The Oil Drum
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

Updated World Oil Forecasts, including Saudi Arabia

Posted by ace on August 5, 2007 - 11:00pm
Topic: Supply/Production
Tags: demand, peak oil, production, saudi arabia, supply [list all tags]

Executive Summary

PLEASE NOTE: click on the link below for the most recent oil forecast update http://www.theoildrum.com/node/3623 which includes forecasts for Kuwait and the UAE.

1. World total liquids supply production (Fig 1) remains on a peak plateau since 2006 and is forecast to fall off this peak plateau in 2009. As long as demand continues increasing then prices will also continue increasing.

2. Forecast world crude oil and lease condensate (C&C) production retains its 2005 peak (Fig 2). The forecast to 2100 shows declining C&C production, using a bottom up forecast to 2012 (Fig 3). The forecast to 2012 shows a 1%/yr decline rate to 2009, followed by a 4%/yr decline rate to 2012.

3. World oil discovery rates peaked in 1965 (Fig 4) and production has exceeded discovery for every year since the mid 1980s. Discoverable reserves in giant fields also peaked during the mid 1960s (Fig 5). The time lag between world peak discovery in 1965 and world peak production in 2005 of 40 years is similar to the time lag of 42 years for the USA Lower 48 (Fig 6).

4. World C&C year on year production changes to March 2007 and April 2007 (Figs 7,8) show significant declines for Mexico, North Sea and Saudi Arabia; significant increases for Russia, Azerbaijan and Angola. As Russia is likely to be on a production plateau and Saudi Arabia has probably passed peak production, the world C&C production will continue to decline slowly.

5. Key producer Saudi Arabia recently released an updated project schedule which does not show originally scheduled expansions of Shaybah phase 2, 0.25 mbd and Al Khafji Neutral Zone, 0.30 mbd. Consequently, it is now almost a certainty that Saudi Arabia passed peak C&C production of 9.6 mbd in 2005 (Figs 9,10).

6. World natural gas plant liquids is forecast to increase due to new OPEC projects (Fig 11). World ethanol and XTL production is forecast to double by 2012 (Fig 12). World processing

gains are forecast to decline slowly to 2012 (Fig 13).

1. World Total Liquids Supply & Demand

Although crude oil & lease condensate (C&C) production is forecast to continue declining, the total liquids supply remains on a plateau until 2009, due to offsetting production increases from natural gas plant liquids (NGPLs), ethanol and XTL (BTL - biomass to liquids, CTL - coal to liquids and GTL - gas to liquids).

Demand is forecast to continue growing but supply will start to fall forcing up prices to reduce demand.

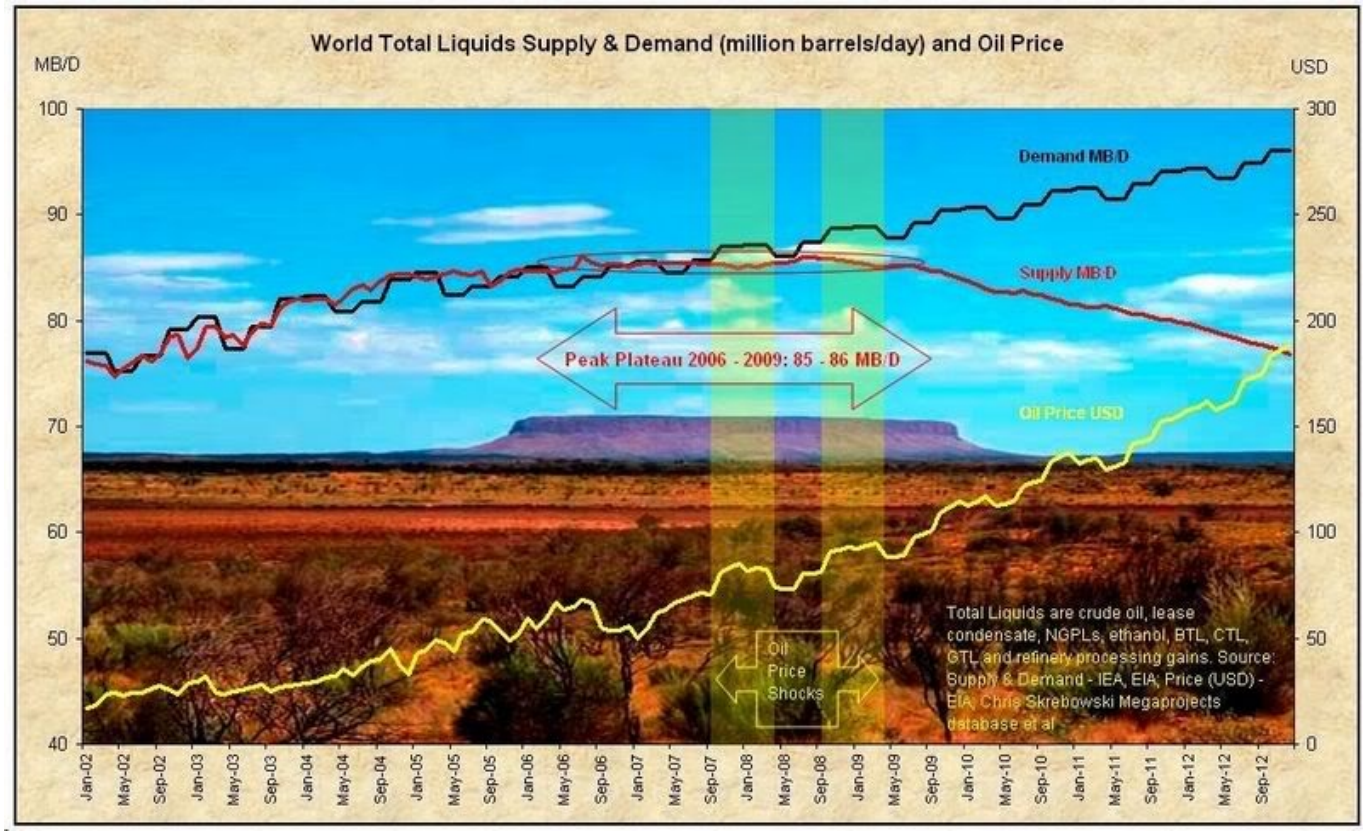

Fig 1 - Total Liquids Supply & Demand to 2012 (bottom up forecast) - click to enlarge

2. World Crude Oil & Lease Condensate Production

The largest component of total liquids is world C&C production. The first part of the forecast to 2100, in the figure below, is created using a bottom up forecast based on over 300 continuously updated regions/projects to 2012 (Fig 3).

After 2012, two scenarios are shown. The green line is a forecast using BP Annual Statistics Review 2006 proven reserves data. The dark red line, the most likely scenario, is based partly on the BP data, but large downward revisions are made to OPEC reserves and small upward revisions are made to the reserves of many countries to derive a more accurate estimate of proven and probable reserves. This estimate is assumed to be equal to the ultimate recoverable

reserves (URR).

