVEYS

- Site Level quantification



- Reconciliation
Site-level with source level measurement



SOURCE LEVEL – Continuous real-time monitoring

FUGITIVES & INCIDENTS

Continuous detection

- Offshore
Network of ATEX sensors
- Onshore well pads
Network of high sensitivity sensors
- Onshore processing plants
Fixed infra-red cameras
- LDAR (Leak Detection&Repair)
campaign (non continuous)



UNBURNT & VENTING continuous real-time EMISSION RATE monitoring

Flaring

- Gas to flare flow measurement
- Flame-out detection
- Methane destruction efficiencies with AUSEA drone.



Stationary combustion

- Fuel gas flow measurement
- CH₄ measurement at exhausts



Venting

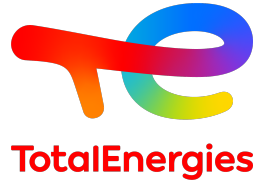
- Main vent lines flow measurement
- Engineering calculation for some venting locations
- Other advanced technologies
Such as fixed cameras and sensors



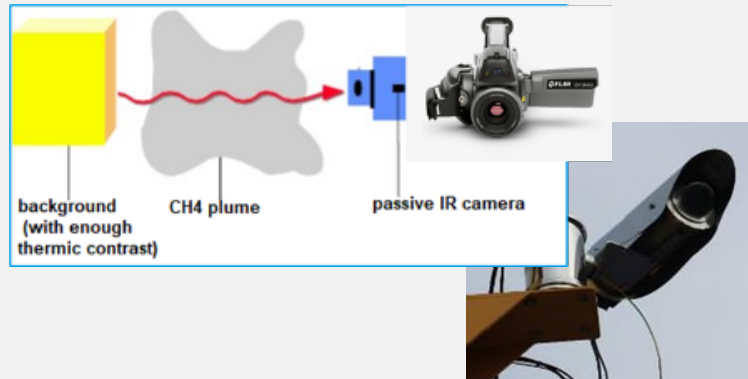
PEMS (Predictive Emission Monitoring System)

Infrared Technologies

SENSIA's fixed flare monitoring camera will be installed in June

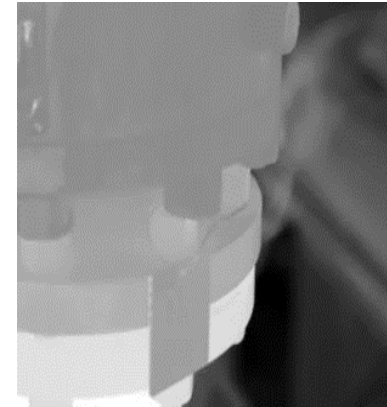


Infrared cameras (fixed or handheld)



- Monitor continuously process areas of onshore assets
- Analyses of the Infrared energy emitted from background
- Detection threshold: > 10 kg/h

Permanent detection of leaks for quick implementation of repair



Pyrometers



- Gives a simple information "lit"/"not lit"
- Associated to the flare gas flow measurement, it allows to know if the flame is lit when gas is flowing. If flow is detected while the flame is off, it associates the flow to unburnt methane emissions.

Enhanced combustion of methane to reduce emissions



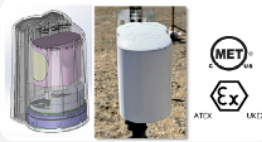
Network to monitor fugitive emissions continuously



Certified by ANATEL and INMETRO

Up to 11,000 IOT sensors to be deployed for Offshore facilities

IOT



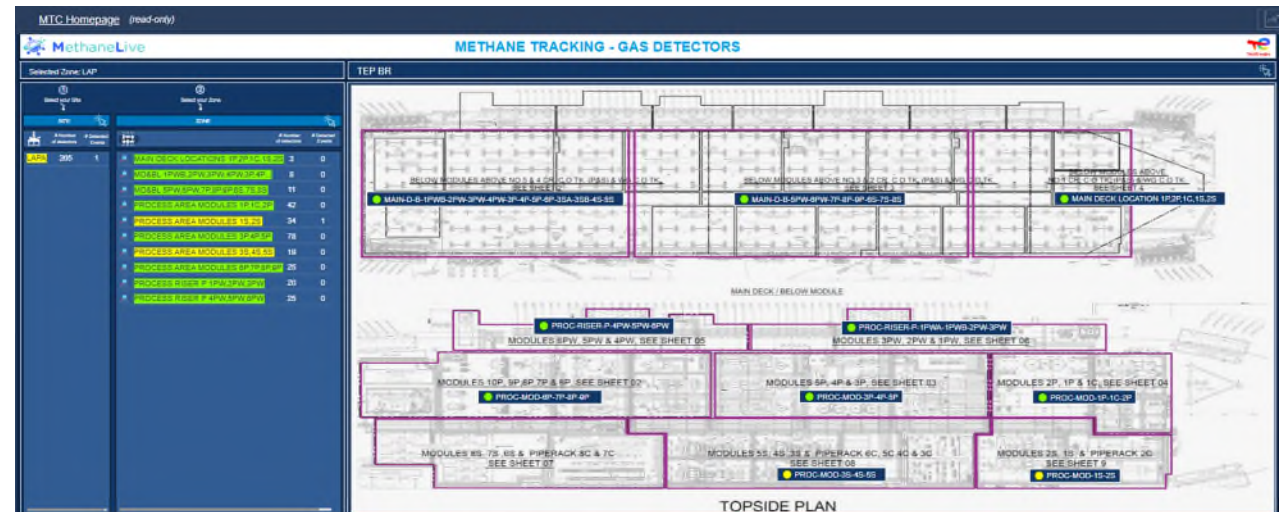
WIRELESS IOT sensor (battery powered): Use a transducer chip measuring properties of air/gas mixture + patent algorithms to report gas concentration

Feature	
Detection Limit	200-3,000ppm, 10kg/h
ATEX	Yes
Data comm	LoRa
Power	Battery, 2y
Weight	400 g

Pilot test at Tempa Rossa, IT



**265 sensors
were installed in
Lapa**





Thank you!
Obrigado !