

Presentation at IENE Conference

THE OUTLOOK FOR OIL

Dr. Leonidas P. Drollas

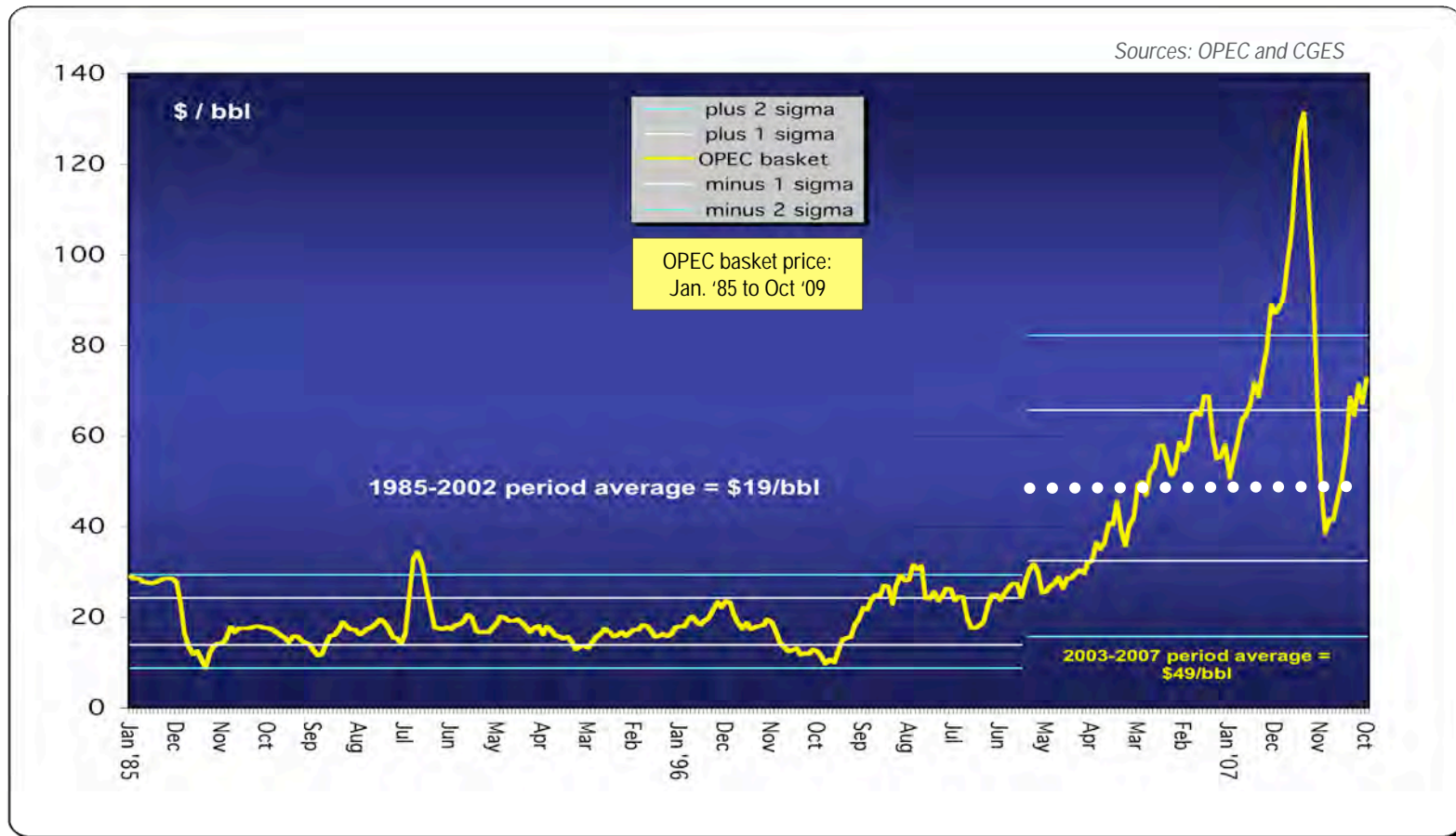
Deputy Director and Chief Economist

Centre for Global Energy Studies

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CGES

Oil price volatility and mean reversion



If we thought the price of oil was volatile in the years between 1985 and 2002, we obviously had seen nothing yet! We are unlikely to revert to the \$19/bbl mean of the earlier period. Could \$60/bbl be the new mean?

Key issues for oil

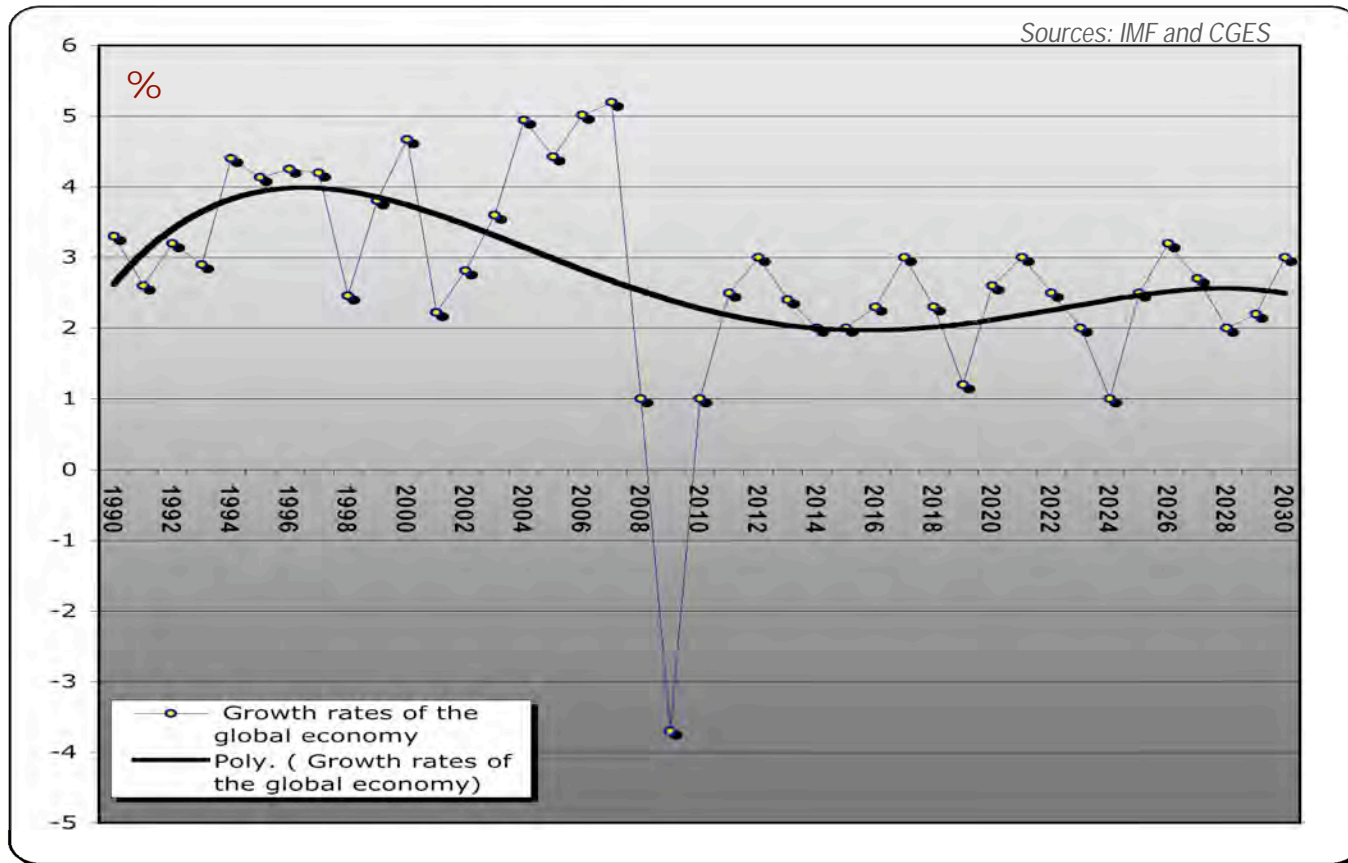
1. What will the global economic recovery be like? Business as usual (3.7% per annum), or a lower trend rate of growth (perhaps 2.5% p.a.)?
2. The effect of movements in the price of oil on demand and supply.
3. What oil price will Saudi Arabia be comfortable with (\$60/bbl)?
4. Will rising spare capacity test OPEC's resolve to constrain output? Iraq is almost certain to upset OPEC's equilibrium.
5. Reducing CO₂ emissions will make a big difference to oil demand — if the political will is there.
6. Oil resources are plentiful, but will the necessary investments be forthcoming?