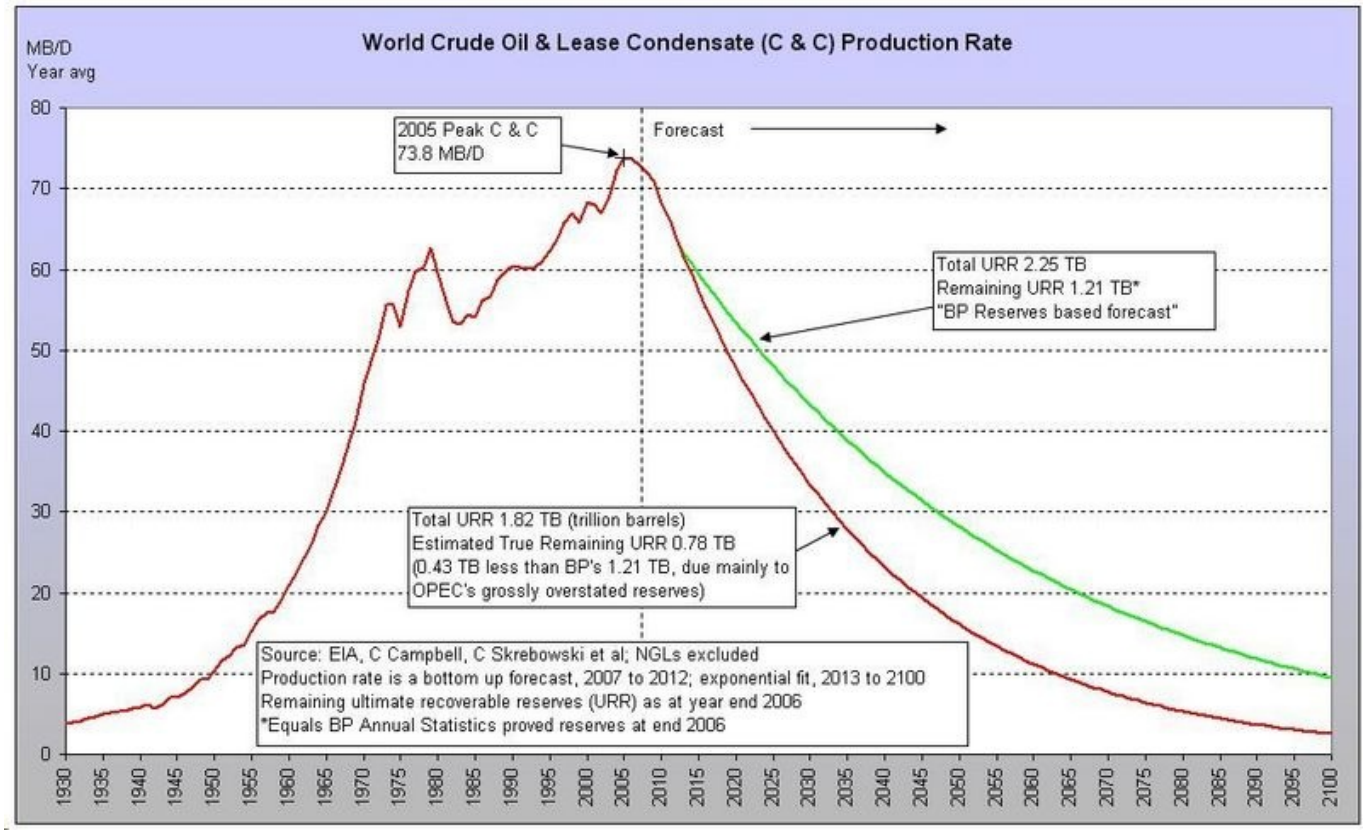

Fig 2 - World Crude Oil & Lease Condensate Production to 2100 - click to enlarge

World C&C production continues to retain its May 2005 peak and is forecast to decline by 1%/yr until 2009. The decline rate steepens to 4%/yr until 2012. The main reason for the end of the total liquids plateau in 2009 (Fig 1) is that the C&C production decline rate changes from 1%/yr to 4%/yr in 2009.

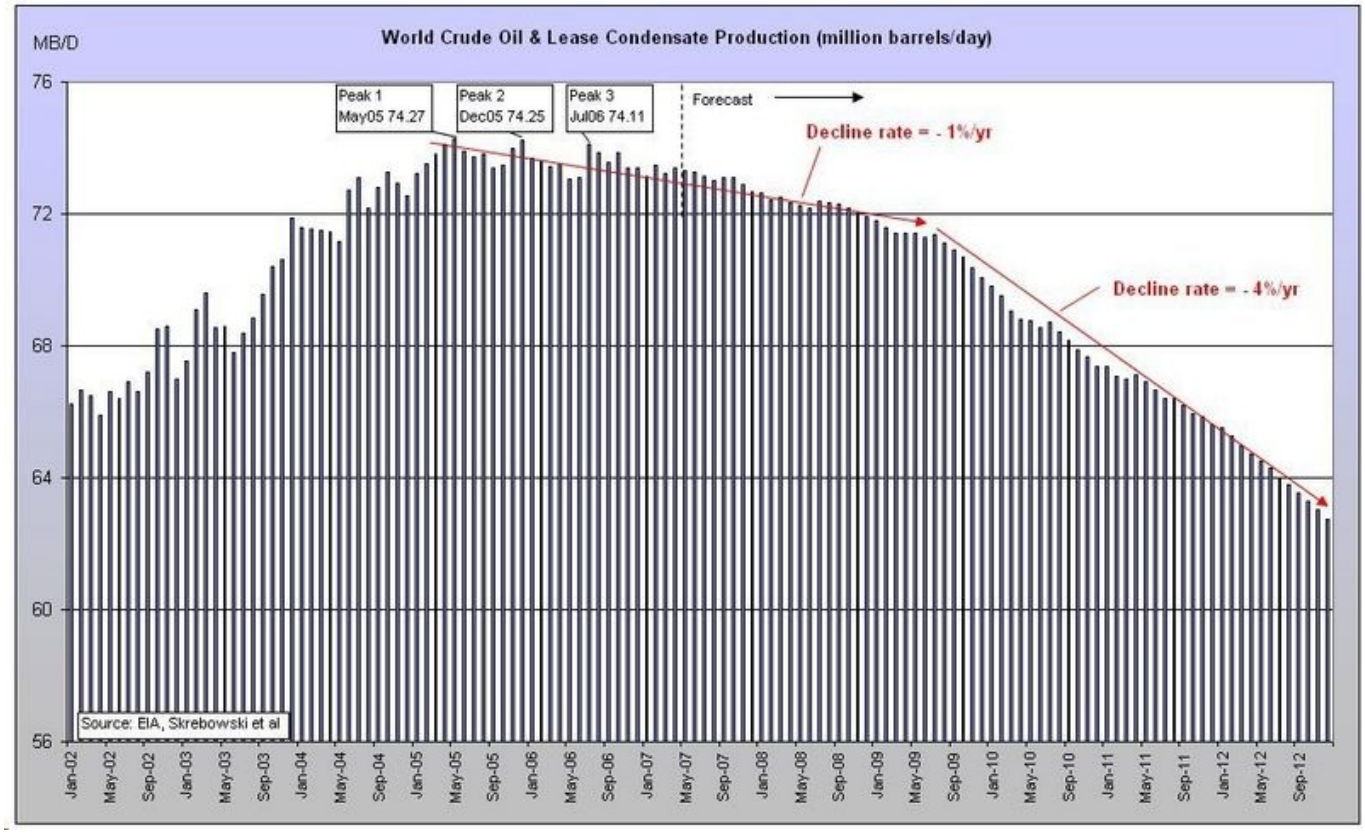

Fig 3 - World Crude Oil & Lease Condensate Production to 2012 (bottom up forecast) - click to enlarge

3. Peak Production and Peak Discovery Time Lags

Although the forecast production decline rate in Fig 2 appears high, it is a natural time lagged response to the peak year for discoveries as shown below. As the world uses more oil each year than is discovered, oil production must decline after a time lag from the peak discovery year.

The figure below shows a peak discovery year in 1965, followed by a steady decline. Since the mid 1980s, annual production has been greater than annual discoveries. This is not sustainable and it is inevitable that world annual production will start to decline. This timing of peak production and rate of decline is forecast by Fig 2.

