



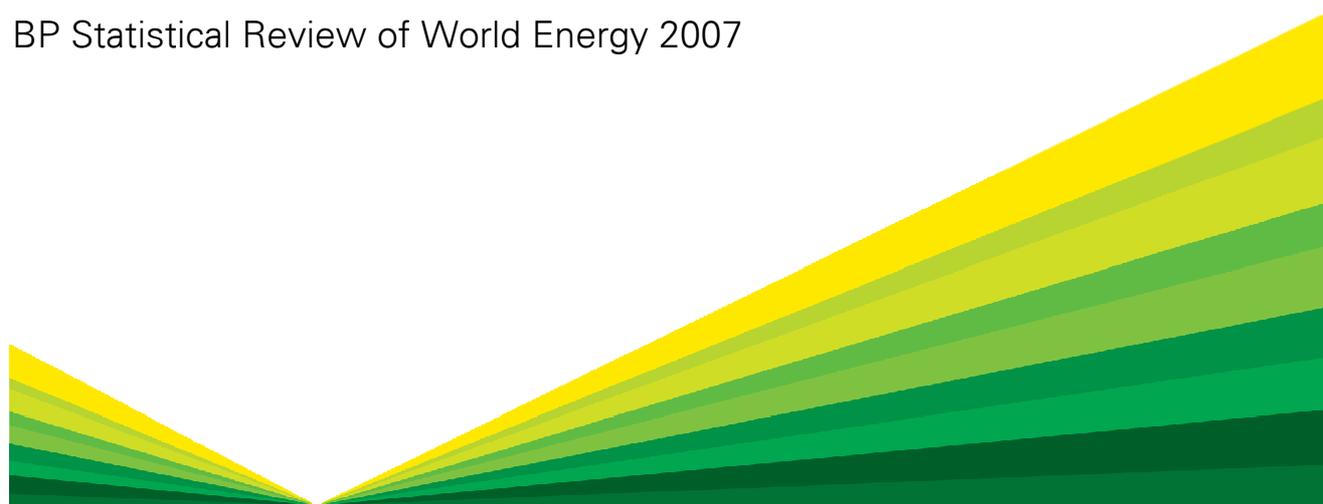
# BP Statistical Review of World Energy 2007

Christof Rühl  
12 June, 2007

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## Contents

1. Introduction
2. What Has Changed? The Medium Term
3. What is New? 2006 in Review
4. Energy Developments by Fuel
5. Conclusion



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London • June 2007

## 1. Introduction

### Outline



- Introduction
- What Has Changed? The Medium Term
- What is New? 2006 in Review
- Conclusion

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Energy has very much been in the spotlight in recent years. One way or another, the reasons usually lead to the increase in prices and the acceleration in energy consumption growth we have witnessed over the last few years.

Based on the data published in this year's *Statistical Review of World Energy*, I will look at recent energy developments from two perspectives. I first look at medium term developments by comparing the last five years with earlier periods. Then I focus on what changed from the beginning of 2006 until now, and why.

Looking through the first lens reveals the magnitude of the changes that have taken place – as global economic growth accelerated, energy consumption grew faster in relation to GDP than in earlier periods, despite higher prices. Looking through the second lens reveals the impact of high energy prices and suggests the possibility of a return to a less energy intensive mode of global economic growth. Both views have important implications, not least for the growth of global carbon emissions.

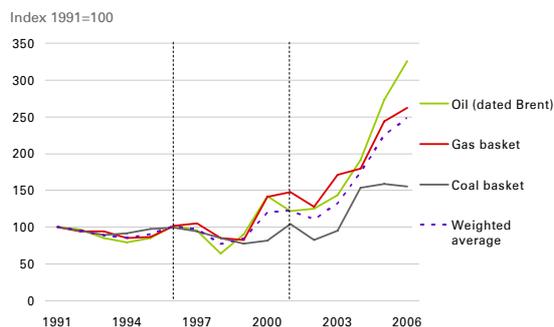
My aim is to provide a rigorous analysis, to understand what has happened, and why.

## 2. What Has Changed?

I want to start by assessing the energy experience over the last five years, 2001 through 2006, and by comparing this period with earlier periods. The objective is to provide the context for more recent energy developments.

The challenge in addressing this question is that the world has not stood still. The last five years have been a period of strong global economic growth. The previous 5 years – 1996 through 2001 – were dominated by the Asian financial crisis and China's coal restructuring. The early 1990s saw the collapse of the Soviet Union and its economy and energy sector. In light of these factors and the reality that history does not divide neatly into 5 year periods, what has happened in world energy markets? How have key forces changed?

## Energy Prices



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The best starting point is the price of energy. The price of all forms of commercially traded energy has increased substantially. Recent energy prices have been significantly different from previous experiences.

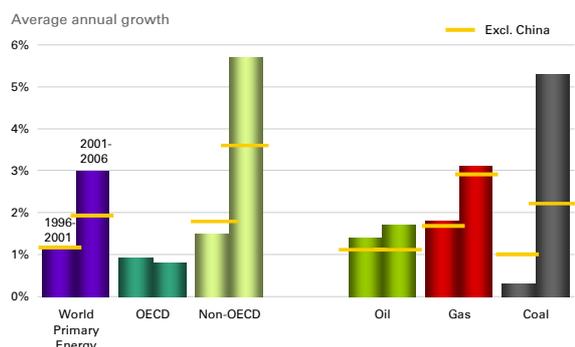
Energy prices were stable during 1991 - 96 in the face of adequate and growing supplies. But this did not last. Growing supplies were supplemented by lower demand due to the Asian financial crisis. Oil prices, in particular, slumped to \$10/bbl. However, OPEC actions rebalanced the market and prices recovered to levels above those of the early 1990s. Gas prices followed oil prices as a result of the end of the US gas bubble and indexation to oil in other markets. Coal remained in adequate supply. By 2001 a weighted average of hydrocarbon prices had increased by 59% from the trough of 1998. However, the average increase for the full five year period of 1996 - 2001 was only 8%.

The last five years have seen exceptional energy prices. The price of oil has gone up each year during this period, despite now rising surplus production capacity. Gas prices have tended to follow, especially in the oil price indexed markets of Europe and Asia Pacific. However, gas prices in the more competitive liberalised markets of the US and UK have seen periods of decline in face of weak demand and an increasing availability of imported natural gas. Coal prices have risen globally but not as much as oil or gas – and in recent years have essentially stabilised.

On average for the last five years, oil prices have more than doubled; gas prices have risen 75% and an average of coal prices has increased by 46% compared to the average of 1996 - 2001. Forward prices indicate that many market participants expect to see high energy prices sustained for at least the rest of the decade.

The next dimension is that of energy consumption growth.

