The attached document details the principal projects being managed within the group. Many of these projects are a core part of the Group's and Upstream's low-carbon and natural gas/methane business and advocacy strategies. Delivery is also heavily dependent upon the commitment of time and resources from the local businesses, notably including BPX, working in close coordination with the Group and Upstream. The importance of this team's role in providing coordination and ensuring alignment of priorities and activities across the piece should not be underestimated -- nor should time and resources required to perform this role.

Commented [SR1]: This document is very comprehensive and I think it could benefit from a shorter and more pointed cover memo that highlights key near-term focus areas and risks plus potential mitigations. I have taken a shot at listing out some of the key points that occur to me but you may have other or different ones. So this is just a starter for 10.

The following are some of the **highest-priority strategic focus areas and risks** requiring near-term attention and coordination by the team:

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- **Methane Leadership**

  BP has staked out a strong and somewhat distinctive external leadership position on *both* reducing methane emissions in its own operations *and* advocating for government policy/regulation and actions by other players to reduce such emissions across the industry. This position is reflected in and supported by a diverse, complex and deeply interrelated set of projects. BP has established substantial positive momentum in developing and beginning to deliver on these projects in 2019. This has enhanced BP's credibility and earned the respect of external stakeholders, which creates reputational and business opportunities. But it also has raised expectations for continued BP leadership in the future such that failure to meet these high expectations also poses risks.

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  To ensure a comprehensive and joined-up approach is taken to leverage the opportunities and mitigate the risks across the various projects, consideration should be given to the appointment of a dedicated SPA/project manager to oversee and support this work for the Upstream in coordination with the Group and the affected businesses and functions. This would ideally be an SLL with strong operational, project, and communication skills/experience along with organizational savvy. A strong interface and ongoing two-way communications with BPX are particularly important, as BPX is heavily involved in developing and implementing a striking number of these projects. Moreover, the US is currently a major focus of climate politics and of concerns about fugitive methane emissions (as well as flaring, notably in the Permian). Thus, it will be critical to devote time and attention to maintaining close ties and keeping BPX leadership and staff in the loop and working alongside them on all of these fronts.

  The key projects included in this bucket, many of which have looming deadlines for decision or action over the coming months, include the following:

  - The CCAC Oil & Gas Methane Partnership (page)
  - Methane Matters events (page)
  - Collaboratory to Advance Methane Science (CAMS) (led by BPX – page)
  - Methane Guiding Principles (page)
  - EDF MOU and other interactions (page)
  - Xpansiv (page)

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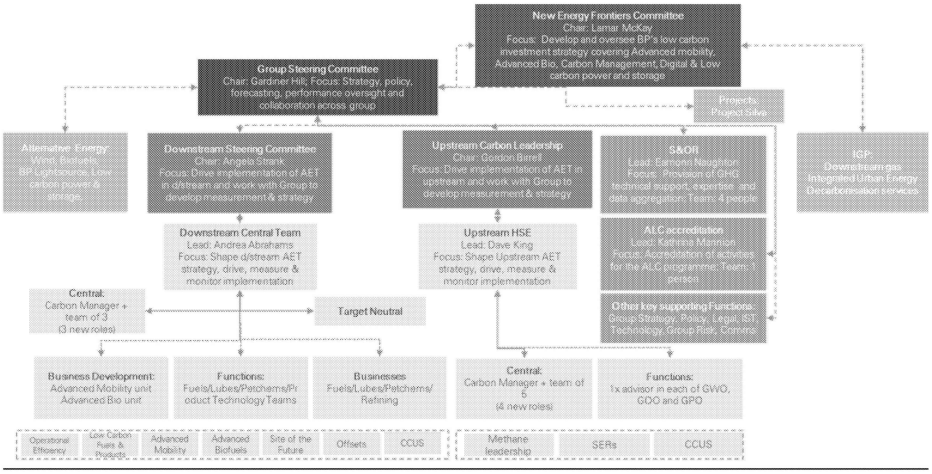
Carbon

Contact is **Karen RagoonananJalim**

How Carbon is Organised



Role of the Central Upstream Carbon Team

The Upstream Carbon Team is in service of embedding a low carbon culture within the Segment and continuous improvement of our low carbon and environmental data performance.

- We develop necessary and appropriate BP Practices, Guides and Standards and implement same throughout the Functions and Regions within the Segment.
- We are responsible for building technical competencies in the area of carbon and methane management through bespoke opportunities as well as in alignment with industry practices and standards.
- We provide strong support for the Upstream Low Carbon Communication Plan, helping to develop and execute key deliverables such as Carbon Workshops, Lunch and Learn sessions and presentation to Leadership teams.
- We lead the integration of key parties in delivering the Upstream contribution to the RIC Framework through active participation in the Group and GPO Carbon Steering Committee meetings, RP/HoF meetings, etc.
- We lead the planning and delivery of the weekly Upstream Carbon Coordination call, bi-weekly Upstream/BPX/BP America Carbon Coordination Call and the 6-weekly Upstream Carbon Steering Committee Meeting.
- In order to effectively execute our roles in these areas, we integrate very closely with the Carbon Teams within GOO, GWO and GPO/GCD as well as the Group Carbon Team, S&OR, Business Development, C&EA, Legal, Downstream, IST, and IGP.
- We work very closely with all the Regional Carbon Tags and RC&E and HSE Managers to support their Low Carbon delivery in Region.

Performance Management and Reporting

The Upstream has implemented quarterly reporting of key GHG-related metrics which requires a significant level of interaction with the Regions during verification.

Additionally (and increasingly common) there is the ad hoc request for “most recent” data, particularly on key GHG-related metrics from the Upstream or Group Executive offices.

The Upstream Carbon team leads co-ordination and review of all of the GHG and Environmental metrics submitted twice-yearly to Group via the current reporting platform (MI View), and also the quarterly submission of GHG data by GOO.

To ensure the GHG reporting process in the Regions are done accurately, a Self-Verification Protocol is being developed, aligned with Environmental Reporting Requirements and the e-training for GHG Reporting. The first draft is currently under development, adopting the same approach with the GOO Self-verification process. This will be reviewed by key relevant stakeholders and finalized by end 2019.

As SERs are part of the RIC framework targets and tied to the Annual Cash Bonus, there has been much attention given to these reductions. In order to avoid issues with different interpretations of SERs between Group, Segment and Regions, work has been ongoing to clarify the Group Reporting Guidance on SERs. Additionally, it has become clear that there are other forms of reductions (e.g. prevented emissions from project design) that should be captured in some way. S&OR are leading an updated guidance on Emissions Reductions and strong technical input continues to be required from this team.

The current reporting platform, MI View, is outdated and urgently in need of replacement – see below. There is a risk that major system issues significantly impact on reporting.

Corporate Sustainability Data Management (OneCSR)

The current reporting system (MI View) has become outdated and some features are no longer supported in modern platforms. For this reason, S&OR has been leading a project over several years to identify~~ing~~ a suitable replacement to MI view; now called OneCSR (previously CSDM).

This has required extensive input from the Upstream Carbon Team to the project team to ensure they understand the current system and what features must be present for the new system to meet our current and future reporting needs. Continued SME involvement is required as we have identified several issues with the new system that need resolving.

The Upstream Carbon Team has provided SME support to the project since it commenced in ca. 2016. Whilst the Team fully support the project, at times it has been necessary to challenge the project and speak-up on serious issues and concerns. Nevertheless, the Team has a good working relationship with the S&OR delivery team.

