

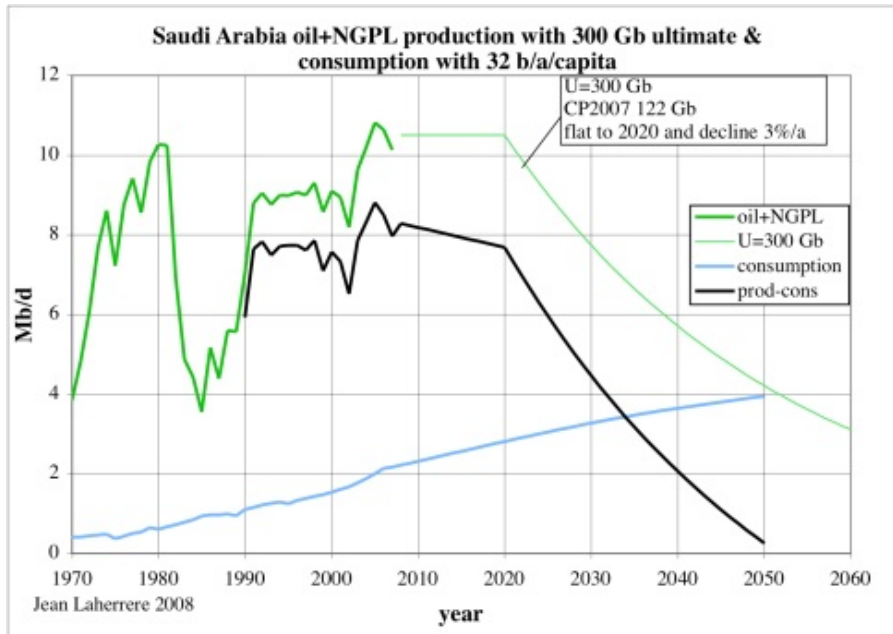


Forecasts on Saudi Arabia liquids production

Posted by [Luis de Sousa](#) on July 29, 2008 - 9:45am in [The Oil Drum: Europe](#)

Topic: [Geology/Exploration](#)

Tags: [aramco](#), [colin campbell](#), [jean laherrère](#), [matthew simmons](#), [sadam al-husseini](#), [saudi arabia](#) [[list all tags](#)]



This is a guest post by [Jean Laherrère](#)

Acronyms

CP – Cumulative Production

U – Ultimate (Recoverable Reserves)

1P- Proven Reserves (95% probability of being produced)

2P – Proven + Probable Reserves (50% probability of being produced)

3P – Proven + Probable + Possible Reserves (5% probability of being produced)

E&P – Exploration and Production

Introduction

Reserves reporting in Saudi Arabia (SA), being unaudited as all OPEC reserves, are mainly political as confirmed by Sadad al Husseini (former VP of Aramco) with the 300 Gb referenced by OPEC being just a speculative number and not a proved one. Field production data are confidential, except for a few publications by Aramco to reply at Matt Simmons book "[Twilight In The Desert](#)".

IHS is obliged to follow Aramco's reporting and has increased cumulative oil discovery from 313 Gb in 2004 to 395 Gb in 2006. It is difficult to check field reserves estimates with oil declines,

because of production quotas and incomplete data, except for Abqaiq which was reported by the end of 2003 as being 73 % depleted (CP = 11.8 Gb or U = 16 Gb) .

Abqaiq's oil ultimate is about 15 Gb when calculated from the decline profile, when Baqi reported 16 Gb in 2004, Saleri 17 Gb in 2007 with wishful EOR. IHS reports 18 Gb (30 Gb OIP) in 2008 (plus 0,5 Gb condensate), but in 1993 was reporting 15 Gb. Old data (before the quotas fight) seem more reliable.

