Gas Transmission

Reducing methane emissions

The session will start at 11.02 to allow people to finish previous meetings

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#NGG6

nationalgrid

Welcome and Opening

Thank you for joining us today

Please feedback via SLIDO

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Who will be speaking today?

Paul Balcombe
Queen Mary University of London

Violeta Bescos Roy
Enagas

Matthew Goldberg
Environmental Assurance Manager

Matt Williams
Environmental Assurance Engineer

Jennifer Pemberton
Stakeholder Manager

Logistics

- Should last for approximately about 90 min
- Questions via slido #NGG6
- All callers will be placed on mute
- We will circulate the slides and a recording of this webinar

Agenda

Overview and Introduction to the challenge

1

Deep dive into each challenge:

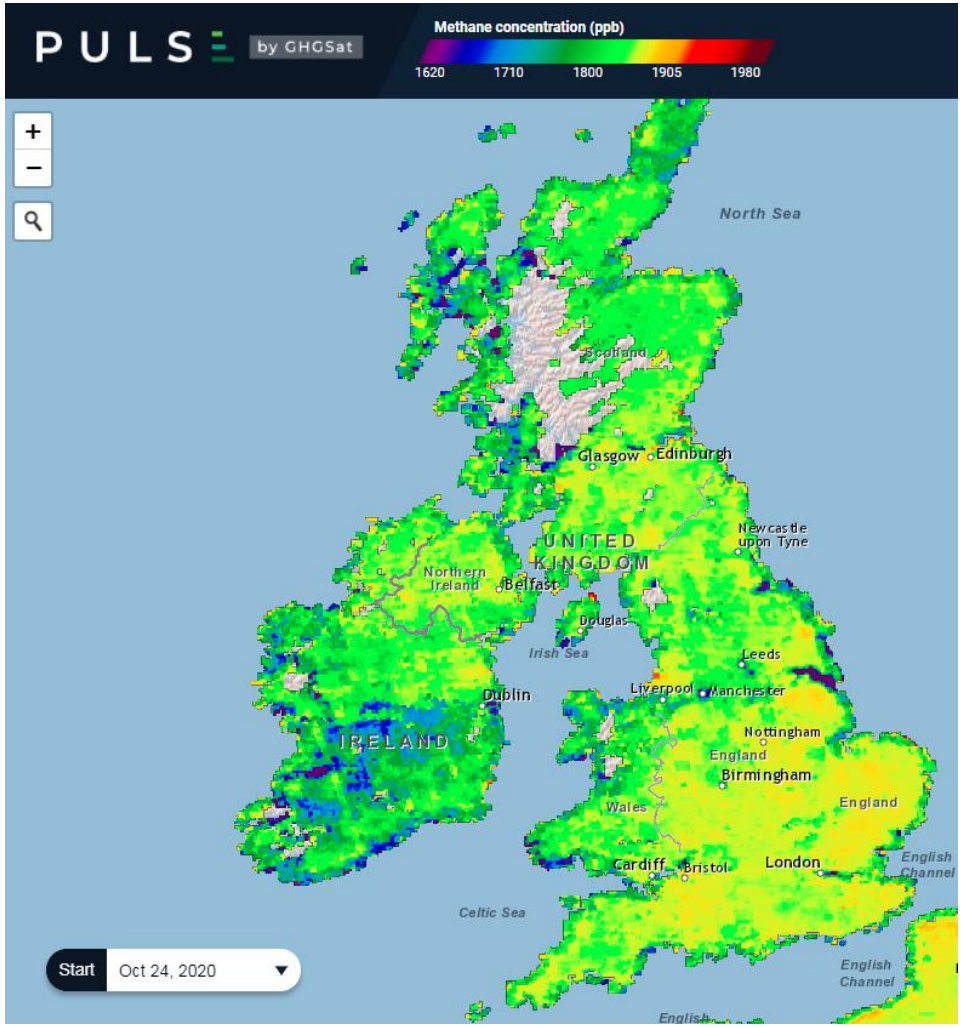
1. Accurate Detection and Quantification
2. Prioritisation – No Standardised Assessment
3. Innovation – Understanding and Visibility of the Latest Technology
4. Reporting – Uncertainty around what is Needed to be Reported

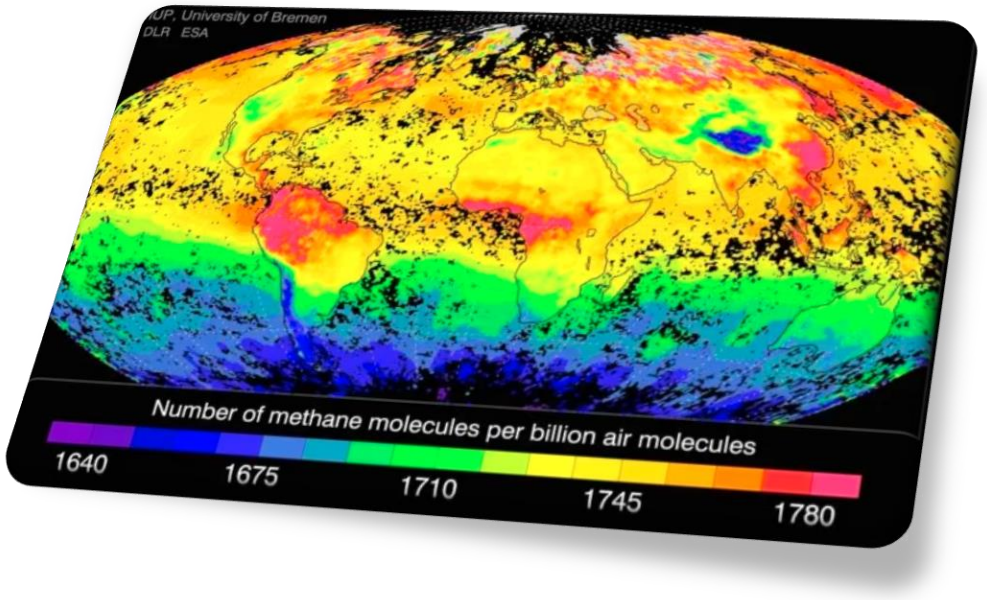
2

Questions and Answers

3

Methane emissions





The challenges to reducing methane emissions

Challenge 1: Accurate detection and quantification

Challenge 2: Prioritisation – no standardised assessment process

Challenge 3: Innovation – understanding and having visibility of latest technology in this area

- CH4RGE
- MORFE

Challenge 4: Reporting – Uncertainty around what is needed to be reported

Quick poll

Do you face similar challenges?

Yes | Somewhat | No

Please explain your answer

Do you have any other challenges that we've not mentioned?

Queen Mary
University of London

What are the challenges with methane detection and quantification?

12th Nov 2020, National Grid

Dr Paul Balcombe

Lecturer in Chemical Engineering and Renewable Energy

Slido.com #NGG6

What are the challenges with methane detection and quantification?

- **Characteristics of methane emissions**
  - Small size (but multiple points); invisible; heavy tail
- **Cost**
  - Equipment; labour
- **Expertise in technologies**
- **Frequency of measurement**
- **Accuracy of quantification**

How are methane emissions quantified?

Venting

- Engineering calculations
- Emission factors
- Direct measurement (flow meter, concentration meter)

Fugitives

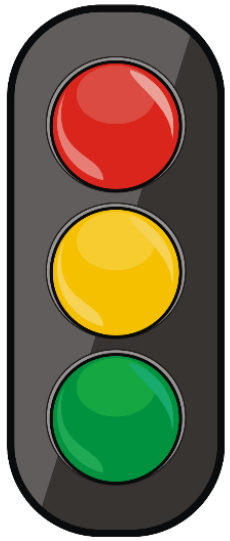
- Emission factor
- Direct measurement
- or most likely a combination both…

Incomplete combustion

- Assumed combustion efficiency (e.g. 98%)
- Should be checked periodically to ensure efficiency is maintained

- Quantification depends on the type of emission
- In a quantification method, it is vital that all potential sources are identified
- More direct measurement is required across all types

