Energy Community

Gas Infrastructure Europe

marcogaz

5th joint technical meeting: Mitigating methane emissions in the gas sector

2nd of December 2021

Online event, 10:00 – 12:30 CET

Moderator

Bogdan SIMION

Gas Infrastructure Europe (GIE)

Housekeeping rules

We recommend you join the telco **without video** **and** **with your microphone muted** **unless differently prompted by the Organisers.**

Please use the **chat section** **for questions/comments** or **raise the hand**.

Thank you very much!

AGENDA

10:00 - Welcome address

- Dirk BUSCHLE | Deputy Director of Energy Community Secretariat

10:10 | What is new?

Energy Community – Activities on methane emissions

- Karolina CEGIR | Energy Community

GIE & MARCOGAZ activities on methane emissions

- José Miguel TUDELA | GIE & MARCOGAZ

10:30 | CEN technical specification to quantify methane emissions from mid & downstream assets

- Ronald KENTER | MARCOGAZ

Q&A

10:50 | Update on OGMP 2.0 & IMEO

- Giulia FERRINI | UNEP

Q&A

11:10 – Technologies

Bottom-up technologies - German pilot project on recording fugitive emissions

- Tobias VAN ALMSICK | OGE

Reconciliations

- Pascal ALAS | GRTgaz

GERG project on top-down/site level technologies

- Tania MEIXÚS | Enagás

Q&A

11:45 | OGCI ongoing activities

- Pietro MEZZANO | OGCI

Q&A

12:05 | Case studies

- Giorgi ARESHIDZE | Socar Georgia
- Oleksii RIABCHYN | Naftogaz

12:25 | Wrap-up, concluding remarks and next steps

- José Miguel TUDELA | GIE & MARCOGAZ
- Predrag GRUJICIC | Energy Community Secretariat

Welcome and introduction

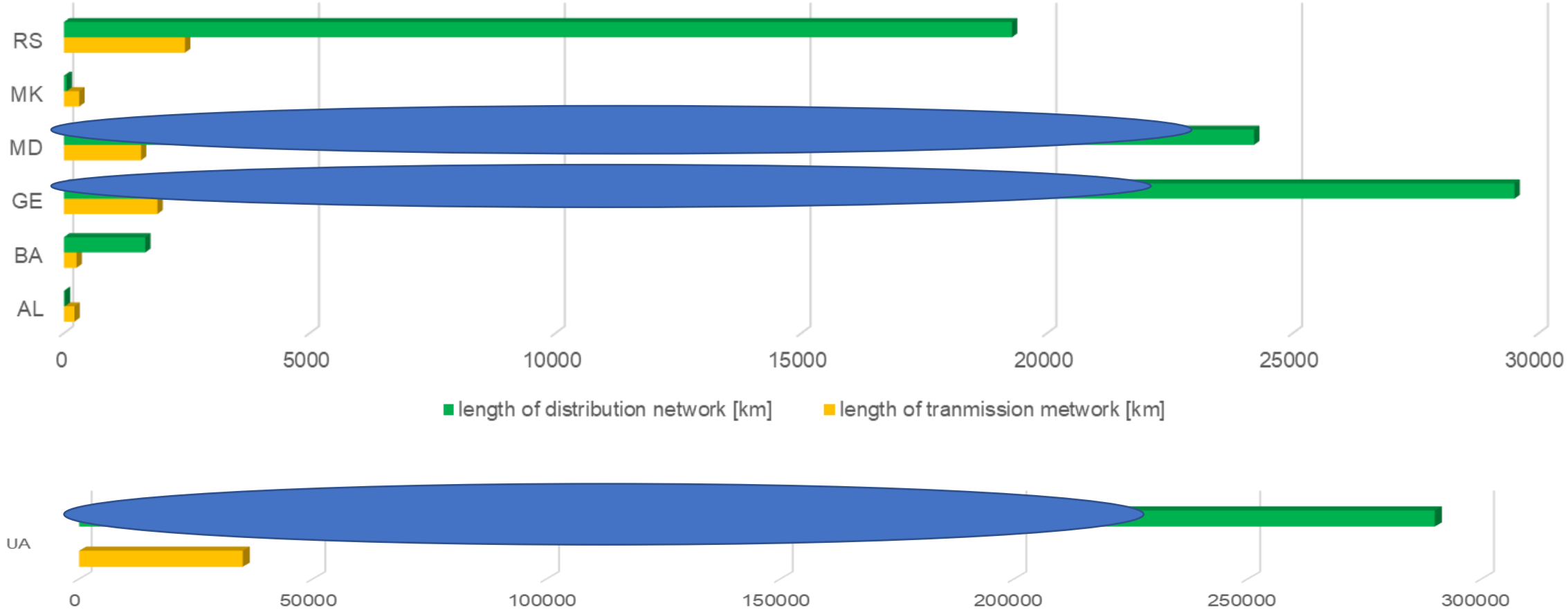
Dirk BUSCHLE | Energy Community Secretariat

Energy Community – Activities on methane emissions

Karolina CEGIR | Energy Community Secretariat

Reporting on methane emissions by gas industry

- 1st report (for 2019) based on 2019 Marcogaz questionnaire (**6 TSOs, 33 DSOs**)
- Data collection for 2020 based on 2020 Marcogaz questionnaire with OGMP 2.0 features (**8 TSOs, 35 DSOs, 1 SSO, 1 gas producer**)



Monthly Methane Mondays

1st of March: **Quantification and reporting framework of methane emissions** (60 min)

29th March: **Energy Community report on methane emissions** (60 min)

26th April **MARCOGAZ technical recommendations on methane emissions** (90 min)

7th of June: **MGP Best Practice Guidelines** (90 min)

13th of September: **MARCOGAZ / GIE Target setting recommendations** (90 min)

11th of October: **Methane emissions detection, measurement and quantification technologies** (90 min)

8th of November: **Round Table: the EU Strategy on methane emissions – What is next?** (60 min)

Focus in 2021
on gas system operators' topics,
and monitoring, reporting, quantifications

In total 700 participants,
85% EU MSs & 15% EnC CPs

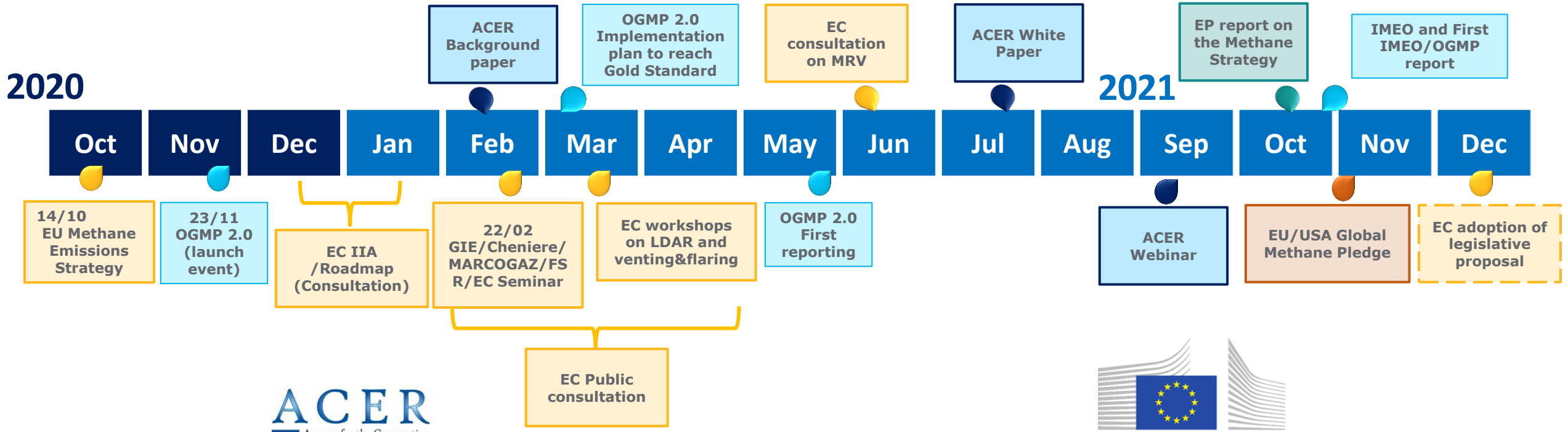
What next?

- ECRB included methane emissions in its 2022 plan / a dialogue with NRAs to be maintained
- All gas Contracting Parties (but Moldova) signed Global Methane Pledge / to launch discussion with environment ministries, agencies
- Technical assistance to Ukraine launched within EU4Climate/ECS – CH4 emissions in the energy sector, LDAR for oil and gas industry
- To include missing gas industry in the reporting framework
- To include oil industry (already approached bilaterally and at the Oil Forum)
- To develop a concept for coal industry
- Cooperation with GIE & Marcogaz to continue…as well as with MGP, OGMP, OGCI, GERG.....
- To follow legislative developments in the EU
- Methane Mondays to continue…..

GIE & MARCOGAZ ongoing activities on methane emissions

Jose Miguel TUDELA | GIE & MARCOGAZ

Methane emissions – Main milestones



- ACER background paper on methane emissions (9th of Feb 2021) (link)
- ACER White Paper on methane emissions (22nd of July 2021) (link)
- ACER Webinar on methane emissions (14th of Sep 2021) (link)
- OGMP 2.0 Launch event (link) (23rd of November of 2020)
- OGMP 2.0 submission of the implementation plan and the first reporting
- IMEO (link) and first report (link) (31st of Oct of 2021)

- Publication of the EU Strategy to reduce methane emissions (link) (14 October 2020)
- EC consultation - Inception impact assessment / Roadmap (link) (22 Dec – 26 Jan)
- GIE/MARCOGAZ/Cheniere Seminar supported by EC & FSR (link)
- EC workshops on LDAR and venting&flaring
- EC consultation on the potential content of the methane emissions legislation (link) (till 1st of May)
- EC consultation on MRV (link)
- EC adoption of legislative proposal (foreseen in Q4 2021)

Methane emissions – Joint declaration

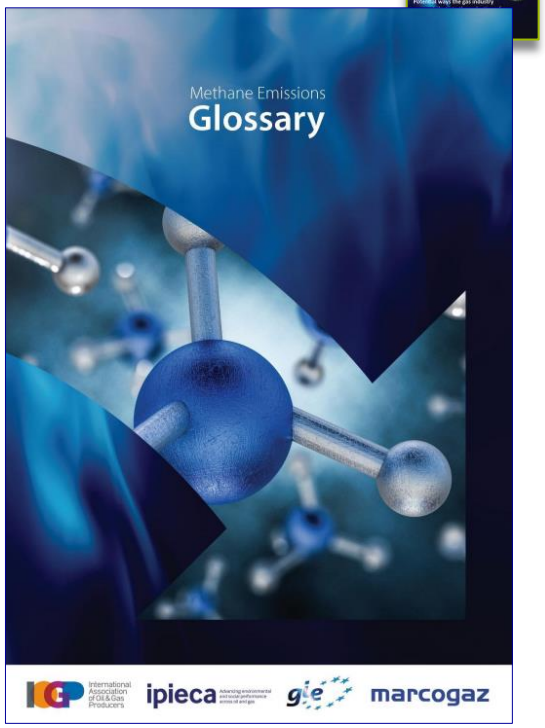
Gas system operators in joint effort to continue curbing emissions and to support the Global Methane Pledge

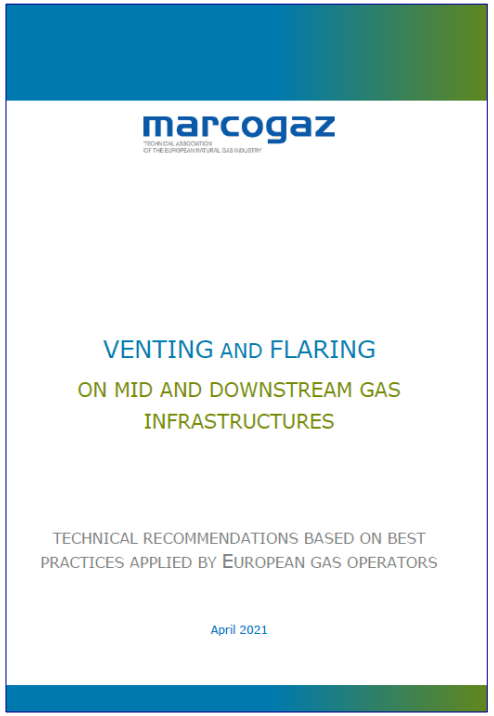
Technically supported by

https://www.gie.eu/events1/email/download/2021/Joint_Declaration_CH4_Emissions.pdf

Recent publications

2020

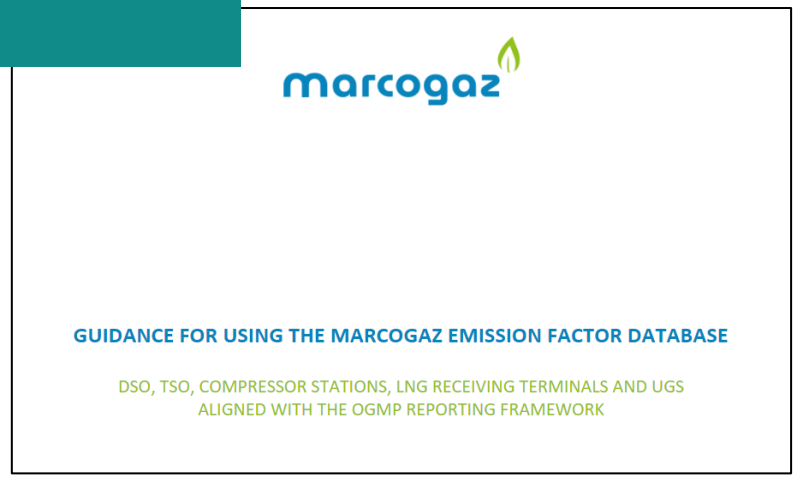




- ✓ Technical recommendations for the gas industry
- ✓ Support the EU legislative process

Ongoing activities and initiatives

Emission factors – Database & Guidance



Methane emissions data assessment (data 2020) for mid/downstream

Based on datasets (data 2020) already submitted to UNEP by OGMP 2.0 members

Aligned with OGMP 2.0 (template).

Goal is to prepare an industry technical position.

Ongoing activities and initiatives

Development of 9 BATs to minimize venting & flaring

Goal:

- To support the industry with the implementation of the future Regulation on Methane Emissions. No BREF will be developed.

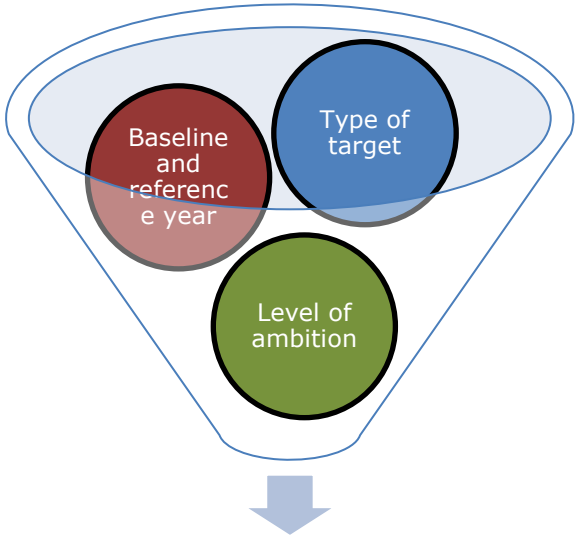
Best Available Techniques		
1	*Reduce pressure before venting*	
2	*Recover and recompress emission in the process gas:*	*mobile compressor*
3		*stationary compressor*
4	*Flaring as replacement of venting (to reduce the environmental impact)*	
5	*High bleed continuous pneumatics mitigation*	
6	*Electrical or pneumatic air starters*	
7	*Use of nitrogen to purge LNG pipes*	
8	*LNG truck loading (dry coupling connectors)*	
9	*Excess flow valves in new service lines*	

EU Methane emissions target – Ongoing analysis

Low representativeness of the data received from downstream activities – Initial Analysis for Midstream

In **2015**:
- 100% of Midstream companies that have responded have available data for 2015

In **2020**:
- 100% of Midstream companies that have responded have available data for 2020



Key elements in target setting

In **2025**:
- 93.1% of Midstream companies have available data
- 65.5% of the companies have already set Emission Reduction Targets

In **2025**:
- Reduction of 51.3% of emission from 2015 baseline year

In **2025**:
- Reduction of 27.3% from 2020 baseline year

In **2030**:
- 44.8% of Midstream companies have available data
- 20.7% of the companies have already set Emission Reduction Targets

In **2030**:
- Reduction of 85.1% of emission from 2015 baseline year

In **2030**:
- Reduction of 77.7% from 2020 baseline year

-Methane Pledge of COP26 Glasgow (-30% in 2030 vs 2020).

-Global Methane Alliance (-45% in 2025 vs 2015).

CEN technical specification to quantify methane emissions from mid & downstream assets

Ronald KENTER | MARCOGAZ

CEN technical specification to quantify methane emissions from mid & downstream assets

2021-12-02

support the decarbonisation by voluntary standards at European level

CEN/TC 234/WG14 methane emissions

Background

I) GHG and methane emissions high topic for gas industry

II) Marcogaz WG_ME-485-Assessment of methane emissions for gas Transmission and Distribution system operator

III) EC strategy and OGMP framework

IV) Launch CEN/TC 234/WG14 in September 2020

Progress

- First draft based on Marcogaz document in September 2020
- CEN/TR changed to CEN/TS to have recommendations (should) and requirements (shall) and text adopted by all CEN members
- Scope extended to underground gas storages and LNG terminals
- Second draft in December 2020
- Final draft in October 2021 / publication in 2022
- Expected standard after 3 years (part of CEN/TS process)

Scope

This document describes a methodology to identify different types of methane emissions from gas infrastructure and it explains, step by step, how to quantify each type of emission in a **gas transmission, distribution and/or storage system and in an LNG terminal**. Gas is considered any product with a high methane content that is in gaseous form inside the respective gas infrastructure (e.g. natural gas, biogas or mixtures thereof with each other or with hydrogen).

Methane emission from utilisation, CNG/LNG fuelling stations, biomethane production and upgrading plants and LNG liquefaction and transport are not covered in this document, except if they are inside the covered asset (see Annex I on granularity).

NOTE 1: These principles can also be applied to other parts of the gas value chain.

NOTE 2: Natural emission by the soil or seepage of methane due to gas field above or next to the storage reservoir are not taken into account.

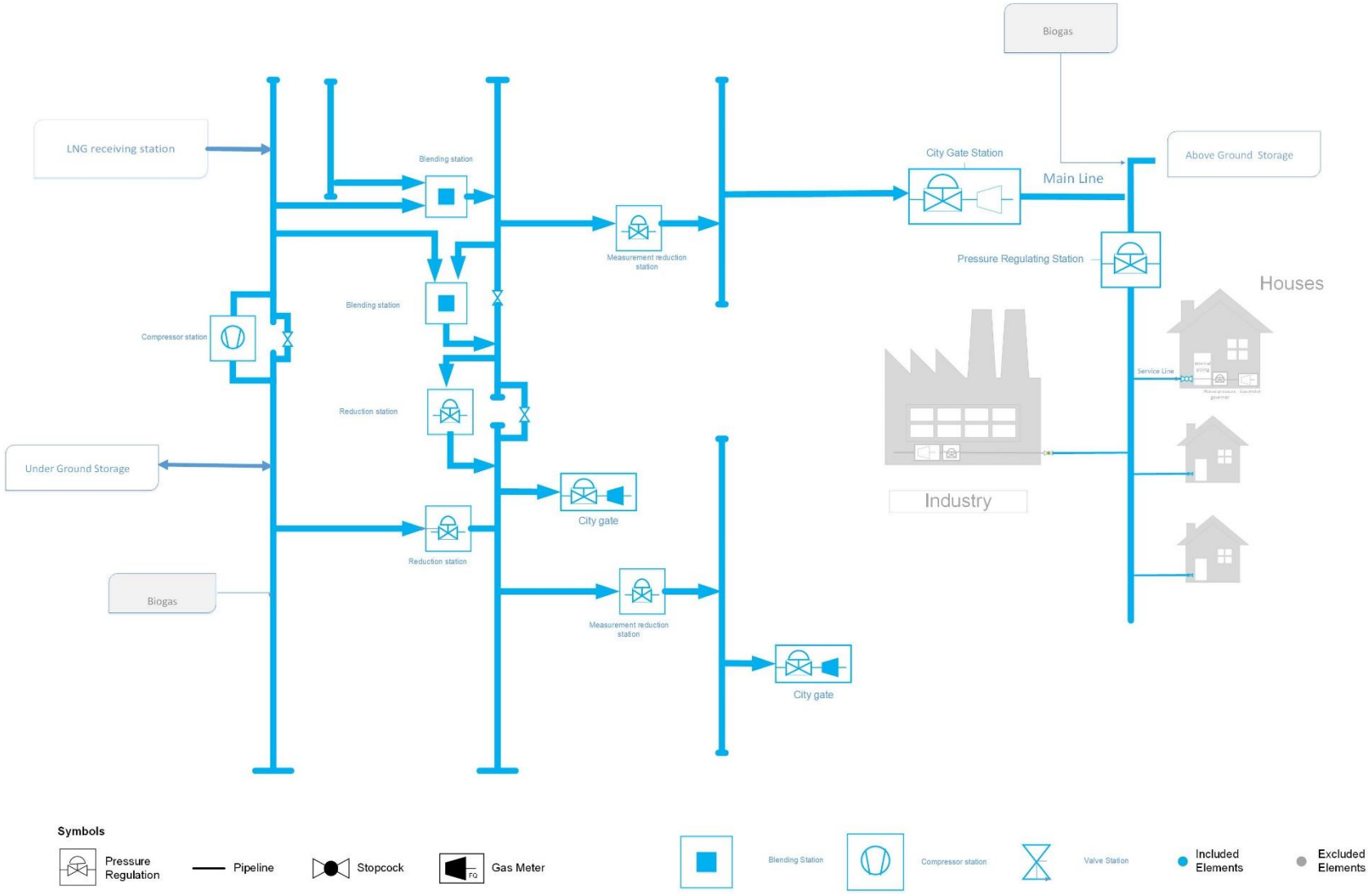
The document specifies a source-level method of quantification of identified methane sources.

NOTE 3: Source-level method - Emissions from each identified source are individually quantified. Total emissions on a given asset are calculated by adding each type of emission source data.

This quantification method consists in **splitting the gas systems into groups of assets, devices and components** and indicating categories of emission that can be expected from these groups to determine the emission factors (EF) and the activity factors (AF). **It comprises measurements of the amount of methane emitted from different origin**, **estimation of emissions from groups of assets or calculation based on available data**. In case of individual measurements or calculations, the total emissions are found by summing the quantified methane emissions.

Finally, a general method to calculate the uncertainties associated with the quantified amounts of emitted methane is described.

NOTE 4: Part of the methods of this document are retrieved by an international research program initiated by GERG for DSO.


Biogas
LNG receiving station
Blending station
City Gate Station
Above Ground Storage
Main Line
Measurement reduction station
Pressure Regulating Station
Houses
Blending station
Compressor station
Service Line
Reduction station
Under Ground Storage
City gate
Industry
Reduction station
Biogas
Measurement reduction station
City gate
Symbols
Pressure Regulation
Pipeline
Stopcock
Gas Meter
Blending Station
Compressor station
Valve Station
Included Elements
Excluded Elements

Preliminary estimation

Make a preliminary estimation of methane emission
- Identification of potential sources
- Split your assets in categories of similar technical characteristics and quantify activity (AD)
- Use standard emission factors for categories (EF)
- Calculate CH4 = $\sum EF \times AD$

Plan field work based on knowledge of category contribution to total methane emission
- Decide on which category measurements will be performed
- Decide technology and instruments to be used during field work
- Decide for which category, simulation tools and/or detailed engineering calculations will be used.
- Decide on which category estimates will be used

- Perform a measuring and data collection campaign
- Document company specific emission factors

- Quantify Company methane emission with available data.
- Derive the total emissions using measured, calculated and estimated data

- Make an uncertainty estimation of methane emission
- Report emissions
- Record in inventory

Improvements

Based on previous years' methane emission estimation
Consider your asset groups: Do you need another or a more detailed split in groups?

