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So good afternoon, everyone. Welcome here those of you -- thank you for joining us on what -- on this beautiful sunny day. So those of you who are on the webcast here, know it's a beautiful day here in London, and welcome to everyone who's joining us on the webcast from all around the globe.

We've got about 7,000 people registered from around the world today. But here, it's great to see so many familiar faces in the audience, and to welcome any new ones today.

I think it's fair to say it's been a pretty eventful year since we met here last summer for the Stats Review. And for a long wavelength business like ours, a lot can happen in a very short space of time. That's why the Stats Review is so important for us. It helps us understand the past, manage the present and plan for the future.

So we hope it also serves to start a discussion. It fuels debates around the world. I think it helps making decision for us and for those in our industry and in governments and well beyond that.

So I'd like to take this opportunity to thank everyone involved in this, this year's project, with a special thank you to our Chief Economist, Spencer Dale, and his team, and I see some of the members here. So once again, they have produced a detailed report, and I think it's very thought provoking.

In a moment, Spencer will take us through this year's findings. But first, let me briefly highlight a few of the most significant changes from last year.

The first of these is we've seen another year of strong demand growth for global oil markets. On the supply side, we have seen OPEC and other participating countries maintain discipline in their production cuts. And the combination of robust demand and OPEC production cuts meant that oil inventories have fallen back towards normal levels. This adjustment caused a firming in the oil price. Brent is up around 40% since last year, rising from below $50 a barrel to now more than $70 a barrel.

Also documented in the Statistical Review is a remarkable growth in U.S. tight oil production, which should caution us that the recent firming in oil prices is unlikely to persist, I think.

Another significant short-term feature highlighted in this year's Stats Review is the strong growth in natural gas. Natural gas was the largest source of energy growth in 2017. This was driven by China, where consumption surged by 15% last year, accounting for a full 1/3 of the global increase in gas demand.

We also saw another year of strong expansion of LNG supplies, helping to improve the accessibility of gas around the globe. The improving accessibility of natural gas, along with rising demand, should help us to underpin its long-term use.

It's really important to keep the long-term picture in mind, and when considering these short-term changes, particularly when it comes to carbon emissions. In 2014, '15 and '16, we saw 3 successive years in which there had been little or no growth in carbon emissions from energy consumption. Last year however, those emissions went up by 1.6%. That's not the direction we want to see emissions going.

It's important to see the uptick in 2017 in a longer-term context. Some of the exceptional performance seen in recent years has been boosted by temporary cyclical developments, so some reversal, as Spencer says, was always likely. He said that last year.

The good news is that the long-term structural factors working towards reducing emissions continues to progress.

As well as the strong growth of natural gas, wind and solar both grew, contributing to a 17% increase in renewable power last year, remarkable number, higher than the 10-year average and the largest increment on record for growth. We also saw strong coal-to-gas switching, particularly in China, and I think this is an important development of global significance.

The power sector accounts for over 1/3 of carbon emissions from energy consumption, so coal-to-gas switching really matters for the energy transition. Keep that in mind when Spencer gets to his section on power. I found the numbers really surprising, Spencer. I'll leave him to tell you about that.

But if there's one big message in this year's review, it's the opportunity to make real progress on carbon emissions in the power sector. There is the potential to make a huge difference if policymakers go after the environmental rewards.

At BP, we're keen to play our part in that. We're growing our gas production. We're also committed, along with our partners in the Oil and Gas Climate Initiative, or OGCI, on working on how we unlock the potential of carbon capture use and storage, which is also known as CCUS, along with reductions in methane emissions.

And like many other providers, we also see a great future for renewables. We believe BP's sizable investments in solar and wind energy and biofuels will continue to build a positive impact in the years ahead along with our oil and gas production.

As you all know, BP is also a strong advocate of carbon pricing. We believe that, that would make energy efficiency much more attractive and make low-carbon solutions of all kinds more cost competitive.

As ever, our sector faces challenges, but we also see lots of opportunities. To help us make these informed decisions and position us for the next phase of the energy transition over the next decades, we rely on understanding how the industry is changing.

And to do that, we require reliable data and timely data. And this is the role that this Statistical Review and our economics teams has played now for the past 67 years. I certainly find it a helpful guide. I see it on the desks of energy ministers all over the world. I hope you will find it useful.

So with that, I'll turn it over to Spencer, who will take you through the report in detail.

Spencer Dale - *BP p.l.c. - Group Chief Economist*

Thank you, Bob. Good afternoon, ladies and gentlemen. And let me add my thanks to everybody for sparing the time to come to today's launch of BP's Statistical Review for 2018, both here in London in St. James, lots of people, lots of familiar faces, and also everybody watching around the world on the web.

As Bob said, we've got over 7,000 people registered for today's webcast, which I think is a record for the Stats Review. And I'm conscious whether you watch on the web, it's not quite the same as watching in person. So please do stay with us today, and please do keep sending in your questions during the next 40 minutes or so.

I realize we don't always get to all the questions that people submit from around the world. So this time, today, we're going to do a bit of a new experiment. We're going to do some crowd sourcing towards the end of the both popular questions. So please do send in your questions. If -- even if we don't get to your actual question, it will show up in the sort of the most popular crowdsourcing questions at the end.

Although one request. When I looked at the questions that people had submitted last year, there was a surprising amount of questions of people saying, how do I apply for a job at BP? Please do apply for jobs at BP. It's a wonderful place to work. But just not today because it really messes up my work, [Klaus]. So not today.

Our aim when producing the Statistical Review is that it should be the one-stop shop of choice for all your statistical needs. Customers like you can come back year after year safe in the knowledge that your regular staples will be available, updated and fresh, impeccably sourced, clean and ready for consumption, neatly ordered in familiar rows.

Some of you may even have an IKEA moment and end up using data that you didn't even know you wanted.

But even though we've been in the marketplace for 67 years, we can't rest on our laurels. The energy world is changing, and we need to keep up with evolving tastes and needs. This year, we're offering new data on the fuel mix within the power sector and on the key materials, such as cobalt and lithium, which are playing an increasing role in the energy transition.

I'm sorry to say that unlike BP's retail outlets, we don't offer customer loyalty cards. If we did, there's a number of people here who would be really high up on that list of the loyalty cards. But we do have the advantage that everything in our one-stop shop is free.

Before taking you through to the highlights of this year's produce, let me just thank everyone who's been hard at work collecting, cleaning and stacking the data shelves over the past couple of months, ready for your convenience. That work was led by the economics team, supported, as always, by the tireless efforts of the team from Heriot-Watt University. Both the economics team and Heriot-Watt team are here today, thank you all very much, guys. It's been a tough couple of months, but it's worth it. It's very much a team effort. Thank you.

As Bob mentioned, at first blush, some of the data for 2017 might seem a little disappointing. Growth in overall global energy demand is up, gains in energy intensity, down. Coal consumption grew for the first time in 4 years. And perhaps most striking of all, carbon emissions are up after 3 consecutive years of little or no growth.

So what does this tell us about the energy transition? Is it progressing less rapidly than we thought? Has it gone into reverse?

I would caution against being too alarmed by the recent data. We always knew that some of the exceptional outcomes seen in recent years reflected the impact of short-run cyclical factors as well as the longer-term structural forces shaping the energy transition.

Global GDP was growing at below-average rates, weighed down by weakness in the energy-intensive industrial sectors. Output from some of China's most energy-hungry sectors was falling in outright terms. Those factors were unlikely to persist.

Indeed, last year's presentation I gave here had the very snappy title, much to the delight of our communications department like Jeff here, of energy in 2016, short-run adjustments, long-run transitions.

And sure enough, some of those short-run adjustments came to an end last year. But many of the structural forces shaping the energy transition continued, particularly robust growth in renewables and natural gas. 2017's energy data is perhaps best seen as a case of 2 steps forward, 1 step back.

To explore this further, let's start by looking at some of the headline numbers.

