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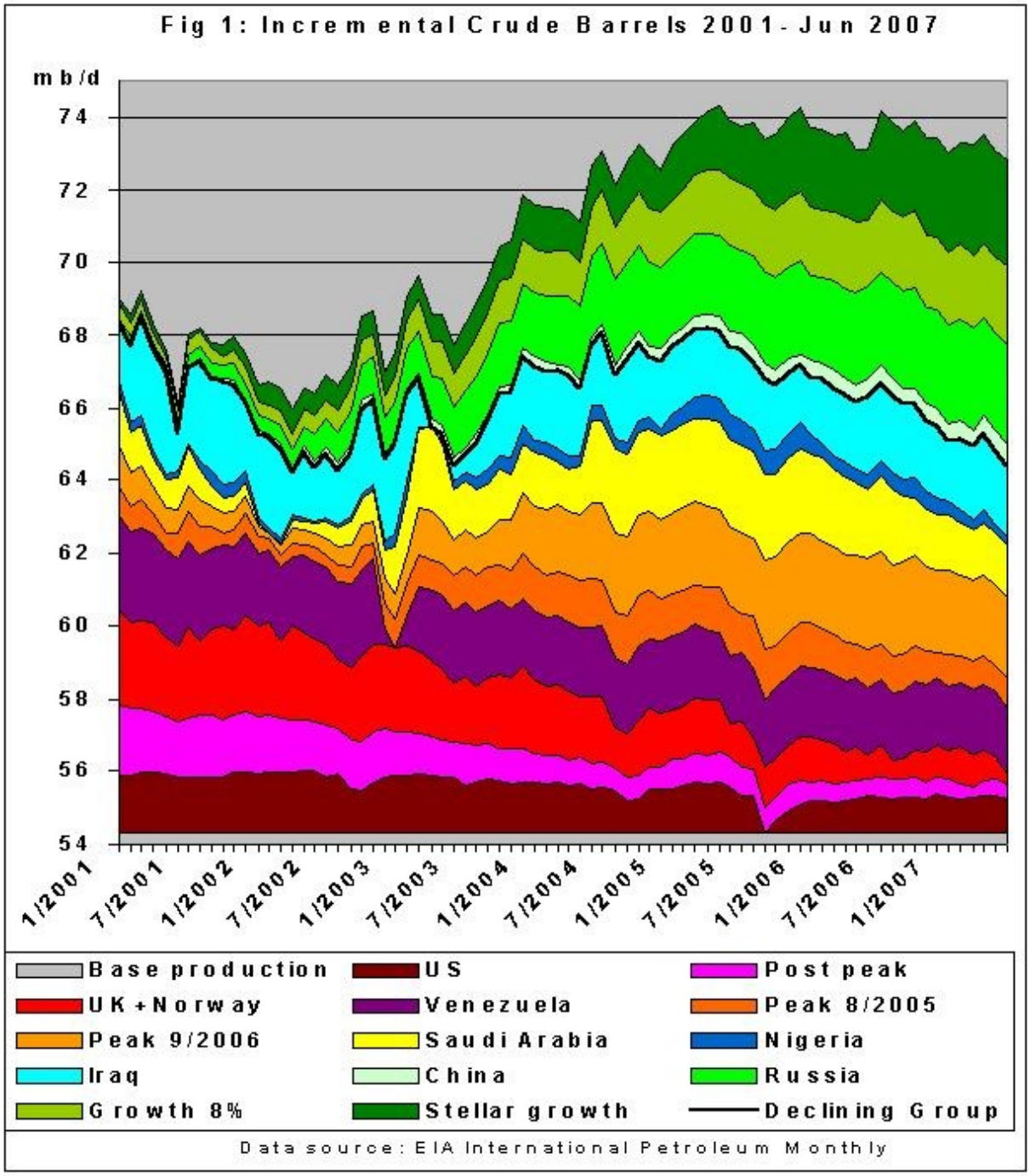
Did Katrina Hide the Real Peak in World Oil Production? and Other Oil Supply Insights

Posted by Gail the Actuary on October 9, 2007 - 10:00am
Topic: Supply/Production
Tags: graphs, hurricane katrina, oil production, original, peak oil [list all tags]

In this post, I collaborate with Matt Mushalik from Sydney, Australia. Matt is a civil engineer, town and regional planner, peak oil advisor, and member of ASPO Australia. Most of the ideas in the post are Matt's. I have added a little to the analysis, particularly in the area of the Katrina impact.

In this post, we use a graphical approach for analyzing oil production since 2001. This analysis shows that more and more countries are showing declining oil production, and that this decline in production is not being offset by increases in production elsewhere. If this pattern continues, this analysis suggests that we may already be past the peak in world oil production.

We also look at the question of whether the impact of Hurricane Katrina may have hidden the real peak in world oil production. We find that if an adjustment is made for hurricane impacts, the peak month of production seems to be December 2005 on a crude and condensate basis, and September 2005 on an all liquids basis. The higher adjusted peaks, and greater declines since the adjusted peaks, further suggest that we may be post-peak.

