

### Forecasts on Saudi Arabia liquids production

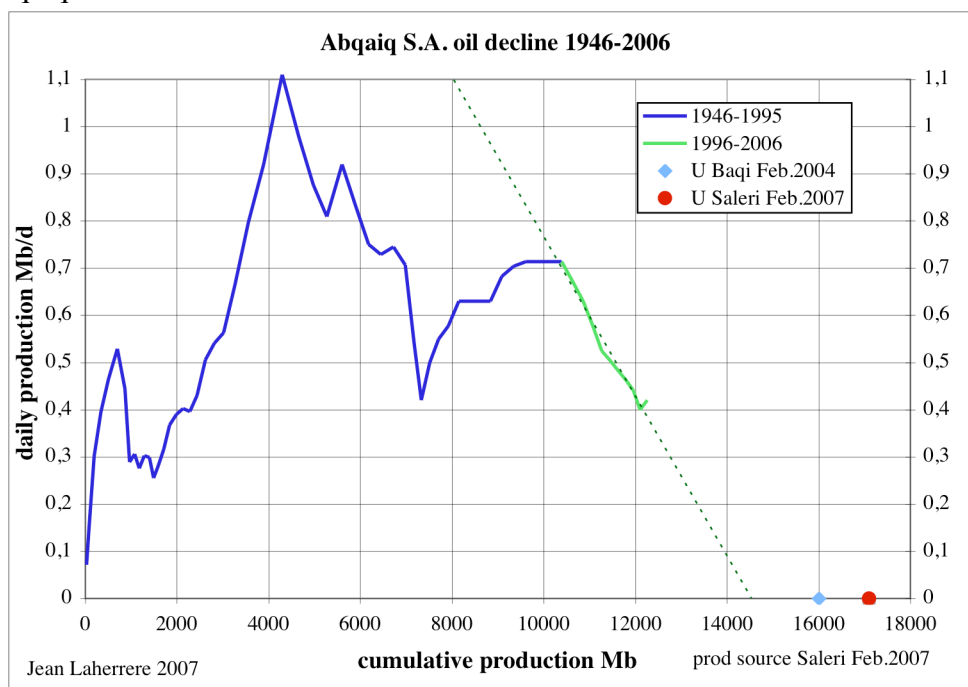
Reserves reporting in Saudi Arabia (SA), being unaudited as all OPEC reserves, is mainly political as confirmed by Sadad al Hussein (former VP Aramco) with 300 Gb OPEC being speculative resources and not proved. Field production data are confidential except few publications by Aramco after Matt Simmons's book

IHS is obliged to follow Aramco reporting and has increased cumulative oil discovery from 313 Gb to 395 Gb from 2004 to 2006

It is difficult to check field reserves estimate with oil decline because quotas and incomplete data, except for Abqaiq which was reported as end 2003 to be 73 % depleted (CP = 11.8 Gb or U = 16 Gb)

