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Monetising flared gas … innovative applications of proven technology

EPRG & CEEPR International Energy Policy Conference

Session: "A reality check on energy technology – are today's tools fit for purpose?"

2 September 2019

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Executive summary

Gas has a key role in the transition, but we must address emissions

- Gas is widely seen as a transition fuel to help to drive decarbonisation
- Most players expect gas consumption to increase significantly
- But there is lot of waste, and a large economic and environmental impact

The GHG problem is fixable … with today's technologies

- Flaring and methane emissions are becoming increasingly transparent
- Existing proven technologies can deliver at no net cost
- Certification technologies are already driving change

… but new approaches and business models are needed

- The business as usual approach isn't working; real change will need:
  - New incentives
  - New operating models
  - New technologies
- It Must, Can and Pays to be done!

Source: Capterio

Agenda

Gas has a key role in the transition, but we must address the GHG emissions challenge

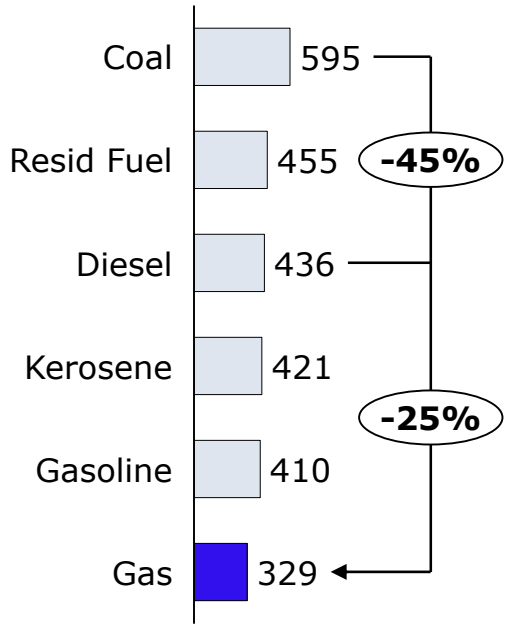
The GHG problem is fixable with today's proven technologies

But technology is not the barrier: systemic change needs innovative approaches and business models

Gas is widely seen as a transition fuel, and its increasing market share is helping to drive decarbonisation …

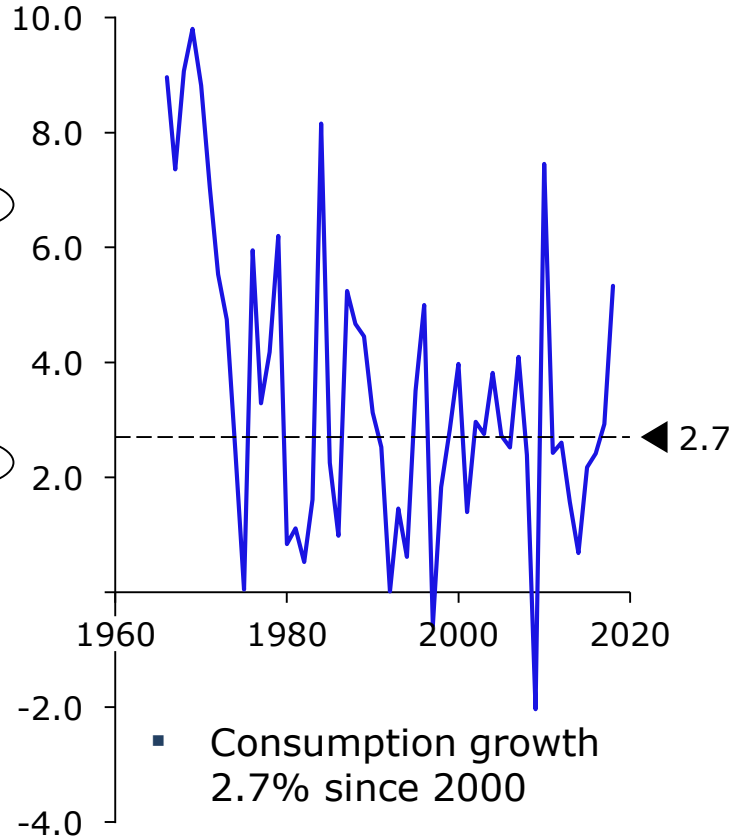
Gas has lower GHG intensity …

Total GHG intensity (kgCO2e/boe)



… and robust growth …

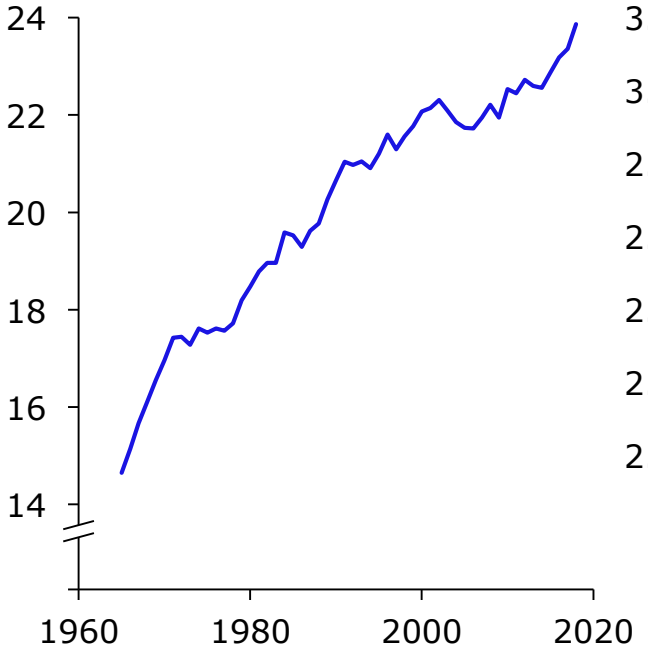
Gas growth rate (%, on prior year)