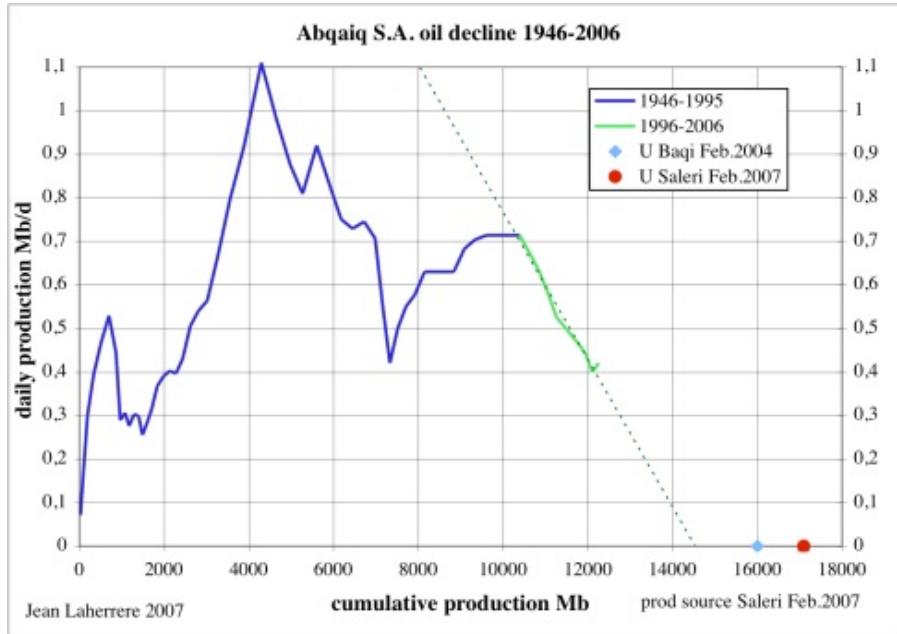


Figure 1: Abqaiq oil decline 1946-2006.

Old and new estimates

In the book *Aramco and its world* published by Aramco in 1980 before nationalisation, Saudi Arabia proved reserves were reported to be 113 Gb and probable reserves 65 Gb, with cumulative production by the end of 1979 being 38 Gb. 2P discovery was 216 Gb for Aramco in 1979. Since then, discovery have been negligible, as shown by the creaming curve (cumulative discoveries versus the cumulative number of New Field Wildcats - NFW). The first 40 NFW (1935-1968) found 360 Gb in 22 fields while the last 40 NFW (1994-2007) found only 6 Gb with 33 fields! From IHS data, the oil ultimate is about 400 Gb and natural gas ultimate about 65 Gboe (= 400 Tcf). Recent natural gas exploration by IOCs has been dry (6 NFW) and Total has withdrawn.

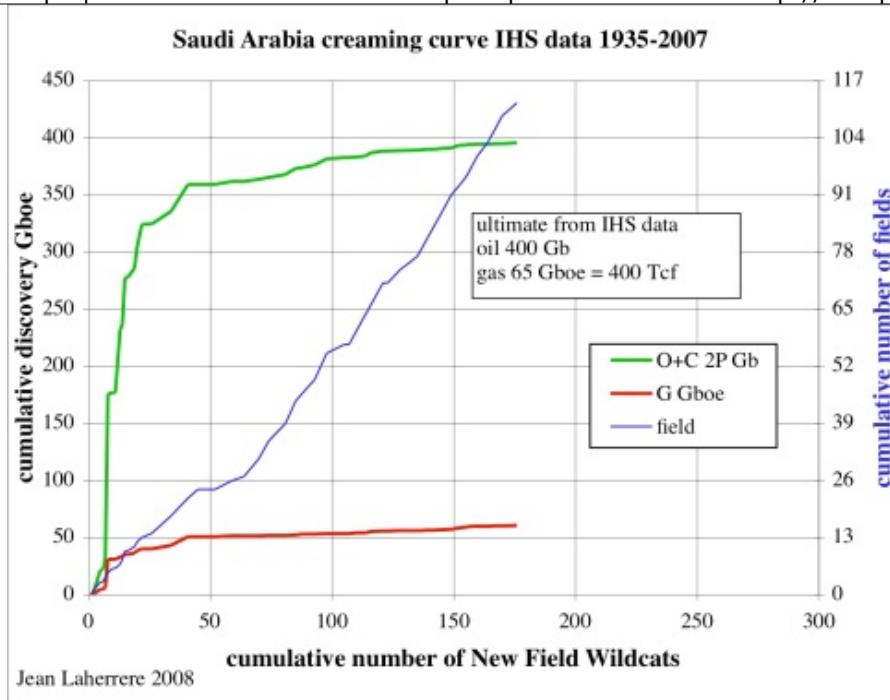


Figure 2: Saudi Arabia oil & gas creaming curve from IHS data 1935-2007.

Aramco (Baqi & Saleri 2005) reported as of end 2003:

- cumulative production (CP) = 99 Gb,
- remaining 1P = 260 Gb,
- 2P = 292 Gb,
- 3P = 363 Gb and
- contingent resources 238 Gb

All of this for an oil in place of 700 Gb. Saleri seemed to have forgotten that contingent resources are potentially producible one day and he assumes that all oil will be produced without leaving one drop in the ground (!) when the range is from 99% to 5%.

Aramco discovery as of end 2003 is then 2P 391 Gb, giving an increase from the 1980 estimate of +175 Gb, mainly for political reasons, because of the quotas fight.