The project identified a vendor and platform for delivery in 1Q 2019 – ThinkStep's 'SoFi' system. Since then significant work has been undertaken, with Upstream SME involvement, to configure the system for BP's needs and run two pilot submissions.

Following the first pilot (June 2019) Upstream, and others involved e.g. S&OR Performance, IT&S, pushed back on the originally planned full-deployment for 2019 reporting as the system was not ready. Improvements have been made since then but it is generally acknowledged that the system is still not ready for full deployment and significant work will be required in 2020 to implement necessary improvements.

It is anticipated that ongoing development and deployment of OneCSR will be a significant pull on Upstream resource in 2020 (both the central team and Regional representatives).

There remain some significant issues with the system as currently configured – and there is a risk that if these cannot be satisfactorily resolved the system will not meet BP's requirements and a decision on how / whether to proceed with it will need to be made – this is seen as a low likelihood but high consequence risk.

2019 Performance (to end 3Q)

- Upstream was able to deliver 987.5 kte SERs YTD in 2019, with 910.1 kte of this delivered by GOO. A further 67.9 kte SER forecast to be delivered by GOO during the remainder of the year, putting it on track to deliver 1.1 MteCO2 of cumulative SER by end of 2019.

- Upstream has now delivered **3.06 million tonnes of SERs** since the beginning of 2016 - achieving our 2025 target 6 years early.

- Significant SER delivered to-date include:
    - Angola Block 18 flaring reduction (1.5Mte)

- Replacement of gas compressors with electric drive in Alaska (~0.2Mte)
- 'Green Completions' and reduced well clean-up flaring in Oman (~0.1Mte)
- Methane reductions in BPX Energy (~0.1Mte)

- New SERs delivered in 3Q included:
  - ACG Phase 2 flare pilot replacement project in AGT completed. These pilots are more energy efficient, with less fuel gas demand.
  - Replacement of fuel gas flow indicators with flow transmitters at Central Azeri.
  - Gas Turbine Generators shutdown, using hoses to transport water instead of water trucks and waste skip trucks changed to compactor trucks in Oman.

- At the end of 3Q 2019, GOO Operated Methane Intensity is 0.04% and GOO Flaring Intensity is 1.1 te/mboe.

- BPX will provide 72.3 kte SERs in 2019.

- Based on the current projection, the GHG emissions forecast for full year 2019 could reach 0.3 Mte above the 2015 baseline, subject to BPX divestment.

- Although the current projection of full year 2019 GHG emissions is above the 2015 baseline, with the "carry forward" of the 2018 1.0Mte below 2015 baseline, the overall Upstream forecast is still expected to be below 2015 baseline by end 2019.

- Work ongoing to understand the impact of the Alaska divestment on Zero Net Growth.

- The three Upstream Low Carbon Project teams presented their findings to the UET in September 2019. These findings are currently being considered as an input into the BP Group Low Carbon Ambition and Strategy.

<u>Upstream Carbon Steering Committee</u>

Upstream Carbon Steering Committee Meetings are conducted approximately once every 6 weeks. The Upstream Carbon Team is responsible for determining and agreeing the agenda for this meeting and preparation of the Upstream Context and Pre-read. A significant input into these meetings include a status update of the actions on the Carbon Roadmap and Methane Leadership Plans which requires us to integrate across the Segment for these updates.

<u>Other Carbon Meetings</u>

- We provide the Upstream Context into the **Group Carbon Steering Committee**
- We coordinate and facilitate the weekly **Upstream Carbon Coordination call** between Upstream, S&OR, Legal, Group Technology, Group Carbon and Strategy Teams and Group Communication.

- We lead the coordination and facilitation of the weekly **Upstream/BPX/BP America bi-weekly Carbon Coordination call**.

Upstream Carbon Roadmap

All actions on the Carbon Roadmap are **complete**

Upstream Methane Leadership Plan

The status of the Methane Leadership Plan actions is:

Action Owner	Open Actions	Due in 2019	Due in 2020
Gordon Birrell	0	0	0
David O'Connor/ Richard Mortimer	3	3	0
Andy Collins	12	9	3
David Lawler	0	0	0
Morag Watson	0	0	0
Ahmed Hashmi	0	0	0
Dominic Emery	0	0	0
Rachel Woods	5	0	5
Mary Streett	2	2	0
Steve Shaw	2	2	0
Dave King	4	4	0
Total	**28**	**20**	**8**

Status of the 4 (four) **Dave King actions**:

Action 3.2: Develop Segment Flaring Practice to further enhance flaring performance in the regions (30/6/19)

- In progress - to be embedded with Upstream Carbon Guide and Practice.

Action 13.5: Develop Upstream specific methane eLearning package covering methane sources and how they're managed (31/12/19)

- In progress - will be addressed through the MGP Executives / Masterclass Training delivery that SGI / Imperial College are delivering as part of the MGPs Tool Kit.

Action 14.3: Develop and implement plan for SLL/ Executive education programme (31/12/19)

- In progress - will be addressed through the MGP Executives / Masterclass Training delivery that SGI / Imperial College are delivering as part of the MGPs Tool Kit.

Action 14.5: Develop and implement 'zero methane emissions mindset' for L48 leaders (31/12/19)

- SPA: Dave Lawler SPR: Kola Fagbayi
- In progress - communications ongoing to build the zero-methane mindset in BPX

Codification of Carbon into OMS

Work is already progressing in the Upstream HSE Team to codify how we will manage carbon in our Operating Management System (OMS) and our supporting business processes by the end of 2019, this includes:

- A new OMS sub element has been drafted and issued for comment and consultation. S&OR is now leading the process to complete and embed this new sub element. It is likely this could be subsumed into a refreshed OMS 6.2 (Energy Efficiency)
- The Upstream Carbon Guide, which is a signposting document to other practices has been drafted and will be issued imminently.
- The Upstream Carbon Practice is currently in draft.

Leadership in Methane and Group Strategy

In 2018 we set an industry-leading methane intensity target of 0.2% and we are currently achieving this.

In September 2019 we publicly committed to deploying continuous methane measurement on all new future major projects. This was seen as an industry first.

Group are developing a refreshed Low Carbon Ambition, to be supported by revised Reduce-Improve-Create targets and also preparing a response to the Climate Action 100+ Shareholder Resolution in the form of a Flexibility & Agility report. This work is being led by Gardiner Hill's team.

This was originally planned for 'launch' at an Investor Day in November but has been delayed to 1Q 2020 following the CEO announcement.

There remains some uncertainty about the timings for the refreshed Group Ambition.

The carbon intensity of energy products could represent a significant additional data gathering / analysis exercise – although it is anticipated most of this burden will fall on S&OR / Group Carbon teams as the data is largely the same as already collected for Sustainability / Financial Reporting.

Asset Energy Studies

These reviews are done in conjunction with ITPe for their expertise in this area and in BP operations. The goal is to evaluate a set of assets to identify opportunities for improvements, some of which could result in SERs. As these are completed, we are working in conjunction with GOO Engineering and UEC to distill common themes and potential

projects which can result in significant SERs. These will be collated into a project plan for execution within GOO, possibly with support from the Upstream $100M Carbon Fund.

