Why are remaining oil & gas reserves from political/financial sources and technical sources so different?

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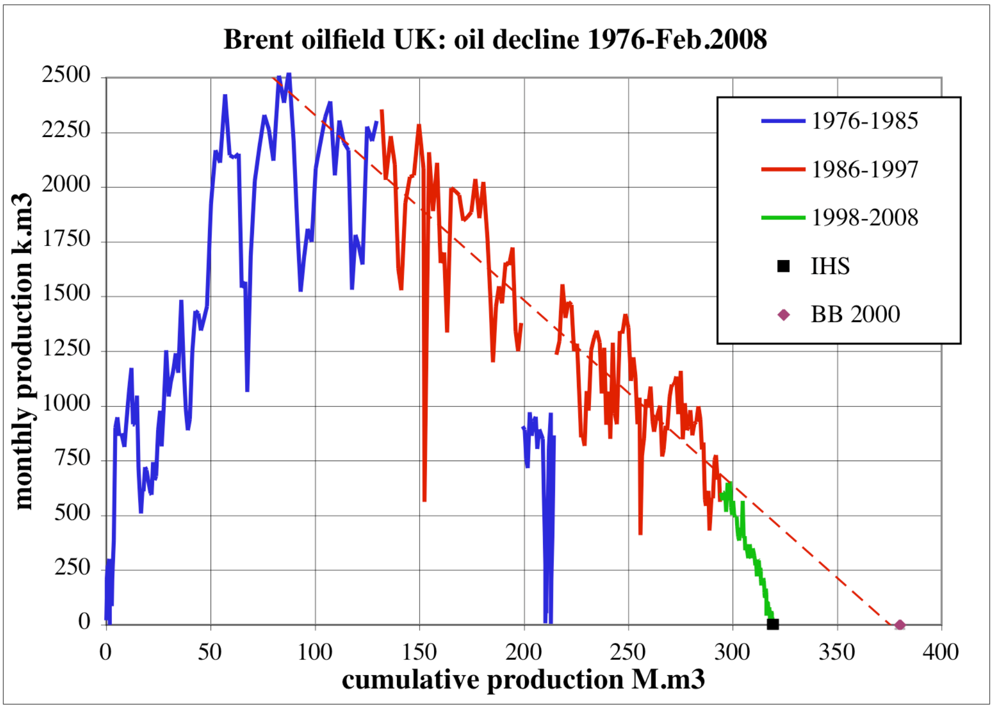
Part 2

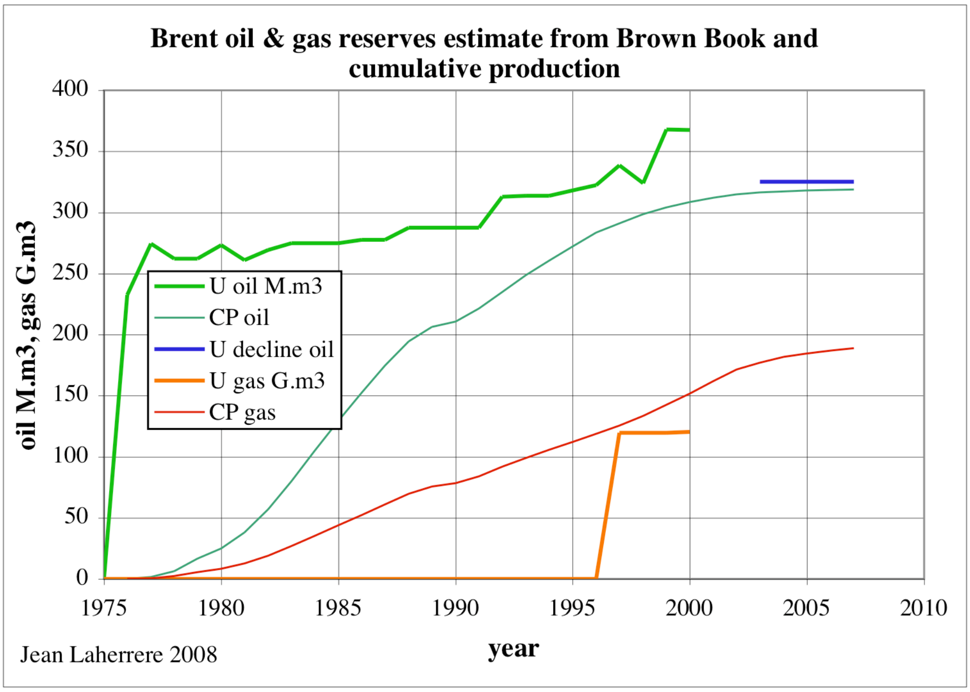
-UK North Sea

-Brent

Brent is the largest oilfield in UK and the UK crude marker. But Brent oil production is almost depleted and the *Brent marker* comes from other fields (worse quality like Buzzard)
Brent decline was linear from 1986 to 1997 (excluding 1990 where production was stopped to convert the field in order to produce the gas which was increasing when oil was declining) using the best technology to produce it. But, as for East Texas, last 1998-2008 decline is more than double the 1986-1997 decline. The extrapolation of last oil production (close to zero) leads to an ultimate of 320 M.m3 when Brown Book 2000 was 367 M.m3 (in line with red decline).
Figure 33: Brent oil decline 1976-Feb.2008

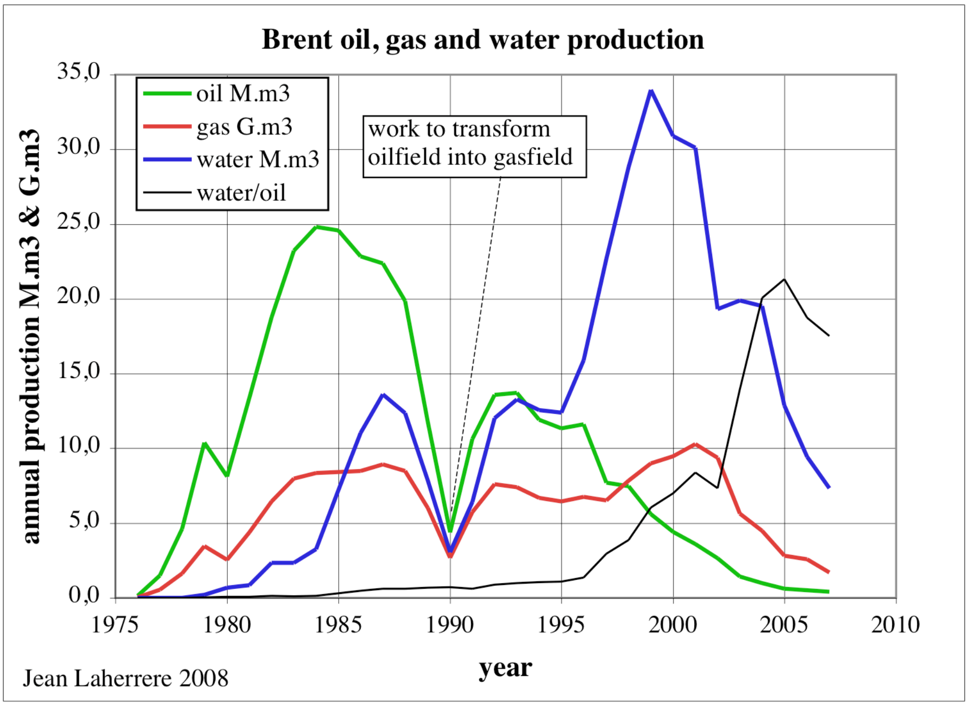


Brown Book last estimates were too optimistic for oil in 2000, not seeing the collapse starting in 1998, but it was too pessimistic for natural gas.
Figure 34: Brent ultimates and cumulative production



Since 1996 oil has decreased more when gas was increasing, peaking in 2001 and water in 1999. But Brent is close to the end.

Figure 35: Brent oil, gas & water production

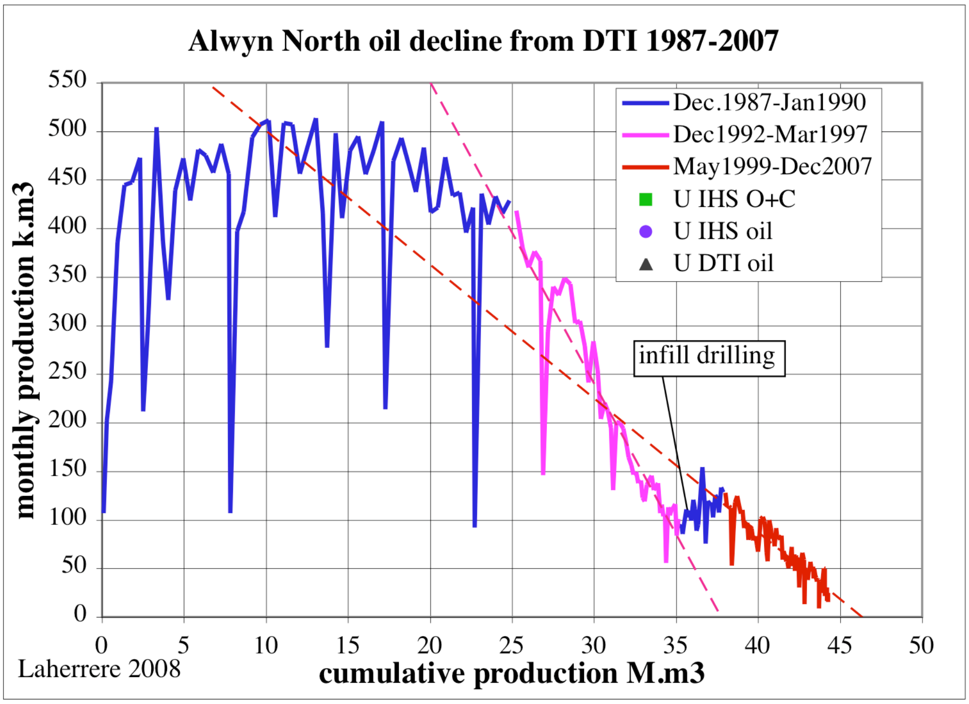


Brent is a good example of negative reserve growth

-Alwyn North

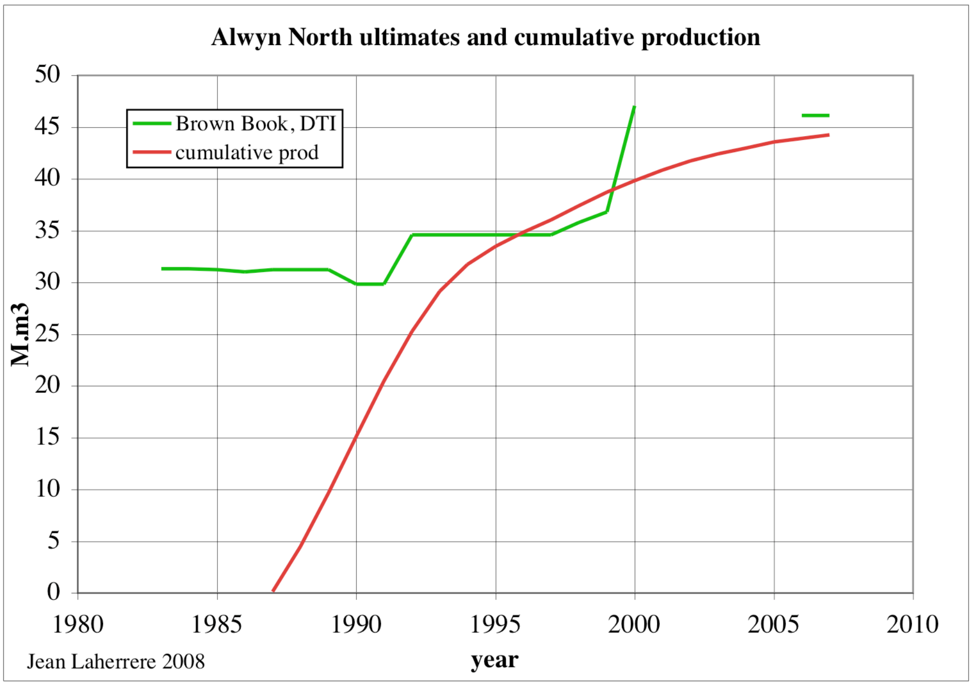
Alwyn North (3/9) was discovered in 1975 and production started in 1987.

