

# 15<sup>th</sup> National Energy Conference - IENE

Must oil prices keep on rising?

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**CGES**

# Why some believe oil prices will keep on rising

## The marginal barrel is difficult to find and expensive to produce

Projects involving tar sands, oil in deep waters and heavy oils all have substantial fully-built-up costs, needing high oil prices to go ahead.

## We are not finding enough oil

Given high current rates of depletion in most areas, the world's reserves are declining and output will too.

## Oil demand is price inelastic

Rising oil prices are not able to curb oil demand sufficiently to reduce the upward pressure on oil prices and China, the world's economic powerhouse, will continue to exhibit high rates of economic growth.

## Saudi Arabia is dominant and will pursue a high-price strategy

Saudi Arabia needs rising oil prices to pay for its ambitious development projects, keep its people content and enhance its security in a dangerous part of the world.

## Curbs are needed on fossil fuel use to stop global warming

Fossil fuel prices must rise sufficiently to reduce the consumption of these fuels for climate change reasons. The development of renewables requires high coal, oil and gas prices.

## Latest fully-built-up costs of projects involving conventional oil

	\$ per peak daily barrel	F-B-U cost \$/bbl	Date of project
Haradh III project, S. Arabia	2,500	1.3	producing
Khurais increment, S. Arabia	10,000	5.3	2009
Chicontepec, Mexico	15,000	9.2	ongoing
Manifa increment, S. Arabia	17,500	10.2	2013
Jubilee field, Ghana	17,875	10.4	producing
Carabobo projects, Venezuela	33,333	20.5	2011
Heavy oil projects, Iran	40,000	24.7	2015
Laggan-Tormore, UK Atlantic	42,920	26.5	2014
S. Iolotan Phase I, Turkmenistan	58,188	35.9	2010
Kashagan final, Kazakhstan	85,000	40.0	2018

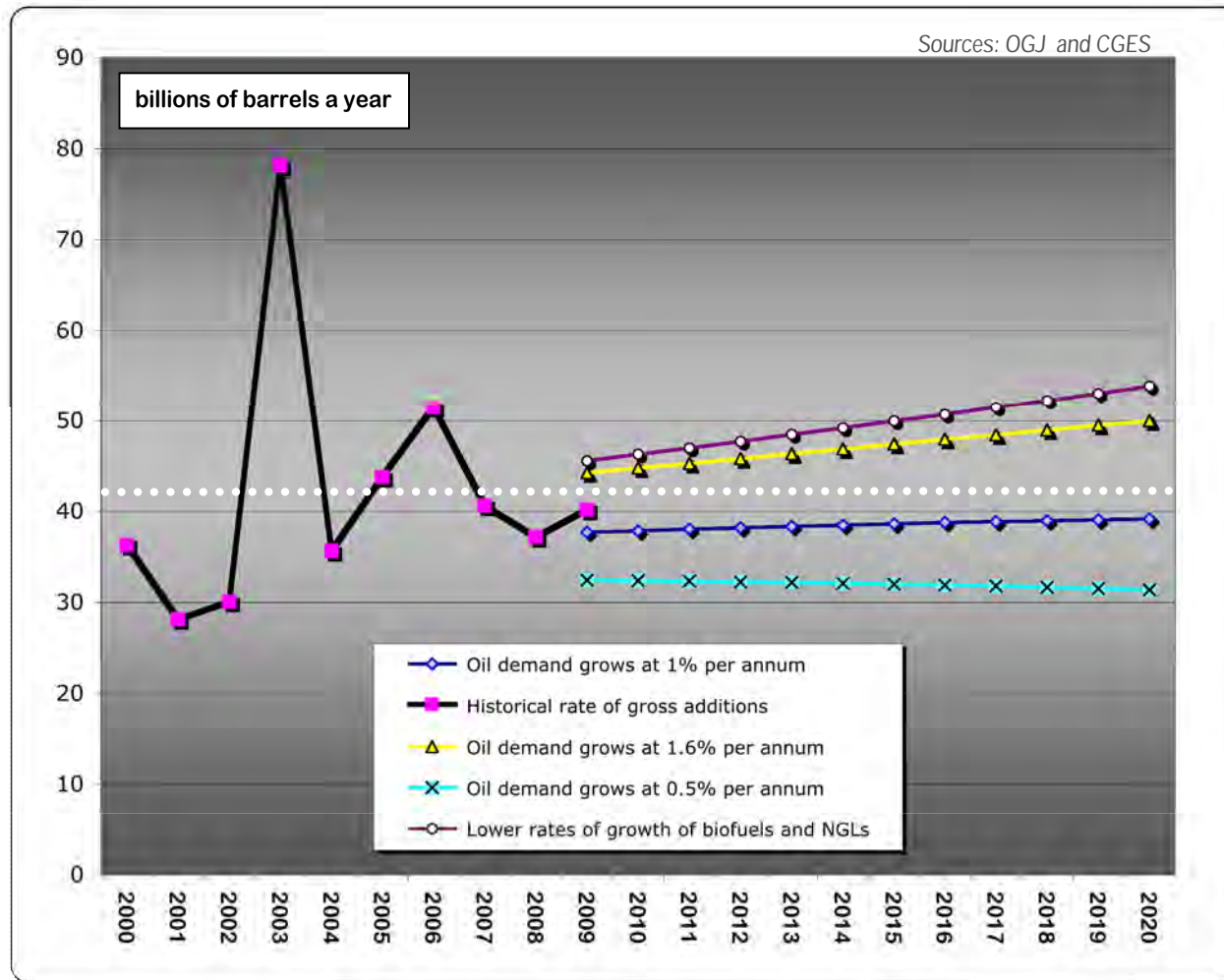
- Based on a formula for capital and operating costs given in *"The Economics of Petroleum Supply: papers by M. A. Adelman, 1962-1993"*, The MIT Press, Cambridge, Mass., page 201.

