



Potential Impact of Cantarell's Decline on Mexico's Oil Production

Posted by [Sam Foucher](#) on July 14, 2006 - 11:08am

Topic: [Supply/Production](#)

Tags: [cantarell](#), [m. king hubbert](#), [mexico](#) [list all tags]

In 2005, Cantarell produced more than 60% of Mexico's oil production. Therefore, Cantarell can be considered as the "Ghawar" of Mexico. As we can see on Fig. 1, Cantarell's output doubled within a few years thanks to Nitrogen injection. However, the oilfield production has started to decline rapidly since 2004:

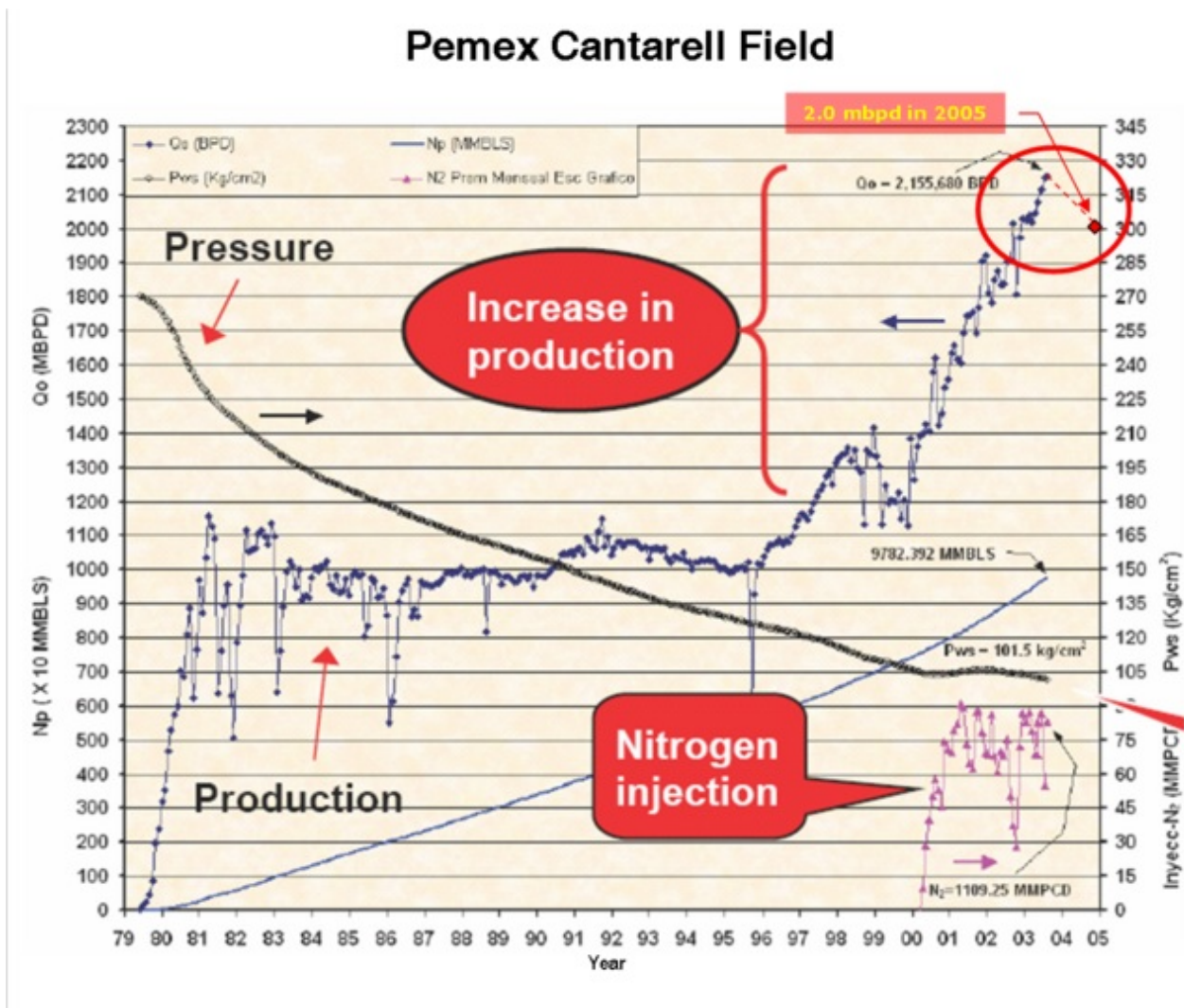


Fig. 1- Cantarell Production (source: PEMEX)