14 studies completed between North Sea, Angola, GoM (NaKika) and AGT between 2013 to present, with further studies planned in AGT (BTC Pipeline Q4 2019) and Trinidad (Beachfield, Q1 2020).

Outstanding assets will be GoM (Thunder Horse, Atlantis, Mad Dog), Trinidad Offshore assets and new assets such as Oman and Shah Deniz 2

To date there has been ineffective use of the data gathered during energy reviews, some opportunities being missed, lessons learnt not shared among comparable facilities in different regions.

Output from the Asset Energy Reviews needs to be owned by the GOO M&E Team

Upstream Emission Reduction (UERs) Projects

The Upstream has been working with IST on the delivery of UERs projects to qualify for credit under the EU Fuels Directive. This was done on an ad hoc basis until a formal engagement in July 2019 between Upstream, Downstream, IST and GEP. Since then, Rob O'Brien has been appointed as the SPA to formally work with IST and GEP to:

- Understand the UER definition and alignment with existing BP definitions;
- Review Regional and Functional Plans to identify potential UER opportunities,
- Develop the process for identifying and progressing future UERs within Upstream.

In progressing this work, there have been significant learnings emanating from these follow up meetings, including the issue of "materiality" of the intervention that lead to the SER.

Shortlisted projects include:

- Angola Block 18 flaring reductions
- West Nile Delta solar plant
- Russia NOJV flare reductions
- Methane technology deployment for advanced leak detection and repair (AGT as test case with potential expansion to other Regions)

Identifying potential UERs within the Upstream continues to be challenging – the UER requirements are stringent, requiring demonstration of 'additionality' (i.e. the reduction would not have happened without additional investment which did not otherwise make financial sense, or driven by regulatory requirements).

'Classic' UER type projects involve things like switching from flaring of associated gas to export to market, and we typically do not have these sorts of emission sources within our portfolio.

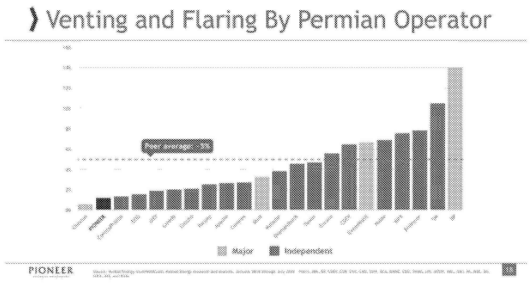
Although the projects listed above look to have the most potential for UER credits from the extensive list evaluated, there is still a real possibility that the Upstream will not be able to deliver any UERs.

Reducing flaring

- Flaring in GOO has reduced by around 30% since 2015 – largely due to action taken to reduce flaring in Angola, AGT and Tangguh.
- We have committed to eliminating routine flaring and have endorsed the World Bank Zero Routine Flaring by 2030 initiative.
- We were a founding member of the Global Gas Flaring Reduction Partnership (GGFR):
- GGFR works to increase the use of natural gas associated with oil production by helping to remove technical and regulatory barriers to flaring reduction.

BPX - Flaring in the Permian

Contact is **Faye Gerard**



It has been published that BP is the highest percentage flaring company in the Permian.

We have small production volumes in Permian today from the legacy BHP assets. The flaring is expressed as a percentage, so when our few wells get backed out of 3rd party facilities and go to flare it makes it a big percentage.

We are starting the design/installation of low flaring/low emissions BP facilities in the Permian so our percentage should come down rapidly.

Dave Lawler will provide an investment versus volume versus time chart so can see the pace of reduction, based on;

- BP is investing in centralized facilities that will include electrified central oil, gas, and water handling equipment eliminating flash gas, a large source of flaring. The first centralized facility is expected to go online in the first half of 2020.
- BP will not put a new well online in the Permian unless the wells have access to a gas pipeline.

$100M Carbon Fund

Contact is **Rob O'Brien**

The Upstream $100M Low carbon Fund was launched on 26th March 2019 (FM signed by Bernard Looney, CEO Upstream) as an incentive to catalyze the delivery of Sustainable Emissions Reductions (SERs) in Regions. The Fund is managed per BP Guide 100629. The scope of the fund is BP Operated Scope 1 (Direct) GHG emissions – as per the scope of our externally stated ambition of Zero Net Growth in Operational GHG Emissions to 2025.

Ideas are submitted into the Upstream Low Carbon challenge in cMore and reviewed on a 6-weekly basis by a cross-Functional team comprising GOO, GWO, GPO, UEC, IST and AE.

Projects recommended for funding are submitted to:

- VP Upstream HSE, for funding up to $1.0M
- Gordon Birrell for funding >$1.0M

By end of October 2019, around 95 (ninety-five) ideas were submitted in cMore from across the Upstream and 13 ideas were approved for funding.

A commitment has been made to expand the Fund to include Downstream and OB&C. Discussions have started with Downstream on the mechanism for expanding the fund. -

Entries to the Fund have slowed in recent months and a renewed effort is required to promote the Fund across Upstream and support those with ideas to enter. Work is underway to review the Energy Studies completed across many Upstream assets over the last few years to identify common themes to be progressed across GOO, with Carbon Funding as required.

The extension to Downstream and OB&C is a positive step, but work has only just begun to understand and overcome the financial control barriers to doing so – it will likely be dependent on the Segment CEOs (or equivalent) approving separate FMs for Downstream and OB&C as was the case for Upstream.

No.	Location	Title	Cost ($)	Potential SER ($kteCO_2e$)	Cost of Reduction ($/te)
1	AGT – Sangachal Terminal	Installation of line from DPCU Stabilizer Feed Drum to Fuel Gas System – ON HOLD	$500k - $1m	10 – 25	20 – 100
2	Trinidad – Beachfield	Gas Cloud Imaging for Methane Intensity Management at Beachfield	$10k - $100k	-	-
3	AsPac - Tangguh	APC (Advance Process Control) for flaring and 3% Reduction of Regeneration Gas Flowrate	$100k - $500k	10 – 25	4 – 50
4	Angola - PSVM	PSVM Power Supply Reliability Improvement (GT 1 Replacement)	$1.5m - $2m	100 – 200	7.5 – 20
5	Angola - PSVM	PSVM LPGC Sparing Strategy	$1.5m - $2m	100 – 200	7.5 – 20
6	AGT – Sangachal Terminal	Sangachal Terminal Solar Power Plant	$500k - $1m	25 – 50	10 – 40
7	North Sea - Foinaven	Recommission 2nd stage separator gas ejectors and flare gas recovery system	$1.5m - $2m	50 – 100	15 – 40
8	North Sea – Clair Phase 1	Viability assessment of the incumbent Clair VRU to determine capability for reliable restart	$100k - $500k	-	-
9	North Sea – Andrew	Screening Studies to appraise, select and recommend Andrew Energy Saving Opportunities	$10k - $100k	-	-
10	AGT	Methane monitoring technology	$10k - $100k	-	-
11	AsPac - Tangguh	Continuous Fixed Methane Monitoring for Tangguh	$10k - $100k	-	-
12	BPX Energy	Optimizing leak detection verification and repairs in BPX Energy using hand held infrared cameras	$500k - $1m	50 – 100	5 – 20
13	West Nile Delta	WND Solar Project	>$5M	10 – 25	200 – 500
		Total	$11m - $15m	300 - 600	25 - 35

Including Carbon in Risk Matrices

Contact is **Bruce Price**

Gordon Birrell has asked Bruce Price to look at how we may want to prioritise SER activity in engineering and operational plans, including potentially changing the risk matrices to include carbon. Summary of proposed way forward by Bruce:

- Prioritising GOO SER activity via EQ's and the adoption of SER creaming curves. Ultimately this will be built into our workflows, but we will be using spreadsheets in 2020.
- Run a short (2-4 week) pilot using real North Sea data to see if this unlocks stuck projects.
- Develop a spreadsheet template to capture regional SER ideas – this will then allow us to generate GOO creaming curves and provide insights at your level as needed. We are ready to issue this to the regions but agreed to complete the short pilot in the NS first.