Plan this year's field work based on knowledge of group contribution to total methane emission
- Consider new groups to be measured (if any)
- Decide for which asset groups emission factors (EF) need to be improved or validated

- Perform a measuring and data collection campaign
- Document new, improved or validate existing emission factors (e.g. EF as appropriate)

Quantify company methane emissions with available data
- Calculate the total emission using measured and estimated data

- Make an uncertainty estimation of methane emission
- Report emission for this year
- Consider possible improvements for next year
- Consider actions or changes in your asset management regarding e.g. maintenance or renewal of equipment

Methane emissions			
Types of emissions			**Examples**
Fugitives	**Leaks due to connections/loss of tightness**	**Leaks typically due to gradual changes in conditions[a]**	Leaks of flanges, seals, joints, valve seats…
	Permeation	**Plastic pipeline permeation**	PE pipeline, PA pipeline,
		Subsurface emissions from a storage reservoir to the atmosphere	Shallow aquifers
Vented	**Operations**	**Purging/venting for works, process, commissioning and decommissioning**	Works, maintenance, renewal
		Regular emissions of devices	Pneumatic emissions actuators, flow control valves, measurement equipment, compressor seals…
		Starts & stops	Emissions from start and stops of compressors, …
	Incidents	**Leaks due to unexpected, sudden changes in conditions[b]**	Leaks due to third party damage, construction defect/material failure, ground movement
Incomplete combustion			Unburned methane in exhaust gases from combustion devices.

Table 4 — Applicable determination methods for different types of emissions for different groups of equipments

Groups of equipment			Types of emissions						
			Fugitives		Vented				
					Operational emissions				
			Permeation	Leaks due to connections /loss of tightness	Purging/venting for works/process, commissioning and de-commissioning	Regular emissions of devices (e.g. pneumatic)	Start & Stop	Incidents	Incomplete combustion
	General	Main lines & service lines	6.4.1	6.4.2	6.5.2.2			6.6	
		Connections (flanges, seals, joints, arms, hoses)		6.4.2					
		Measurement devices (chromatographs, analysers …)		6.4.2		6.5.2.3			
		Valves[2] (regul. stations, blending stations, compressor stations, block valve stations)		6.4.2	6.5.2.2	6.5.2.3			
		Pressure / Flow regulators		6.4.2		6.5.2.3			
		Safety valves		6.4.2				6.6	
		Combustion devices (turbines, engines, boilers…)		6.4.2	6.5.2.2		6.5.2.4		6.7
		Compressors & compressor seals		6.4.2	6.5.2.2	6.5.2.3	6.5.2.4	6.6	
		Flares					6.5.2.4		6.7
	UGS	Sub-surface	6.4.3						
	LNG	LNG arms			6.5.2.2				
		LNG truck loading hoses			6.5.2.2				
		LNG pumps		?	6.5.2.2				
		LNG tanks (e.g. BOG)		?	6.5.2.2			X	
		Recondenser						X	
		Vaporisers						X	6.7

Important items detailed in the document

- Description of current methodologies and techniques for quantification and measurement
- Description of AF and EF to be used and associated calculation methods
- Elements on uncertainty
- Connection to OGMP reporting template (TSO, DSO, UGS, LNG)

1 Scope
2 Normative references
3 Terms and definitions
4 Symbols and abbreviations
5 Quantification of methane emission sources
5.1 Strategy for quantification of methane emission from a gas system
5.2 Emission types for gas systems
5.3 Identification of emission sources.
6 Quantification
6.1 General concept of quantifications
6.2 Determination of Emission Factors (EF)
6.2.1 General
6.2.2 Measurements
6.2.3 EF estimations
6.3 Determination of Activity Factor (AF)
6.4 Quantification of fugitive emissions
6.5 Quantification of vented emissions
6.6 Emissions from incidents
6.7 Methane emissions from incomplete combustion
7 Methods for detection and/or quantification (Informative)
8 Uncertainty calculations
8.1 Introduction
8.2 Example of uncertainty calculation based on deterministic calculation

Pending items

- For publication
  - More input from LNG
  - Finalization needed on uncertainty, table on methodologies
  - Editing to be done
  - Consultation

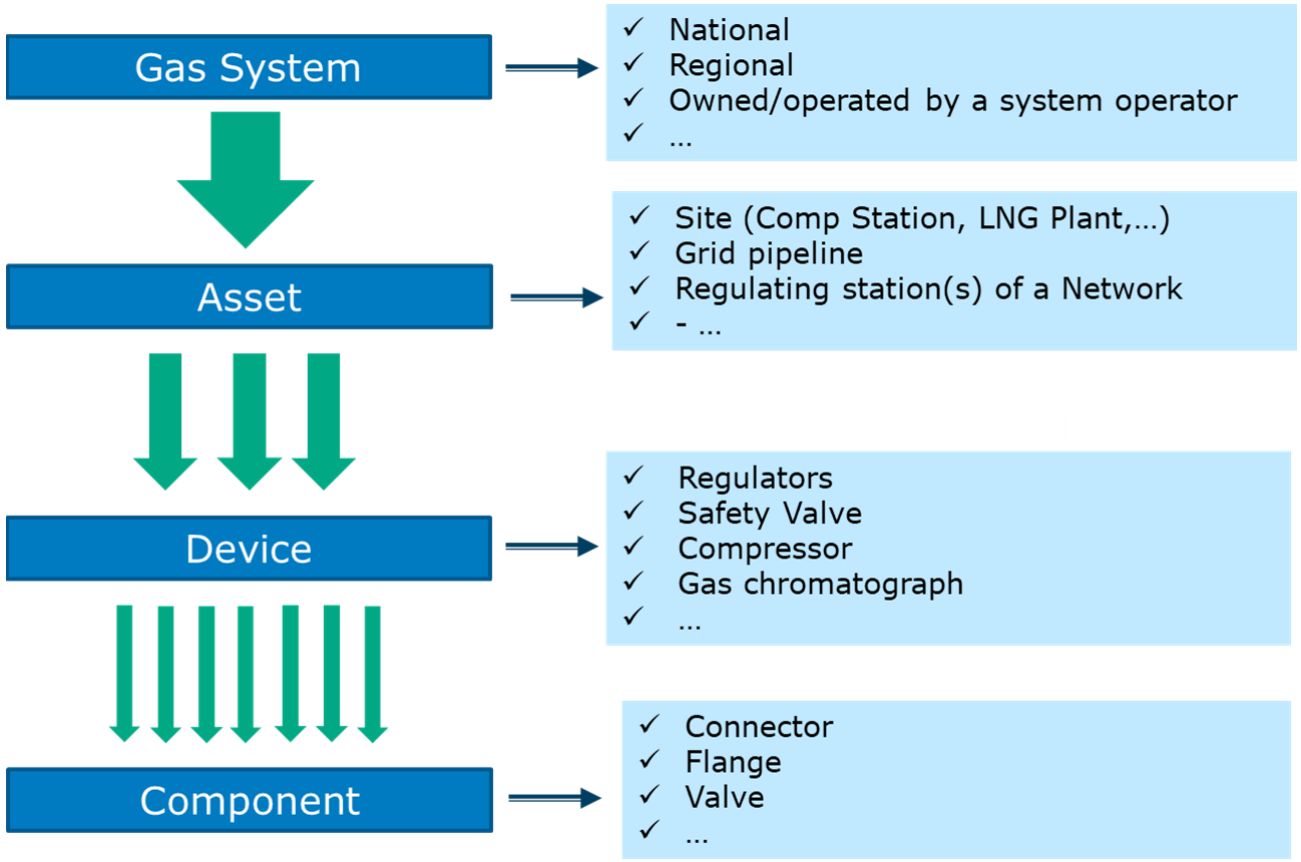
- After publication
  - More development to come (OGMP, research programs…)
  - After gathering additional knowledge and feedback from users, alternative choices could be made for requirements in the standard

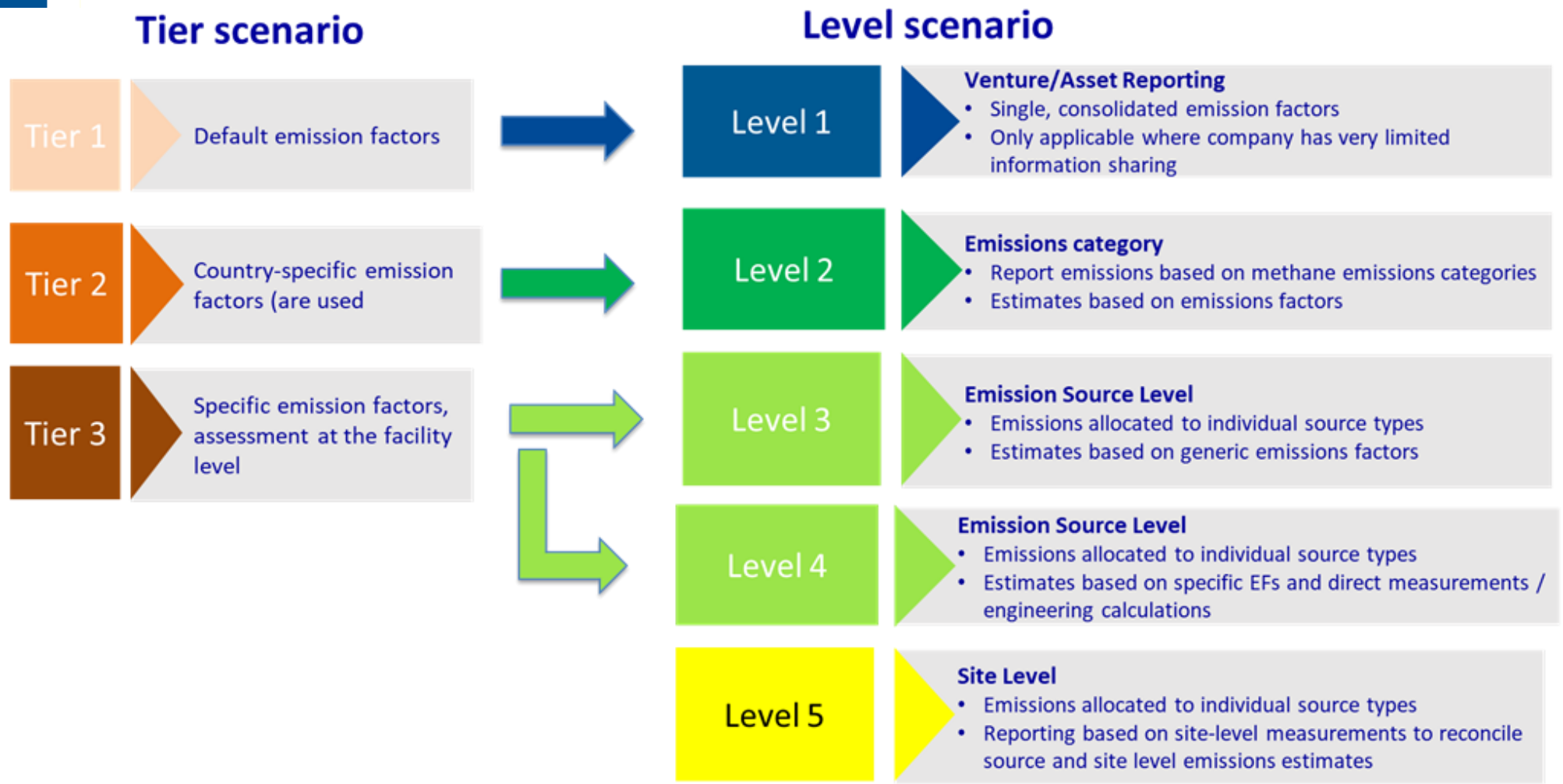
Annexes

Types of emissions			EF	AF
Fugitive emissions	Pipeline permeation		Q_m in [kg/km*a]	N = length of pipelines, in [km] t = duration of the leak expressed in [year] (for new pipeline, t can be < 1)
Fugitive emissions	Leaks due to connections/loss of tightness (flanges, pipe equipment, valves, joints, seals)		Q_m in [kg/component*a]	N = number of potentially leaking components of each group t = duration of the leakage expressed in [year]
Vented	Operational emissions	Purging/venting for works, process, commissioning and decommissioning	Q_m in [kg/event]	N = number of vents or purges t is not relevant (t=1)
Vented	Operational emissions	Regular emissions of devices (e.g. pneumatic)	Q_m in [kg/h*device]	N = number of devices of each type t = duration in [hour]
Vented	Operational emissions	Start & Stop	Q_m in [kg/(start/stop)]	N = number of starts & stops t is not relevant (t=1)
Vented	Incident emissions	Distribution grid	Q_m in [kg/incident] or [kg/km]	N = number of incidents or km of pipeline t is not relevant(t=1)
Vented	Incident emissions	Transmission grid, UGS and LNG terminals	Q_m in [kg/incident]	N = number of incidents t is not relevant(t=1)
Incomplete combustion			Q_m in [kg/h]	N = gas consumption of combustion devices in service t = duration in running [hour]

Annex A Terms used to define granularity

For sake of clarity the following terms are used as a basis to define the granularity associated to level description here below: Gas system, Asset, Device, Component (see definitions)




Tier scenario
Level scenario
Tier 1
Default emission factors
Tier 2
Country-specific emission factors (are used
Tier 3
Specific emission factors, assessment at the facility level
Level 1
Venture/Asset Reporting
• Single, consolidated emission factors
• Only applicable where company has very limited information sharing
Level 2
Emissions category
• Report emissions based on methane emissions categories
• Estimates based on emissions factors
Level 3
Emission Source Level
• Emissions allocated to individual source types
• Estimates based on generic emissions factors
Level 4
Emission Source Level
• Emissions allocated to individual source types
• Estimates based on specific EFs and direct measurements / engineering calculations
Level 5
Site Level
• Emissions allocated to individual source types
• Reporting based on site-level measurements to reconcile source and site level emissions estimates

Update on OGMP 2.0 & IMEO

Giulia FERRINI | Programme Management Officer in UNEP

November 2021

The Oil and Gas Methane Partnership 2.0 & the International Methane Emissions Observatory (IMEO)

Giulia Ferrini

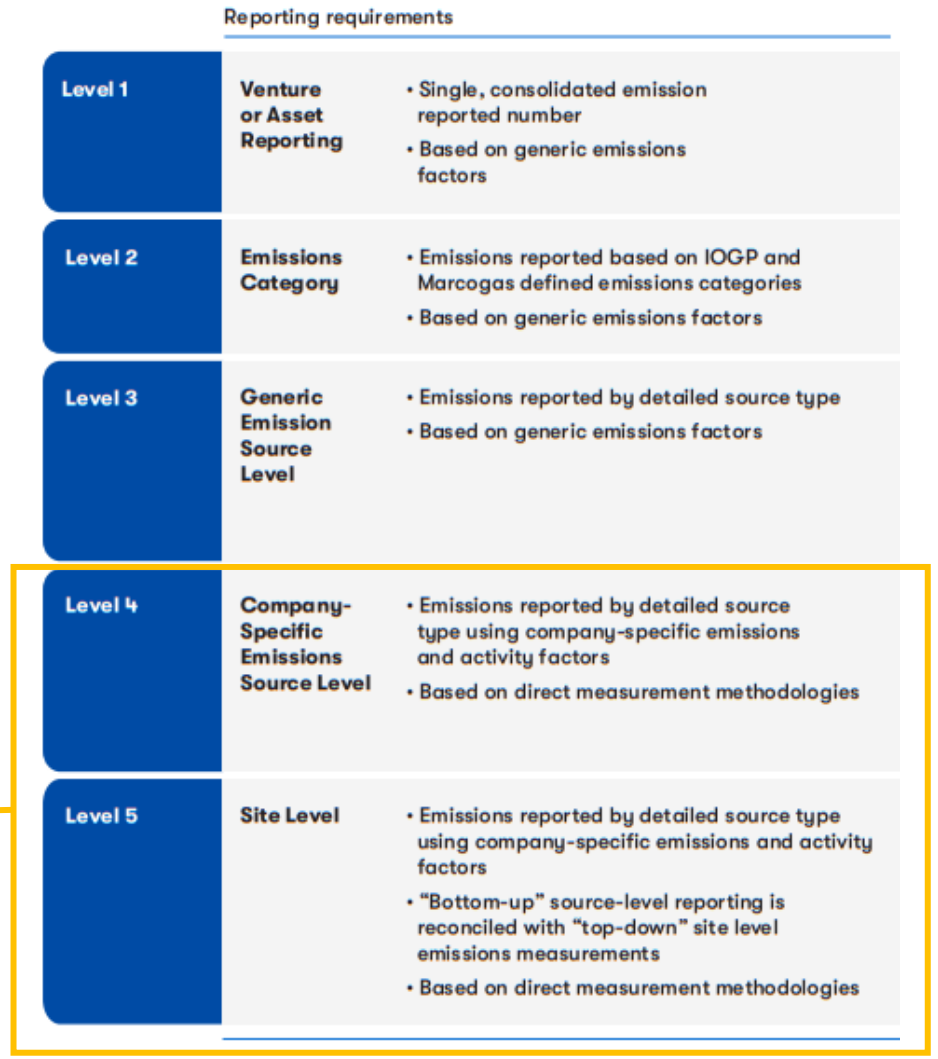
UN environment programme 50 1972-2022

The Oil and Gas Methane Partnership 2.0 (OGMP 2.0) is the industry methane reporting framework for the oil and gas industry

- OGMP is a comprehensive, measurement-based reporting framework for oil and gas
- Member companies report on **all material sources** of methane from both **operated and non-operated** assets across **all segments** of the value chain
- Companies commit to achieving **Gold Standard** reporting within three years for operated assets and five years for non-operated assets.

"Gold Standard" = both the highest reporting levels and companies' plans to achieve this level.

- Gold Standard pathway = a credible and explicit path towards Level 4/5 reporting
- Gold Standard Reporting: empirical reconciliation measurements at source (Level 4) and site (Level 5) level



Key takeaway of OGMP 2.0 first year reporting: member companies are on the right path to achieving Gold Standard

Read the full analysis in the IMEO report: http://www.unep.org/methane

Overall Assessment

- Good demonstration of effort by member companies
- The quality of data in most cases is low (L1 to L3), but expected
- Several operators begun the journey of incorporating measurements.

Targets

- Most companies indicate that their existing emissions are already below their corporate targets.
- The higher reporting levels is anticipated to result in changes to the current corporate emissions intensity.
- Ratcheting of absolute targets is encouraged once measurement-based baselines are established.

Implementation Plans

- Significant efforts are needed to transition from current reporting practices to L4/L5
- Companies should prepare to procure measurement technology, mobilize resources to interpret results and cope with difficulties working with different partners.

Reporting

- Operators should report the highest level available.
- Level 4 and Level 4/5 require specific details regarding methodologies.
- Level 5 is should not be reported alone. The reconciliation of top-down and bottom-up measurements defines 4/5.

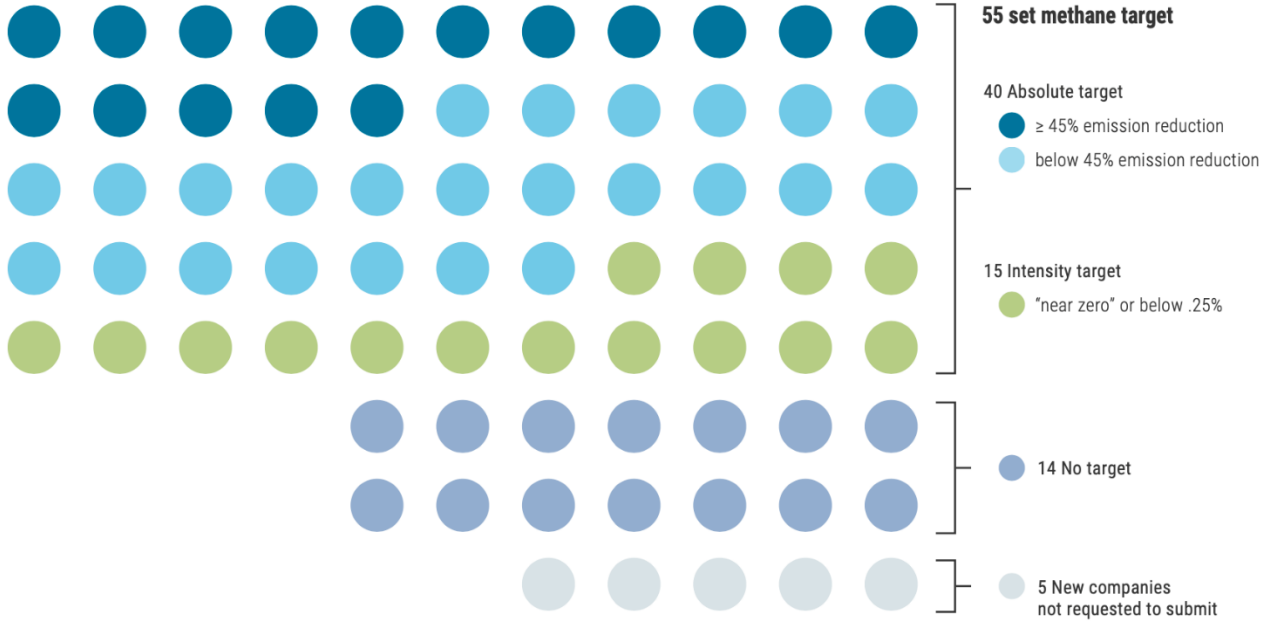
Member companies are committing to methane reduction targets – but ratcheted targets are needed to meet collective ambition

CCAC/UNEP-Backed Industry Targets

45% absolute reduction by 2025 and 60-75% reduction by 2030

“Near-zero” methane intensity (below 0.25%)

Overview of OGMP Member Company Targets

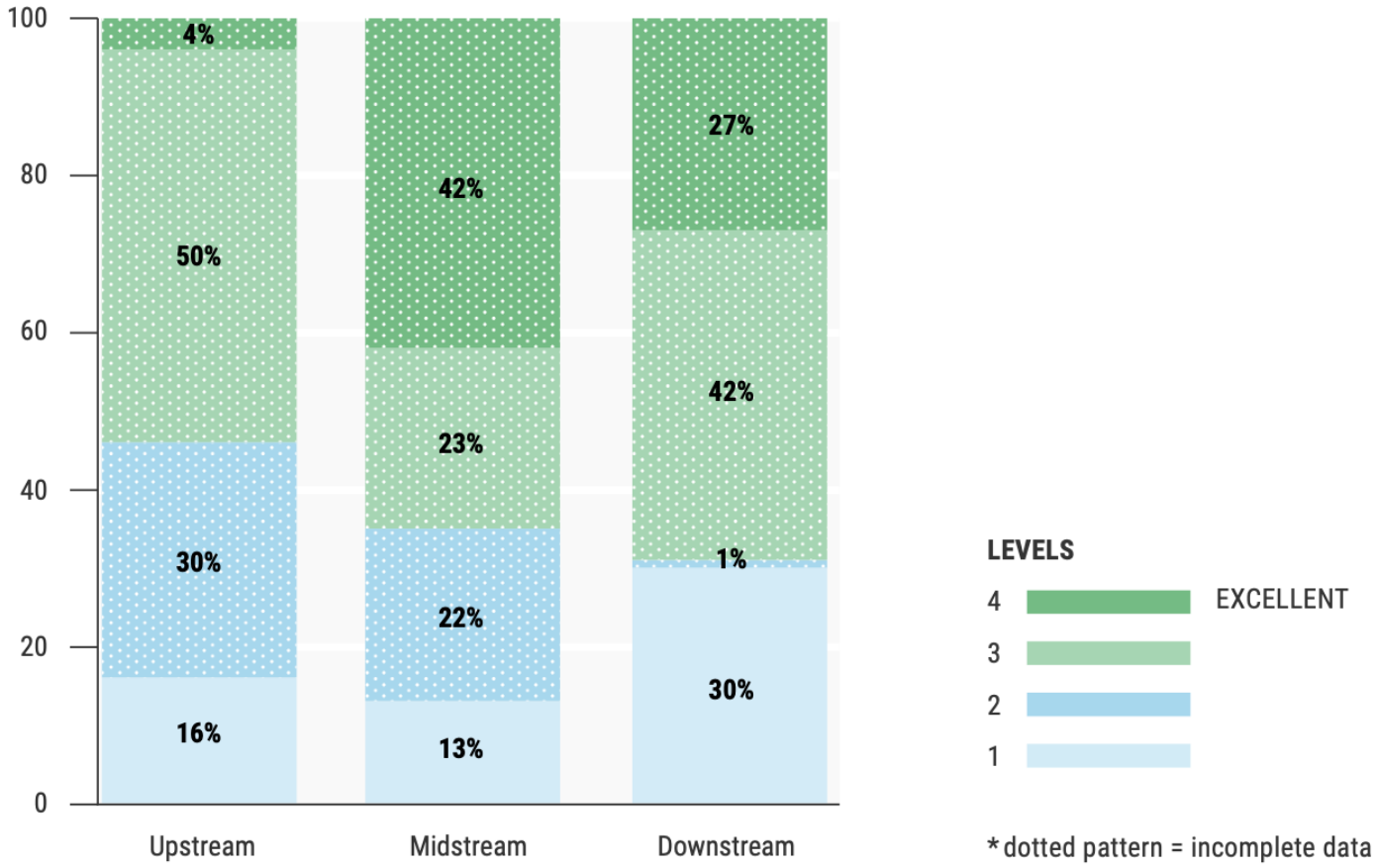


The first year's reporting shows impressive progress towards achieving Gold Standard, with room for improvement

- 65 out of 74 member companies were required to report for 2021
- Most assets are currently reported at Levels 2 and 3
- 15 per cent of the total submissions from the upstream segment disclosed reported data for all their non-operated assets.