We are proposing to analyze the Mexican production based on two separate Hubbert Linearizations. The resulting production decline is much more important than the decline

Acronyms:

URR= *Ultimate Recoverable Ressource*
HL= *Hubbert Linearization*
mbpd= *Millions of barrels per day*
Gb= *Billions of barrels*

Cantarell is in fact an oil field complex situated near the Yucatan peninsula (see Fig. 2) which has produced 11.674 Gb since 1979 (Mexico's cumulative production is around 34.0 Gb). The volume of oil in place (3P) is estimated to be around 33.7 Gb according to PEMEX. Click To Enlarge.

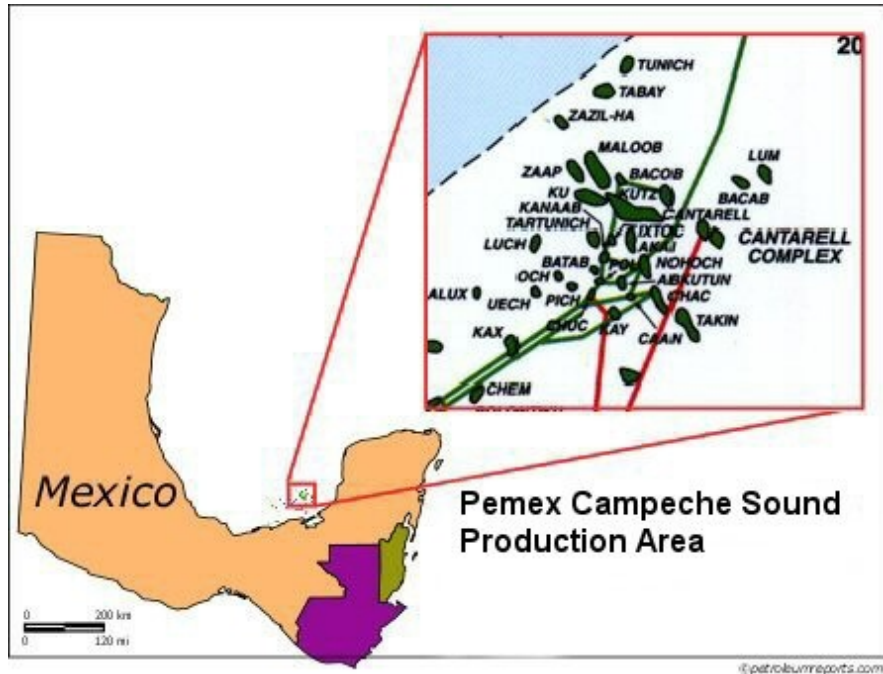


Fig. 2- Cantarell complex. [EIA](#). [Click To Enlarge](#).

