Bernard Looney Briefing Pack
CERA Week

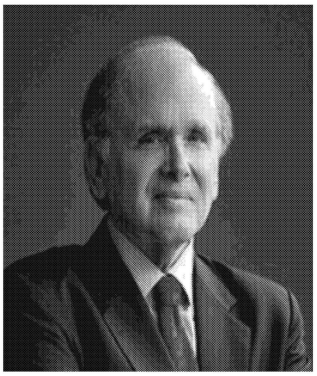
Theme: 'Methane Emissions: Getting to Zero'

Date: Wednesday 13 March at 14.50-15.30

Other BP speakers attending the conference: *See separate CERA Week overview doc*

Format: Panel discussion. No audience Q&A.

Session Chair: Dan Yergin, IHS Markit, Vice Chairman



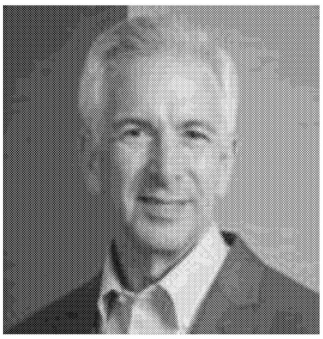
Daniel Yergin is a highly respected authority on energy, international politics, and economics. He is Vice Chairman of IHS Markit and cofounded Cambridge Energy Research Associates®. In selecting Dr. Yergin as one of the "hundred people who mattered" worldwide, Time Magazine said, "If there is one man whose opinion matters more than any other on global energy markets, it's Daniel Yergin." Fortune said that he is "one of the planet's foremost thinkers about energy and its implications." A Pulitzer Prize winner, Dr. Yergin is the author of the recent bestseller The Quest: Energy, Security, and the Remaking of the Modern World. The Quest has been called "a masterly piece of work" by The Economist and described by the Financial Times as "a triumph." Dr. Yergin is known around the world for his book The Prize: the Epic Quest for Oil Money and Power, which was awarded the Pulitzer Prize. It became a number one New York Times best seller and has been translated into 17 languages. Of Dr. Yergin's book Commanding Heights: The Battle for the World Economy, which has been translated into 13 languages, The Wall Street Journal said, "No one could ask for a better account of the world's political and economic destiny since World War II." Both The Prize and Commanding Heights were made into award-winning television documentaries for PBS and BBC. Dr. Yergin was awarded the United States Energy Award for "lifelong achievements in energy and the promotion of international understanding."

He received the Charles Percy Award for Public Service from the Alliance to Save Energy. The International Association for Energy Economics gave Dr. Yergin its 2012 award for "outstanding contributions to the profession of energy economics and to its literature." In 2014 India's Prime Minister Manmohan Singh presented him with a Lifetime Achievement Award. Dr. Yergin serves on the US Secretary of Energy Advisory Board. He is a member of the National Petroleum Council, a trustee of the Brookings Institution, and a director of the United States Energy Association and of the US-Russia Business Council. He is a member of the Advisory Board of the Massachusetts Institute of Technology Energy Initiative, Singapore's International Energy Advisory Board, and the Russian Academy of Oil and Gas.

Other members of the panel are:

- **Fred Krupp,** President from EDF
- **Stalle Gjervik** who has taken over as head of XTO Exxon Mobil
- **Suhail Mazroui**, oil minister of UAE, who is keenly interested in this topic

Biographies:



Fred Krupp, Environmental Defense Fund (EDF), President

Fred Krupp, President, Environmental Defense Fund (EDF), has guided EDF for three decades. A leading voice on harnessing the power of the marketplace to protect the environment, Mr. Krupp appeared on the TED stage in 2018 to announce plans to launch MethaneSAT, an EDF satellite that will measure and map planet-warming methane emissions from the oil and gas industry worldwide. Under his leadership, EDF has become one of the world's most influential environmental organizations, with offices in the United States, China, Mexico, and Europe and an annual budget of more than $200 million. Mr. Krupp has led EDF's innovative corporate partnerships with FedEx, KKR, McDonald's, Walmart, and others. He is co-author with Miriam Horn of

the New York Times bestseller Earth: The Sequel – The Race to Reinvent Energy and Stop Global Warming and frequently appears in the media. Mr. Krupp is a recipient of the 2015 William K. Reilly Environmental Leadership Award from the Center for Environmental Policy at American University. He was educated at Yale and the University of Michigan Law School.