## World Energy Consumption Growth



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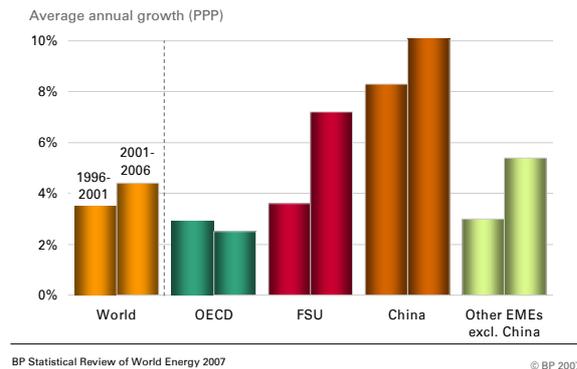
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We can firstly observe that the consumption of all fuels except nuclear accelerated in the 2001 - 06 period compared to the previous five years. That implies that world primary energy consumption accelerated from 1.2% p.a. in the 1996 - 2001 period to 3% p.a. during the period 2001 - 06. China alone generated almost half of the world's energy growth over the last 5 years and thus dominated the global aggregate data. Nevertheless this acceleration also occurred in the world outside China – from 1.2% to 1.9% p.a.

Importantly, this was a non-OECD phenomenon. Energy consumption growth in the OECD slowed, but accelerated elsewhere – in Asia Pacific, Africa, the Middle East, the FSU and in South and Central America.

How can we reconcile rapid increases in energy prices with accelerating consumption growth?

## World Economic Growth

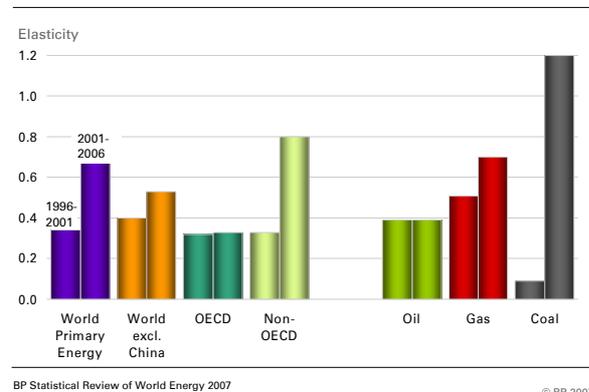


The first part of the answer is economic growth. Over the last five years the world economy has grown strongly. Measured at 'Purchasing Power Parity' exchange rates (PPP) global economic growth averaged 4.4%. This exceeded the 3.5% average in the 1996 – 2001 period. And it is the strongest five year period since the 1960s.

The acceleration of growth was concentrated outside the OECD, most notably in China, and it occurred despite rising energy prices. OECD economic growth actually slipped to 2.5% p.a. on average, with slower growth in both the US and EU.

The question then becomes – to what degree can economic growth explain the rise in energy consumption growth? To analyse this relationship we can consider energy elasticities – the ratio of energy growth to GDP growth. When elasticities increase, economic growth is increasingly energy intensive.

## Income Elasticities of Energy Demand



Even with higher average energy prices, energy elasticities have been higher over the 2001- 06 period than during the previous five years. In other words, energy consumption grew faster relative to GDP growth from 2001 through 2006 than in the previous period. And this conclusion holds even if China is excluded from the calculation. It also holds when compared to the 1991 - 96 period, although this data is significantly affected by the FSU declines.

Oil stands out as the only fuel where income elasticities remained constant in 2001- 06. It is not a coincidence that oil demand growth was relatively weak when oil prices rose more than those of other fuels.

And again, all this does not apply to the OECD. Here a slowdown in economic growth was matched by a slowdown in energy consumption growth. The OECD's demand for additional energy in relation to GDP growth was unchanged, whereas outside the OECD this elasticity increased. Economic growth in the developing world thus tended to be more energy intensive, despite higher energy prices. Economic growth in the OECD has tended to be relatively less energy intensive – most consumers already own cars and are adequately heated and cooled.

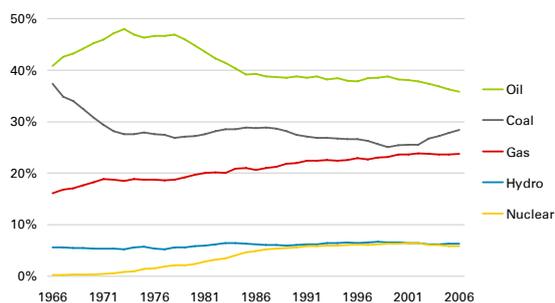
However, industrial activity in the OECD over this period also shows a reduction in energy intensive industrial sectors and an increase in the share of less energy intensive sectors. There appears to have been a combination of the effect of high prices and of a longer term structural change. The aggregate data, of course, mirror two effects: changes of the energy mix within countries; and changes in the weight of countries in global energy consumption.

So, part of the acceleration of energy growth can be explained by economic growth – but not everything. Economic growth is still the main driver of energy consumption growth. But, if anything, the relationship between economic growth and energy consumption has strengthened rather than weakened. There is a specific China story. But there is also a difference in the energy intensity of economic activity and growth between OECD and non-OECD countries. And it appears that the price effects that dampen energy consumption have been bigger in the richer and more open markets of the OECD.

## World Fuel Shares



Share of global primary energy consumption



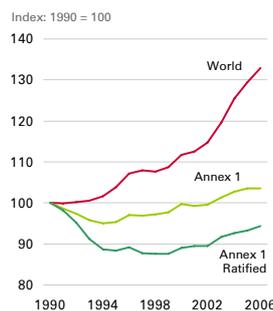
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## Carbon Emissions

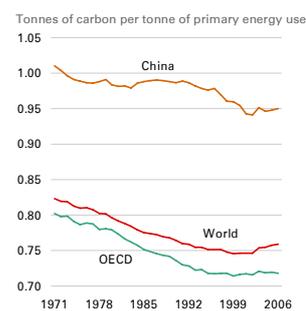


World Carbon Emissions



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Carbon Intensity



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I now want to consider the consequences of the acceleration of energy growth outside the OECD, first by asking what happened to fuel shares. From the mid-1980s to the late 1990s the answer was clear. Natural gas was the preferred fuel, especially in power generation. It gained market share, primarily at the expense of coal, while the shares of oil, nuclear and hydro were relatively constant. However, in recent years this has begun to change, partly as a result of price changes and partly as a result of Chinese developments.

