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Megaprojects analysis explained

By Chris Skrebowski

[Chris Skrebowski is the editor of the UK Petroleum Review. Most famously he projects oil production capacity growth by tracking all the world's 'megaprojects' scheduled to come online. This data he compares to known global depletion rates, to see how projected oil production will compare with expected growth in demand, or indeed when global oil production looks likely to peak. That's my simplified version, a more in depth explanation is provided below.

Skrebowski's analysis has provided one of the most important independent methodologies supporting the 'imminent peak oil' hypothesis proposed by Hubbert inspired modelers such as Colin Campbell, Jean Lahererre, Ken Deffeyes, Stuart Staniford and GraphOilogy. His most recent studies conclude that, should no major disruptions take place, global peak oil should be delayed until at least 2010, ?but shortly thereafter production is more likely to decrease than increase.? This is, I think, more optimistic than earlier estimations, however the margin of error appears to be declining as smaller projects are also being considered. Skrebowski's latest figures also include deepwater oil, Athabasca tar sands, as well as natural gas liquids and condensate production.

The following is a generous explanation by Chris Skrebowski of his methods. This is fairly technical, so be warned if you're not that way inclined. There are some excellent interviews available at Global Public Media which delve into the significance rather than technicalities of his work.
-AF]

I am naturally pleased that my periodic revisions to my megaprojects analysis attract interest and comment. However, it has become clear that a certain amount of misunderstanding and confusion has grown up, particularly about my treatment of depletion. Having spent my entire professional life working in the oil industry as either an analyst or as a journalist I regard myself as a concerned insider and have no interest in detailing worst possible outcomes. My aim is to give a clear-eyed account of the most plausible scenarios of future global oil production, based on the detailed analysis of available data. The following comments aim to clearly explain my methodology and approach.

There is much confusion between **reserves** and **production flows**. Consumers and users of oil and oil products require timely flows. Reserves are only of interest when they can be turned into production flows. Reserves in new fields have the potential to be produced at high flowrates but additional reserves in old and well-depleted fields usually can only be produced at low flowrates. This means that the discovery and exploitation of additional reserves in old fields only rarely leads to increased production rates, although a field?s decline rate may be slowed.

All my analysis is done on the basis of flows ? **current flows** (production), **incremental flows** (production increases resulting from new projects and in-field development work) and **production declines (**the erosion of production capacity). Production declines may be temporary and caused by a lack of investment or by political action, or it may be permanent and largely irreversible causing flows to fall progressively as a result of the depletion of the reservoirs.

My analysis consists of three separate but interdependent parts.

- **Analysis of the Megaprojects database** (the database I have developed detailing the new capacity that will add new production flows in each year up to 2012. It is published at intervals in Petroleum Review).
- **Analysis of production data** (allowing me to identify those countries where total production is currently declining).
- **A combined analysis of production trends and Megaprojects data** (allowing me to identify those countries that will start to experience depletion in the period to 2012).

Graphical presentation of future capacity and the capacity lost to depletion shows the volume of new capacity available to meet new demand. Such presentations can, by changing the variables used to produce them, demonstrate a set of possible future outcomes.

My first attempt at a Megaprojects analysis in early 2003, aimed to get a rough answer to the question ?Is the oil industry developing enough new capacity to satisfy likely demand?? The apparent answer was that, although the early years looked reasonably well supplied, there was a marked reduction of new projects in the later years which indicated a potential shortfall in future supply. Since that early date the analysis has been expanded and refined, month by month, with periodic public updates published in *Petroleum Review* (which I edit for the Energy Institute in London). In addition I have made multiple presentations, to industry and governments, based on the Megaprojects analysis.

The following factors inform my analysis:

I only incorporate **publicly available and verifiable data**. Current stock exchange disclosure requirements mean that timely and accurate information is now available for all publicly quoted companies. Although state oil companies are not under this sort of disclosure pressure they are becoming **increasingly open and accurate with new project data**. Many are now being partially privatised or opened up to private shareholdings and as a result they increasingly see the need for data disclosure comparable to a quoted company.