Global energy demand grew by 2.2% in 2017, up from 1.2% last year and above its 10-year average. This above-trend growth was driven by the OECD, particularly the EU. Much of this strength can be directly related to the pickup in economic growth. So in that sense, it's a good news story.

But it also reflected a slight slowing in the pace of improvement in energy intensity, or, if you like, energy productivity, the amount of energy needed to produce a unit of output.

Despite unusually strong growth in the OECD, the vast majority of the increase in energy demand came from the developing world, accounting for nearly 80% of the expansion.

China alone contributed over 1/3 of that growth, with energy consumption growing by over 3% in 2017, almost 3x the rate seen over the previous couple of years. This sharp pickup in China was driven by a rebound in the output of some of its most energy-intensive sectors, particularly iron, steel and nonferrous metals.

Yet, despite this increase, the growth of China's energy demand in 2017 was still significantly slower than its 10-year average, and the rate of decline in its energy intensity was more than twice the global average. Two steps forward, one step back.

These contrasting dance moves forward and backwards can also be seen in the fuel mix. The forward movement can be seen in 60% of the increase in primary energy last year being provided by natural gas and renewable energy, the red and orange bars on the left-hand side here. Natural gas provided the single largest contribution to the expansion, buoyed by exceptional growth in China. This was closely followed by renewable energy, which, again, grew rapidly, punching far above its weight, driven by robust gains in both wind and solar power.

The step back was coal, which grew for the first time since 2013, and you can see this quite stark turnaround of growth in 2017 relative to the falls we saw in 2016. This growth was largely driven by China -- by India, sorry, but Chinese coal consumption also increased after 3 years of successive falls.

That's a very quick summary of the big picture for 2017. The plan now is to look at some of these developments and issues in last year's energy markets in a little more detail, starting first with global oil markets.

One of my favorite TV shows when I was growing up was a show called Dallas. Some of you may remember Dallas, tracking the trials and tribulations of the powerful Ewing family as it sought to dominate the Texan oil market.

It had a cast of many characters, some who'd been in the show for a long time but still had the power to surprise, battling against newcomers to the market who were less well known and who we had to get to know and learn about their behavior. The show would lurch from crisis to crisis with building tension and intrigue, often ending at nail-biting moments. Sound familiar at all?

The good thing about Dallas is you only needed to wait a week until the next episode. We have had to wait a year until the next installment of the Stats Review to see how the drama of real-life oil markets has developed.

To remind you where we left off at the time of last year's Statistical Review, or perhaps, I should say, previously in the Stats Review, flows of oil production and consumption had come back broadly into balance in 2016, but inventories remained at record high levels. OPEC, together with 10 non-OPEC countries led by Russia, sometimes known as the Vienna Group, had begun to implement their production cuts with the aim of accelerating the adjustment in inventories. But U.S. tight oil had started to pick up, threatening to offset the impact of the cuts.

Like all good cliffhangers, this begged a number of questions. Would the production cuts by OPEC and the other members of the Vienna Group work? How much and how quickly would U.S. tight oil respond? And what would all this mean for oil prices? So what happened next?

All good soap operas typically have an element of continuity against which more unpredictable elements of the storyline can unfold. Dallas, for those of you old enough to remember, had J.R.'s constant nastiness and Sue Ellen's constant drinking.

The constant in oil markets in recent years has been the strength of demand growth, and that indeed continued in 2017 with oil demand growing by 1.7 million barrels a day, similar to that seen in 2016 and significantly greater than the 10-year average of a little over 1 million barrels a day.

To put that recent strength of oil demand in some sort of context, average growth over the past 5 years is at its highest level since the peak of the commodity super cycle in 2006/'07. This, despite all the talk of peak oil demand, efficiency of electric -- efficiency of cars, the growth of electric vehicles. All those factors are real and are happening, but persistently low oil prices can have a very powerful offsetting effect.

Not surprisingly, oil demand in 2017 continued to be driven by oil importers, shown here in light blue, benefiting from the windfall of low prices, with both Europe and the U.S. posting notable increases. Growth in Chinese consumption, the largest single contribution, was closer to its 10-year average.

But there were some signs in the product mix that the boost from low prices may be beginning to wane. Growth in consumer-led fuels most exposed to oil price movements, especially gasoline, shown in these dark green bars here, slowed in 2017. In contrast, diesel demand, in the light green bars, bounced back, buoyed by the acceleration in industrial activity. That's the constant bit of the storyline.

What about the unpredictable events, particularly on the supply side and the interaction between OPEC production cuts and the response of U.S. tight oil?

That interaction can be seen in the pattern of supply growth last year. At an aggregate level, output growth of 0.6 million barrels a day last year was pretty similar to that seen in 2016. But the pattern of that growth flip-flopped quite sharply last year. Output by OPEC and other members of the Vienna Group, shown by these yellow and orange bars, after growing strongly in 2016, fell by almost 1 million barrels a day last year as the cuts in production took effect.

In contrast, after falling in 2016, oil production by countries outside of the Vienna Group grew by around 1.5 million barrels last year, led by the U.S. together with the bounce back in Libya, which was not part of the Vienna agreement.

If we look at the production cuts in a little bit more detail, the Vienna Group had a target for the production cuts of almost 1.8 million barrels a day relative to the base month of October 2016. In practice, the production cuts have far exceeded that, with the most recent data for April of this year showing cuts totaling nearly 2.5 million barrels a day.

This overshoot has been concentrated in particular in Venezuela, which is the first bar in this second row of bars here, where the economic crisis has caused production to fall by far more than the targeted amount.

These production cuts were instrumental in increasing the pace at which oil stocks fell back to more normal levels last year. In particular, the dampening in aggregate supply growth, combined with the robust growth in aggregate demand, meant daily consumption exceeded production for much of last year.

As a result, OECD commercial inventories fell by about 150 million barrels in 2017. And in March of this year, were broadly in line with the 5-year moving average measure originally highlighted by the Vienna Group.

Now there's no perfect measure of the normal or equilibrium level of stocks. The 5-year moving average measure shown here is obviously distorted since it includes the most recent couple of years during which stocks were excessively high. That's why this line is trending up over this period of time.

But if we exclude the most recent period and consider a measure based on the average level of stocks prior to 2015, this has a drawback that it doesn't take account of the increase in desired inventories as oil consumption has grown in recent years.

This inventory star measure here tries to avoid both these problems by considering the average level of stocks prior to 2015, adjusted for the increase in consumption since then. This measure suggests that the current level of inventories may be just a little above normal levels.

However normal stocks are precisely measured, the big message to take from last year is that the OPEC production cuts worked. The targeted cuts were met and indeed exceeded, and stocks fell back to around more normal levels.

That said, the impact of the production cuts would have been even bigger had it not been for the response of U.S. tight oil, which has grown by around 1.3 million barrels a day from October 2016. Indeed, the pace of this second wave of growth seen over the past 18 months or so is comparable to the rapid growth in tight oil between 2012 and 2014 despite a backdrop of much lower oil prices shown here in the red line.

To put the size of the increase in tight oil in the context of the production cuts, this chart shows a sort of horse race between the Vienna Group production cuts on the bottom and the growth in tight oil, including NGLs, on the top.

As you can see, the scale of the increase in U.S. tight oil meant the impact of the production cuts was progressively offset during the course of last year. It started at close to 2 million barrels a day and ended up at less than 1 million barrels a day. So another message to take from last year's data is that U.S. output -- U.S. tight oil did respond to the higher price signals.

The speed and scale of OPEC's actions mean that it continues to have the ability to smooth temporary disturbances to the oil market such as the pace of adjustments in inventories. But the relatively rapid response of U.S. tight oil reinforces the limits on OPEC's power. If OPEC tries to resist more permanent or structural changes to the market, such as the emergence of new sources of supply or the growth of electric vehicles, there's an increasing risk that these actions will quickly be canceled out by the responsiveness of U.S. tight oil.

