



World Oil Forecasts Including Saudi Arabia, Kuwait and the UAE - Update Feb 2008

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Executive Summary

1. World total liquids production (Fig 1) remains on a peak plateau since 2006 and is forecast to fall off this peak plateau in 2009. Increasing numbers of oil experts are forecasting impending peak production plateaus. According to the International Energy Agency (IEA), the current peak production of 87.2 mbd occurred on January 2008. As long as demand continues increasing then prices will 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 slight decline to 2009, followed by a 3%/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 October 2007 and November 2007 (Figs 7 and 8) show significant declines for Mexico, North Sea and Saudi Arabia and significant increases for Russia, Azerbaijan and Angola. As Russia is likely to be on a production plateau and Saudi Arabia, Kuwait and the UAE have probably passed peak production, the world C&C production will continue to decline slowly.
5. Saudi Arabia retains its 2005 C&C peak (Fig 10), which is the same as the peak year for world C&C (Fig 2). Saudi Arabia C&C production has dropped to 9.0 mbd which is 0.6 mbd less than its peak in 2005. It is now almost a certainty that Saudi Arabia passed peak C&C production of 9.6 mbd in 2005 (Figs 9 and 10).

6. Kuwait retains its 2006 minor C&C peak (Fig 12). Kuwait C&C production has now dropped to 2.5 mbd which is less than its peak in 2006. There is a strong likelihood that Kuwait has passed its minor 2006 peak (Figs 11 and 12). Kuwait's major peak was 3.3 mbd in 1972.
7. UAE retains its 2006 C&C peak (Fig 14). UAE C&C production has now dropped to 2.6 mbd, adjusted for maintenance, which is just less than its peak in 2006. There is a reasonable likelihood that UAE passed its 2006 peak (Figs 13 and 14).
8. World natural gas plant liquids is forecast to increase due mainly to new OPEC projects (Fig 15). World ethanol and XTL production is forecast to almost double by 2012 (Fig 16). World processing gains are forecast to decline slowly to 2012 (Fig 17).

Major Changes from the [Previous Update Oct 2007](#)

The major changes from the previous update are the inclusion of additional forecast production from the projects listed at [Wikipedia Oil Megaprojects](#) and the increase in OPEC production quota by 0.5 mbd starting 1 Nov 2007. There are also a few paragraphs added in section 1 below describing the increased consensus about peak oil by more oil industry experts.

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 (Fig 1), 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). The main causes for the end of the total liquids plateau in 2009 (Fig 1) are that the C&C production decline rate accelerates to 3%/yr in 2009 (Fig 3) and the production growth from natural gas plant liquids stalls (Fig 15).

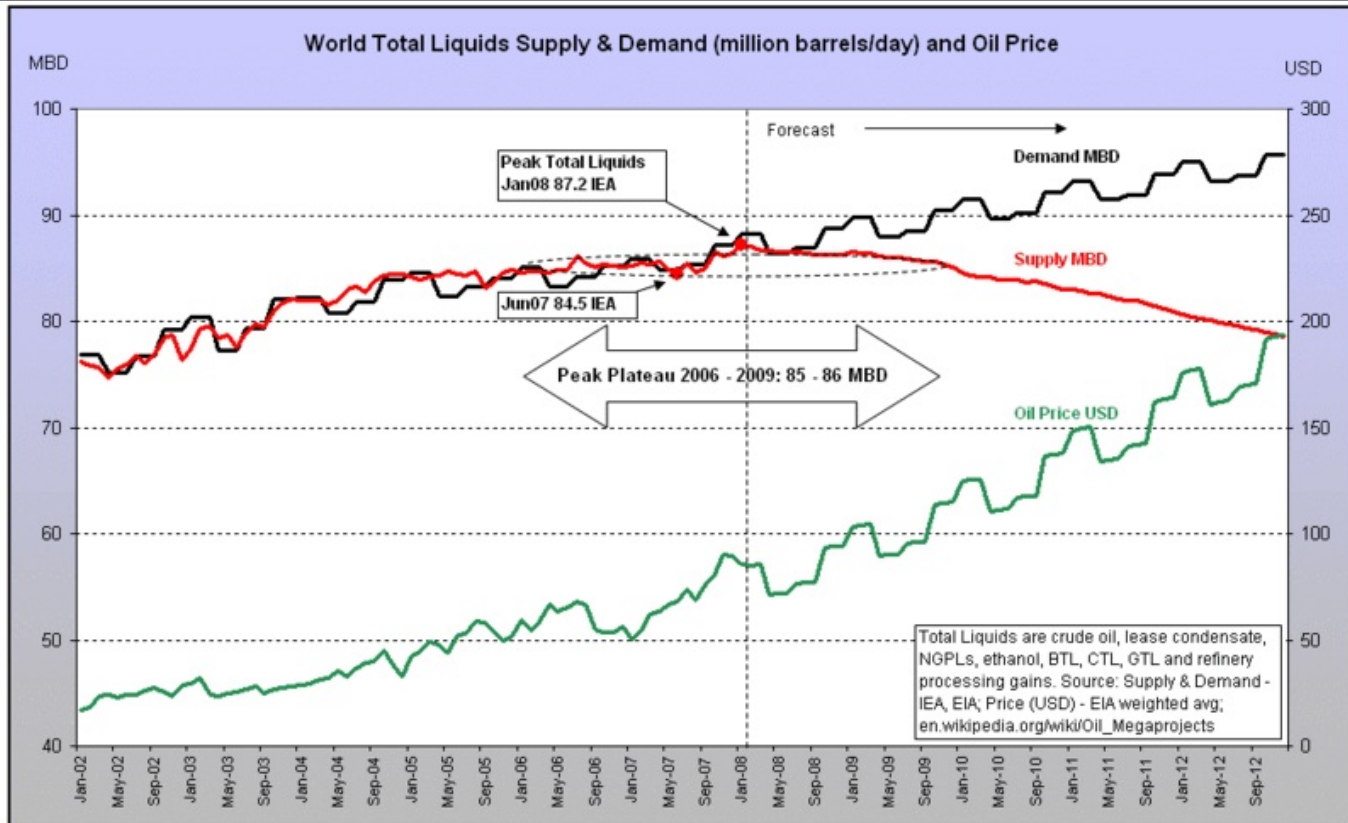


Fig 1 - Total Liquids Supply & Demand to 2012 (bottom up forecast) - click to enlarge

Is future total liquids production likely to exceed the current peak of 87.2 mbd on January 2008? It might be possible but it appears unlikely. North Sea production continues to decline. Mexico's production is also in [decline](#). Former USSR production might increase by a small amount. Canada's production should [increase slowly](#) but the oil sands are experiencing [production constraints](#) and despite claimed reserves of up to [315 Gb \(billion barrels\)](#), the oil sands will probably produce, at best, a maximum of only [2.5 mbd \(million barrels/day\)](#). Biofuels production should also continue increasing. Non OPEC total liquids production might increase slowly, assuming that no unexpected disruptions occur.

Increasing Numbers of Oil Experts are Forecasting Impending Peak Production Plateaus

Matt Simmons' [presentation to the Minnesota House of State Representatives, February 4, 2008](#), shows the current production plateau on slide 29, with a forecast of 69 mbd crude oil and lease condensate by 2012. On January 31, 2008, Kang Wu and Fereidun Fesharaki, of the [East-West Center](#), released a book titled "[Asia's Energy Future: Regional Dynamics and Global Implications](#)" which stated that global oil production might increase to 100 or perhaps even 105 mbd somewhere between 2015 and 2020. Jeff Rubin and Peter Buchanan, CIBC World Markets, wrote a report, dated January 10, 2008, which forecasts a [peak production plateau of just over 88 mbd from 2011 to 2012](#). On January 22, 2008, Jeroen van der Veer, CEO of Shell, in an [email to all Shell employees](#), acknowledged the reality of peak plateau when he said that "after 2015 supplies of easy-to-access oil and gas will no longer keep up with demand". In a similar acknowledgement in November 2007, the CEO of Total, Christophe de Margerie, and

the CEO of ConocoPhillips, James Mulva, both stated that supply would [not exceed 100 mbd](#). Colin Campbell, in his [November 2007 newsletter](#) also stated the possibility of a peak plateau now, altering his original forecast of a depletion based “Peak in 2010 at 87.3 Mb/d that becomes 90 Mb/d with refinery gain. A depletion-based Peak may not of course be reached if high prices hold down demand, delivering more of a plateau than a peak”.

On October 30, 2007, Shokri Ganem, Libya's National Oil Corp Chairman, said that [supply may not exceed 100 mbd](#) and later, in January 2008, he said that [OPEC can do little and that most OPEC countries are producing at capacity](#). Sadad Al-Husseini, former Saudi Aramco exploration and production head, presented this [production forecast](#) at the [Oil & Money October 2007 conference](#) which showed a production plateau of crude oil, condensate and natural gas liquids extending from 2009 to 2012 at 83 mbd, followed by a decline. Dr. Werner Zittel and Jorg Schindler, Energy Watch Group, wrote a report, dated October, 2007, which forecasts a [historic peak of 81 mbd in 2006 of crude oil, condensate and natural gas liquids](#). On October 8, 2007, Jim Buckee, retired CEO of Talisman Energy, said that the [world is at peak production or close to it](#). Finally, Chris Skrebowski, editor UK Petroleum Review, said in October 2007, that [world total liquids production will reach a peak plateau of 92 mbd during 2010 to 2011](#) but he adds: “so what my analysis is saying is that we’ve got another 5 to 7 million barrels a day to come if everything works properly”.

Another expert who made great contributions to the awareness of peak oil is [Dr. Ali Morteza Samsam-Bakhtiari, a retired director of the National Iranian Oil Co.](#), who regrettably passed away in October 2007. Dr Samsam-Bakhtiari, using his [WOCAP model](#), predicted a [2006 to 2007 peak plateau of 81 to 82 mbd](#) of crude oil, lease condensate and natural gas plant liquids. He also said that “it became clear that the modelling phase of ‘Peak Oil’ had come to an abrupt close and that henceforward ‘Peak Modelling’ should be shelved once and for all”.

As world total liquids production is forecast to decrease to 2012 (Fig 1), two important consequences are likely to occur. First, as demand is forecast to increase, prices are forecast to rise, using [short and long run price elasticities](#), which will force demand downwards to equal supply. Second, the decreased available supply may invoke the [IEA Response System for Oil Supply Emergencies](#). Unexpected supply reductions could trigger oil rationing among the 26 countries which are signatories to this IEA Response System, but unfortunately China, Russia, India and Brazil, which are not signatories, are highly unlikely to agree to the [IEA’s rationing method because its rationing basis is by country rather than by person](#). The resulting tensions, from oil supply shortages, among the signatory and non-signatory countries could lead not only to continued [competitive oil bidding](#), but also to continued [conflicts and violence](#) in order to secure vital oil supplies.

2. World Crude Oil & Lease Condensate Production

The largest component of world total liquids production is world C&C production. The first part, 2008 to 2012, of the forecast to 2100 (Fig 2), is created using a bottom up forecast based on over 350 continuously updated regions/projects from 2008 to 2012 (Fig 3). After 2012, two scenarios are shown.

The first scenario, shown by the red line, is based partly on [BP reserves 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](#). Yet to find C&C reserves are added to this estimate of proven and probable reserves to give world total ultimate recoverable reserves (URR) of 1.85 Tb (trillion barrels) including remaining URR of 0.78 Tb as at end 2007.