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

Figure 1: Abqaiq oil decline 1946-2006

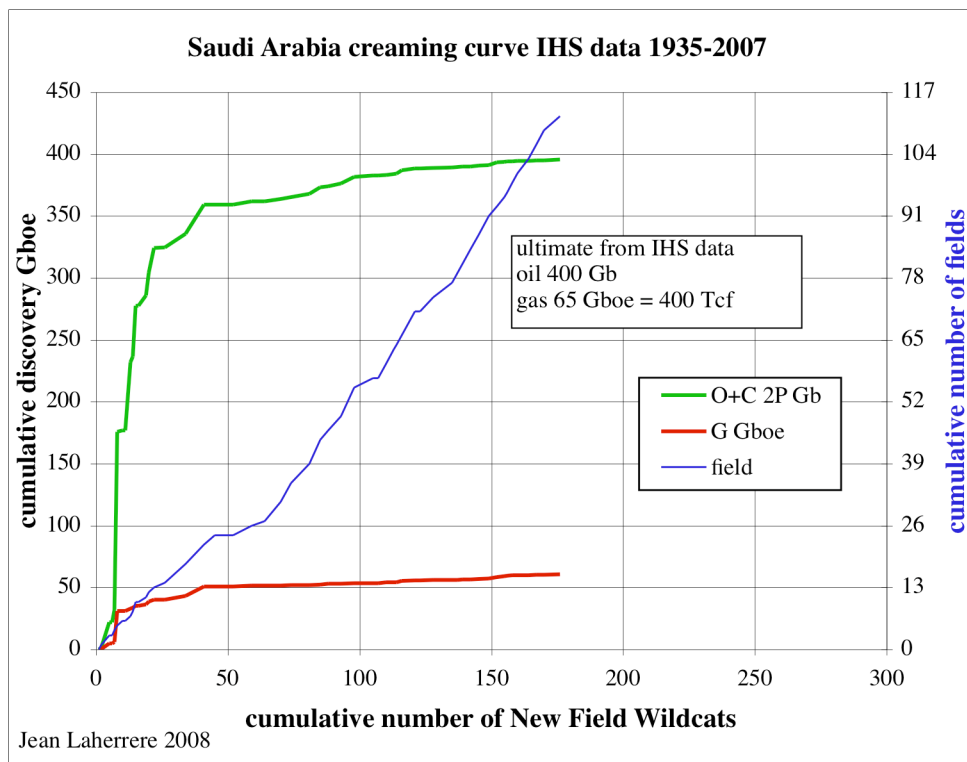


### Old and new estimates

In its book *Aramco and its world* published by Aramco in 1980 before nationalisation, Saudi Arabia proved reserves are reported 113 Gb and probable reserves 65 Gb with cumulative production end 1979 being 38 Gb. 2P discovery were 216 Gb for Aramco in 1979. Since, 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 when the last 40 NFW(1994-2007) found only 6 Gb with 33 fields !

From IHS data 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 Recent natural gas exploration by IOCs has been dry (6 NFW) and Total has withdrawn.

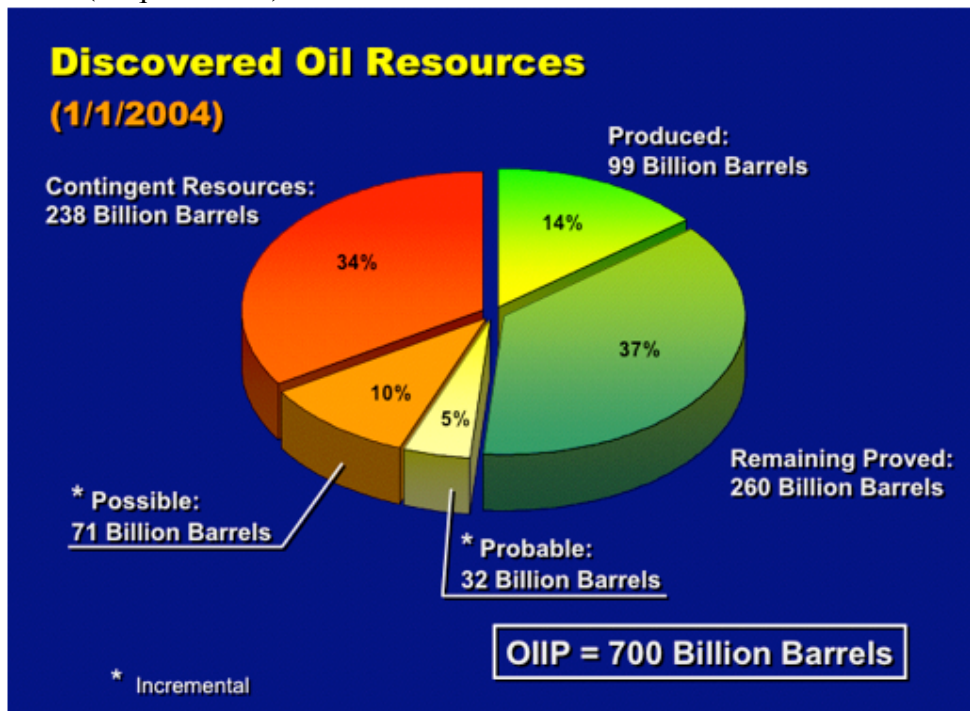
Figure 2: Saudi Arabia oil & gas creaming curve from IHS data 1935-2007



Aramco (Baqi & Saleri 2005) reported as end 2003: cumulative production (CP) = 99 Gb, remaining 1P = 260 Gb, 2P= 292 Gb, 3P=363 Gb and contingent resources 238 Gb 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%.

