



Discussion with Rocky Mountain Institute

25th September 2020

P&O
production & operations

Agenda

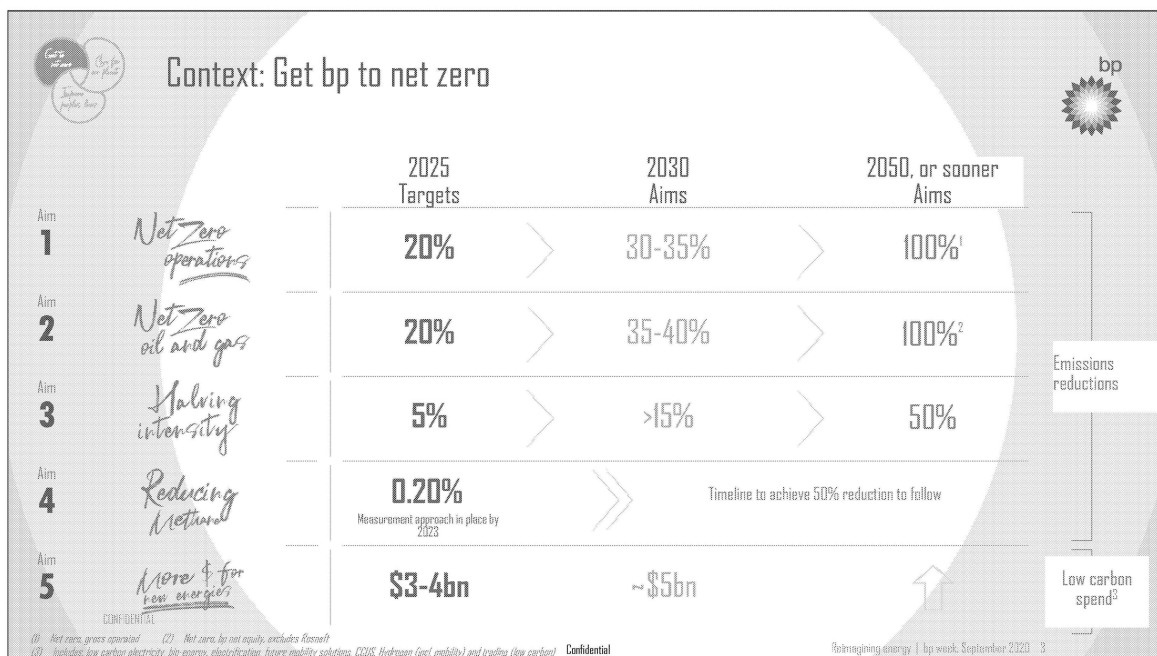


- Welcome and introductions
- Context: Get bp to net zero
- Delivery of Aim 4: methane intensity
 - Technology suite
- Third Derivative

CONFIDENTIAL

Confidential

P&O



Aim 1 is to get to net zero for our operational emissions by 2050 or sooner.

We communicated a target of 20% reduction in our operational emissions by 2025 and aim for a 30-35% reduction by 2030.

Aim 1 covers what are often called Scope 1 and Scope 2 emissions. Scope 1 is emissions from running our own assets. Scope 2 is emissions associated with producing the electricity, heat and cooling that we buy to run our operations.

Aim 2 is to get to net zero on an absolute basis across the carbon in our oil and gas production by 2050 or sooner.

Here we target a 20% reduction by 2025 and aim for a 35-40% reduction by 2030.

This is our Scope 3 aim, because it covers the carbon dioxide which is emitted if someone burns the gas we produce, or a product made from the oil we produce.

Aim 3 is to halve the carbon intensity of the products we market by 2050 or sooner.

We also set ourselves a 2025 target to reduce our carbon intensity by 5%, and an aim to reduce it by at least 15% by 2030.

Aim 3 covers marketing sales of energy products – such as fuels, gas and power – as well as offsets supplied to customers. It covers the estimated lifecycle emissions associated with the production, processing and transportation of those products. And it also includes the CO2 emitted from the use of fuels and gas.

Aim 4 is to install methane measurement at our major oil and gas processing sites by 2023, publish the data, and then drive a 50% reduction in methane intensity in our operations.