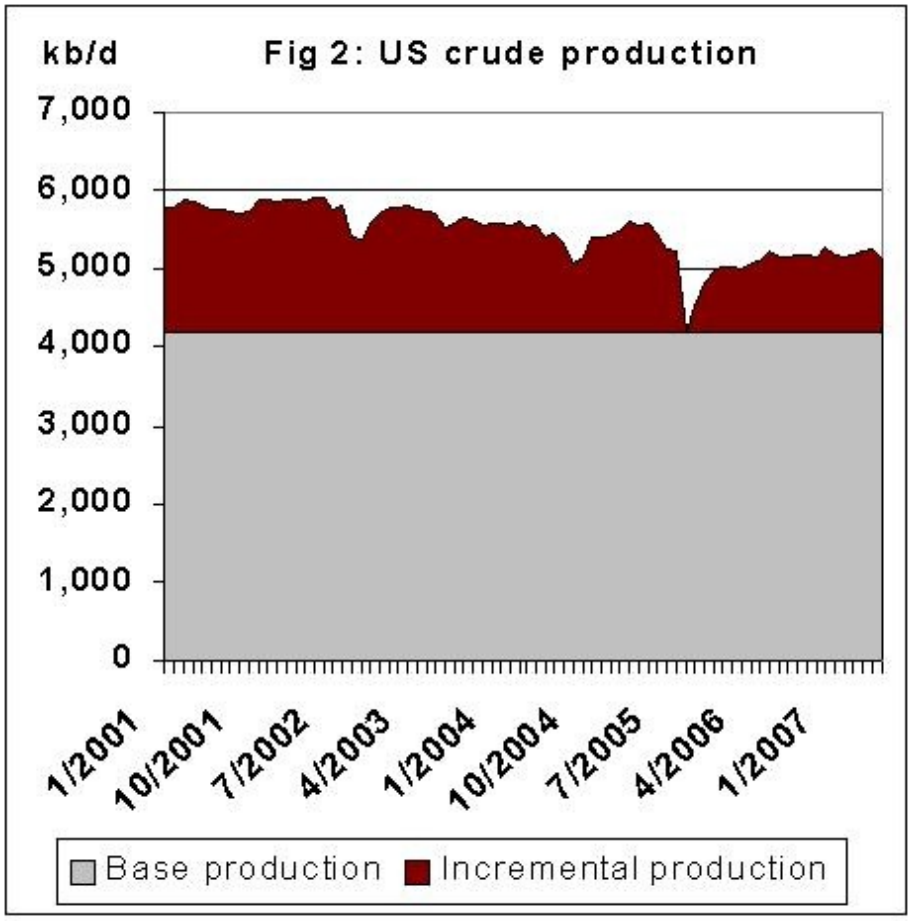


What Does Figure 1 Show?

One way of analyzing crude oil production is in terms of how much production has increased or decreased in recent years. To get a visual picture of this, Matt has prepared graphs of what he calls *incremental crude oil production* for various groupings of countries. Figure 1 shows incremental crude oil production for January 2001- June 2007 using EIA data.

The data used in Figure 1 is developed as follows:

(1) For each country, Matt finds the minimum monthly production in the period 2001-June 2007 and subtracts this minimum from each monthly production to arrive at an incremental production relative to the minimum. For example, for the United States, the incremental oil production is the area in dark red on Figure 2. The data used in the analysis is EIA "crude plus condensate" data.



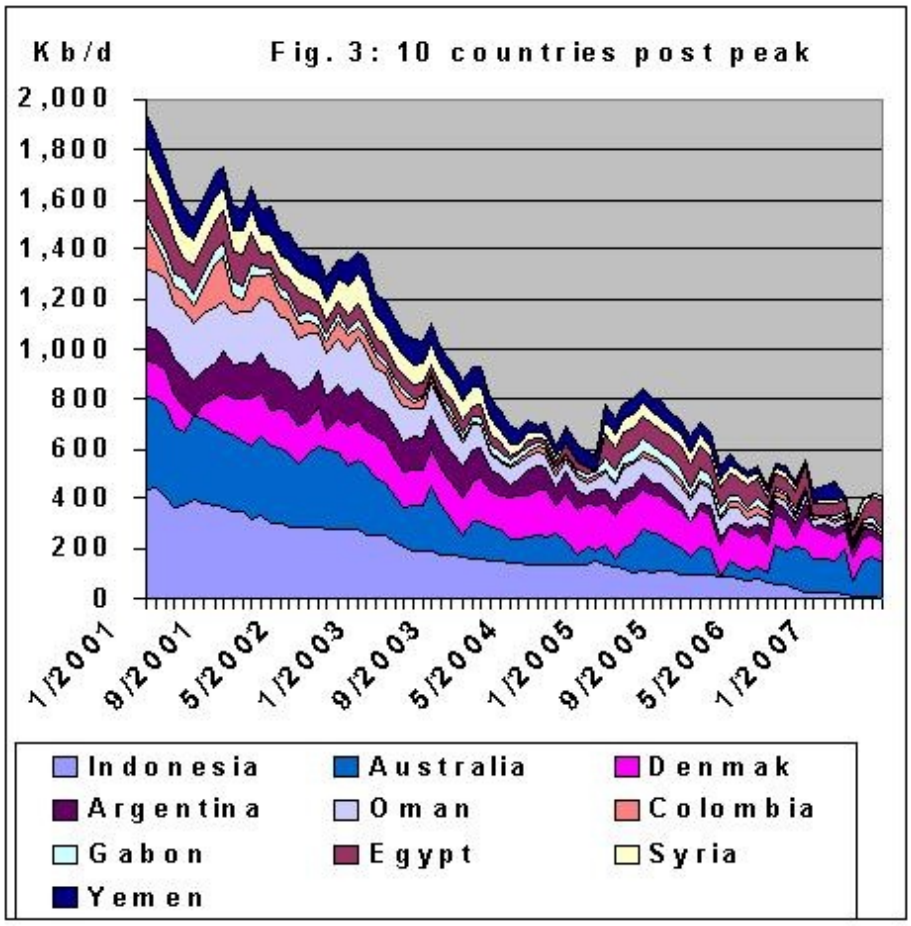
(2) Note that the amount in the "base" is determined by the minimum, and not the first month. If the first month were used, this would result in positive and negative areas which cannot be stacked to give a useful production profile. Also note that when the bases plus the incremental amounts are stacked, as in Exhibit 1 or 2, in total we get back to the full amount of crude for the appropriate grouping.

(3) For each country, the size of the area on the graph is proportional to the variation in production for the period under consideration. This is a measure for the size of the impact changes have had on the overall production profile, both positive and negative. The US, for example, had only a decline of around 600 thousand bpd, if one excludes the impact of Hurricane Katrina in 2005. The big drop in production after Katrina causes the US layer to be much "thicker".

