BEFORE THE

ILLINOIS COMMERCE COMMISSION

THE 68TH ANNUAL BP STATISTICAL REVIEW OF WORLD ENERGY

Monday, July 29, 2019

Chicago, Illinois

Met pursuant to notice at 10:30 a.m. at 160 North LaSalle Street, Chicago, Illinois.

PRESENT:

CARRIE ZALEWSKI, Chairman

SADZI M. OLIVA, Commissioner

D. ETHAN KIMBREL, Commissioner

MARIA S. BOCANEGRA, Commissioner

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1 CHAIRMAN ZALEWSKI: Hi, everyone. We're
2 going to go ahead and get started. We have a lot of
3 information to get through today. If everyone could
4 take their seat, I'd really appreciate it. I have
5 10:34, and the goal is to be done at 12:30 sharp.
6 So welcome. We're glad to have you
7 here. On behalf of the Illinois Commerce Commission,
8 we're excited to have this Policy Session on BP's
9 68th Statistical Review of World Energy.
10 This session is convened under the
11 Illinois Open Meetings Act, and our guests and
12 panelists are advised that a court reporter is
13 present. A transcript of this session will be
14 available on the Commission's website after the
15 hearing.
16 With me today are Commissioners
17 Bocanegra, Oliva, and Kimbrel, and with myself, we
18 have a quorum, so I call this Policy Session to
19 order.
20 On behalf of the Commissioners, I'd
21 like to thank BP for their time and effort in
22 preparing this report and coming today to present the

1 report to us.

2 I'd like to thank everyone in the

3 audience. It's great to see so much interest in the

4 report, and I'd like to recognize a couple of

5 distinguished guests:

6 Naomi Kroloff from the British

7 Consulate General, Susan Evans from the Canadian

8 Consulate General, and Cook County Commissioner

9 Bridget Degnen. So welcome.

10 In today's discussion we will discuss

11 the world's energy overview and trends of 2018. As

12 you know, energy plays a crucial role in the economy

13 and welfare of every nation. It affects every

14 industry, every social group, and every level of

15 government. It shapes corporate and environmental

16 policies and everyday lives of the most sensitive

17 populations.

18 Recognizing the very interconnected

19 nature of the energy sector, we, as regulators, must

20 pay close attention to global trends and the world's

21 energy markets. Today's presentation will delve into

22 global trends in energy demand and consumption across

1 various fuel sources. I had the chance to briefly
2 review the report before today's session, and I think
3 what I was most focused on was Bob Dudley, BP's Chief
4 Executive. He made an introductory note, and he
5 pointed out some very interesting facts.
6 First, he noted that much of the rise
7 in energy growth in 2018 can be traced back to
8 weather-related affects as families and businesses
9 increase their demand for cooling and heating in
10 response to a unusually large number of hot and cold
11 days. He notes that in 2018, global energy demand
12 and carbon emissions from energy use grew at the
13 fastest rate since 2010 and 2011 moving the world
14 further away from the Paris Climate Agreement.
15 According to Dudley, quote, the world
16 is on an unsustainable path. The longer carbon
17 emissions continue to rise, the harder and more
18 expensive it is to adjust to net zero carbon
19 emissions.
20 Mr. Dudley believes that
21 decarbonizing the power sector might be the single
22 most important challenge facing the global energy

1 system over the next 20 years. The BP Statistical
2 Review will provide a good insight on these
3 developments and possibly talk about some suggestions
4 on how we change course.
5 To give an overview of the report and
6 to start us with our discussion, I'd like to
7 introduce Michael Cohen. Mr. Cohen is BP's Chief
8 U.S. Economist and Head of Oil Analysis. Before
9 joining BP in May 2019, Michael worked in
10 international energy policy in both the public and
11 private sector as a lead researcher and economist for
12 Barclay's Capital, now the International Energy
13 Agency, and the U.S. Department of Energy.
14 Michael received an MA in
15 International Economics from Johns Hopkins and a BSBA
16 in Business Economics as well as a BA in Political
17 Science from Ohio State University.
18 At BP, Michael is responsible for oil
19 transportation and U.S. energy policy analysis for
20 BP's Statistical Review of World Energy. A new
21 addition of this report is released every year in
22 June. So we're very lucky to be sitting here in July

1 to hear the latest from the most recent report.
2 Just a quick logistics so you know
3 what's coming ahead. I mentioned the 12:30 stop
4 time. Mr. Cohen will present the report taking 45
5 minutes to an hour. There will be a brief break. BP
6 was so kind to provide lunch. So if you have to grab
7 lunch and go, but if you can, please come back into
8 the room with your lunch, and there will be a Q and A
9 session as well. The goal is to be out of here by
10 12:30.
11 With that, I'd like to introduce
12 Mr. Cohen.
13 (Applause.)
14 MR. COHEN: Thank you so much. It's really
15 an honor to be here this morning. As an
16 undergraduate of Ohio State University, it's a
17 pleasure to be back in the Midwest, and I feel it's
18 always my home. So thank you for welcoming me this
19 morning.
20 I want to make a couple of main
21 points about the world that we saw in 2018. Before I
22 get to that, I just want to give a little bit of a

1 background about what the statistical review is. As
2 it says here, you know, this is the 68th Edition.
3 We've done this many, many, many times, and we do
4 this basically as a public good.
5 I'm a member of a team of about 10
6 people. We have people in Russia, people in China,
7 and the main group of people that work on this
8 report that I'm a part of are based in London. And
9 we work with a university, Heriot-Watt University in
10 the UK, that helps us collect primary source data in
11 order to prepare this report, and at the end of it
12 all, we come up with what did we find in terms of
13 2018 in terms of total energy, what were the trends
14 in energy that we saw, and that is a compilation of
15 data with respect to the oil sector, the natural gas
16 power sector, and what does all of this mean for
17 emissions.
18 Traditionally, in the first couple of
19 years that -- the first couple of decades that this
20 report was produced, we would just produce the data,
21 we would put it in a form, and we would sort of say,
22 well, use it for what you'd like. And then many of

1 you that are involved in energy analysis may have
2 seen BP data being cited. It's available to any of
3 you in spread sheet form.
4 But I think at least in the last two
5 years, we've tried to make sense of what it all
6 means. So we've done some further analysis, not just
7 sort of saying, here's the data. So I'm excited to
8 share some of those conclusions with you today.
9 So this last year was one where we
10 saw increasing awareness in society for concern about
11 climate change. And the problem, though, is that
12 despite that increasing societal awareness, the data
13 was moving in the wrong direction. And so as we just
14 heard, you can see that energy growth and, likewise,
15 Co2 emissions were both growing at their fastest rate
16 in several years, and this occurred despite a
17 backdrop of a slowdown in GDP growth, and it also
18 occurred despite an increase in energy prices.
19 Now, both of those trends would have
20 indicated or should have indicated at least some sort
21 of moderation in energy demand growth, but the
22 opposite happened. Why was that the case?