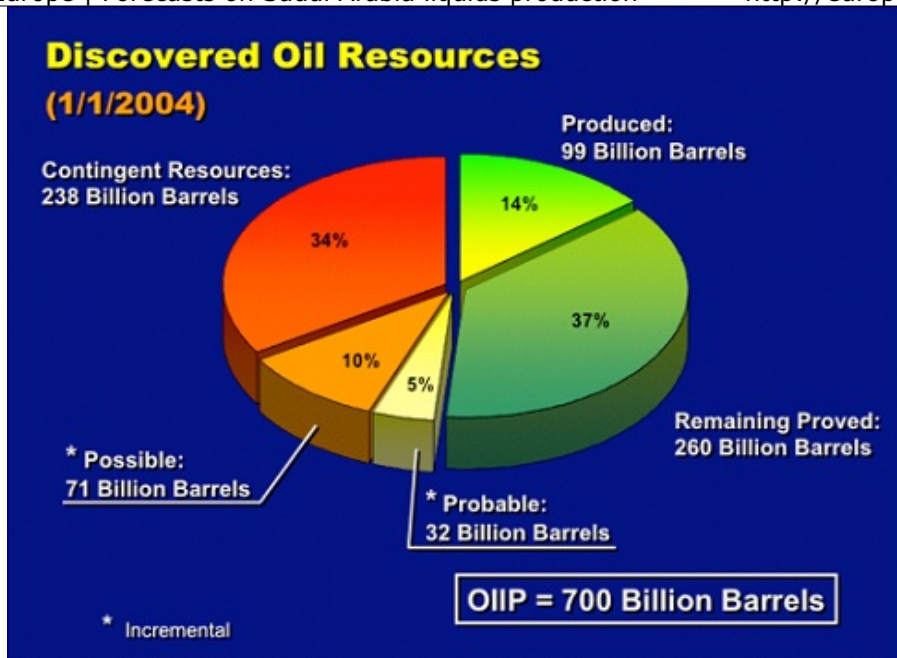


Figure 3: Aramco (Baqi & Saleri) reserves as of end 2003.

IHS was obliged to accept Aramco's field estimates and reports 396 Gb at the end 2007 . But Sadad al-Husseini (VP of E&P) when retired in 2007 stated that the 300 Gb proved reserves increase from 1985 to 1990 by OPEC are based on speculative resources and that Saudi Arabia's increase in 1990 was 90 Gb. In 1980 Aramco's 2P reserves were about reported 1P.

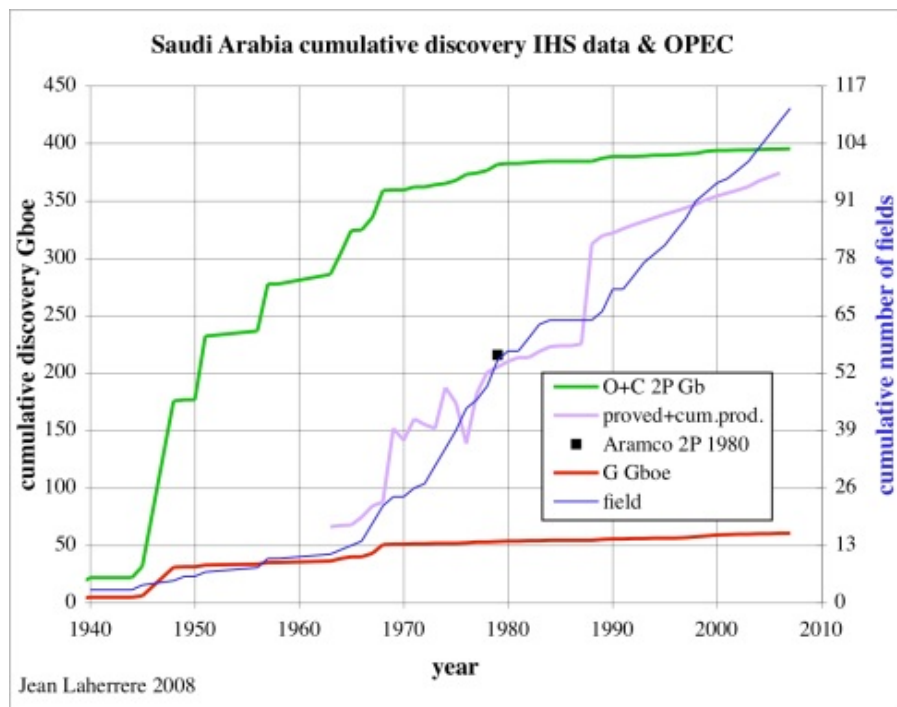


Figure 4: Saudi Arabia oil cumulative discovery and remaining plus produced.

What is the real ultimate?

