The Oil Drum
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

World Oil Production Peaked in 2008

Posted by ace on March 17, 2009 - 9:15am
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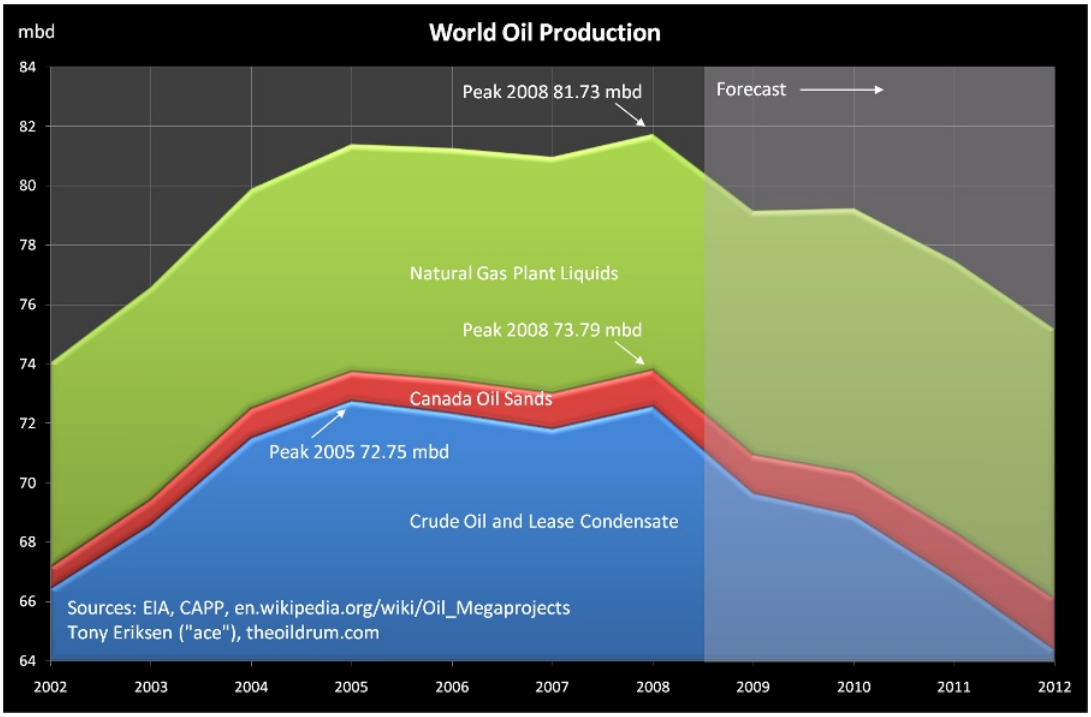
As everyone knows, there is never a post on The Oil Drum that the entire staff agrees on. Nonetheless, Tony bases his findings on solid research, and a staff survey shows that most agree with a 2008 peak. A post discussing whether an alternate scenario with a second later peak might be feasible is planned for later.

World oil production peaked in 2008 at 81.73 million barrels/day (mbd) shown in the chart below. This oil definition includes crude oil, lease condensate, oil sands and natural gas plant liquids. If natural gas plant liquids are excluded, then the production peak remains in 2008 but at 73.79 mbd. However, if oil sands are also excluded then crude oil and lease condensate production peaked in 2005 at 72.75 mbd.

The US Energy Information Administration (EIA) and the International Energy Agency (IEA) should make official statements about declining world oil production to renew the focus on oil conservation and alternative energy sources.



World Oil Production to 2012 *- click to enlarge*

Sources for historical data: world crude and condensate (EIA) but with oil sands excluded, oil sands (CAPP), and world natural gas liquids (EIA).

World Oil Production

Both natural gas plant liquids and Canada oil sands production are expected to grow over the near term. Much of the growth of natural gas plant liquids comes from OPEC. Non OPEC oil production peaked in 2004 and is forecast to decline at a faster rate in 2009 and beyond due mainly to big declines from Russia, Norway, the UK and Mexico. OPEC has the ability to increase production later this year and in early 2010. Although key OPEC producer Saudi Arabia peaked in 2005, it probably has sustainable annual surplus capacity of 1 mbd. Iraq and possibly Nigeria also have potential to increase production but these countries continue to have serious internal conflicts. By the time 2011 arrives, OPEC will not have the ability to offset cumulative non OPEC declines and world oil production is forecast to stay below its 2008 peak.

