The Oil Drum
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

Peak Oil Overview - July 2009

Posted by Gail the Actuary on July 20, 2009 - 10:07am
Topic: Supply/Production
Tags: overview, peak oil [list all tags]

Most people who have read a little about peak oil have heard that US oil production peaked in 1970. This happened, even though oil companies have been working as hard as they can to keep production up. Oil companies have even applied enhanced oil recovery techniques to wells where it looked like doing so would be profitable. After the US mainland (48 states) peaked in 1970, extra effort was expended to ramp up Alaskan production. It soon peaked as well, in 1988.

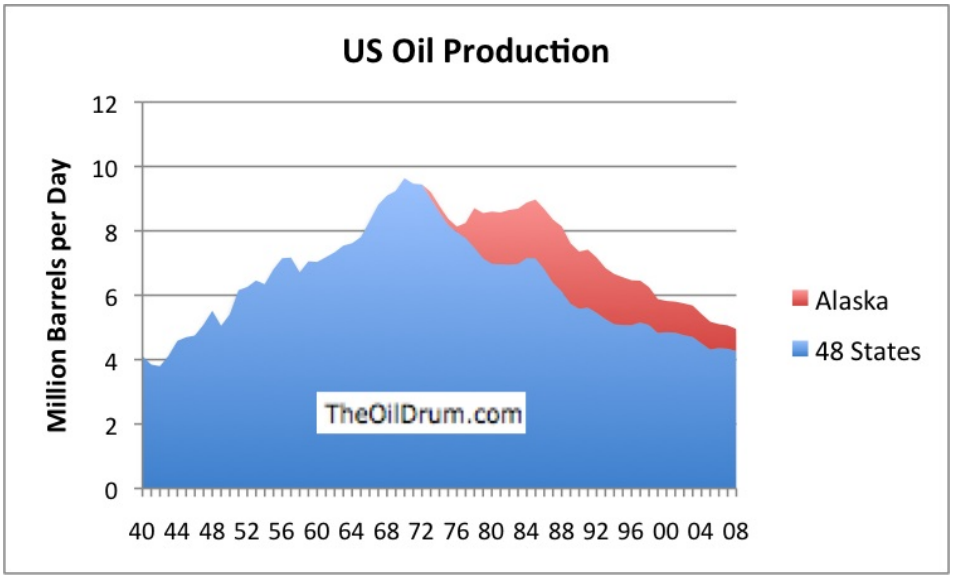

Figure 1 - US Oil Production, based on data of the US Energy Information Administration.

The question now is with respect to world production. The price of oil isn't very high--is there any possibility of a near-term peak in world oil production? Lower prices would seem to suggest there is no problem.

It seems to me that if we look closely at the situation, world oil production has likely peaked, even though prices are not behaving as most had expected. Furthermore, the peaking of world oil production seems to be a major cause of the current financial crisis. The tie of peak oil to recent demand destruction points to a possible continuing destruction in demand in the years ahead, with oil prices fluctuating, but not necessarily rising to great heights.

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1. Where are we now with respect to world peak oil?

There is considerable evidence that we may already be somewhat past the peak in world oil production.

