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### Methodological changes

This year's Statistical Review introduces two changes in how oil and gas are reported in energy units. First, primary consumption of energy from oil is now reported in tonnes of oil equivalent where one tonne of oil is defined as 10 Gcal (gigacalories) or 41.868 GJ (gigajoules). Second, the tables now report natural gas volumes in terms of a standardized gas at a temperature of 15°C and a pressure of 1013 mbar with a gross calorific value of 40 MJ (megajoules) per cubic metre.

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# Group chief executive's introduction



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Welcome to BP's Statistical Review of World Energy which records the events of 2017, a year in which global energy markets took a partial step back from the exceptional momentum of recent years towards a lower carbon energy system.

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Prior to 2017, there had been three successive years of little or no growth in carbon emissions from energy consumption. This came about through accelerating gains in energy efficiency muting growth in energy demand, and rapid growth in renewable energy combined with successive falls in global coal consumption leading to improvements in the fuel mix.

That progress partially reversed last year. Growth in energy demand picked up as gains in energy efficiency slowed, coal consumption increased for the first time in four years, and carbon emissions from energy consumption grew.

This reversal should not come as a complete surprise. As we highlighted at the time, in addition to benefitting from longer-term structural forces, some of the exceptional performance seen in recent years had been boosted by temporary, cyclical developments, particularly in China, and so some reversal was always likely.

Those longer-term forces shaping the transition continued last year. Renewable energy grew strongly again, with particularly striking gains in solar capacity and generation. Natural gas was the largest source of energy growth, boosted by a massive programme of coal-to-gas switching in industrial and residential sectors in China.

But much more progress is needed. In particular, data included in this year's Review for the first time highlight the need for greater advances in the power sector. The power sector really matters. It absorbs more primary energy than any other sector. It accounts for over a third of carbon emissions from energy consumption. However, despite the huge policy push encouraging a switch away from coal and the rapid expansion of renewable energy in recent years, there has been no improvement in the mix of fuels feeding the global power sector over the past 20 years. Astonishingly, the share of coal in 2017 was exactly the same as in 1998. The share of non-fossil fuels was actually lower, as growth in renewables has failed to compensate for the decline in nuclear energy. The failure to make any inroads into the power sector since the turn of the century should be both a cause for concern and a focus for future action.

As well as highlighting these longer-term trends, this year's Statistical Review also shines a light on the shorter-term developments affecting our industry. In the oil market, yet another year of robust demand growth, combined with the production cuts of OPEC and other participating countries, allowed oil inventories to fall back towards more normal levels. But the rapid growth of US tight oil over the same period should caution us that the recent firming in oil prices is unlikely to persist. In BP, we remain firmly focused on efficiency, reliability and capital discipline.

In natural gas markets, another year of strong expansion of global LNG supplies helped to improve the accessibility of gas around the globe, with clear signs that the major regional gas markets are becoming increasingly integrated. This greater accessibility and integration should help to underpin the long-term use of natural gas.

Our industry operates and makes decisions at many different frequencies. Day-to-day, year-to-year, we need to understand how the markets in which we operate are changing and developing as new sources of supply emerge and demand evolves. Over the longer-term, we need to gauge the forces shaping the energy transition and ensure that we play our part in meeting the dual challenge of supplying the energy the world needs to grow and prosper, while also reducing carbon emissions.

These judgements and decisions require timely and reliable data. This is the role that the Statistical Review has been playing for the past 67 years. I know that in BP we find the data and analysis invaluable for our own decision making. I hope you find it a useful resource for your own work.

Let me conclude by thanking BP's economics team and all those who helped us prepare this review – in particular those in the governments around the world who contributed their official data again this year. Thank you for your continuing cooperation and transparency.

**Bob Dudley**  
Group chief executive  
June 2018

# 2017 at a glance

Global primary energy consumption grew strongly in 2017, led by natural gas and renewables, with coal's share of the energy mix continuing to decline.

## Energy developments

- Primary energy consumption growth averaged 2.2% in 2017, up from 1.2% last year and the fastest since 2013. This compares with the 10-year average of 1.7% per year.
- By fuel, natural gas accounted for the largest increment in energy consumption, followed by renewables and then oil.
- Energy consumption rose by 3.1% in China. China was the largest growth market for energy for the 17th consecutive year.

## Carbon emissions

- Carbon emissions from energy consumption increased by 1.6%, after little or no growth for the three years from 2014 to 2016.

## Oil

- The oil price (Dated Brent) averaged \$54.19 per barrel, up from \$43.73/barrel in 2016. This was the first annual increase since 2012.
- Global oil consumption growth averaged 1.8%, or 1.7 million barrels per day (b/d), above its 10-year average of 1.2% for the third consecutive year. China (500,000 b/d) and the US (190,000 b/d) were the single largest contributors to growth.
- Global oil production rose by 0.6 million b/d, below average for the second consecutive year. US (690,000 b/d) and Libya (440,000 b/d) posted the largest increases in output, while Saudi Arabia (-450,000 b/d) and Venezuela (-280,000 b/d) saw the largest declines.
- Refinery throughput rose by an above-average 1.6 million b/d, while refining capacity growth was only 0.6 million b/d, below average for the third consecutive year. As a result, refinery utilization climbed to its highest level in nine years.

## Natural gas

- Natural gas consumption rose by 96 billion cubic metres (bcm), or 3%, the fastest since 2010.
- Consumption growth was driven by China (31 bcm), the Middle East (28 bcm) and Europe (26 bcm). Consumption in the US fell by 1.2%, or 11 bcm.
- Global natural gas production increased by 131 bcm, or 4%, almost double the 10-year average growth rate. Russian growth was the largest at 46 bcm, followed by Iran (21 bcm).



# +2.2%

Growth of global primary energy consumption, the fastest growth since 2013

- Gas trade expanded by 63 bcm, or 6.2%, with growth in LNG outpacing growth in pipeline trade.
- The increase in gas exports was driven largely by Australian and US LNG (up by 17 and 13 bcm respectively), and Russian pipeline exports (15 bcm).

## Coal

- Coal consumption increased by 25 million tonnes of oil equivalent (mtoe), or 1%, the first growth since 2013.
- Consumption growth was driven largely by India (18 mtoe), with China consumption also up slightly (4 Mtoe) following three successive annual declines during 2014-2016. OECD demand fell for the fourth year in a row (-4 mtoe).
- Coal's share in primary energy fell to 27.6%, the lowest since 2004.
- World coal production grew by 105 mtoe or 3.2%, the fastest rate of growth since 2011. Production rose by 56 mtoe in China and 23 mtoe in the US.

## Renewables, hydro and nuclear

- Renewable power grew by 17%, higher than the 10-year average and the largest increment on record (69 mtoe).
- Wind provided more than half of renewables growth, while solar contributed more than a third despite accounting for just 21% of the total.
- In China, renewable power generation rose by 25 mtoe – a country record, and the second largest contribution to global primary energy growth from any single fuel and country, behind natural gas in China.
- Hydroelectric power rose by just 0.9%, compared with the 10-year average of 2.9%. China's growth was the slowest since 2011, while European output declined by 10.5% (-16 mtoe).
- Global nuclear generation grew by 1.1%. Growth in China (8 mtoe) and Japan (3 mtoe) was partially offset by declines in South Korea (-3 mtoe) and Taiwan (-2 mtoe).

## Power generation

- Power generation rose by 2.8%, close to the 10-year average. Practically all growth came from emerging economies (94%). Generation in the OECD has remained relatively flat since 2010.
- Renewables accounted for almost half of the growth in power generation (49%), with most of the remainder provided for by coal (44%).
- The share of renewables in global power generation increased from 7.4% to 8.4%.

## Key materials

- Cobalt production has grown by only 0.9% per annum since 2010, while lithium production has increased by 6.8% p.a. over the same period.
- Cobalt prices more than doubled in 2017, while lithium carbonate prices increased by 37%.

Left: China Hong Kong SAR at night.

# Group chief economist's analysis



## Energy in 2017: two steps forward, one step back

At first blush, some of last year's data might seem a little disappointing. Growth in overall energy demand is up; gains in energy intensity are down. Coal consumption grew for the first time in four years. And, perhaps most striking of all, carbon emissions are up after three consecutive years of little or no growth.

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 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 sector. Output from some of China's most energy-intensive sectors was falling in outright terms. Those factors were unlikely to persist. Indeed, last year's Statistical Review presentation had the title of "short-run adjustments and long-run transition".

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. Last year's energy data is perhaps best seen as a case of "two steps forward, one step back".

### Key features of 2017

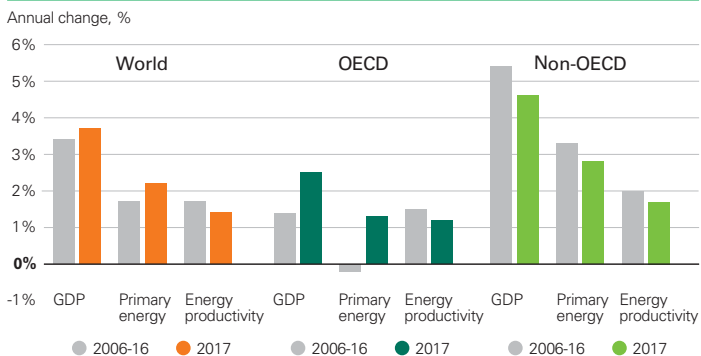
Let's start by looking at some of the headline numbers. Global energy demand grew by 2.2% in 2017, up from 1.2% last year and above its 10-year average of 1.7%. This above-trend growth was driven by the OECD, particularly the EU. Much of this strength can be directly related to the pickup in economic growth. But it also reflected a slight slowing in the pace of improvement in energy intensity (or energy productivity): the amount of energy needed to produce a unit of output.

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

# 3.1%

Growth of primary energy consumption in China, up from 1% in 2016.

## Growth in GDP and energy

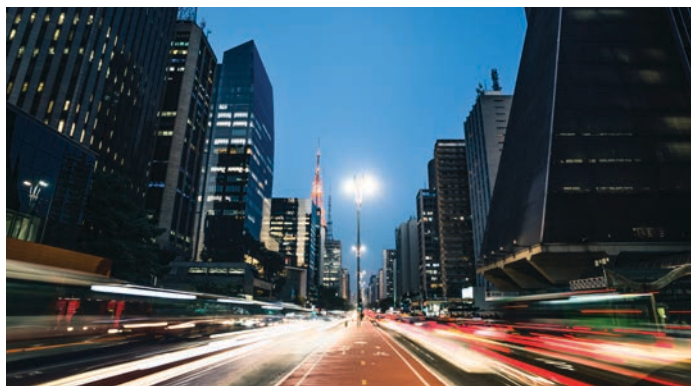


China alone contributed over a third of that growth, with energy consumption growing by over 3% in 2017, almost three times the rate seen over the past couple of years. This sharp pickup was driven by a rebound in the output of some of China's most energy-intensive sectors, particularly iron, crude steel and non-ferrous metals. Despite this increase, the growth of China's energy demand in 2017 was still significantly slower than its 10-year average, and its rate of decline in energy intensity was more than twice the global average. Two steps forward, one step back.

This phrase can be equally applied to the fuel mix. The forward progression can be seen in that around 60% of the increase in primary energy was provided by natural gas and renewable energy. Natural gas (3.0%, 83 Mtoe) provided the single largest contribution to the growth of primary energy, buoyed by exceptional growth in China. This was closely followed by renewable energy (including biofuels) (14.8%, 72 Mtoe), which again grew rapidly driven by robust growth in both wind and solar power.

The step back was coal (1.0%, 25 Mtoe), which grew for the first time since 2013. This was largely driven by India, but it's also notable that Chinese coal consumption increased after three years of successive falls.

That's a very quick summary of the big picture for 2017. I will now take you through some of the developments and issues in last year's energy markets in a little more detail.



Above: The financial centre of São Paulo in Brazil.



Above: A view of Atlantis platform in the Gulf of Mexico.

## Oil

To remind you where we left off at the time of last year's Statistical Review: flows of oil production and consumption had come back broadly into balance, 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 promised cuts in oil production in order to accelerate the adjustment in inventories; but US tight oil had started to pick up threatening to offset the impact of the production cuts. So what happened next?

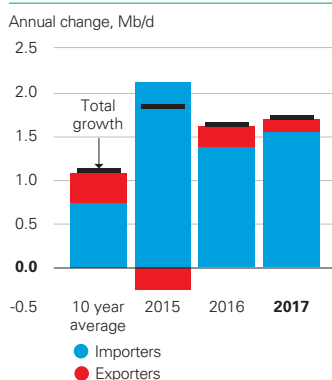
Starting first with consumption, oil demand grew by 1.7 Mb/d – similar to that seen in 2016 and significantly greater than the 10-year average of around 1.1 Mb/d. To put the recent strength of oil demand in context, average growth over the past five years is at its highest level since the height of the commodity super-cycle in 2006/7. This was despite all the talk of peak oil demand, increasing car efficiency, growth of electrical vehicles. All of 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 benefitting from the windfall of low prices, with both Europe (0.3 Mb/d) and the US (0.2 Mb/d) posting notable increases, compared with average declines over the previous 10 years. Growth in China (0.5 Mb/d) was closer to its 10-year average.

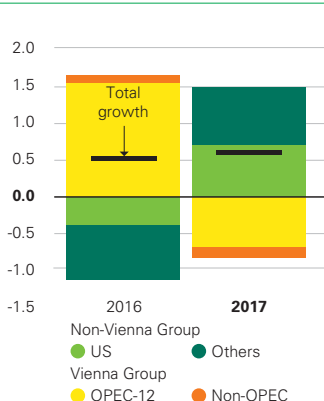
But there were some signs in the product mix that the boost from low oil prices may be beginning to wane. Growth in consumer-led fuels most exposed to oil price movements – especially gasoline – slowed in 2017. In contrast, diesel demand bounced back, buoyed by the acceleration in industrial activity.

### Oil demand and supply growth

#### Oil demand growth



#### Oil supply growth



That was demand, what about supply, particularly the interaction between the OPEC production cuts and the response of US tight oil? The impact of the production cuts can be seen in growth of supply last year. At an aggregate level, output growth in 2017 (0.6 Mb/d) was similar to that in 2016. But the pattern of that growth flip-flopped quite sharply. After growing by 1.6 Mb/d in 2016, output by OPEC and other members of the Vienna group fell 0.9 Mb/d 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 1.5 Mb/d, led by the US and a bounce back in Libya (which was not part of the Vienna agreement).

The Vienna group had a target for production cuts of almost 1.8 Mb/d, relative to the base month of October 2016. In practice, the production cuts have far exceeded that, with cuts totalling nearly 2.5 Mb/d in April 2018. This overshoot has been concentrated in Venezuela – where the economic and political crisis has caused production to fall by almost 700 Kb/d, far in excess of the target reduction of 100 Kb/d – and to a lesser extent in Saudi Arabia and Angola.

The production cuts were instrumental in increasing the pace at which oil stocks fell back to more normal levels last year. With the cuts in place, daily consumption exceeded production for much of 2017. 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 five-year moving average measure originally highlighted by the Vienna group.

That said; the impact of the production cuts would have been even bigger had it not been for the response of US tight oil and NGLs, which have grown by almost 2 Mb/d since October 2016. Indeed, the pace of this second wave of growth in US tight oil seen over the past 18 months or so is comparable to the rapid growth seen in 2012-2014, even though prices in the earlier period were materially higher. The scale of the increase in US tight oil meant the impact of the production cuts was increasingly offset as we moved through 2017.

The speed and scale of OPEC's actions mean that it continues to have the ability to smooth temporary disturbances to the oil market. But the relatively rapid response of US tight oil reinforces the limits on OPEC's power. If OPEC tries to resist more permanent or structural changes in the market, there is an increasing risk that these actions will quickly be cancelled out by the responsiveness of US tight oil.

Finally, bringing these developments in demand and supply together in terms of their implications for prices. 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 \$66/bbl by the end of last year. For the year as a whole, Brent averaged \$54/bbl, up from \$44/bbl in 2016 – the first annual increase since 2012.

## Refining

The strong growth in oil demand fed through into refining, with refining runs increasing by 1.6 Mb/d in 2017, more than twice their 10-year average. The increase in throughput, together with continuing declines in availability in Latin America, allowed space for refinery runs in US and Europe to expand after being squeezed in 2016. The increase in refinery runs, together with another year of weak capacity growth, pushed refining utilization to its highest levels for almost 10 years. Refining margins also rose, supported by the impact of hurricane Harvey, high utilization rates and product stocks falling back to more normal levels.

# 1.7 Mb/d

Growth of global oil consumption, above the 10-year average of 1.1 Mb/d.

## Natural gas

2017 was a bumper year for natural gas, with consumption (3.0%, 96 bcm) and production (4.0%, 131 bcm) both increasing at their fastest rates since the immediate aftermath of the financial crises. The growth in consumption was led by Asia, with particularly strong growth in China (15.1%, 31 bcm), supported by increases in the Middle East (Iran 6.8%, 13 bcm) and Europe.

The growth in consumption was more than matched by increasing production, particularly in Russia (8.2%, 46 bcm), supported by Iran (10.5%, 21 bcm), Australia (18%, 17 bcm) and China (8.5%, 11 bcm).

### Surge in China's gas demand

The single biggest factor driving global gas consumption last year was the surge in Chinese gas demand, where consumption increased by over 15%, accounting for around a third of the global increase in gas consumption. 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 five years. With that five-year deadline looming, the Chinese authorities in the spring of last year announced an enhanced set of measures for Beijing, Tiajing and 26 other cities in the North-East provinces of China, designed to meet the environmental objectives.

These measures, which were further reinforced in the autumn of last year, were focused on the use of coal outside of the power sector. In particular, a combination of very sizeable carrots and sticks were used to encourage industrial and residential users to switch away from coal to either gas or electricity, with the vast majority opting for gas. Although most attention has focused on the 3 million households affected by this policy, the biggest factor driving the expansion in gas demand was switching within the industrial sector. The resulting increase in gas demand was greatly compounded by the switch into gas reaching a peak just as winter heating demand was ramping up.

Chinese gas demand looks set to continue to increase strongly this year, but it seems unlikely that the extent of the surge in gas demand seen in China last year will be repeated in 2019 and beyond.

### Growth in LNG trade

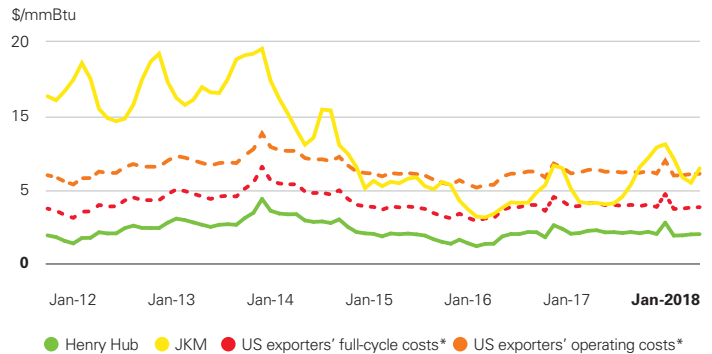
The other central factor supporting the strength of global gas markets last year was the continued expansion of liquified natural gas (LNG), which increased by over 10% in 2017, its strongest growth since 2010, aided by the start-up of new LNG trains in Australia and the US. China's increased need for LNG accounted for almost half of the global expansion, with China 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 to predict the emergence of surplus LNG as it took time for demand to catch up with the rapid growth in supplies. But many observers have so far been surprised by the apparent absence of such a glut. There is certainly little evidence of LNG facilities standing idle due to a lack of demand. This absence partly reflects that, due to a variety of technical issues, actual LNG supplies have come on stream less quickly than originally planned, moving supply more into line with the 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 a build-up of idle capacity.

# 15.1%

Growth of Chinese natural gas consumption, the fastest since 2011.

## US LNG exporters' costs and Asian spot prices



\*Operating costs = 115\* Henry Hub + \$2/mmBtu (transport); Full costs also include liquefaction fee (\$3/mmBtu).

This is illustrated by Asian spot LNG prices – shown by the Japan Korea Marker (JKM) – over the past couple of years fluctuating in a range between US LNG exporters' full-cycle costs and their short-run operating costs. Exporters of US LNG have been willing to supply LNG as long as they covered their operating costs, even if that was less than their full-cycle costs. So there has in fact been an LNG glut of sorts in recent years, but this has manifested itself in periods of unsustainably low prices rather than idle LNG capacity.

## Coal

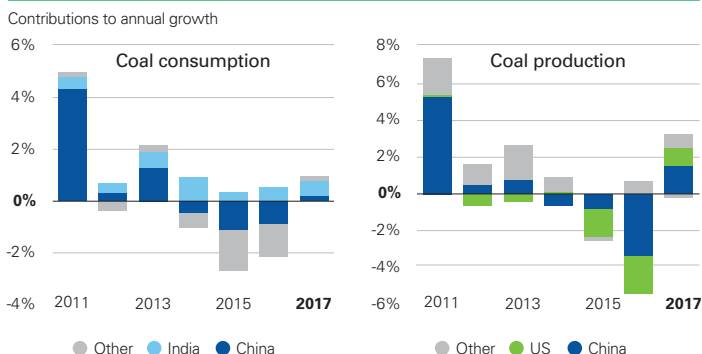
After several years of free-fall, the coal market experienced a mini-revival last year, with both global consumption and production increasing. Global coal consumption rose by 1%, (25 mtoe), with India (4.8%, 18 Mtoe) recording the fastest growth, as demand both inside and outside of the power sector increased. Interestingly, after three years of successive declines, China's coal consumption (0.5%, 4 Mtoe) also ticked-up. This is despite the substantial coal-to-gas switching in the industrial and residential sector, as increases in power demand in China sucked in additional coal as the balancing fuel.

World production of coal increased more strongly (3.2%, 105 mtoe), driven by notable increases in both Chinese (3.6%, 56 Mtoe) and US (6.9%, 23 Mtoe) output. Interestingly, the increase in US production came despite a further fall in domestic consumption, with US coal producers instead increasing exports to Asia.



Above: Trucks move coal at a mine.

## Global coal consumption and production



Somewhat counter-intuitively, the increase in Chinese coal production was a result of the on-going measures to reduce excess capacity within the Chinese coal sector. A central part of this reform process has been managing the need for a Goldilocks-type price for coal. Too hot and it would reduce the pressure for inefficient mines to close or merge, as well as raising general energy costs. Too cold and it would threaten the underlying viability of a sector that still provides around 60% of China's energy.

The fact that Chinese spot coal prices were above the government's target price band through much of last year spurred a series of policy measures to increase coal supplies and so ease price pressures. The increase in Chinese coal production of over 3.5% last year, its strongest growth for six years, was a direct result of these actions.

## 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 the world electrifies. This year's Statistical Review for the first time includes comprehensive data on the fuel mix within the power sector, aiding our understanding of this key sector.

Global power generation increased by 2.8% in 2017 close to its 10-year average. Almost all that growth came from the developing world. OECD demand edged up slightly, but essentially the decoupling of economic growth and power demand in the OECD seen over the past 10 years continued, with OECD power broadly flat over the past decade.