The second scenario, shown by the green line, uses Colin Campbell's URR estimate from his [February 2008 newsletter](#). His URR estimate is equal to 2.23 Tb, excluding natural gas plant liquids. His estimate is higher than the first scenario estimate of 1.85 Tb due to an additional 0.23 Tb URR from the UAE, Iran, Iraq, Kuwait and Saudi Arabia, and higher URR estimates from heavy oil and polar oil. The green line forecast shows what might be possible if the middle east gulf countries really do have the reserves close to what they [have claimed](#), if promised production increases from heavy oil occur and if additional significant polar oil is discovered.

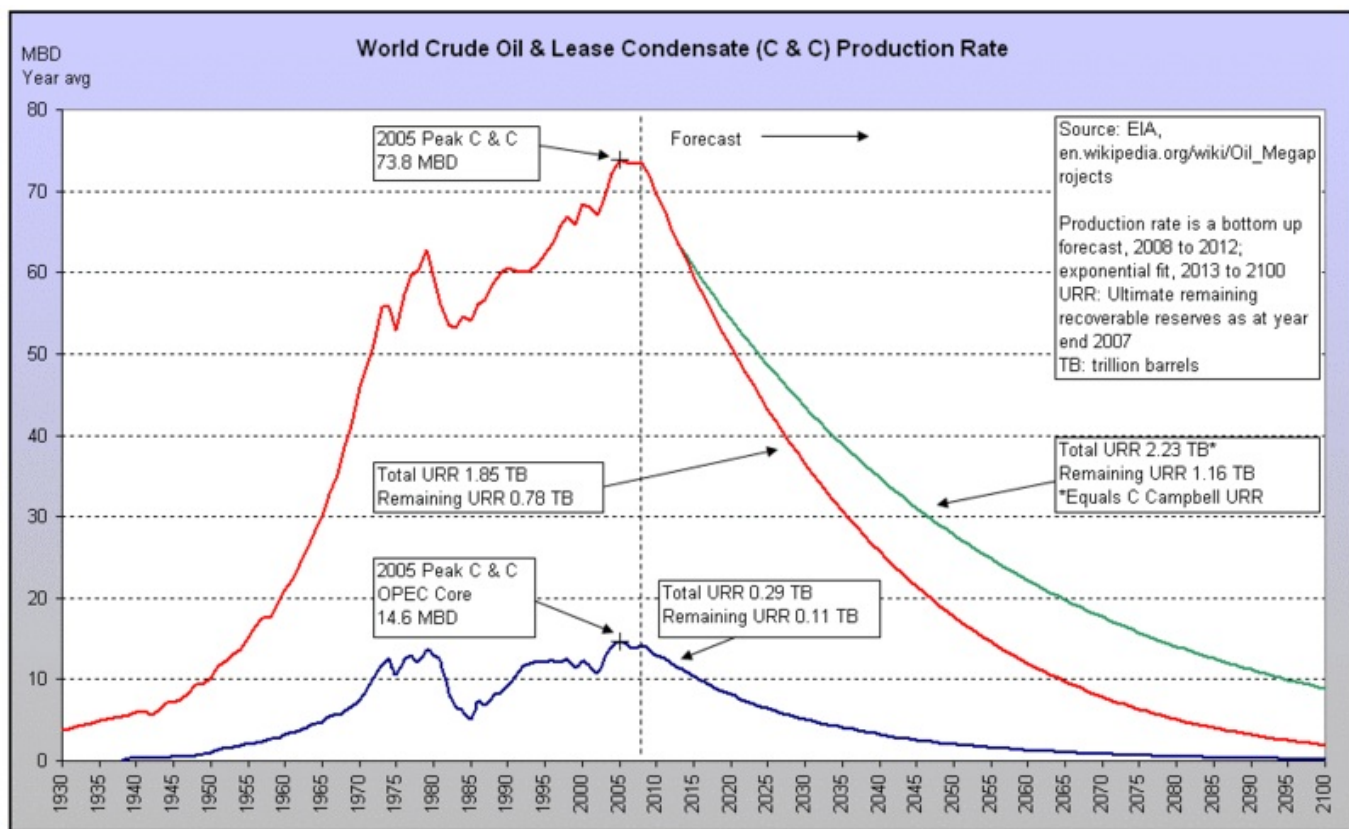


Fig 2 - World Crude Oil & Lease Condensate Production, including OPEC Core, to 2100 - [click to enlarge](#) - (the reserves and production of the Neutral Zone are shared equally between Saudi Arabia and Kuwait)

The production from OPEC Core countries of Saudi Arabia, Kuwait and UAE is shown by the blue line and retains its 2005 peak (Fig 2). These three countries are labelled as OPEC Core because these countries have over 50% of proven reserves of OPEC-12 total proven reserves, (according to BP statistics) and produce almost 50% of the OPEC-12 total C&C production. [Gately](#) also labelled these countries as core potentially due to similar reasoning. There is a strong correlation between the production from the OPEC Core and the world.

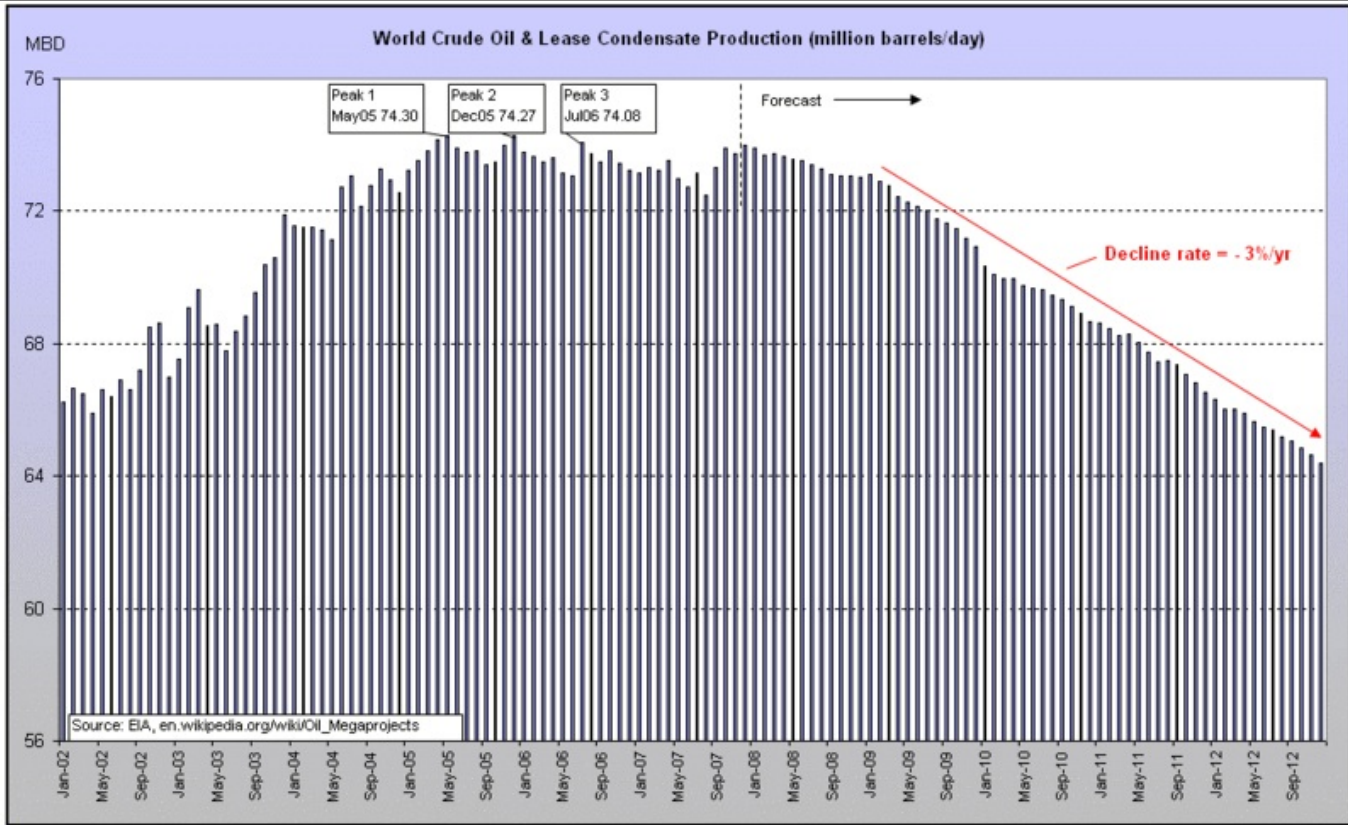


Fig 3 - World Crude Oil & Lease Condensate Production to 2012 (bottom up forecast) - click to enlarge

World C&C production retains its May 2005 peak and is forecast to decline slightly until 2009. The decline rate from early 2009 to 2012 is 3%/year.

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 in this section. Fig 4 shows the peak discovery year in 1965, followed by a steady decline in the discovery rate. For every year 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.

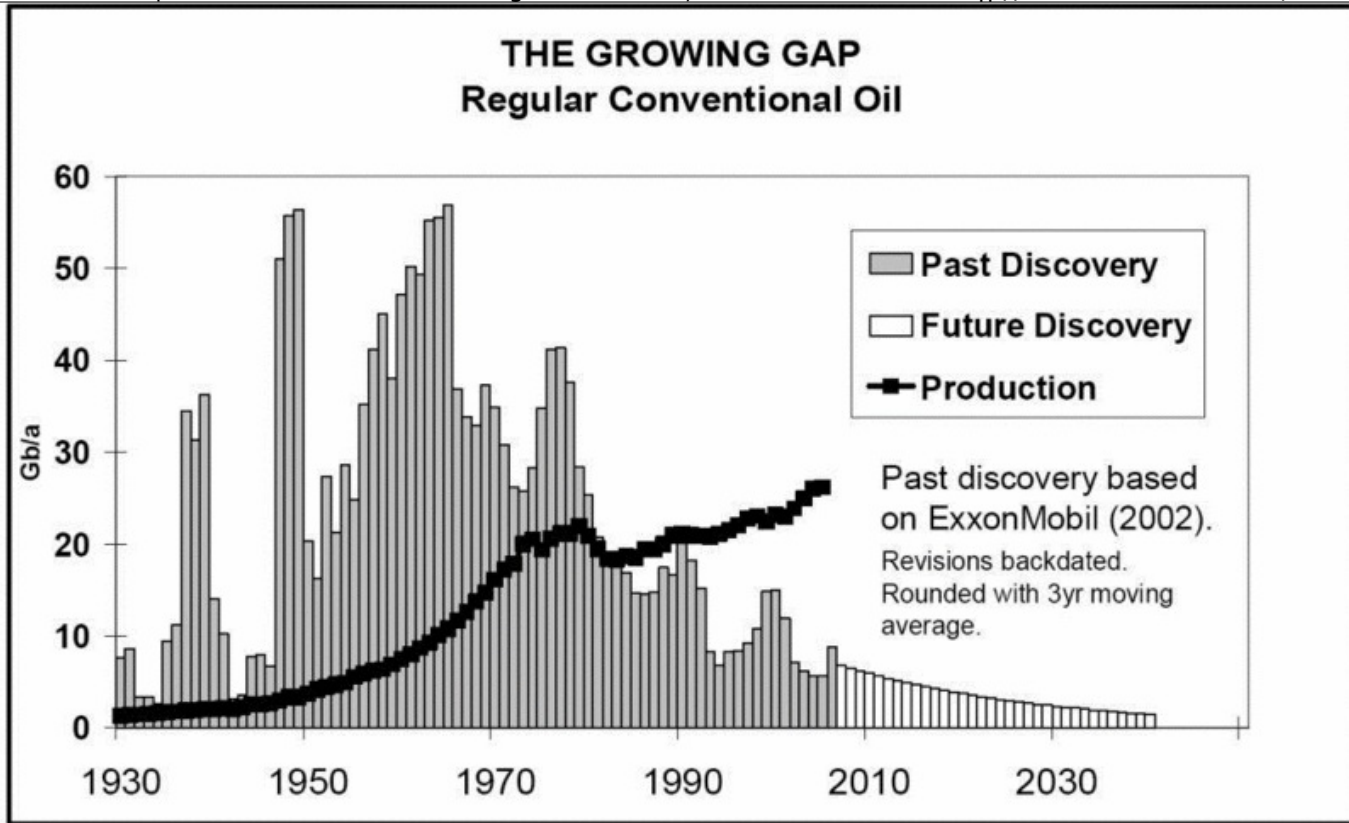


Fig 4 - World Discoveries (source [ASPO Ireland Newsletter No. 80, August 2007](#)) - [click to enlarge](#)

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.