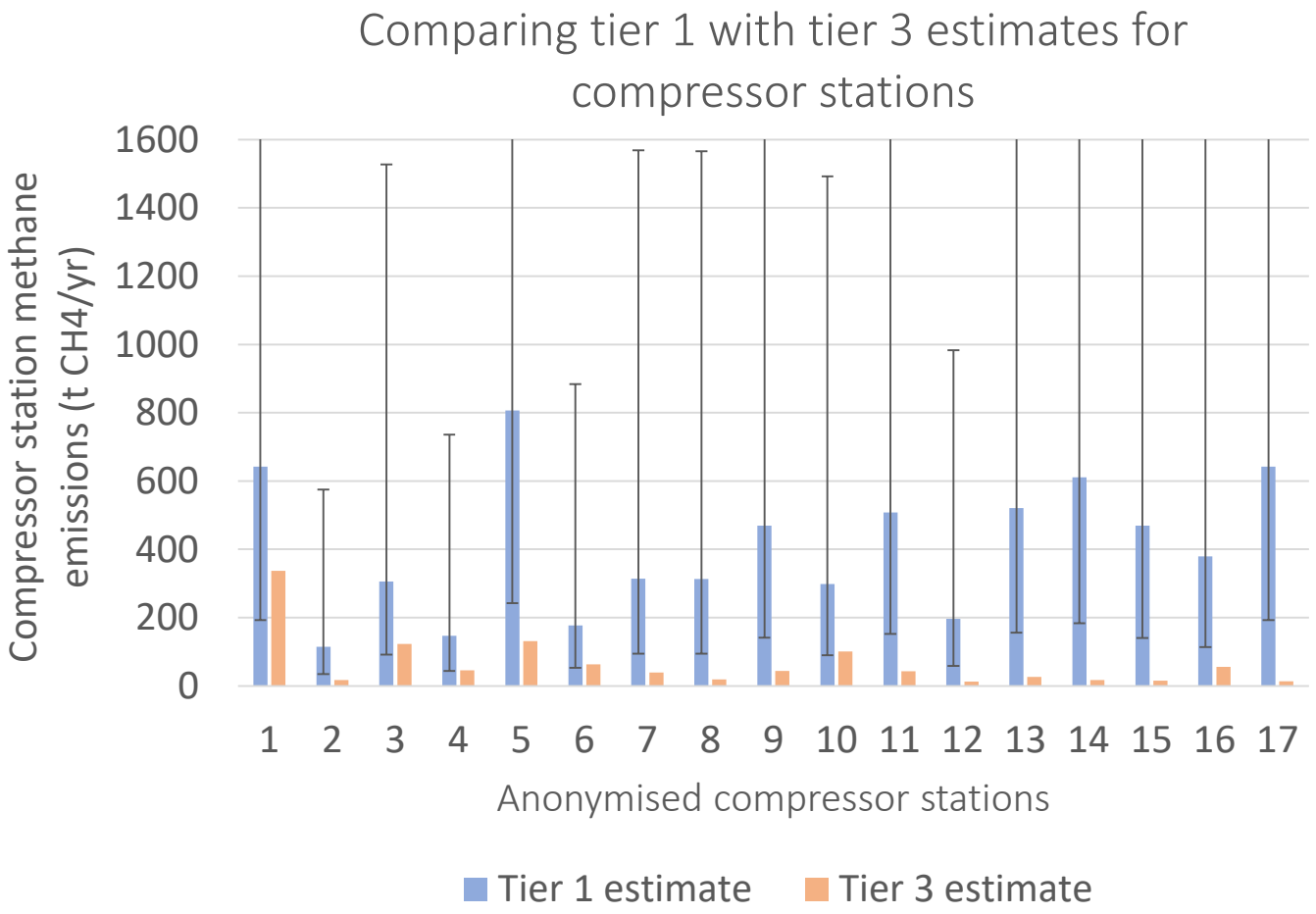
IPCC tiered fugitive emission factors



- **Tier I- Non-region-specific emission factor, highest uncertainty**
- **Tier II- Region-specific emission factor, high uncertainty**
- **Tier III- Facility or asset-level-specific, lowest uncertainty**

- Non-region specific emission factors carry uncertainties of +500%!
- Generic factors should be avoided
- Use asset-specific measurements to develop emission factors
- Tier 3 is very broad and there are many approaches to achieving this

Case study: comparing Tier 1 and Tier 3 emission factors



- We estimate total methane emissions from compressor stations using tier 1 and tier 3 (LDAR and venting calculations) methods.
- On average, our estimate was 17% of the tier 1 estimate
- Tier 1 factors are not representative and should be avoided

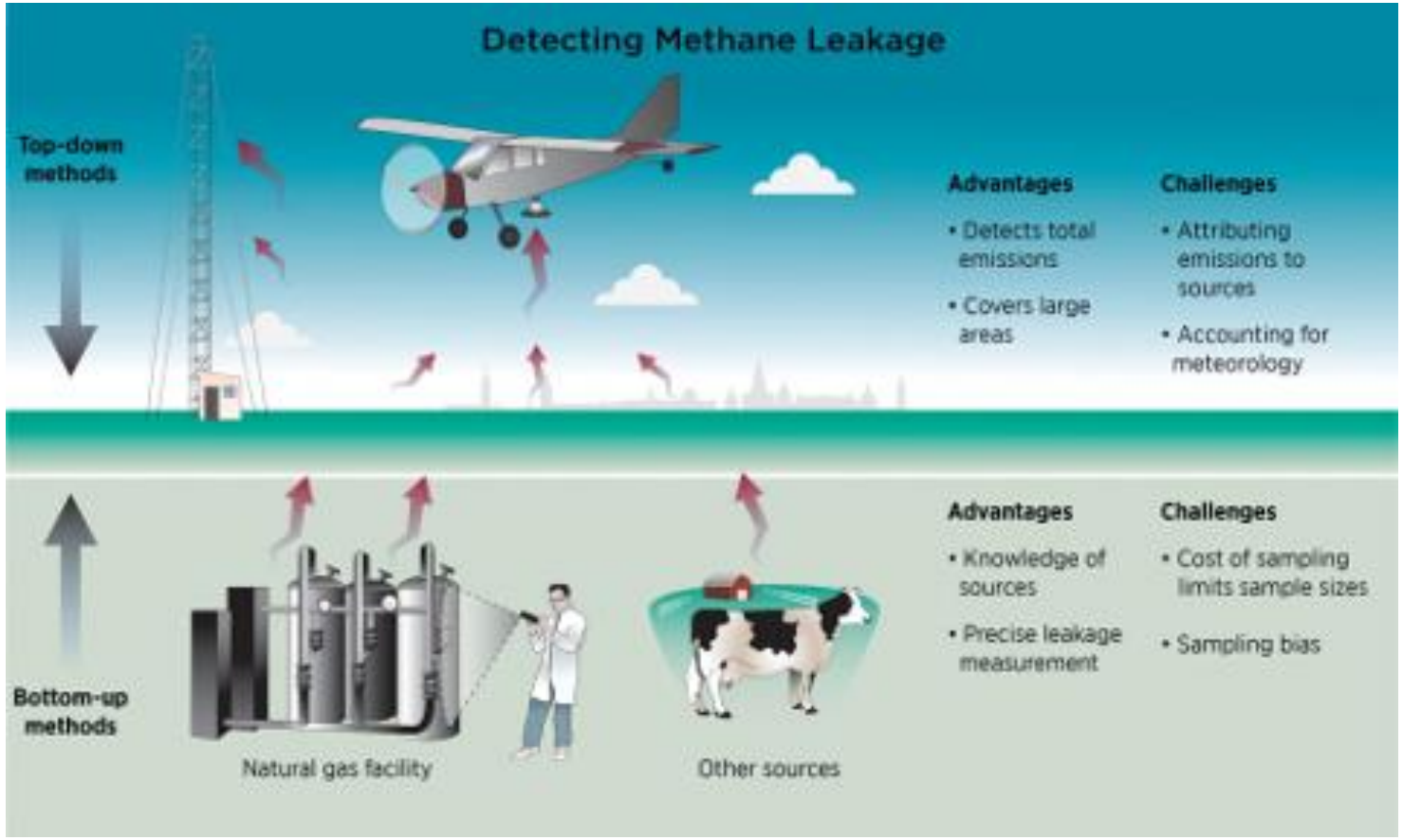
Direct measurement

Top-down

- Estimate total emissions from a region, then allocate
- Aerial surveys, satellite or ground-based surveys (e.g. lidar)

Bottom-up

- Estimate emissions from point-sources, then extrapolate
- Targets equipment
- Measures emission rate or concentration



Top-down vs bottom-up

Top-down:

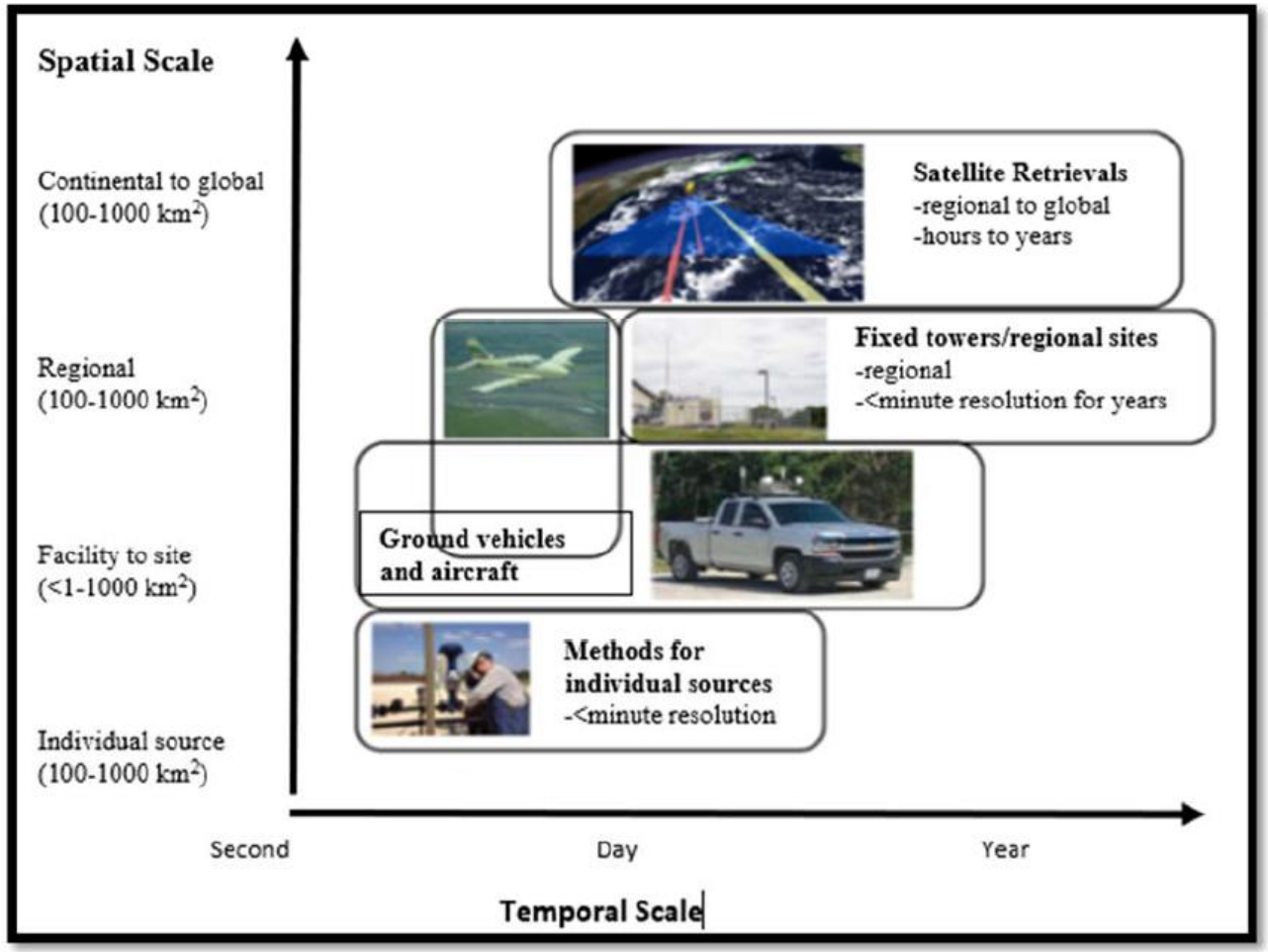
- Uncertainty in allocation of emissions
- Equipment expense

Bottom-up:

- High uncertainty in extrapolating
- Less able to ensure heavy tail is accounted for
- Labour-intensive

- Mixed-methods help improve both methods and reconcile differences
- Most methods are periodic, not continuous
- Future challenge: develop cost-effective frequent/continuous monitoring to quickly identify super-emitters

Methods applied at a range of scales



- Satellites
- Aircraft
- Drones
- Ground Vehicles
- Fixed Site
- Foot

https://methaneguidingprinciples.org/best-practice-guides/

Typical hand-held technologies used for LDAR

Technology	Description	Detection/ measurement	Quality	Suitability for quantification	Cost
Optical gas imaging (OGI)/ Infrared (IR) camera	Infrared absorption monitor	Mainly detection	Fast identification of point source	Medium	USD $85,000 - $115,000
Organic vapour analyser/ flame ionisation detector (FID)	Estimates concentration of VOC by flame ionisation	Measurement (concentration)	Fast gauging of leak size, but uncertain quantification	Medium	~ USD $10,000
High flow sampler	High volume air suction with VOC concentration measurement	Measurement (emission rate)	Accurate quantification of leak rate	High	~ USD $20,000

Plus several others…

Best practice for identification, detection, measurement and quantification (IDM&Q)

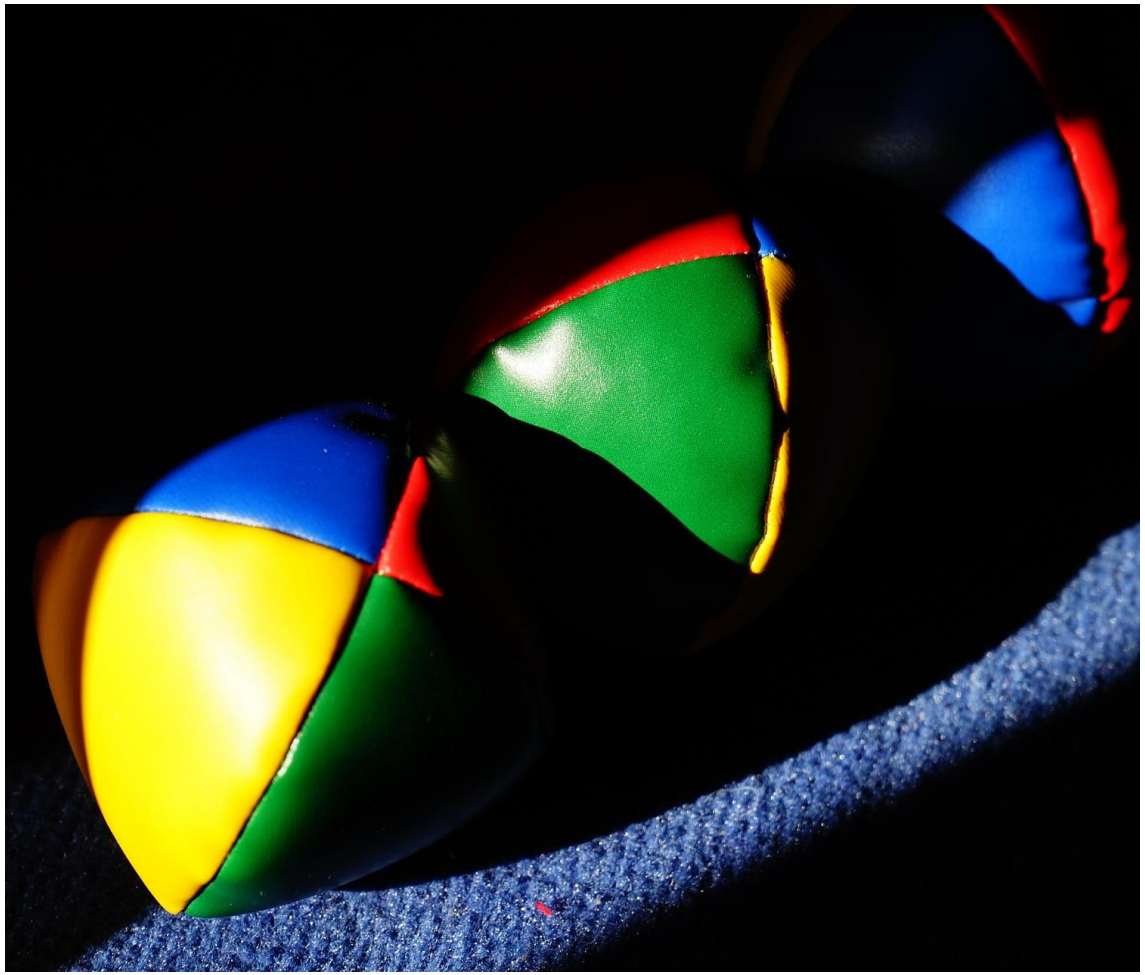
Best practice for identifying, detection, measurement and quantification:
• Identify known sources and potential sources of emissions in an inventory
• Survey known and potential sources to detect actual emissions
• Quantify methane emissions directly by measuring emission rates, or indirectly using a combination of measurements, calculations and modelling
• Use information from quantification to create or update inventories
• Periodically update and improve IDM&Q programs

https://methaneguidingprinciples.org/best-practice-guides/

Challenge 2 – Prioritisation – no standardised assessment process

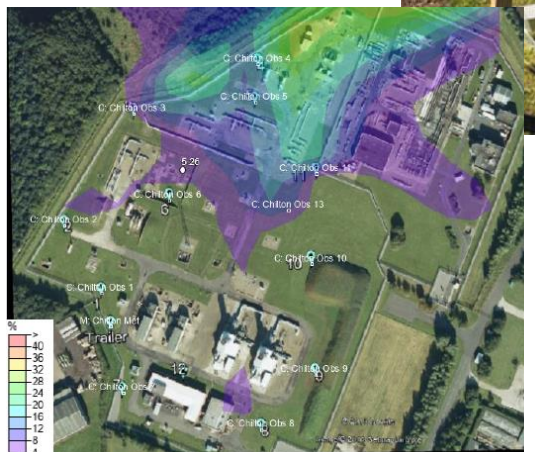
We face lots of questions…

1. Which assessment process should we follow?
   - BS EN 15446 vs EPA Method 21
   - Emissions factors v's HiFlow sampler vs bagging techniques v's quantitative OGI?
2. How should we rollout this process?
   - Leak detection and repair on all large above ground equipment
   - Prioritise smaller above ground equipment
3. How should we prioritise repair?
   - Cost
   - Net Zero implications
   - Balanced cost benefit analysis