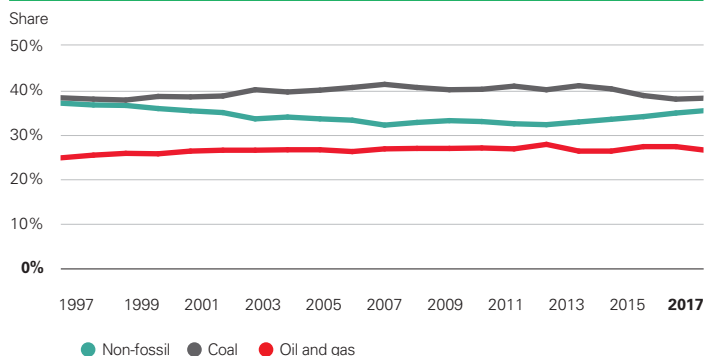
The increase in global power generation was driven by strong expansion in renewable energy, led by wind (17%, 163 TWh) and solar (35%, 114 TWh), which accounted for almost half of the total growth in power generation, despite accounting for only 8% of total generation. Although wind continued in its 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 GW last year, with China on its own building by over 50 GW – that is roughly equivalent to the generation potential of more than two-and-a-half Hinkley Point nuclear power plants. Global solar generation increased by more than a third last year. Much of this growth continues to be underpinned by policy support. But it has been aided by continuing falls in solar costs, with auction bids of less than 5 cents/KWh – which would have been unthinkable for most projects even just a few years ago – now almost common place.

# 38%

The share of coal in global power generation, similar to the share in 1998.

## Fuel shares in power generation



Standing back from the detail of what happened last year, the most striking – and worrying – chart in the whole of this Statistical Review is the trends in the power sector fuel mix over the past 20 years.

Striking: because despite the extraordinary growth in renewables in recent years, and the huge policy efforts to encourage a shift away from coal into cleaner, lower carbon fuels, there has been almost no improvement in the power sector fuel mix over the past 20 years. The share of coal in the power sector in 1998 was 38% – exactly the same as in 2017 – with the slight edging down in recent years simply reversing the drift up in the early 2000s associated with China's rapid expansion. The share of non-fossil in 2017 is actually a little lower than it was 20 years ago, as the growth of renewables hasn't offset the declining share of nuclear. I had no idea that so little progress had been made until I looked at these data.

Worrying: because the power sector is the single most important source of carbon emissions from energy consumption, accounting for over a third 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. But this is one area where at the global level we haven't even taken one step forward, we have stood still: perfectly still for the past 20 years. This chart should serve as a wake-up call for all of us.

## Carbon emissions from energy consumption

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



Above: Lightsource BP's floating solar farm near London in the UK.



The factors driving the pick-up in carbon emissions are of course the same factors that we have just been discussing. Global 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 three years to a small rise last year, meant the improvement in carbon intensity was more muted. How worried should we be?

Last year when we discussed the exceptional performance seen over the previous three years, I suggested that some of that improvement was likely to be structural and would persist, but that the degree of improvement was probably exaggerated by several cyclical factors, particularly in China. Given that, as those short-run factors unwind – like they have done this year – it's not surprising that carbon emissions increased to some extent.

But the extent of that pick-up has probably 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 bounce back in power demand in China, which sucked in coal as the balancing fuel.

My guess is that some of the deterioration in 2017 relative to the previous three years will persist, but not all of it. So I'm a bit worried, but not overly so. Personally, I am 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.

## Cobalt and lithium

A key challenge for the Statistical Review is that it needs to adapt to the changing needs of you, our customers. One of the questions I am most often asked is whether the available supplies of raw materials used to produce batteries for electric cars could act as a constraint on the speed with which they grow. That question was one of the reasons why we included a new section in this year's Statistical 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 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.

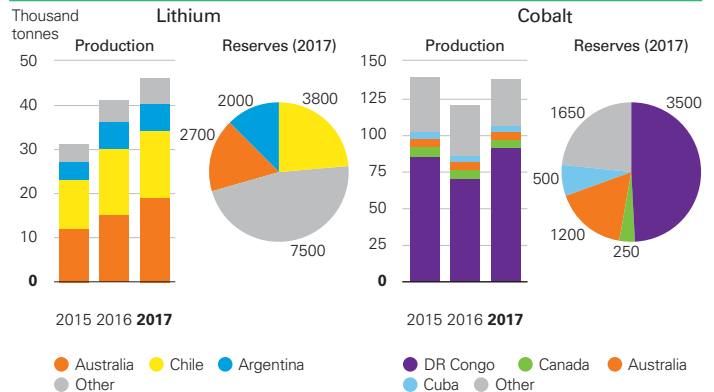
For cobalt, the Democratic Republic of Congo accounts for the vast majority of both production (66%) and proved reserves (49%). Cobalt prices picked up sharply last year as demand increased, but this has not yet fed through into a significant increase in production. The pace of this response may be affected by the fact that cobalt is produced as a by-product of copper and nickel mining and so production depends on price trends in these metals as well.

### In detail

New data has been included on the fuel mix of power generation and the production and reserves of key material for the changing energy system (cobalt, lithium, graphite and rare earth metals).

Additional information – including historical time series for the fuels reported in review; additional country and regional coverage for fuels consumption; further details on renewable forms of energy; oil consumption by product – together with the full version of Spencer Dale's presentation is available at [bp.com/statisticalreview](http://bp.com/statisticalreview).

## Lithium and cobalt: reserves and production



In terms of whether the availability of either of these metals could act as a constraint on the growth of electric cars, that question really deserves a whole presentation on its own. The short answer is that if either metal is likely to pose a bottleneck, it appears most 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 the new wave of battery technologies now being developed require less cobalt. So rather than act as a constraint on the growth of electric vehicles, the availability of cobalt could simply provide further momentum to this technological change. Watch this space.

## Conclusion

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 three years. Some backsliding was almost inevitable.

The road to meeting the Paris climate goals is likely to 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 the role of BP's Statistical Review.

**Spencer Dale**

Group chief economist  
June 2018

This is a shortened version of the presentation given at the launch of BP's Statistical Review of World Energy in London on 13 June 2018.

## Acknowledgements

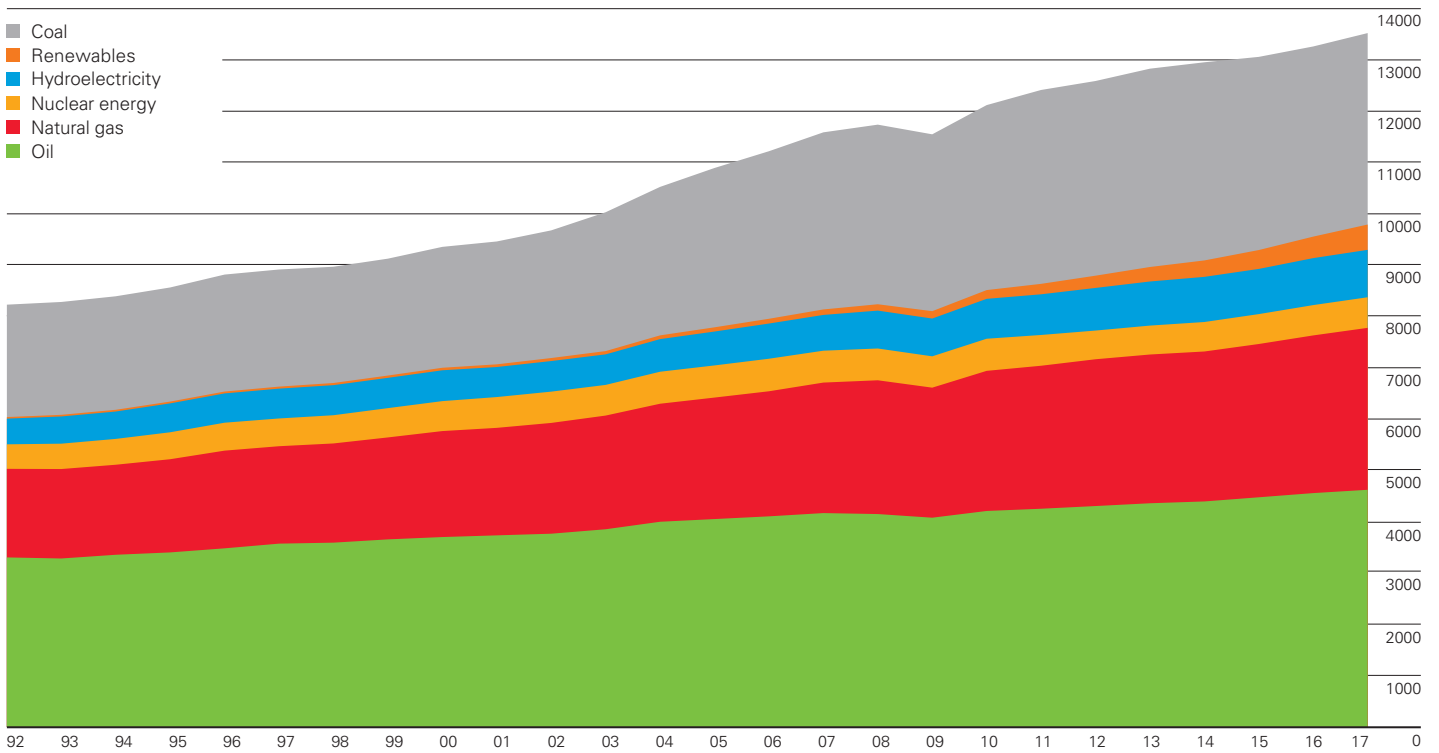
We would like to express our sincere gratitude to the many contacts worldwide who provide the publicly available data for this publication, and to the researchers at the Centre for Energy Economics Research and Policy, Heriot-Watt University who assist in the data compilation.





## World consumption

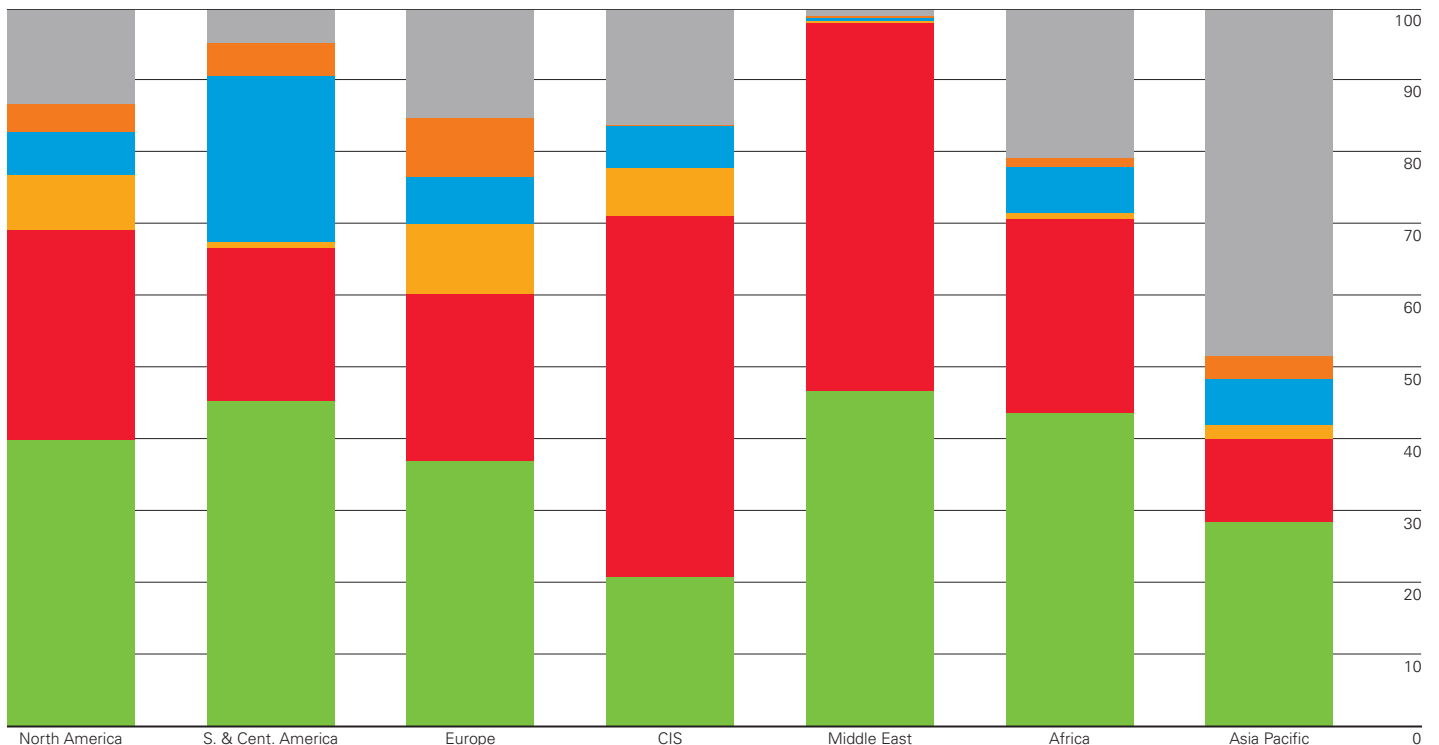
Million tonnes oil equivalent



World primary energy consumption grew by 2.2% in 2017, up from 1.2% in 2016 and the highest since 2013. Growth was below average in Asia Pacific, the Middle East and S. & Cent. America but above average in other regions. All fuels except coal and hydroelectricity grew at above-average rates. Natural gas provided the largest increment to energy consumption at 83 million tonnes of oil equivalent (mtoe), followed by renewable power (69 mtoe) and oil (65 mtoe).

## Regional consumption by fuel 2017

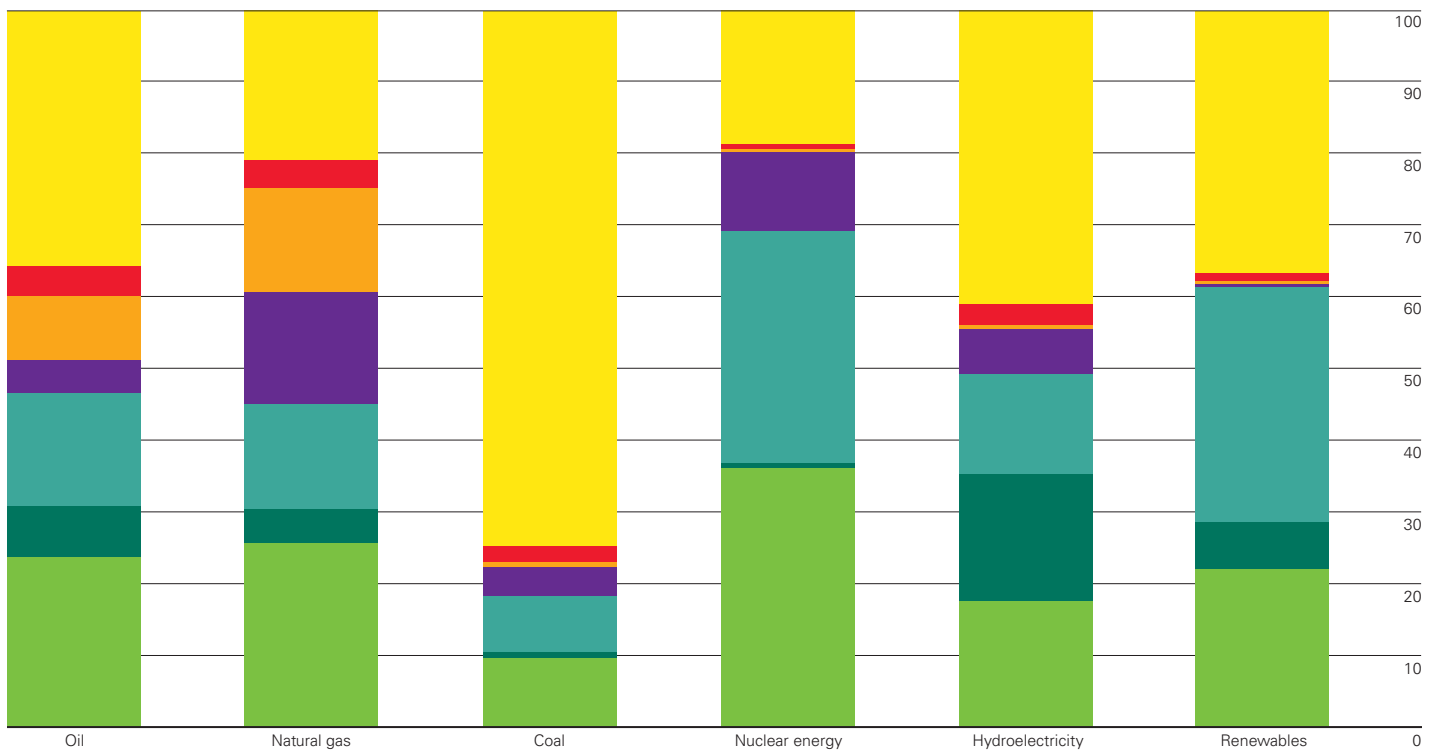
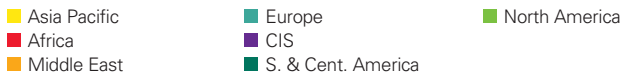
Percentage



Oil remains the dominant fuel in Africa, Europe and the Americas, while natural gas dominates in CIS and the Middle East, accounting for more than half of the energy mix in both regions. Coal is the dominant fuel in the Asia Pacific region. In 2017 coal's share of primary energy fell to its lowest level in our data series in North America, Europe, CIS and Africa.

## Fuel consumption by region 2017

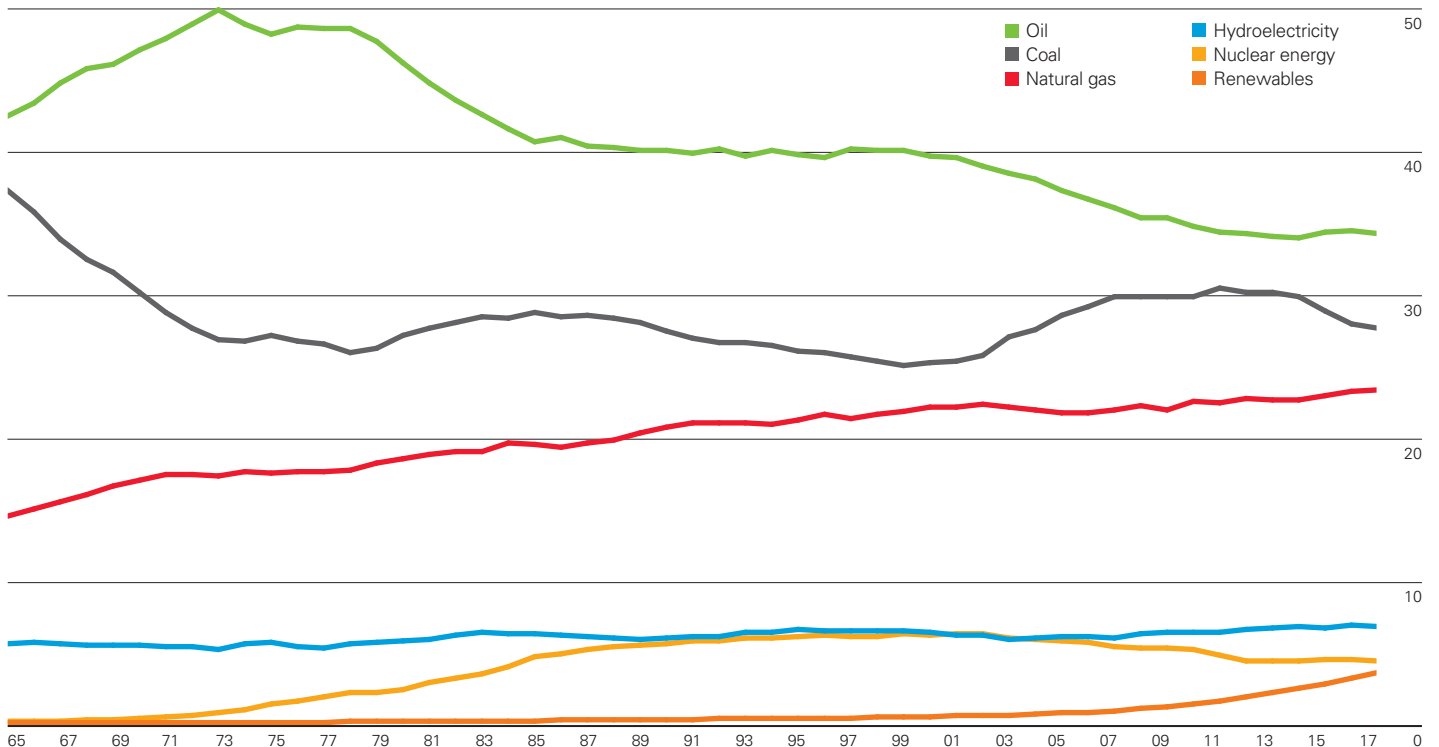
Percentage



Asia is the leading regional consumer of oil, coal, renewable power and hydroelectricity, while North America leads for nuclear power and natural gas. Asia dominates global coal consumption, accounting for almost three quarters of global consumption (74.5%). Asia's share of the coal market has grown steadily since 1965 when it made up only 17% of the coal consumption. It reached the 50% mark in 2001.

## Shares of global primary energy consumption by fuel

Percentage



Oil remains the world's dominant fuel, making up just over a third of all energy consumed. In 2017 oil's market share declined slightly, following two years of growth. Coal's market share fell to 27.6%, the lowest level since 2004. Natural gas accounted for a record 23.4% of global primary energy consumption, while renewable power hit a new high of 3.6%.