Methane intensity is the amount of methane emissions from our operated upstream oil and gas assets as a percentage of the total gas that goes to market from those operations.

We have been doing a lot of work on this since we announced the aim in February. As you can see from the slide, we have now also set ourselves a methane intensity target to two decimal places – of 0.20% by 2025, using a measurement approach.

Gordon Birrell, who leads production and operations, will be providing more details on Aims 1 and 4 in a moment.

Aim 5 is to increase the proportion of investment we make into our non-oil and gas businesses. As presented on August 4th, we aim to scale our investment in low carbon energy by up to eight-fold by 2025 and 10-fold by 2030 to around \$5 billion per year.

Ref

Aim 4 is to install methane measurement at all our existing major oil and gas processing sites by 2023, publish the data, and then drive a 50% reduction in methane intensity of our operations. And we will work to influence our joint ventures to set their own methane intensity targets of 0.2%”



Let me now turn to Aim 4 which focuses on methane.

Methane has a much higher global warming potential than carbon dioxide. So tackling methane emissions can play an important role in meeting the Paris goals.

The science on methane and climate is complex and we have benefited hugely from the expertise of Princeton University through our long-standing partnership in the Carbon Mitigation Initiative.

Current protocols for reporting methane emissions rely mostly on estimation and calculation rather than actual detection and measurement.

It is therefore understandable when NGOs like the Environmental Defense Fund - or EDF - raise questions about data quality. We recognise the importance of such concerns. Aim 4 seeks to respond to these challenges by shifting from the current protocols towards greater use of measurement.

And we have been doing a lot of work on this since we set out our Aim in February.

First, we have systematically reviewed our methane inventory. And we have decided to apply Aim 4 to all operated upstream oil and gas sites which contribute towards our reported methane intensity.

Methane emissions from these Aim 4 sites contribute to around 98% of our reported methane emissions. It's worth pointing out that the other 2% - from operations such as refineries - are covered by Aim 1.

Second, we have developed a new 'measurement approach' to implement aim 4. We aim to have this in place at all relevant sites by 2023. We plan to publish this data which will help us to baseline our aim to halve our methane intensity.

Our measurement approach includes deploying continuous detection and quantification technologies. And we will test these - we are learning which of them will work best for our assets.

Importantly, our measurement approach also includes using technologies such as drones and satellite-based measurement to help validate our estimated or calculated emissions data. So we plan to deploy the right elements of our measurement approach for each site.

More information regarding our measurement approach can be found on bp.com.

Aim 4 and our new measurement approach represent a significant step forward. They shift our focus from the estimation and calculation on which current protocols largely depend to a much greater focus on measurement.

Third, as Giulia mentioned, we are announcing today that we are targeting 0.20% methane intensity by 2025 as determined by our new measurement approach. This is an important supplement to our Aim 4, because the 0.2% methane intensity target, we have had until now - and the 0.14% we reported for 2019 - have both been based on current protocols.

We are already in action detecting, monitoring and improving our measurement of methane emissions, and working to reduce them. And we continue to collaborate with a range of stakeholders such as EDF and the Oil & Gas Climate Initiative and to work under the Methane Guiding Principles.

Our newly established non-operating joint venture centre of excellence will support our efforts to influence methane management in our non-operated activities.

We have also been an active participant in contributing to the Oil and Gas Methane Partnership, or OGMP, version 2, which is all about enhancing reporting and methane emission reductions. I am delighted to say that this month we have signed up to this.

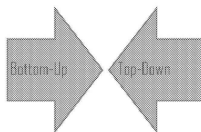
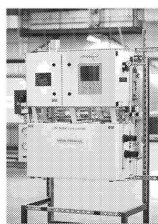
Finally, we are advocating for robust methane policies. We support the use of OGMP V2 to inform EU policies on performance

standards for natural gas. And we have made clear our opposition to rollback of federal methane regulation in the US. So I hope you will agree we have made tremendous progress but we have so much more to do. Thank you – now back to you, Giulia.