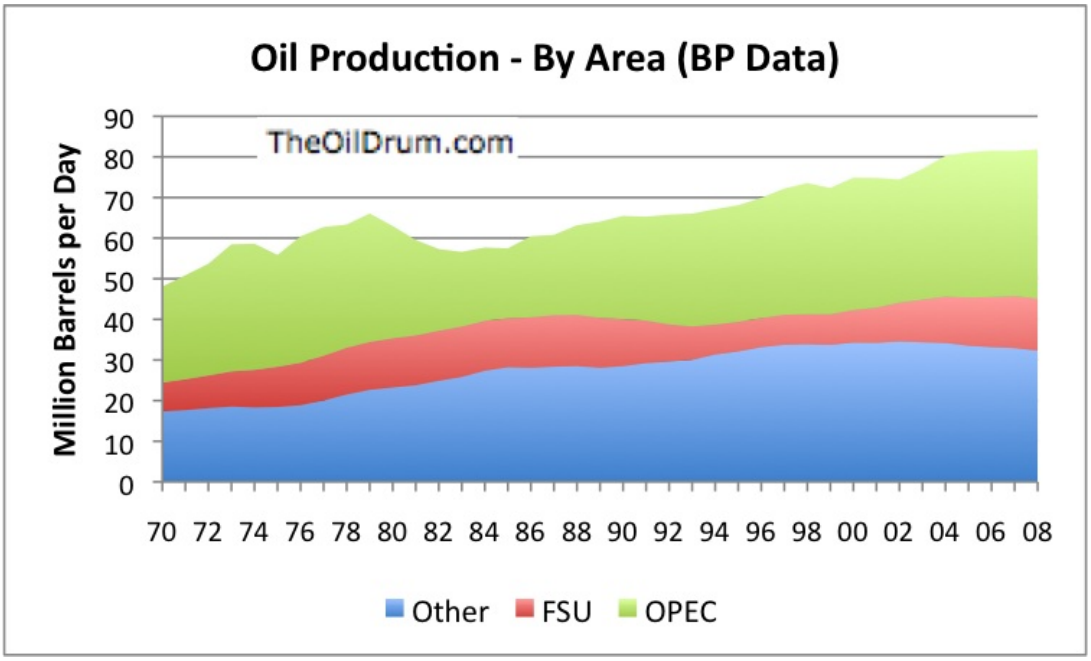


Figure 2 - World Oil Production, separated between Organization of Oil Producing Countries (OPEC), Former Soviet Union (FSU), and others based British Petroleum Statistical Data (BP)

Figure 2 indicates that world oil production was rising up until 2005, but then leveled out in the 2005 to 2008 period, at a little over 80 million barrels a day of oil production. If we divide up world production into three components--Organization of Petroleum Exporting Countires (OPEC), Former Soviet Union (FSU) and All Other, the three groups act quite differently.

OPEC production bounces around, as production is raised and lowered because of planned production changes, wars, over-production and need to rest fields, depletion, and response to market conditions.

FSU production reached a peak prior to the breakup of the Soviet Union in 1990. It is currently at a new lower maximum (still rising, but not quickly), with the application of new technology and additional investment.

Oil production for the big group of All Other countries (shown in blue on Figure 2) is characterized by more steady investment. When one considers the steady investment, production for this group has almost certainly peaked. This group would include US, Canada, the North Sea, Mexico, China, and many smaller oil producers not in OPEC or the FSU.

The peak for this group occurred in 2002, with a plateau occurring more or less in the 2000 to 2004 period. Once this group started declining, there wasn't enough of a production increase elsewhere (FSU and OPEC) to bring total production up. One could argue that this was just because FSU and OPEC chose not to increase production more, but there seems to be more to the situation than this.

2. What makes you think that world oil production has peaked? Figure 2 just shows that it has been flat recently.

There are several things:

a. Recent drop in world oil production. In 2009, there has been a drop in oil production, that doesn't show up in the annual data in Figure 2.