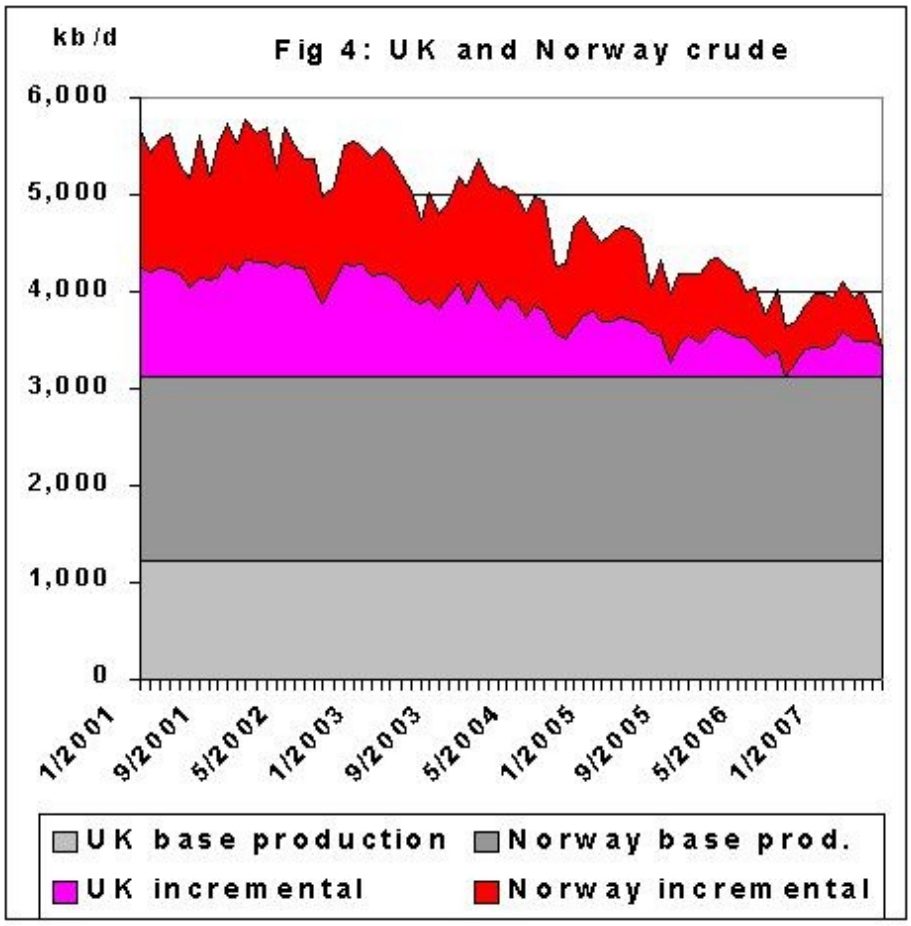
(4) Matt then sorts countries into following groups, from bottom to top in the graph:

(a) US (Figure 2, shown above)

(b) "Post Peak" grouping: Indonesia, Egypt, Syria, Gabon, Argentina, Colombia, Australia, Oman, Yemen, Denmark