# 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
Libra	Brazil	2010	7.0
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 61 billion barrels. The recoverable oil found since 2000 in such massive fields sums to 33.2 billion barrels. Note that the world consumes these days about 26.5 bn bbls of crude oil a year.

## Are we finding enough oil? Global gross additions to oil reserves, 2000-2020



This graph shows how much crude oil needs to be added to oil reserves globally each year in order to keep the world's crude oil R/P ratio at 43 years' worth (the average from '86 to '09), stocks of crude oil at refineries at 30 days' worth and product inventories at 25 days of forward consumption,

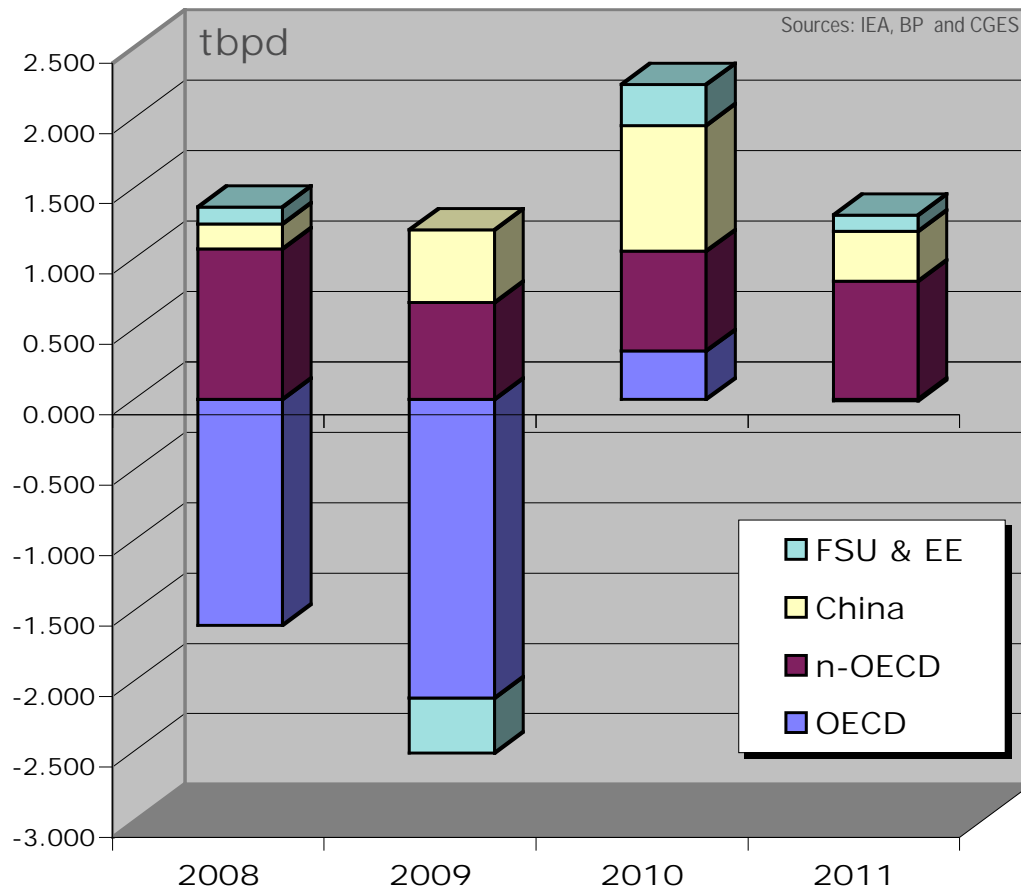
with ...

the supply of biofuels growing at 6.6% per annum and

the supply of NGLs growing at 3.5% a year.

*Note that gross additions to crude oil reserves averaged 42.1 billion barrels a year between 2000 and 2009 and worldwide oil consumption in 2008 amounted to 31.4 bn bbls.*