Staale Gjervik, XTO Energy, Incoming President

Staale Gjervik became president of XTO Energy, an ExxonMobil subsidiary, in April 2019. He is based in Houston. Staale, a native of Norway, earned his degree in naval architecture and marine technology from the University of Strathclyde in Glasgow, Scotland. He served with the Norwegian Navy prior to joining Esso Norway in 1998, a subsidiary of ExxonMobil. Staale has held various technical, planning, operations and leadership positions in Norway, Nigeria, the United Kingdom and the United States. These roles included operations area manager for the Gulf of Mexico, general manager for ExxonMobil projects in Nigeria and operations manager for ExxonMobil's North Sea operation. In 2013, Staale was appointed senior upstream advisor to the ExxonMobil Management Committee, based in Irving, Texas. In 2015, he relocated to Luanda, Angola, to serve as the ExxonMobil lead country manager and as managing director for Esso Angola. Staale joined XTO in January 2018 as senior vice president, Permian Integrated Development, where he focused on optimizing value chain integration across ExxonMobil's upstream, downstream and chemical business with regard to the long-term development of the corporation's Permian Basin assets. Staale and his wife, Hilde, have two children, one currently enrolled at Texas A&M University and one still residing at home.

Suhail Mohamed Al Mazrouei, United Arab Emirates, Minister of Energy & Industry

HE Eng. Suhail Mohamed Faraj Al Mazrouei was appointed as UAE Minister of Energy on 12 March 2013. The Ministry contributes to sustainable development; coordinates and represents petroleum

affairs, minerals, electricity, and water; and is responsible for assuring that these resources are utilized to support the national economy in collaboration with other relevant authorities. Early in his career, he gained corporate administration experience in ship building, defense systems, oil and gas services sector, and real estate development, and held positions in government and private sector. Mr. Al Mazrouei had a10-year career at Abu Dhabi National Oil Company (ADNOC) prior to joining the Mubadala Company in 2007. Mr. Suhail Al Mazrouei served as Director of Production and Engineering Facilities for all the companies operating in the offshore area of Abu Dhabi. In addition Mr. Al Mazrouei was seconded to Shell EP in the Netherlands, where he gained experience with international projects in Nigeria, North Sea, Brunei, and the Netherlands. During his career with Mubadala Company, he added new projects to the company's portfolio assets in Bahrain, Oman, and Kazakhstan and was responsible for the development of new projects and E&P investments in the Middle East and Africa. Mr. Al Mazrouei currently serves as Chairman of the Board of Directors of the Federal Electricity and Water Authority, Mubadala Petroleum Co., and Emirates Liquified Gas Co.; as a Member of the Higher Advisory Committee of the Supreme Petroleum Council.; as a Member of the Board of Directors of the Petroleum Development Co. and Dolphin Energy Co.; and a Member of the Audit Committee of ADNOC. He holds a Bachelor's degree from the University of Tulsa, Oklahoma, United States.

Key messages:

- There are real challenges for the industry with methane leakage.
    - There has to be a concerted effort to control methane emissions to maximise the benefits of cleaner burning gas.
- Methane is our product.
    - The better we control leakage, the more product we send to market.

- BP is leading a charge to improve methane detection, measurement and mitigation.
    - There has been a real pull from our organisation to trial new measurement, monitoring and mitigation techniques to control methane emissions from our operations.
    - We set ourselves a methane intensity target of 0.2% in 2018.