Colin Campbell estimates Saudi Arabia's ultimate to be at 275 Gb. Production linearization is not reliable, ranging from 180 Gb to infinite depending on the selected period. The plot is linear only if the pattern is logistic but this is not the case because of above and below ground conditions.

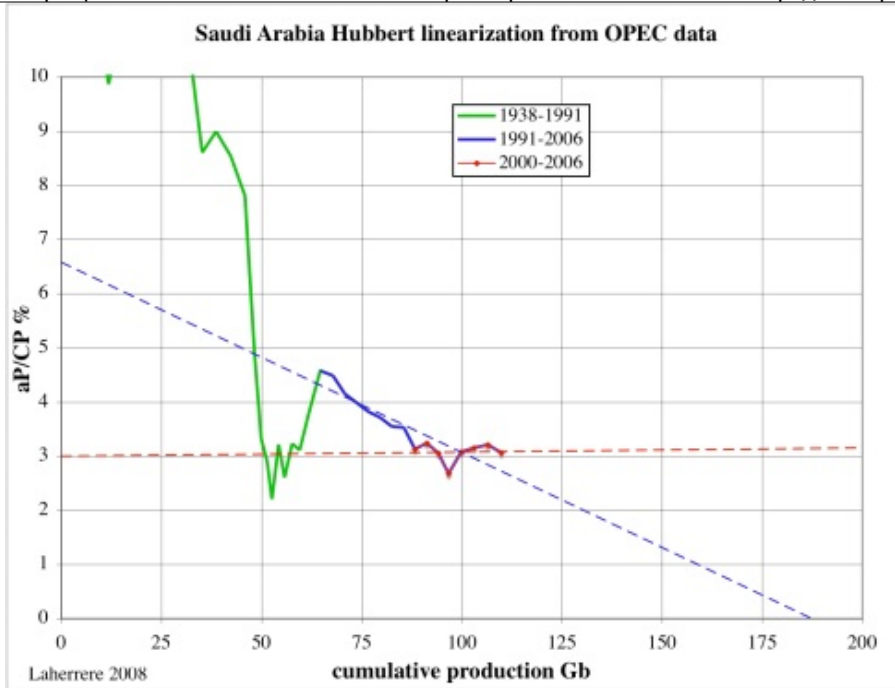


Figure 5: Hubbert Linearization from OPEC production data.

Oil production seems to have been pushed very hard with new drilling. The comparison between oil production and number of rigs seems to show that oil production is at the peak, despite that the new drilling could be the redevelopment of fields like Khurais and Khusanyah.

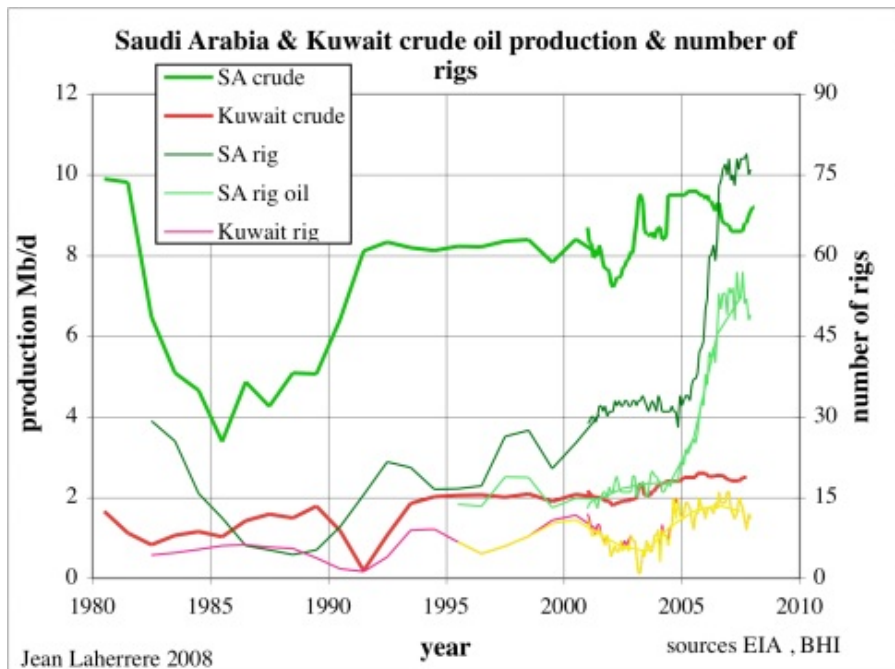


Figure 6: Saudi Arabia and Kuwait oil production and number of rigs.

Anyway King Abdallah has declared that, if new fields are discovered, they will be kept for the next generation.

I am inclined to choose 250 Gb for the oil ultimate with 110 already produced as of end 2006. Colin's 275 Gb seems optimistic and the maximum is 300 Gb, far from IHS 400 Gb.

