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Bumpy Crude Oil Plateau in the Rear View Mirror

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Which countries are increasing in oil production? Which are decreasing? How is this changing? Can we expect that the increasing ones will continue to increase in 2008? Does the megaprojects data give any insight into the future increases of growing countries? These are some of the questions that Matt Mushalik and I explore in this post using what Matt calls "incremental production graphs".

Matt Mushalik is a retired civil engineer and regional planner from Sydney, Australia. In this post, he provides an update of his incremental production graphs, which he first provided in the post Did Katrina Hide the Real Peak in World Oil Production? And Other Oil Supply Insights

Matt has an ingenious way of graphing oil production. In his graphs, he separates oil production between **base** production, which stays the same during the entire graphing period, and **incremental** production, which is the "top" of the graph, after base production is subtracted. He then groups together different countries with similar production patterns, for some interesting analyses.

It has been about six months since our previous article. The additional time allows us to continue and deepen the analysis. As in the earlier post, incremental production profiles of various countries or groups of countries are stacked in such a way that it gives us information about production trends. Incremental production in a given country and period is defined as the production exceeding the minimum production in that period.

Individual Country and Small Group Profiles

Figure 1 shows incremental production profiles for selected countries and groups. The tick marks on the side correspond to 1 million barrels of oil a day, so one can tell approximately how much production has recently been increasing or decreasing, for the countries or groups shown. What is shown for each country or group is equivalent to the top "slice" of the graphs for that country or group.