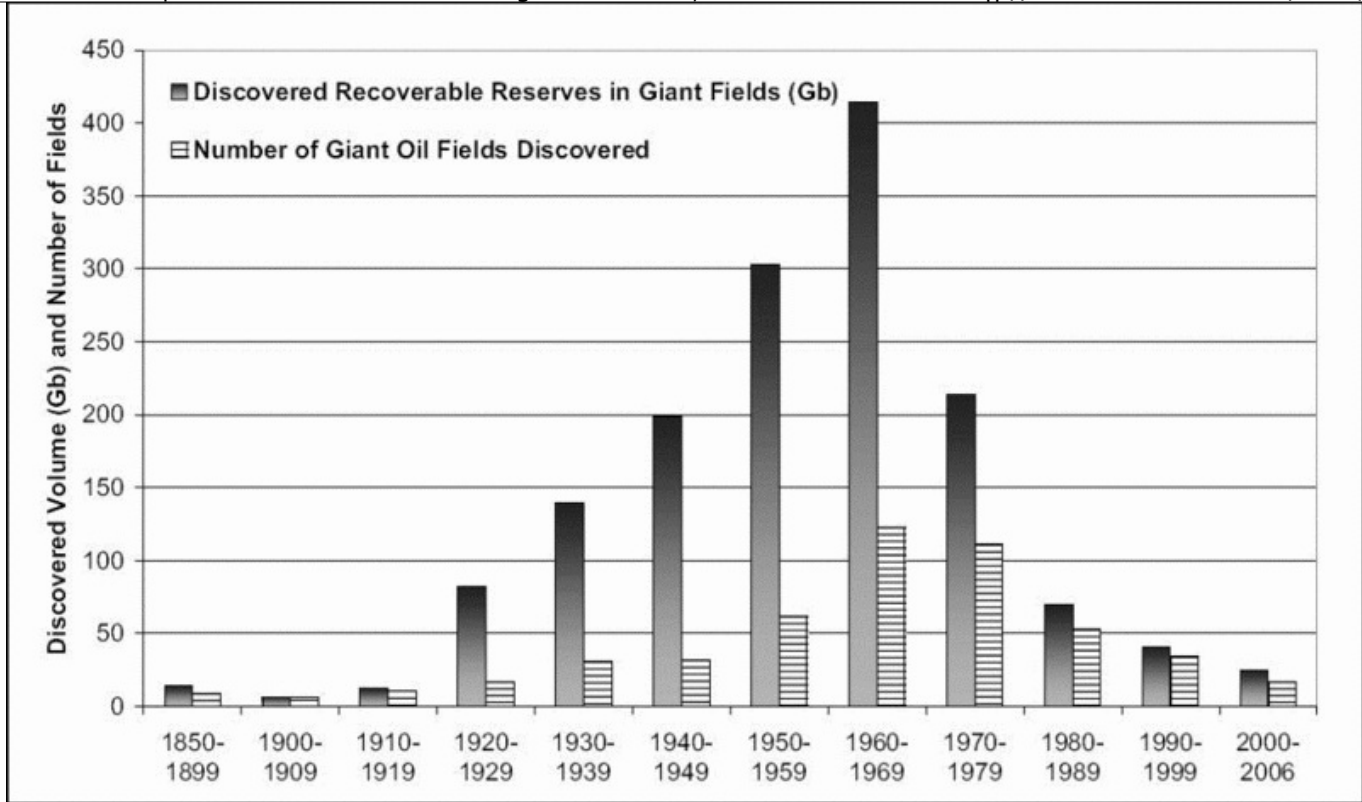


Fig 5 - World Discoveries, Giant Oil Fields (source [Giant Oil Fields – The Highway to Oil, Fredrik Robelius, March 2007](#)) - [click to enlarge](#)

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.

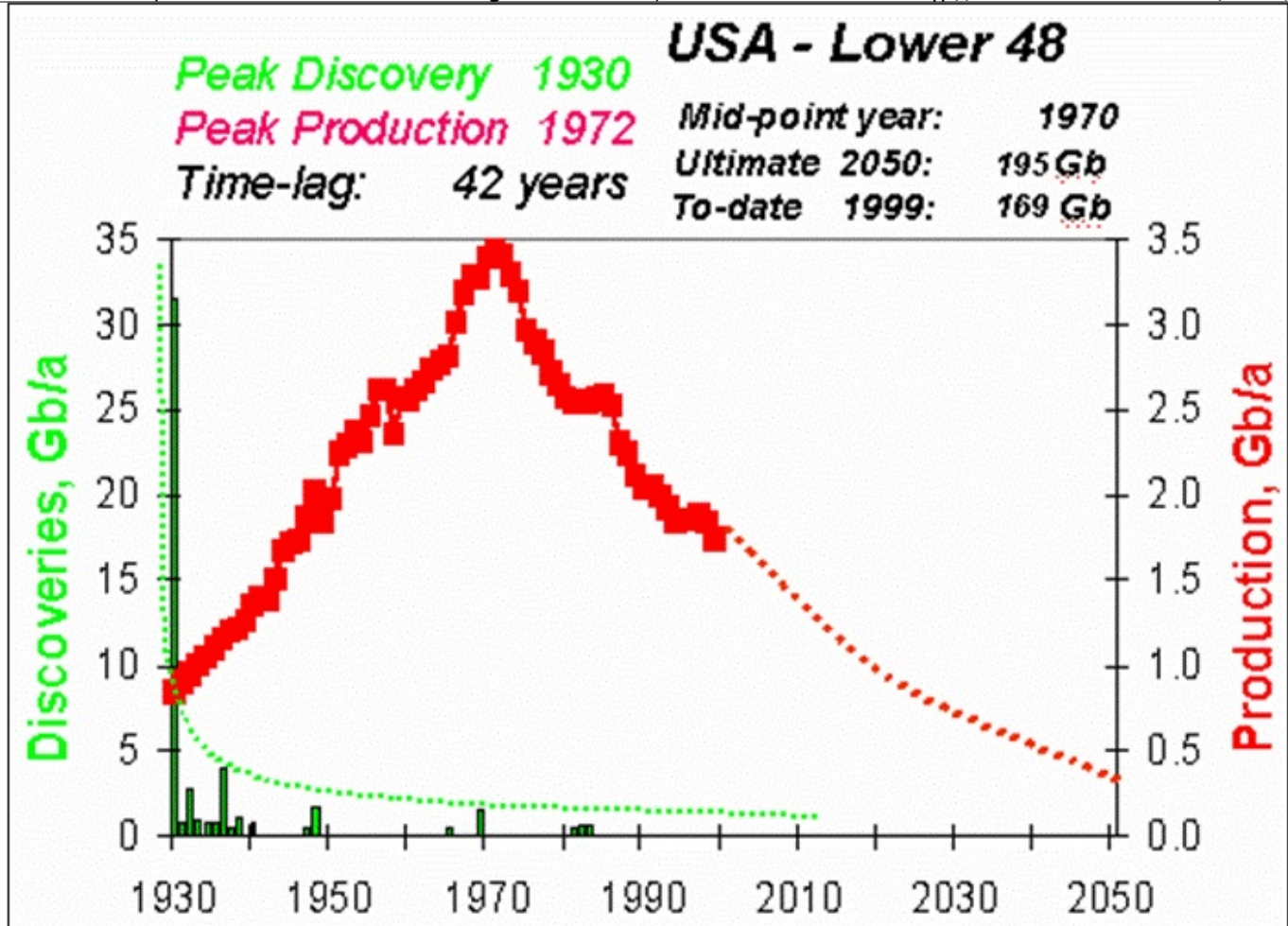


Fig 6 – USA Lower 48 Peak Discovery and Peak Production (source [Peak Oil: an Outlook on Crude Oil Depletion, Colin J.Campbell, February 2002](#)) - click to enlarge

4. World Crude Oil & Lease Condensate Production Changes

Year on year production changes, represented by the green bars in Figures 7 and 8 below, show the biggest declines for Mexico, North Sea and Saudi Arabia and the biggest increases for Russia, Azerbaijan and Angola. Angola has many projects which should increase its production capacity but actual crude production rates will be limited to [its new OPEC quota of 1.9 mbd](#). Russia’s mature field production will probably limit Russia’s future production growth.

Month on month changes from Sep 2007 to Oct 2007 (Fig 7), represented by the light blue bars, indicate decreases for Canada, Egypt and Mexico. Over the same time period, Angola, Azerbaijan, Iraq, USA and the North Sea showed good increases.

