The Oil Drum
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

Koppelaar: Peak Oil, Separating Facts from Fiction

Posted by Prof. Goose on October 25, 2006 - 10:28am
Topic: Supply/Production
Tags: oil discoveries, oil supply forecasts, peak oil [list all tags]

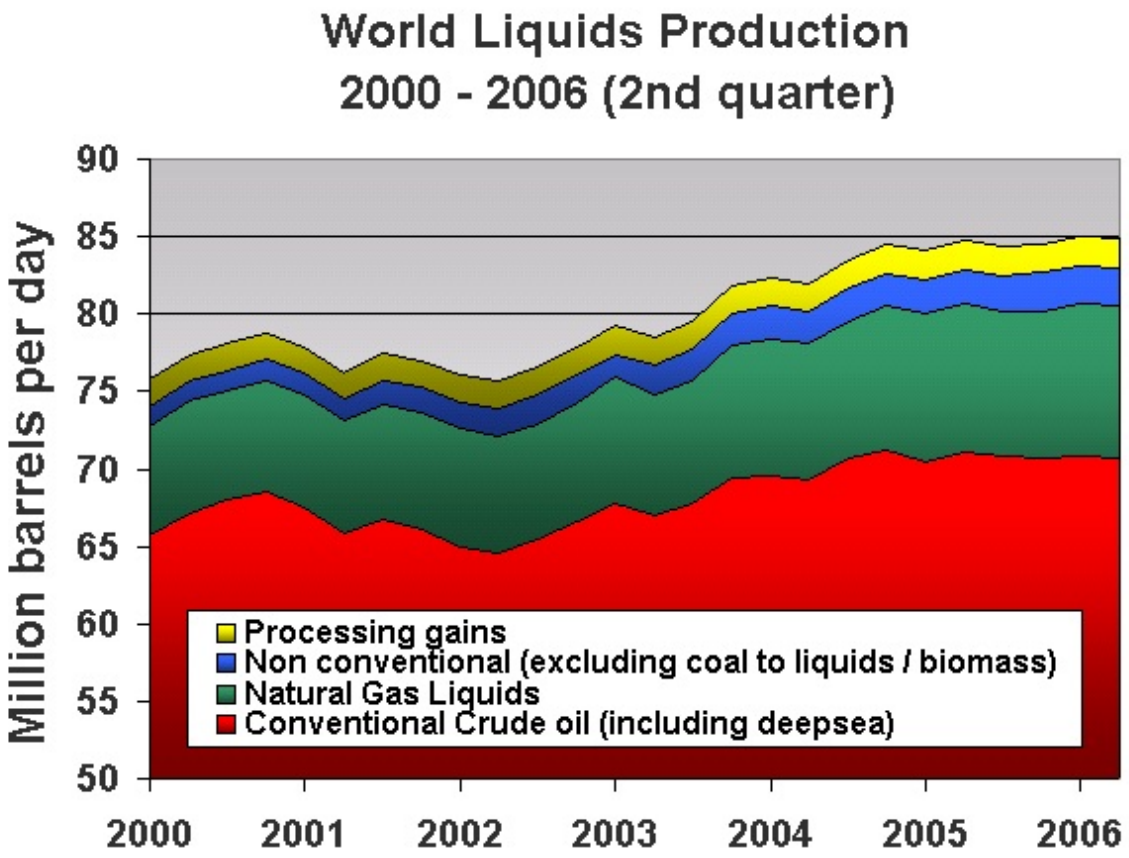
[editor's note, by Prof. Goose] This is a guest post by Rembrandt Koppelaar, Chairman of ASPO Netherlands.

In the discussion about the date of peak oil production there is often a lack of a common framework. This makes it difficult to compare arguments concerning the date of peak oil / liquids production. In this post I outline a set of clear suppositions that, I hope, will help to understand the issue better.

My personal knowledge comes from dedicating a large part of the past years my life on the issue of peak oil and energy. In 2005 I and several friends established the Dutch Cluster of ASPO. Some of the information in this post comes from the ASPO Netherlands database which includes oil field developments throughout the world.

#1) Liquids Production has not increased since the 4th quarter of 2004.

This is a very simple observation shown in the chart below.



Source: International Energy Agency, Quarterly Statistics, Oil, Gas, Coal & Electricity

Liquids production can be subdivided in five sources:

a. Conventional crude oil (including lease condensate recovered from associated and non-associated gas production)

b. Natural Gas Liquids (NGL): (liquids or liquefied hydrocarbons recovered from natural gas in separation facilities or gas processing plants.)

c. Non Conventional oil (Tar sands, bitumen, extra heavy crude, oil shale)

d. Processing gains (backflows to refineries returned from final consumers to refineries for processing)

e. Alternative liquid sources (coal to liquids / biomass to liquids / gas to liquids). The first streams of coal to liquids have been planned in China to start around 2011/2012. A few Gas to Liquids projects are underway, mainly from Shell. Both sources will not provide more then a few million barrels per day at maximum by 2020. Biomass could provide a significant amount of liquids by 2020, at the moment however, this seems unlikely to happen.

#2) Current World conventional oil + NGL production is declining at an approximate annual rate of 4%. For 2006 this means that 4% of 81.76 mb/d (added sum of world conventional oil + NGL production) needs to come on-stream from new liquid sources such as oil fields under development to keep production steady.

It is important to define what decline rate means, especially when reading figures from other

people/institutes. In general for an oil field, there are two divisions between production declines:

Gross decline rate - the drop in production that would occur if oil companies would not try to halt declines, or the natural decline level. Decline can be halted by introducing new techniques / workovers / drilling more wells and so forth.

Net Decline rate - the drop in production that occurs when the efforts by oil companies to halt decline are included.