# Incremental oil demand, 2008-2011

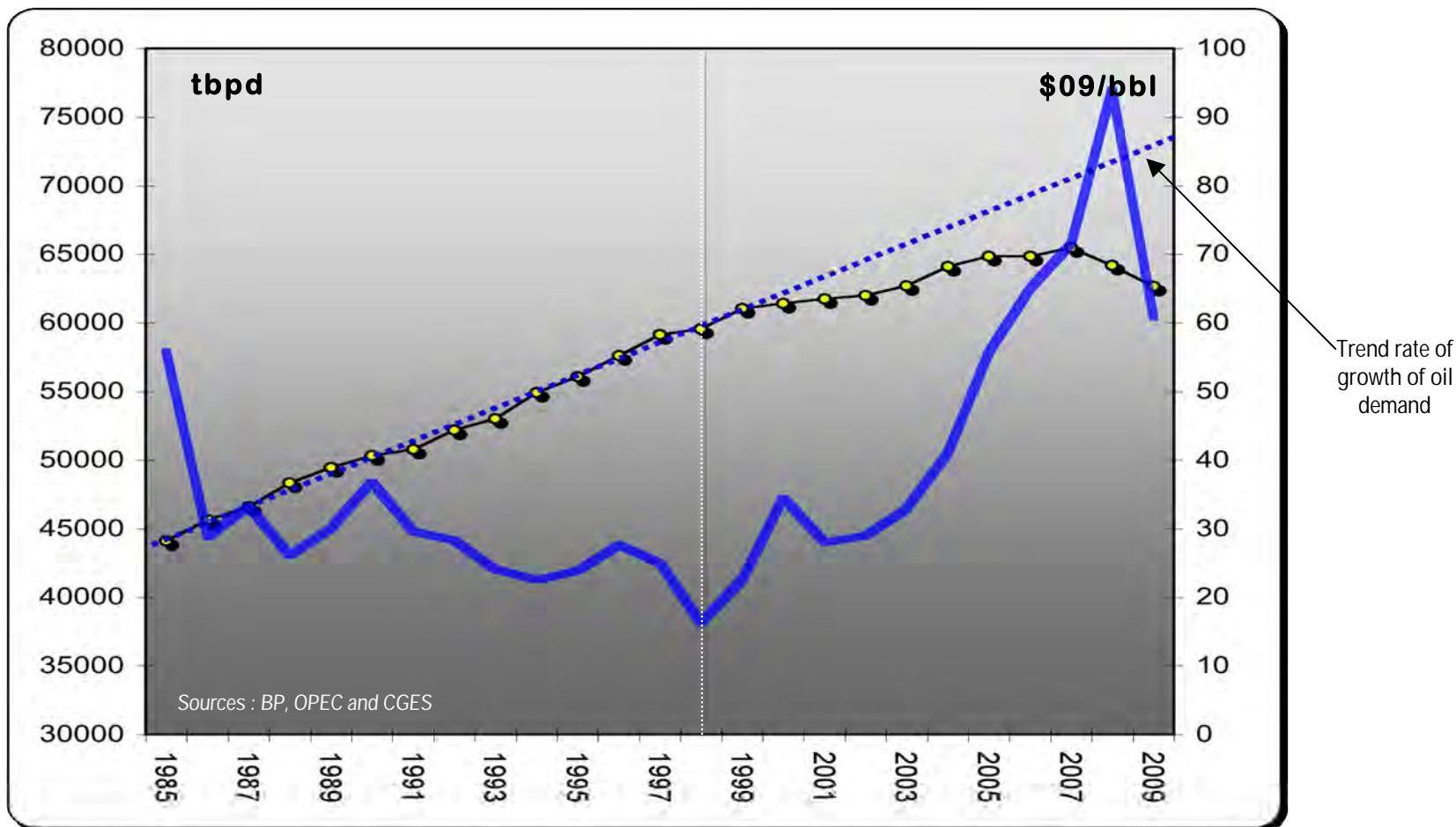


The decline in global oil demand in 2008 and 2009 was essentially because of the collapse in oil demand in the OECD countries due to the recession, not forgetting the lagged effect of the high oil prices faced by these economies prior to 2009. The non-OECD countries have carried on regardless, in part due to oil subsidies. In 2009, Saudi subsidies amounted to \$43/bbl, Iranian subsidies were \$46/bbl, India's \$10/bbl and even China offered a \$2/bbl subsidy.

# Incremental oil demand, 2000-2010

	Change in mbpd	% change per annum	% of non- OECD $\Delta$
<b>OECD</b>	<b>- 2.2</b>	<b>- 0.5</b>	
<b>Non-OECD</b>	<b>12.4</b>	<b>3.6</b>	<b>100 %</b>
<b>China</b>	<b>4.6</b>	<b>7.0</b>	<b>37 %</b>
<b>Other Asia</b>	<b>2.7</b>	<b>3.0</b>	<b>22 %</b>
<b>Latin America</b>	<b>1.4</b>	<b>2.5</b>	<b>11 %</b>
<b>Middle East</b>	<b>2.6</b>	<b>4.2</b>	<b>21 %</b>
<b>Africa</b>	<b>0.8</b>	<b>2.7</b>	<b>9 %</b>

## Inelastic oil demand? : consumption in the market economies and the real price of oil, 1985-2009



Oil demand might be insensitive to prices, but its inelasticity is not zero. The consumption of oil in the market economies (excluding the former non-Communist world and OPEC) started reacting to oil price increases way back in 2000 and continued to do so during the 2000s.



## Arriving at the minimum oil price needed by Saudi Arabia, based on expected expenditures and income in 2010

	\$ bn	\$ bn
General expenditure	141.0	122.6
Debt interest	3.5	3.1
Capital expenditure	20.0	21.0
Total expenditure	164.5	146.7
Non-oil income	15.3	14.0
Investment income	3.5	3.9
Oil revenues* (CGES estimates)	157.0	116.8
Total income	175.8	134.7
<b>Surplus/Deficit</b>	<b>11.3</b>	<b>- 12.0</b>

2009 actuals

- With Saudi output at 8.2 mbpd (the expected 2010 average), the minimum OPEC basket price required to cover expected Saudi general expenditure in 2010, less non-oil and investment income, is \$61/bbl.
- To cover general and capital expenditure plus debt interest (less non-oil and investment income) the price needed is \$71/bbl. To cover total expenditure and debt interest, plus a contingency reserve of \$5bn, the Kingdom needs \$74/bbl. The CGES expects the OPEC basket price to average \$77/bbl this year.