- Consumption growth 2.7% since 2000

… building market share …

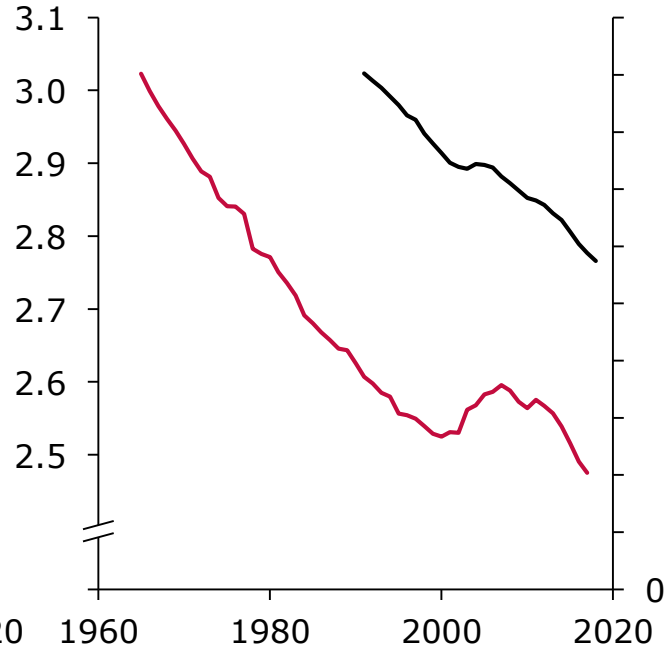
Market share (% primary)



- Market share increasing at 100 bps per decade

… driving decarbonisation …

CO2 intensity (tonnes / toe)
CO2 intensity (g CO2 / $ GDP)



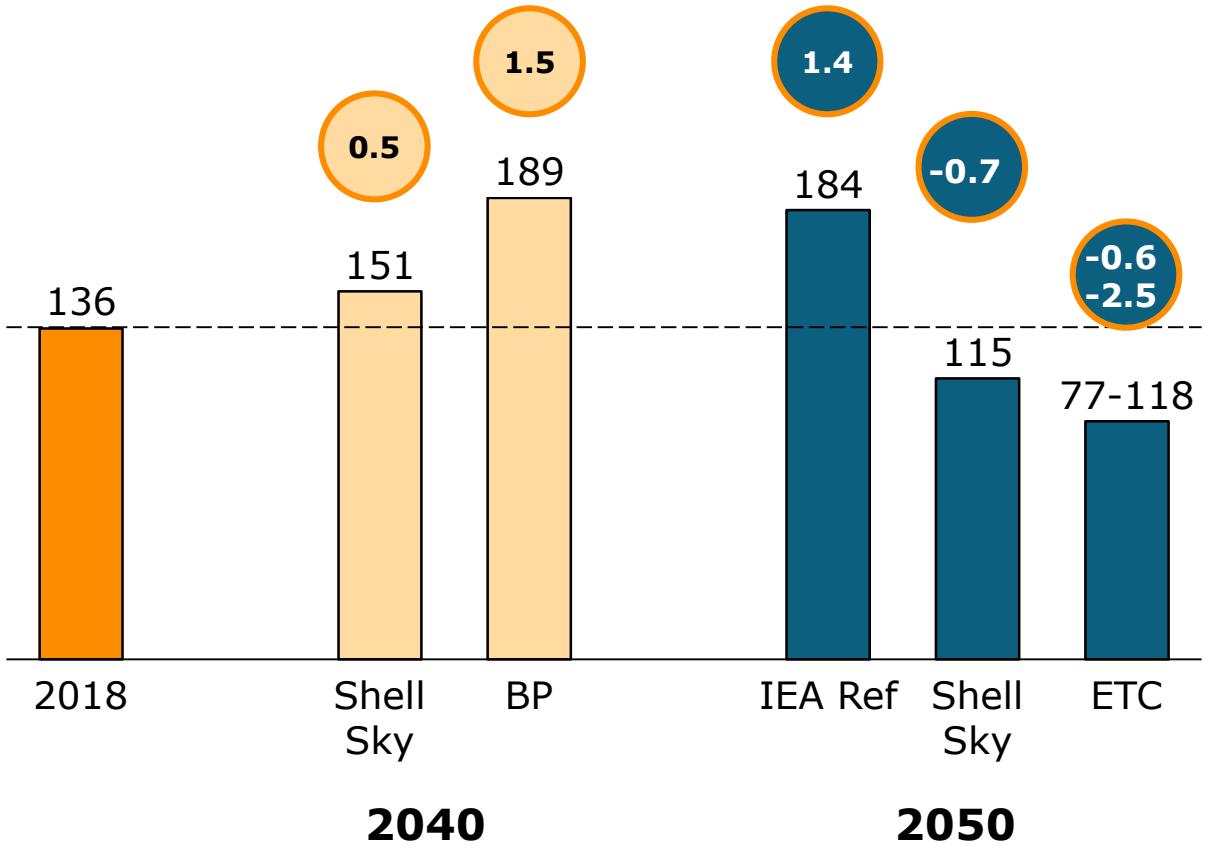
- Decarbonisation underway, but CO2 emissions 34 billion tonnes

Source: BP Statistical Review of World Energy, 2019; IPCC; World Bank (GDP is PPP, 2011)

… and gas is expected to grow in the medium term, but the outlook in 2050 is, for gas, more challenging