Perhaps to know just one caveat on the potential for tight oil to grow. As many of you know, we've recently seen increasing bottlenecks within the supply chain in the U.S. There's also signs that investors are becoming less willing to finance continued high levels of investment. This suggests there may be some limits to the speed with which tight oil can grow going forward, at least in the near term.

Focusing the tight oil -- focusing on tight oil just for a moment longer. A central part of its success over the past 5 or 6 years has been the strong and continuous gains in productivity as technology and know-how have improved.

However, the most recent data for the Permian, which accounted for around 2/3 of the increase in U.S. tight oil in 2017, paints a sharply different picture for last year. In particular, using conventional measures based on initial output per rig, measured productivity is estimated to have fallen sharply through late 2016 and much of 2017 before picking up a little bit in the final quarter or so.

But much of the fall in this conventional measure was driven by a sharp decline in the rate at which drilled wells were subsequently fracked and completed as the supply chain within the Permian tightened and drilling processes became more complex, rather than by a fall in the underlying productivity of the drills -- the wells drilled.

We can control for changes in the completion rate by considering a measure of productivity based on the initial output per completed well, which points to a gradual flattening off in productivity last year rather than a sharp decline. This measure can be further refined to control for the increasing length of drilled wells by considering a measure of initial output per lateral foot of each completed well. This points to a slight decline in productivity during 2017 but less pronounced than implied by the conventional measure.

So what should we make of all this? It's perhaps not surprising that as U.S. tight oil increased rapidly with production spreading out from the sweetest spots, productivity began to flatten out. And importantly, this measure of productivity doesn't link directly to profitability if the cost of drilling continues to fall or if acreage is drilled more intensively. But it does perhaps suggest that the rapid increases in tight oil productivity that characterized much of the initial phase of the shale revolution may be beginning to fade.

Wrapping up last year's episode, if we consider finally the implication of these developments in demand and supply for oil prices, as you can see, prices drifted lower during the first half of 2017 as stocks remained stubbornly high.

But as the production cuts started to bite and inventories began to fall, prices increased with dated Brent reaching a high of a little over $65 by the end of last year.

As you know, oil prices have increased even further since then, raising the question of, what happens next? That will depend, amongst other things, on the behavior of OPEC and the other members of the Vienna Group. How will they respond to the overshoot in the production cuts? And when and how will they begin to exit from those cuts?

It would also depend on the behavior of U.S. tight oil. Will productivity keep declining? And are the recent issues with credit availability and supply chain bottlenecks short-term growing pains? Or could they act as more persistent constraints on growth?

To find out the answers to these and other key developments, tune in to the next exciting installment of the Stats Review.

Until then, if we turn next to natural gas, which, believe it or not, was equally intriguing last year.

2017 was a bumper year for natural gas with consumption and production both increasing at their fastest rates since the immediate aftermath of the financial crisis.

As Bob mentioned, the single biggest factor driving gas consumption was a surge in Chinese gas demand, shown here in this blue bar here, where consumption increased by over 15% in China, accounting for around 1/3 of the global increase.

Much of this rapid expansion can be traced back to the environmental action plan announced in 2013, which set targets for improvements in air quality over the subsequent 5 years. With that deadline looming, the Chinese authorities in the spring of last year announced an enhanced set of measures concentrated in the northeast provinces of China designed to meet those environmental objectives before the deadline was hit.

Those measures were focused on the use of coal outside of the power sector, with a combination of carrots and sticks used to encourage both industrial and residential users to switch away from coal into either gas or electricity with the vast majority opting for gas. The resulting increase in gas demand was greatly compounded by this switch into gas reaching a peak just as winter heating demand was ramping up.

This surge in gas demand led to severe strains within China. Retail and wholesale gas prices, shown here on the left, increased sharply. Imports of LNG were ramped up beyond notional capacity limits. There was also widespread rationing of gas, especially for industrial users as priority was given to households.

Now some of these tensions and strains simply respect the speed with which gas demand expanded. There's a limit to how quickly LNG imports can be increased. Imports of pipeline gas didn't grow by as much as perhaps expected.

But the strains also highlighted the underlying weakness of gas infrastructure in China. The network of pipelines across China is incomplete, leading to significant distributional issues.

Even more importantly, gas storage capacity in China is inadequate to match the seasonal fluctuations in demand. Effective storage capacity in China is around 3% of consumption compared with close to 20% in the U.S. and Europe. These types of structural issues can't be fixed overnight and are likely to constrain the extent to which Chinese gas demand outside of the power sector can grow in the near term.

In the very near term, Chinese gas demand looks set to continue to increase strongly this year, not least because the surge in consumption continued into the first part of this year, and some of that rationing that held back demand in the final part of last year is likely to ease. But it seems unlikely that the extent of the surge in gas demand will be repeated in 2019 and beyond.

The other central factor supporting the strength of global gas markets last year was the continued expansion of liquefied natural gas, LNG, which increased by over 10% in 2017, its strongest growth since 2010, aided by the startup of new LNG trains in Australia and the U.S.

On the demand side, China's increased need for LNG accounted for almost half of the expansion in global demand, overtaking Korea to be the world's second largest importer of LNG after Japan.

The tidal wave of LNG projects that were sanctioned between 2009 and 2014 led many commentators to predict the emergence by now of surplus levels of LNG as it took time for demand to absorb the rapid growth in supplies.

The green line here gives a sense of the implied profiles for LNG supplies as at the end of 2014 given the LNG projects that had been sanctioned at that point. And as you can see, this implied profile was materially higher than the range of LNG demand forecasts at that time, shown by the blue wave, suggesting a persistent surplus of LNG or an LNG glut.

But many observers so far have been surprised by the apparent absence of such a glut. There is certainly little evidence of LNG facilities standing idle due to lack of demand.

This absence partly reflects that due to a variety of technical issues, actual LNG supplies, shown by this yellow line, have come onstream less quickly than originally planned, moving supply more closely into line with those original demand profiles.

However, the apparent absence of a glut also reflects the fact that the surplus LNG supplies which did emerge resulted in bouts of unsustainably low prices rather than the buildup of idle capacity. This is illustrated in this chart, which shows Asian spot LNG prices in this yellow line here moving in a band defined by the top of that band, U.S. exporters' full cycle costs, and the bottom of the band, U.S. exporters' operating costs, with those operating costs at points during the last couple of years acting as a sort of quasi floor for Asian spot prices.

The way to read this chart is that rather than shutting capacity, U.S. exporters have been willing to supply LNG since they were covering their operating costs, even though that was often less than their full cycle costs. So there has, in fact, been an LNG glut of sorts in recent years, but this has been resulted in unsustainably low prices rather than idle LNG capacity.

If I may, just one final point on LNG.

As some of you have known before, I tend to sort of go on about how the great mobility of LNG exports in terms of their ability to alter their destination in response to price signals in a way that pipeline exports cannot is likely to lead gas markets around the world to become increasingly integrated, with regional gas prices increasingly moving in unison.

Interestingly, this growing integration can already be seen in global gas prices. This chart shows a correlation between the main regional gas prices. The correlation between European and Asian spot prices, shown by the red line, have been really quite high since the previous wave of LNG trains around the turn of this decade.

But over the past couple of years, the correlation between these markets and U.S. gas prices has also begun to increase. And this correlation is likely to increase further as Henry Hub increasingly plays a role as the anchor price for global gas markets.

This growing integration is also apparent in the convergence of the volatility of different gas prices. As markets open up, disturbances in one region are shared across the world, leading to more similar patents of variability across markets. So clear signs from the recent data that global gas markets are indeed becoming increasingly integrated.

If we turn next to coal, which is one of the focal points for the step back seen last year. Indeed, after several years of free fall, the coal market experienced a mini revival last year, with both global consumption and production increasing. Consumption rose by 1% with India recording the fastest growth as demand both inside and outside of the power sector increased.

As I mentioned, after 3 years of successive declines, China's coal consumption also ticked up. This, despite the substantial coal-to-gas switching in the industrial and residential sector that we just discussed, and instead was driven by the increases in Chinese power demand sucking in additional coal as a balancing fuel.