A HEALTH WARNING ...

“ The thing that has not been is the thing that shall be; ... no beliefs, no values, no institutions are safe. ”

— J. B. S. Haldane (biologist)

Global economic growth: before and after the fall



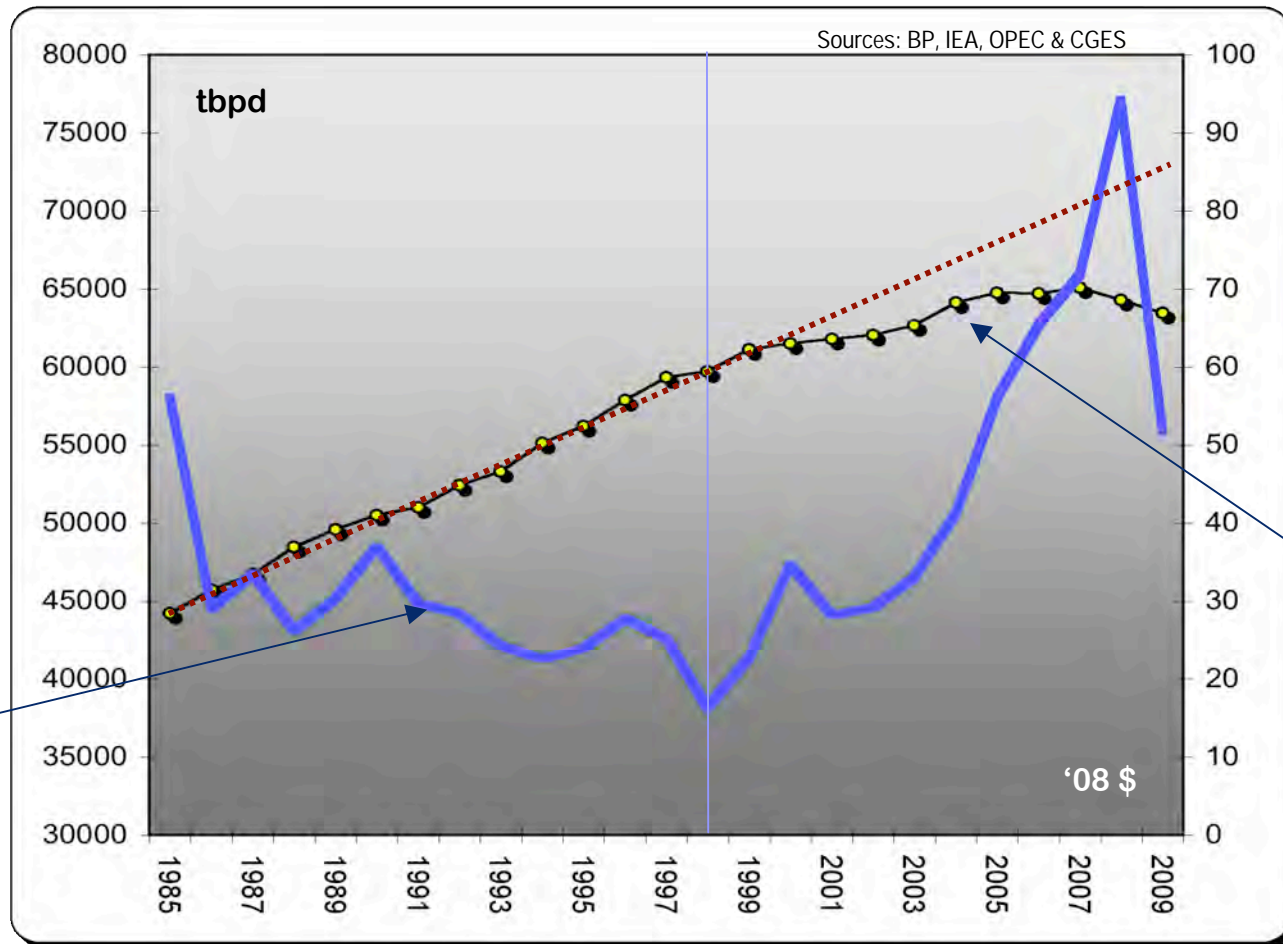
Prelapsarian global economic growth between 1990 and 2007 was 3.7% per annum. After the deepest recession since the 1930s, we expect economic growth to average 2.3% a year due to slower population growth, lower gains in productivity, higher savings rates and tighter fiscal policies.

Oil demand growth ... falling off a cliff ... then recovering

	2006 tbpd	2007 tbpd	2008 tbpd	2009 tbpd	2010 tbpd
OECD	- 267	- 397	- 1585	- 1790	149
<i>of which USA</i>	-115	0	- 1180	- 850	50
Non-OECD	690	1285	1028	304	312
Former CPEs	687	450	373	- 230	343
<i>of which China</i>	520	325	323	67	250
<u>GRAND TOTAL</u>	1110	1338	- 185	- 1716	803
	1.4 % ↑	1.6 % ↑	-0.2 % ↑	-2.0 % ↑	1.0 % ↑

The trend rate of growth of global oil demand since 1986 has been 1.6% per annum. Oil demand in the OECD has been on a downward trajectory since 2005 despite strong economic growth, suggesting that high oil prices hammered its rate of oil demand growth. In the second half of 2008 the global economy slid into recession and this adverse development, in conjunction with record high oil prices in the first half, took world oil demand into negative territory. A deep recession has taken hold of the OECD economies in 2009, pushing incremental world oil demand heavily into the red.

