

**Issues Management Working Group
21 September 2018**

Pre-read

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**Agenda Item 1:
Context, Agenda, Minutes**

Members of the Issues Management Working Group

IMWG agenda and pre-read for 21 September 2018

At this meeting, we will:

- Review IMWG's future focus and remit, including forward agenda.
- Discuss and agree;
 - a blueprint and advocacy stance for carbon pricing policy design
 - a new position and advocacy stance for methane emissions policy
 - an update to the position and advocacy stance on the electrification of road transport

I look forward to our discussions on 21 September.

David Eyton

14 September 2018

BP p.l.c.
ISSUES MANAGEMENT WORKING GROUP MEETING
Friday 21 September 2018
SJS 4.53 Caspian 14.00-17.00pm, St James's Square London

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|---------------|
| AGENDA |
|---------------|

| | | | |
|-------|---|--|-----------------|
| 14.00 | 1 | Context <ul style="list-style-type: none">To confirm minutes from the June 2018 meeting and review actions*To confirm objectives for today's meetingTo highlight key activities in current context | David Eyton |
| 14.10 | 2 | IMWG's remit* <ul style="list-style-type: none">To discuss and agree IMWG's future remit | David Eyton |
| 15.00 | 3 | Forward agenda* <ul style="list-style-type: none">To discuss priority agenda items for the December 2018 meeting and 2019 | Antony Andrews |
| 15.10 | 4 | Blueprint for carbon pricing policy design* (<i>new position</i>) <ul style="list-style-type: none">To discuss and agree detailed principles for carbon pricing policy designTo discuss and agree our advocacy stance | Paul Jefferiss |
| 15.55 | 5 | Methane emissions policy* (<i>new position</i>) <ul style="list-style-type: none">To discuss and agree a positionTo discuss and agree our advocacy stance | Bob Stout |
| 16.25 | 6 | Electrification of road transport* (<i>position review</i>) <ul style="list-style-type: none">To note current context and changes since position was last agreedTo discuss and agree a revised positionTo discuss and agree our advocacy stance | Richard Harding |
| 16.55 | 7 | AOB and date of next meeting | David Eyton |

* Papers attached

Dial in details are as follows:

UK Freephone Dial-In Number: [REDACTED]

Conference code: [REDACTED]

UK Local Call Dial-In Number: [REDACTED]

STD International Dial-In Number: [REDACTED]

United States: [REDACTED]

Issues Management Working Group

IMWG Meeting Notes – 27 June 2018

Caspian 4.53

14.00 – 17.00

Attendees: Dev Sanyal (chair), Antony Andrews, Richard Bridge, Spencer Dale, David Eyton, Richard Harding, Peter Mather, Geoff Morrell, Mike Nash, Eamonn Naughton, Nick Wayth

By phone: Dominic Emery, Paul Jefferiss, Bob Stout

Apologies: Gordon Birrell, Susan Dio, Anthony Harbridge

Context

- There is significantly more attention being paid to issues related to climate and the energy transition across financial, political and industrial environments. This is resulting in demands for increased disclosure from BP. IMWG could play an important role in defining the path forward.
- There is a trend of greater interest from non-traditional actors, including religious institutions and central banks. Meanwhile, multi-lateral corporate approaches – such as OGCI – have really taken root and are now a key driver for action.
- Lamar McKay will succeed Dev as the chair of IMWG, starting at the September meeting. Members noted the progress made on issue management since IMWG's inception. IMWG has delivered against its mission, but now is an appropriate time to review and refresh the process to ensure it can meet changing stakeholder demands. The original terms of reference for IMWG were shared with members.
- Following the distribution of the carbon offsets and carbon life-cycle assessment positions to members, both positions were approved as final and will be uploaded to messagebank.
- The March minutes were agreed. All actions have been completed.

Fossil fuel subsidies

IMWG members made the following points:

- Include some reference points for the scale of subsidies as often

- quoted, noting that this is for background information only.
- Provide an indication of the scale of revenue generated from oil and gas.
- Review the wording of the fifth key message relating to industrial policy.
- Consider developing a position on production revenues.

Action: Update position to reflect feedback and circulate to IMWG members (SD) – by mid-August. Unless feedback is significant, the position will be considered agreed and uploaded to messagebank.

GHG emissions performance standards

IMWG members made the following points:

- BP supports technology-neutral, market-based approaches to GHG emissions reduction. An economy-wide carbon price is the best policy.
- We do not in principle support technology-specific approaches, including GHG EPS for power or other sectors, including refining.
- However, where carbon pricing systems are poorly designed or missing, we should retain the latitude to support other, less than perfect policies. A pragmatic approach is both necessary and desirable.
- The decision whether to join peers in supporting the EU Commission's proposal to remove access to capacity payments to generators above 550gm/kWh (coal) rests with the region, affected businesses and central function teams, and should be based on data and analysis.

Actions: Draft a position on emissions performance standards for IMWG review in September (PJ). Assess impacts of supporting EU Commission's capacity payment proposal (Strategy, Europe, Gas & Downstream businesses).

Role of gas

IMWG members made the following points:

- The key intent of the position should be to make the case for gas as a destination fuel. The paper and position should focus on the role that we think gas should play in the future energy mix.

- It was noted that making the case for gas is particularly important for the European market.
- Position should stress gas as a complement to renewables, whose growth can help gas.
- Position to be clearer about the distinction between natural gas vs. hydrogen, biogas etc., and the pathway to low emissions gas.
- Clarity is required on the benefits of gas vs coal switching and the viability and scale of such opportunities.
- Need further detail on the role and benefits of LNG.
- The position should be updated to reflect output from the gas workstream.

Action: Bring an updated position to the December meeting, reflecting feedback and output from the gas workstream (DEm).

Methane

IMWG members made the following points:

- Position needs to provide context for the issue and the significance of action by BP. Consider how to capture the intent of Steve Pacala's points on the scale of the possible contribution of methane management in the oil and gas sector, without overstating the scale of the problem.
- Strengthen description of how we are deploying technology to address methane – how BP is a leading applier of technology. Amend the last bullet around deploying leak detection to include details of what BP is doing.
- Acknowledge other sectors for whom methane is also an issue, including agriculture and coal. Consider how we might share learnings with those sectors.
- Clarify our position on emissions across the full value chain.
- Focus on the 0.2% target for BP – remove reference to 0.3%.
- Noted that the issue is changing rapidly and data points will need frequent updating.

Action: Update position to reflect IMWG feedback and bring back to the September meeting (EN).

Role of oil

IMWG members made the following points:

- A position laying out the key conclusions and implications for oil of the Energy Outlook would be helpful.
- Support for a position that describes why investment in oil exploration and production is still required in a world of abundance.
- The position should provide an overview of decline curves and consider the possible implications from under-investment.
- Provide common language for use when describing advantaged oil.
- For internal purposes, provide reserves to production ratios separately for oil and gas.

Actions: Draft a position for review at the September meeting (SD).

IMWG process

IMWG members made the following comments on the forward agenda:

- Positions to be reviewed at the September meeting are emissions performance standards, methane, role of oil, electrification and automation of transport and air quality.
- The sensitive and protected areas position and strategic resilience position reviews will be deferred to the December meeting. Other issues on the December agenda are role of gas and long-term emissions targets.

AOB

The next IMWG meeting is 21 September 2018.

IMWG Action Log: Updated 14 September 2018

| | Issue | Action | Lead | Complete by | Status | Notes | IMWG Meeting |
|-----|-------------------------------------|---|---|----------------|----------|----------------------------------|--------------|
| 223 | Fossil fuel subsidies | Update position to reflect feedback and circulate to IMWG members | SD | August 2018 | Complete | Position uploaded to messagebank | 27/06/2018 |
| 224 | GHG emissions performance standards | Draft a position on emissions performance standards for IMWG review in September (PJ). | PJ | September 2018 | Complete | Position drafted | 27/06/2018 |
| 225 | GHG emissions performance standards | Assess impacts of supporting EU Commission's capacity payment proposal | Strategy, Europe, Gas & Downstream businesses | n/a | Ongoing | | 27/06/2018 |
| 226 | Role of gas | Bring an updated position to the December meeting, reflecting feedback and output from the gas workstream | DEm | December 2018 | Complete | Position review deferred to 2019 | 27/06/2018 |
| 227 | Methane | Update position to reflect IMWG feedback and bring back to the September meeting | EN | September 2018 | Complete | Position updated | 27/06/2018 |
| 228 | Role of oil | Draft a position for review at the September meeting | SD | September 2018 | Complete | Position drafted | 27/06/2018 |

**Agenda Item 2:
IMWG's remit**

Members of the Issues Management Working Group

IMWG's remit

A note has been prepared to propose changes to the approach IMWG takes in managing key social and environmental issues.

The purpose of this IMWG session is to discuss and agree this proposal.

David Eyton

14 September 2018

Members of the Issues Management Working Group

Issues Management Refresh

Purpose of this note

This note recommends refreshing our approach to managing key environmental, social and governance (ESG) issues and proposes a way forward.

Objectives of the refresh

The intent is to simplify and streamline our approach to issues management, by bringing focus and building a tight consensus on where we stand on key issues. The aim is to be flexible, dynamic and responsive to issues as they emerge in real time.