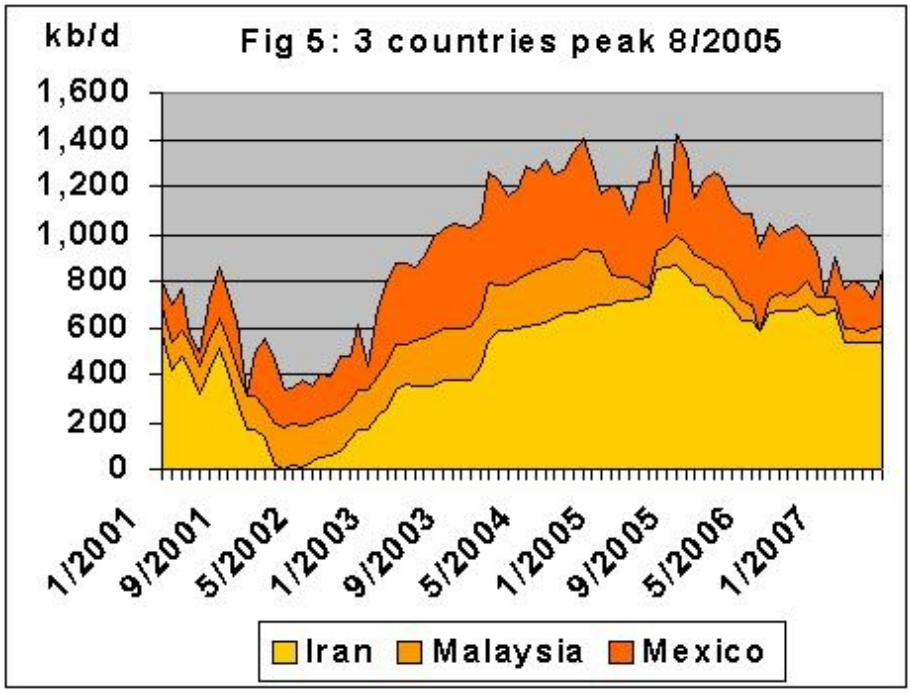


(c) North Sea: UK and Norway



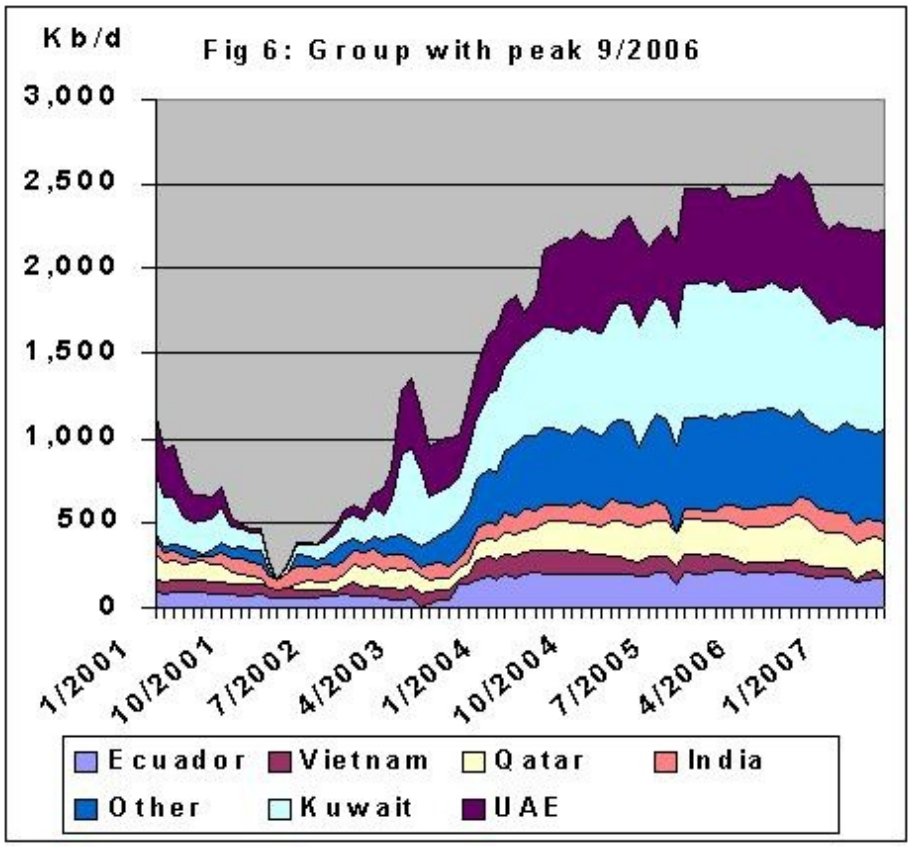
(d) Venezuela (thick layer because of the production drop during the strike)

(e) A group of countries with a common, recent peak in 8/2005: Iran, Mexico, Malaysia



(f) A group of countries with a common, recent peak in 9/2006: Ecuador, Vietnam, Qatar, Kuwait,

UAE, India and other



(g) Saudi Arabia

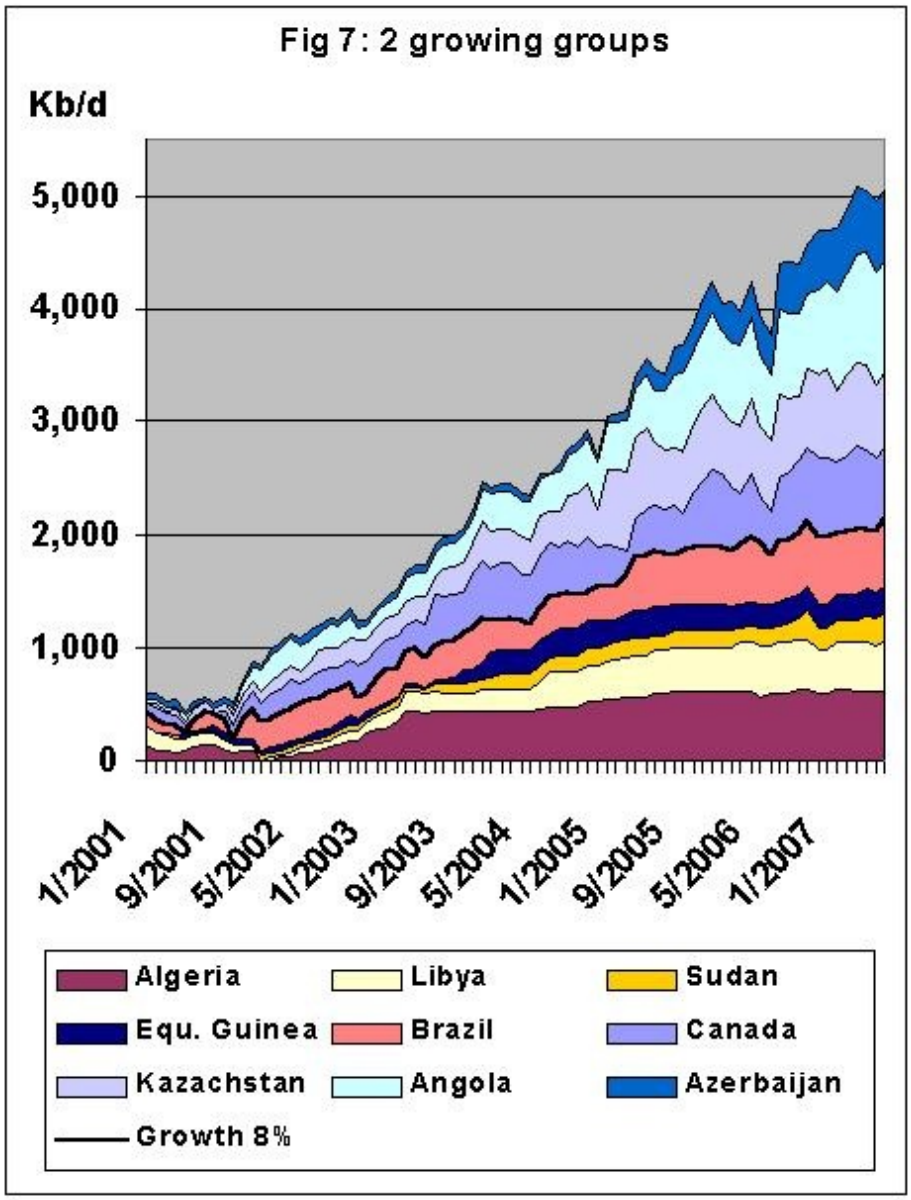
(h) Nigeria

(i) Iraq - A line is drawn between Iraq and China. All countries above the line are considered to be countries with increasing production. The countries below the line are either decreasing, or have variable production that appears not to be increasing.