GLOBAL OIL CONSUMPTION EXCLUDING THE FORMER CPES

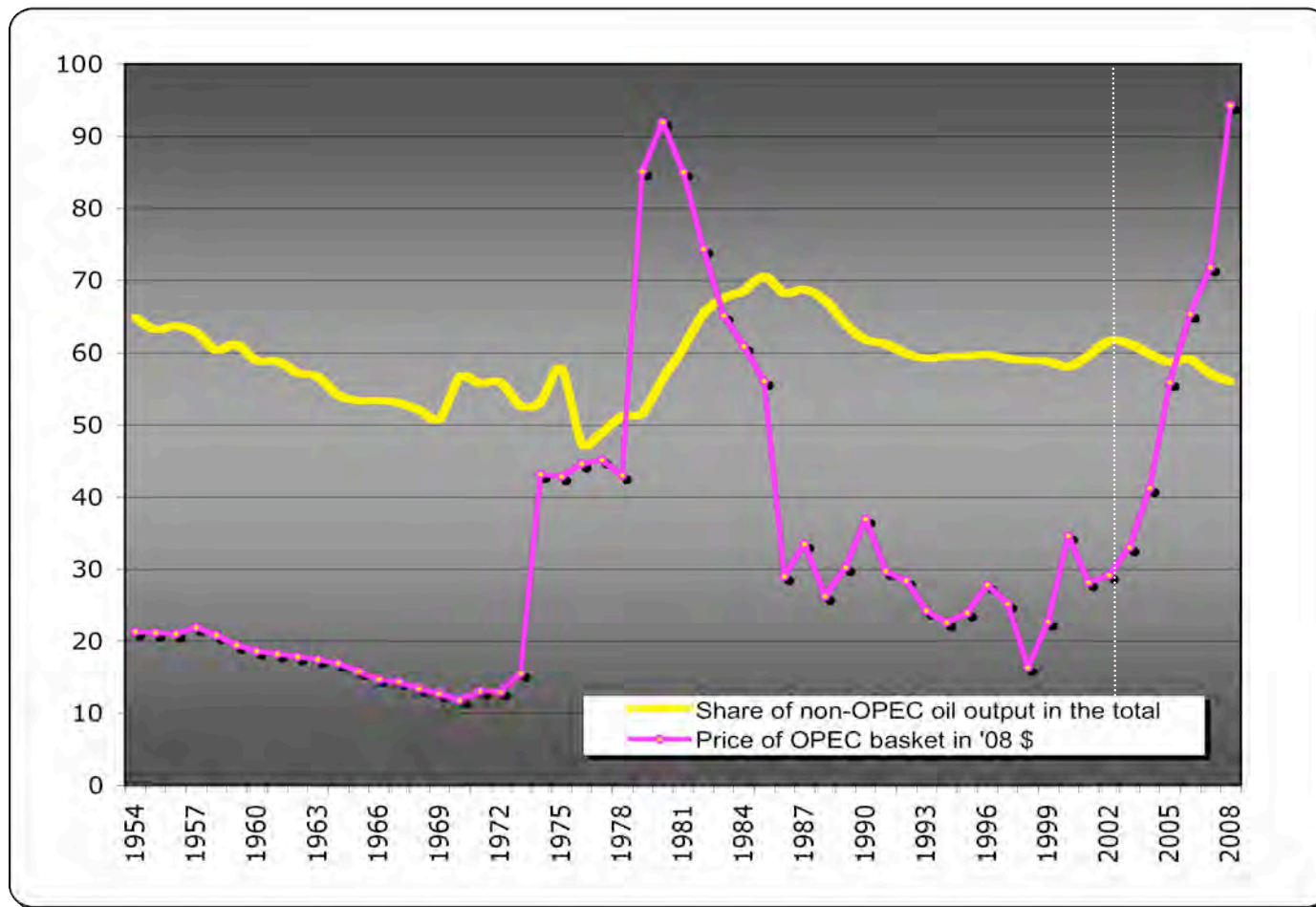


Real price of oil

Oil demand

This graph is a dramatic illustration of how the steep rise in the real price of oil, from the low point in 1998 to the peak in 2008, led to a slowing up of oil demand growth in the market economies and finally to an actual fall in their aggregate oil consumption in 2006, 2008 and 2009 (estimated).

NON-OPEC OIL OUTPUT'S SHARE IN THE TOTAL



Historically, the non-OPEC countries' share of global oil production has responded positively to changes in the real price of oil, but with lags. Much has been made of the breakdown of this relationship since 2003, but the devil is in the detail — e.g., Mexico, Russia, North Sea, Angola.

The minimum oil price needed by Saudi Arabia, based on expected expenditures and income in 2009

	\$ bn	\$ bn
General expenditure	127.2	102.6
Debt interest	2.4	3.4
Capital expenditure	40.0	30.0
Total expenditure	169.6	136.0
Non-oil income	22.0	21.0
Investment income	25.0	27.0
Oil revenues* (CGES estimate)	129.6	245.0
Total income	176.6	293.3
Surplus	+ 7.0	+ 157.3

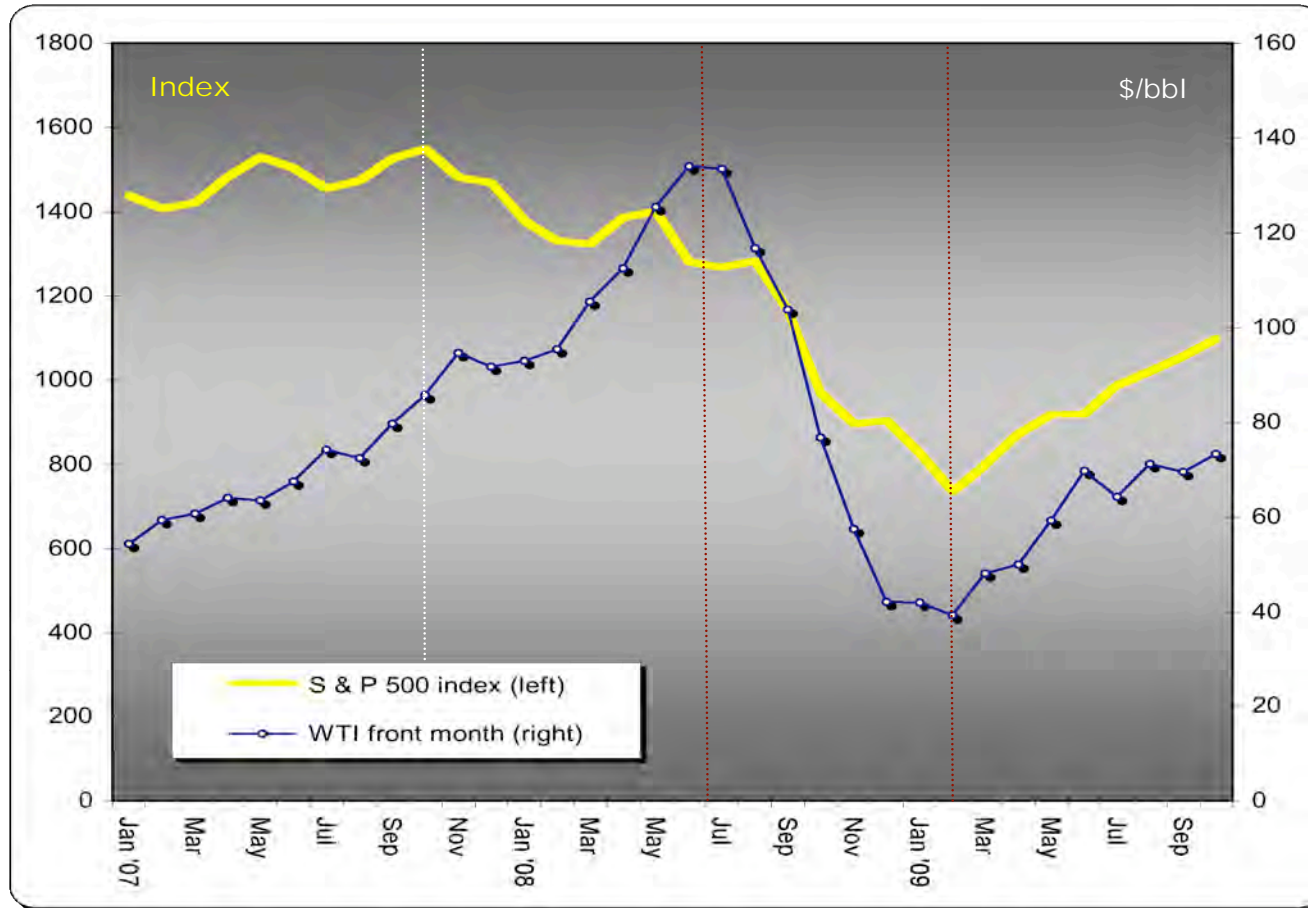
2008 actuals

- With Saudi output at 8.0 mbpd (the expected 2009 average), the minimum OPEC basket price required to cover expected Saudi general expenditure and debt interest in 2009, less non-oil and investment income, is **\$40/bbl**.
- To cover total expenditure (less non-oil and investment income) the price needed is **\$57/bbl**. To cover total expenditure and retire also \$8bn of debt the Kingdom needs **\$60.4/bbl**. The CGES expects the OPEC basket price to be around **\$60/bbl** in 2009.