1 So when we look and break this down,
2 primary energy growth, into region, you can see that
3 China, the U.S., and India account for the majority
4 of the trend in growth last year; China accounting
5 for 35 percent -- almost 35 percent, U.S., 20, and
6 India, 15 percent. So all in all, that is the main
7 share of contribution to growth.
8 When you look at it by fuel, you can
9 see here that the biggest increase compared to the
10 trend from 2007 to 2017 really occurred in natural
11 gas in red, and it's a little bit hard to see or
12 distinguish between red and orange here, but you can
13 see this is natural gas. Here, you can see that the
14 growth rate doubled. And as well, there was an
15 increase in the amount of contribution from
16 renewables. The rest of the bar stayed pretty much
17 the same, some increase in coal consumption last year
18 that I'll get into later.
19 But now to go back to the original
20 point that I was trying to make, why did this
21 increase in energy demand occur despite a slowdown in
22 GDP growth and despite an increase in energy prices?

1 We constructed an econometric model
2 to try to explain this. So here is what you would
3 have expected if you developed a model just based on
4 those two parameters; one, energy prices and energy
5 price change, and, two, looking at GDP growth. And
6 you can see that that model would have missed the
7 ball. It would have missed the target for 2018,
8 because in reality, demand just continued to grow.
9 And so what we tried to do in this
10 econometric framework is try to understand why that
11 was the case. So the first thing that we looked at
12 was weather. So here you can see -- this is just for
13 the United States. The chart on the left is showing
14 heating degree days and cooling degree days.
15 And you can see that for most of the
16 history, you see peaks in heating degree days and
17 peaks in cooling degree days kind of offsetting one
18 another. What is a heating degree day? A heating
19 degree day is a day where the temperature is a
20 certain amount below 65 degrees Fahrenheit. A
21 cooling degree day is the opposite. So a cooling
22 degree day of 3 would be a day where the temperature

1 was 68 degrees Fahrenheit. So that's what we're
2 talking about here. Basically, it's a way that
3 analysts try to assess the extremes in weather
4 looking at it from this very narrow perspective of
5 temperature.
6 So what you can see is that we saw
7 extremes in both heating degree days and cooling
8 degree days last year. When you combine this, you
9 can see that that extreme was more extreme than what
10 we have seen at any time since 1950.
11 You can see there are some cold
12 extremes here in the '80s and this part of the polar
13 vortex here, but you can see for the most part, on
14 the top end, a very extreme year last year, and so
15 that led to much higher energy consumption than what
16 we have seen in the past as families and businesses
17 switched on their
18 air conditioners and heaters.
19 So when we take into account that
20 weather affect, you can see that it explains some but
21 not all of the variation in terms of the demand
22 profile.

1 So we think that the other bit is
2 explained by what was going on in China. So these
3 three components of China's economy, iron, crude
4 steel, and cement account for about a quarter of
5 China's energy consumption, just within those three
6 industries alone.
7 So what you can see here from this
8 chart is that from 2004 to 2014, all three of those
9 industries were growing at quite robust rates, almost
10 10 percent growth in the output of iron, steel, and
11 cement, and then between 2014 and 2015, that trend
12 declined. It went negative. And as a result, in
13 between 2016 and 2018, we see an increase again in at
14 least two of those three industries.
15 And so as a result, when we take that
16 into account, what's happening in China, the cyclical
17 decline there and the rebound over the last two years
18 explains the rest of the variation in energy demand.
19 So what can we take from all of this?
20 The point is if these hot and cold days are just
21 random variations, then you could expect that in the
22 future, you know, we might see energy demand go to

1 revert to more normal levels. And so as energy
2 demand reverts to a more normal level, you might have
3 emissions also revert to a more normal level.
4 But the dangerous thing -- and this
5 is the important point here -- is that if you link
6 these increasing amounts of carbon emissions in the
7 atmosphere and the types of weather patterns that we
8 observed last year, then you can conceivably see a
9 more worrisome trend, a vicious cycle where
10 increasing demand for energy to mitigate those
11 weather extremes just results in more emissions that
12 then results in more weather extremes that then
13 results in more energy demand in order to mitigate
14 it.
15 So we could see that over the future,
16 and we could see increasing amounts of energy demand
17 growth to mitigate it. So I think wherever you come
18 down in that discussion, even if these weather
19 effects are short-lived such that the growth in
20 energy demand and the growth in emissions that we saw
21 last year are just something that's temporary, the
22 trends that we saw in the last year, as was

1 mentioned, are very different than what we should
2 expect from a system that is moving in line with the
3 Paris Climate Accords.
4 So that's the first point, and I
5 think that you can see here that we're not doing
6 enough to decarbonize. What this chart is showing is
7 that this growth in carbon emissions in gray is just
8 the net result of the bars on the left, the purple
9 and the yellow. The purple is primary energy demand,
10 and the yellow is just the change in the fuel mix,
11 the extent to which the fuel mix is decarbonizing.
12 So in terms of this chart, growth in
13 energy demand was about 1 1/2 percentage points
14 higher than its five-year average, and emissions
15 growth was likewise about 1.4 percentage points
16 higher. So one is just simply leading to another.
17 So this is not a trend that we want to be on.
18 So the other major point of
19 discussion I wanted to address with you is to look
20 specifically at the oil market last year. So last
21 year, we saw this very steady growth in oil demand.
22 We saw from an economic perspective almost all