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Supporting messages:

- Today we are announcing an agreement with EDF to work collaboratively to test methane emissions technology
    - ~~$2 million over three years~~
- [US team: can we name check the University of Colorado or any of the proposed pilots?]
  The supermajors represent only the 'tip of the iceberg' of emissions across the value chain.
    - For example, the OGCI is approximately 20% of the US market.
- We believe there's an important role for industry leaders on methane to help raise the bar – not only in their own operations but among other industry players, particularly smaller operators.
    - That focus was reinforced in a series of expert roundtables BP hosted with Princeton in Washington DC and London last year.
- In the US, independents represent 85% of America's natural gas, they employ on average 12 people, so there needs to be particular focus in building US capability [https://www.ipaa.org/independent-producers/]
- The opportunity is to extend the best practices we've developed in BP and through the Methane Guiding Principles to these smaller operators.
- Given the competing priorities faced by smaller operators, this support has to be structured around improving efficiency, reducing emissions and increasing profitability.

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Commented [SR2]: Probably yes but still being negotiated with EDF and Colorado State

Q1. What is your strategy on methane? (Leadership role/goals and targets)

- The way we think about methane is that the better we get at minimising methane leakage from natural gas production, the greater the cleaner energy benefits of natural gas.
- It's also good business sense to keep more methane in the pipes so you get more of your gas to market.
- Two-thirds of the new projects we'll start up between 2016 and 2021 will be producing gas.
- So we think it's incredibly important to bring down methane emissions so we maximise the low carbon and cleaner energy benefits of gas.
- While methane doesn't last anywhere near as long in the atmosphere as carbon dioxide, it is understood to be a more potent greenhouse gas, so the better we contain it the bigger the impact we can have in helping society meet its climate goals.
- We stepped out and set ourselves a target for methane emissions in our Upstream operations a year ago, last April – a methane intensity target of 0.2%.
- We work with others in the industry. The OGCI has announced its first collective methane target for member companies – 0.25% methane intensity by 2025, with an ambition to bring that down to 0.2%.
- We have our own best practice, and there is an excellent set of Methane Guiding Principles developed by a coalition of producers, international gas bodies, NGOs and academics.

Q2. What actions are you taking, and what other activities are you involved in?

- Today we are announcing a ~~$2 million~~ MOU with EDF to work collaboratively to test methane emissions technology (Still TBC and confidential)

Commented [SR3]: See comment above

- We want to move towards continuous monitoring of potential leaks – it means we need to leverage a suite of technologies to help us do it.
- We're already testing a wide range of technologies
- Some of our people on the frontline are using hand-held detectors to quantify and prioritize any leaks they find.
- We've got the latest imaging cameras being deployed to some of our regions to identify issues in real time. As we speak, we are installing a new gas cloud imager camera in Khazzan.
- We've got drones in the air at some of our sites equipped with ultra-precise sensors developed with NASA expertise.
- We're also supporting research to improve understanding and hosting workshops to share knowledge and promote action.
- In 2017 we gathered leaders in our Upstream business for a workshop, with experts from Princeton University, and identified nearly 100 new actions we can take – in addition to activity underway already.
- We've used that to create our BP Methane Leadership Plan, organising the actions around 15 distinct areas, to keep us within our 0.2% methane intensity target.
    - In our operations, we are upgrading some of our facilities and deploying new technologies to track and minimise methane emissions.
    - We are aiming for zero routine flaring by 2030, removing a persistent source of carbon emissions from oil and gas operations.
    - We are testing a variety of high-tech cameras to enable us to move towards continuous monitoring at our major operations.
- We are working with industry partners to take collective action on methane emissions
    - We are one of the 13 companies in the Oil and Gas Climate Initiative (OGCI), which is prioritising action on methane, including introducing an intensity target for members and supporting the development of new detection and mitigation technologies.

- We are signatories to the Methane Guiding Principles drawn up by a coalition of producers, international gas bodies, NGOs and academics – developing best practices on methane emissions. The new set of 'methane management best practices' being developed through the Methane Guiding Principles, will be made widely available. We will look to speed ~~supercharge~~ their adoption among small independent producers in our key gas markets, starting in the US.