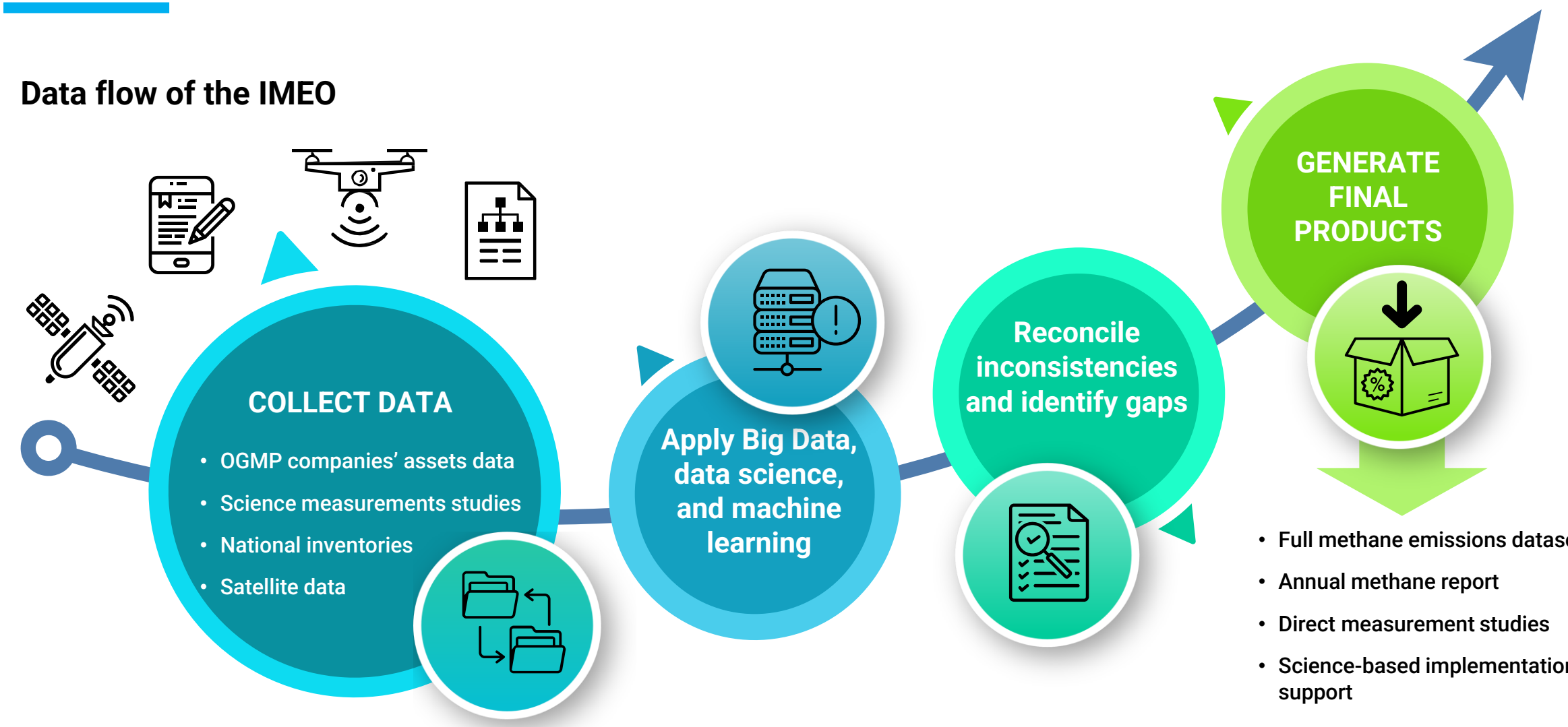
As companies begin to achieve Gold Standard reporting for an increasingly significant share of their assets, these figures will become more certain

Percentage Emissions by Reporting Level



OGMP 2.0 data as a key input of IMEO's data solution

Data flow of the IMEO



IMEO current work

Building the Data Taxonomy and Platform

Engaging Satellite Providers

Funding Scientific Measurement Studies

Stakeholder Engagement Throughout IMEO's Governance

- **Implementation Committee:** guiding the establishment of IMEO
- **Executive Board:** Leads strategic direction of IMEO, comprised of funding countries
- **Scientific Oversight Committee:** Oversees scientific and technical aspects of IMEO, includes leading scientists representing a variety of expertise and disciplines
- **Advisory Council:** Representatives from NGOs, IGOs, scientific community, and industry (through member companies of OGMP 2.0) share guidance on IMEO activities

IMEO current work

Building the Data Taxonomy and Platform

Funding scientific measurement studies

Engaging satellite providers

Stakeholder Engagement Throughout IMEO's Governance

High-level Country Engagement

Original funder, collaborated on design, positioning IMEO to help deliver EU methane strategy

Launched at Rome Summit, referenced in communique

Referenced in Global Methane Pledge

In discussions with other major oil and gas producing and consuming nations

IMEO: a key implementing vehicle of the Global Methane Pledge

“The Global Methane Pledge Makes cutting methane emissions a global undertaking. This must be supported by sound scientific basis and a capacity to monitor and calculate methane emissions. Because we all know that only what gets measured gets done.”

-- Ursula von der Leyen, President of the European Commission

“IMEO will play an important role in creating a sound scientific basis for methane emissions calculations and delivering the Global Methane Pledge”

-- Joint EU-US Press Release on the Global Methane Pledge

“IMEO is crucial for the Global Methane Pledge to be successful. IMEO is uniquely placed to create a sound & independent scientific basis for methane emissions calculations & reductions: no other organization can fill this role as effectively.”

- Kadri Simson, European Commissioner for Energy

IMEO will serve as the implementation vehicle for major methane commitments like the Global Methane Pledge

110 — Countries that have signed on to the EU- and US-led Global Methane Pledge

40% — Portion of the global anthropogenic methane emission covered by signatories*

42% — Portion of the global methane emission from oil and gas covered by signatories*

30% — Methane reduction target by 2030

IMEO will create a

- **sound scientific basis for methane emissions calculations**

which will help countries to

- **prioritize mitigation actions**

and

- **credibly track and prove progress**

towards targets.

* Based on methane data from the World Bank and IEA

November 2021

Thank you

Giulia Ferrini

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UN environment programme 50 1972-2022

Technologies - German pilot project on recording fugitive emissions

Tobias VAN ALMSICK | FNB Gas

FNB Gas
DIE FERNLEITUNGSNETZBETREIBER

Results of our pilot project to systematically record diffuse methane emissions

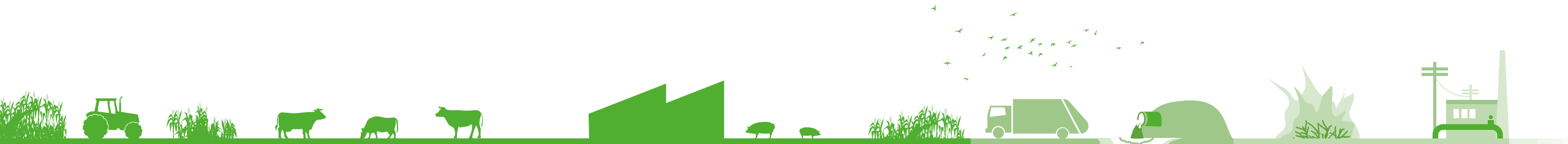
Breakdown of German methane emissions by source (2018)

Methane emissions in Germany: 52.6 Mt of CO_2 equivalents in total

61.8%
Agriculture

16.7%
Waste and waste water

17.5%
Energy industry and diffuse emissions from fuels

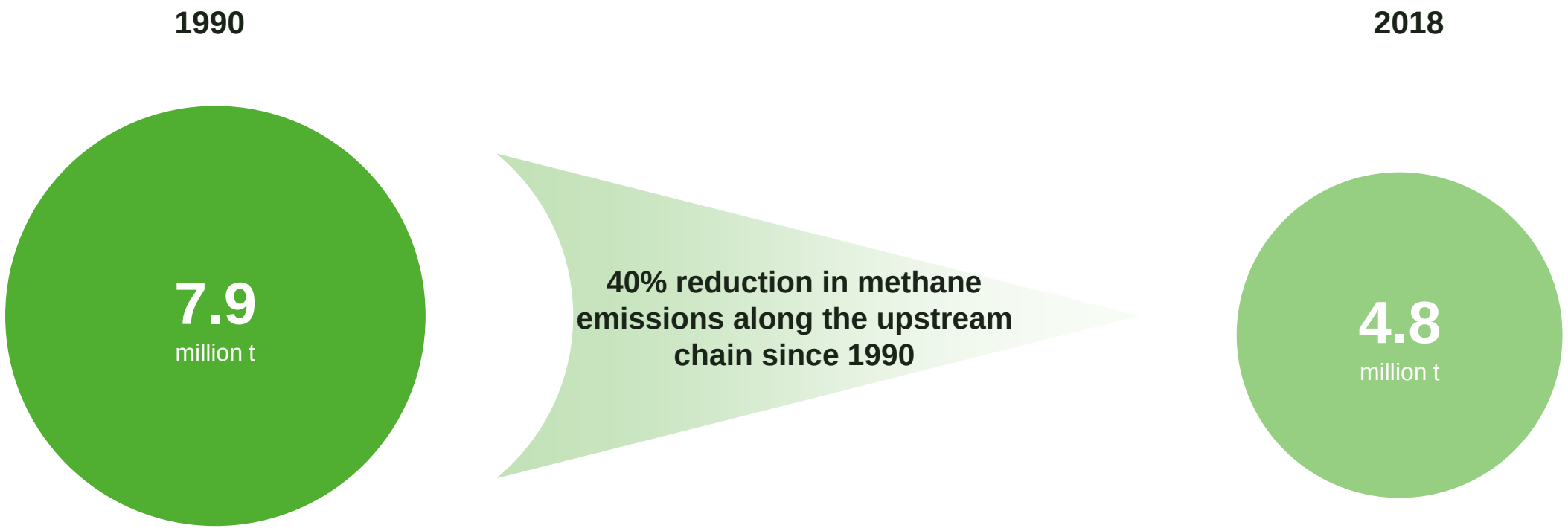


4% Others
Households and small consumers
Industrial processes
Manufacturing industry

Rounded figures. Source: "Zukunft Gas" based on Federal Environment Agency (2020)

Methane emissions from German gas industry in CO_2 equivalents

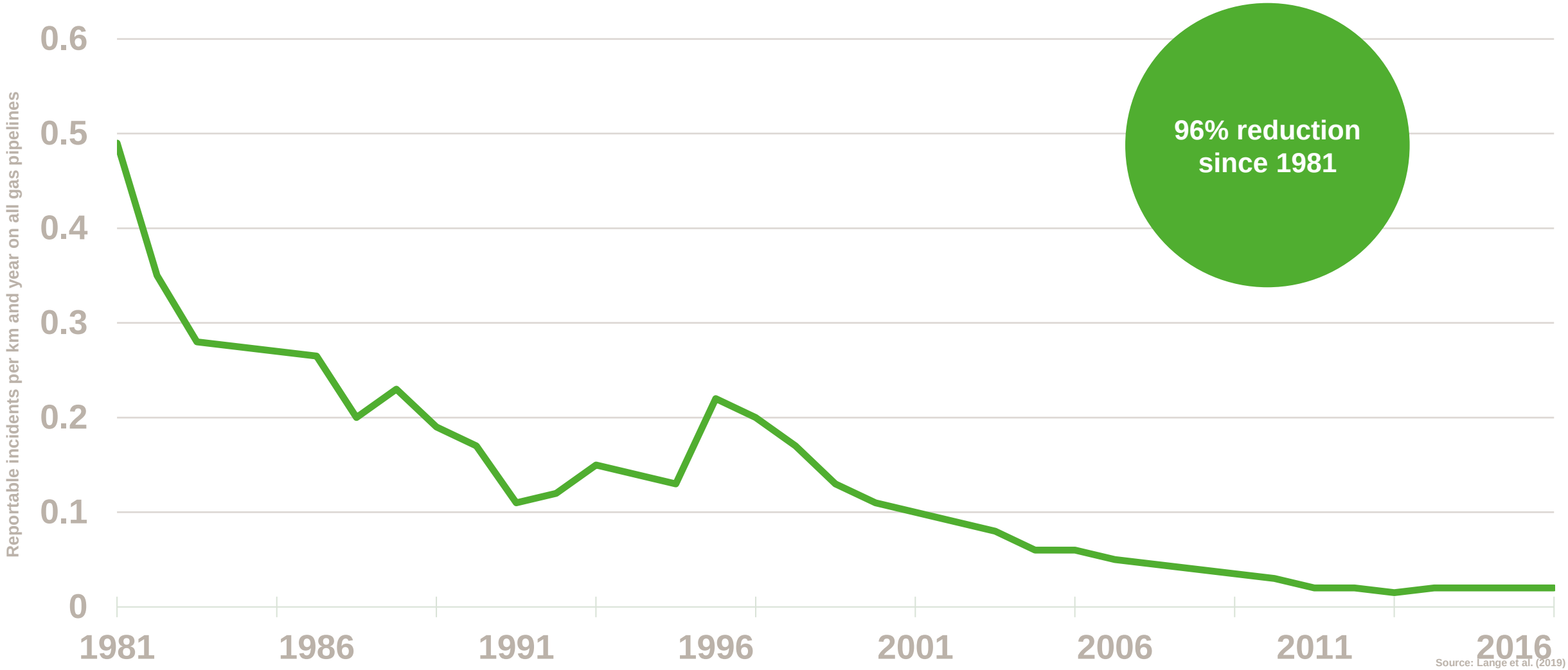
Methane emissions from gas industry already down by 40% thanks to continuous efforts



Source: Zukunft Gas

Reportable incidents per km and year on all gas pipelines in Germany (1981-2017)

Number of reportable incidents across the German gas industry has been steadily decreasing for many years



Source: Lange et al. (2019)

First systematic recording of diffuse methane emissions

Pilot project by FNB Gas provides important basis for reduction target and reduction measures

1. **Improvement / renewal** of the data basis to ensure maximum transparency
2. **Reconciliation of data and correction** of the National Inventory Report in collaboration with the Federal Environment Agency
3. **Basis for better understanding** of the origin of diffuse methane emissions
4. **Basis for reporting** as part of Oil and Gas Methane Partnership (OGMP)
5. **Contribution to EU-wide database** for emission factors (under development)

Further development of targeted reduction measures
to improve the carbon footprint, technical safety and economic efficiency in the interest of the pipeline network users

Joint reduction target

Causes of methane emissions and project focus

Capturing diffuse emissions is a key part of emission reduction efforts

1

Emissions from operations

- Depressurising / venting processes
- Emissions from technical components (including measuring equipment)
- Start-stop emissions

2

Fugitive emissions

- Permeation (plastic pipes only)
- Leakage

PROJECT FOCUS

3

Emissions due to incidents

- Damage caused by external influences/incidents (e.g. excavators, natural disasters)
- Corrosion

4

Incomplete combustion

- Gas turbines
- Flares
- Other combustion processes

Key parameters of measurement campaign

Pilot project delivers robust results thanks to representative measurements

HFS with bagging method

Drone used for measurements, compressor station in Blankenloch

Service provider:

- The measurements were carried out by "The Sniffers", a renowned and independent service provider based in Belgium.

Assets investigated:

- approx. 43,000 potential emission sources
- 5 compressor stations, 131 gate valve stations
- approx. 5% of all assets under the responsibility of the gas TSOs
- Statistical basis according to the German Fuel Institute (DBI) is "good to very good"

Period for bottom-up measurements:

- 8 weeks during the period from Sept. to Nov. 2020

Top-down measurements by drones:

- Postponed to autumn 2021 due to pandemic

Bild: Sniffers, FNB Gas / terranets bw GmbH

Pilot project involves the use of qualitative detection methods as well as quantitative measurement methods

Bubble testing
Very easy to perform – qualitative only

GasCam
Allows only qualitative measurements; well suited for screening

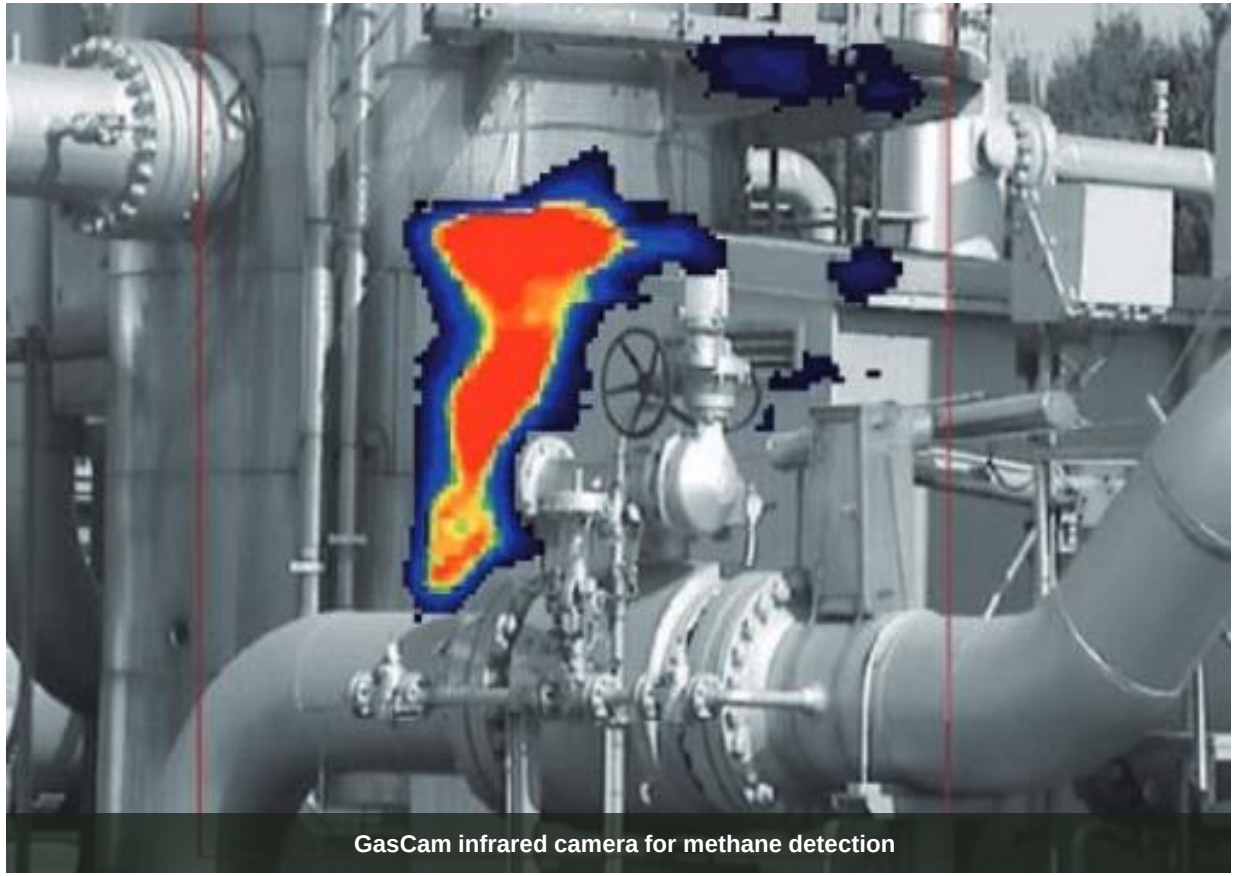
"Sniffing"
Measurements are carried out with a gas detector, quantification according to DIN EN 15446

High-flow sampling (HFS)
Leakage gas is drawn into the instrument together with a defined air flow and while the concentration is being measured. Used for point leaks.

Bagging method
Similar to HFS, but source of leak is "wrapped"
Used for larger emission sources (e.g. gate valves).

PROJECT METHODS

Full suction method (only used in distribution grids)
Gas in soil is drawn in via probes, quantification as with HFS.
So far only used in distribution grids.



GasCam infrared camera for methane detection

Bild: OGE

More than just a camera: drone flight provides additional safety

Test drone with instruments

Tracer method
Use of a tracer gas in the vicinity of the leak in a known concentration. Both the tracer and the target gas concentrations in the plume are measured. Strongly dependent on weather conditions.

Inverse dispersion modelling method (IDMM)
Optical remote measurement technique for methane detection in downwind plume. Background concentration of the environment must be known. Strongly dependent on weather conditions.

PROJEKTMETHODE

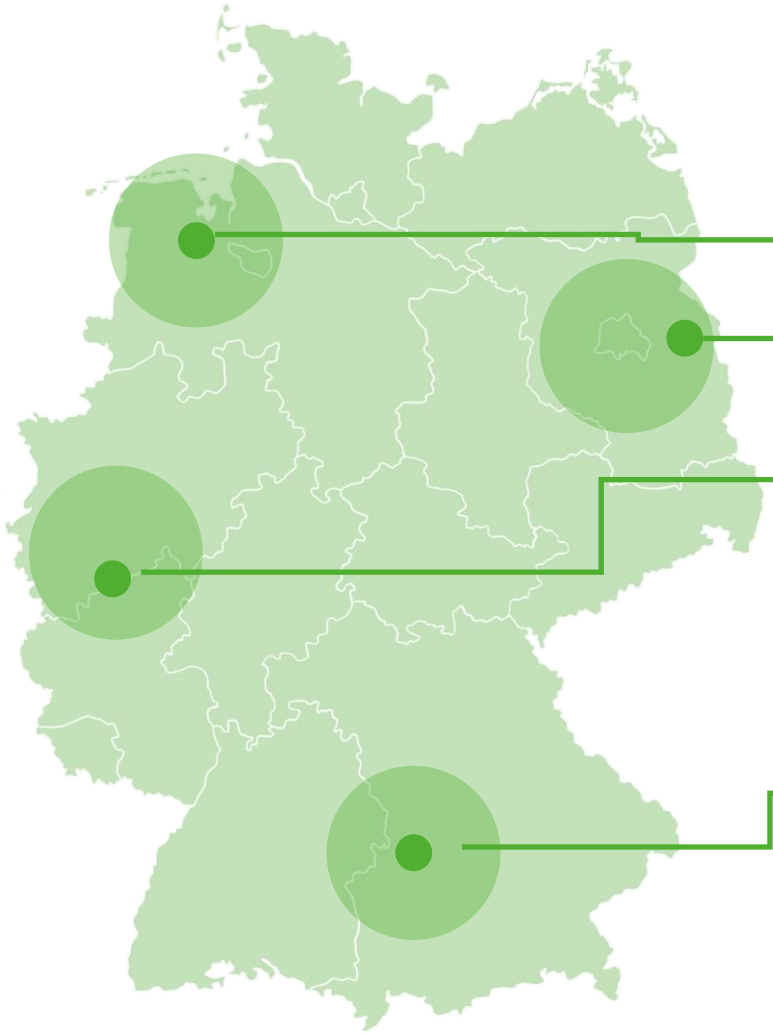
LIDAR (Charm)
Optical detection method using infrared laser. Reliable identification of even the smallest traces of natural gas (from of 80 m to 140 m). Operational leak detection limit from 20 l/h, depending on wind conditions

Satellite measurement
ESA Sentinel 5P; EDF MethaneSat; GHGSat Claire

Bild: Sniffers

Project scope

Measurements across the country



5 compressor stations, 131 valve stations

Combination of bottom-up and top-down measurements

North

Compressor stations: 2x Wardenburg - Gasunie Deutschland Transport Services, Open Grid Europe

Pipeline network: Open Grid Europe, GASCADE Gastransport, Gasunie Deutschland Transport Services, Nowega

West

Compressor station: Stolberg - Open Grid Europe, Fluxys TENP

Pipeline network: Thyssengas, Open Grid Europe

East

Compressor station: Mallnow - GASCADE Gastransport

Pipeline network: GASCADE Gastransport, ONTRAS Gastransport

South

Compressor station: Wertingen - bayernets

Pipeline network: bayernets, Open Grid Europe

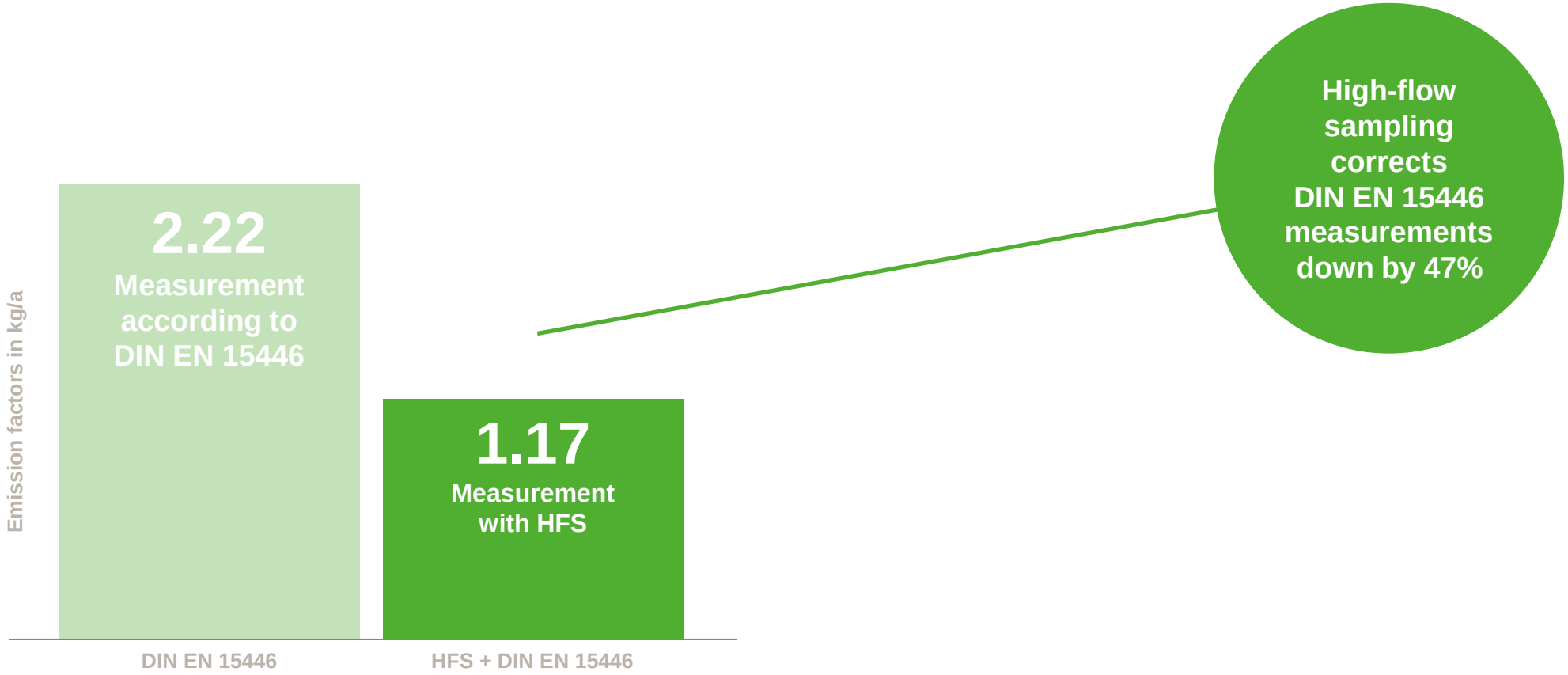
High-flow sampling provides more accurate readings for the roughly 400 main emission sources

All individual measurements were made in accordance with the international DIN EN 15446 standard: they involve a mixture of a measurements and calculations based on algorithms provided e.g. by the petrochemical industry. The results obtained with this method are therefore not precise. Due to the conversion factors used, the emissions determined this way are usually higher than the actual emissions.