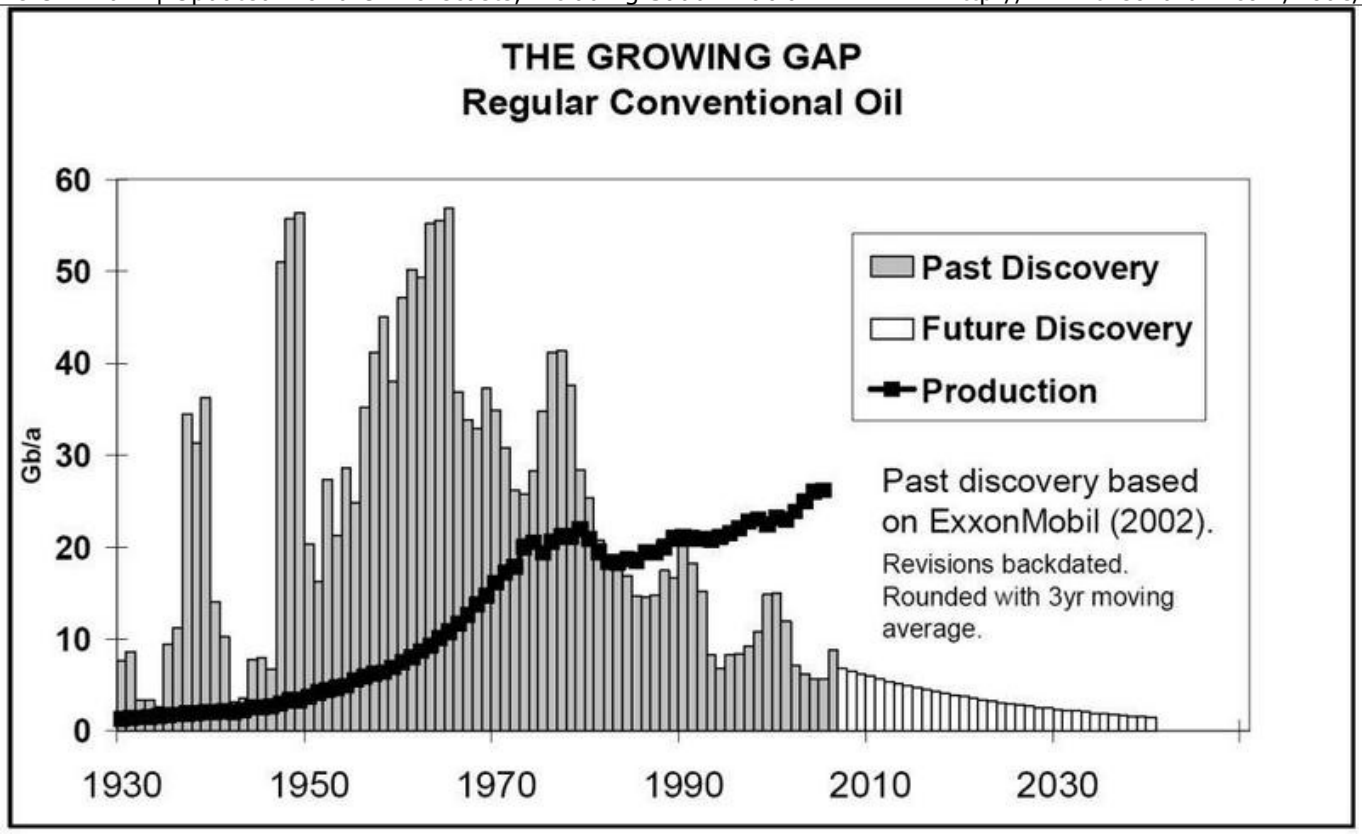

Fig 4 - World Discoveries (source [ASPO Ireland Newsletter No. 79, July 2007](#)) - click to enlarge

The figure below focuses on giant oil field discoveries and shows a similar shape to the figure above. The number of giant oil fields discovered peaked in the 1960-69 decade and both the number of giant fields and their respective recoverable reserves have declined steadily. The shape of the discovery decline curve below from 1960 to 2006 is similar to the production decline curve (Fig 2) from 2005 to 2100.

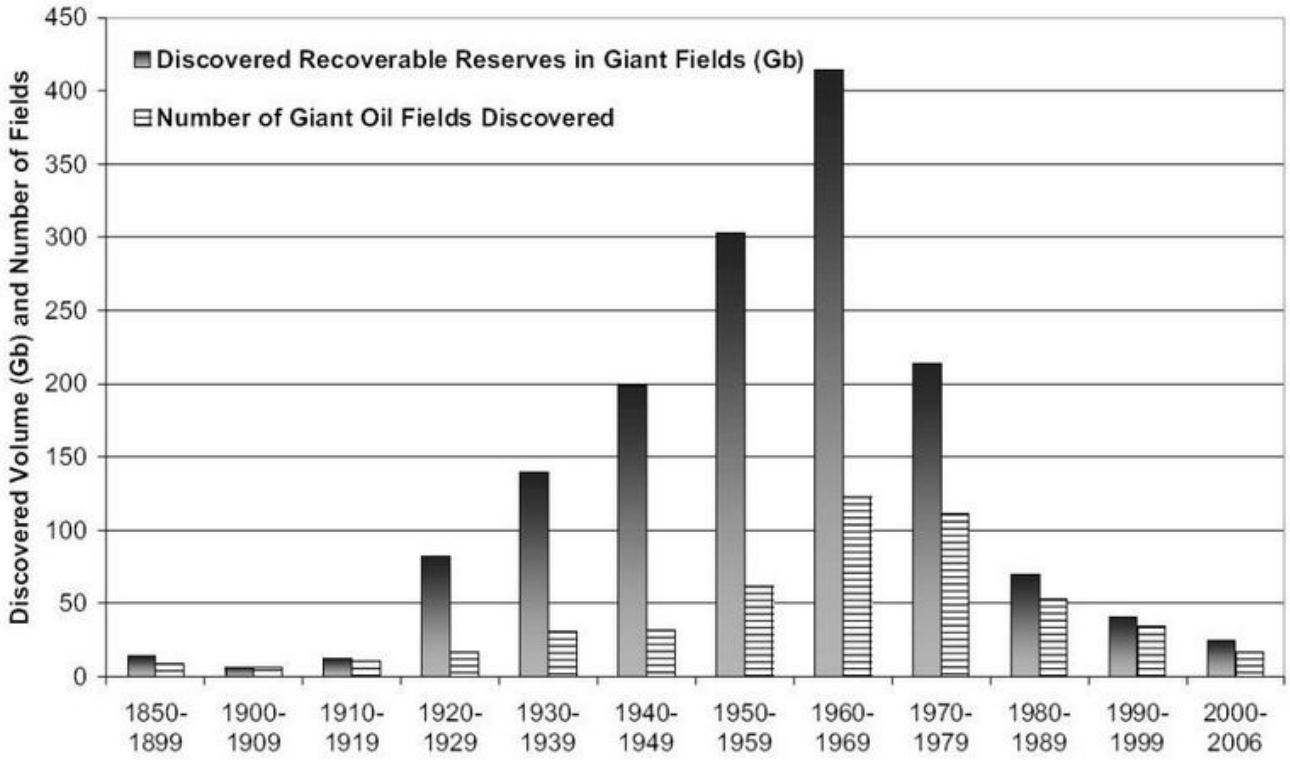

Fig 5 - World Discoveries, Giant Oil Fields (source Giant Oil Fields – The Highway to Oil, Fredrik Robelius, March 2007) - click to enlarge

A very good example of the time lag between peak discovery and peak production is the USA (Fig 6). Peak discovery was 1930 and peak production occurred 42 years later in 1972. Fig 4 shows peak discovery for the world occurred in 1965. Fig 3 predicts that peak production occurred in 2005, which is 40 years later than peak discovery, a similar time lag to the USA.