Gas consumption outlook

EJ per year



Commentary

Wide range of outlooks, but with Asia and rest of China underpinning demand increase, partly by shift from coal:

- BP: "Rapid Transition" & "Less Globalisation" scenario sees expanded role of gas, with much higher market share
- Shell "Sky": sees strong gas growth in the shorter term, but losing share to stronger renewables
- ETC "Mission Possible": believes that gas will be replaced in core areas, remaining only for critical sectors (e.g. "Hard to Abate")

Source: BP Outlook; Shell Scenarios; Energy Transitions Commission

… but the industry's social license to operate is challenged by 273 BCM of gas is waste, increasing emissions and missing revenue

END USE

occurs when the gas is combusted in the end use

Primarily CO2 with some CH4

OPERATING

gas used in operations to power facilities

Primarily CO2

FLARING

burning of waste gas (often incompletely)

Primarily CO2 with some CH4

VENTING

the deliberate release of methane

Primarily CH4

LEAKING

the accidental release of methane

Primarily CH4

Emissions: 273 BCM

Source: Capterio; World Bank; IEA

Methane emissions are challenging, given 84x potency vs CO2

VENTING

the deliberate release of methane

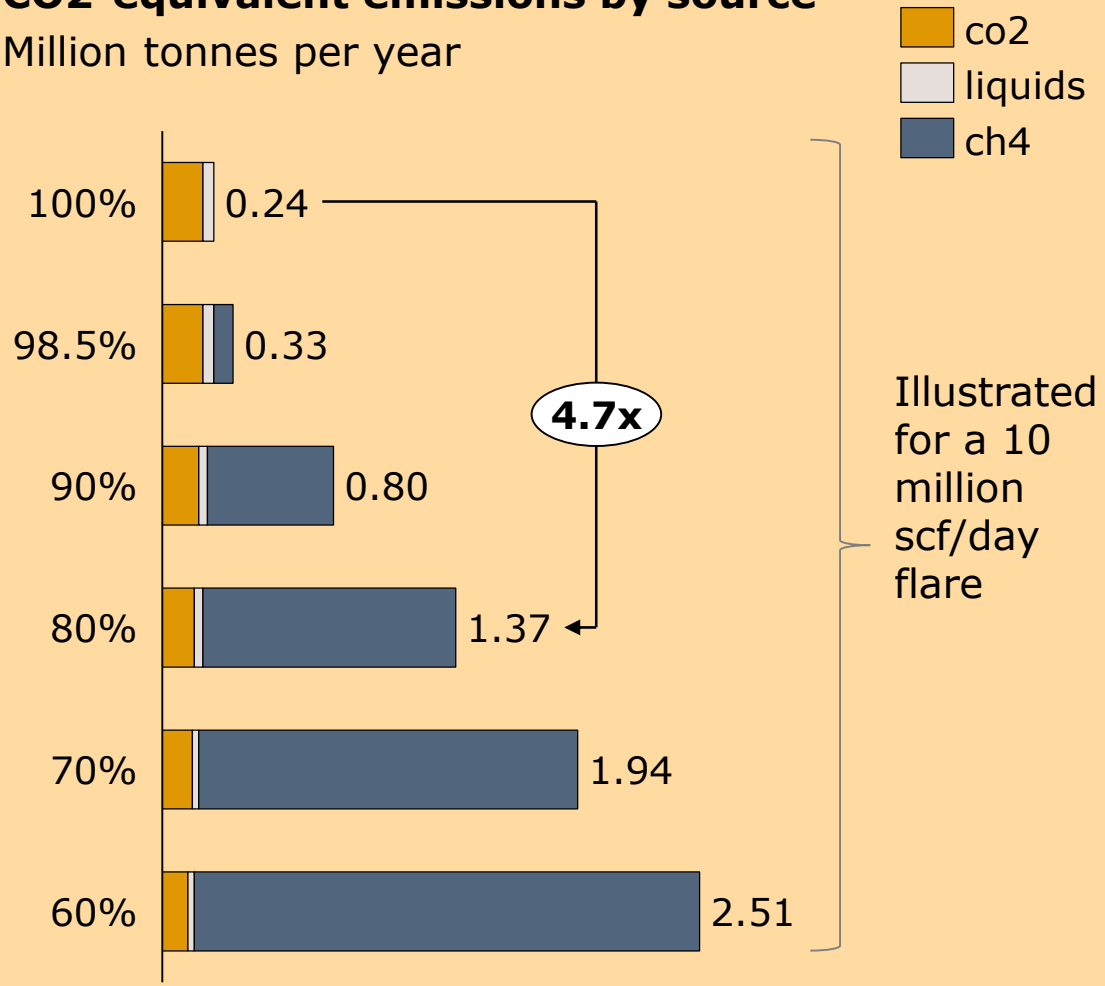
LEAKING

the accidental release of methane

FLARING

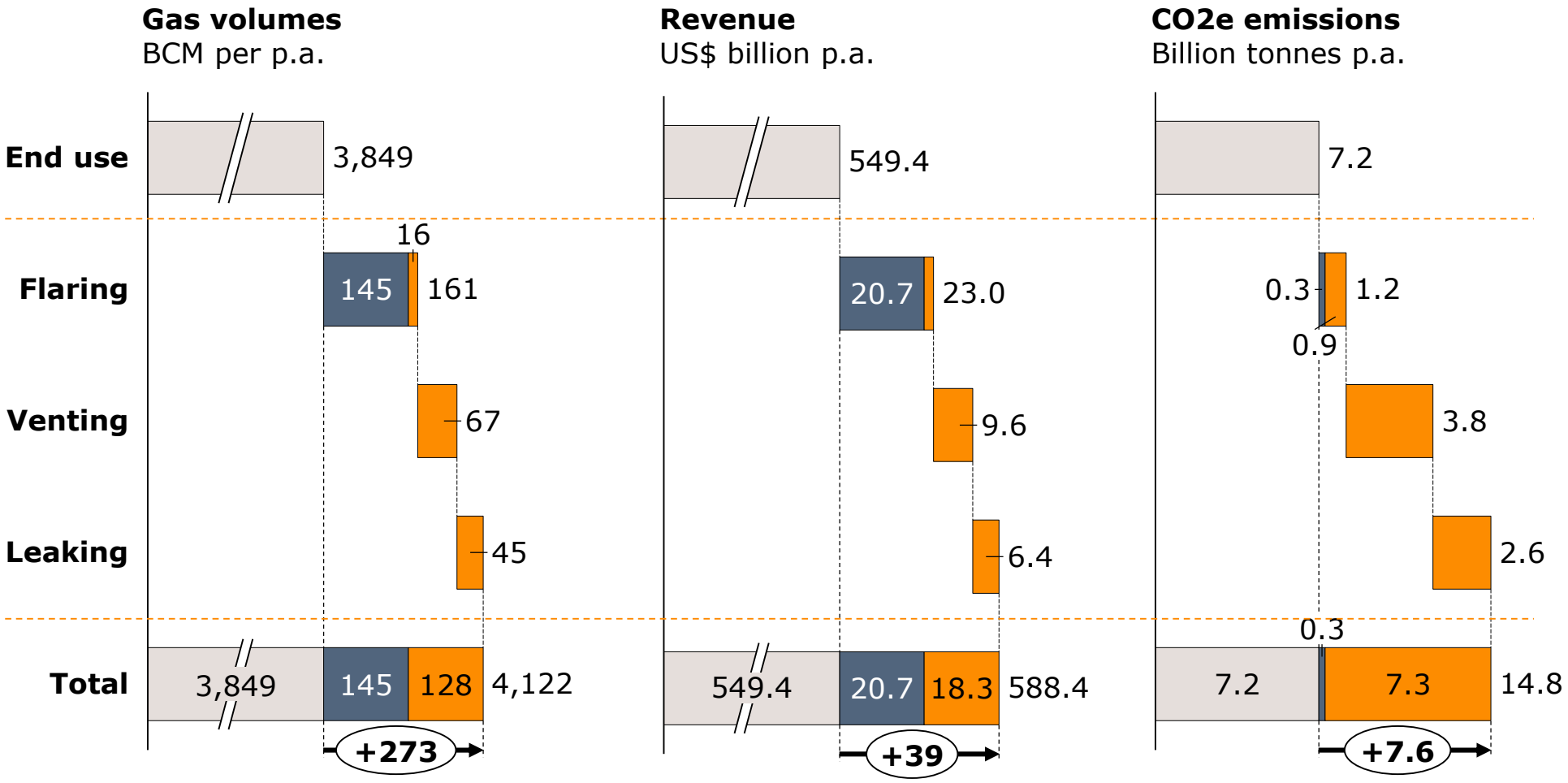
CO2-equivalent emissions by source

Million tonnes per year



Source: Capterio; FLIR

Wasted gas is a large economic opportunity and doubles the CO2-equivalent emissions of natural gas



- Flaring alone is equivalent to consumption of whole of Africa, or 30% of Europe
- Missed revenue $39 billion per year (at $4/mmbtu) – some 7% of total)
- CO2-equivalent emissions from natural gas are >100% greater when methane emissions are included

Note: gas priced at approx. global average of 4 $/MMBTU. CO2e emissions from methane estimated using a multiple of 84 of that of CO2, based on a 20-year timescale. We assume methane slip is 10% at flares, due to incomplete combustion and that natural gas is predominantly methane.

Source: BP Statistical Review of World Energy (2019); World Bank / GGRF / NOAA (2019); IEA World Energy Outlook (2019); Capterio estimates

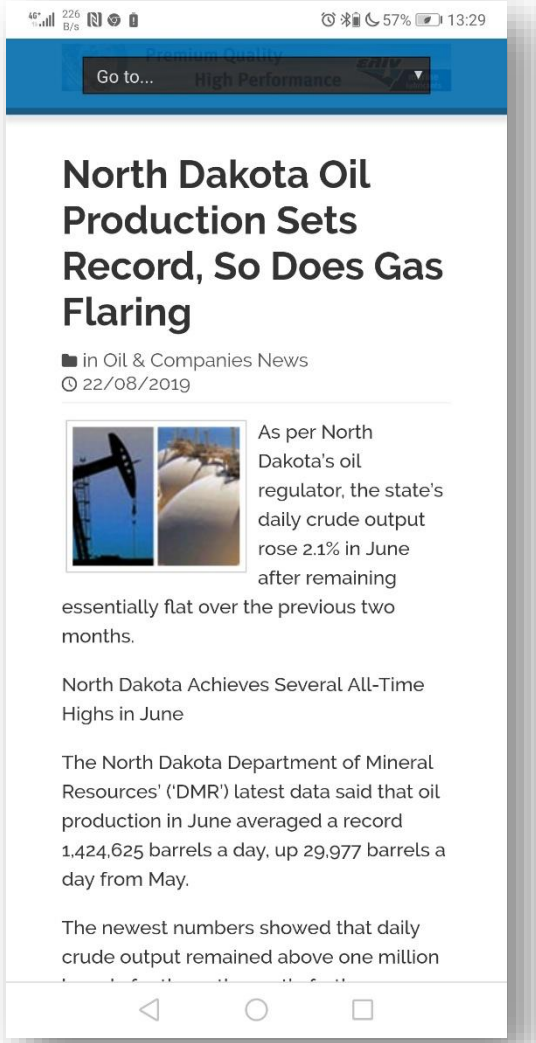
Agenda

Gas has a key role in the transition, but we must address the GHG emissions challenge

