The Oil Drum
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

Tech Talk - New Energy Report from Harvard Makes Unsupportable Assumptions

Posted by Heading Out on July 2, 2012 - 11:56am
Topic: Supply/Production
Tags: bakken, bp, crude oil production, eagle ford shale, harvard, iraq, russian production, united states [list all tags]

The Tech Talks of the last few months have followed a path of looking in a relatively realistic manner at crude oil production with emphasis on that coming from the United States and Russia, as well as Saudi Arabia, the current focus of my weekly pieces. An earlier piece looked at a Citigroup report of considerable optimism, and the post explained why, in reality, it is impractical to anticipate much increase in US production this decade. Since then, after reviewing the production from Russia, several posts have shown why the current lead in Russian daily crude oil production is likely to be soon over and then decline, as the oil companies are not bringing new fields on line as fast as the old ones are running out. Saudi Arabia, as the current posts are in the process of explaining, is unlikely to increase production much beyond 10 mbd, since Ghawar, the major field on which its current production level is built, is reaching the end of its major contribution, though it will continue to produce at a lower rate into the future. The bottom line, at least to date, is that there is no evidence from the top three producers that their production will be even close, in total, to current levels by the end of the decade.

So, (h/t Leanan) there now comes an Energy Study from Harvard which boldly states that this is rubbish - that by 2020, global production will be at 110.6 mbd and these concerns that most of us have at The Oil Drum (inter alia) are chimeras of the imagination.

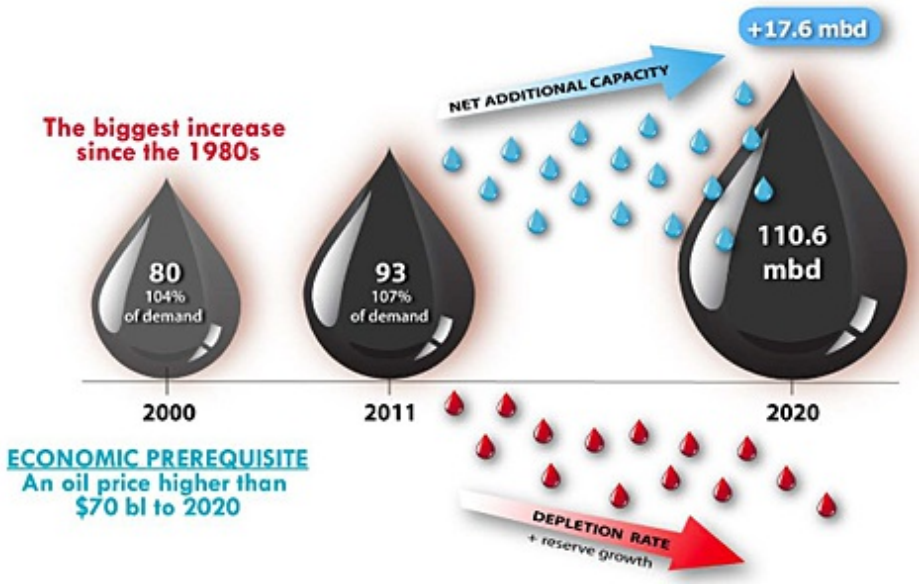

Figure 1. Anticipated Growth in global oil production by the end of the decade (Maugeri, Leonardo. "Oil: The Next Revolution" Discussion Paper 2012-10, Belfer Center for Science and International Affairs, Harvard Kennedy School, June 2012.)

It is therefore pertinent to begin with examining where the study (which was prepared with BP assistance) anticipates that the growth in supply will come from.

That too is shown as a plot:

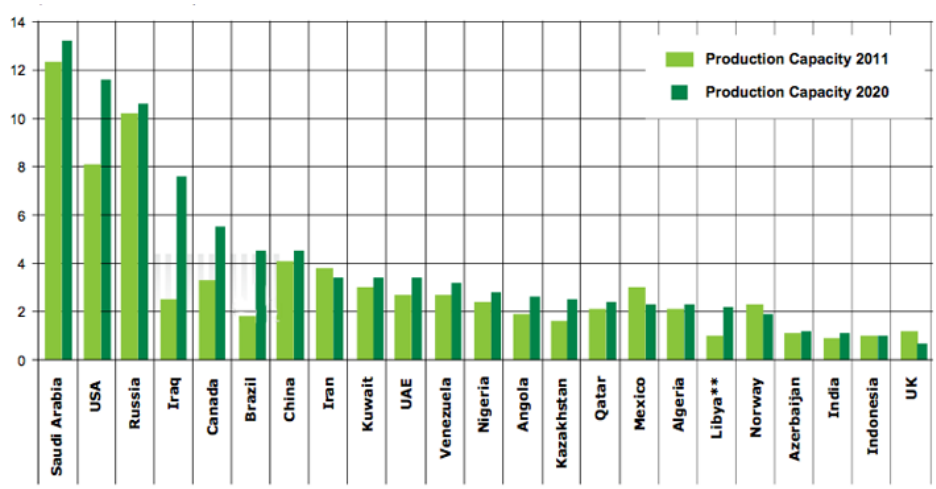

Figure 2. Anticipated sources of the growth in global production by 2020 (showing only the top 23 producers). ((Maugeri, Leonardo. "Oil: The Next Revolution" Discussion Paper 2012-10, Belfer Center for Science and International Affairs, Harvard Kennedy School, June 2012.)

It is instructive, in reading this plot, to first recognize that it is a plot of anticipated production capacity rather than projected actual production. The reason for this can perhaps be illustrated by an example. Within the current production capacity that Saudi Arabia claims adds up to 12 mbds, is the 900 kbd that will come from Manifa as it is further developed and comes on line within the next few years. However, at that time. the increase in production will, to some degree, offset the declines in existing wells and producing fields that will become more severe as more existing horizontal wells water out. Manifa is not currently in significant production, and is unlikely to be at such a level for at least another 18 months, with production being tied to the construction of the two new refineries being built to handle the oil. It is not, therefore, a currently instantaneously available source of oil. At a relatively normal 5% per year decline in production from existing fields, Saudi Arabia will have to bring on line (and sustain) at least 500 kbd per year of new production. While it is likely that it can do this for a year or two more, betting that it will be able to do this plus raise production 2 mbd or more in 2020 is on the far side of optimistic. Just because a reserve exists does not mean that it can be brought on line without the physical facilities in place to produce it.

It is interesting, however, to note the report's view on field declines in production:

> Throughout recent history, there is empirical evidence of depletion overestimation. From 2000 on, for example, crude oil depletion rates gauged by most forecasters have ranged between 6 and 10 percent: yet even the lower end of this range would involve the almost complete loss of the world's "old" production in 10 years (2000 crude production capacity = about 70 mbd). By converse, crude oil production capacity in 2010 was more than 80 mbd. To make up for that figure, a new production of 80 mbd or so would have come on-stream over that decade. This is clearly untrue: in 2010, 70 percent of crude oil production came from oilfields that have been producing oil for decades. As shown in Section 4, my analysis indicates that only four of the current big oil suppliers (big oil supplier = more than 1 mbd of production capacity) will face a net

> reduction of their production capacity by 2020: they are Norway, the United Kingdom, Mexico, and Iran. Apart from these countries, I did not find evidence of a global depletion rate of crude production higher than 2-3 percent when correctly adjusted for reserve growth.

Sigh! I explained last time that with the change in well orientation from vertical to horizontal, that there was a change in the apparent decline rates. When the wells run horizontally at the top of the reservoir, they are no longer reduced in productive length each year as vertical wells are, because the driving water flood slowly fills the reservoir below the oil as it is displaced. This does not mean that because the apparent decline rate from the well has fallen that it will ultimately produce more oil.

The amount of oil in the region tapped by the well is finite, and when it is gone it is gone, whether from a vertical well that shows gradual decline with time, or from the horizontal well that holds the production level until the water hits the well and it stops. I am not sure that the author of the report understands this.

The point concerning support logistics is critical in a number of instances. The political difficulties in increasing production from the oil sands in Alberta, through constraints on pipeline construction either South or West, are at least as likely to restrict future growth of that deposit as any technical challenge.

The four countries that the report sees contributing most to future oil supplies are (in the ranked order) Iraq. the United States, Canada, and Brazil. For Iraq, he sees production possibly coming from the following fields within the next eight years.

