



---

# BP Statistical Review of World Energy June 2008

Christof Rühl  
11 June 2008

[www.bp.com/statisticalreview](http://www.bp.com/statisticalreview)

---

## Contents

---

1. Introduction
  2. High Energy Prices
  3. The Oil Market
  4. Other Fuels
  5. Conclusion
-

Christof Rühl  
London June 2008

## 1. Introduction

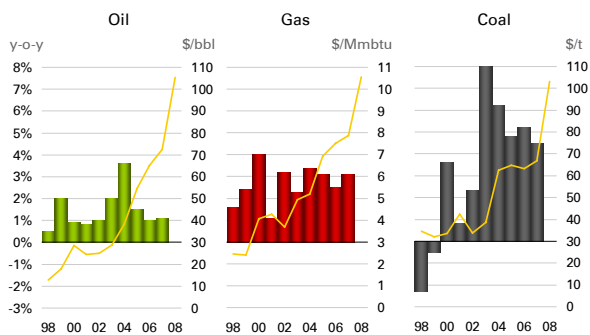
Every year, when the data are collected, we take a long hard look at them – 55,000 data points in all. And then, before trying to find out what has happened, to make sense of another chapter in the unfolding story of global energy, my colleagues and I discuss what matters: What characterizes a given year?

This time, there was not much of a debate. Instead, there was a central question: Why are prices so high?

We took this topic as given. Luckily, we are not in the forecasting business. Instead, we try to interrogate the data, with as much rigour and objectivity as we have and in this way, try to tease out what has happened.

## 2. High Energy Prices

### Energy Consumption and Energy Prices



BP Statistical Review of World Energy 2008

© BP 2008

Prices for all major fuels continued to rise in 2007 and into 2008. Oil has seen the steepest and the longest rise – it rose for six consecutive years, the longest stretch ever in our data, which goes back until 1861. Ten years ago today, the price of Brent stood at \$11.36 – we have seen a tenfold increase since then.

Since January 2003 the world has seen cumulative price growth of 300% for oil, 200% for traded coal,

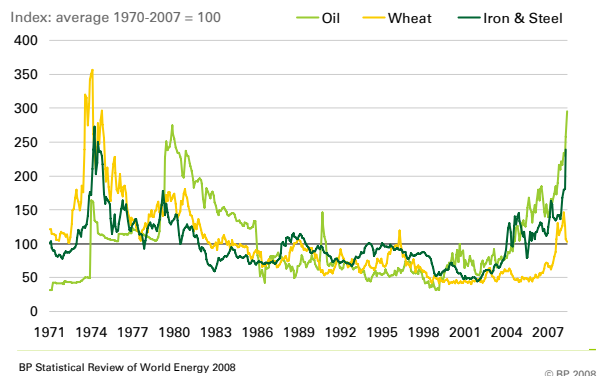
and 100% for US gas, all accelerating toward the end of the period. Other commodity prices have increased as well.

The backdrop is another year of strong economic growth. In 2007, the global economy grew 3.7% (at market exchange rates), a little below 2006, but still above the average of the last five years. It was different for primary energy consumption growth, which slowed from 2.7% to 2.4%, and remained below the five year average. The link between GDP growth and energy growth weakened.

While demand for all fossil fuels grew, oil at 1.1% and coal at 4.5% also remained below their five year averages. The strongest price increases were for those fuels where consumption grew the least, and especially so in the more recent past.

## 2.1 Commodity Cycles

### Real Commodity Prices

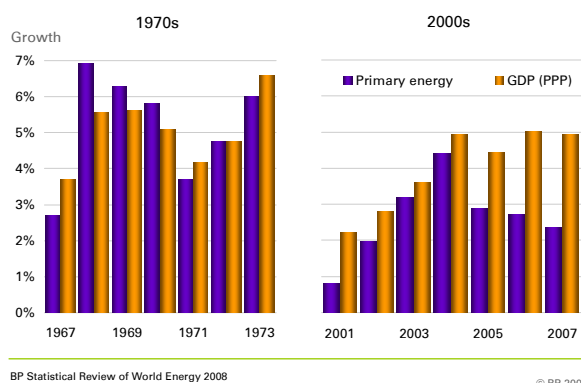


BP Statistical Review of World Energy 2008

© BP 2008

In trying to make sense of a new landscape, it is tempting to look back and ask whether a similar situation has occurred before. The last equivalently big, synchronized commodity cycle occurred in the early 1970s. At that time, real oil prices increased by 230%, from trough to peak, and coal prices by 125%.

## GDP and Primary Energy Growth



There are similarities in this run-up to higher prices. The most obvious one is economic growth, the ultimate driver of energy demand growth. The global economy grew by an annual average of 5.3% (at PPP) in the ten years preceding 1973 – the highest for any ten year period on record. And it grew by 4.6% per year over the last five years – the highest for any five year period on record, except for that very period, leading into the 1970s.

Political events aside, the commodity price cycle in the 1970s ended in text-book fashion: with a demand and a supply response. Economic growth (and energy consumption!) faltered, while supply continued to grow. Energy prices fell back.

The most straightforward question this raises is also the one most difficult to answer: Are we seeing a replay?

Or is it a structural shift, perhaps with cyclical froth on top, but unlikely to lead prices back to where they came from?

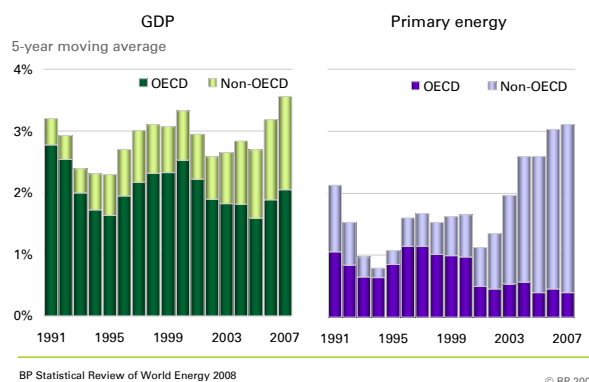
## 2.2 Economic Growth and Energy Demand

As you can see, we have had periods of rapid economic growth with high energy demand before. But something is new this time: Economic growth has stayed at record levels for years, but energy demand growth is slowing. Why this disconnect?