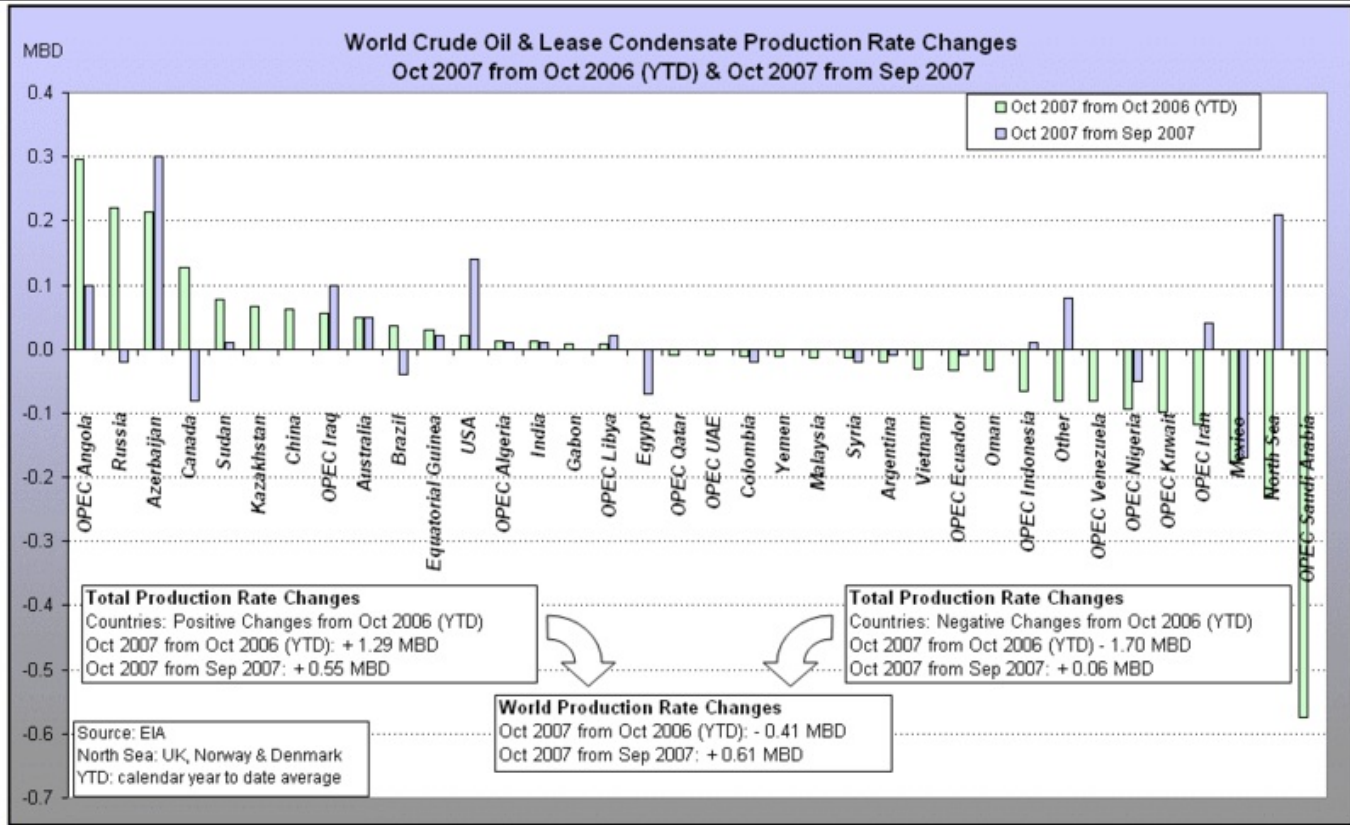


Fig 7 - World Crude Oil & Lease Condensate Production Changes to October 2007 - click to enlarge

Month on month changes from Oct 2007 to Nov 2007 (Fig 8) showed good increases for Azerbaijan and Saudi Arabia. Production fell for UAE due to significant maintenance. The production drop for Mexico is due mainly to continued geological decline as PEMEX [announced](#) that “oil reserves may run out in seven years”. Also from Oct 2007 to Nov 2007, Canadian production remained constant, despite the optimism about oil sands. Russia showed a small decrease in production. Could this mean that Russia’s C&C production is on a slight decline now?

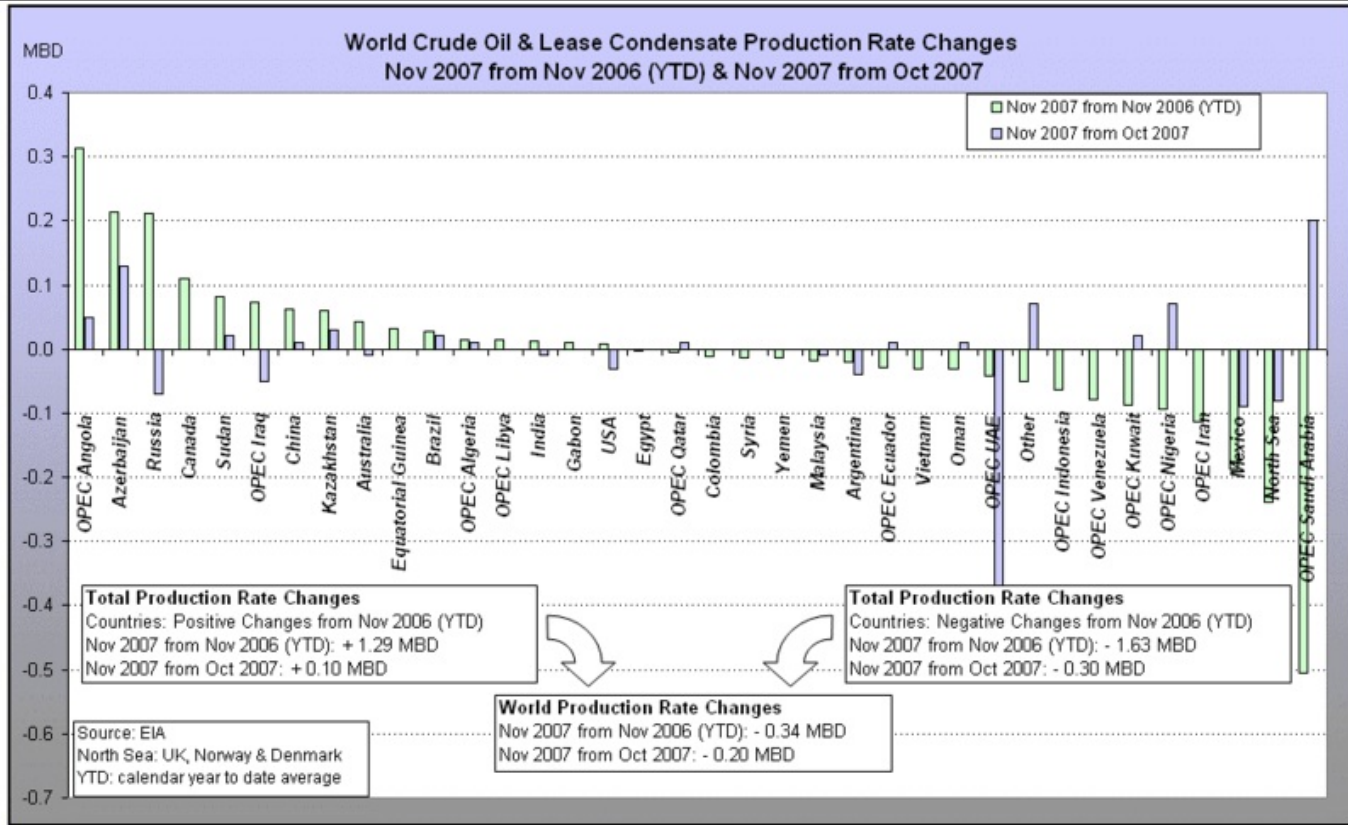


Fig 8 - World Crude Oil & Lease Condensate Production Changes to November 2007 - click to enlarge

World C&C production is dropping, on an annual basis, by about 0.4 mbd (Figs 7 & 8). This is not a high decline rate but given that Russia is probably [unable](#) and [unwilling](#) to increase production and that Saudi Arabia, Kuwait, the UAE, the North Sea and Mexico are unlikely to reverse their decline rates, the world C&C production rate is forecast to continue its 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. In August 2007, energy analyst Bill Herbert [reaffirmed IEA's views](#) when he said that “even if OPEC decides to open the spigot a bit more, it's hardly a guarantee prices would stay in check. Most of OPEC's spare capacity is in heavy sour crude oil, which must be processed in types of refineries that already are running at full capacity. There's very little ability on the part of the supply system to respond to more demand”. Furthermore, the [EIA Short Term Energy Outlook, 7 August 2007](#) stated that “The low level of surplus OPEC oil production capacity, which is primarily in heavy crude oil, remains a key reason for the continued tight market conditions ...Further, the apparent unwillingness by OPEC to use available surplus capacity in the face of rising crude oil prices reduces any downward price impact that additional surplus capacity might have.” Given these statements by the IEA, Herbert and the EIA, the following forecast assumes no effective spare capacity of easily marketable Saudi Arabia crude.

It is also assumed that Saudi Arabia will produce their fields while maintaining the [annual depletion rate](#), which is annual production as a percentage of ultimate recoverable remaining reserves, at less than 5.0%/yr. This should ensure that reservoir damage does not occur due to overproduction from their fields. The figure of 5.0%/yr was selected because it's slightly more than the annual depletion rate of remaining reserves reaching a previous peak of 4.5%/yr in the third quarter of 2006 (Fig 9), based upon estimated ultimate recoverable reserves (URR) of 185 Gb for Saudi Arabia. This figure of 5.0%/yr could be slightly optimistic. Tariq Shafiq, a petroleum engineer who was Vice President and Executive Director of the Iraq National Oil Company (INOC), said that a [depletion rate of 4-5%](#) is well within good reservoir management for large fields. In addition, Colin Campbell stated on page 7 of his [ASPO Ireland Newsletter No. 80, August 2007](#) that “a Depletion Rate of 4.2%...sounds quite reasonable for a mature country like Kuwait, compared for example with 6.5% in the United Kingdom or 4.5% in the US-48”. If a lower forecast annual depletion rate is assumed then Saudi Arabia's production rate would drop faster than is forecast (Fig 9).

The estimated URR of 185 Gb is equal to 150 Gb of non heavy crude plus 35 Gb of heavy crude. The 35 Gb includes the heavy sour crude fields of Safaniya and Manifa, which is slightly less than [Horn's 2006 estimate of 37 Gb](#). The non heavy crude URR of 150 Gb includes [75 Gb for Ghawar \(light\)](#) which is greater than Horn's estimate of 66 Gb, 13 Gb for Abqaiq (extra light), 9 Gb for Berri (extra light), 6 Gb for half of the Neutral Zone 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 on the information sources about Saudi Arabia, located at the end of this article and the previously mentioned [Horn's 2006 paper](#). Furthermore, this estimate of [URR 186 Gb](#), from this [source](#), gives good support for the estimated URR of 185 Gb.

The possibility of a lower Saudi Arabia total URR exists. Based on this [mathematical technique](#), this [recent research](#) “suggests that the Saudi Qt (or total URR) is only 150 Gb, which in turn suggests that Saudi Arabia is now over 70% depleted, with about 40 Gb in remaining recoverable reserves.” [A 2006 research paper](#), using the same method, estimated a total URR of 160 Gb, as shown [in this plot](#). Another source of oil reserves, prior to nationalization of Saudi Aramco in 1980, is a report titled “Critical Factors Affecting Saudi Arabia's Oil Decisions”, published by the US General Accounting Office in 1978. As referenced on page 72 of [Twilight in the Desert](#), this report stated that the remaining proven reserves as at the end of 1976 was 110 Gb with 70 Gb in

the four super giants of Ghawar, Safaniya, Abqaiq and Berri. Cumulative production from these four giant fields was 26 Gb and cumulative production for all Saudi Arabia was 29 Gb. Thus, total proven reserves (produced and remaining) at the end of 1976 was equal to 139 Gb (29 Gb plus 110 Gb), of which 96 Gb (26 Gb plus 70 Gb) was attributable to the four super giants and 43 Gb (3 Gb plus 40 Gb) was attributable to the rest of the fields. This figure of 139 Gb does not include probable reserves, unlike total URR, and is less than the total URR estimates of 150 Gb and 160 Gb from the two research sources above. Allowing for the inclusion of probable reserves, heavy oil reserve upgrades and only small discoveries since the last giant field Shaybah was found in 1968, an appreciation from 139 Gb to the total URR of 185 Gb appears reasonable.

As of December 2007, Aramco’s total cumulative C&C production was 113 Gb, being 61% of the URR 185 Gb. Over half of the 113 Gb has been produced from the super giant Ghawar. Abqaiq, Berri and Safaniya have also been significant producers. Aramco has increased their production during this winter to 9 mbd according to recent [OPEC quota increases](#). Aramco has produced over half of the estimated URR and the production curve is forecast to follow a typical post peak decline curve, shown by the red line in Fig 9. Unfortunately, the new production capacities from AFK, Shaybah expansion, Nuayyim and Khurais are not enough to offset decline from existing fields. Aramco has probably scheduled Manifa last because it will produce heavy oil which is less marketable than lighter grades.