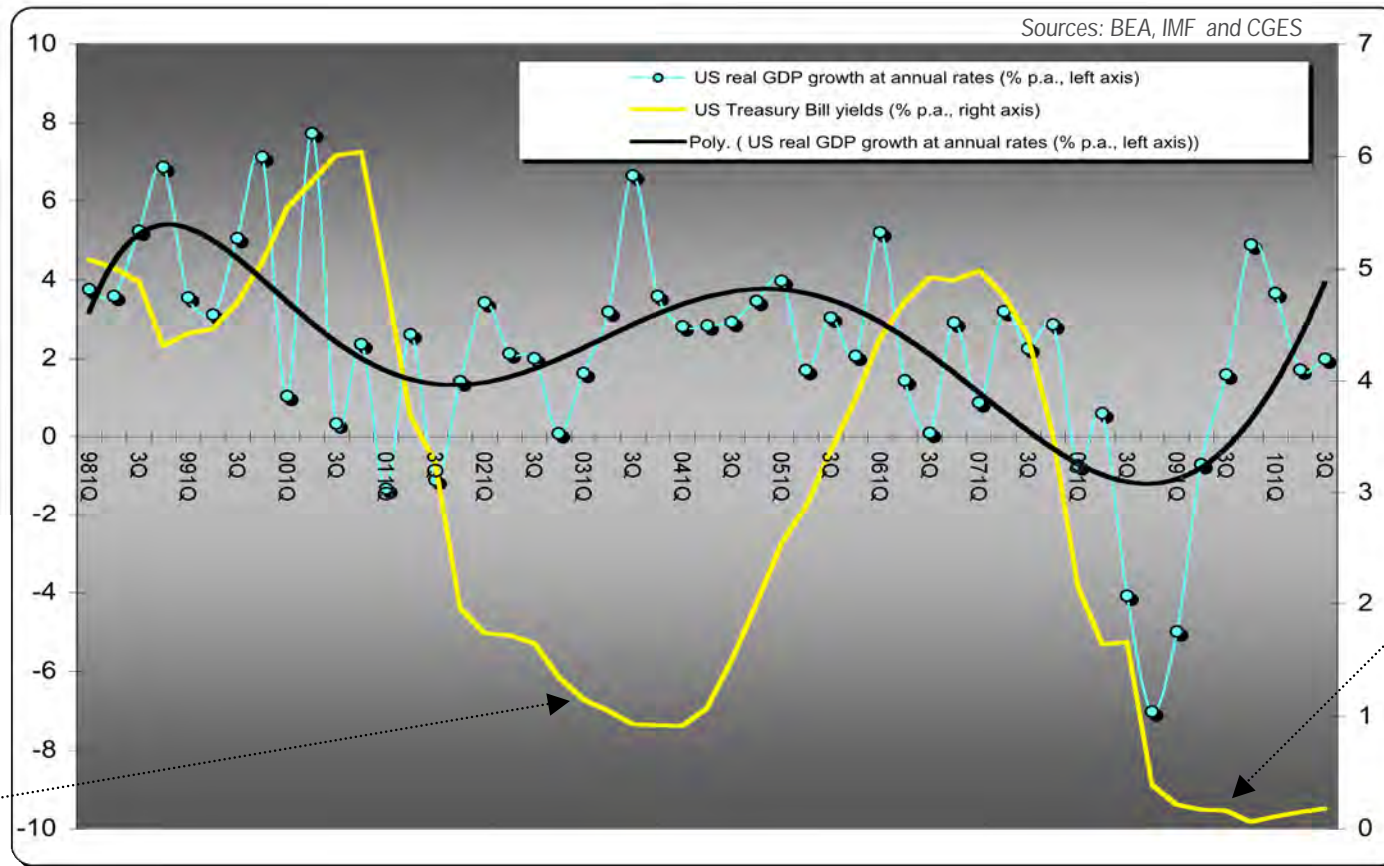
\* Including \$17 bn from NGL exports.

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## The role of financial factors in driving oil prices higher

- Thus far we have looked at fundamentals. What about financial considerations?
- Under both Greenspan and Bernanke the Fed has pursued on occasion 'cheap money' policies, augmented recently by QE.
- Cheap money has encouraged the so-called Dollar carry trade. Creditworthy players borrow US Dollars at low cost and invest them in higher-yielding, dollar-denominated assets — including oil.
- 'Investment' in oil can take many forms — equities, corporate bonds, trades in physical oil and plays in oil derivatives.
- The last has low participation costs and can be leveraged up by a factor of ten or more; the physical market has very high entry costs.