There are at least three methods to determine the rate at which new production needs to come on-stream to offset declining production in peaked fields and peaked countries.

a. By estimating the reserve base of all oil field/countries and combining this with the production rate. With the help of mathematical formulas this can deliver the right depletion rate (decline rate of reserves) and therefore decline rate (decline rate of production). A very difficult method, due to the uncertainty of oil reserve figures worldwide.

b. By combining decline rates from literature / oil companies press releases per oil producing country and other sources to give the added sum of the world decline rate for oil production.

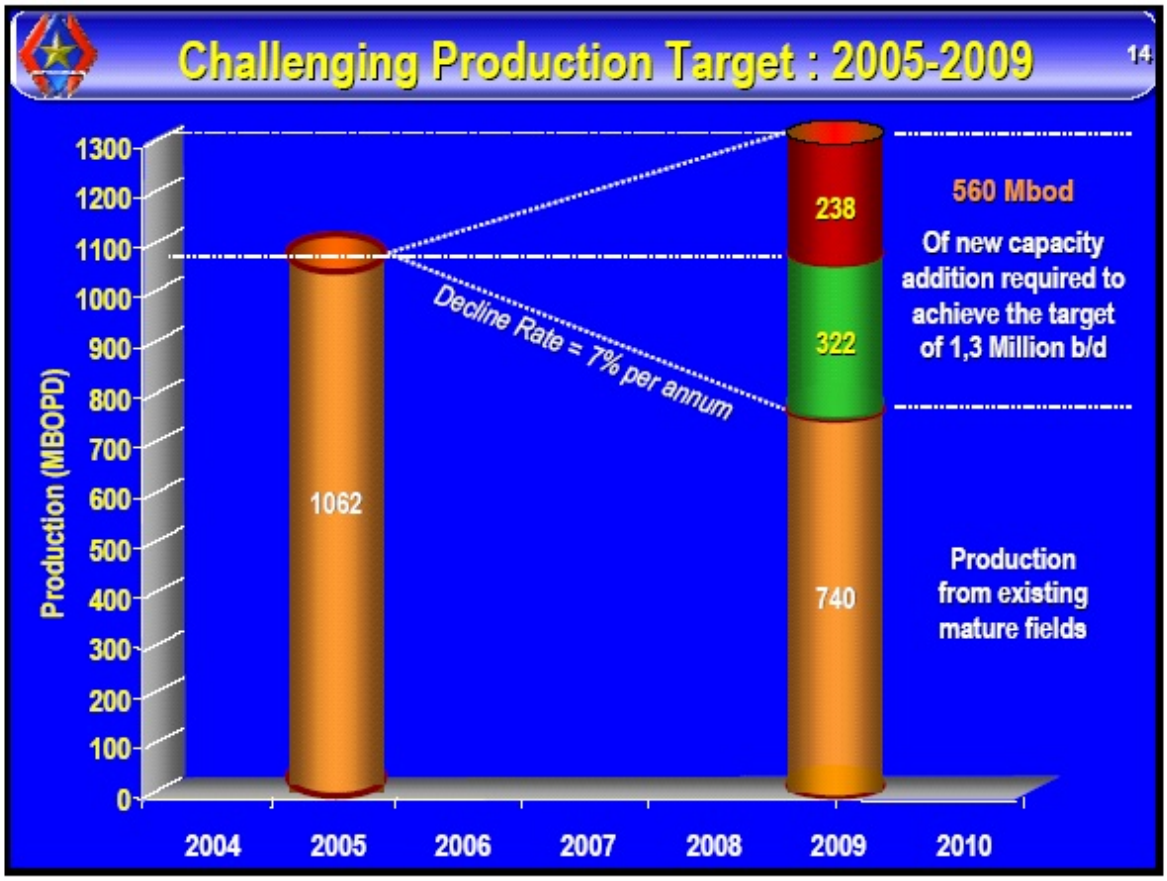
c. By calculating the total amount of new oil production coming from oil fields under development for a given year (say 2006) and comparing this with actual production figures for that year. The difference between both figures gives the approximate decline rate.

Personally I work with method b and c due to the huge uncertainty involving reserves. In the latest ASPO NL Newsletter I have come to an approximate net decline rate of 4% by means of method C.