Context

In an increasingly complex political and policy environment and with the dual challenge of the energy transition the company is evolving rapidly on three fronts:

1. Strategy and business focus. New emphases and activities are emerging (NEF, Renewal Committee), and these will continue to develop.
2. Operating practice. A review of the environmental and social parts of OMS (GDP 3.6) is under way. If this leads to changes, the plan would be to deliver those in 2019-20.
3. Advocacy and communications. Positioning on major ESG issues must be responsive to fast-changing stakeholder perspectives.

Key issues¹

In the context of rapid change within BP and society, issues can quickly arise that potentially place BP in tension with stakeholders, including investors, consumers, civil society, governments and staff. Such issues usually relate to sensitive social and environmental matters, can erupt unexpectedly, and may relate to strategic or commercial choices, operational practices, or public policy and advocacy positions. Some lie at the interface of all of these. They sometimes originate from a specific activity in a particular place and time but may quickly be picked up globally.

¹ For examples of specific issues, see Appendices 1 and 3.

They can create both risk and opportunity depending on how well – and how quickly – they are managed.

Current approach to issues management

Remit and focus of the Issues Management Working Group

The Issues Management Working Group (IMWG) was established in 2011 as an advisory committee to the Group Chief Executive with a remit to recommend formal company positions on strategy, business activities, operational practice and public policy positioning. It comprises Group Leaders (GLs) from most of the major businesses and functions, with members authorised to give the definitive view from the part of the company they represent.²

To date, the IMWG has focused on BP positions on public policy – how we believe governments should act to protect society's interests and our own. It has also developed key communications messages about the company's existing strategic, commercial and operational activities.³

What it has not attempted to do is to change or even influence the company's strategic, commercial and operational activities themselves – in short, it has not provided explicit recommendations for substantive change. These have remained the accountability of the relevant segments, businesses and functions – and ultimately the Executive Team and Board.

This focused approach is pragmatic but means there is no BP-wide entity below the Executive Team explicitly charged with scrutinising and informing strategic, commercial and operational decisions with the potential to cause environmental or social issues of group significance. The possible exception is the Group Operational Risk Committee (GORC), chaired by the Group Deputy CEO as a subcommittee of the Executive Team. But the focus of the GORC is on operational integrity, efficiency and safety, rather than on interactions between strategy/business/operations and reputation on ESG issues.

Modus operandi of the IMWG

Even in respect of public policy positioning, IMWG has generally preferred to take a neutral stance, emphasising policy-relevant facts and context, or focused on policy approaches we would prefer to avoid. IMWG positions have tended to focus less on policies we would like to see, and not to

² For a full list of current members and the functions they represent, see Appendix 2.

³ For a full list of existing IMWG positions, see Appendix 1.

address how pre-emptively or proactively we should advocate for them in practice. This neutral or defensive orientation may sometimes have placed us behind or outside important public debates and led some stakeholders to perceive that our positions on certain topics are held in principle only.

It is also common for draft IMWG positions to return for two or even three discussions. With IMWG meetings scheduled only quarterly this cadence means that IMWG positions can be in development for 6-12 months. This is now too slow to respond in a timely way to the fast pace of internal and external change. It is critical that this process is speeded up, and that IMWG can develop a more rapid reaction capacity.

Because of its focus on public policy positioning, and on communicating existing BP activities, rather than on the substance of BP activities themselves, IMWG members have spent the great majority of their time crafting and refining the words used in key messages. This is an inefficient use of GL time and expertise.

Once agreed, IMWG positions have been posted on Messagebank. This internal online platform was chosen to strike a balance between allowing access for those who need to know – executives and BP communications professionals – but maintaining confidentiality generally. But Messagebank is unwieldy and has constrained understanding and use of IMWG positions even by those for whom they are intended. Background papers are available only on request. A more proactive approach and transparent platform for users is needed.

Proposed approach to issues management⁴

To address concerns about the current approach and improve the effectiveness and functioning of the IMWG, the following main changes are proposed:

1. *Extend and strengthen the remit of the IMWG*

The IMWG's remit should be expanded beyond positioning on public policy and messaging around existing BP activities. IMWG should also recommend/decide substantive changes to BP activities themselves – where those activities potentially have significant environmental or social impacts that are important to

⁴ See Appendix 3.

stakeholders and to BP's reputation. This would, in fact, be consistent with the IMWG's original (2011) mandate, rather than a departure. An example might be whether BP should declare World Heritage Sites as no-go areas for operational activities.

If the suggestion for IMWG to recommend/decide substantive strategic/commercial/operational change is adopted, it raises questions of governance, and the role of IMWG in relation to existing executive decision-making bodies, such as GORC and ET. There are several options:

- a. Reconstitute IMWG as a sub-committee of the ET, on a par with GORC. This would require a very significant change in IMWG membership and add to EVP workload on issues that may be unfamiliar to them.
- b. Require that IMWG recommendations are provisional, subject to EVP ratification/modification, which could occur either individually or, more likely, via discussion at existing meetings such as GORC or ET. This would both add to EVP workload and delay decision making more than at present.
- c. Delegate discretion to the IMWG chair, who is also chair of the GORC and an ET member, to determine whether to adopt an IMWG recommendation as a decision or escalate it for ratification at the GORC or ET. This choice might vary case by case according to the magnitude of the strategic/commercial/operational impact of the issue. Issues can be tiered according to whether they (1) require a simple clarification or modification of an agreed position; (2) require a substantive decision that can be taken by IMWG or; (3) require escalation. Any choice to escalate a decision beyond the IMWG will inevitably slow the final decision-making process but this is likely to be necessary in some cases.

Option c appears the most efficient, pragmatic and feasible.

2. Consider refreshing IMWG membership

If IMWG's remit is refocused towards substantive strategic, commercial and operational issues, and governance option c is adopted, a smaller number of more senior representatives may be sensible. On the other hand, IST and IR representation is currently missing and is arguably required.

3. *Rename the IMWG*

Whichever governance option is adopted, the IMWG should be rebranded with a label commensurate with its extended and strengthened remit. One possibility is the ESG Meeting (ESGM).

4. *Clarify advocacy stance*

For any position on public policy (but especially carbon and climate policy), the IMWG should be as clear as possible about what we would like to see as well as what we would prefer to avoid, and on how proactively or even pre-emptively we wish to advocate the position to decision makers and other stakeholders in practice.

5. *Delegate the communications function*

To make more efficient use of GL time and expertise, the task of converting the substance of decisions (once final) to simple, clear communications messages should be delegated to a standing sub-committee of IMWG members from 3 group functions: Communications & External Affairs (C&EA); Group Policy; and Legal, plus the Subject Matter Expert (SME) for the relevant topic. This communications sub-committee should be supported by a dedicated writer who is expert in communications. This approach would also help align or converge IMWG positions and AGM briefs, which are currently similar but different, and therefore confusing.

6. *Develop a rapid reaction capacity*

In addition to the underlying IMWG process decision making and position development, a reactive capability should be established to address rapidly emerging issues (e.g. trade tariffs, methane policy) and to make real time updates to existing decisions or positions in light of important new information. This capability can be provided by the proposed communications sub-committee, which should also perform an active horizon-scanning function. Only if a new issue or new information requires substantive change to a practice or position would it be brought formally to IMWG itself.

7. *Develop new internal IMWG communications channels*

Alongside Messagebank (or an improved equivalent), quarterly (Deputy) CEO updates to all GLs and C&EA and GPA professionals could be considered. Other internal IMWG communications should be developed.

8. *Modify inputs to and outputs from discussion*

It is likely that a decision-making remit will require some modification of pre-reads to include business impact as well as reputational analysis. This in turn may require more time and resource-intensive preparation. It may also require new pre-read templates and discussion formats. To supplement/replace 10-page background papers, it might be helpful to invite experts into the room to inform discussion using multiple presentation forms.

Templates for communicating positions publicly should also be revised to be simpler and clearer with sections on, for example: What is the issue? What is BP's position (what we want or will do, as well as don't want or do) and why, with supporting analysis and factual information clearly separated from the position itself. Positions should also be much clearer on how proactively and pre-emptively the position should be advocated.

9. *Leverage external relationships*

To date the IMWG has made limited use of external academic / think-tank relationships, but more can be made of this. For example, Princeton-CMI, Harvard-Tufts and Columbia.

Timetable for implementation

The IMWG has meetings scheduled for September and December. It is suggested that this proposal is scheduled for discussion at the September meeting and, subject to feedback, implemented for the December meeting.