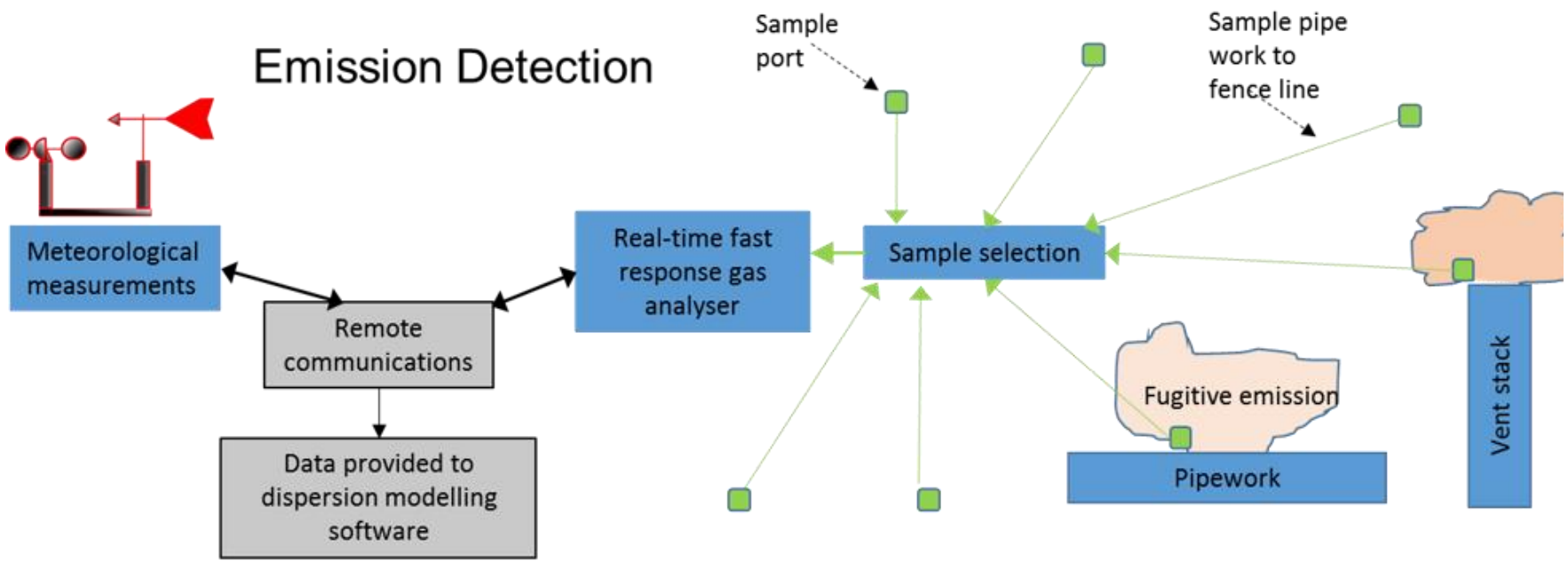


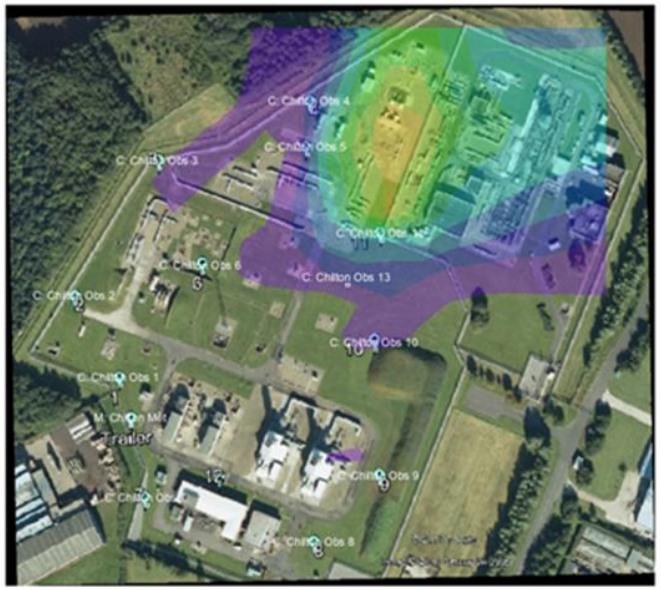
Challenge 3 – Innovation – understanding and having visibility of latest technology

- Global challenge
- Cross sector
- Huge amount of innovation going on around the world
- How do we get visibility of this?



Monitoring of Real-time Fugitive Emissions (MoRFE)

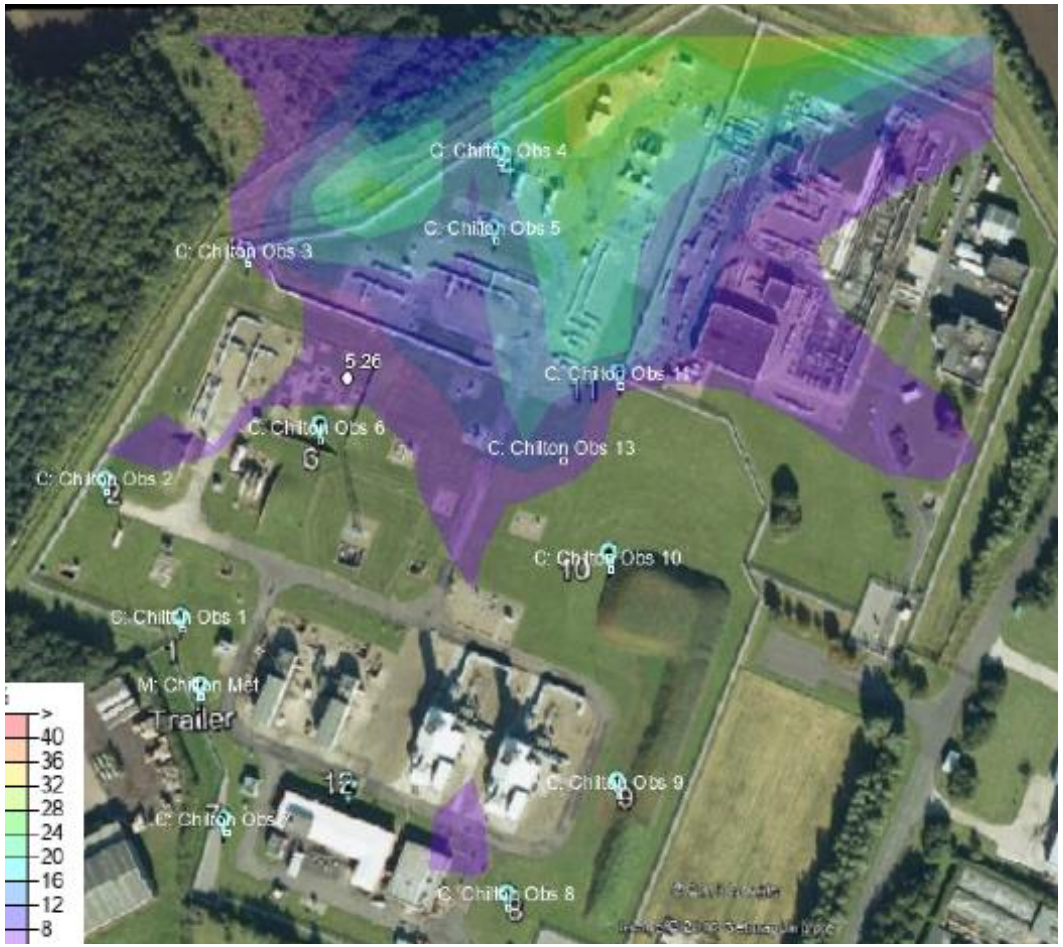


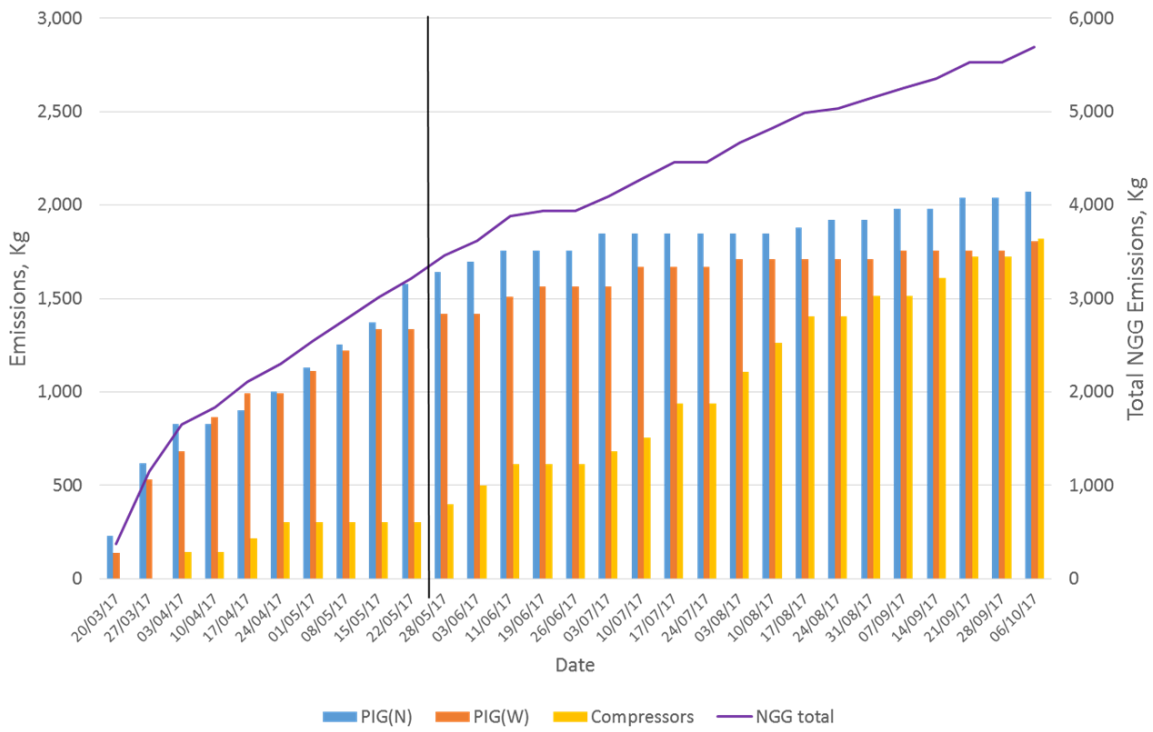


- Work package 1 to 6 – refinement of continuous fugitive emission detection system (FEDS)
- Work package 7 – optical gas imaging (OGI) for leaking component identification