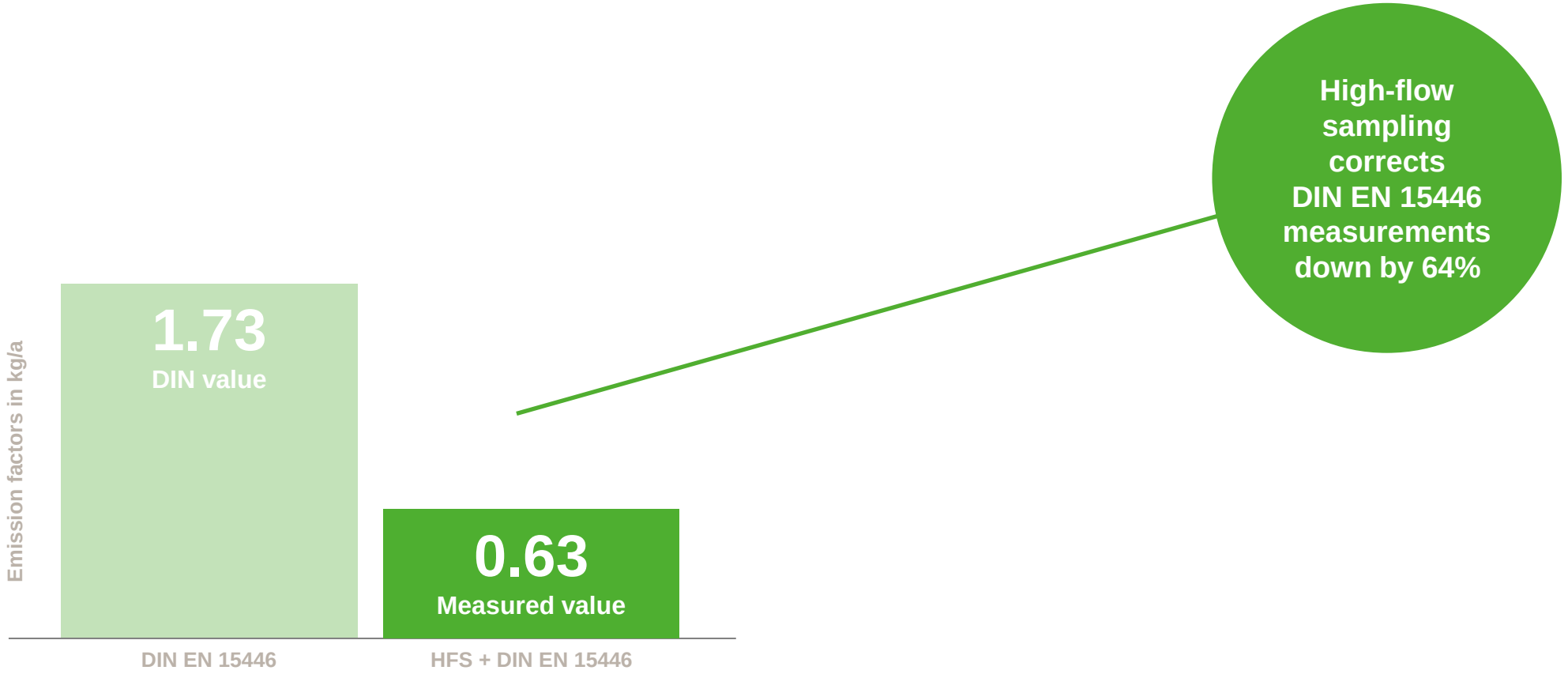
Additional high-flow sampling of the approx. 400 main emission sources determined with the DIN method provides more precise results.

This allows much more reliable statements about methane emissions.

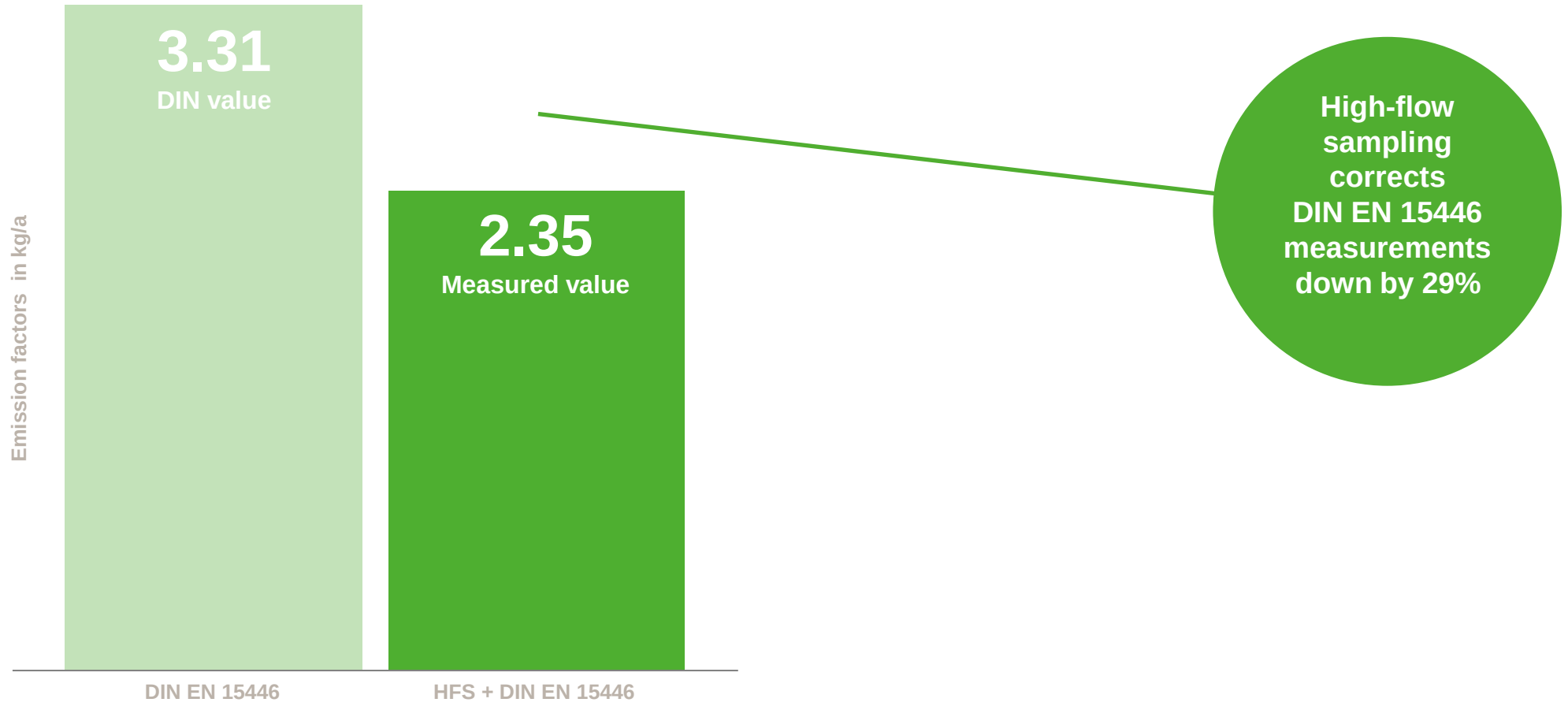
Fugitive emissions per potential leakage point Average across all measurements:



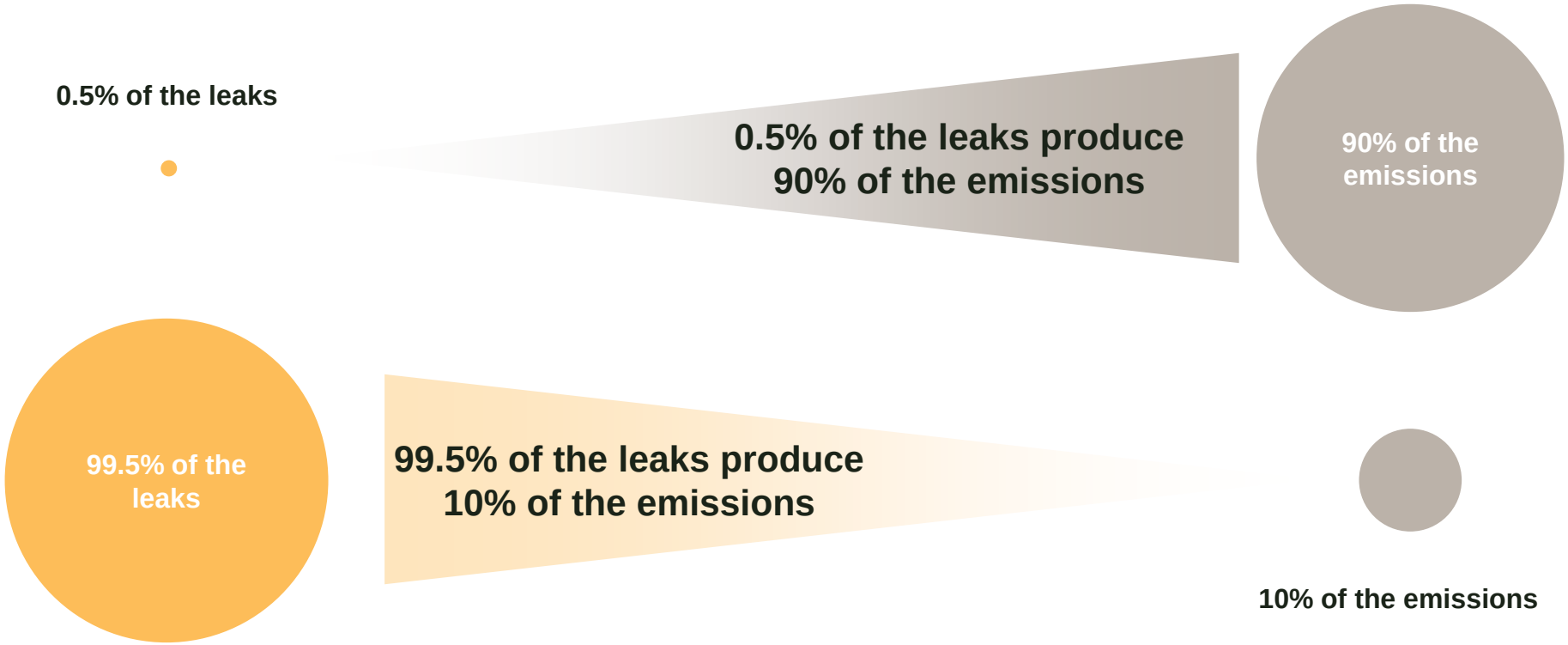
Fugitive emissions per potential leakage point
Mean value across compressor stations:



Fugitive emissions per potential leakage point
Mean value across valve stations:



0.5% of the leaks cause 90% of the measured emissions – emissions can be significantly reduced quickly



Methods for reducing methane emissions from operations have been tried and tested over many years, e.g.

1

Hot tapping and plugging

Maintenance and repair work during which the gas quantities released to atmosphere are minimised

2

Direct use

Gas is used as an energy source e.g. in small CHP units or boilers

3

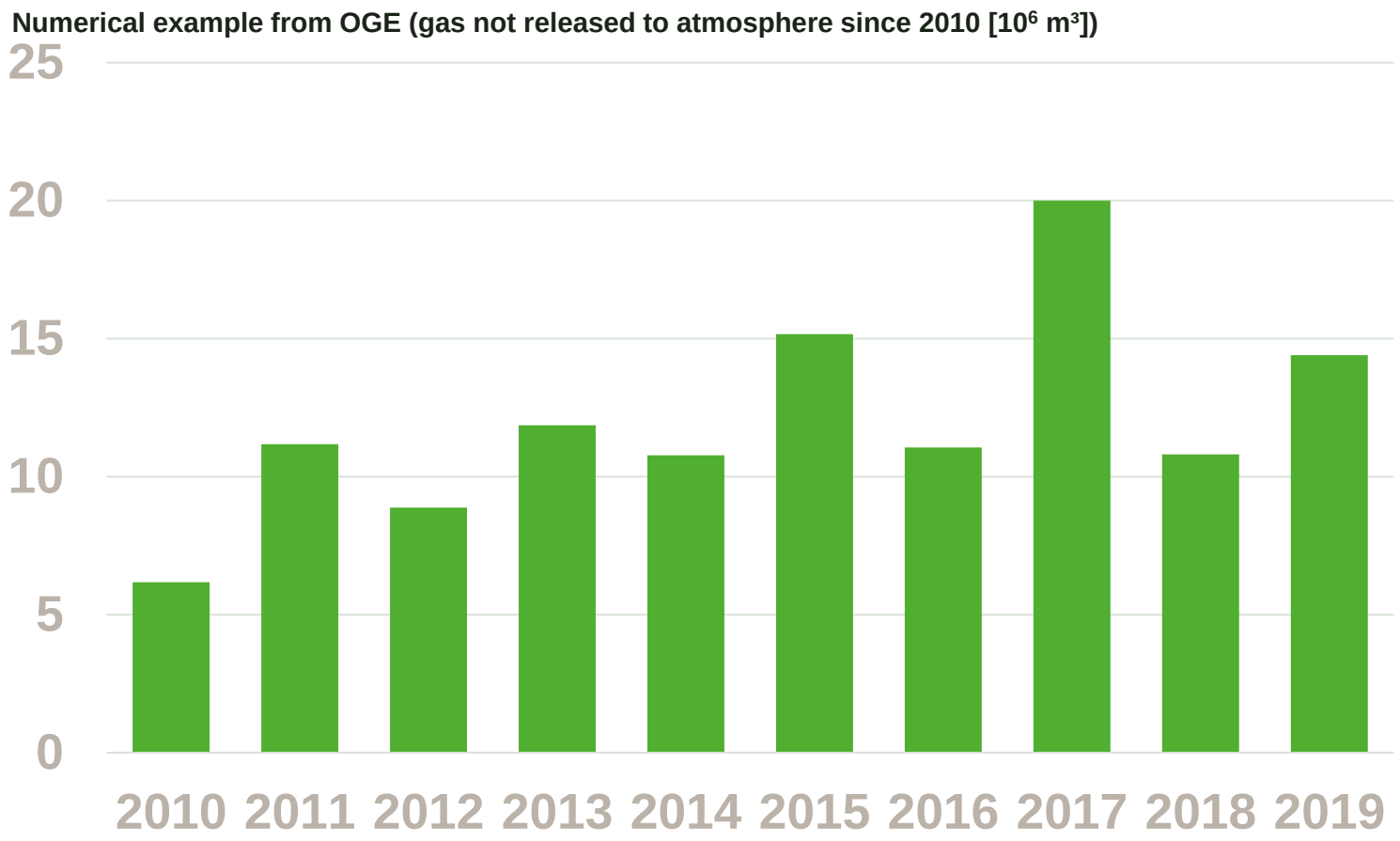
Mobile compressor

Gas is pumped back into pipeline system instead of being released to atmosphere

Pictures: OGE, Adobe/Communication Works, Ontras Gastransport GmbH

Recompression vs. release to atmosphere e.g. at OGE

Mobile compressors can significantly reduce emissions from operations



OGE example:
2.4 million tonnes of CO_2 equivalents saved since 2010

120 million m³ of methane emissions saved since 2010

Next steps

Gas TSOs consistently pursue strategy based on a joint reduction target and further reduction measures

1

Comparison of recorded measurements with existing data incl. updates

- Data provided by German gas industry: renewal of the database reported to the Federal Environment Agency (National Inventory Report)
- Reporting of methane emissions as part of the Oil and Gas Methane Partnership (OGMP), data reconciliation with Marcogaz, the European Gas Research Group (GERG) and international databases (Canada Report)

2

Discussion with stakeholders (politicians, authorities, NGOs)

- Discussion with the Federal Environment Agency
- Information provided to national and international initiatives, NGOs, politicians

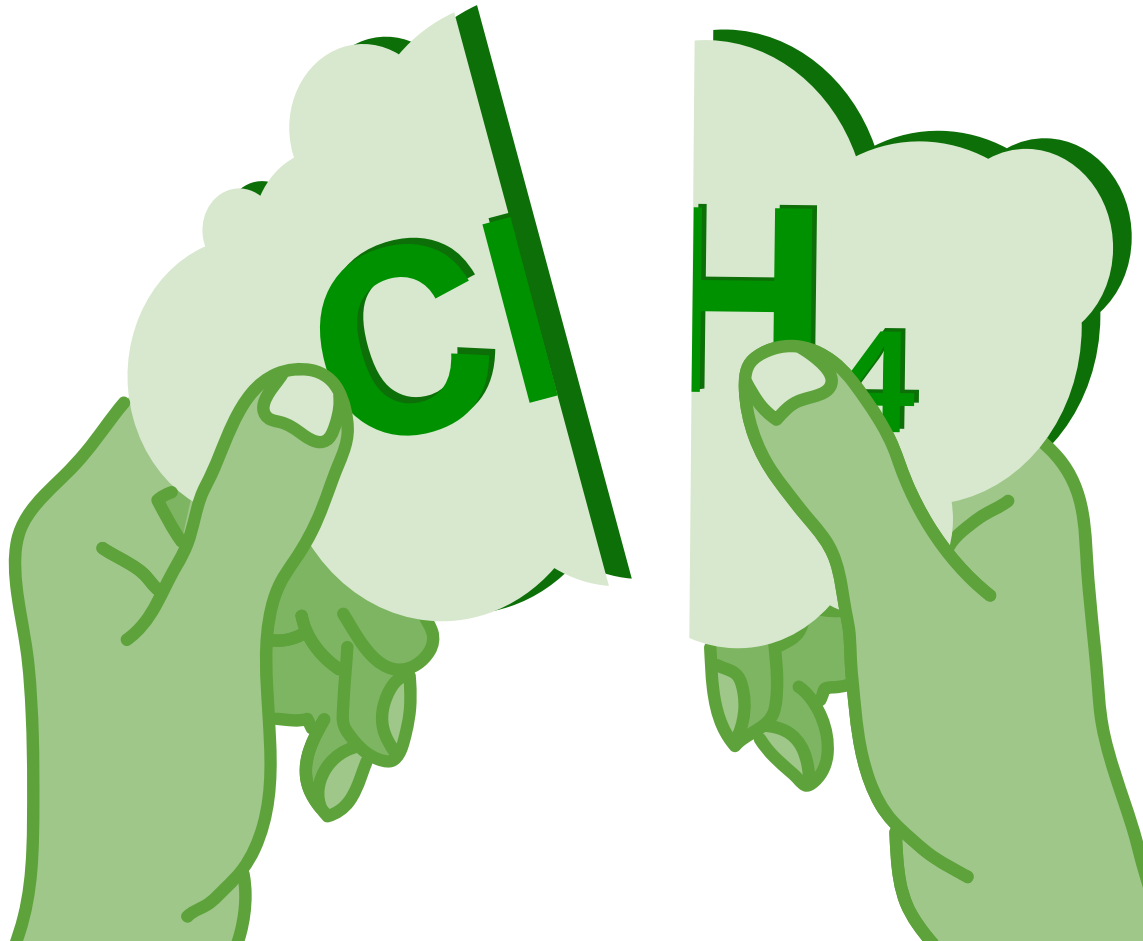
3

Emission reduction targets and mitigation measures

- Basis for selected measures and targets
- Continuation of the measurement campaign in 2022
- Continued systematic implementation of already proven strategies to reduce GHG emissions (use of mobile compressors, etc.)
- Identification and implementation of further reduction measures at all sites

FNB Gas reduction target until 2025

Gas TSOs aim to reduce their methane emissions by 50 per cent by 2025 compared to 2015 levels



Savings of 305 000 t of CO_2 equivalents by 2025

Reduction by 16 million m^3 of natural gas by 2025

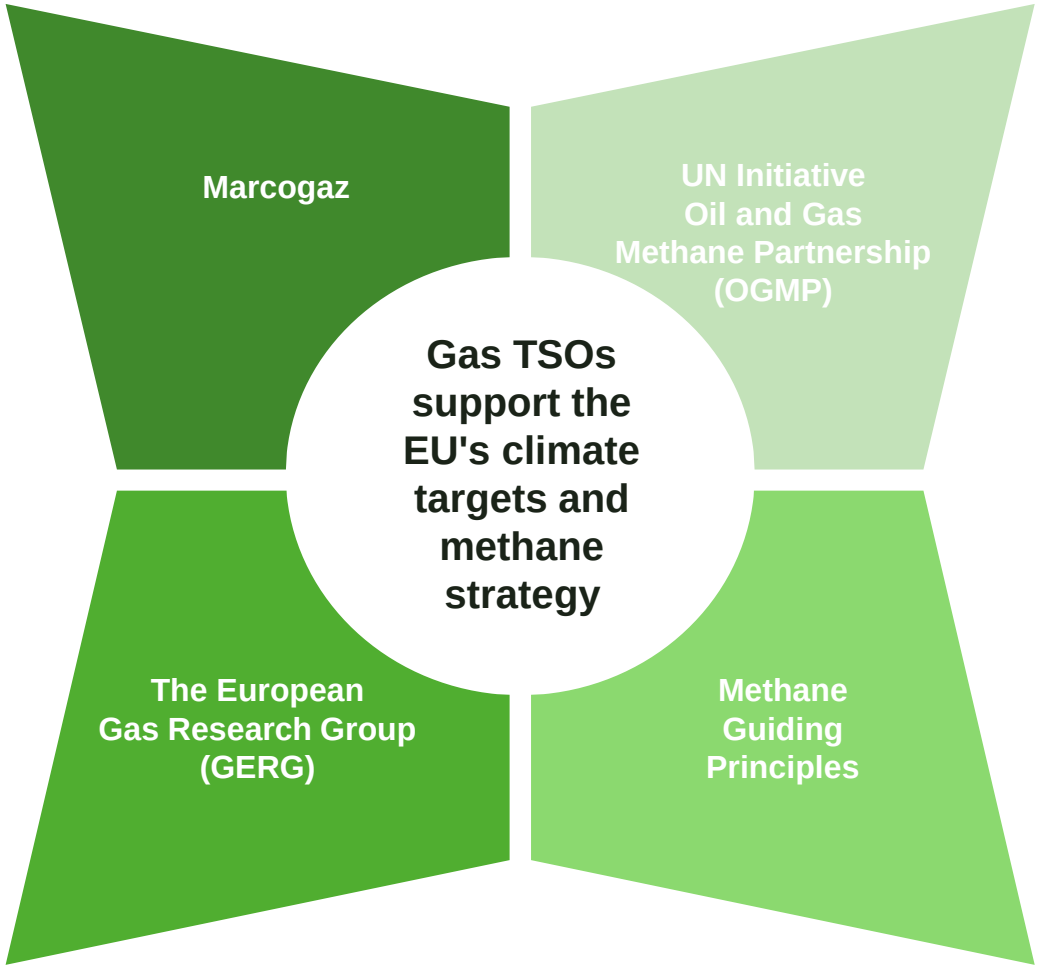
The target is based on the goals of the UN Oil and Gas Methane Partnership OGMP

Examples of measures

Gas TSOs are adopting a range of measures to achieve the goal of halving their methane emissions by 2025

Measurement activities (LIDAR) expanded to include innovative methods and techniques such as HFS/bagging	**Replacement of single block valve venting systems with double block valve venting systems**	**Reduction of potential emission sources (e.g. individual assets)**	**Mobile (small) compressors**
(Mobile) flares	**Use of leakage gases from sealing systems (e.g. boilers)**	**Low-emission gas quality measurement techniques (PGC, dew point measurement)**	**Use of electric compressors**

Gas TSOs are engaged at international level. They support the climate targets as well as the EU's strategy to reduce methane emissions



EU methane strategy
As part of its "Green Deal", the EU published a methane strategy in October 2020. The aim is to improve measurement and reporting and to reduce methane emissions in cooperation with the UN Climate and Clean Air Coalition and the IEA.