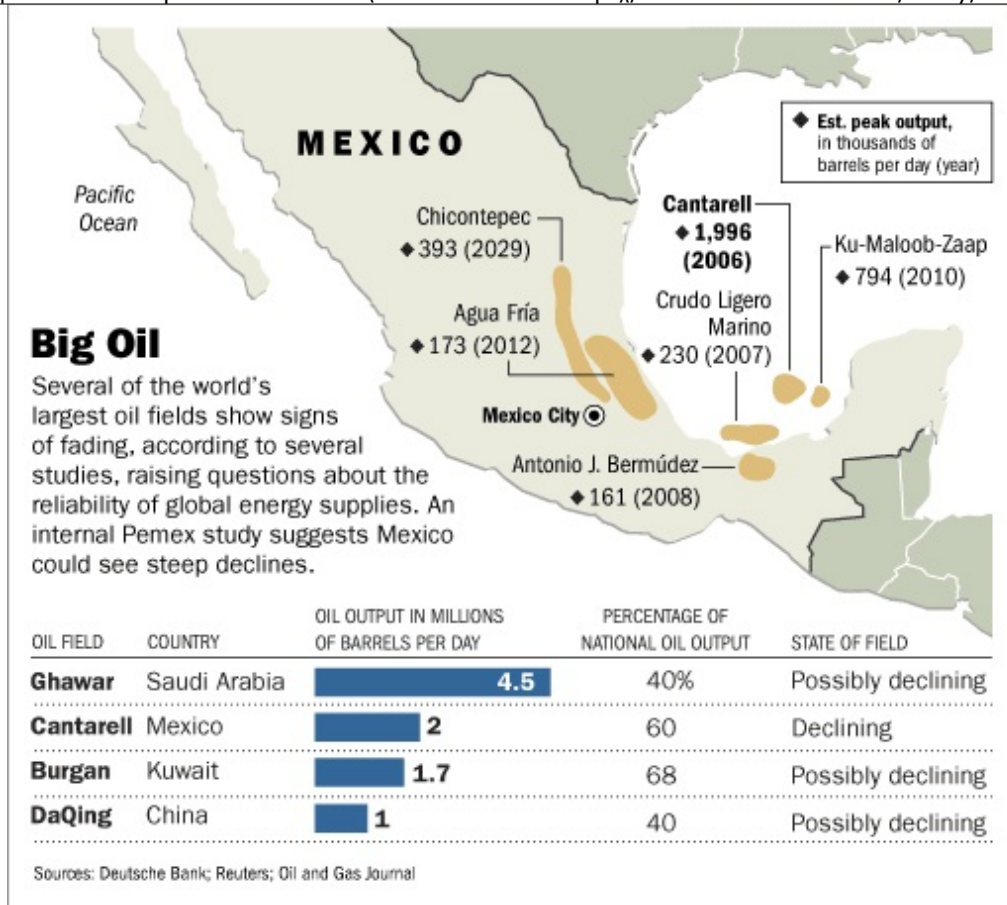
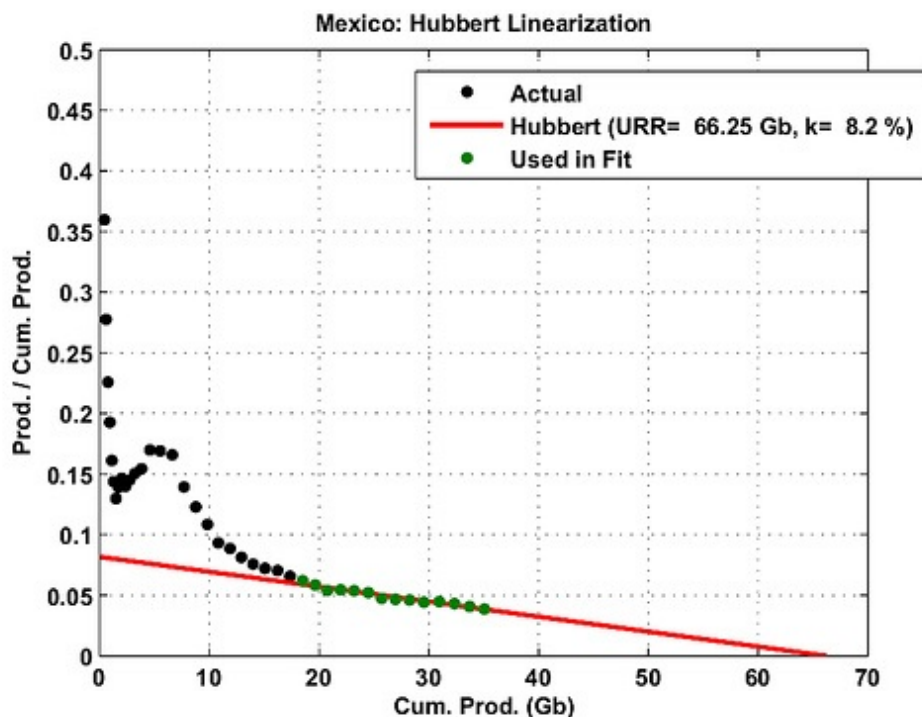


Fig. 3- Mexican main oilfields (Deutsche Bank). Click To Enlarge.

We estimate the logistic curve parameters on the total Mexican production (Fig. 4). The estimated URR is around 66 Gb which means that cumulative production will reach 52% of the URR in 2006.