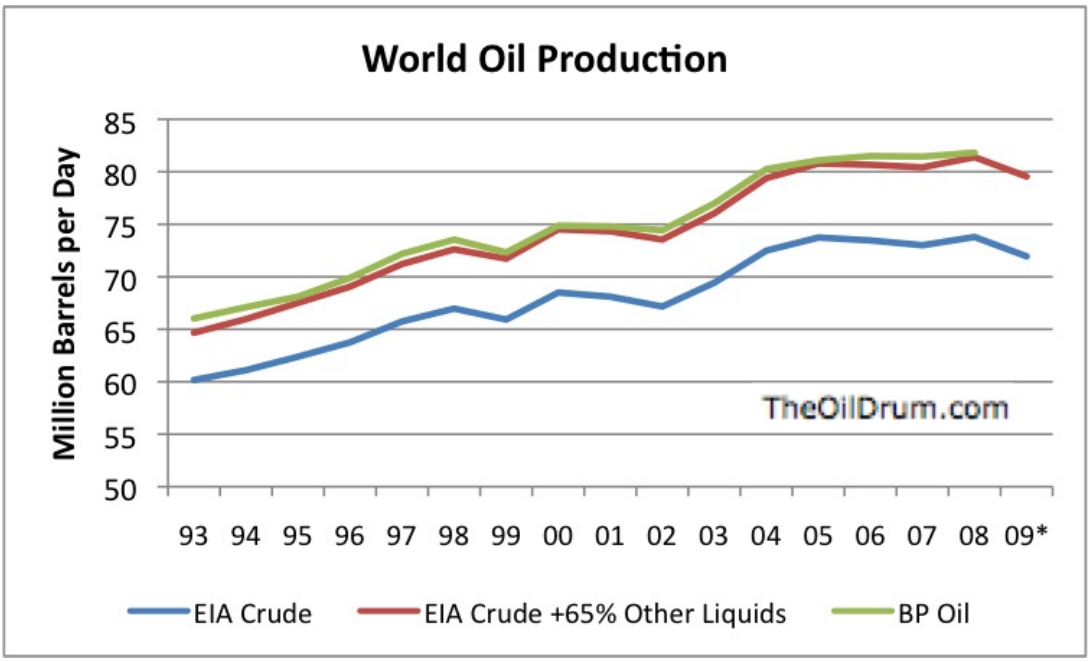


*Figure 3 - World Oil Production, based on data of the US Energy Information Administration and British Petroleum (BP). *2009 is January - April*

There are a number of sources of oil production data. Figure 3 compares three measures of oil production, two of them from the US Energy Information Administration (EIA), the official US source of data.

The EIA now reports a broad measure of oil production called "all liquids". It includes everything from crude oil, to natural gas liquids, to refinery gain, to ethanol. The problem with this measure is most of the "other liquids" are lower in energy content than crude oil. They have been growing by volume in recent years. I have attempted to correct for the lower energy content by showing a line called crude + 65% x "other liquids".

One can see that with each of these measures, oil production is clearly down in 2009. In fact, since oil production was close to flat between 2005 and 2008, with the drop, production for 2009 year-to-date is at or below the level of 2004 production. Since population is rising, and the number of vehicles in use is rising, this is truly alarming.

b. Strange behavior in oil prices in the 2003 to 2009 period. One would expect oil prices to rise with the general inflation rate, but instead prices rose much faster than inflation in the 2003 to 2008 period. Then, a sudden break came, and oil prices dropped from $147 barrel to $30 barrel in the second half of 2008. Oil prices have since risen to above $60 barrel. (The graph shows only annual data, so you cannot see this detail.)