The forecast assumes that prices will rise, causing OPEC to produce more oil which explains why the 2010 forecast is slightly greater than that in 2009. If world oil demand drops further, OPEC might not increase production causing 2010 production to be lower than 2009. It is also assumed that OPEC complies with 85% of cumulative announced cuts of 4.2 mbd. This compliance is assumed from March to June of 2009. At the March 15 OPEC meeting, no additional cuts were announced, there was 80% compliance to cumulative cuts in February and full compliance remains the target by May which would reduce OPEC-11 production by another 0.8 mbd.

My forecasting method aggregates forecasts from all oil producing countries, taking into account forecast field production profiles from existing and new oil projects. Colin Campbell uses a similar forecasting method but does not directly take into account the timing of new oil projects. Nevertheless, as peak oil has passed, new oil projects can only serve to slow the production decline rate. Consequently, Campbell has also stated that peak oil was in 2008, excluding biofuels. Another method used to estimate the peak production year is to use this oil project database to derive totals of future annual supply additions. As these additions are insufficient to offset future existing field decline, this indicates that oil production peaked in 2008, excluding biofuels.

Another similar forecast which incorporates forecast production profiles from giant oil fields is Fredrik Robelius' worst case scenario from his 2007 thesis. He used actual production data to 2005 and said that "the worst case scenario peaks at just above 83 mbd in 2008", excluding biofuels. This scenario has closely tracked actual data since 2005 and assumes a 7% annual decline rate for production from existing non giant oil fields as at the end of 2005, delays of many large projects and low recoverable oil reserves for some giant oil fields. There are just over 500 giant oil fields in the world, each with at least 500 million barrels recoverable oil. More support is provided for his worst case scenario as Robelius' original forecast for deepwater production was for a peak of almost 9 mbd in 2012. Now it appears that deepwater production entered a 7 mbd peak plateau in 2008 due partly to decline rates as high as 20% per year from mature deepwater oil fields.

Peak oil production often occurs when about half of the initial recoverable oil reserves are produced. In the US, production from the lower 48 states peaked in 1970 when 52% of the oil reserves were produced. In this forecast of crude and condensate, the peak production occurred in 2005 which coincidentally happened when 52% of world crude and condensate reserves were

produced. If Campbell's world reserves estimates are used then 49% of world oil reserves would have been produced in 2005. The discovery of future oil reserves will decrease these percentages and will also help to slow the production decline rate.

World Liquids Production

The definition of oil used by the International Energy Agency (IEA) also includes bio-fuels, processing gains and other liquids derived from natural gas and coal. Although bio-fuels production has been growing exponentially, world liquids production has probably passed peak in 2008 at 85.47 mbd as shown below. In 2008, US ethanol production was 0.6 mbd, Brazilian ethanol production was 0.4 mbd, and bio-fuels production outside the US and Brazil was 0.5 mbd.

Processing gains arise at refineries when crude oil is processed into products which have a lower density causing an increase in volume when measured in barrels. Processing gains are proportional to the volume of the crude oil inputs. In 2008, the IEA estimated that processing gains were 2.2 mbd, excluding gains from China and non-OECD Europe. As crude oil and condensate peaked in 2005, it is expected that future contributions from processing gains will decrease.

Production from gas to liquids (GTL) and coal to liquids (CTL) has been increasing but from a very small base and remains negligible. GTL is about 0.10 mbd in 2009 and is expected to increase to 0.27 mbd by the end of 2012. CTL is about 0.20 mbd in 2009 and should increase only marginally by the end of 2012. Liquids production from GTL and CTL has significant energy losses and high carbon dioxide emissions implying that it is probably preferable to directly burn the gas and coal to produce electricity.

As production from bio-fuels, oil sands and natural gas plant liquids increase there is a slight chance that world liquids production in 2010 might be close to its 2008 peak. However, given the suspension of many crude oil and oil sands projects, it is likely that future world liquids production will stay below its 2008 peak and that the world urgently needs to adopt policies to reduce consumption and focus on alternative energy sources.