Figure 36: Alwyn North oil decline



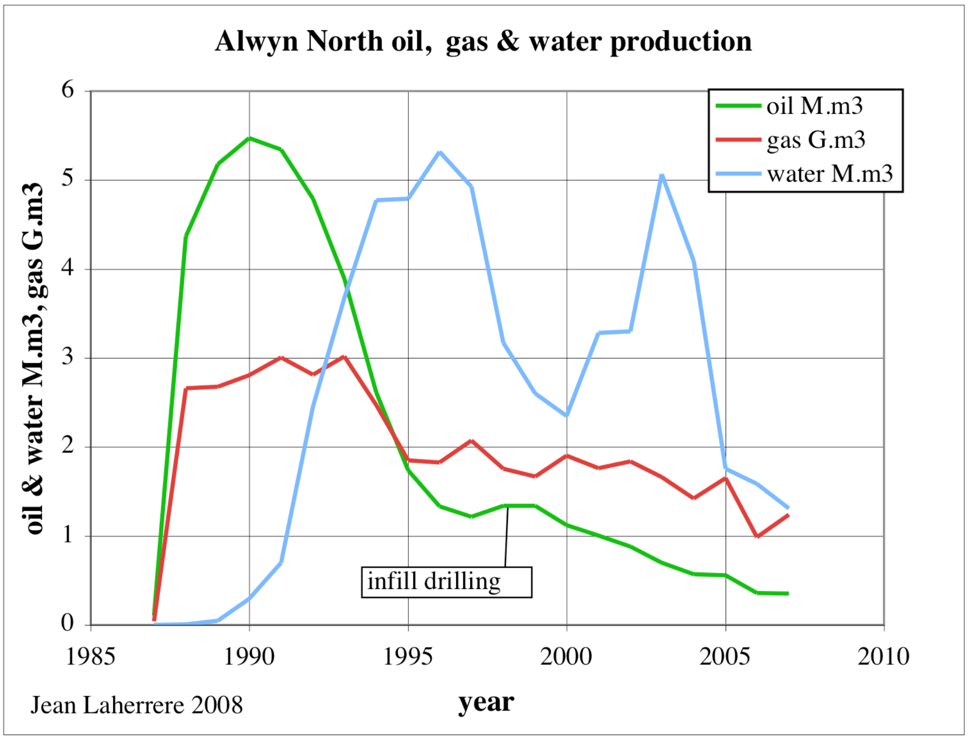
The Brown Book 1997 & 1999 ultimate was wrong when lower than cumulative production, but the 2000 value was right.

Figure 37: Alwyn North ultimates & cumulative production



In 1998 an infill drilling was developed and in 2001 an EOR gas miscible.

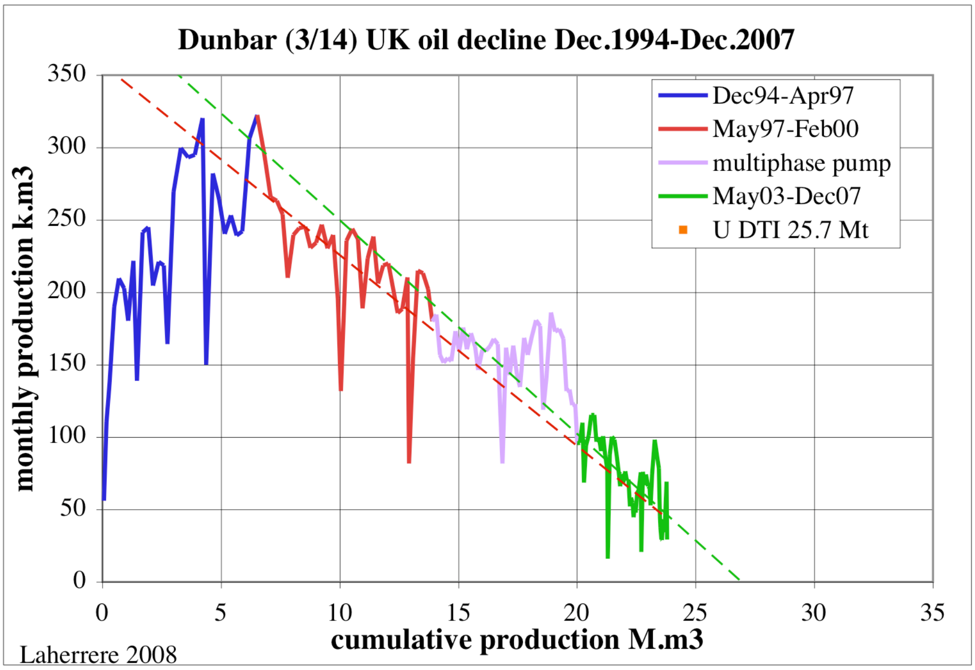
Figure 38: Alwyn North oil, gas & water production



-Dunbar (3/14)

Dunbar is an interesting case as complex (several compartments) and I was involved in the estimate of reserves before development (3/14)

Figure 39: Dunbar oil decline 1997-2007



The extrapolation of the decline is about 27 M.m3 or 170 Mb. The internal reserves estimates varied from 1980 to 1985 from 320 to 120 Mb. Brown Book value for 2000 was 200 Mb too high! Dunbar can be presented either as a positive or negative reserve growth, depending on the date.

Figure 40: Dunbar ultimates & cumulative production

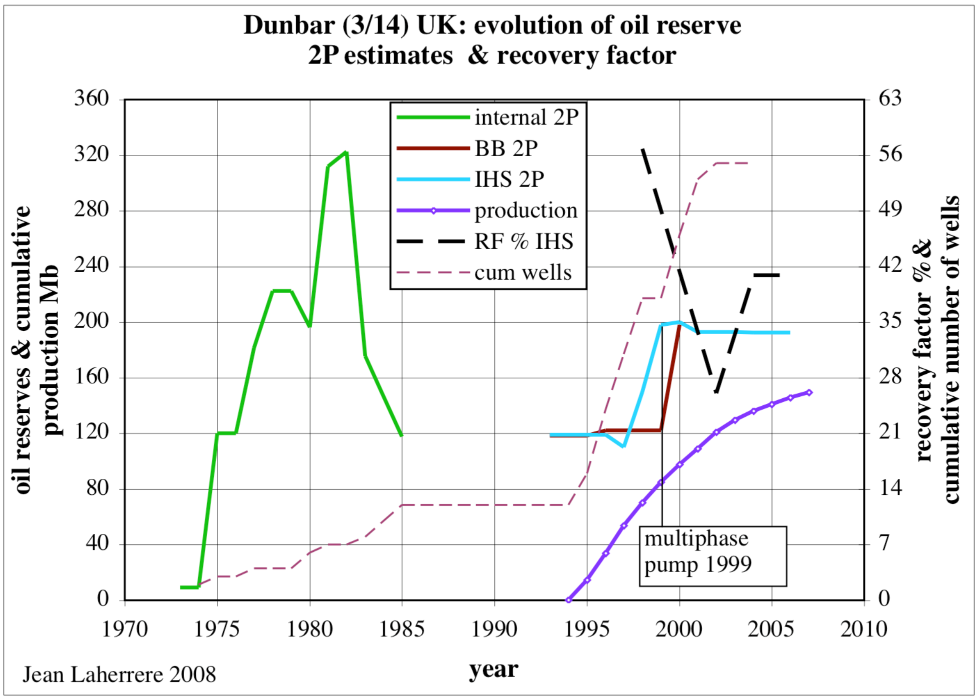
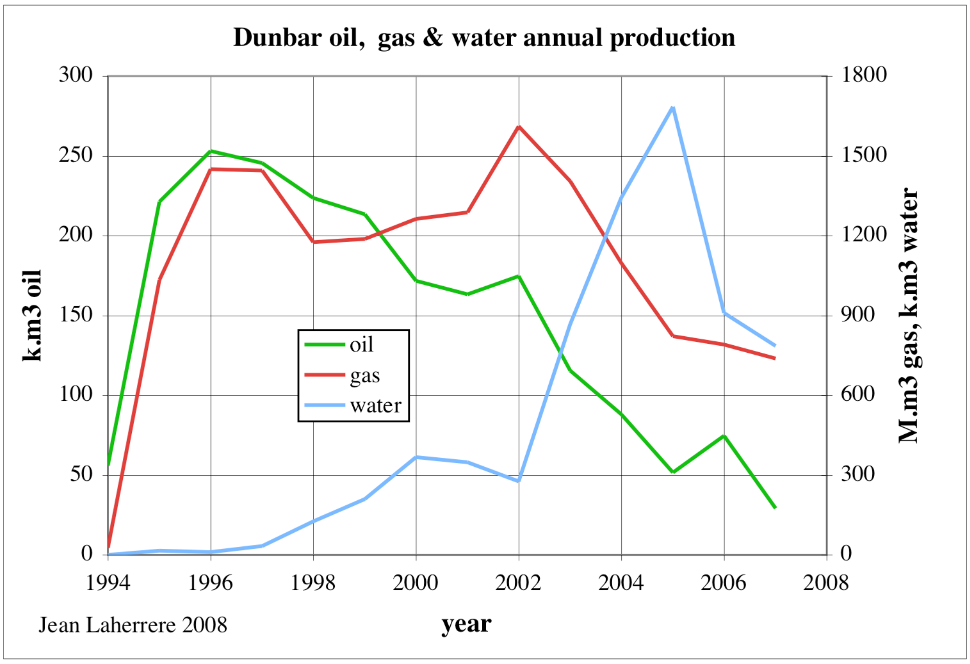


Figure 41: Dunbar oil, gas & water production



-Magnus

Magnus was presented by BP and IFP Panorama 2005 as innovation and an example of EOR potential reserve growth with Magnus EOR project using Foinaven-Schiehallion miscible gas to get more oil and avoiding flaring.