Technology Suite

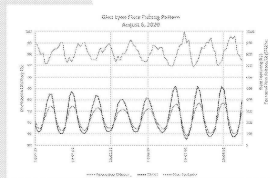
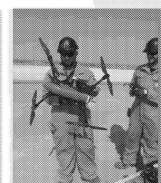
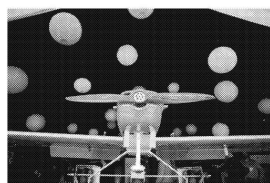


Bottom-Up: quantification of major sources (flares, exhausts) augmented with improved LDAR
 Top-Down: verification tailored to work both onshore and offshore using drone techniques
 Developing continuous measurement and satellite methodologies

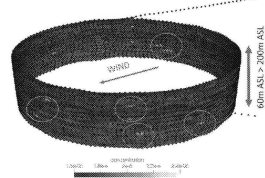


Data Management

Reconciliation



CONFIDENTIAL



P&O

Confidential

Back ups



CONFIDENTIAL

Confidential

P&O

bp Aim 4



" Aim 4 is to install methane measurement at all our existing major oil and gas processing sites by 2023, publish the data, and then drive a 50% reduction in methane intensity of our operations. And we will work to influence our joint ventures to set their own methane intensity targets of 0.2%"

*Reducing
Methane*

CONFIDENTIAL

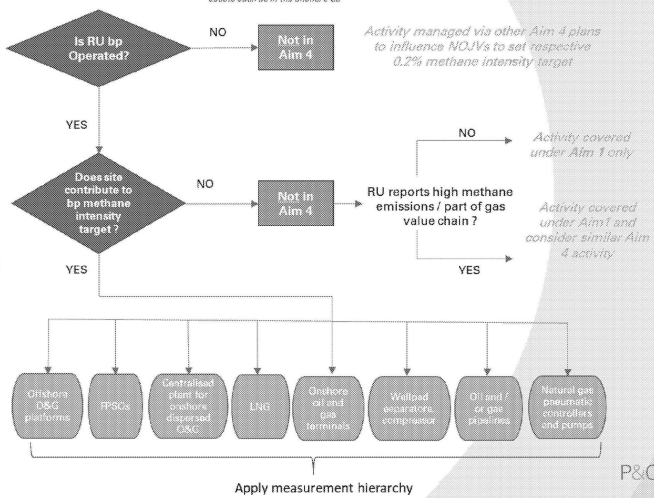
Confidential

P&O

- Broad definition of “major oil and gas processing site”
- Sites in scope of our methane intensity target
- Limits to upstream, operated sites
- Covers c.98% of total methane emissions
- Methane emissions outside of Aim 4 will be managed through Aim 1 e.g. in refineries, shipping

bp Reporting Unit (RU)

Reporting Units in bp are typically sites but could also reflect a logical grouping of assets such as in the onshore US



Measurement Hierarchy and Application



- **Hierarchy approach** for methane measurement covers range of methodologies including quantification:
 - reflects advancements in new technologies and potential to emerge;
 - recognises technical and commercial constraints
- Document rationale at each step of hierarchy;
- When appropriate tier is reached the technologies are applied and quantified data reported;
- Statistically representative periodic site level measurement will undertaken in conjunction with Tiers B – E

CONFIDENTIAL

Confidential

P&O

bp Methane Measurement Hierarchy

Hierarchy of Methane measurement	Measurement strategy	Example Technology solutions	Verification
TIER A ★ Continuous site or source(s) quantification where > 95% methane covered	Add quantification of fugitives, leaks and vents if needed plus everything in Tier B	Quantitative Hyper and Multi-spectral cameras* Quantitative sensor networks* Acoustic vent monitors Quantitative LDAR	May be included
TIER B ★ Continuous quantification at source level where 80-95% emissions covered	Fuel metering combined with continuous or validated predictive emissions monitoring High accuracy flare metering with validated continuous efficiency tracking	Continuous Emissions Monitoring (CEMS) Predictive Emissions Monitoring (PEMS) Ultrasonic meters to API14.10 FlareQ – predictive efficiency In-line gas analysers Measured flare destruction efficiency	Site Level Statistical Representative Methane Measurement in line with OGMP2.0 Level 5 Satellite* Aircraft Drone
TIER C ★ Continuous site level detection	Install High sensitivity monitoring	Permanently installed hyper and multi-spectral cameras Permanently installed high resolution sensors	
TIER D Source reporting methodologies in line with OGMP2.0 L4	Systemised metering and site observations	Infra-red gas imaging for LDAR Fuel and flare metering	
TIER E ★ Source reporting methodologies in line with OGMP2.0 L3	De minimis ^a methane emissions		