1 industrialized countries in the first half of last
2 year were growing in a synchronous manner. So all of
3 them were showing positive economic growth, and as a
4 result, we saw a very strong contribution from the
5 industrialized world.
6 At the same time, China and India
7 were accounting for about two thirds of that growth
8 increase. And when you look at what was happening in
9 the United States, much of the growth in the U.S. was
10 happening because of new petrochemical facilities
11 that had been put in place in the Gulf Coast.
12 So that's the growth from the U.S.
13 you can see here in green, and it's off-setting the
14 decline that we saw from the rest of the world. So
15 here, the orange is the rest of the world, and you
16 can see in 2018, it basically went to nothing, and
17 only because of this massive increase in the U.S.
18 were we still able to see roughly 1.4 to 1.5 million
19 barrels a day of growth in oil demand.
20 Now, oil demand from the perspective
21 of the market and market balances has always been
22 roughly 1 to 1 1/2 million barrels a day, and the

1 aftermath of OPEC's decision to start to add output
2 in the 2014-2015 time frame, we saw a massive decline
3 in energy prices and also in oil prices, and as a
4 result, that stimulated oil demand growth, and
5 obviously in 2017 as growth became synchronous, we
6 saw very strong oil demand growth as well.
7 But we can no longer rely on this
8 very strong growth in oil demand. I think that we're
9 going to see contributions from the developing world,
10 but it remains to be seen, especially as we look
11 forward into the possibility of a recessionary
12 environment, whether industrialized countries will
13 continue to provide the support that they have in the
14 past to oil demand.
15 The growth that we see in our
16 projections, which I'll talk about maybe next time I
17 come and talk to you after we release that report,
18 much of the growth is really coming from
19 petrochemicals. So even if you take out single-use
20 plastics, it doesn't really impact the -- it doesn't
21 really impact the overall demand profile by that
22 much. We see it peaking a little bit earlier.

1 Even if you took out and said, we're
2 going to ban the sale of all internal combustion
3 engines by 2030 in industrialized countries and ban
4 the sale of all internal combustion engine vehicles
5 by 2040 in all countries outside of the
6 industrialized world, you would still not see a
7 massive impact to oil demand.
8 The major component -- the major
9 contribution to oil demand offsets within the
10 transport sector actually happens because of fuel
11 efficiency standards, and it's the institution of
12 those fuel efficiency standards that actually
13 contributes the most, actually two-to-three times as
14 much offset to oil demand than a high penetration of
15 electric vehicles.
16 So, in fact, we saw only about
17 300,000 barrels a day of oil demand displaced because
18 of electric vehicles, and most of that came more
19 because of electric bikes in China. We saw electric
20 buses in China also displace a greater share of oil
21 demand.
22 In the United States versus in other

1 developing countries, EVs here would displace more
2 oil than either Europe and China just because of the
3 lower efficiency of the cars that they are replacing
4 and because the vehicle miles traveled or the extent
5 to which those vehicles are traveling here in the
6 United States is larger than they are in Europe or in
7 China on average.
8 So I wanted to just reflect on some
9 of the trends on electric vehicles here. I'm happy
10 to come back to that, because I know this is
11 something that is an issue of concern here.
12 But I want to just sort of focus here
13 on gasoline specifically. And as I mentioned, we saw
14 this increase in energy prices. And this chart may
15 be a little bit hard to digest, but just to look
16 here, you can see that gasoline demand growth has
17 basically flattened for the last couple of years in
18 the United States. The U.S. is in blue here. You
19 can see it's always a steady component of gasoline
20 demand. And then it basically falls out of the mix
21 in these last two years, in 2017 and 2018.
22 So the U.S. represents roughly half

1 of global gasoline demand, and so we saw a very sharp
2 increase in prices last year.
3 Here, you can see this side of the
4 axis is inverted, and you can see this is the oil
5 price increase over the last year. It was over 25
6 percent. And as a result, it flattened the amount of
7 gasoline demand in the United States.
8 So the point is that we saw this very
9 sharp relationship, this high elasticity between oil
10 prices and oil demand within the gasoline sector, but
11 we don't see that in other sectors that are more
12 dependent on the path of industrial demand growth or
13 on idiosyncratic reasons like policy or because of
14 the institution of or the construction of
15 petrochemical facilities. So that's the story on the
16 demand side in oil.
17 The story on the supply side is very
18 interesting, because it's extremely U.S. centric. So
19 what you can see here in green, the U.S. is
20 accounting for almost all of global oil supply growth
21 last year, and much of that is coming from tight oil
22 supplies.

1 And it's such a large number that it
2 actually broke all the records in our books, even the
3 record that the United States set in 2014. So last
4 year, U.S. oil supply grew by 2.2 million barrels a
5 day. That was more than the Saudi supply growth in
6 the '90s and the '70s and the 1980s.
7 So now what's happened is that U.S.
8 exports are now a major part of global oil exports.
9 You can see here, the U.S. share. It's reaching
10 about 10 percent of global oil exports. You can see
11 as a result, there are other countries that have
12 continued to see a decline in their share of exports;
13 namely, the Saudis, the Russians obviously in the
14 aftermath of the fall of the Soviet Union began to
15 export even more, but this has, again, been trailing
16 off.
17 At the same time, though, and I think
18 this may be a surprise to many here that I speak to,
19 although the U.S. is a major share of global oil
20 exports, we still import 10 million barrels a day.
21 So this idea that because we are producing more makes
22 us completely, you know, not susceptible to the

1 things that are going on in the rest of the world, I
2 think is a bit of a farfetched conclusion to make.
3 Because we are still importing
4 10 million barrels a day of oil, a destruction in the
5 Strait of Hormuz will still affect us, because we're
6 still having to import that 10 million barrels a day.
7 And not only that, the exports --
8 we're still exporting not just the crude oil and
9 natural gas plant liquids, we're the number one
10 product exporter in the world. So when you look at
11 U.S. gross exports last year rose to about 7 million
12 barrels a day, so that is a very high level of
13 exports. It means that we're very much susceptible
14 to anything that happens in the global oil market.
15 So what happened with OPEC last year
16 is that the Organization of Petroleum Exporting
17 Countries along with other countries decided to
18 engage in market management and supply restraint, and
19 they did this to such an extent that they actually
20 overshot their targets in 2017, and then they
21 continued to overshoot their targets in 2018, largely
22 as a result of Venezuela's output continuing to slide

1 lower.