## Total proved reserves

	At end 1997 Thousand million barrels	At end 2007 Thousand million barrels	At end 2016 Thousand million barrels	At end 2017			
				Thousand million barrels	Thousand million tonnes	Share of total	R/P ratio
US	30.5	30.5	50.0	<b>50.0</b>	<b>6.0</b>	2.9%	10.5
Canada	48.8	178.8	170.6	<b>168.9</b>	<b>27.2</b>	10.0%	95.8
Mexico	47.8	12.2	7.2	<b>7.2</b>	<b>1.0</b>	0.4%	8.9
<b>Total North America</b>	<b>127.1</b>	<b>221.5</b>	<b>227.7</b>	<b>226.1</b>	<b>34.2</b>	<b>13.3%</b>	<b>30.8</b>
Argentina	2.6	2.6	2.2	<b>2.2</b>	<b>0.3</b>	0.1%	10.0
Brazil	7.1	12.6	12.6	<b>12.8</b>	<b>1.9</b>	0.8%	12.8
Colombia	2.6	1.5	2.0	<b>1.7</b>	<b>0.2</b>	0.1%	5.4
Ecuador	3.7	6.4	8.3	<b>8.3</b>	<b>1.2</b>	0.5%	42.7
Peru	0.8	1.1	1.2	<b>1.2</b>	<b>0.1</b>	0.1%	26.4
Trinidad & Tobago	0.7	0.9	0.2	<b>0.2</b>	<b>†</b>	♦	6.7
Venezuela	74.9	99.4	301.8	<b>303.2</b>	<b>47.3</b>	17.9%	393.6
Other S. & Cent. America	1.1	0.8	0.5	<b>0.5</b>	<b>0.1</b>	♦	10.5
<b>Total S. &amp; Cent. America</b>	<b>93.4</b>	<b>125.3</b>	<b>328.9</b>	<b>330.1</b>	<b>51.2</b>	<b>19.5%</b>	<b>125.9</b>
Denmark	0.9	1.1	0.4	<b>0.4</b>	<b>0.1</b>	♦	8.7
Italy	0.6	0.5	0.5	<b>0.6</b>	<b>0.1</b>	♦	18.9
Norway	12.0	8.2	7.6	<b>7.9</b>	<b>1.0</b>	0.5%	11.0
Romania	0.9	0.5	0.6	<b>0.6</b>	<b>0.1</b>	♦	21.8
United Kingdom	5.2	3.4	2.3	<b>2.3</b>	<b>0.3</b>	0.1%	6.3
Other Europe	1.6	1.5	1.6	<b>1.5</b>	<b>0.2</b>	0.1%	16.2
<b>Total Europe</b>	<b>21.3</b>	<b>15.1</b>	<b>13.1</b>	<b>13.4</b>	<b>1.7</b>	<b>0.8%</b>	<b>10.4</b>
Azerbaijan	1.2	7.0	7.0	<b>7.0</b>	<b>1.0</b>	0.4%	24.1
Kazakhstan	5.3	30.0	30.0	<b>30.0</b>	<b>3.9</b>	1.8%	44.8
Russian Federation	113.1	106.4	106.2	<b>106.2</b>	<b>14.5</b>	6.3%	25.8
Turkmenistan	0.5	0.6	0.6	<b>0.6</b>	<b>0.1</b>	♦	6.4
Uzbekistan	0.6	0.6	0.6	<b>0.6</b>	<b>0.1</b>	♦	30.0
Other CIS	0.6	0.6	0.5	<b>0.5</b>	<b>0.1</b>	♦	15.0
<b>Total CIS</b>	<b>121.4</b>	<b>145.3</b>	<b>144.9</b>	<b>144.9</b>	<b>19.7</b>	<b>8.5%</b>	<b>27.8</b>
Iran	92.6	138.2	157.2	<b>157.2</b>	<b>21.6</b>	9.3%	86.5
Iraq	112.5	115.0	148.8	<b>148.8</b>	<b>20.1</b>	8.8%	90.2
Kuwait	96.5	101.5	101.5	<b>101.5</b>	<b>14.0</b>	6.0%	91.9
Oman	5.4	5.6	5.4	<b>5.4</b>	<b>0.7</b>	0.3%	15.2
Qatar	12.5	27.3	25.2	<b>25.2</b>	<b>2.6</b>	1.5%	36.1
Saudi Arabia	261.5	264.2	266.2	<b>266.2</b>	<b>36.6</b>	15.7%	61.0
Syria	2.3	2.5	2.5	<b>2.5</b>	<b>0.3</b>	0.1%	278.4
United Arab Emirates	97.8	97.8	97.8	<b>97.8</b>	<b>13.0</b>	5.8%	68.1
Yemen	1.8	2.7	3.0	<b>3.0</b>	<b>0.4</b>	0.2%	156.6
Other Middle East	0.2	0.1	0.1	<b>0.1</b>	<b>†</b>	♦	1.6
<b>Total Middle East</b>	<b>683.2</b>	<b>754.9</b>	<b>807.7</b>	<b>807.7</b>	<b>109.3</b>	<b>47.6%</b>	<b>70.0</b>
Algeria	11.2	12.2	12.2	<b>12.2</b>	<b>1.5</b>	0.7%	21.7
Angola	3.9	9.5	9.5	<b>9.5</b>	<b>1.3</b>	0.6%	15.6
Chad	–	1.5	1.5	<b>1.5</b>	<b>0.2</b>	0.1%	39.7
Republic of Congo	1.6	1.6	1.6	<b>1.6</b>	<b>0.2</b>	0.1%	15.1
Egypt	3.7	4.1	3.4	<b>3.3</b>	<b>0.4</b>	0.2%	13.8
Equatorial Guinea	0.6	1.7	1.1	<b>1.1</b>	<b>0.1</b>	0.1%	15.2
Gabon	2.7	2.0	2.0	<b>2.0</b>	<b>0.3</b>	0.1%	27.4
Libya	29.5	43.7	48.4	<b>48.4</b>	<b>6.3</b>	2.9%	153.3
Nigeria	20.8	37.2	37.5	<b>37.5</b>	<b>5.1</b>	2.2%	51.6
South Sudan	n/a	n/a	3.5	<b>3.5</b>	<b>0.5</b>	0.2%	88.3
Sudan	0.3	5.0	1.5	<b>1.5</b>	<b>0.2</b>	0.1%	47.8
Tunisia	0.3	0.6	0.4	<b>0.4</b>	<b>0.1</b>	♦	22.1
Other Africa	0.7	0.7	4.0	<b>4.0</b>	<b>0.5</b>	0.2%	35.6
<b>Total Africa</b>	<b>75.3</b>	<b>119.7</b>	<b>126.5</b>	<b>126.5</b>	<b>16.7</b>	<b>7.5%</b>	<b>42.9</b>
Australia	4.0	3.4	4.0	<b>4.0</b>	<b>0.4</b>	0.2%	31.6
Brunei	1.1	1.1	1.1	<b>1.1</b>	<b>0.1</b>	0.1%	26.6
China	17.0	20.8	25.7	<b>25.7</b>	<b>3.5</b>	1.5%	18.3
India	5.6	5.5	4.7	<b>4.5</b>	<b>0.6</b>	0.3%	14.4
Indonesia	4.9	4.0	3.3	<b>3.2</b>	<b>0.4</b>	0.2%	9.2
Malaysia	5.0	5.5	3.6	<b>3.6</b>	<b>0.5</b>	0.2%	14.1
Thailand	0.3	0.5	0.3	<b>0.3</b>	<b>†</b>	♦	2.1
Vietnam	1.2	3.4	4.4	<b>4.4</b>	<b>0.6</b>	0.3%	36.0
Other Asia Pacific	1.2	1.3	1.2	<b>1.2</b>	<b>0.2</b>	0.1%	12.6
<b>Total Asia Pacific</b>	<b>40.3</b>	<b>45.3</b>	<b>48.3</b>	<b>48.0</b>	<b>6.4</b>	<b>2.8%</b>	<b>16.7</b>
<b>Total World</b>	<b>1162.1</b>	<b>1427.1</b>	<b>1697.1</b>	<b>1696.6</b>	<b>239.3</b>	<b>100.0%</b>	<b>50.2</b>
of which: OECD	151.4	239.3	244.0	<b>242.6</b>	<b>36.3</b>	14.3%	27.8
Non-OECD	1010.6	1187.8	1453.1	<b>1454.0</b>	<b>203.0</b>	85.7%	57.9
OPEC	820.7	956.1	1217.4	<b>1218.8</b>	<b>171.0</b>	71.8%	84.7
Non-OPEC	341.4	471.0	479.6	<b>477.8</b>	<b>68.3</b>	28.2%	24.6
European Union	8.7	6.4	4.8	<b>4.8</b>	<b>0.6</b>	0.3%	9.0
Canadian oil sands: Total	42.0	172.6	164.4	<b>163.4</b>	<b>26.6</b>	9.6%	
of which: Under active development	3.9	22.0	23.1	<b>22.1</b>	<b>3.6</b>	1.3%	
Venezuela: Orinoco Belt	–	20.0	223.0	<b>224.0</b>	<b>35.9</b>	13.2%	

† Less than 0.05.

♦ Less than 0.05%.

n/a not available.

**Notes: Total proved reserves of oil** – Generally taken to be those quantities that geological and engineering information indicates with reasonable certainty can be recovered in the future from known reservoirs under existing economic and operating conditions. The data series for total proved oil reserves does not necessarily meet the definitions, guidelines and practices used for determining proved reserves at company level, for instance as published by the US Securities and Exchange Commission, nor does it necessarily represent BP's view of proved reserves by country.

**Reserves-to-production (R/P) ratio** – If the reserves remaining at the end of any year are divided by the production in that year, the result is the length of time that those remaining reserves would last if production were to continue at that rate.

**Source of data** – The estimates in this table have been compiled using a combination of primary official sources, third-party data from the OPEC Secretariat, World Oil, Oil & Gas Journal and independent estimates of Russian reserves based on official data and Chinese reserves based on official data and information in the public domain.

Canadian oil sands 'under active development' are an official estimate. Venezuelan Orinoco Belt reserves are based on the OPEC Secretariat and government announcements.

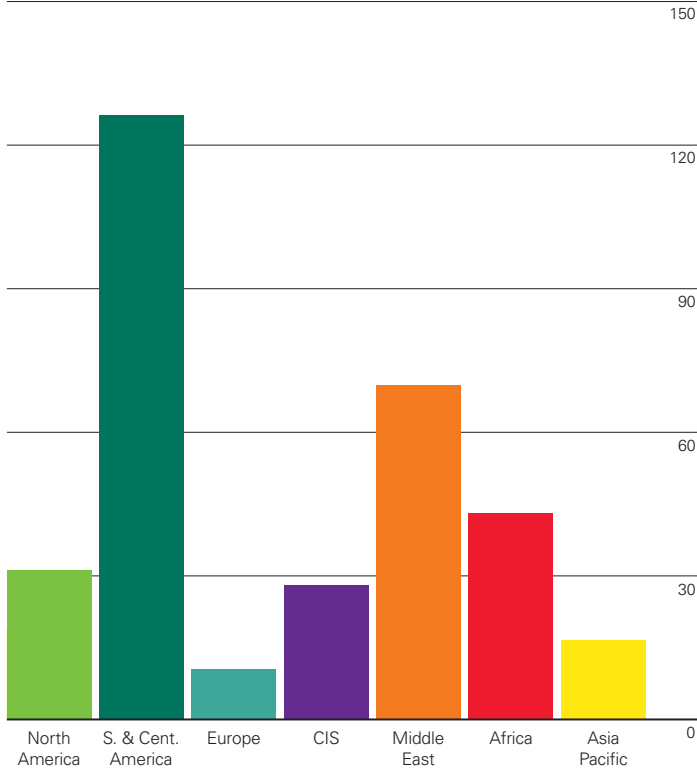
**Reserves include gas condensate and natural gas liquids (NGLs) as well as crude oil.**

**Shares of total and R/P ratios are calculated using thousand million barrels figures.**

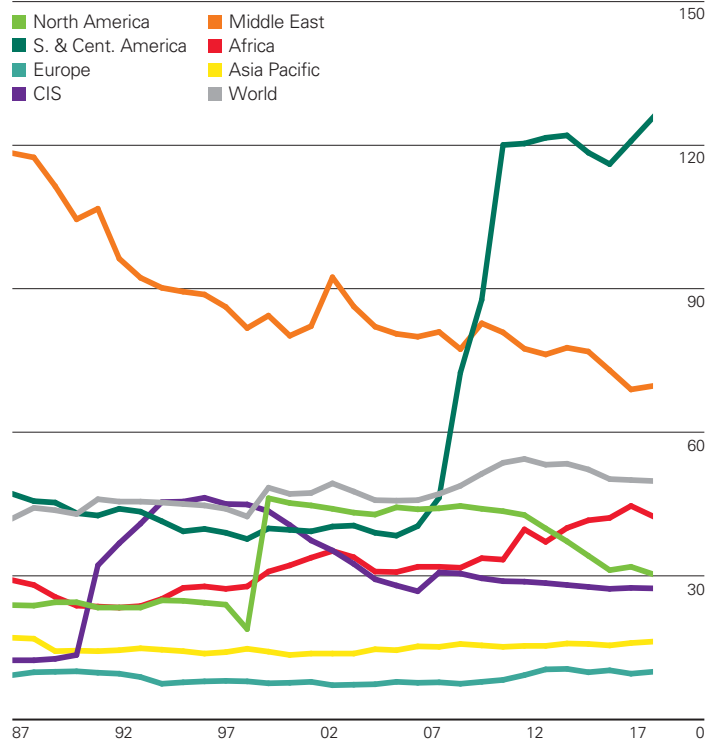
## Reserves-to-production (R/P) ratios

Years

### 2017 by region



### History



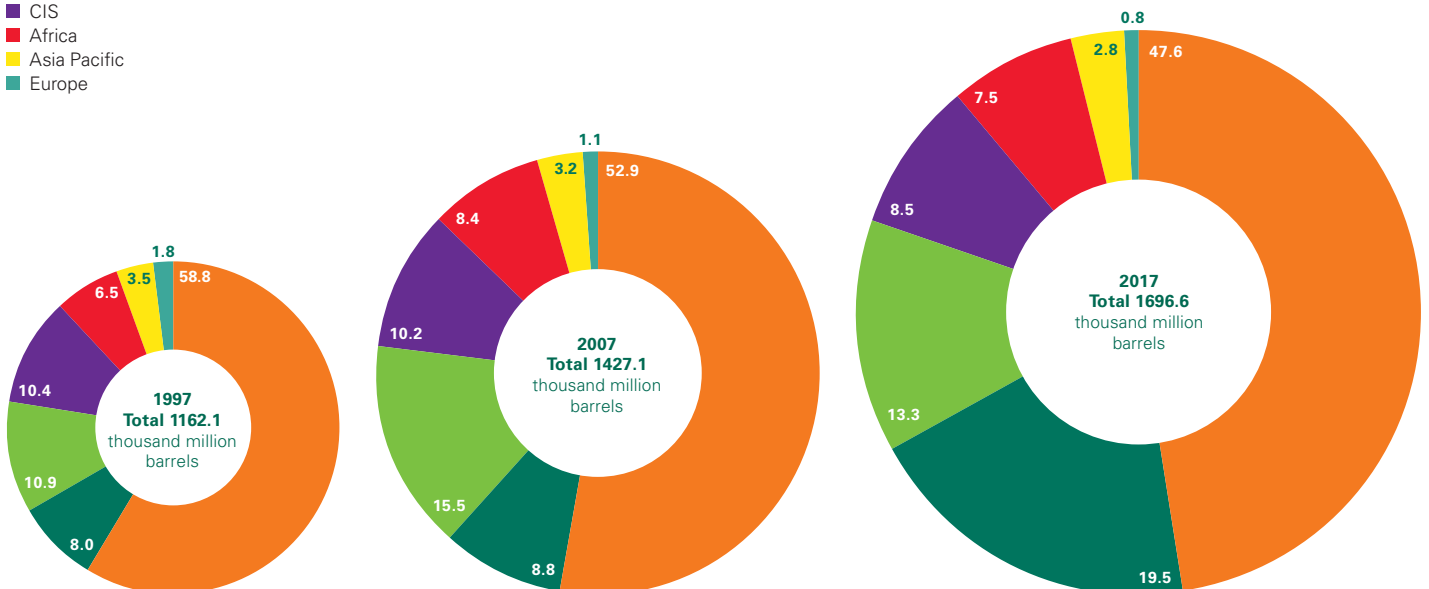
Global proved oil reserves in 2017 fell slightly by 0.5 billion barrels (-0.03%) to 1696.6 billion barrels, which would be sufficient to meet 50.2 years of global production at 2017 levels. Higher reserves in Venezuela (up by 1.4 billion barrels) were outweighed by declines in Canada (-1.6 billion barrels) and smaller declines in a number of other non-OPEC countries. OPEC countries currently hold 71.8% of global proved reserves.

Note: Lags in reporting official data mean that 2017 figures for many countries are not yet available.

## Distribution of proved reserves in 1997, 2007 and 2017

Percentage

- Middle East
- S. & Cent. America
- North America
- CIS
- Africa
- Asia Pacific
- Europe







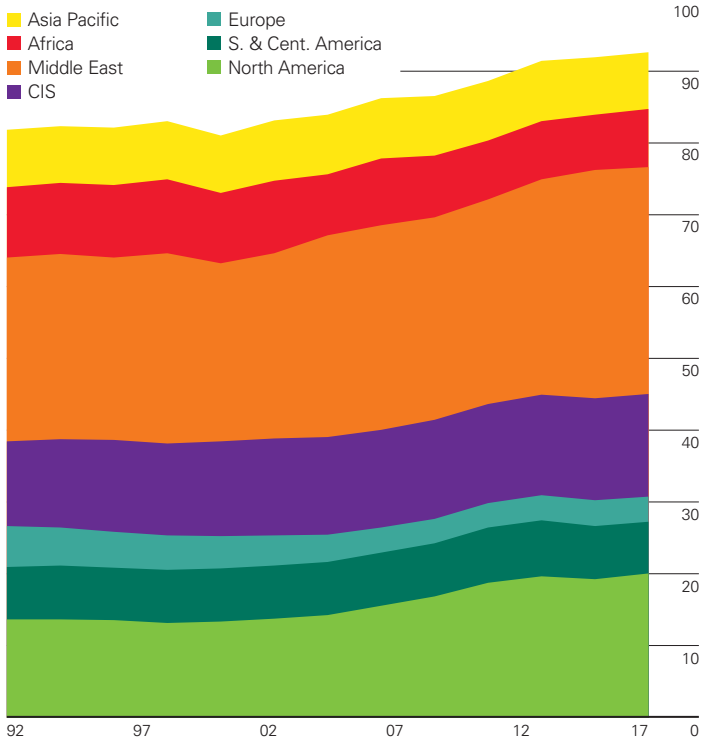






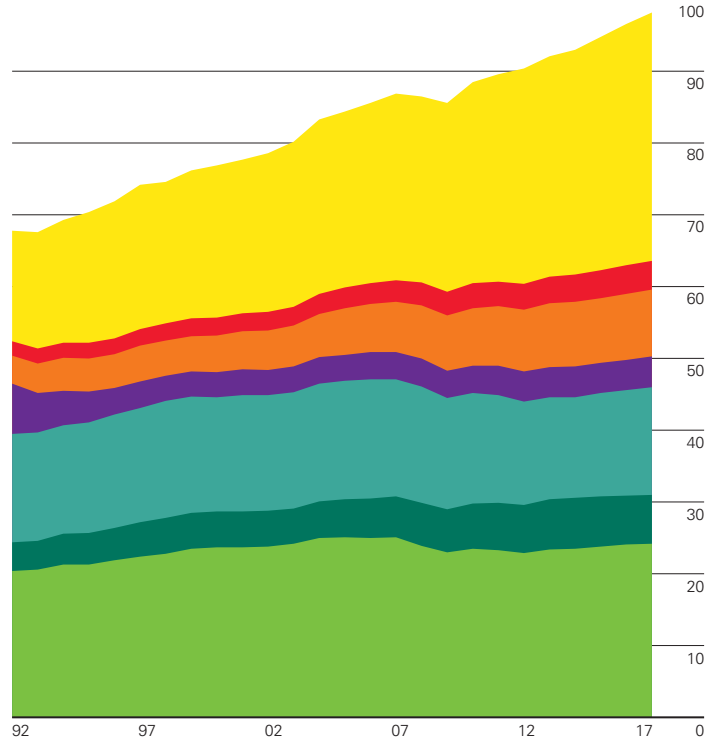
## Oil: Production by region

Million barrels daily



## Oil: Consumption by region

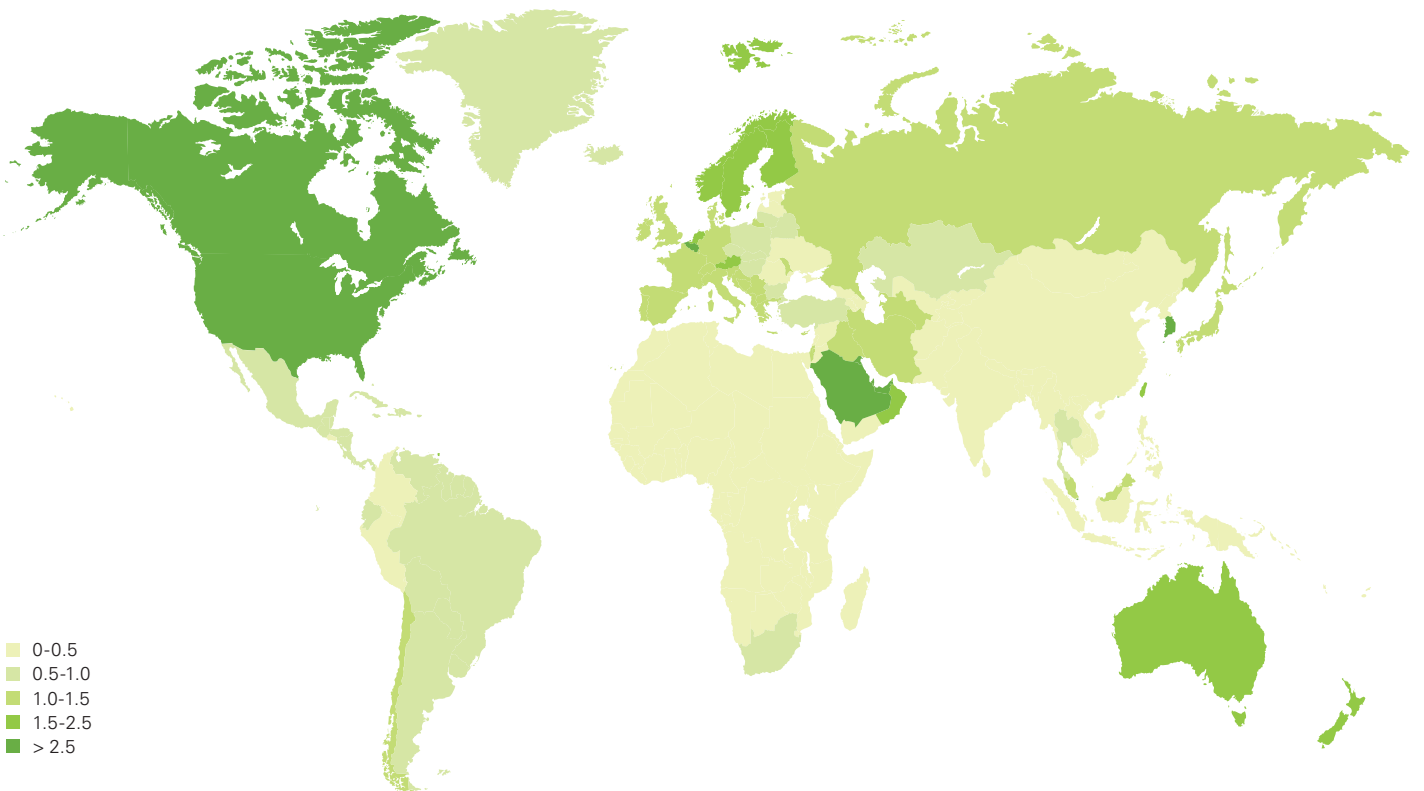
Million barrels daily



World oil production rose by only 0.6 million b/d in 2017, below average for the second consecutive year. Production fell in the Middle East (-250,000 b/d) and South & Central America (-240,000 Kb/d) but this was outweighed by growth from North America (820,000 b/d) and Africa (390,000 b/d). Global oil consumption growth averaged 1.7 million b/d, above its 10-year average of 1.1 million b/d for the third consecutive year. China (500,000 b/d) and the US (190,000 b/d) were the single largest contributors to growth.