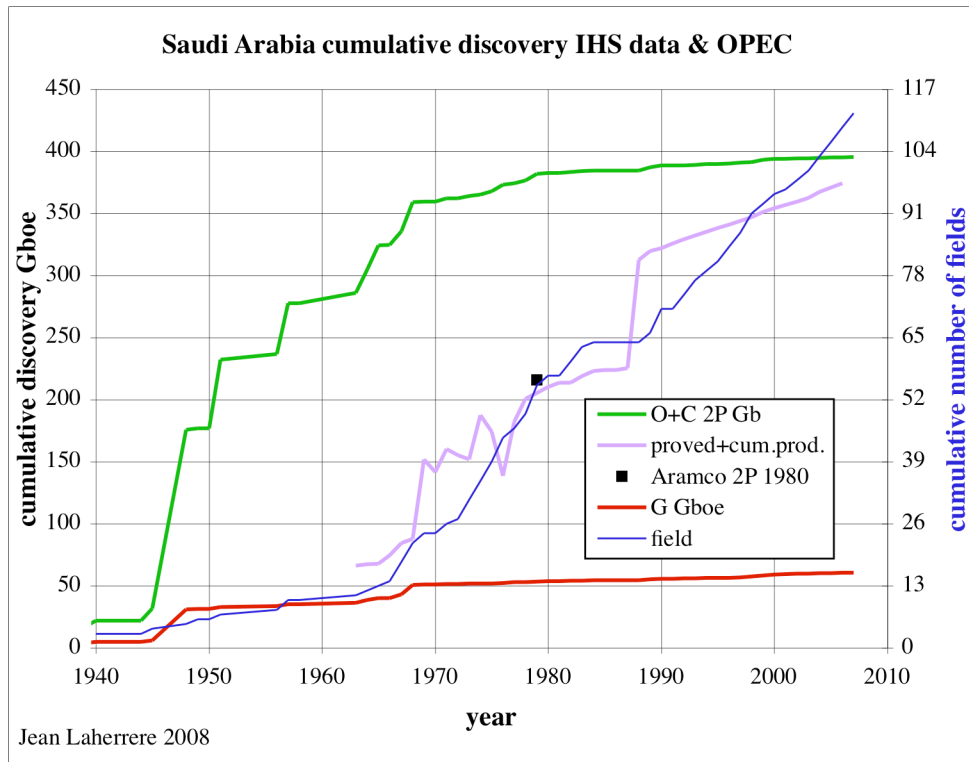
Aramco discovery as end 2003 is then 2P 391 Gb, giving an increase from 1980 estimate of +175 Gb, mainly political because quotas fight.

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



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

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



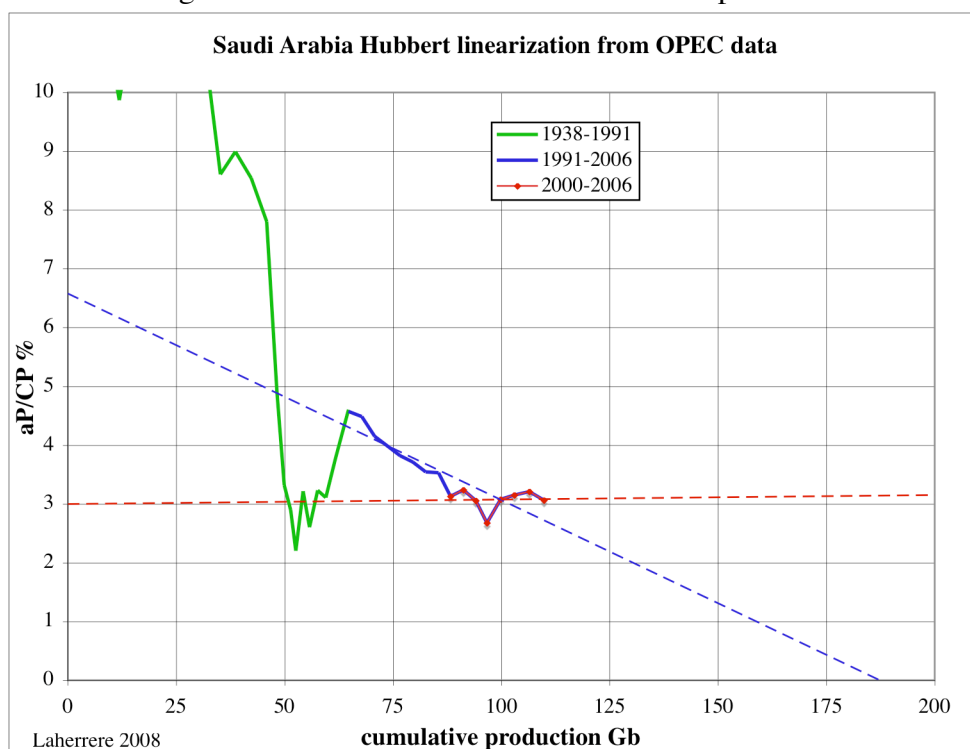
### What is the real ultimate?

Colin Campbell estimates SA ultimate at 275 Gb.

Production linearization is not reliable ranging from 180 Gb to infinite from the selected period.