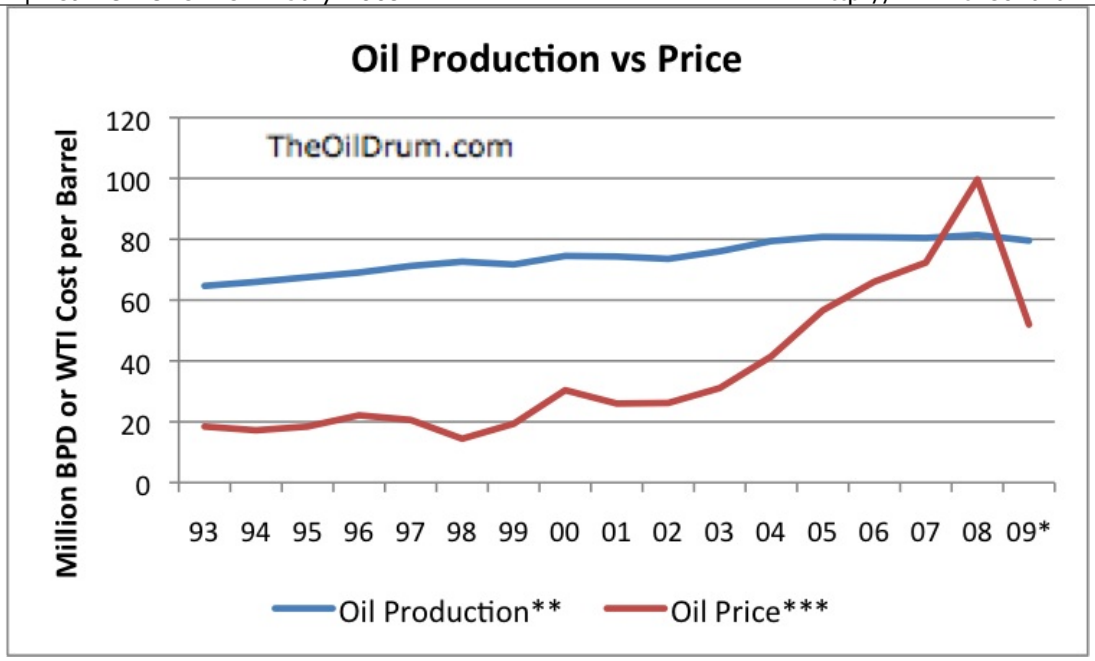


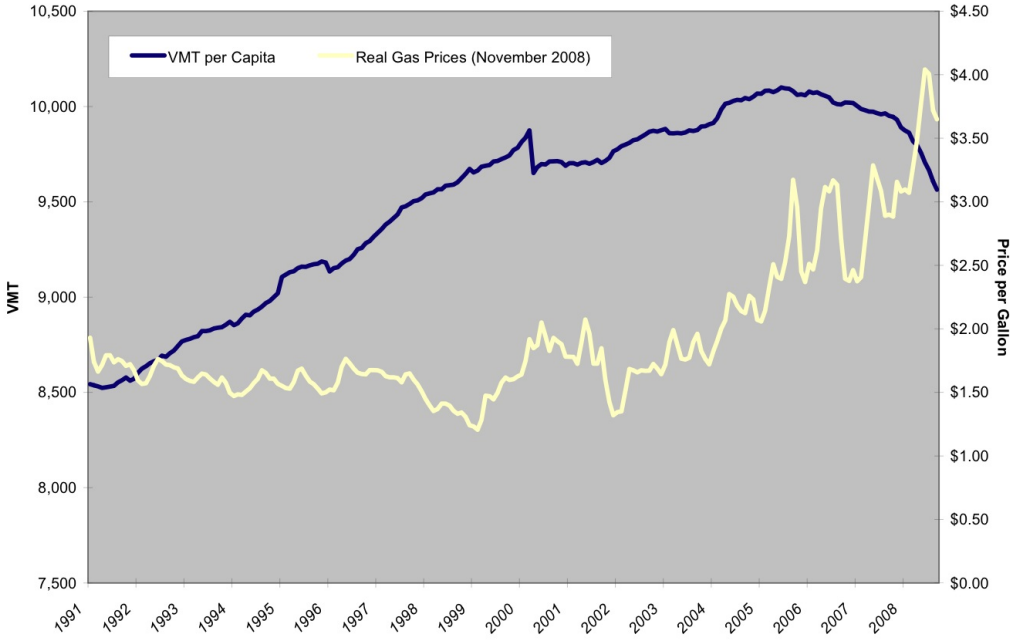
*Figure 4 - World crude and condensate oil production, based on [**EIA crude and condensate oil production data] and [***EIA West Texas Intermediate spot prices]. *2009 oil production is average January - April; prices are average January - June*

The long rise in the price of oil between 2003 and 2008 seems to indicate production of oil was not rising as much as was needed by the economy and the growing number of vehicles. Oil prices were rising to encourage increased production.

According to economic theory, higher oil prices should have lead to higher oil production (or substitutes-but the impact of biofuels is small, and included in "All liquids" in Figure 3), but this did not happen, suggesting that it really was not possible to ramp up production as much as the economy needed. Even if some of the price rise at the end may have been speculation, the price rise still did not result in much of an increase in production.

It should be noted that the rise in energy prices started right after the production of the "All Other" group in Figure 2 began to decline. It was at this point that a real increase in production was needed from OPEC or FSU to offset the drop in oil production from Mexico and the North Sea. While there was some increase in production, it was not enough of an increase to keep oil prices steady. Instead oil prices keep rising. In response, per capita vehicle miles traveled declined starting in 2005, according to a study by the Brookings Institution.