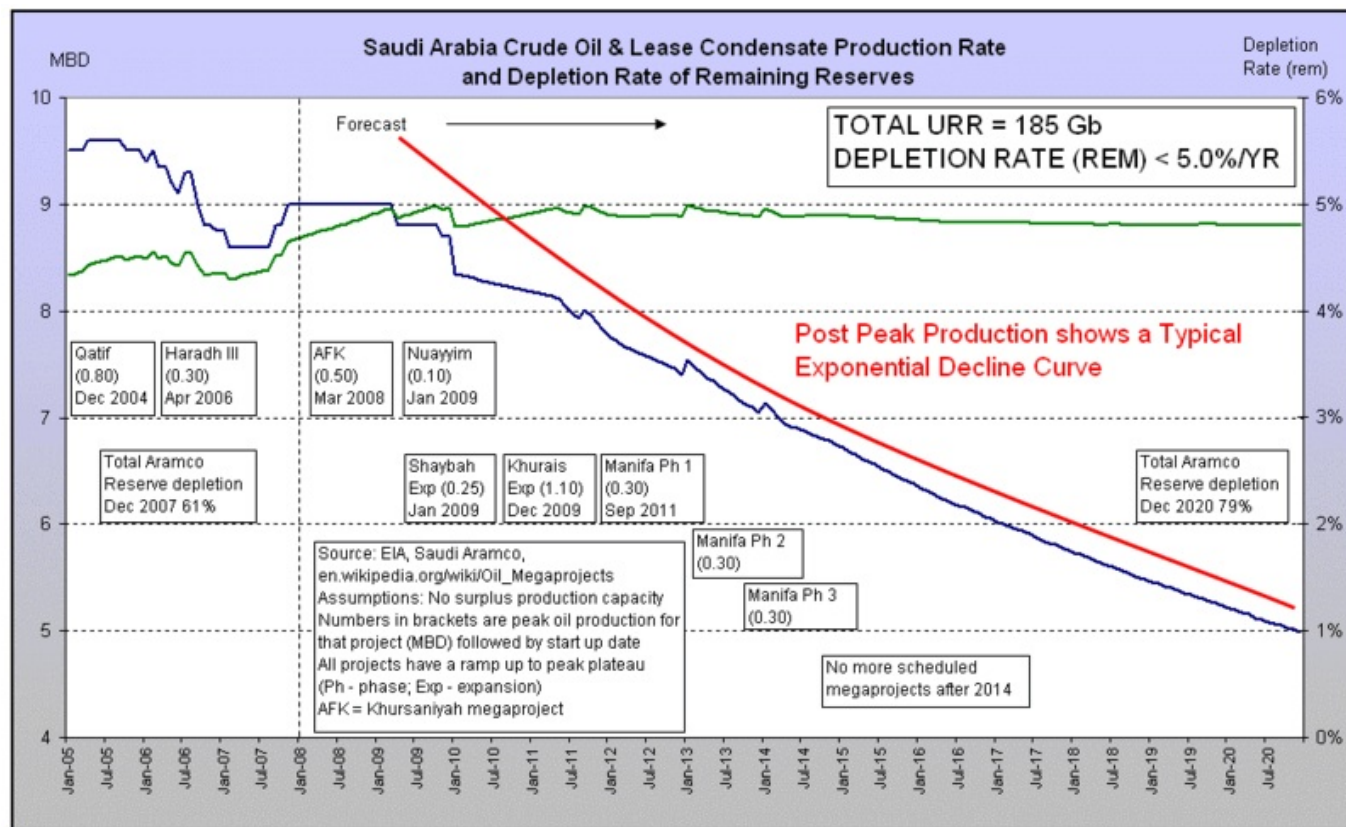


Fig 9 - Saudi Arabia Crude Oil & Lease Condensate Production to 2020 (bottom up forecast) - click to enlarge

Figs 9 and 10 have been updated for [Wikipedia Oil Megaprojects](#). Although Khurais is forecast to produce 1.1 mbd, Matt Simmons [doubts](#) that Khurais will produce 0.8 mbd. This [report](#) stated that the “Khurais field west of the giant Ghawar field could potentially increase Saudi production by a further 800,000 b/d” and another [report](#) made a similar statement “Another potential project, at the Khurais field, could increase Saudi production capacity by 800,000 bbl/d”. These

There are three forecast scenarios from 2008 to 2080, shown in Fig 10. The solid red line shows a “Do Nothing” forecast scenario. This represents a production decline rate of 8%/yr which is equivalent to ultimate recoverable reserves of 148 Gb (billion barrels). This scenario is highly unlikely but serves as a useful lower bound for the forecast 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 mbd would be required from other projects and infill drilling. This is highly unlikely and predicts that a peak in 2005 has passed. **The “Bottom Up” dark blue line in Fig 10 represents the most likely scenario and includes the bottom up forecast to 2020 from Fig 9, followed by an annual production decline rate of 4.5%/yr.**

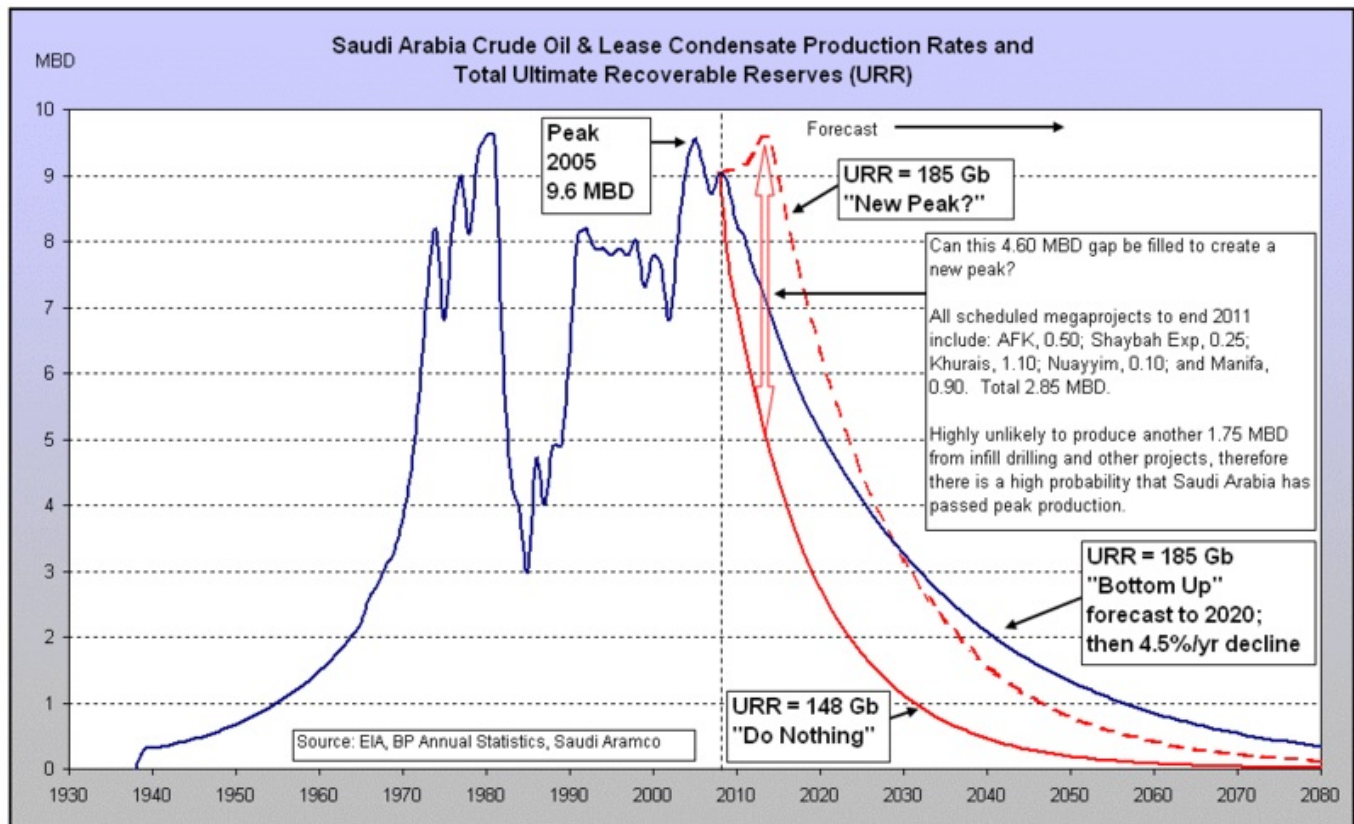


Fig 10 - Saudi Arabia Crude Oil & Lease Condensate Production to 2080 - [click to enlarge](#)

Saudi Arabia has never directly admitted that it has passed peak C&C production, but in August 2004 a former OPEC president, Purnomo Yusgiantoro, [admitted that](#) “oil prices were at crazy levels, but that OPEC was powerless to cool the market...There is no more supply”. Thus, based on Yusgiantoro’s statement, in August 2004, Saudi Arabia’s C&C production was at maximum capacity of 9.5 mbd, up by a significant 1.1 mbd from April 2004 (EIA). Furthermore, on 11 April 2006, according to this [source](#) and requoted [here](#), [Platts](#) quoted a Saudi Aramco spokesman saying that “Saudi Aramco’s mature crude oil fields are expected to decline at a gross average rate of 8%/yr without additional maintenance and drilling” and that **“This maintain potential drilling in mature fields combined with a multitude of remedial actions and the development of new fields, with long plateau lives, lowers the composite decline rate of producing fields to around 2%.”** Therefore, as of April 2006, Aramco’s crude oil production was forecast by this Aramco spokesman to decline at 2%/yr which

means that Saudi Arabia has passed peak crude oil production.

These three sources provide additional information about Saudi Arabia's production decline rates. Aramco Senior Vice President Abdullah Saif [admitted that](#) "One challenge for the Saudis in achieving this objective is that their existing fields sustain 5 percent-12 percent annual "decline rates," (as reported in Petroleum Intelligence Weekly and the International Oil Daily) meaning that the country needs around 500,000-1 million bbl/d in new capacity each year just to compensate". The [Schlumberger CEO said](#) that "the industry is dealing with a phenomenon that is exaggerated by the lack of investment over the past 18 years. This phenomenon is the decline rate for the older reservoirs that form the backbone of the world's oil production, both in and out of OPEC. An accurate average decline rate is hard to estimate, but an overall figure of 8% is not an unreasonable assumption." [The EIA also stated](#) that a "challenge for the Saudis in achieving their strategic vision to add production capacity is that their existing fields sustain, on average, 6 to 8 percent annual "decline rates" (as reported by Platts Oilgram) in existing fields, meaning that the country needs around 700,000 bbl/d in additional capacity each year just to compensate for natural decline."