2 And so Libya and Nigeria then in the

3 latter part of last year actually raised their output

4 significantly above the target level, and that also

5 led to -- it was roughly 600,000 barrels a day so it

6 also led to an overshoot not just from where they

7 were before, you can see here, way overshooting, but

8 as Libya and Nigeria increase their supply, they came

9 more in line with target.

10 And as that happened, you saw the

11 inventories that were in a very good position, below

12 the five-year average, which is what this chart is

13 showing, moving to way above the five-year average.

14 And so as a result of that, in

15 addition to the allowance of significant reduction

16 exemptions by U.S. officials who allow countries to

17 import Iranian oil, and as a result of U.S. tight oil

18 outperformance, and as a result of the global

19 economics slowdown in the latter part of the fourth

20 quarter last year, we saw oil prices decline pretty

21 quickly.

22 When you look at the refinery

1 utilization, this is maybe of less interest, you can
2 see that the U.S. here in gray is the highest
3 utilization rate of any country. You can see here
4 the unfortunate story of Venezuela as Latin American
5 refinery utilization continues to slow. We also saw
6 low utilization in Brazil.
7 But part of the good story for U.S.
8 Gulf Coast refineries last year is basically a direct
9 function of the fact that the close market for those
10 exports was seeing a decline in utilization. So U.S.
11 product exports served to fill that void that was no
12 longer being filled by those countries within the
13 country, itself.
14 So I want to switch from oil to
15 natural gas. So last year, we saw a very strong
16 growth in natural gas consumption. We saw it
17 increase by over 5 percent, which was one of the
18 strongest growths that we've seen in several years.
19 So the U.S. here is in green. You
20 can see on the consumption side, it takes up the
21 lion's share of the change in incremental
22 consumption, and it also accounts for roughly half of

1 the increase in production last year of natural gas.
2 And that massive increase here of over 70 billion
3 cubic meters basically put it in the record books as
4 well.
5 So not only did we see this massive
6 increase in oil supply last year, we also saw a
7 massive increase in natural gas supply. So we saw
8 this double first, a large growth in oil and gas
9 supply, and it happened in the same year in the same
10 country and broke all the records that we had seen by
11 Russia, by the former Soviet Union, and by the U.S.,
12 itself, in 2014.
13 So what happened on the consumption
14 side? This was driven in large part for the same
15 reason, by those weather effects that I mentioned.
16 And I would expect that this year as well -- and I'm
17 sure that many of you had to live through the hot
18 weather as we did on the East Coast over the course
19 of the last two weeks. We are seeing now 15 percent
20 to 20 percent higher cooling degree days over the
21 course of this past summer than what we have seen
22 compared to the 10-year average. So we could very

1 easily have the same weather affect drive up energy
2 demand this year.
3 So we saw this increasing amount of
4 use not necessarily in buildings compared to --
5 sorry. We did see this in buildings, but the major
6 increase, if you look at the delta between 2017 and
7 2018, was in the power sector. So that is the major
8 source of incremental natural gas demand as we've
9 seen continued coal-fired retirements and continued
10 use of natural gas within the power sector.
11 Now, in China, the story is a little
12 bit different. We saw consumption increase as well
13 by about 20 percent last year. There, over the
14 course of the last two years, policies encouraged the
15 switchover of about 10 million households from coal
16 to natural gas boilers.
17 Now, what does 10 million mean?
18 China has half a billion households. So for
19 10 million out of half a billion to switch over, it's
20 just a little bit in terms of the total amount of
21 households. That's the same amount, you know, as the
22 households in the UK, that 10 million amount, but in

1 the context of broader China, there's a lot more that
2 will happen and a lot more incremental natural gas
3 demand that will result from that switchover.
4 And you saw also greater switchover
5 in the industrial sector as well compared to the last
6 five years.
7 So the U.S. also contributed in a
8 much bigger way to incremental LNG exports last year.
9 So as we saw, the strength in Asian gas demand last
10 year was able to absorb some of those incremental
11 supplies of LNG, but the problem is that over the
12 course of the last part, we saw a waning in the
13 strength of Asian demand, and combined with this
14 surge in LNG exports that I showed on the prior
15 slide, we saw prices slide to the very bottom of this
16 range.
17 So what this chart is showing is the
18 range of U.S. exporters' full cycle costs at the top
19 and then their operating costs at the bottom. So for
20 most of the time over the course of the last several
21 years, we've never seen -- only for limited amounts
22 of time have we seen natural gas prices bounce below

1 on this lower end of the spectrum. But now we have
2 this prospect of further substantial expansion of LNG
3 supplies in the coming couple years, and we have the
4 seasonal effects as we move into the shoulder seasons
5 where we can likely see natural gas prices fall down
6 into this very low end of the range.
7 So we could see the first meaningful
8 curtailment of LNG exports in this coming year if the
9 price in Asia stays at this lower end of the range.
10 It could actually lead to some kind of turnoff of
11 those supplies or at least a prolonged maintenance
12 for the first time that those supplies have been in
13 existence.
14 So when we look at the natural gas
15 sector and switch over to coal, we also saw a
16 worrisome trend. Last year, the growth in coal
17 demand was the second -- we saw the increase for the
18 second consecutive year following three years of
19 falling consumption. You can see that for the most
20 part, many had thought that we might have seen
21 between 2013 and 2014 a peak in coal consumption.
22 Now it's looking far less certain. So we've seen

1 this increase in the aftermath of 2016, and now we're
2 seeing an increase in '17 and in 2018.
3 So I wanted to add to our
4 traditional -- sort of our slides for this report,
5 what the U.S. contribution was, and it was still very
6 small last year and has been decreasing little by
7 little every year. As we saw the mercury and air
8 toxin standards get implemented and natural gas
9 prices have remained at quite a low level, we're
10 starting to see additional coal-fired retirements on
11 a consistent basis.
12 So the important point I want to make
13 here is that we saw India and China continue to
14 increase at very high levels in terms of their coal
15 consumption last year, and that happened despite
16 renewable energy supplies growing by about 25 percent
17 in both of those countries.
18 So despite this massive growth in
19 renewables, they were not sufficient enough to meet
20 the incremental amount of demand in those countries.
21 And I'm going to come back to that point in terms of
22 the decarbonization of the power sector.

