

Peak Oil

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The looming oil shortage is the most important economic issue of our lifetime. For this reason, I have researched it in depth. I've read books by Matthew Simmons, Kenneth Deffeyes, and James Kunstler as well as numerous web articles.

The most important question is, "When will we reach global peak oil production?" The answer is very soon (by my estimate within 3 years). Yes, new production is coming online, but there are a limited number of projects that will begin production in the next three years. These projects must offset annual production decreases at existing fields of at least 2%, and a projected annual demand increase of 2%.

To meet the expected 2% annual demand increase for the next three years (2006-2008), production must reach 90 million barrels per day. This will require an increase of 11 million barrels per day of new production (5.5 million barrels a day to meet new demand and 5.5 million barrels per day offset declining production at existing fields).

Can global oil production increase 11 million barrels per day over the next three years? Very unlikely. What is much more likely is that peak oil production will never reach 90 million barrels per day, but something closer to 87 million barrels per day. If you want an estimated time for peak oil production, my bet is 2007. This will also likely be the year when oil reaches \$100 a barrel.

My research has come to these conclusions:

1. Within 3 years we will reach global peak production.
2. Within 3 years high oil prices will have begun creating economic havoc.
3. High oil prices will eventually collapse the economy.

Let's look at the data:

Global demand was 77 million barrels per day in 2002. At the end of 2005, demand had risen to 83.5 million barrels per day. Thus, daily demand has increased on an annual basis of more than 1.5 million barrels production per day since 2002. Furthermore, we can expect demand to increase 2% annually for the next three years. The result will be demand reaching 90 million barrels a day by the end of 2008.

Here are the calculations:

$$2006: 83.50 + 2\% = 83.50 + 1.67 = 85.71$$

$$2007: 85.71 + 2\% = 85.71 + 1.71 = 87.42$$

$$2008: 87.42 + 2\% = 87.42 + 1.75 = 89.71$$

The problem we face is that to meet demand for the next three years we will have to annually produce an additional 3.4 million barrels per day to meet demand (1.7 million barrels per day for increased demand and 1.7 million barrels per day to offset production declines at existing fields. There are enough projects to meet demand in 2006, but 2007 becomes problematic, and 2008 becomes very unlikely.

Why is this happening? We stopped finding oil. Peak discovery was in 1967. Since then, discovery has steadily decreased. By 2012 discoveries will be paltry, likely only 3-4 billion barrels (about one month's worldwide demand).

In 2004, 29.9 billion barrels of oil were consumed worldwide, while only eight billion barrels of new oil reserves were discovered. Thus, we consumed 3.8 barrels for every barrel found.

In 2005, 30.4 billion barrels of oil were consumed worldwide, while only five billion barrels of new oil reserves were discovered. Thus, we consumed 6 barrels for every barrel found.

In 2005, Oil companies spent \$8 billion on discovery and only found \$4 billion worth of oil. Discovery is becoming more and more of a losing proposition.

In 2006, expect less than 5 billion barrels of new oil discovered. Thus, with so little oil being found it is very difficult to add to global production on the scale that is needed.

Approximately 95% of all oil has been found. Thus, only about 100 billion barrels are left to be discovered (3 years supply). Of this 100 billion, there is likely only one or two major fields that will produce more than 100 thousand barrels per day. World demand has become so huge that this is a drop in the bucket.

There are approximately 1.3 trillion barrels of oil reserves claimed by oil companies (this does not include the Tar Sands in Canada or the heavy oil in Venezuela). This number is inflated because OPEC countries over-estimate their total in order to get larger production quotas. It is projected that it will take 30-35 years to consume all of the remaining reserves. However, most likely, we only have 20 years of plentiful supply (oil available for sale on the global market). Once we get towards the end, there is going to be very little exporting. Countries will keep their last remaining barrels for themselves.

Plentiful supply does not mean that demand is being met. For, demand will exceed supply long before we run out of plentiful oil, thereby disrupting the supply chain and causing economic havoc. This will likely occur this decade, although reaching peak oil does not necessarily mean there will be shortages. As we reach peak oil, the price will soar thereby depressing demand. This will allow supply and demand to find an equilibrium thereby reducing or possibly preventing shortages. This kind of market mechanics is the reason many economists dismiss peak oil in the near term. They expect the high price of oil to reduce demand and allow other energy sources—that are currently not economical—to provide our energy needs.

Daily global production is nearing its peak. We have stopped finding oil in abundance at the same time that we need to produce an additional 3.4 million barrels annually to meet demand. Less than a decade ago, OPEC had 15 million barrels of excess daily capacity. Now all of that excess capacity is gone.

Peak production is also evident by that fact that production is either declining or on the precipice of decline in every country except Canada and the Middle East (where the majority of reserves remain). Soon the Middle East (Canada's increases are minimal on an annual basis) will have to increase production dramatically on an annual basis to

meet world demand. At a certain point this will not be possible and global peak production will be reached.