Paul Jefferiss

14 September 2018

Appendix 1: Current IMWG positions

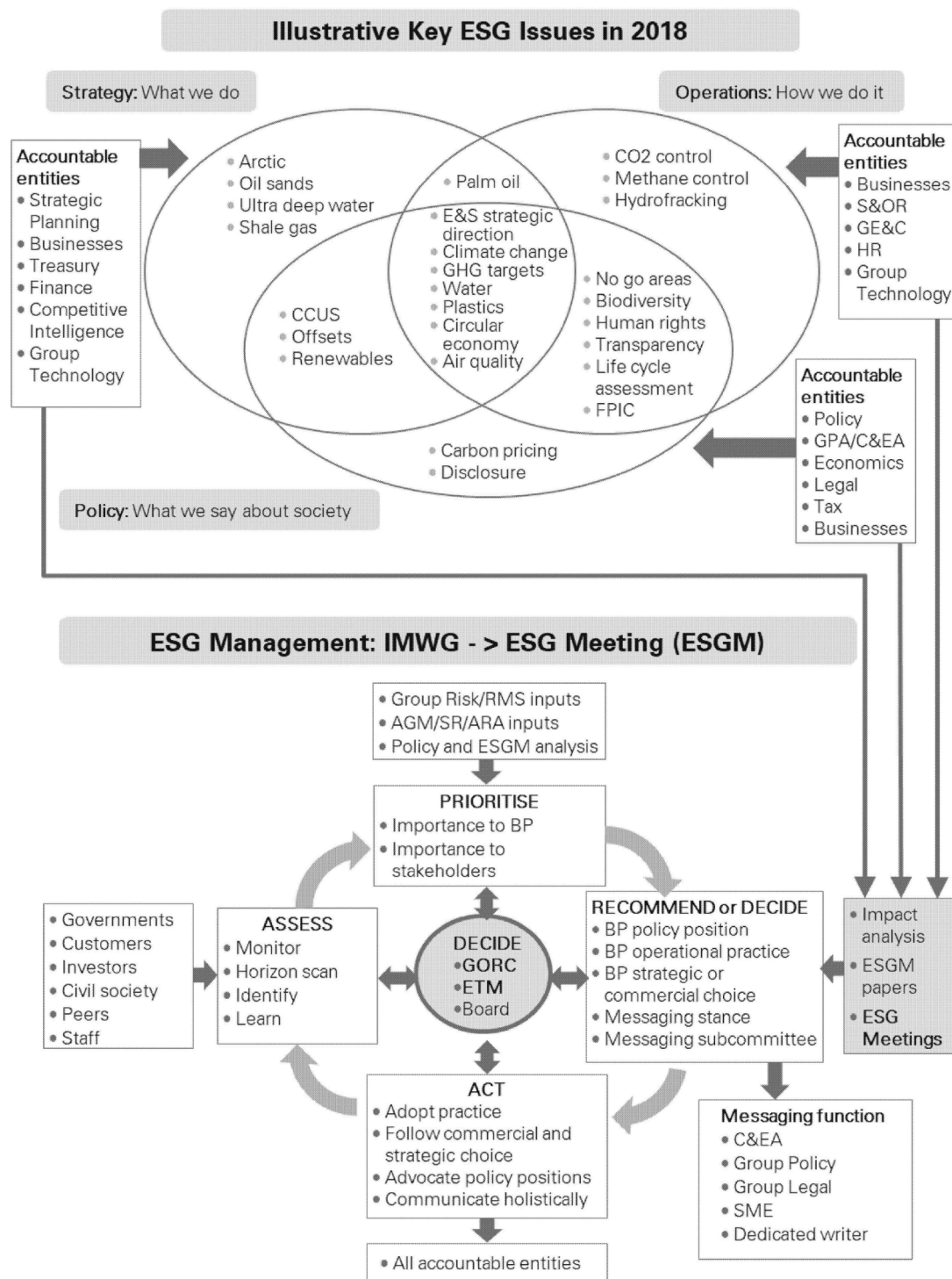
| Position | Last revised |
|---|--------------|
| Advocacy and lobbying | 2014 |
| Air quality | 2018* |
| Arctic | 2014 |
| Biodiversity | 2016 |
| Biofuels | 2016 |
| Canadian oil sands | 2014 |
| Carbon capture, use & storage | 2018 |
| Carbon life cycle assessment (LCA) | 2018 |
| Carbon offsets | 2018 |
| Carbon pricing | 2015 |
| Climate change adaptation | 2014 |
| Electrification of road transport | 2018* |
| Energy efficiency | 2015 |
| Fossil fuel subsidies | 2018 |
| Free, prior & informed consent (FPIC) | 2014 |
| GHG emissions performance standards (EPS) | 2018* |
| Human rights | 2014 |
| Innovation policy | 2016 |
| Low carbon and the energy transition | 2017 |
| Low carbon fuel standards | 2016 |
| Marine spatial planning | 2016 |
| Methane emissions from the oil and gas sector | 2018 |
| Outlook for oil demand and supply | 2018* |
| Renewable energy | 2017 |
| Responsible supply chain management | 2016 |
| Revenue and contract transparency | 2018 |
| Role of natural gas | 2015 |
| Sensitive and international protected areas | 2018* |
| Strategic resilience | 2018* |
| Sustainable development goals (SDGs) | 2016 |
| Unburnable carbon | 2015 |
| Unconventional gas and hydraulic fracturing | 2015 |
| Water management | 2013 |

*planned

Appendix 2: Current IMWG members

- Lamar McKay, Chair
- Gordon Birrell, Upstream
- Richard Bridge, GPA
- Spencer Dale, Economics
- Susan Dio, BP America
- Dominic Emery, Strategic planning
- David Eyton, Technology
- Richard N Harding, Downstream
- Paul Jefferiss, Policy
- Peter Mather, Europe
- Geoff Morrell, C&EA
- Mike Nash, Legal
- Eamonn Naughton, S&OR
- Bob Stout, BP America
- Nick Wayth, AE
- Antony Andrews, IMWG secretariat/Policy

Appendix 3: Approach to issues management



Agenda Item 3:
Forward agenda

Members of the Issues Management Working Group

Forward agenda

The purpose of this IMWG session is to:

- Review and approve the agenda for the December meeting.
- Discuss initial proposals for the 2019 agenda.

Antony Andrews

14 September 2018

Members of the Issues Management Working Group

Forward agenda

The following issues are scheduled for discussion in December 2018:

- **Air quality (revision):** Since the position was agreed in 2015, air quality has continued to grow as an issue. The use of diesel cars in cities is particularly relevant for BP and engagement with stakeholders, primarily in Europe. A revised position should reflect this changing focus. An alternative option would be to develop a position on diesel itself.
- **Sensitive and protected areas (revision):** External stakeholders, including investors, have continued to raise concerns with BP about operating in sensitive and protected areas. Extraction companies continue to be pressured to declare specific “no go” commitments. A review of this position is proposed to reflect external changes, as well as any internal developments.
- **Long-term emissions targets (information note):** Investors have called for companies in the oil and gas sector to clarify their future in a low-carbon world, including to consider commitments to reduce carbon emissions, assess the impact of emissions from the use of their products and to explain how investments are compatible with a pathway towards the Paris goal. This information note will describe these demands and the mechanisms proposed to assess companies’ alignment with the Paris Agreement.

Discussion of a position on the role of gas has been postponed to Q1 2019 to accommodate air quality on the December agenda.

2019 IMWG issues for consideration

A list of proposed issues for discussion in 2019 is provided in Appendix 1. This incorporates input provided through the issue prioritization process managed by group reporting and group policy. This is an annual process to solicit views from internal stakeholders on issues of high materiality to the group and high interest to stakeholders.

Following IMWG discussion and input, a final proposed 2019 agenda, including timings, will be provided for the December meeting.

IMWG members are asked for their views on the issues proposed:

- Which issues should be prioritised?
- Are any issues missing – new issues or existing positions requiring revision?
- Are there any issues that shouldn't be on the list?

Antony Andrews

14 September 2018

Appendix 1: Issues proposed for discussion in 2019

| Issue | Further information | Lead |
|--|---|---------------------------------|
| Advocacy and lobbying (revision) | A step change in reporting on trade association membership from some companies in the mining sector has raised expectations in oil and gas. There is a focus on the process used to oversee membership and alignment with company positions. | Group policy / GPA |
| Circular economy (new) | The concept of a circular economy is gaining support from stakeholder groups, consumers, corporations and legislators – particularly in Europe. It represents both an opportunity and a potential threat to established business models. Parts of BP (and some of our peer group) are already in action. | Group technology / Group policy |
| Climate change adaptation (revision) | Adaptation has attracted a lot more attention since the position was last agreed in 2014. We may wish to consider a proactive position, with more detail on what we are doing operationally and how important this is to our business activities. | S&OR / Group policy |
| Land carbon (new) | The emissions reduction opportunity from land carbon is technically vast and low cost. Land carbon offsets can both support BP's GHG targets and potentially provide a source of revenue as carbon market evolve. A position on land carbon should consider how and what we advocate on policy, how we collaborate and how finance is provided. | Group policy |
| Non-operated joint ventures (new) | There is increasing interest from external stakeholders in understanding how we systematically manage risks associated with JVs, including those relating to human rights. | Group risk / Group policy |

| | | |
|----------------------------------|---|------------------------------------|
| Role of gas (revision) | Since the original position was agreed, BP has deepened its commitment to gas. A revised position is needed to reflect the evolution of our strategy relating to gas, as well as recent activity looking at gas in Upstream, Midstream and Downstream. It will also expand to consider the role of hydrogen and biogas. | Group strategic planning |
| Waste plastics (new) | Awareness and concern about the disposal of plastics, primarily into the marine environment, is escalating quickly. This is raising questions about the way in which plastics are used. There is growing pressure on the suppliers, users and retailers of plastics and plastics feedstocks. | Group technology / Group policy |
| Water (revision) | BP is currently considering its approach to water management, which may lead to changes including providing proactive support to governments in water scarce areas where we operate. | S&OR / Group policy |

Agenda Item 4:
Blueprint for carbon pricing policy design

Members of the Issues Management Working Group

Blueprint for carbon pricing policy design

The purpose of this IMWG session is to discuss and agree a detailed “blueprint” for carbon pricing policy design and implementation. The principles it contains are not new but based on existing BP principles for the design of carbon trading systems – extended and adapted to include carbon taxation. The aim is to agree on the substance of the principles, not the precise words, which will be worked subsequently for communications purposes.