The GHG problem is fixable with today's proven technologies

But technology is not the barrier: systemic change needs innovative approaches and business models

Emissions from the natural gas system are daily news … with many companies making commitments



North Dakota Oil Production Sets Record, So Does Gas Flaring

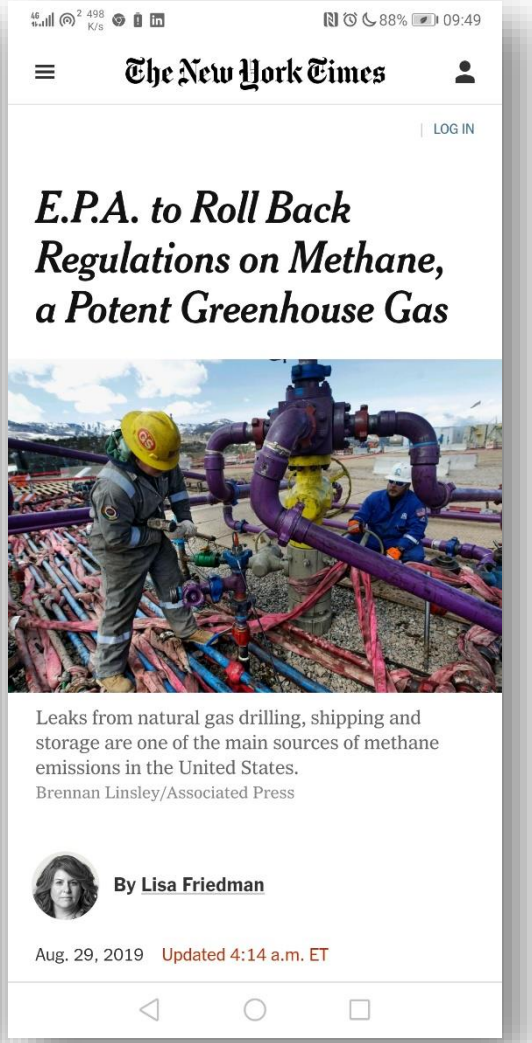
in Oil & Companies News
22/08/2019

As per North Dakota's oil regulator, the state's daily crude output rose 2.1% in June after remaining essentially flat over the previous two months.

North Dakota Achieves Several All-Time Highs in June

The North Dakota Department of Mineral Resources' ('DMR') latest data said that oil production in June averaged a record 1,424,625 barrels a day, up 29,977 barrels a day from May.

The newest numbers showed that daily crude output remained above one million



The New York Times

E.P.A. to Roll Back Regulations on Methane, a Potent Greenhouse Gas

Leaks from natural gas drilling, shipping and storage are one of the main sources of methane emissions in the United States.
Brennan Linsley/Associated Press

By Lisa Friedman

Aug. 29, 2019 Updated 4:14 a.m. ET

S&P Global

S&P GLOBAL PLATTS — 15 Aug, 2019

Insight from Brussels: EU gas sector pins hopes on 'green tags' to face low-carbon future

Author Siobhan Hall
Theme Renewables, Transportation, ESG
Tags Europe

Aug. 15 2019 — Trading tags guaranteeing renewable or low-carbon

- Flaring up
- Regulation down
- Guarantees of origin?

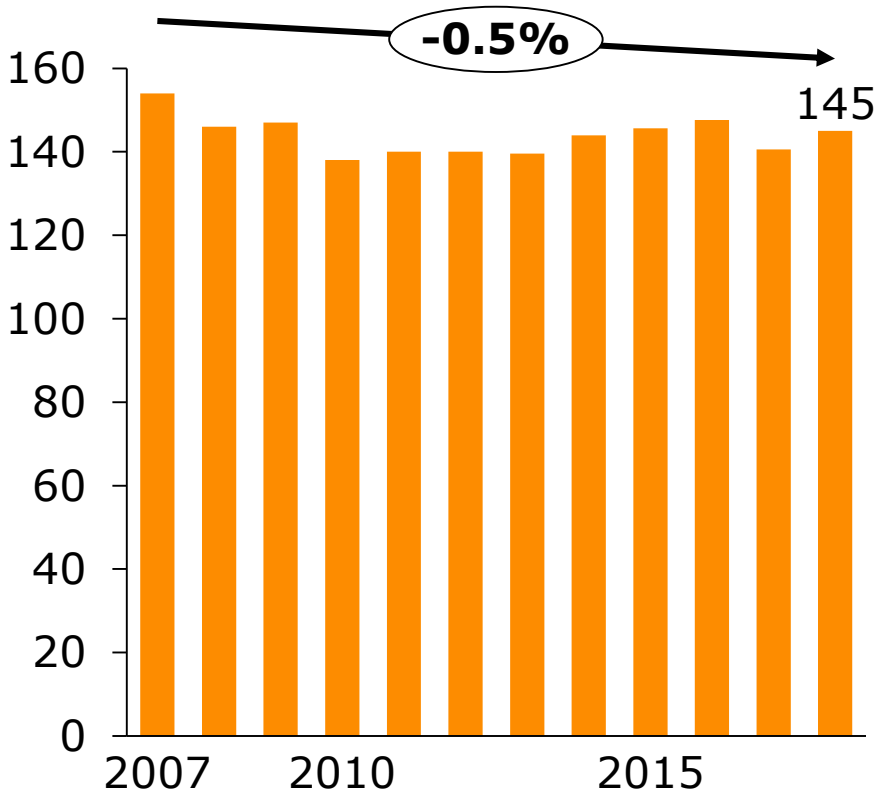
Source: Literature searches

OGCI members:

NOCs and others:

"Business as usual" has not made material progress on flaring due to 3 main factors

Global flared gas has not materially reduced in a decade …
BCM p.a.