While the risk matric approach is probably too course for project prioritisation, there is a belief that including Carbon in our risk matrices will reinforce the importance of carbon management in our operations and broader decision making.

Bruce Price has an action to see how we can better integrate with the other functions on SERs. Once we have proven the concept of creaming curves, we need to define how this could work cross functionally, linking in Finance, RD, GOO and GWO for brownfield SERs prioritisation. GPO has its own approach for greenfield projects which is working well.

2020 Planning

In 2020, Upstream will:

- Embed Low Carbon into our Operating Management System and Ways of Working
    - Continue to provide strong support for the development, issue and prioritization of a stand-alone Low Carbon sub-element in OMS.
    - Develop an implementation plan for the segment for the Upstream Low Carbon Guide and the Upstream Low Carbon Practice, in support of OMS 6.2 (revised to Low Carbon) and GDP 3.6-0002

- Participate in the development of refreshed RIC metrics, KPIs and targets commensurate with BP's Low Carbon ambition and strategy.

- Plan and deliver and Upstream Leadership Low Carbon Workshop to:
    - Determine Upstream Strategy to deliver new Low Carbon ambition
    - Refresh Methane Leadership Plan and Carbon Leadership Plan into a new Low Carbon Leadership Plan for multi-year delivery

- Continue to lead the administration of the $100M Low Carbon Fund, now expanded to include Downstream and OB&C.

- Continue to lead the deployment of methane detection, monitoring and measurement in Regions

- Continue to eliminate routine flaring per BP's commitment to the World Bank Zero Routine Flaring by 2030 initiative through re-issue of BP Guide 100533

- Support the development of a global portfolio of CCUS, including:
    - UK Clean Energy Park (Teesside & Humberside): BP leading project delivery;
    - Tangguh feasibility studies
    - Support evaluations for Mauritania & Senegal, Trinidad, Australia (Browse) and Canada (Kirby OBO)

- Launch Low Carbon Influencers Network in 1Q 2020 with Gordon Birrell as the Executive Sponsor.

- Continue collaboration with Environmental Defense Fund (EDF)

    - NOJV Methane Workshop under the auspices of the Methane Guiding Principles and develop action plan
    - Work with EDF, and others, on the development of a rigorous Global Environmental Standard for the certification of differentiated low methane emission gas

- Scale up of the Xpansiv platform

- Host an MGP Outreach event

<u>2020 Targets</u>

The 2020 SER Target for Upstream is **255 kTeCO2e**

Region	2020 SER, ktCO2e
North Sea	23
AGT	19
Angola	51
Oman	62
BPX	100
Total	***255***

GOO

- Bruce Price has reviewed every line item with the regional M&E managers for technical readiness and deliverability. High confidence the SER activities are underpinned.

- Removed scopes that are not ready or have been delayed by TAR movement or delivery risk.

- This results in a revised GOO SER Target of **120kTeCO2e for 2020**. This is down 98 kTeCO2e from the original submission. The detailed changes are captured in the workbook in the electronic handover file.
- The Galeota expansion Project has not been included in the above numbers. The team are looking into this to understand the most likely start-up timing. This is estimated in the region of 10-25 KTeCO2e for 2020. This will need further work with GPO and the region to define.
- Although not fully worked, there is line of sight to additional SER activity in GOO.
    - The North Sea have options for an additional ~25 kTeCO2e
    - Angola are working options up to ~40 KTeCO2e.
    - There is also likely some upside in GoM as they don't have any submissions in the above numbers.

GWO

- The plan includes **35 kTeCO2e** from Green completions in Oman. The region support this and confirmed this was underpinned by planned activity.

BPX

- Kola Fagbayi has confirmed BPX's 2020 SER target is **100 kTeCO2e**. Details below.

Project	2020 SERs CO2e tonnes
WBU Treating Site equipment and wellhead compressor removals	69,740
ex-BHP LDAR	13,437
PBU Solar methanol pumps	784
PBU Pipelines instead of trucking produced water	737
PBU Electrification	17,560
SoHa Compressor optimization	816
TOTAL	**103,074**

GHG forecast re-built using 2QPF 2019 data - trajectory is for significant growth through the mid-2020s driven by the start-up of the major projects.

While Upstream will deliver its Sustainable Emissions Reduction target ahead of the 2025 target, it is off-track for delivering Zero Net Growth without offsets by 2025.

<u>Environmental Data Domain improvement</u>

There is an extensive amount of environment data (environmental sensitivity, monitoring data, performance data, etc) acquired at different points along the Upstream value chain in support of BP activities, from exploration and projects through to operations and

decommissioning. Collection and analysis of environmental data forms an essential component of conformance with BP internal requirements (e.g. GDP 3.6-0001, corporate HSE reporting) and international standards (i.e. ISO 14001), as well as compliance with increasing external legal and regulatory requirements.

The aim of the Environmental Data Domain improvement project is to standardise the way Environment data is acquired, stored and delivered, ensuring contract terms are globally consistent and that data is delivered to BP in a standardized format. This work will ensure that data of a known quality can be consistently collected, easily loaded and made available in the Upstream Systems of Record.

Status

- There is Upstream Environmental Data Domain proposal document created covering existing situation and suggesting the way forward.
- At the moment, opportunities to integrate environmental data in existing corporate data storage and visualization platforms (as OneCSR, OneMap, Sharepoint, PowerBI, Upstream Data Lake), are being investigated. Contacts established with Upstream Digital Organization.

A large variety and volume of available carbon and environmental data across the Upstream and lack of consistency among data formats, makes it difficult to ensure consistency and extract a value from the data and ensure it is accessible.

External Carbon Initiatives

Climate and Clean Air (CCAC) – Oil and Gas Methane Partnership

Launched in September 2014 with the aim of supporting oil and gas companies to identify and reduce methane emissions cost effectively.

- Executive Sponsor – Dave King
- Steering Committee Representative – Liz Rogers
- Technical Working Group – Alejandro Castano
- Reporting Task Force – Ismayil Jabiyev and Rob O'Brien

The Climate and Clean Air Coalition Oil and Gas Methane Partnership (CCAC OGMP) was launched in 2014 with an aim to provide oil companies with "a credible mechanism to systematically and responsibly address their methane emissions…."

BP has been a member since 2015, and we have progressively added operating regions over the past 3 years.

Progress within OGMP has been limited with no expansion in participation and no material methane reductions reported – in part related to the focus on 'core methane sources', many of which are predominantly used in US onshore operations.

Recent changes in the chairmanship of the OGMP (with the EU Commission becoming a co-chair) has led to an increased urgency for meaningful progress. The intent is to transition OGMP to an initiative that provides a benchmark for best-in-class methane management performance for signatories.