1 It is that power sector that really
2 needs to play the most important role in terms of
3 decarbonizing and getting to a lower carbon energy
4 system. It's the single largest source of Co2
5 emissions in the energy sphere, and it is where the
6 lowest hanging fruit does lie in terms of reducing
7 carbon dioxide emissions.
8 So last year, the power sector
9 absorbed roughly half of the growth in primary energy
10 demand. We saw power demand increase by about almost
11 4 percent last year, which was the strongest growth
12 rate that we've seen in 20 years, and much of the
13 source of that incremental demand growth came from
14 the developing world, again, led by China and in
15 India.
16 The strong growth in the
17 United States last year also was a result of the
18 weather affect and those weather extremes that I
19 showed, and that was in sharp contrast to the trend
20 decline that we've seen from the United States over
21 the last several years.
22 So what's the story on renewables?

1 Here, we can see the share of power generation that
2 comes from renewable energy by a number of countries
3 in 1998. So about 1 to 5 percent of the power that
4 is produced in 23 or so countries, it was only about
5 1 to 5 percent of those countries had renewable
6 energy as contributing.
7 Here I'm talking about non-hydro
8 renewables. I'm not talking about nuclear. So it
9 was very much a small contribution and only for a
10 small subset of countries.
11 So when we fast forward, though, and
12 look at the 78 countries that we cover within the
13 statistical review in 2018, you can see a much larger
14 share. So around a third of the countries were using
15 renewables in 1998, and now the picture has changed
16 quite substantially.
17 So in the United States, renewables
18 consumption, just for your reference, now accounts
19 for about 19 percent of global renewables
20 consumption.
21 And when you look at the
22 United States, the story for this country is that the

1 coal share of the total power sector has fallen
2 dramatically. We've seen nonfossil energy, which
3 includes nuclear, continue to increase, and we saw
4 natural gas and oil consumption within the power
5 sector continue to increase.
6 When you look at it just for 2018,
7 you can see the share by fuel renewable is about 10
8 percent. Add hydro, you get about 16 percent.
9 So this is the story for the
10 United States. It's not a terrible story; right?
11 Because we're seeing -- in terms of decarbonization,
12 because we're seeing increasing share renewables and
13 a very sharp decline from coal. But the problem is
14 that despite what I showed here, this broad expansion
15 of renewable energy on a global basis, it's a pretty
16 depressing picture, because the change in the fuel
17 mix has basically not changed at all since 1998.
18 So despite that increasing adoption
19 of renewable energy, the fuel mix is just basically
20 where it was in 1998. The share of both nonfossil
21 fuels and coal in 2018 remain at basically the same
22 level that they were at 20 years ago.

1 So this comes back to that primary
2 point I was trying to make, that this shift towards
3 greater electrification is needed. We need to see
4 this in order to decarbonize the system. But
5 unless we decarbonize the power system, we cannot
6 go -- we cannot fully get to the place that we want
7 to go. So that's the main point that we want to make
8 here.
9 And I think as we look at this chart,
10 what this is showing -- this will help support that.
11 What this chart is showing is that Co2 emissions are
12 basically tracking the increase in energy demand
13 basically one for one during this period of time
14 between 1998 and 2014. You're seeing very little in
15 this chart -- you're seeing very little fuel mix
16 change, very little decarbonization in the fuel mix
17 happening during this period of time.
18 The happy thing is that over the
19 course of the last several years, we're finally
20 seeing some decarbonization occurring, but the
21 problem is that energy demand is increasing by such a
22 strong level, by such a strong rate, that it's not

1 being able to offset the increase in energy demand,
2 and, therefore, emissions just continue to increase.
3 So the carbon intensity of the power
4 sector has basically not been getting good enough or
5 improving at a rate that we need to see in order to
6 offset that increase in energy demand. So we tried
7 to think of a thought experiment.
8 What was the extent to which the
9 power sector fuel mix would have needed to change
10 over the past three years in order to maintain carbon
11 dioxide emissions at their 2015 level? So in terms
12 of this chart, how much bigger would those blue bars
13 at the bottom need to get in order to have no growth
14 in Co2 emissions. And so that's what this chart
15 shows. It's the same thing as this but in a level
16 space of gigatons of carbon dioxide emissions.
17 And so the answer that we came up
18 with looking at our analysis was that renewables over
19 the past three years would have needed to grow at
20 least twice as quickly than they actually did. So
21 rather than renewables growing by about 800 terawatt
22 hours over the last three years, renewable generation

1 would have needed to increase by 1800 terawatt hours.
2 So that's a massive number.
3 That incremental, 1,000 terawatt
4 hours of renewable energy generation is roughly
5 equivalent to the entire renewable energy generation
6 in China and the U.S. combined in 2018, and you would
7 have had to add that in just three years' time in
8 order to keep this emissions profile flat.
9 Or you could switch 10 percent of
10 current coal-fired generation to natural gas and
11 achieve the same result. Just 10 percent.
12 So this point I think is important in
13 terms of supporting the fact that we cannot achieve
14 decarbonization in the power sector by renewables
15 alone. It needs to come with other fuels, and
16 there's obviously -- within the energy system, if
17 power is just half of it, we need to see other ways
18 of actually decarbonizing the energy system. It
19 can't be just by renewables.
20 So the rapid -- just to conclude
21 here, first, this rapid growth in energy demand last
22 year was unable to keep pace with what was going on

1 in the power sector, and we saw this massive increase
2 in power consumption, and as a result, coal got
3 sucked in.
4 In China, for example, we saw the
5 massive increase in power consumption renewables
6 growing by 25 percent. They actually put on 10
7 gigawatts of nuclear power in China last year, and
8 still, we saw the story that I laid out, and that was
9 increasing carbon emissions.
10 So in the U.S., over the last five
11 years, the second point I want to make is just
12 looking back at the oil and gas sector. The past
13 five years we saw oil production grow by about
14 5 million barrels a day. That's the entire amount of
15 oil supply in Canada. In just the last five years,
16 we've added a Canada to the oil market.
17 We've also added 176 billion cubic
18 meters of gas supply. That's the equivalent of
19 Qatar. All in the last five years.
20 So these massive increases in energy
21 supply have created an aura of invincibility in the
22 United States, but that's not the case. We're still

1 very much a part of a global market. That's the
2 second point I want to make.
3 And the final point I want to make is
4 that this renewables share that has increased is not
5 sufficient. It's not sufficient to have met the
6 amount of incremental power consumption, and so,
7 therefore, we need to see a whole suite of solutions
8 and increasing deployment of alternative technologies
9 including nuclear, including hydrogen, including in
10 CCUS in order to get to a more sustainable path,
11 because the trends that we saw over the last year
12 were not ones that are consistent with moving towards
13 a decarbonizing -- a more decarbonized system.
14 So I'll stop there, and I'm happy to
15 take your questions.
16 CHAIRMAN ZALEWSKI: We're going to take a
17 break now.
18 MR. COHEN: Sorry about that. So we're
19 going to break now, and then we're going to go get
20 something to eat, and then we'll come back.
21 CHAIRMAN ZALEWSKI: We're doing great on
22 schedule. So we'll take a ten-minute break, and I

1 think the lunch is out there.