The gas TSOs' measurements, targets and mitigation measures make an important contribution to these initiatives.

FNB Gas
DIE FERNLEITUNGSNETZBETREIBER

Vereinigung der
Fernleitungsnetzbetreiber Gas e.V.

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Top Down reconciliation : the GERG project on site level technologies

Pascal ALAS | GRTgaz

Tania MEIXÚS | Enagás

GERG Project Phase I

Methodologies for methane emissions quantification

Main objective : Provide a state of the art of the different methodologies for Methane Emissions quantification and define the next steps for methodologies implementation.

Pilot :

RICE GRTgaz
Research & Innovation Center for Energy

Peer review :

TNO

LSCE

Members :

Synergrid

kiwa

snam

Italgas

elengy

uniper

storengy

GERG
THE EUROPEAN GAS RESEARCH GROUP

Thyssengas

gasunie

enagas

DBI

sedigas

GRDF
GAZ RÉSEAU DISTRIBUTION FRANCE

GAZ system

ENERGINET

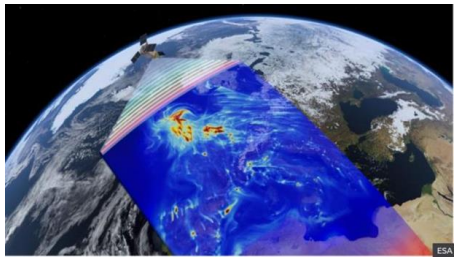
wintershall dea

ENGIE Lab CRIGEN

GERG Project Phase I

Methodologies for methane emissions quantification

WP1 - Satellites



WP2 – Top Down methodologies

WP3 – Methodologies for distribution

WP4 – Definition of next steps

Conclusions :

- Mobile survey : Good to spot super emitters rapidly, but with limited accuracy.
- Dominance of a small number of large leaks on methane emissions : opportunity for a cost-effective way to reduce methane emissions
- Direct survey : The existing measurement campaigns have shown the suitability of suction method (although time consuming).

GERG Project Phase I

Methodologies for methane emissions quantification

WP2 Conclusions :

- **Very broad panorama in terms of techniques**, Technology Readiness Level (TRL), and typology of actors – identification and analysis of 26 different methodologies
- **Based on existing test campaigns**, all technologies have showed good detection measurements but also **important limitations in quantification**
- There is a **lack of** more **comprehensive reliable data** and independent performance assessment campaigns.

NEXT STEPS : Conclusions of WP4

- Need of tests to quantify the accuracy and uncertainties of such methodologies through tests based on controled release

=> Phase 2.A

GERG Project Phase II.A

Technology Benchmark for site level methane emissions quantification project

Conclusions of the study of the state of the art

A first-of-its-kind research project covering midstream assets!

Blind above-ground controlled releases to analyse the accuracy of the most promising site level technologies (quantification)

WP1	WP2	WP3	WP4
Detailed definition and preparation of tests	Perform the tests	Analysis of results (CH_4 quantification)	Definition of next steps for Phase II.B. (test in sites)

ADVISORY BOARD to validate the scope and test program and to check the results
Internationally recognized experts from Authorities and Institutions, Academia, Industry and Civil Society

GERG Project Phase II.A

Partners

GERG Project Phase II.A

Technology Benchmark for site level methane emissions quantification project

WP1
Detailed definition and preparation of tests

Location - hybernated (inerted) Compressor Station in Spain

- ✓ Inerted
- ✓ Isolated (no other methane sources nearby)
- ✓ Flat field, can be easily surrounded by car
- ✓ No strong winds normally
- ✓ Premises available

GERG Project Phase II.A

Technology Benchmark for site level methane emissions quantification project

GERG
THE EUROPEAN GAS RESEARCH GROUP

WP1
Detailed definition and preparation of tests

Inerted and isolated Compressor Station

9 most promising site-level technologies

3 bottom-up

1 week of blind tests with controlled releases of methane

17 different emissions rates

Different heights and gas diffusion at the outlet

Independent analysis to assess accuracy and repeatability

GERG Project Phase II.A

Technology Benchmark for site level methane emissions quantification project

GERG
THE EUROPEAN GAS RESEARCH GROUP

WP1
Detailed definition and preparation of tests

Tests organization managed by a collaborative team:	enagas + BUREAU VERITAS
Releases plan determined by a collaborative team:	enagas + LSCE Laboratoire des Sciences du Climat & de l'Environnement
Tests coordination managed by Bureau Veritas:	BUREAU VERITAS
Independent analysis of data and results	LSCE Laboratoire des Sciences du Climat & de l'Environnement

GERG Project Phase II.A

- Flow rates of methane varying from 0.01 kg/h to 50 kg/h (randomized releases)
- Heights were defined to represent fugitives and vents average heights in midstream sites

WP2
Perform the tests

CRF	location	height	type of exit
node 1	vent stack	28	open end
node 2	structure1	9	open end
node 3	structure1	4	ring shaped
node 4	structure 2	1,5	linear
node 5	structure 2	1,5	open end

GERG Project Phase II.A

Technology Benchmark for site level methane emissions quantification project

GERG
THE EUROPEAN GAS RESEARCH GROUP

WP2
Perform the tests

12 technologies were tested!

- **9 Top-down / Site-level**
- **3 Bottom-up**

Top-Down / Site-level	ABB Hover Guard
	ABB Mobile Guard
	Aeromon
	DGC Tracer Gas
	Dial NPL
	SeekOps
	CHARM
	Mirico
	Sensia
Bottom-up	FLIR
	OPGAL
	HFS Prototype

Technologies

ABB Hover guard

- Off-Axis Integrated Cavity Output Spectroscopy (OA–ICOS) technology
- Mounted on a drone
- With GPS and anemometer

ABB Mobile guard

- Off-Axis Integrated Cavity Output Spectroscopy (OA–ICOS) technology
- Mounted on a car
- With GPS and anemometer

Technologies

Aeromon

- NDIR (Non-dispersive infrared), MOS (Metal-oxide semiconductor) and laser spectroscopy
- Mounted on a drone

DGC tracer gas

- Tracer gas technology (Acetylene)
- Cavity Ring Absorption Spectroscopy for measurement

Technologies

SeekOps

- Turnable diode laser absorption spectrometer sensor (SeekIR)
- Mounted on a drone

DIAL NPL

- LiDAR DIAL sensor
- Mounted on a truck
- 3D picture

Technologies

CHARM

- LIDAR DIAL
- Mounted on a helicopter
- High travelling speed
- Photographic documentation

MIRICO – ORION CH4

- Laser Dispersion Spectroscopy (LDS) for concentration measurement
- 10 retroflectors were located across the site to return the laser beams to the detector
- Not affected by climate adversities

Technologies

SENSIA

- Caroline FYL
  - Uncooled LWIR detector
  - OGI analytics for mass flow quantification
- Mileva 33F
  - Cooled MWIR detector

FLIR

- FLIR OGI QL320
  - Handheld device
  - Temperature assessment
  - Colorized video

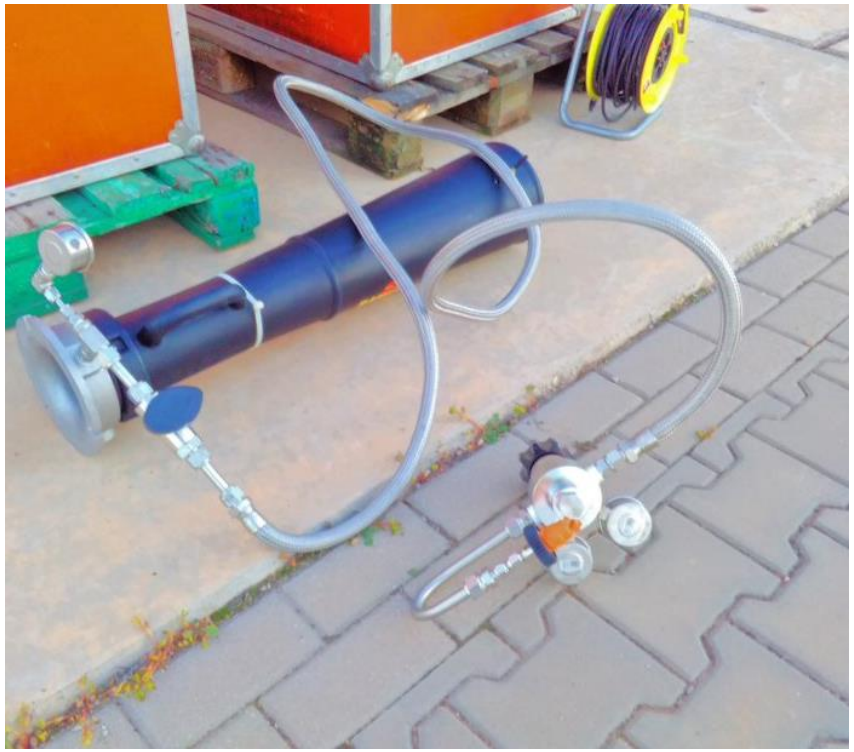
Technologies

OPGAL

- EyeCGas 2.0 - OGI
    - Handheld device
    - Temperature assessment

HFS Prototype /RICE

- Pneumatic Venturi Prototype (low TRL)



GERG Project Phase II.A

Technology Benchmark for site level methane emissions quantification project

Full week tests plan

	Monday	Tuesday	Wednesday	Thursday	Friday
7:00	Arrival Safety briefing Organisational briefing Antigen tests	Arrival + Time for preparation	Arrival + Time for preparation	Arrival + Time for preparation	Arrival + Time for preparation
8:00					
9:00		**Experiment 3**	**Experiment 7**	**Experiment 11**	**Experiment 15**
10:00	**Installation time for:** **CRF** **All technologies**				
11:00		**Experiment 4**	**Experiment 8**	**Experiment 12**	**Experiment 16**
12:00	Lunch break	Lunch break LSCE instructions for reporting	Lunch break	Lunch break	Lunch break Debriefing
13:00					
14:00	**Experiment 1**	**Experiment 5**	**Experiment 9**	**Experiment 13**	**Experiment 17**
15:00					
16:00	**Experiment 2**	**Experiment 6**	**Experiment 10**	**Experiment 14**	Desisntallation
17:00					
18:00	Calibration of Mini CRF				
19:00					

GERG Project Phase II.A

Technology Benchmark for site level methane emissions quantification project

WP3
Analysis of results
(CH_4 quantification)

→ **Independent report** – **Before end of December** (only for partners and key stakeholders)

→ **Peer-reviewed article**
Q1 2022

GERG Project Phase II.A

Technology Benchmark for site level methane emissions quantification project

WP4
Definition of next steps for Phase II.B. (test in sites)

- **Phase II. B** to be kicked-off probably in **February 2022.** Further work is needed to determine how these technologies can be applied to reconcile bottom-up/source-level quantification.
- Select technologies based on the findings of the study of the state of the art and the results of phase II.A

Bottom-up

Top-down Site-level

Reconciliation to be done with external support

OGCI ongoing activities

Pietro MEZZANO | OGCI

OIL AND GAS CLIMATE INITIATIVE

Towards near zero methane emissions

Energy Community Methane Mondays - Methane emissions detection, measurement and quantification technologies

December 02, 2021

OUR MEMBER COMPANIES

aramco bp Chevron CNPC eni equinor ExxonMobil OXY Occidental BR PETROBRAS REPSOL Shell TotalEnergies

Oil and Gas Climate Initiative (OGCI)

THE INITIATIVE : LOWER CARBON VIA COLLECTIVE ACTION & PARTNERSHIPS

- CEO-led
- Voluntary
- Ambitious
- Additional
- Action oriented

PARIS2015 UN CLIMATE CHANGE CONFERENCE COP21·CMP11

Paris Agreement

Our Focus

- **CCUS**
- **Role of Gas**
- **Transport**
- **Energy Efficiency**
- **Low Emission Opportunities**
- **Natural Climate Solutions**

CLIMATE INVESTMENTS : LOWER CARBON VIA INVESTING IN SOLUTIONS

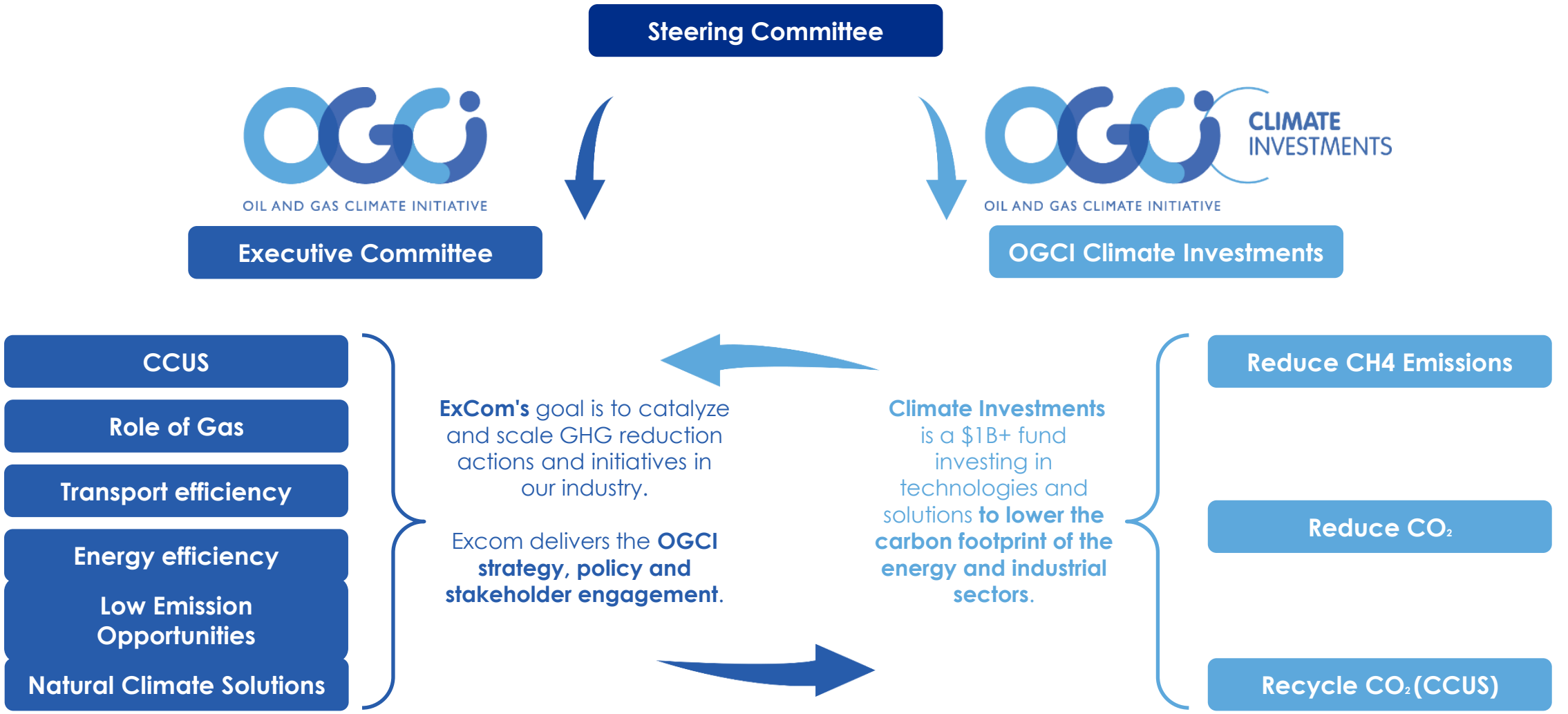
- Invest
- Implement
- Achieve impact at a global scale

Reduce methane emissions through detection, measurement & mitigation

Reduce carbon dioxide emissions, by increasing energy efficiency in power, industry and transport

Recycle and store carbon dioxide (CCUS) in applications such as industrial processes and power generation

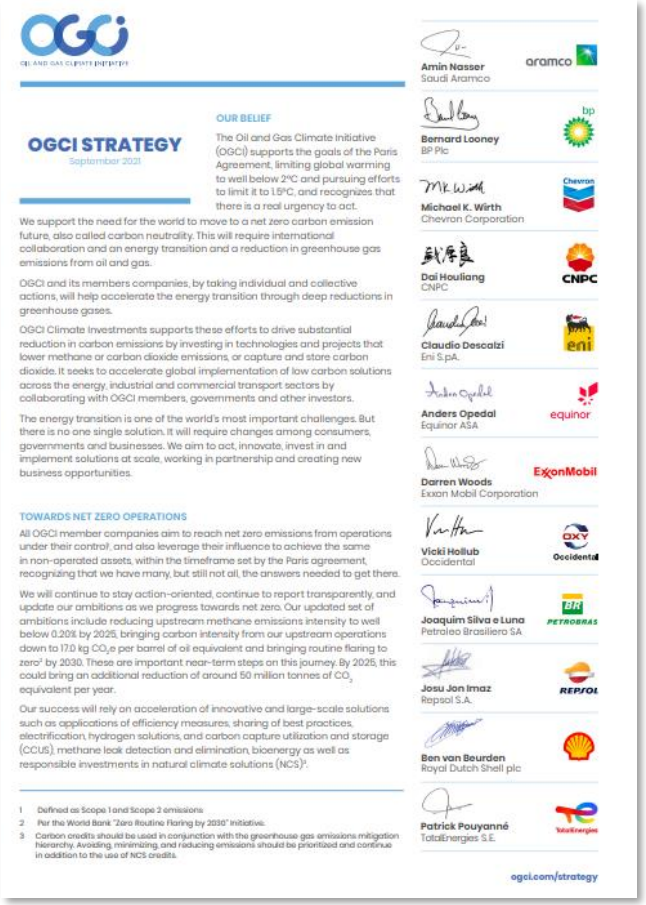
OGCI current operating structure



OGCI Strategy Refresh: September 2021

Three Pillars

1	**Net zero operations + leverage influence in non-operated assets.**	Refresh our targets: 2025 for upstream carbon intensity (17.0 kgCO2e/boe) and methane (well below 0.20%).	**~1 GTCO2e/y**
2	**Leading the entire oil and gas industry**	Reinforce concrete action to engage & collaborate with industry towards net zero.	**~ 3 GTCO2e/y**
3	**Accelerating actions to help decarbonise society**	Focus on CCUS and H2.	**~ 16 GTCO2e**



OGCI STRATEGY

September 2021

OUR BELIEF

The Oil and Gas Climate Initiative (OGCI) supports the goals of the Paris Agreement, limiting global warming to well below 2°C and pursuing efforts to limit it to 1.5°C, and recognizes that there is a real urgency to act.

We support the need for the world to move to a net zero carbon emission future, also called carbon neutrality. This will require international collaboration and an energy transition and a reduction in greenhouse gas emissions from oil and gas.

OGCI and its members companies, by taking individual and collective actions, will help accelerate the energy transition through deep reductions in greenhouse gases.

OGCI Climate Investments supports these efforts to drive substantial reduction in carbon emissions by investing in technologies and projects that lower methane or carbon dioxide emissions, or capture and store carbon dioxide. It seeks to accelerate global implementation of low carbon solutions across the energy, industrial and commercial transport sectors by collaborating with OGCI members, governments and other investors.

The energy transition is one of the world's most important challenges. But there is no one single solution. It will require changes among consumers, governments and businesses. We aim to act, innovate, invest in and implement solutions at scale, working in partnership and creating new business opportunities.

TOWARDS NET ZERO OPERATIONS

All OGCI member companies aim to reach net zero emissions from operations under their control[1], and also leverage their influence to achieve the same in non-operated assets, within the timeframe set by the Paris agreement, recognizing that we have many, but still not all, the answers needed to get there.

We will continue to stay action-oriented, continue to report transparently, and update our ambitions as we progress towards net zero. Our updated set of ambitions include reducing upstream methane emissions intensity to well below 0.20% by 2025, bringing carbon intensity from our upstream operations down to 17.0 kg CO_2e per barrel of oil equivalent and bringing routine flaring to zero[2] by 2030. These are important near-term steps on this journey. By 2025, this could bring an additional reduction of around 50 million tonnes of CO_2 equivalent per year.

Our success will rely on an acceleration of innovative and large-scale solutions such as applications of efficiency measures, sharing of best practices, electrification, hydrogen solutions, and carbon capture utilization and storage (CCUS), methane leak detection and elimination, bioenergy as well as responsible investments in natural climate solutions (NCS)[3].

1 Defined as Scope 1 and Scope 2 emissions.
2 Per the World Bank "Zero Routine Flaring by 2030" initiative.
3 Carbon credits should be used in conjunction with the greenhouse gas emissions mitigation hierarchy. Avoiding, minimizing, and reducing emissions should be prioritized and continue in addition to the use of NCS credits.