- We are active members of trade groups like IPIECA and the IOGP - where we can work with industry partners and share knowledge.

- We are members of the Environmental Partnership, which aims to continually improve industry's environmental performance through reducing emissions of methane and volatile organic compounds (VOCs).

- ~~[US team, should we add anything more specific on API: We are working with API and as part of the Environmental Partnership to share methane best practices with the wider industry including xxx]~~

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- . In the US specifically, BPX Energy efforts include:
  - Replacing over 10,000 (around 99 percent) high-bleed pneumatic controllers with continuous low-bleed and intermittent pneumatic controllers. We have less than 70 remaining.
  - [See appendix for more detail]

Q3. What we have learnt?

- We're learning more every day in terms of how we run our projects, and how we design sites to be more 'methane tight' in the future.
- There's still a lot we don't know about the way methane behaves in the atmosphere. We are building on a 20-year partnership we have had with Princeton University – through the Carbon Mitigation Initiative – to

target new research on methane so we can close some of these knowledge gaps. That is really important for focusing, improving and accelerating action, and helping guide policy.

- Over the past 12 months we've convened over 100 experts on methane, across three continents.

That's been a good opportunity to build a shared global perspective on this issue. The supermajors represent only the 'tip of the iceberg' of emissions across the value chain.

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Q5. What do you do with the methane that you capture?

- Methane is the main component of natural gas, so the way to look at the issue is not about 'capturing' methane, but maximising the gas you send to market.
- The more you keep in the pipe the more send to the market for the gas from that plant or pipeline – whether that's here in the US, in Oman or the North Sea or elsewhere.

Q6. Is infrastructure still holding back the Permian?

- Operationally, there are gas pipelines available, however, the challenge is that pipeline pressures are very high (>1200 psi), which requires gas compression.
- Most Permian sites have well site compression as opposed to more centralized gathering compression, which under certain operational conditions leads to flaring (pressures being too high to enter the pipeline or well site compression going down).

- It is our mission, and that of the entire operating community, to continue to build out infrastructure to reduce the amount of flaring, protect the environment, and get as many hydrocarbons into the system for marketing as possible.
- Pipeline solutions are underway for gas and oil takeaway including the Gulf Coast Express and Permian Highway pipeline for natural gas (roughly 2 Bcfd each bringing total takeaway nearly 14 Bcfd). For crude oil, the EPIC (approximately 400 kbd), Gray Oak (385 initial kbd), the Cactus II (585 kbd) pipelines and other projects will provide additional takeaway.
- While there may be some takeaway challenges this year, we expect these bottlenecks to ease and this is reflected in current futures prices for Permian gas and oil with relatively tight differentials going forward.
- More broadly, the entire operating community is also working to address basic infrastructure needs in the Permian basin, including roads, hospitals, and schools. I'm proud to say we formally joined the Permian Strategic Partnership (PSP) at the beginning of this year, through which we, along with nearly two dozen other companies, have committed to $2M annually over the next five years to address basic infrastructure deficiencies impacting our employees who live and work there.
- Beyond the PSP, we will continue to look for ways to support infrastructure projects that support development in the Permian for decades to come.

Q8. Is the Permian different than other areas to work on in terms of methane?

- Like many liquids rich plays, the primary methane considerations for the Permian are from flaring. . By moving to centralized production facilities with backup compression, combined with our intelligent operations, we are confident that we can reduce the amount of flaring, and find a number of other ways to reduce methane emissions across our operations.

- We approach our operations in the Permian like we would anywhere else in the world by continuing to support efforts that encourage energy investment while protecting the environment. We are rapidly developing and deploying new technologies that reduce our methane emissions. We're already doing that in the Permian, and will do the same across our upstream portfolio.

Q9. BP has stepped up on its commitment to unconventionals/shale?

Why?

What do we know about shale today that we didn't know four years ago?