Monitoring of Real-time Fugitive Emissions (MoRFE)

Monitoring of Real-time Fugitive Emissions (MoRFE)

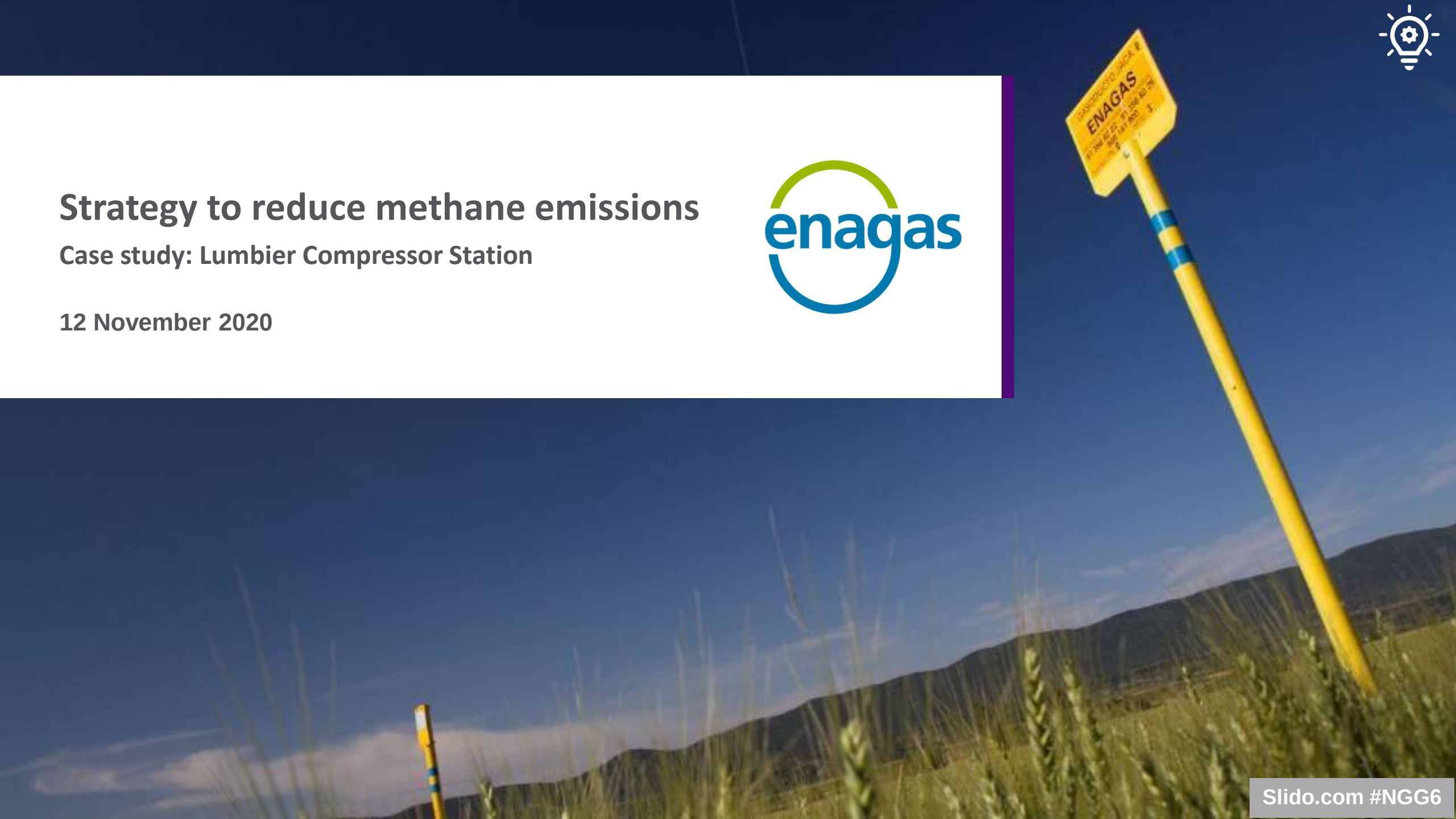




Strategy to reduce methane emissions

Case study: Lumbier Compressor Station

12 November 2020

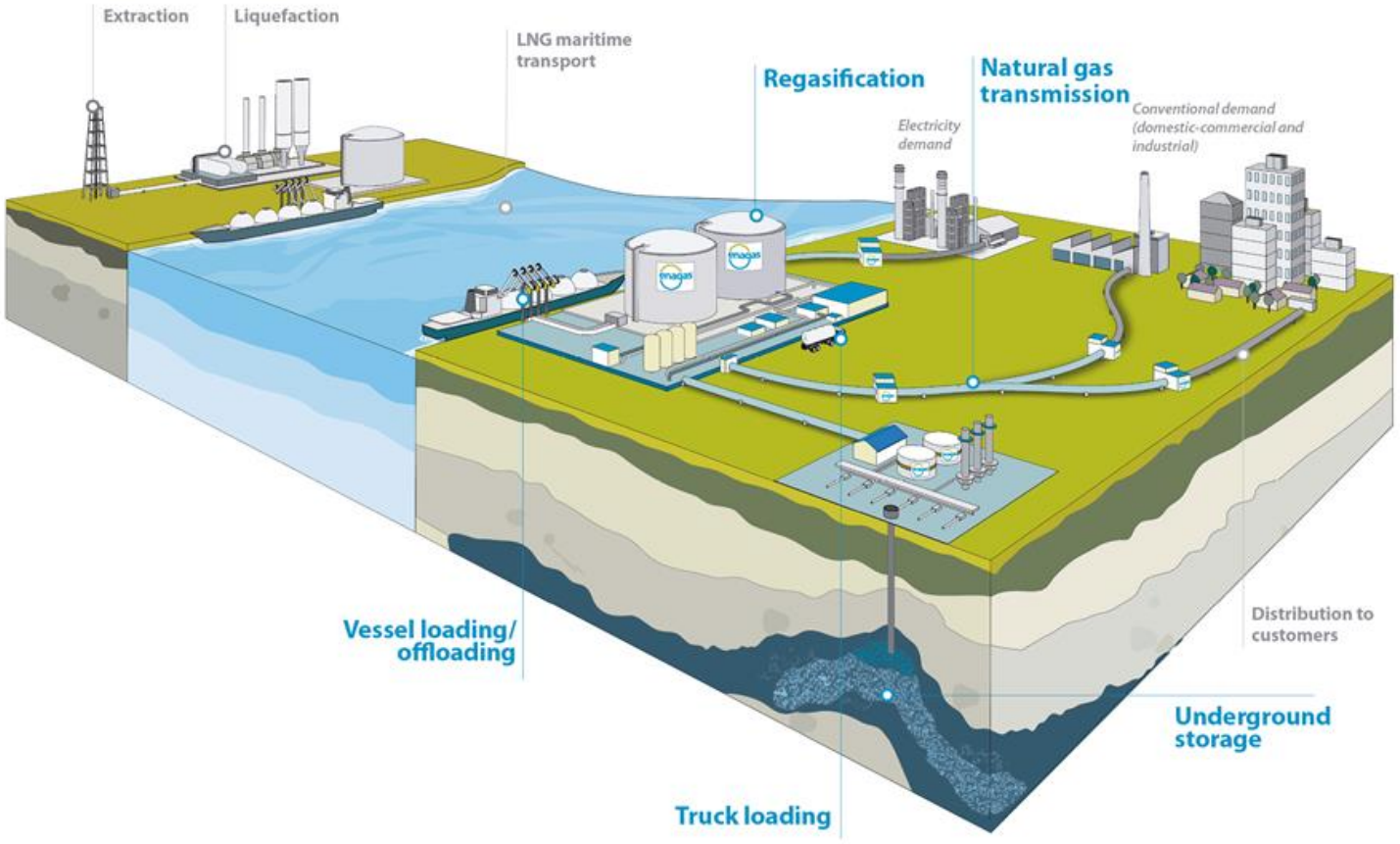


50 years' experience

A midstream company

Leader in energy infrastructures

Our technological skills, expertise, leadership and experience in managing gas infrastructure development, operation and maintenance, combined with our sound financial structure, position us as leading international player.