Figure 42: Magnus EOR project from BP

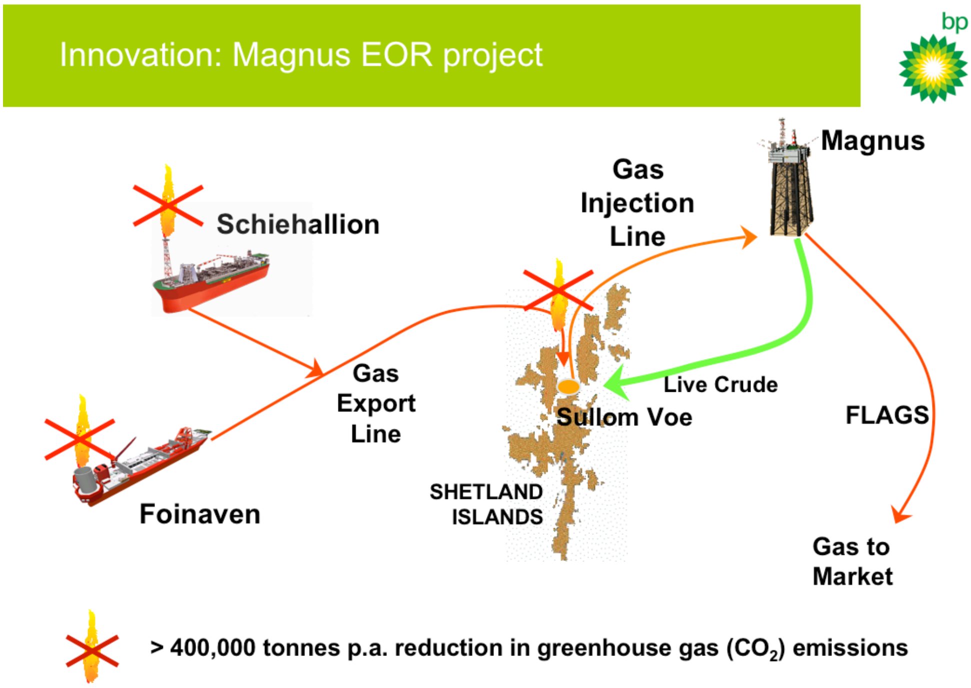
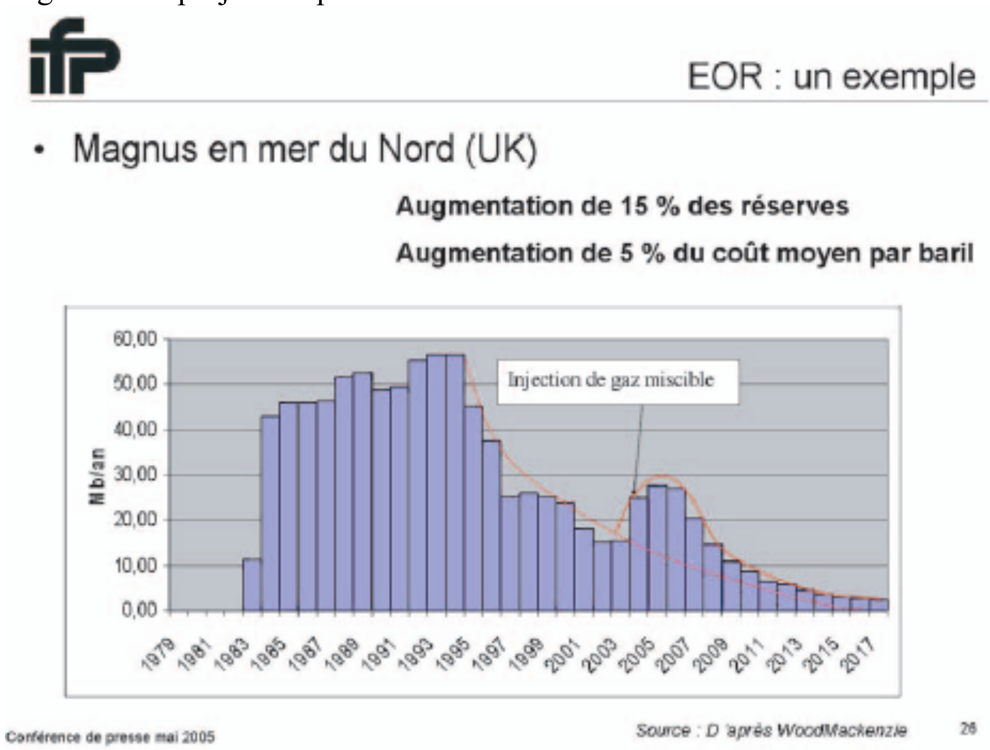


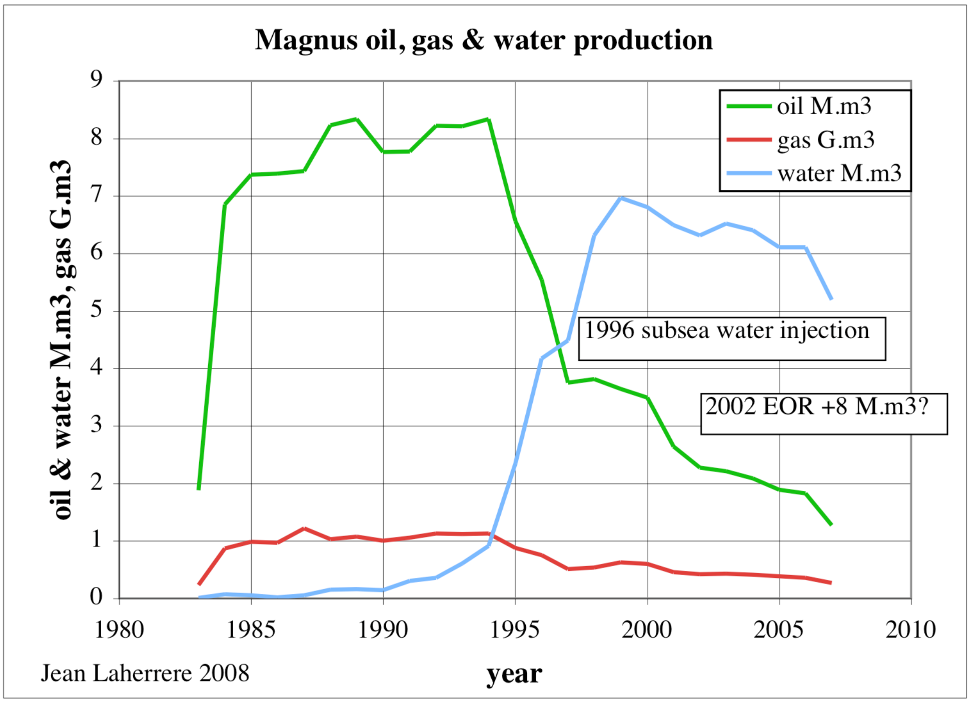
Figure 43: Magnus EOR project oil production from IFP Panorama 2005



The expected additional 50 Mb from the above bump from 2005 to 2010 does not seem to be achieved up to now!

There were many papers on the project (420 M$) and almost none on the results: another Badami!

Figure 44: Magnus oil, gas & water production



Oil decline was diminished thanks to a subsea water injection in 1996, but little sign of improvement by the 2002 EOR

Figure 45: Magnus oil decline 1983-2007

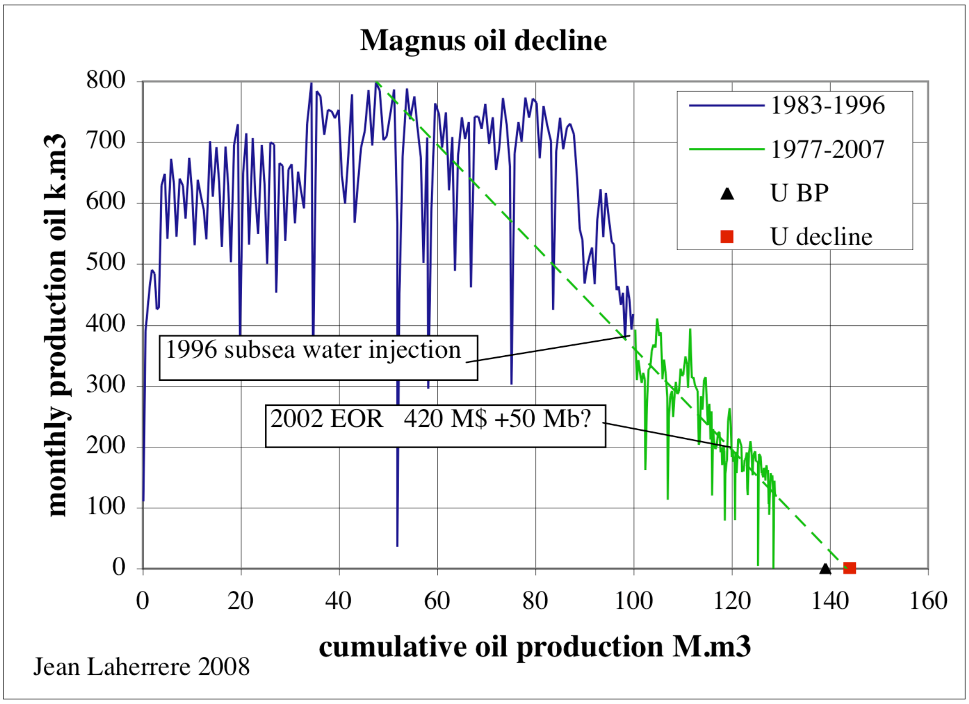
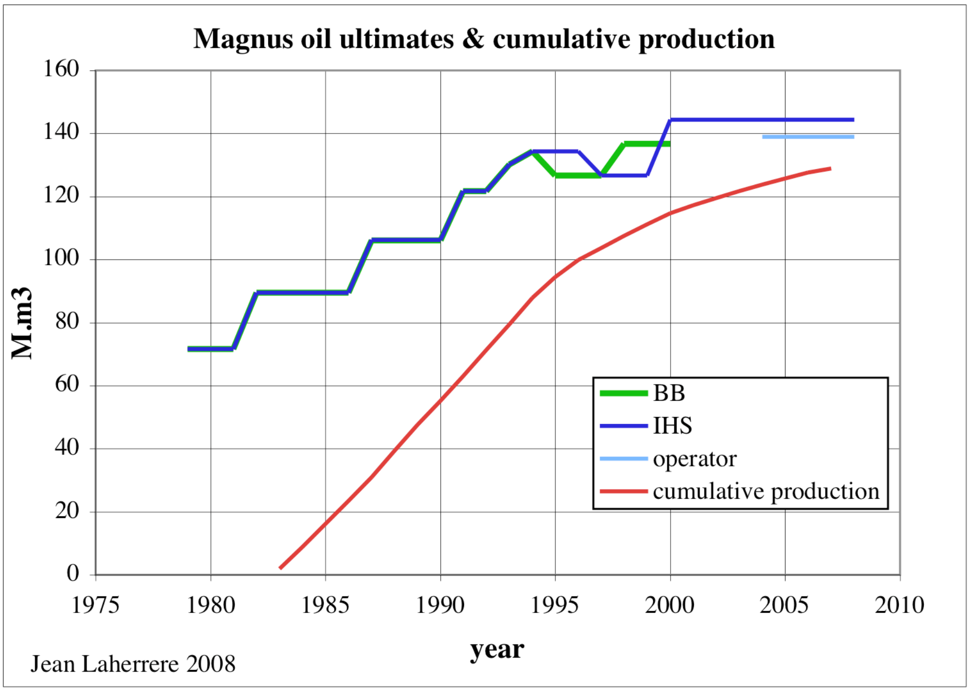


Figure 46: Magnus oil ultimates & cumulative production



-Beryl

Beryl is a good example of poor reserves estimates and of negative reserve growth.