U.S. Government economic planners currently project global peak production to be around 2015. This seems way too optimistic to me. The current excess worldwide production capacity is estimated to be only 1.5 million barrels per day. In fact, only one country, Saudi Arabia, claims any excess production capacity. With future demand requiring at least 3.4 millions barrels per day of new production each year, this leaves new projects to meet demand. Simply put, there aren't enough projects.

In Saudi Arabia, which claims to hold a quarter of all global reserves, six giant fields produce 90 percent of their oil. All of these giants are old (beginning production in the 1950s and 1960s) and mature, and likely past their peak production. In 1982, OPEC countries stopped releasing production and reserve numbers on a field by field basis. In effect, they became secretive and have remained secretive. For this reason, we can only estimate (guess) when each field will reach peak. What we do know is that they have had ongoing technical problems with each of their maturing giants. They have depended on water injection for decades and are now experiencing recurring high water cuts. In essence, they are pumping too much water out of the ground instead of oil.

Getting the easy oil has long past for the oil industry. They now have to revert to modern technical innovations, which are becoming more and more complicated. From what I read in "Twilight in the Desert" by Matthew Simmons, the Saudi's are struggling just to maintain production, let alone have the ability to increase it. According to Simmon's analysis, he thinks it is likely that one of their giants is on the precipice of decline. If they lose one giant, they will likely go into production decline as a country. Whereas, U.S. Government planners are expecting Saudi Arabia to increase their production to meet worldwide demand, even the Saudis have claimed that the best they can do by 2009, is 11.5 million barrels per day.

Production Decreases:

Currently 116 large fields produce nearly 50 percent of production. Most of these fields are old and in depletion. The fields below show the common theme of production declines at the world's giant fields. (numbers are production in barrels per day)

Oseberg (Norway):	1994 (800 thousand)	2002 (200 thousand)
Brent (North Sea):	1984 (450 thousand)	2001 (80 thousand)
Prudhoe (Alaska):	1981 (1.6 million)	2000 (500 thousand)
Romashkino (Russia):	1970 (1.6 million)	1998 (250 thousand)
Forties (North Sea):	1977 (500 thousand)	2000 (50 thousand)
Samotlor (Russia):	1978 (3 million)	2001 (300 thousand)
Daqing (China):	2000 (1 million)	2006 (600 thousand)
Canterell (Mexico):	2003 (2 million)	2009 (600 thousand)
Norway (All Production)	2000 (3.1 million)	2005 (2.5 million)
U.K. (All Production)	2000 (2.9 million)	2005 (1.7 million)
USA (All Production)	2005 (5 million)	2010 (3.5 million)

When you look these numbers you can understand why the annual production decline is at least 2%. Once we get to 2010, the annual decline will be even higher. The reason for this is because we stopped finding giant fields after the 1970s. Most of the large producing fields today are old and mature and declining.

Expected Production Increases (Next 3-4 years):

A large portion of the increased production from 2000 to 2005 was excess capacity coming online. With the increase in price everyone began producing whatever they could. However, now that there is no longer any excess capacity, we are forced to rely new projects to meet increased demand.

Currently there are only a few major projects around the world, and only two that are expected to produce more than 1 million barrels per day. In fact, the last new field that produced more than 1 million barrels per day was Canterell, discovered in 1975 (Gulf of Mexico).

Saudi Arabia:	1-2 million.
Canadian Tar Sands:	250-350 thousand.
Heavy Oil (Venezuela):	100-300 thousand.
Deep Water (Brazil, Mexico, Angola and Nigeria):	2-4 million barrels per day.
Kazakhstan:	200-400 thousand.
Azerbaijan (Caspian Sea):	100-500 thousand.
Libya:	100-500 thousand.
Iraq:	100-500 thousand.
Russia:	100-500 thousand.

Current Tar Sand production is about 800 thousand barrels day and is increasing about 10 percent per year. They expect to produce about 2.5 million barrels a day by 2015. There is an incredible quantity of Tar Sands. Current proven reserves are estimated to be 350 billion barrels. Potential reserves are projected to be as much as 2 trillion barrels. The problem is that it takes a long time to increase production. At a 10 percent annual rate it won't be until 2015 before Canada is a major producer.

Venezuela has potentially 300 billion barrels of reserves in heavy oil. Thus, they could increase production dramatically on a scale approaching that of Canada. This can only occur with massive investments and technological breakthroughs.

When you compare these major projects (4 to 9 million barrels) in tandem with global demand and production decreases over the next three years (11 million barrels), we are headed for peak oil production very rapidly. Even if we achieve the 9 million barrels of new production for these projects, we will still be short by nearly 2 million barrels.

It is difficult to find information about projected production for future projects. One number that I found that reinforces my expectation for peak oil less than 90 million barrels per day was from ODAC (Oil Depletion Analysis Center). They claimed to have analyzed all new projects for 2004 to 2010 and estimated the combined additional production to be 11.5 million barrels per day. We need that much added production just for new projects in 2006-2008.