Figure 1b. U.S. Vehicle Miles Traveled Per Capita, Annualized and Real Gasoline Pump Prices, January 1991–September 2008



Source: Traffic Volume Trends and Energy Information Administration

Figure 5 - Brookings Institution comparison of Gasoline Prices and US Per Capita Vehicle Miles Traveled from this study.

In the 2004 to 2006 period, the Fed, it its minutes, expressed concern about rising oil prices, and raised interest rates because it felt the economy must be overheating, if such inflationary effects were occurring. The combination of higher oil prices, higher food prices (caused by higher oil prices) and the higher interest rates set by the Fed in response to higher oil prices had a braking effect on the economy. People's discretionary income dropped. Housing prices began to drop, especially in the more distant suburbs, as people could afford less. People began defaulting on loans, and the financial condition of banks became worse and worse. Still, through all of this, oil prices continued to rise.

Finally, in July 2008, a break came. The economy could no longer tolerate the high oil price. Instead of rising higher, other changes started occurring, affecting the economy as a whole. Banks began cutting back on lending. This cut-back in lending, as much as anything else, caused demand for all kinds of products to drop, since without more loans, people couldn't buy automobiles and all of the other things they wanted, and without loans, businesses couldn't fund new investments.

Once the break in oil prices occurred, oil companies began delaying their plans for increased production, especially in high cost places like the Oil Sands in Canada, where it would not be possible to produce oil and make a profit at the new lower prices. The cutback in lending also affected some of the oil companies, forcing them to limit investments to what could be financed through cash flow from current production. Since prices were low, cash flow was low, further reducing investible funds. Production from existing wells continues to decline, and new investment is needed to offset this decline. With the current lower investment, though, the

amount of new investment is almost certainly inadequate, so future oil production is very likely to drop.

Spikes in oil prices have in the past have been associated with recessions, according to Jeff Rubin. In addition, an econometric study by James Hamilton of the University of California at San Diego shows a link between oil prices and the current recession:

> Whereas historical oil price shocks were primarily caused by physical disruptions of supply, the price run-up of 2007-08 was caused by strong demand confronting stagnating world production. Although the causes were different, the consequences for the economy appear to have been very similar to those observed in earlier episodes, with significant effects on overall consumption spending and purchases of domestic automobiles in particular. In the absence of those declines, it is unlikely that we would have characterized the period 2007:Q4 to 2008:Q3 as one of economic recession for the U.S.

If there is a single day for peak oil, it would be the day the price break took place. This was July 11, 2008.

c. Forecasts by Tony Eriksen ("ace") based on megaprojects data show declining future oil production.