A second purpose of the meeting is to agree our advocacy stance on these principles, in particular whether we might consider publishing them in a communications-friendly form suitable.

Paul Jefferiss

14 September 2018

Members of the Issues Management Working Group

Blueprint for carbon pricing policy design

Context and background

For the past 20 years BP has believed – and communicated publicly – that a carbon price is the best policy to limit GHG emissions. Until around 2012, we held a strong preference for cap and trade over taxation, developed detailed design and implementation principles for carbon trading systems, and advocated their integration into actual carbon trading systems that were under development in specific jurisdictions (EU, Australia, US, China, etc.).

Around 2012, recognising that there was growing political resistance to carbon trading in some jurisdictions, we shifted to a pragmatic position of agnosticism between carbon taxation and trading – providing both approaches were well-designed and flexibly implemented.

What we have not done, in respect of content, is:

1. Developed detailed design and implementation principles for carbon taxation that are equivalent to those we have for carbon trading.
2. Developed detailed but generic design and implementation principles that could be applied to either trade or tax.

What we have tended not to do, in respect of advocacy stance, is:

1. Proactively supported poorly-designed pricing proposals already on the table. In this situation we have either remained silent or, where necessary, sought to improve them.
2. Pre-emptively proposed our own alternatives where proposals on the table could not, for a variety of reasons, be sufficiently improved. In this situation, we have either remained silent or, where necessary, opposed them.

This advocacy stance may sometimes have placed us behind or outside important public debates and some stakeholders have perceived our positions in support of carbon pricing to be held in principle only.

Recommendation

Content

The blueprint for carbon pricing design attached to this note is intended to fill the second gap identified above under content – by providing a set of detailed design and implementation principles that could be applied to either tax or trade. If IMWG accepts these principles, it is recommended that they should then form the basis of further work to develop a more detailed blueprint focusing specifically on carbon tax design – to complement our pre-existing blueprint for carbon trading design.

Advocacy stance

The intent is that the attached blueprint be used immediately, in particular to fill the second gap identified above under advocacy stance – to enable us pre-emptively to propose alternatives to poorly designed pricing systems. For this purpose, we recommend that the communications sub-committee convert the blueprint into communications-friendly messages that can be shared publicly, on the website, as handouts, etc. The more detailed version attached would be retained as an internal guide for BP staff directly engaged in actual public policy design discussions.

The IMWG is asked to review and endorse the principles and the advocacy stance proposed.

Paul Jefferiss

14 September 2018

Appendix 1: Blueprint for carbon pricing policy design

- Policy objectives: Policies to reduce GHGs should aim to deliver socially desired environmental goals at least cost, carefully balancing economic and social goals, including providing access to affordable energy. Such policies should be simple, technology-neutral, market-based and economy-wide.
- Carbon pricing: The most comprehensive and economically efficient form of GHG reduction policy is an economy-wide carbon price. It encourages all parties, including producers and consumers in all sectors, to make economic choices that reduce carbon, for example by using less energy, using energy more efficiently, choosing lower carbon sources of energy, shifting to industrial and agricultural practices that emit less carbon, capturing and using or storing carbon that is emitted (CCUS), or developing negative emissions technologies and enhancing natural sinks.
- Double regulation: While carbon pricing systems are in development and until they are widespread, other forms of carbon regulation may initially be necessary. However, once a carbon pricing system has been introduced, additional, future carbon pricing regulation should be pre-empted and existing, non-price regulation reformed and reduced, wherever there is the potential for direct overlap with or duplication of the carbon price. Double regulation will undermine the economic efficiency and cost-effectiveness which carbon pricing is intended to provide. This does not rule out the need for the limited use of supplementary or enabling policies where there are clear market failures (see below).
- Tax or trade: A carbon tax or a cap and trade system can be equally effective, provided both are well-designed and flexibly implemented according to the principles described below. Hybrid approaches, in which cap and trade systems for large industrial emitters are combined with taxation or “linked fees” for smaller emitters, can also be effective if they are well-designed.
- Price/abatement level and trajectory: Advance signalling and then gradual introduction of carbon pricing are the most cost-effective approach, with the carbon price (abatement level) starting low and ramping up slowly before accelerating and then levelling off. The

ultimate, long-term target price/abatement level should be signalled as clearly and early as possible, ideally at the start. This approach is important to enable industry to make necessary operational and investment decisions in a timely way, so that intended environmental benefits can be delivered with minimal social impacts (e.g. on employment or energy security) and economic costs. To create investor confidence, clarity, stability and predictability are key, with a minimum of political interference. These objectives must be carefully balanced against the need to periodically review and potentially adjust the price/abatement level to deal with unanticipated changes in the economic or environmental context.

- Review: environmental and economic assurance: It will be necessary to assure that both the environmental goal of carbon pricing, and the economic cost of meeting it remain appropriate over time. Environmental assurance is more likely to be needed in a price system (tax), where the level of abatement is an outcome, whereas economic assurance is more likely to be needed in a quantity system (cap) where the traded price is an outcome. To the extent possible, to minimise uncertainty and unnecessary opportunities for political interference, both environmental and cost objectives should be delivered on an ongoing basis via, flexible, dynamic and self-adjusting measures, such as a credit reserve in a traded system, or the ability to transfer liabilities between parties under a tax system. The proportion of offsets eligible for compliance, especially from AFOLU¹, should also be adjustable (up or down) to achieve both higher net ambition and lower net cost in both tax and trade systems. However, given the inevitability of technological innovation, economic change, or improved scientific understanding, scheduled and/or quantitatively triggered reviews will also be necessary, although the schedule and basis for review should be defined from the outset, and the degree and duration of deviation from the long-term price/abatement level trajectory limited.
- Wide coverage: The fairest and most economically efficient approach is to apply a carbon price consistently (i.e. the same price) to all GHGs (on a CO₂ equivalent basis) and to all sources of GHG

¹ Agriculture, forestry and other land use

emissions (in all economic sectors) for which reliable emissions data can be acquired. Where data aren't reliable, incentives should be provided to encourage the collection of necessary information so that carbon pricing coverage can be expanded.

The key point is that a well-designed carbon pricing policy will not arbitrarily exempt a GHG or company or sector or emissive product from exposure to the carbon price, which would be neither fair nor efficient.

- Leakage: Until approximate equivalence of carbon pricing exists between trading jurisdictions (regions, nations or states), measures will be necessary to prevent the "leakage" or displacement of domestic economic/industrial activity – and carbon – to jurisdictions that lack a comparable price. Failure to prevent leakage will undermine the primary purpose of the carbon price – to reduce GHG emissions economy-wide.

There are various ways to prevent or reduce carbon leakage. If the point of regulation is far upstream, border carbon adjustments (BCAs) are probably the simplest option, in which the price on direct and indirect (e.g. purchased electricity or heat) emissions from the manufacture of products is removed (for exports) or imposed (for imports) at the border. However, BCAs can be politically divisive (seen as a barrier to trade) and depend heavily on life cycle assessment, for which data may be lacking or inaccurate. Partly for this reason, a downstream point of regulation is preferable (see below), in which direct and indirect GHG emissions from domestic manufacturing (large industrial emitters) in trade exposed and energy intensive (EITE) sectors are compensated for the carbon price (via free allowances in a trade system and rebates in a tax system), though the level of compensation should be less than 100% to preserve an incentive to abate at the margin, and with less efficient facilities receiving proportionately lower compensation. Sector eligibility for compensation should not be opaque, arbitrary or discriminatory but determined via a transparent, objective, evidence-based process that assesses:

- The proportion of domestic production that is exported
- The proportion of domestic consumption that is supplied by imported products
- The energy-intensity of domestic production.

Fuels or other emissive products (e.g. solvents) that are regulated immediately upstream of the point of emission (see below), including domestic/commercial fossil heating and transport fuels, should be subject to the carbon price whether they are domestically produced or imported.

- Point of Regulation: The point of application / collection of a carbon price should be as far downstream and close as practically possible to the point of actual emissions/point of final sale. This is preferable to far upstream regulation, in which coal, oil or gas are regulated at the mine mouth or well head. While an upstream point of regulation may appear to be administratively simple, environmentally effective and economically efficient, this is not the case because:
 - Not all coal, oil or gas emits CO₂ or CH₄ over its life cycle. Some fossil carbon remains embedded in non-emissive products. An increasing proportion of CO₂ may be captured and used or stored.
 - Many GHG emissions, including a significant proportion of CO₂, do not arise from the combustion of fossil fuels, but from other industrial and agricultural processes
 - If a carbon price is applied upstream, it is harder and more complex to design and implement a system for preventing carbon leakage from energy intensive and trade exposed industries downstream (see leakage point below).
 - An upstream approach does not expose emitters directly or transparently to the carbon price (polluter pays) and decreases the ability to pass on costs to the end user.