World production, shown in the right here, increased more strongly, driven by notable increases in both Chinese and U.S. output. Interestingly, the increase in U.S. production came despite a further fall in domestic consumption, with U.S. coal producers instead increasing exports to Asia.

Somewhat counterintuitively, the increase in Chinese coal production was a result of ongoing measures to reduce excess capacity within the Chinese coal sector. These measures have been successful in reducing excess capacity in the coal sector by around half over the past couple of years. So significant inroads are being made into the Chinese excess coal capacity problem.

But how did measures to reduce capacity lead to an increase in coal production last year? Let me try and explain.

A central part of this reform process has been managing the need for a Goldilocks-type price for coal in China. Too hot, and it would reduce the pressure on inefficient mines to close or merge as well as raising energy costs for the economy as a whole. But too cold, and it would threaten the underlying viability of a sector that still provides around 60% of China's economy -- China's energy.

To help achieve this balancing act, the Chinese authorities at the beginning of last year introduced a target band for steam coal prices, shown by this green middle sway here. The blue area either side of the target band signals increasing attention by the authorities, and the red lines denote just that, the authorities' red lines for domestic coal prices triggering intervention.

The fact that Chinese coal prices were above the red line through much of last year spurred a series of policy measures to increase production and so ease price pressures. The increase in Chinese coal production of over 3.5% last year, its strongest growth for 6 years, was a direct result of those actions.

I want to focus for a few minutes now on the power sector.

The power sector really matters. It's by far the single biggest market for energy, absorbing over 40% of primary energy last year. And it's at the leading edge of the energy transition as renewables grow and energy efficiency improves.

As I mentioned, this year's Stats Review for the first time includes comprehensive data on the fuel mix within the power sector, helping to improve our understanding.

Global power demand, on the left here, increased by 2.8% in 2017, close to its 10-year average. Almost all of that growth, well over 90%, came from the developing world, shown by the light green bars.

Demand within the OECD edged up slightly, but the decoupling of economic growth and power demand seen over the past 10 years in the OECD continued with essentially no growth in [OEC] power over the past decade. It's worth remembering that when commentators proclaim the world is electrifying, the power demand in the developed world hasn't grown for the past 10 years. Quite a striking fact.

The increase in power generation was driven by strong expansion in renewable energy, led by wind and solar, which accounted for almost half of the global growth. Although wind continued in its role of the bigger, more established elder cousin, it was solar energy that made all the waves.

In particular, solar capacity increased by nearly 100 gigawatts last year, with China on its own building over 50 gigawatts. Very roughly, that's roughly equivalent to the generation potential of more than 2.5 Hinkley Points in solar energy in 1 country in 1 year.

Global solar generation on the right increased by more than 1/3 in 2017. Much of this growth continues to be underpinned by policy support but has been aided by continuing falls in solar costs with auction bids of less than $0.05 a kilowatt hour, unthinkable for most projects even just a few years ago, now seemingly almost commonplace.

Yes, I know there's lots of fine prints that need to be read when understanding the true price of these auctions, and I realize that these costs do not cover the system-wide stability issues associated with renewables. But even so, the cost reductions in solar over the past few years are significant.

Standing back from the detail of what happened last year, for me, the most striking and worrying chart in the whole of this year's Stats Review is the trends in the power sector fuel mix over the past 20 years. Striking, because despite the recent extraordinary growth in renewables and the huge efforts to encourage a shift away from coal, there's been almost no improvement in the power sector fuel mix over the past 20 years.

The share of coal in the power sector in 2017 was exactly the same as in 1998, with a slight edging down in recent years simply reflecting the early drift-up associated with China's rapid expansion. The share of nonfossil fuels in 2017, the blue line, is actually a little lower than it was 20 years ago as the growth in renewables hasn't offset the declining shares of nuclear and hydro energy. Rarely has a chart of 3 flat lines been so striking.

Worrying, because the power sector is the single most important source of carbon emissions from energy consumption, accounting for over 1/3 of those emissions in 2017. To have any chance of getting on a path consistent with meeting the Paris climate goals, there will need to be significant improvements in the power sector.

As I bored many of you during the energy outlook, the answer to almost any policy question on how best and how economically efficiently to reduce carbon emissions from the energy sector over the coming decades is start with the power sector, then focus on the power sector. And then if you've got any spare policy space, push even harder in the power sector, for this is one area where at a global level, we haven't even taken one step forward. We have stood still, almost perfectly still, for the past 20 years. This chart should serve as a wake-up call for all of us.

The backward step in last year's data is most stark in carbon emissions from energy consumption, which are estimated to increase by 1.6% in 2017. That follows 3 consecutive years of almost no -- little or no growth in carbon emissions. So on the face of it, a pretty big backward step.

This chart contrasts the growth in emissions in 2017 with the almost flat emissions in the previous 3 years, and shows the factors contributing to this backward step. These, of course, are the same factors that we've just been discussing. GDP growth picked up to above-trend rates. Much of that growth was driven by industrial activity, which is more energy hungry, causing gains in energy intensity to slow. And the turnaround in coal consumption from the substantial falls seen in the previous 3 years to a small rise last year meant the improvement in carbon intensity was more muted.

So how worried should we be? Last year in this room, when we discussed the exceptional performance seen over the previous 3 years, I suggested that some of the improvement was likely to be structural and would persist. But that the degree of improvement was probably exaggerated by several short-run cyclical factors, particularly in China.

As those short-run factors unwind, as they did last year, it's not surprising that carbon emissions increased to some degree. But the extent of that pickup has probably been -- also been exaggerated by some short-run factors working in the opposite direction: the unusually strong economic and industrial growth in the OECD and the extent of the increasing power demand in China, which sucked in coal as a balancing fuel. My guess is that some of the deterioration in 2017 relative to the previous 3 years will persist but not all of it.

So a bit worried but not overly so. Personally, I'm more worried by the lack of progress in the power sector over the past 20 years than by the pickup in carbon emissions last year.

Finally, as I mentioned at the outset, a key challenge for the Stats Review is it needs to adapt to the changing needs of you, our customers.

One of the questions I'm most often asked is whether the availability of metals used to produce batteries for electric cars could act as a constraint on the pace at which they grow. That question was one of the reasons why we included a new section in this year's Stats Review on key materials for the changing energy system, including data on cobalt and lithium, which are used in the production of batteries for electric cars.

In terms of just the basic facts, lithium production is concentrated in Chile and Australia, with Chile holding the majority of proved reserves. Lithium production increased by almost 50% between 2015 and 2017 as prices more than doubled.

For cobalt, shown here on the right, the Democratic Republic of Congo, in purple, accounts for the vast majority of both production and proved reserves. Cobalt prices picked up sharply last year as demand increased, but this hasn't yet fed through into a significant increase in production.

The pace of this response may be affected by the fact that cobalt is produced as a by-product of copper and nickel mining, and so production depends on price trends in those metals as well.

The question of whether the availability of either of these metals could act as a constraint on the growth of electric cars really deserves its own presentation.

The short answer is that if either metal is likely to pose a bottleneck, it appears most -- more likely to be cobalt. The announced expansion plans for lithium production look sufficient to ensure ample supplies for the next 10 or 15 years.

In contrast, the geographical concentration of reserves, together with the nature of its production process, means this is less clear for cobalt. But this needs to be seen in the context of the new wave of battery technologies now being developed, which require less cobalt. So rather than acting as a constraint on the growth of EVs, the availability of cobalt could simply provide further momentum to this technological change.

The good news is you can now watch this question unfold in future issues of the Stats Review.

Let me conclude before handing over to Bob for the Q&A.

Global energy markets in 2017 took a backward step in terms of the transition to a lower-carbon energy system. Growth in energy demand, coal consumption and carbon emissions all increased.

But that should be seen in the context of the exceptional outcomes recorded in the previous 3 years. Some backsliding was almost inevitable, 2 steps forward, 1 step back.