One source I found, Jeff Rubin, the Chief Economist at CIBC World Markets, predicts new oil production to be 3.6 million barrels per day in 2006, 1.5 in 2007, and 1 in 2008. If you add these up, he is expecting 6.1 million barrels of increased production over the next three years. I think his estimate is low, but note that it is nowhere near the 11 million barrels that are going to be needed.

Another source I found was Oilcast #28 on OilCast.com. This audio file includes an interview with a PEMEX engineer. He has a few insightful comments. 1) Peak oil will be somewhere between 85 and 90 million barrels per day. 2) The Saudi's are already producing at maximum capacity. 3) It is unlikely the Saudi's will produce much more than what they are currently producing.

If you add up future projects they do not meet the production requirements needed over the next three years. That leaves Saudi Arabia to fill the void. The producer of last resort.

In 1978 (the last year Aramco was ran by International Oil companies such as BP, Exxon, and Chevron), Aramco publicly released reserves on field by field basis that totaled 110 billion barrels in proven reserves. In 1979, Aramco changed from foreign stewardship to Saudi Aramco (The Saudi Royal Family). In 1982, after the formation of OPEC, the Saudis increased their reserves to 150 billion barrels, although they had not discovered any new fields. Today, they claim 260 billion barrels in proven reserves, yet have never provided any documentation to substantiate their claims.

What we do know about Saudi reserves is that no oil has been found in any significant quantities since 1978 (90% of their production is coming from old fields). In addition, we know that they have produced more than 75 billion barrels since 1978. So, if we are to believe their numbers, Aramco should have stated their reserves at 335 billion barrels ($260 + 75$) in 1978! This number is so inflated as to be ridiculous, and yet everyone uses it (I hear the number on television all the time). The correct number is closer to 100. Even with that number, the Saudis would have had to found 65 billion barrels since 1978.

When you put this smaller reserve number in perspective, you realize that Saudi Arabia is not the producer of last resort. In fact, it's possible that they have already passed peak production, which for them was 10.5 million barrels per day in 1980.

All OPEC countries have lied about their reserves in order to have larger quotas. It is considered normal business practices for OPEC members. Proof of this transgression was recently found in Kuwait. Petroleum Intelligence Weekly recently reported that Kuwait has 48 billion barrels of reserves, and not the 99 billion that they have claimed publicly. I would bet this is the same for all OPEC countries. This begs the question, how far off are the OPEC claimed reserves versus actual proven reserves? Is the oil supply situation worse than we realize?

Some people point to the huge reserves in Canadian Tar Sands as a producer or last resort for the global market. However, as more oil production comes online in Canada after 2015 (if they have enough natural gas to expand production), production declines elsewhere will be intensifying. The bell curve for global production from 2015 to 2030 is not pretty. Even if Canadian Tar Sands production increases to 5-7 million barrels per day by 2025, I don't think this will have much impact on global supplies.

Another producer with large potential production is Venezuela. Their heavy oil production could increase dramatically. As oil prices increase, there is going to be a lot of investment in Venezuela. We could see 1-3 million barrels per day of heavy oil production sometime in the next decade. Most likely they will supply Central and South America.

One interesting thing I have learned from researching peak oil is that oil shortages are not inevitable in the short term. Oil companies could meet global demand for the rest of this decade and beyond. This possibility could occur if prices are high enough to significantly decrease demand. Once gasoline hits \$5 to \$7 per gallon, less people will be driving and demand will go down. This could prevent shortages. However, once peak oil is reached, there is nothing that will prevent high prices.

If prices are going to increase dramatically once we reach peak oil, at what point do these high prices collapse the economy? What can the economy absorb? \$100 a barrel? \$200? All of my research leads to one conclusion: we're screwed. We have become utterly dependent on cheap oil and it's about to get expensive. Initially, inflation is going to skyrocket as businesses increase their prices to pay their shipping/delivery bills. Consider how many delivery trucks are needed to move goods in this country. Consider global transportation costs for imported goods. Does everyone realize how

dependent we've become on imports for manufactured goods? I don't see how we can get through this without economic havoc.

The magnitude of the approaching oil crisis is beyond the average person's comprehension. It is such a huge problem that it is difficult to conceptualize the ramifications. For instance, how do we commute to work when it costs too much to drive? How do we pay for our food, gas, and electric bills when they double and triple from increased energy costs? It's mind boggling. All I know is that the world is about to change dramatically and know one seems prepared.

If you think there is a substitute for oil, there isn't, at least not an economical one. We get 40% of our energy from oil. There is no easy replacement for that much volume. Yes, we will eventually find one, but it does not exist today. We have become dependent on cheap oil and it is about to go away. We've been making plans for a world that is no longer going to exist in its current form. If you're still optimistic that our world can continue on in its current form, you need to do more research. There's no fix. The market or human ingenuity can't keep our current system intact.

The way I see it, our only option is to start over. We have to create a new world based on new requirements. I am not depressed about the possibility. The opportunity to build a new sustainable civilization based on love and humanity has always appealed to me. I feel like we are being given an opportunity to build something new, something from which we can be proud.

Sources:

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