For an answer, one has to dig a little deeper. For more than one hundred years after the industrial revolution, economic growth was asymmetric: Rich countries grew faster than poor ones, despite their

shrinking share of the global population. This has been changing.

## Contributions to Growth



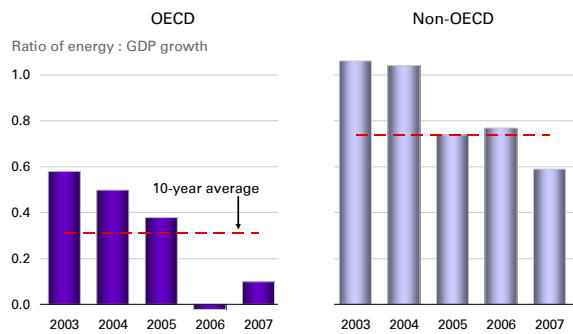
It started to change slowly in the 1950s and then accelerated. What we have witnessed over the last few years is an extraordinary shift in the composition of global economic growth.

There are many ways to put statistics on it. Let me just focus on what is most important: The non-OECD contribution to global economic growth has almost doubled since the 1990s, to well over 40% today. Most of this has happened since the turn of this century.

The impact on energy demand has been disproportionate. The contribution of the developing world to primary energy consumption growth rose to approximately 90% in the same period, much faster than its contribution to economic growth.

This tells us something about OECD and non-OECD alike. The underlying reason is that in non-OECD economies energy intensity – the energy necessary to produce one unit of GDP – is still three times higher than in the OECD. In 2007, developing countries used 4.4 boe to produce \$1,000 worth of GDP, but the OECD only used 1.4 boe.

## Energy Growth Relative to GDP Growth



BP Statistical Review of World Energy 2008

© BP 2008

The relationship between GDP and energy demand illustrates how changes in primary energy consumption in both groups of countries are tied to changes in economic growth. In 2007, energy demand growth in relation to GDP growth slowed in the non-OECD, and grew in the OECD. We will discuss the reasons below.

The effect was not large enough, however, to alter the conclusion that changes in economic growth affect energy consumption more in the developing world than in the OECD.

Why then does growth in poorer countries require more energy? Why do they seem to be less sensitive to prices?

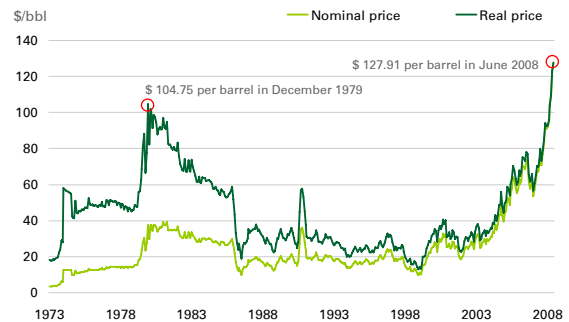
One set of explanations is that we see a rational response to prices, which initially increased least for coal; and an inelastic price response to oil, where the desire for transport fuels at rising incomes outweighs the effect of rising prices. Another would be the discovery of structural reasons or distortions, such as electricity growth, which account for a different price responsiveness in the non-OECD than in the OECD.

The answer lies in an analysis fuel by fuel.

We start with the key energy market, the market for oil. Oil is the fuel which has risen the most in price, and the least in consumption. It has the largest fuel share, and is the most traded fuel. Other fuels are tied to its price by contract, and there is no economic substitute for oil in transportation. Why has it become so expensive?

## 3. The Oil Market

### Real and Nominal Crude Oil Price



BP Statistical Review of World Energy 2008

© BP 2008

How high is the oil price? As an annual average, dated Brent rose by 11% to \$72/bbl last year, the lowest percentage increase since 2003. But it went up throughout the year, from \$59/bbl to \$96/bbl on the last day of trading – at 63% this was the highest intra-year rate of increase since 1999. And so far this year, prices have kept on rising.

In inflation adjusted terms, this is the highest price ever. Adjusted for efficiency gains – that is, the amount of oil needed to produce one unit of global GDP – it is almost, but not quite, at the previous peak in 1980.

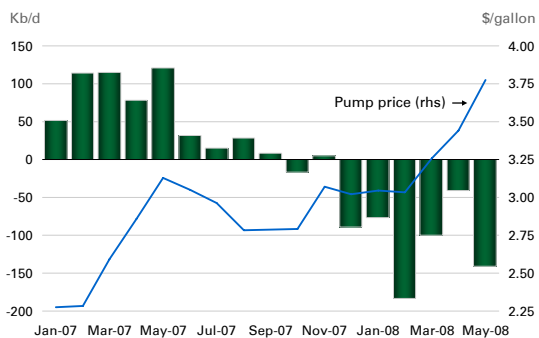
At these levels, one would expect demand to respond.

### 3.1 Oil Consumption Growth

Global oil consumption grew by 1 Mb/d, or 1.1%, in 2007, below the ten-year average of 1.4%. Two sources of rising consumption muted the demand response: Oil exporting countries and a number of fast growing non-OECD economies, including China. Viewed through a different lens, global consumption growth stayed positive in countries which subsidised oil products. Consumers in countries where prices are liberalized, and oil products are taxed, were first to be squeezed out of the global market place.

OECD consumption thus suffered its biggest decline since 1983. It fell for the second year, by 390 Kb/d or 0.9%. Non-OECD consumption growth, in contrast, accelerated for the second year running to 1.4 Mb/d, well above the ten year average.

## US Gasoline Consumption Growth



BP Statistical Review of World Energy 2008

Source: EIA  
© BP 2008

US consumption provides a good example for the wider picture in OECD markets. As pump prices rose from \$2.30 per gallon at the beginning of the year to \$3.00 at year-end, and then further into 2008, gasoline consumption contracted from growth of 100 Kb/d in early 2007 to a 140 Kb/d decline by May 2008.