## Oil: Consumption per capita 2017

Tonnes





## Spot crude prices

US dollars per barrel	Dubai \$/bbl*	Brent \$/bbl†	Nigerian Forcados \$/bbl	West Texas Intermediate \$/bbl‡
1982	31.80	32.97	33.29	33.65
1983	28.78	29.55	29.54	30.30
1984	28.06	28.78	28.14	29.39
1985	27.53	27.56	27.75	27.98
1986	13.10	14.43	14.46	15.10
1987	16.95	18.44	18.39	19.18
1988	13.27	14.92	15.00	15.97
1989	15.62	18.23	18.30	19.68
1990	20.45	23.73	23.85	24.50
1991	16.63	20.00	20.11	21.54
1992	17.17	19.32	19.61	20.57
1993	14.93	16.97	17.41	18.45
1994	14.74	15.82	16.25	17.21
1995	16.10	17.02	17.26	18.42
1996	18.52	20.67	21.16	22.16
1997	18.23	19.09	19.33	20.61
1998	12.21	12.72	12.62	14.39
1999	17.25	17.97	18.00	19.31
2000	26.20	28.50	28.42	30.37
2001	22.81	24.44	24.23	25.93
2002	23.74	25.02	25.04	26.16
2003	26.78	28.83	28.66	31.07
2004	33.64	38.27	38.13	41.49
2005	49.35	54.52	55.69	56.59
2006	61.50	65.14	67.07	66.02
2007	68.19	72.39	74.48	72.20
2008	94.34	97.26	101.43	100.06
2009	61.39	61.67	63.35	61.92
2010	78.06	79.50	81.05	79.45
2011	106.18	111.26	113.65	95.04
2012	109.08	111.67	114.21	94.13
2013	105.47	108.66	111.95	97.99
2014	97.07	98.95	101.35	93.28
2015	51.20	52.39	54.41	48.71
2016	41.19	43.73	44.54	43.34
2017	53.13	54.19	54.31	50.79

\*1982-1985 Arabian Light, 1986-2017 Dubai dated.

†1982-1983 Forties, 1984-2017 Brent dated.

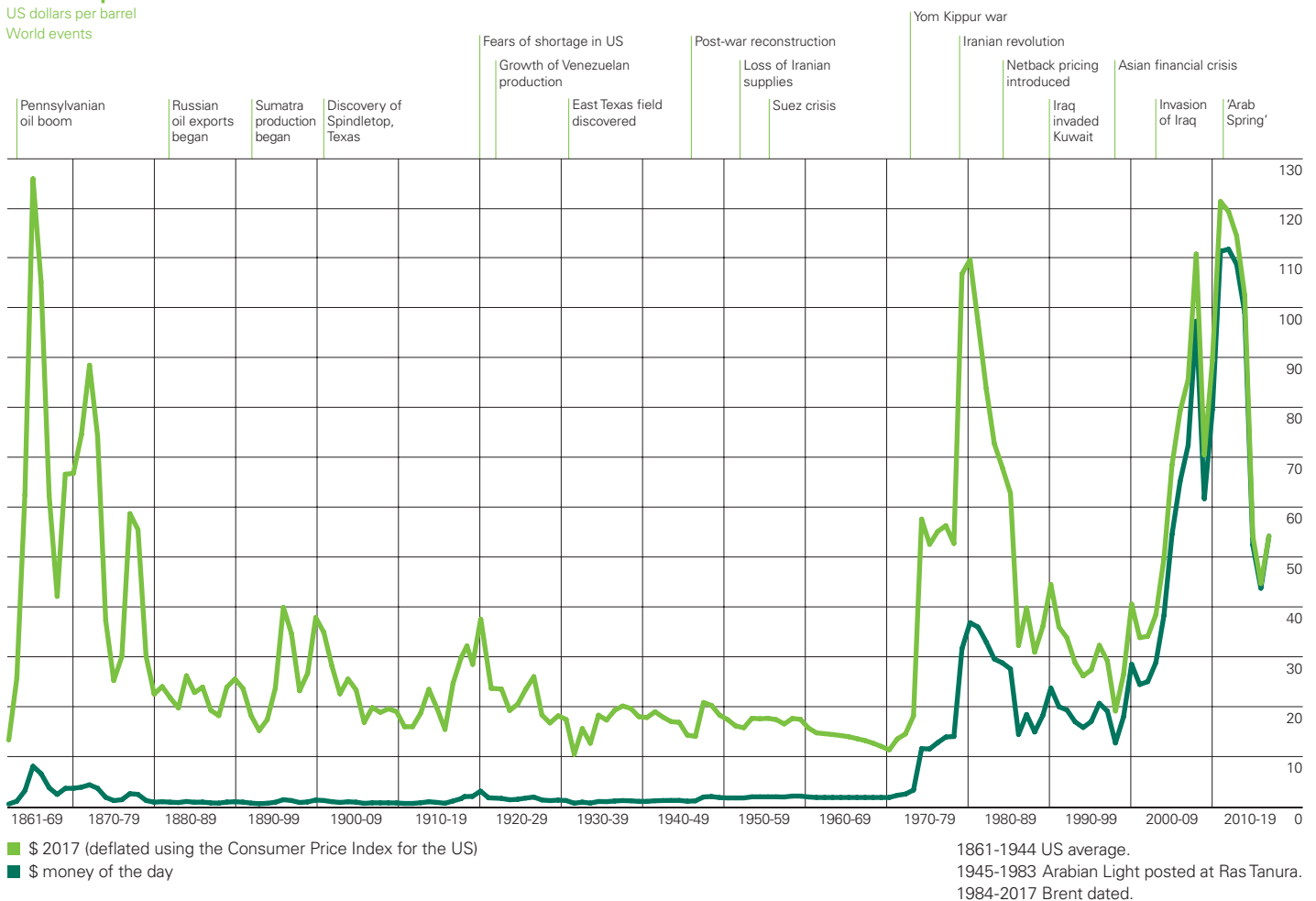
‡1982-1983 Posted WTI prices, 1984-2017 Spot WTI (Cushing) prices.

Source: S&P Global Platts, © 2018, S&P Global Inc.

## Crude oil prices 1861-2017

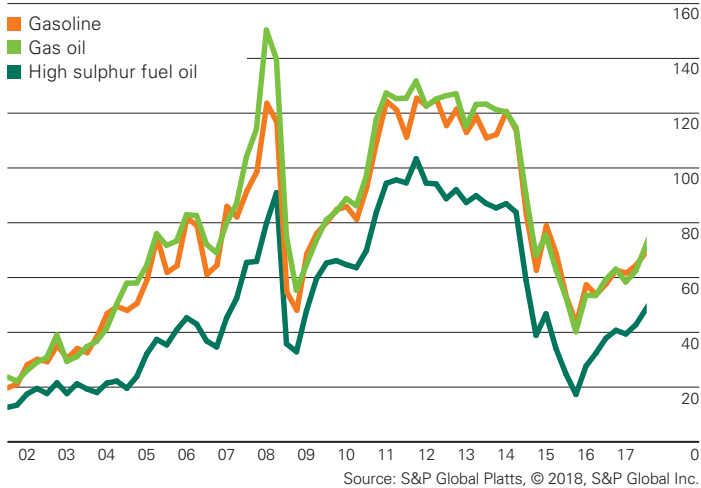
US dollars per barrel

World events



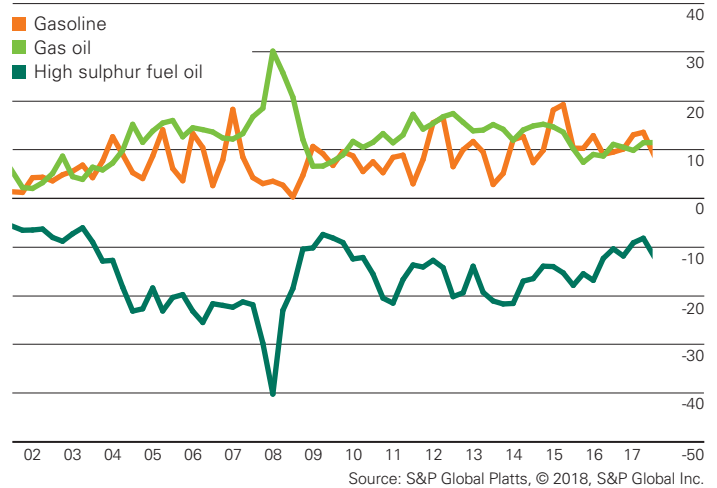
## Oil product prices (Rotterdam)

US dollars per barrel



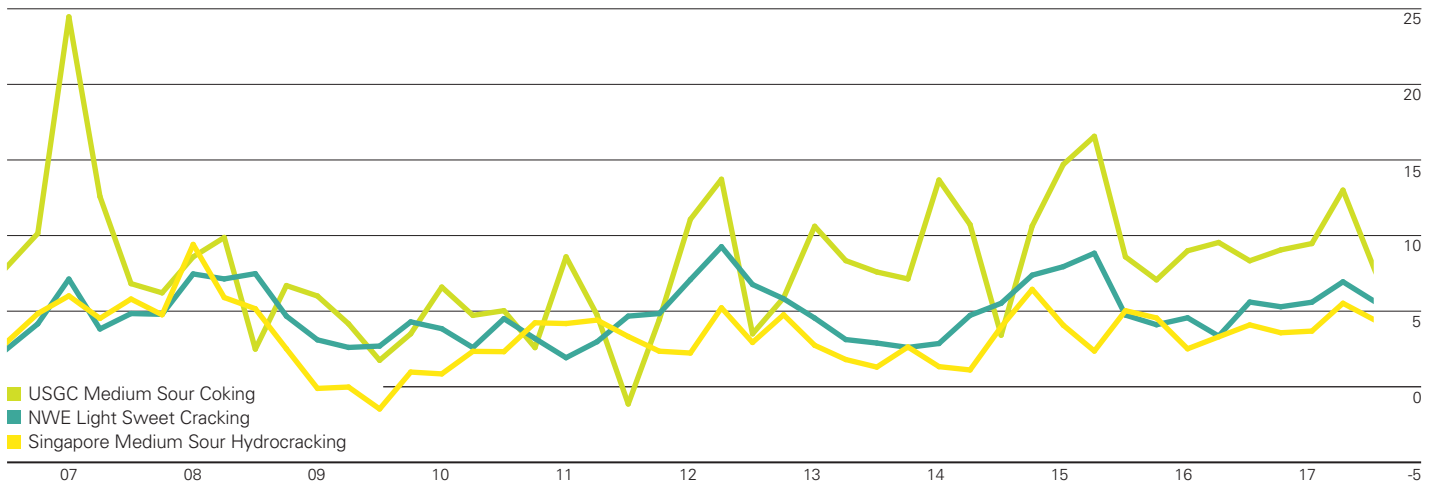
## Product differentials to crude (Rotterdam products minus Dated Brent)

US dollars per barrel



## Regional refining margins

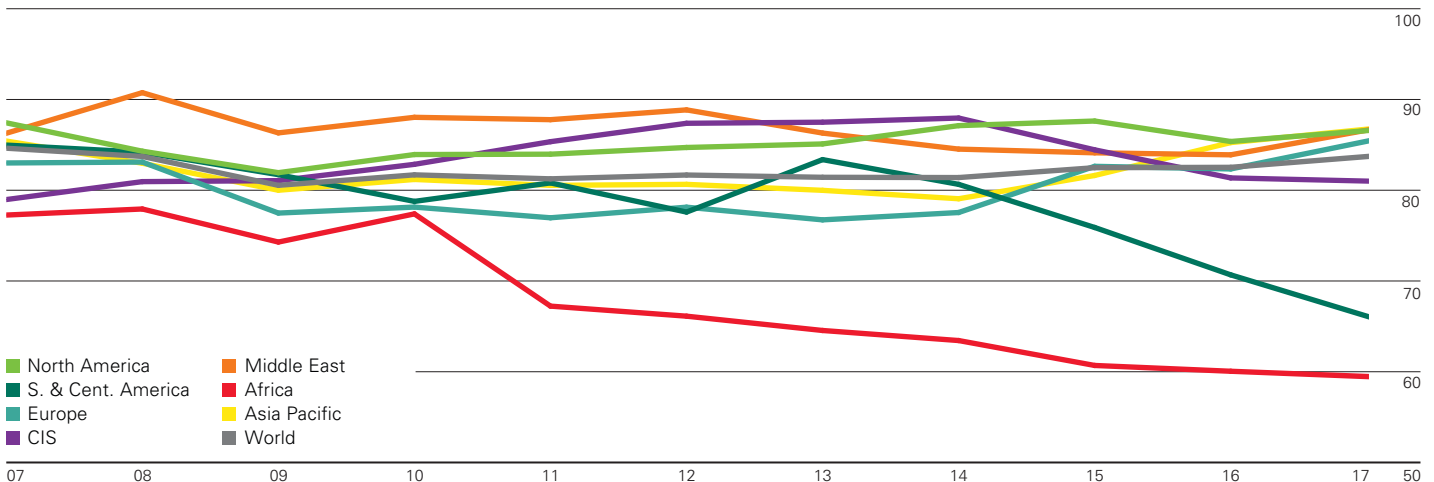
US dollars per barrel



**Note:** The refining margins presented are benchmark margins for three major global refining centres: US Gulf Coast (USGC), North West Europe (NWE – Rotterdam) and Singapore. In each case they are based on a single crude oil appropriate for that region and have optimized product yields based on a generic refinery configuration (cracking, hydrocracking or coking), again appropriate for that region. The margins are on a semi-variable basis, i.e. the margin after all variable costs and fixed energy costs.

## Refinery utilization

Percentage (based on average annual capacity)



Refinery throughput growth averaged 1.6 million b/d, up from only 0.5 million b/d in 2016. Growth was driven by China (570,000 b/d), the US (410,000 b/d) and Europe (370,000 b/d) which outweighed a decline of 280,000 b/d in South & Central America. Global refining capacity growth was 0.6 million b/d, below average for the third consecutive year, with China and India the main contributors to growth. As a result, refinery utilization rose from 82.5% to 83.7% – the highest in nine years. Utilization in South & Central America fell to 66.1% – the lowest since 1985.



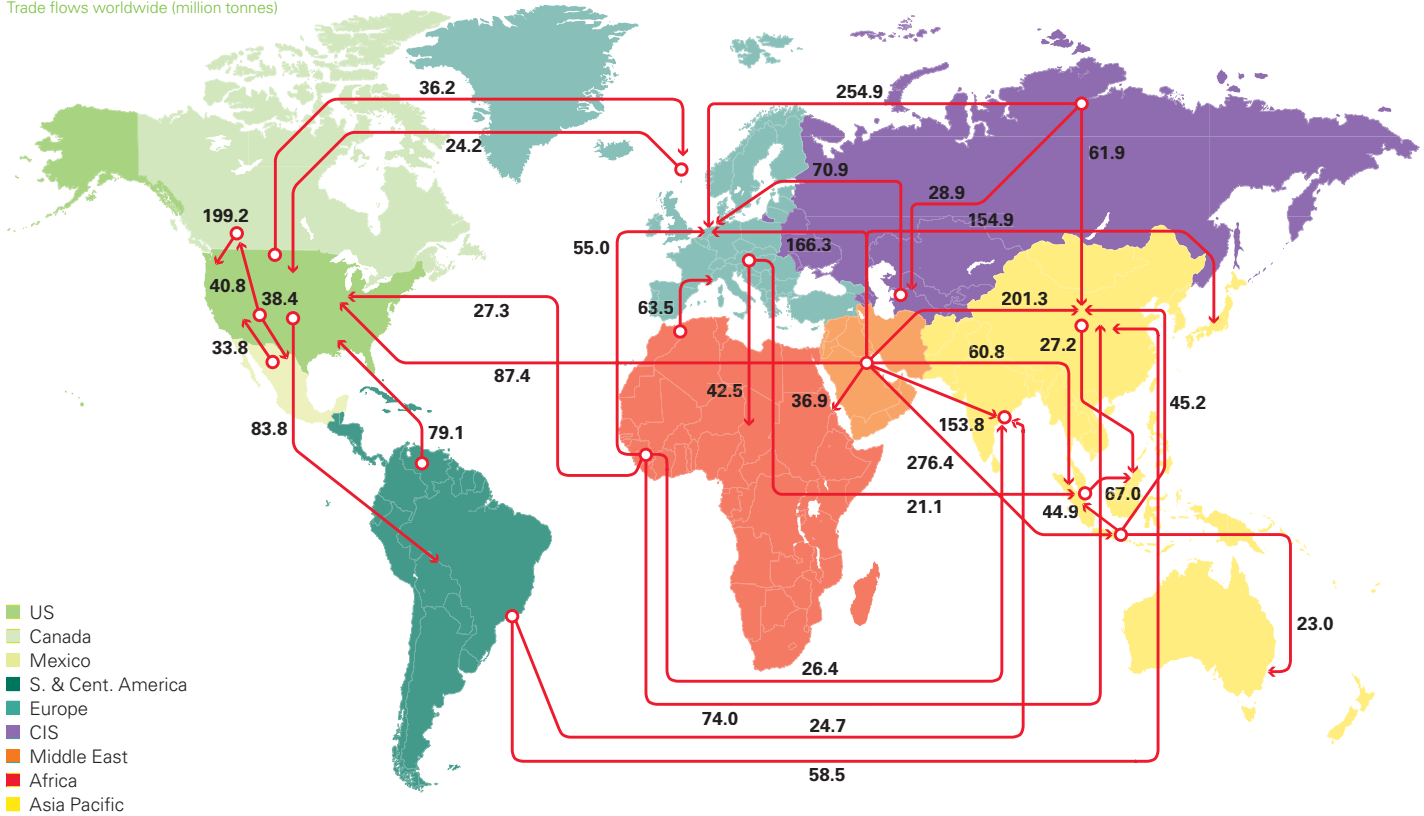






## Major trade movements 2017

Trade flows worldwide (million tonnes)



## Oil trade in 2016 and 2017

Million tonnes	2016				2017			
	Crude imports	Product imports	Crude exports	Product exports	Crude imports	Product imports	Crude exports	Product exports
US	392.0	105.8	27.6	207.2	394.1	103.5	45.8	221.0
Canada	31.2	32.1	163.0	29.9	29.7	31.2	173.3	34.5
Mexico	†	38.0	59.6	8.8	†	43.9	57.3	6.2
S. & Cent. America	24.8	90.9	176.2	29.5	23.1	102.9	168.8	28.8
Europe	489.7	192.3	18.2	124.8	516.0	176.9	23.6	134.2
Russia	0.2	1.4	272.2	139.2	0.6	1.2	277.2	145.6
Other CIS	18.2	10.6	82.7	9.1	18.3	13.7	90.0	8.0
Iraq	†	1.7	179.0	1.4	†	1.3	189.0	5.1
Kuwait	†	0.7	103.2	25.6	†	0.7	101.6	23.5
Saudi Arabia	†	4.4	375.5	47.7	†	5.9	357.5	50.7
United Arab Emirates	1.1	12.5	124.4	60.6	1.3	21.8	125.7	65.8
Other Middle East	26.5	17.4	202.1	44.9	27.2	18.7	215.4	48.9
North Africa	4.3	38.1	58.5	25.2	5.2	34.3	81.2	25.1
West Africa	0.6	26.1	212.2	7.0	0.3	31.6	214.2	8.1
East & S. Africa	21.2	27.1	7.0	2.5	17.2	31.0	7.4	2.2
Australasia	20.7	29.2	10.6	4.0	21.5	31.2	9.9	2.6
China	382.6	74.4	2.7	45.9	422.1	84.4	4.7	48.0
India	214.0	30.0	†	49.2	211.1	33.9	†	56.2
Japan	168.0	39.1	†	14.4	162.5	42.1	0.1	15.9
Singapore	48.1	121.7	0.7	94.5	53.7	128.5	1.7	95.9
Other Asia Pacific	272.6	181.7	41.0	103.6	280.2	196.6	39.9	108.9
<b>Total World</b>	<b>2116.2</b>	<b>1075.2</b>	<b>2116.2</b>	<b>1075.2</b>	<b>2184.2</b>	<b>1135.1</b>	<b>2184.2</b>	<b>1135.1</b>
Thousand barrels daily								
US	7851	2205	553	4320	7914	2163	919	4621
Canada	626	670	3264	623	596	653	3481	720
Mexico	1	793	1193	183	†	917	1150	129
S. & Cent. America	498	1894	3528	616	465	2151	3391	603
Europe	9807	4010	364	2602	10363	3697	474	2806
Russia	3	30	5451	2903	13	25	5567	3044
Other CIS	365	222	1657	190	368	285	1807	167
Iraq	†	36	3585	28	†	28	3796	107
Kuwait	†	15	2066	534	†	15	2040	492
Saudi Arabia	†	91	7520	995	†	124	7178	1060
United Arab Emirates	22	260	2491	1263	27	456	2524	1374
Other Middle East	532	362	4048	935	547	390	4325	1022
North Africa	87	795	1171	526	103	717	1631	524
West Africa	12	543	4250	146	7	660	4302	168
East & S. Africa	424	564	140	53	345	648	148	47
Australasia	415	609	213	83	432	653	199	55
China	7663	1551	54	957	8477	1764	94	1003
India	4286	625	†	1026	4239	708	1	1174
Japan	3365	815	†	301	3263	879	2	331
Singapore	963	2538	13	1971	1078	2685	34	2004
Other Asia Pacific	5460	3787	820	2161	5628	4109	801	2276
<b>Total World</b>	<b>42381</b>	<b>22414</b>	<b>42381</b>	<b>22414</b>	<b>43864</b>	<b>23728</b>	<b>43864</b>	<b>23728</b>

†Less than 0.05.

‡Less than 0.5.

**Notes:** Bunkers are not included as exports. Intra-area movements (for example, between countries in Europe) are excluded. Crude imports and exports include condensates.