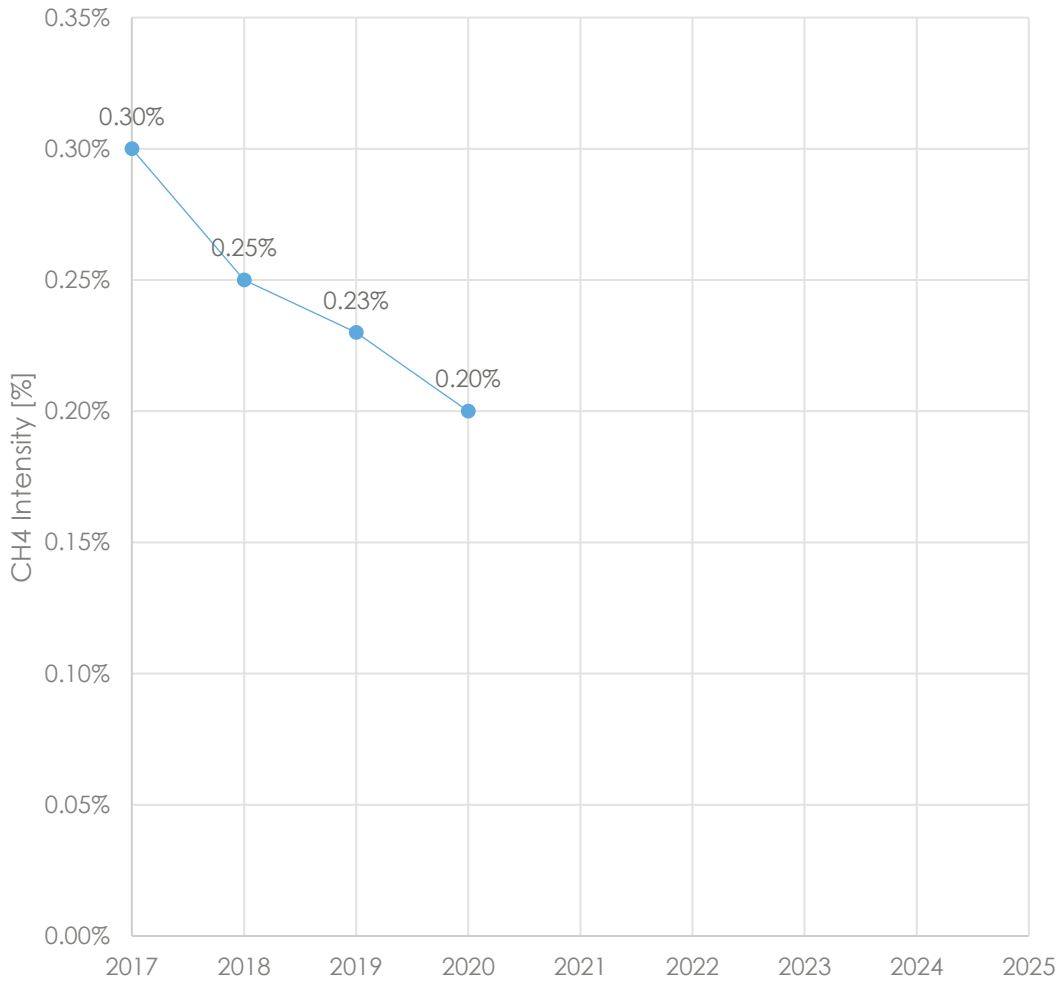
Amin Nasser, Saudi Aramco
Bernard Looney, BP Plc
Michael K. Wirth, Chevron Corporation
Dai Houliang, CNPC
Claudio Descalzi, Eni S.p.A.
Anders Opedal, Equinor ASA
Darren Woods, Exxon Mobil Corporation
Vicki Hollub, Occidental
Joaquim Silva e Luna, Petroleo Brasileiro SA
Josu Jon Imaz, Repsol S.A.
Ben van Beurden, Royal Dutch Shell plc
Patrick Pouyanné, TotalEnergies S.E.

ogci.com/strategy

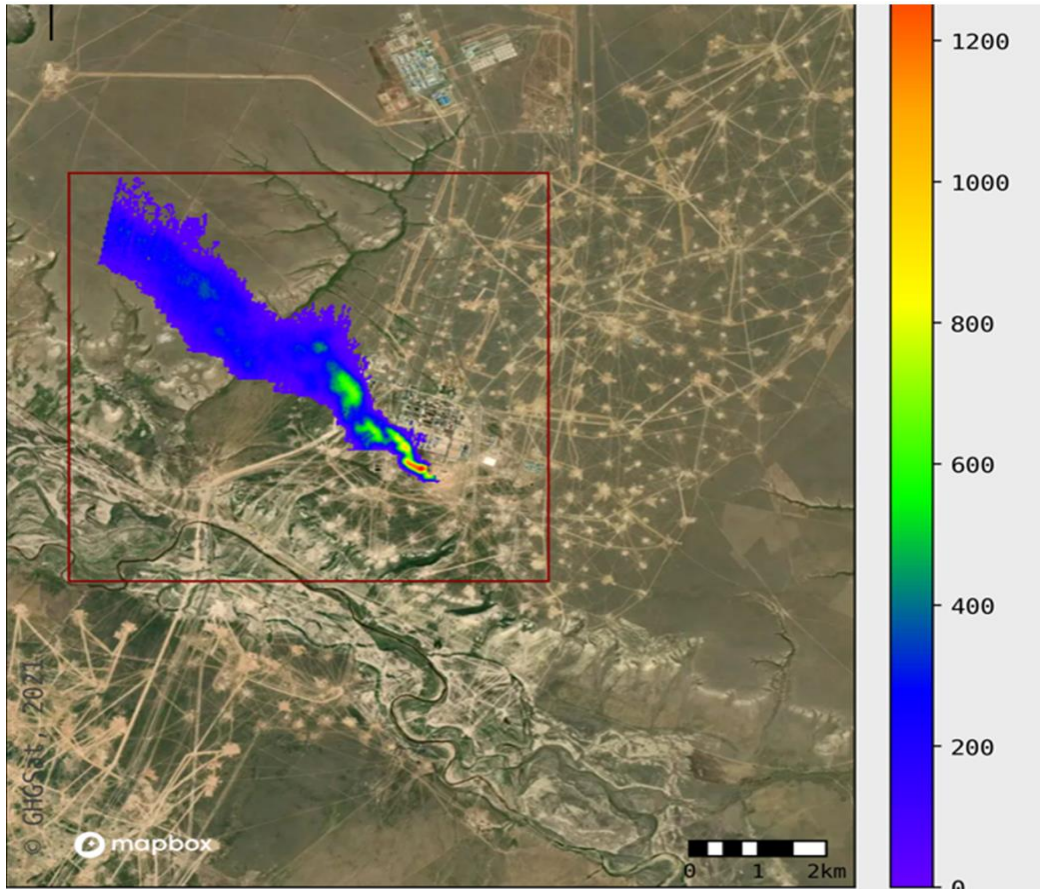
Source: OGCI (2021)

#1 Mitigate methane emissions

OGCI Upstream Methane Intensity Target

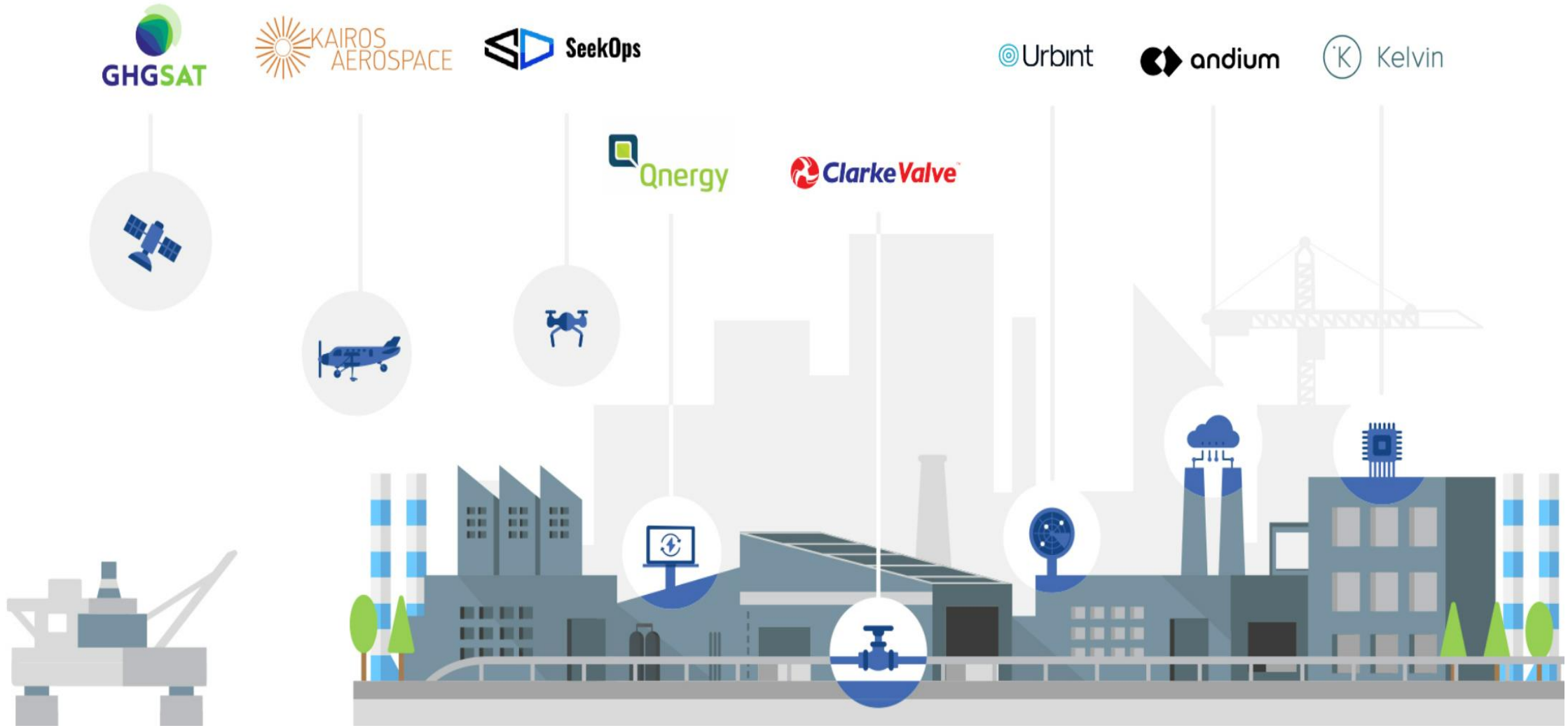


Deploying satellite campaigns to mitigate methane emissions in developing countries



Sources: OGCI Website(2021), GHGSat (2021)

OGCI Climate Investments efforts in the CH4 mitigation space



Source: OGCI (2021)

Draft 2022 High Level Workplan on CH4 emission reduction

OIL AND GAS CLIMATE INITIATIVE

Value chains / geographical areas

Technology deployment

Best practices and toolkit

Reporting

CH4 detection and quantification campaigns

Engagement

Case Studies – SOCAR GEORGIA

Giorgi ARESHIDZE | SOCAR

“SOCAR Georgia Gas”

Giorgi Areshidze

Head of Project Management

SOCAR Georgia Gas

5th joint Energy Community, GIE and MARCOGAZ Technical meeting: Mitigating methane emissions in the gas sector

December 2, 2021

Tbilisi, Georgia

SOCAR GEORGIA GAS

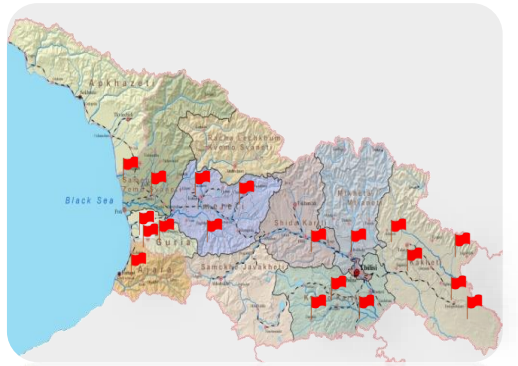
SOCAR Georgia Gas

SOCAR Georgia Gas is a subsidiary company of SOCAR Energy Georgia, founded by State Oil Company of Azerbaijan.

SOCAR Georgia Gas was established in August 2007 with purpose of implementation of gasification program in Georgia.

Current scope of work includes import, sales, distribution of natural gas through operation of low and medium pressure gas network.

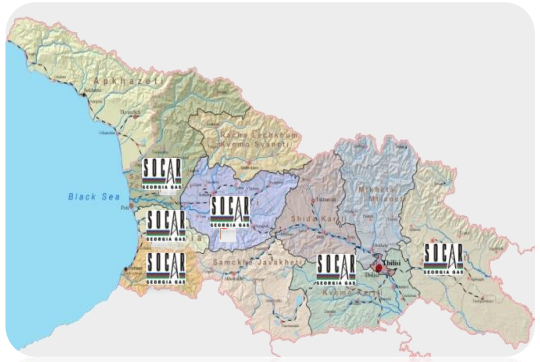
Institutional Development of Company



2008

29 regional companies

In 2008, 29 smaller regional companies were merged into 6 larger regional entities.



2008-2014

6 regional companies

In 2014, 6 regional companies were merged into one company “SOCAR Georgia Gas”

2014

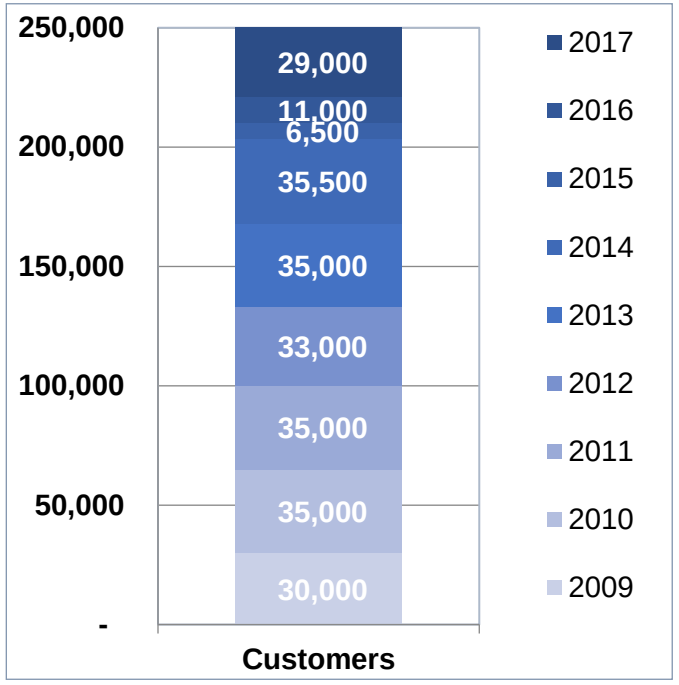
1 company

- Unification of regional work processes
- Unification of tariffs
- Optimization and consolidation of financial resources
- Increase of management effectiveness

Fulfilment of Investment Obligations

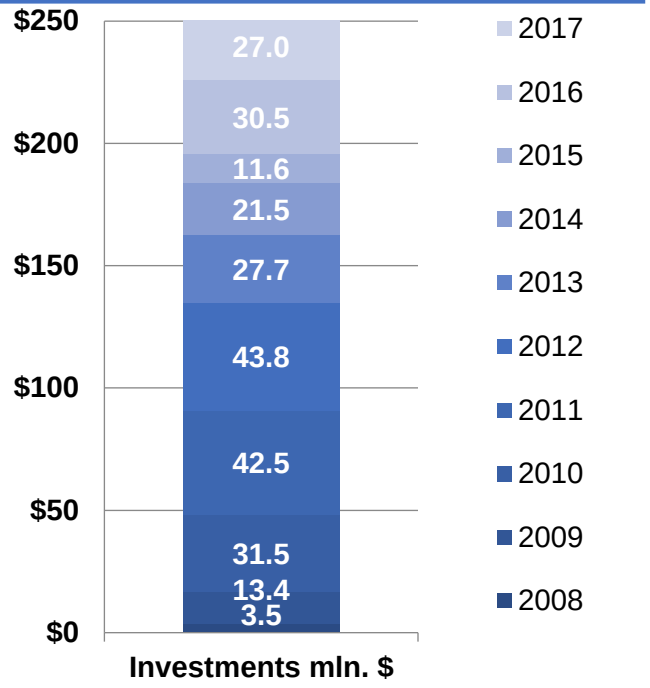
SOCAR GEORGIA GAS

300,000 customers at the end of 2017



FULFILLED

$290 mln. investments at the end of 2017



2008 — 2014 — 2017

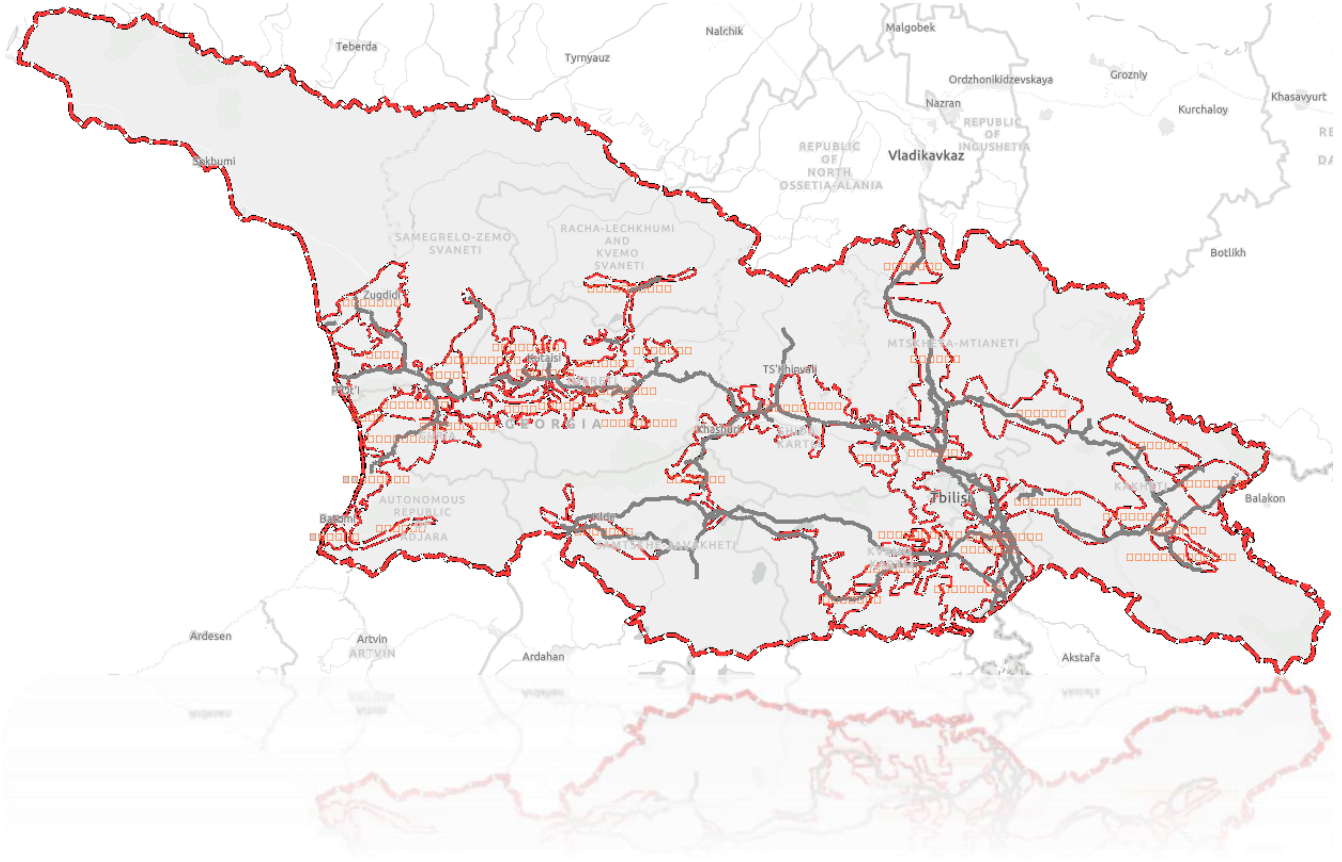
Agreement between SOCAR Georgia Gas and Ministry of Economic Development of Georgia on obligations to invest $40 mln. and provide gasification to 150,000 customers.

Agreement between SOCAR Georgia Gas and National Agency of State Property of Georgia on new investment obligations.

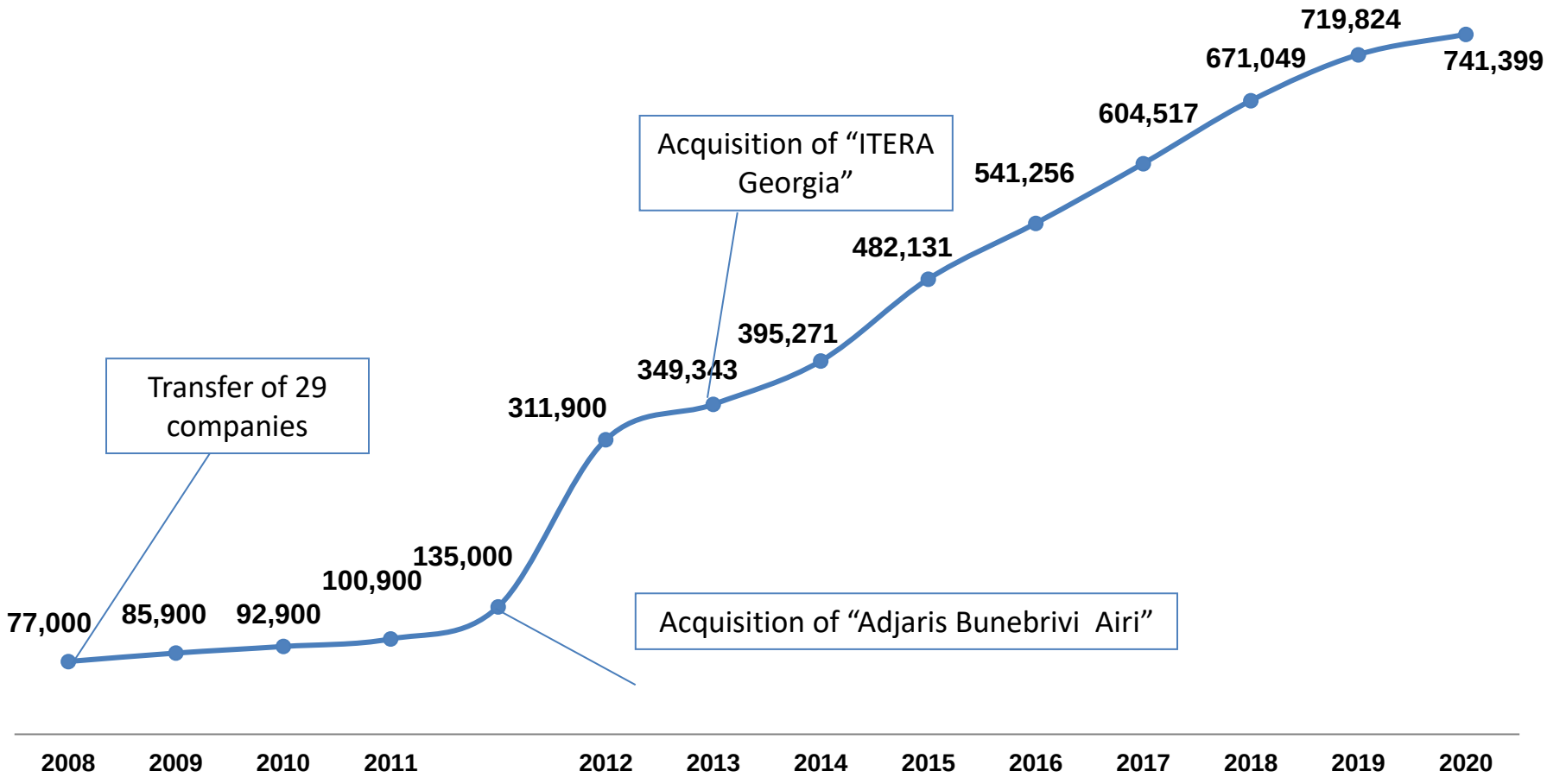
According to new obligations, total number of gasified customers should increase from 150,000 to minimum of 250,000 in 2017.