European Union-accredited independent TSO

Top natural gas transmission company in Spain

Technical Manager of Spain's Gas System

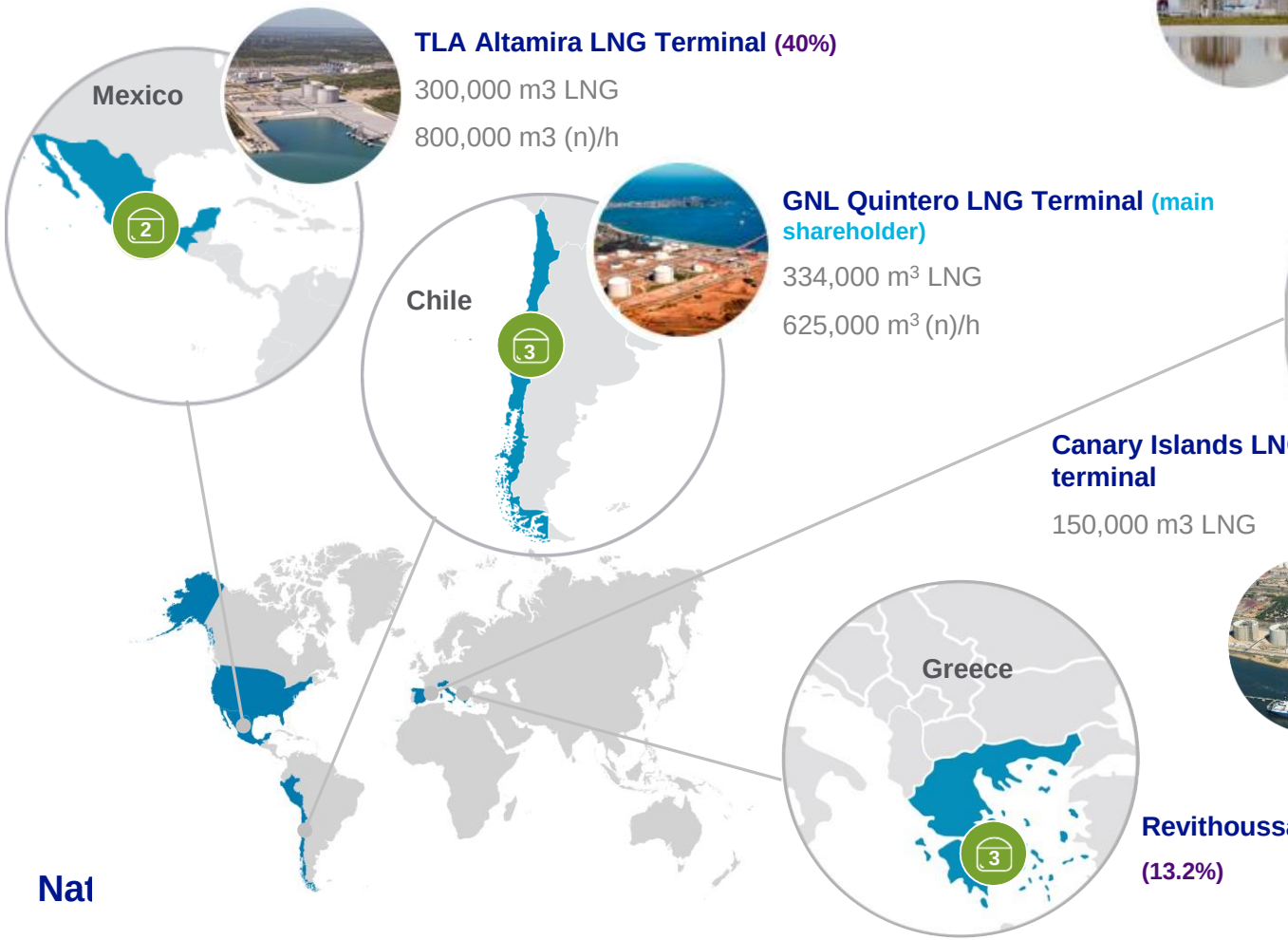
> 11,000 km of pipelines + 19 compressor stations

4 LNG terminals + main shareholder in other 2

3 underground gas storages

Our activities. LNG

One of the companies with the most LNG terminals in the world



TLA Altamira LNG Terminal (40%)

300,000 m3 LNG

800,000 m3 (n)/h

GNL Quintero LNG Terminal (main shareholder)

334,000 m^3 LNG

625,000 m^3 (n)/h

El Musel LNG Terminal

300,000 m3 LNG

800,000 m3 (n)/h

BBG LNG Terminal (50%)

450,000 m3 LNG

800,000 m3 (n)/h

Canary Islands LNG terminal

150,000 m3 LNG

Barcelona LNG Terminal

760,000 m3 LNG

1,950,000 m3 (n)/h

Saggas LNG Terminal (72.5%)

600,000 m3 LNG

1,000,000 m3 (n)/h

Huelva LNG Terminal

619,500 m3 LNG

1,350,000 m3 (n)/h

Cartagena LNG Terminal

587,000 m3 LNG

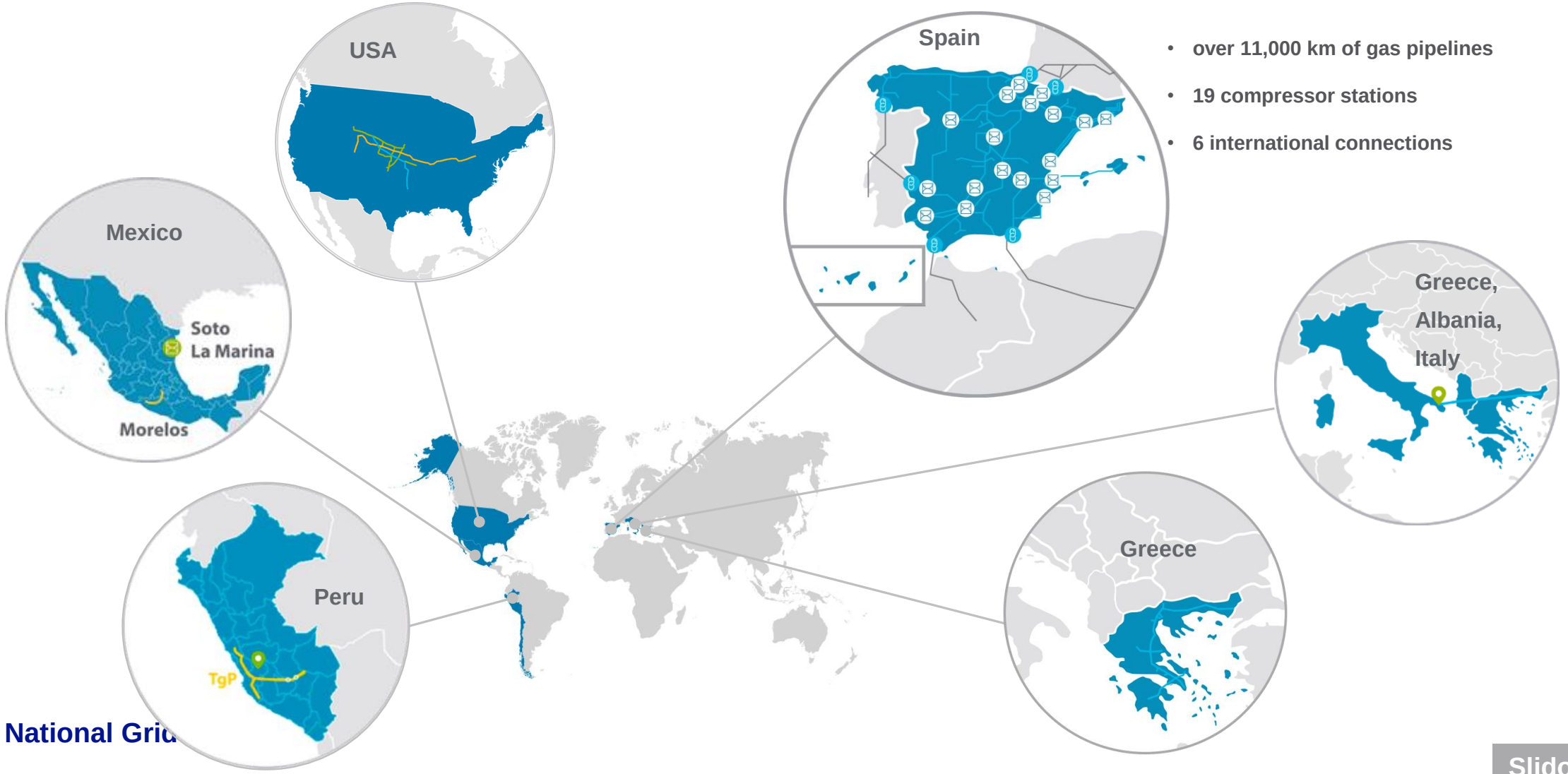
1,350,000 m3 (n)/h

Revithoussa LNG Terminal (13.2%)

Nat

Our activities. Transmission

Since 2011, we have partnered on transmission projects outside Spain



- over 11,000 km of gas pipelines
- 19 compressor stations
- 6 international connections