In summary, the key proposed changes are:

- Inclusion of all operated methane emissions, reported by source, within 3 years (previously signatories were able to determine the scope and timeframe for inclusion);
  - Inclusion of all BP operated assets would bring BPX into scope
  - Previously, BPX has elected not to participate in OGMP opting to join API's Environmental Partnership.
  - If BPX do not agree to participation in OGMP then BP would not be able to continue to be a member.
- Inclusion of NOJV methane emissions on a 100% basis (not equity share);
- Declaring targets, either methane reduction (at least 45%) or near-zero intensity target (currently defined as 0.25%)
- Assessment of reporting uncertainty and reconciliation with alternate techniques (e.g. top-down measurements) – and demonstration of improvement over time.

This represents a significant change in the scope and intent of OGMP, and current participants would need to re-sign to the revised initiative, and a decision on whether to join is **required by w/c 16th December**

A briefing note (in electronic handover file) that has been prepared for Bernard and Lamar on this issue, and I have written to David Lawler and Kola Fagbayi to test their views on whether BPX would be willing to be part of OGMP.

Commented [SR2]: Could you share this briefing note for background?

Contact is **Sonna** (Muhunthan Sathiamoorthy) in Group S&OR.

Global Gas Flaring Reduction (GGFR) Partnership

This partnership was launched in 2002 and aimed at increased use of natural gas associated with oil production by helping to remove technical and regulatory barriers to reduce flaring, conduct research, disseminate best practices and support the development of country specific gas flaring reduction programs.

- Executive Sponsor – Dave King
- Steering Committee Representative – Karen Ragoonanan-Jalim
- Technical Working Group – Alejandra Castano, Doog Wright
- Utilisation of Associated Gas Task Force - Boris Ertl

A new 3-year amendment has just been signed 2019-2021. Membership is $200k/year and is paid from the Upstream HSE budget. Procurement is managed via Backbone. There are ongoing issues getting this PO set up between BP and World Bank.

GGFR is becoming more strategic:

- Shift in focus to Monetising Associate Gas
  - Policy, financial instruments, regulatory, infrastructure and market support to governments and other stakeholders for monetising AG
  - In-Country support for capacity building to monetise associate gas
  - New Task Force on Financial Instruments to be set up

- Shift towards acting as Technology a Clearing House:
  - LNG, GTL, Gas to methanol, adsorbed Nat Gas
  - Task Force for small scale technology for utilisation of associated gas established
- Linking more to NDCs
- Including Black Carbon in remit
- Satellite measurement of flaring is ongoing including reporting on website
- Biggest issue: GGFR can only influence partners to GGFR. There is no leverage on non-partners

BP Iraq and SOCAR/AGT are the 2 BP Regions that have had the most recent engagement with World Bank GGFR, both with strong outcomes.

World Bank Zero Routine Flaring by 2030

Multi-stakeholder initiative launched in April 2015 to eliminate routine flaring from oil producing assets.

- Executive Sponsor – Dave King
- Steering Committee Representative – Karen Ragoonanan-Jalim
- Technical Working Group – Ismayil Jabiyev

As of June 2019, BP now includes all its oil assets into reporting commitments under the GGFR.

The Zero Routine Flaring network does not have its own formal Technical Working Group, or a Steering Group and discussions are interchanged within GGFR even though the ZRF is a separate initiative. There has been a strong request by GGFR members to keep ZRF separate to GGFR since the membership is different for both.

The extent of the routine flaring is not fully quantified with S&OR due to lack of clarity on the definition of what is "routine flaring." BP guide (100533) provides interpretation and adaptation of the WB definitions, and some regions are still in the process of assessing whether they are have any flaring reportable as routine. Level of detail in how flaring events are classified across Regions is also inconsistent.

Strong recommendation that GOO manage implementation of the Zero Routine Flaring Plan in GOO (via Carbon Manager).

Methane Matters - Brussels

Methane Matters events were run in London, Washington DC and China and Brussels during 2019. They were aimed at engaging external stakeholders on what they saw as the key issues we needed to work on as a leader in methane.

Rutger Huijgens (Brussels – Direct European Government Affairs) want to run a series of workshops in 2020 to provide input into the Commission's next set of gas regulations.

Contact is **Sue Ford**

The Collaboratory to Advance Methane Science (CAMS)

CAMS is an industry-led collaborative research consortium Members comprise BP, Cheniere, Chevron, Equinor, ExxonMobil, Pioneer Natural Resources and SIEP, Inc. (Shell). Dan Zimmerle (Equivalency model project) is part of CAMS and there is cross-over between the initiatives regarding methane leak detection.

BP Leads are Kola Fagbayi and ~~is~~ **Faye Gerard** (BPX)**.**

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Methane Guiding Principles

See separate section in this handover.

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- The MoU is based upon the methane guiding principles and designed to be a mechanism that turns commitments in to tangible actions.
- To underpin the relationship, BP has committed to $2M of shared activity.
- The MoU was signed on 12 March 2019~~98~~ by Bernard Looney and Fred Krupp (at CERA week) and lasts for three years
- No money can be paid directly to EDF – therefore all shared activities need to include a third-party, including research organisations and workshop organisers.

EDF MoU – Steering Committee (SC)

- Convenes monthly by telephone to track progress on projects and proposals. SC members:
  - VP Upstream HSE
  - Bob Stout – VP and Head of US Policy, ~~regulatory Affairs~~ BP America C&EA
  - Ben Ratner – EDF
  - Peter Evans (BP), Nuno Alves (BP America C&EA) and Isabel Mogstad (EDF) normally also attend.

EDF MoU - Projects

There are three agreed projects progressing under the MoU between BP and EDF

Project 1 - Equivalency Model

- A statistical tool for onshore use that assesses the ability of different measurement and monitoring campaigns to manage methane emissions (for example, is it better to identify one super-emitter rapidly through the use of aircraft compared to finding it as part of a scheduled programme of site visits). Builds upon a pre-existing model (FEAST) developed by CSU. The end product will be an open-source code open for use by oil companies and regulators.

- BP Lead – Peter Evans and Raj Bose (Upstream Technology) with support from Nuno Alves

- EDF Lead – David Lyon, Isabel Mogstad

- Contract signed by Upstream HSE with $82,500 in 2019 and **$82,500 in 2020** (budgeted)

- Research conducted by Colorado State University (Dan Zimmerle), with start date of December 2019 and a 12-month duration. Exxon Mobil and Chevron have both committed $150k to the project with EDF putting $50k of their own funds in to the programme.

- Forward Plan
  - Next meeting – to develop detailed work programme will be in the US in January with Peter Evans and Raj Bose in attendance.
  - First model output due for completion Q2 2020

Project 2 - NOJV Workshop

- EDF and BP will co-host a workshop in 1Q 2020, facilitated by consultants (Water Street Partners) with jointly selected oil and gas companies to increase understanding about joint ventures, learn from others in industry about their practices for reducing emissions at non-operated assets, and identify potential opportunities to expand the coverage of methane efforts and commitments. The cost of the workshop is **$150k** (budgeted)

- BP Lead – Sue Ford

- EDF Lead – Isabel Mogstad

- This workshop is foundation-setting for further engagement on NOJV methane influencing with joint venture partners beyond 2020. The information and learnings derived from this workshop will help to inform a strategic plan for subsequent years.