- We continue to look for opportunities to high grade our portfolio
- Last year we acquired BHP's assets in the Permian, Eagle Ford and Haynesville – some of the best acreage in the best basins in the onshore US. We were proud of the unconventionals business we had had prior to the transaction, but the reality was that it was an 86% gas business producing about 10,000 barrels a day of oil and therefore in a commodities sense it was quite challenged.
- What we bought was a 50/50 oil/gas business with potential to grow to 200,000mbd of oil in the mid 20's. These are world class assets that have upgraded our American onshore business and will bring synergies with our existing operations.
- What has changed the most in the past four years that has made us more comfortable with the transaction:
    - Performance – Has improved significantly over the past 5 years (unit production costs, development costs are 35% lower than 2013). Examples include:
        - our work in Haynesville where we engineered a fit for purpose completion to create a stimulation design that improved capital efficiency and value – the results are generating returns at between 30-45% at HH 2.75
        - increased recovery by 225% in the Eagle Ford by re-engineering stimulation designs

- Transformation – our focus on it is creating billions of dollars of value and we expect our unconventionals portfolio to benefit from it as well
    - Already have delivered value, but there is much more to come
    - Apex and the rest of our production digital toolkit added 30mboed in 2018 alone
    - We are accelerating Digital further with the creation of a new function
    - Teams are embracing agile ways of working – it is a potential game changer in the way we work

Q10. What's holding back investment – or is investment being held back?

- Changing global conditions mean we have to adapt, as an industry, if we are to continue to provide energy to the world.
- The world has changed
    - A lot of industry focus on the L48
    - We see a lot fewer players internationally
    - We can do more with a dollar invested today thanks to technology than in the past
        - From Woodmac - Capex/boe in 2018 $5.5/boe compared to over $10/boe in 2014.
        - We have only just scratched the surface with this, there is much more to come.
- Investment decisions must be taken in this new context.
- Each participant in the industry will have their own criteria for making investment decisions.
- Investment in the future looks promising
    - At BP, we are taking account of the reality into which we are investing.
        - We're still investing we took 9 FID's in 2018:
          Khazzan Phase 2, KG D6 Satellites, Manuel, Vorlich, Alligin, Zinia 2, Cassia compression, Matapal and Tortue

Key facts:

- The industry is investing in more projects than before 2014, from Woodmac

- 2018 49 FID's in the industry vs 44 in 2012. Low point in 2015 of 10
- 2018 average project sanction size was 680 mmboe double 2017
- 2018 sanctioned reserves trebled to 33.5 bnboe vs ~5bnboe in2015
- NOCs sanctioned more reserves than IOCs ~12bnboe vs ~9.5bnboe
- 2018 big year for Middle East; capex 55% and 40% reserves.
- Investment in the future looks promising
    - 2019/20 100 mtpa of LNG capacity expected to be sanctioned

Confidential Partnership Launch TBC: BP & EDF (Dave King to provide information)

Appendix:

Provided by Bob Stout, VP & Head of Regulatory Affairs (06.03.2019) – this may be subject to editing over the next few days.

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  - And we follow the Methane Guiding Principles drawn up by a coalition of producers and international gas bodies, NGOs and academics.

- Steve Pacala, from Princeton University, one of the world's leading climate scientists, has said that if the 0.2 target became an industry standard it would, "take oil and gas methane from being a big component of global warming to being essentially a negligible component of global warming."

- Additionally, through the OGCI we're working to develop Carbon Capture Utilization and Storage (CCUS) so that oil and gas can play their full part in the energy transition especially in the power generation sector.

Q: What specific measures have been taken to reduce methane emissions from BP's U.S. onshore operations?