# Growth rates of US real GDP and yields of US Treasury Bills, 1Q98 - 3Q10



Greenspan's cheap money



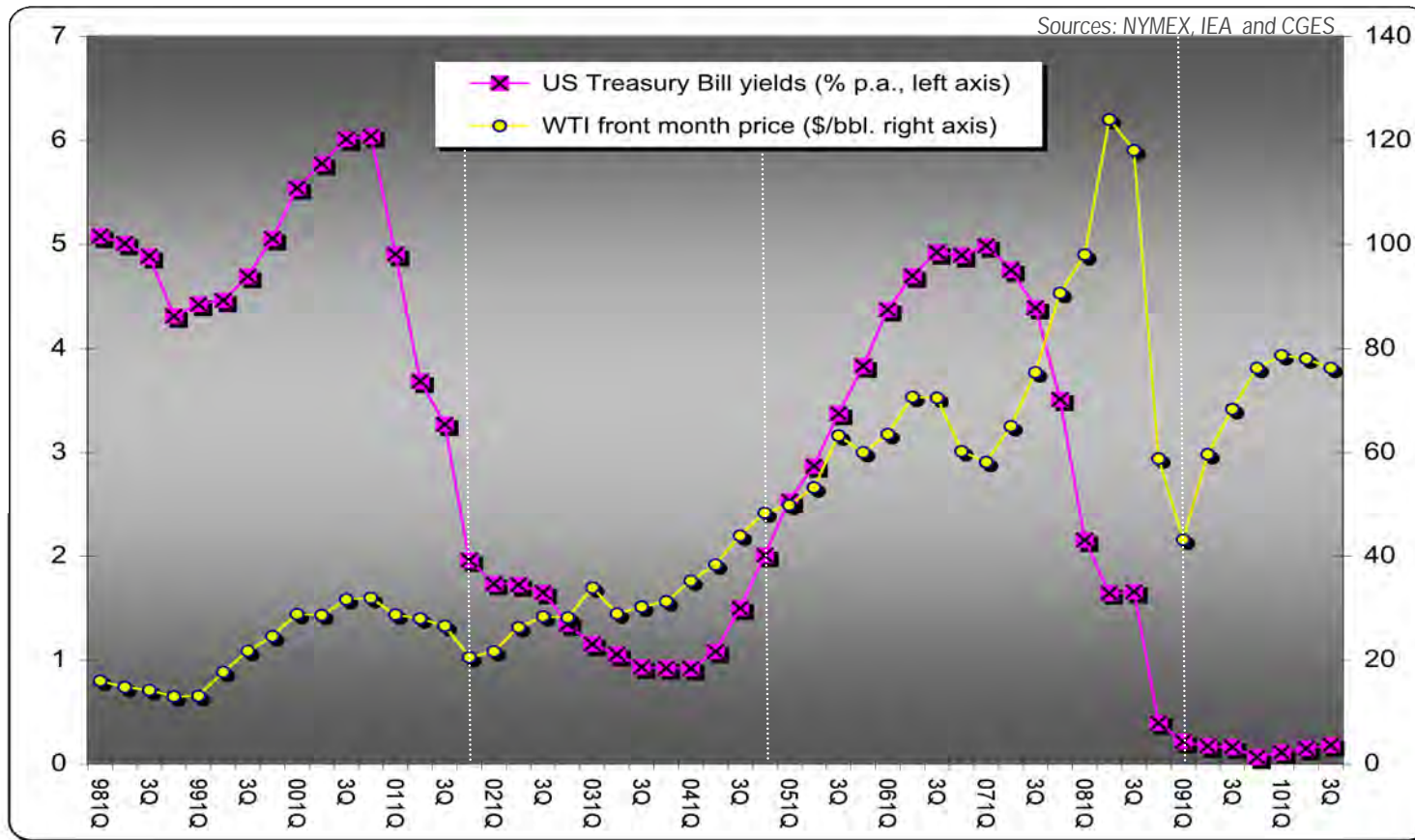
Bernanke's cheap money



Former Chairman of the Federal Reserve, Alan Greenspan, kept interest rates too low when the US economy was clearly recovering from 1Q03 onwards. Some think Ben Bernanke, the current incumbent, is repeating previous errors by keeping US interest rates ultra low and by engaging in a second round of quantitative easing.

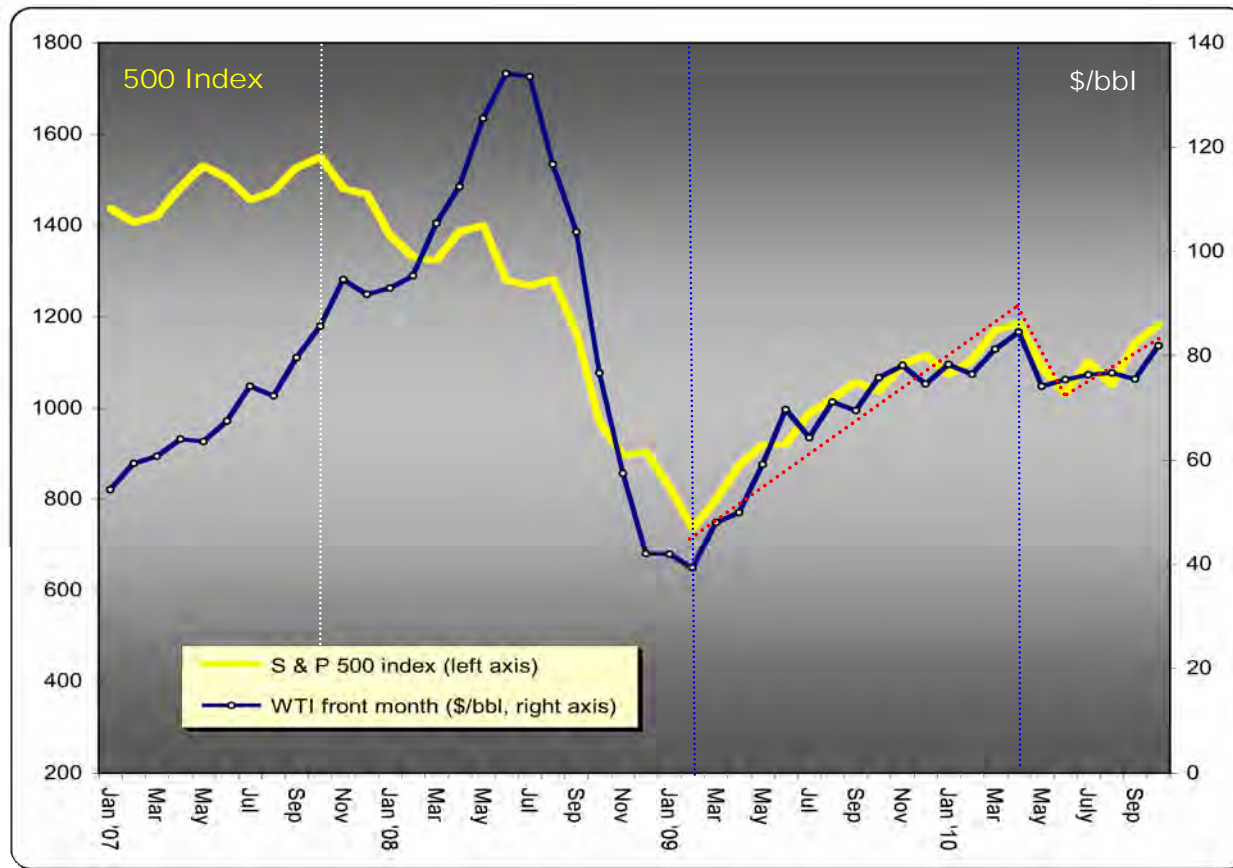
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## Cheap money and the price of oil : US Treasury Bill yields and WTI front-month prices, 1Q98 - 3Q10