But there are also NGL (natural gas liquids, reported as natural gas plant liquids by USDOE/EIA) and it is hard to forecast NGL production which increases more than crude oil because it is outside

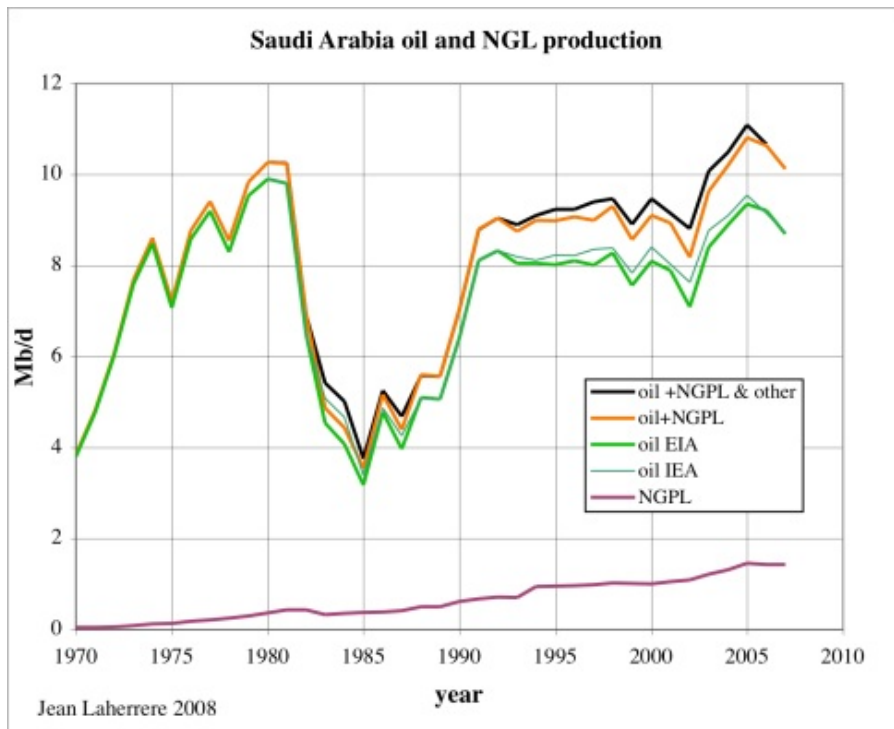


Figure 7: Saudi Arabia Crude Oil and NGL production.

Natural gas (NG) production data varies with sources. The ratio Mb NGPL to Tcf NG seems stable at 200 Mb per Tcf during the last 20 years.

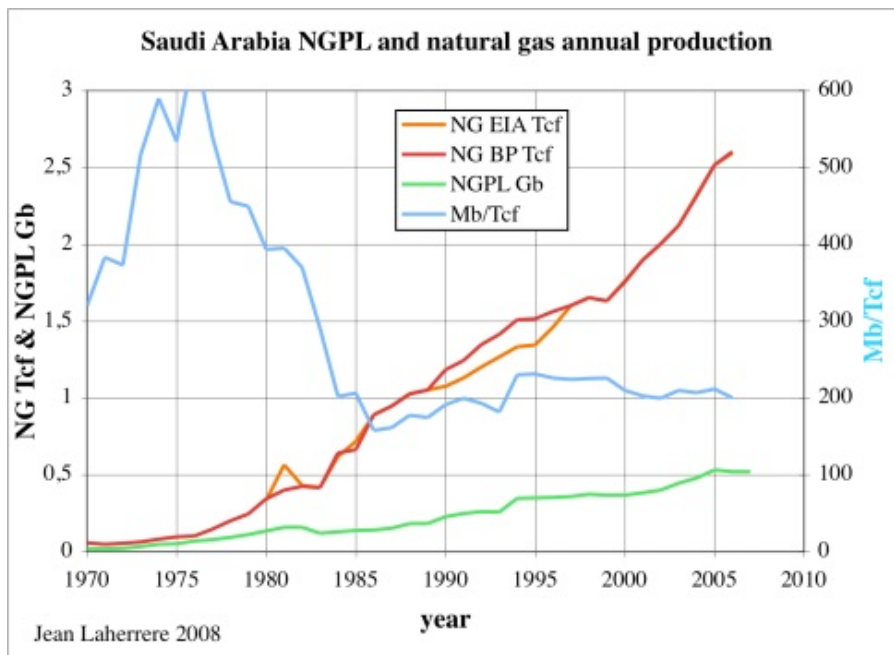


Figure 8: Saudi Arabia NG and NGPL production.