Methane SAT
Honeywell

Baker Hughes

Satellytics

hobré

PROVIDENCE PHOTONICS

CAUTION AEROSPACE



P&O

CONFIDENTIAL

^a de minimis defined in line with OGMP 2.0 Framework as not aggregated to more than 5% of the annual reported methane emissions

* Further development and validation required

Confidential

★ Determination of whether a specific technology should be used will be achieved by following a technical and commercial feasibility assessment

Baseline



- Baseline to be established based on data derived from implementation of hierarchy;
- Covers the period 2020 to 2023 inclusive;
- Sites included when bp has data from technology / improvements under Aim 4;
- Supports and encourages methane reduction efforts under Aim 1 and Aim 4 without creating an artificial timeline for starting;
- Continue to seek options to further improve as technology advances.

CONFIDENTIAL

Confidential

P&O

50% reduction in methane intensity



- After establishing baseline i.e. post 2023
- Reduce by 50%
- Set timeline for reduction once current performance using our measurement approach is fully understood

CONFIDENTIAL

Confidential

P&O

NOJVs



- Prioritise key NOJVs: ability to influence, emissions, complexity
- Increased reporting and transparency from all NOJV within 5 years (OGMP2.0)
- Workshops, best practice sharing, technology sharing
- Work underway to detail approach for 0.2% e.g. methodology, aggregated, timeline etc.

CONFIDENTIAL

Confidential

P&O

Partnerships



- **CCAC OGMP 2.0** – bp has signed up to the revised initiative
- **EDF-MOU** to work together to advance activity in key areas
- **MGP** – with bp leading on several actions (best practice guides and NOJV)
 - Advancing science (Stanford Global Methane Budget, Payne Institute)
 - Industry level methane intensity targets
 - GHGSat, Kairos Aerospace, Clarke Valves, SeekOps, Kelvin
- **OGCI** through Role of Gas workstream and OGCI Climate Investments
 - Advancing science (Stanford Global Methane Budget, Payne Institute)
 - Industry level methane intensity targets
 - GHGSat, Kairos Aerospace, Clarke Valves, SeekOps, Kelvin
- **CAMS** – including technology pilots
- **Environmental Partnership** – now >50 members
- **Princeton CMI** – to advance methane science

CONFIDENTIAL

OGMP = Oil and Gas Methane Partnership; OGCI = Oil and Gas Climate Initiative; MGP = Methane Guiding Principles; CAMS = Collaboratory to Advance Methane Science; CMI = Carbon Mitigation Initiative

P&O

Confidential

Data Transparency & Verification



- bp working on transparency and verification plans;
- Transparency plans guided by:
 - prepared to share results with broad range of trusted stakeholders
 - confidentiality via MOU
 - guide industry through learnings
- Verification plans guided by:
 - robust MRV
 - support for differentiated gas
 - policy developments
 - test what might be possible

CONFIDENTIAL

Confidential

P&O

Application of Hierarchy – Offshore example



Current Situation

Site reports methane through a combination of the following:

- generic emission factors e.g. gas turbine
- equipment specific emission factors e.g. compressor seals, combustion efficiency
- flare meters for measurement flow of gas to the flare*
- fuel gas (to gas turbines) meters
- engineering calculations e.g. glycol overheads, cold flaring events, process vents
- estimates e.g. leaks from joints, flanges, connectors

Aim 4 related enhancements

- Reduced measurement uncertainty on fuel and flare meters e.g. replace meters, re-siting meters, improved turndown, gas sampling / online chromatals etc.
- FLIR QL320 cameras (quantification) used to support LDAR programme
- Adjustments to site gas detection system to trigger alarms at lower gas (methane) concentrations
- Handheld MANTIS camera for quarterly assessment of flare burn efficiency.
- Top-down methane measurement campaign once per annum.
- PEMS system installed / upgrade to ensure optimal gas turbine combustion