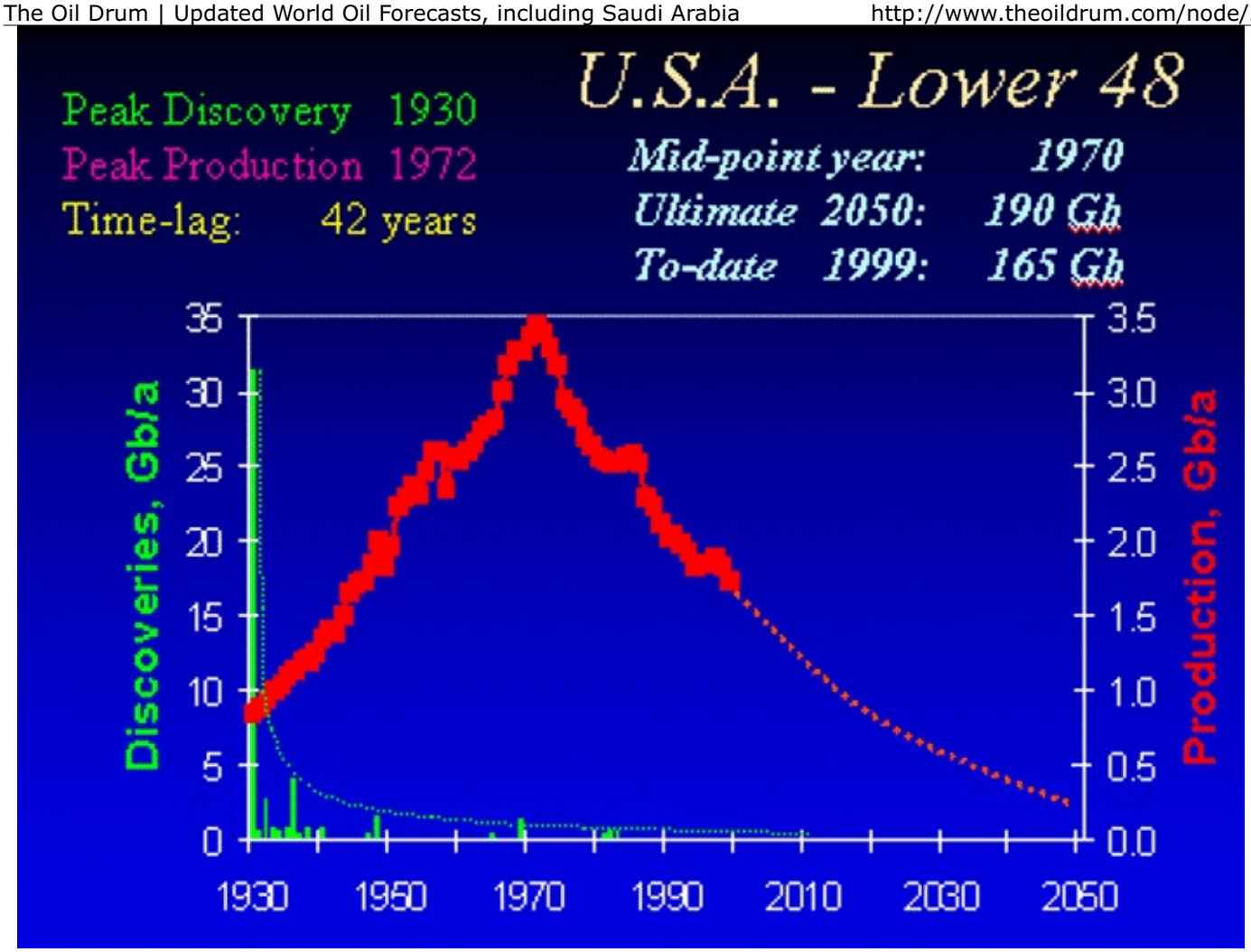

Fig 6 – USA Lower 48 Peak Discovery and Peak Production (source Presentation at the Technical University of Clausthal, C.J.Campbell, December 2000) - click to enlarge

4. World Crude Oil & Lease Condensate Production Changes

The green bars, representing year on year changes, in Figures 7 and 8 below, show the biggest declines for Mexico, North Sea and Saudi Arabia; the biggest increases for Russia, Azerbaijan and Angola. Angola has many projects which should continue to increase its production but Russia's mature field production will probably limit Russia's future production growth.

Militant action in Nigeria and maintenance in the North Sea decreased production from Feb 2007 to Mar 2007.

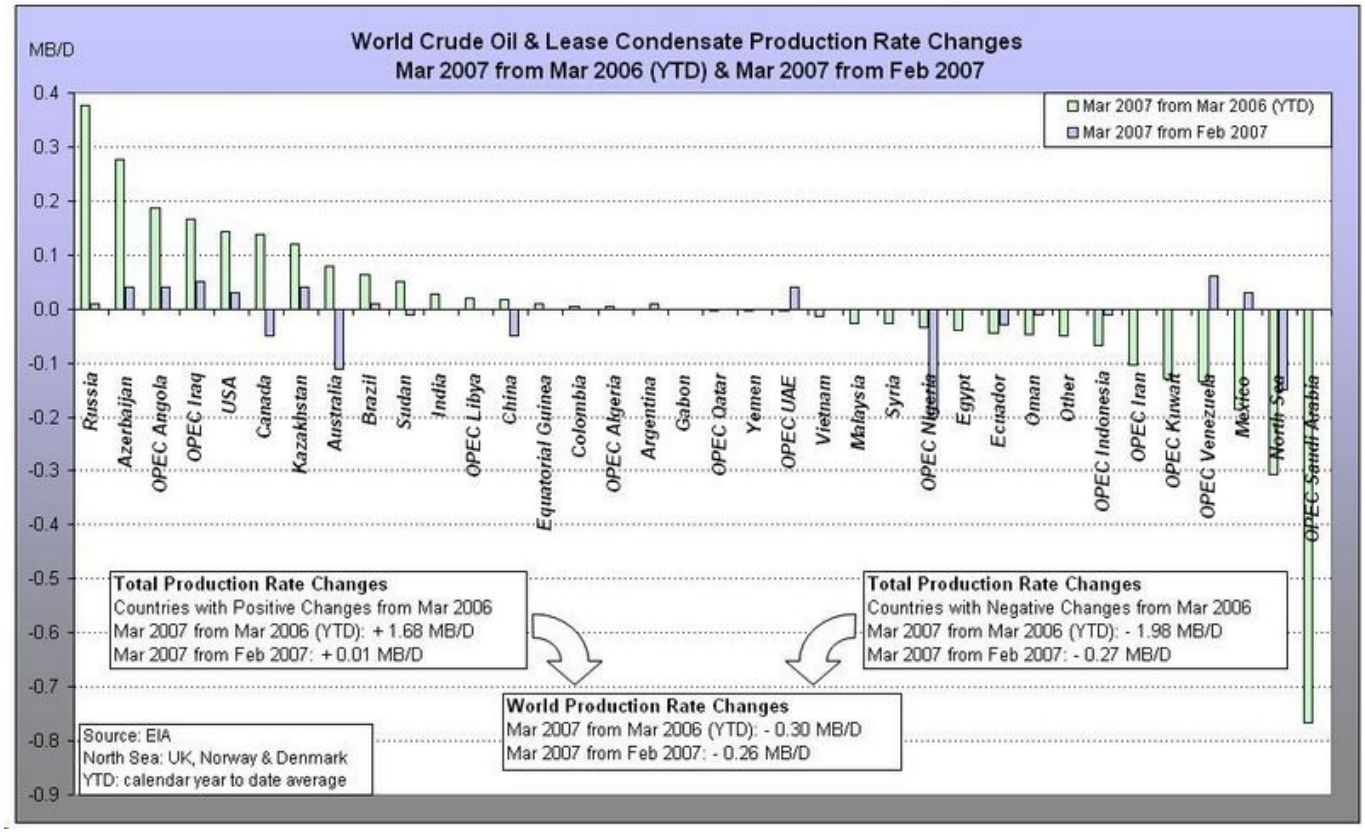

Fig 7 - World Crude Oil & Lease Condensate Production Changes to March 2007 - click to enlarge

Both Nigeria and the North Sea reversed some of their Mar 2007 losses to show small increases in Apr 2007. However, Nigeria's production growth appears to have stalled and the North Sea shows continuing decline.