**Total proved reserves**

	At end 1997 Trillion cubic metres	At end 2007 Trillion cubic metres	At end 2016 Trillion cubic metres	At end 2017			
				Trillion cubic metres	Trillion cubic feet	Share of total	R/P ratio
US	4.5	6.4	8.7	<b>8.7</b>	<b>308.5</b>	4.5%	11.9
Canada	1.7	1.6	2.0	<b>1.9</b>	<b>66.5</b>	1.0%	10.7
Mexico	1.8	0.4	0.2	<b>0.2</b>	<b>6.9</b>	0.1%	4.8
<b>Total North America</b>	<b>8.0</b>	<b>8.4</b>	<b>10.9</b>	<b>10.8</b>	<b>381.9</b>	<b>5.6%</b>	<b>11.4</b>
Argentina	0.7	0.4	0.3	<b>0.3</b>	<b>11.6</b>	0.2%	8.8
Bolivia	0.1	0.7	0.3	<b>0.3</b>	<b>9.6</b>	0.1%	15.8
Brazil	0.2	0.4	0.4	<b>0.4</b>	<b>13.5</b>	0.2%	13.8
Colombia	0.2	0.1	0.1	<b>0.1</b>	<b>3.9</b>	0.1%	10.8
Peru	0.2	0.3	0.4	<b>0.4</b>	<b>15.5</b>	0.2%	33.7
Trinidad & Tobago	0.5	0.5	0.3	<b>0.3</b>	<b>9.2</b>	0.1%	7.7
Venezuela	4.6	5.4	6.4	<b>6.4</b>	<b>225.0</b>	3.3%	170.2
Other S. & Cent. America	0.1	0.1	0.1	<b>0.1</b>	<b>2.2</b>	♦	21.6
<b>Total S. &amp; Cent. America</b>	<b>6.6</b>	<b>7.8</b>	<b>8.3</b>	<b>8.2</b>	<b>290.3</b>	<b>4.2%</b>	<b>45.9</b>
Denmark	0.1	0.1	†	†	<b>0.5</b>	♦	2.7
Germany	0.2	0.1	†	†	<b>1.1</b>	♦	5.1
Italy	0.3	0.1	†	†	<b>1.5</b>	♦	8.1
Netherlands	1.7	1.2	0.7	<b>0.7</b>	<b>23.1</b>	0.3%	17.9
Norway	1.2	2.3	1.8	<b>1.7</b>	<b>60.6</b>	0.9%	13.9
Poland	0.1	0.1	0.1	<b>0.1</b>	<b>2.4</b>	♦	16.6
Romania	0.3	0.6	0.1	<b>0.1</b>	<b>3.6</b>	0.1%	9.9
United Kingdom	0.8	0.3	0.2	<b>0.2</b>	<b>6.5</b>	0.1%	4.4
Other Europe	0.2	0.2	0.1	<b>0.1</b>	<b>5.1</b>	0.1%	16.0
<b>Total Europe</b>	<b>4.9</b>	<b>5.0</b>	<b>3.0</b>	<b>3.0</b>	<b>104.5</b>	<b>1.5%</b>	<b>12.2</b>
Azerbaijan	0.7	1.0	1.3	<b>1.3</b>	<b>46.6</b>	0.7%	74.4
Kazakhstan	1.5	1.5	1.1	<b>1.1</b>	<b>40.4</b>	0.6%	42.2
Russian Federation	33.6	33.9	34.8	<b>35.0</b>	<b>1234.9</b>	18.1%	55.0
Turkmenistan	2.6	2.6	19.5	<b>19.5</b>	<b>688.1</b>	10.1%	314.1
Ukraine	0.7	0.8	1.1	<b>1.1</b>	<b>37.1</b>	0.5%	54.0
Uzbekistan	1.2	1.3	1.2	<b>1.2</b>	<b>42.7</b>	0.6%	22.7
Other CIS	†	†	†	†	<b>1.2</b>	♦	160.0
<b>Total CIS</b>	<b>40.3</b>	<b>41.2</b>	<b>59.0</b>	<b>59.2</b>	<b>2091.1</b>	<b>30.6%</b>	<b>72.6</b>
Bahrain	0.1	0.1	0.2	<b>0.2</b>	<b>5.5</b>	0.1%	10.3
Iran	22.7	27.7	33.2	<b>33.2</b>	<b>1173.0</b>	17.2%	148.4
Iraq	3.0	3.0	3.5	<b>3.5</b>	<b>123.9</b>	1.8%	337.7
Israel	†	†	0.2	<b>0.5</b>	<b>16.1</b>	0.2%	48.3
Kuwait	1.4	1.7	1.7	<b>1.7</b>	<b>59.9</b>	0.9%	97.6
Oman	0.5	0.9	0.7	<b>0.7</b>	<b>23.5</b>	0.3%	20.6
Qatar	8.8	26.4	24.9	<b>24.9</b>	<b>879.9</b>	12.9%	141.8
Saudi Arabia	5.6	6.9	8.0	<b>8.0</b>	<b>283.8</b>	4.2%	72.1
Syria	0.2	0.3	0.3	<b>0.3</b>	<b>9.5</b>	0.1%	86.5
United Arab Emirates	5.9	6.3	5.9	<b>5.9</b>	<b>209.7</b>	3.1%	98.2
Yemen	0.3	0.3	0.3	<b>0.3</b>	<b>9.4</b>	0.1%	410.6
Other Middle East	†	†	†	†	<b>0.2</b>	♦	48.2
<b>Total Middle East</b>	<b>48.6</b>	<b>73.6</b>	<b>78.8</b>	<b>79.1</b>	<b>2794.2</b>	<b>40.9%</b>	<b>119.9</b>
Algeria	3.9	4.3	4.3	<b>4.3</b>	<b>153.1</b>	2.2%	47.5
Egypt	0.9	2.0	1.8	<b>1.8</b>	<b>62.8</b>	0.9%	36.3
Libya	1.2	1.5	1.4	<b>1.4</b>	<b>50.5</b>	0.7%	124.0
Nigeria	3.3	5.0	5.2	<b>5.2</b>	<b>183.7</b>	2.7%	110.2
Other Africa	0.8	1.2	1.1	<b>1.1</b>	<b>37.8</b>	0.6%	41.1
<b>Total Africa</b>	<b>10.2</b>	<b>14.0</b>	<b>13.8</b>	<b>13.8</b>	<b>487.8</b>	<b>7.1%</b>	<b>61.4</b>
Australia	1.2	1.8	3.6	<b>3.6</b>	<b>128.3</b>	1.9%	32.0
Bangladesh	0.3	0.4	0.2	<b>0.2</b>	<b>6.3</b>	0.1%	6.7
Brunei	0.4	0.3	0.3	<b>0.3</b>	<b>9.5</b>	0.1%	22.4
China	1.2	2.3	5.5	<b>5.5</b>	<b>193.5</b>	2.8%	36.7
India	0.7	1.0	1.2	<b>1.2</b>	<b>43.8</b>	0.6%	43.6
Indonesia	2.2	3.0	2.9	<b>2.9</b>	<b>102.9</b>	1.5%	42.9
Malaysia	2.2	2.4	2.7	<b>2.7</b>	<b>96.6</b>	1.4%	34.9
Myanmar	0.3	0.5	1.2	<b>1.2</b>	<b>41.3</b>	0.6%	65.0
Pakistan	0.4	0.7	0.4	<b>0.4</b>	<b>13.4</b>	0.2%	11.0
Papua New Guinea	†	†	0.2	<b>0.2</b>	<b>6.8</b>	0.1%	15.7
Thailand	0.2	0.3	0.2	<b>0.2</b>	<b>7.1</b>	0.1%	5.2
Vietnam	0.2	0.5	0.6	<b>0.6</b>	<b>22.8</b>	0.3%	68.3
Other Asia Pacific	0.4	0.3	0.3	<b>0.3</b>	<b>9.5</b>	0.1%	14.7
<b>Total Asia Pacific</b>	<b>9.4</b>	<b>13.6</b>	<b>19.2</b>	<b>19.3</b>	<b>681.8</b>	<b>10.0%</b>	<b>31.8</b>
<b>Total World</b>	<b>128.1</b>	<b>163.5</b>	<b>193.1</b>	<b>193.5</b>	<b>6831.7</b>	<b>100.0%</b>	<b>52.6</b>
of which: OECD	13.8	14.7	17.7	<b>17.8</b>	<b>628.9</b>	9.2%	13.6
Non-OECD	114.2	148.9	175.4	<b>175.6</b>	<b>6202.8</b>	90.8%	74.2
European Union	3.6	2.6	1.2	<b>1.2</b>	<b>41.7</b>	0.6%	10.0

†Less than 0.05.

♦Less than 0.05%.

**Notes: Total proved reserves of natural gas** – Generally taken to be those quantities that geological and engineering information indicates with reasonable certainty can be recovered in the future from known reservoirs under existing economic and operating conditions. The data series for total proved natural gas does not necessarily meet the definitions, guidelines and practices used for determining proved reserves at a company level, for instance as published by the US Securities and Exchange Commission, nor does it necessarily represent BP's view of proved reserves by country.

**Reserves-to-production (R/P) ratio** – If the reserves remaining at the end of any year are divided by the production in that year, the result is the length of time that those remaining reserves would last if production were to continue at that rate.

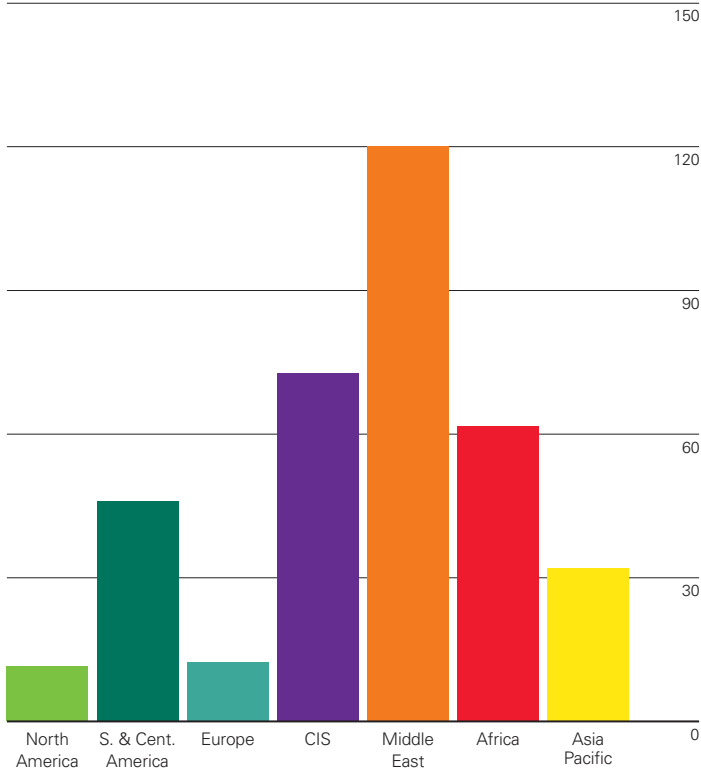
As far as possible, the data above represents standard cubic metres (measured at 15°C and 1013 mbar) and have been standardized using a gross calorific value (GCV) of 40 MJ/m<sup>3</sup>.

**Source of data** – The estimates in this table have been compiled using a combination of primary official sources and third-party data from Cedigaz and the OPEC Secretariat.

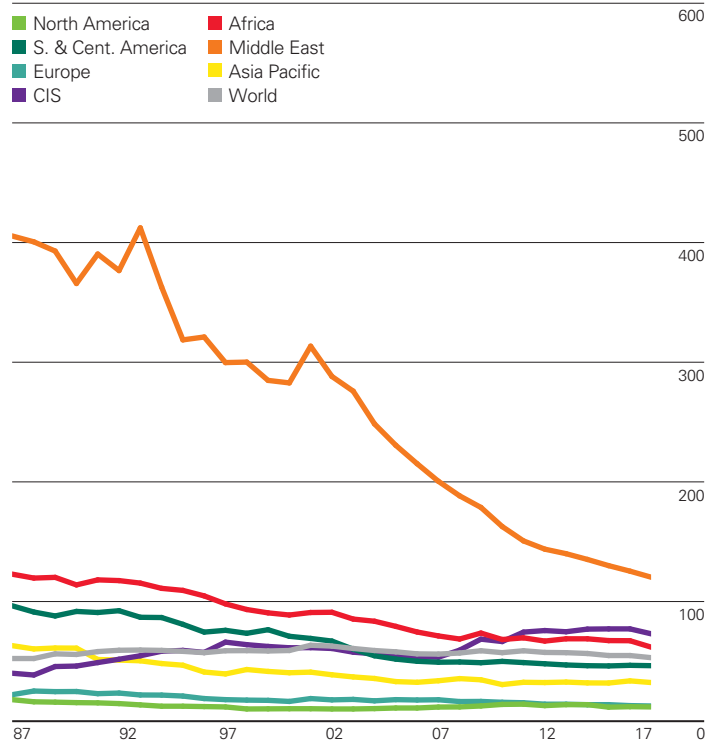
## Reserves-to-production (R/P) ratios

Years

### 2017 by region



### History

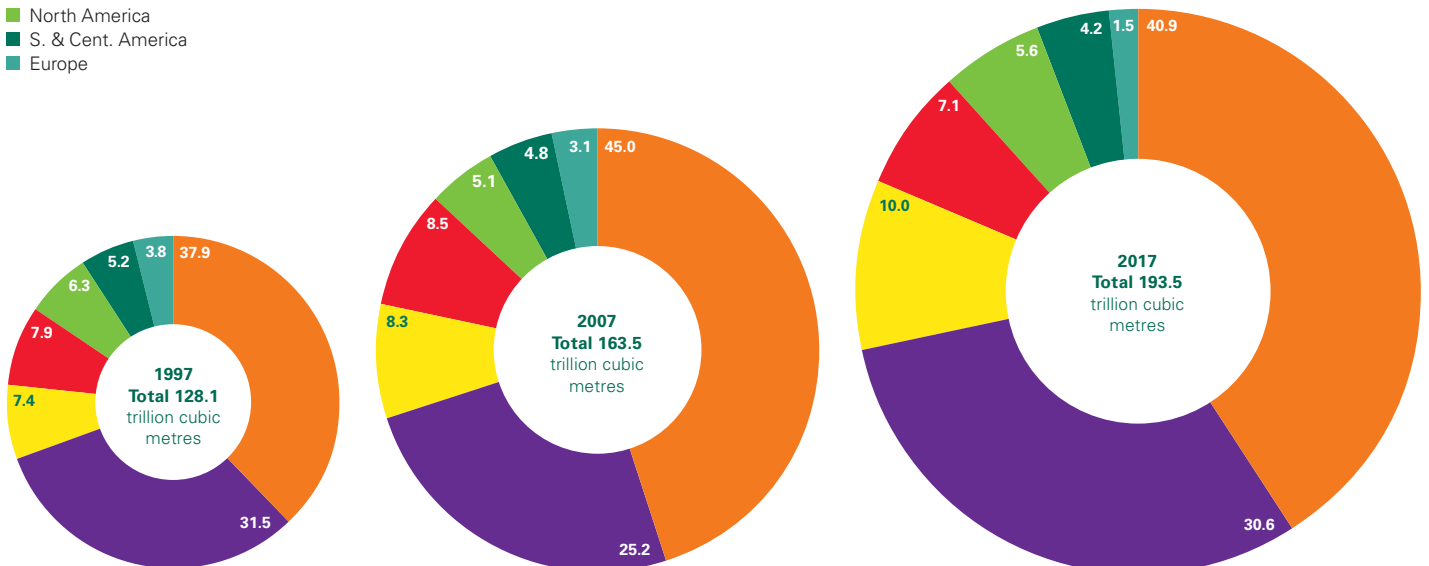


Global proved gas reserves in 2017 rose slightly by 0.4 trillion cubic metres (tcm) or 0.2% to 193.5 tcm. This is sufficient to meet 52.6 years of global production at 2017 levels. Israel was the largest single contributor to growth (0.3 tcm), while the CIS region also added 0.2 tcm to reserves. By region, the Middle East holds the largest proved reserves (79.1 tcm, 40.9% of the global total), followed by CIS (59.2 tcm, a 30.6% share). Note: Lags in reporting official data mean that 2017 figures for many countries are not yet available.

## Distribution of proved reserves in 1997, 2007 and 2017

Percentage

- Middle East
- CIS
- Asia Pacific
- Africa
- North America
- S. & Cent. America
- Europe







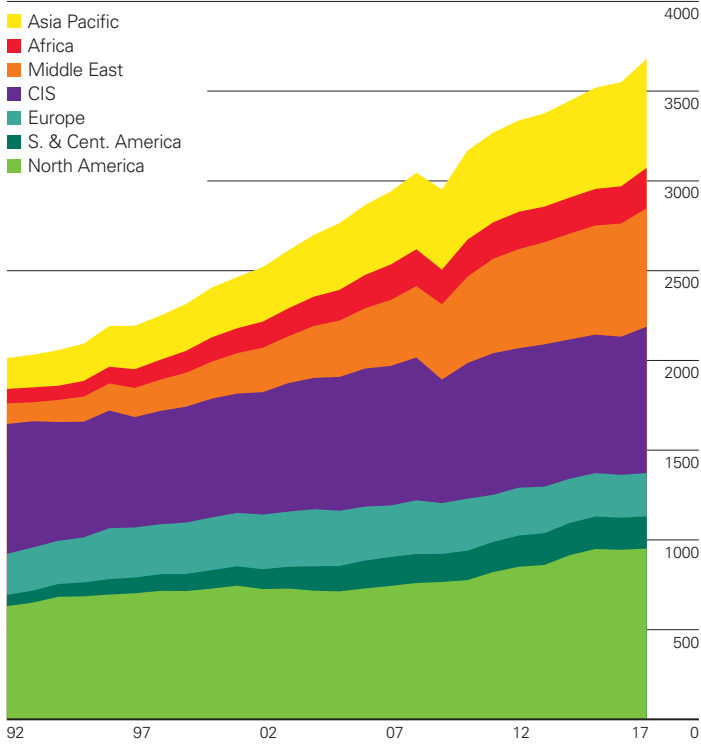






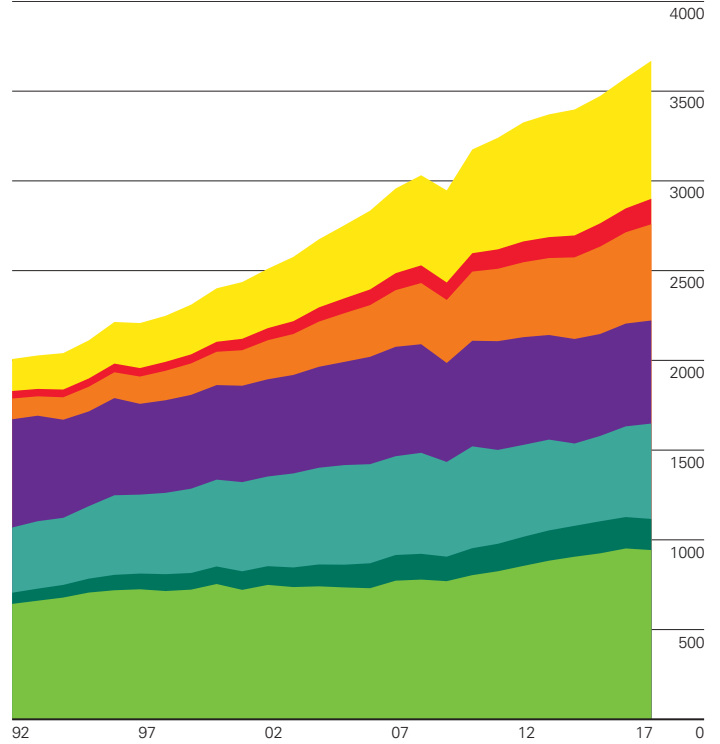
### Natural gas: Production by region

Billion cubic metres



### Natural gas: Consumption by region

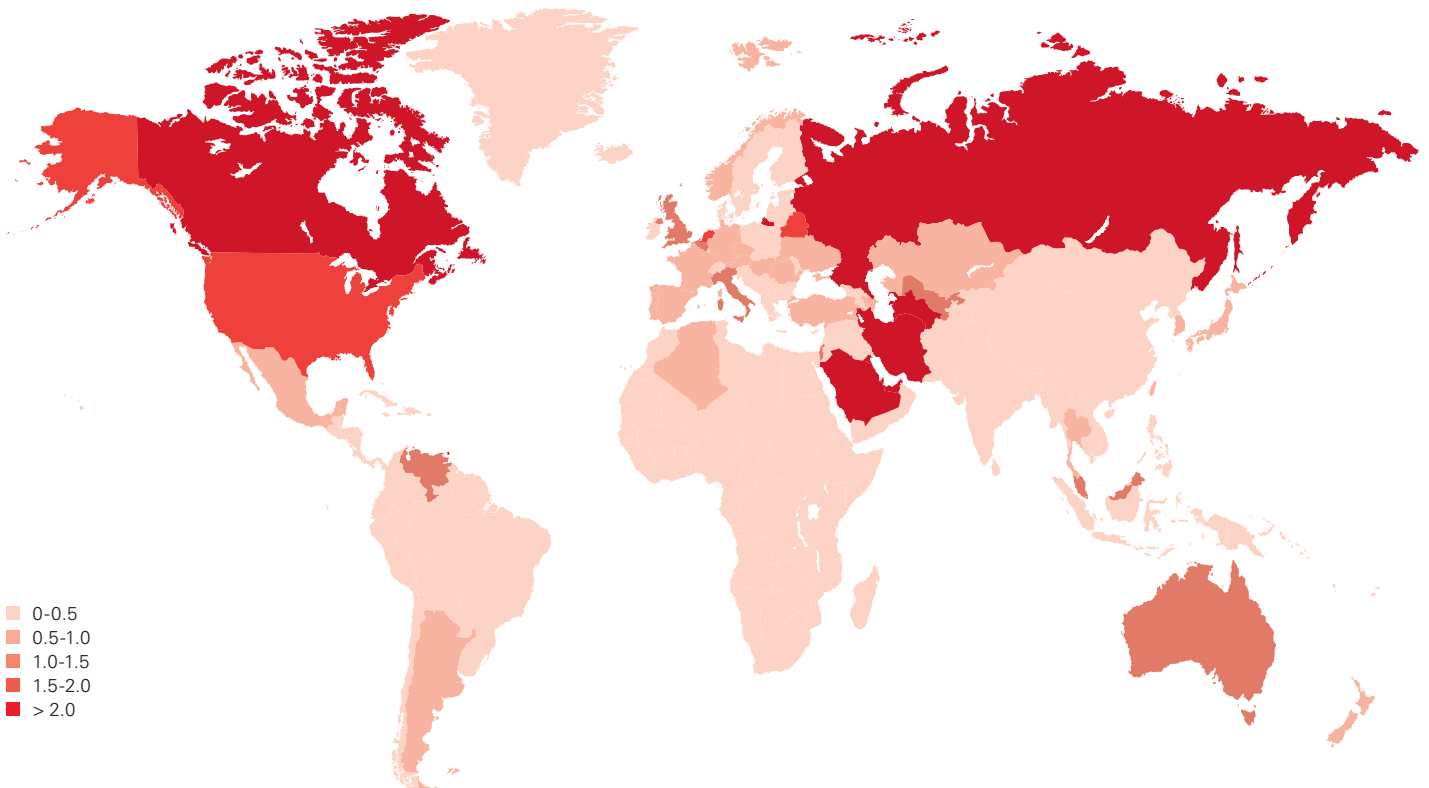
Billion cubic metres



Global natural gas production increased by 131 billion cubic metres (bcm), or 4%, almost double the 10-year average growth rate of 2.2%. Russian growth was the largest by far at 46 bcm, followed by Iran at 21 bcm, and Australia at 17 bcm. Gas consumption rose by 96 bcm, or 3% – the fastest growth since 2010. Growth was driven by China (31 bcm, or 15.1%), the Middle East (28 bcm) and Europe (26 bcm). Consumption in the US fell by 1.2%, or 11 bcm.