Project 3 - Digital Methane

- In early 2019 EDF produced a white paper on the role that digital technologies will play in reducing methane emissions – these include both hardware (sensors) and data management platforms. The thinking is closely aligned with BPs internal methane technology strategy. The intent is to identify an area of collaboration that will extend this thinking for the benefit of the wider industry. Proposal is in development - the commitment was to agree scope of work by end of 2019.

- BP lead – Peter Evans

- EDF Lead – Isabel Mogstad

- Forward Plan
  - The National Physical Laboratory (UK) has developed a scope of work around 'High Frequency Monitoring' that would develop standards for continuous observation systems such as the gas Cloud Imaging cameras in deployment by BP.
  - This would be a major project, possibly leading to design of an offshore equivalent of the METEC and TADI test facilities used for onshore scenarios.

Other interactions with EDF

- **EDF 'Moonshot' Ideas -** In August 2019 EDF organised a workshop with BP, Exxon, XTO and Shell (and the National Physical Laboratory, UK) to explore big ideas that could be a game changer in methane. Two concepts arose, both of which are still in the concept stage:
    - Shared sensor networks onshore
    - Shared data sharing between adjacent block operators – offshore

- **OGCI -CCAC studies -** University led research, funded by OGCI and delivered through the CCAC with input from EDF to characterise emissions from different territories. Early phase research was hampered by lack of interaction between research groups and operators, leading to unrealistic interpretations of data. Second generation studies will need greater involvement from OGCI members. Peter Evans will be meeting with his EDF counterpart in Q4 to continue to discuss planning and is in discussion with the affected regions to understand how best to engage. BP leads are **Peter Evans, Sonna** (Muhunthanan Sathiamoorthy).

- **CSU Field Testing** - BP and EDF both submitted letters of support to a Colorado State proposal for funding to the US Department of Energy for funding to extend field testing of leak detection technologies. Output from this work could help populate the equivalency model

- **Permian Methane Campaign** – EDF are concerned about the level of flaring in the Permian Basins and our participation in this following the acquisition of the BHP assets. We have assured Ben Ratner that BPX are working to address the issue. EDF are keen to have BP participate to whatever extent we can in the core users group for their Permian emissions monitoring/reporting campaign. If we want to continue building and managing our relationship with EDF more proactively, in addition to joining their core users group, we might consider providing an overview of what we are doing to reduce flaring. As they talk to others in EDF – or even answer questions from the media or other stakeholders – this could arm them with a positive story about how BP is getting at the problem. Ultimately, it also could help set the stage for a successful discussion when Bernard talks to Fred Krupp as part of his transition outreach plan over the months ahead. It seems quite likely that Permian flaring (along with methane and perhaps other issues)will come up in those discussions.

  On 8/11/19, BP formally told EDF we have agreed in principle to join the Core Users' group for the Permian Methane Campaign, subject to establishing a bilateral NDA with EDF. Contact is **Kola Fagbayi** in BPX and **Nuno Alves** in BP America

- **Methane Leadership in Operations**: Ben Ratner has expressed concerns about whether the leadership on methane emissions reflected in the Methane Guiding Principles (MGP) discussions was being communicated and reflected in the line operations of MGP member companies. However, Ben Ratner has said they had seen first-hand from the site visit that we gave them to SoHa in June 2019 that this was happening at BPX.

However, Ben has stated that on another field visit that EDF did with an unnamed major MGP member company they found that the operations personnel had no awareness of the MGP commitments etc.

- Redacted - First Amendment

- Redacted - First Amendment

BP leads on this topic are **Sue Ford and James Samuel** from BP Legal (who will serve as BP's delegate at the 15th January Workshop)

- **Global Methane Alliance:** EDF and UN Environment are co-sponsoring a programme that encourages governments to set ambitious in-country targets to significantly cut methane emissions, with a target reduction of 45% by 2025 compared to 2012 levels. They are asking major oil and gas companies to work with governments with whom they have relationships to progress these targets.

  We are being asked to influence the governments of Angola, Senegal, Mauritania and Indonesia. So far only Senegal have shown interest in engaging – which has been done by Gaelle Baldelli in the Tortue Project.

  Nuno Alves, BP America senior business and technical advisor, participated in the Global Methane Alliance forum in November in Cote d'Ivoire. Nigeria and Cote d'Ivoire are the only countries that have signed on to the Global Methane Alliance.

  Clair Fitzpatrick (or delegate) had planned to attend the South America event in Lima (which included the Caribbean) but BP withdrew due to the event being held in Spanish. We will determine our attendance at future workshops when dates are confirmed.

  Contact is **Sue Ford**

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Methane Guiding Principles

Contact is **Sue Ford**

Launched in November 2017, the Methane Guiding Principles are to:

1. continually reduce methane emissions
2. advance strong performance across gas value chains
3. improve accuracy of methane emissions data,
4. advocate sound policies and regulations on methane emissions
5. increase transparency.

www.methaneguidingprinciples.org

BP was a founding signatory of the Methane Guiding Principles at the first Methane Roundtable meeting in January 2018.

- Executive Sponsor – Bernard Looney
- Steering Committee Representative – Sue Ford
- Technical Working Group – John Drinkwater (Canada), Faraz Haider (GPO)

Bernard Looney has been BP's executive representative on the Steering Committee ('the Roundtable') and has a strong relationship with Maarten Wetsellar of Shell who chairs the Roundtable and was the inspiration for the initiative.

In 2018, BP led the development of 8 Reducing Methane Emissions Best Practices.

At the last Roundtable Meeting in Paris in January 2019 the following work products were agreed for delivery in 2019:

- Development of the Methane Emission Best Practices Tool Kit. **BP (Sue Ford)** is leading this and it is nearing completion.

- Development of a 1-day Outreach Masterclass. **Shell** is leading this, and the first Masterclass sessions were delivered in November 2019.

- Development of a Policy Framework for Reducing Oil and Gas Methane Emissions. **Exxon** are leading this.

The development of the Methane Emission Best Practices Tool Kit comprises:

- Detailed Guides
- Summary Synopses
- Methane Cost Model (7 modules)
- Gap Assessment Tool
- Training Content for a 1-day Methane Masterclass
- Content for the Website

SLR international Ltd and University of Texas (Austin) were contracted to develop the materials. John Drinkwater (BP Canada) and Faraz Haider (GPO) were brought on board to help with the technical evaluation of the materials being produced by the contractors.

This Tool Kit will be available on the MGP website in late November 2019.

The draft BP Upstream Carbon Practice (to be released end 4Q) **requires BP entities** to put an implementation plan in place to adopt the Reducing Methane Emission. Plans to be in place by end 2020.

The Shell Outreach pilots have been completed and courses go live mid-November in Woodside Perth. A further 6 courses are scheduled out till end 1H2020.

Next Roundtable

The next **Global Methane Roundtable** will take place at the Royal Society in London on **15th January** (6pm-9pm) and **16th January** (full-day discussion).

Due to the number of companies and organisations represented, it is only possible for us to accommodate the senior representative. There is not enough room for working level representatives to attend.

Gordon Birrell and/or Bernard Looney will represent BP. Sue Ford is preparing the briefing.

MGP 2020 Workplan

The MGP 2020 Workplan is currently under development. BP will co-lead a project with EDF on managing methane emissions in NOJVs. A workshop is planned for 1H 2020.

Other projects are currently being proposed by other members. BP need to decide which they want to support (sweat equity and/or funding).