In Apr 2007 Canada decreased C&C production by almost 0.10 mbd. On a year on year basis their production is only up by 0.10 mbd, as shown by the green bar in Fig 8. Given all the promise of the oil sands this increase is small.

Russia also showed a decrease in production from Mar 2007 to Apr 2007 of 0.10 mbd. Could this mean that Russia's C&C production is on a plateau?

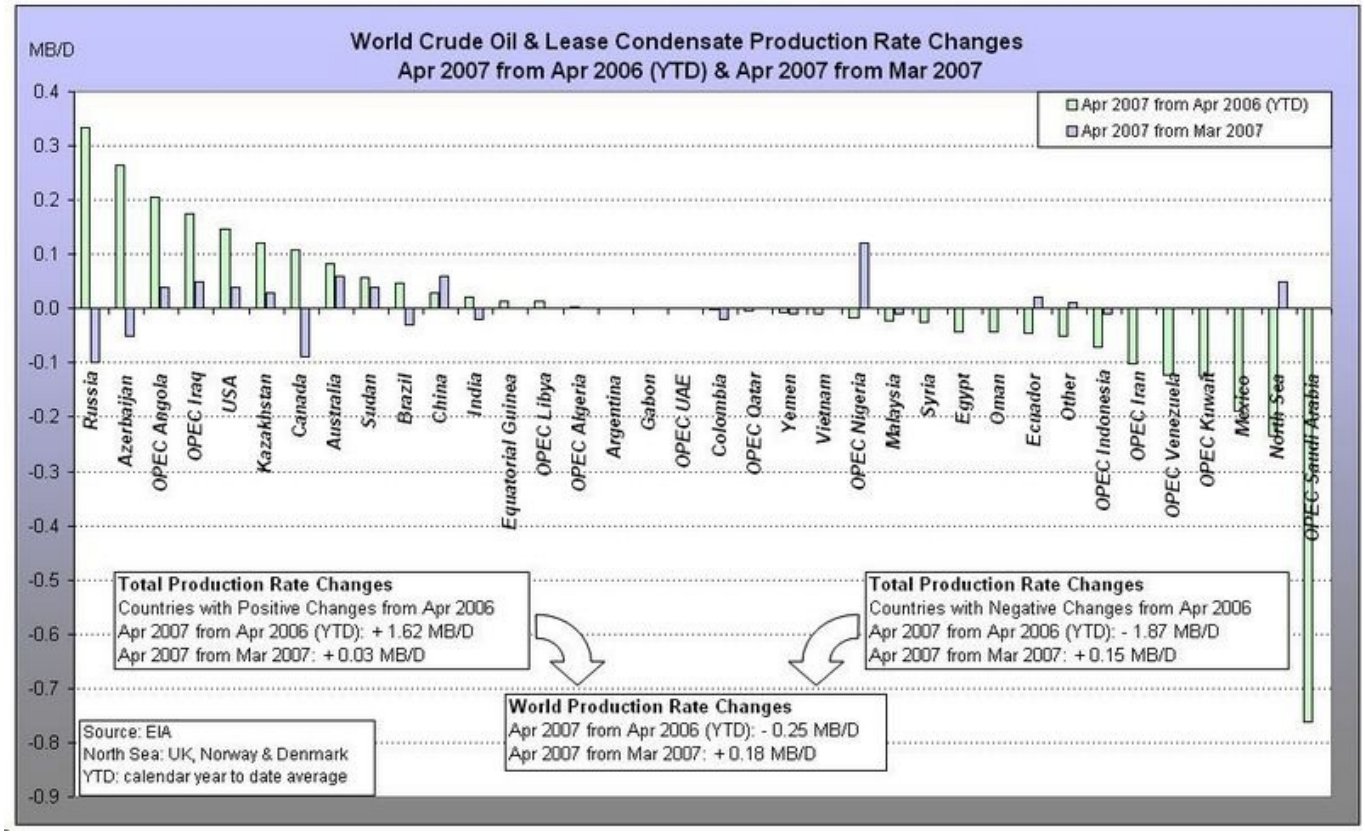

Fig 8 - World Crude Oil & Lease Condensate Production Changes to April 2007 - click to enlarge

Both Figures 7 and 8 show world C&C production dropping on a year on year basis by about 0.30 mbd. This is not a large decline but given that Russia is unlikely to increase production and that Saudi Arabia, North Sea and Mexico are unlikely to reverse their decline, this means that the world C&C production rate will continue to slowly decline (Fig 3).

5. Saudi Arabia Crude Oil & Lease Condensate Production

Saudi Arabia remains a key producer in the world and continually reminds the world of its enormous reserves and surplus production capacity.

This paragraph on capacity in IEA's 12 June 2007 Oil Market Report, page 15, explains Saudi Arabia's current surplus capacity situation within an OPEC context.

> Notional spare capacity stands at 4.0 mb/d, while our measure of *effective spare capacity* (excluding Indonesia, Iraq, Nigeria and Venezuela) stands at 2.85 mb/d. Although these volumes are physically producible, even this lower figure likely overstates what OPEC could actually shift onto the market given current prices and shortages in refinery upgrading capacity. Heavy, sour Saudi Arabian and Kuwaiti crude accounts for 88% of the *effective spare capacity* figure. In the absence of substantial discounts, these volumes might struggle to find buyers while sizeable amounts of refinery upgrading capacity remain offline for scheduled and unscheduled maintenance. **Readily marketable spare crude capacity may therefore be much lower, and a more accurate reflection of current market tightness**.

In other words, this IEA paragraph says that the world has only 0.35 mb/d spare capacity of readily marketable light sweet crude because the spare capacities of 2.20 mb/d from Saudi Arabia and 0.30 mb/d from Kuwait are hard to sell heavy sour crudes. Given the statements in this IEA monthly market report, the following forecast assumes no effective spare capacity of easily marketable Saudi Arabia crude.

The new production capacities from AFK, Shaybah expansion, Nuayyim and Khurais are just enough to offset decline from existing fields. Aramco has scheduled Manifa last because it will produce heavy oil which is less marketable than lighter grades.

It is also assumed that Saudi Arabia will produce their fields while maintaining the annual depletion rate of remaining reserves at less than about 5.3%/yr, which should ensure that reservoir damage does not occur due to overproduction from their fields. The figure of 5.3%/yr was selected because the annual depletion rate of remaining reserves reached a peak of 5.3%/yr in the third quarter of 2006 (Fig 9), based upon estimated ultimate recoverable reserves (URR) of 175 Gb for Saudi Arabia.