### Natural gas: Consumption per capita 2017

Million tonnes oil equivalent



- 0-0.5
- 0.5-1.0
- 1.0-1.5
- 1.5-2.0
- > 2.0

## Prices

US dollars per million Btu	LNG		Natural gas					Crude oil
	Japan CIF <sup>1</sup>	Japan Korea Marker (JKM) <sup>2</sup>	Average German Import Price <sup>3</sup>	UK (Heren NBP Index) <sup>4</sup>	Netherlands TTF (DA Heren Index) <sup>4</sup>	US Henry Hub <sup>5</sup>	Canada (Alberta) <sup>5</sup>	OECD countries CIF <sup>6</sup>
1987	3.35	-	2.55	-	-	-	-	3.09
1988	3.34	-	2.22	-	-	-	-	2.56
1989	3.28	-	2.00	-	-	1.70	-	3.01
1990	3.64	-	2.78	-	-	1.64	1.05	3.82
1991	3.99	-	3.23	-	-	1.49	0.89	3.33
1992	3.62	-	2.70	-	-	1.77	0.98	3.19
1993	3.52	-	2.51	-	-	2.12	1.69	2.82
1994	3.18	-	2.35	-	-	1.92	1.45	2.70
1995	3.46	-	2.43	-	-	1.69	0.89	2.96
1996	3.66	-	2.50	1.87	-	2.76	1.12	3.54
1997	3.91	-	2.66	1.96	-	2.53	1.36	3.29
1998	3.05	-	2.33	1.86	-	2.08	1.42	2.16
1999	3.14	-	1.86	1.58	-	2.27	2.00	2.98
2000	4.72	-	2.91	2.71	-	4.23	3.75	4.83
2001	4.64	-	3.67	3.17	-	4.07	3.61	4.08
2002	4.27	-	3.21	2.37	-	3.33	2.57	4.17
2003	4.77	-	4.06	3.33	-	5.63	4.83	4.89
2004	5.18	-	4.30	4.46	-	5.85	5.03	6.27
2005	6.05	-	5.83	7.38	6.07	8.79	7.25	8.74
2006	7.14	-	7.87	7.87	7.46	6.76	5.83	10.66
2007	7.73	-	7.99	6.01	5.93	6.95	6.17	11.95
2008	12.55	-	11.60	10.79	10.66	8.85	7.99	16.76
2009	9.06	5.28	8.53	4.85	4.96	3.89	3.38	10.41
2010	10.91	7.72	8.03	6.56	6.77	4.39	3.69	13.47
2011	14.73	14.02	10.49	9.04	9.26	4.01	3.47	18.55
2012	16.75	15.12	10.93	9.46	9.45	2.76	2.27	18.82
2013	16.17	16.56	10.73	10.64	9.75	3.71	2.93	18.25
2014	16.33	13.86	9.11	8.25	8.14	4.35	3.87	16.80
2015	10.31	7.45	6.72	6.53	6.44	2.60	2.01	8.77
2016	6.94	5.72	4.93	4.69	4.54	2.46	1.55	7.04
2017	8.10	7.13	5.62	5.80	5.72	2.96	1.60	8.97

<sup>1</sup>Source: EDMC Energy Trend.

<sup>2</sup>Source: S&P Global Platts ©2018, S&P Global Inc.

<sup>3</sup>Source: 1987-1990 German Federal Statistical Office, 1991-2017 German Federal Office of Economics and Export Control (BAFA).

<sup>4</sup>Source: ICIS Heren Energy Ltd.

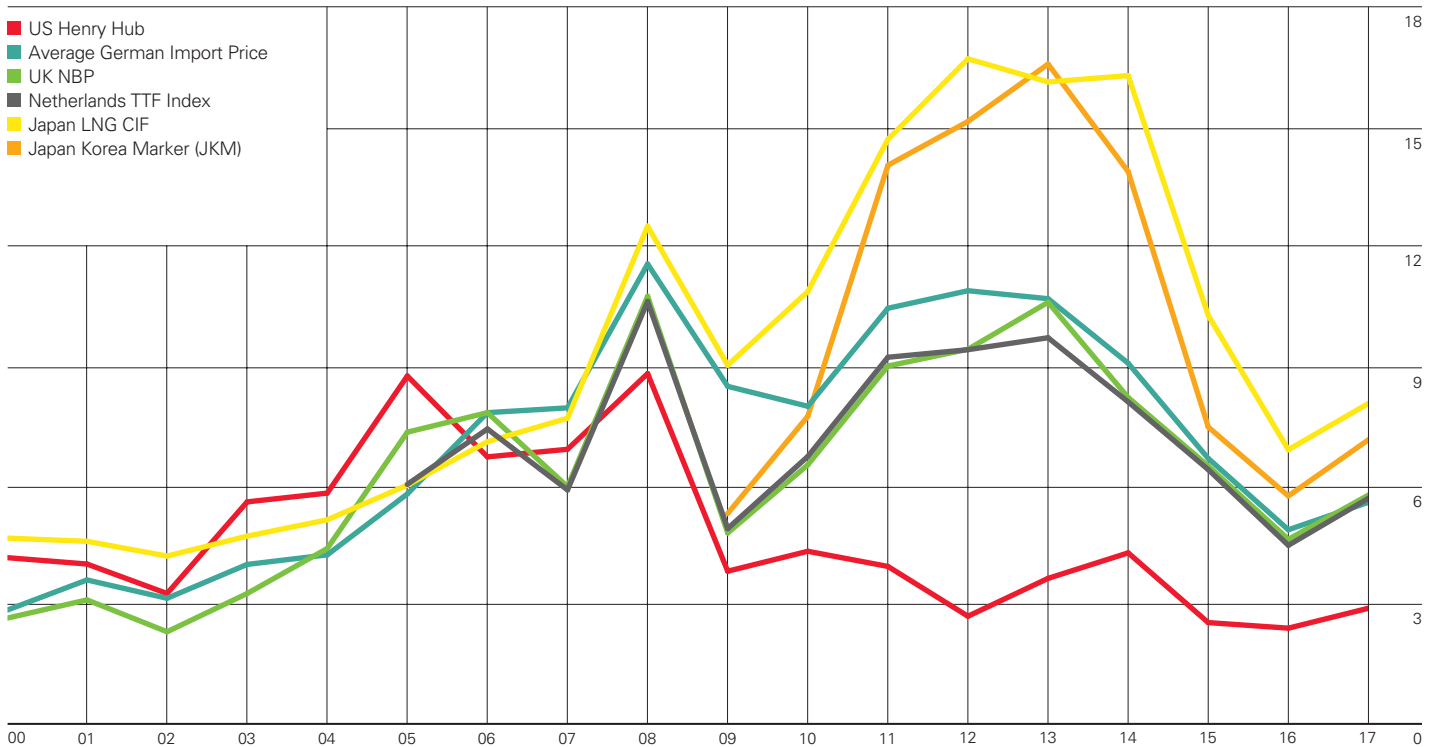
<sup>5</sup>Source: Energy Intelligence Group, Natural Gas Week.

<sup>6</sup>Source: ©OECD/IEA 2018, Oil, Gas, Coal and Electricity Quarterly Statistics [www.iea.org/statistics](http://www.iea.org/statistics).

**Note:** CIF = cost+insurance+freight (average prices).

## Prices

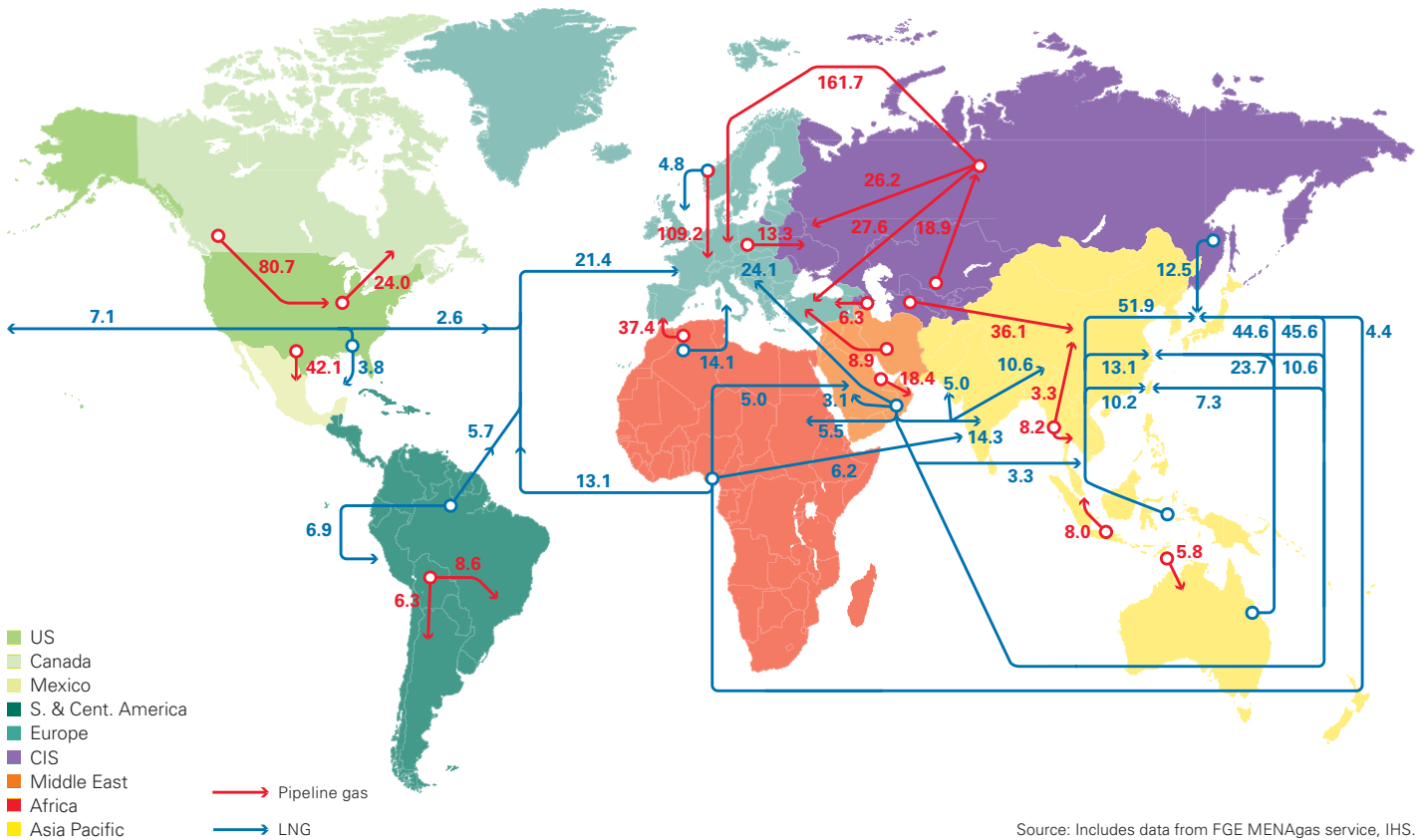
\$/mmBtu





## Major trade movements 2017

Trade flows worldwide (billion cubic metres)



## Gas trade in 2016 and 2017

Billion cubic metres	2016				2017			
	Pipeline imports	LNG imports	Pipeline exports	LNG exports	Pipeline imports	LNG imports	Pipeline exports	LNG exports
US	79.5	2.4	58.6	4.3	80.7	2.2	66.1	17.4
Canada	21.1	0.3	79.5	†	24.0	0.4	80.7	†
Mexico	37.5	5.9	†	–	42.1	6.6	†	–
Trinidad and Tobago	–	–	–	14.3	–	–	–	13.4
Other S. & Cent. America	16.2	15.6	16.2	6.4	15.4	13.8	15.4	5.8
France	32.2	9.1	–	1.5	33.5	10.8	–	1.0
Germany	95.6	–	9.1	–	94.8	–	7.1	–
Italy	60.5	5.9	–	–	53.8	8.4	–	–
Netherlands	36.8	1.3	46.8	0.9	40.9	1.6	43.3	0.8
Norway	†	–	109.4	6.0	†	–	109.2	5.8
Spain	15.5	13.8	0.6	0.2	14.4	16.6	0.1	0.1
Turkey	36.9	7.8	0.6	–	42.8	10.9	0.6	–
United Kingdom	35.2	11.0	9.7	0.6	39.4	7.2	10.8	0.3
Other Europe	94.8	7.9	13.9	1.3	103.7	10.2	21.6	0.2
Russian Federation	18.1	–	200.1	14.6	18.9	–	215.4	15.5
Ukraine	10.5	–	–	–	13.3	–	–	–
Other CIS	29.3	–	68.5	–	30.1	–	67.5	–
Qatar	–	–	18.5	107.2	–	–	18.4	103.4
Other Middle East	–	13.7	8.0	18.8	22.2	13.0	12.5	19.1
Algeria	–	–	38.1	15.8	–	–	36.4	16.6
Other Africa	8.3	10.7	8.6	30.0	7.6	8.2	8.7	38.9
Australia	6.4	0.1	–	59.2	5.8	–	–	75.9
China	36.0	35.9	–	–	39.4	52.6	–	–
India	–	23.6	–	0.1	–	25.7	–	–
Japan	–	113.6	–	–	–	113.9	–	–
Indonesia	–	–	8.2	22.2	–	–	8.0	21.7
South Korea	–	45.7	–	0.1	–	51.3	–	0.1
Other Asia Pacific	18.1	32.5	20.0	53.4	17.7	40.0	18.8	57.2
<b>Total World</b>	<b>714.4</b>	<b>356.7</b>	<b>714.4</b>	<b>356.7</b>	<b>740.7</b>	<b>393.4</b>	<b>740.7</b>	<b>393.4</b>

Source: Includes data from FGE MENAgas service, IHS.

†Less than 0.05.

Note: As far as possible, the data above represents standard cubic metres (measured at 15°C and 1013 mbar) and has been standardized using a gross calorific value (GCV) of 40 MJ/m<sup>3</sup>.

## Total proved reserves at end 2017

Million tonnes	Anthracite and bituminous	Sub-bituminous and lignite	Total	Share of total	R/P ratio
US	220800	30116	250916	24.2%	357
Canada	4346	2236	6582	0.6%	111
Mexico	1160	51	1211	0.1%	116
<b>Total North America</b>	<b>226306</b>	<b>32403</b>	<b>258709</b>	<b>25.0%</b>	<b>335</b>
Brazil	1547	5049	6596	0.6%	*
Colombia	4881	–	4881	0.5%	55
Venezuela	731	–	731	0.1%	*
Other S. & Cent. America	1784	24	1808	0.2%	*
<b>Total S. &amp; Cent. America</b>	<b>8943</b>	<b>5073</b>	<b>14016</b>	<b>1.4%</b>	<b>141</b>
Bulgaria	192	2174	2366	0.2%	69
Czech Republic	1099	2541	3640	0.4%	81
Germany	8	36100	36108	3.5%	206
Greece	–	2876	2876	0.3%	76
Hungary	276	2633	2909	0.3%	366
Poland	19808	6003	25811	2.5%	203
Romania	11	280	291	♦	11
Serbia	402	7112	7514	0.7%	188
Spain	868	319	1187	0.1%	427
Turkey	378	10975	11353	1.1%	115
United Kingdom	70	–	70	♦	23
Other Europe	1108	5172	6280	0.6%	192
<b>Total Europe</b>	<b>24220</b>	<b>76185</b>	<b>100405</b>	<b>9.7%</b>	<b>159</b>
Kazakhstan	25605	–	25605	2.5%	230
Russian Federation	69634	90730	160364	15.5%	391
Ukraine	32039	2336	34375	3.3%	*
Uzbekistan	1375	–	1375	0.1%	340
Other CIS	1509	–	1509	0.1%	418
<b>Total CIS</b>	<b>130162</b>	<b>93066</b>	<b>223228</b>	<b>21.6%</b>	<b>397</b>
South Africa	9893	–	9893	1.0%	39
Zimbabwe	502	–	502	♦	171
Other Africa	2756	66	2822	0.3%	184
Middle East	1203	–	1203	0.1%	*
<b>Total Middle East &amp; Africa</b>	<b>14354</b>	<b>66</b>	<b>14420</b>	<b>1.4%</b>	<b>53</b>
Australia	68310	76508	144818	14.0%	301
China	130851	7968	138819	13.4%	39
India	92786	4942	97728	9.4%	136
Indonesia	15068	7530	22598	2.2%	49
Japan	340	10	350	♦	252
Mongolia	1170	1350	2520	0.2%	51
New Zealand	825	6750	7575	0.7%	*
Pakistan	207	2857	3064	0.3%	*
South Korea	326	–	326	♦	219
Thailand	–	1063	1063	0.1%	65
Vietnam	3116	244	3360	0.3%	88
Other Asia Pacific	1326	687	2013	0.2%	31
<b>Total Asia Pacific</b>	<b>314325</b>	<b>109909</b>	<b>424234</b>	<b>41.0%</b>	<b>79</b>
<b>Total World</b>	<b>718310</b>	<b>316702</b>	<b>1035012</b>	<b>100.0%</b>	<b>134</b>
of which: OECD	320377	177608	497985	48.1%	282
Non-OECD	397933	139094	537027	51.9%	91
European Union	22913	53416	76329	7.4%	164

\*More than 500 years.

♦Less than 0.05%.

Source: Includes data from Federal Institute for Geosciences and Natural Resources (BGR) Energy Study 2017.

**Notes: Total proved reserves of coal** – Generally taken to be those quantities that geological and engineering information indicates with reasonable certainty can be recovered in the future from known reservoirs under existing economic and operating conditions. The data series for total proved coal reserves does not necessarily meet the definitions, guidelines and practices used for determining proved reserves at company level, for instance as published by the US Securities and Exchange Commission, nor does it necessarily represent BP's view of proved reserves by country.

**Reserves-to-production (R/P) ratio** – If the reserves remaining at the end of any year are divided by the production in that year, the result is the length of time that those remaining reserves would last if production were to continue at that rate.

**Reserves-to-production (R/P) ratios are calculated excluding other solid fuels in reserves and production.**

**Shares of total and R/P ratios are calculated using million tonnes figures.**

## Prices

US dollars per tonne	Northwest Europe marker price†	US Central Appalachian coal spot price index‡	Japan steam spot CIF price†	China Qinhuangdao spot price†
1997	38.92	29.76	–	–
1998	32.00	31.00	–	–
1999	28.79	31.29	–	–
2000	35.99	29.90	–	27.52
2001	39.03	50.15	37.69	31.78
2002	31.65	33.20	31.47	33.19
2003	43.60	38.52	39.61	31.74
2004	72.08	64.90	74.22	42.76
2005	60.54	70.12	64.62	51.34
2006	64.11	57.82	65.22	53.53
2007	88.79	49.73	95.59	61.23
2008	147.67	117.42	157.88	104.97
2009	70.66	60.73	83.59	87.86
2010	92.50	67.87	108.47	110.08
2011	121.52	84.75	126.13	127.27
2012	92.50	67.28	100.30	111.89
2013	81.69	69.72	90.07	95.42
2014	75.38	67.08	76.13	84.12
2015	56.64	51.57	60.10	67.53
2016	60.09	51.45	71.66	71.35
2017	84.51	63.83	96.02	94.72

†Source: IHS Northwest Europe prices for 1997-2000 are the average of the monthly marker, 2001-2017 the average of weekly prices. IHS Japan prices basis = 6,000 kilocalories per kilogram NAR CIF. Chinese prices are the average monthly price for 2000-2005, weekly prices 2006-2017, 5,500 kilocalories per kilogram NAR, including cost and freight (CFR).

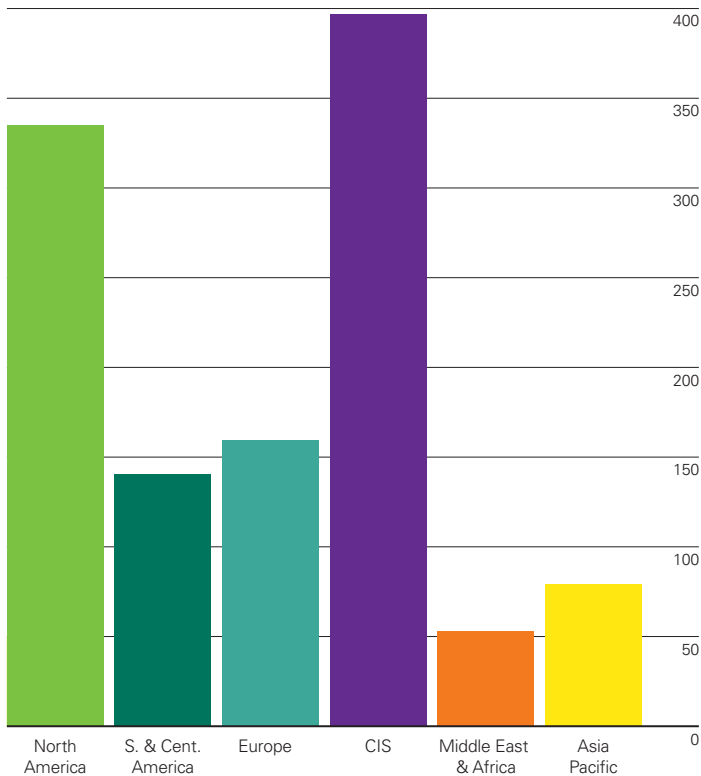
‡Source: S&P Global Platts. © 2018, S&P Global Inc. Prices are for Central Appalachian 12,500 BTU, 1.2 SO<sub>2</sub> coal, FOB. Prices for 1997-2000 are by coal price publication date, 2001-2005 by coal price assessment date, 2006-2017 weekly CAPP 12,500 BTU, 1.6 SO<sub>2</sub> coal, FOB.

**Note:** CIF = cost+insurance+freight (average prices); FOB = free on board.

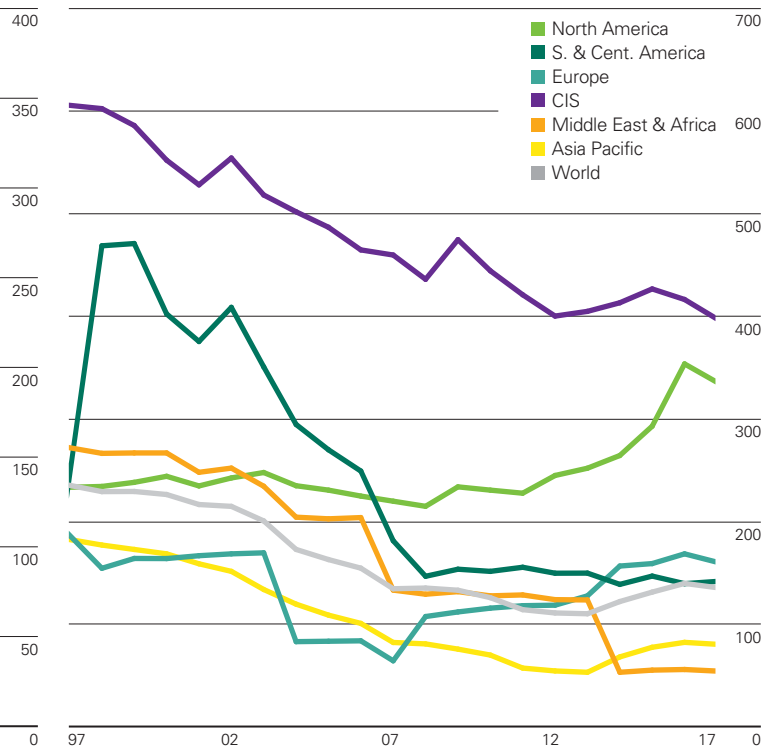
## Reserves-to-production (R/P) ratios

Years

2017 by region



History

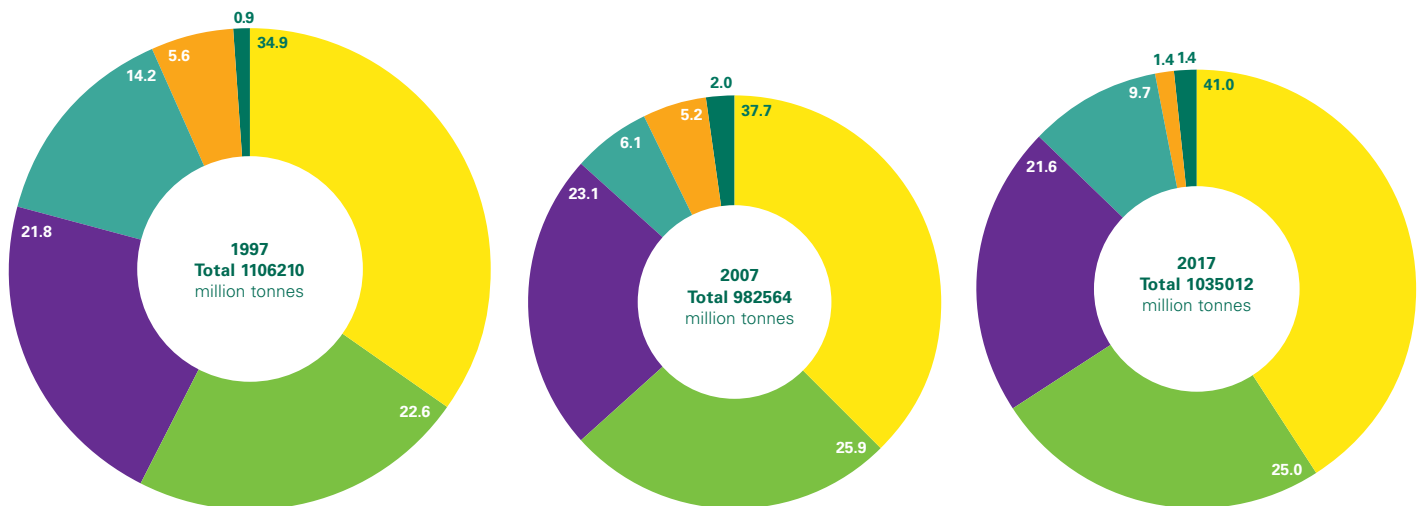


World proved coal reserves are currently sufficient to meet 134 years of global production, much higher than the R/P ratio for oil and gas. By region, Asia Pacific holds the most proved reserves (41% of total), split mainly between Australia, China and India. The US remains the largest single reserve holder (24.2% of total).

