

## Upstream Methane Workshop Pre-Read

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### Context

- To meet the rising demand for cleaner energy we are aiming to increase the amount of gas in our portfolio from 50% to 60% by 2020.
- In order to fully realise the climate benefits of gas over coal (for power generation) it is essential to minimise methane emissions across the entire gas value chain.
- Methane emissions of <1% across the gas value chain supports the climate credentials of gas.
- BP methane emissions for marketed sales gas from Upstream segment operations averaged less than 0.2% in 2017<sup>1</sup>.
- BP has committed externally to lead on reducing methane emissions<sup>2</sup>, and the aim of the Upstream Methane Workshop is to develop a plan to enable Upstream to deliver its contribution towards meeting this aspiration.

### Methane Science

- Methane has a strong warming effect on the climate - with a high global warming potential (GWP) compared to CO<sub>2</sub>, but it breaks down quicker than CO<sub>2</sub>:
  - Over 100 years methane has 25 times<sup>3</sup> the GWP of CO<sub>2</sub>.
  - Over 20 years methane has 72 times<sup>3</sup> the GWP of CO<sub>2</sub>.
- Most governments and companies use the 100-year time frame for reporting.

<sup>1</sup> 0.18% in 2017 compared to 0.22% in 2016; reduction mainly due to methane emission reductions in L48 and increased gas export in Angola in 2017 compared to 2016.

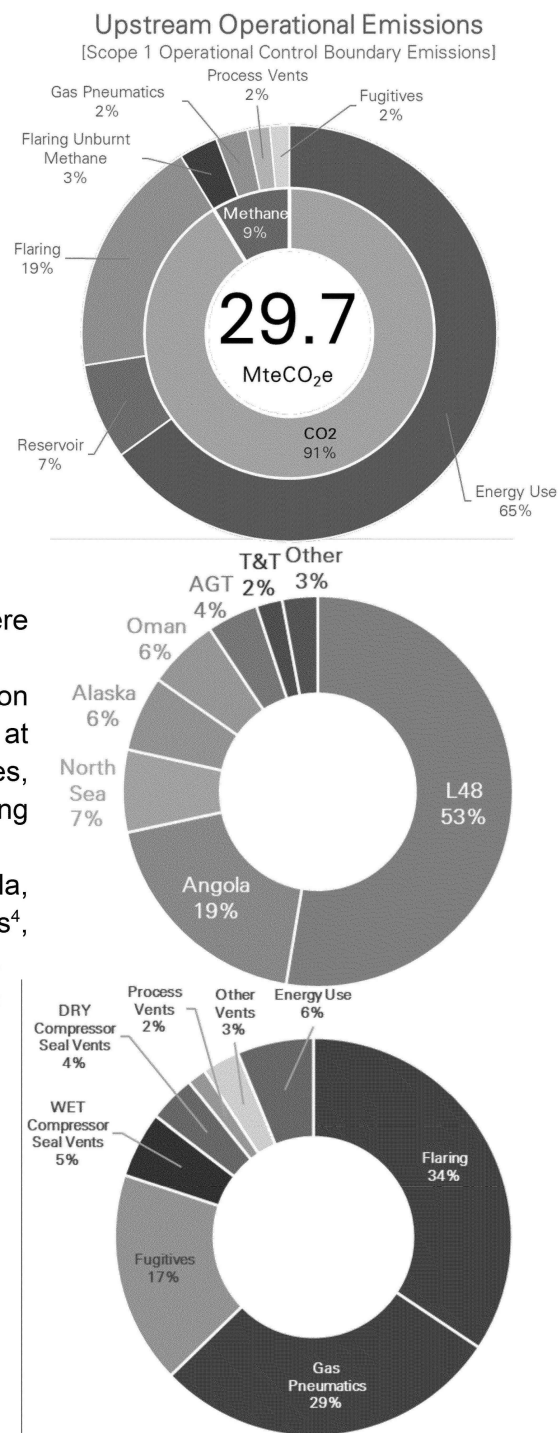
<sup>2</sup> <https://www.bp.com/energytransition/shifting-towards-gas.html>

<sup>3</sup> From IPCC Assessment Report 4 (AR4; 2007) and in line with current BP GHG reporting methodology and IPIECA guidance. IPCC AR5 (2013) values for methane GWP are 28 (100-year) and 84 (25-year).