* Including \$16 bn from NGL exports.

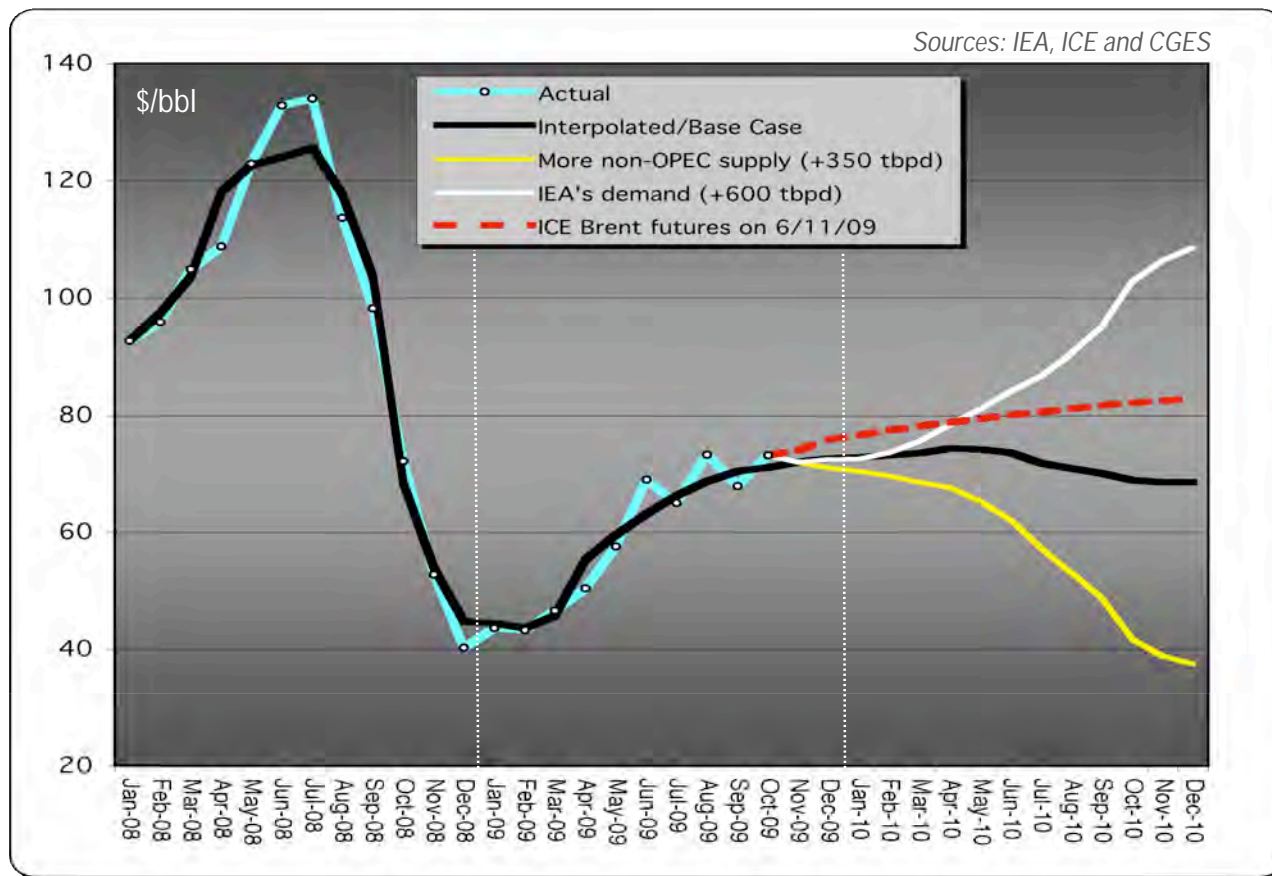
Note that Saudi national debt averaged \$63.2 bn in 2008.

Is oil a financial play? The S&P '500' index and front month WTI.



The Standard & Poor's 500 index fell almost continuously between October 2007 and February 2009; however, from February '09 it has staged an impressive rally. As for WTI, it kept on rising from Oct '07 until the peak in July '08; thereafter it has mirrored the movements of the S&P Index, suggesting that oil is more of a financial play these days than it was in 2007 and the first half of 2008.

OIL PRICE SCENARIOS: 2009 AND 2010



What happens to the oil price in the next year and a quarter depends critically on three factors — how quickly the world emerges from the recession, how does this affect the demand for oil and how OPEC responds to the changing economic circumstances. In all three cases, OPEC's output is kept around current levels.

Projecting the trend rate of increase in global oil demand : 2007-2020

Sources: BP, IEA, IMF and CGES

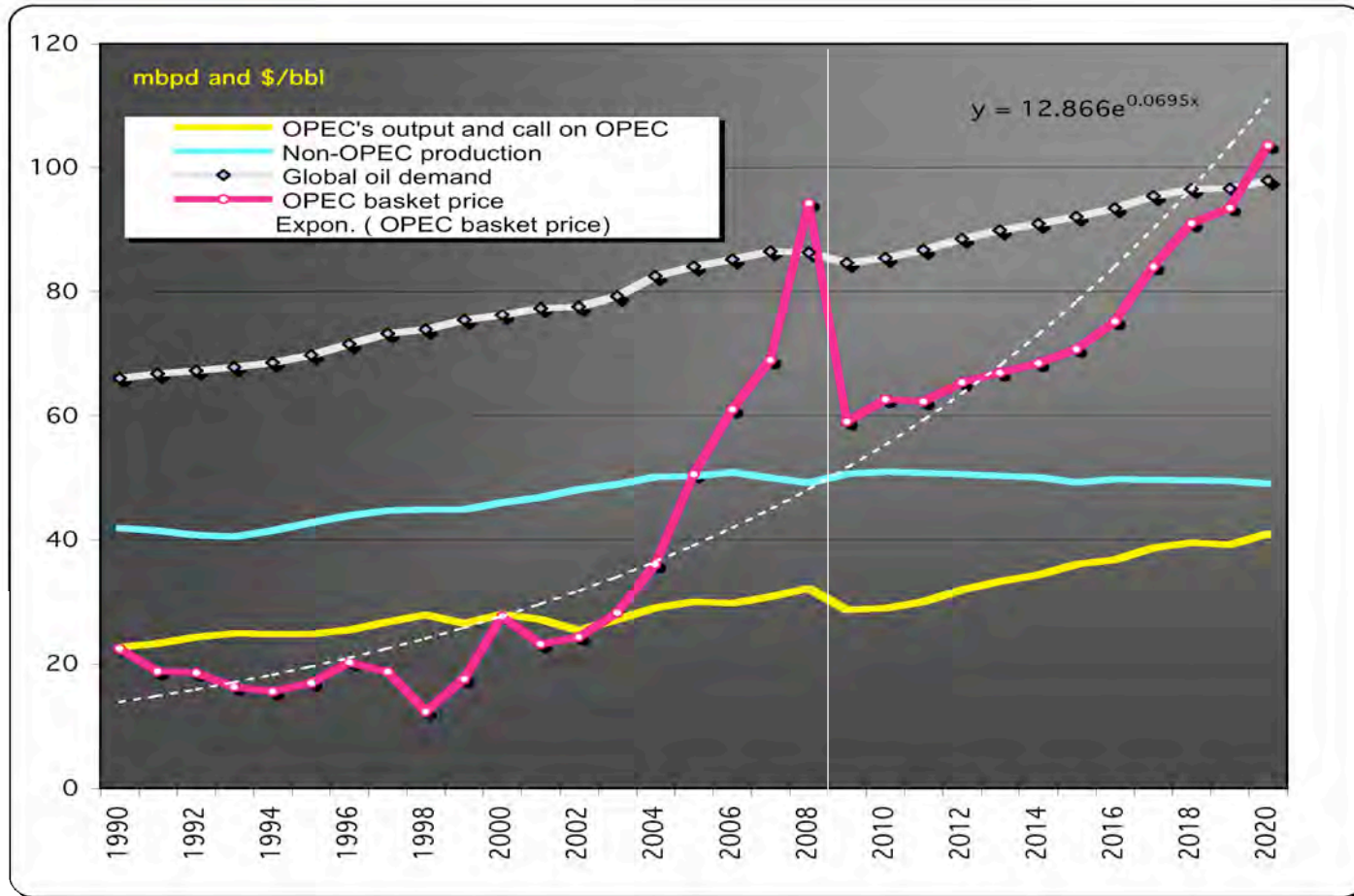
	Exponential rates of change in real income % a year	Exponential rates of change in real oil prices % a year	Exponential rates of change in oil demand % a year	
1986-2007 elasticities >	3.8 0.7	4.3 -0.25	1.6 1.2 mbpd	< Actual
2007-2020 elasticities >	3.8 0.5	4.3 -0.3	0.6 0.6 mbpd	< As during the period 1986-2007
Base Case 2007-2020 elasticities >	2.5 0.5	0.8 -0.3	1.0 0.9 mbpd	< Lower economic growth and lower prices
Zero growth 2007-2020 elasticities >	2.5 0.5	4.2 -0.3	0.0 0.0 mbpd	< Lower economic growth and higher prices