(j) China

(k) Russia

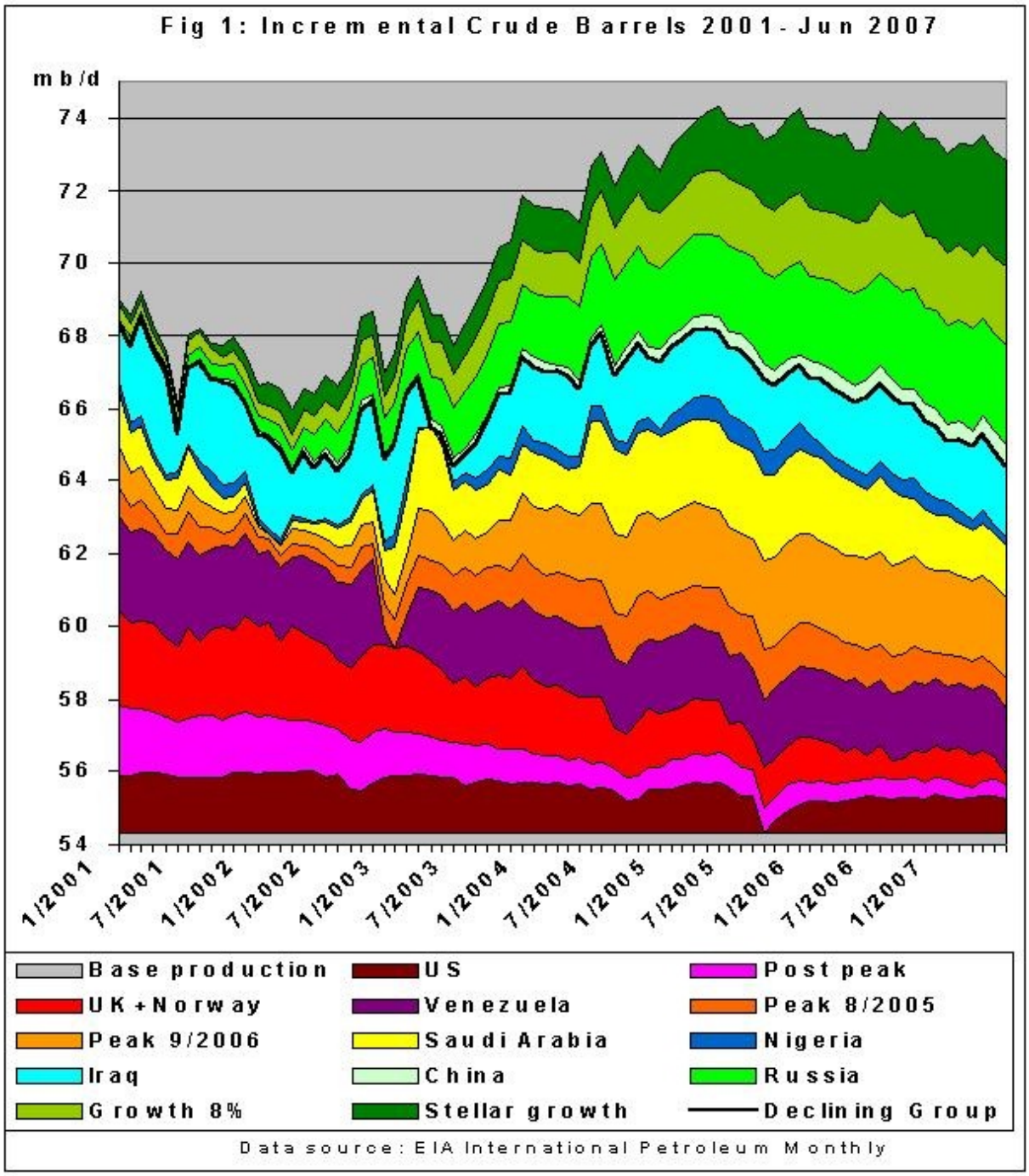
(l) "Growth 8%" group: Algeria, Libya, Sudan, Eq. Guinea, Brazil. These are the countries below the black line in Figure 7.



(m) "Stellar growth" group: Canada, Kazakhstan, Angola, Azerbaijan. These are the countries shown above the black line in Figure 7.

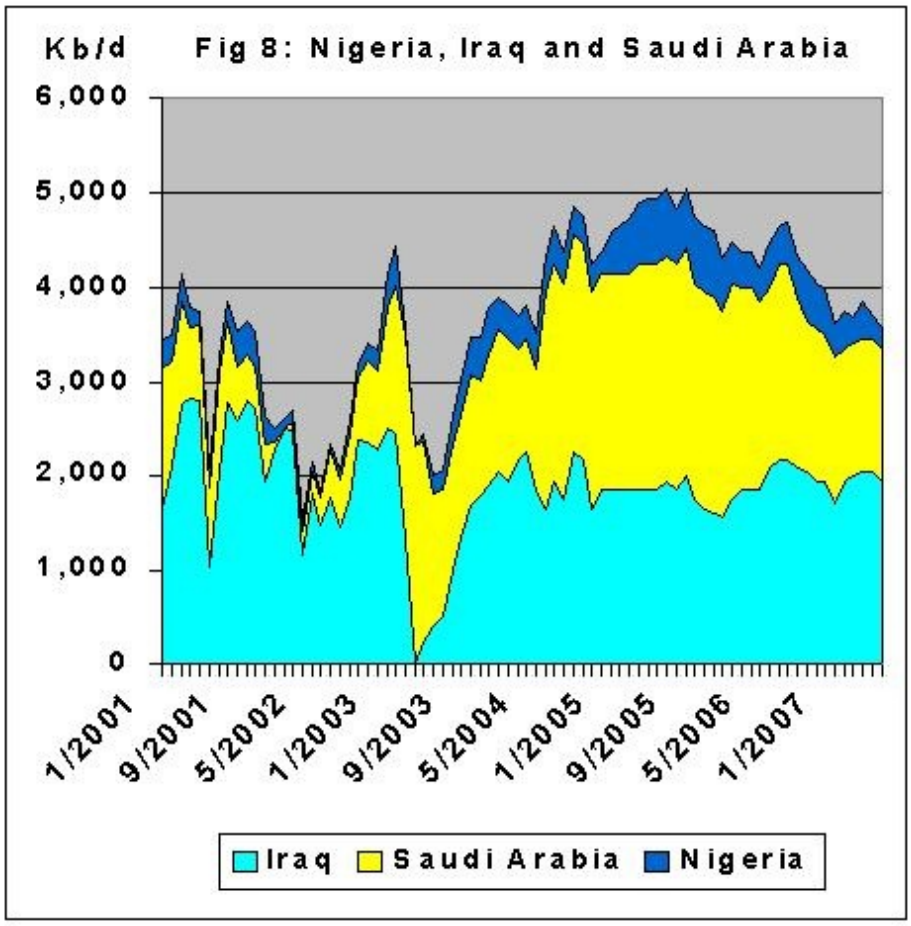
What Can We Learn From the Graphs? (Matt and Gail)