The estimated URR of 175 Gb is equal to 155 Gb of non heavy crude plus 20 Gb of heavy crude. Although the heavy sour crude fields of Safaniya and Manifa may ultimately produce much more than 20 Gb, only 20 Gb is assigned because this low quality crude is difficult to market and difficult to process by refineries. The non heavy crude URR of 155 Gb includes 85 Gb for Ghawar (light), 15 Gb for Abqaiq (extra light), 8 Gb for Berri (extra light) and the remaining URR is assigned to Aramco's other non heavy crude fields including Marjan, Qatif, Khurais, Zuluf, Shaybah, Abu Safah and Khursaniyah. The estimated URR is based mainly on the information sources about Saudi Arabia, located at the end of this article.

As of June 2007, Aramco's total C&C production is 112 Gb, being 64% of the URR 175 Gb. Over half of the 112 Gb has been produced from the super giant Ghawar. Abqaiq, Berri and Safaniya have also been significant producers. As Aramco has produced over half of the estimated URR, the production curve is forecast to follow a typical post peak decline curve, shown by the red line in Fig 9.

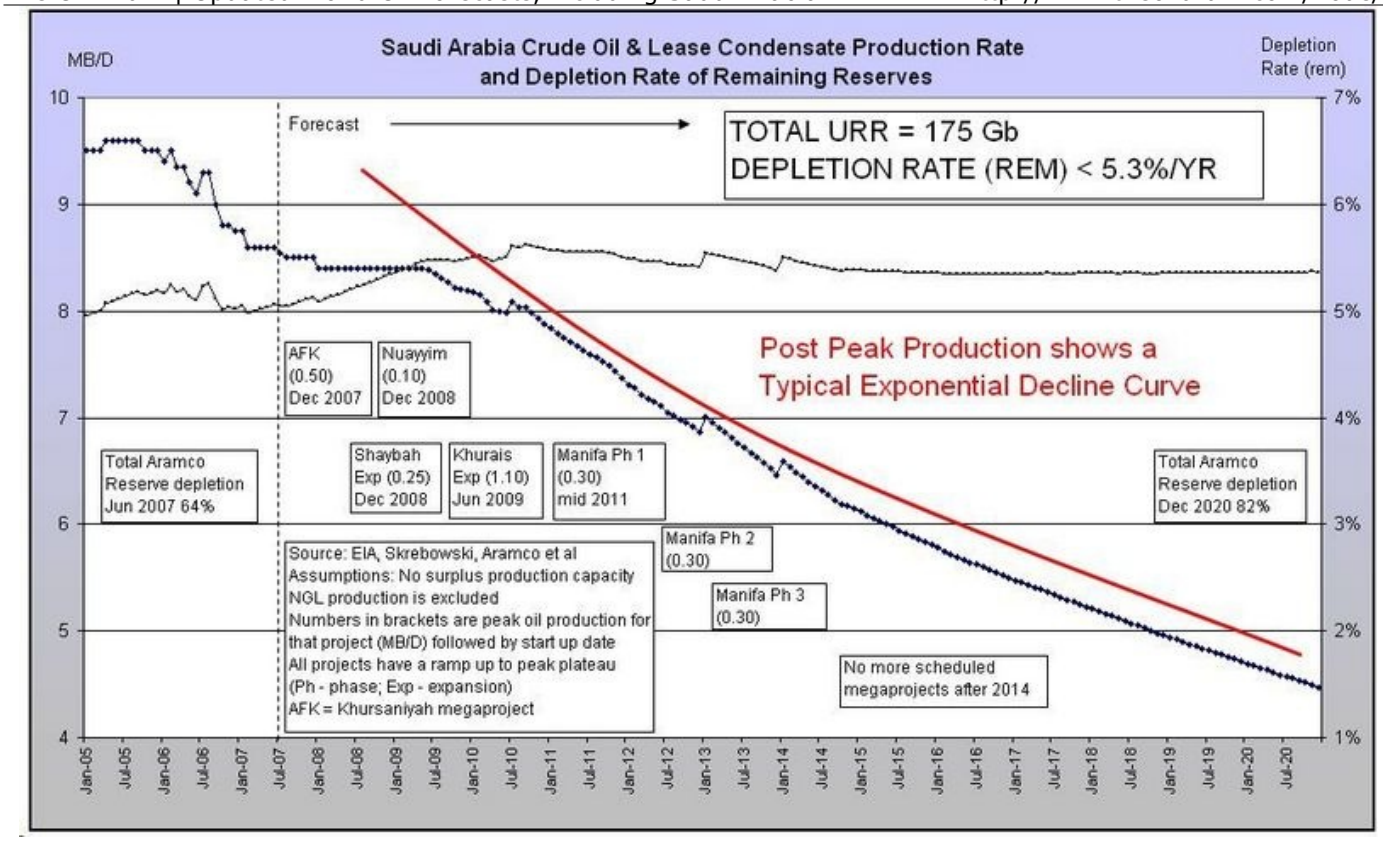

Fig 9 - Saudi Arabia Crude Oil & Lease Condensate Production to 2020 (bottom up forecast) - click to enlarge

Figs 9 and 10 have been updated for Aramco's most recent project schedule, released in June 2007. Due to both Al Khafji (0.30 mbd) and Shaybah ph 2 expansion (0.25 mbd) being removed from Aramco's recent project schedule, the probability that Aramco has passed peak production in 2005 is almost a certainty.

The solid red line shows a "Do Nothing" forecast scenario in Fig 10. This represents a production decline rate of 8%/yr which is equivalent to ultimate recoverable reserves of 148 Gb (billion barrels). Of course this scenario is highly unlikely but serves as a lower bound for the production profile.

The "New Peak?" dashed red line represents a scenario for which another peak is attained. However, the inset in the chart explains that another 1.75 MB/D would be required from other projects and infill drilling. This is highly unlikely and confirms that a peak in 2005 has passed.

The "Bottom Up" dark blue line represents the most likely scenario and includes the forecast to 2020 from Fig 9 and a 5%/yr decline thereafter.