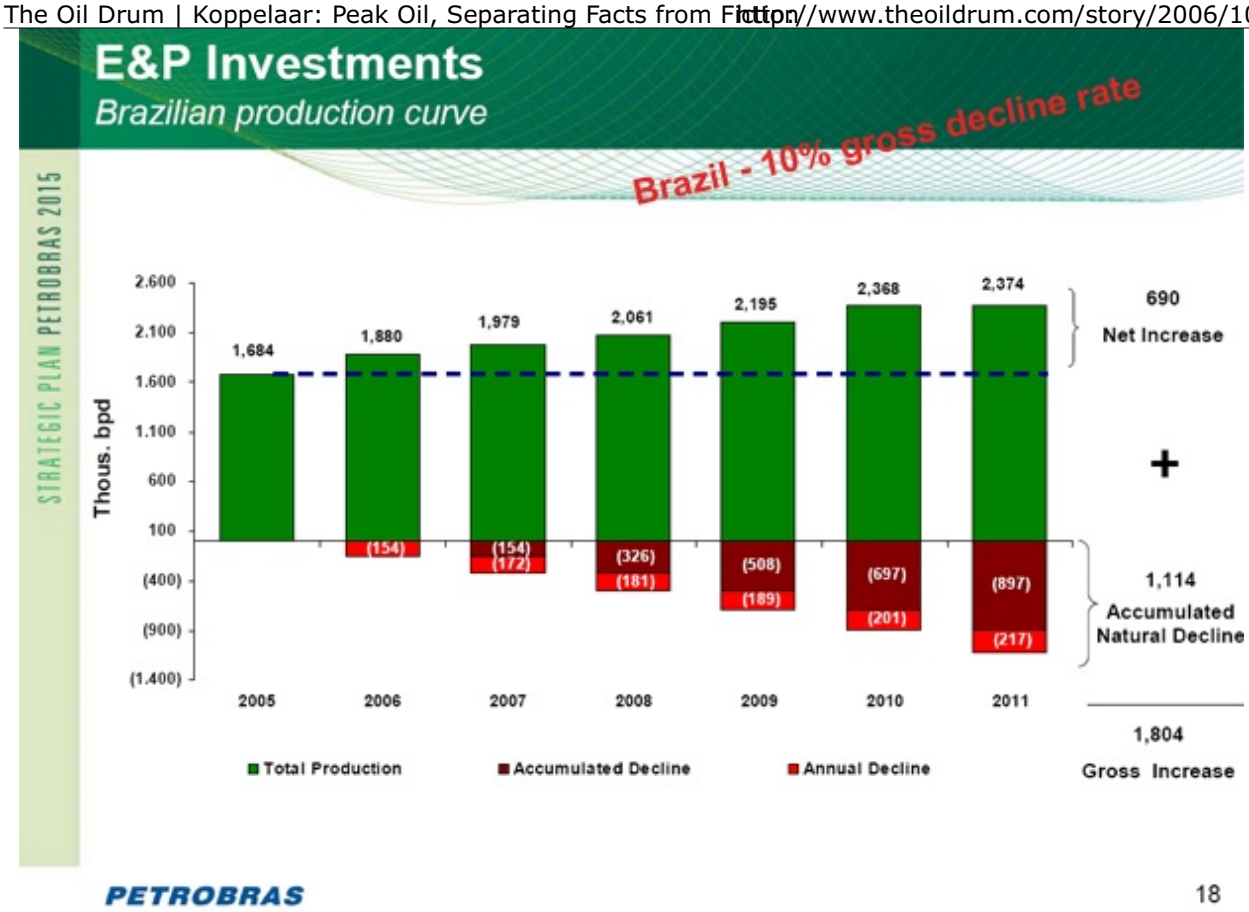
I have tried to see whether my analysis is correct by using method b. From various sources I have obtained gross decline rates for nearly all large oil producing countries in the world. This varies between 4% and 10% depending on the country and the type of production (onshore / offshore / deepsea).

Two examples:

Indonesian oil production decline rate

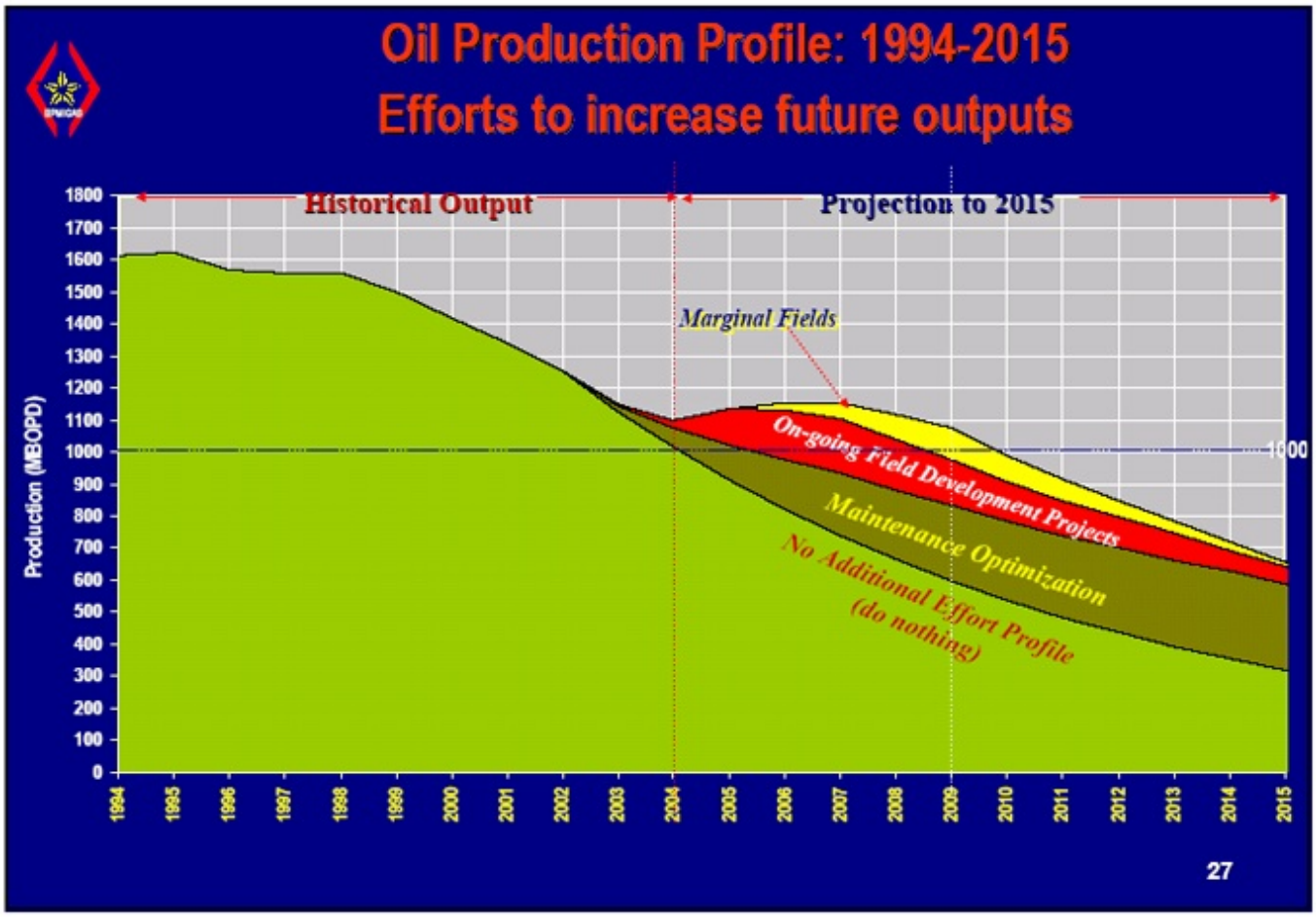


Source: Dr. Abdul Muin, senior advisor BPMIGAS



By combining these gross decline figures with new techniques / workovers / drilling more wells and so forth one can determine the net decline level. When separate decline rates from various countries are taken together, they give an annual net decline rate for world oil production at the order of 4% to 5%. An illustrative example is shown below, which gives the expectation from the Indonesian government for their oil production.