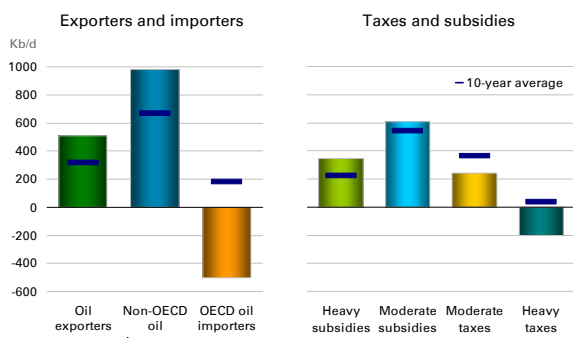
exporters declined (by 83 Kb/d), because of an exceptionally warm winter.

Each region has its own story to tell, but they all fit into the general pattern. Latin America grew above average; it is a net exporting region where power shortages added to oil demand. In the Middle East, high economic growth met high subsidies; in Africa, economic growth finally caught on.

One quarter of global consumption was consumed at subsidized retail prices last year. In the subsidizing economies, consumption growth exceeded the 10 year average by 190 Kb/d; in taxing economies, it fell short by 360 Kb/d.

In many emerging economies, the fiscal burden of subsidies has put strain on public finances. In 2008, a whole range of countries – India, Thailand, Indonesia, and Egypt among them – have had to adjust. If high crude prices are sustained, this tendency will put further pressure on demand.

## Global Oil Consumption Growth



BP Statistical Review of World Energy 2008

© BP 2008

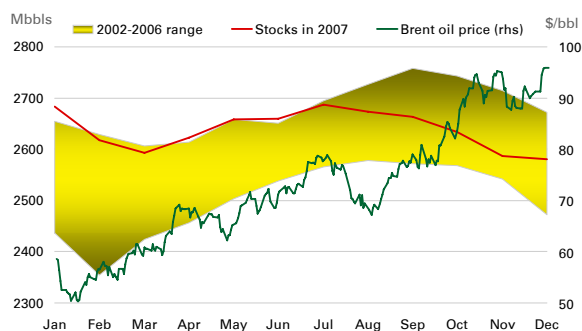
Last year's growth in non-OECD consumption had two components: fast growing emerging market economies, and oil exporters. With growth of 320 Kb/d China was the biggest source of non-OECD growth, although its growth rate slowed. Non-OECD consumption growth was led by Asia, with an increase of almost 600 Kb/d, more than half of which was in China and nearly one third was in India.

Worldwide, the consumption of oil exporters increased by 510 Kb/d or 3% in 2007. It surpassed growth in importing countries, despite the fact that consumption in the main Former Soviet Union (FSU)

Consumer subsidies were a market distortion last year, which may help explain why oil demand in the non-OECD was less responsive to price changes than in the OECD. But to understand the impact on the oil price, one needs to turn to the supply side.

## 3.2 Market Developments in 2007

### OECD Commercial Inventories



BP Statistical Review of World Energy 2008

Sources: IEA, Platts  
© BP 2008

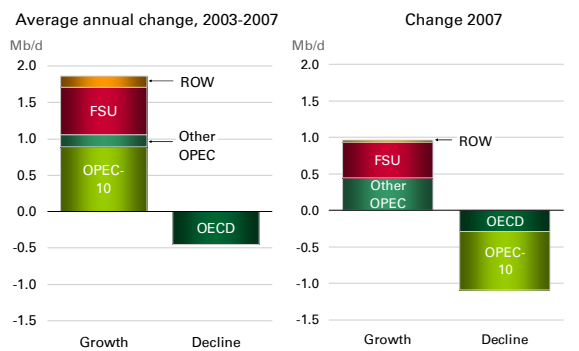
If there was a defining moment in oil markets in 2007, it was the re-emergence of OPEC in successfully managing its production. After prices had fallen rapidly in late 2006 and early 2007, when the OPEC price basket breached \$50/bbl, two cuts

were implemented, the latest and biggest one in February 2007.

The decline in production drained OECD inventories over the second half of the year. By September 2007, inventories had fallen from eight year highs. Future prices moved into backwardation (with spot prices exceeding future prices). Ever since the second cut in February, crude prices have been on the rise.

Total oil production in 2007 fell to 81.5 Mb/d in 2007, 130 Kb/d below the 2006 level. OPEC output fell by 360 Kb/d, but this hides a much larger decline of 900 Kb/d in crude output among those countries which participated in production cuts – mostly Saudi Arabia, which took on 40% of the cuts, UAE, Kuwait and Venezuela –, offset by growth in Angola, Iraq, and NGLs (which are not subject to quota). OECD production fell by about 290 Kb/d. Combined these offset an increase of 520 Kb/d in the rest of the world, almost all of it in the Former Soviet Union.

### World Oil Production Changes



BP Statistical Review of World Energy 2008

© BP 2008

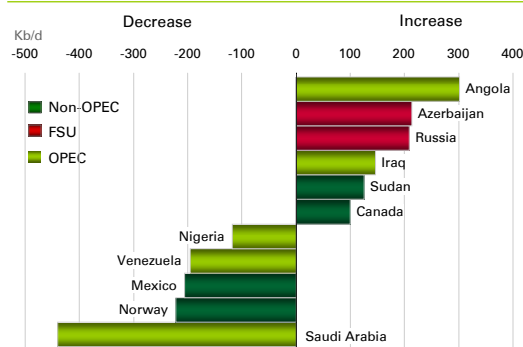
In September, as prices continued to increase, OPEC announced a net 500 Kb/d increase in production effective November 2007. However, the immediate impact was neutralized by maintenance in Abu Dhabi, and this year partially offset by outages in Nigeria. For the first four months of 2008, average OPEC-10 crude output was 850 Kb/d above the 2007 average.

Why have six years of rising prices not triggered a much larger supply response elsewhere?