Field	Foreign Companies *(Share)*	Production Target *(initial production)*
Rumaila	BP (38%) CNPC (37%)	2,850,000 *(1,100,000)*
West Qurna 1	Exxon (60%) Shell (15%)	2,350,000 *(270,000)*
Zubair	Eni (32.8) Occidental (23.5%) Kogas (18.75)	1,200,000 *(200,000)*
Missan fields**	CNOOC (63.75%) TPAO (11.25%)	450,000 *(100,000)*
Majnoon	Shell (45%) Petronas (18.75%)	1,800,000 *(50,000)*
West Qurna 2	Lukoil (56.25%) Statoil (18.75)	1,800,000 *(120,000)*
Halfaya	CNPC (37.50%) Petronas (18.75%) Total (18.75%)	535,000 *(70,000)*
Gharaf	Petronas (45%) Japex (30%)	230,000 *(35,000)*
Badra	Gazprom (30%) Kogas (22.5%) Petronas (15.5%) TPAO (7.5%)	170,000 *(15,000)*
Qaiyarah	Sonangol (75%)	120,000 *(20,000)*
Najmah	Sonangol (75%)	110,000 *(20,000)*
Total Production Targets * (Current capacity)*		11,615,000 *(2,000,000)*
Iraq Total Current Capacity* **		**2,800,000**

**Excluding the Kurdish Region*
***Includes the Fakka, Buzurgan* and *Abu Ghirab fields*

Figure 3. Anticipated production gains in Iraq in the next eight years. (Maugeri, Leonardo. "Oil: The Next Revolution" Discussion Paper 2012-10, Belfer Center for Science and International Affairs, Harvard Kennedy School, June 2012.)

I understand that one ought to show some optimism at some point over Iraq, but it has yet to reach the levels of production that it achieved before the Iran/Iraq War, and that was over some time ago. The EIA has shown that it is possible to get a total of over 13 mbd of production, but it requires investment and time, and some degree of political stability in the country. That is still somewhat lacking. Prior to that war, Iraq was producing at 3.5 mbd, the production curve since then has not been encouraging:

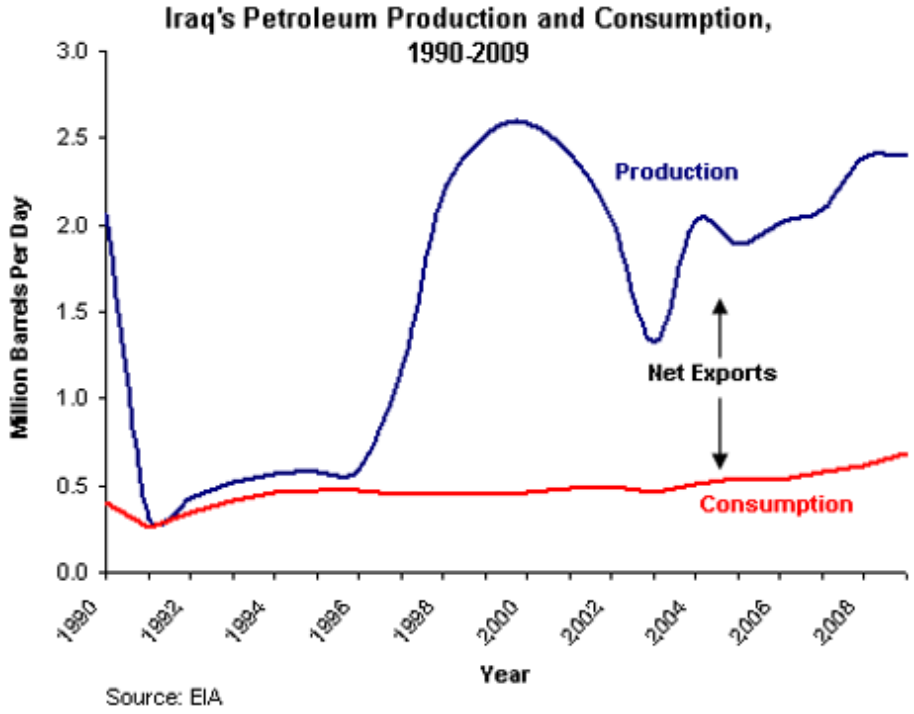

Figure 4. History of Iraqi Production since the start of the Iran:Iraq War. (Source: EIA)

Recognizing that the country has problems, the report still expects that there will be a growth in production of some 5.125 mbd by the end of the decade. This appears to be a guess as to being some 50% of the 10.425 mbd that the country could potentially achieve.

As for US production, this is tied to increasing production from all the oil shales in the country, which will see spurts in growth similar to that seen in the Bakken and Eagle Ford.