The road to meeting the Paris climate goals is likely to be long and challenging with many twists and turns, forward lurches and backward stumbles. To navigate our progress will require timely, comprehensive and relevant data. That's where BP Stats Review comes in.

We've been welcoming customers into our one-stop statistical shop for the past 67 years. But there are many shops, much loved household names that have failed to adapt and change with the times. We will continue to provide all the data that you've come to rely on, together with updating our wares for the changing world. So perhaps more John Lewis than Woolworths.

Thank you.

Robert Warren Dudley - *BP p.l.c. - Group CEO & Executive Director*

Spencer, you managed to take the rows and shelves and columns of data and flat lines and turn them into the drama of the real world. Well done. Well done.

So ladies and gentlemen, we've got already a lot of questions up here. But let me start in the room over here, 1, 2, and then, 3, 4, and then we'll keep going. We'll get to you, but first, and welcome again, those of you who are staying with us on the web.

QUESTIONS AND ANSWERS

Unidentified Participant

And as you warned us last year, carbon emissions have increased, and so making Paris that much more difficult. What are the reasons why BP has not yet aligned its business plans to the Paris targets?

Robert Warren Dudley - *BP p.l.c. - Group CEO & Executive Director*

There's a lot of requests for targets and scenario setting and detail, to lay it out. I will tell you it will be the market that will drive it. I hope it will be carbon pricing. BP has a set of scenarios, many scenarios. You did 6 scenarios over the outlook in January. And we're constantly adjusting our strategy to align with the markets and promote absolutely the things that will be needed to head to the 2-degree scenario. I am confident with the use of natural gas and then mixing that with our renewables portfolio, our autonomous vehicles, our advancing mobility work, along within a based, well-costed oil portfolio, that BP will be a leader in heading in that direction. But laying out a scenario right now, we've talked about it in detail, to get to 2 degrees, I think we'll just be pulling numbers out of a big range in the air right now. Spencer?

Spencer Dale - *BP p.l.c. - Group Chief Economist*

I'm not sure this is a correct way of characterizing it. I think the way I characterize it, so would we all definitely want to get to Paris? Of course, we would. If I offered you today a portfolio that would pay off 200%, 300% if we did and pay off nothing if we didn't, would you put your pension on it?

Unidentified Participant

Yes.

Spencer Dale - *BP p.l.c. - Group Chief Economist*

You would?

Unidentified Participant

Yes.

Spencer Dale - *BP p.l.c. - Group Chief Economist*

Okay. In which case you have more confidence...

Unidentified Participant

(inaudible).

Spencer Dale - *BP p.l.c. - Group Chief Economist*

You have more confidence than I do in policymakers. And the problem here and the essence of this problem here is we can all make a difference by using energy more efficiently. BP can make a difference by improving the way it operates and improving more and more efficient fuels. But ultimately, they will need to be led by governments. What you're asking governments to do in one form or another is increase the cost of energy for their citizens today for the benefit of an unborn child in another completely different part of the world. I've worked with politicians for much of my working life. That's quite a hard ask to do. So to put your entire pension on believing that policymakers will do that, you're more optimistic than I am.

Robert Warren Dudley - *BP p.l.c. - Group CEO & Executive Director*

So 2 hands up over here. One before? Or was it -- yes, okay. And then we'll go here, here and then we'll go to the web.

Jon Gibbins

Jon Gibbins, UKCCS Research Centre. The flat lines in electricity generation are very telling. And clearly, emissions from coal have to go down. One of the ways to do that is to replace it with gas with some substitution. Obviously, better if you can replace it with renewables, but you've got intermittency problems. So the third option is carbon capture and storage. What do you think it would take to get oil and gas companies interested in providing some very necessary input on particularly the storage side of carbon capture and storage? Because historically, oil and gas companies have not really got involved with coal and CCS?

Spencer Dale - *BP p.l.c. - Group Chief Economist*

So should I start?

Robert Warren Dudley - *BP p.l.c. - Group CEO & Executive Director*

Go ahead.

Spencer Dale - *BP p.l.c. - Group Chief Economist*

Or do you want to talk about it? Let me start and then -- and Bob can talk about some of the work that's happening in the OGCI. I -- my impression is that oil and gas companies are hugely interested in CCS. I think the economics of this is, if I've got to try and store carbon, I think I'd prefer to store carbon from natural gas than I would from coal because it produces about roughly half as much. So I've got half as much carbon to store. So then the issue becomes slightly less problematic. I think frankly, we should all be wanting to store carbon in any way possible, coal or gas. And I think it's related a little bit to some of the work we were doing in the energy outlook. In all the studies I've seen consistent with meeting the Paris climate goals, CCS plays a very significant role. If we get 5 or 10 or 15 years down the line and we're not seeing CCS play an increasingly significant role, we should worry. We should worry because either we're not on a path consistent with meeting the Paris climate goals or we're going on a very expensive path. And so I think we -- I think oil and gas companies, my impression is, are very keen to help, to work here. But there's a public good element to CCS just like there's a public good element to renewables. And we know if there's a public good element, that private sector will underinvest in that on its own without government support. It's just basic economics. What is interesting, and I think somewhat depressing, is there is enormous amounts of public support for renewables, there is not enormous amounts of public support for CCS. And in terms of both of them having a public good element, I think that's a failure of public policy.

Robert Warren Dudley - *BP p.l.c. - Group CEO & Executive Director*

Like you said, the oil companies are absolutely committed to working with CCS and CCUS. The main ways we can do that is, of course, storage in reservoirs. That's what we're good at. And we do, do that in a number of places around the world. The Oil and Gas Climate Initiative has picked 2 areas to focus on. These are the 10 companies around the world that have come together and formed a -- what will be a $1 billion fund to put it into new technologies that we'll share with anyone and everyone. CCUS is 1 of the 2 areas of emphasis. It's not only talking about storage, it's investing in companies. So those of you who know about a company called Solidia, it -- cement causes huge amounts of CO2 around the world. There's no incentive in the market for cement makers to take up this technology, but this company has a way of reducing the CO2 from just curing cement by half, as an example. So I think you'll see more and more. As Spencer said, renewables are highly subsidized around the world. If consumers really knew the cost of the subsidies on renewables, I think they'd be surprised. That's a good thing because there's tremendous progress being made all around the world in those. But all this -- there's no subsidies in CCUS. That has not enabled this to happen across the broad base, including with power's CO2. Norway has come close. The U.K. has come close twice. OGCI is working with the U.K. to look at CCS off of the back of the power

system here. And they're getting close. I think you could see some events this year in Britain. Maybe you're working on it, I don't know. Let me go here first, second and then...

Morten Frisch

It's Morten Frisch from MFC. Spencer, I'm very pleased that you highlighted the current problems in the shale oil patch in the United States because problems we see there likely will support the current high oil price we see the right now for about 18 months, we think. But a question to you, a clarifying question. On your chart, you were showing U.S. [tight] oil and NGLs, and you compared this with the Vienna Group numbers. In the U.S. tight oil and NGLs, there's about 900,000 barrels of 50.1 [APA] plus liquids condensate. Have you also included the condensate in the Vienna numbers? Or is the world comparing apples and oranges here?

Spencer Dale - *BP p.l.c. - Group Chief Economist*

The Vienna Group is a bit of a mixed bag. Now the OPEC cuts for the OPEC members -- and somebody will correct me if I'm wrong, for the OPEC members referred purely to crude. But for the non-OPEC members of the Vienna Group, it was crude plus NGLs. For the Vienna Group production cuts, I just added up what they said they wanted to cut, and I added them up. What I was then saying is, if that's what they wanted to cut, to what extent was that offset by growth of liquids from U.S. tight oil on the other side? And that's why I included U.S. tight oil and NGLs. It was just essentially sort of saying, trying to put these 2 things in perspective. And so I was just looking at what the Vienna cuts were committed to. So it was a mixture of both. And I was just comparing that with what was the liquids growth coming out of tight oil? To what extent, just in terms of just oil as a magnitude were they, comparing it against each other? So that's why, one. I think it's not quite -- I don't think it's quite fair measuring apples and oranges. It's measuring the production cuts as defined by what the production cuts were trying to cut against the growth of U.S. tight oil liquids.