BPX Energy efforts include:

- Replacing over 10,000 (around 99 percent) high-bleed pneumatic controllers with continuous low-bleed and intermittent pneumatic controllers. We have less than 70 remaining.
- Reducing venting during liquids unloading by implementing enhanced automation, plunger lift and optimized shut-in cycles through BP's "Smart Automation" project in the San Juan Basin. We have achieved 75% reduction in emission events.
- Implementing green completions before it was a regulatory requirement. (Green completion technology recovers natural gas for sale and minimizes the amount of gas that is flared or vented during the completion of wells.)
- Replacing chemical injection pumps with solar pumps.
- Optimizing compressor engine fleet to reduce the size and number of engines.
- Installing a waste heat recovery unit at our Florida River gas plant in Colorado.

Q: What actions will BP take moving forward to address methane emissions in its U.S. onshore operations?

- BP will continue to reduce methane emissions across our global operations. We are targeting a methane intensity of 0.2% and holding it below 0.3%.
- We are testing remote sensing technologies for detecting and measuring methane leaks in our operations. As these technologies are proven and become cost-effective, we will deploy them over time for both new and existing sites. These new technologies are particularly critical where natural gas is produced from wells spread across wide geographical areas.
- We will continue to replace the remaining high bleed pneumatic controllers in our inventory and will replace a number of pneumatic pumps with solar pumps.
- We continue to participate in the U.S. Environmental Partnership and share what we learn with its members.

Q: What does the BHP acquisition mean for BP's methane reduction plans?

- In the near term — nothing. We are committed to reducing our methane emissions across our U.S. onshore portfolio.

- As we continue to better understand the assets we are acquiring from BHP, we will incorporate these assets into our methane reduction plans accordingly.

Q: BP has announced the potential sale of some onshore assets — specifically in Colorado, New Mexico and Wyoming. What does this mean for BP's methane reduction plans?

- We remain committed to reducing our methane emissions across our U.S. L48 portfolio in line with our Group targets.

Q: Why doesn't BP adopt the concept of a central processing plant like the one in Oman for its U.S. operations?

- Our experience in the U.S. helped inform the design of our Oman operations, including the benefit of a central processing facility. The geographic locations of our sites in the U.S. — how they are dispersed over mass acreage, often with varying ownership structure — make a central processing facility impractical.
- We are taking a number of other steps to address methane emissions from our U.S. operations instead.

Q: Why are BP's methane emissions higher in the U.S. than the rest of the world?

- The reported emissions reflect the different kinds of operation.
- BPX Energy has thousands of wells spread across 6 million acres and five different states. Many of these are in very remote locations, far from any municipal power grids and facilities, and governed by different licensing and regulatory requirements.
- This means that we use technology, such as gas pneumatic pumps and controllers, which have higher methane emissions associated with them than used in more centralized operations.
- We don't have to use these types of devices in our other gas operations because we can generally make use of centralized electric power for pumps and controllers - even in our new Khazzan operation in Oman which spans an area of over 2,000 km2.
- BPX Energy has been responsible for around half of BP's total operated methane emissions — so we've made methane reduction here a priority.

Q: Are BP's onshore emissions going up or down?

- BP's onshore business has been in action for more than 15 years to reduce methane emissions from our U.S. onshore operations.
- Since the year 2000 our Lower 48 business has reduced its total GHG emissions by more than 2 million tons of carbon dioxide equivalents - most of these reductions were methane emissions.
- This has been achieved by, for example, converting high-bleed pneumatic controller to low-bleed or intermittent controllers, replacing pneumatic pumps with solar-powered ones, and implementing 'green completions' to reduce venting and flaring during well completions.
- We are continuing to pursue emissions reductions through conducting systematic leak detection and repair programs and replacing even more of our methane emitting equipment.

Q: What is BP's current methane intensity in the U.S., and what progress has been made so far to reach the 0.2% target?

- We are currently reducing our methane emissions, while enhancing our ability to

measure our emissions. We are comfortable that we will be able to meet our global 0.2% methane intensity target, which includes the U.S. contribution.

Q: Aren't Transmission emissions so small that they do not need to be regulated?

- BP is a member of the Methane Guiding Principles and we think emissions across the value chain need to be managed to preserve the role of gas.