A fully downstream approach works well for large or industrial emissions sources (process and combustion). For emissions from multiple small sources, such as the combustion of residential/commercial fossil heating and transport fuels, it may not be practical (or politically acceptable) to apply the price fully downstream at the point of sale, especially in a cap and trade system (which would require retailers or even individual users to acquire permits). For this reason, for these sources, at least in a trading system, the point of regulation may need to be moved upstream from the final point of sale to the closest practical point

of regulation.² This could be an existing duty point, such as the terminal rack for liquid transport fuels, or the distributor for other fuels. A downstream carbon pricing system will therefore need to define an entity emissions threshold (e.g. 25,000te CO₂ pa) to determine which sources are “large emitters” to be regulated fully downstream, and which are regulated immediately upstream.

- Use of revenues: It is for governments to determine how to spend carbon price revenues. Ideally, they should be returned to the economy in a non-distortionary way, preferably through reductions in other taxes that create economic distortions—for example, corporation, income or payroll taxes—with no net increase to the overall tax burden. Some proportion of revenues may be used to address adverse political, social or industrial impacts from the price, including citizen “dividends” or sector retraining programmes, or to reinforce the carbon reduction effects of the price by supporting low carbon research and development. However, ring-fencing of this kind is likely to be economically inefficient.
- Offsets: Reductions of emissions in sectors that for practical reasons (see below under supplementary policies) are not directly exposed to the carbon price (potentially AFOLU), should be allowed as offset credits for emissions from sectors which are exposed to the price – provided reductions can be shown to be real, measurable, permanent and additional. This flexibility effectively exposes a wider scope of emissions to a carbon price and enables higher net abatement at lower cost.
- Supplementary policies: While carbon pricing is necessary and should be the central policy to limit GHG emissions, other, related forms of market failure may sometimes justify supplementary policies – provided they are highly targeted and, in some cases, time-limited. These include:
 - Direct regulation of some GHG emissions in some sectors which cannot, at least initially, be directly exposed to the carbon price for practical reasons (e.g. because they have hard-to-measure/attribute/abate emissions, such as methane emissions from AFOLU or oil & gas). Verified reductions in

² In a tax system it would be possible to impose a carbon tax, like a sales tax, at the point of final sale (the pump or gas retailer) and this could improve transparency and cost pass through. However, this very transparency may also make it unpalatable to political decision makers.

these sectors that go beyond regulatory requirements should be eligible for use as compliance offsets in sectors exposed to the carbon price (see above).

- Standards to accelerate uptake of energy efficient technologies such as appliances, vehicles or buildings, where incentives to adopt are split or unclear, even with a carbon price.
- Transitional incentives to help promising but immature low carbon technologies (e.g. CCUS and renewables) overcome various barriers to deployment. However, such incentives must be:
 - Tightly focused on technologies with objectively demonstrated potential for significant cost reduction and significant carbon savings
 - Truly transitional (i.e. gradually reduced and finally removed once the technology has either become commercial or shown that it cannot).
- Enabling policies: To underpin, amplify or enable market responses on the supply and demand side public support should be provided for:
 - Research and development to catalyse innovation to provide low-carbon options for the future.
 - Education to raise public awareness to highlight the energy challenges the world faces, and potential solutions.
 - Large-scale infrastructure (e.g. grid reinforcement or CO₂ pipelines) if it is market-enabling but too high-risk, large-scale and capital-intensive for the private sector to invest in alone.

Agenda Item 5:
Methane emissions policy

Members of the Issues Management Working Group

Methane emissions policy

In the US, the Trump Administration has begun revising or rescinding various Obama-era regulations covering methane emissions from oil & gas operations. Just this week the Environmental Protection Agency proposed a new rule relaxing a number of regulatory requirements.

Increased stakeholder interest has already led to public challenges for BP, as a leader on methane reduction, to confirm its position on methane policy and regulation. We are likely to face further public stakeholder challenge at forthcoming external events in the US where BP representatives will be present, including a methane event on 1 October in DC, which BP is sponsoring.

To be able to respond consistently and coherently to these challenges a short position on methane policy and regulation is currently being developed and will be circulated immediately prior to the IMWG meeting or will be walked into the room.

The purpose of this IMWG agenda item will be to discuss and approve a position and define our advocacy and communications stance.

Bob Stout

14 September 2018

Members of the Issues Management Working Group

Methane emissions policy

[Pre-read being developed. Will be circulated immediately prior to the IMWG meeting or walked into the room]

Agenda Item 6:
Electrification of road transport

Members of the Issues Management Working Group

Electrification of road transport

A position on the electrification of road transport was originally agreed by IMWG in 2016. Since then, interest in and the use of electrification in transport has continued to evolve, driven by climate and health concerns. Further, a rise of autonomous driving technology and changing preferences for vehicle ownership has been observed. An up to date position is needed to reflect recent developments and help inform advocacy efforts.

Communication

The external audiences for this position are:

- Regulators and policymakers
- Investors
- Other external stakeholders e.g. NGOs

The suggested internal staff that need to be aware of this position are:

- Group and Downstream Technology teams
- Group Economics
- Downstream Market Analytics teams
- C&EA
- GPA teams (Europe, US, China)

The purpose of this IMWG session is to discuss and agree the updated position and advocacy stance.

Richard Harding

14 September 2018

The electrification of road transport

Key messages

- **Plug-in electric vehicles (PEVs) are on the increase** and can bring air quality benefits, especially in urban areas.
- They can also help the **transport sector transition to a low carbon future**, provided the electricity source is low emissions. Electric vehicles using coal-fired electricity may not lead to lower emissions than conventional vehicles.
- The **scale and pace of plug-in electric vehicle growth** (currently around 3% of all light vehicles) depends on a range of issues, including the rate of customer adoption, progress in battery technology and vehicle charging infrastructure, and future policy and regulation.
- **BP is actively engaged** in understanding customer trends and preferences in this area, and looking to develop our business in this growing market.
- We expect **oil to still account for the lion's share of transportation fuels in 2040** due to lower cost conventional/hybrid vehicles, slow fleet turnover, the advantages of liquid fuels and the scope for further efficiency improvements.

Related briefs: Biofuels, Carbon pricing, Carbon life cycle assessment

Additional information

BP activity on electric vehicles

- BP monitors and projects market and technology trends through our Energy Outlook, Technology Outlook and Demand 2050 (our liquid fuels demand model).
- BP's advanced mobility unit has been set up to further understand, and develop options for BP in respect of new businesses, strategic partnerships, and venturing in this growing market space.
- BP Chargemaster, StoreDot, and FreeWire are all recent investments in this area.

Outlook for electric vehicles and liquid fuels demand

- Plug-in electric vehicles will increase their penetration into the vehicle fleet. The scale and pace will be determined by:
 - Customer preferences and lack of familiarity with new technology.
 - Technology barriers, including battery costs and energy density, slower refuelling, limited electric range, and higher cost of ownership.
 - Growing conventional vehicle fleets, especially in developing countries.
 - The development of widely available vehicle charging infrastructure.
 - The impact of new business models, including ride-sharing and offers based on autonomous driving technology.
 - Future policy and regulation, including initiatives to improve urban air quality, tailpipe CO₂ regulation, incentives and lower liquid fuel duty income.
- Global liquids demand is projected to be higher in 2040 than in 2018. Demand growth will be led by developing economies with overall global growth lessened by decreased demand in the OECD.

- The IEA WEO2017 Sustainable Development scenario suggests that liquid fuels will still account for ca. 76% of transportation demand (Oil 62% Biofuels 14%) in 2040.
- BP's ICE ban scenario, which limits ICE car sales from 2030 and fully curtails sales by 2040, suggests that up to an additional 15% of global road fuel demand in 2040 could be removed. However, even in this case, demand for road fuels would still be significant (greater than 40 million barrels per day).
- Increasingly stringent tailpipe CO₂ regulations, and growth of PEVs, will gradually curtail the growth of liquid road fuel demand. This will be dampened by the relatively slow pace of fleet turnover.

Policy and regulation

- Regulations to curtail tailpipe CO₂ emissions from cars have been enacted in many OECD and some developing economies (e.g. China). Regulation for medium and heavy duty vehicles commenced in USA in 2017, and other regions may follow.
 - The immediate burden of emission regulation falls on car manufacturers, who must persuade customers to purchase lower emitting, but more efficient, vehicles.
 - Some countries offer subsidies and incentives to close the cost gap between plug-in electric and conventional vehicles.
 - BP supports a level playing field for road transportation that considers fuel duty alongside an economy wide carbon price, as well as the life cycle impacts (including manufacturing of key components such as EV batteries) for all types of vehicles.
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Car manufacturers and consumers

- Development and sales of electric vehicles will be a key aspect of car industry strategies, as they seek to comply with increasingly stringent tailpipe CO₂ regulations.
 - Lithium-ion (Li-ion) batteries seem likely to remain the predominant vehicle battery technology. While the cost of Li-ion battery packs has fallen, parity with internal combustion engine technology is not expected soon without subsidies.
 - Electric vehicles offer consumer benefits including lower fuel costs and CO₂ emissions, and quieter vehicles with strong acceleration. On the other hand they can have higher total cost of ownership, limited range, and/or slower refuelling.
 - The number of plug-in electric models on sale is accelerating. In 2017, sales of plug in electric vehicles globally exceeded 1m units (although still less than 2% of light vehicle sales), but is likely to continue to grow.
-

Different types of electrification

- Plug-in electric vehicles (PEVs) are vehicles that receive electricity from the grid.
 - Plug-in hybrid electric vehicles are partly powered by electricity from the grid but also have an internal combustion engine and use liquid fuels.
 - Battery electric vehicles that run only on battery power charged from the grid.
- PEVs, owing to their substantial electric powered range, are likely to have significant impact on liquid fuels demand over the long term. They will also require investment to be made into local electricity distribution and vehicle charging infrastructure.
- Hybrid electric vehicles (such as Toyota Prius) that combine electric motors and an internal combustion engine, but do not use electricity from the grid for power, are sometimes also referred to as electric vehicles. Their greater efficiency is largely the result of more efficient internal combustion engine operation.
- Autonomous vehicles (i.e. driverless) can be either electric or powered by liquid fuels.