Irene Himona - *Societe Generale Cross Asset Research - Equity Analyst*

Irene Himona, Societe Generale. Your data on LNG pricing highlights the increased correlation between regional prices and, of course, rising U.S. exports. I wonder if you can share with us your view for future LNG prices, of that convergence. Apart from the obvious one, which is reduced opportunities to arbitrage for big trading companies, how do you see LNG pricing evolving?

Spencer Dale - *BP p.l.c. - Group Chief Economist*

Yes. Those charts are fascinating, weren't they? I've put them up partly because I go around the world talking about this and people often say, I know this is -- when do you think this will actually start to happen, Spencer? I was going, "It's happening now." But I suddenly realized I kept saying it's happening now, but I had no actual hard data to show it. So that's why we showed these correlations and looked for these correlations. And I thought they were quite striking. Now if I -- in some sense, they are quite striking. If I put the corresponding correlations up for oil, they will look really disappointing because the correlation correlations -- the corresponding correlations for oil are just sort of almost 0 (inaudible) 1. So it's still a long way to go. And the amount of gas trade as a proportion of total trade is still very small relative to the amount of oil trade, total oil trade. So we've still got a way to go before you see a fully integrated gas market. My expectation is that over time, we will see increasing correlations between these spot markets. And if you leave -- you give it perhaps another 5 or 10 years, you may see those Henry Hub correlations with Asia and Europe start to move closer to what that correlation you were seeing between the Asia and European markets. Within that, my own personal expectation is I think that Henry Hub will increasingly play the role as the anchor price for global markets. And the intuition for that is that U.S. energy will be large, possibly this sort of 1 of the 2 largest suppliers of LNG alongside Qatar. Plus, the nature of where U.S. LNG exports are coming from means those LNG exports are likely to be far more diversified. Some will go to South and Central America, some will go to Europe, some will go to Asia. At the margin, the U.S. -- the marginal U.S. exporter should be indifferent to sending a cargo to any 1 of those 3 destinations, and as a result of which you would expect Henry Hub as a result to end up increasingly playing sort of an anchor role for all 3 of those markets. So my expectation is those correlations will gradually increase over time. It will take a long time because we're still seeing lots of contracts, long-term contracts indexed to oil, so this is not going to happen overnight, but a gradual drifting up in those correlations with a sort of anchor role being increasingly played by Henry Hub.

Robert Warren Dudley - *BP p.l.c. - Group CEO & Executive Director*

Thank you. So we've got an interesting question from [James Ball] in the U.K., [Tacky Boys]. "Is gas doomed in Western Europe? Or is the U.K. experience finally convincing policymakers that the reduced CO2 gas plays a vital role?" Now before turning it over to you, it's interesting that when you look at the U.S., the emissions -- greenhouse gas emissions are now down to 1990 levels because of the increased use of natural gas for power. Coal is being exported. The U.K. here is probably the best example in the world because greenhouse gas emissions in the U.K. are now down to 1890 levels, Victorian times, because of effectively a price on carbon and almost no use of coal in the U.K. It's extraordinary. And that's why I think, is gas doomed in Western Europe? Or is the U.K. experience finally convincing policymakers? What do you think?

Spencer Dale - *BP p.l.c. - Group Chief Economist*

I agree with you, Bob. I think -- I'm glad that [James] asked this question because I think it's a really great example about how should we react to the 3 flat lines? And what's at 1 level, you look at those 3 flat lines, 3 flat and still straight lines, and it looks very depressing. The other point, which is what Bob said, is think of it as an opportunity. In the U.K., the U.K. introduced a carbon floor price, I think, in 2015 at just over $20 -- GBP 20 a tonne for carbon. Over the next couple of years, they almost eliminated the role of coal in the power sector, massively crowded in natural gas as well as renewables, and that's a significant fall in carbon emissions. So I think -- I hope the answer is, James , is, no, gas is not doomed in Western Europe. They will look at these charts, they will worry and then they will say, but we can do something about it at relatively small cost. This is not the sort of cost and subsidies that one needs to do to encourage people to buy an electric vehicle rather than an internal combustion engine car that can often go at $200 or $300 a tonne in terms of carbon abatement. This is $20 or $30 a tonne of carbon abatement that can lead to an enormous impact. So I hope not doomed, but people will look at the U.K. as a clear practical example. This is not theory, this is actually a clear case study of a small shift in relative prices leading to a very significant shift in the fuel mix in the power sector. And intuitively, that's why the power sector really matters because you can make big impacts with relatively small changes in prices, and that's why it's the economically efficient way of trying to get after carbon.

Robert Warren Dudley - *BP p.l.c. - Group CEO & Executive Director*

So this is a question from Liam Denning, who is in the U.S. with Bloomberg. So get ready, Spence. "Your chart showing fuel shares in power generation suggests little movement in the mix since 1998. At a high level, that's true, but what do you think about the mix of power demand growth? Where has there been a clear shift since 2008? For example, fossil fuels account for 77% of power demand growth in the decade leading up to '08 but 55% in the years since?"

Spencer Dale - *BP p.l.c. - Group Chief Economist*

Great. And I slightly worried. For those that -- many of you will know, Liam Denning, I think, is one of the most -- one of the best writers writing on oil and gas markets at the moment. So if you don't know Liam's work, he works for Reuters. He's a fantastic writer. You can subscribe to his things. So when I saw Liam come up, I was a bit worried about how difficult his question was going to be. There was actually -- Bob was really polite. There's a sub-question of who shot J.R. as well. So I think to Liam's point -- so Liam's challenge is a fair one in the sense of, Spencer, you were careful. You picked 20 years. If you picked a shorter period, you would have seen -- in a shorter period, you have seen a bit more progress on coal. And in that period, you've seen a bit more progress on nonfossil fuels. It's picked up because of some sense, the big decline in nuclear had sort of flattened off and renewables is starting to come through. And so if you like, I picked my period, but I could have picked another period and got a slightly different picture, a slightly different picture. But the chart is the chart. I mean, you can see how much variation is there. So yes, if you look over a shorter period of time, we are seeing progress. And I'll see if I -- see if we're going to get bogged down and see if I can explain this. Just because you see a flat line doesn't necessarily mean no progress is being made. It could be that every single country is making progress in reducing its coal share. But if the share of the world's energy is shifting towards countries with a higher level of coal, even if every country is making progress, the overall average may not improve. So this is not a sort of council of despair. But ultimately, what we care about is not sort of how individual countries are doing. What we care about is what's going on at the global average and the global system as a whole. And the global system as a whole, there

hasn't been any improvement. The coal share, to 1 percentage point, is the same in 2017, 38%, as it was in 1998. It was 38%. And that's quite worrying, I think.

Robert Warren Dudley - *BP p.l.c. - Group CEO & Executive Director*

Another one here, but you seem to have something urgent on your mind.

Unidentified Participant

[Van Kleims, PwC and LSE]. Just got a question, a follow-up on that really. That for me, there are 2 key points that are missing. One is the split between OECD and non-OECD countries, and I'm sure there'd be a bifurcation between those 2 groups of countries and what they've achieved over 20 years, which I think is an important message. And having worked in this area for the last dozen years or so, I think there's also a message that people were talking in 2006 about no countries being able to achieve what the U.K. has achieved in the last 3 or 4 years without a full slowdown in the economy and the economy not being able to grow again. The U.K. for me is a real marker in a country that has continued to grow and has made that structural transformation, which I think should be applauded and I also think is a great example to other countries around the world.