The two periods during which US Treasury Bill yields were especially low coincided with rising oil prices. This is not to say that there is a clear causal connection between the two; however, there is more than a suspicion that cheap money provided both the means and the incentive to search for higher-yielding 'asset classes', oil being one of them.

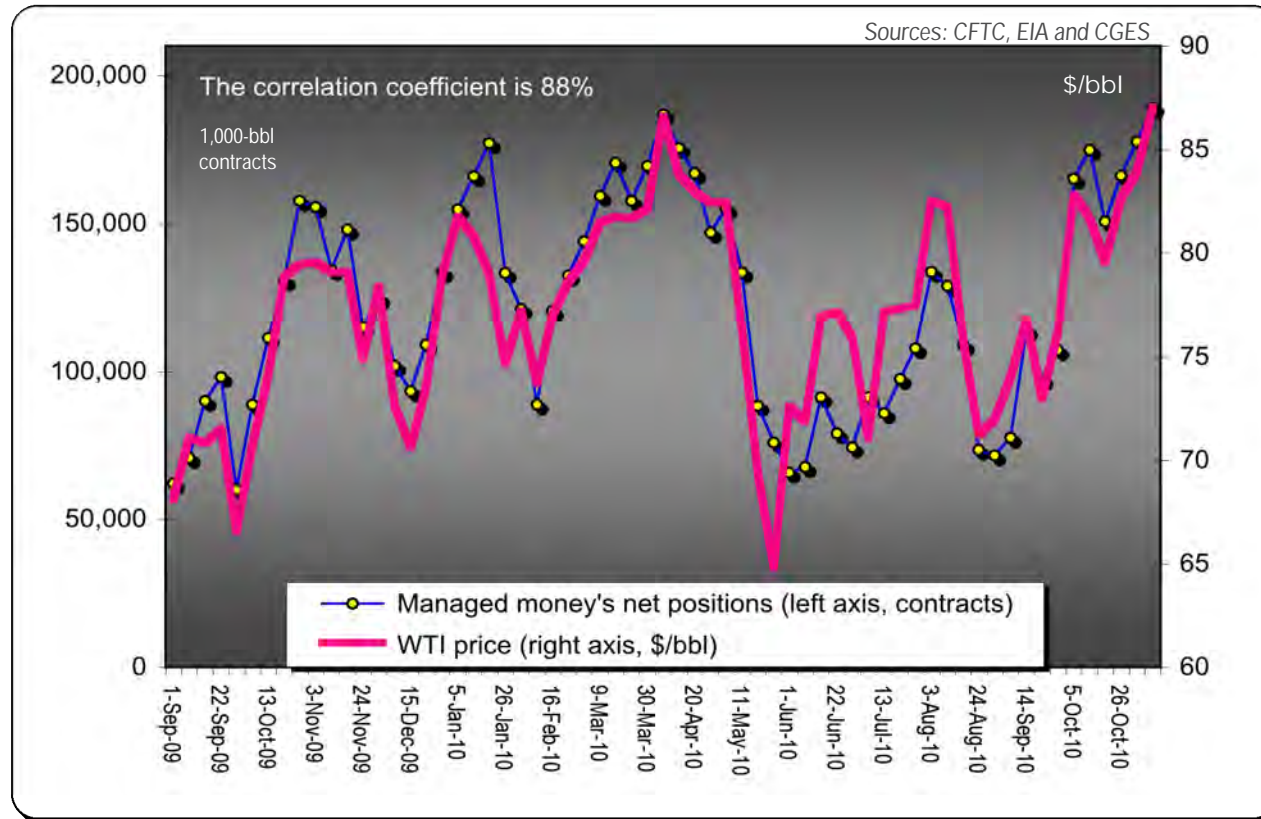
# Has oil become a financial play? The S&P '500' index and front month WTI



Note that the correlation coefficient for the whole sample is 45%, but for the period July 2008 till October 2010 it is 89%.

The Standard & Poor's 500 index fell almost continuously between October 2007 and February 2009; however, from February '09 it staged an impressive rally until April '10. As for WTI, it kept on rising from Oct '07 until the peak in early July '08; thereafter it has moved with 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.

# Managed money net open interest positions on NYMEX and WTI prices



Since September '09, the US Commodity Futures Trading Commission has been publishing its disaggregated Commitment of Traders report, which separates its former category of non-commercials (large-scale speculators) into 'managed money' and 'other reportables'. Managed money operators include commodity pool operators, commodity trading advisors and hedge funds. Notice the high correlation (88%) between the WTI price and the managed money's net open interest positions for the period from the 1st of September 2009 till the 9th of November 2010.

# The transmission mechanism

How do rising futures prices along the forward curve affect the spot price of oil?

If the contango in the oil market is sufficiently large to support a cash-and-carry hedge, there is a clear-cut financial **incentive** to buy oil in the spot market and simultaneously sell it forward. The desire to get hold of physical oil raises the spot price and the selling of oil forward reduces the futures prices, reducing the contango.