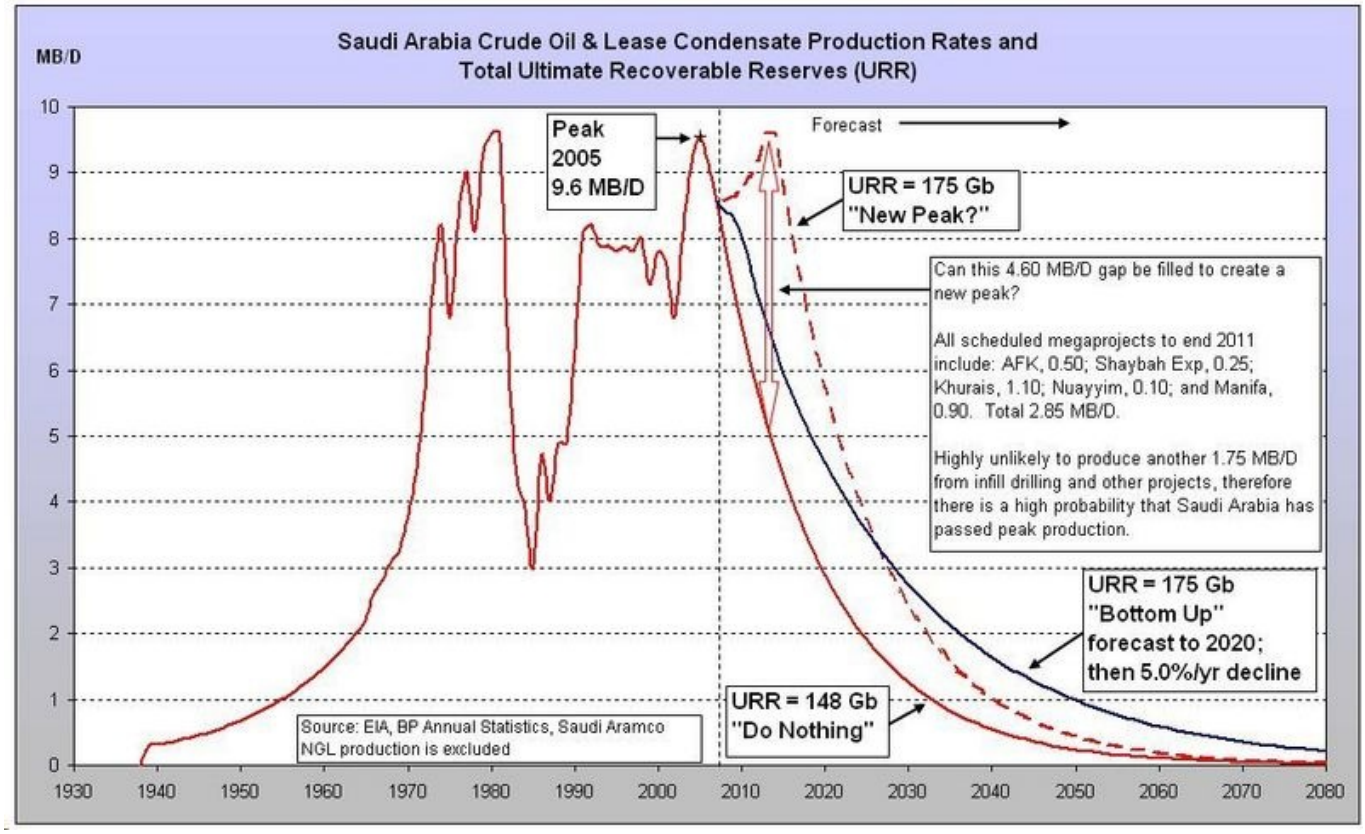

Fig 10 - Saudi Arabia Crude Oil & Lease Condensate Production to 2080 - click to enlarge

6. Other Components of Total Liquids Production

Natural gas plant liquids show an increase in production due to OPEC projects from Saudi Arabia, Algeria, Iran and Qatar.

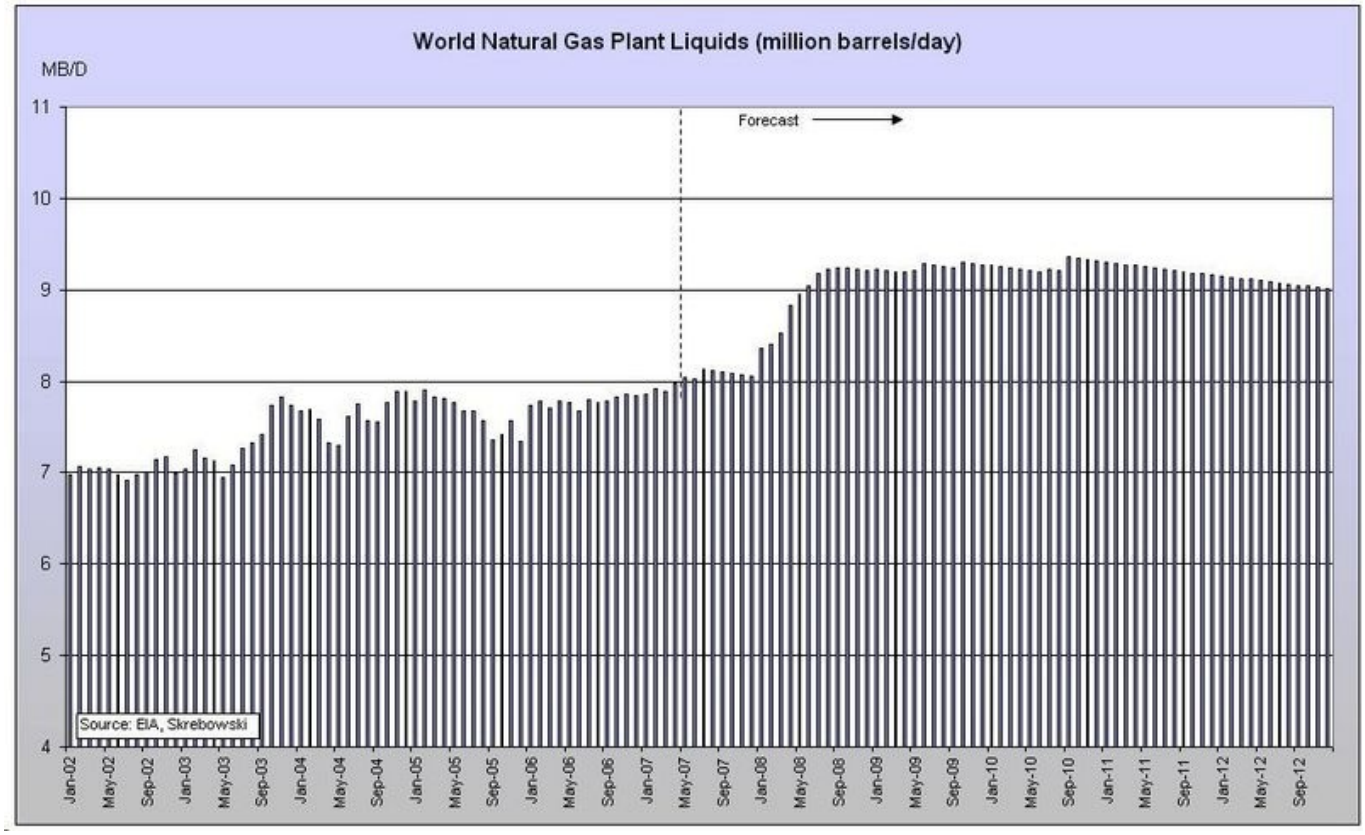

Fig 11 - World Natural Gas Plant Liquids Production to 2012 (bottom up forecast) - click to enlarge

Ethanol and XTL (BTL, CTL and GTL) production is forecast to double to 2012. Unfortunately, the increased production of government subsidised corn based ethanol in the USA is increasing the prices of many other food products.