Spencer Dale - *BP p.l.c. - Group Chief Economist*

I agree. Coming from the U.K., whenever I go around the rest of the world, I sort of make a conscious decision never to highlight the U.K. as a good case study. They'll just think that's not minding my place. But I do highlight the U.K. for this because I think it is quite unusual and I think it is a great case study. And yes, there is a difference between OECD and non-OECD. And if you like, that's a polite way of saying there's a difference between rich countries and poor countries. And if you look at rich countries and then, for this case, include also China, there has been very material progress. But for poor countries, whose energy demands are expanding massively, who are trying to increase the accessibility of energy for their citizens and whose sort of primary focus on making sure there's plentiful supplies of cheap and affordable energy, they make less progress. What I'm -- I guess I'm not quite sure where you are. Where I'm sort of less keen is to start wagging my finger at those poorer countries and say, you must try harder. When those people have income per head of 10% or 15% of the West, it seems to me slightly uncomfortable to say, you must start doing this, but they can't afford to do this. And I think the emphasis should be the West, who can afford this, the richer countries, should try even harder and make even more progress to give a bit more breathing space for those -- the developing countries, who aren't yet got the economic means to be able to pay for more expensive, cleaner fuels. And so for them, for the initial thing, just get plentiful supplies of energy, allow your citizens to start to grow and prosper. And then as you -- and as you become richer, then you can start having -- be able to afford the mix -- the switch to sort of clean and more expensive fuels.

Robert Warren Dudley - *BP p.l.c. - Group CEO & Executive Director*

Good question. Now Spencer, a question from China. They've been listening to you. [Tony Fung, PRCEE]: "Could you please present a snapshot of the energy mix in China? You've shown a lot of data and a lot of information, but what is the actual breakdown in terms of percentage of energy?"

Spencer Dale - *BP p.l.c. - Group Chief Economist*

Yes. So in terms of just the overall energy mix today, about 60% of China's energy is still coal. So despite the huge improvements we've seen in China, 60% of it is still provided by coal. But I don't think you'd have to go back many years for that number to be closer to 70%. So they are moving quite materially in the right direction. 20% or so is oil. In transport -- but I -- my -- now, I'm just trying to remember my facts I had. My memory tells me that for oil, it's used outside of the transport sector in China more than in many other parts of the world. So oil in transport, but other parts of that as well. Nonfossil fuel is around 15% of the energy mix today and growing rapidly. That's not just wind and solar energy. It's also hydro energy, which had -- is growing extremely strongly, and also very rapid growth or beginning of a program of very rapid growth of nuclear energy. In the last few years -- last year, I think they only brought on 2 new nuclear reactors in China. But prior to that, it was like 4. And I think it's something of the region of 19 or 20 nuclear reactors currently under -- currently being built in China. So very significant moves there. And only about 7% or 8%

left, which is natural gas. And so an interesting question is, what would one need to do to increase the role of natural gas in China? I guess what I think the message I try to convey in the -- in my discussion was trying to really increase the use of natural gas in the residential and household sector significantly in the near term is going to be constrained by those infrastructure issues. And so I think if you're going to see a significant increase in gas over -- in a share over the next sort of -- significant increase over the next 5, 10 years, that may well have to come in the power sector.

Robert Warren Dudley - *BP p.l.c. - Group CEO & Executive Director*

That explains a comment someone made to me from China, who said that natural gas is the French perfume of fuel. It is very nice, it is very rare and it's very expensive. It's only 7%. So another question over here, Martijn, and then the gentleman behind him.

Martijn Rats - *Morgan Stanley, Research Division - MD and Head of Oil Research*

It's Martijn Rats from Morgan Stanley. I wanted to ask you about the strong oil demand that we've now enjoyed for a number of years. And of course, connected to that, the strong rise in prices over the last 12 months. With your backdrop, I was wondering if you have a view on the world's economy to absorb these higher prices and what kind of impact it would have in terms of perhaps the return of subsidies, perhaps economic slowdown. Is there a level of price or a rate of price increase where you would start to become worried about sustainability of this strong demand growth? And also connected with that, given your backdrop -- background, how would you expect central banks to incorporate these strong rises in oil prices in their policymaking and interest rates?

Spencer Dale - *BP p.l.c. - Group Chief Economist*

So there was like -- there's a sort of odd dichotomy when you're thinking about the impact of the reduction in oil prices. The impact -- so when you just -- from an economic perspective, for those of you who can remember your Economics 101, you sort of have a substitution effect and an income effect when prices fall, right. So the substitution effect happens in oil prices, where people move away from other goods, and they consume more oil. And that pretty much came through to a first-order approximation like we expected. The growth -- oil demand has been very strong over the last few years. And if you say, well, has it been surprisingly strong? First order, not really, given what's happened to oil prices and the sort of [elastics] we had. So the substitution effect sort of seemed to work. The income effect is, because we're spending less on oil, we can spend less on -- or more on lots of other goods, and that's what should drive aggregate growth. And that's where we -- what we didn't see as much through this time, when people tried to find the sort of beneficial impact of that lower oil prices, stimulating growth. For much of the first couple of years, in '15, '16, people say it hasn't come through. The problem with that is there's always a counter-factor. What would it have done in -- had it not been the case? One argument that people were saying about why it may not come through, and an argument, I think, that the IMF was saying at the time, was one mechanism in the past, how it had come through, was as prices fell, that allowed monetary policy to set lower and easier monetary policy than they otherwise would have done because inflationary pressures were lower. And that helped stimulate the economy. But with interest rates essentially at 0 at the lower bound, perhaps there was less scope for that accommodating monetary policy to come through, and that may have been the question. So now -- the answer now is, as oil prices start to rise, do you see more of a bigger impact on economic growth? And I think in part, it will be a function of how monetary policy responds. If the central banks are confident that higher prices and higher sort of temporary inflation won't feed through, there's no need for them to react to that, and the impact on monetary -- on growth should be relatively limited. If they are more worried about higher prices leading into wages and develop in a wage-price spiral, they will have to respond to that, and that will act to dampen growth. My -- the lovely thing about -- well, there's many lovely things about working at BP. But one of the lovely things about BP is I don't have think about that problem anymore. So I let other people do that. The one other thing, I think, is -- we should all be looking for, I think, is over the last few years, we have seen quite significant reductions in the level of fuel subsidies in many countries around the world. In some sense, that was a relatively easy thing to do when oil prices were low. The question is, as oil prices now start to rise, will those oil -- will those reductions in oil price subsidies stick? Or will there be mounting political pressure to increase those subsidies in order to sort of cushion the impact on the sort of low -- on the sort of less able or less wealthy parts of society. And so I think that will be another thing we should -- that we need to look at when sort of thinking about the implications of this recent rise in oil prices.

Robert Warren Dudley - *BP p.l.c. - Group CEO & Executive Director*

Brazil is an interesting signal right now of maybe responses. Yes?

David Elmes

David Elmes from Warwick Business School. In your one step back, you said that it was probably a mix of coal in China, which we have sort of just discussed. But you also mentioned coal in India. Would you shed any light on the relative between those 2? And I suppose in both those cases, you would hope that there are policy measures in place to change the mix. And while you might not put your pension on them, does it offer any confidence that it might be a short step back rather than a long step back?

Spencer Dale - *BP p.l.c. - Group Chief Economist*

Yes. So the -- arithmetically -- so the role of India here, in terms of did it contribute to the sharp change of pattern in 2016 relative to 2017? Not really, because its increase of -- increases coal consumption in 2016 and increases coal consumption in 2017 as well. Arithmetically, India accounted for around 3/4 of the growth in coal consumption in 2017. So it played a big role arithmetically. It just didn't play a big role in terms of explaining the switch between the 2. When you look at India in terms of, well, where is that coal going, it's both into the power sector, where you saw increasing coal demand in the power sector, but also it was outside of the power sector into industry as well. I was in India recently and was discussing with various policymakers and officials about how the power mix may evolve, and they expect to see very rapid growth in power demand over the next 10, 15 years as electricity becomes increasingly accessible to more and more of their citizens and their citizens' wealth and prosperity increases. Huge growth in renewable energy, particularly solar energy there is extraordinarily exciting, but that's only going to provide a relatively small proportion of that, of the energy they need. And the question then is, well, how do we make up the rest? Do we use coal? Or do we use natural gas? And the question they said to me was, Spencer, look, what would you do? The cost of natural gas is significantly more expensive, even -- less so if we're successful increasing our domestic production. But to the extent we're having to import for our LNG, that's more expensive than the domestic coal that we can produce at home. Is that a cost worth paying when our sort of levels of income per head in India are significantly less than 20% of that in the U.S.? And it's quite a hard thing to say, yes, you really should do that. And so I think they're very aware of this, but they're also very aware of the need to make plentiful available supplies of power and electricity available to their citizens so they can start to even begin to have some of the luxuries and well-being that we all enjoy here.