## Distribution of proved reserves in 1997, 2007 and 2017

Percentage

- Asia Pacific
- North America
- CIS
- Europe
- Middle East & Africa
- S. & Cent. America



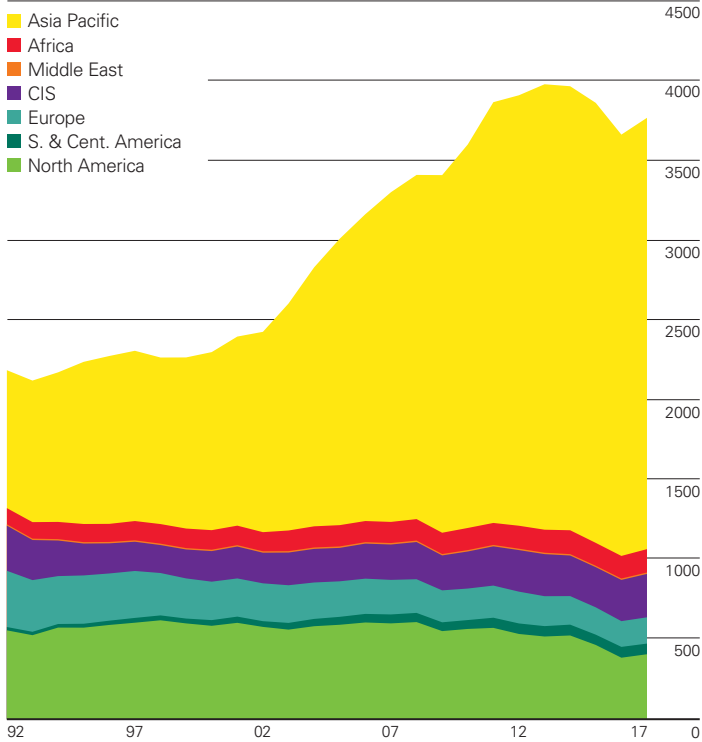






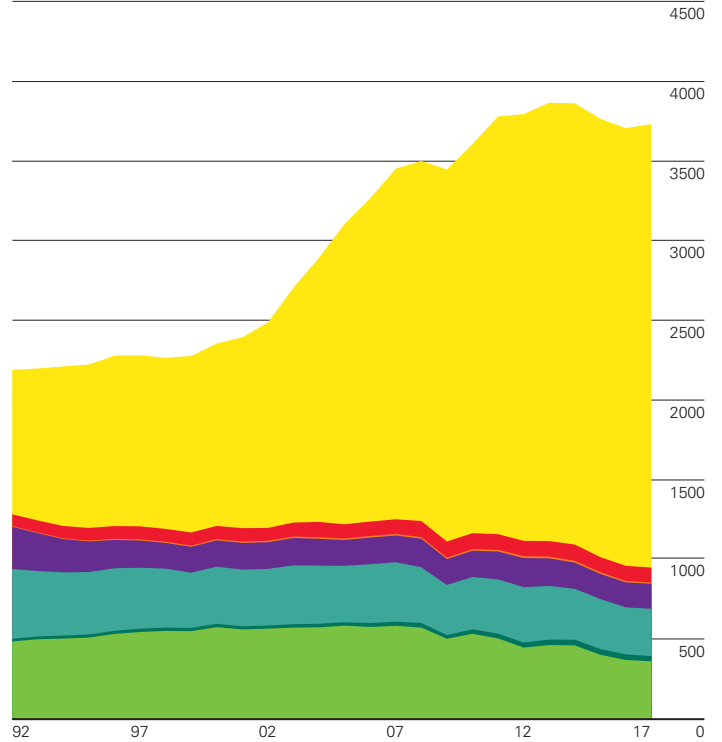
## Coal: Production by region

Million tonnes oil equivalent



## Coal: Consumption by region

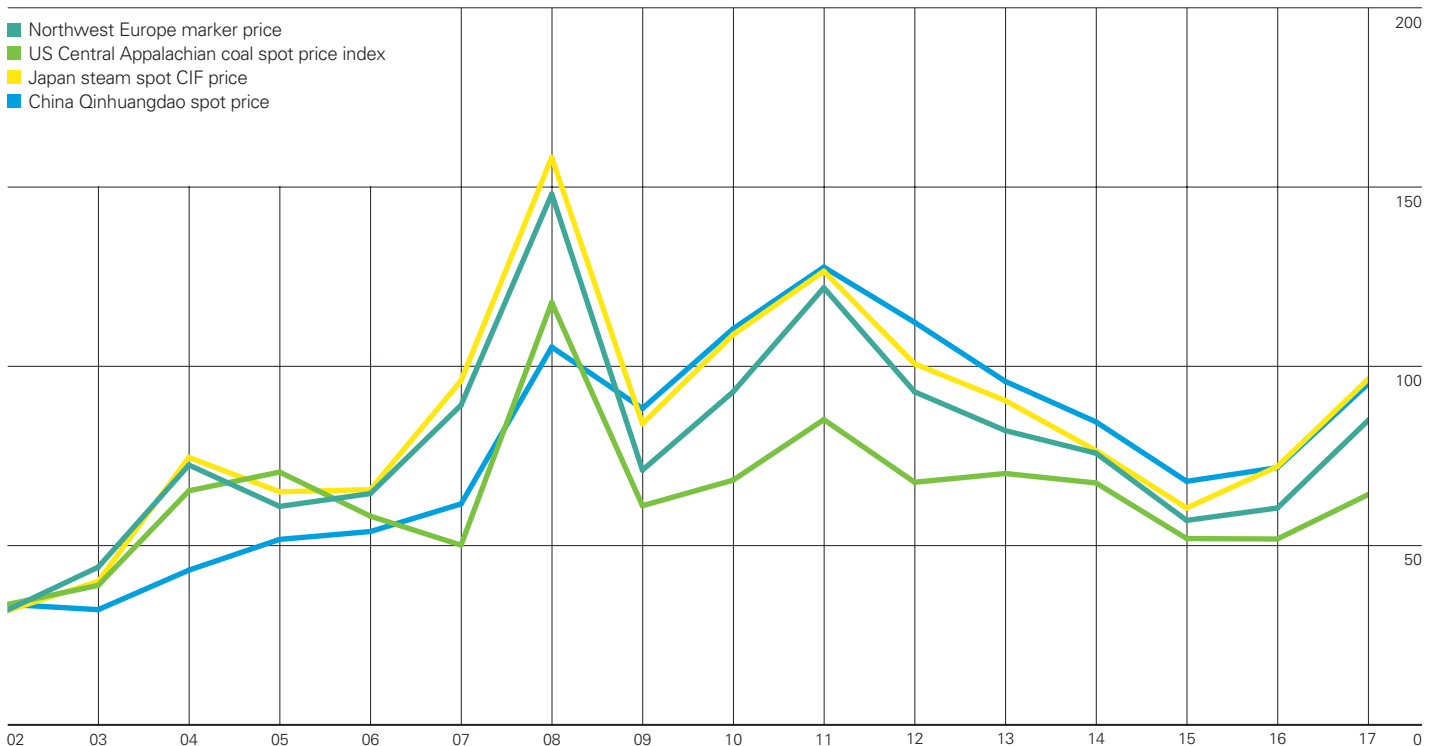
Million tonnes oil equivalent



World coal production increased by 105 million tonnes of oil equivalent or 3.2%, the fastest rate of growth since 2011. Production rose by 56 mtoe in China and 23 mtoe in the US. Global coal consumption grew by 25 mtoe, or 1%, the first growth since 2013. Growth was driven largely by India (18 mtoe), with China consumption also up slightly (4 mtoe) following three successive annual declines during 2014-2016. OECD demand fell for the fourth year in a row (-4 mtoe).

## Coal prices

US dollars per tonne

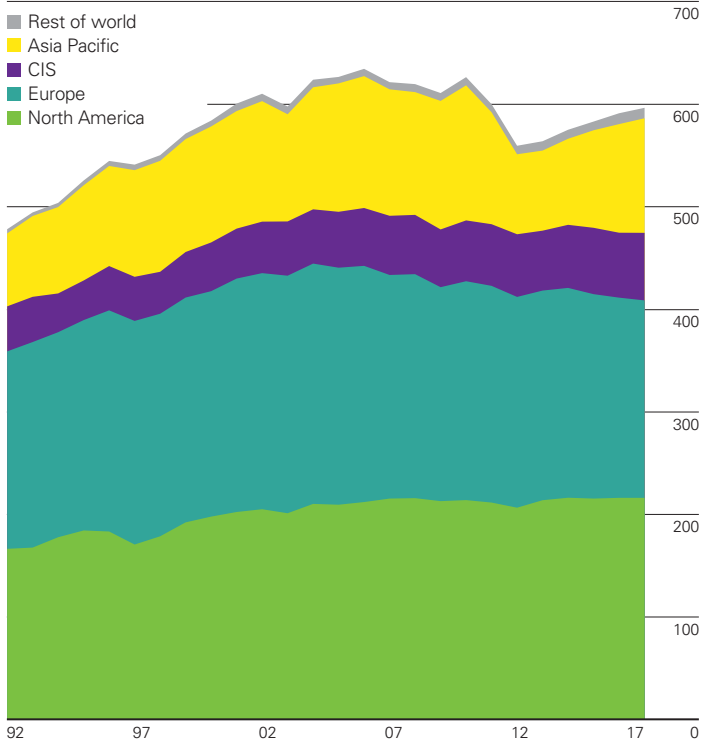






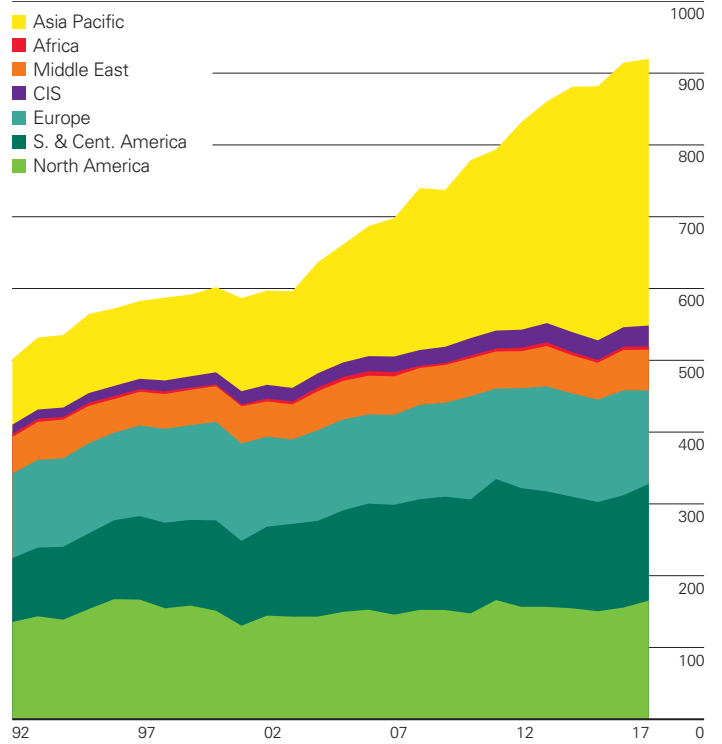
## Nuclear energy consumption by region

Million tonnes oil equivalent



## Hydroelectricity consumption by region

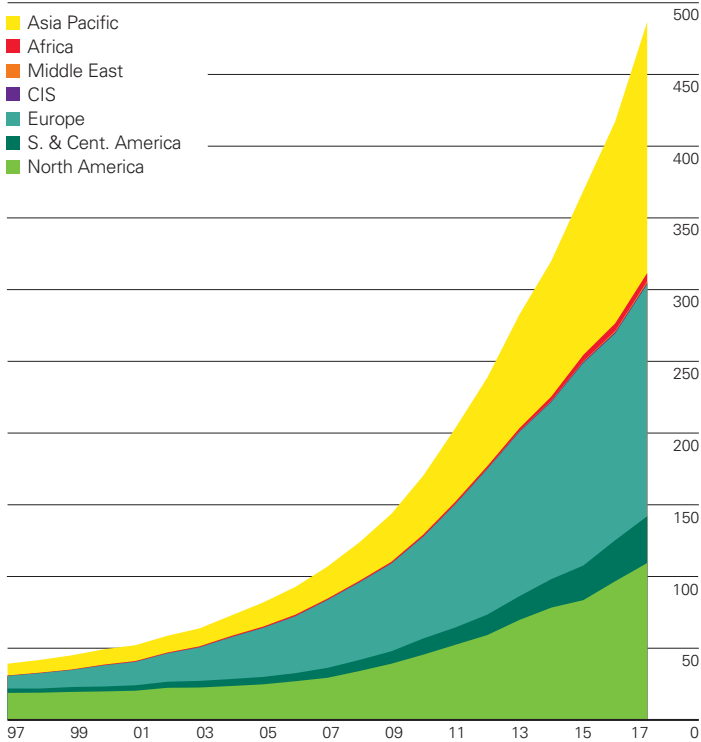
Million tonnes oil equivalent



Global nuclear generation rose by 5 million tonnes of oil equivalent (mtoe), or 1.1%, above the 10-year average growth rate of -0.7%. Growth in China (8 mtoe) and Japan (3 mtoe) was partially offset by declines in Europe (3 mtoe). World hydroelectric power generation rose by 5 mtoe, just 0.9%, compared with the 10-year average of 2.9%. The US (7 mtoe) provided the largest increment. China's growth was the slowest since 2011, while European output declined by 10.5% (-16 mtoe).

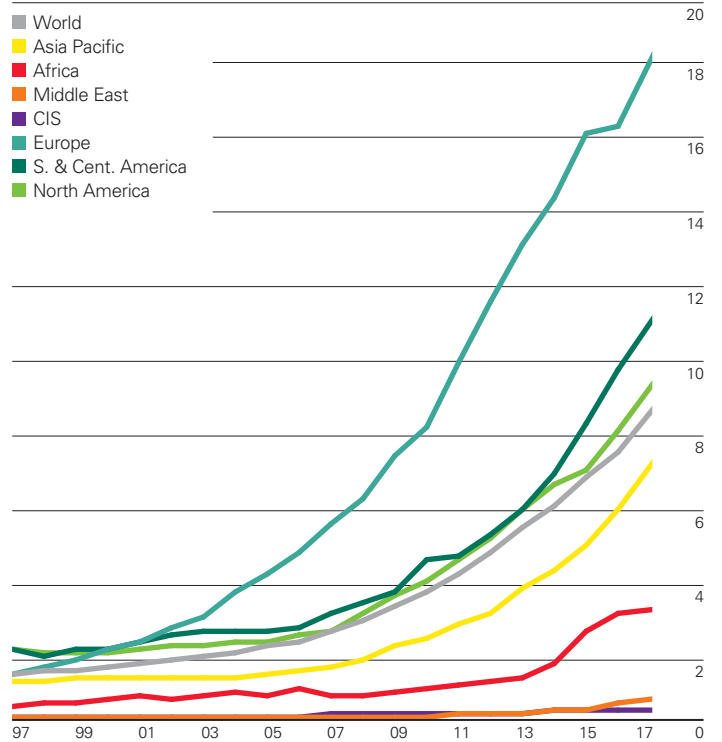
## Other renewables consumption by region

Million tonnes oil equivalent



## Other renewables share of power generation by region

Percentage



Renewable energy in power generation (not including hydro) grew by 17%, slightly higher than the 10-year average (16.2%) and the largest increment on record at 69 million tonnes of oil equivalent (mtoe). Wind provided more than half of renewables growth, while solar contributed more than a third despite accounting for just 21% of the total. In China, renewable power generation rose by 25 mtoe – a country record, and the second largest contribution to global primary energy growth from any single fuel and country, behind natural gas in China. The share of renewables in total power generation increased from 7.4% to 8.4% globally, and from 16.5% to 18.3% in Europe, a new high.



## Biofuels production

Thousand tonnes oil equivalent	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Growth rate per annum		Share 2017
												2017	2006-16	
US	14709	20934	23761	28044	31184	29808	31057	32890	33849	35986	<b>36936</b>	2.9%	12.9%	43.9%
Canada	502	543	761	787	899	1004	1059	1188	1142	1197	<b>1239</b>	3.8%	21.4%	1.5%
Mexico	5	5	5	10	13	9	7	7	5	14	<b>14</b>	-	-	♦
<b>Total North America</b>	<b>15216</b>	<b>21481</b>	<b>24527</b>	<b>28841</b>	<b>32095</b>	<b>30821</b>	<b>32124</b>	<b>34086</b>	<b>34996</b>	<b>37197</b>	<b>38190</b>	<b>3.0%</b>	<b>13.1%</b>	<b>45.4%</b>
Argentina	173	635	1055	1670	2234	2295	2014	2644	2038	2828	<b>3131</b>	11.0%	57.3%	3.7%
Brazil	12427	15486	15277	16866	14403	14739	17114	18005	19332	18168	<b>18465</b>	1.9%	6.6%	22.0%
Colombia	155	158	320	455	572	627	650	676	693	626	<b>617</b>	-1.1%	15.8%	0.7%
Other S. & Cent. America	606	806	634	232	313	304	359	382	385	409	<b>456</b>	11.8%	-2.3%	0.5%
<b>Total S. &amp; Cent. America</b>	<b>13360</b>	<b>17085</b>	<b>17285</b>	<b>19223</b>	<b>17522</b>	<b>17965</b>	<b>20136</b>	<b>21707</b>	<b>22448</b>	<b>22030</b>	<b>22669</b>	<b>3.2%</b>	<b>7.9%</b>	<b>26.9%</b>
Austria	222	269	373	391	390	390	374	329	381	419	<b>391</b>	-6.5%	14.4%	0.5%
Belgium	146	282	486	523	525	536	526	666	482	477	<b>471</b>	-1.0%	35.8%	0.6%
Finland	54	101	231	301	208	263	330	367	432	109	<b>219</b>	101.9%	24.2%	0.3%
France	1153	2064	2408	2353	1935	2145	2306	2573	2559	2405	<b>2224</b>	-7.3%	13.4%	2.6%
Germany	3243	2805	2834	3022	2967	3031	2770	3460	3191	3228	<b>3293</b>	2.3%	2.2%	3.9%
Italy	448	623	772	678	486	298	454	575	572	600	<b>595</b>	-0.5%	0.1%	0.7%
Netherlands	82	78	242	391	674	1276	1495	1980	1816	1477	<b>1658</b>	12.6%	51.4%	2.0%
Poland	103	290	408	439	414	652	697	750	940	928	<b>920</b>	-0.6%	19.7%	1.1%
Portugal	162	149	226	284	330	276	274	301	321	298	<b>315</b>	5.9%	15.5%	0.4%
Spain	378	384	1001	1312	851	620	749	1030	1122	1200	<b>1541</b>	28.7%	16.0%	1.8%
Sweden	150	183	254	339	400	491	635	789	222	211	<b>185</b>	-12.0%	8.7%	0.2%
United Kingdom	374	289	220	304	322	303	517	403	310	554	<b>617</b>	11.8%	9.3%	0.7%
Other Europe	504	956	1153	1153	1259	1413	1449	1494	1679	1745	<b>1738</b>	-0.1%	15.7%	2.1%
<b>Total Europe</b>	<b>7019</b>	<b>8473</b>	<b>10609</b>	<b>11490</b>	<b>10761</b>	<b>11692</b>	<b>12578</b>	<b>14717</b>	<b>14025</b>	<b>13652</b>	<b>14167</b>	<b>4.1%</b>	<b>10.0%</b>	<b>16.8%</b>
Total CIS	2	7	36	34	28	29	23	25	19	19	<b>19</b>	-	-	♦
Total Middle East	-	-	-	5	5	5	5	5	5	5	<b>5</b>	-	-	♦
<b>Total Africa</b>	<b>6</b>	<b>11</b>	<b>18</b>	<b>8</b>	<b>8</b>	<b>23</b>	<b>32</b>	<b>40</b>	<b>40</b>	<b>40</b>	<b>40</b>	-	<b>15.8%</b>	<b>♦</b>
Australia	75	111	174	222	223	241	210	163	162	183	<b>144</b>	-21.1%	13.4%	0.2%
China	982	1194	1224	1584	1970	2103	2346	2609	2653	1811	<b>2147</b>	18.8%	6.9%	2.6%
India	100	154	61	123	192	168	198	198	438	544	<b>435</b>	-19.9%	22.0%	0.5%
Indonesia	217	530	469	723	1110	1397	1750	3110	1314	2238	<b>2326</b>	4.2%	48.1%	2.8%
South Korea	78	146	358	511	309	283	321	337	385	386	<b>406</b>	5.3%	25.1%	0.5%
Thailand	148	525	656	700	765	1054	1330	1490	1603	1610	<b>1846</b>	15.0%	33.9%	2.2%
Other Asia Pacific	227	390	478	443	692	1067	1363	1522	1777	1767	<b>1727</b>	-2.0%	28.5%	2.1%
<b>Total Asia Pacific</b>	<b>1827</b>	<b>3051</b>	<b>3419</b>	<b>4306</b>	<b>5262</b>	<b>6313</b>	<b>7518</b>	<b>9429</b>	<b>8333</b>	<b>8540</b>	<b>9031</b>	<b>6.0%</b>	<b>20.1%</b>	<b>10.7%</b>
<b>Total World</b>	<b>37429</b>	<b>50109</b>	<b>55894</b>	<b>63906</b>	<b>65680</b>	<b>66848</b>	<b>72415</b>	<b>80009</b>	<b>79866</b>	<b>81483</b>	<b>84121</b>	<b>3.5%</b>	<b>11.4%</b>	<b>100.0%</b>
of which: OECD	22297	30020	35413	40832	43107	42773	44936	49000	49235	51054	<b>52552</b>	3.2%	12.2%	62.5%
Non-OECD	15133	20090	20481	23074	22573	24074	27478	31009	30630	30429	<b>31569</b>	4.0%	10.1%	37.5%
European Union	6944	8332	10460	11387	10569	11581	12492	14632	13906	13532	<b>14044</b>	4.1%	10.0%	16.7%

♦ Less than 0.05%.