Business Development for 2008-2020

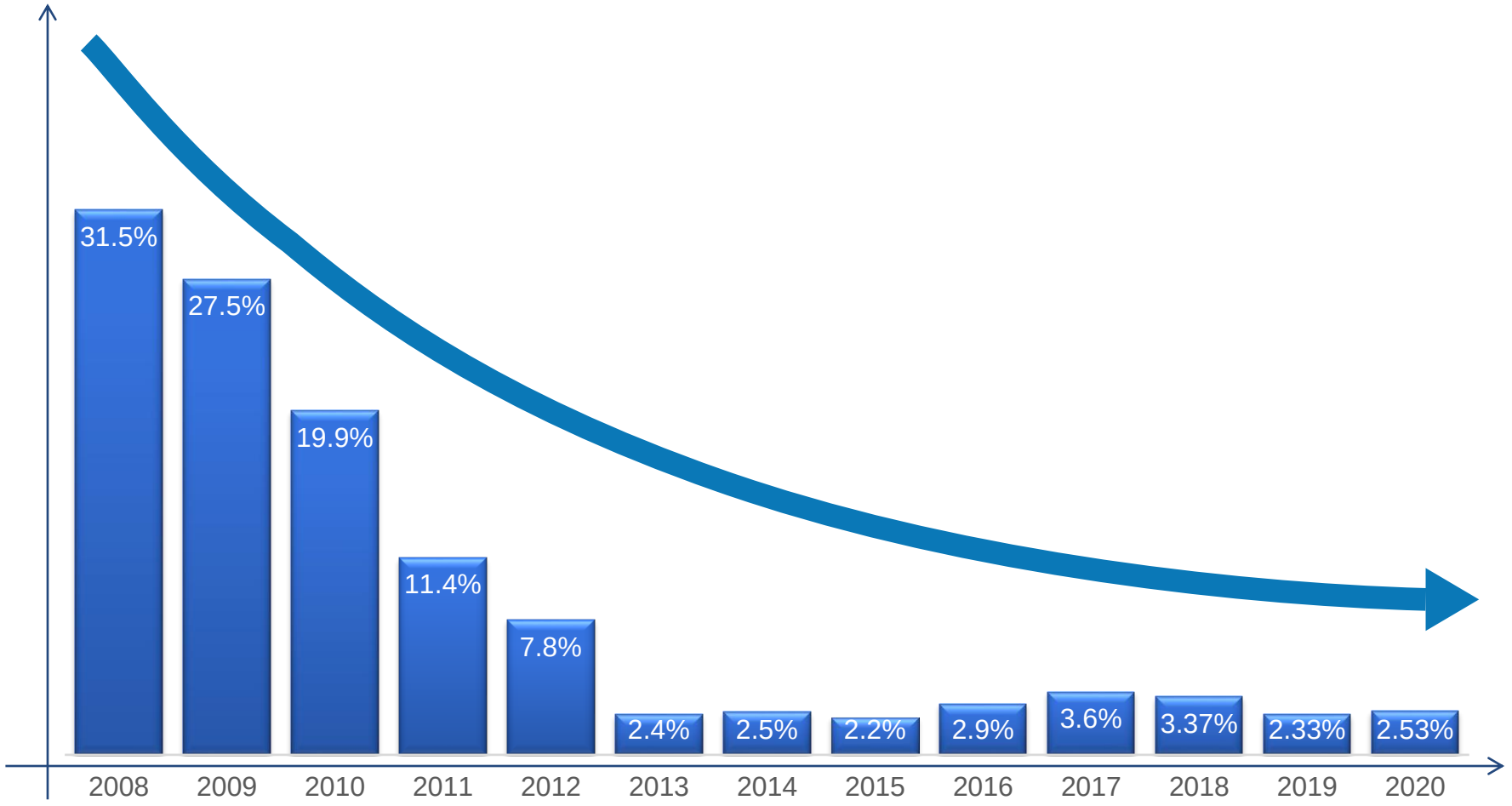
- **741 399 Active Subscribers;**
- **24 400 Km of Pipelines;**
- **1.25 Bln м³ Gas Sales;**
- **38 Service Centers.**



Active Customers



Reduction of Losses (Emissions)



Factors that contributed to Reduction of Losses

- Rehabilitation of old soviet gas distribution network
- New gas analyzers (+underground), GORE-TEX sealing materials, gaskets
- Preventive Planed Works – house network and meter checks, subscriber visits
- Still technical losses exist (compatible with regulator standards) – terrain issues, thermal corrector-less meters (few exist, subject to change)

SOCAR GEORGIA GAS

Emissions reductions – CDM Project

In 2012, the company became a member "Clean Development Mechanism“ project within the framework of the Kyoto Protocol, with aim to reduce leaks at aboveground infrastructure in SOCAR Georgia Gas distribution system, specifically at valves and cranes installed at gate stations, pressure regulator stations, surface facilities, as well as at connection points with industries and residential buildings

Project scope - 87000 cranes and 5225 valves

SOCAR GEORGIA GAS

Project Design Document

Maintenance practise	Technology before project implementation/ Conventional LDAR program	Equipment / technology to be implemented in the framework of advance LDAR program
Leak detection	Although there is a requirement to perform inspections 'Socar Georgia Gas' lacks regular staff to perform systematic leak detection Soap solution or sniff tests are used for leak detection.	Additional staff will be hired to monitor and detect leaks in the system Catalytic oxidation / thermal conductivity detectors
Measurement of leaks	No equipment	Hi-Flow Sampler
Leak repair	Repairs are performed only in emergency cases. Currently applied sealant is a round twisted cord made of flax sodden with oil. The packing loses containment after pressure variations and changes in weather conditions.	Ball cranes Gore-Tex sealing materials

SOCAR GEORGIA GAS

A.4.4.Estimated amount of emission reductions over the chosen crediting period:

Years	Annual estimation of emission reductions in tonnes of CO_2e
01/11/2012 – 31/12/2012 (2 months)	29,005
01/01/2013 – 31/12/2013 (12 months)	173,556
01/01/2014 – 31/12/2014 (12 months)	173,556
01/01/2015 – 31/12/2015 (12 months)	173,556
01/01/2016 – 31/12/2016 (12 months)	174,031
01/01/2017 – 31/12/2017 (12 months)	173,556
01/01/2018 – 31/12/2018 (12 months)	173,556
01/01/2019 – 31/12/2019 (12 months)	173,556
01/01/2020 – 31/12/2020 (12 months)	174,031
01/01/2021 – 31/12/2021 (12 months)	173,556
01/01/2022-31/10/2022 (10 months)	144,550
Total estimated reductions (tonnes of CO_2e)	1,736,509
Total number of crediting years	10 years
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	173,651

SOCAR GEORGIA GAS

SOCAR
GEORGIA GAS

THANK YOU FOR YOUR ATTENTION

Case Studies – NAFTOGAZ

Oleksii RIABCHYN

METHANE EMISSIONS REDUCTION IN UKRAINE: NAFTOGAZ CASE STUDY

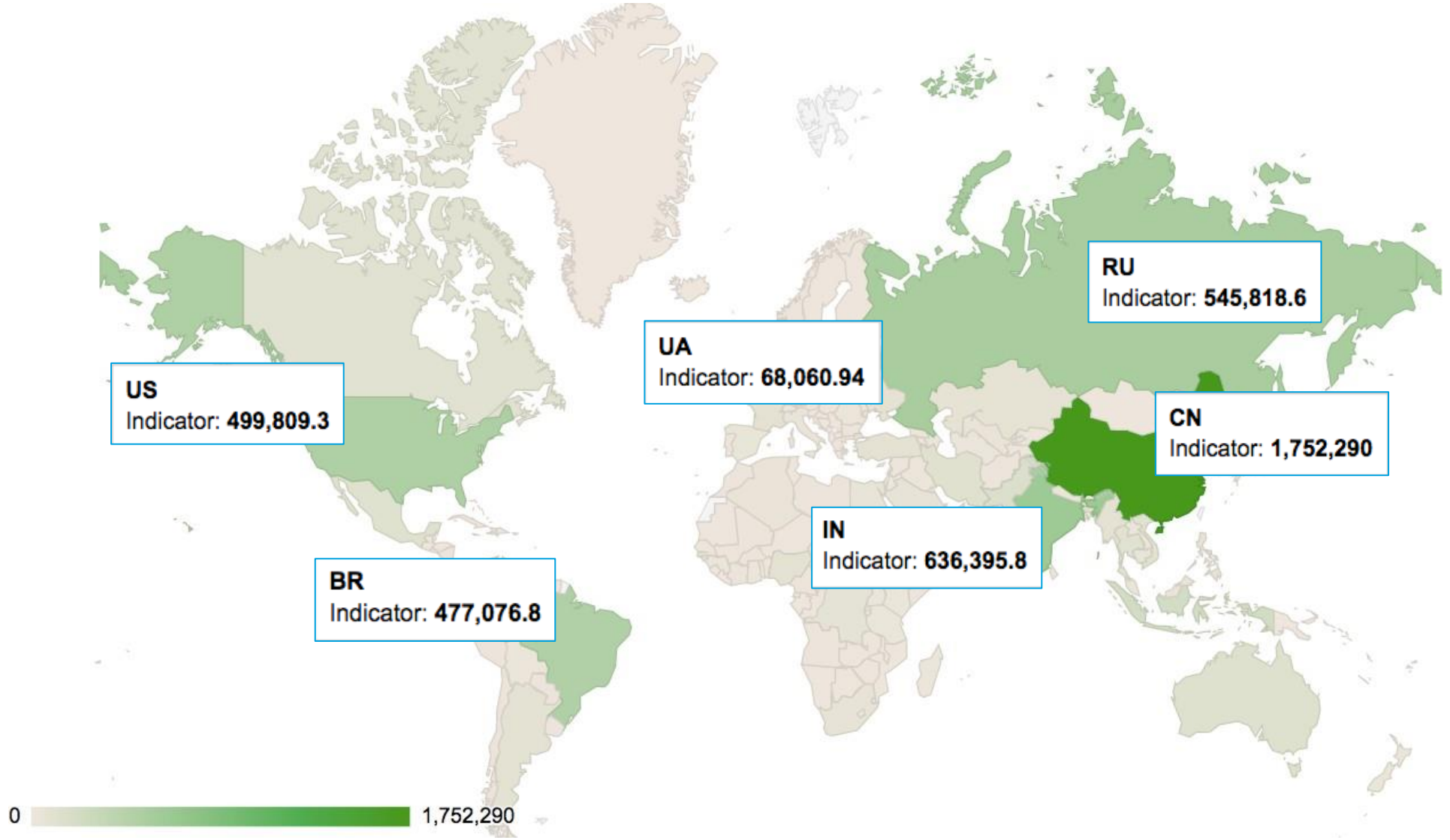
Oleksii Riabchyn

Advisor to the CEO of Naftogaz of Ukraine
on low-carbon businesses and EU Green Deal

Vienna-Kyiv

2 November 2021

Methane emissions by country (kt of CO2-eq)

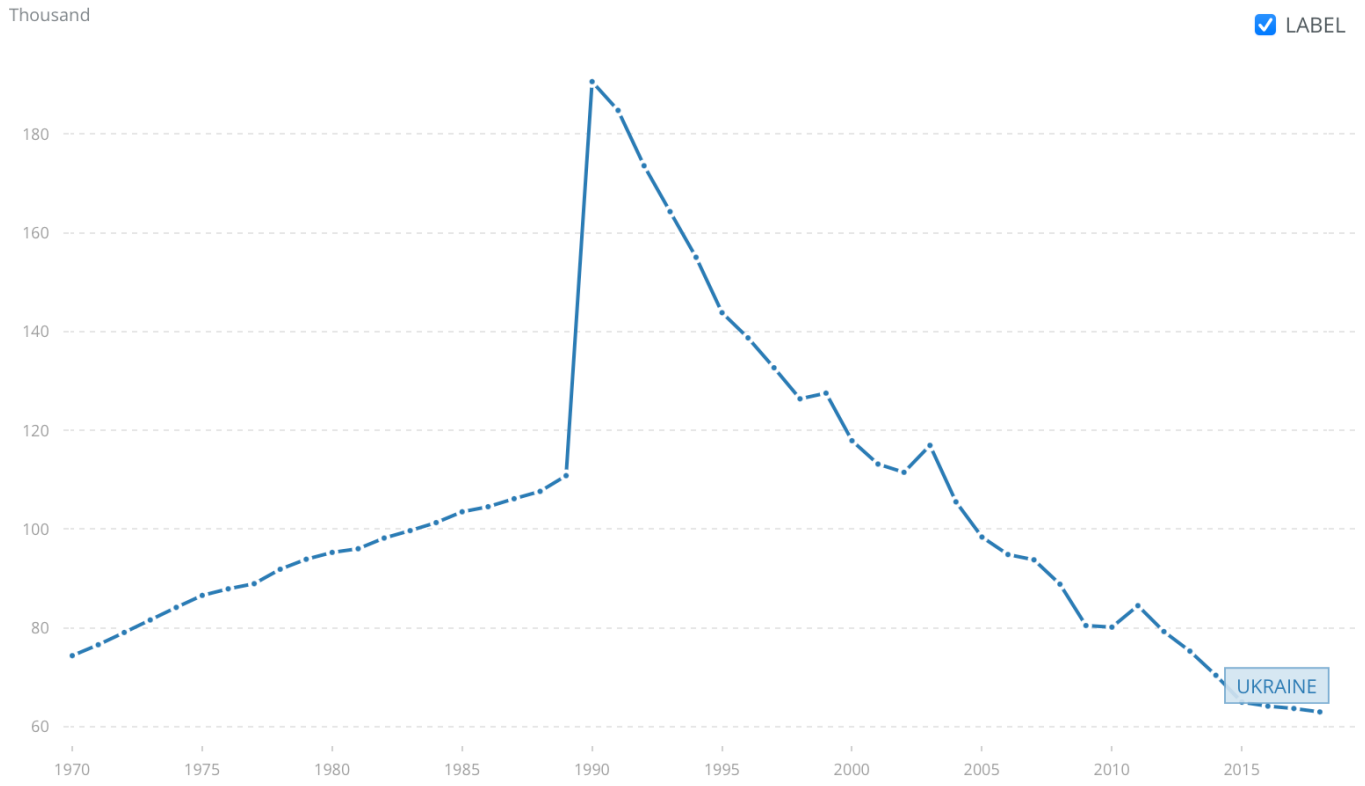


Source: European Commission, Joint Research Centre (JRC)/Netherlands Environmental Assessment Agency (PBL). Emission Database for Global Atmospheric Research (EDGAR): http://edgar.jrc.ec.europa.eu/

Ukraine ranks 24th in the world in "Methane Emissions (CO2 Equivalent)

The world Methane Emissions (CO2 Equivalent) ranking chart:Ukraine ranks 24th

Rank	Country	Methane Emissions (CO2 Equivalent) [kt]
20	Myanmar	80,637
21	Turkey	78,853
22	Congo, the Democratic Republic of the	75,336
23	Kazakhstan	71,350
24	Ukraine	68,061
25	Colombia	67,979
26	Poland	65,071
27	Ethiopia	64,481
28	South Africa	63,156
29	Saudi Arabia	62,903



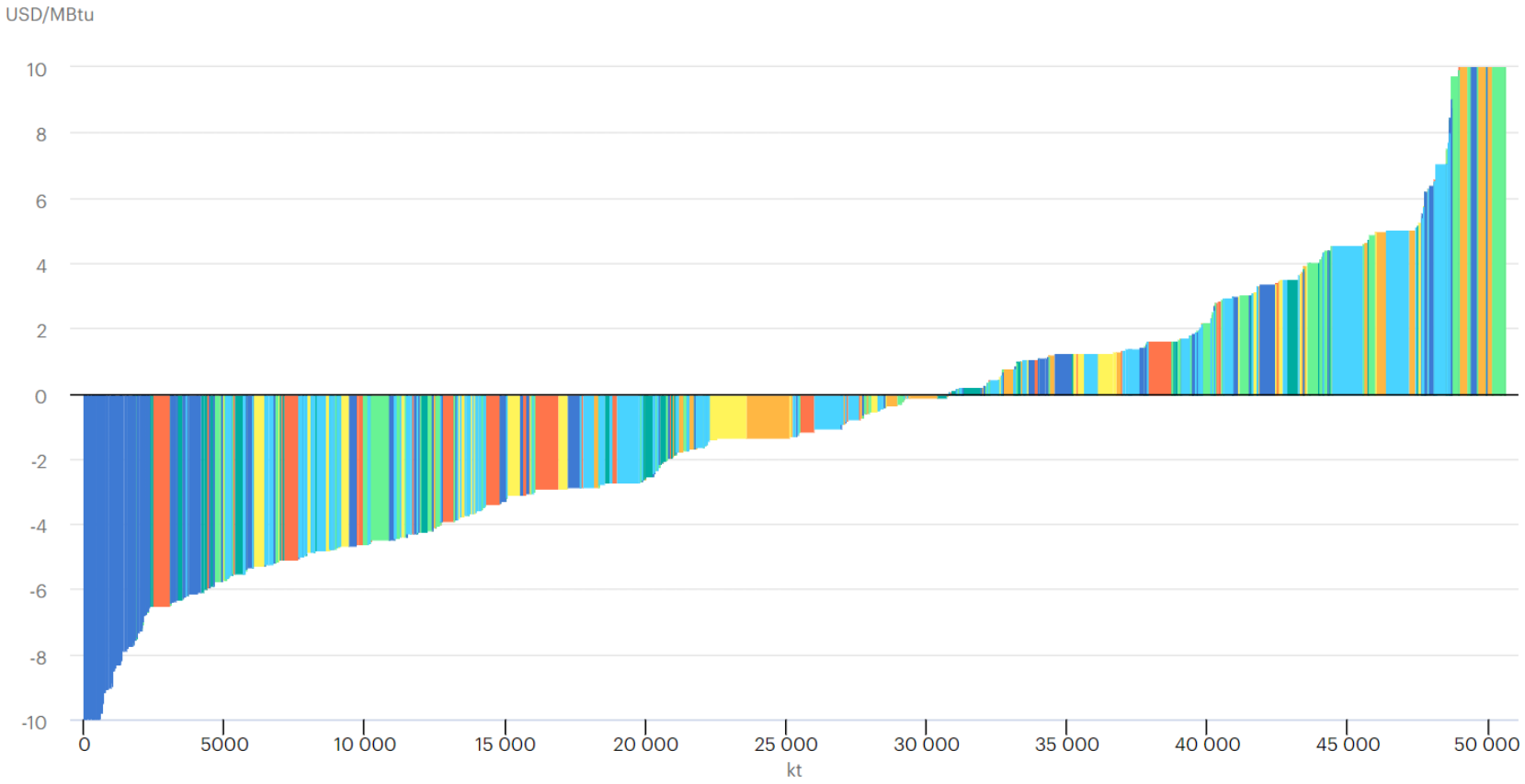
https://data.worldbank.org/
https://en.graphtochart.com/environment/ukraine-methane-emissions-kt-of-co2-equivalent.php#worldranking

What theory says…

IEA marginal abatement cost curve for oil- and gas-related methane emissions

- **"A significant share of [O&G methane emissions] could be avoided at no net cost"…**

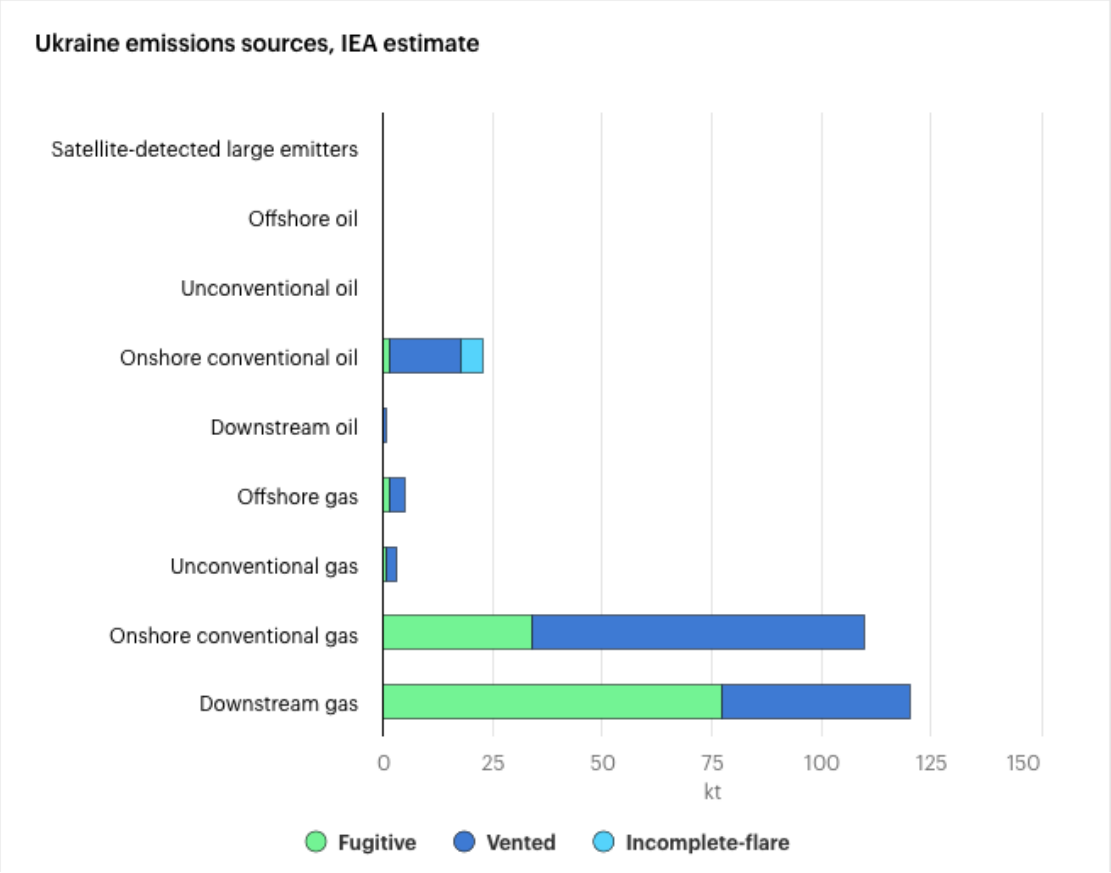
IEA Methane Tracker 2021 report



Source: ***IEA Methane Tracker 2021 report***

Methane emissions in Ukraine

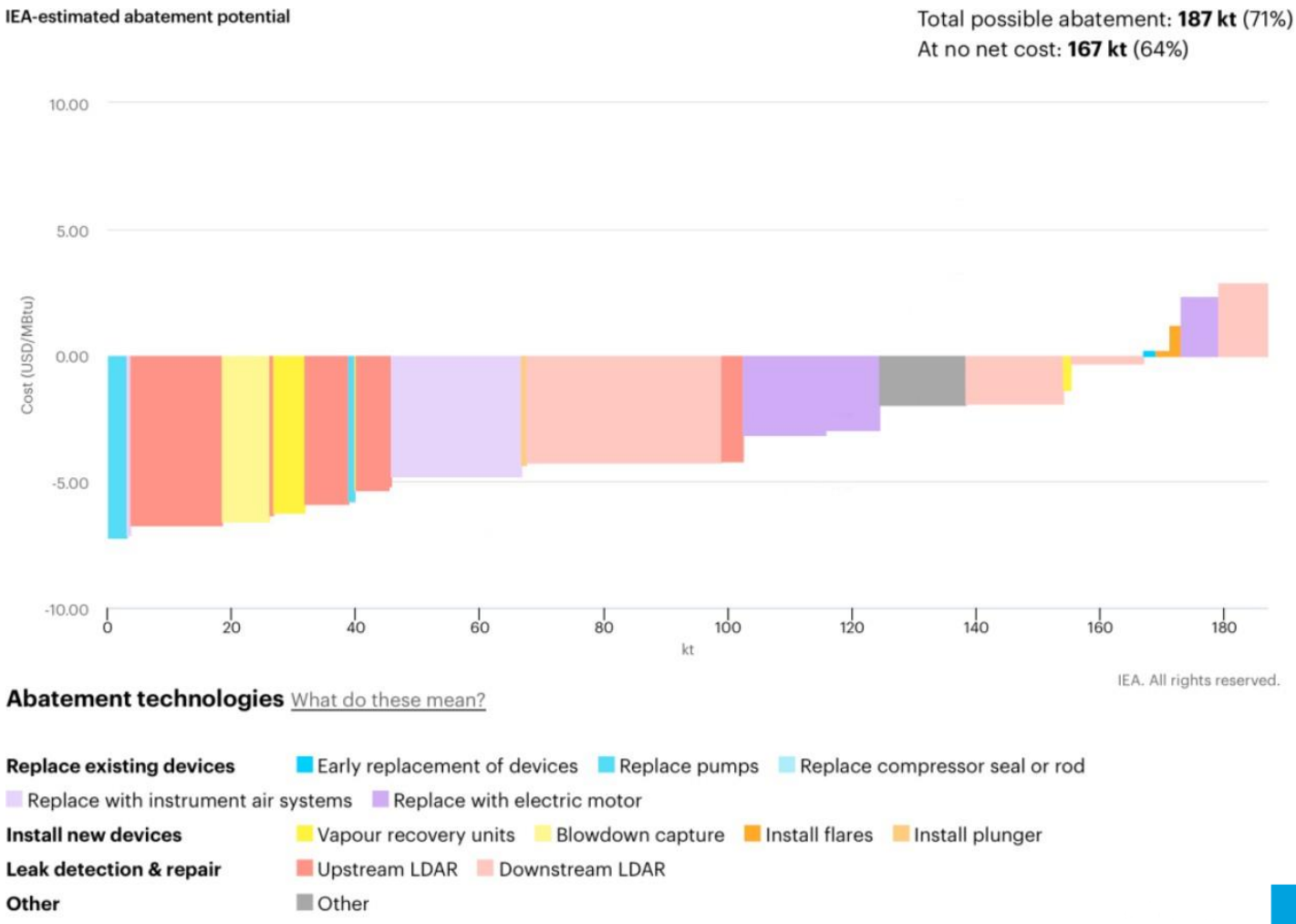
- Emissions from oil and gas sector in 2020: **262 kt** (0.3% of global emissions) or
- **~22Mt of CO2-eq** (84 Global warming potential)
- Emission types: venting, fugitive emissions, incomplete-flare



Source: IEA

Methane emissions in Ukraine can be eliminated at little or no net cost?