Robert Warren Dudley - *BP p.l.c. - Group CEO & Executive Director*

And they have made significant changes in gas pricing offshore. So we're making big investments as BP in the offshore gas industry. They really do want to bring as much gas in the economy as they can, with a goal, I think, of getting up to 20% of the energy provided by natural gas by 2025. We'll see. So I'm going to -- there's a whole series of questions because this term fascinates everyone. What is the current definition of a swing producer? Does Saudi Arabia still hold that title? And is the U.S. moving towards such a title -- to such a title?

Spencer Dale - *BP p.l.c. - Group Chief Economist*

So I have a rule that whenever somebody asks me, do you think this will -- Saudi Arabia or U.S. tight oil as a swing supplier, I always stop and say, what do you mean by a swing supplier? Because I have no idea what people mean by swing supplier. So the answer -- the true definition -- I don't know if Saudi Arabia is still the swing supplier or not because I don't know what swing supplier means. I think what I do know, and it's a sort of story I told last year and it's a story I told again this year, I think OPEC, because it has ability to switch output from one period to another and it can do that at great scale and at quick pace, has the ability to stabilize the market in terms of short-run shocks. If there's a short-run shock such as demand suddenly slows down because the economy goes into recession, it can reduce its supply, stabilize prices and bring that back on when demand comes on. If inventories are at very high levels, it can take that supply off the market for a period of time, wait until the inventories come back to more normal levels and then bring it back on. And we've seen the power of that. U.S. tight oil can mitigate some of that impact, but it can't offset that just because of the sheer scale and speed with which OPEC can respond. But what OPEC could never do, and that was true before and it's true now, it can't resist structural shocks in the market. If the world just needs less oil because we suddenly wake up tomorrow and the world's

full of electric cars, OPEC can't do anything about that. It could -- and ultimately, if we need less oil, the market equilibrium to that is high-cost oil has to be competed off the supply curve. If OPEC says, well, I'm going to take my price -- oil off the market, everybody would say, great, thank you very much. We can keep a high-cost oil on the market for a bit longer. That won't help anybody. And so -- and the rationale equilibrium there is for OPEC just to accept that's the new world they're in and for high-cost oil to be moved off. So to the extent swing supplier means the ability to respond to short-run cyclical shocks, I think that power still relies with OPEC because of the sheer scale and speed with which it can shift production from one period to another. But that power only rely -- only sort of relates to the ability to short -- to respond to short-term shocks, not to long-term ones. And I would argue -- and don't take my word for it. Last year, I quoted Khalid Al-Falih, the Minister of the Saudi Arabian oil ministry, who said exactly that. And you can find that quote from CERA, from his CERA speech of last year when he said exactly that. So again, don't take my word for it. I was just copying someone -- one of the leaders of OPEC.

Robert Warren Dudley - *BP p.l.c. - Group CEO & Executive Director*

Thank you. That was Randall Mohammed from the UAE as the leader of a whole set of questions around that topic. Now Spencer and the team, you put together the word cloud concept. And we're running out of time for some people on the webcast, but can we show what word cloud would come from all the questions that have come?

Spencer Dale - *BP p.l.c. - Group Chief Economist*

And let's hope it's not job applications. That's what -- okay. So it's not -- oh, here. Okay, right. So I'm glad it's energy. So my idea here was -- I had no idea what this was going to look at. One question we haven't talked about here -- we haven't talked about so far of all these is oil prices, and there's 2 -- and there's a quite big oil price story there. So an obvious question is, is oil prices -- what has caused that increase to happen? And is it sustainable? For what it's -- so one is I don't know. But for what it's worth, my interpretation is that some of the firming that we've seen in oil prices reflects the adjustment in the oil market we've just been speaking about. The oil market has moved in position of very significant surplus a few years ago to a period of excess stocks a year ago. Those excess stocks have come down now to within touching distance of normal levels, and that's helped to stabilize and helped to firm prices. My hunch is that prices have gone beyond that. And some of the reason why they've gone beyond that reflects the uncertainty about future supply. I think there's 2 obvious components to that future supply -- well, 2 most obvious components to that future supply. One is the one we talked about in terms of Venezuela. Venezuela has lost something like 700,000 barrels since October of 2014. It's been losing production of something like 100,000 barrels -- a little over 100,000 barrels a month. It's still producing about 1.4 million barrels a day at the moment. How much more will come off and how quickly is one clearly significant supply uncertainty. The other significant supply uncertainty is the decision by the U.S. administration not to renew their waiver on Iranian sanctions. Just how much could that affect future oil supplies? And I think those 2 sources of uncertainty are adding to that price pressure at the moment. And so the instinct with that would be, as that uncertainty materializes, we will get a better, clearer, better feeling for the underlying level of oil prices? So that's my instinct so far. My instinct of why oil prices have gone up is a function of -- some of it is the structural adjustment we've seen in the oil market. That's what we needed to see, and we've seen it. But some of it reflects uncertainty on the supply side. Two significant pieces of uncertainty. And I think that will take a while until that plays out. Is there any other things, Bob, we should be looking at here that we haven't talked about?

Robert Warren Dudley - *BP p.l.c. - Group CEO & Executive Director*

EVs, maybe.

Spencer Dale - *BP p.l.c. - Group Chief Economist*

So EV. So as I said, I had no idea what the answer to the cobalt and lithium question was going to be until I started to look at these data. My hunch was it was going to be an issue because I just hadn't focused on these data at all. And I think -- and others who have been looking at these data more seriously than I have should tell me if our reading is wrong. But my sense is it looks less of a significant issue that I thought. And one thing I was struck by -- so one is there's a quantity. Will they just be able to get enough quantities of cobalt and lithium? And this suggests is lithium looks not -- looks -- doesn't look a significant issue. Cobalt perhaps so, but that may get overtaken by shifts in technology. The other question is just what

happens to cost. Could the cost -- the rising cost of lithium and cobalt just become prohibitive in terms of raising the cost of the overall cost of electric cars? But I was struck about how small a total -- small a fraction they are -- a small fraction they are of total vehicle cost. So batteries, typically it varies across cars and so on. But a battery in an electric car is very roughly about 40% of the cost of an electric car. These types of raw materials are about 3% or 4% of the cost of the battery. So they're only about 1% or 2% of the overall cost of the electric car. So even if the cost of these materials go up materially -- go up significantly, they don't -- they're not going to have a huge impact on the overall cost of the electric cars. So I ended up concluding from that work on lithium and cobalt that it was less of a constraint and less of an issue than perhaps some people, when they were asking me the question, had thought.

Robert Warren Dudley - *BP p.l.c. - Group CEO & Executive Director*

I think, Spencer, because people have certain times booked for the webcast, I think we need to wrap it up. You have all your data on the cloud. Now you have your questions on the cloud.

Spencer Dale - *BP p.l.c. - Group Chief Economist*

Indeed.

Robert Warren Dudley - *BP p.l.c. - Group CEO & Executive Director*

And I'd like to thank everyone around the world on the line for joining us today. I hope you found it interesting. Thank the organizations and governments who actually cooperate with the data because this comes with the cooperation of many of you around the world. And thank you all here in the room in London.