A fresh wave of upward price expectations will push up the forward curve and start the cash-and-carry hedge cycle all over again. When the market is backwardated (the convenience yield is high) there is a financial **disincentive** to store oil surplus to requirements, because oil can be sold spot and bought back forward, locking in a financial gain.

# PREDICTING SPOT WTI PRICES

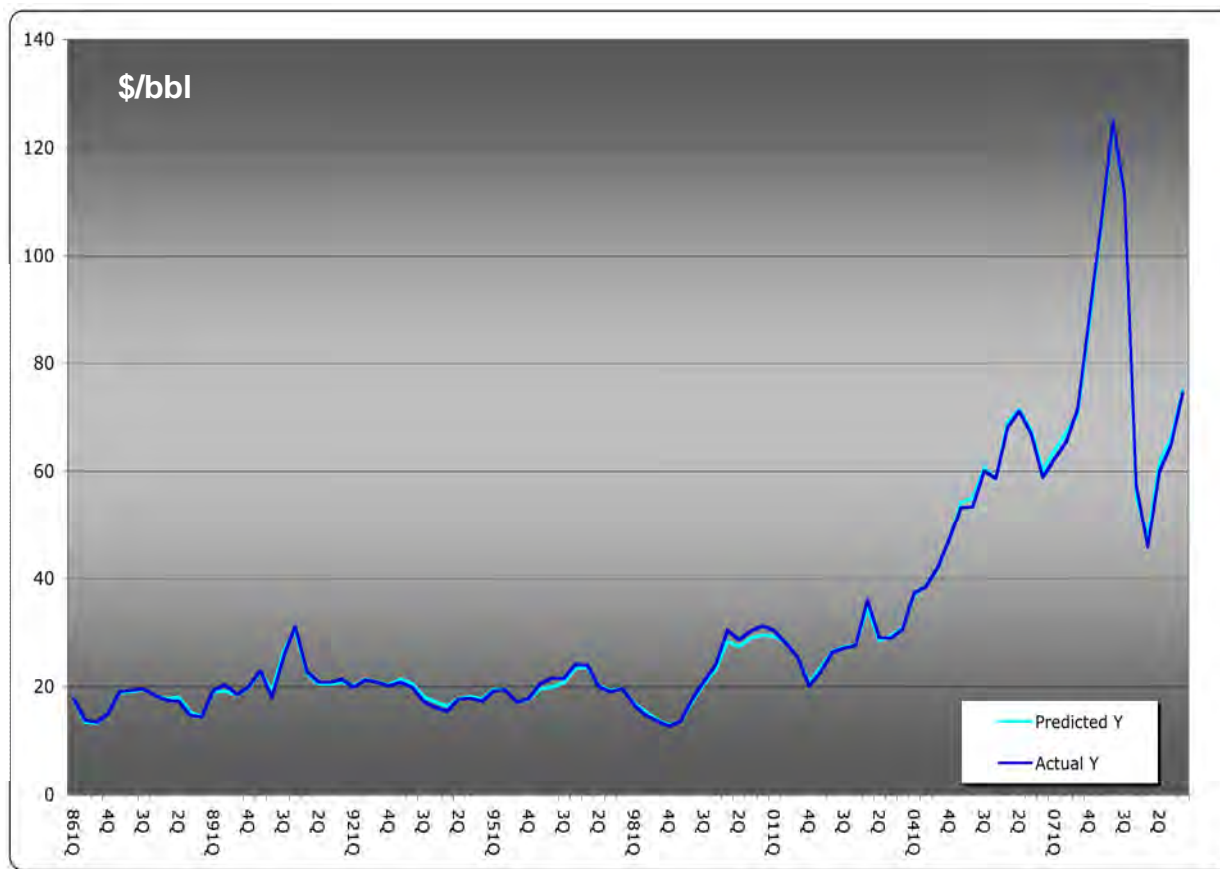
Actual vs predicted over the period 1Q86-4Q09, based on a model estimated over the period 1Q86-4Q09.

The model is based on inventory disequilibrium: that is, the oil price adjusts to the discrepancy between desired and actual stocks.

**The largest effect on the spot price of oil is cash-and-carry hedging, largely driven by the futures price in relation to the spot price and the cost of carry.**

Oil consumption and the level of stocks are also significant, but spare oil production capacity does not seem to be an important consideration.

Note that all variables are seasonally adjusted.





# What could cause oil prices to trend downwards?

## Slow rates of growth of oil consumption

Long-run global oil demand growth at a rate below 1.1% would remove some of the upward price pressure.

## Non-OPEC oil supplies on a rising trend and high rates of reserves additions

Non-OPEC supplies should fall by 0.4% p.a. from '11 onwards; a rising trend would keep oil prices down.

## OPEC's spare capacity staying above 8% of global oil demand

It is over 8% at present. If OPEC's plans materialise, spare capacity will drop below this level only by 2016. Much will depend on whether Saudi Arabia is comfortable living with high levels of spare capacity.