Figure 47: Beryl oil decline 1976-2007

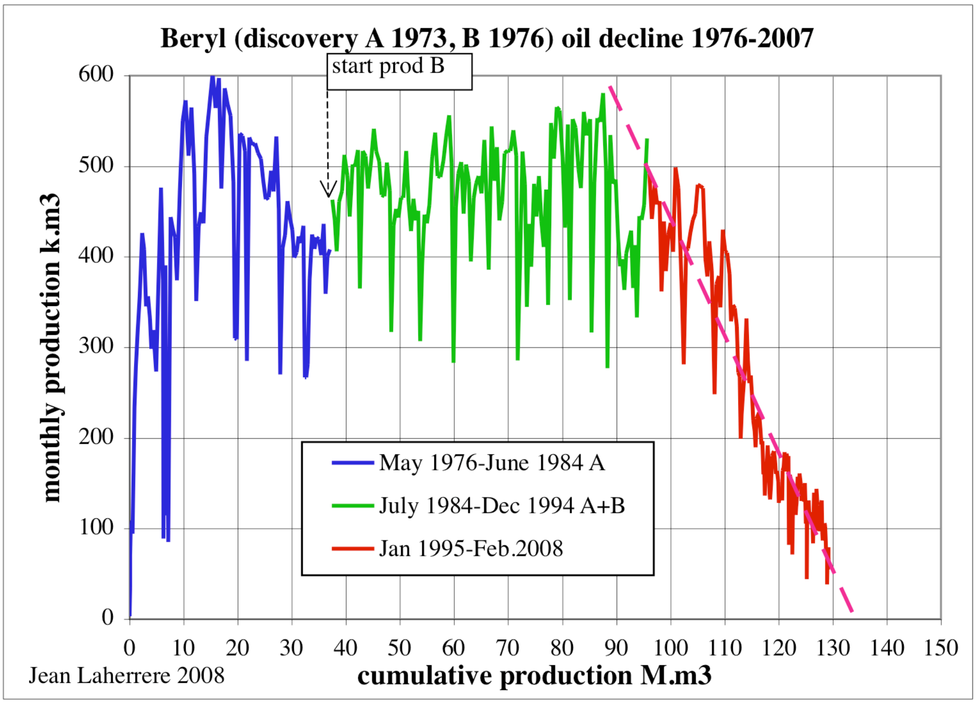
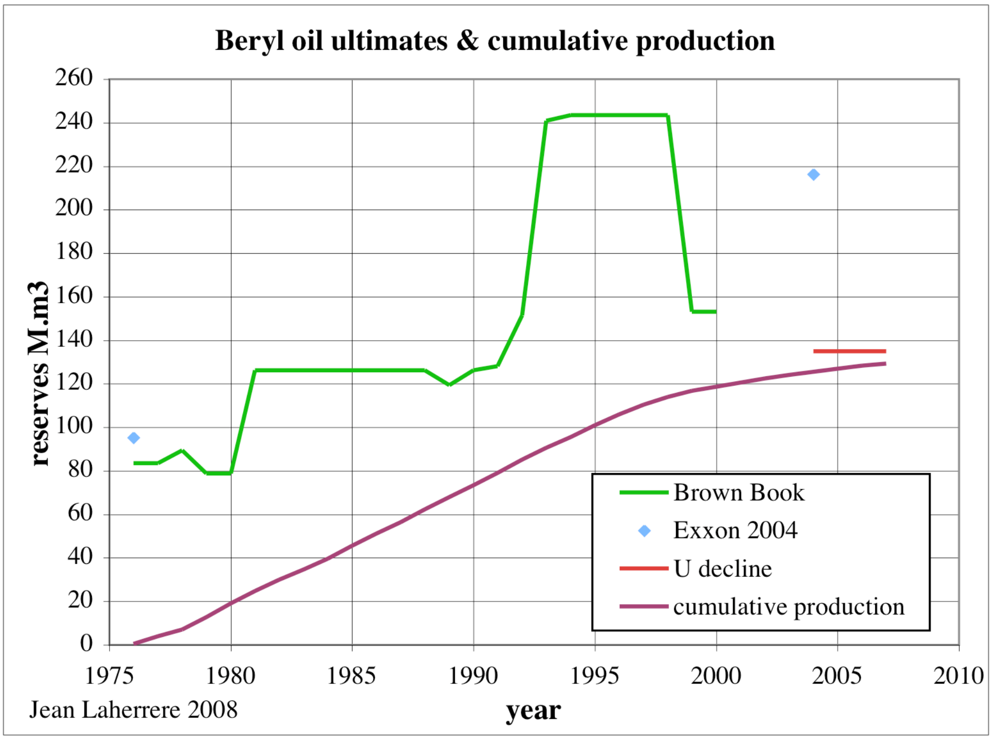


Figure 48: Beryl oil ultimates & cumulative production



-Norway

-Ekofisk

Ekofisk is, with Eugene Island 330 shown above, a good example of exceptional reserve growth, clearly seen in the oil decline, due to exceptional geological conditions. Ekofisk chalk reservoir was compacted with the decrease of pressure so that the seafloor has fallen by 9 meters (platforms had to be raised) and the compaction has increased the reserve from 180 to 560 M.m3. There is no other such reservoir compaction case in North Sea and Ekofisk reserve growth cannot be extrapolated to other North Sea fields.

Figure 49: Ekofisk oil decline 1971-2008

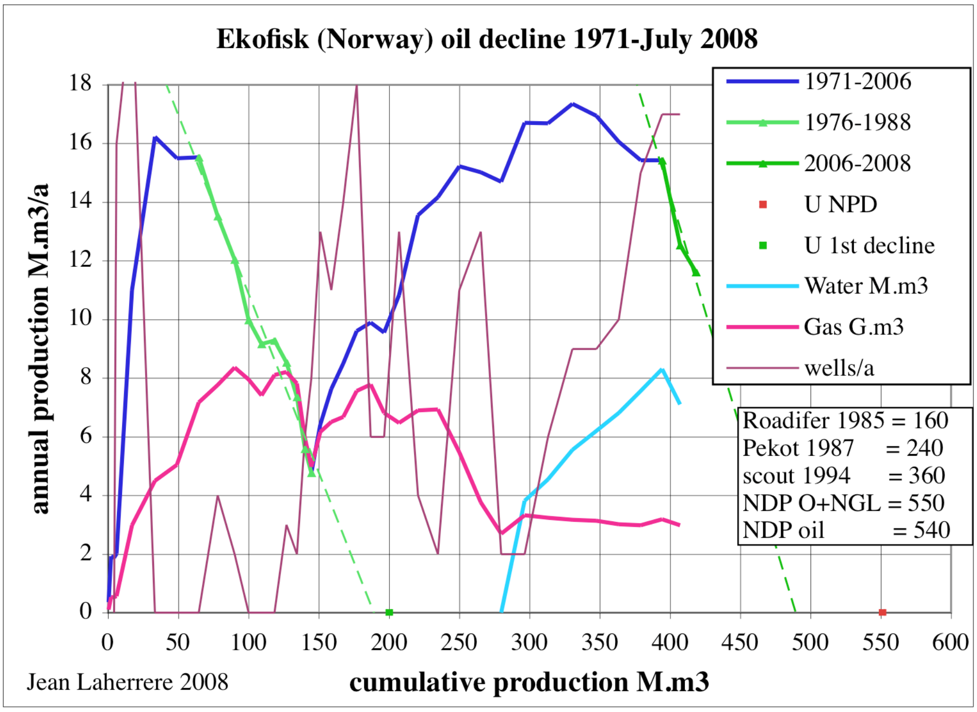


Figure 50: Ekofisk oil ultimates & cumulative production

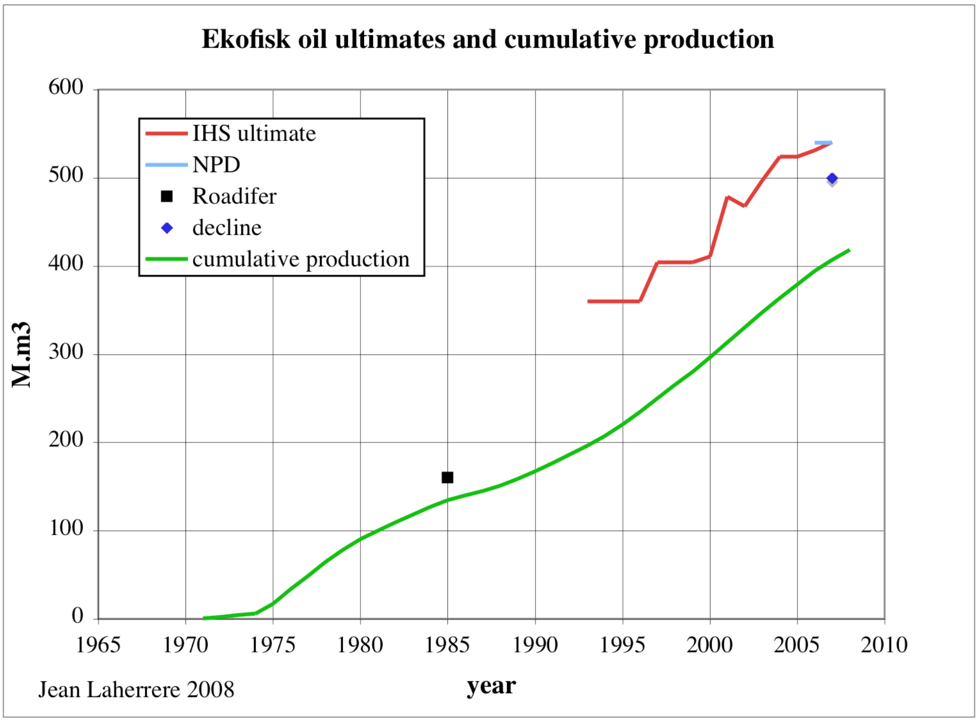
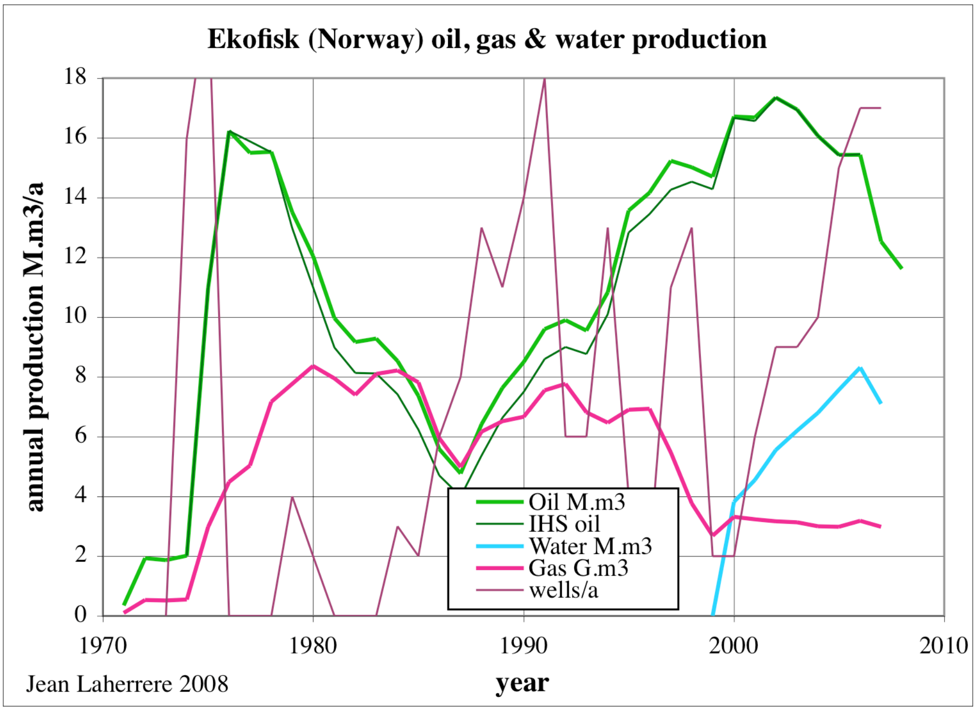