Another recent major improvement has been **the publication by Opec of future project data** on its website. In March 2006 they gave information on most of the member countries with revisions and expansions to the project listings in April 2006. This means we now have good public data about new capacity investments for all the Opec producers except Venezuela. It should be noted, however, that Opec reserves are unaudited and continue to be regarded as state secrets.

The latest megaproject listings include **all known projects with a peak flow of 50,000 b/d or over**. Megaproject is now something of a misnomer now that it includes projects with peak flows down to 50,000 b/d. Earlier versions had higher cutoffs of 100,000 b/d and 75,000 b/d. This is the primary reason the current Megaprojects future production totals are rather higher than previous Megaprojects totals. Other recent revisions are due to better data on Canadian tarsands projects becoming available and the publication of the Opec projects.

In addition to the main database where I have **enough reliable information to allocate projects by year of startup**, I also have a subsidiary list. This **secondary listing is predominantly of major discoveries** that are likely to become projects, but it also includes projects where there is insufficient or insufficiently reliable data for incorporation in the main tabulation by startup year. When Opec published their new project listings I was able to transfer a large number of projects from the subsidiary listing to the main database. Few, if any, of these potential projects in the secondary listing could be onstream before 2012.

The time lag between declared **discovery and first oil production** for a major project is currently averaging **over 6 years**. A few large projects are taking as little as 4 years but many others are taking up to 10 years. This means there is **now little or no chance of significantly altering the production outlook for 2010 while even that for 2012 is already largely determined.** Only in the post 2013 period is there real uncertainty about likely production levels because new and currently unannounced projects could be onstream by that date.

Any recent new oil discoveries of any size will have little or no impact on production in the period to 2010 or even 2012 as they cannot be turned into development projects fast enough. Small finds being hooked back to existing infrastructure in areas such as the North Sea are essentially equivalent to infill drilling and do little more than slow established production declines.

The principal revision that regularly occurs is **project delays**. Most projects are subject to delay and I actually know of only one project ?Kizomba B--which genuinely came in early versus the original timetable (Corporate public relations departments regularly announce that projects have come in early. Usually this is only versus the multiply revised timetable and may actually be months or even years late). Project delays are incorporated into the database as soon as they become public.

Because companies do not like drawing attention to project delays, when doing analysis and projecting future capacity I find it appropriate, based on the actual experience of the last two years, **to add in an additional 20% delay in the startup year**. This sounds dramatic but 20% in the startup year is only **a little over two months**.

The other **adjustment factor** I make when performing analysis and projecting future capacity is to **deflate peak flows by 10%.** This adjustment factor was advised to me by a source within the industry. He pointed out that although the peak flow capacity numbers are accurate they need to be deflated by 10% because operationally it is virtually impossible to operate flat out all year, even in the Peak production years. Examination of the UK field monthly production profiles on the DTI website shows how ragged even peak production flows are. This 10% adjustment is realistic and possibly even slightly conservative.

All wells deplete from the moment they go onstream. This is of no significance until the point when the whole field?s depletion cannot be offset by infield development activities (infill drilling, increasing gas-oil separator capacity, system debottlenecking etc). It does however, become important once a field, region or country starts **consistently producing less oil each year than it did the year before**.

At this point production can only be sustained if there are areas of expanding production to make up for the ?lost? production.

In the North Sea reliable oilfield production data by individual oilfield is publicly available. But in all other parts of the world it is either regarded as secret or is simply not publicly available. Similar considerations generally apply to data on regions within a country. North America is the notable exception as production is available by state in the US and by province in Canada. This means that the only depletion data that can be consistently used (publicly available and verifiable) is ?whole-country? data (Type 3 depletion). This is the data that I use in the analysis.

Over the last year or two there has been a great deal of discussion about **depletion rates** within certain countries. Usually what is described **is the loss of capacity in existing fields that would occur if no remedial or offsetting action is taken and sometimes referred to as ?natural decline rates?.** Typically this is assessed at around 5% but an increasing number of reports now cite even higher decline rates. For Example the IEA?s ?World Energy Outlook 2005? which provided a detailed analysis of prospects for the Middle East and North African producers (all Opec members except Egypt) noted current natural decline rates of 600,000 b/d per year for Saudi Arabia and 270,000 b/d per year for Iran.