… due to …

1. Lack of **awareness** from the consumers, market and/or operators
   - Awareness lacking
   - Lack of measurement / standards
   - Some operators are in denial

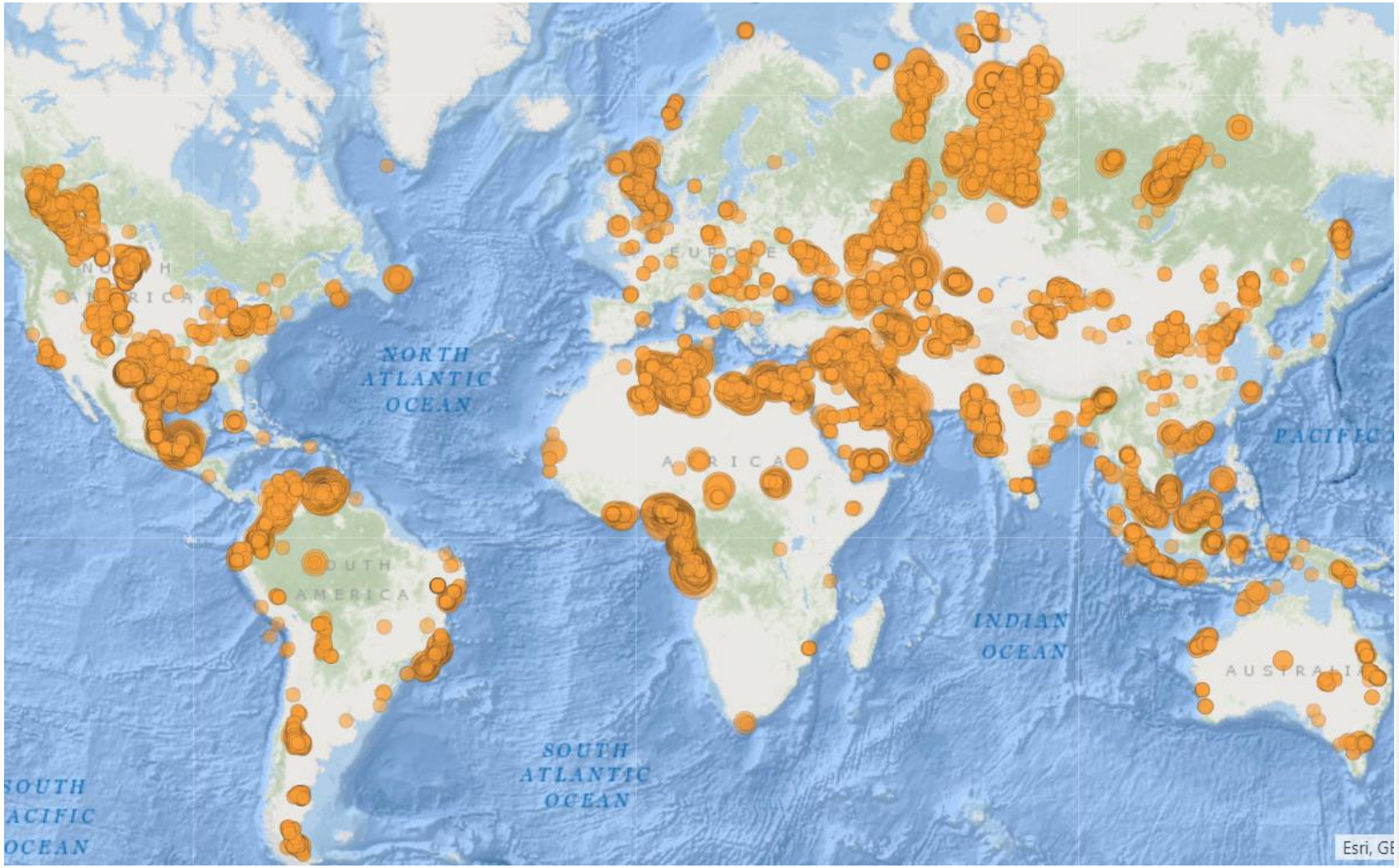
2. Capture not sufficiently **commercially attractive**
   - Low value of gas capture
   - High unit cost
   - Lack of infrastructure

3. Capture is commercially attractive, but not **operationally deliverable**
   - Lack of funding from partners
   - Challenging bureaucracy
   - Lack of execution capacity