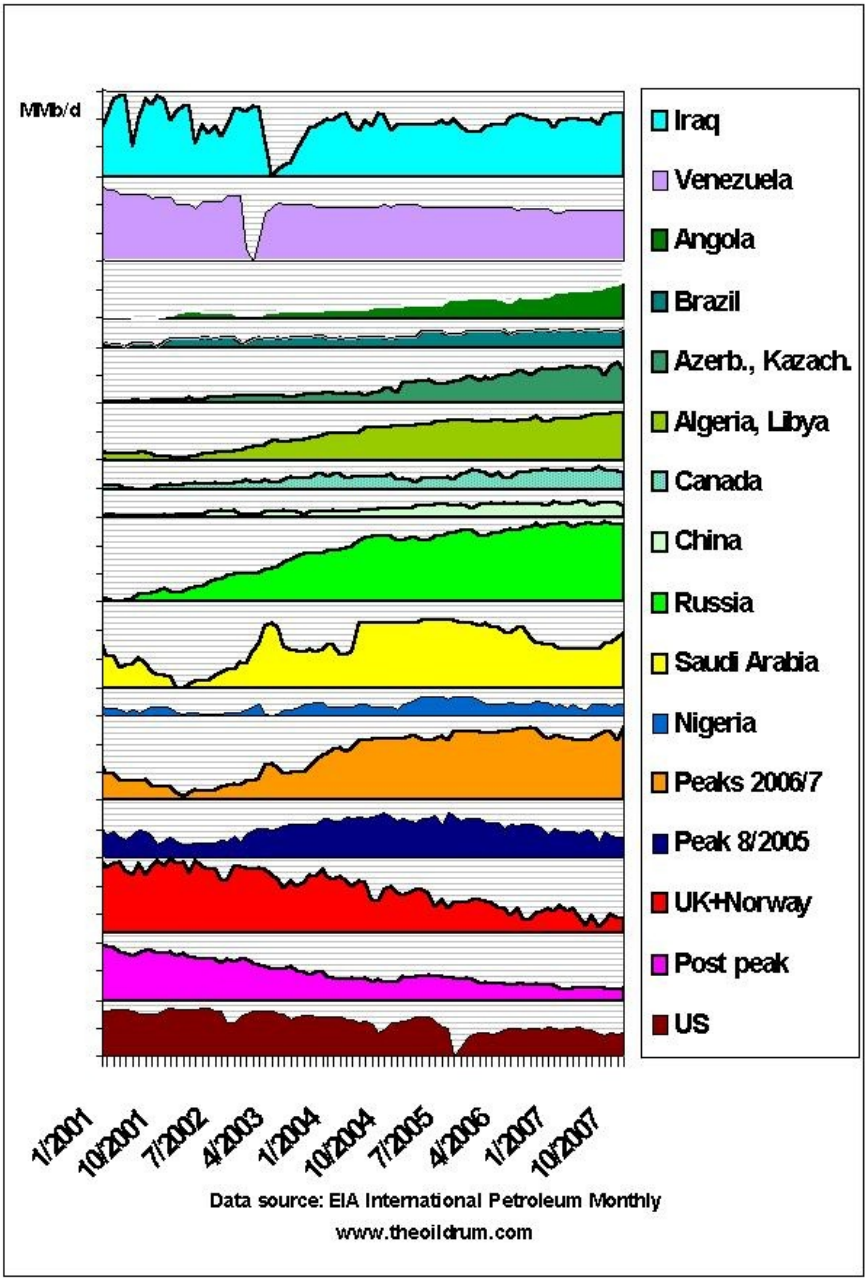

Figure 1 - Incremental Crude Oil Production Profiles, December 2007

A few comments about the profiles on the above chart:

• Iraq - production drops during and after the Iraq war
• Venezuela - a steady decline and a big drop during the strike in 2003
• Angola, Brazil, Azerbaijan, Kazakhstan, Algeria, Libya, Canada, China, and Russia - all countries with increasing production
• Saudi Arabia - boosts production during the Iraq war and in 2004, but then is not able to maintain production levels in 2006/07. Recent uptick in production still leaves it below 2004/2005.
• Nigeria - fairly flat production; high year 2005
• Peaks 2006/2007 - Ecuador, Vietnam, India, Qatar, EIA's "Other", Kuwait, UAE - These countries appear to be on a plateau or slightly declining.
• Peak 8/2005 - Iran, Mexico, Malaysia
• UK and Norway - shows North Sea decline

• Post Peak - Indonesia, Egypt, Syria, Gabon, Argentina, Colombia, Australia, Oman, Yemen, Denmark - all in terminal decline
• US - on a declining path since its peak in 1971, showing production drops during hurricane seasons

Four Major Groups of Countries

To get a better overview of the underlying trends further groups are formed:

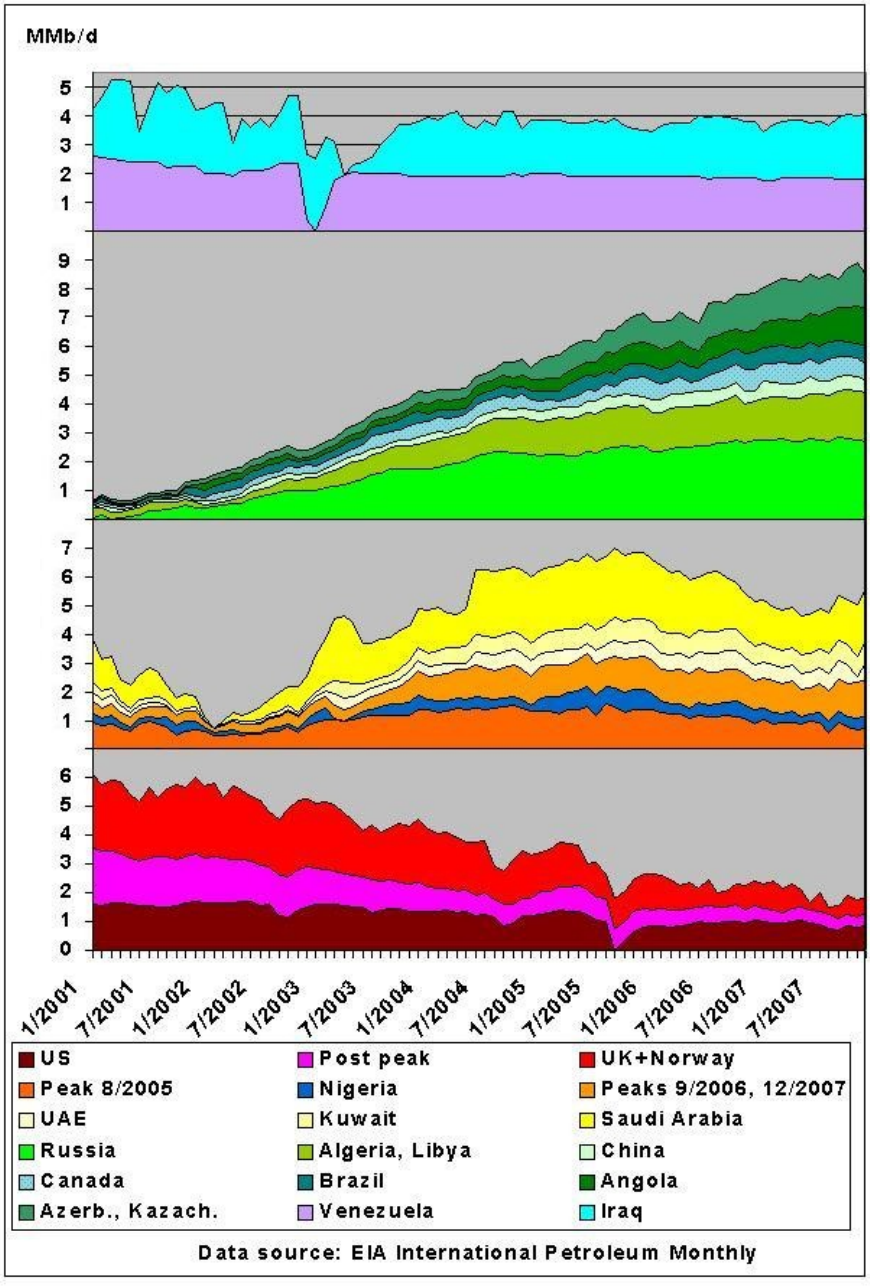

Figure 2 - Incremental Crude Oil Production Profiles for Groupings of Countries 2007

• Top Group - Iraq and Venezuela shown separately with their big production drops in 2003

• Second Group - the growth wedge (+ 8 million b/d) showing clear signs that Russia plus some other hitherto growing countries are maxing out

• Third Group - "peaking group" - the various recent peak and the plateau groups - This group is dominated by Saudi Arabia, Kuwait and UAE. The rebound in 2007 is mainly from Saudi Arabia. Production for this group dropped between 2001 and 2002, then increased by a whopping 6 million barrels a day between 2002 and 2005. If one compares 2001 and 2007, production is just 2 million barrels a day higher now.

• Fourth Group - the decline wedge (US, North Sea, others post peak). This group's incremental production went down from 6 million barrels a day in 2001 to 2 million barrels a day in 2007.

In these graphs, note that the base production (the amount that did not change) is not shown. Also note the colors of countries are the same between graphs, so that they can be better identified.

These groups can now be stacked in two different ways to give us different information:

(1) Starting with declining countries on the bottom
(2) Staring with the growing countries on the bottom

Graph with Declining Countries on the Bottom

From bottom to top: declining group, peaking group and growing group. Iraq and Venezuela are put on top as their one-off production drops in 2003 distort the picture if stacked somewhere in between. Because of the definition of incremental production, their layers are disproportionately thick because of the big temporary drops in production. To minimize the distortion this causes, they are put at the top of the graph. This is the graph shown at the top of the post, which we show again here.