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| Contact: Robert Spicer / Richard Harding |
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Members of the Issues Management Working Group

Electrification of road transport

What is the issue?

A position on the electrification of road transport was agreed by IMWG in 2016. Since then, interest in and the use of electrification in transport has continued to evolve, driven by both climate (reducing carbon emissions) and health (reducing air pollution) concerns in many parts of the world where BP has interest. Further, the rise of autonomous driving technology and changing preferences for vehicle ownership has been observed. Both may increase electrification and substitute the use of liquid hydrocarbon fuels. The pace and scale of reduction in demand for liquid fuels is of critical interest to BP in terms of strategic planning and future portfolio management, and providing differentiated and diverse mobility offers as consumer preferences evolve. It is also of great interest to many external stakeholders including shareholders, government and pressure groups. An up to date position is needed to reflect recent developments and to inform advocacy efforts.

Policy and regulation

In response to climate change and health concerns, regulations to curtail tailpipe emissions from light duty vehicles have been enacted; and it is widely regarded that ultra-low, preferably zero, emission vehicles, with electrified powertrains, offer potential pathways to address such concerns and improve conditions with respect to pollutants such as NO_x.

It is estimated that around 80% of new LDVs sold globally are now subject to some kind of GHG emission or fuel economy standards. In the most progressive geographies mandates are in place to require sale of “zero” emission vehicles¹, which are largely being met by plug-in electric vehicles (PEVs). By 2025, in such regions and under test cycle conditions, new passenger cars will be required to emit ca. 40% less CO₂ emissions than in 2010. Many governments also provide incentives for encourage consumer uptake of PEVs. In addition, end dates are being actively considered by some countries for the sale of passenger vehicles powered solely by conventional internal combustion engine (ICE) technology.

Focused action on urban air quality is also driving improvements to bus &

¹ California’s ZEV mandate and China’s NEV programme

taxi fleets in major cities; and the search for improvement is likely to evolve to include urban delivery fleets. More pervasive CO₂ regulation for medium / heavy duty vehicles is still nascent, but is following as part of global initiatives to decarbonise road transportation.

The immediate burden of much of this regulatory push falls on Automobile Manufacturers (OEMs). To meet the burden, OEMs not only need to cut emissions as required (which is technically and economically challenging) but also to persuade end customers in a competitive market to purchase the lower emitting, more efficient, but also more costly vehicles that they must produce (which is commercially challenging).

Unregulated markets are also still likely to see new vehicles with lower CO₂ emissions given a globalised automobile industry but a lag behind the leading regulated markets (US, EU, Japan and China) is likely. The level and rate of closure of the gap, owing either to spread of technology, changes in consumer preference, or the growth in regulation, is a key uncertainty. Significant uncertainty also lies with the future direction of regulation & measurement of CO₂ emissions and other critical pollutants.

A key policy point is that most current vehicle CO₂ regulations, including both tail pipe regulations and incentives for electric vehicles, focus on emissions from the vehicle itself (so called tank to wheels basis or TTW). They do not account for CO₂ emissions upstream of the vehicle, which can be significant. Critically this systematically favours plug-in over conventional liquid fueled vehicles, even if the electricity supply is carbon intensive. That said, advancing the electrification of road transportation is likely to enable an overall greater decarbonisation of the total energy system through leverage of more cost-effective lower carbon power generation.

Technology status and development

A. Light Duty Vehicles

The options for decarbonisation of light vehicles range from improvements to conventional ICE powertrains and associated vehicle elements (e.g. bodymass reduction, improved lubricants, and aerodynamics), through lower carbon fuels (biofuels), to combination with electric powertrains (hybridization) and ultimately to vehicles with solely electric powertrains. The term “electric vehicles” can be applied to hybrid electric vehicles (HEV) that use electric energy captured from braking to allow more efficient operation of the ICE but these vehicles still rely on liquid fuels for the energy consumed; more predominantly the term refers

to plug-in electric vehicles (PEVs) that use electricity from the grid transferred to the on-board battery prior to departure. PEVs are segmented into two broad categories:

- PHEVs (plug-in hybrid electric vehicles) combine electric drive with a conventional internal combustion engine (ICE) to give range flexibility and a lower initial cost owing to use of ICE/liquid hydrocarbon fuel capability with smaller battery/AER².
- BEVs (battery electric vehicles) are initially more expensive with larger, more costly batteries but have greater AER. They are more range challenged given use of less energy dense batteries that re-energise more slowly. However BEVs offer the greater potential for reduction in TTW CO₂ emissions. EREV (extended range electric vehicle) is a BEV variant with a small ICE on board as a generator; its sole function is to provide additional energy to the electric motors.

(i) Decarbonisation potential of PEVs

Although CO₂ emissions from grid generation are largely ignored by vehicle regulations that focus on TTW emissions, PEVs with electric drive that use stored grid electricity are an attractive way to significantly reduce CO₂ emissions, even on a well-to-wheels basis. This is because conventional internal combustion engines are relatively thermally inefficient and more costly in terms of the primary energy required to move their mass over distance. PEVs are also attractive because they position transport for longer term decarbonisation through associated action within the power system.

(ii) Refueling / charging times

A notable difference for PEVs is the much longer time required to refuel. Battery charging times vary greatly depending on battery size and charging equipment. However, it is clear that future drivers of PEVs will need to adapt their approach to energy acquisition in order to stay mobile.

(iii) Battery technology and cost of PEVs

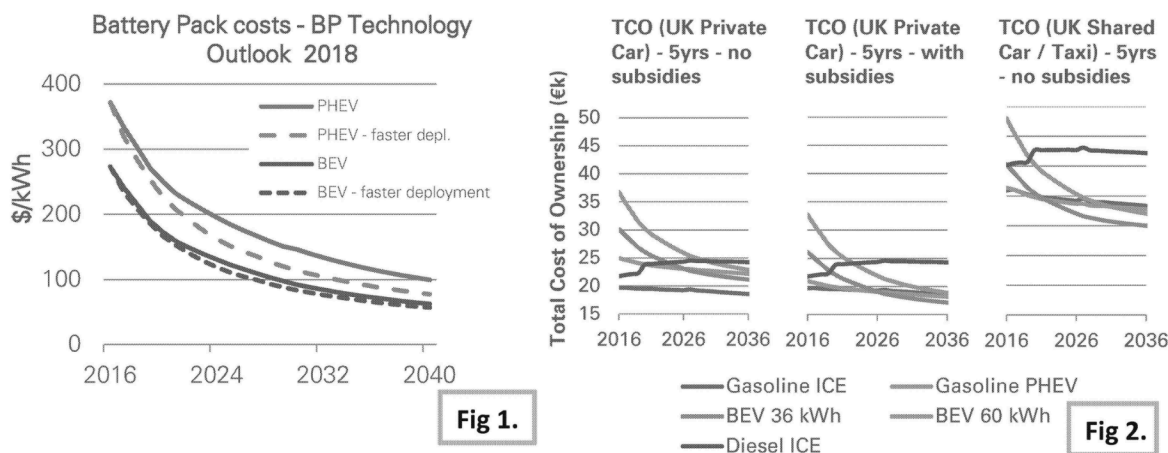
The 2017 BP Battery Study reaffirms our view that Lithium Ion (Li-ion) technology will remain the dominant electricity storage medium in PEVs for the foreseeable future. Crucially the cost of Li-ion battery packs has fallen significantly over the past 5 years and will continue to fall (see Fig 1). With improving battery pack costs electric vehicles will steadily become more cost competitive vs. conventional ICE vehicles. That said,

² AER – All Electric Range. The range of the vehicle driving solely under electric power

battery storage and other parts in 2030 will still add an incremental €5-10,000 to the cost of a BEV vs ICE equivalent (depending on size & AER).

(iv) Economics of PEVs

Total Cost of Ownership (TCO) analysis³ suggests that privately-owned vehicles with conventional gasoline ICE powertrains are likely to be a lower cost option than plug-in variants on an unsubsidised basis. With incentives the gap can be closed. Fig 2 shows results analysis for medium cars in the UK. If the UK's current plug-in grant remains, TCO crossover for a short-range BEV (36 kWh, ca 100 miles range) vs. Gasoline ICE car is projected in the mid 2020's. Without incentives Gasoline ICE remains the most competitive option, despite reduced costs for Li-ion battery packs. BEVs with larger batteries (e.g. 60 kWh, for 200 mile+ range) do not become cheaper than an ICE equivalent in either scenario, but the gap will close significantly. Results are similar for other geographies and car segments. Clearly, there are technological and, policy uncertainties that could change this view. Vehicles with higher utilisation (i.e. more km driven, such as taxis) show reversed outcomes, and demonstrate the benefit of the technology change.