Current MGP projects under consideration:

- NOJV Methane Workshop (BP and EDF)
    - **Funded and in 2020 HSE Budget at $150k**
- BP Hosting an Outreach Event (BP)
    - **Funded and in 2020 HSE Budget at $50k**
- Version 2 of the Reducing Methane Emissions Best Practice Tool Kit (BP and XX)
    - **Funded and in 2020 HSE Budget at $80k**
- Methane emissions LCA study for LNG (APPEA)
- Upgrade to Outreach (e-learning) (Shell and SGI)
- Development of a Global Standard for Low Methane Emission Gas (RMI and XX)
- EU opportunity for clean gas Working Group (EDF and Shell)
- Raising the Political Will to set ambitious methane NDCs via GMA (UNEP and XX)
- Setting up a Methane Regulator Network (IEA and XoM)
- Version 2 of Methane Tracker (IEA)

Xpansiv

Contact is **Sue Ford**

BP Ventures invested in Xpansiv as a supporting technology for the purpose of trading differentiated commodities. A proof of concept (PoC) funded by NEF ($0.4M) was launched 2Q 2019 to test:

- the ability of the technology to calculate methane leakage rates from field data
- to understand the potential to execute digitised trading of natural gas with low associated fugitive emissions and other attributes

The PoC has been led by DIO (Julian Gray) and Upstream HSE (Sue Ford).

Two locations hosted the PoCs; BPX SoHa (South Haynesville) and AGT SDA (Shah Deniz Alpha). Each PoC comprised about 10 wells. The major focus was on the SoHa location since the North American market is more receptive to differentiated natural gas trading. The PoCs in both locations were successful. They demonstrated:

- Upload of production and associated data packages onto the Xpansiv platform
- The ability of the Xpansiv platform to carry out analysis of the ingested data to:
    - conduct product characterisation
    - uncover differentiation features
- The ability to transform these differentiated characteristics into Digital Feedstock, enabling production data to be structured, transacted, and retired within a common trading architecture.

The Xpansiv platform was not used to calculate the methane intensity of the gas from field data. There is insufficient field equipment in BPX and AGT for the Xpansiv platform to directly calculate methane intensity. Enabling this would require a combination of:

- Additional meters and infrastructure
- Upgrades to meter polling frequency (0.1 sec interval for optimal data resolution)
- Use of thermodynamic modelling technology to enable the Xpansiv platform to calculate closer to real-time methane intensity.

Therefore, the decision was made as part of the proof of concept to calculate the BPX methane intensity outside the Xpansiv platform, using the EPA methodology, and to represent the calculation on the platform in the form of 3rd party certificates from the IES Trustwell low Methane Verified Attribute program.

Using the EPA Methodology, the methane intensity of the East Texas Basin (incorporating the 9 PoC SoHa Wells) was reported as 0.029%.

The differentiated commodities market is demanding data on methane and carbon intensity. There are no universally accepted methodologies for computing these values.

Currently there are 2 key approaches for calculating methane intensity:

- Theoretical estimates using standard equipment emission factors (e.g. US EPA)
- Measurement of actual values using field measurement systems – which is still evolving.

This is a key opportunity for BP to become a market leader in the trading of low methane intensity gas. In addition, BP should work in partnership with others to develop a global standard against which methane emissions and carbon intensity could be adjudicated.
BPX First Trade

As a follow up to the BPX PoC, it was decided to test the market by structuring a potential trade opportunity for the 9 SoHa wells. The methane intensity calculation was applied as a digital attribute on the Xpansiv platform for trading in the form of a certificate. This digital attribute is key to the end to end transaction, from purchase to retirement.

Additional LDAR data was provided by BPX to Xpansiv as a secondary data source. This provided greater confidence in the calculated methane intensity to Xpansiv and IES Trustwell. It also provided evidence of good operator discipline. It was proven that:

- BPX gas can be differentiated as low methane intensity gas when compared with the industry average methane intensity benchmark derived from EPA data (0.62%) and the methane intensity threshold for entry into the OGCI collective methane target program (0.29%).
- BP can trade digital feedstock via the Xpansiv and the CBL Registry - a dedicated Environmental Products Trading Platform.

BP will be 'trade ready' for this specific opportunity in early November to test the market with potential buyers.

The differentiated commodities market is still maturing. The market is ready for bilateral trading with binary attributes (where a volume of gas with a 3rd party certified attribute is sold to a limited number of buyers) but not ready for real time trading of digitised attributes to multiple buyers.

2020 funding is being sought from NEF. NEF have funded the current PoCs ($0.4M)

The commercial opportunity to BP is very significant. BP are well placed to monetise "responsible gas" due to our operational design, operator discipline and digitization preparedness.

Risks to delivery include resourcing and pace. For BP to take advantage of our unique situation a dedicated cross discipline team needs to be stood up before EoY to deliver the recommendations by end 1Q 2020.

Assurance on Legal risks (misleading market) are ongoing

Recommended Way Forward:

- Execute further trades under current market conditions: Assuming the first BPX trade is successful, execute similar trading opportunities.
- Develop a larger pilot to meet potential future market conditions: In parallel, structure a pilot that demonstrates a more robust emissions profile using field data. BP could act as first movers, using field data to calculate low methane intensity gas for trading.

CCUS

Contact is **Martin Towns**

There are currently 6 CCUS projects being progressed see below.

1. UK Clean Energy Park (Teesside & Humberside)

   Plans are progressing well for the development of a Clean Energy Park at Teesside. BP is leading this project, now renamed 'Net Zero Teesside' through pre-FEED on behalf of the OGCI. A consultation process with local stakeholders is underway, and potential partnerships are being scoped. BP is working with the UK government on business models to establish commerciality. We are also exploring synergies with Humberside to establish an East of England cluster.

   a. BP flagship for CCUS enabled low carbon businesses
   b. FEED in 2020 and in FID 2022
   c. First ops 2025
   d. Being managed within GCD under Colin McGill

2. Tangguh

   Nader Zaki, RP Asia Pacific, with GPO held a workshop in September 2019 to scope options to reduce CO2 emissions from Tangguh, as part of a suite of development opportunities. The team is progressing an option to reinject separated reservoir CO2 into the Vorwata reservoir as an alternative to venting.

   a. Eliminate BP's largest source of high concentration CO2 emissions
   b. In concept development
   c. Being managed between Russell Smith and Andy Lane

3. Gulf Coast (Freeport) Clean Energy Park
   a. Developing a decarbonized gas and carbon storage offer for Gulf Coast customers. Enabling hydrogen.
   b. Currently assessing market and framing advocacy

4. Cherry Point Clean Fuels
   a. Near term opportunity to produce an ultra-low carbon fuel as part of Cherry Point Green Diesel Project
   b. Target FID 2020/21
   c. Being managed via Downstream

5. Whiting Clean Energy Park
   a. Large opportunity for low carbon fuels and hydrogen production, in partnership with Fulcrum biojet production and Linde for blue hydrogen.
   b. Target appraisal in 2020
   c. Being managed via Downstream

6. Port of Rotterdam
    a. Supports role of decarbonised gas in EU
    b. Currently assessing market and framing advocacy
    c. Being managed via Downstream, but Guy Moyens and Gordon Birrell have agreed to collaborate to progress with cross segment support.

Methane Technology

Contact is **Peter Evans**

- The technology strategy is informed by the BP target methane intensity of 0.2% as part of a wider commitment to shifting to a low carbon future.