Implied nominal oil price in 2020 is \$106/bbl

Implied nominal oil price in 2020 is \$164/bbl

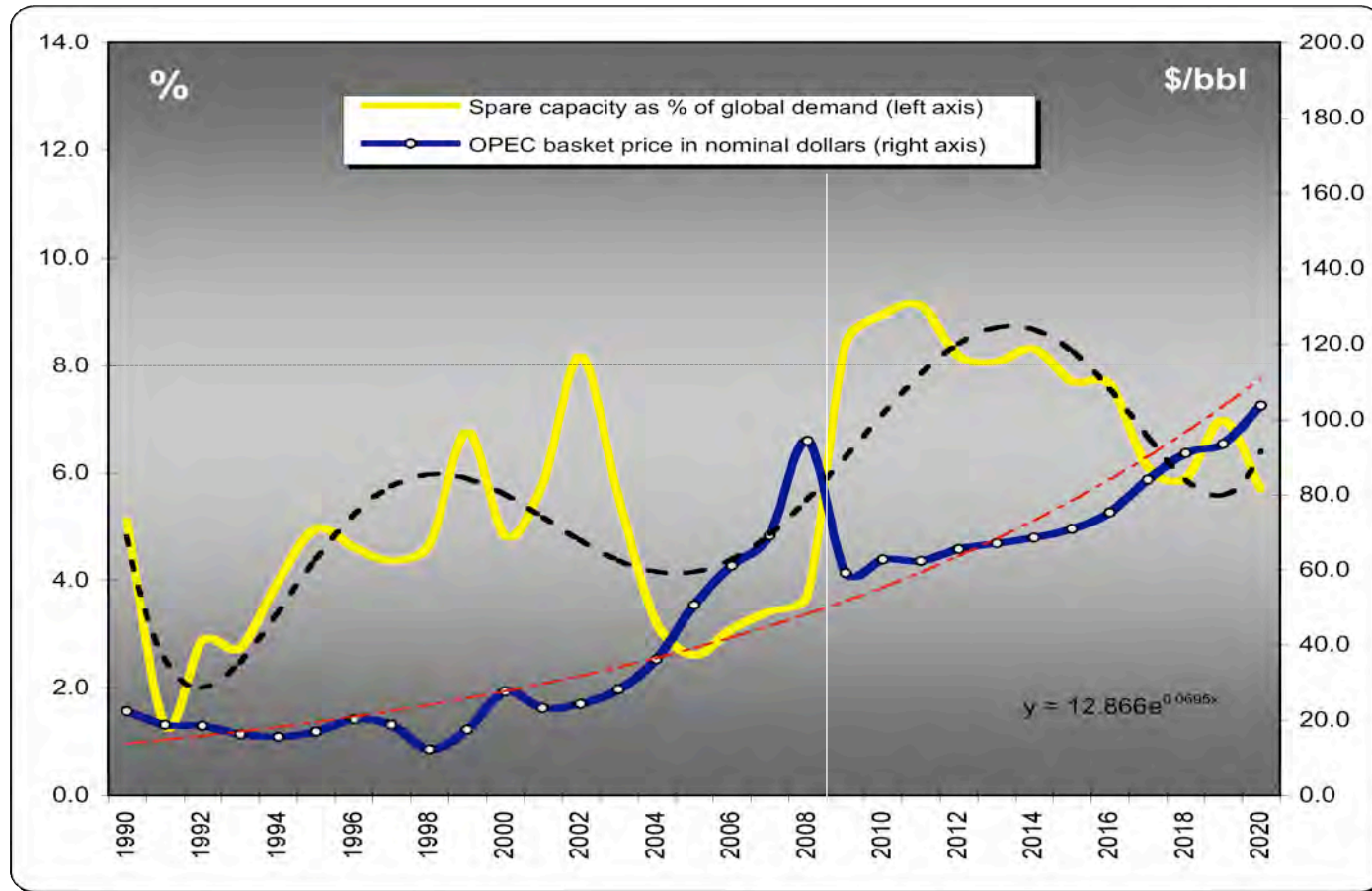
To bring global oil demand 10% below 2007 levels, a nominal price of \$233/bbl for crude oil is needed by 2020, or a final price of \$373/bbl versus a final price of \$93/bbl in 2009.

GLOBAL OIL DEMAND, SUPPLY AND PRICES : 1990 - 2020



Once the global economy starts recovering from 2010 onwards, the price of oil begins to rise again, but on a trajectory below its long-run, steady-state growth path, because of persistent excess capacity. It is driven upwards by the rising demand for oil set against a slow decline in non-OPEC output and OPEC's ongoing attempts to constrain its production in the interests of higher prices.

GLOBAL SPARE OUTPUT CAPACITY AND THE PRICE OF OIL : 1990 - 2020



Spare oil production capacity (all of it in OPEC) surges well above 8% of global oil demand between now and 2012, leaving the Organisation with the difficult task of constraining its output to keep oil prices from falling below \$60/bbl and staying there. After 2014, spare capacity begins to decline, making life somewhat easier for OPEC.