Part of the answer is that OECD production continued to fall, although at a moderating pace. UK growth was flat after seven years of decline. Canadian production grew by 100 Kb/d, of which 70 Kb/d was from oil sands, and US production increased for the first time since 1991 (40 Kb/d). But these could not outweigh accelerating decline in Mexico (210 Kb/d), and in mature fields in Norway (220 Kb/d).

### 3.3 Supply

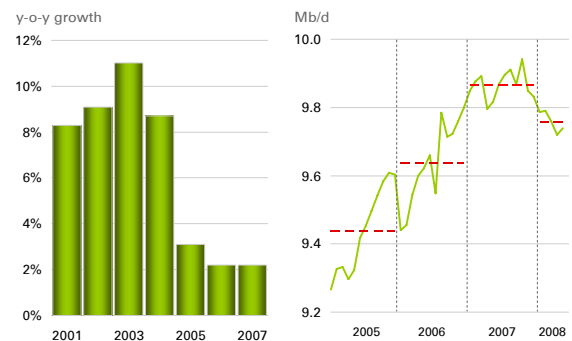
#### 2007 Oil Production: Largest Changes



BP Statistical Review of World Energy 2008

© BP 2008

#### Russian Oil Production



BP Statistical Review of World Energy 2008

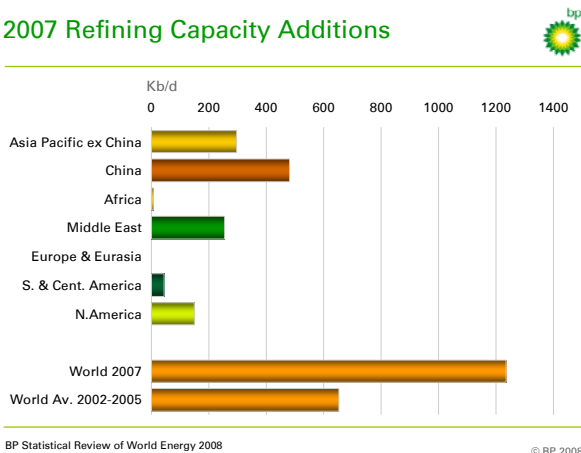
Source: Russian Ministry of Industry and Energy © BP 2008

The only grouping where output increased substantially was the Former Soviet Union. And here, a major shift is taking place. Russia's production, still up 210 Kb/d for the year, has since January 2008 been in year on year decline – mostly due to an unattractive tax system and lack of investment in new fields. The ramp-up of production in Azerbaijan by 210 Kb/d was able to mitigate Russia's slowdown.

Bottlenecks in refining have in the past been blamed for the rise in crude prices. Has this changed?

### 3.4 Refining

#### 2007 Refining Capacity Additions



Global refining margins did establish another record last year. Light-heavy spreads remained wide and widened again into 2008, when fuel oil values could not keep pace with the escalating price of crude. Declining product stocks last summer, as the OPEC cuts worked their way through the system, protected refining margins for a limited time even as demand started to weaken.

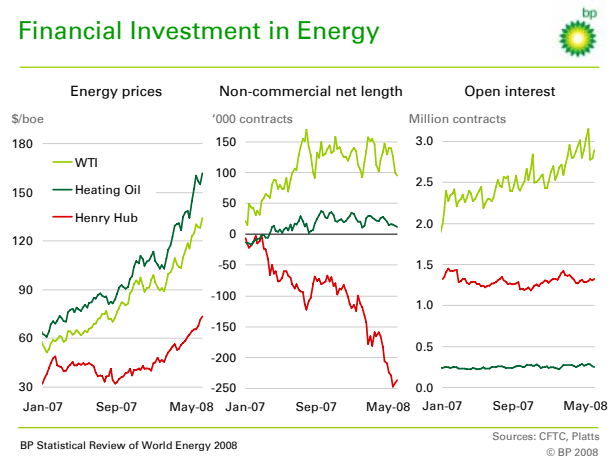
Nevertheless, ethanol supply is growing and gasoline exports from Europe are plentiful. As a result, gasoline cracks have hit record seasonal lows in Rotterdam – while pump prices are at record highs on both sides of the Atlantic. Consistent with dieselisation in Europe and the global expansion of commercial transport, middle distillate demand in 2008 is rising further, and gasoline demand is reeling.

Meanwhile, global refining capacity is being added about twice as fast as earlier this decade. Capacity additions in 2007 totalled 1.2 Mb/d and exceeded crude run growth by more than 400 Kb/d. Most of the new capacity was installed in Asia, 60% of which (480 Kb/d) was accounted for by China, and in the Middle East (250 Kb/d). Global utilisation rates have slipped to their lowest since 2003. By and large, the discussion on whether crude oil prices increases are caused by a lack of refining capacity has ceased.

### 3.5 Financial Investment

Another issue in the public debate has been the role of financial “speculation” in bringing up crude prices.

#### Financial Investment in Energy



Financial investment in energy and other commodities has increased sharply. The available data is incomplete, but NYMEX indicators do provide a perspective on this question.

Total open interest on the NYMEX crude contract (futures and options) has roughly tripled over the past five years. Non-commercial participants, often viewed as a proxy for “speculative” activity, have consistently been net buyers of crude.

However, the comparison of investment profiles across fuels shows an ambiguous connection between financial investment flows (“open interest”), their positioning (“net length”) and fuel prices. In crude oil, non-commercial net length has remained fairly stable over the past year, although total open interest continued to increase, along with prices. Heating oil open interest and non-commercial net length has changed little, but heating oil prices have increased more rapidly than crude oil. Similarly, natural gas open interest was flat in 2007 and so far this year, even though natural gas prices surged. In sharp contrast to crude oil, non-commercial traders have increasingly become net sellers of gas.

In summary, it is difficult to establish a causal relationship. The data indicate that financial markets don’t create underlying fundamentals or the changing perceptions about risk or future trends. They reflect them.

### 3.6 Oil: Summing Up

Oil prices rose the most because it is a constrained market. First, the supply response has been muted: in 2007, OPEC controlled production; while over the



longer term a muted supply response has been facilitated by above ground problems in member states such as Iran, Iraq or Nigeria.