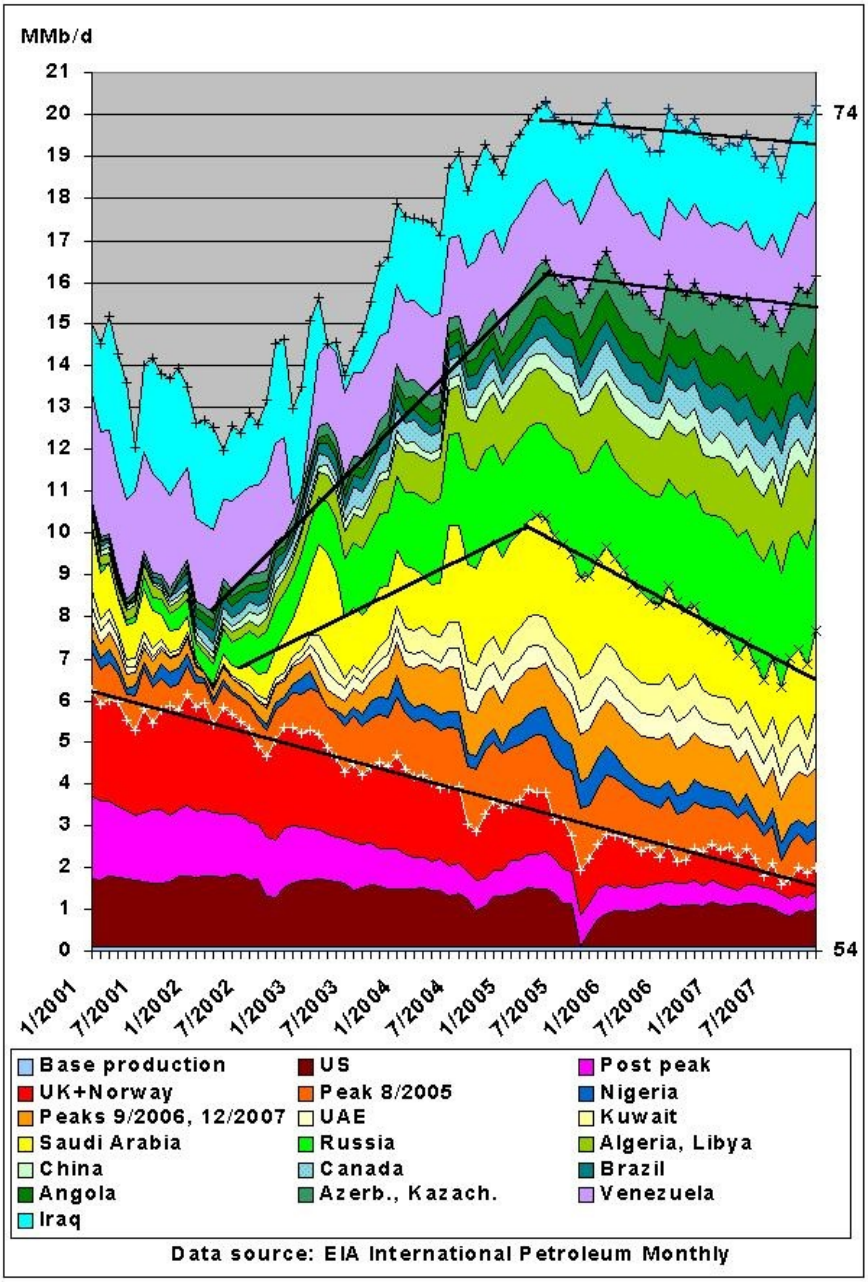

Figure 3 - Incremental Oil Production Stacked with Declining Groups at Bottom

The bottom black line shows the underlying trend in the declining group of countries.

The second from the bottom black line outlines the sum of the bottom two groups - that is, the declining group, and the recent peak/plateau group. The trend line clearly shows an underlying peak when these two groups are combined.

The third from the bottom black line adds the "growing group" to the previous two groups. The growing group of countries was able to offset the declining trend after the peak and lift total crude production to an only slightly declining trend.

White and black crosses mark the points used for the declining trend lines. Increasing trend lines have been inserted by estimating the growth between a low in 2002 to a maximum in May 2005.