This is a repeat of Figure 1, so you don't have to scroll up:

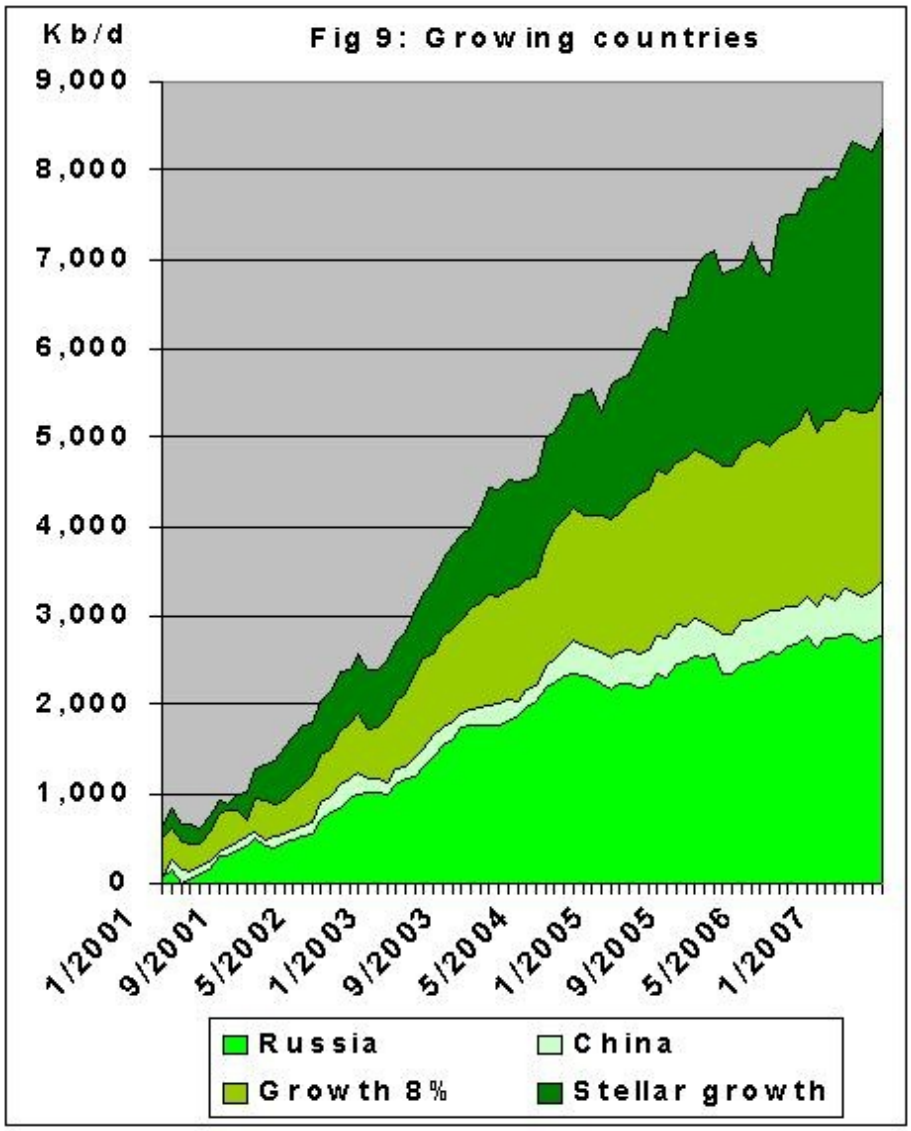


If a person looks at the black line, and the production beneath the black line, one thing that stands out is the extent of the decline since early 2005. Production for this group of countries is now about 3.8 million barrels a day lower than it was in May 2005 . This decline equates to a decline of about 1.8 million bpd per year for these countries. One reason for the large decline is the increasing number of countries that are now post peak, including the countries in the Peak 8/2005 and the Peak 9/2006 groups.

This annual decline of 1.8 million bpd can be broken down to about .6 million bpd annual decline relating to the countries Nigeria, Iraq, and Saudi Arabia (combined), and about 1.2 million bpd for other countries below the black line. One might argue that the production of Nigeria, Iraq, and Saudi Arabia (Figure 8) is not necessarily in long-term decline, so should not be below the black line. Since the production for these countries has recently declined, it is shown in this group.



What is offsetting this decline in oil production below the black line? Figure 9 shows a graph of the increases in production for all of the growing countries (the countries above the black line in Figure 1).



This group of countries has been increasing its production by an average of about 1.2 million bpd a year. While this is good, it is not enough to keep up with the decline in production of about 1.8 million bpd per year of the declining group of countries. Clearly, if the mismatch between increases and declines continues, a long-term decline in world crude oil production can be expected. If this happens, world oil production is past its peak.

If a person looks only at the group of countries that are currently level or declining, the overall rate of decrease in production has recently been 4% per year. This suggests that some day, world production may decrease by something in the range of 4% per year, once there is little new production being added. If there are many offshore wells (which tend to have high decline rates), or if there are above ground issues (like hoarding), the decline rate could be much higher than this.

Where is there a possibility for change?

One possible change is in the countries shown in Figure 8 - Iraq, Saudi Arabia, and Nigeria. If their production can be increased, it could eliminate the recent 0.6 million bpd per year decline, and possibly even increase production. At this point, there is no evidence of this happening, however.