B. Medium and heavy duty vehicles

Moving goods requires greater energy, and medium/heavy duty vehicles are much more challenged to use electric power given need for range, and carrying capacity at an economic price, requiring battery size optimization. Charging large batteries effectively and quickly is also a barrier.

³ This TCO analysis is based on a feeder model to BP's Demand 2050. View shown are based on Demand 2050 reference case technology assumptions, fuel costs based on end user product prices (including duties & VAT) built off the BP Energy Outlook 2018 oil price assumptions, and further assumptions on driving distances, vehicle pricing and residual values.

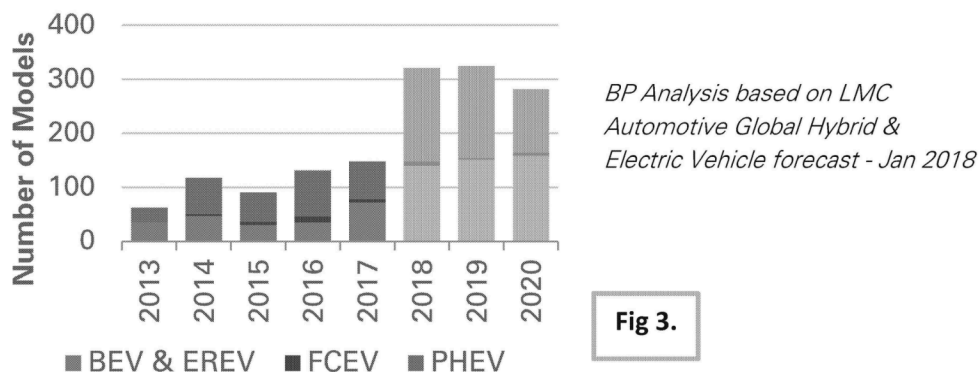
The development of battery powered medium duty trucks may come faster than heavier long haul trucks. A solution for the latter may be found via electricity supplied on the move that removes the need for large batteries. The power could be provided via catenaries or induction charging. But either of these requires costly infrastructure and so electrification for heavy trucks remains in an initial trial phase, with a number of studies ongoing.

Electric buses are more feasible, given their operating cycle, with an increasing range of size options available e.g. 2016 saw the first double deck electric bus enter service in London. The higher cost (reportedly 2 x alternatives) trades off against fuel savings and emissions benefits.

Supply and demand of PEVs

Supply: trends among automobile manufacturers (OEMs)

Despite being more costly for end consumers, PEVs are likely to become a key element of most OEM's model ranges; this both reflects their need to compliance with ZEV mandates, requirements for polluted urban zones, as well as wider CO₂ emission regulations. Although conventional ICE powertrains have been improved, to meet such future regulations for light vehicles BP analysis indicates that OEMs are likely to need PEVs in their sales mix. As a result we can see that the number of models on sale, being launched, and in development has expanded significantly. It is likely that the next few years will see further growth. (Fig 3.)



Sales of PEVs have been concentrated as smaller BEVs and premium BEVs/PHEVs. The Renault Zoe & BAIC EC180 are examples of the former where smaller range & battery costs offset by incentives have made the consumer offer more feasible. In the latter category are models such as the Tesla S/X and larger PHEVs from BYD, BMW, & Mercedes, for these models the higher costs of the electrified variant are traded off vs benefits

in terms of performance, image, and taxation as well as fuel savings.

There are benefits to OEMs in concentrating activity on BEVs – in terms of greater compliance benefit, and technical simplification. In contrast, PHEVs offer a more complex, but stepwise pathway away from conventional ICE vehicles for uncertain consumers.

Uncertainty for OEMs also stems from the evolving regulatory landscape, particularly in Europe, that includes further changes such as the introduction of an improved test cycle⁴ (WLTC, to replace NEDC) and in-use vehicle compliance testing on NO_x / other pollutants. Past failures, by VW, Mitsubishi and others, have added to industry tensions.

Electrification is also a significant opportunity for OEMs, and is key element of the “ACES” (Autonomous – Connected – Electrified - Shared) construct that is shaping strategies at the current time. In responding, and adapting to this changing future, leading OEMs can be seen to be acting similarly, e.g. in developing & launching electric variants of their models, but there are also differences in emphasis, e.g. in participation approach & strategy in autonomous driving trials, mobility services, power storage or micro-mobility (electric bi-, tri-, or quadri-cycles).

Demand: trends among end consumers

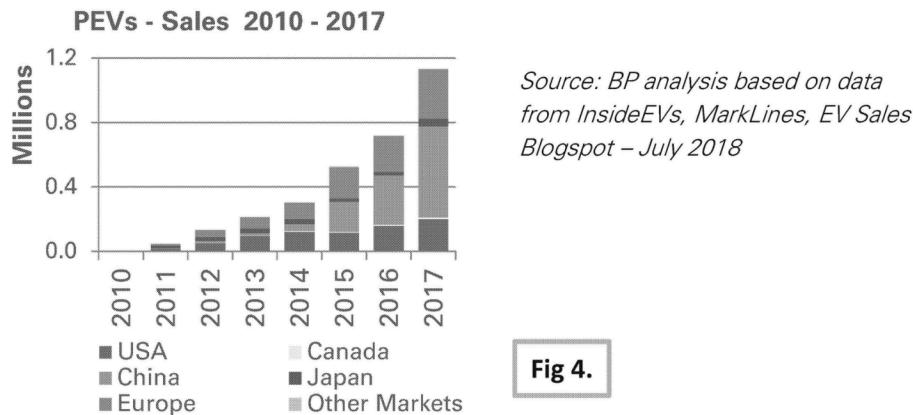
The electrification of road transport is initially likely to be most material in respect of light vehicles. For drivers the increasing viability of electrified powertrains may enable access to different product benefits.

1. An attraction for some will be that PEVs are a means to minimize, and potentially eliminate the need to visit traditional service stations.
2. In addition, electric drive may attract as it offers a different driving experience: quieter with high torque and strong acceleration.
3. For some, there will be the perceived benefit that it is a more efficient, lower CO₂ emitting vehicle.
4. For others the key attraction will be acquisition, or use, of new technology.

Yet the arrival of these vehicles in the market place is recent, and still developing. Many will perceive risks in buying a vehicle that is more costly than conventional alternatives, with unproven durability, limited range, charging limitations, and faster obsolescence. In terms of the diffusion,

⁴ NEDC – New European Driving Cycle. Current test cycle used for homologation of vehicles in the EU. WLTC – World Light (Vehicle) Test Cycle. Replacement test cycle for homologation of vehicles in Europe and other markets. Mandatory from September 2018. Unlikely to replace US cycles.

or adoption, of new technology, PEVs can firmly be seen to be at the start of their customer journey. This is will change as consumers share their awareness but the pace of adoption is an area of significant uncertainty.



Policymakers have recognized these issues and deployed incentives, including cash subsidies, to reduce customer resistance. Incentives assist penetration through closing the TCO gap, encouraging OEMs to develop their ranges, and boosting the development of charging infrastructure.

Sales of PEVs have been growing rapidly since 2010 (Fig. 4). In 2017 sales exceeded 1m units, but with growing light vehicle sales of ca. 97 million units the penetration was just 1.1%. There was strong growth in China and in the EU, with the latter sales share rising to 1.7%. Global interest was been shown to be strong with over 500,000 initial pre orders for the Tesla Model 3 that started to ship in July 2017.

Autonomous driving technology has also been developing rapidly, and potential wide-scale deployment in fleets for mobility services is on the horizon. Powertrain choice is still an open question, given the need for significant additional electric load to power the on-board computers, but in mass deployment these vehicles are likely to travel much longer on average than today's taxis such that the fuel savings from using electric vehicles will be material, leading to not only lower operating cost but also pricing opportunity. As such services are likely to be urban-focused, some cities may seek to mandate electric vehicles to reduce, or at least not increase, air pollution from these vehicles. Overall the expansion of driverless mobility services is likely to aid the growth of electric vehicles and provide new business opportunities, e.g. in provision of fast charging.