OPEC'S DILEMMA : how to accommodate Iraq

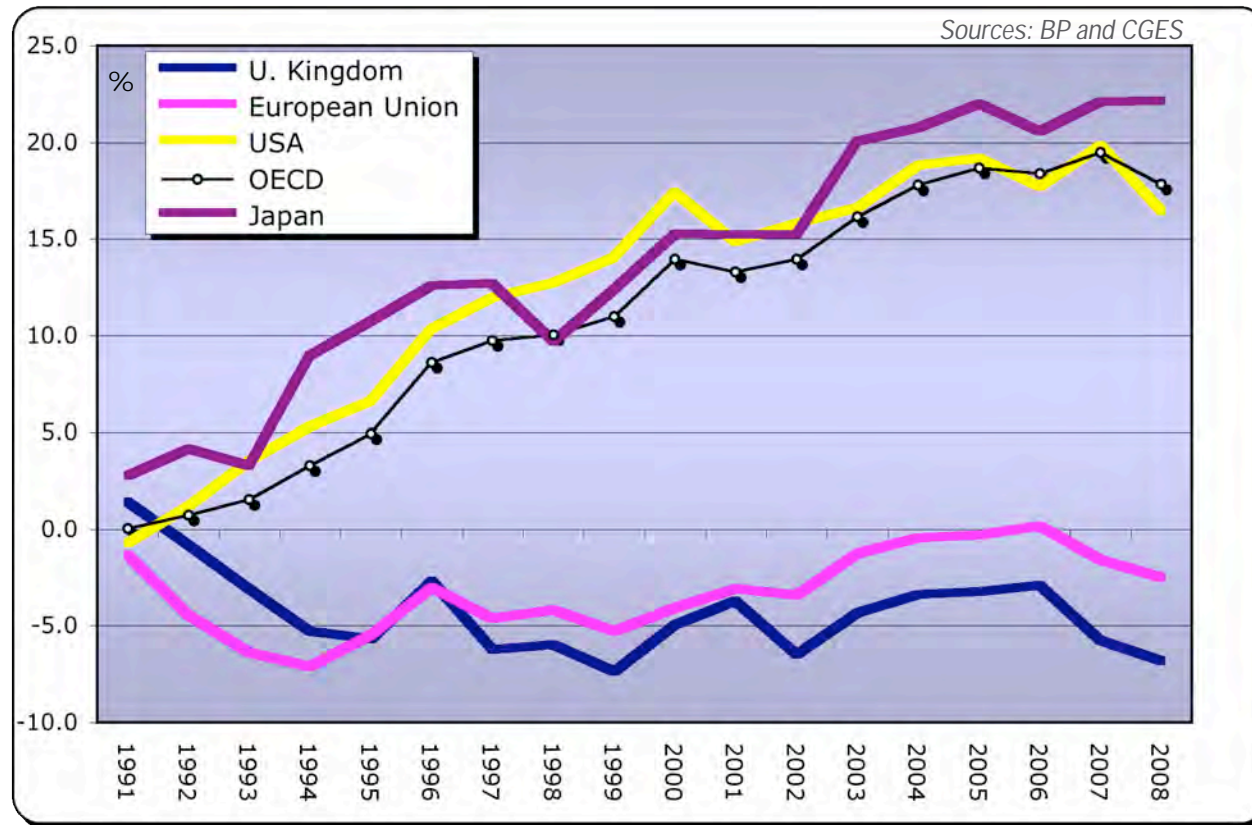
	2009 mbpd	2015 mbpd	2020 mbpd
Global oil demand	84.6	92.0	97.9
<i>of which China</i>	8.0	9.5	10.5
Non-OPEC supply	50.6	49.3	49.1
Call on OPEC	28.7	36.0	41.0
Met by ... Saudi Arabia	8.5	9.0	10.1
Iraq unconstrained A	2.5	8.4	9.9
Met by ... Saudi Arabia	8.5	9.7	10.4
Iraq unconstrained B	2.5	6.3	8.9
Met by ... Saudi Arabia	8.5	9.9	11.3
Iraq constrained C	2.5	5.5	6.3

Case A > Iraq achieves a capacity level of 10 mbpd by 2017.

Case B > Slower rate of capacity expansion for Iraq; 10 mbpd by 2022.

Case C > Iraq reaches quickly its 1990 capacity of 3.5 mbpd; it is then allowed to reach 5 mbpd by 2013 (a 42% increase equal to OPEC's output gain between 1990 and 2008) and is subsequently made to abide by OPEC's quota restrictions.

CO₂ emissions with respect to 1990 levels (%)



The UK has come closest to meeting its Kyoto target by '*dashing for gas*' and keeping taxes on transport fuels high. The EU as a whole has a long way to go, having regressed in the period 2002-6. Japan's emissions have increased considerably due to its greater use of coal. Although the USA ratified the Kyoto Treaty under President Clinton, it ignored its implementation until Obama's election.

Reducing CO₂ emissions by 20% below 1990 levels by 2020

	2008		2020	2020	
	mbpd	oil's share %	business-as-usual mbpd	20-20 mbpd	oil's share %
OECD	44.2	43	43.6	24.6	35
EU	14.2	46	14.4	8.9	35
USA	17.9	39	17.5	10.3	33
China	7.6	15	16.6	4.4	30
Japan	4.5	46	3.6	2.3	36
UK	1.6	38	1.6	1.0	28

The climate change jamboree in Copenhagen in December '09 will try hard to get a new set of binding restrictions on CO₂ emissions accepted internationally. The EU has already approved as its target a 20% reduction in emissions below 1990 levels, to be implemented by 2020. Should the other major economies follow suit, the usage of fossil fuels would have to be curtailed drastically. Since burning coal generates 48% more and gas 12% less emissions than oil, it is obvious that coal use should be restricted the most. Natural gas' share of the fossil fuel mix will rise considerably, while oil's share will have to shrink along with coal's. The oil shares in 2020 given in the table above are indicative of what might have to be achieved by various countries in order to attain the 20-20 targets.