Source: World Bank GGFR, 2018

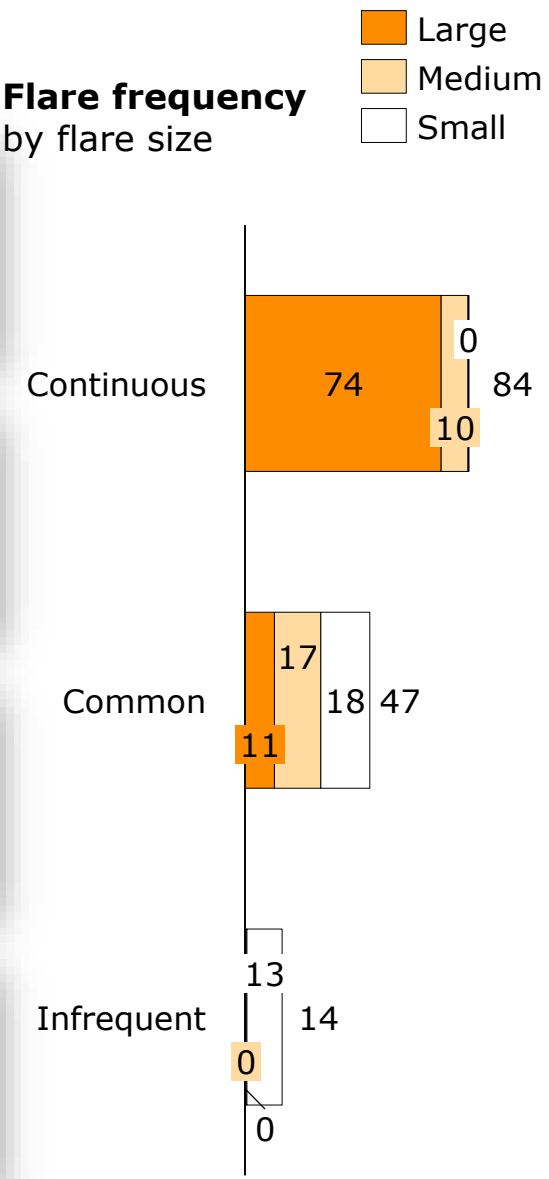
Capterio has developed a new global tool to inspect each of the 10,000 flares globally and yield unique insights

Global and country view of flares



Site view

Flare frequency by flare size



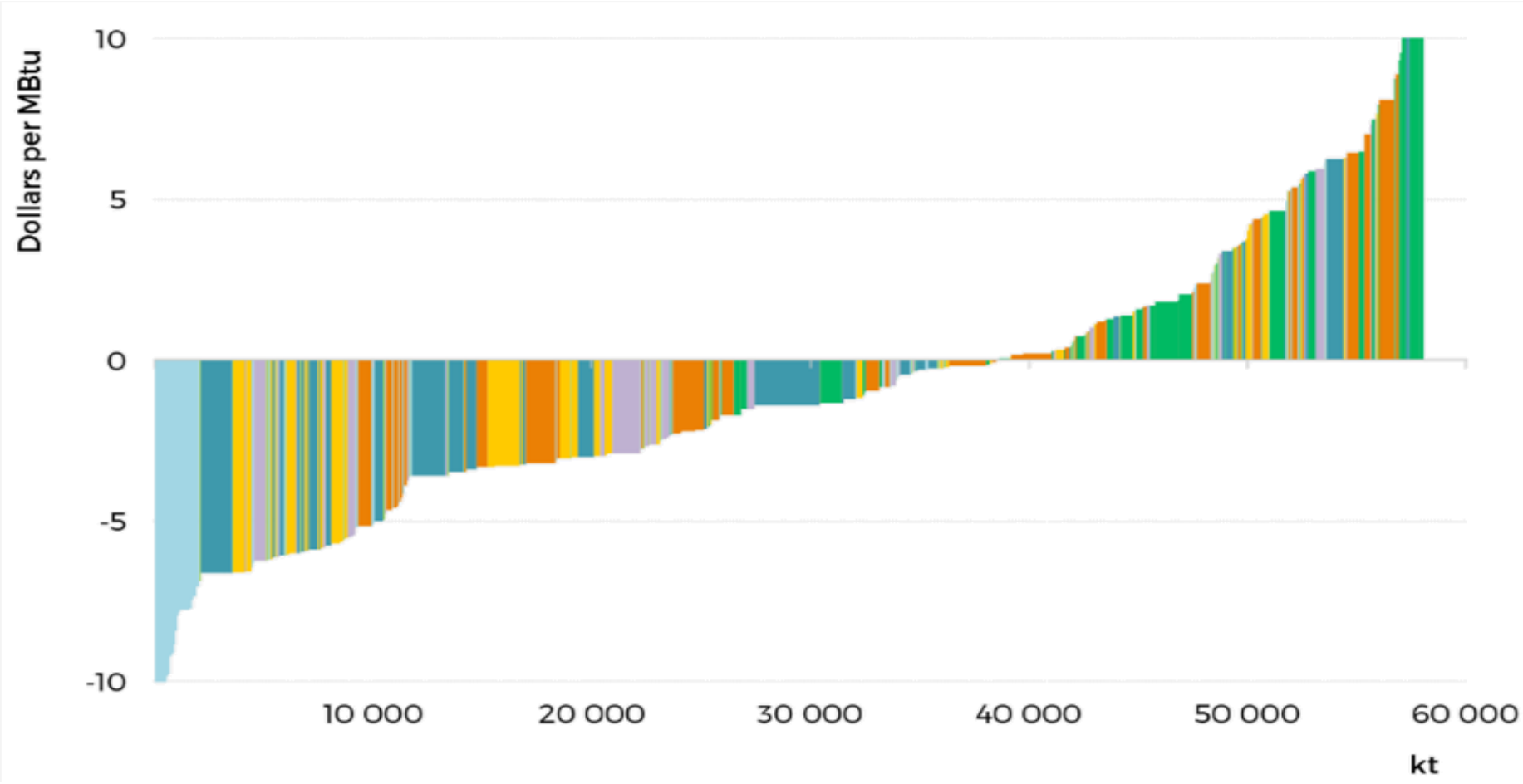
Source: Capterio Global Flare Tool; NOAA / GGFR / Colorado School of Mines