Figure 51: Ekofisk oil, gas & water production



-Mexico

-Cantarell Complex

The largest Mexican oilfield the Cantarell Complex was discovered in 1977, and named after a fisherman named Cantarell who told Pemex about a large seepage in the sea (polluting his nets) , gathering on the same place six superposed oilfields (thrust tectonic): Akal, Chac, Ixtoc, Kutz, Nohoch, Sihill. Cantarell. The Cantarell Complex was boosted by a very large nitrogen injection in 1997 with 26 new platforms and many wells (211 wells up to 2007). The production raised to a peak in 2004, but a sharp (14%) decline for 2005-2007, trending towards an ultimate of 16 Gb when IHS ultimate is over 18 Gb.

Figure 52: Cantarell complex oil decline

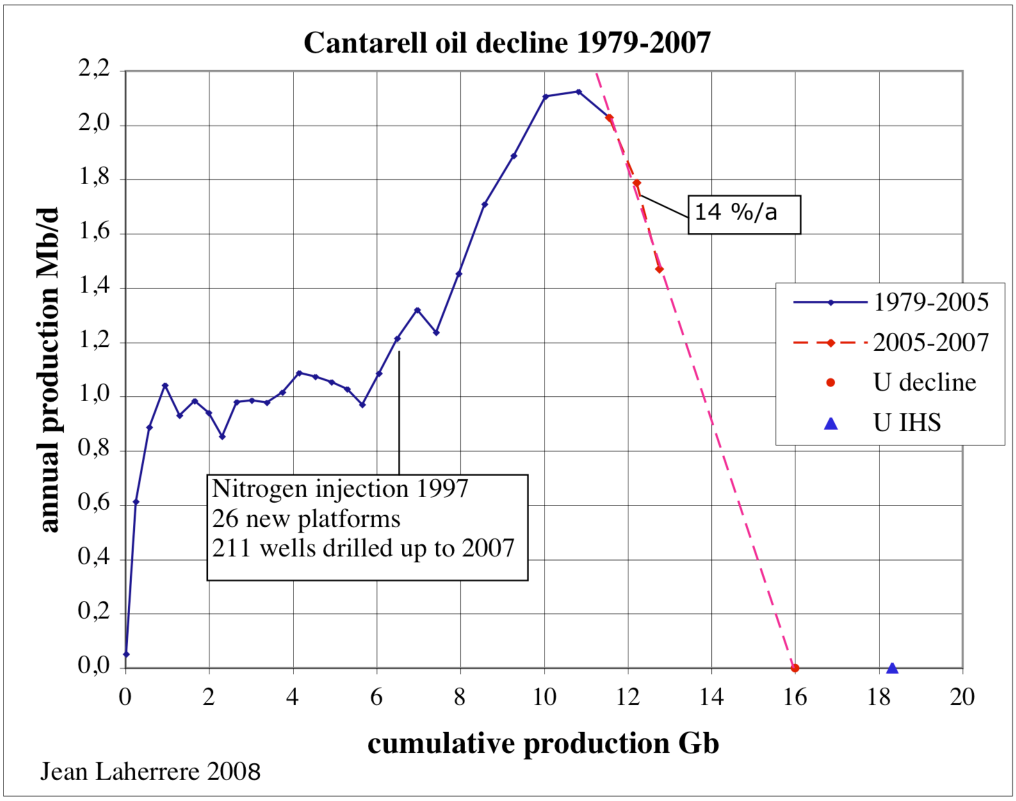
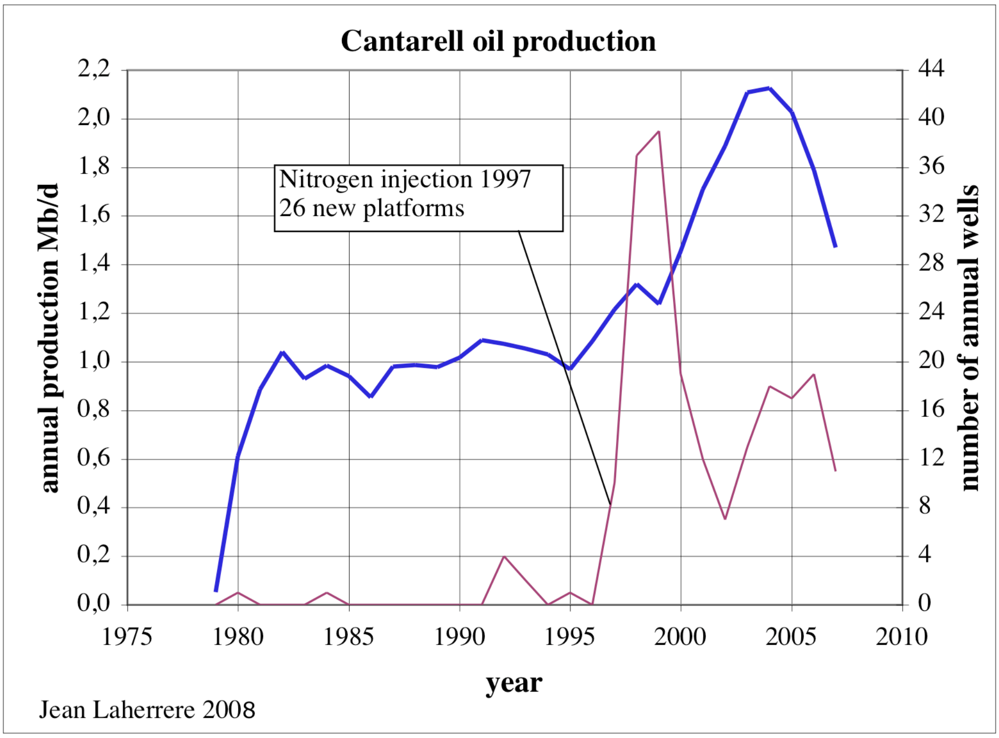


Figure 53: Cantarell complex oil production

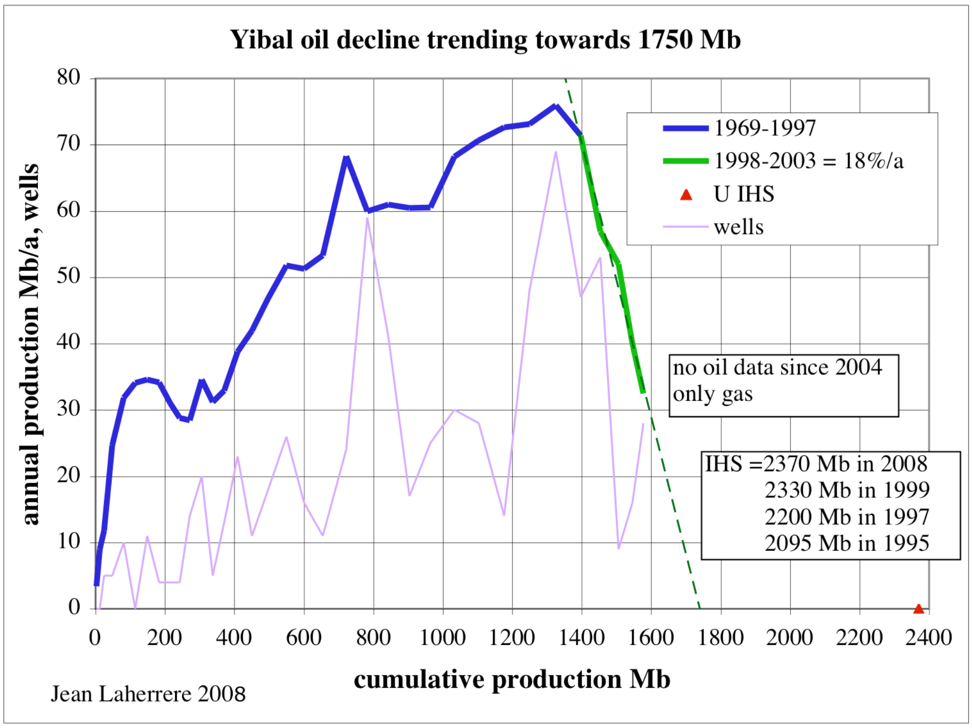


-Oman

-Yibal

Yibal is the largest oilfield in Oman, discovered in 1962 and production started in 1969 increasing up to 1996 thanks to horizontal wells, but the decline from 1998 to 2004 is quite sharp, trending towards 1750 Mb when ultimate is reported by IHS in 2008 as 2370 Mb (2095 Mb in 1995)