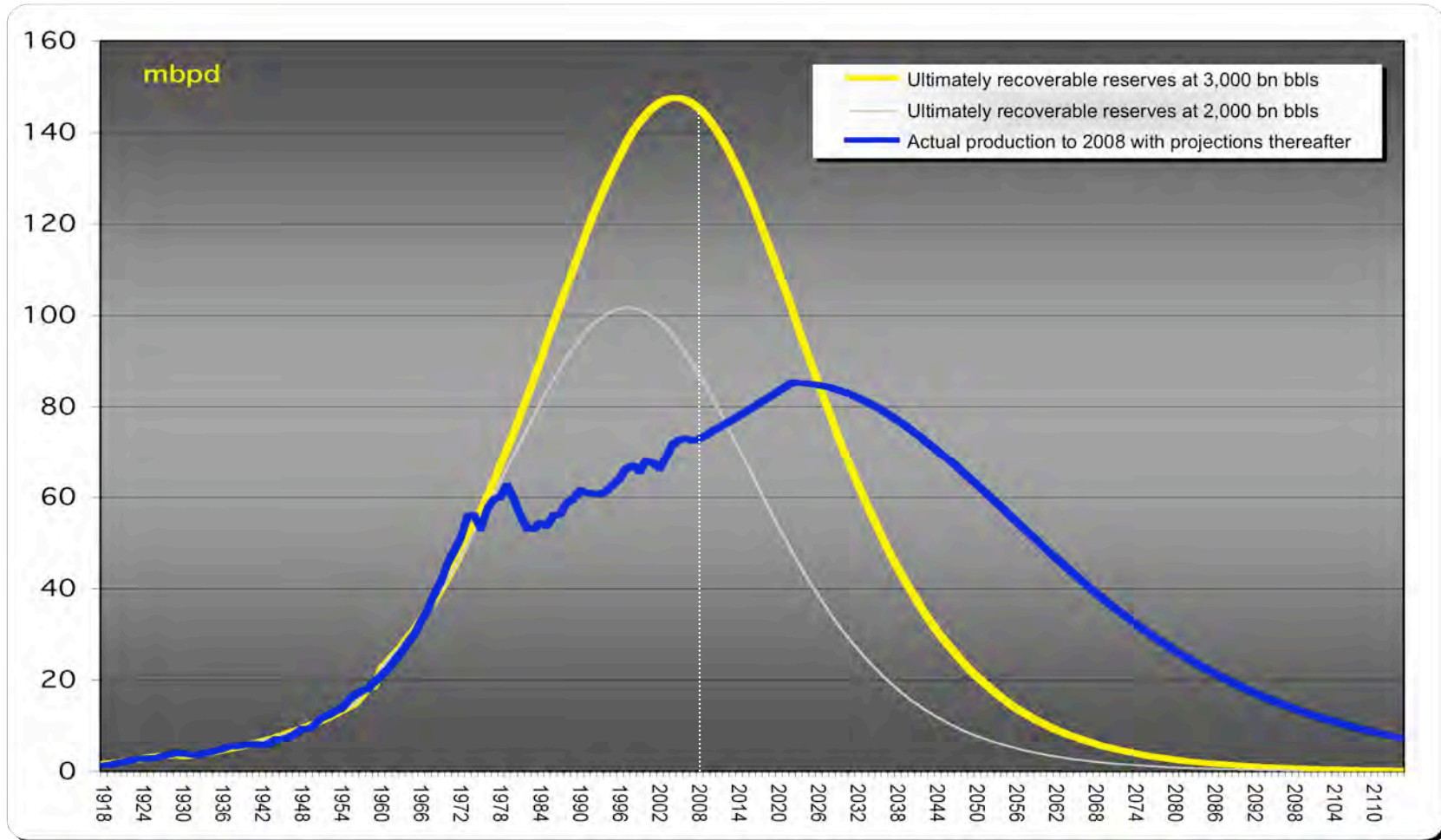
ACHIEVING THE REQUISITE REDUCTION IN THE EUROPEAN UNION'S OIL CONSUMPTION

	2008		2020	2020	
	mbpd	oil's share %	business-as-usual mbpd	20-20 mbpd	oil's share %
OECD	44.2	43	43.6	24.6	35
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Cutting oil consumption in the European Union by 5.3 mbpd in the 12 years between 2008 and 2020 is a very tall order indeed. On the assumption that the long-run oil price elasticity of demand is -0.4 and consumer prices in Europe increase by 2.5% per annum, retail oil prices will have to rise in nominal terms by 147% (or by 12% exponentially each year) to effect the requisite reduction. To give you a concrete example of what this might mean for gasoline, consider that at present it costs roughly €60 in Europe to fill a 60-litre tank. The retail price of gasoline in Europe would have to rise from €1 per litre in 2008 to €4.34 a litre in 2020, requiring €260 to fill a 60-litre tank at that time.

An oil resources issue? Are we reaching peak oil?



- Global conventional crude oil production rises between 2008 and 2020 at an exponential rate of 1.3% per annum (the CGES' base case for crude oil demand). Thereafter, having peaked in 2022 at 85.4 mbpd, it declines at a rate that generates a cumulative output figure of 2,998 billion barrels (99.9% of the ultimately recoverable reserves) by 2114.

Global oil reserves are not a problem

	<u>bn barrels</u>
Cumulative oil production ¹	1,091
Remaining oil reserves ²	1,167
Reserves growth ³	360
Undiscovered conventional oil ³	382
GRAND TOTAL	3,000

1. Until the 1st of January 2009. The figure refers to crude oil only. Sources are the Oil and Gas Journal, DeGolyer and MacNaughten, and the CGES.
2. On the 31st of December 2008, as reported by the Oil & Gas Journal, representing 44 years of reserves at current rates of oil production. Note that we have excluded tar sands from Canada's total as given by the OGJ.
3. We have arrived at these figures by subtracting cumulative output and remaining oil from 3,000 bn bbls and then pro-rating the result by the US Geological Survey's split between reserves growth and undiscovered oil.

Running out of crude oil — the US case

Proven oil reserves - end 1973	35 bn bbls
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R/P ratio at the end of 1973	11 years
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Proven oil reserves - end 2008	21 bn bbls
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R/P ratio at the end of 2008	12 years
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Cumulative output 1974 to 2008	92 bn bbls
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1. Proven reserves in the US are obviously lower now, but output is lower too, keeping the R/P ratio constant at the 11-year level.
2. The US definition of proven oil reserves seems to be somewhat restrictive.
3. Each year the US replaces almost as much oil as it produces. Most of this oil comes from reserves growth in existing fields.
4. The onward march of knowledge and technology is relentless.

Super-giant and giant oilfields found since 1979

Oilfield	Country	Year discovered	Recoverable reserves in bn bbls
Kashagan	Kazakhstan	1996	8.8
Tupi	Brazil	2007	7.3
Ku Maloob Zaap	Mexico	2000	5.8
Marlim	Brazil	1985	3.9
Vankorskoye	Russia	1988	3.8
Nanpu	China	2007	3.7
Iara	Brazil	2008	3.0
Azadegan	Iran	1999	2.9
Karachaganak	Kazakhstan	1979	2.4
Cusiana	Colombia	1988	2.4
Yadavaran	Iran	2002	2.4
Girassol	Angola	1996	2.0
Kizomba B	Angola	1998	2.0
Thunder Horse	USA	2001	2.0
Guara	Brazil	2009	2.0

The estimated recoverable reserves of these 15 oilfields (with a cut-off point of 2 bn bbls) amount to 54 billion barrels. The recoverable oil found since 2000 in such massive fields sums to 26.2 billion barrels. Note that the world consumes these days about 26.6 bn bbls of crude oil a year.

Some observations

- Is the world of oil experiencing a ‘paradigm shift’? I do not think so.
- Nothing untoward, unusual or inexplicable is going on. Oil demand is responsive to oil prices, albeit with delays, except where subsidies are in evidence.
- Oil supplies outside OPEC are not collapsing. Where conditions — fiscal, political and geological — are favourable, output is stable or expanding and, by the way, we still seem to be finding gigantic oilfields.
- OPEC, led by Saudi Arabia, has tried to keep the oil market ‘tight’. Part of this tightening is deliberate and part due to losses of productive capacity in certain OPEC member-countries.
- The OPEC angle has been masked by a lot of ‘noise’ about security of demand, ballooning costs of supply, investment needs, oil peaking and refining difficulties.
- A large, powerful and active oil futures market has surmised that oil will be tight for the foreseeable future and has been acting accordingly.

Final remarks

- The oil price peak of \$147/bbl in July 2008 is highly unlikely to be seen again for the foreseeable future; however, nor will the price settle below \$50/bbl. It will probably be quite volatile in a \$20/bbl range around a long-term level of \$60/bbl.
- OPEC will try to keep prices above \$60/bbl; the outcome will depend on the amount of spare oil production capacity available and the fiscal needs of the oil-producing states.
- In the longer term, oil demand growth is likely to be on the low side due to OPEC's preoccupation with high oil prices, concern about the environment and technological change.
- The world's oil resources are ample; getting them out of the ground is the problem. Key questions : **(a)** is there the desire to do so, **(b)** will there be enough investment by OPEC and the oil companies and **(c)** will there be political stability?