If the NG ultimate is 400 Tcf (assuming no overestimation as for oil because there's no quotas), the NGPL ultimate is about 80 000 Mb (400 x 200) or 80 Gb. The ultimate for Oil + NGL could be about 250 Gb + 80 Gb, rounded to 300 Gb.

Crude Oil+NGL production (CP 2007 = 122 Gb) is plotted assuming a plateau up to 2020 and a decline of 3%/a after 2020 with a 300 Gb ultimate, but the big problem is domestic oil

The Oil Drum: Europe | Forecasts on Saudi Arabia liquids production <http://europe.theoil Drum.com/node/4299>
 consumption which is increasing with population. The oil consumption estimated in Figure 14 is plotted as the volume of production less consumption available for export, which could be zero in 2050.

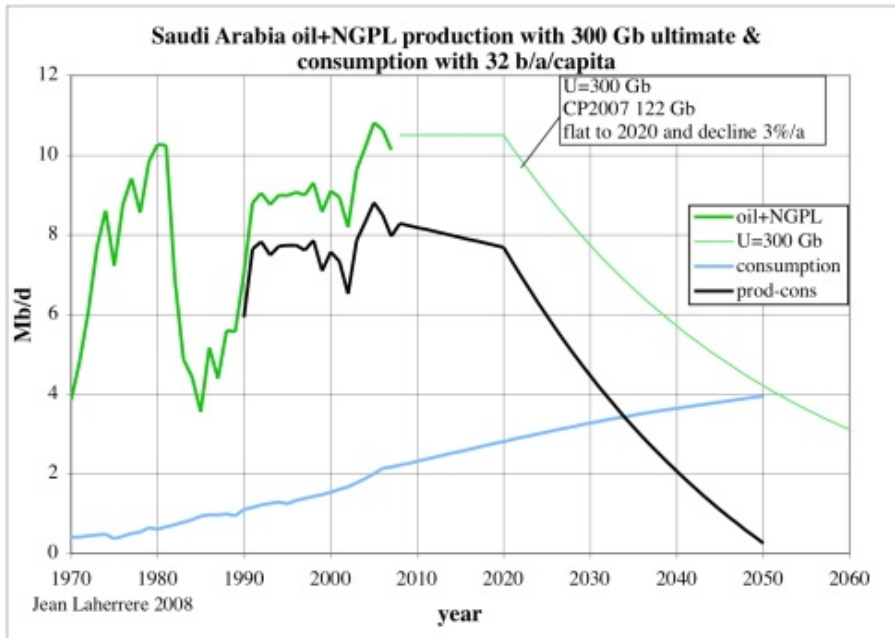


Figure 9: Saudi Arabia oil and NGL production forecast & consumption.

Oil consumption is plotted, estimated from population forecasts (UN 2006, USCB, PRB = population reference bureau) and per capita consumption.

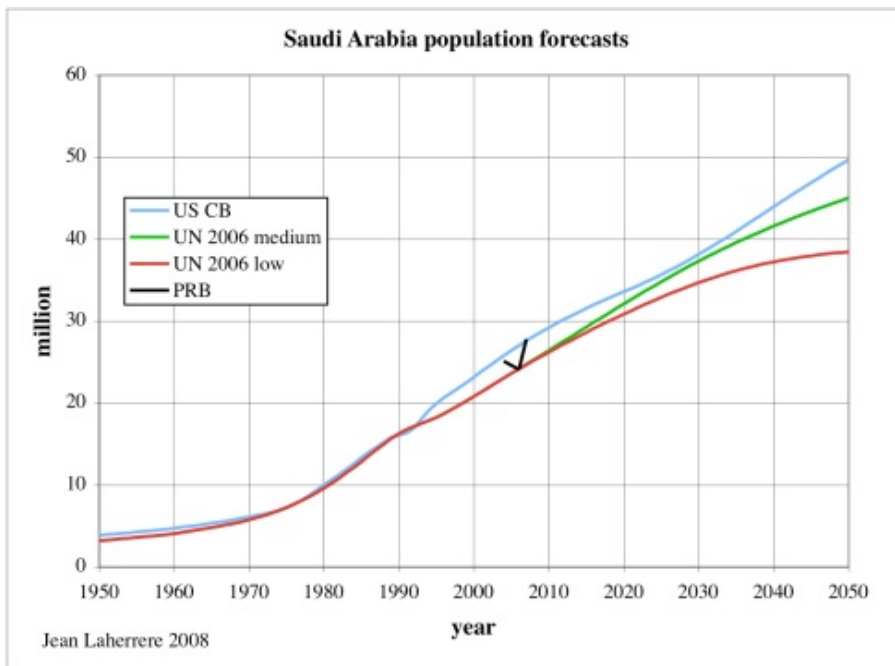


Figure 10: Saudi Arabia population forecasts.

