Energy solutions for a changing world

Measuring and Eliminating Flaring & CH₄ emissions

PIDX London
June 22nd, 2022
Overview Proposal & Value Proposition

FEP Leadership
- Best practices advice
- Solution design
- Partner selection
- Project management

One stop access & direct measurement

Reservoir Development/Management
- Fit for purpose solutions for each situation

Agnostic to data platforms & technology preferences

AI / ML Calibration & integration into existing systems

Tailored & Cost effective

Work with the operator to systematically reduce emissions

Regional capability development

Sensor test centre

• Suite of top-down & bottom-up technologies
• Directly MEASURE flare and CH4 emissions and Report
• Holistic / integrated approach
• Open to deploy technologies outside the consortium
• Translate measurements into dashboards
• Integrate with operational management decision tools and reporting systems
Biomass measured emissions (ranging from 5–28 mg m\(^{-2}\) hr\(^{-1}\)) were found to be an order of magnitude greater than those simulated by land surface models (ranging from 0.6–3.9 mg m\(^{-2}\) hr\(^{-1}\)), suggesting much greater emissions from tropical wetlands than currently accounted for.

https://doi.org/10.1029/2021GB007261
Uganda GHG Inventory Report 2019

Greenwashing?

• The environmental, social, and governance (ESG) data provided in firms’ sustainability reports is often **unaudited**. If ESG information disclosed by firms is not reliable, a firm’s greenwashing behavior can be a barrier to integrating ESG factors into investment decisions.

• ........ “greenwashers” are firms which seem very transparent and reveal large quantities of ESG data but perform poorly in ESG aspects. By creating peer-relative greenwashing scores for a cross-country dataset comprised by **1925 large-cap firms**, we measure the extent to which large-cap firms engage in greenwashing.

# The O&G Majors GHG Reporting 2020

<table>
<thead>
<tr>
<th>Item\Company</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
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<tbody>
<tr>
<td>1. 2020 GHG Report</td>
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<td>2. Linkage to 2020 Executive Remuneration</td>
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<td>3. ~3 Year GHG Ambitions</td>
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<td>4. Link to ~3 Year Executive Remuneration</td>
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**“Greenwashing” Overview**

*Table 2 – FEP evaluation of European Majors 2020 GHG emissions report*

- **Clear - Comprehensive - Quantitative**
- **Debateable – Partial - Qualitative**
- **Questionable - Absent**

*Table 1 – FEP “traffic-light” system to identify European Majors 2020 GHG Emissions Reporting performance*
Source of Emissions

Global greenhouse gas emissions by sector

This is shown for the year 2016 – global greenhouse gas emissions were 49.4 billion tonnes CO₂eq.
Scope 3 Emissions are Challenging to Report

About 80% of total emissions from most business sectors are scope 3

Several operating companies we’ve spoken to don’t know that their suppliers are Scop3 emission sources

Source: WBCSD based on data from GreenGauge, CDP and McKinsey & Company

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Methane Elimination Plans- BP

Methane measurement
Our plans to install methane measurement at all our existing major oil and gas processing sites continued in 2021 with the ongoing installation of enhanced metering, software for flare efficiency and predictive emissions monitoring on gas turbines in line with our three-year timeframe.

At our US onshore operations we trialled new technologies for site level emissions detection and continued using drones and aircraft with methane sensors.

Methane reduction activity
Across our US onshore operations, we are working to achieve zero routine flaring by 2025 or sooner. This includes installing air assisted flares to improve combustion efficiency and thermocouple sensors on all flare stacks that notify bp operations teams of unit flares. All bp flares have auto-igniters to attempt to remotely reignite extinguished flames.

At a number of our North Sea assets, we made improvements such as optimizing the restart sequence of our operations and changing operational parameters to minimize the potential for flares to extinguish under high winds.

Our actions on methane reduction enable our businesses to capture value by supplying the gas to customers. Otherwise the gas would be wasted with both an economic loss and an adverse impact on emissions.

Technology improvements
Technologies to detect and measure methane are evolving at pace. A flexible approach to using different technologies allows us to move towards increased continuous site and source-level measurement systems as more advanced technology becomes available. We use different methods, including drones, aircraft, satellites and fixed video monitoring. We continue to monitor emerging technologies to assess their potential as methane measurement tools.