2 So boxed lunches, if you have to go,

3 you can take them. If not, you can grab them and

4 then come back in in 10 minutes, and we'll do a Q and

5 A session. Thank you.

6 (Applause.)

7 (WHEREUPON, a recess was had

8 in the above matter.)

9 CHAIRMAN ZALEWSKI: Hi. Okay. We're going

10 to go ahead and keep moving. We're going to start

11 with the question-and-answer session, and so I'm

12 going to let Mr. Cohen, obviously, stand up here and

13 answer questions.

14 Catherine is going to be walking

15 around with a microphone, and we ask that you say

16 your name and speak slowly for our court reporter,

17 who is still recording this. That's kind of our only

18 request.

19 We'll go for probably 20, 25 minutes,

20 and we'll just kind of keep time with a timekeeper,

21 but we're grateful that Mr. Cohen is willing to stay

22 here for questions.

1 The man in the back with the glasses
2 has his hand up.
3 MR. DAVE LUNDY: Hi. Thanks for coming.
4 Always a great presentation.
5 A question for you about renewables
6 and renewable adoption around the world. With the
7 prices of renewables continuing to fall and the
8 prices of some other fuels rising, what impact is
9 that having from your data both in the U.S. and
10 around the world? Dave Lundy.
11 MR. COHEN: So that's what the chart that I
12 showed is showing here. This is the blue. So here,
13 much of this change in fuel mix includes the
14 renewable contribution.
15 I'd say it's maybe 40 percent of
16 these bars. It's not a majority. So some of that
17 fuel mix changing is just coal switching to natural
18 gas. That's the greatest share.
19 And as I said, last year, the biggest
20 improvement in nuclear generation was in China. We
21 also saw in the Middle East, I think -- if I get my
22 numbers right -- roughly 5 gigawatts of new

1 generation capacity added in the Middle East. So
2 that was maybe 5, 10 percent of the switchover in
3 last year.
4 So to answer your question, I don't
5 have an exact number for you, but it's still a big
6 share in terms of renewables contribution.
7 The important thing to keep in mind,
8 obviously, is that in certain countries policies have
9 been extremely progressive in seeing renewables
10 penetration. In other countries, it just hasn't been
11 sufficient to compensate for that increase in energy
12 demand.
13 But I think -- sorry. Just to come
14 back, if you'd like to find the exact number -- I
15 don't have it off the top of my head. It's available
16 if you go to -- Google BP Statistical Review, and you
17 can look at the spread sheet and you can see
18 renewables contributions.
19 MR. LUNDY: My question was really about
20 the impact of the all-in cost. In other words, how
21 that affected adoption.
22 MR. COHEN: Okay. So I don't know if I can

1 answer that question directly. We've seen,
2 obviously, as you full well know, an improvement in
3 the cost of solar, especially over the last couple of
4 years.
5 So if you look at that spread sheet
6 that I mentioned to you, the amount of new
7 solar-powered generation has increased exponentially,
8 and I would say the major reason for that is just the
9 result of lower costs.
10 MS. KATIE STONEWATER: Thank you. My name
11 is Katie Stonewater.
12 I just wanted to ask a point of
13 clarification. You mentioned earlier on that fuel
14 efficiency standards have a larger impact on Co2
15 reductions than EV adoption.
16 MR. COHEN: No, on oil demand.
17 MS. STONEWATER: On oil demand, okay.
18 MR. COHEN: Which as a result is going to
19 have an affect on emissions. But the main point I
20 wanted to make is it's about one third/two thirds.
21 One third is from EVs, and two thirds from fuel
22 efficiency standards.

1 So I think maybe to just pause for a
2 second on that point, when we think about breaking
3 down the components of the 100 million barrels a day
4 that we currently consume of oil demand, roughly half
5 of that is in the transport sector, and half of that
6 transport sector is personal vehicles.
7 So really, when we're talking about
8 electric vehicles for light-duty use or for personal
9 use, we're talking about a quantum of just 25 million
10 barrels a day. So there's still a whole lot of other
11 oil that is used in other sectors that is going to
12 have a steeper hill to climb in terms of seeing
13 alternatives penetrate into those sectors.
14 I'm not saying they can't. I'm just
15 saying it's going to be a different dynamic, and if
16 we're dealing with the possibility that that
17 25-million-barrel-a-day component can be more easily
18 substituted via electric vehicles, it still results
19 in these profiles for that 100 million barrels a day
20 evolving over the longer term as only seeing a small
21 impact from an even very high penetration scenario of
22 electric vehicle sales.