Indonesian governmental oil production expectation



Source: Directorate General of Oil and Gas, Republic of Indonesia

#3) The increase in world liquids production from current developments in the oil industry is sufficient to offset declines until 2010 plus an increase in production to meet low to medium demand.

There are various publications that confirm this supposition. By gathering data on oil projects / oil field developments one can estimate the amount of production that comes on-stream in the near term future, necessary to offset declines and meet demand. There are three such works that are available in the public domain: The International Energy Agencies Medium term oil outlook, Chris Skrebowski's Mega Projects report from Petroleum Review and my own estimates for which the latest data (until 2007) is available in the ASPO Netherlands newsletter #5.

In addition there are also several publications that are available for a large fee or clients only, such as CERA's liquid capacities report, Merril Lynch their oil supply analysis (12 october 2005) and Credit Suisse oil supply analysis (15 march 2006).

All these publications confirm supposition number 3; they disagree on the point of future oil price predictions and on long term oil production levels.

#4) The Peak in world liquids production is mainly influenced by new discoveries and non-conventional production increases, not by increasing the recovery factor

of an oil field.

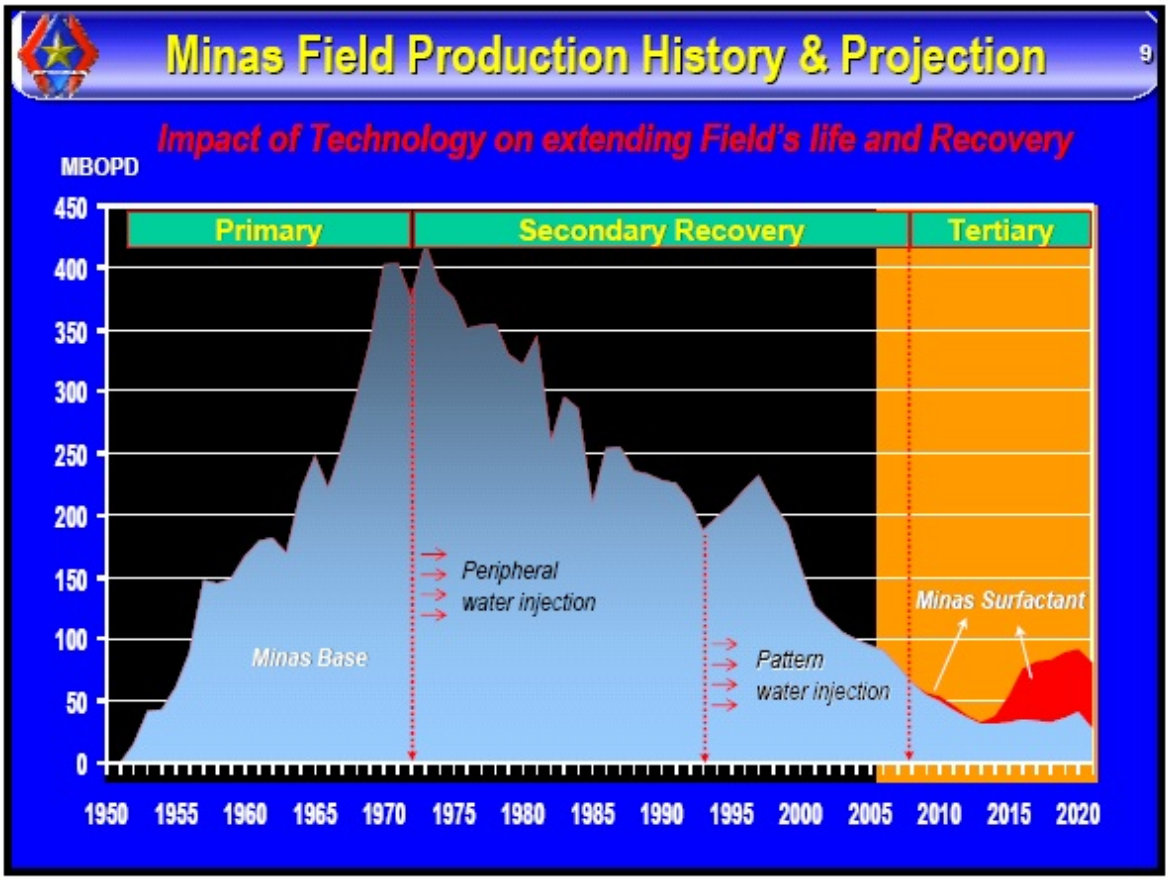
This point often leads to a large discussion between "the early and the late peakers". Can technological innovation such as the "smart wells" from shell which influence the recovery factor postpone peak?

One needs to think in terms of production not reserves to understand supposition four. Basically we know that 22 of the 50 large oil producers (more than 100.000+ barrels per day of production) have peaked for sure. (This excludes countries such as Iran due to the large uncertainty of their reserve base and therefore peak production). The production in these 22 countries is declining every year. At best the production in these countries will stay stable for a few years or have a short production increase after which the relentless decline goes on. In order to postpone the world production peak, other countries need to offset this decline every year.