On a global basis coal has regained market share and become the fastest growing fuel. This is a result of the surge in Chinese coal use and the end of the backing out of coal in the rest of the world as the change in relative prices improved coal economics. Outside China, coal's share stabilised. Gas's share of total energy has stabilised globally. Gas is still the fastest growing fuel in the world outside China. But the surge in Chinese coal use has been so large, that it has more than offset the strength of gas. Oil meanwhile has begun to lose global share. This reflects the fact that oil prices have risen the most – and also the strength of electricity and other static sector energy demand, as against transportation. Electricity consistently grows faster than primary energy consumption everywhere, and faster outside, than inside, the OECD.

The US experience has been different. High natural gas prices have weakened gas consumption and reduced its share. Oil has actually gained share slightly in the US as industrial energy consumption, especially of natural gas, has declined.

All of this has implications for carbon trends. Energy consumption growth has been strong and coal has gained market share. The growth in world carbon emissions from hydrocarbon consumption has increased to 3.4% p.a. since 2001, three times the rate in the previous 5 year period. North America was the only region or grouping where emissions growth slowed.

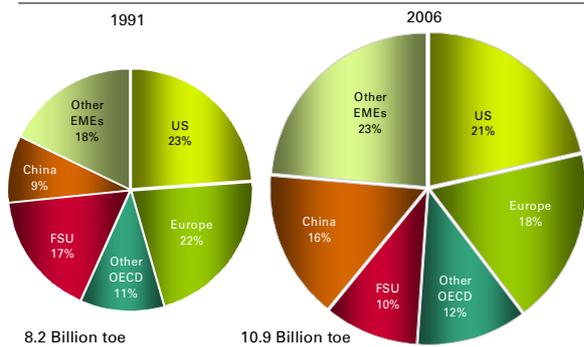
Energy consumption has also become more carbon intensive – that is, carbon emissions have risen more rapidly than energy consumption. After falling steadily from 1970 to 1996, the world's average carbon intensity of energy flattened in 1996 - 2001 and has been increasing since then. The world remains squarely on a trajectory of rising CO<sub>2</sub> concentrations despite the growing international consensus that action is required.

To be clear, in this paper we have as an approximation estimated carbon emissions based upon consumption of fossil fuels, using standard conversion rates. This does not allow for any carbon that is sequestered, for other sources of carbon emissions, or for emissions of other greenhouse gases. Our emission data may therefore differ from other sources.

Meanwhile concerns about energy security have grown. Part of this has resulted from higher energy prices. Part stems from growing unease about geopolitical trends and events. But there have also been concerns about changing energy geography.

What has been happening?

## Shares of World Energy Consumption



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There is an ongoing realignment of both energy demand and supply and, as a result, of energy trade. It has been driven predominantly by the process of economic development, especially outside the OECD, and by the maturing of the hydrocarbon resource base, mainly within the OECD. The balance of energy markets and energy production is shifting geographically.

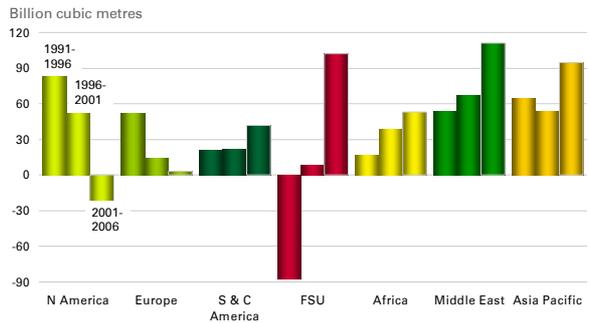
The change in the structure of world energy consumption is dominated by China. China alone generated 46% of world energy growth in the 2001 - 06 period, of which 73% was coal. This raised China's share of world energy consumption to 16%, up from 9% in 1991. The early 1990s saw a collapse in energy consumption in the former Soviet Union, even though its share has begun to edge up again. At the same time, slow energy growth in the OECD has reduced its share over this period by some 5.5 percentage points to below 52%.

There is a parallel, but different, shift in energy production. China's coal consumption is predominantly supplied domestically. China has as a result generated 73% of the growth of world coal production since 2001 and now produces 40% of the world's coal.

## Regional Growth of Gas Production



5 year cumulative changes in natural gas production by region

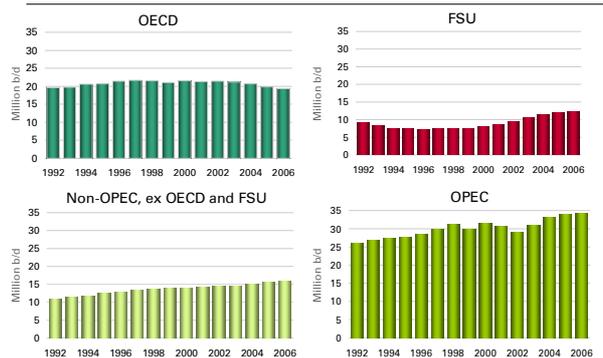


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Gas has become increasingly internationalised as both LNG and long distance pipelines have been developed. In 1991 only 15.7% of gas production worldwide crossed an international border (outside the CIS). By 2006 this has increased to 26% – a volume growth of 6% a year on average. In the early 1990s gas production was increasing in every region outside the FSU. Over the last five years North American production has fallen by 3% while European output has flattened. The biggest production declines have been in the world's largest and the fifth largest markets for natural gas – the US and the UK. Meanwhile global production has become increasingly diversified with growth in every other region. The number of LNG exporters has increased from 8 in 1991 to 14 today.

## World Oil Production



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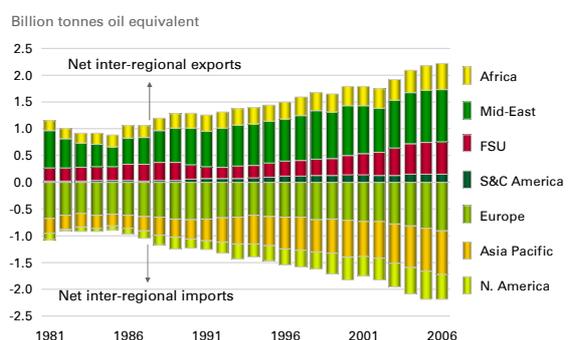
World oil production is undergoing a similar structural shift. OECD output peaked in 1997 when North Sea oil production started to be unable to offset US declines. More recently the UK, Norway and Mexico have also declined and so the almost flat

OECD production of 1996 - 2001 has now turned into a trend aggregate decline.

Non-OPEC production outside the OECD continues to grow from a diverse set of countries. FSU oil production stabilised in the mid 1990s and then returned to rapid growth. OPEC 11 production has been on a slow trend increase with annual volatility as production has been adjusted to balance the market. 27% of the OPEC growth since 2001 has come from NGLs which are outside formal quotas. The FSU and the Middle East supplied 51% of the world's oil trade in both 1996 and 2006. However, over this period the FSU's share has risen from 8% to 13% while the Middle East's share has commensurately fallen back from 44% to 38%.