Graph with Growing Countries at the Bottom

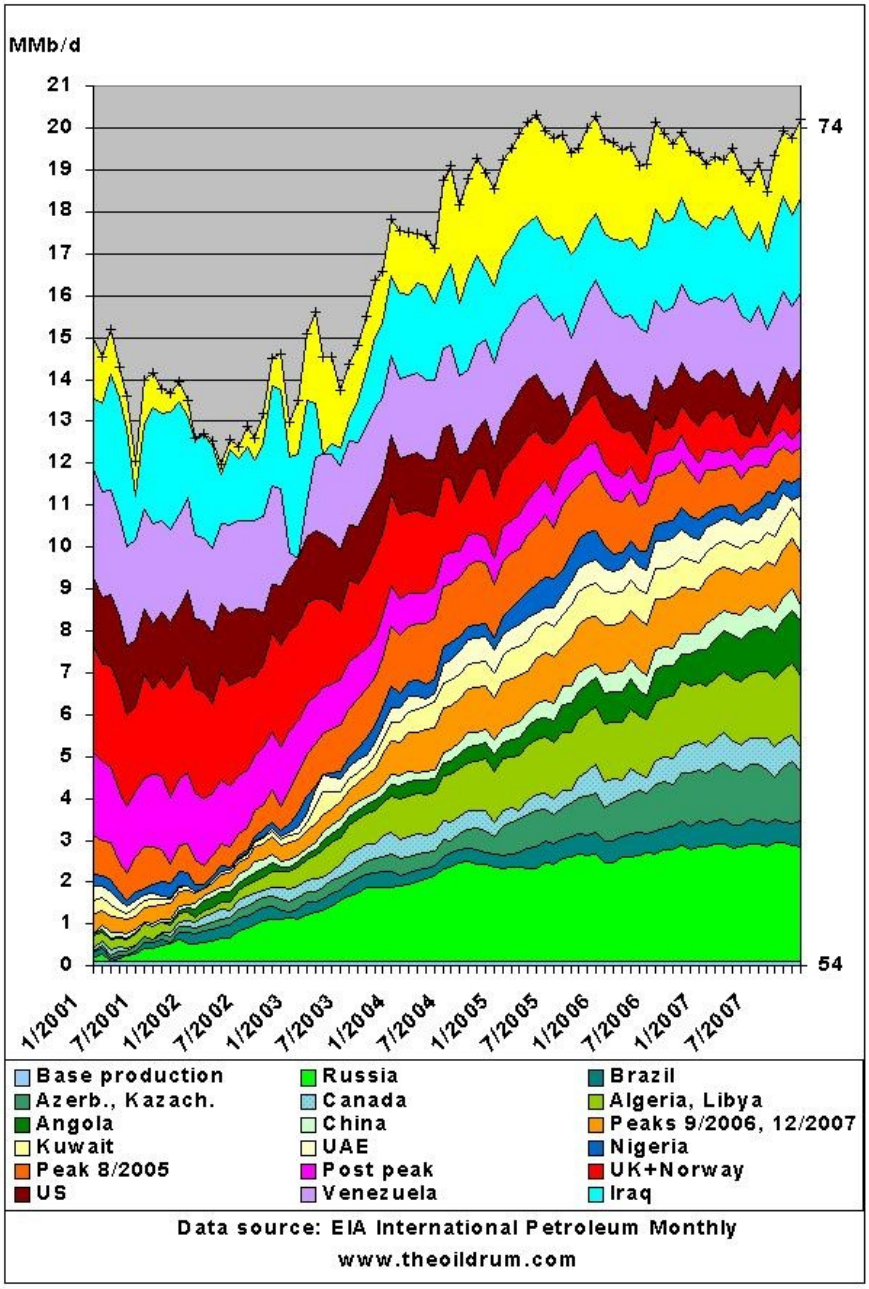

Figure 4 - Incremental Oil Production Stacked with Growing Groups at Bottom

In a different view of the same data, production profiles from growing countries are stacked at the bottom and Saudi Arabia on top. The graph clearly shows that Russia, Kazachstan and Brazil have maxed out (unless megaprojects change this in the future) and that Saudi Arabia is no longer performing its function as swing producer.

This analysis helps us understand what the late Dr. Ali Bakhtiari called the transition phase T1 between growth and decline. During the Australian Senate hearings on oil supplies in July 2006 Ali said this transition phase would start in 2006 and last for three to five years. It seems the transition phase is marked by two crude oil peaking events, one in 2005 and another one happening right now. The big question is therefore how long will that peaking of the hitherto growing group take? These are the current trends:

Former Soviet Union

We have already mentioned that Russia seems to be at peak. In other Former Soviet Union countries, Kazachstan's doubling of oil production starting in 2005 has stalled, leaving just Azerbaijan with an annual increase of 200 thousand barrels a day.

It is possible that the increase will be greater than this. Russia, Kazachstan, and Azerbaijan have megaprojects scheduled to begin production in 2008 which total 1,186,000 million barrels a day in maximum production. This total production is not expected to be reached in 2008, and a significant share of it will be needed to offset declines in older fields. Given these considerations, increased production for the Former Soviet Union may be somewhat more than 200,000 barrels a day, perhaps on the order of 400,000 barrels a day. This may very well be an overestimate. Numerous reports suggest, such as this one, indicate that Russian production will fall in 2008.