- Methane totals 57% of all Scope 1 & 2 emissions.
- Total possible abatement: **187 kt** (71%)
- At no net cost: **167 kt** (64%)
- Multiple emissions reduction choices



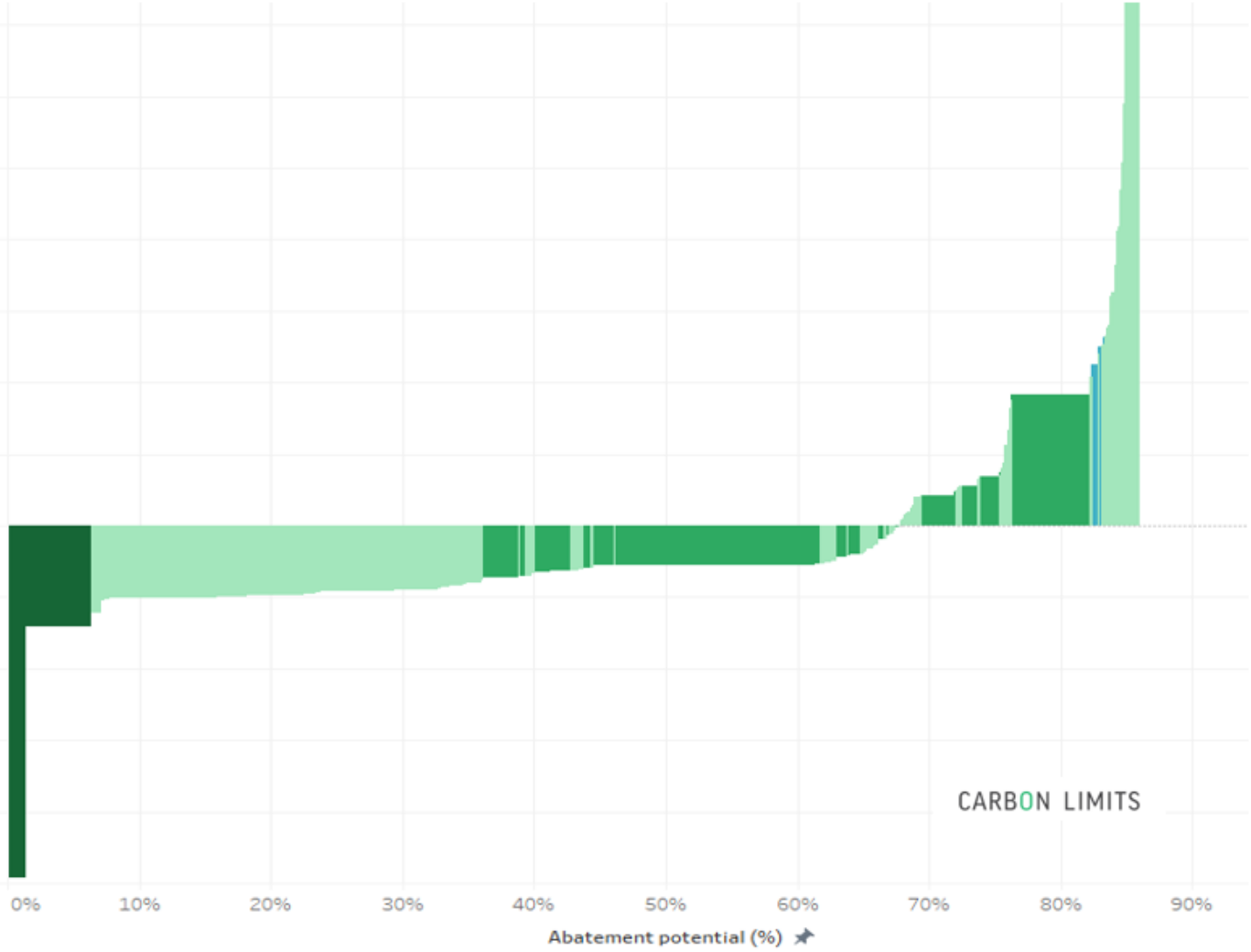
https://www.iea.org/articles/methane-tracker-database

What we see:

Measurement-based marginal abatement cost curve analysis, EBRD/Carbon Limits

- Costs are negative but returns are low
- Volume savings can be achieved by a combination of a large number of small measures

- Methane abatement requires strong company commitment and investment in organizational structures and staff



https://www.iea.org/articles/methane-tracker-database

Timeline of Naftogaz methane emissions reduction

2018

Signed **memorandum** on methane emissions reduction with EBRD and Ministry of Environment

2019

First stage of measurement campaign:

- UGV
- UTG
- Kirovogradgaz

2020

Second stage of measurement campaign (winter):

- UGV
- UTG

Investment program and Roadmap prepared

Naftogaz joined **OGMP**

2021

Submitted level 1 report under **OGMP 2.0**

2022 and after

Compliance with Level 4 of OGMP requirements by 2024

Implementation of some measures from Investment Program

Partners

European Bank for Reconstruction and Development

Ministry of Environment and Natural Resources of Ukraine

CARBON LIMITS

How we detected and measured methane emissions

Top-down
Satellite data, Plane, Drone, Truck, boat,

The top-down approach cannot provide accurate component-level information required for mitigation

Most comprehensive approach: Mutually-reinforcing techniques

Bottom-up
IR Camera, Methane sensors

The bottom-up approach can be complemented by aerial measurement to identify high-emitting facilities

FOCUS

Region

Facility

Equipment

Component

* Carbon limits

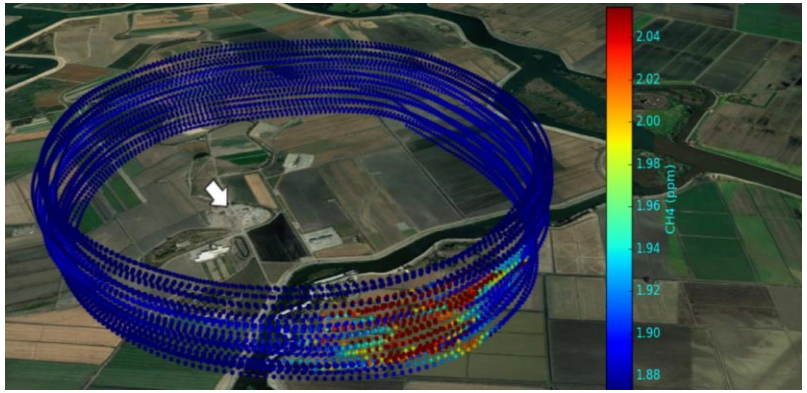
“On foot” survey

Detection		Quantification	
Methane Laser Detection	Optical Gas Imaging	High Flow Sampling	QOGI
			
RMLD laser technique to detect gas leaks from a distance	FLIR GF320 Infrared Camera to visualize leaks	HFS – Direct Measurement to quantify the leak in mass/hr	Providence QL320 QOGI - Accuracy’s susceptible to environment testing conditions

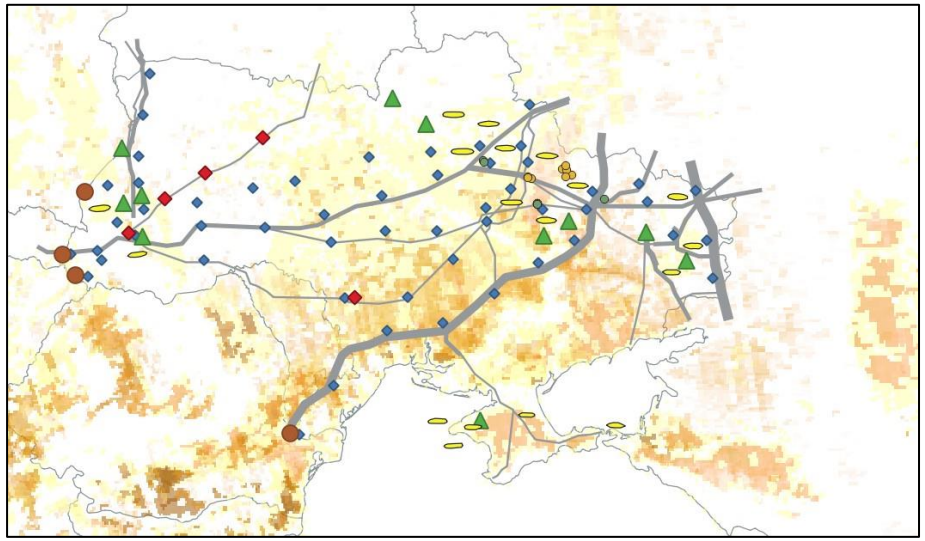
* Carbon limits

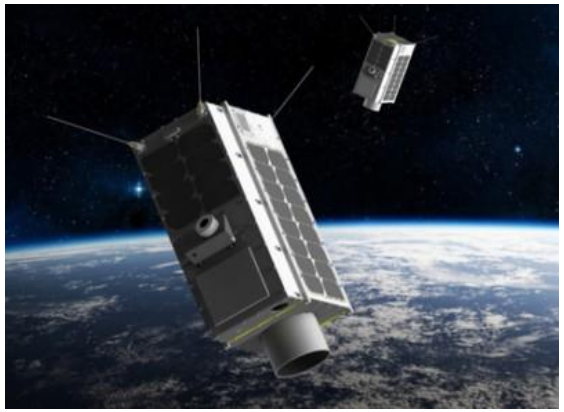
Areal approach

DRONE



SENTINEL 5





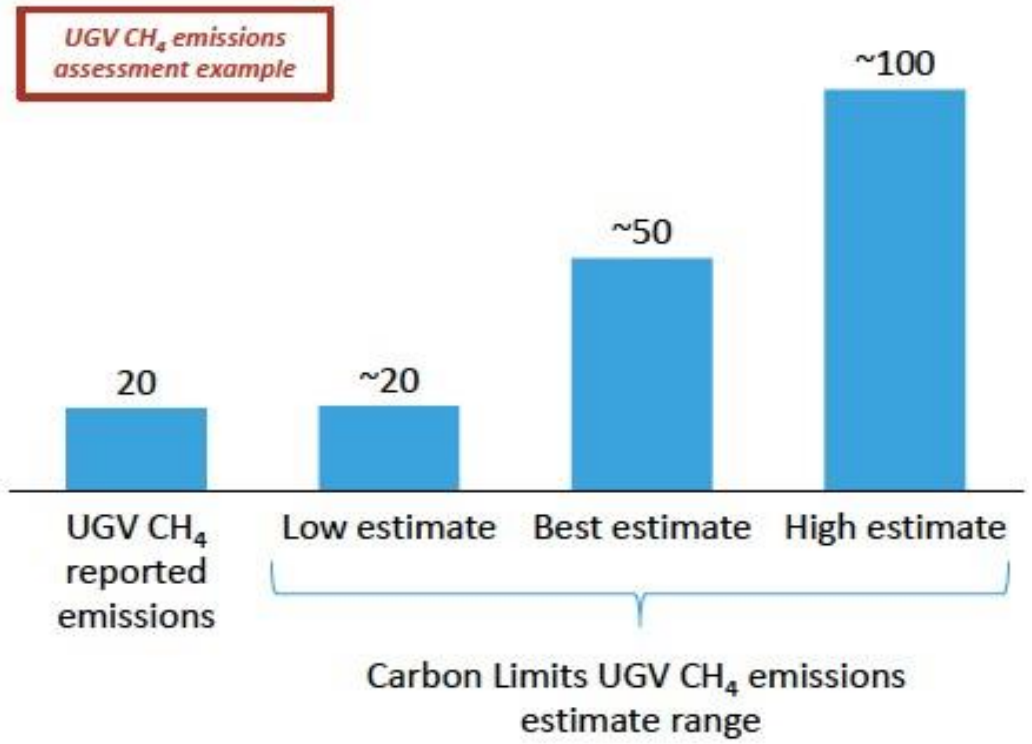
NOV 2020:
GHGSat IRIS

* Carbon limits

Naftogaz plans to continue actively working with the state and international partners on emission detection and reduction

CH_4 emissions assessment conducted by Naftogaz and Carbon Limits showed possibility of high volume of undetected emissions…

(CH_4 emissions, kt)



…making it essential for Naftogaz to ensure full industry standard emissions detecting and reporting

Міністерство захисту довкілля та природних ресурсів України

European Bank for Reconstruction and Development

CARBON LIMITS

Continue cooperation withing MOU with the Ministry of Ecology and Natural Resources of Ukraine and the EBRD and work with Carbon Limits to improve detection and reduce CH_4 emissions

UN environment programme

GMP Oil and Gas Methane Partnership 2.0

Improve CH_4 monitoring, reporting and reduction effort in line with OGMP 2.0 framework
Prepare first emission report in line with OGMP 2.0 guidelines

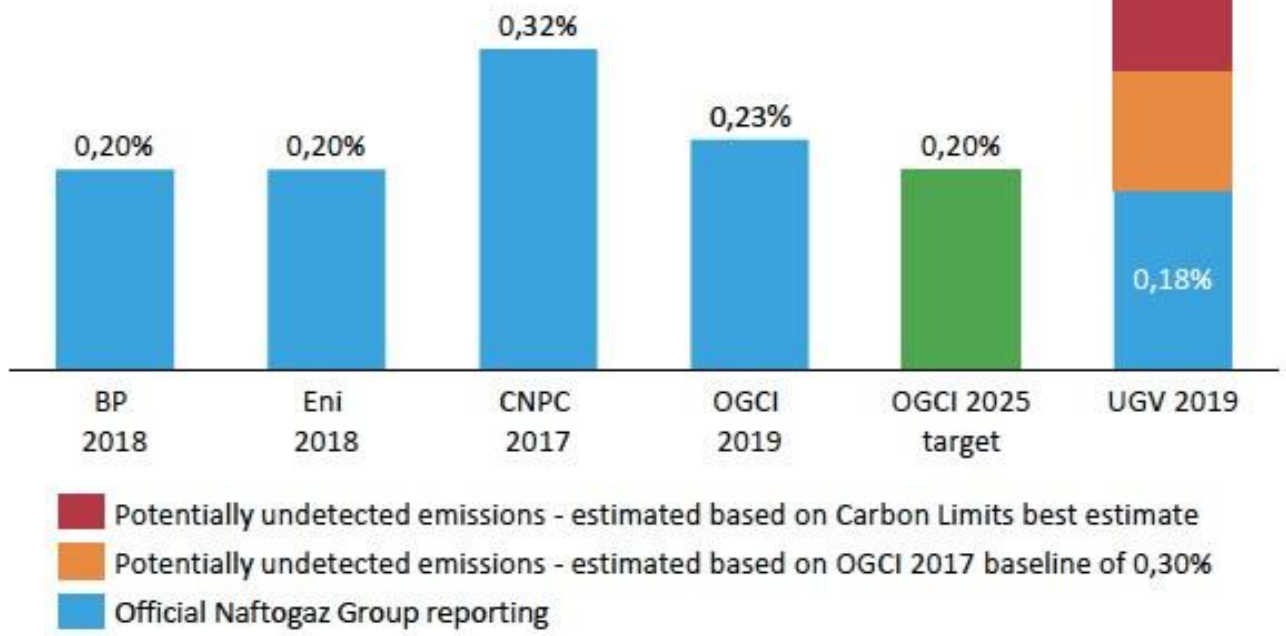
Naftogaz to implement rigorous methane emissions reduction program and live “near zero CH4 emissions” vision

UGV CH_4 emissions assessment example

While official estimates show UGV being on par with global leaders, undetected emissions may make the catch-up gap substantial...

(CH_4 intensity, %)

Although CH_4 emissions make up 20-25% of UGV CO_2 equivalent volume, they are critical to deal with as CH_4 emissions heat up 80x the same volume of CO_2 in 20 years after its release into atmosphere



Note: CH_4 intensity index is calculated as total CH_4 emissions divided by the marketed gas volume
Source: Naftogaz Group

...to be addressed through a complex emissions reduction effort

- Well flaring reduction program
- Usage of well testing equipment and other methane capture technologies
- Well monitoring equipment and reduction of well blowdown time
- Modernization of old booster compressor stations and other surface infrastructure
- Leakage identification and prevention program

Naftogaz will aim to maximize reduction of methane intensity by 2040, guided by OGCI’s “near zero emissions” vision

Global Methane Pledge

Naftogaz supported joining Global Methane Pledge by Ukraine that sets a goal of 30% emissions reduction by 2030 at the country level:

"Naftogaz welcomes the joining Global Methane Pledge by Ukraine and notes that GHG reduction, including methane, is one of the Company's priorities, which is stated in Naftogaz Corporate Strategy."

Yuri Vitrenko, CEO of Naftogaz
In a letter to the Ministry of Environment of Ukraine on joining Global Methane Pledge

Methane emissions reductions at UGV

Business-as-usual

As gas deposits get depleted and liquid starts to accumulate, unloading well to atmosphere is needed. This is usually done with gas* that is then burned

Alternative

There are around 15 technologies of artificial extraction that do not require gas to remove liquid. UGV launched the process of wells modernization, using the technologies of plunger-lift and capillary systems.

Wells modernization

2019	2020	2021	2022
10 wells	44 wells	90 wells	230 wells
Spending ~$1 mln	**~$3 mln**	**~$6.5 mln**	**~ $17 mln**
		8.5 mln m3 of gas losses during well blows was reduced over 10 months 43.5 mln m3 of gas was additionally extracted	20 mln m3 of gas losses during well blows is planned to be reduced

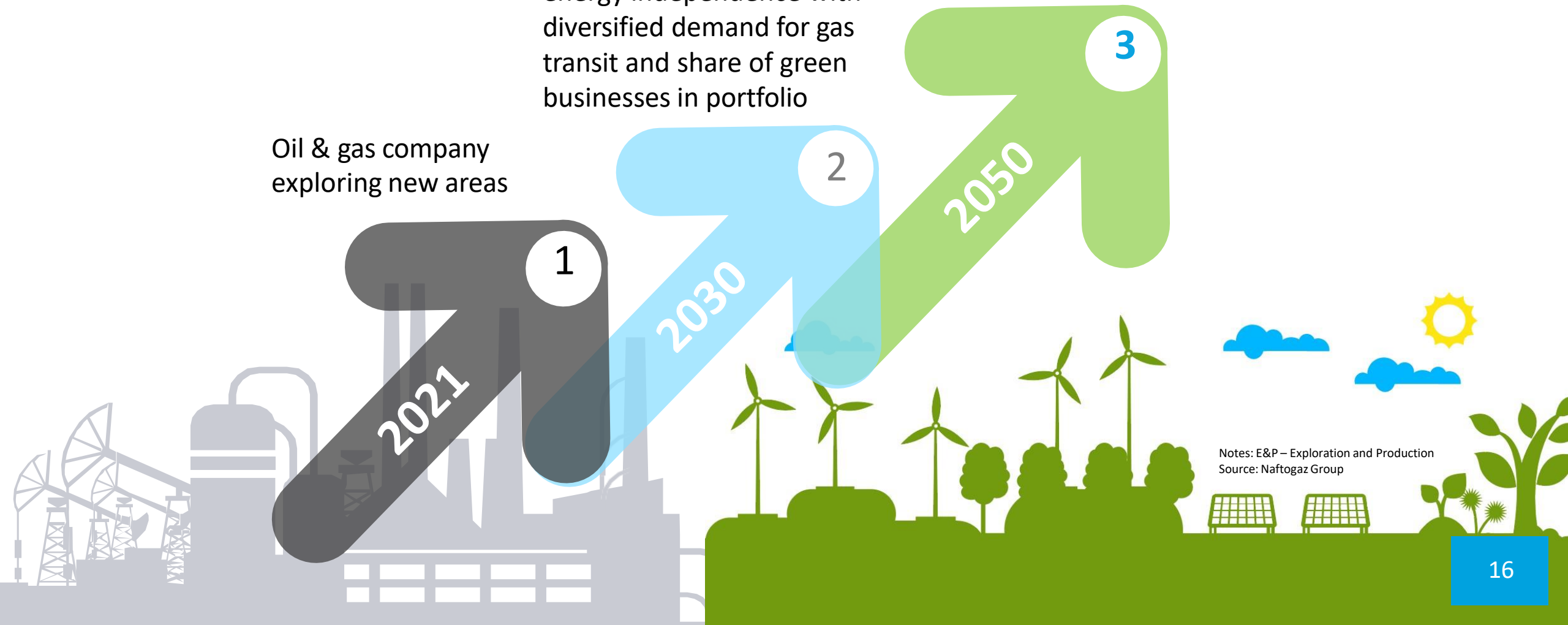
*75-95% of methane in gas

Naftogaz energy transition timeline

Oil & gas company exploring new areas

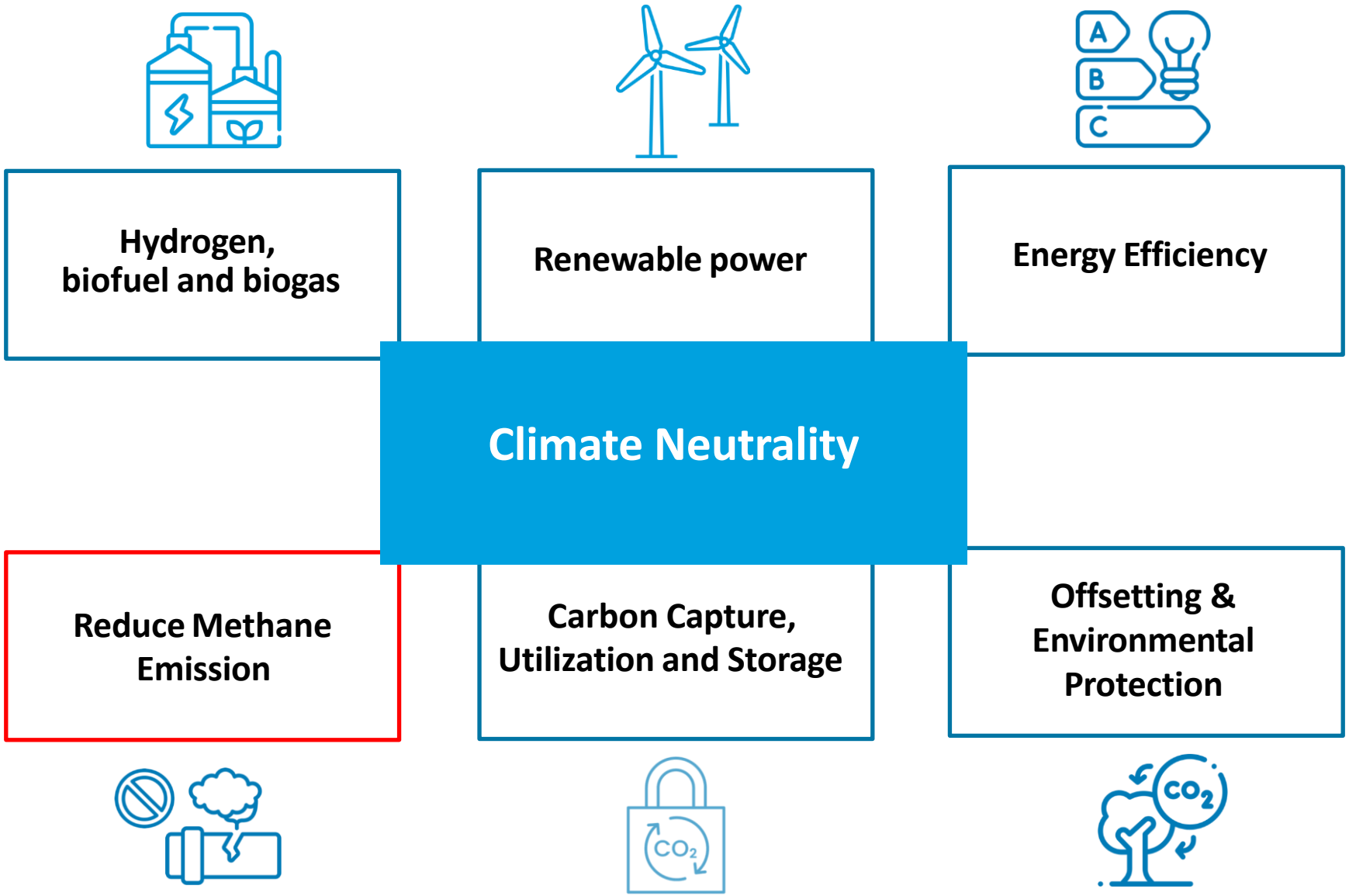
Oil & gas company securing energy independence with diversified demand for gas transit and share of green businesses in portfolio

Sustainable energy company with a focus on renewable and bio energy with minimized impact on environment and climate



Notes: E&P – Exploration and Production
Source: Naftogaz Group

Naftogaz priorities of energy transition on its pathway for climate neutrality



Notes: E&P – Exploration and Production
Source: Naftogaz Group

Thank you!

Next steps, wrap-up and concluding remarks

Jose Miguel TUDELA | GIE / MARCOGAZ
Predrag GRUJICIC | Energy Community

Energy Community

Gas Infrastructure Europe

marcogaz

THANK YOU

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