1 MR. JOHN WEINBERGER: Hi, I'm John
2 Weinberger. I'm an independent attorney and
3 lobbyist.
4 There's a lot of talk about exporting
5 natural gas, whether the United States is exporting
6 up to its potential. I'm wondering, does the U.S.
7 have any competitive disadvantage in terms of
8 shipping natural gas to Europe or Asia? Is it -- are
9 European customers better off buying from Russia or
10 Chinese customers better off buying from Indonesia or
11 Australia?
12 MR. COHEN: I'll try to answer that
13 question. You know, when a European utility chooses
14 its suite of natural gas supplies, obviously, it's
15 looking at trying to ensure that there is some amount
16 of redundancy, or it has some availability of other
17 supplies in the case of a disruption.
18 U.S. natural gas exports will
19 obviously lose out on a purely cost basis to Russian
20 pipeline natural gas exports. But there will be
21 other reasons why seasonally where that natural gas
22 from the United States is more competitive or is

1 needed in order to meet the demand profile at that
2 given time.
3 So that's why over the course of the
4 last several years, we've seen more re-gas terminals
5 be put in place in Europe in order to have and build
6 that resiliency.
7 In other cases, for example, in the
8 Baltics or in Spain or in the southern Mediterranean,
9 there isn't pipeline gas into those places, and so
10 U.S. LNG in addition to Algerian natural gas exports,
11 in addition to Qatari natural gas exports, LNG
12 exports, is part of a wide mix of alternative
13 supplies that economically can make their way into
14 that system at various points in the year depending
15 on their costs.
16 I'm not sure if that answers your
17 question. It's an economic decision at the end of
18 the day.
19 MR. WEINBERGER: Yes.
20 MR. JERRY STRUBE: My name is Jerry Strube.
21 The city of Berkeley and some other places have done
22 this no more gas hookups in their city, natural gas

1 hookups, I guess, to businesses, and they want to go
2 to electrification.
3 If that became a trend in the U.S.,
4 what would the possible pros and cons or impact to
5 energy in the U.S. be?
6 MR. COHEN: I'm sorry. Natural gas hookup
7 to a household; right?
8 MR. STRUBE: Or a business.
9 MR. COHEN: Or a business. What effect
10 would that have? It would increase demand for
11 natural gas.
12 But I don't have a specific country
13 projection to share with you for the U.S. and what
14 that would mean. But clearly, as I mentioned in the
15 China case, we saw a massive switchover, and that led
16 to this 20 percent increase in natural gas
17 consumption.
18 So I don't think that there's -- in
19 terms of looking at the United States, outside of the
20 northeast, the opportunity for direct natural gas
21 switching is not as large as it may be in other
22 places. In the northeast, it still is. That's where

1 we see a lot of oil used for residential heating, and
2 there you can see continued offset from the provision
3 of natural gas into those households or into those
4 businesses.
5 But I'm not sure -- I'm sure there
6 have been studies looking at that specifically. I
7 just don't know the numbers off the top of my head.
8 Sorry.
9 MR. JEFF HARDIN: I have a question
10 regarding the increase in economic development from
11 sub-Saharan Africa from 2010 to current as well as
12 the opening in southeast Asia. That's one eighth of
13 the world's population has increased, and they're
14 going to start demanding natural gas, gasoline,
15 diesel, et cetera.
16 The middle class particularly in
17 sub-Sahara Africa has been growing at about 6 percent
18 a year, and now they're going to start competing with
19 all the western countries, northern industrialized
20 countries, and China/Asia in particular.
21 Those demands, have you thought about
22 or mapped out what the impact is going to be both on

1 the consumption as well as on the supply curves?

2 MR. COHEN: And your name again? Sorry.

3 MR. HARDIN: Jeff Hardin.

4 MR. COHEN: Thank you.

5 So as I mentioned, this is just

6 fiscal review, so we look just backward for the

7 purposes of this presentation. I look forward to

8 coming back and discussing the projections, and you

9 can find those projections on BP's website.

10 The trend that you mentioned is a key

11 part of our outlook presentation. When you look at

12 the -- we have two main scenarios. One is an

13 evolving scenario and one is a rapid transition

14 scenario. The key difference between those is just

15 the rate of change of the income levels within that

16 low income component of global population.

17 So one quick statistic that I looked

18 up before, because I hoped I would get a question

19 similar to this. The IEA wrote in a report just this

20 morning that roughly 2.8 billion people today live in

21 hot countries where the average daily temperature is

22 greater than 25 degrees celsius, so roughly 77

1 degrees Fahrenheit. Less than 10 percent of those
2 people own an air conditioner. So this goes to the
3 point that you're saying. Compared with ownership of
4 more than 90 percent in countries like Japan or here
5 in the United States.
6 And while as many as 2.5 billion
7 people in hot countries are expected to have an
8 air conditioner by 2050, another 1.9 billion could
9 still be going without.
10 So ultimately, projections about the
11 energy system go back into judgment calls about the
12 rate of change of that group of people and what their
13 behavior is in terms of how much they want to cool,
14 whether they want appliances, refrigerators, of all
15 these different types, all of those consume energy.
16 So it's a judgment call for us, well, are they
17 demanding more energy in a system where there's a
18 carbon price? Are they demanding more energy where
19 there's a government policy about what they can buy?
20 Are there labeling standards? Are there appliance
21 standards? All of that is a question.
22 And companies like ourselves and

1 agencies like the IEA or EIA all have a subjective
2 set of policies that we have to decide on to try to
3 desensitize what the energy system is going to look
4 like.
5 So in the forecasts that are out on
6 the web page, as you can see, we have a more energy
7 scenario; right? And there you see oil demand
8 continue to increase not from 100-to-108-million
9 barrels a day by 2040, but instead goes up to 112 or
10 116 million barrels a day if you assume that there's
11 a larger share of that component that does want to
12 have air conditioning or mobility; right?
13 So it's just a brief sort of snippet
14 of how we think about that.
15 CHAIRMAN ZALEWSKI: Hi. Carrie Zalewski.
16 Thank you, Michael. This whole presentation has been
17 very enlightening. I appreciate all the information.
18 You spoke a little bit about
19 environmental regulation and how it affected a
20 coal-fired power plant. But did you look into energy
21 efficiency policies either in the United States or
22 internationally and how it impacted some of the

1 numbers we're seeing today?

2 MR. COHEN: I didn't address that directly.

3 I'm a very strong believer in efficiency standards.

4 So when I was at the Department of Energy many years

5 ago, Steven Chu, the Secretary at the time, would say

6 that energy efficiency isn't just low-hanging fruit.

7 It's fruit on the ground.

8 And I agree with that. I think that

9 it's something that, obviously, has the potential.

10 When we think about this dual challenge of needing

11 more energy as the population demands more and as we

12 want those countries to be able to have the same

13 prosperity or at least some of the prosperity that we

14 have in industrialized countries, there's going to

15 be this demand for more energy. But how can we

16 provide more energy, but at the same time reduce

17 emissions?

18 Well, that goes back to this premise

19 that we need more energy. But if we can provide

20 energy efficiency or solutions that -- then do we not

21 need to provide more energy. Right?