The net effect of these disparate trends is for global oil production to continue to rise to meet demand but with growth concentrated outside the OECD, and predominantly in countries where state oil companies dominate.

### Energy Trade



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This complex set of forces has the additional effect of changing energy trade flows. World energy trade has been – and remains – dominated by oil flows. 64% of world oil, 26% of natural gas, and an estimated 15% of coal are traded internationally. The proportion traded continues to rise in face of the increasing geographical disparity between consumption and production.

In brief, energy importing regions are importing more energy and the exporting regions are exporting more energy. The location of production changes and consumption growth rates ensures that this trend will continue for the immediate future and that gas, in

particular, will be traded more. The world's reserves of oil and gas tend to be located away from consuming regions; while coal reserves tend to be geographically closer to energy consuming markets.

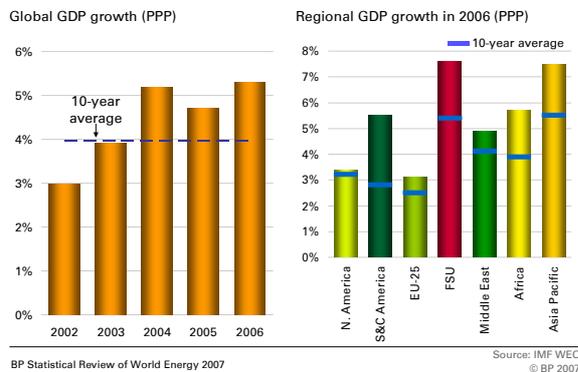
Where does this leave us when we put recent energy trends into a wider context? 2001 - 06 has been a period of high and rising energy prices. It has seen strong global economic growth and this faster growth has been energy intensive and concentrated outside the OECD. It has also been carbon intensive and has accentuated the growing regional disparities between energy production and consumption. These trends have served to raise, rather than reduce, concerns about climate change and energy security.

Yet energy consumers have benefited from a continued availability of and access to energy, albeit at much higher prices than in the past. Energy producers have benefited from higher prices and incomes. Energy security has been delivered to consumers and producers through well-functioning markets. The flexibility of the world economy and sound macroeconomic policies have cushioned the world economy from rising energy prices. However the five year experience has been broadly counter to the longer term energy policy objectives of many countries.

Having set out the medium term context, what has happened over the last year or so, and how does it compare with these underlying trends?

### 3. 2006 in Review

#### World Economic Growth

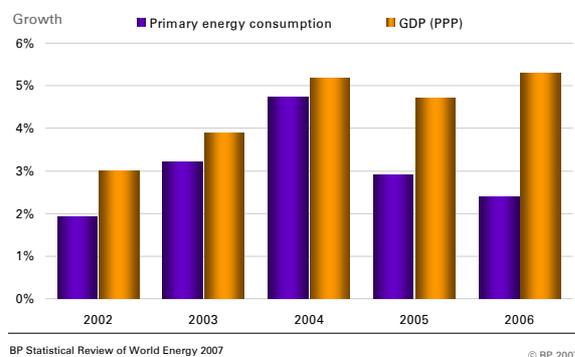


Taking the short term view brings us back to the starting point of high economic growth. Not only were the last five years exceptional, 2006 was as well. Measured at Purchasing Power Parity exchange rates, global economic growth last year was 5.3% – the highest rate since 1973.

In many ways, the year 2006 conformed to a broad pattern which has established itself over the last few years.

- Each of the world's regions grew faster than its 10 year average.
- An ever larger share of global GDP has been produced in the developing world. In 2006, non-OECD economies accounted for 67% of global GDP growth.
- China's contribution to global growth is nearing that of the OECD. With 29%, it contributed more than the US, the EU and Japan combined.

#### GDP and Primary Energy Growth



In one respect, however, 2006 appears to differ. Over the last few years, energy growth mirrored global GDP growth almost one to one. But in 2006 – and to some extent 2005 – energy elasticity has decreased. In 2006, primary energy consumption grew 2.4% when GDP grew 5.3%. In previous years, the relationship was much closer.

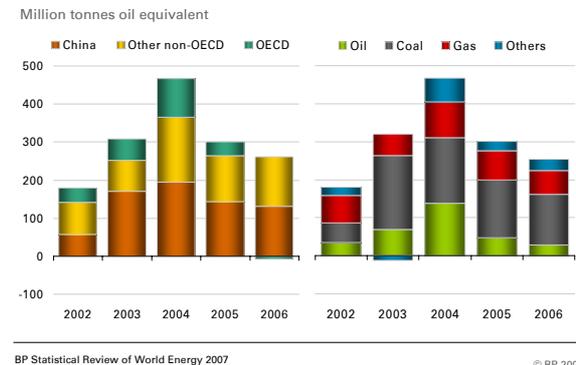
What has happened? Do the data tell of a structural change in the long term relationships I have just discussed, or of a cyclical aberration – part of the ups and downs which tend to be wiped out over the longer term?

The best way to find the answer is to discuss last year's energy developments fuel by fuel, and region by region. Overall, the data appear to suggest that higher prices are having an impact.

### 4. Energy developments by fuel

#### 4.1 Primary Energy

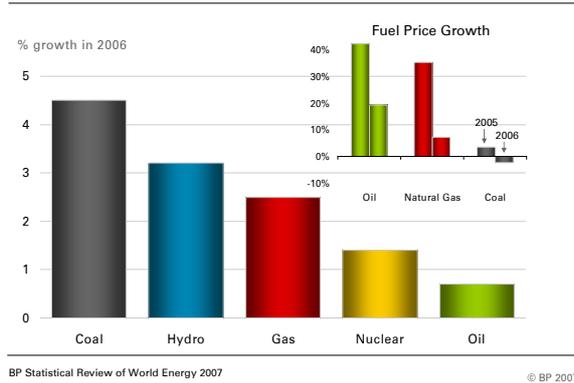
#### World Energy Consumption Growth



Lower energy intensity is most obvious in the OECD economies. In 2006, OECD demand for energy fell, despite good economic growth. But the decline in energy elasticity is widely spread. The data show improvements all around – growth in energy consumption relative to GDP growth fell in the non-OECD countries as well, including China.

By fuel, the growth in oil consumption was slower than that of the static fuels, gas, and coal. To recall, price increases in 2006 were highest for oil (19.5%) before gas (7.5%) and coal (-2.5%).