Second, supply was affected by an increase in state control and limits to access for private investment in other large provinces, of which Russia is a good example.

Third, natural decline in OECD provinces, exacerbated by the limited scalability of biofuels and heavy oil, has accentuated restrictions in provinces still open to private investment.

Constrained industrial capacity and cost inflation have furthered hampered project implementation.

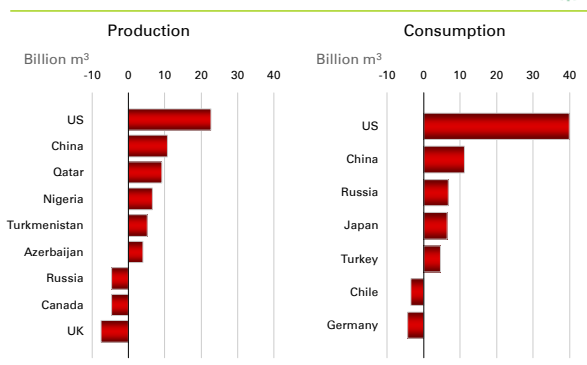
Global demand has been dominated by the effect of high incomes growth more than by price effects, partially because the share of consumers with subsidised retail prices has risen to new heights.

As a result, fundamentals and long term expectations have been changing. Financial markets are not able to trigger these developments, but they are capable of following them – and of course, are perfectly capable of accelerating movements up or down.

Did other fuels experience similar constraints?

## 4. Other Fuels

### 2007 Natural Gas: Largest Changes



BP Statistical Review of World Energy 2008

© BP 2008

Natural gas is in transition between being a regional fuel, where consumers and producers are connected via pipeline systems, often based on a legacy of long-

term bilateral contracts; and a globally integrated market where LNG cargoes acquire flexibility in destination and short-term pricing. Beyond the broad numbers, these structural changes provide the backdrop for the most important trends in 2007.

### 4.1 Natural Gas

Gas consumption grew by 3.1% in 2007, the only fossil fuel where growth accelerated. The weather played a role in different regional outcomes; relative price changes and fuel substitution were other important ingredients.

The largest increment worldwide came from the US, where domestic production – increasingly of unconventional gas – surged by 23 Bcm in a lagged response to high prices. The US also saw the largest increment in consumption (40 Bcm, or 6.5%), driven by cold weather and the continued discount to residual fuel oil. Europe was at the other extreme – a warm winter led to a decline in consumption of 8 Bcm in the EU, just balanced by a lower than usual increase of 8 Bcm in the FSU.

Production declined in Europe (with the exception of Norway) and in Russia. Improvements by other FSU countries, especially in Azerbaijan, kept overall FSU production positive, albeit at the lowest growth rate since 2001. The depletion in the North Sea and mature Russian fields were one source of low production; low demand, as European spot prices reached record discounts to contract prices, was another.

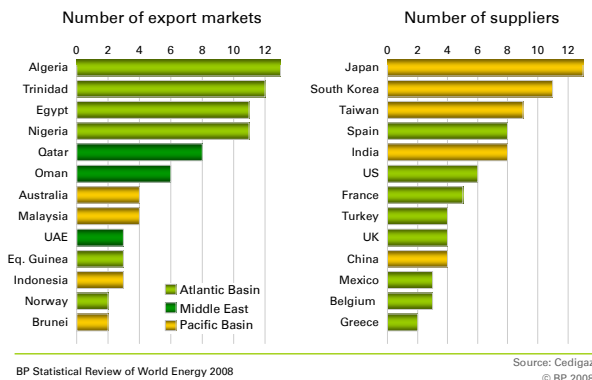
The second largest increase in production (18 Bcm) and in consumption (27 Bcm) was in Asia Pacific. 60% of the increase in production and 41% of the increase in consumption came from China – which nevertheless retained a very low share of only 3.3% of natural gas in total energy consumption.

#### 4.1.1 International Trade

The decline of consumption in Europe and disruptions in South America meant that global pipeline trade stayed flat as a share of production (19%), despite strong growth in North America, Asia and the Middle East.

LNG trade grew 7.3%, slower than over the last few years, but enough to raise its share in total gas production to 8% and in total gas trade to 29%.

## 2007 LNG Market Diversification



BP Statistical Review of World Energy 2008

Source: Cedigaz © BP 2008

Global LNG trade is becoming more integrated. The most diversified suppliers are in the Atlantic Basin, from where they export globally. Asian suppliers typically serve a smaller number of customers; none of them exports to the Atlantic basin.

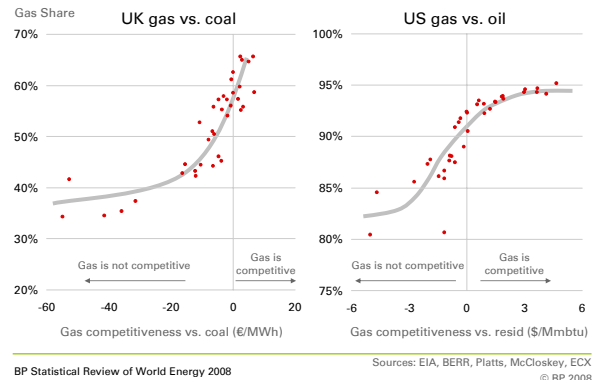
The ability of Atlantic basin suppliers to switch was demonstrated in 2007, when supplies to Asia Pacific doubled, in response to higher prices. After nuclear outages caused a sudden increase in the demand for power generation fuels in Japan, LNG imports increased by 8.5% or 7 Bcm, the largest increment in 2007. Japan constitutes the world's largest market for LNG, and also has the most diversified supply portfolio.

In contrast, interruptions and knock-on effects in 2007 highlighted the risk of bilateral pipeline trade. Iran stopped gas exports to Turkey in late autumn, after Turkmenistan cut gas exports to Iran. Chile was left empty handed when production growth in Bolivia, Brazil and Argentina slowed but consumption in all three countries grew strongly.