For a typical offshore platform the flare will represent between 60 - 80% of the total reported methane.

bp has examples where the flare contribution will be much lower or higher

Example assumption:

85% of the annually reported methane (based on 2019) is now covered by measurement

CONFIDENTIAL

*the methane is calculated using the measured volume of gas, the gas composition and an assumed combustion efficiency

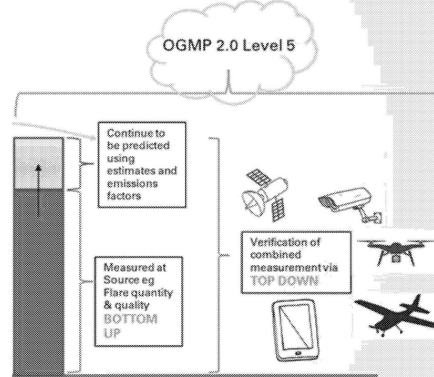
P&O

Application of Hierarchy – Offshore example cont.



Application of hierarchy

- Site assesses continuous site quantification (Tier A) - determines not technical or commercially viable. This is documented.
- Since measured methane sources only represent 85% of the total, site documents why additional source quantification is not viable with regards > 95%. This is documented
- Site meets Tier B threshold as > 80% of methane is continuously quantified.
- No requirement to further review the hierarchy but site-wide detection systems may cover Tier C.
- Annual top-down measurement plan meets the requirements to be statistically representative. The uncertainty analysis is sufficient to meet the requirements for reconciling the site reported data.



Aim 4

Site is Tier B with an acceptable site reconciliation programme
And measured data as per Tier B is used under Aim 4 baseline

CONFIDENTIAL

Confidential

P&O

Application of Hierarchy – Offshore example



Current Situation

Site reports methane through a combination of the following:

- EPA published emission factors (e.g. controllers, seals)
- Equipment specific factors (better than EPA)
- flare and fuel meters
- engineering calculations (glycol)
- Drone mounted DGI cameras for LDAR

Aim 4 related enhancements

- Site assesses continuous site-wide measurement technologies
- Site identifies suitable low cost continuous site-wide detection technology
- Engages with aircraft methane measurement (e.g. Kairos Aerospace) on a quarterly basis

CONFIDENTIAL

Confidential

P&O

Application of Hierarchy – Offshore example cont.



Application of hierarchy

- Site assesses continuous site quantification (Tier A) – not viable. Decision documented.
- Measured methane sources well below 80%:
 - Site documents why additional source quantification to > 95% is not viable. Not Tier A
 - Site documents why additional source quantification to > 80% is not viable. Not Tier B
- Technology review identifies a viable continuous detection solution and implements. This meets the requirements of Tier C
- Site current reporting already meets the Tier D requirement in the hierarchy
- Quarterly top-down measurement plan meets the requirements to be statistically representative. The uncertainty analysis is sufficient to meet the requirements for reconciling the site reported data.

Site is Tier C with an acceptable site reconciliation programme and continues to use existing reporting, as reconciled, as the basis for measured data for Aim 4 target

CONFIDENTIAL

Confidential

P&O

Example technologies under the Tiers



Example 1: bpx centralised processing facility

Application of hierarchy

- The site will need to assess and document that continuous site quantification (Tier A) is either not available or not economic.
- Metered methane sources (fuel, flare) only represent 20% of the total reported methane. The site does not meet the Tier B threshold and would document why additional source quantification is not practical
- The site-wide continuous detection proposal is reviewed and if solution is implemented then site would be Tier C. If not technically feasible or economically viable then site would move to Tier D, where it can show it meets those requirements.
- The site wide quarterly measurement plans meets the requirements to be statistically representative and the associated uncertainty analysis is sufficient to meet the requirements for reconciling the bpx site reported data.
- Summary: Site is Tier D with an acceptable site reconciliation programme. Site would be Tier C if the monitoring system is installed and effective

CONFIDENTIAL

Confidential

P&O