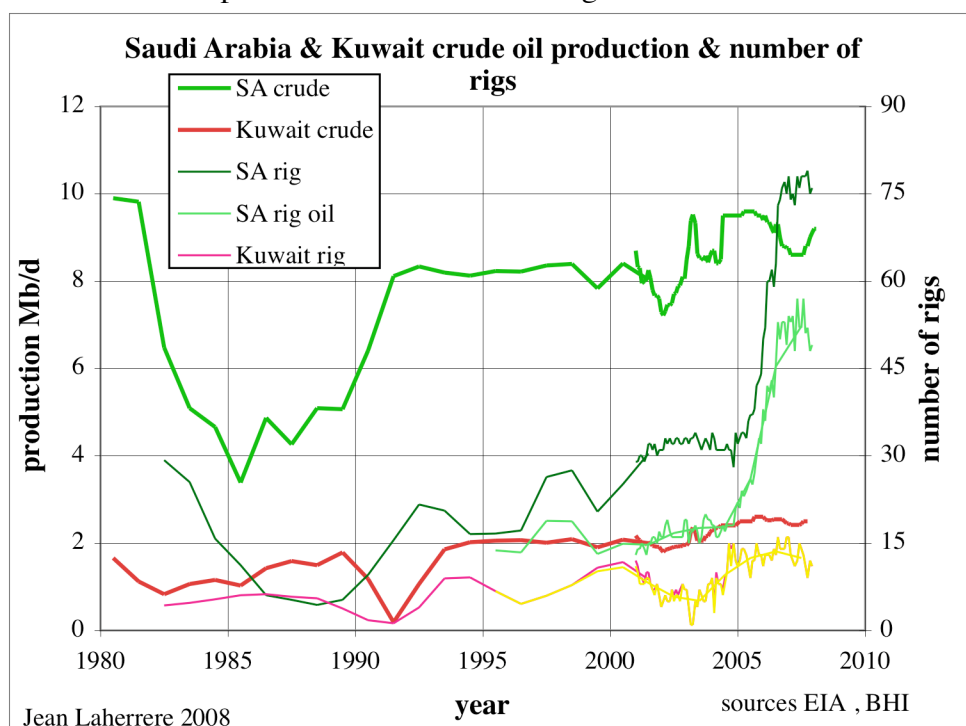
The plot is linear only is the pattern is logistic but it is not the case because above and below ground conditions

Figure 5: Hubbert linearization from OPEC production data



Oil production seems to be 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 as Khurais and Khusanyah

Figure 6: SA and Kuwait oil production and number of rigs

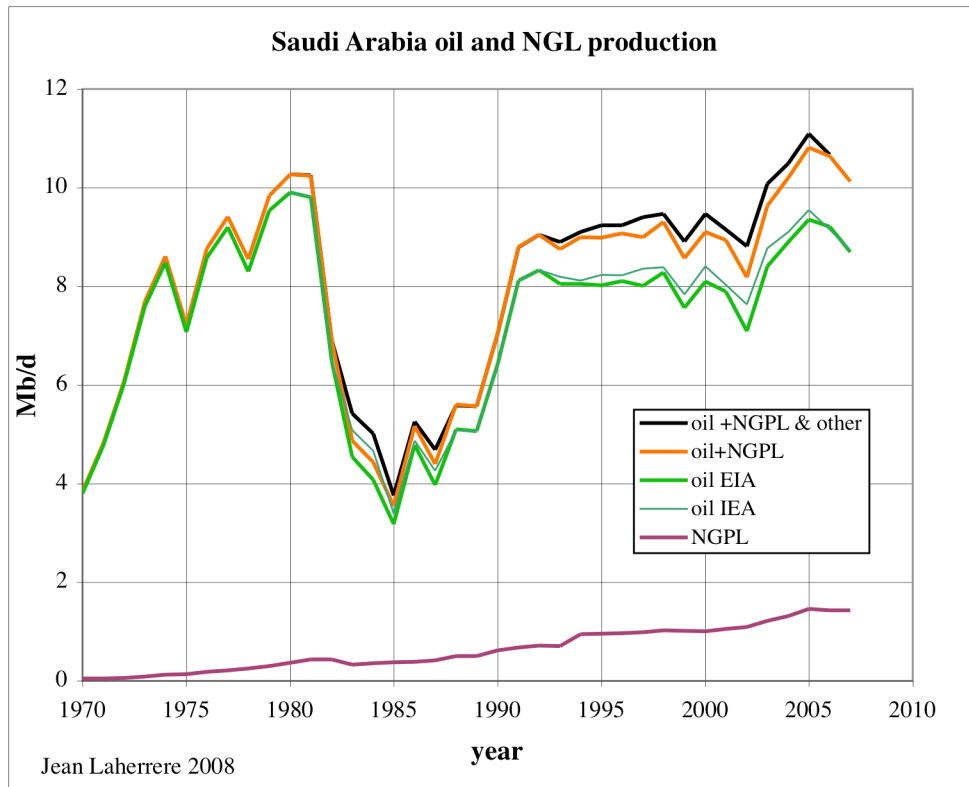


Anyway King Abdallah has declared that, if new fields are discovered, they will be kept for the next generation.