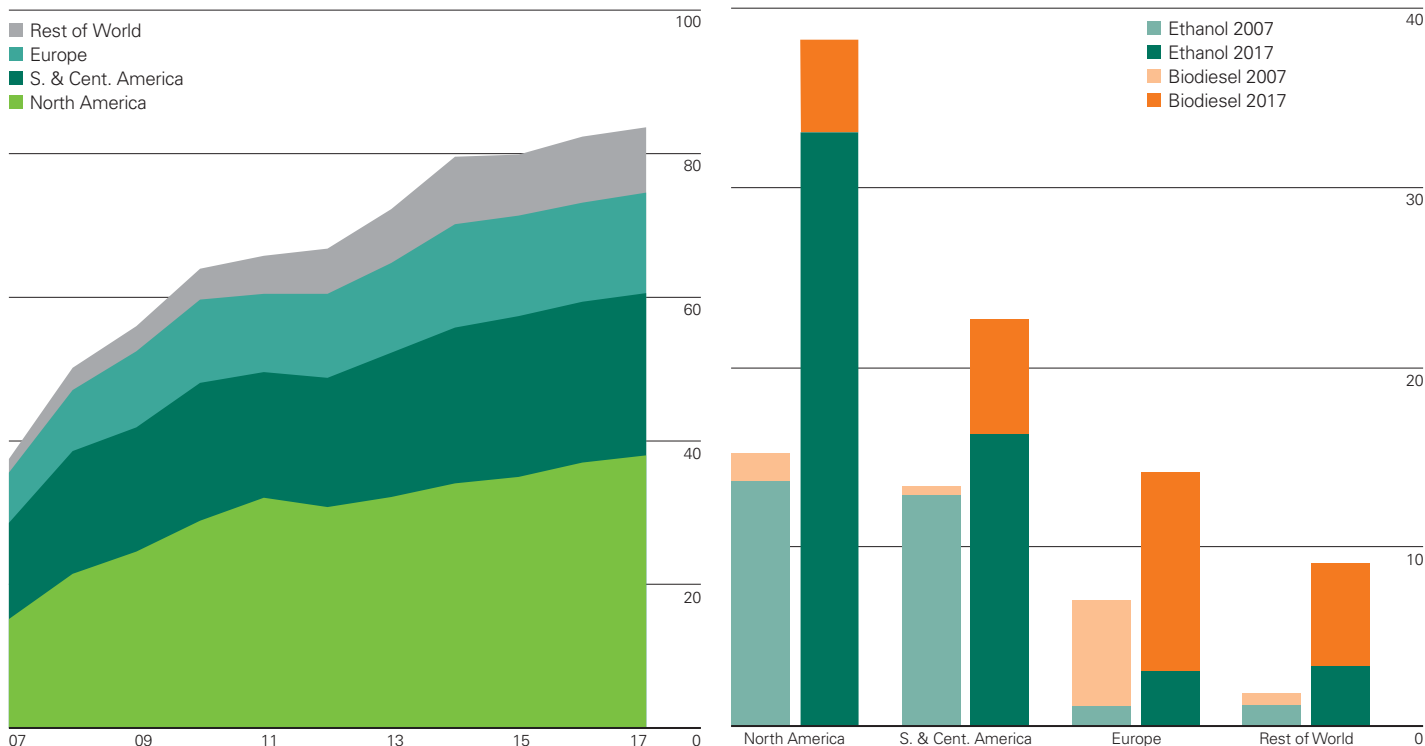
Notes: Consumption of fuel ethanol and biodiesel is included in oil consumption tables.

Growth rates are adjusted for leap years.

Source: Includes data from F.O. Lichts; Strategie grains; US Energy Information Administration (March 2018).

## World biofuels production

Million tonnes oil equivalent



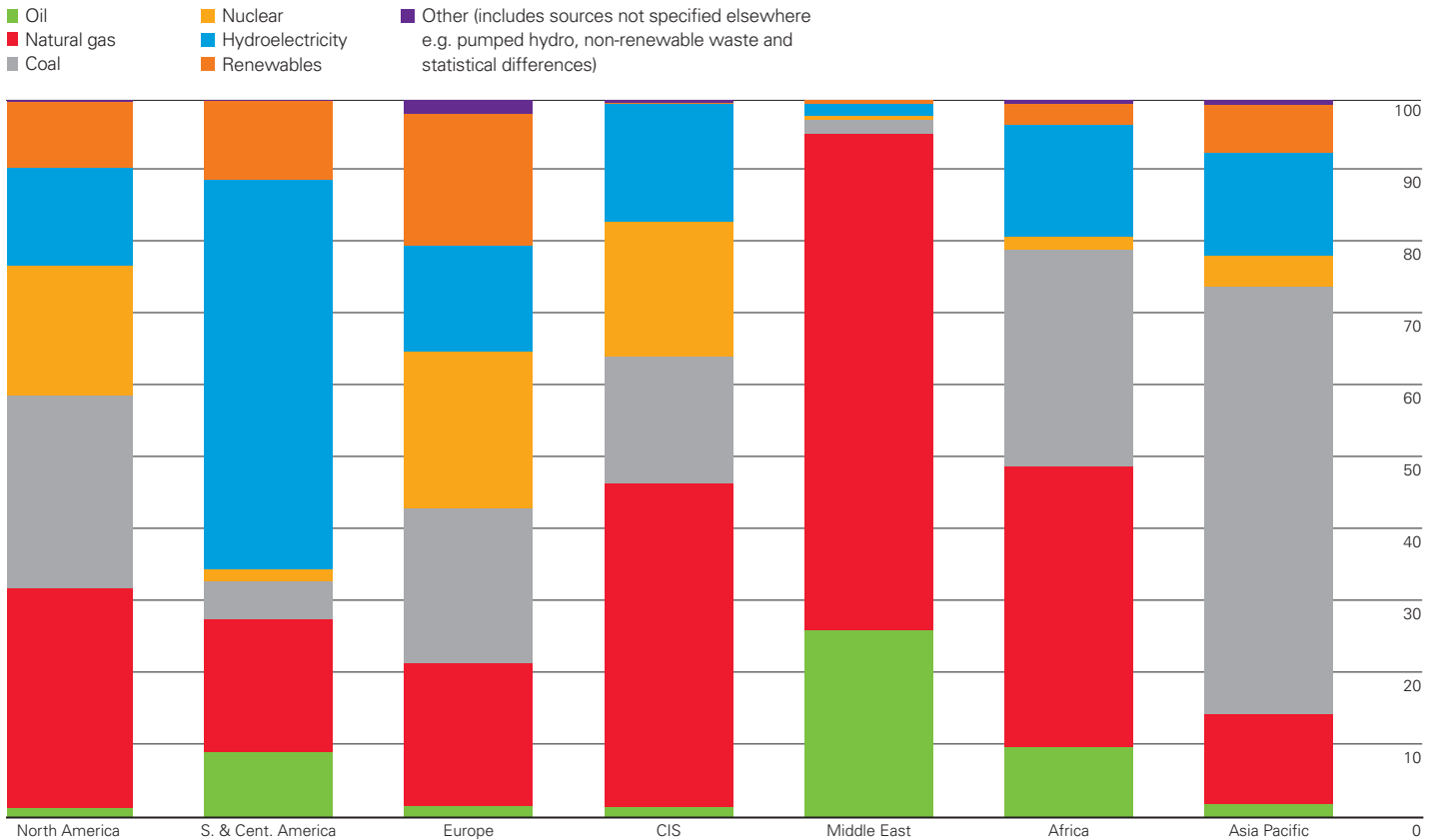
World biofuels production increased by 3.5% in 2017, well below the 10-year average of 11.4%, but the fastest for three years. The US provided the largest increment (950 thousand tonnes of oil equivalent, or ktoe). By fuel type, global ethanol production grew at a similar rate of 3.3%, and contributing over 60% to total biofuels growth. Biodiesel production rose by 4%, driven mainly by growth in Argentina, Brazil and Spain.





## Regional electricity generation by fuel 2017

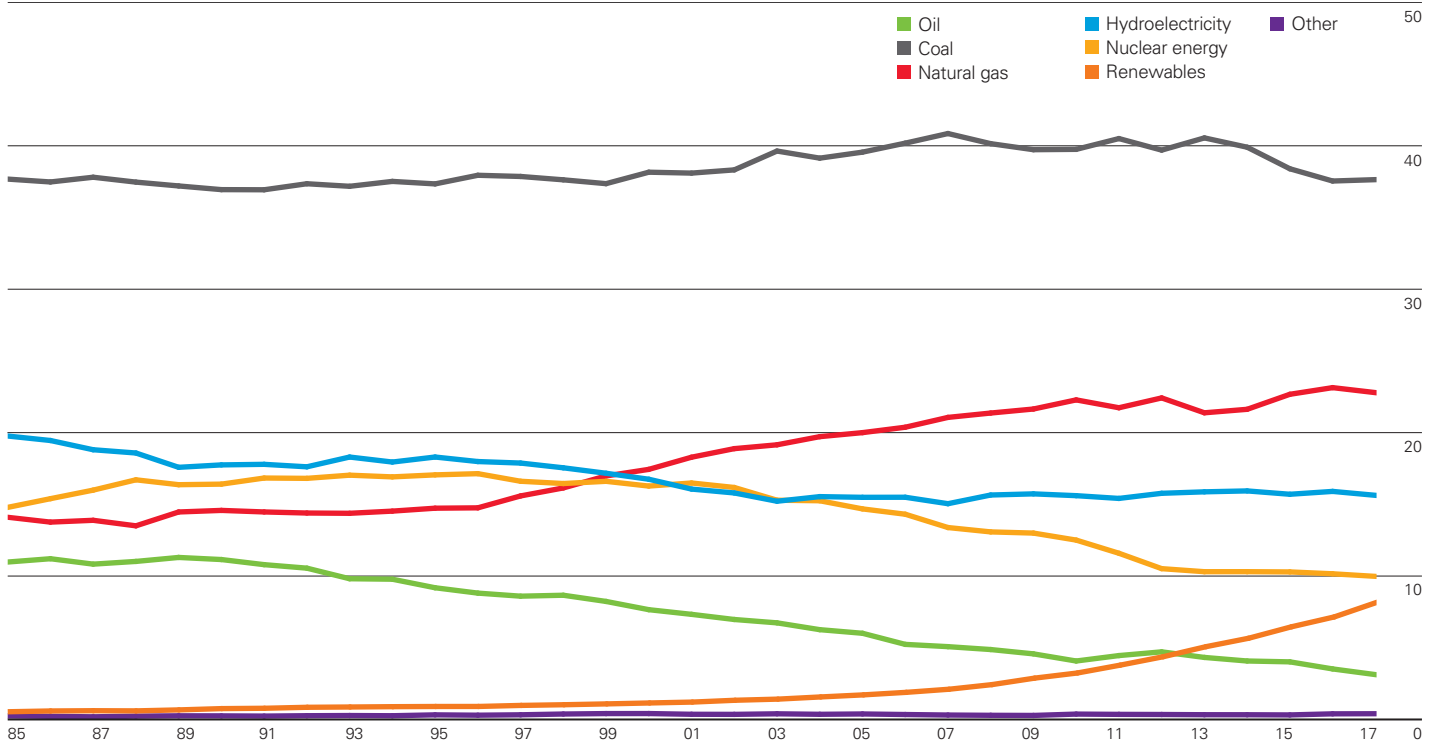
Percentage



Natural gas is the dominant fuel used for power generation in North America, CIS, the Middle East and Africa. South and Central America gets more than half of its power from hydroelectricity, with a share far higher than any other region. In Europe, nuclear energy is the top source of electricity, but only just, as the shares of nuclear, coal, natural gas and renewables are all in a narrow range of 18-22%.

## Share of global electricity generation by fuel

Percentage



Coal remains the world's dominant source of power, with a share of 38.1% in 2017, almost as much as natural gas (23.2%) and hydroelectricity (15.9%) combined, which sit in second and third positions. Renewables' share of power generation was 8.4% in 2017, having risen 6.1 percentage points since 2007. Over the same period, nuclear's share declined by 3.4 percentage points while coal lost 3.1 percentage points.







## Reserves of key materials

### Cobalt reserves

Thousand tonnes	At end of 2017	Share	R/P ratio
Australia	1200	16.9%	257
Canada	250	3.5%	39
Democratic Republic of Congo	3500	49.3%	39
Cuba	500	7.0%	121
Madagascar	150	2.1%	48
Morocco	17	0.2%	7
New Caledonia	64	0.9%	23
Papua New Guinea	51	0.7%	16
Philippines	280	3.9%	66
Russian Federation	250	3.5%	45
South Africa	29	0.4%	12
Zambia	270	3.8%	102
Rest of World	539	7.6%	101
<b>World</b>	<b>7100</b>	<b>100.0%</b>	<b>52</b>

### Lithium reserves

Thousand tonnes	At end of 2017	Share	R/P ratio
Argentina	2000	12.5%	364
Australia	2700	16.9%	144
Brazil	48	0.3%	240
Chile	7500	46.9%	500
China	3200	20.0%	1067
Portugal	60	0.4%	150
US	35	0.2%	39
Zimbabwe	23	0.1%	23
Rest of World	434	2.7%	-
<b>World</b>	<b>16000</b>	<b>100.0%</b>	<b>358</b>

\*Reserves included in world total.

♦Less than 0.05%.  
n/a not available.

### Natural graphite reserves

Thousand tonnes	At end of 2017	Share	R/P ratio
Brazil	70000	25.9%	972
Canada	*	n/a	n/a
China	55000	20.4%	71
India	8000	3.0%	173
Madagascar	1600	0.6%	194
Mexico	3100	1.1%	808
Mozambique	17000	6.3%	739
Russian Federation	14800	5.5%	592
Sri Lanka	*	n/a	n/a
Ukraine	*	n/a	n/a
Zimbabwe	*	n/a	n/a
Rest of World	*	n/a	n/a
<b>World</b>	<b>270000</b>	<b>100.0%</b>	<b>261</b>

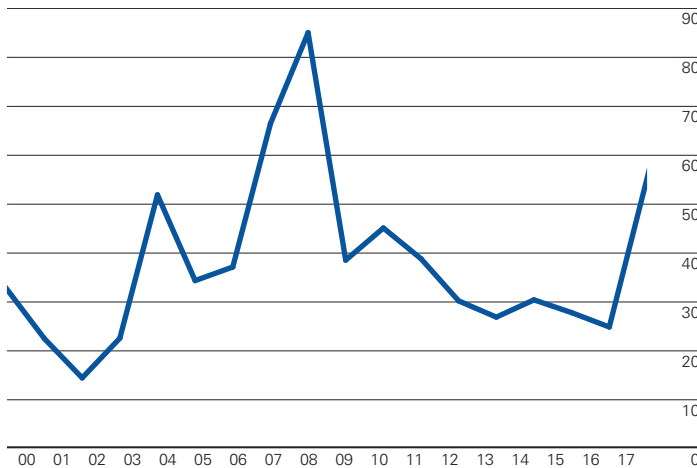
### Rare earth metals reserves

Thousand tonnes	At end of 2017	Share	R/P ratio
Australia	3400	2.8%	197
Brazil	22000	18.3%	11000
China	44000	36.7%	419
India	6900	5.8%	7218
Malaysia	30	♦	100
Russian Federation	18000	15.0%	5485
Thailand	*	n/a	n/a
US	1400	1.2%	-
Rest of World	*	n/a	n/a
<b>World</b>	<b>120000</b>	<b>100.0%</b>	<b>920</b>

Source (for all tables): includes data from US Geological Survey.

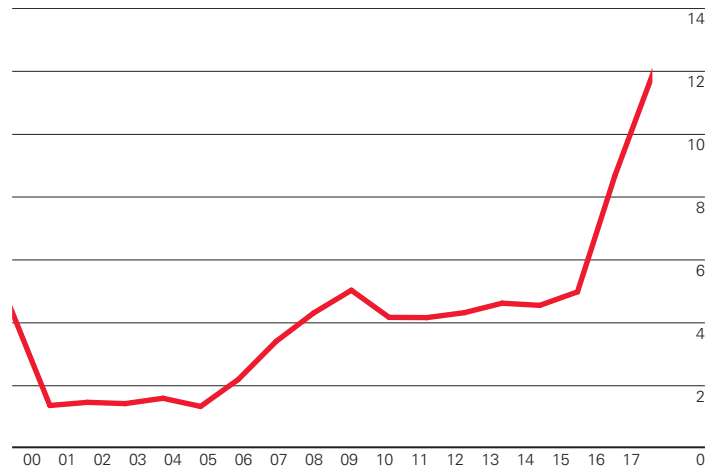
## Cobalt prices

Thousands of US dollars per tonne\*



## Lithium carbonate prices

Thousands of US dollars per tonne†



\*2000-2012 spot grade for cathodes, source US Geological Survey.  
2013-2017 minimum purity 99.8%, source London Metal Exchange.  
†2000-2008 unit value, data series 140, source US Geological Survey.  
2009-2017 FOB South America, source Benchmark Mineral Intelligence.

# Appendices

## Approximate conversion factors

### Crude oil\*

From	To				
	tonnes (metric)	kilolitres	barrels	US gallons	tonnes per year
	<b>Multiply by</b>				
Tonnes (metric)	1	1.165	7.33	307.86	–
Kilolitres	0.8581	1	6.2898	264.17	–
Barrels	0.1364	0.159	1	42	–
US gallons	0.00325	0.0038	0.0238	1	–
Barrels per day	–	–	–	–	49.8

\*Based on worldwide average gravity.

### Products

	To convert			
	barrels to tonnes	tonnes to barrels	kilolitres to tonnes	tonnes to kilolitres
	<b>Multiply by</b>			
Liquefied petroleum gas (LPG)	0.086	11.60	0.542	1.844
Gasoline	0.120	8.35	0.753	1.328
Kerosene	0.127	7.88	0.798	1.253
Gas oil/diesel	0.134	7.46	0.843	1.186
Residual fuel oil	0.157	6.35	0.991	1.010
Product basket	0.125	7.98	0.788	1.269

### Natural gas (NG) and liquefied natural gas (LNG)

From	To					
	billion cubic metres NG	billion cubic feet NG	million tonnes oil equivalent	million tonnes LNG	trillion British thermal units	million barrels oil equivalent
	<b>Multiply by</b>					
1 billion cubic metres NG	1.000	35.315	0.860	0.735	34.121	5.883
1 billion cubic feet NG	0.028	1.000	0.024	0.021	0.966	0.167
1 million tonnes oil equivalent	1.163	41.071	1.000	0.855	39.683	6.842
1 million tonnes LNG	1.360	48.028	1.169	1.000	46.405	8.001
1 trillion British thermal units	0.029	1.035	0.025	0.022	1.000	0.172
1 million barrels oil equivalent	0.170	6.003	0.146	0.125	5.800	1.000

## Definitions

Statistics published in this review are taken from government sources and published data. No use is made of confidential information obtained by BP in the course of its business.

### Country, regions and geographic groupings

Country and geographic groupings are made purely for statistical purposes and are not intended to imply any judgement about political or economic standings.

#### North America

US (excluding US territories), Canada, Mexico.

#### South & Central America

Caribbean (including Puerto Rico and US Virgin Islands), Bermuda, Central and South America.

#### Europe

European members of the OECD plus Albania, Bosnia-Herzegovina, Bulgaria, Croatia, Cyprus, the former Yugoslav Republic of Macedonia, Georgia, Gibraltar, Latvia, Lithuania, Malta, Montenegro, Romania and Serbia.

#### Commonwealth of Independent States (CIS)

Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Russian Federation, Tajikistan, Turkmenistan, Ukraine, Uzbekistan.

#### Middle East

Arabian Peninsula, Iran, Iraq, Israel, Jordan, Lebanon, Syria.

#### North Africa

Territories on the north coast of Africa from Egypt to Western Sahara.

#### West Africa

Territories on the west coast of Africa from Mauritania to Angola, including Cape Verde, Chad.

#### East and Southern Africa

Territories on the east coast of Africa from Sudan to Republic of South Africa. Also Botswana, Madagascar, Malawi, Namibia, Uganda, Zambia, Zimbabwe.

#### Asia Pacific

Brunei, Cambodia, China†, China Hong Kong SAR\*, China Macau SAR\*, Indonesia, Japan, Laos, Malaysia, Mongolia, North Korea, Philippines, Singapore, South Asia (Afghanistan, Bangladesh, India, Myanmar, Nepal, Pakistan, Sri Lanka), South Korea, Taiwan, Thailand, Vietnam, Australia, New Zealand, Papua New Guinea, Oceania.

†Mainland China.

\*Special Administrative Region.

#### Australasia

Australia, New Zealand.

#### OECD members

**Europe:** Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, UK.

**Other member countries:** Australia, Canada, Chile, Israel, Japan, Mexico, New Zealand, South Korea, US.

#### OPEC members

**Middle East:** Iran, Iraq, Kuwait, Qatar, Saudi Arabia, United Arab Emirates.

**North Africa:** Algeria, Libya.

**West Africa:** Angola, Equatorial Guinea, Gabon, Nigeria.

**South America:** Ecuador, Venezuela.

### Units

1 metric tonne	= 2204.62lb
	= 1.1023 short tons
1 kilolitre	= 6.2898 barrels
	= 1 cubic metre
1 kilocalorie (kcal)	= 4.1868kJ
	= 3.968Btu
1 kilojoule (kJ)	= 0.239kcal
	= 0.948Btu
1 British thermal unit (Btu)	= 0.252kcal
	= 1.055kJ
1 kilowatt-hour (kWh)	= 860kcal
	= 3600kJ
	= 3412Btu

### Calorific equivalents

One tonne of oil equivalent equals approximately:

<b>Heat units</b>	10 million kilocalories
	42 gigajoules
	40 million British thermal units
<b>Solid fuels</b>	1.5 tonnes of hard coal
	3 tonnes of lignite and sub-bituminous coal
<b>Gaseous fuels</b>	See Natural gas and liquefied natural gas table
<b>Electricity</b>	12 megawatt-hours

One million tonnes of oil or oil equivalent produces about 4400 gigawatt-hours (= 4.4 terawatt-hours) of electricity in a modern power station.

1 barrel of ethanol = 0.58 barrels of oil equivalent  
 1 barrel of biodiesel = 0.86 barrels of oil equivalent  
 1 tonne of ethanol = 0.68 tonnes of oil equivalent  
 1 tonne of biodiesel = 0.88 tonnes of oil equivalent

### European Union members

Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, UK.

### Non-OECD

All countries that are not members of the OECD.

### Methodology

Primary energy consumption is reported in net terms. The gross calorific value to net calorific value adjustment is fuel-specific.

The primary energy values of nuclear and hydroelectric power generation, as well as electricity from renewable sources, have been derived by calculating the equivalent amount of fossil fuel required to generate the same volume of electricity in a thermal power station, assuming a conversion efficiency of 38% (the average for OECD thermal power generation).

Fuels used as inputs for conversion technologies (gas-to-liquids, coal-to-liquids and coal-to-gas) are counted as production for the source fuel and the outputs are counted as consumption for the converted fuel.

### Percentages

Calculated before rounding of actuals.

### Rounding differences

Because of rounding, some totals may not agree exactly with the sum of their component parts.

### Tonnes

Metric equivalent of tons.

# More information

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