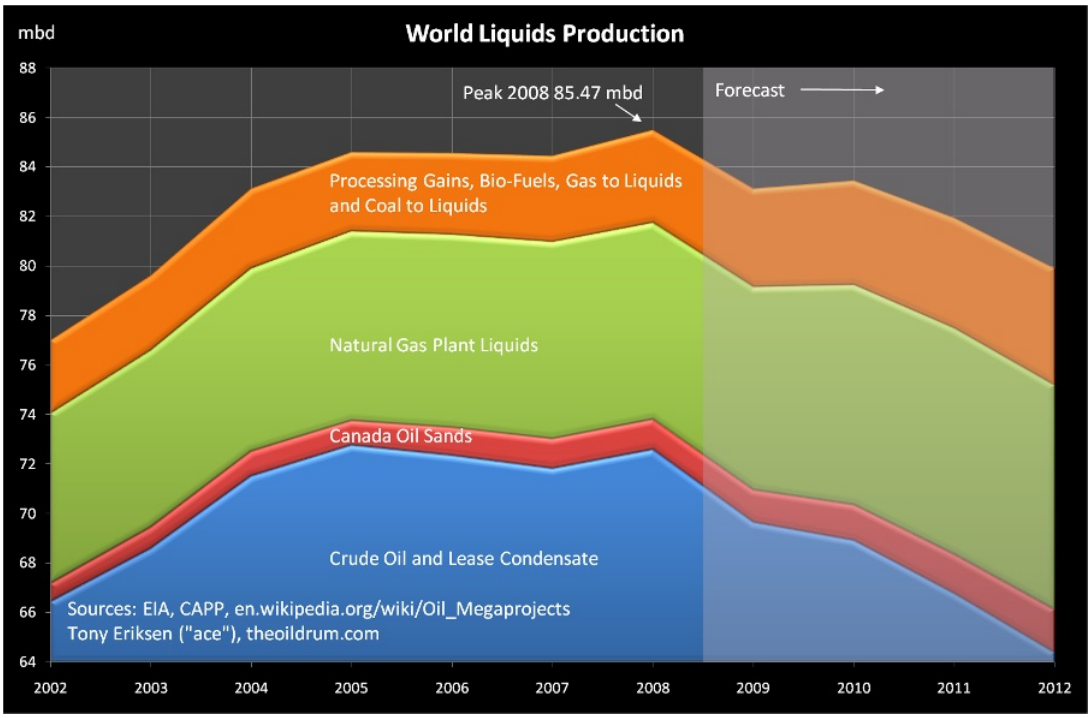
In contrast, the IEA WEO 2008 forecasts that total liquids production will increase steadily to 106.4 mbd in 2030, excluding bio-fuels. Similarly, the ExxonMobil Energy Outlook 2008 forecasts total liquids to be 108 mbd by 2030, including bio-fuels. Even these two forecasts have now been cast in doubt as Cambridge Energy Research Associates (CERA) have stated this month that, due mainly to the credit crisis and low oil prices causing significant oil project delays, world liquids production could be reduced by almost 8 mbd in five years. In five years, the production forecasts of both IEA and ExxonMobil indicate 93 mbd, including bio-fuels. Consequently, both of these forecasts are now revised down to 85 mbd in five years, adjusted for CERA's supply reduction, which is less than the 2008 peak.

As the production forecasts by the IEA and ExxonMobil are primarily demand derived forecasts, rather than supply based, it is only a matter of time until the IEA and ExxonMobil, as well as CERA, admit that world liquids production peaked in 2008. OPEC also uses a demand derived forecast which predicted total liquids production of 117.6 mbd in 2030 in their World Oil Outlook 2007 which stated the underlying logic on page 24:

> A central tenet of the OPEC long-term supply perspective assessment is that resources

> are sufficient to meet future demand. The resource base, as defined by estimates from the US Geological Survey (USGS) of ultimately recoverable reserves (URR), does not constitute a constraint to supplying the rising levels of oil demanded in the reference case...so supply projections are, by definition, plausible from the resource perspective.

In other words, first, OPEC forecasts the future oil demand to 2030 based on a 3.5% annual economic growth rate and second, assumes that future oil production will be equal to the demand because of the huge increase in the world reserve base suggested by this USGS World Petroleum Assessment 2000 report. In Jean Laherrere's analysis, he said that this USGS report was misleading and that the USGS claimed reserves growth was excessive. Similarly, Colin Campbell stated in his response that it "is ironic that OPEC puts out excessive numbers to discourage western investments in renewables, energy saving etc, and the US does the same thing to try to undermine OPEC's confidence."



World Liquids Production to 2012 - *click to enlarge*

Source for historical world liquids data (EIA).