## Primary Energy Growth by Fuel



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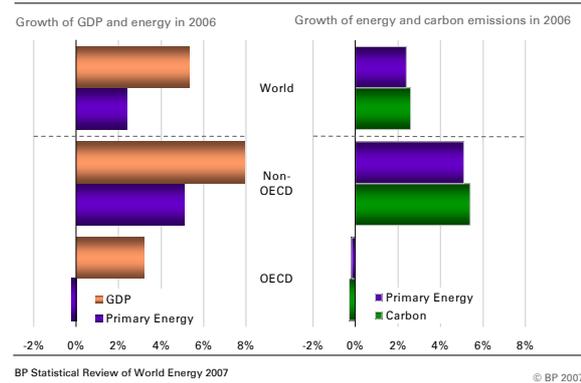
Coal was once again the fastest growing fuel, with China accounting for 39% of global coal consumption and 72% of the growth in coal. Coal accounted for more than half of the growth in global primary energy consumption. Coal thus has gained market share in 2006 as well, while oil has continued to lose ground.

However, as over the longer period, there have been two basic mechanisms at work. One is the change in relative importance of countries that have different energy profiles as economic growth outside the OECD accelerates. The other is a change within countries, either as a result of fuel substitution, or because different fuels grow at different rates as the economy develops.

Fuel substitution played an important role in global energy developments in 2006. Among fossil fuels in the OECD, coal increased, but gas remained the fastest growing fuel. In the EU, coal increased the most, followed by oil. We will discuss in a minute why this has happened.

The point I want to make here is that there may be structural as well as cyclical reasons why the fuel mix differs across countries.

## GDP, Energy and Carbon Emissions



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The outcome for 2006 indicates just how strong the weight of countries with high GDP growth and high carbon energy is. Despite the fact that energy intensity has declined for all regions, carbon intensity has not. The weight of coal in carbon intensive non-OECD economies has been growing so fast that their addition to global carbon emissions outpaces the increased energy efficiency.

Thus 2006 continued the same trend that we have seen for the last five years.

## 4.2 Oil

It is time to look at fuels one by one. I will start with the largest of them, and the one that is globally the most integrated, oil.

### Oil Prices



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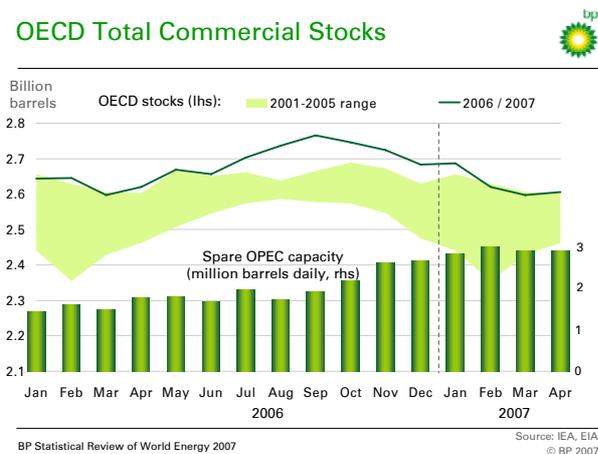
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Dated Brent prices averaged \$65.14 for the year, 19.5% higher than in 2005, and in money of the day terms the highest annual average ever recorded. But prices were volatile. The price of oil rose from \$58 in

January to peak at \$78.69 on August 8, marking a new all time high in money of the day terms. It then fell back, ending the year almost where it had begun, at \$59.

The price increase through 2006 was driven by concerns over security of supply, against a background of limited spare capacity. There were plenty of reasons for concern: The preparation of sanctions against Iran's nuclear program, the uncertainty in Iraq, the closure of Prudhoe Bay, the armed conflict in Lebanon, increasing violence and shut-ins in Nigeria, the nationalisation of energy assets in Latin America, the conflict about gas delivery in the former Soviet Union, and the threat of the hurricane season.

### OECD Total Commercial Stocks



Markets responded by stock-building. Forward prices remained in contango throughout 2006 and into 2007, and OECD commercial inventories, already at five year heights, ballooned to 120 million barrels above their 10-year average by September. Crude stocks rose to their highest level for almost 8 years.

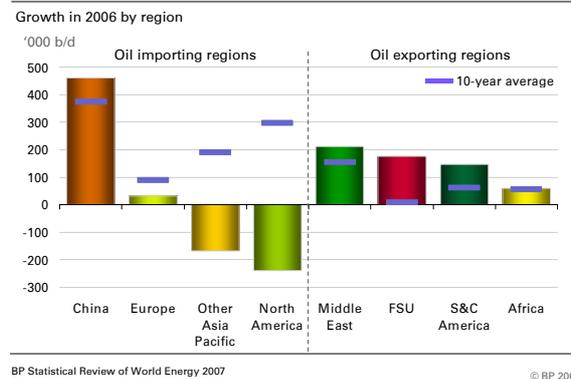
And perceptions adjusted. High stock levels, the Lebanon ceasefire and the absence of major hurricane damage, contributed to a decline in oil prices of more than \$20 from their August peak in less than seven weeks.

In the event, OPEC managed supply by announcing a 1.2 million b/d cut relative to actual output levels in October – the first in nearly two years – and, after an only transitory effect on prices, followed by a further 500,000 b/d cut effective February 1, 2007.

Prices had been near \$50 during a warm January this year, but have not fallen below \$60 since March.

Commercial inventories have declined to less than 2.6 billion barrels and OPEC spare capacity (as estimated by the EIA) rose from 1.5 million b/d at the beginning of 2006 to 2.7 million b/d by year-end, to 2.9 million b/d today. Three-quarters of this spare capacity is in Saudi Arabia.

### Oil Consumption



As economic growth accelerated to 5.3% in 2006, oil consumption growth fell by half – from 1.5% to 0.7%.

The continued increase in oil prices was a factor behind the slowdown; other factors include milder weather, the reduction of fuel subsidies in parts of Asia, and switching from resid to natural gas in the US.

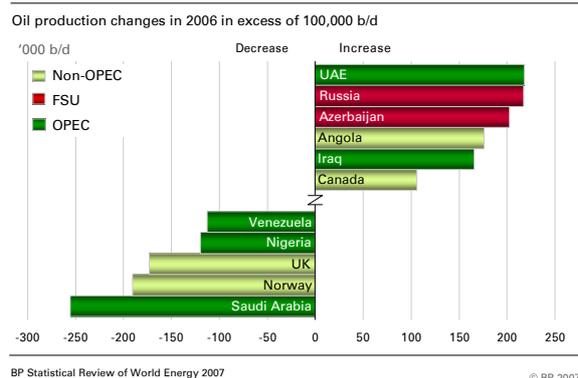
Only two years ago, with economic growth running at a similar rate, oil consumption grew by more than five times the 2006 rate.

A closer look at regional differences reveals the price and income effects in more detail.

Consumption growth in every importing region, if adjusted for China's impact, was slower than the ten year average (and – including China – slower than the five year average). OECD consumption declined by 407,000 b/d or by 0.9% – its biggest decline since 1983.