Figure 54: Yibal oil decline



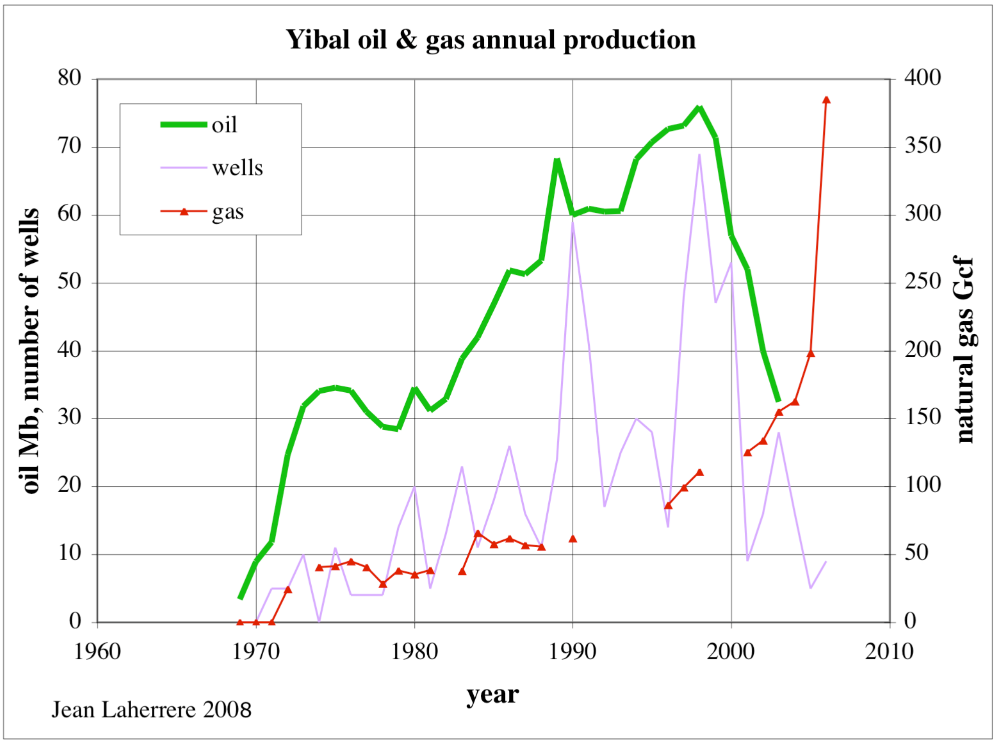
Oman's Oil Yield Long in Decline, Shell Data Show J. GERTH & S. LABATON: April 8, 2004 NYTimes.com: *Internal company documents and technical papers show that the Yibal field, Oman's largest, began to decline rapidly in 1997. Yet Sir Philip Watts, Shell's former chairman, said in an upbeat public report in 2000 that "major advances in drilling" were enabling the company "to extract more from such mature fields." The internal Shell documents suggest that the figure for proven oil reserves in Oman was mistakenly increased in 2000, resulting in a 40 percent overstatement*

In fact, since 1998 the sharp decline leads to less reserves than expected.

Technology leads to faster production in detriment of total recovery.

Oil production data ceases in 2004, but gas production has raised sharply from 2004 to 2006

Figure 55: Yibal oil & gas production



-Gabon

-Rabi-Kounga

Same sharp decline as Yibal after large use of horizontal wells again by Shell with Rabi-Kounga (largest oilfield in Gabon) leading to high production peak, but a decrease in oil reserves

Figure 56: Rabi-Kounga oil decline 1989-2006

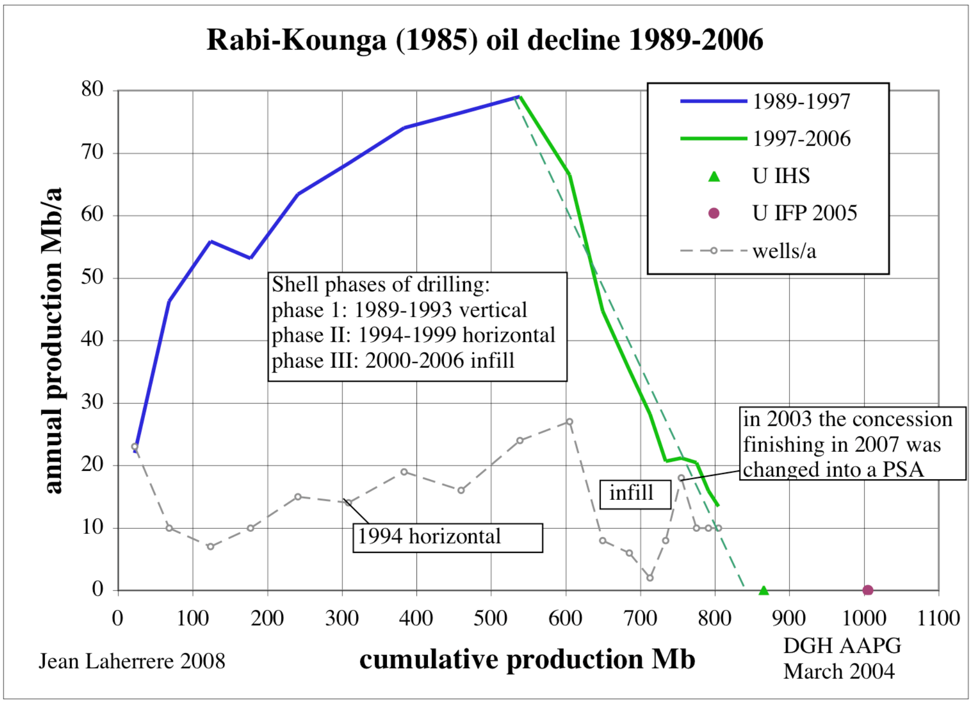
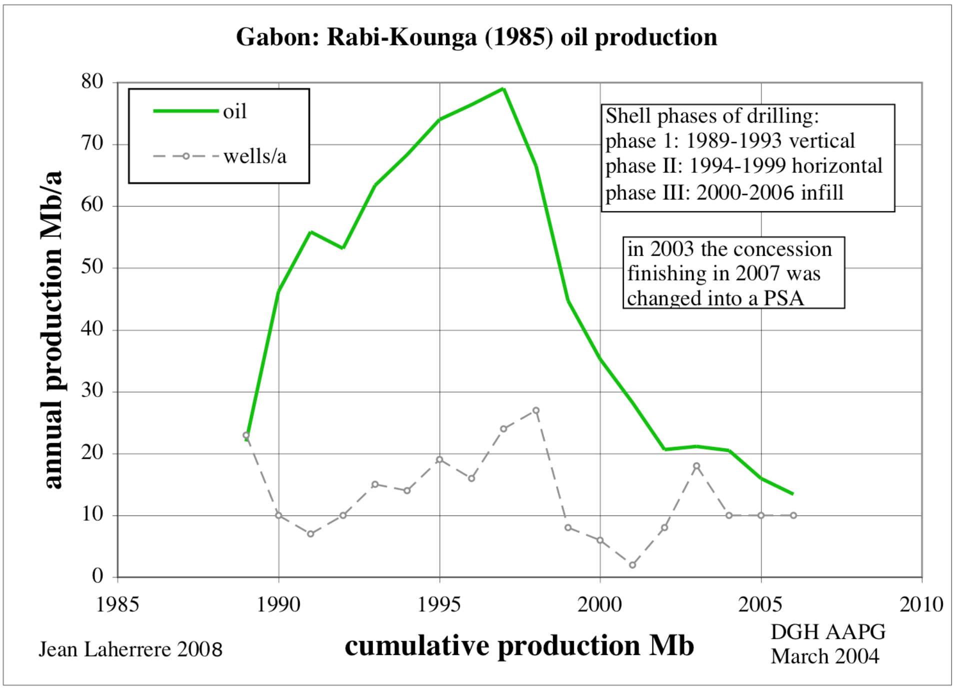


Figure 57: Rabi-Kounga oil production



IFP panorama 2005 quoted Rabi-Kounga as an example of the impact of horizontal drilling to increase recovery factor from 31% (1986) to 55% (2004), going from 905 Mb in 1993 to 1005 Mb (what an accuracy!) in 2004, when IHS reports in 2008 865 Mb

Figure 58: Rabi-Kounga oil production from IFP Panorama 2005

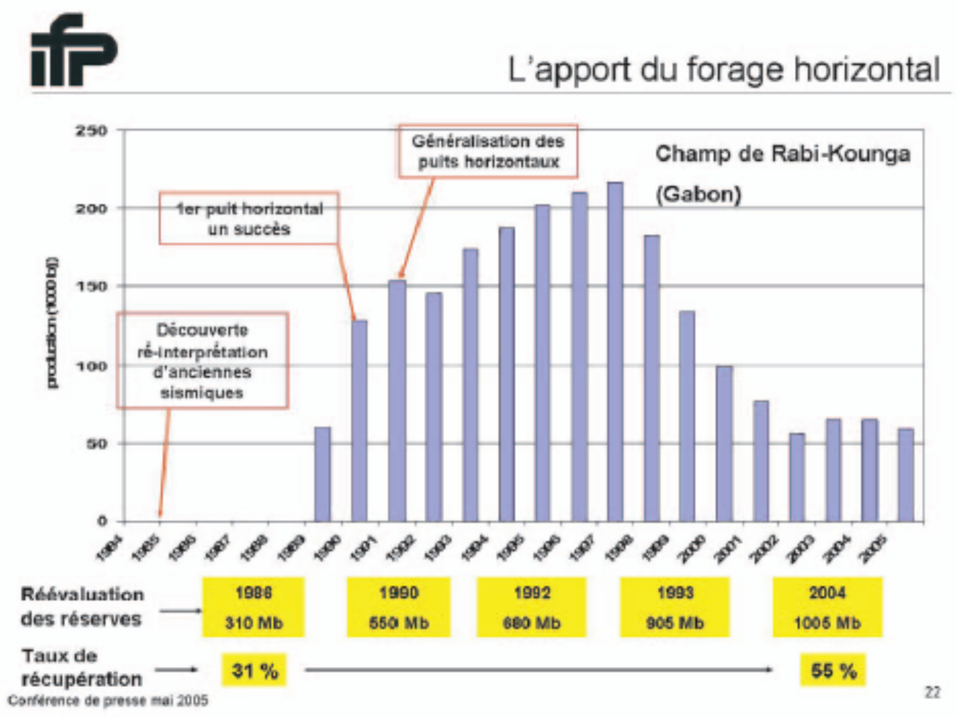
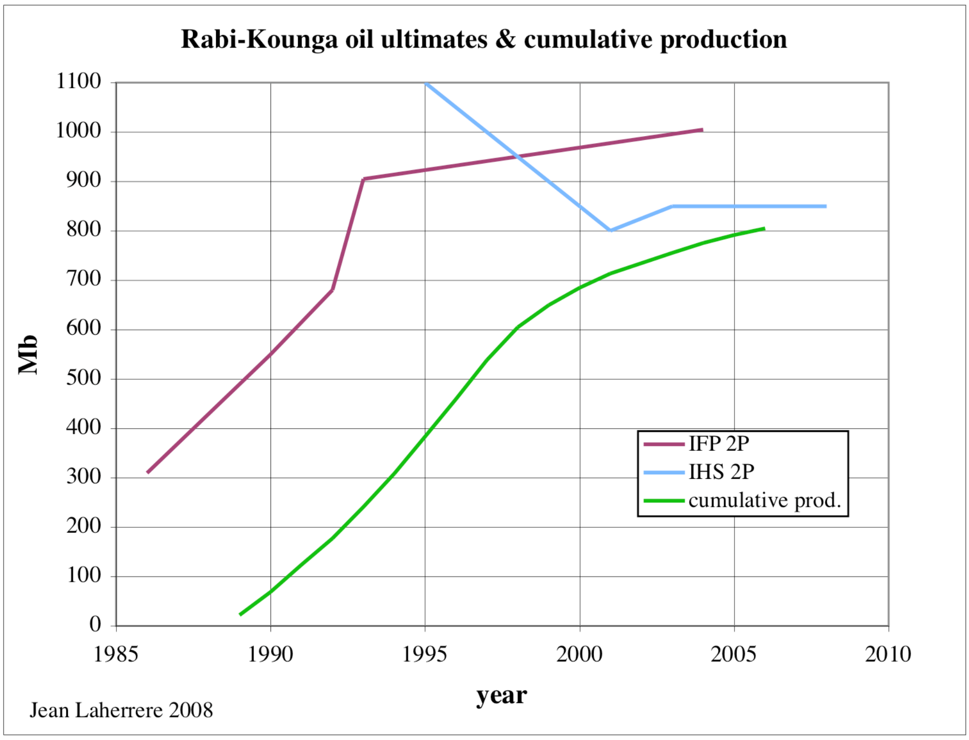