National Grid

Sustainability, a key pillar of our strategy

Strategic drivers

Energy efficiency and emissions reduction

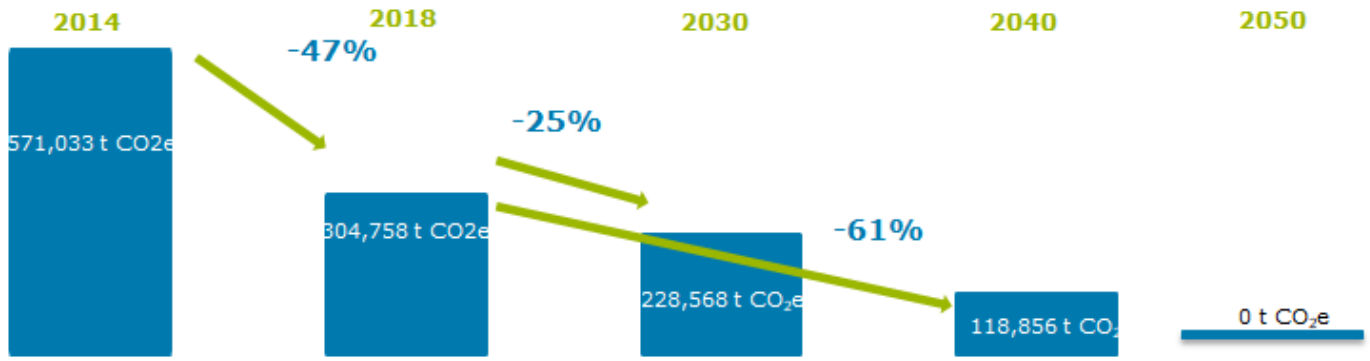
People and culture

Role of natural gas and renewable gases in the energy model

Commitment to the energy transition

GHG emissions reduction: a cornerstone of Enagás' sustainability strategy

Enagás is committed to set Science Based Targets (scenario of 1.5 ºC): ambitious **Emission Reduction Path** to reach **carbon neutrality by 2050** in line with the European Union's commitment.



Path to carbon neutrality in 2050:

energy efficiency + mitigation measures + carbon offsetting

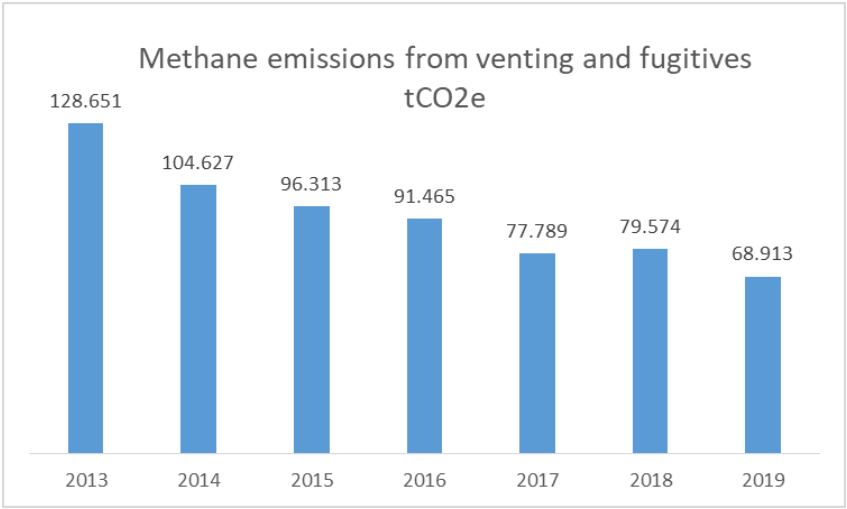
Energy Efficiency and Emissions Reduction Plan

Methane quantification and reduction

In recent years, Enagás has acquired a **leadership role** in the field of **reducing methane emissions**

Measures included in the **Energy Efficiency and Emissions Reduction Plan**, such as:

- Annual Leak Detection And Repair (LDAR) Campaigns
- Use of Boil-off gas (BOG) compressors in LNG regasification plants
- Predominant use of air-operated or electric valves in regasification plants
- Use in all our facilities of electric pumps
- Minimisation of venting



Leadership of European **gas industry initiatives and collaboration with voluntary initiatives and with Authorities** to drive CH_4 emissions reduction

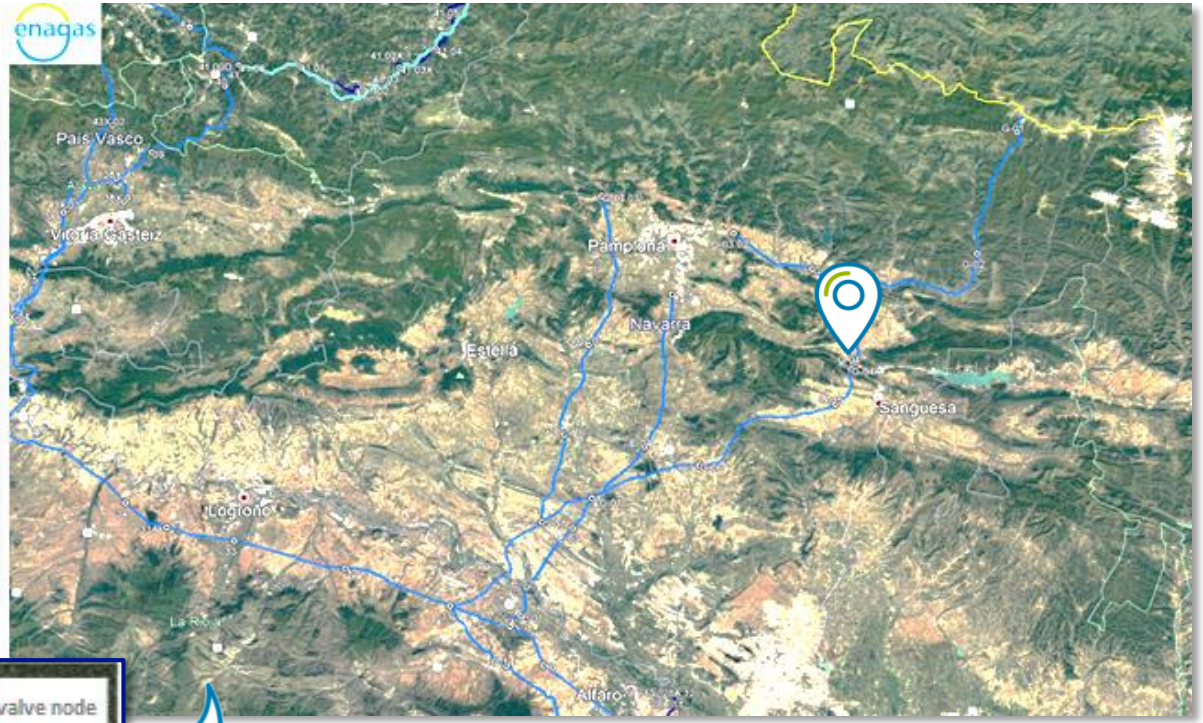
Since 2013 until 2019:

- 47% fugitive emissions	**- 61% vents emissions**

Initiatives aimed at **reducing uncertainty in quantifying methane emissions** in gas infrastructures

- Research **projects** related to methane emissions quantification technologies (GERG)
- Several **initiatives** to gather knowledge on site-level measurements (wheeled vehicles, drones, satellites) in order to reconciliate the data with the source-level data

Lumbier Compressor Station



Environmental protection requirements in the region are **more restrictive** than in other regions within Spain (Legislation - *Orden Foral 344/07*), in particular regarding the **venting** of natural gas in the Compressor Station.

Additional emissions reduction measures have been taken accordingly

Gas recovery system incorporating two sub-systems:

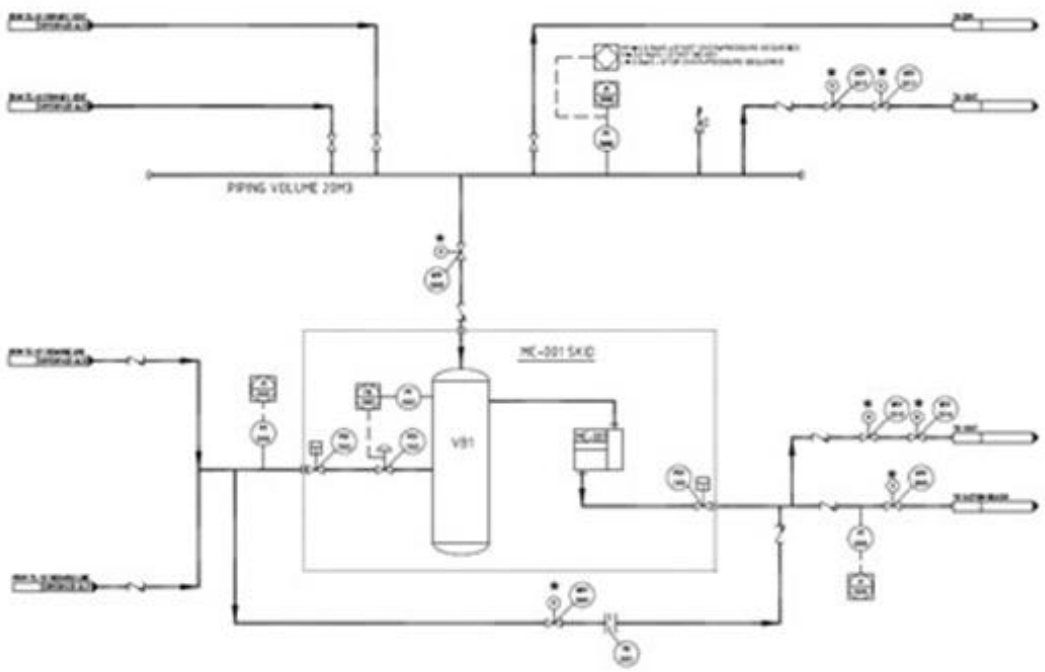
- Gas recovery after each non-emergency stop of the turbo-compressors. Gas between isolation valves is recovered and re-injected to the suction line of the station
- Gas recovery from the primary seal. Gas is used at the boilers of the turbine fuel gas' regulating and metering station.