Uncertainties in the trajectory for electrification

In addition to the trajectory of future CO₂ emissions regulations, and the rate of adoption by end consumers of PEVs, there are a number of other

policy/regulatory and investment issues that are likely to also impact the future evolution of electrification in road transport. These include:

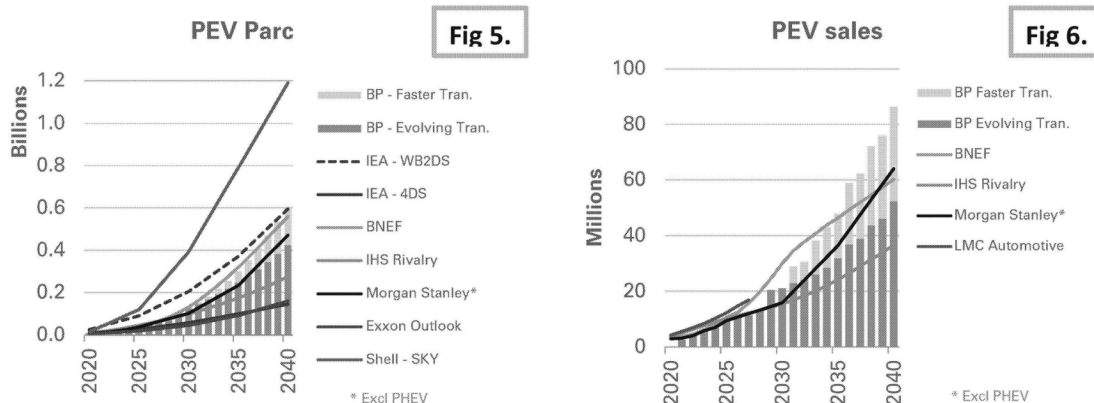
- a) The depth and longevity of incentives that narrow the TCO gap with ICE vehicles, and assist the pace of adoption. Incentive schemes remain active in many countries, but some have been withdrawn (e.g. Denmark) and there are clear signals, e.g. as in China, that other countries will follow. In the US, federal subsidies are limited to the first 200,000 vehicles sold by each OEM. In 2019, federal subsidies will no longer be available for new Tesla customers.
- b) The slow pace of fleet turnover has been recognized as a barrier to penetration of PEVs. To overcome this hurdle California & China have introduced “low” or “zero” emission vehicle mandates. These require OEMs to ensure the penetration of PEVs into the fleet through a mandated level of sales. This approach has been rejected in Europe, but remains an option that could yet be (re-)introduced in the current consultation on targets for tailpipe CO₂ for 2025/2030.
- c) PEV charging behavior and infrastructure development: PEV range limitations and charging times suggest that consumers will need to change the way in which they acquire energy for mobility. More PEVs in the parc will require more charging infrastructure - both in homes but also at public locations. Unresolved questions include whether growth of charging points is matching policymakers’ ambitions for parc penetration, and whether local grids can cope with the increase in instantaneous load and peak generation challenge that widescale vehicle charging requires. System integration of vehicle batteries combined with smart charging may also assist with grid resilience. In addition, there are competing standards for charging points. The quality & reliability in operation of charging networks is also a factor in consumer attitudes to PEVs.
- d) Fuel taxation: in many countries, hydrocarbon fuels provide material tax income to national and local governments; in others fuel duty income maintains roads, whereas electricity is not taxed in the same manner. Reducing demand for hydrocarbons will likely require this to change.
- e) Urban transportation & air quality policy development: PEVs will assist with progress on air pollution, but in addition restrictions, or bans, on higher polluting vehicle classes are also being introduced, such as in London with the introduction of the ULEZ. While restrictions or cost penalties will clearly encourage drivers to take action, it is not clear what the long term outcome will be in terms of the level, type of vehicle ownership and consequent usage.

- f) Alternative decarbonisation pathways including the greater use of natural gas, biofuels, and, hydrogen (H₂). Biofuel use is growing, particularly with local supply, but the policy drive to higher blends in the USA and Europe has moderated, in recognition that some biofuels are more sustainable than others, and slower than expected development of advanced ligno-cellulosic biofuels. H₂ fuel cells are attractive in that the range and refueling limitations of PEVs are largely overcome, but the cost of this technology is high and needs to reduce. Moreover green H₂ supply is also costly, and refueling infrastructure is generally scarce, and the re-development costs for greater hydrogen usage will be very significant.

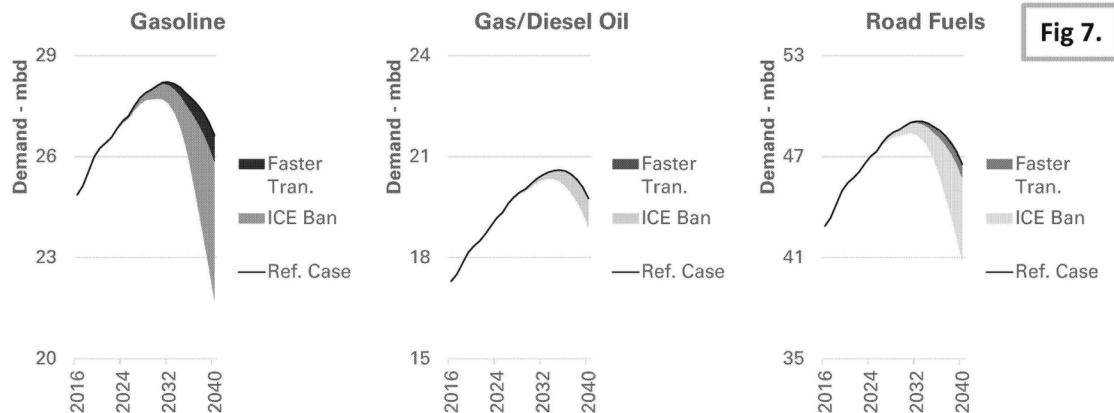
Scenarios and outlook for liquid hydrocarbons demand

To gauge the impact of these uncertainties, particularly to test the level and pace of penetration of PEVs into the light vehicle fleet, we continue to create alternative cases, including the “ICE ban” and “Faster Transition” scenarios, alongside our reference case. These have featured in the BP Energy Outlook and have also been used in internal studies over past years. Such scenarios explore multiple pathways to lower CO₂ emissions, including the impact of electrification in road transport.

The results from this BP analysis are shown in Figures 5 and 6. They depict the changing nature of PEV sales and parc penetration in both our current reference case and the faster transition case⁵; also included are some external projections for comparison. These scenarios also give indications of how demand for liquid hydrocarbon fuels would change in line these cases. Fig 7. illustrates the potential impact for Gasoline, Diesel and Road Fuels from the reference case, + faster transition and ICE Ban scenarios.



⁵ Demand 2050's faster transition scenarios look at the impact of a) more stringent tailpipe emissions standards (leading to more PEVs), b) shifts in sales mix to smaller cars, c) increased use of biofuels, and d) reduced mileage to test the limits of achievable CO₂ reductions from road transportation. Results presented in this paper are filtered to focus on the impact of accelerated PEV sales.



The most severe drop in liquids demand is seen in the so-called “ICE Ban” case⁶, where the potential impact on liquids demand for road transportation is a reduction of ca. 6 mbd vs the reference case in 2040. This would be a reduction of ca. 15% liquids demand in road transportation, and a decline of 6% of total global liquids demand across all sectors in our projection. The potential decreases are material, and likely disruptive, but they do not appear to spell the end for liquid hydrocarbon fuels before 2040. That said, the rate of change by 2040 indicated in these alternative scenarios is quite significant and so the impact on liquids demand by 2050 would be much greater.

Competitor views:

- Exxon – Conservative about the pace of PEV penetration. Accompanying their 2018 Outlook for Energy is a projection with 160m PEVs in 2040 (9% of LD parc). The accompanying commentary states “future battery costs and government policies are uncertain, hence there is a wide range of perspectives on future electric vehicle growth”
- Shell – Committed and anticipating transition. Shell consider that over the long term passenger transport can be mostly electrified and all Shell scenarios show a rise in demand for electric vehicles, with the latest SKY scenario – depicting a technically feasible solution to the Paris targets – suggesting very aggressive PEV uptake. Shell has established a New Energies business segment and purchased NewMotion, a European network of PEV charge points in 2017.

⁶ The ICE ban case considers the global outcome on fuels consumption from progressive withdrawal of ICE technology from 2030, with complete ban by 2040. It is intended as a bounding or maximum impact case rather than a scenario that is likely to be enacted.

- Chevron – Resistant. Chevron suggests that “although the increasing market share of electric vehicles will be a factor in reducing demand for oil, the overall demand for oil will increase because only 10 percent of global oil demand comes from cars”. Referencing IEA scenarios Chevron points out that “Oils and natural gas will account for about half of global energy consumption under almost any scenario”.
- Total – “Negotiating the curve” and pragmatic. Total thinks “the face of transportation will be transformed in the coming decades” and that “electric vehicles will be extensively used in large urban areas within 20 years”. Total is looking to reposition itself “as an Energy supplier rather than an oil company” but doesn’t consider that there is a silver bullet, and so “instead of putting all our energy into one disruptive technology like electric vehicles, it will be much more effective to leverage all our efforts to improve existing technologies and the energy efficiency of vehicles with internal combustion engines”. In addition Total has investments in solar power generation (SunPower), battery storage (Saft) and system control (Stem) that are likely to assist with sustainable PEV penetration.

Conclusions/Recommendations:

- Penetration of PEVs into the global vehicle fleet is happening and will continue given perceived benefits, and policymakers’ desire to improve air quality and target CO2 emissions that are in part discretionary.
- OEMs will supply increasing volumes of PEVs as a core element of their CO2 compliance strategies and early adopter customers are buying the technology. Current fleet share is small, but growing; the pace of adoption is dependent on OEM expansion of model offers, development of charging infrastructure, consumer interest, as well as subsidies and incentives.
- While there are a number of uncertainties, electrification appears not to provide an existential threat to liquid fuels demand up to 2040 but is likely to be highly disruptive.
- We should continue to take a pragmatic and factual tone, with the aim of being highly trusted on this topic. We should be unafraid to debate the choices that society faces and challenge unsupported assertions.

Robert Spicer

14 September 2018

Agenda Item 7:
AOB and date of next meeting