I am inclined to choose 250 Gb for oil ultimate with 110 already produced as end 2006. Colin's 275 Gb seems optimistic and the maxi 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 outside quotas and SA needs for gas (desalt plant)

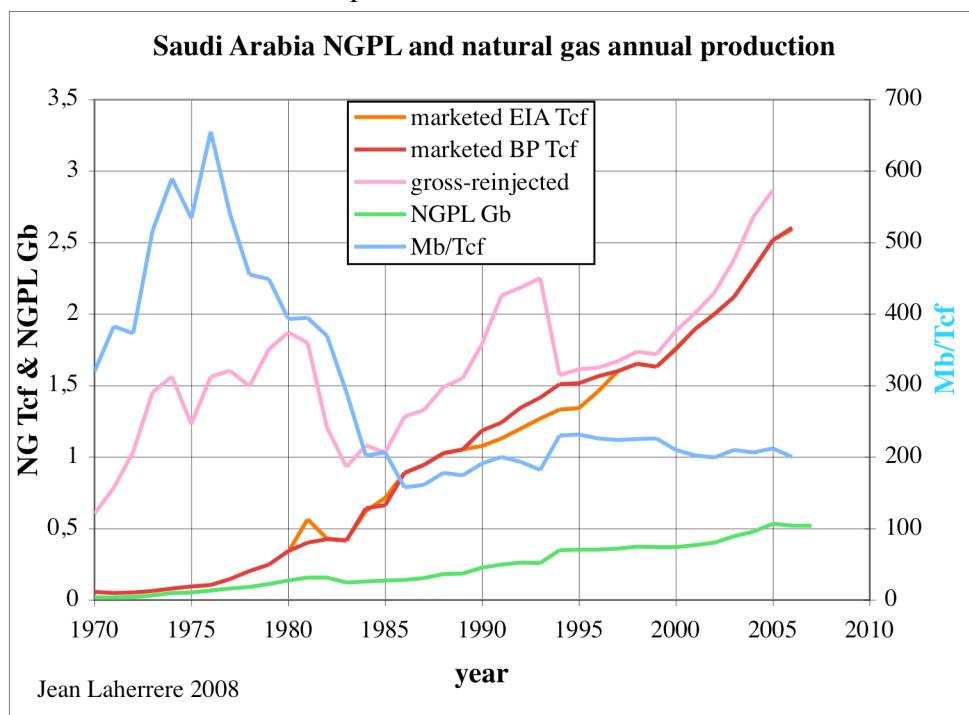
Figure 7: Saudi Arabia oil and NGL production



Natural gas (NG) production data varies with sources, but the most reliable (?) is gross-reinjected with a cumulative production end 2005 at 68 Tcf.

The ratio Mb NGPL to Tcf NG seems stable at 200 Mb per Tcf for the last 20 years.