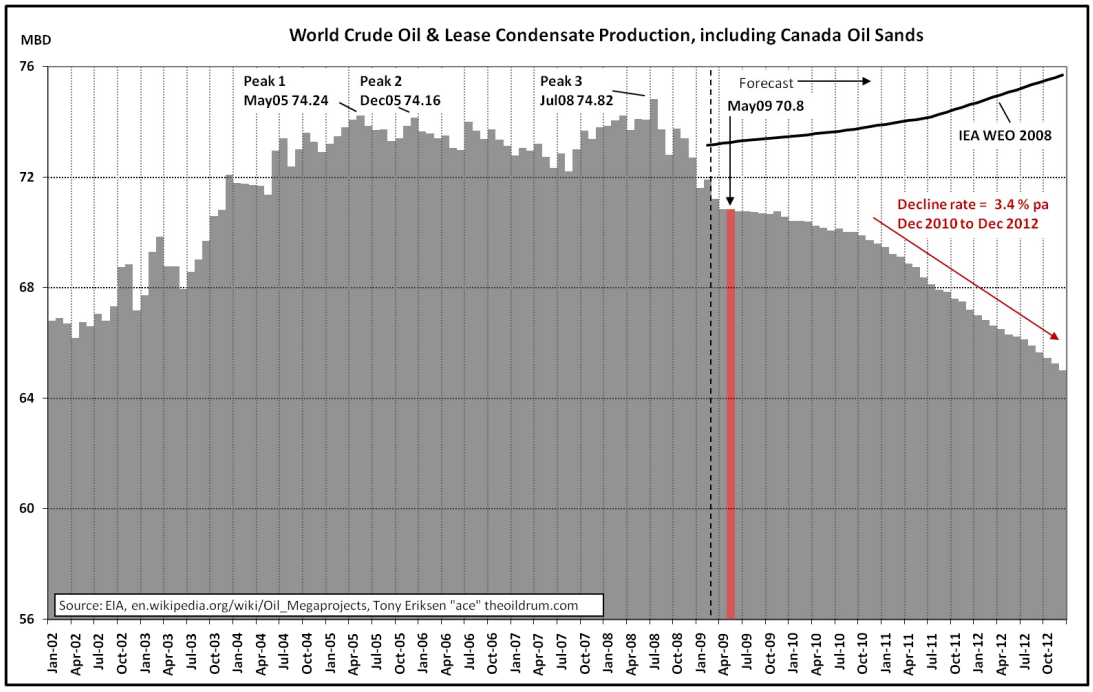


Figure 5 - World Oil Production to 2012 as forecast by Tony Eriksen ("ace") in May 2009. Oil includes crude oil, lease condensate and oil sands.

Tony and others have put together a database of planned investments in oil fields called the megaprojects database on Wikipedia. This database includes all known capacity additions of 100,000 barrels a day or more, and is constantly updated. With the drop in oil prices, more and more projects have been pushed off to future dates. At the same time, existing fields continue to deplete.

Prior to the recent drop in prices, it seemed likely that production could continue to rise, at least for a few more years. Now with lower prices, enough projects have been delayed that based on Tony's analysis, oil decline can be expected for the next several years.

d. OPEC wells are for the most part very old. Decline can be expected in the not-too-distant future.

We really have very poor information about OPEC's true oil production capability. Several of the OPEC countries have published very high reserve estimates, but these amounts are not audited, and there is serious doubt that the actual amounts are as high as they claim. Also, we don't know how fast the oil can be extracted. We don't know if these high reserves mean they actually have enough to maintain, or increase, their current production levels. The reserves could also be consistent with a near-term drop in production, and a continuing dribble for hundreds of years.