This information indicates that these two countries and any other with similar declines face considerable challenges in maintaining or expanding their capacity. However, this information on natural decline rates is of limited value unless the volumes that can be offset by infill and infield work are known. **Once a country consistently fails to offset this natural decline rate and starts to produce reducing volumes year-on-year we can then say it is in Type 3 depletion.** Until depletion starts to consistently appear in the production statistics all we can confidently say is that the country is **in danger of moving into depletion**.

Taking Saudi Arabia and Iran as examples: both countries have announced plans that would offset their current natural decline rates and add capacity in the period to 2010/2012. However, increases in the decline rates, delays to the new projects or the new projects underperforming could tip them into Type 3 depletion. This in turn might be temporary or more sustained. In terms of Saudi Arabia the size of the ?spare capacity? is another critical component of any analysis of their future production. Little reliable information is available about Saudi spare capacity.

To establish future production levels we can devise a simple equation:

Future production levels in year n = Current production levels + gross new capacity from new projects to year n - gross natural decline to year n + capacity gains from normal field operations to year n.

For example if Saudi is producing 9.5 million b/d in mid 2006 how much will it be producing in mid 2010?

Adding 9.5 million b/d to the gross new capacity of 3 million b/d gives 12.5 million b/d. However, natural depletion has removed 0.6 x 4 = 2.4 million b/d giving a net capacity of 10.1 million b/d.

The unknown is how much of that annual 0.6 million b/d of depletion can be offset by the normal field work (infill drilling, workovers, debottlenecking etc). If it can all be offset Saudi production could rise by 3 million b/d while if none of it can be offset Saudi production would only rise by 600,000 b/d (3.0-2.4). In addition we don?t know if natural decline rates are stable or accelerating. Our only **public window** into the balance of these opposing trends is **current production rates.** If a country?s production rate is less than would be expected by adding new capacity to existing flows, then either the anticipated new flows are not fully materialising, or normal fieldwork is not offsetting natural decline rates.

My treatment of depletion is quite straightforward and is based on measureable data, with 2005 as the base year. By comparing the gross new capacity coming onstream in 2005 from the megaprojects analysis with the amount of new capacity that actually came on stream (the net new capacity) we find that around 1.2-1.4 million b/d of capacity has been lost to depletion in 2005. From examination of BP and IEA statistics we know that this loss is made up of 1.0-1.2 million b/d from the non-Opec producers and up to 0.2million b/d from the Opec producers, predominantly Indonesia and Venezuela. To verify this we can get essentially the same result by noting that in 2005 roughly 30% of global production (85 million b/d) was coming from countries in Type 3 decline. This decline averaged 5% per year (2004-2005). By taking 30% of 85 = 25.5 and then 5% of this gives 1.28 million b/d per year.

In order to project this analysis forward to determine depletion losses in the future we need to calculate the total amount of global production which will come from countries in Type 3 decline. If, for example, we were to project that by 2010 around 40% of global production would be coming from areas in decline, that the decline would average 5% and that global production would have risen to 92 million b/d; then depletion would be running at 5% of 40% of 92 million b/d which equals 1.84 million b/d. This is the technique which I have used to determine future production levels.

All my **analysis is based on flowrates**, which are generally subject to a quite limited margin of error and for which there are several reliable **public data sources**. My other key input is the amount of **new capacity** due to come onstream derived from my **megaprojects analysis.**

By graphing the data in such a way as to show the volumes of incremental oil production that could be available to meet demand in future years it is relatively easy to see the **impact of varying the underlying assumptions.**

In broad terms, my analysis shows that under a wide range of assumptions, but excluding major political disruptions or other catastrophes, oil production has the potential to expand for the rest of the decade but shortly thereafter production is more likely to decrease than increase.

Chris Skrebowski June 2006

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~~~~~~~~~~~~~~~~ *Editorial Notes* ~~~~~~~~~~~~~~~~~~~

Chris Skrebowski has previously helped define the various forms of depletion, including the 'Type 3' (whole country) depletion mentioned in this article.

The most recent Megaproject update available at Syndey Peak Oil was reviewed by Heading Out at The Oil Drum.

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