- BP reporting is carried out in line with the IPIECA/API/IOGP Oil and gas industry guidance on voluntary sustainability reporting and UK Government Environmental Reporting Guidelines.
- BP is partnering with Princeton University on research to better understand the methane cycle.

## BP Upstream Methane Emissions

- In 2017 Upstream emitted 104,000 tonnes of methane (100% of operated basis) compared to 115,000 tonnes in 2016:
  - Over the 100 year timeframe this is equivalent to around 2.6 million tonnes of CO<sub>2</sub> (9% of the Upstream total GHG emissions).
  - Over a 20 year timeframe this would be equivalent to around 7.5 million tonnes of CO<sub>2</sub> (22% of the Upstream total GHG emissions).
- Over 70% of the Upstream methane emissions in 2017 (100% of operated basis) were from L48 and Angola:
  - 53% were from L48, which has instrumentation and rotating machinery driven by natural gas at many small, dispersed and often remote sites, with associated high levels of methane venting and fugitive emissions.
  - 19% of methane emissions were in Angola, related to high flaring levels from its FPSOs<sup>4</sup>, reservoir gas issues associated with Angola LNG<sup>5</sup> unavailability. The region is investigating options for reducing flaring in 2018.
- Sources of Upstream operated methane emissions:
  - 34% from flaring, with over 50% from Angola.
  - 29% from gas pneumatic controls and pumps in L48, with ~60% of this from Wamsutter.
  - 17% from Fugitives.



<sup>4</sup> Angola FPSOs Greater Plutonio and PSVM currently account for just over half of Upstream's flaring

<sup>5</sup> Angola LNG is the associated gas export route for the Angola offshore region; it is a 3rd party facility operated by Chevron

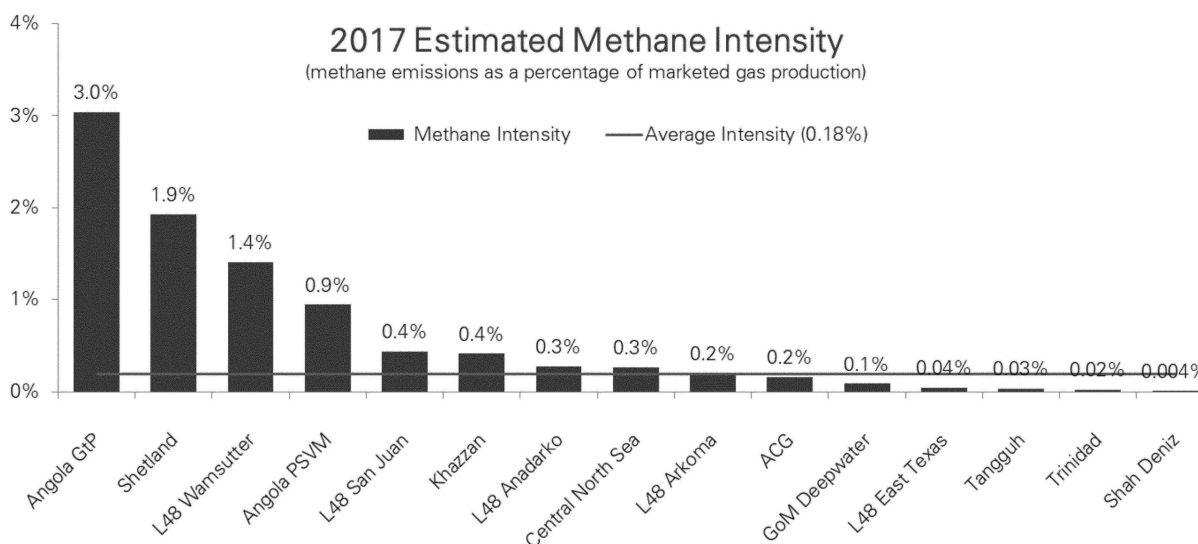
- 9% from compressor seals, mainly wet seals at FPS (divested at end of 2017).
- 5% from venting
- 6% during combustion of fuel gas.