- Current reported emissions are primarily based on emissions factors. The methane technology strategy is to reduce uncertainty using site-level data to complement these calculations (not replace all of them), target specific opportunities for emission reductions and improve confidence in reporting.

- Technology is needed to:
    - Monitor – identify sources of methane and any changes that might occur
    - Measure – to prioritise interventions reduce uncertainty in reporting
    - Manage – Intervene through established maintenance protocols

- We have identified a suite of complementary technologies that address the principal sources of methane in the Upstream (fugitives, flaring, venting etc.)

- Each technology forms part of a standardised toolkit from which a bespoke combination of technologies can be selected to suit the individual circumstances of each asset.

- The toolkit is not complete, but we now believe we have at least one proven technique for all scenarios. The emphasis in 2020 will shift towards deploying what has been developed.

- Work will continue to evaluate new products as they enter the market to augment our options in an informed and systematic way. For example, we continue to monitor improvements in satellite technology but do not use this technology routinely yet. In time, it is expected to add to our facility-level surveillance options.

- All future major projects (>$$250m) will include continuous methane measurement, underpinned by technology such as gas cloud imaging. This will minimise uncertainty in the total emissions for each facility, but we do not intend to start reporting per facility. Currently the only technology that fulfils the new requirements for GP 31-03 is the Rebellion Gas Cloud Imaging (GCI) camera

- OGCI-CI Investments has invested in several methane technologies and whilst it is not a requirement for BP to use them, there is an expectation that we will evaluate whether they form part of BPs internal strategy:
    - SeekOps - currently used by BP in drone surveys
    - Clarke Valves - low emission valves, being monitored for progress by UEC
    - Kairos – Airborne survey method no selected for use by BPX
    - GHGsat - See satellites

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Technology Provider	Role in methane management	Deployments
Providence QL320	Enhancement to existing LDAR protocol by converting OGI camera images to a quantified measured emission rate. $30k/unit plus existing costs of FLIR camera ($100k)	Global deployment underway All regions will have at least one unit in operation by end of 2019 and training of one 'super-user' per region.
Providence Mantis VISR	Specialist survey that measures the efficiency of flare combustion on a known periodic basis. Note this is a site survey and not a permanent installation. $40k per week, depending upon ease of access	Complete for Alaska and Angola (where flares were better than 98%). 70% of flaring by volume to be surveyed in 2020. Oman survey will include drill-site flaring.
Rebellion Gas Cloud Imaging	Permanently installed camera that provides 24/7 measurements across the site and automatically monitors for changes. Currently the only technology that fulfils the new requirements for GP 31-03 Full size system (1700m range) $280k plus install costs (requires power, comms and elevated viewing position). For planning purposes increase unit costs by x2 Smaller units (200m range) also available at $100k Once installed, requires annual maintenance and software upgrades ~$20k per unit	Installed in Oman with Trinidad (Beachfield) installation ongoing
SeekOps Drone survey (With Flylogix for offshore)	Specialist drone mounted survey of whole facilities to identify and measure methane sources.	Onshore drone version used in Oman Offshore long-range drone deployed to measure methane

		emissions from Clair in the North Sea. Future plan is to extend across the whole of the North Sea (would require collaboration with other operators)
PrecisionHawk	Drone mounted LDAR monitoring for onshore use incorporating OGI and methane sensor $50k per week	Deployed across BPX
FieldBit	Augmented reality glasses – connecting field engineers with experts	Deployed across BPX as part of
BHGE - FlareIQ (trials complete 2019)	Predictive flare efficiency measurement system for ultrasonic flow meters providing continuous efficiency measurement intended to work in partnership with periodic Mantis VISR surveys	Testing to complete 2019 (Oman, N Sea, GOM, Angola)
BHGE – Lumen (trials complete 2019)	Ground based sensor network providing continuous monitoring alternative to GCI	Testing to complete 2019 (Egypt)

Region	Strategic Contribution	Indicative Costs ($K)
AGT	• Priority location for use of continuous measurement using GCI technology • One QL320 already in use (further units required) • Mantis flare survey commissioned for 2019. Explore application of Flare IQ to complement Mantis survey with continuous prediction. • Key deployment for continuous measurement capability. Would require 3 standard camera units in Sangachal Terminal utilising exiting elevated structures (ACG, SD1 and SD2) and 10 mini units alongside pipeline facilities for Midstream • Drone survey of Sangachal to characterise emissions and optimise GCI installations	• $300 • $50 • $5000 • $50 **Total ~$5400**
Angola	• Embed use of QL320 quantitative LDAR and predictive flare efficiency • One QL320 supplied in 2019, a second may be needed to equip both vessels • Mantis survey complete. No repeat measurements in 2020. Deploy FlareIQ on both vessels • Review use of GCI technology and drones based on other deployments	• $130 • $50 **Total ~$180**
AsPac	• Priority location for continuous measurement (GCI) backed-up by drone survey. Monitor flare performance • QL320 in use by end of 2019 • Flare survey to be completed in 2019. Embed use of FlareIQ • Critical location for use of continuous measurement (will require multiple GCI cameras to provide total coverage). GCI Costs can be minimised by conducting detailed site survey by drone ahead of deployment.	• $50 • $1500 **Total~$1550**

Egypt	• Deploy continuous measurement (once Lumen trial is complete). Survey flaring to coincide with peak flow (Q4) and embed FlareIQ. Use QL320 • QL320 supplied in 2019 • Flare survey to be conducted during periods of peak flow (Q4 2020), Install FlareIQ • Review outcomes of Lumen trial and then select and deploy a continuous measurement capability	• $100 • $1000 **Total~ $1100**
Gulf of Mexico	• Embed QL320 and assess number of units required for total coverage. Conduct Mantis flare survey. Review options for measuring total flux from facilities (to compare to recent academic reports) • One QL320 supplied, but further units may be required to augment existing cameras • Conduct flare efficiency survey. Embed FlareIQ (costs covered by development phase) • Review use of offshore continuous measurement once other priority locations are complete (2021+)	• $120 • $150 **Total~$170**
North Sea	• Embed QL320 use in to region. Complete Mantis survey of offshore flares and complete FlareIQ tests and deployment. Monitor how other priority facilities are using GCI systems. Work with Technology to complete and operationalise offshore drone surveys. • One QL320 deployed with regional intent to equip all assets in 2020 with further units • Conduct flare efficiency survey and embed use of FlareIQ • Maintain a watching-brief of GCI deployments (including new offshore projects) to evaluate where and when to deploy in region. • Work closely with Upstream Technology, other operators to develop offshore drone survey in to a routine service	• $120 • $200 **Total~$320**
Oman	• Complete GCI coverage by installing a second unit on Khazzan phase 2. • QL320 deployed by end of 2019 • Mantis survey complete in 2019. FlareIQ costs to be covered by UT trial. • Additional GCI to provide coverage for Khazzan phase 2	• $500 **Total~$500**

Trinidad	• Complete deployment of GCI at Beachfield and deploy further units at Galeota, with potential drone survey of the full facility • QL320 deployed by end of 2019 • Complete Mantis survey and embed FlareIQ: • Continuous measurement at Galeota . • Drone survey as precursor to GCI deployment	• $1250 • $50 **Total~$1300**
Total	Total Commitment across GOO during 2020	$10.470