Current elements of instability

- **OPEC** thinks oil demand is highly inelastic and that restricting residual supplies of oil will ensure rising prices and ever-growing revenues; it also does not differentiate between consumers, tending to treat them as one.
- **OPEC** also believes that the marginal non-OPEC producers need oil prices above \$80/bbl today in order to make reasonable returns.
- **OPEC** wishes to keep oil inventories low, fearing the 'ghost of Jakarta' in 1997. Stock increases in 4Q06 led to an OPEC-led output squeeze.
- The **COMPANIES** are kept out of the low-cost areas with potential and are opportunity constrained as a result. Their horizons are foreshortened and they have not been investing enough, preferring to return funds to their shareholders.
- **GOVERNMENTS** of oil-consuming countries, especially in the developed world, wish to reduce their dependence on oil in the longer-term; they are also fearful of rising levels of CO₂ emissions and have pledged to reduce drastically their use of hydrocarbons.
- **THE OIL DERIVATIVES MARKET** has grown hugely since 2001 and exaggerates the effect of changes in fundamentals.

Examples of politics interfering with oil supplies

- The formation of OPEC in September 1960.
- Iraq's Law 80 (1961) and the expropriation of unexplored areas, especially the North Rumaila oilfield.
- Colonel Ghaddafi forces Occidental in Libya to yield to his demands (Aug. 1970) and takes over BP's Sarir concession in Dec. 1971.
- The Arab oil embargo of October 1973.
- The oil nationalisations of the mid-1970s.
- The Iranian Revolution of 1978-79.
- Saddam's invasion of Iran in 1980 and the 8-year Iraq-Iran War.
- Saddam's invasion of Kuwait in 1990 and Operation Desert Storm.
- Venezuela and Hugo Chavez's ending of the 'apertura' policy in 1999.
- The unilateral embargoing of Iran by the United States.
- Invasion of Iraq in 2003 and the removal of the Saddam regime.
- Nigeria's conflict in the Niger Delta with MEND.
- Chavez's insistence on 51% of joint ventures in Venezuela.

The Straits of Hormuz — a key choke point

- In 2008, the Gulf countries exported 20.1 mbpd of oil, of which 18.3 mbpd were exported via the Straits of Hormuz.
- These 18.3 mbpd represented roughly 33% of the world's traded oil and 25% of the global supply of oil last year.
- Saudi Arabia has three main oil export terminals. Ras Tanura in the Gulf has a capacity of about 6 mbpd, the Ras al-Ju'aymah facility, also in the Gulf, has a capacity of 3 to 3.6 mbpd and the Yanbu' terminal on the Red Sea has a loading capacity of around 4.5 mbpd for crude and 2 mbpd for NGLs and oil products.
- Sixty per cent of the oil exported from Saudi Arabia would have to negotiate the Straits of Hormuz.

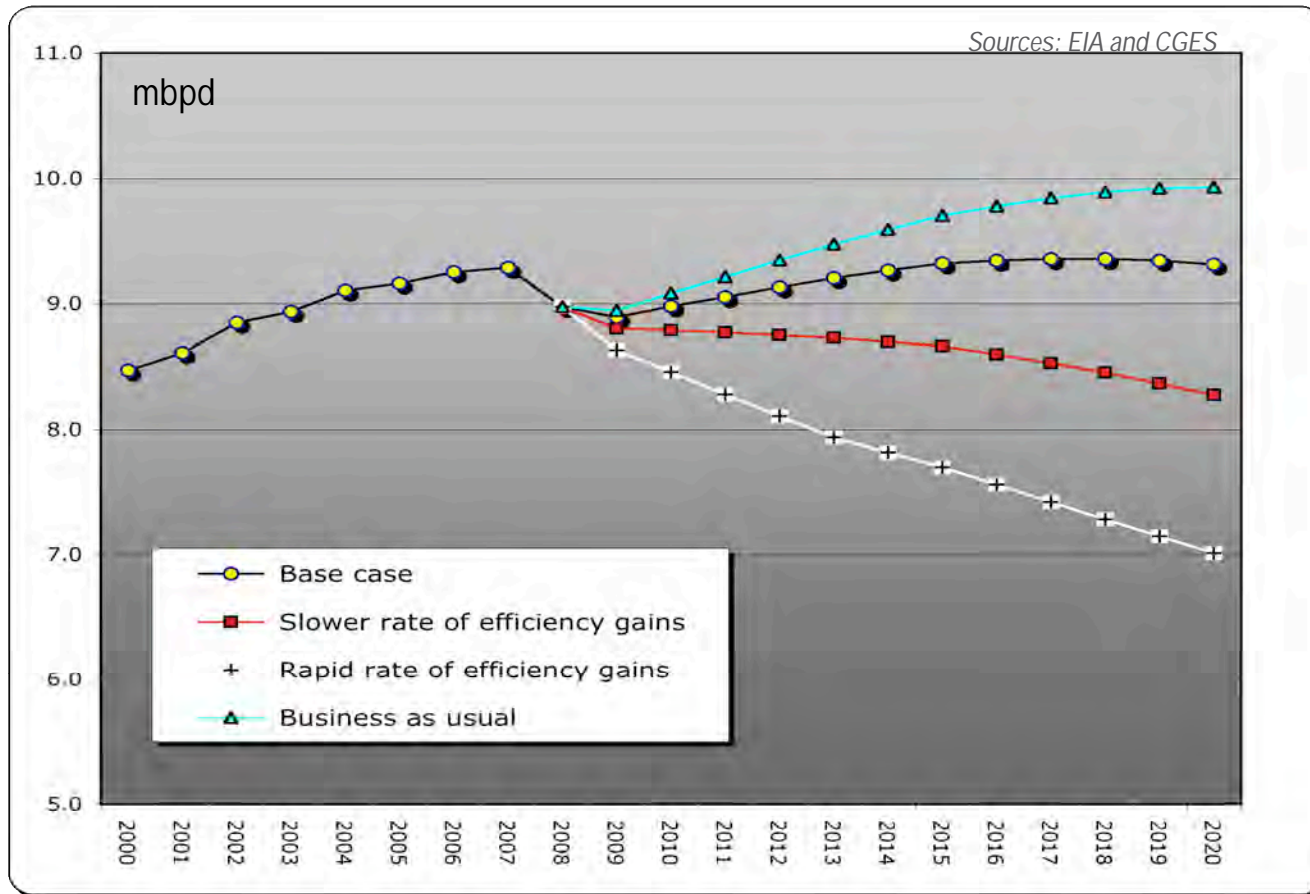
Strategic oil reserves

		Reserves mn barrels	days of imports
United States	strategic	720	80
	commercial	375	42
Japan	strategic	321	71
	commercial	250	56
Eur. Union	commercial (required)		90
South Korea	strategic	118	59
China	strategic	100	28

Oil's fundamental truths

- **Oil exploration** remains a gamble despite technological progress.
- From the very beginning there have been those who fear the world is running out of oil; the idea that **oil is peaking** is not new.
- **Oil demand** is relatively insensitive to oil prices and reacts fully to changes in these prices with long lags.
- **Oil supply** responds to oil prices too, but in a complicated fashion.
- As a result, the oil market is subject to **large price swings**, unless ...
- ... oil supplies are controlled and managed in the interests of **price stability**.
- Pre-1973 the **oil majors managed supplies**; since then OPEC has arrogated to itself this role.
- **OPEC has tried to stabilise prices** by fixing prices (OGSPs from 1974 to 1983), by Saudi Arabia acting as the residual supplier (1983-85), by quotas (1986-98) and since 1998 by trying to control stocks.

US Gasoline demand scenarios



Two factors will play a key role in determining the future path of US gasoline consumption, once the US emerges from the current recession — the rate of fuel efficiency gains in the non-hybrid vehicle fleet and the rate at which hybrids gain market share. I have varied only the rate of fuel efficiency gains in order to show its potential impact on US gasoline consumption.

“ OPEC would have to realise that there is no natural law which provides for the sale of a commodity in abundant supply at prices which are many times its cost. ”

— Paul Frankel, **“Oil : the facts of life”** (1962 essay)