On the other hand, oil consumption in the exporting regions grew by 600,000 b/d. It grew above the ten (and five-) year average in every exporting region, as the income from high revenues fed through into investment and economic growth.

## Oil Production



Global oil production increased by 410,000 b/d or 0.4%, the lowest increment in five years. OPEC-10 production stayed nearly flat, but crude oil output fell about 200,000 b/d, with the difference accounted for by NGLs (which is not subject to quotas). Saudi Arabia reduced production by 260,000 b/d whereas the United Arab Emirates increased production by 220,000 b/d, the world's largest increase in 2006. Production in Venezuela and Nigeria fell by a combined 230,000 b/d. OPEC's 11<sup>th</sup> member, Iraq, raised output 170,000 b/d on average and reached 2 million b/d.

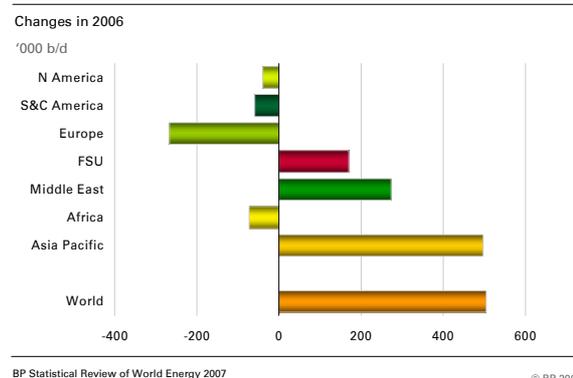
Elsewhere, OECD production fell by 430,000 b/d or 2.2%. This was the fourth successive year of decline, but recovery of production in the Gulf of Mexico caused the decline rate to moderate for the first time since 2002. North American production was flat. Canadian oil sands production grew by 15%. This was enough to offset the decline from Mexico. Output continued to decline in the UK (-9.6%) and in Norway (-6.9%).

Production growth in the Former Soviet Union of 460,000 b/d or 4% came close to matching the OECD decline. At 12.3 million b/d, oil production for the first time reached the Perestroika level of 1989 again. However, Russian production only grew by 220,000 b/d, substantially below its five year average, with the gap being bridged by faster growth in Azerbaijan, where the ACG project ramped up, and Kazakhstan.

Elsewhere, growth has been dominated by Angola (up 180,000 b/d or 14%) which has now joined OPEC. Meanwhile, China overtook Mexico as the world's fifth largest oil producer.

## 4.3 Refining

### Refining Throughput



Moving on to refining, slower oil demand growth in 2006 failed to weaken global margins, which averaged \$8.49, just 7 cents short of the record established in hurricane-affected 2005. Moreover, margins have continued to grow in 2007 and gasoline cracks have risen sharply in the run-up to this year's driving season. The global refining system is still constrained by a lack of upgrading capacity and although not reported in this review, upgrading capacity additions in 2006 did not resolve this bottleneck. Furthermore, continued crude oil production problems in Nigeria diluted the potential yield benefits of refining a large volume of good quality light sweet crude oil.

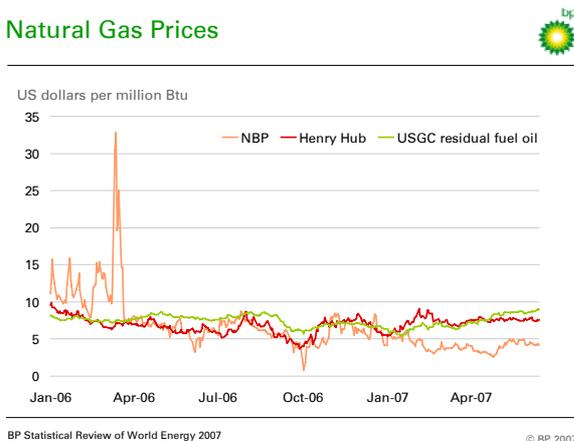
Refinery availability was also an issue in 2006. The US industry started the year with 800,000 b/d of Gulf Coast capacity still out of action after the 2005 hurricanes – and facing the difficult switch from MTBE to ethanol blended reformulated gasoline. Global refining throughputs increased by about 500,000 b/d in support of oil demand growth of 640,000 b/d but the throughput growth was concentrated in the FSU, the Middle East and Asia. To the extent that these regions are dominated by simple capacity, this added to excess fuel oil supply and maintained the pressure on global light-heavy spreads, which remained wide by historic standards. Moreover, the widespread substitution of fuel oil with cheaper natural gas added to the pressure on relative fuel oil values.

Meanwhile, 1.3 million b/d of global distillation capacity was added last year, outpacing demand growth for the first time since 2001. 1 million b/d of

this investment was in Asia, the majority of it split between India (434,000 b/d) and China (442,000 b/d).

## 4.4 Gas

### Natural Gas Prices



2006 was a turbulent year for natural gas. Gas markets are segmented and regional developments therefore particularly important for understanding global outcomes.

One of these global outcomes was robust gas consumption growth. Consumption grew by 2.5% in 2006, above the ten year average. However, markets diverged from each other, and cross-country variability was higher than usual. The aggregate therefore hides a number of separate developments.

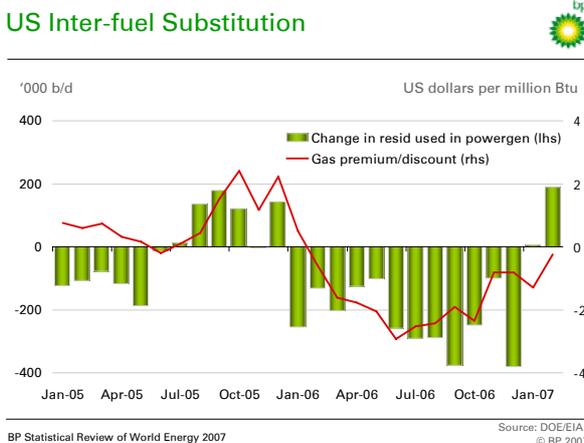
The world's two largest liberalised gas markets, the UK and the US, saw the largest and third largest consumption declines in volume terms in 2006, 10 bcm (1.7%) in the US and 4.3 bcm (4.5%) in the UK. Was there a link between these declines and prices, or other features, of deregulated markets?

The answer is that both economies face a difficult mix of cyclical and structural adjustments, and that flexible prices provided signals to address these issues.

In the UK, the story is one of high prices early in the year, as the former net gas exporter adjusted to perceived supply constraints amid unusually cold weather in early 2006. Fears about sufficient winter supplies were eased by cheap coal as a viable alternative in power generation, as the European Union's Emissions Trading Scheme (ETS) failed to impose a binding carbon constraint. High relative

prices and substitution from gas to coal contributed to the lowest UK natural gas consumption in volume terms since 1998. For the same reason, the share of coal in the UK fuel-mix increased.