### 4.1.2 Substitution

Greater flexibility in LNG trade is adding a new dimension to traditional fuel-switching, as relative fuel prices change. Japan provided one example in 2007, Europe provided another.

## Fuel Switching in Power Generation 2005-07



BP Statistical Review of World Energy 2008

Sources: EIA, BERR, Platts, McCloskey, ECX © BP 2008

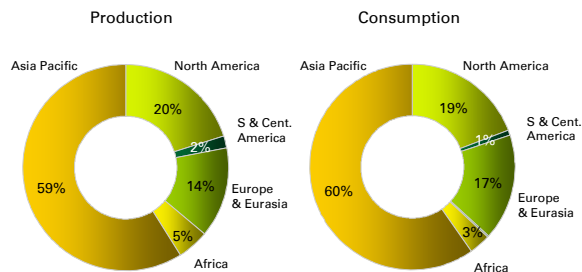
When European spot prices were particularly weak in the first half of the year, gas substituted for coal and oil in power generation. This was most evident in the UK power sector, where gas consumption increased by 25% in the first half of 2007 at the expense of coal, which fell 22%.

In addition to local fuel-switching, low European spot prices created an incentive to switch flexible LNG supplies to the US market. The resulting flow helped to keep Henry Hub gas prices low relative to oil prices, and so encouraged fuel switching out of oil in the US. Comparisons with 2006 are masked by that year's mild winter, such that changes relative to 2005 give a more representative picture: Compared to 2005, oil use in power generation in 2007 declined 224 Kb/d, while gas consumption rose 500 Kboe/d.

### 4.2 Coal

Demand in power generation helps to explain why demand and prices for coal have risen in the OECD, but why such a strong price increase for coal in 2007 and 2008? If coal is available everywhere and in sizeable quantities, why was there not more of a supply response?

## 2007 Coal Production and Consumption



BP Statistical Review of World Energy 2008

© BP 2008

Coal was once again the fastest growing fuel in 2007, with consumption increasing by 4.5%. More than 50% of the increment in global primary energy consumption is from coal, and more than 70% of this increase is growth in China – almost 40% of global primary energy growth therefore originates from one fuel in one country.

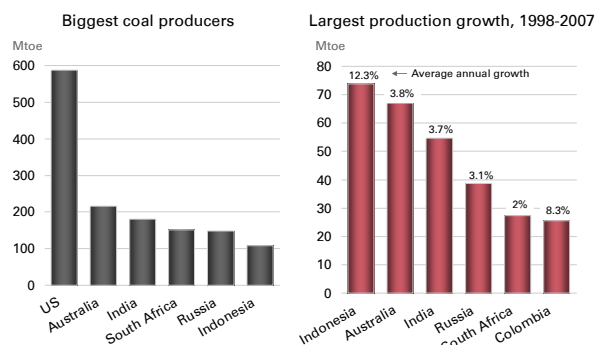
Like GDP and primary energy growth, coal consumption growth slowed in 2007. A strong spurt in US growth (1.4%) was neutralized by decline in the EU, the FSU and the Middle East. Global consumption decelerated because China grew at 7.9% – its lowest growth in percentage, and in volume terms, since 2002.

### 4.2.1 International Trade

Coal markets are both highly concentrated by size, and very local at the same time. China accounts for 41% of global consumption and 41% of production, the US for 18% of consumption and 19% of production. The next four biggest producers have a combined share of 22%, and the next four biggest consumers a share of 17% – but three out of the four overlap: they are in both the producer and consumer categories.

Correspondingly, global trade in coal is small, equivalent to only 15% of global consumption. This simple structure is changing, as countries learn how to exploit their comparative advantages better. Trade is increasing.

## Coal Production Outside China



BP Statistical Review of World Energy 2008

© BP 2008

Over the last ten years, four countries (Australia, China, India and Indonesia) accounted for 95% of the increase in global coal production (1,557 million tonnes). However, this happened for very different reasons: In China (1,164 mt) and India (159 mt), growth was driven by domestic demand; in Australia (114 mt) and Indonesia (120 mt), it was led by exports.

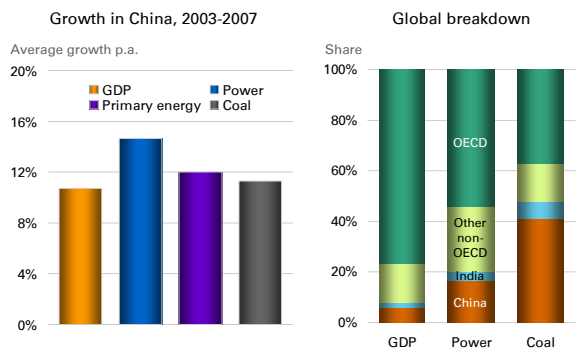
A sample of the five biggest coal exporters outside China (Australia, Indonesia, South Africa, Colombia and Russia) shows that fully 88% of the growth in production since 1997 has been produced for export. In Russia for example, which has privatized and liberalized coal markets (and cheap gas), production grew by 3.1% p.a. over the last ten years, while consumption fell by 1.2%.

But transport and infrastructure facilities have not kept pace with this expansion. Worldwide infrastructure bottlenecks became apparent in 2007, exacerbated by bad weather conditions. Exports suffered from congested transport facilities or mine closures in Indonesia, Australia and South Africa.

As a result, prices for traded coal outpaced domestic prices, and shipping and freight rates reached record levels.

## 4.2.2 Coal in China

### GDP and Power Generation



BP Statistical Review of World Energy 2008

© BP 2008

The aggregate numbers continue to be dominated by China. But China also provides an illustration for the prerequisites that make market adjustment happen.

China ended the dual pricing system for coal in January of 2007, and liberalized domestic prices, which duly rose over the course of the year. The price changes were part of a drive toward greater efficiency improvement in the coal sector.

They were flanked by measures to limit net exports, including higher export duties for coking coal, and the abolition of import duties for steam coal on June 1. As a result, China's exports of coal fell by 16%, and imports surged by 33%. The country was barely a net exporter in 2007.