Our progress in 2021
We made further progress against our operational emissions reduction targets in 2021. Our combined Scope 1 and Scope 2 emissions, covered by aim 1, were 35.6MtCO₂e, a decrease of 35% from our 2019 baseline of 54.4MtCO₂e.

The total decrease of almost 19MtCO₂e includes 14.7MtCO₂e in divestments and 2.6MtCO₂e in sustainable emission reductions (SERs).

Compared with 2020 (45.5MtCO₂e), Scope 1 and 2 emissions in 2021 decreased by 22%.

This means that while we have exceeded our 2025 target, we have more work to do to achieve our overall net zero aim by reducing emissions while bringing new projects online.

Scope 1 (direct) emissions, covered by aim 1, were 33.2MtCO₂e in 2021, a decrease of 20% from 41.7MtCO₂e in 2020. Of those Scope 1 emissions, 32.0MtCO₂e were from CO₂ and 1.1MtCO₂e from methane. Emissions decreased due to divestments, delivery of SERs and other permanent operational changes.

Scope 2 (indirect) emissions decreased by 1.4MtCO₂e to 2.4MtCO₂e in 2021, a 37% reduction compared with 2020. This decrease resulted from lower carbon power agreements, including at our Gelsenkirchen site, and the divestment of our petrochemicals business at the end of 2020.

In 2021 compared with 2020:

- Divestments accounted for 9.3MtCO₂e of the Scope 1 and Scope 2 emissions decrease including the divestment of our operations in Alaska, our petrochemicals business and bpx energy divestments.
- The delivery of SERs reduced Scope 1 and 2 emissions by 1.6MtCO₂e (in addition to the 1.1MtCO₂e delivered in 2020).
- Other permanent reductions in 2021 included the repurposing of Kwinana refinery (0.7 MtCO₂e reduction) and cessation of production at Fonan FPSO (0.2 MtCO₂e reduction).
- Temporary production-related changes accounted for an increase of 1.1MtCO₂e associated with higher activity levels, particularly in refining, and temporary flaring increases in 2021.
- Total hydrocarbons flared increased from 831kt to 987kt in 2021 due to operational variances including temporary flaring associated with a new production start-up.
TotalEnergies is Addressing Methane Emissions

Ausea consists of a miniature dual sensor mounted on a drone, capable of detecting methane and carbon dioxide emissions, while at the same time identifying their source.

Measuring methane emissions more accurately
Methane emissions have numerous and dispersed sources. TotalEnergies is a pioneer in detecting and quantifying emissions across the entire value chain. The Company operates a site for testing methane emissions measurement technology. Known as the TADI complex, it is unparalleled in Europe; only one comparable site exists worldwide, in the United States.

In addition, TotalEnergies is speeding up deployment of its drone-mounted methane detection technology, AUSEA, at all of its operated sites starting in 2022 (see sidebar).
**TotalEnergies Reported Methane Emissions**

<table>
<thead>
<tr>
<th>GHG EMISSIONS</th>
<th>Operated</th>
<th>Equity Share</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scope 1 – Direct GHG emissions</strong></td>
<td>Mt CO₂e</td>
<td></td>
</tr>
<tr>
<td>Methane emissions</td>
<td>kt CH₄</td>
<td>49</td>
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<tr>
<td><strong>BREAKDOWN BY PRODUCT</strong></td>
<td></td>
<td></td>
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<tr>
<td>Upstream Oil &amp; Gas Operations</td>
<td>kt CH₄</td>
<td>48</td>
</tr>
<tr>
<td>Integrated Gas, Renewables &amp; Power, excluding upstream gas operations</td>
<td>kt CH₄</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Refining &amp; Chemicals</td>
<td>kt CH₄</td>
<td>1</td>
</tr>
<tr>
<td>Marketing &amp; Services</td>
<td>kt CH₄</td>
<td>0</td>
</tr>
<tr>
<td><strong>BREAKDOWN BY REGION</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Europe: E.U. 27 + Norway + UK + Switzerland</td>
<td>kt CH₄</td>
<td>7</td>
</tr>
<tr>
<td>Eurasia (including Russia)/Oceania</td>
<td>kt CH₄</td>
<td>1</td>
</tr>
<tr>
<td>Africa</td>
<td>kt CH₄</td>
<td>23</td>
</tr>
<tr>
<td>Americas</td>
<td>kt CH₄</td>
<td>18</td>
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</tbody>
</table>
Current realities!