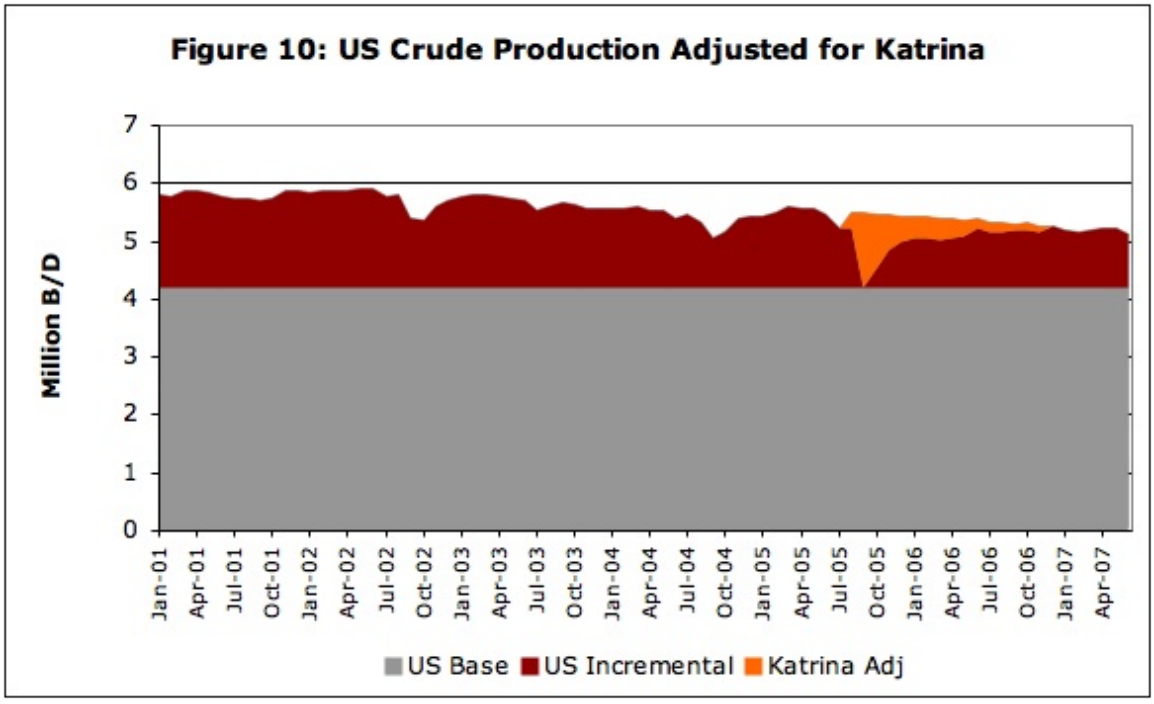
Another possible change is in China and Russia. These are the countries with the greatest oil production in the growing group. Many are forecasting that their production will begin to decline in the next few years. If this happens, the mismatch between countries with increases and decreases will be worse, leading to more of an overall decline.

Another issue is whether the Azerbaijan and Kazakhstan can continue to grow at the rate they have in the recent past. The capacity of the BTC pipeline (1 million bpd) and of other infrastructure are limiting factors in bringing oil to the market. Thus it is not clear their high rate of growth in the past can continue very long into the future.

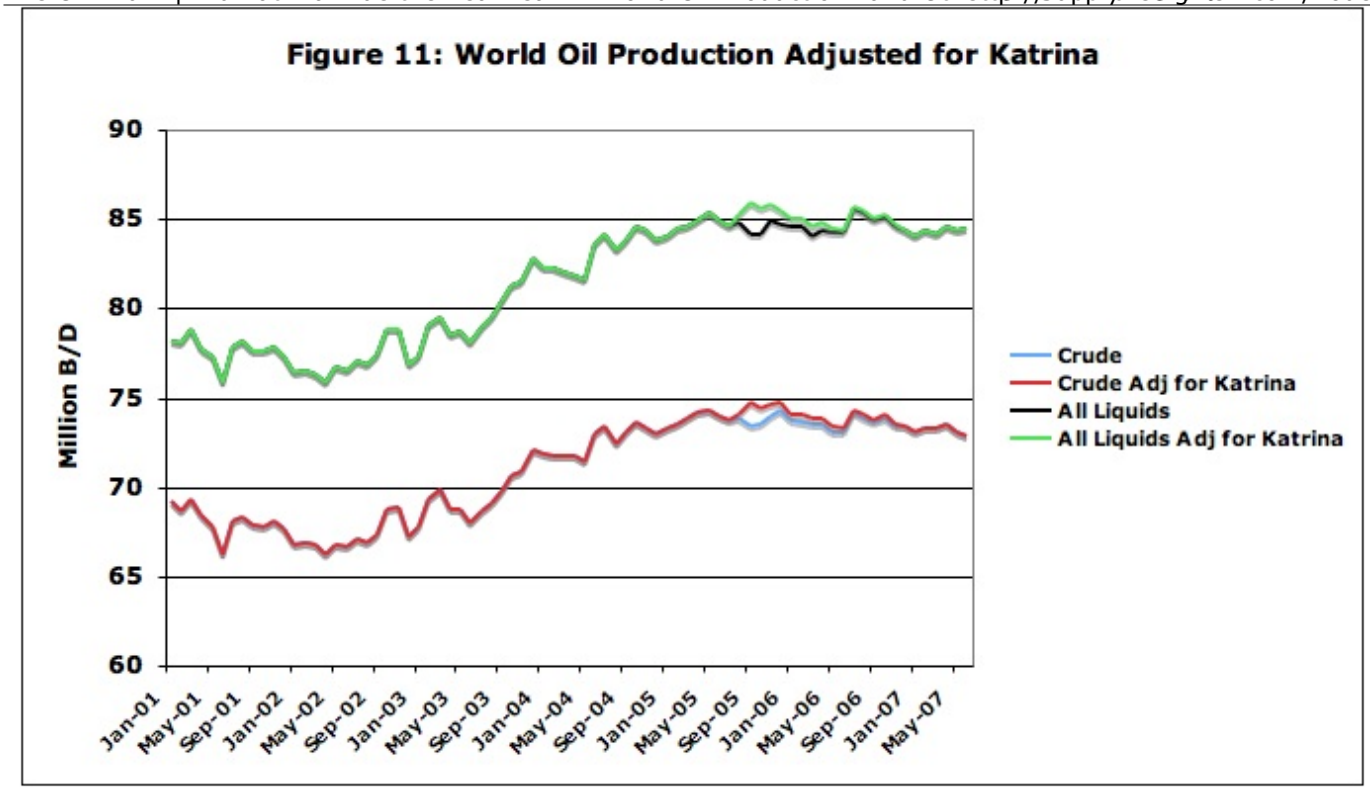
Impact of Hurricane Katrina (and Rita) (Matt and Gail)

The graphs of EIA oil production we are used to looking at are distorted by the impact of Hurricane Katrina (August 23, 2005) and Hurricane Rita (September 2005). Figure 2 above indicates that these hurricanes clearly had an impact on US crude oil production. What happens if we make an adjustment for this impact?