Saudi Arabia C&C production was 9.5 mbd in August 2004. According to the previous EIA statement, Saudi Arabia needs 0.7 mbd additional capacity each year just to compensate for natural decline. Therefore, three years later, by August 2007, additional capacity of 2.1 mbd (3*0.7 mbd) would have been required just to compensate for natural decline. Since August 2004 there was a total capacity addition of only 1.1 mbd from these two projects as stated by Saudi Aramco's Press Kit on [their website](#). In late 2004, Qatif (including Abu Safah) began operations with production capacity of 0.8 mbd and in early 2006, 0.3 mbd capacity from Haradh III, 0.3 mbd (Fig 9), which leaves a shortfall of 1.0 mbd. This implies that Saudi production in August 2007 is 8.5 mbd, 1.0 mbd less than the 9.5 mbd production in August 2004, excluding capacity additions from infill drilling. Accordingly, this number of 8.5 mbd is slightly less than the number of 8.6 mbd for July 2007, from the [EIA Short Term Energy Outlook, Table 3a, 7 August 2007](#). Based on the quotes and statements in this and the previous two paragraphs, **it is highly unlikely that capacity additions from new projects, including infill drilling, are sufficient to compensate for existing production decline, and consequently the "Bottom Up" scenario in Fig 10 remains the most likely scenario.**

6. Kuwait Crude Oil & Lease Condensate Production

It is assumed that Kuwait will produce their fields while maintaining the annual depletion rate below 4.5% which is slightly higher than its peak depletion rate of 4.1% on Oct 2006. The URR of Kuwait, including its share of the Neutral Zone, is assumed to be 60 Gb. This is based partly on Colin Campbell's [August 2007 newsletter](#) which states that the balance of evidence points to a total URR of 53 Gb for Kuwait only (excluding the Neutral Zone - NZ). Adding in 6 Gb for half the Neutral Zone and rounding up gives a total URR of 60 Gb. This [research](#) estimates Kuwait URR to be 75 Gb, but if the most recent data point is treated as an outlier then the URR could drop to about 65 Gb. Furthermore, in January 2006, this [surprise downgrade](#) of remaining proven reserves to only 24 Gb, 25% of the BP Annual Statistics official figures of 99 Gb, with 15 Gb in its biggest field Burgan, adds further support to a URR of 60 Gb. The accompanying [reserves data table](#) shows the total produced and remaining proven reserves to be 60.2 Gb, including the NZ. This figure may indicate that the above URR might be too low, but given the insignificant new scheduled production capacity by KOC (Fig 11), the URR of 60 Gb will be assumed for forecasting the production rates.

As of December 2007, Kuwait's total cumulative C&C production was 38 Gb, being 63% of the URR 60 Gb. Over half of the 60 Gb has been produced from the super giant Burgan. It is assumed that Kuwait will increase their production during this winter according to recent [OPEC quota increases](#). Kuwait has produced over half of the estimated URR and the production curve is forecast to follow a typical post peak decline curve, shown by the red line in Fig 11. Unfortunately, the insignificant new scheduled production capacities from Project Kuwait Phase 1 and Sabriya GC-24 are not enough to offset decline from existing fields.

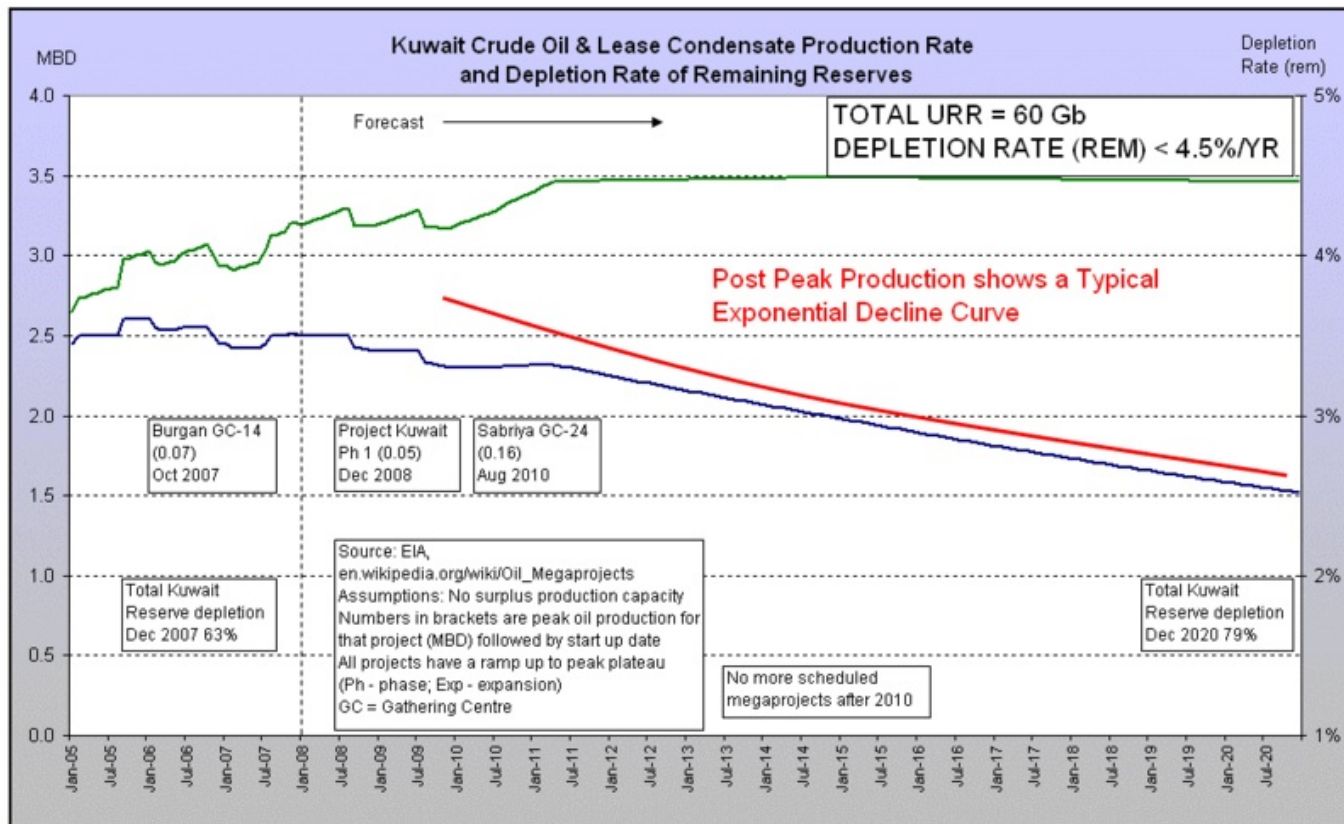


Fig 11 - Kuwait Crude Oil & Lease Condensate Production to 2020 (bottom up forecast) - click to enlarge

There are only two new projects shown in Fig 11, Project Kuwait Phase 1 and Sabriya GC-24, according to [Wikipedia Oil Megaprojects](#). Project Kuwait, costing \$US8.5 billion, which has been discussed in Kuwaiti parliament for ten years has [still not been officially approved as of February 5, 2008](#). This extensive delay probably means that Project Kuwait's key assets are difficult reservoirs similar to heavy oil which will comprise a large part of Kuwait's [future oil production](#).

The unsubstantiated production targets of the Kuwait Oil Company (KOC) are partly explained in their publication, The Kuwaiti Digest, on [KOC's website](#). The [Jan-Mar 2006 issue](#) stated that the KOC's production target is 4 mbd, up 1.5 mbd from their current 2.5 mbd production at that time. However, the only significant project mentioned is the \$US8.5 billion Project Kuwait which aims to raise production by only 0.37 mbd, over a 20 year period, which is small relative to the required 1.5 mbd increase. The [Jul-Sep 2007 issue](#) stated that "There may be surprises for our general readers – that we cannot reach our 4 million barrels per day strategy for 2020 without unlocking the potential partnerships of International Oil Companies (IOC)." In other words, the KOC is struggling to increase their output without assistance from the IOCs. However, even if an agreement can be made with the IOCs to start Project Kuwait and identify other projects, the time to first oil could be several years which means that decline rate in Fig 11 may only be a little

There are three forecast scenarios shown below. The solid red line shows a “Do Nothing” forecast representing an equivalent URR of 53 Gb, which serves as a lower bound. The “New Peak?” dashed red line represents a scenario for which another minor peak is attained. However, the inset in the chart explains that at least another 0.49 mbd would be required from other projects and infill drilling. This is highly unlikely and predicts that a minor peak in 2006 has passed. **The “Bottom Up” dark blue line in Fig 12 represents the most likely scenario and includes the bottom up forecast to 2020 from Fig 11, followed by an annual production decline rate of 4.5%/yr.**

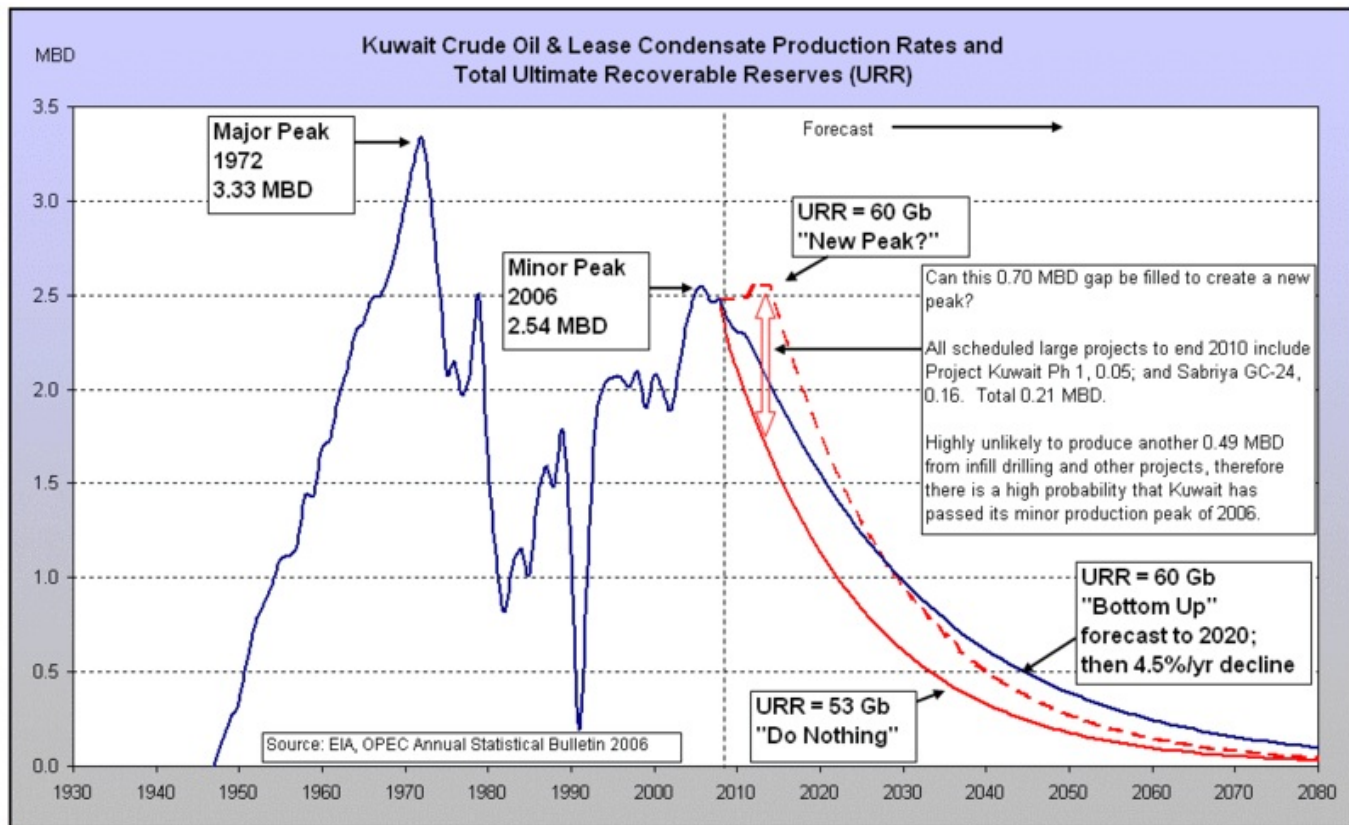


Fig 12 - Kuwait Crude Oil & Lease Condensate Production to 2080 - click to enlarge

Like Saudi Arabia, Kuwait has never directly admitted that it has passed peak C&C production. However, in November 2005, the Kuwait Oil Company admitted that Burgan, Kuwait’s biggest field and the world’s second largest, [had passed peak](#). This admission is further supported by EIA data showing that Kuwait C&C production fell off a 2.6 mbd peak plateau in February 2006. As Burgan is Kuwait’s largest field, comprising at least 60% of the total URR, the Kuwait Oil Company admission provides strong evidence for Kuwait having passed its minor peak C&C production in 2006.