• The Oil & Gas Industry is under intense scrutiny regarding GHG Emissions and Flaring:

• *Under-reporting by companies operating there is widely observed in work by independent bodies (using satellites, fixed wing aircraft).*

• By extrapolation, we might assume that under-reporting of GHG Emissions is a problem across all industries....
Must do better!

‘Public’ Reporting:

• Found in Annual Reports, Sustainability Reports, sometimes on Websites:
  ➢ Majors = Reasonably comprehensive but diverse, heterogeneous
  ➢ E&Ps = with one or two exceptions, partial, incomplete, non-existent
  ➢ ‘Foundation Industries’ = indistinguishable from E&Ps

‘Bottom-up’ Reporting:

× Usually based on ‘engineering estimates’, not operational measurements

??How can a company Measure - and thus accurately Report - Operated (and Equity) flaring and GHG emissions?

??How can a company accurately document – and report – GHG emissions within its Supply Chain?

Without reliable measurement, how can Mitigation plans and promises be assessed and delivered?
Temporal & Spatial Dimensions of monitoring & measurement

- Flaring
- Venting
- Leaks
- Major Emissions
- Asset Emissions ‘Signal’

- Sq m/Point
- Sq 10m
- Sq Kms

- Hours
- Months
- Years

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### Temporal & Spatial Dimensions of monitoring & measurement

<table>
<thead>
<tr>
<th>VISITS</th>
<th>MONTHS</th>
<th>YEARS</th>
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<tr>
<td><strong>DURATION</strong></td>
<td><strong>RESOLUTION</strong></td>
<td><strong>RESOLUTION</strong></td>
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<tr>
<td>SATELLITES (FLARING)</td>
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<td>SATELLITES (EMISSIONS)</td>
</tr>
<tr>
<td>Sq m/Point</td>
<td>Sq 10m</td>
<td>Sq Kms</td>
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</tbody>
</table>

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Temporal & Spatial Dimensions of monitoring & measurement

- SATELLITES (FLARING)
- SATELLITES (EMISSIONS)
- FIXED SENSORS (FLARING/EMISSIONS)
- UAV with SENSORS (FLARING/EMISSIONS)
- WALKERS with SENSORS (FLARING/EMISSIONS)

NPL DIAL facility fits in this space

Sq m/Point | Sq 10m | Sq Kms

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Digital Technologies

Physical Measurement to Digital Integration → Integrated Digital to Actionable Display

Digital Twin
Geospatial Intelligence
Control Centre
Future Energy Partners Flaring & Venting Outline Program

Project initiations & validations

- Initial Contracts for advice & implementation projects
  - Project – specific element selection
  - Piloting and validation of technologies / solutions
  - Tailoring & integration with operator & OGA reporting systems

Full project implementations

- Provide 10 years of flare history
- Flare measurement calibration trials
- Offshore QLM LiDAR trials
- Ongoing drone / LiDAR combination development
- Offshore drone / camera validation trials
- Ongoing PPE-sensor validations
- Stand-alone demonstrations
- Data Integration/KPI definition - reporting standards to match operators OMS and OGA requirements

Ongoing validation, optimization & implementation by technical element

- “QUICK WINS” definition & implementation
  - 10 year satellite flare history
  - Flare recognition software calibrations
  - PPE-sensor validation trials
  - Define KPIs, reporting standards

- Initial full project identification & definition

2022

- Systematic reporting

2023+

- Available now

Follow-on stages

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Conclusion

1) What gets measured gets done!
   • Reporting is seriously underestimating emissions..especially CH4

2) Reporting needs simplification and consistency and $$$

3) Consistent regulation and monitoring/enforcement is missing
Energy solutions for a changing world

Measuring and Eliminating Flaring & $\text{CH}_4$ emissions

Thank you!!