## Calculating Methane Emissions

- BP uses standard industry methods to calculate and estimate (e.g. using industry emission factors) our methane emissions.
- Currently there are no viable methods to directly measure methane in the field, however a number of new technologies are being developed and trialled both within BP and through external initiatives.

## Reporting Methane Emissions

- **Internal** - since 3Q 2015, GOO has been reporting methane intensity internally based on total methane emissions from GOO operated assets over total operated oil and gas production and throughput. GOO's average methane intensity is around 0.02 te/mboe.
- **External** - To support our external advocacy position on gas we report total Upstream operated methane emissions over total operated sales gas<sup>6</sup>:
  - Our average methane intensity in 2017 was less than 0.2%, varying from <0.01% for Shah Deniz to 3% for Greater Plutonio.
  - Angola methane intensity is high due to flaring, but lower than in 2016 (>5%) due to gas export to Angola LNG occurring throughout the year.
  - L48 methane intensity is higher than average due to the use of gas pneumatics.



## Reducing Methane Emissions and Role of Technology

- BP seek to reduce methane emissions in our current operations through:
  - implementing leak detection and repair (LDAR) programmes,

<sup>6</sup> This includes gas from production facilities and associated gas that reaches a sale or export point (e.g. Angola) and excludes gas that does not reach market (e.g. Prudhoe Bay) or gas processed in BP operated facilities but is not BP sales gas (e.g. FPS)

- quantification and minimisation of methane sources where technically and economically feasible,
- reducing flaring.
- BP designs new projects to be inherently low in methane emissions (e.g. Khazzan).
- Technology will play a key role both in improving the efficiency of our operations and identifying, quantifying and reducing sources of methane.
- We trial and deploy key technologies within our own operations, and through joint industry projects with our peers, e.g. through the \$1 billion over ten years OGCI Climate Investments and the Petroleum Environmental Research Forum (PERF).
- For example, we are:
  - Evaluating and trialling technologies for improved measurement of flare combustion efficiency and fugitive emission rates to verify / enhance quantification of methane emissions and emission reductions.
  - Piloting methane identification and quantification technology and its potential for use in a systematic LDAR program across GOO.

## Peer Activities and External Disclosure

- The Upstream industry's methane performance has been incorrectly represented externally, with onshore unconventional US intensities being extrapolated to represent the entire oil and gas industry global methane emissions.
- In response, some of our industry peers have published data and targets related to methane intensity, as well as joining a number of external initiatives focusing on methane and flaring in the Upstream Oil & Gas Industry (see table below).

Company	Published Methane Intensity	Methane Target	Oil & Gas Climate Initiative (OGCI)	CCAC Oil & Gas Methane Partnership	World Bank Zero Routine Flaring by 2030	Global Gas Flaring Reduction Partnership
BP	0.2%	None	✓	✓	✓	✓
Shell	0.5%	None	✓	✓	✓	✓
Total	<0.5%	None	✓	✓	✓	✓
ENI	Not published	80% reduction in upstream <u>fugitive</u> methane by 2025 (vs 2014) <sup>7</sup>	✓	✓	✓	✓
Statoil	0.015% (Norway operated only)	Methane intensity <0.3% across the Norwegian gas value chain	✓	✓	✓	✓
Repsol	Not published	None	✓	✓	✓	
XOM	Not published	None				✓
Chevron	Not published	None				✓
Conoco Phillips	Not published	None				
Aramco	Not published	None	✓			
Pemex	Not published	None	✓	✓		✓

<sup>7</sup> ENI methane target is an absolute reduction target, but a large proportion will be due to a methodology change. Some reduction will come from actual methane reductions.

**Redacted - First Amendment**