Population forecasts are based on fertility rate forecasts, but Saudi Arabia's fertility rate is badly reported.

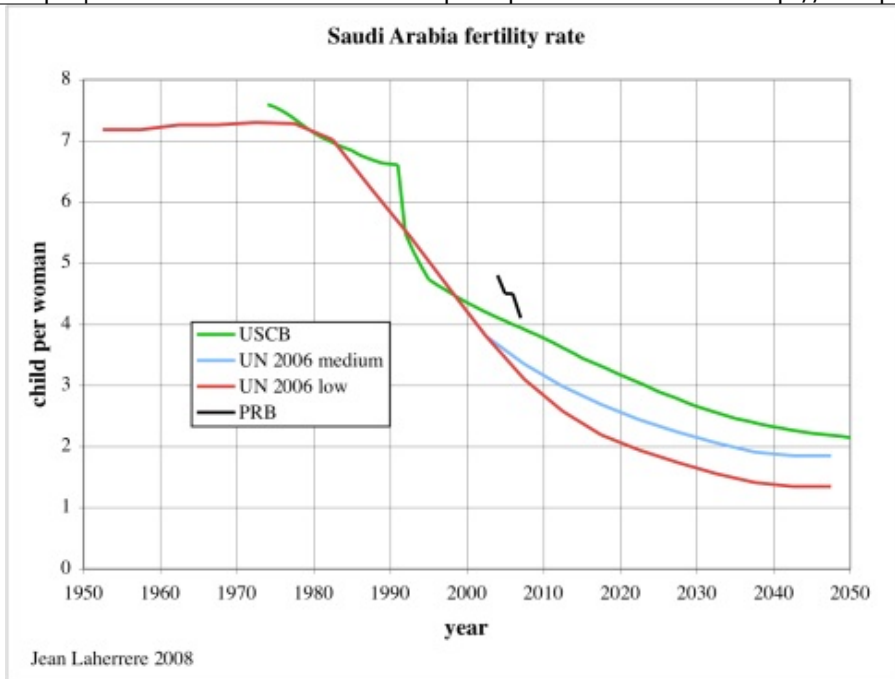


Figure 11: Saudi Arabia fertility rate.

Oil consumption per capita was about 25 annual barrels, but it has increased lately to 32 b because domestic gasoline price is well below the normal price: in 2006 gasoline was 0.16 \$/l compared to a normal price of 0.58 \$/l (USDOE/EIA study).

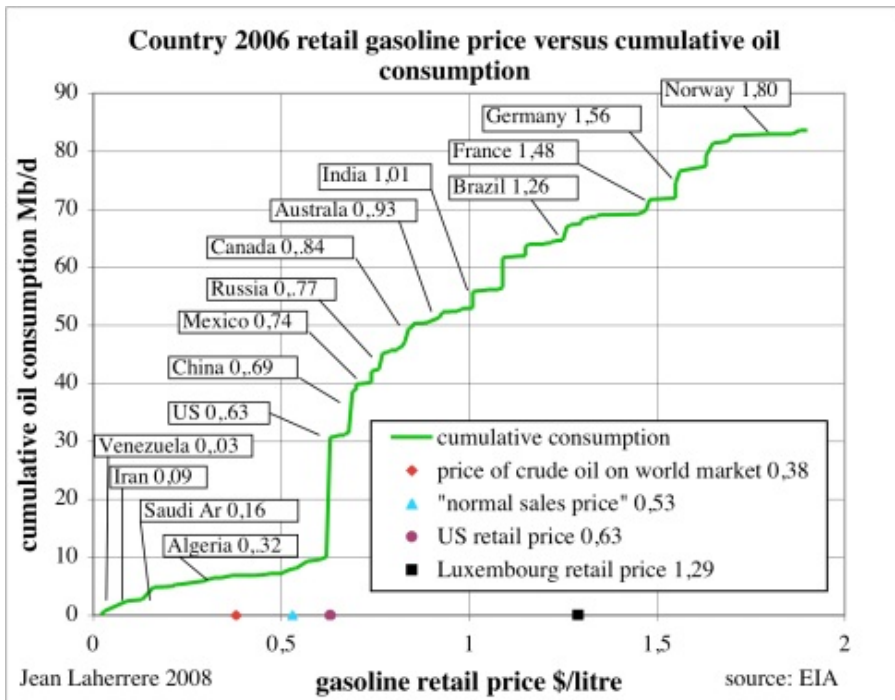


Figure 12: Country by country 2006 retail gasoline price versus cumulative oil consumption.

Oil consumption for the producing countries where gasoline price is well below the normal price increases more than the world's mean, meaning that their exportation will decrease rapidly.