## Iraq expands its output capacity and OPEC fails to accommodate this increase

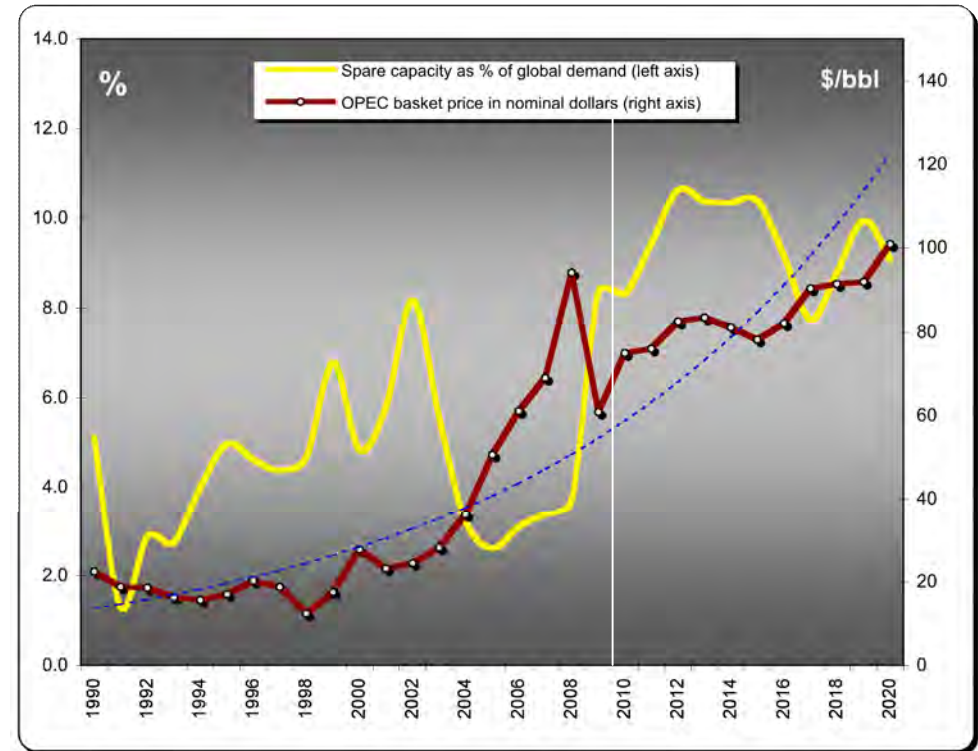
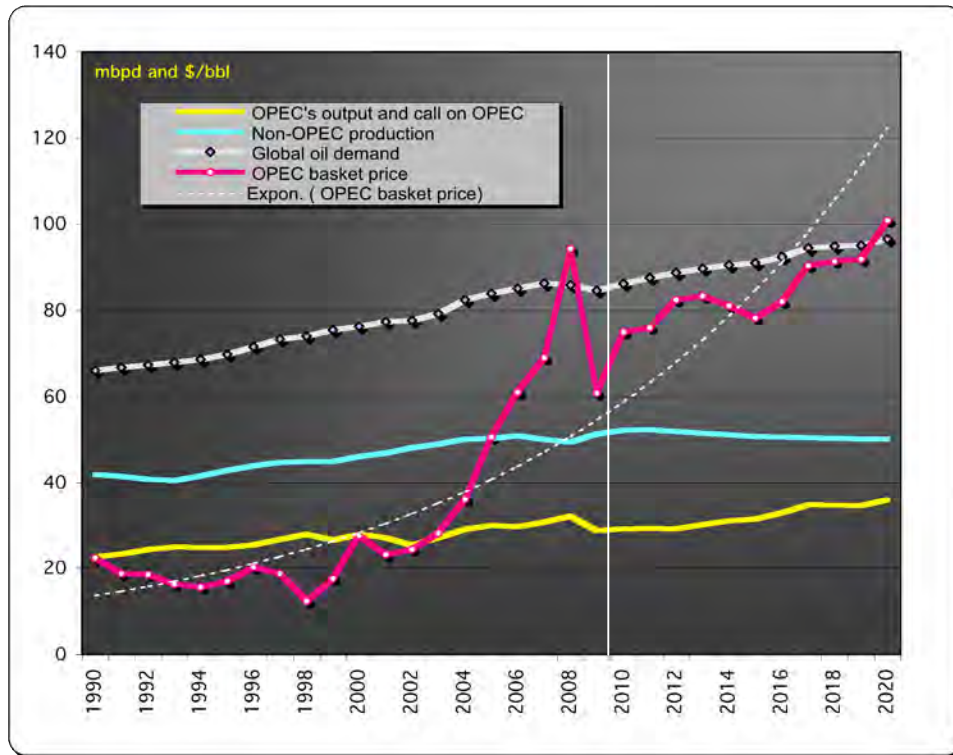
Iraq expands its production capacity by 7.5 mbpd by 2020 and the rest of OPEC does not make way for some of this increase.

## A concerted worldwide effort to curb CO<sub>2</sub> emissions

The EU is the only country grouping or nation that is making a serious effort to reduce CO<sub>2</sub> emissions — but at a very high cost. Should the US, China and India follow suit, then it would result in much reduced demand for oil and other fossil fuels.

# A longer-term view of the oil price

Historical sources : IEA and BP Future : CGES



Following the huge bull run from 2001 till 2008, the numbers point to a period of relative oil price stability, with OPEC having to work hard to prevent its growing excess production capacity from causing the price to fall back down below \$60/bbl. If OPEC does not expand capacity as planned, then we shall face a period of high and volatile prices, weak demand and healthier non-OPEC supplies.

# Conclusions

- ❖ For oil prices to keep on rising, certain conditions must be met ...
- Future gross additions to global oil reserves prove inadequate, oil-related development/production costs increase inexorably and oil demand is sufficiently inelastic not to react to rising prices.
- China, India and other developing economies continue to grow at breakneck speed without any serious inflationary repercussions, both domestically and internationally, in a world that is perceived to be resource constrained.
- OPEC manages to keep its output under control, despite massive excess capacity occasioned by Iraq's upstream expansion programme.
- Efforts to curb the use of fossil fuels are intensified, requiring high oil, gas and coal prices to justify expenditure in renewable sources of energy.