### US Inter-fuel Substitution



The reason for lower consumption in the US is different. As in the UK, the warm weather explains in part the lowest consumption in volume terms since 1994. In addition, there was further decline in consumption in the industrial sector.

High inventories, increased supply, and the warm weather, together with the high price of oil, kept prices below parity with residual fuel oil. Flexible prices induced fuel switching in power generation – while overall US gas consumption declined, it rose in power generation. In 2005, when natural gas had traded at a premium to resid, 400,000 b/d of resid was used in US power generation. When gas prices fell below resid parity, use of resid in power generation fell by 60%. Gas also substituted for coal, thus supporting the decline in coal use in the US in 2006.

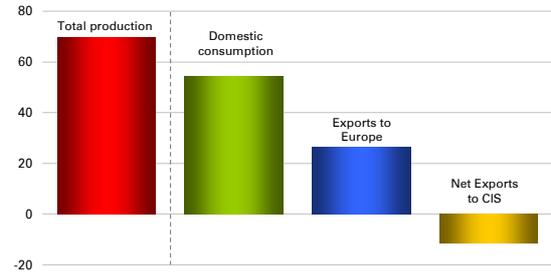
However, US production of natural gas also increased by 2.3%, the largest gain since 2001. This increase is the outcome of persistent onshore drilling efforts. The average national rig count of 1,372 last year was a record, and it continues to rise.

## Russia Gas



Supply and demand changes between 2001 and 2006

Billion cubic metres



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The biggest increment to both consumption and production, however, was in Russia. Natural gas consumption grew by 6.7% in 2006 – five times the ten year average and faster than any other fuel.

Domestic gas prices have remained low, at \$40 per thousand cubic meters. At these prices, domestic gas producers are unable to meet the growing demand from power generation. As a consequence, natural gas is rationed.

The market balanced through declining exports and an increase in Russia's imports of natural gas from Central Asia. Gas exports to Western Europe remained flat in 2006, and declined by 23.5% in the first quarter of 2007. Exports to the FSU declined and together with transit agreements and imports from Central Asia, this enabled the increase in domestic consumption.

Russia was not the only natural gas producer which increased domestic consumption as a share of production. 2006 saw a broad tendency of major gas producers in emerging markets to do the same – in Asia, South America, FSU and North Africa. Exceptions are concentrated in the Middle East, where consumption slowed sharply.

China also experienced a leap in natural gas production and consumption. Domestic production rose 17.2% (9 Bcm) and consumption grew by 21.6% (10 Bcm), globally the second largest increment after Russia. LNG became available as China's first regasification terminal started commercial operation in the southern province of Guangdong. In its first half year since the summer, LNG imports clocked up 1 Bcm in 2006.

Global gas production rose by 3%, leaving markets well supplied during the mild winter 2006 - 07. Russia, up 14 bcm or 2.4%, and the US, up 12 bcm or 2.3%, were the two largest contributors to global production growth.

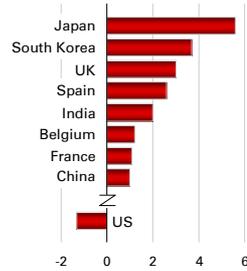
## LNG Trade



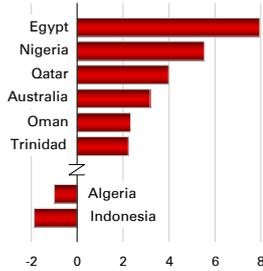
Trade changes in 2006 in excess of 1 billion cubic metres

Billion cubic metres

Importers



Exporters



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Source: Cedigaz  
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These trends and the overall slow down of consumption growth in the OECD had a discernable impact on last year's trade in natural gas. Global gas trade, excluding intra-CIS flows, increased by 3.1%, roughly in line with production growth, but only half of its five year average. The ratio of all trade to production remained constant, at 26.1%. However, this is entirely due to stagnant pipeline trade: LNG grew by 11.8%, faster than its five year average. It now accounts for 28.2% of the global gas trade.

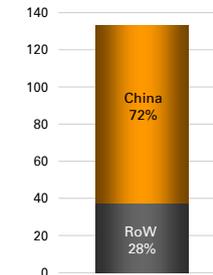
## 4.5 Coal

### Coal Consumption



Global consumption growth 2006

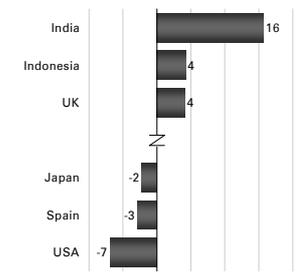
Million tonnes oil equivalent



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Consumption growth outside China 2006

Million tonnes oil equivalent



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I have said it already, but it bears repeating: Coal was the world's fastest growing fuel in 2006, for the fourth year running. Excluding China, world coal

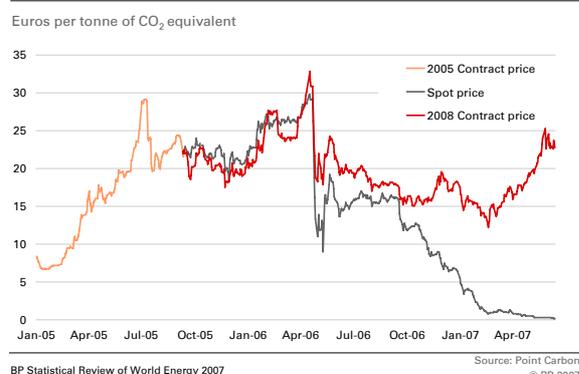
consumption rose by 2% and so for the world outside China, natural gas was the fastest growing fuel.

Coal prices vary widely and are subject to regional variations. The composite price basket introduced earlier declined by 2.5% for 2006.

China's growth in coal consumption was driven by strong, heavy industry-led, economic growth that raised electricity demand. Coal-fired power generating capacity increased by 24% in 2006, while steel production rose by 21%. Measures to promote imports and discourage exports amid increasing domestic needs led to a 45% drop in net exports in 2006.

Global coal consumption grew in all regions except in North America and the Middle East. Growth was widely distributed, but particularly strong in India (16 Mtoe), Indonesia (4 Mtoe) and the UK (4 Mtoe). Outside of China, relative fuel price changes and strong economic growth that raised demand for electricity were the main factors behind rising coal consumption. In Europe, high natural gas prices in early 2006 led to increased demand for relatively cheaper coal as a substitute for gas.