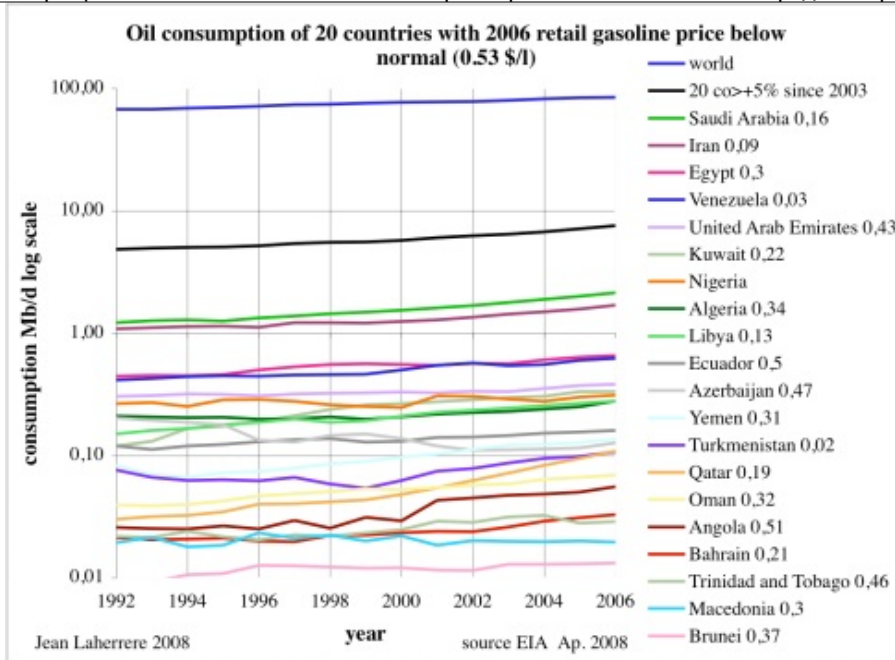


Figure 13: Oil consumption in 20 countries where 2006 retail gasoline price was below normal.

Saudi Arabia domestic oil consumption could reach 4 Mb/d in 2050 if consumption per capita stays at the present ratio of 32 b/a, but it has to decrease because Crude Oil+NGL production will be at this level (Figure 9).

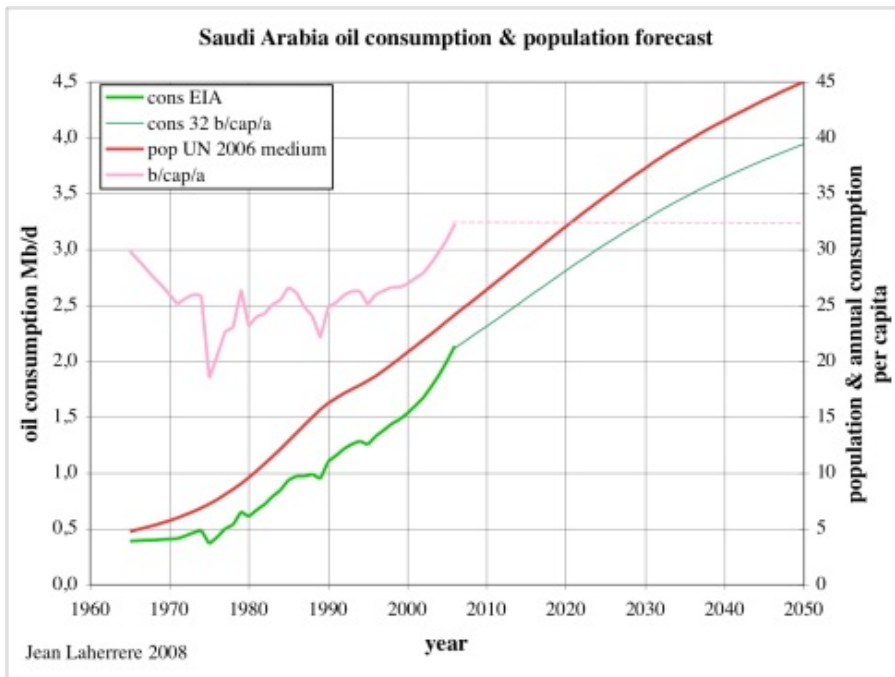


Figure 14: Saudi Arabia oil consumption and population (UN 2006 medium) forecast.

Conclusion

There are many uncertainties in liquids forecasts mainly because of the poor quality of the data for production and population. Saudi Arabia should improve the quality of these data in order to manage the coming crisis. Saudi Arabia could stop exporting oil in 2050 meaning that they will be in trouble to finance their budget.

Furthermore the world needs to know that Saudi Arabia cannot fulfill the wishes of many



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