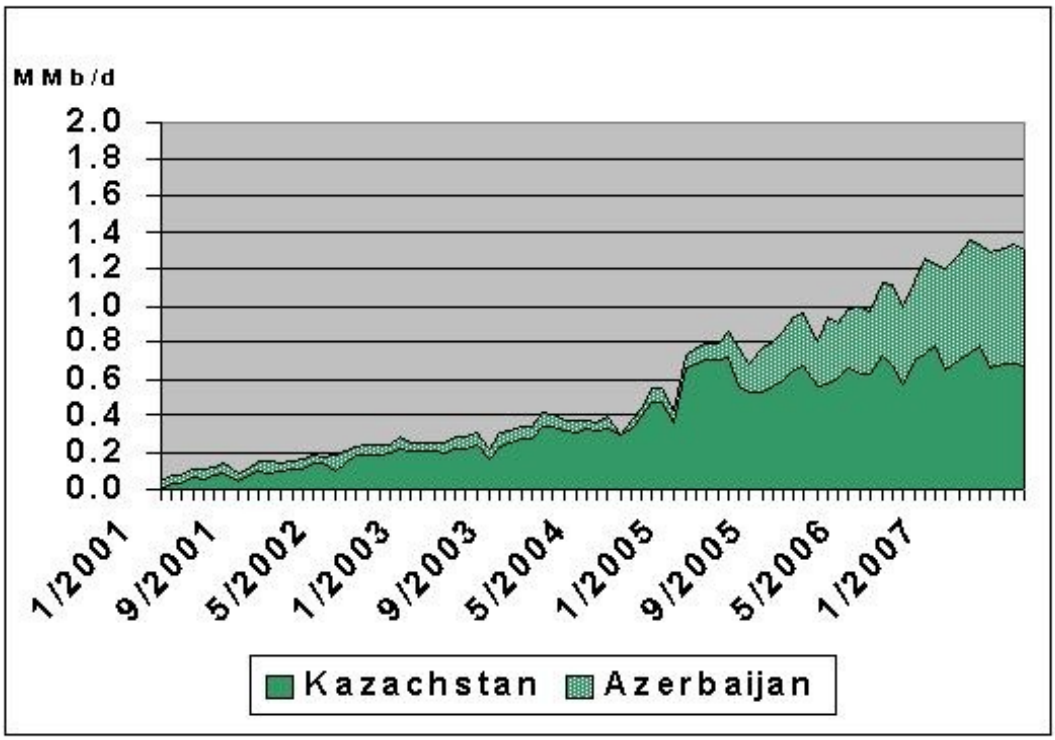

Figure 5 - Incremental Oil Production for Azerbaijan and Kazachstan

Angola and Brazil

Angola joined OPEC and will come under a quota system. A recent announcement indicates that Angola's production for 2008 is expected to reach a plateau of 2 million barrels a day, and maintain that level until 2013. Production for December 2007 is reported to be 1,986,000 barrels per day, so Angola has apparently now reached its peak production, and only a plateau can be expected henceforth.

Brazil's growth has apparently flattened. There are four megaprojects scheduled to start production in Brazil in 2008. The ultimate production for the 2008 projects is expected to be 475,000 barrels a day, although not all of this is expected to be realized in 2008. There are also a number of megaprojects (totalling 648,000 barrels a day in ultimate production) that were expected to begin near the end of 2007. If the various 2007 and 2008 projects come on board as planned, Brazil's production may increase by 400,000 or 500,000 barrels a day in 2008. (All of these future production estimates are very rough.)

Other African Countries

In another group of African countries Algeria's and Libya's growth is modest, but steady while Sudan and Equatorial Guinea grew at 300 Kb/d last year. There do not seem to be any significant megaprojects for these countries for 2007 and 2008. If decline rates are as in other countries, the increases for these countries may be smaller for 2008.