Life after Peak Oil

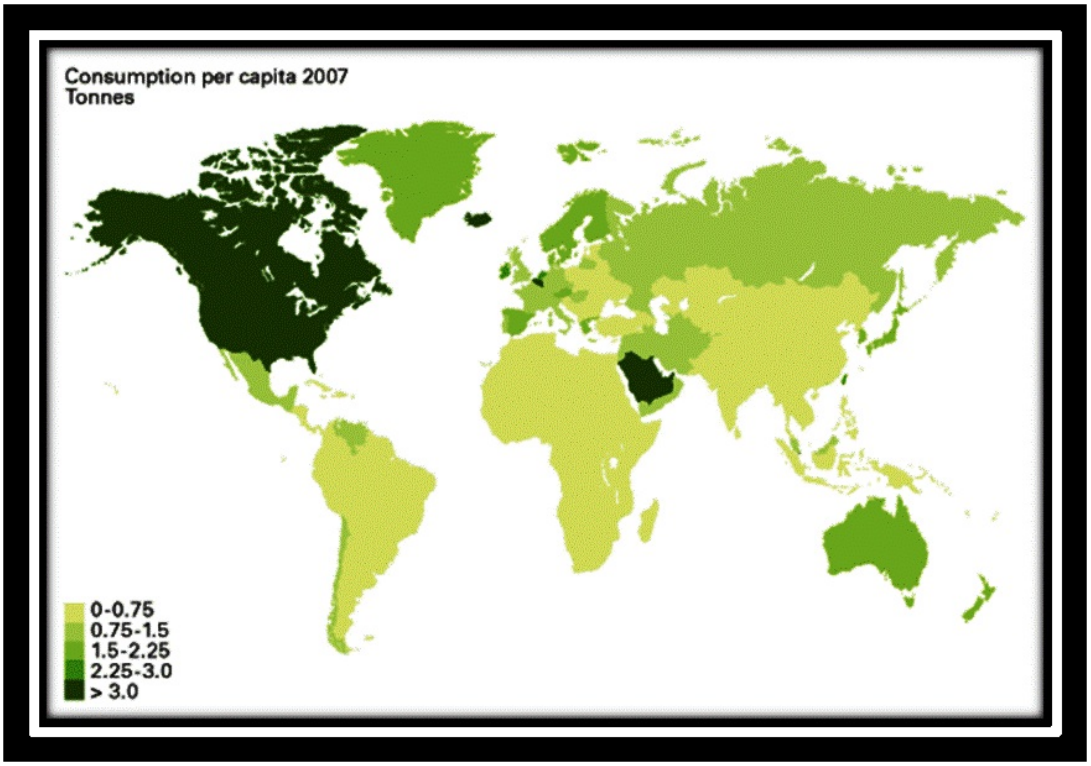
As oil production declines, consumption must also decline. Consequently, action must be taken to reduce oil consumption and switch to alternative energy sources such as electricity from the wind and the sun. This recent Oil Drum story proposes many oil conservation ideas for individuals such as moving to a walkable neighbourhood and trading in your car for one with better mileage.

The IEA has recently published some recommendations to improve energy efficiency which apply not just to individuals but also to industry. For example, in the transport sector, the IEA is

encouraging the use of fuel efficient tires and introducing mandatory fuel efficiency standards for light duty vehicles. In addition, this IEA document, called Energy Efficiency Policy, also encourages energy efficiency by providing links to almost 30 documents containing energy efficiency policies. One of these documents called Saving Oil in a Hurry suggests many conservation actions including increased use of public transit, car-pooling, telecommuting and speed limit restrictions. For further information, the IEA has its own energy efficiency web page.

If there are sudden future oil supply shortages due to events such as natural disasters or acts of terrorism, the IEA has a rationing agreement which applies only to IEA OECD member countries. As there is no global energy agency, non OECD countries such as China and India do not have to comply with the IEA rationing method. The IEA has been encouraging China and India to become members but this is highly unlikely until the IEA's rationing method is based upon oil consumption by person rather than by country.

The map below shows oil consumption per person in 2007 and also indicates the high consumption per person of the oil importing country USA. In 2007, the USA consumed twelve times more oil per person than China and in 2008, using recent data, this ratio was just under eleven. In 2009, USA consumption is forecast to fall further while China's consumption is forecast to increase, according to EIA forecasts. This implies that the USA will consume just over ten times more oil per person than China in 2009.



Annual World Oil Consumption per Capita in 2007 *- click to enlarge*

Source: BP - Oil Consumption.

As oil production declines, countries such as India and China will probably increase focus on ensuring their own future oil supplies. India now has the world's largest refinery complex, ahead of Venezuela, which can process heavy sour crude oil. China has been taking advantage of low oil

prices and credit constraints to secure future oil supplies from Russia, Venezuela and Iran. Once global economic growth returns causing increased oil demand, there is a risk that oil importing countries could act aggressively for their own self interests rather than cooperating to manage oil consumption in the context of declining world oil production.