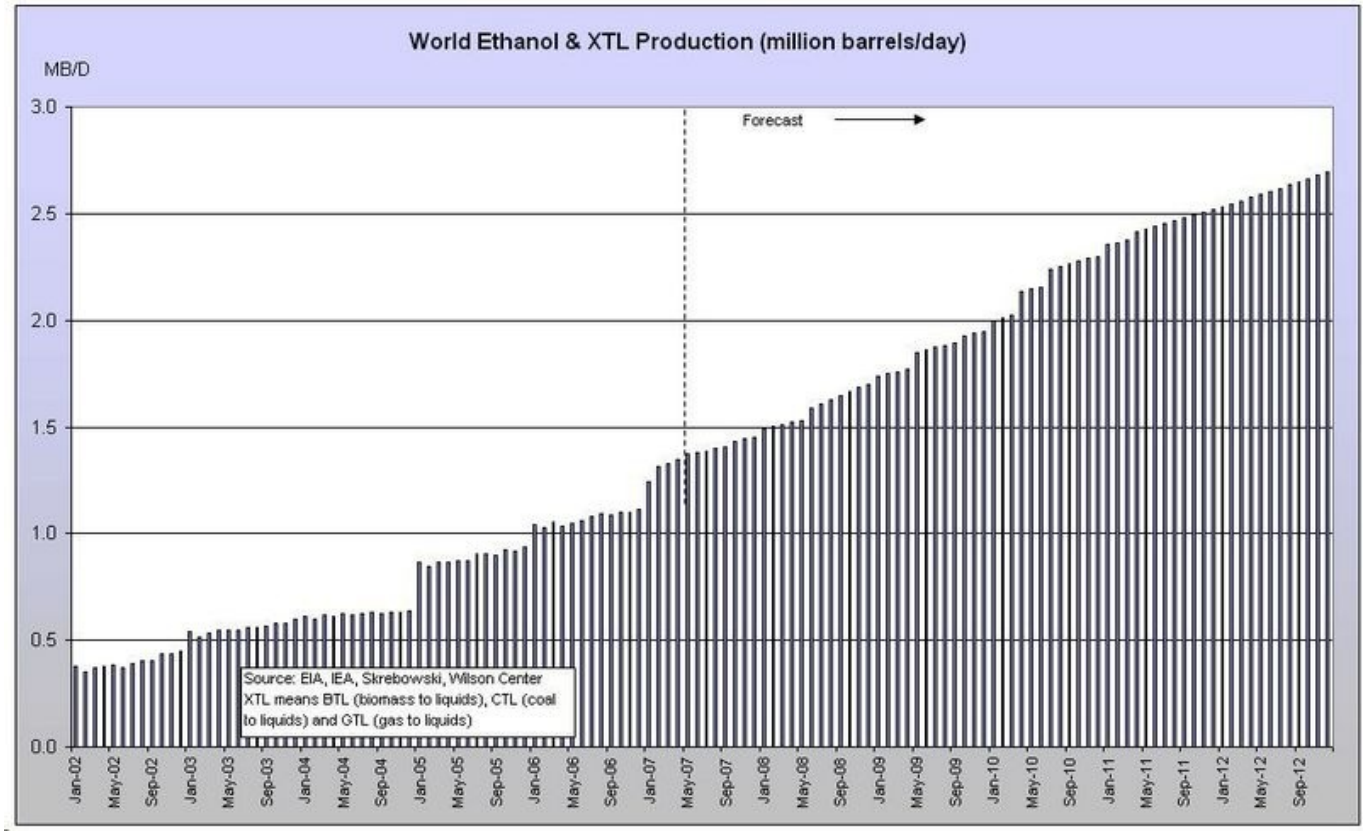

Fig 12 - World Ethanol & XTL Production to 2012 (bottom up forecast) - click to enlarge

Processing gains are defined by the EIA as "The volumetric amount by which total output is greater than input for a given period of time. This difference is due to the processing of crude oil into products which, in total, have a lower specific gravity than the crude oil processed." These gains are forecast to decline slowly based on the decline in C&C (Fig 3).

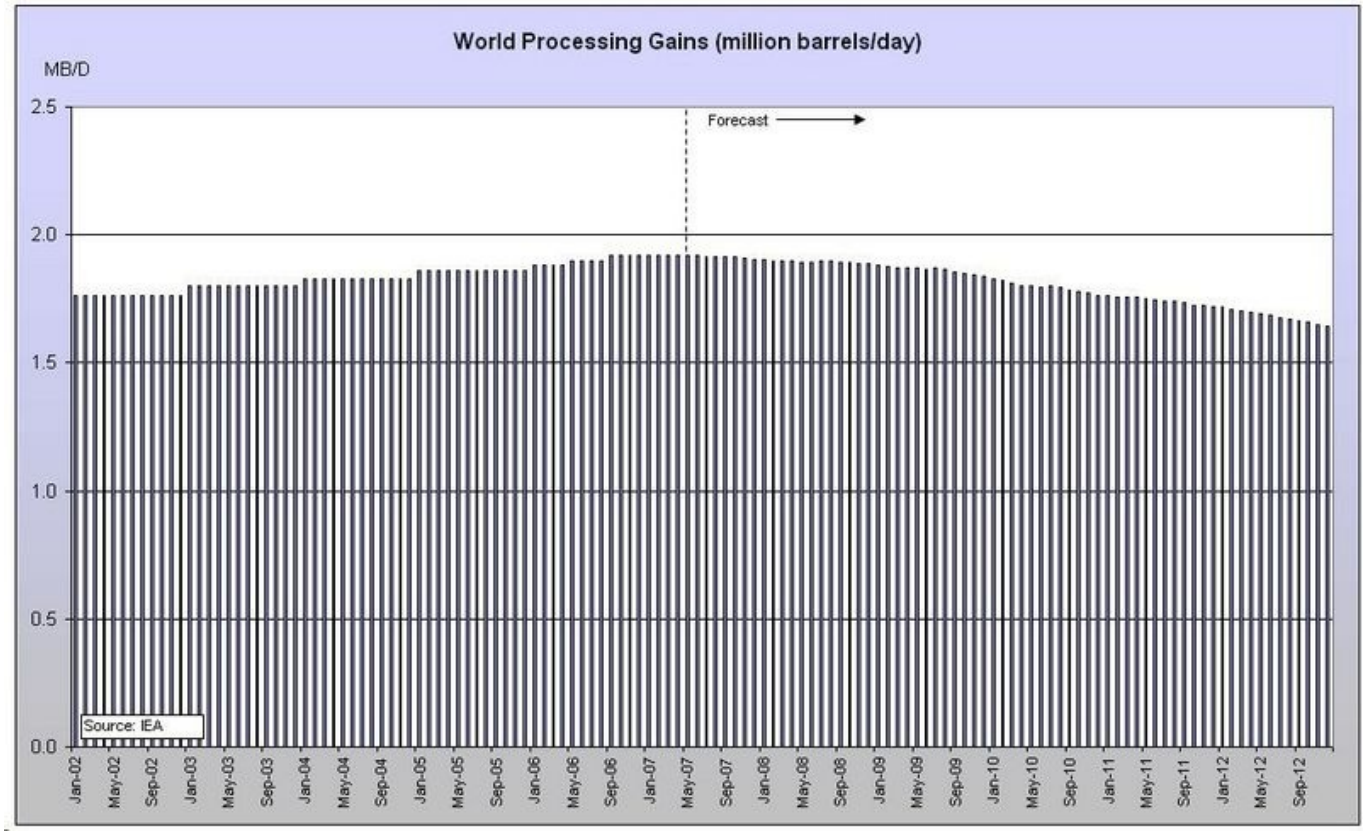

Fig 13 - World Processing Gains to 2012 (bottom up forecast) - click to enlarge

7. Additional Information Sources

For more forecasts please refer to this article by Khebab, Peak Oil Update - June 2007: Production Forecasts and EIA Oil Production Numbers

Further articles about Saudi Arabia:

by Stuart Staniford

- **Saudi Arabia and Gas Prices**
- **Depletion Levels in Ghawar**
- **The Status of North Ghawar**
- **Further Saudi Arabia Discussions**
- **Water in the Gas Tank**
- **A Nosedive Toward the Desert**
- **Saudi Arabian oil declines 8% in 2006**

by Euan Mearns

- Ghawar reserves update and revisions (1)
- GHAWAR: an estimate of remaining oil reserves and production decline (Part 2 - results)
- GHAWAR: an estimate of remaining oil reserves and production decline (Part 1 - background and methodology)

- **Saudi production laid bare**
- **Saudi Arabia and that $1000 bet**

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- **Simple mathematics - The Saudi reserves, GOSPs and water injection**
- **Of Oil Supply trains and a thought on Ain Dar**

by Ace

- **Saudi Arabia's Reserve "Depletion Rates" provide Strong Evidence to Support Total Reserves of 175 Gb with only 65 Gb Remaining**
- **Further Evidence of Saudi Arabia's Oil Production Decline**