Figure 8: Saudi Arabia NG and NGPL production

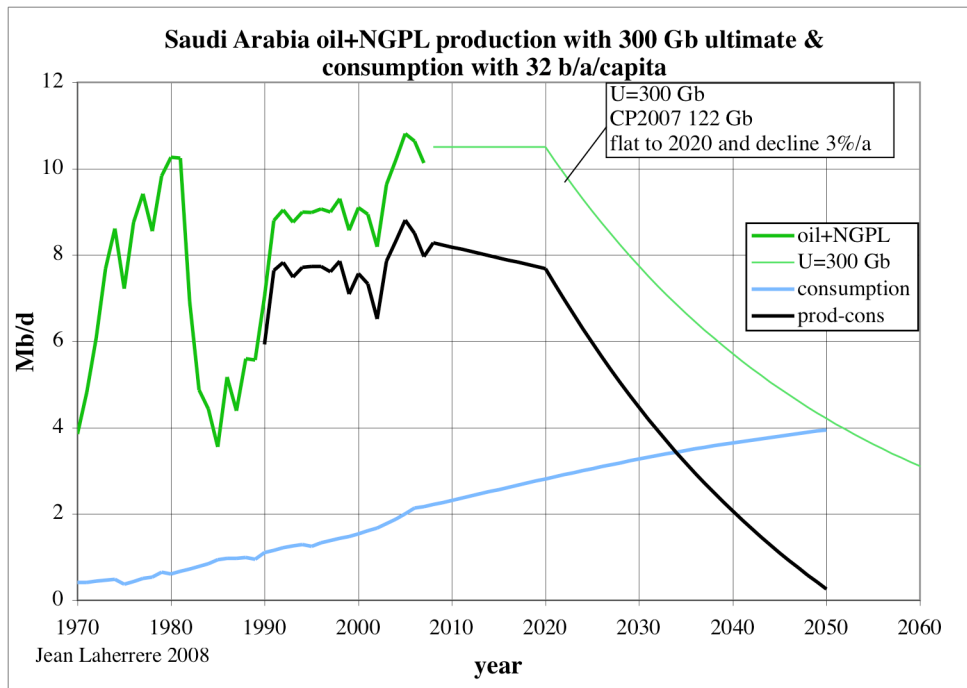


If NG ultimate is 400 Tcf (assuming no overestimation as for oil because no quotas), the NGPL ultimate is about 80 000 Mb (400 x 200) or 80 Gb

The ultimate for oil +NGL could be about 250 Gb + 80 Gb, rounded to 300 Gb

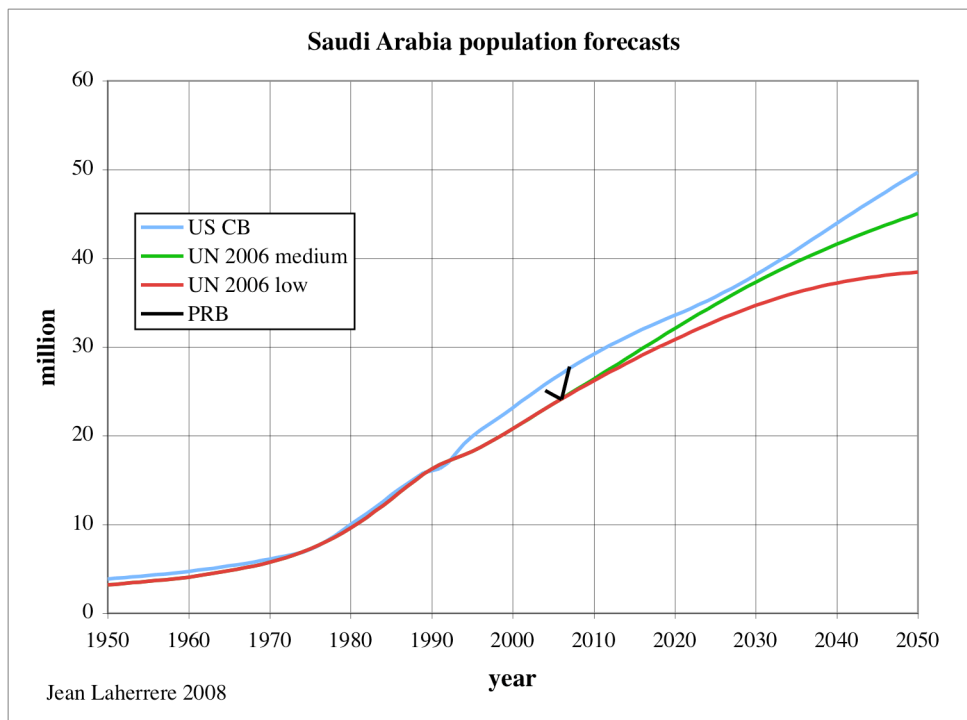
The oil+NGL production (CP 2007 = 122 Gb) is plotted assuming a plateau up to 2020 and a decline of 3%/a after 2020 with a 300 Gb ultimate, but the big problem is domestic oil consumption which is increasing with population. The oil consumption estimated in figure 14 is plotted as the volume of production less consumption available for export which could be zero in 2050.