### EU Emissions Trading Scheme

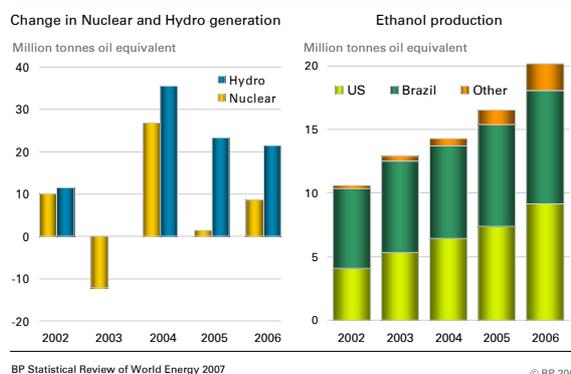


The EU Emissions Trading Scheme entered its second year of operations in 2006. With generous allocation rules, the price for carbon did not reach levels that would have prevented switching from gas to coal in the EU. Prices contracted sharply in May 2006, when it became apparent that the number of permits exceeded verified emissions in most member states. However, trading in new permits, covering the Kyoto period 2008-12 resumed fast, and prices have risen over recent months – reflecting the market's belief

that the EU's commitment to continue and develop this market is credible.

## 4.6 Nuclear, Hydro and Renewables

### Non-Fossil Fuels



Interest in non-fossil fuels has increased in face of growing concern about climate change and energy security. While these fuels play an important part in the energy mix of many countries, at a global level they remain small.

Hydroelectricity and nuclear power each account for about 6% of global primary energy consumption, and those shares have been broadly constant for the past 15 years. Nuclear output rose by 1.4% last year, close to the 10-year average. Output increased due to higher capacity utilisation and capacity upgrades at existing plants. Only two new nuclear plants entered into service, one each in China and India, but these were more than offset by the closure of eight reactors in Europe.

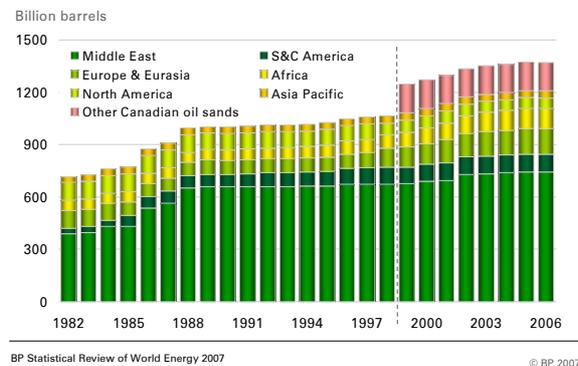
Global hydroelectricity output rose by 3.2%, the third consecutive year of above-average growth. Output rose due to a combination of expanded capacity in China, India, and Brazil, and adequate rainfall in the USA, which offset lower production in Scandinavia and Canada.

Sources of renewable energy – wind, solar, and geothermal power, as well as ethanol – are not reported separately in the printed Statistical Review due to the lack of consistent global data, but we track and report developments on our website. The data shows that renewable energy continues to grow rapidly – aided by government incentives – but from a very small base. Ethanol output, for example, grew by

more than 20 percent last year – and has grown by an average of 17% annually since 2001 – but is equivalent to just 0.5% of global oil consumption.

## 4.7 Reserves

### World Oil Reserves



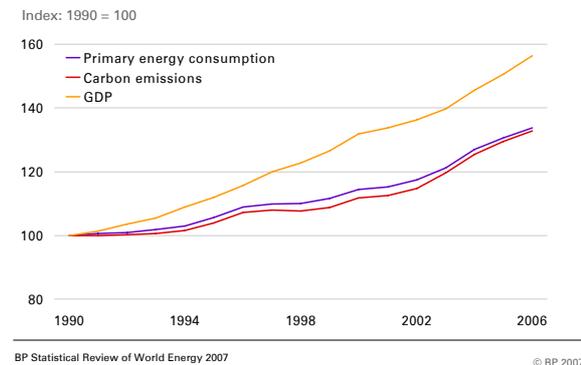
Finally, a brief review of oil and natural gas reserves. Proved oil reserves continue to exceed 1.2 trillion barrels, equivalent to current production levels for more than 40 years. Global proved reserves in 2006 were 1 billion barrels below last year’s total, with declines in Mexico and Norway offsetting increases in Russia and Brazil. But as has often been the case, we have “rolled over” the 2005 reserves figures for many countries due to reporting lags. For this same reason, the 2005 global total reported last year has now been revised up by nearly 9 billion barrels – marking 15 consecutive increases up to this year. This year we have also added a line item in our reserves table for that portion of the Canadian oil sands (denoted as “other”) which are not included in proved reserves – a further 164 billion barrels.

World proved natural gas reserves now exceed 181 trillion cubic meters – 1 trillion cubic metres higher than last year and equivalent to current production for more than 60 years. OPEC members accounted for most of the increase.

Global proved oil and natural gas reserves thus have been on an increasing trend since 1980, when our data set begins. They remain adequate to cover expected consumption for decades to come: There is no global scarcity of hydrocarbon reserves.

## 5. Conclusions

### GDP, Primary Energy and Carbon Emissions



Where does this leave us? In concluding, it is appropriate to return to the fundamental relationship between GDP, energy consumption, and carbon emission growth.

The last five years or so have been characterised by an acceleration of economic growth outside the OECD, almost matched by an acceleration of energy consumption growth.

One implication has been that the gap between GDP and energy consumption has been widening more slowly than it did only a few years ago.

All over the world, the acceleration of energy consumption growth has been driven by static fuels. Partially because of price effects, partially because of access and location, and partially because of the demands of industrialisation and economic development, coal has become the static fuel of choice. It continues to increase its share in global primary energy consumption.

As a consequence, the tiny gap between primary energy consumption growth and the growth of carbon emissions is closing. Rapid global energy growth has become more, not less, carbon intensive over the last five years.

## Conclusions



- Medium term
  - Fast economic growth driving energy consumption growth
  - Coal fastest growing fuel
  - Non-OECD growth trends generate more energy intensive and carbon intensive growth
  - Rising energy prices
- 2006 in review
  - Slower (but above average) consumption growth
  - Consumption responsive to price, especially in OECD
  - Rapid coal growth; carbon intensity increased
  - OPEC re-engages

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Global energy elasticity, the relationship between energy consumption growth and economic growth, has improved in 2006. However, global carbon intensity – the link between energy growth and carbon emissions growth – has deteriorated further, as the share of high carbon economies continued to grow.

There is nothing in the data which indicates that this is likely to change by itself.

But there is hope in this data: 2006 was again a year which showed that the global energy system reacts to the incentives provided by price changes.

Does a rigorous analysis of 2006 give reasons to suspect that these trends are about to change?

And that would remain the case, if there were to be a price for carbon.

2006 showed markets at work. Primary energy consumption growth has decelerated – the most for fuels which had seen the highest increase in price.