7. UAE Crude Oil & Lease Condensate Production

It is assumed that UAE will produce their fields while maintaining the annual depletion rate below 5.0% which is the same as its peak depletion rate of 5.0% on Oct 2007. The URR of UAE is assumed to be 45 Gb which is between the two following estimates. This [chart](#) predicts that the

As of December 2007, UAE's total cumulative C&C production was 26 Gb, being 57% of the URR 45 Gb. The drop in November 2007 was due to previously scheduled maintenance. UAE has produced over half of the assumed URR and the production curve is forecast to follow a typical post peak decline curve, shown by the red line in Fig 13. Unfortunately, the new scheduled production capacities do not start until 2009 and are not enough to offset decline from existing fields.

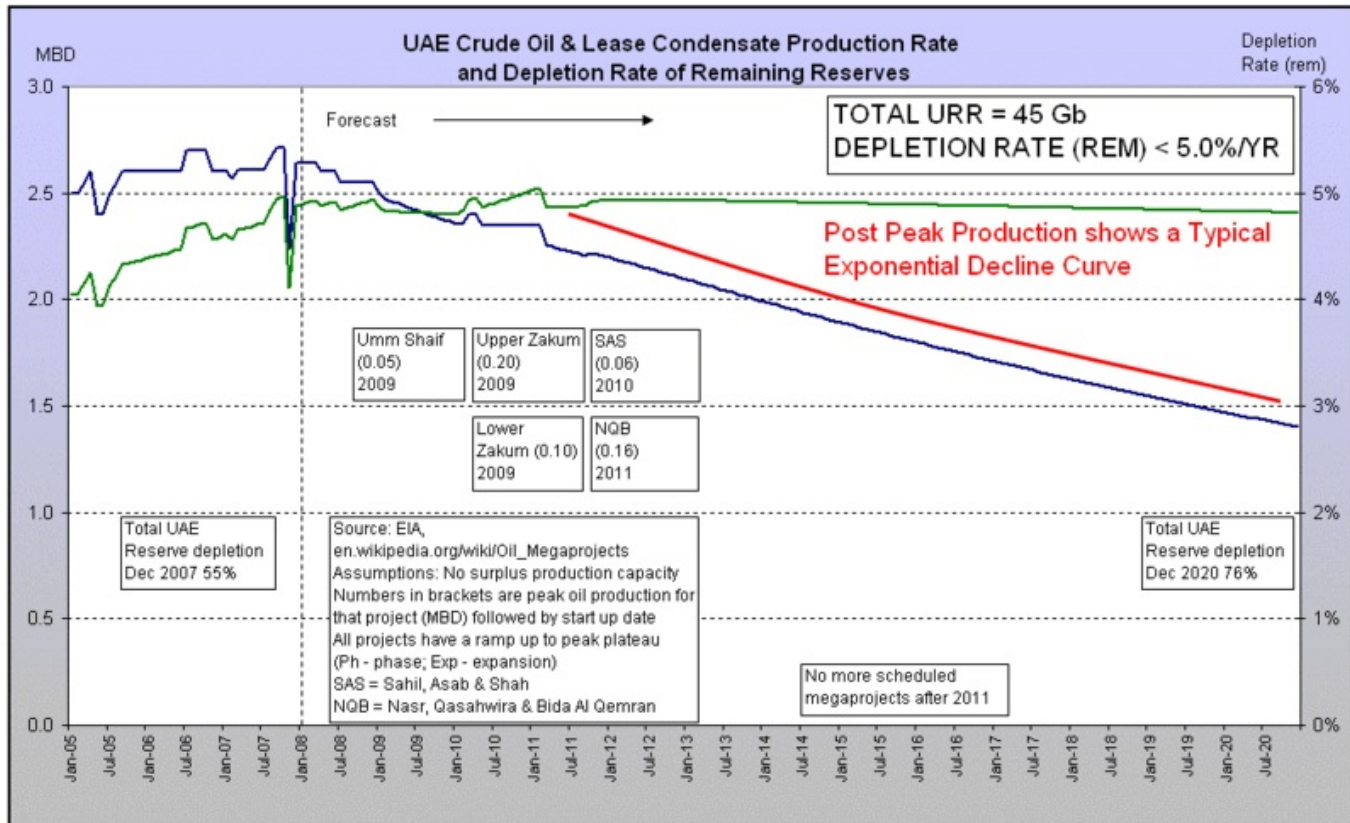


Fig 13 - UAE Crude Oil & Lease Condensate Production to 2020 (bottom up forecast) - click to enlarge

There are three forecast scenarios shown below. The solid red line shows a “Do Nothing” forecast representing an equivalent URR of 40 Gb, which serves as a lower bound. The “New Peak?” dashed red line represents a scenario for which another peak is attained. However, the inset in the chart explains that at least another 0.23 mbd would be required from other projects and infill drilling. This is highly unlikely and predicts that the peak in 2006 has passed. **The “Bottom Up” dark blue line in Fig 14 represents the most likely scenario and includes the bottom up forecast to 2020 from Fig 13, followed by an annual production decline rate of 5.0%/yr.**

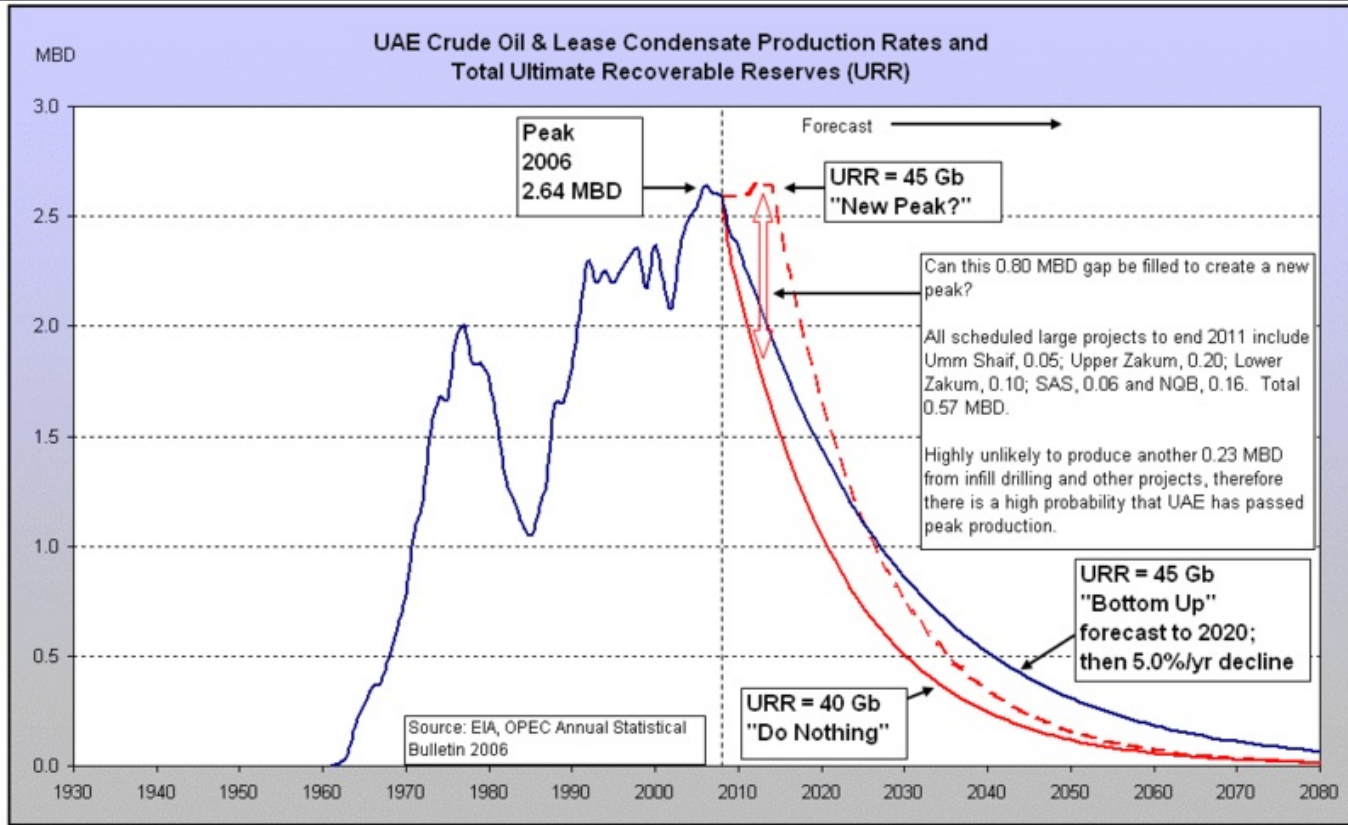


Fig 14 - UAE Crude Oil & Lease Condensate Production to 2080 - click to enlarge

Also like Saudi Arabia, UAE has never directly admitted that it has passed peak C&C production. The scheduled maintenance in November 2007, reducing production by 0.6 mbd, may only serve to ensure that production remains at just over 2.5 mbd for 2008, as there has been no disclosure by UAE about the impact of this maintenance on future production rates. As UAE does not have any projects scheduled until 2009, it is likely that UAE has passed its peak in 2006.

8. 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. [Saudi Aramco's most recent project schedule](#), released in June 2007, shows two significant NGPL projects to be completed by the middle of 2008: Hawiyah at 318,000 barrels/day and Khursaniyah at 290,000 barrels/day.