Figure 59: Rabi-Kounga oil ultimates & cumulative production



-Russia

-Urengoy

As stated by Khalimov in 1993 (he presented the Russian classification at WPC 1979), Russian ABC1 reserves are *grossly exaggerated,* being 3P and they should be multiplied by 70% to obtain 2P estimates. This reduction is based on the extrapolation of the decline of the main fields and it is now confirmed by the 2008 audit of Gazprom by DGMN (20,8 G.m3 against 29.8 G.m3 ABC1). For a long time Urengoy was presented as the largest gasfield in the world, but now North Dome (being North field in Qatar and South Pars in Iran) is about 4 to 5 times bigger. Urengoy is still reported having 382 Tcf when decline (1992-2006) indicates less than 250 Tcf (65%).

IHS 2006 production is reported very low (0.2 Tcf when 4.7 Tcf in 2005) and is obviously wrong (not for them) and we use the Gazprom value of 3,9 Tcf

Figure 60: Urengoy natural gas decline 1979-2006

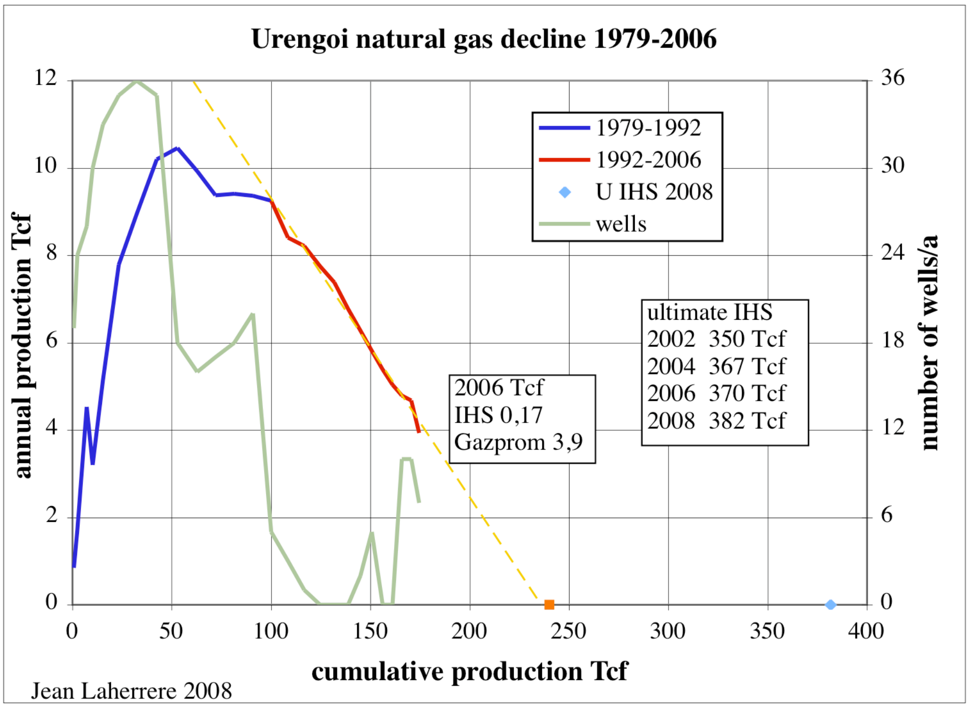


Figure 61: Urengoy natural gas & condensate production

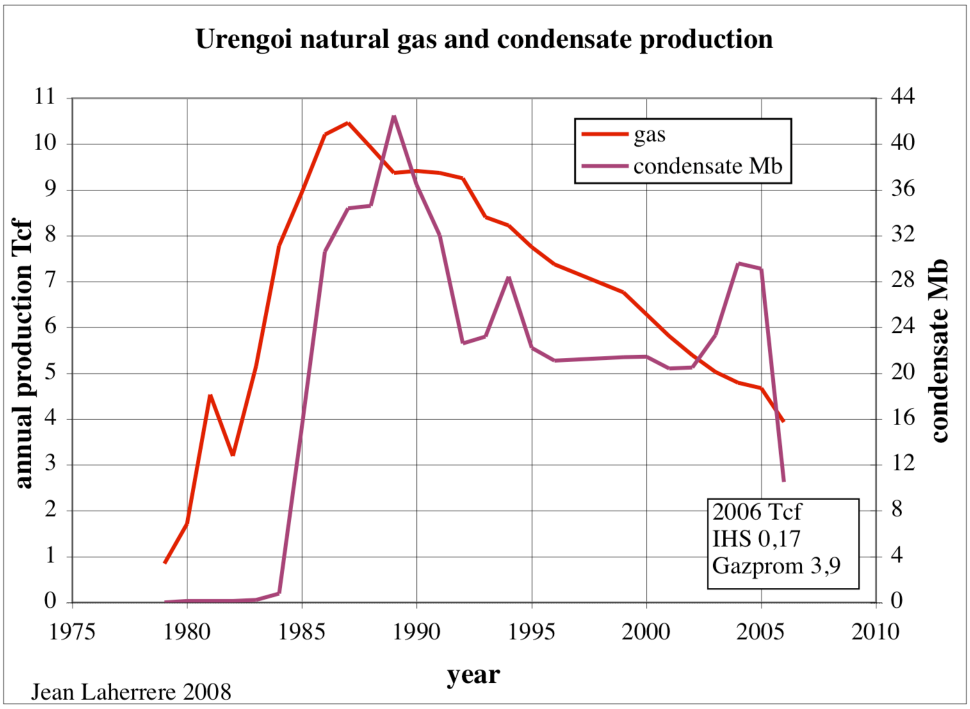
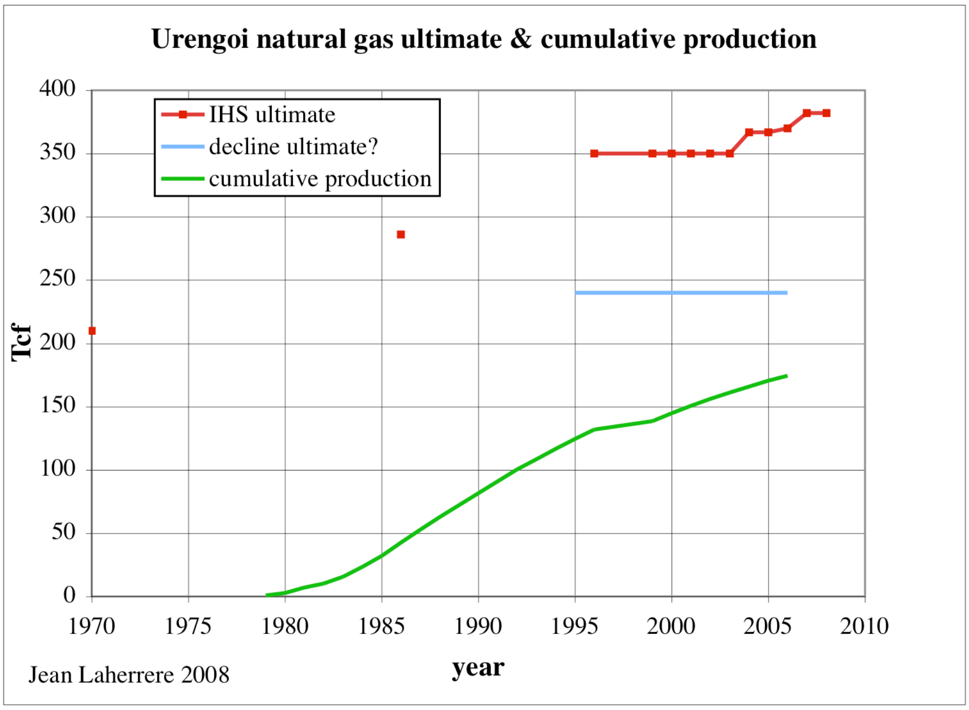


Figure 62: Urengoy natural gas ultimates & cumulative production

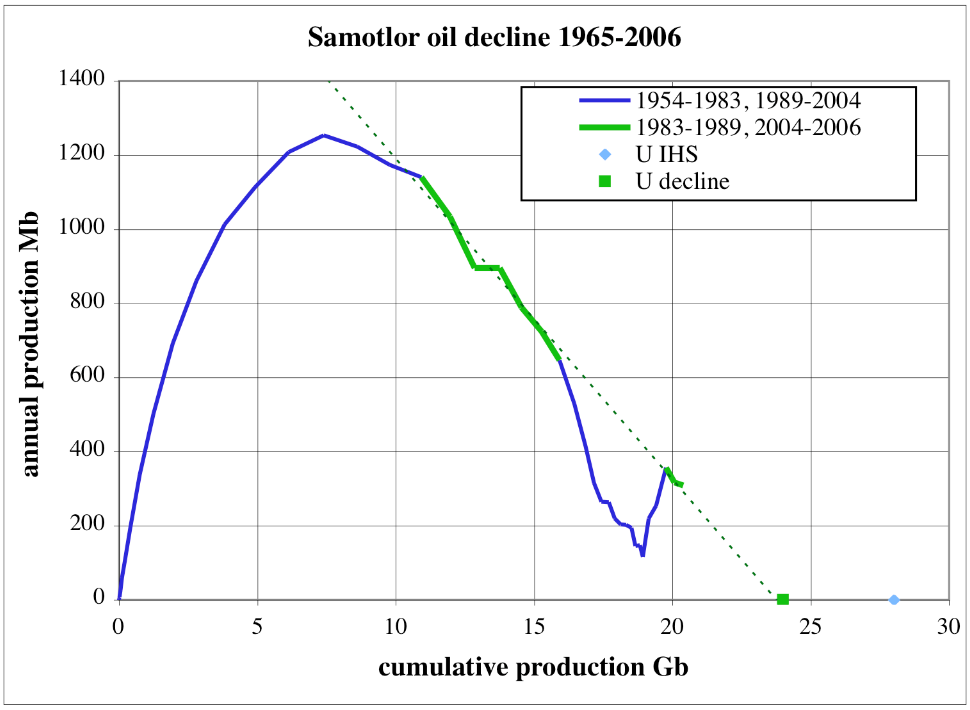


-Samotlor

Samotlor is the largest Russian oilfield. The FSU break-up has disturbed its decline. But TNK-BP is now operating Samotlor and has increased production, but declining again in 2006