There are several proven technology options to monetise waste gas

- **Uses of Flared Gas**
  - **Onsite**
    - **Reinjection** — EOR | Disposal | Storage
    - **Powergen** — Operations | Services
    - **Heat** — Operations | Services
  - **Saleable product**
    - **Raw gas** — Pipeline | Virtual pipeline
    - **Liquids** — Condensate | LPG | CNG | GTL
    - **Petchems** — Methanol | Ammonia
    - **Products** — Cement | Fertilizer
    - **Other** — Alternative protein, …

Source: Capterio

Projects demonstrate that capturing flared gas with innovative, modular and scalable solutions can work with strong IRRs



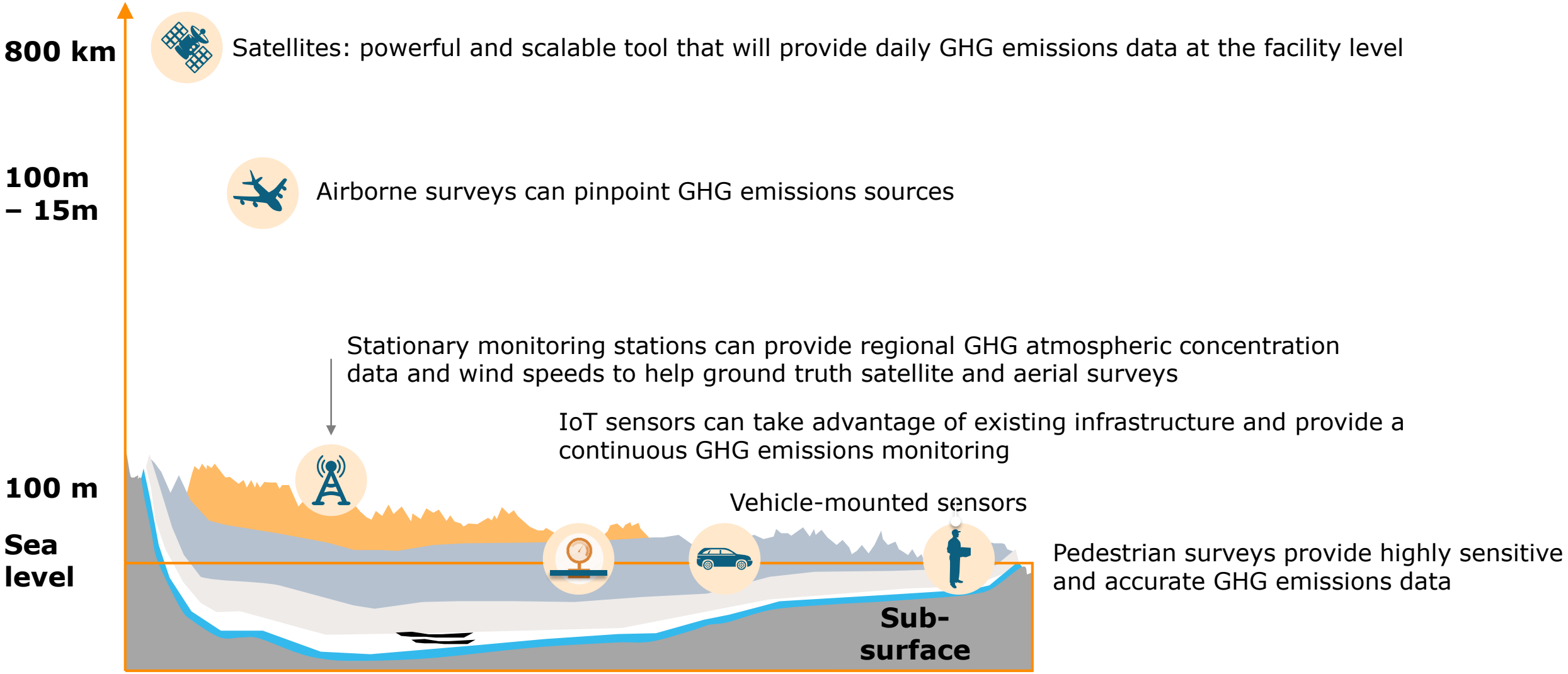
- ✓ Standardised
- ✓ Modular
- ✓ Plug and Play
- ✓ Limited FEED

- ✓ Reusable
- ✓ Rapid deployment
- ✓ Low cost

- ✓ Attractive IRRs

Source: Capterio; IEA

New technologies help to monitor and measure emissions, but so far, no all-seeing method, so integrating datasets is key …



Source: SYSTEMIQ; RMI

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To drive real change in the upstream, many countries will need to consider change, supported by new types of players

Improving the economic incentives

- Review and revise fiscal policy
- Open-up third party access
- Bring third party capital

Drive more enforcement

- Create bodies in-country to oversee flare monetisation and total gas conservation
- Technology and measurement
- Establish "teeth"

Build new national capabilities

- Build national capability in flare abatement and total gas conservation
- Bring best technology and capabilities

New data and insights

- Data transparency

Bring the best technology solution with deep expertise

- New technologies

Bring new operating models

- New ways of funding/operating

Source: Capterio

A very clear message is becoming evident …

M

IT MUST BE DONE

It's critical to the industry – and the planet – that the GHG emissions of natural gas are reduced

C

IT CAN BE DONE

Technologies can be applied in upstream production and downstream consumer areas to drive change

P

IT PAYS TO DO IT

Solving the issues are a triple win: for asset owners, national government, consumers (and the planet)

Source: Capterio; SYSTEMIQ; RMI

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