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



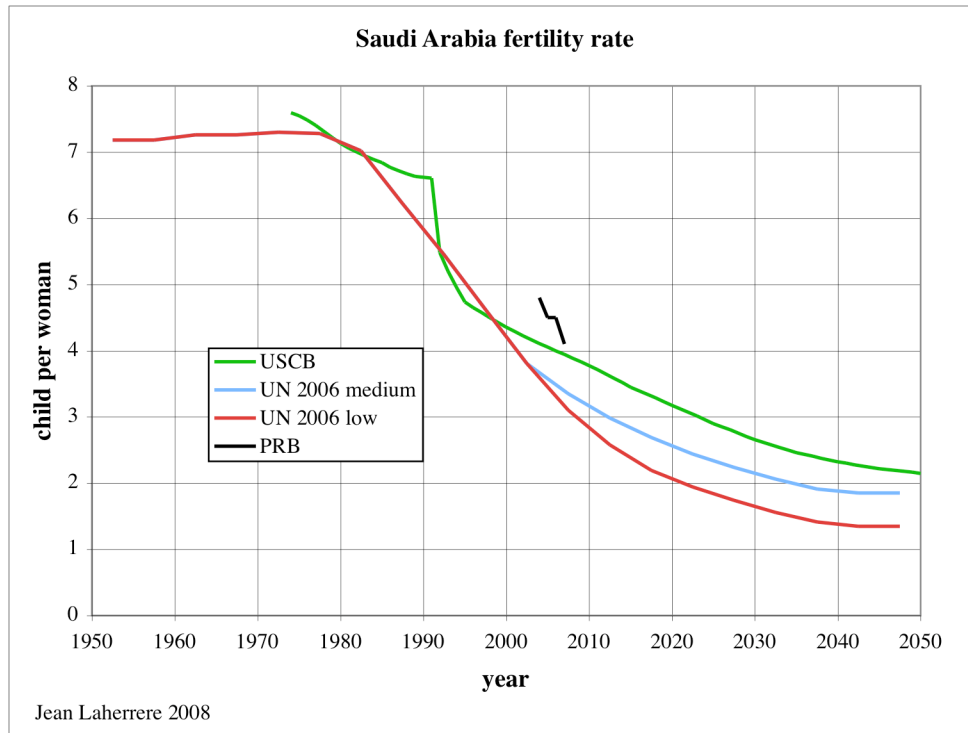
Oil consumption is plotted, estimated from population forecasts (UN 2006, USCB, PRB = population reference bureau) and capita consumption

Figure 10: Saudi Arabia population forecasts



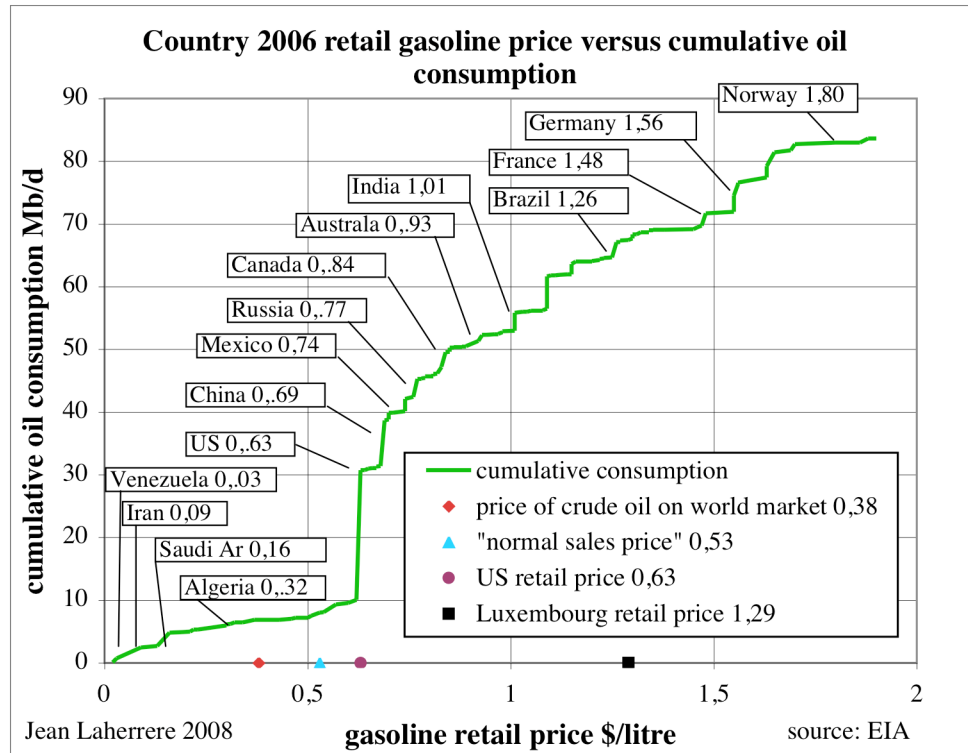
Population forecasts are based on fertility rate forecasts, but SA fertility rate is badly reported