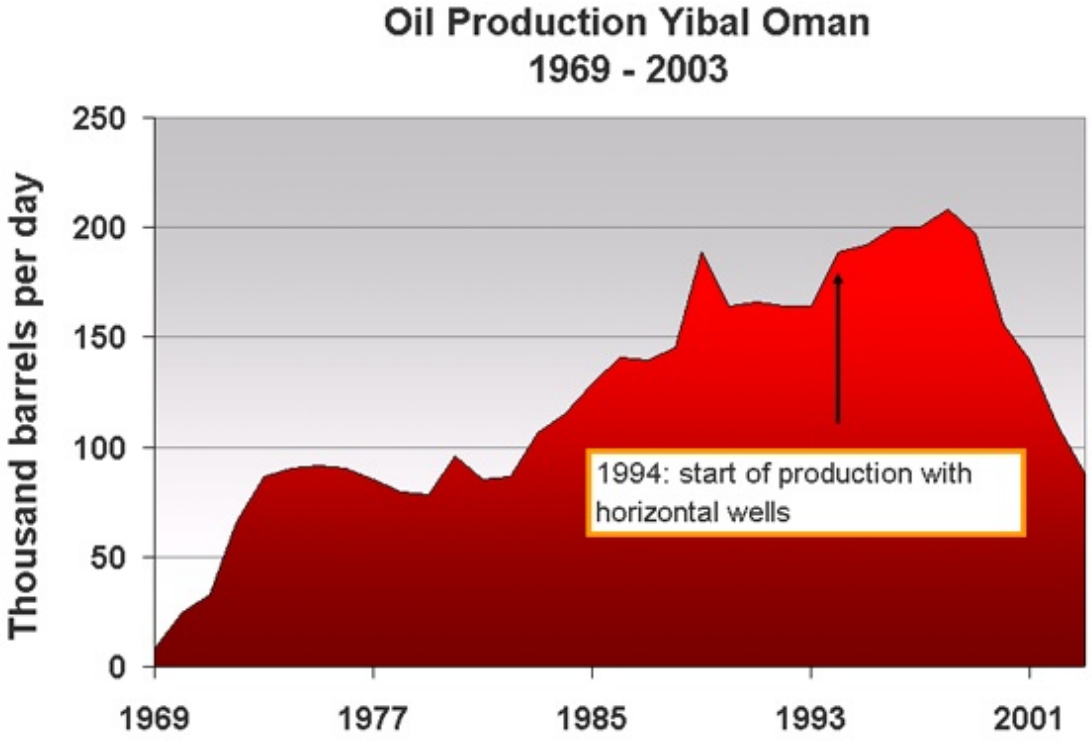
The other 28 countries that still manage to increase their production do so mainly due to new fields coming on-stream and/or non-conventional production. Thanks to technological advancement, more oil from a given field can be produced, but in general this only helps to lower the decline rate in an already peaked field.

There are various cases such as the Cantarell complex in which nitrogen injection helped to push the oil production of the complex to very high levels before peaking, but these are not the standard. New techniques are introduced in most fields when the peak has already occurred, causing a slower decline or at best a temporary increase in production. Some examples:

Minas Oil Field Indonesia

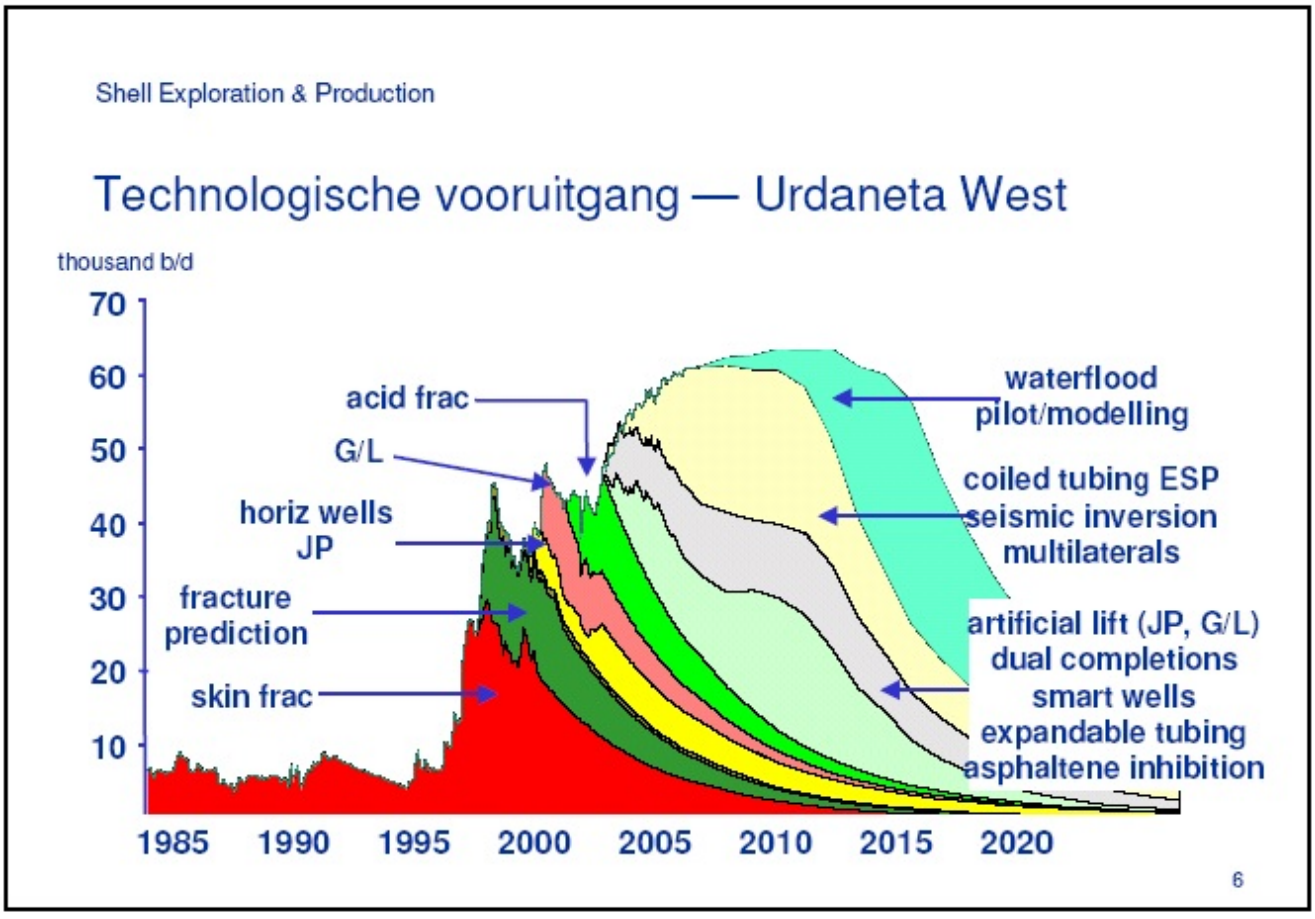


Source: Dr. Abdul Muin, Senior Advisor BPMIGAS



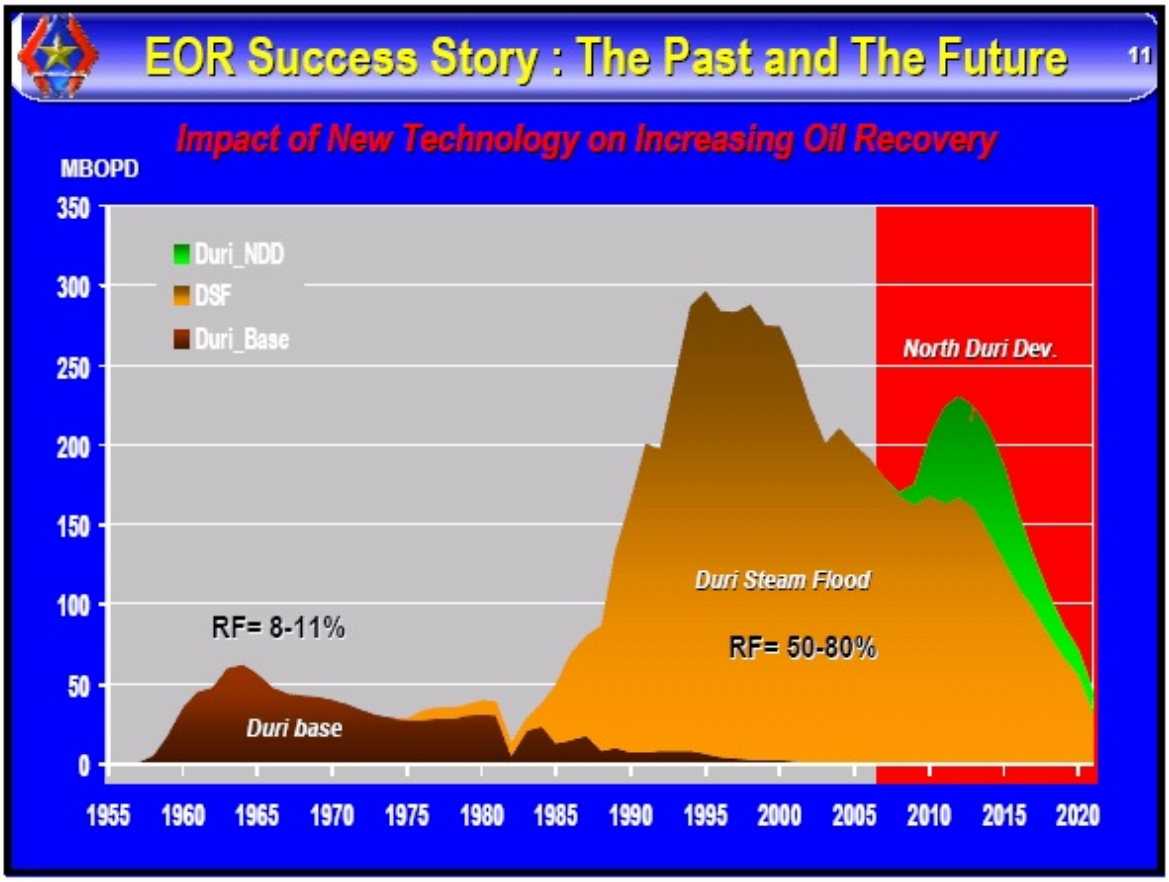
Urdaneta field in Venezuela, operated by Shell

Last known figures (may 2006) gave a production level of round 43.000 b/d because of a lack of workover/ drilling due to the political situation in Venezuela



In order to increase production at the scale that is necessary to offset declines, a significant amount of new fields needs to be put on-stream annually, next to the introduction of techniques that help to produce non-conventional reservoirs. An old example of the latter is the Duri oil field in Indonesia (18 to 20 degrees American Petroleum Gravity or medium to extra heavy oil). This field reached high production thanks to steam injection, which greatly enhanced the oil flow.