Gas recovery after turbo compressors' stops

The subsystem that collects gas after the stops of the two centrifugal turbo-compressors is able to re-compress gas to the station's suction pressure (45 bar).

- A reciprocating compressor will be installed
  - *60 kW, 3 stages, water cooled, 750 RPM*
  - *Maximum discharge pressure: 62 bara*
  - *Maximum discharge temperature after cooler: 50ºC*

- It has been considered appropriate to regulate the recovered gas from around 56 bar to 4.5 bar, for its later re-compression at the suction pressure of the TC's, around 45 bar.



Average of 25 start/stops per year	**System will avoid on average the emission of ~108.000 Nm³ CH_4/year***

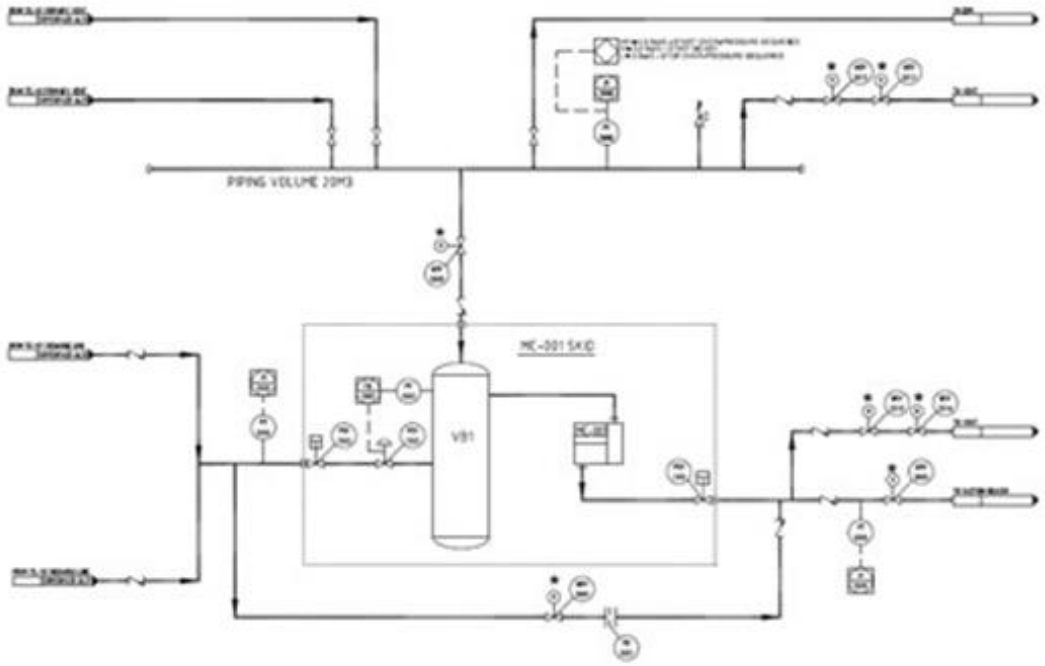
(*Estimates based on data from the previous three years)

Gas recovery from turbo compressors' primary seals

The second subsystem is designed for the recovery of gas from the primary seal, as normal losses occur at the mechanical seal of the rings around the rotating compressor shaft while it is working.

Gas is re-routed to the boilers of the pressure regulating station:

- Recovered gas is circulated to the pressure regulating station boilers at the same pressure (4.5 bar).
- A 32" accumulative vessel with a capacity of 20 m^3 is included, allowing to manage the surplus of seal gas over the gas consumed in the boilers.
- This vessel is connected to the system that recovers gas after TC's stops. In the event that back pressure of the primary seal gas is exceded, gas in the vessel is fed to the compressor.



System will avoid on average the emission of ~8.500 Nm^3 CH_4/year	**Up to an 85% of boilers' fuel gas could be displaced by recovered gas**

Thank you

Challenge 4 – Reporting: Uncertainty around what is needed to be reported

Significant amount of movement with **methane monitoring, reporting and validation** (MRV)

- EU have launched a **methane strategy** with legislation by the summer 2021
- UN has developed the **oil & gas methane partnership 2.0** and will be launching it at COP26 next year

Reporting to **National Inventories** and **financial regulators** continues, but additionally within the Oil & Gas sectors

METHANE GUIDING PRINCIPLES

OIL AND GAS CLIMATE INITIATIVE

CLIMATE & CLEAN AIR COALITION TO REDUCE SHORT-LIVED CLIMATE POLLUTANTS

We must:

Collaborate

Innovate

Set targets

Challenge 4 – What are we doing about it?

- Creating **relationships** across Europe/UK
- **Shaping** future **frameworks** for the UK gas industry
- Creating **visibility** of the issues with government and BEIS to make sure they're thinking about the **implications** during negotiations
- **Aligning** our own **science-based targets** around methane quantification in the short-term

Quick poll - results

Do you face similar challenges?

Yes | Somewhat | No

Please explain your answer

Do you have any other challenges that we've not mentioned?

Quick poll

Have you found this session useful?

Yes | Somewhat | No

Please explain your answer

How would you like to continue the conversation?

Q&A

Quick poll - Results

Have you found this session useful?

Yes

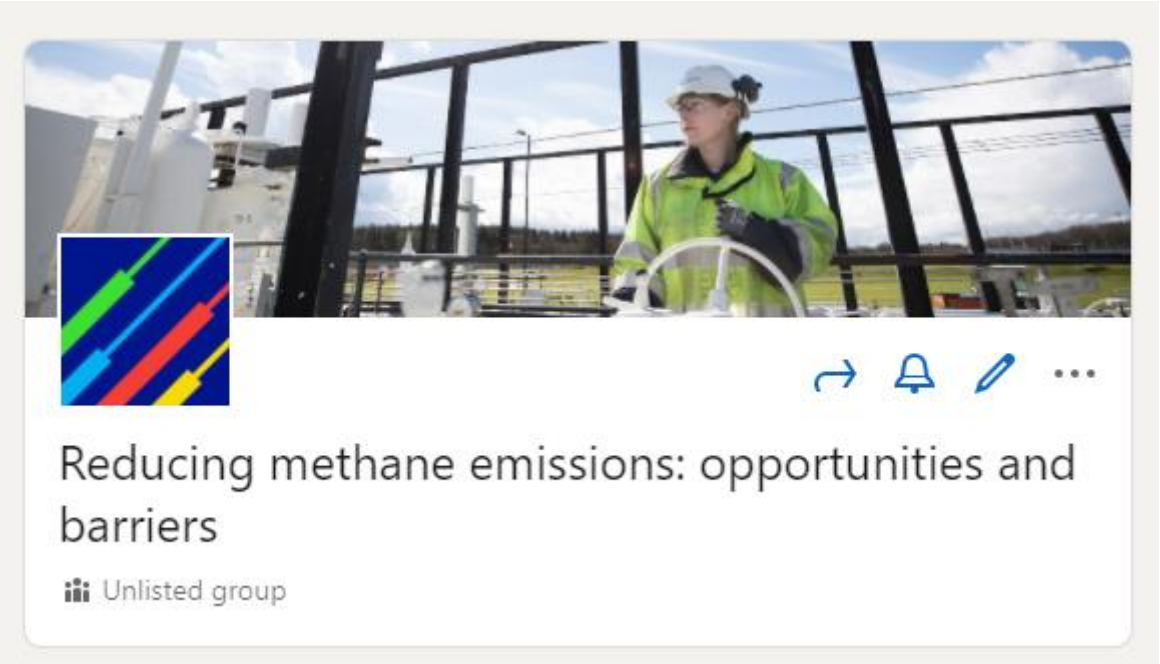
Somewhat

No

Please explain your answer

How would you like to continue the conversation?

Summary and Next steps



https://www.linkedin.com/groups/8987746/

Thank you for taking part in todays discussion

Continue the conversation…

Thank you for joining us today

Gas Markets Action Plan (GMaP)	Mon 16th Nov @ 10.00 – 11.00	Register here
Mapping our hydrogen transition	Wed 18th Nov @ 14.00 – 15.00	Register here
Net Zero construction2025/26 roadmap	Thu 19th Nov @ 10.00 – 11.00	Register here
Heating our homes in a Net Zero future	Fri 20th Nov @ 9.00 – 10.00	Register here
Planning the network	Mon 23rd Nov @ 14.00 – 15.00	Register here
HyNTS FutureGrid	Tue 1st Dec @ 14.00 – 15.00	Register here

Thank you