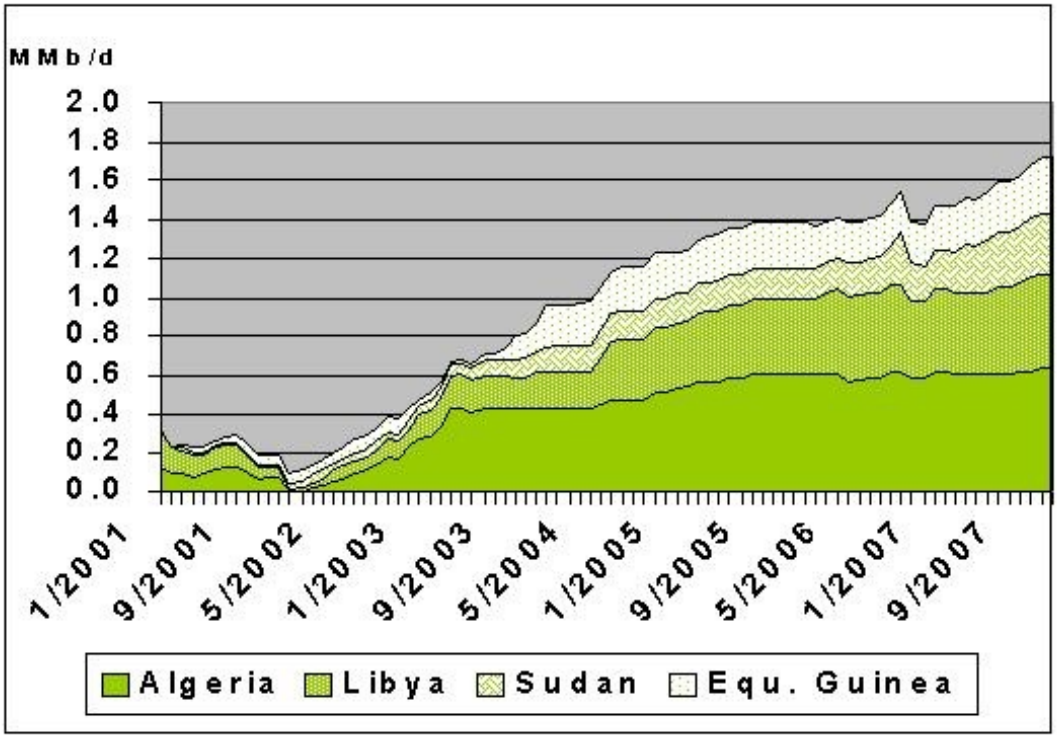

Figure 6 - Incremental Oil Production for Several African Countries

Canada

For Canada we know the potential is in syn crude from tar sands but this is limited by the supply of natural gas. CO2 emissions are a big problem and NASA climatologist James Hansen has not included this un-conventional oil in his carbon balance. There is just no room for it, according to this paper he wrote.

Irrespective of environmental and climate change concerns, there are a number megaprojects planned for the Canadian tar sands. The ultimate production from these total 266,000 barrels a day from projects with 2007 start dates and 605,000 barrels a day for projects that are planned to start in 2008, according to the megaprojects list. Some of these are very long term projects - not to be completed until 2018. Actual production increases are likely to be much more modest. Canada's oil production grew less than 100,000 barrels a day in 2007. It would be surprising if Canada's 2008 oil production grows more than 200,000 or 300,000 barrels a day.

Conclusions

This analysis is mostly a review of what has happened in the past with oil production. Another article, very closely related to this one, was written by Matt and is posted on the Sydney Peak Oil website.

We have included a few very rough estimates of production for some of the increasing countries for the future. It looks as though there still will be countries with increases in 2008. Our rough

estimates of increases for the countries shown total only about 1.0 to 1.5 million barrels a day. This is fairly similar to what the increases for the growing group of countries has been over the past five years. This is not very much to offset the countries with declining production.

There are many countries that we have not considered to be growing, that theoretically may grow in the future. Saudi Arabia and Iran would be two in this category. We have not made any estimates, upward or downward, for these countries. If oil production is to stay on its current plateau, it would seem like we would need increases from some of these countries as well.

We remain on a bumpy crude plateau, where the exact timing of new projects and the coming hurricane season will determine which temporary wiggles we get on the production curve. 2008 should be an interesting year.