Generally, the drive to raise efficiency meant continued investment in new mining and rail capacity, as well as continued attempts to take smaller, less efficient mines off line.

However, coal price liberalization was not accompanied by freeing up consumer prices for electricity. Money-losing power generators responded by running down inventories, leaving the system vulnerable. For a brief period in the aftermath of the snowstorm last January, the government stopped export shipments. A massive effort at mobilising domestic coal for power generation unfolded, sometimes contradicting efficiency targets.

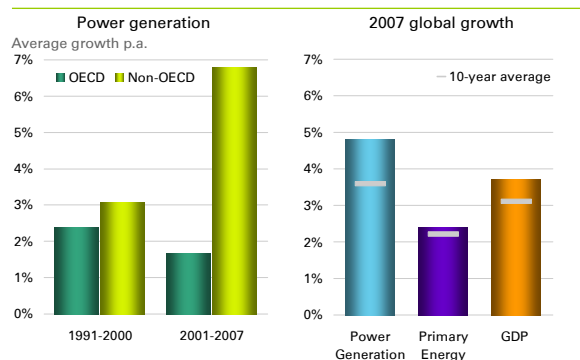
In 2007, economic growth in China was 11.9%, and power generation grew by 15.6%, but coal growth, at 7.9%, was much slower. The official data suggest a

mix of successful policy efforts to improve energy efficiency, a rise in the share of coal for power generation, and increased use of oil and gas to the same effect.

Thus, the global supply of coal continued to respond to increased demand; in 2007, this response was facilitated – and triggered – by the continued rise in the trade of coal, and domestic market liberalization, notably in China. However, both could not display their full potential: The internationalization of coal ran into infrastructure problems; and Chinese market liberalization, while improving efficiency, was marred by an inability of power generators to pass on higher prices.

## 4.2.3 Power Generation

### Power Generation and Primary Energy



BP Statistical Review of World Energy 2008

© BP 2008

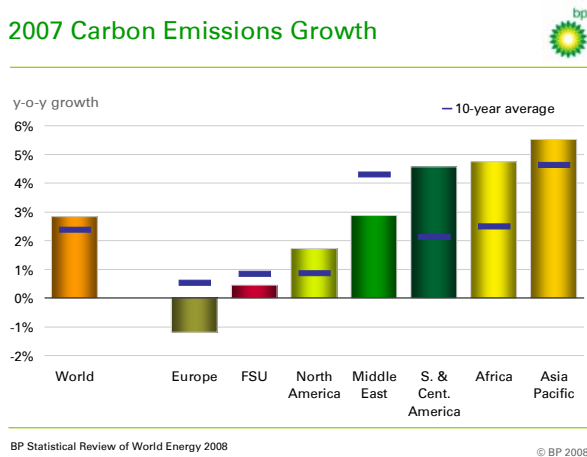
This leads back to an earlier question – are there structural reasons for high non-OECD energy demand growth? The strong demand for coal in the non-OECD matches the comparatively low increase in relative price over the medium term, and also the local availability of fossil fuels. However, there is a structural reason for the shift into coal as well. For most of the developing world, high economic growth means to move labour from agriculture into industry. Building up an industrial infrastructure requires electrification. Accordingly, power generation in the developing world is surging.

The decade before the Millennium compared with the years thereafter saw OECD power generation growth slow from 2.4% to 1.6% per annum, while non-OECD growth doubled from 3.1% to 6.7%. China supplied the lion's share of this surge, doubling its share in global generation to 16% in 8 years.

Calculating the share of electricity from fossil fuels shows it rising, driven by strong growth in the non-OECD segment. The supply of electricity has become a major driver of fossil fuel growth.

### 4.3 Carbon Prices and Emissions

#### 2007 Carbon Emissions Growth



Growth in global consumption of fossil fuels implies growth in carbon emissions. Based on energy consumption and standard conversion rates – and with the caveat that our estimates therefore are not comparable to official data – we estimate that carbon emissions from energy use in 2007 grew by 2.8%.

The warm winter and the decline of oil, gas and coal consumption in Europe meant that Europe became the only region where carbon emissions fell in 2007 (by 1.2%), for the first time since 2002. In North America emissions grew 1.7%, as consumption of coal and gas accelerated. Chinese carbon emissions rose by 7.5% – below the five-year average of 12.1%, in line with lower growth of coal and oil consumption.

Global carbon markets continued to grow, led by the EU Emissions Trading Scheme, which nearly doubled its trading volume and value. Although small compared to energy markets, global carbon markets saw a 71% increase in the volume of carbon and a 105% increase in value, summing up to \$64 billion in turnover.

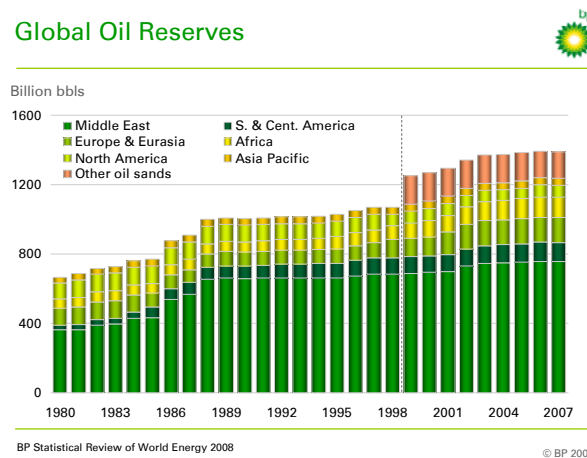
Both short term substitution at the burner tip, or by changing the order in which power plants dispatch electricity, as well as long term substitution through a change in the composition of available power plants will be affected if carbon prices are high enough. Oil-

indexed gas prices were not competitive with coal in 2007. However, with the start of Phase 2 of the EU ETS, this appears to be changing.

Have there been other developments in 2007, which changed the global energy picture? Notably, has anything changed in the amount of reserves, and where do we stand in the effort of increasing the contribution of non-fossil fuels, and of renewable energy in particular?