Figure 11: Saudi Arabia fertility rate



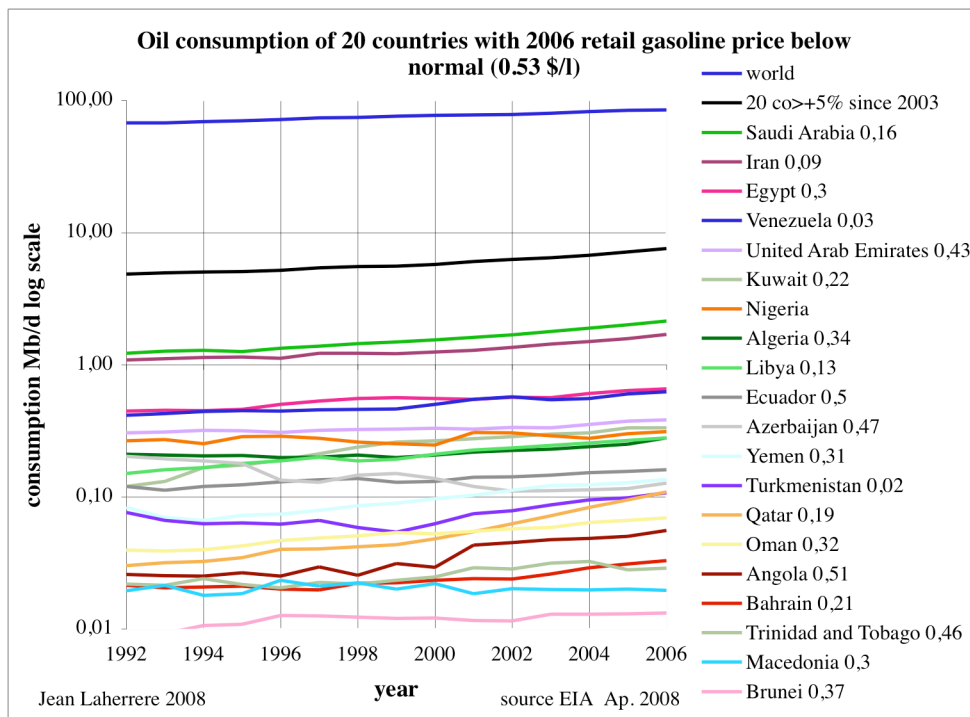
Oil consumption per capita was about 25 annual barrels, but it has increased lately to 32 b because domestic gasoline price is well below the normal price : in 2006 SA gasoline was 0.16 \$/l compared to 0.58 \$/l normal price (USDOE/EIA study).

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



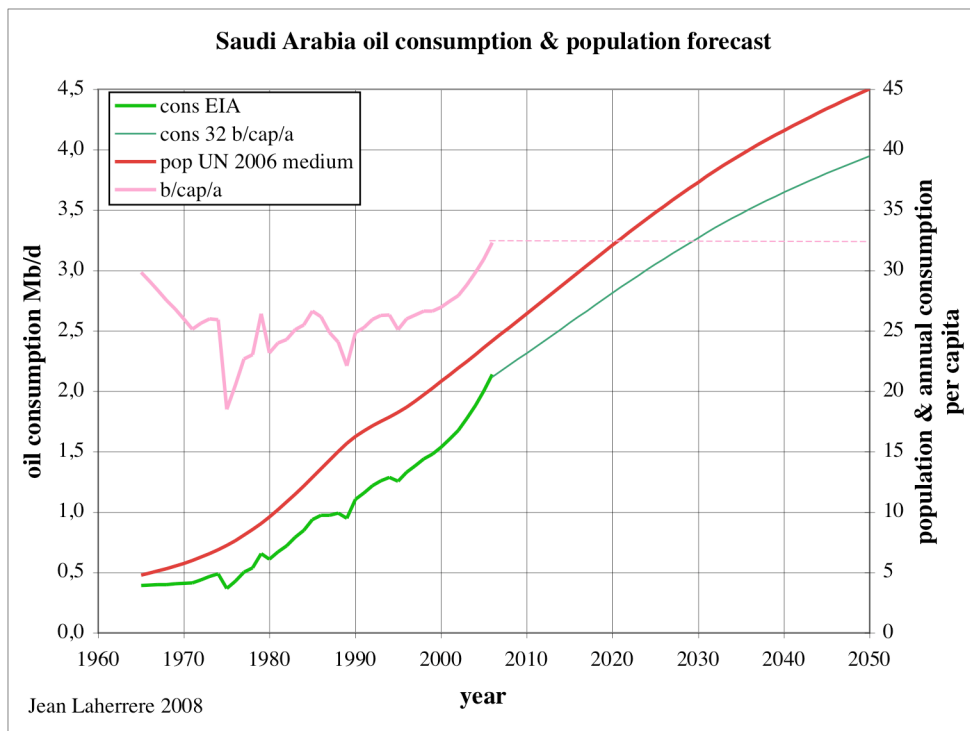
Oil consumption for the producing countries where gasoline price is well below the normal price increases more than the world, meaning that their exportation will decrease rapidly

Figure 13: oil consumption of 20 countries where 2006 retail gasoline price 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 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 the poor quality of the data for production and population. Saudi Arabia should improve the quality of these data in order manage the coming crisis. Saudi Arabia could stop importing oil in 2050 meaning that they will be in trouble to finance their budget.

Furthermore the world need to know that Saudi Arabia cannot fill the wish of many countries to increase their oil imports.