22 So I don't have a direct way of

1 saying, you know, in the United States how much did
2 energy efficiency deliver in terms of helping to
3 reduce the emissions profile, because it's very
4 difficult, and in my experience with data, it's very
5 difficult to measure what that is.
6 You can do it at maybe a company
7 level or if there's a program at a municipality
8 level or state level, you can say, well, look, we
9 incorporated this standard in buildings and,
10 therefore, this group of buildings is now consuming X
11 percent less.
12 But at a national level, it's very
13 difficult -- and that's one of the challenges. It's
14 very difficult to measure the effectiveness of those
15 efficiency standards unless you're looking at it as a
16 sub, sort of, state level.
17 MR. CRAIG SIEBEN: Thank you. My name is
18 Craig Sieben with AECOM. I have heard your
19 predecessor, Mark Finley, who has been here probably
20 for the last ten years.
21 MR. COHEN: Yes, big shoes to fill.
22 MR. SIEBEN: Yes, and you've done a great

1 job so far. We did an informal poll, and you're
2 doing great.
3 (Laughter.)
4 MR. COHEN: Thank you.
5 MR. SIEBEN: And you're right. He's done
6 an excellent job. He has commented on efficiency as
7 a resource, and I never asked him the question, but
8 this brings to mind, to what extent do you look at
9 efficiency as a resource?
10 Because he's commented in the past
11 years about the contribution efficiencies made
12 towards some of the demand reductions globally. And,
13 you know, given the criticality of that as a
14 resource -- and you worked for Dr. Chu. You
15 understand it.
16 I met Amory Lovins 40 years ago when
17 I was a college student, so I focused on energy
18 efficiency my whole career, for 40 years so far.
19 And we know efficiency is critical.
20 It would be interesting to factor that more
21 programatically in your examination, because you
22 wonder what's happened with the -- say, presidential

1 administrations change. Different administrations
2 put different emphasis on efficiency or even around
3 the world.
4 MR. COHEN: Right.
5 MR. SIEBEN: So it would be interesting,
6 how do you examine that or factor that in as a
7 resource, or might you in your new tenure of leading
8 this effort do it?
9 MR. COHEN: Because I haven't lived through
10 one energy outlook cycle, it's difficult for me to
11 comment on the way in which we approach this.
12 I am responsible for the transport
13 modeling effort, and I know, as I mentioned here
14 earlier, that the transport side, that fuel
15 efficiency standards are playing a massive role.
16 So when we go and look across the
17 world and try to assess what is the assumption in
18 terms of what the average miles per gallon of the
19 fuel fleet looks like and what the scrappage rate is
20 for different countries around the world, those are
21 judgment calls; right? But ultimately, they are a
22 call on how efficient at least the transport side of

1 the system will get.

2 Now, my colleagues that focus on the

3 power system obviously will address -- you know, in

4 terms of the ultimate energy demand estimate. We

5 have to make a call on what the profile is in each of

6 these scenarios for the end-use energy demand.

7 And there will be clearly

8 opportunities in the coming year where we will say,

9 well, in this country, we see this policy, or in this

10 country, we don't see a policy yet, but we expect a

11 policy to be in place in the future where that energy

12 demand profile is going to be mitigated.

13 So again, I don't have specifics for

14 you, but the decision about efficiency comes at the

15 end use -- in the end-use sector. And so it's not --

16 I hear what you're saying in terms of can we treat

17 this as a resource, but we still have to -- the way

18 that our modeling works is that it's ultimately a

19 competition within each sector for each fuel.

20 If I say, well, the end-use transport

21 sector level is X, and in the future, it's going to

22 be 90 percent of X, then the remaining technologies

1 and alternatives will compete with one another to
2 provide 90 percent of X. That's how the efficiency
3 comes into the modeling.
4 MR. RICHARD STUCKEY: My name is Richard
5 Stuckey.
6 I have a question for you on the
7 impact of a carbon tax. You mentioned how sensitive
8 demand was to the price of gasoline particularly. If
9 we were to put a carbon tax on it, would it have a
10 very substantial impact on total demand? It's almost
11 a given now and not talked about much about how we
12 can reduce it, but that would be one way possibly to
13 do that, and if it were to work, how high do you
14 think that would have to be to be effective?
15 MR. COHEN: Ultimately, the carbon tax
16 would have to be quite high in order to see an impact
17 on the oil side, but at current levels, we can see
18 much more of an impact in terms of coal to gas
19 switching, and mainly, within the power sector
20 from -- there's been a number of different studies.
21 The IEA just recently put out a study
22 in terms of seeing $100 per ton tax, metric ton tax,

1 on carbon would basically -- if you look at the
2 entire stack within ERCOT, for example, it would
3 cause a substantial amount. I think they came up
4 with 20 or 25 percent switch from coal to natural gas
5 if that were in place.
6 And obviously, it ratchets up the
7 higher you go. But the main point I want to convey
8 is that within the oil sector, the impact is not as
9 much on the upstream side as what you might see
10 switching over in the power side.
11 When we look at our projections over
12 the long term, there is one, you know, the rapid
13 transition scenario is one in which we actually
14 assume a carbon price or a carbon tax. So in that
15 scenario, you see emissions fall pretty dramatically.
16 But in the one -- you know, a more energy scenario or
17 in an evolving transition scenario, the emissions
18 profile does not improve nearly as much.
19 So it comes back to this criticality
20 of having some kind of global carbon price in place,
21 and, you know, we see it in some countries, but not
22 everywhere.

1 CHAIRMAN ZALEWSKI: Thank you very much. I
2 hope everyone enjoyed it as much as I did.
3 (Applause.)
4 CHAIRMAN ZALEWSKI: I just wanted to
5 mention that we have Senator Rezin here, who is the
6 Minority Spokesperson for the Senate Energy
7 Committee. So we're grateful she's here to be able
8 to listen in as well.
9 Thank you everyone for being here in
10 attendance, and hopefully, we'll see you next year if
11 not before then.
12 So thank you, Michael, we appreciate
13 it.
14 (Applause.)
15 CHAIRMAN ZALEWSKI: And the meeting is now
16 adjourned.
17 (WHEREUPON, the meeting was
18 adjourned.)
19
20
21
22