Figure 10 shows an estimate of the extent of the impact of these hurricanes. Since it is not possible to distinguish which hurricane, we call this the Hurricane Katrina adjustment.



The adjustment shown on Figure 10 applies to crude and condensate. It is also possible to use a similar approach to calculate an adjustment to all liquids. With these adjustments, one can then approximate what world oil production would have looked like, in the absence of the hurricanes. The revised graphs are shown in Figure 11.



The numeric amounts corresponding to the production amounts used in Figure 11 are shown in Figure 12.

Figure 12: Oil Production Adjusted for Katrina
In Million Barrels per Day

	EIA Unadjusted Crude	Crude with Katrina Adjustment	EIA Unadjusted All Liquids	All Liquids with Katrina Adjustment
Jan-05	73.23	73.23	84.06	84.06
Feb-05	73.51	73.51	84.44	84.44
Mar-05	73.84	73.84	84.57	84.57
Apr-05	74.14	74.14	84.96	84.96
May-05	74.30	74.30	85.38	85.38
Jun-05	73.92	73.92	84.90	84.90
Jul-05	73.76	73.76	84.53	84.53
Aug-05	73.82	74.10	84.85	85.25
Sep-05	73.40	74.68	84.15	85.87
Oct-05	73.50	74.43	84.15	85.54
Nov-05	73.98	74.60	84.89	85.78
Dec-05	74.27	74.73	84.70	85.42
Jan-06	73.70	74.08	84.53	85.00
Feb-06	73.65	74.02	84.52	84.97
Mar-06	73.46	73.85	84.06	84.52
Apr-06	73.53	73.85	84.38	84.78
May-06	73.09	73.36	84.23	84.51
Jun-06	73.11	73.28	84.21	84.38
Jul-06	74.13	74.30	85.54	85.71
Aug-06	73.87	74.04	85.30	85.47
Sep-06	73.60	73.72	84.89	85.01
Oct-06	73.89	74.01	85.13	85.25
Nov-06	73.44	73.56	84.59	84.71
Dec-06	73.40	73.40	84.38	84.38
Jan-07	73.04	73.04	84.02	84.02
Feb-07	73.31	73.31	84.34	84.34
Mar-07	73.25	73.25	84.11	84.11
Apr-07	73.52	73.52	84.59	84.59
May-07	73.04	73.04	84.35	84.35
Jun-07	72.82	72.82	84.50	84.50
Peak Month Minus June 07	1.48	1.90	1.04	1.37

With these adjustments, the peak moves to late 2005, on both a "crude and condensate" and an "all liquids" basis. On a crude and condensate basis, the peak was December 2005, so perhaps Kenneth Deffeyes was correct after all. On an all liquids basis, the peak month appears to be September 2005. With these adjusted peaks, the June 2007 crude amount is 1.90 million bpd below peak and the all liquids is 1.37 million bpd below peak. These adjustments make a stronger case that (apart from the hurricanes) production in late 2005 was the true peak, and we are now on a declining slope.

What Should We Do Now? (Matt)

One of the things we need to do now is monitor the data, and confirm the 2005 peak in world oil production. We cannot know whether this peak was a geological peak per se, or whether there were other factors, such as geopolitical feed back loops involved.

Besides confirming the 2005 peak, it is time (and **past** time) for governments to take action. I strongly recommend that governments set aside oil and gas fields for the sole purpose of serving as an energy input into all those projects which are required to:

(A) Mitigate the impact of peak oil (e.g. rail development)
(B) De-carbonize our economies (e.g. renewable energy systems)

If this is not done immediately, all these projects may get stuck in diesel shortages. In the worst

case scenario, peak oil may damage our economy and financial system to such an extent that we no longer have the strength to decommission and replace our coal fired power plants. The result of all of this could be a different planet Earth (2-3 degree Celsius warming, sea level rises, and crop failures, as warned by NASA climatologist James Hansen).

Hansen writes in his latest paper Global Warming: East-West Connections:

> The Earth's history provides a sobering perspective on prospects for climate change. The Earth's climate is sensitive to changes in climate forcings, human-made forcings now overwhelm natural climate forcings, and the climate system is dangerously close to tipping points that could have disastrous consequences. Atmospheric composition is now near the limits that must not be exceeded if we wish to maintain a planet resembling the one on which civilization developed, with the equable climate of the Holocene.

How urgent action on global warming is will be seen when the summary IPCC report comes out in November. Tim Flannery, author of the book "The Weathermakers" and Australian of the year, informed us about new data presented in this report in an interview with the Australian public broadcaster ABC TV:

> TIM FLANNERY: ..... We thought we'd be at that threshold within about a decade, we thought we had that much time. But the new data indicates that in about mid 2005 we crossed that threshold. So as of mid 2005, there was about 455 parts per million of what's called carbon dioxide equivalent. And that's a figure that's gathered by taking the potential of all of the 30 greenhouse gases and converting them into carbon dioxide potential, so we call it CO2 equivalent.

So 2005 seemed to have been the tipping point year both on peak oil and global warming.

To close on a more positive note, here is an example from the Australian city of Perth how to prepare for peak oil. The mass transit authority Transperth has built a rail line on the median strip of 2 freeways.

Park & Ride facilities as well as bus interchanges at stations allow long distance commuters access to the rail line from low density suburbs. Perth has also introduced TravelSmart, individualized marketing, bringing together various modes of transport including car pooling and cycling.