### 4.4 Reserves

#### Global Oil Reserves



Since we have been tracking the data, the world has added more in proved reserves than it has used in oil production. In terms of years at current production rates, oil reserves are equivalent to 42, natural gas 60, and coal 133 years.

Global proved oil reserves fell slightly in 2007, by 0.1%, and stand at 1.24 trillion barrels. But this is the result of reporting lags forcing us to roll over 2006 data. As is usually the case, the 2006 decline reported in last year’s Statistical Review has now been revised up by 31 billion barrels, as new data came in.

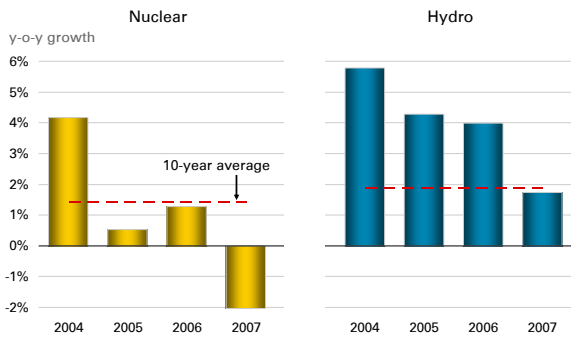
Oil reserves remain concentrated. The top ten reserves holders account for 81% of the total, OPEC members hold 76%, 10% are in the FSU. The OECD’s share has edged up due to growth in Canadian proved reserves of oil sands, as the Albertan government doubled the estimate of reserves “under active development” to 21 billion barrels. Similarly, Venezuela increased official reserves by 7 billion barrels after an updated assessment of extra-heavy oil in the Orinoco. Brazil’s

reserves increased with greater deepwater activity; however, our figures exclude the recent Tupi discovery, which has not yet been recorded as a proved reserve. Qatari reserves were revised up by 12 billion barrels to update condensate and NGLs reserves in the North Field.

Global proved natural gas reserves rose by just over 1 Trillion cubic metres in 2007, or 0.6%, to stand at 177.4 Tcm. Reserves in the Middle East and FSU dwarf other regions, with 41% and 32% of global reserves, respectively. Growth last year came largely from the re-evaluation of earlier discoveries, led by Indonesia, Iran and China.

## 4.5 Hydro and Nuclear

### Changes in Nuclear and Hydroelectric Output



In 2007 global hydroelectricity production increased by just 1.7%, well down from the 4% growth in both 2005 and 2006. Drought conditions in the US reduced hydroelectric production by 14% – partially offsetting strong capacity growth in China, India and Brazil.

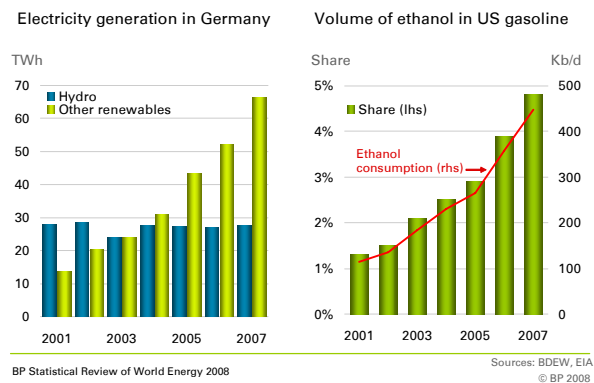
Nuclear power generation declined by 2% in 2007, the largest one-year decline since 1965. One-off factors account for more than the entire net decline, including an earthquake in Japan, unexpectedly long maintenance time in Germany and the UK, and unscheduled maintenance in France. In addition, seven European reactors were permanently shut at the end of 2006, in pursuit of opting out of nuclear energy.

Four new reactors were brought on line in 2007, in China, India, Romania and in the US (which restarted a reactor taken out of service in 1985). The high number of construction start-ups is evidence for the

renewed interest in nuclear energy. Construction was begun on seven new units: two each in China, South Korea and Russia, and one in France.

## 4.6 Renewables

### Renewables



For renewable energy, the basic constellation has not changed – it continues to expand rapidly, and with government support, but from a very low base. However, progress over the years means that in some countries, renewables have grown enough to make a significant contribution. Examples are ethanol in Brazil and the US, and wind power in various European countries.

At 920 Kb/d in volumetric terms, or 0.7% of total oil consumption, global ethanol supply at the margins has had an impact on US and Brazilian gasoline consumption and refining. However, this obviously was not yet enough to tip the tight balance in global oil markets described earlier.

Available estimates suggest a share of around 1-1.5% of global power generation from wind, solar and geothermal power. Under current fuel shares, this would have but a small contribution to reduced global carbon emissions from energy. However, in Denmark, Portugal, Spain and Germany, wind has become a double-digit contributor to power generation, at least in terms of capacity.

---

## 5. Conclusions

market forces and competition to complete what liberalization of global energy markets has started.

### Conclusion



- High economic growth and improvements in energy intensity
- Importance of developing world
- Oil market constrained, gas market integrating, global coal market emerging
- Prices are effective, where allowed to work

Where does this leave us?

I started out with the question of why energy prices are high. On a basic level, it is not that complicated.

The global economy has become more flexible in combining high economic growth with lower energy intensity. This makes sense, especially if one recalls that the timing of this improvement coincides with market reforms replacing central planning, which 30 years ago controlled one third of the world's population.

In the developing world, energy consumption growth is a more important companion of economic growth than in the OECD economies. At least in part, this is for structural reasons, such as the high need for electricity which comes with industrialisation; and it is also the desire for transport fuels which comes with higher income levels.

Of the three major fuel markets, oil, the most important one, is subject to constraints which limit the ability of private investment to go and do what it does best – create adequate supply. However, the other two are in transition to internationalisation and global integration. They are creating a supply response, although it is limited in both cases, as infrastructure limitations and regulations have not kept pace.

I said we make no predictions. And I won't. Let me just conclude that a lot rides on whether we allow