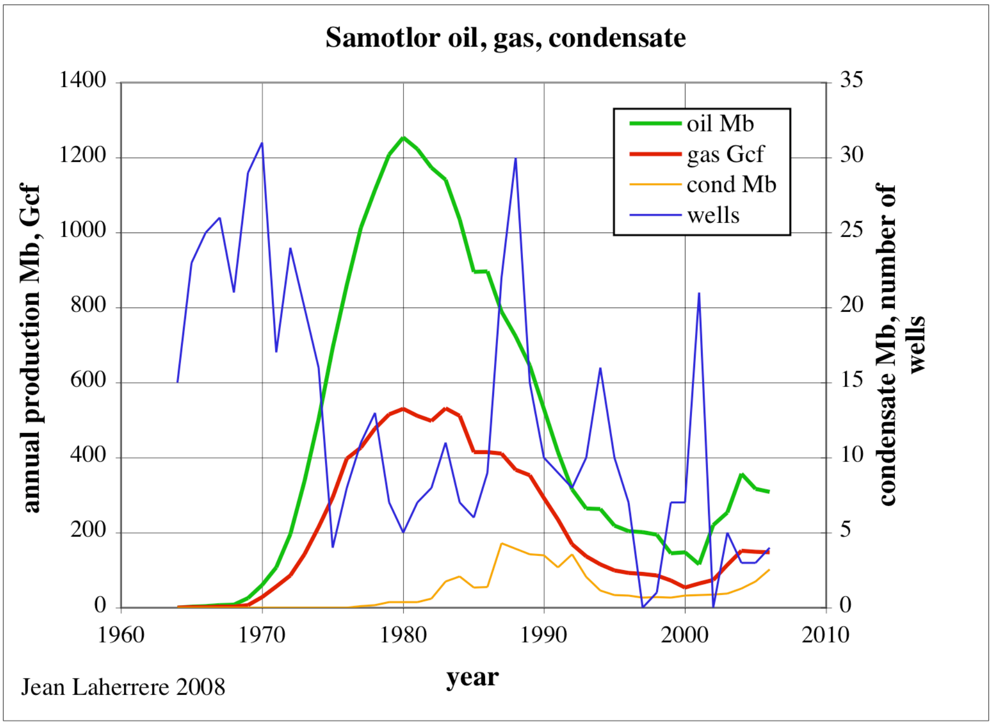
Extrapolation of the chaotic decline leads to a speculative 24 Gb, less than the reported 28 Gb (85%)

Figure 63: Samotlor oil decline 1965-2006



Oil is up again in 2001 but down again in 2006, like gas, but water is down.

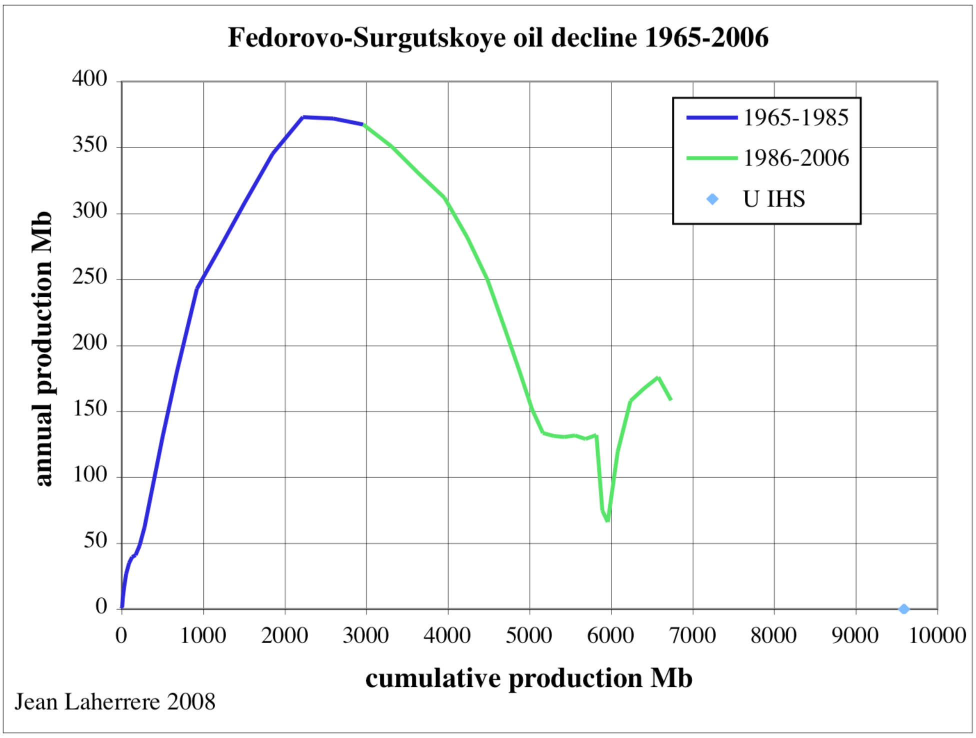
Figure 64: Samotlor oil, gas & condensate production



-Fedorovo-Surgut

Fedorovo-Surgut also displays a collapse at the FSU break-up and then a recovery, but declines again in 2006. The ultimate is likely much less than the reported 9,6 Gb, yet the decline trend is really unreliable.

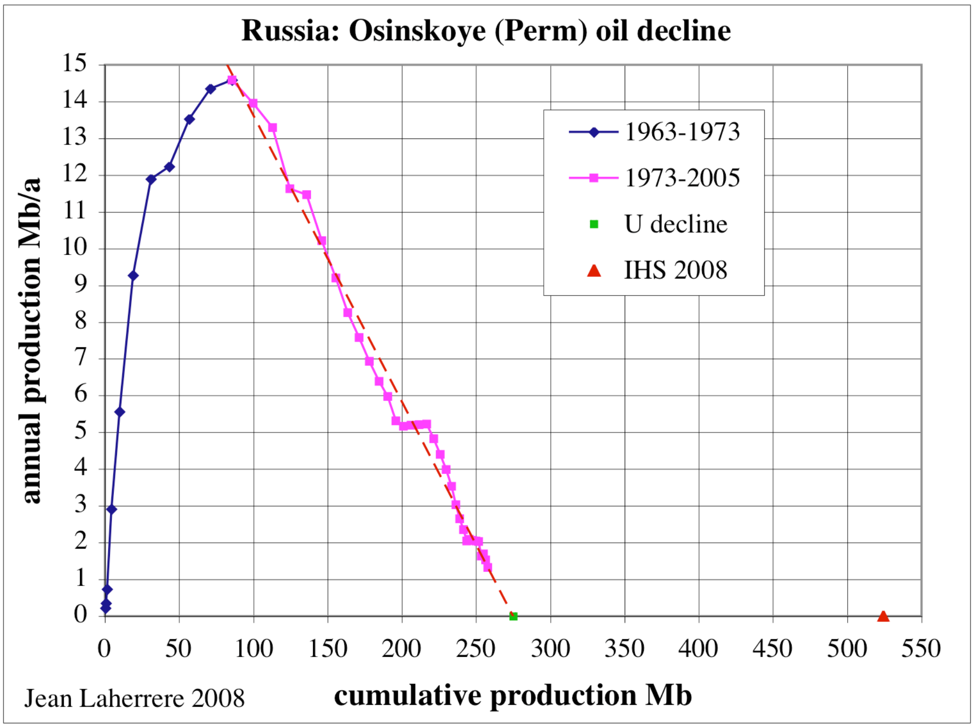
Figure 65: Fedorovo-Surgut oil decline 1965-2006



-Osinskoye

Osinskoye (Perm) oilfield displays a decline since 1976, being not disturbed by the FSU collapse. It is almost depleted going towards 275 Mb very far (about half) from the reported ultimate of 530 Mb

Figure 66: Osinskoye (Perm) oil decline 1963-2005



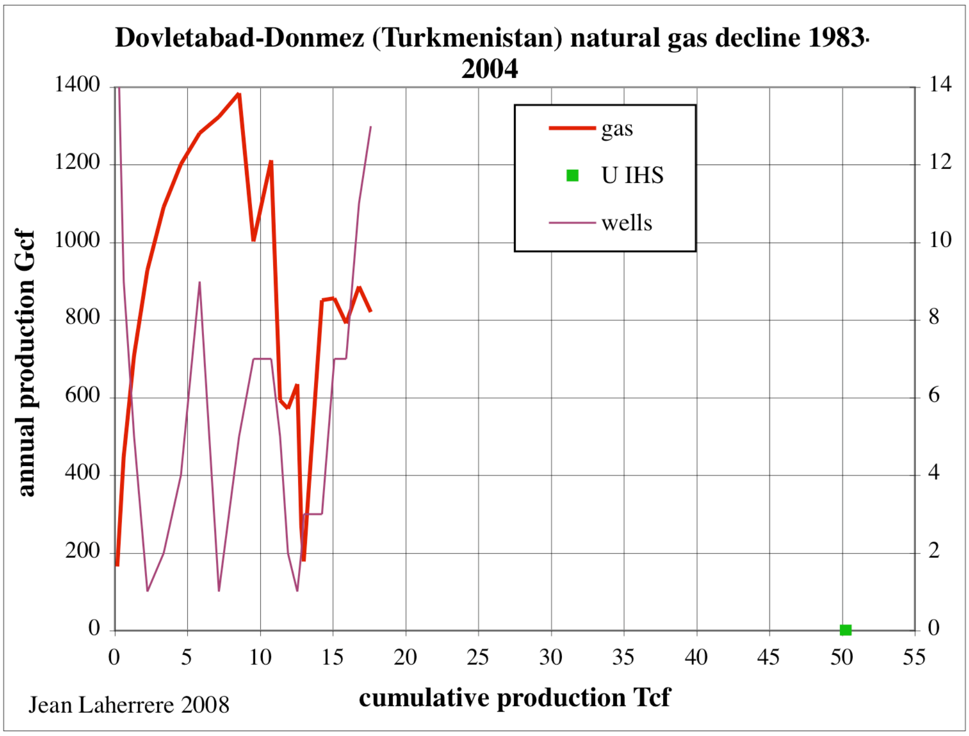
All these Russian field declines confirm that ABC1 reserves are grossly exaggerated, as stated by Khalimov in 1993, and as confirmed by the audit of Gazprom in 2008.

-Turkmenistan

-Dovletabad

Turkmenistan reserves are also ABC1 values and the production is also disturbed by the FSU break-up. The largest gasfield Dovletabad-Donmez has peaked at 1,4 Tcf/a in 1991 and now produces about 0,8 Tcf/a with a cumulative production at 18 Tcf far from the reported ultimate of 50 Tcf

Figure 67: Dovletabad-Donmez natural gas decline



All plots of FSU (CIS) major fields decline confirm that ABC1 have to be multiplied by 70% to obtain 2P values in line with the rest of the world outside the ME.