> I estimate that additional unrestricted production from shale/tight oil might reach 6.6 mbd by 2020, or an additional adjusted production of 4.1 mbd after considering risk factors (by comparison, U.S. shale/tight oil production was about 800,000 bd in December 2011). To these figures, I added an unrestricted additional production of 1 mbd from sources other than shale oil that I reduced by 40 percent considering risks, thus obtaining a 0.6 mbd in terms of additional adjusted production by 2020. In particular, I am more confident than others on the prospects of a faster-than-expected recovery of offshore drilling in the Gulf of Mexico after the Deepwater Horizon disaster in 2010.

As I noted in my review of the Citicorp report this optimism flies in the face of the views of the DMR in North Dakota – who ought to know, since they have the data. The report further seems a little confused on how horizontal wells work in these reservoirs. As Aramco has noted, one cannot keep drilling longer and longer holes and expect the well production to double with that increase

in length. Because of the need to maintain differential pressures between the reservoir and the well, there are optimal lengths for any given formation. And as I have also noted, the report flies in the face of the data on field production from the deeper wells of the Gulf of Mexico.

It seems pertinent to close with the report's list of assumptions on which the gain in oil production from the Bakken is based:

> *A price of oil (WTI) equal to or greater than $ 70 per barrel through 2020
>
> *A constant 200 drilling rigs per week;
>
> *An estimated ultimate recovery rate of 10 percent per individual producing well (which in most cases has already been exceeded) and for the overall formation;
>
> *An OOP calculated on the basis of less than half the mean figure of Price's 1999 assessment (413 billion barrels of OOP, 100 billion of proven reserves, including Three Forks).
>
> Consequently, I expect 300 billion barrels of OOP and 45 billion of proven oil reserves, including Three Forks;
>
> *A combined average depletion rate for each producing well of 15 percent over the first five years, followed by a 7 percent depletion rate;
>
> *A level of porosity and permeability of the Bakken/Three Forks formation derived from those experienced so far by oil companies engaged in the area.
>
> Based on these assumptions, my simulation yields an additional unrestricted oil production from the Bakken and Three Forks plays of around 2.5 mbd by 2020, leading to a total unrestricted production of more than 3 mbd by 2020.

Enough, already! There are too many unrealistic assumptions to make this worth spending more time on. To illustrate but one of the critical points - this is the graph that I have shown in earlier posts of the decline rate of a typical well in the Bakken. You can clearly see that the decline rate is much steeper than 15% in the first five years.

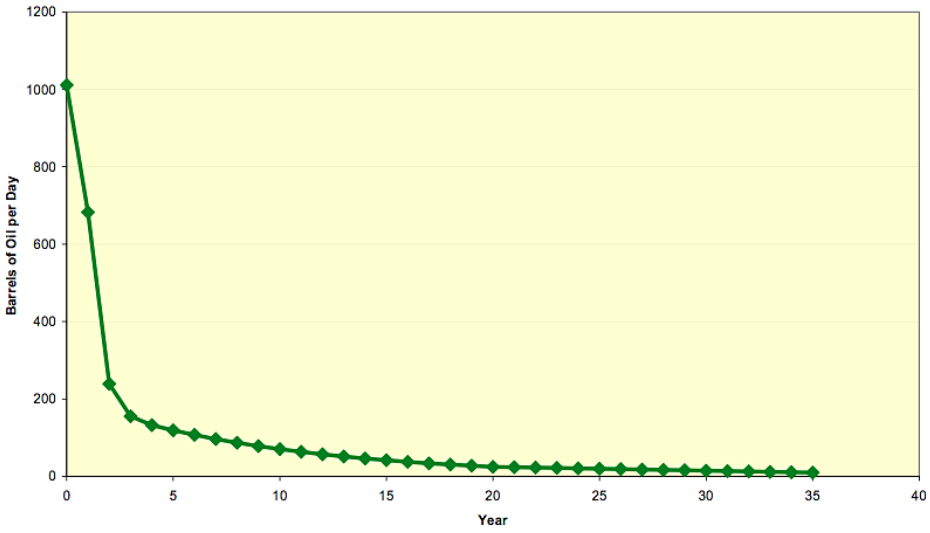

Figure 5. Typical Bakken well production (ND DMR)

Oh, on a related note, the Alaskan pipeline was running at an average of 571,462 bd in May.