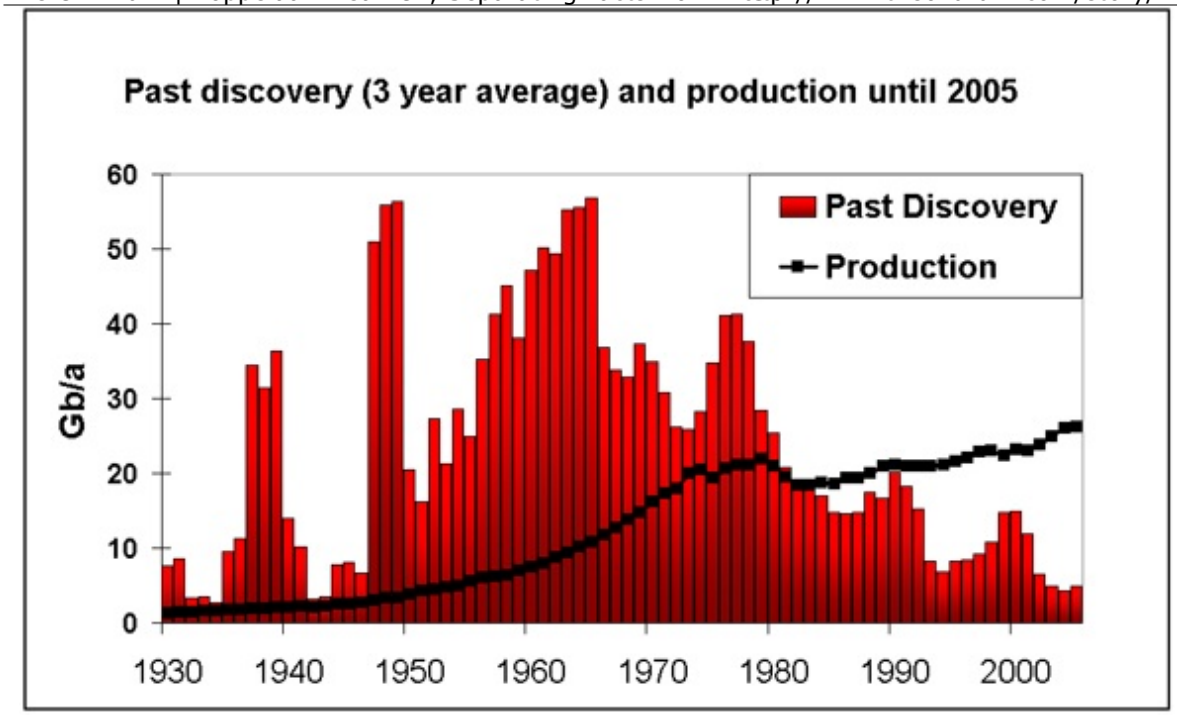
Duri Oil Field Indonesia



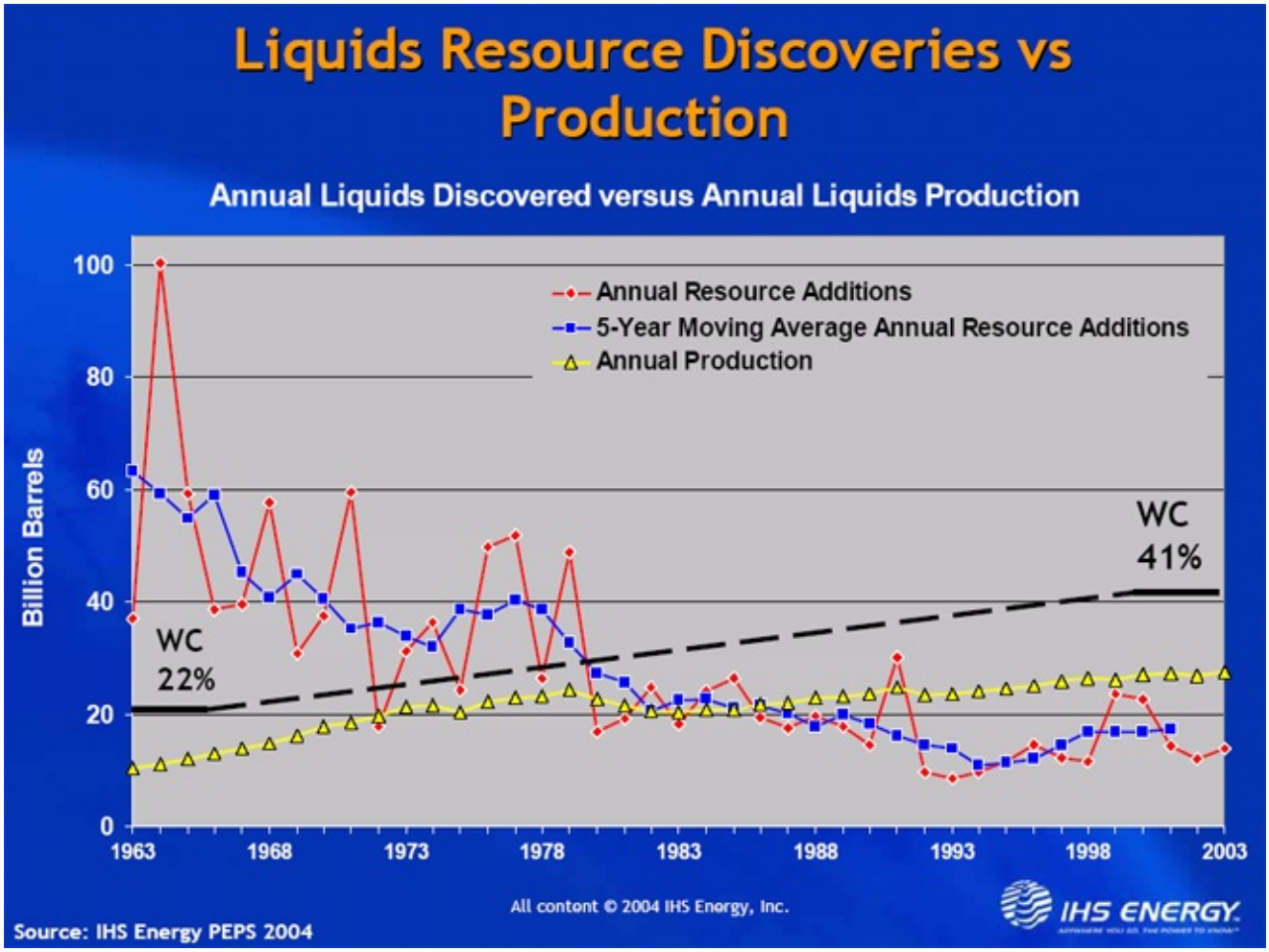
Source: Dr. Abdul Muin, Senior Advisor BPMIGAS

#5) Oil Discoveries have been declining since the `60s. We are currently producing three to four times as much oil as is being found.