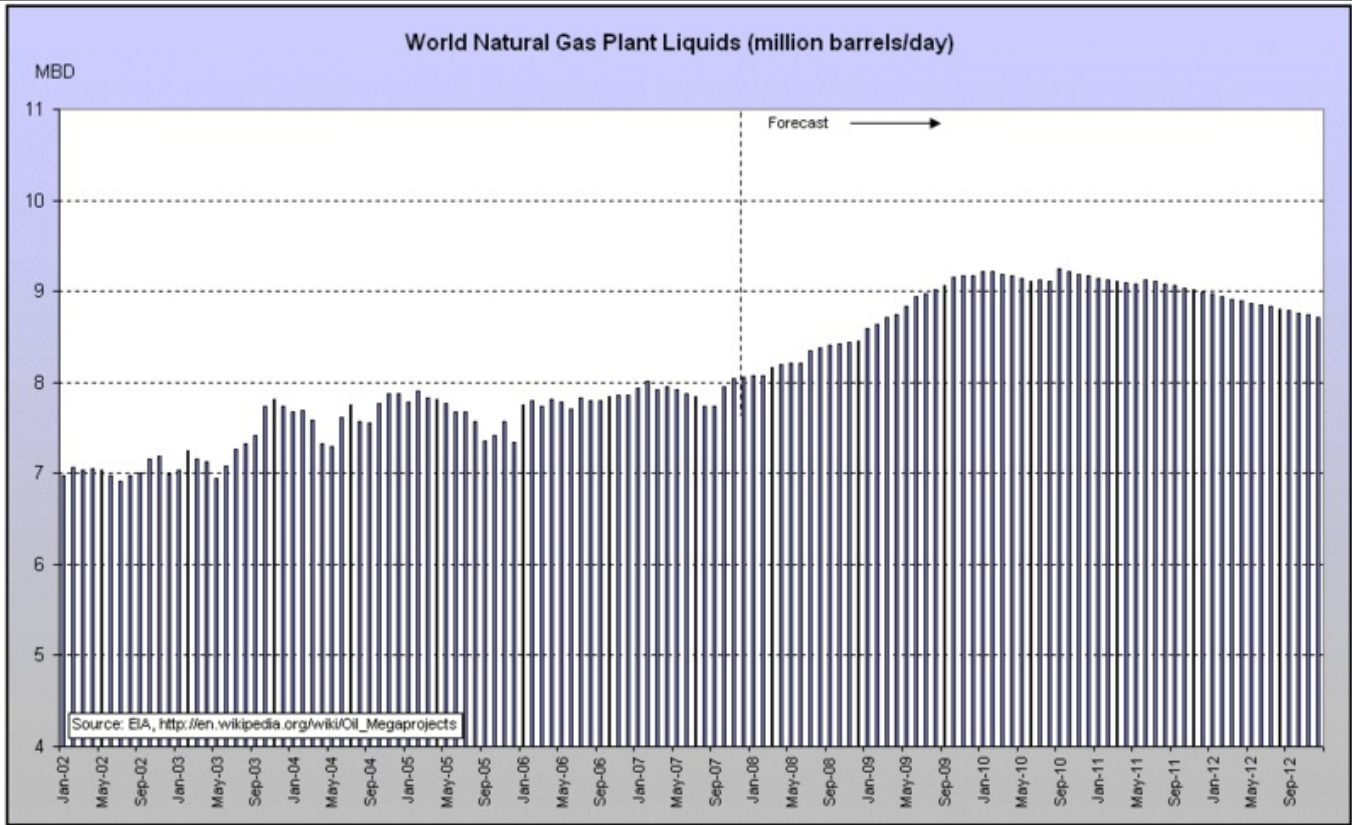


Fig 15 - World Natural Gas Plant Liquids Production to 2012 (bottom up forecast)
 - click to enlarge

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

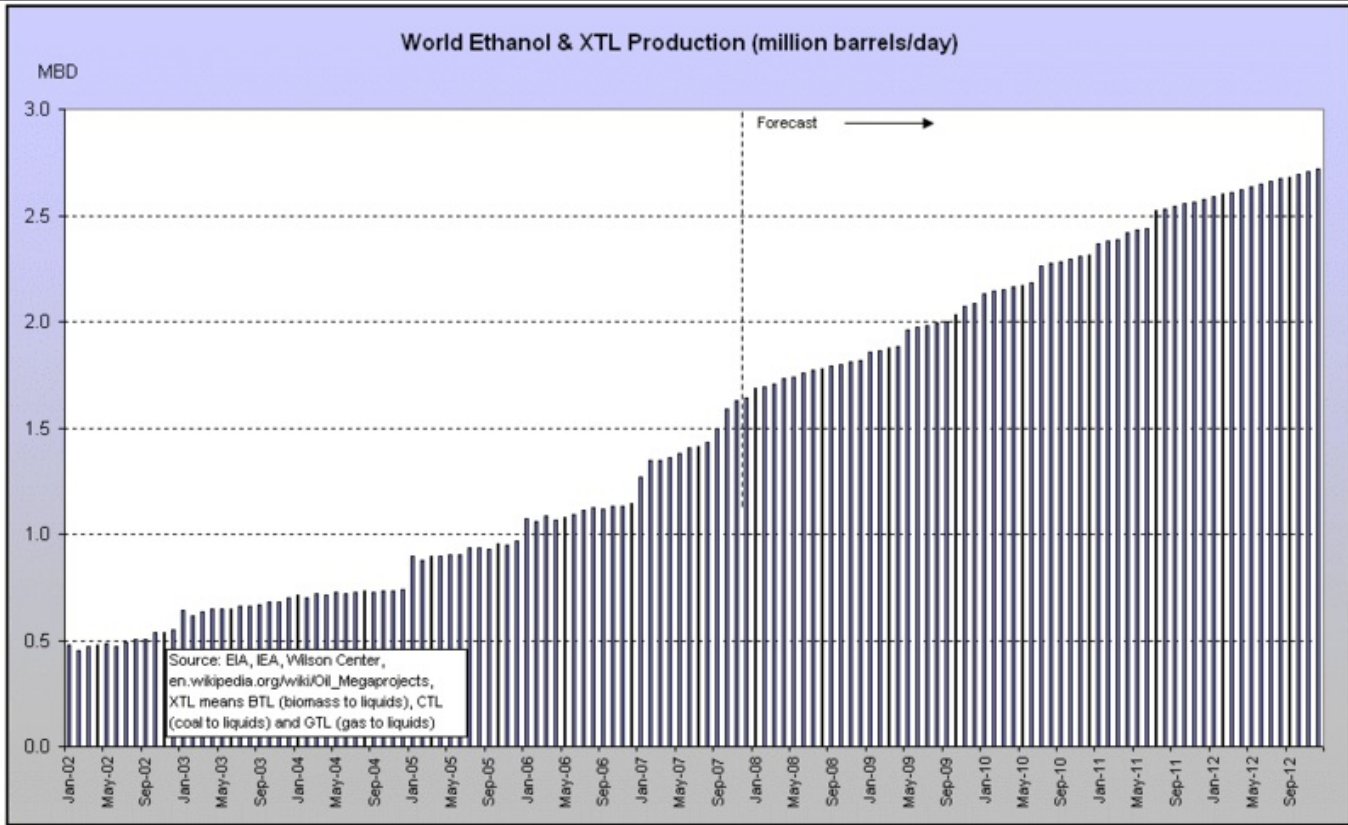


Fig 16 - World Ethanol & XTL Production to 2012 (bottom up forecast) - click to enlarge

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).

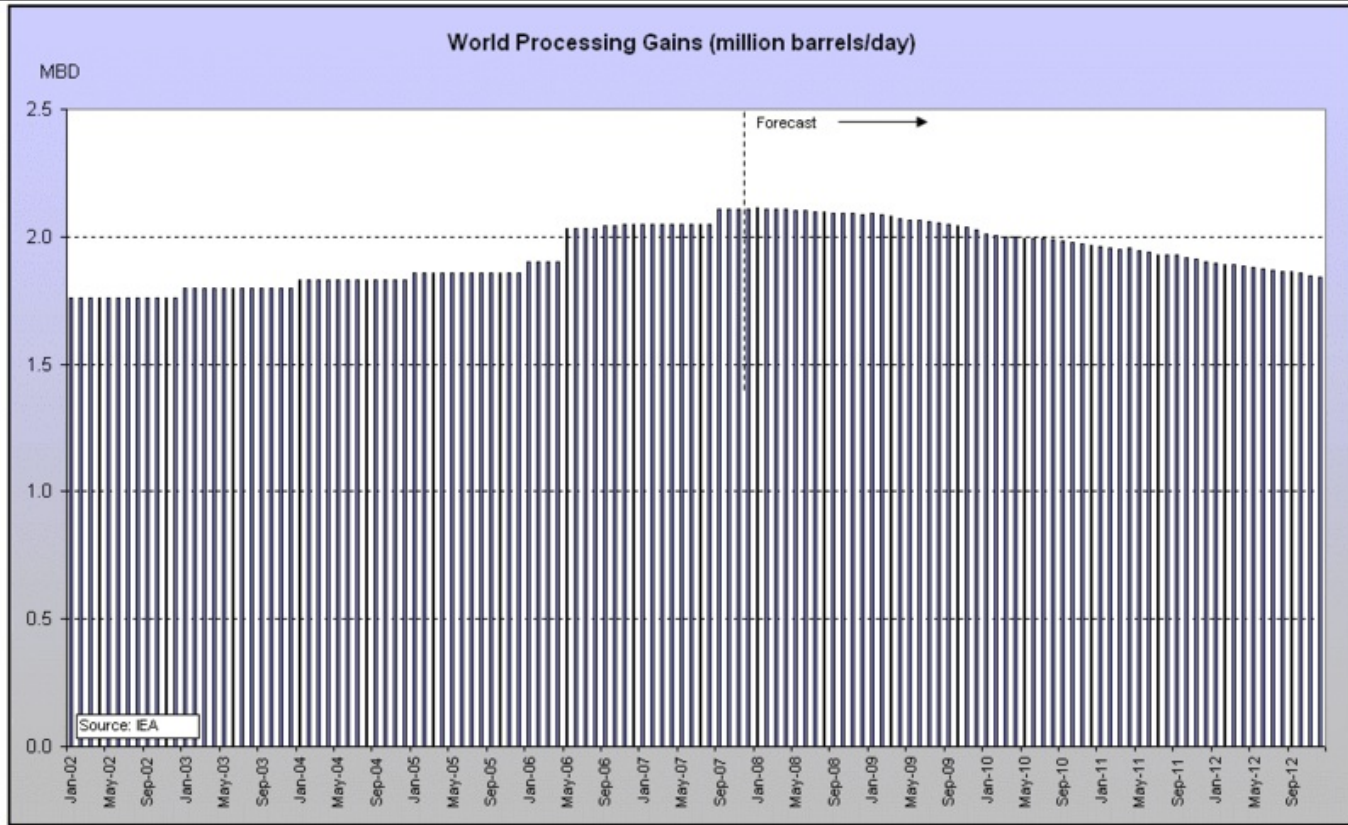


Fig 17 - World Processing Gains to 2012 (bottom up forecast) - click to enlarge

9. Additional Information Sources

For more forecasts please refer to this article by Khebab, [Peak Oil Update - December 2007: Production Forecasts and EIA Oil Production Numbers](#) and to [Peak Oil Media Redux](#) by Prof Goose, including [this lecture](#) by Dr. Albert Bartlett.

Further articles about Saudi Arabia, Kuwait and UAE:

by Stuart Staniford

- [Satellite O'er the Desert](#)
- [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](#)
- [What would we have predicted for Kuwait?](#)

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**](#)
- [**IHS Data Suggest Kuwaiti and Global Proved Oil Reserves Significantly Lower Than BP Estimates**](#)

by Gail the Actuary

- [**President Bush Questions Saudi Ability to Raise Oil Supply**](#)

by Jerome a Paris

- [**Saudis officially happy with \\$100 oil**](#)

by Heading Out

- [**Another look at the Kingdom of Saudi Arabia**](#)
- [**Simple mathematics - The Saudi reserves, GOSPs and water injection**](#)
- [**Of Oil Supply trains and a thought on Ain Dar**](#)

by Khebab

- [**Saudi Arabia: An Attempt to Link Oil Discoveries, Proven Reserves and Production Data**](#)
- [**The Hubbert Linearization Applied on Ghawar**](#)
- [**An Attempt to Apply The Parabolic Fractal Law to Saudi Arabia**](#)

by Ace

- [**World Oil Forecasts, including Saudi Arabia, Kuwait and the UAE – Update Oct 2007**](#)
- [**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**](#)



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