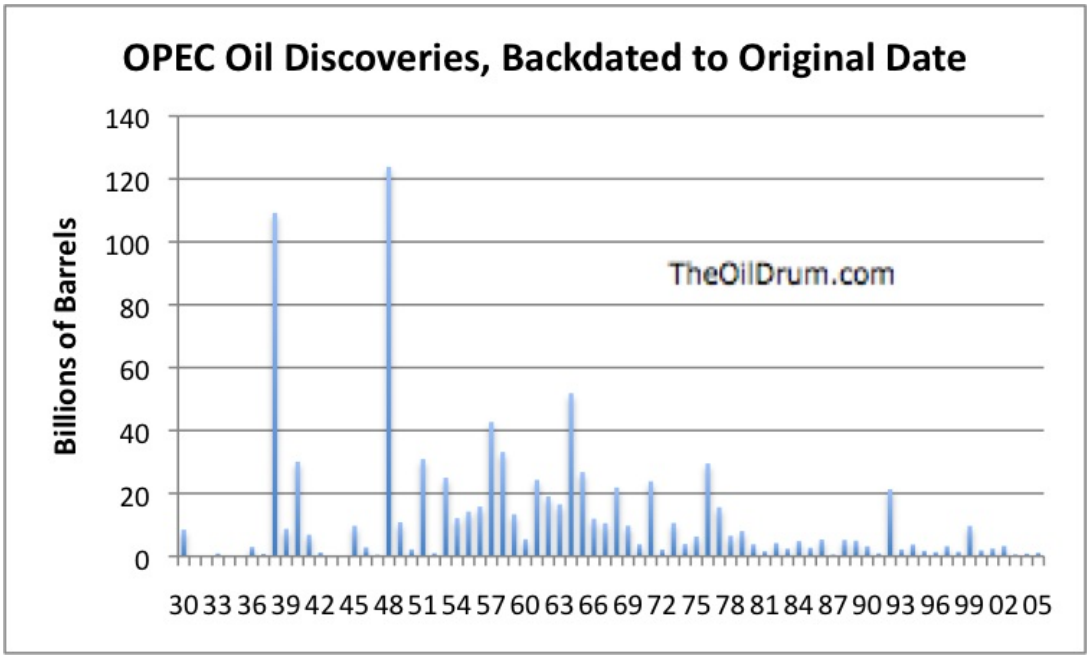


Figure 6 - OPEC oil reserves, by backdated to year. Summarized by author, using 2005 ASPO database and current list of OPEC members.

Figure 6 shows that most of OPEC oil reserves relate to fields that were discovered more than 40 year ago. In fact, some were discovered more than 60 years ago.

The problem is that at some point, oil fields become depleted. Instead of being able to pump a constant or rising amount of oil out, production begins to drop rapidly, even with rising investment. In the United States, that drop in production occurred in 1970 (see Figure 1), about 40 years after production from its major oil fields began. In the North Sea, the time frame was shorter--about 28 years between initial production and the time when it became virtually impossible to maintain the prior level of production.

Several of the OPEC countries have not been pumping at maximum capacity for the full time and initial reserves seem to be quite large, so the time until terminal decline starts playing a major role is likely longer--but could be very soon.

We know that Saudi Arabia is using aggressive techniques to maintain it production. But at some point, these techniques are likely to stop working, and production may drop by as much as 3

million barrels a day quite quickly. We have heard reports that Saudi Arabia is "resting" 1.5 million barrels a day of production from its largest field, Ghawar. This may--or may not--indicate a problem in maintaining production in the field. If Ghawar (with at one point, 5 million barrels a day of production) should start declining rapidly, this would be a problem.

e. The FSU does not look like it can play a major role in offsetting declines elsewhere.

Russia represents the largest part of the FSU. Its production seems to have recently started declining. Investment available for further development is limited by the lower oil prices, so Russia's production is likely to continue to decline. The production of the other countries in the FSU are relatively small. Their production may be able to offset Russia's decline for a few years, but are unlikely to add enough to offset much of the "All Other" decline in Figure 2. As a result, the vast majority of the decline in the "All Other" category will need to be made up by OPEC.

3. Can't OPEC adjust prices so that they are just right--high enough to keep production rising, and low enough so the world economy will not go into shock?

There are a couple of problems with adjusting prices. The first is that it is not all that clear that OPEC has that much control over price. Most members would prefer to produce "flat out", so it is difficult for OPEC to reduce production by very much, from their maximum available production. While we are often told that there is "x million barrels a day" in spare capacity, we have no way of verifying that that is in fact the case. So if production is down, we don't know if that is because of an intended cutback, or if it is because there are other issues (for Venezuela, inability to pay creditors; for Saudi Arabia, need to rest wells).

Apart from the difficulty in controlling the price, the real problem is that there really is no "sweet spot" where oil prices are high enough to encourage adequate production, but low enough to keep the world economy running. The US Fed found that even when oil prices increased from $30 barrel to $40 barrel back in 2004, this had inflationary effects on the economy, which they felt were necessary to control.

Clearly a much higher price than $40 barrel is needed to encourage production. We don't know exactly what that price is, but this graph gives an indication of the range in production costs:

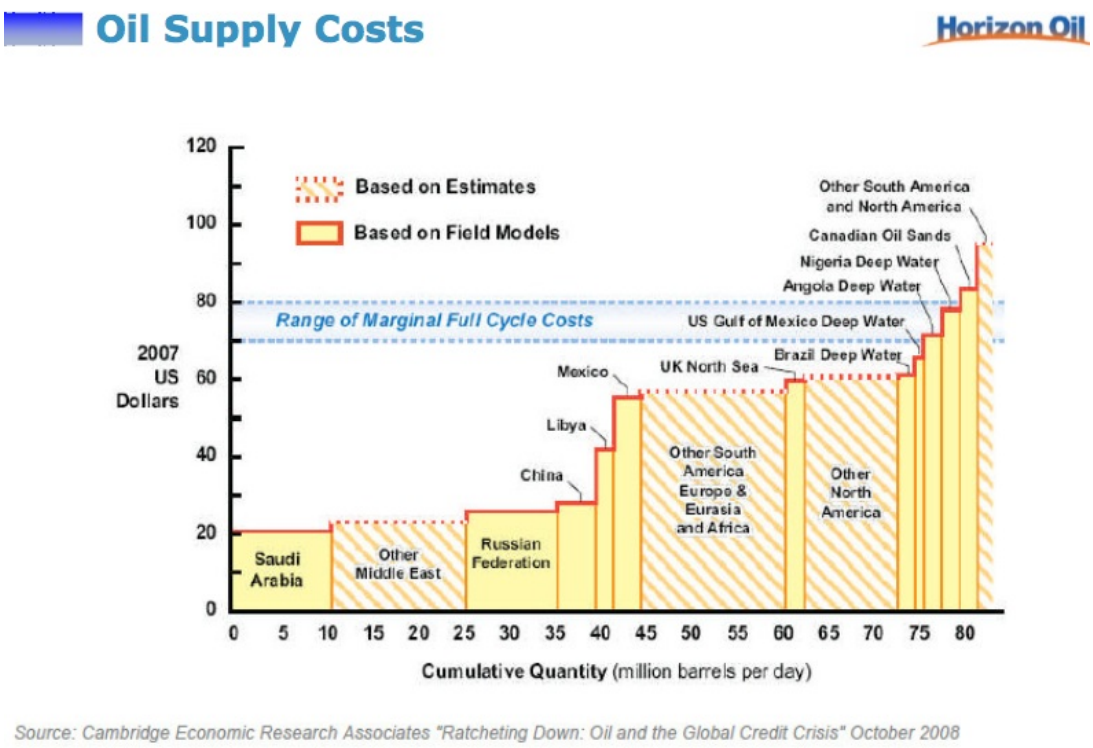


Figure 7 - CERA estimates of full costs of oil production, from a Horizon oil presentation. The CERA graph was put together when oil was about $90 barrel. The dotted line seems to indicate the highest cost types of production that would be profitable at the $90 barrel price.

In order to get oil production to rise, we need new oil production from even the most expensive sources, including new deep water production and oil sands production. This means we likely need oil prices of something like $100 barrel. The world economy cannot support such high oil prices, without people defaulting on their loans, banks getting into serious financial difficulty, and the whole financial system crashing.

4. Where can oil prices and production be expected to go from here?

Opinions differ on this, but my view is that I don't expect oil prices to go radically higher. Instead, I expect that oil prices will continue to fluctuate, and the economy to continue to collapse. Thus, what we will see will look more like collapsing demand than collapsing supply.

In my view, the underlying problem is the fact that the current level of debt (by individuals, businesses, and governments) cannot be maintained, unless we have a growing economy. The reason we need a growing economy for the debt system to work is the fact that a person can borrow from tomorrow, only if tomorrow is better than today. (This is especially the case if loans require the payment of interest.) But if tomorrow is worse than today, borrowing from the future doesn't work. Even if tomorrow is the same as today, the system doesn't work, if loans need to be paid back with interest.

The problem is that the economy cannot grow unless oil production is truly rising. This lack of growth in world oil production since 2005 is what is causing the debt collapse we are now seeing. This debt collapse is in turn giving rise to the demand destruction we are seeing currently. Since oil production cannot rise in the future, it seems to me that we are going to see a continuing unwind of the credit bubble that was made possible by rising oil production. Without credit,

people will be unable to buy cars and houses. Businesses will be unable to finance new investment, and we will see greater and greater demand destruction.

The result will be oil prices dropping, more and more people unemployed, and fewer goods and services purchased. In short, the whole system will unwind from the demand side. At some point, there may be a major break, if the international financial system cannot stand the strain. There may also be political upheaval, both in oil producing countries (because the price is too low) and in oil consuming nations (because more and more people are out of work). The results are likely not to be very nice.