This observation was first clearly published by the well known Dr. Colin Campbell, one of the founders of ASPO International. The chart below, which is adapted from his work, shows the trend for conventional oil (excluding NGL and non-conventional oil).



The same observation is confirmed by the largest database company on oil & gas in the world, IHS Energy, for annual liquids discovered.



#6) Conventional oil production will likely peak in the beginning of the next

decade.

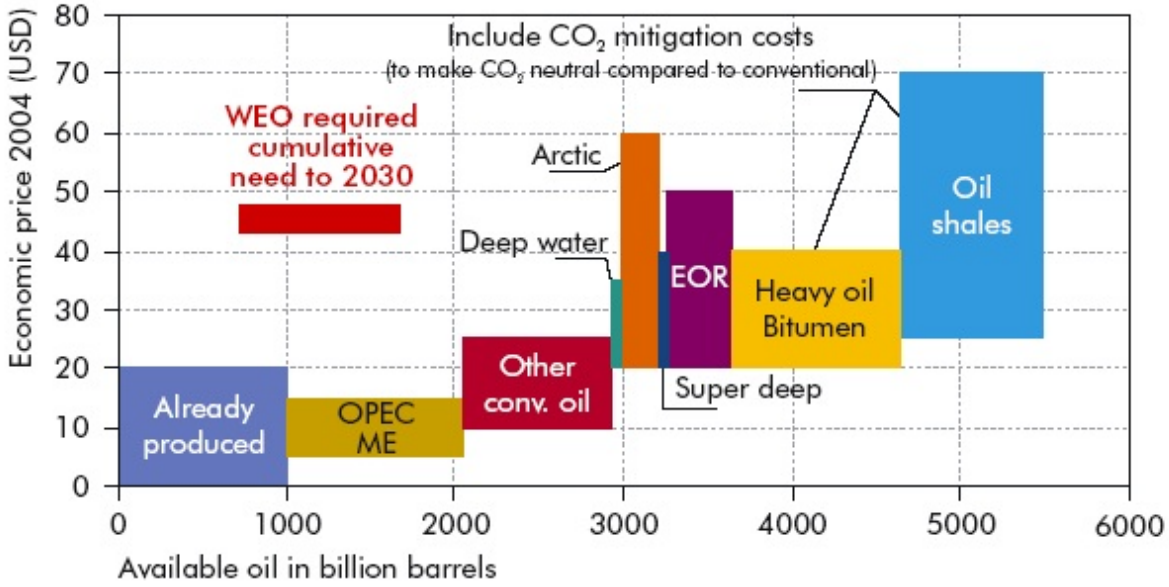
The amount of nations that can increase production from their conventional resource base (including deepsea) is declining every year. As said before, 22 of the 50 large oil producing nations have peaked. Some of the largest producing nations such as Brazil, Russia, Angola and Algeria are expected to peak/ reach a plateau at the beginning of the next decade. The only producers that might have the possibility to increase their conventional oil production at the scale needed in the beginning of the next decade will be the countries in the Middle-East. However, it is very unlikely that they can do so. Most of the supergiant to giant fields in these countries are at or near the end of their plateau production. To give an example, the largest oil field in the world, Ghawar in Saudi-Arabia, will start declining in the coming five years (if it has not already happened). The International Energy Agency expects this to happen around 2010 (World Energy Outlook 2005).

The only way that conventional oil production peak can be postponed, is by making various giant to supergiant discoveries in the coming years, which is very, very unlikely.

#7) The increase of non-conventional liquids production has it's limits due to scalability effects.

Many tout the advancement of oil sands in Canada and other unconventional sources as a wonderful source of new oil. The basic idea behind this is shown below in a graph from the Resources to Reserves report from the International Energy Agency. This graph is often used by the IEA, oil company CEO's and sometimes journalists as "proof" that there are plenty of reserves out there. Based on this assumption they conclude that there is no peak in sight.

***Figure ES.1** • Oil cost curve, including technological progress: availability of oil resources as a function of economic price*



The x axis represents cumulative accessible oil. The y axis represents the price at which each type of resource becomes economical.

Source: IEA.

The point that the IEA makes regarding reserves is partially true, in the case of non-conventional

oil. However, it totally misses the notion that the limiting factor for non-conventional oil is not the reserve base, but the extraction rate. Comparing conventional and non-conventional liquid sources as done in the graph above is
like comparing apples and oranges.

As an example, we take the most promising non-conventional source, the tar sands of Canada. The optimistic predictions from institutes such as the Canadian Association of Petroleum Producers state that a production of 3 to 4 million barrels per day around 2020 is possible from the Canadian tar sands. At the same time, conventional production is declining at an annual rate of 4%, which means a decline of more then 3 million barrels each year.

To summarize: The most promising source of non-conventional oil in the world cannot postpone liquids peak for more then a single year.

#8) Liquids production will probably peak in the next decade.

Given the arguments above I do not see how liquids production peak can be postponed much further then the end of the next decade. The increase in production from the conventional resource base (including deepsea) + NGL will probably plateau/peak at the beginning of the next decade. At this point, non-conventional sources may postpone a total liquids peak for a few years, but not much longer. At this moment, I see no reason to change my peak/plateau prediction for all liquids, which stands between 2012 and 2017.