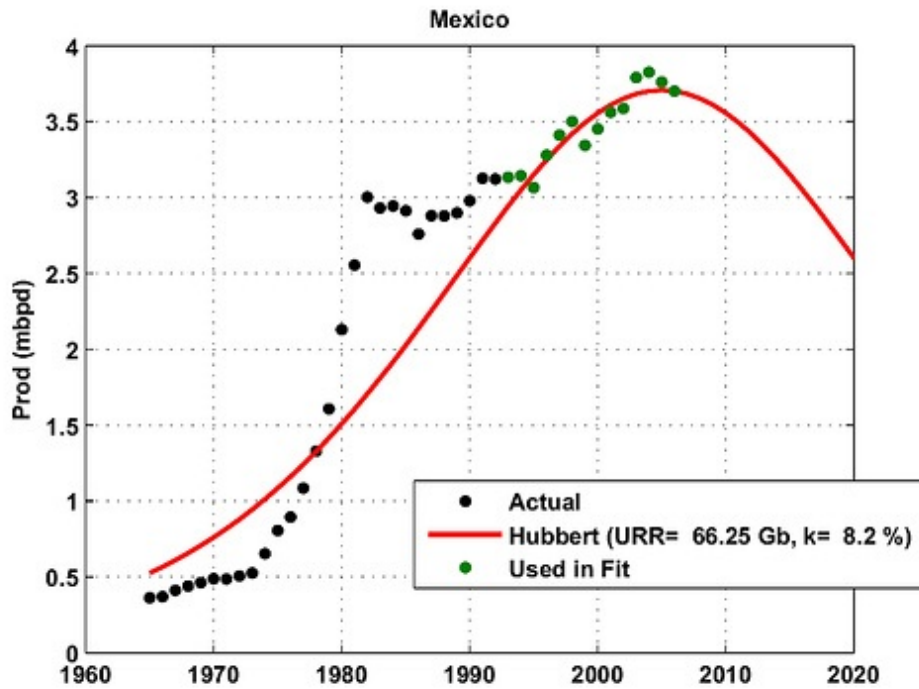
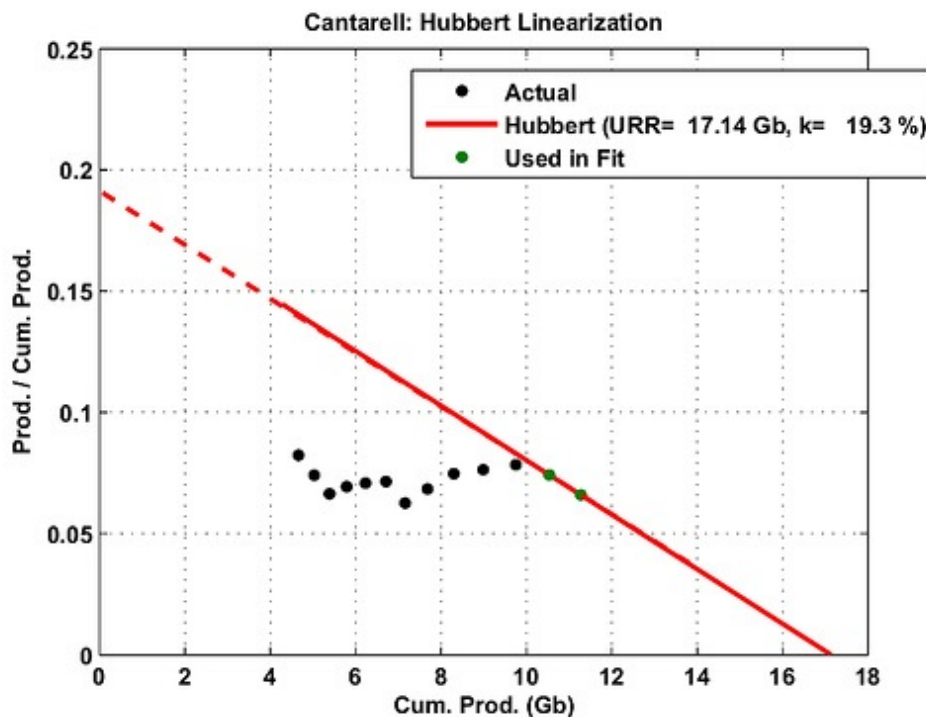


Fig. 4- Hubbert Linearization applied on the Mexican Production (crude oil + NGL, source: BP).
 Click To Enlarge.

We don't need a complete production profile for Cantarell, we use only the data from 1992 to 2005 available on PEMEX website. The result of the HL technique applied on Cantarell is shown on Fig. 5, only the last two or three points can be used to perform the linear fit. The resulting decline is quite steep (K= 19.3%) and the URR is 17.14 Gb which means that $11.674 / 17.14 = 68\%$ of what is recoverable has been produced!



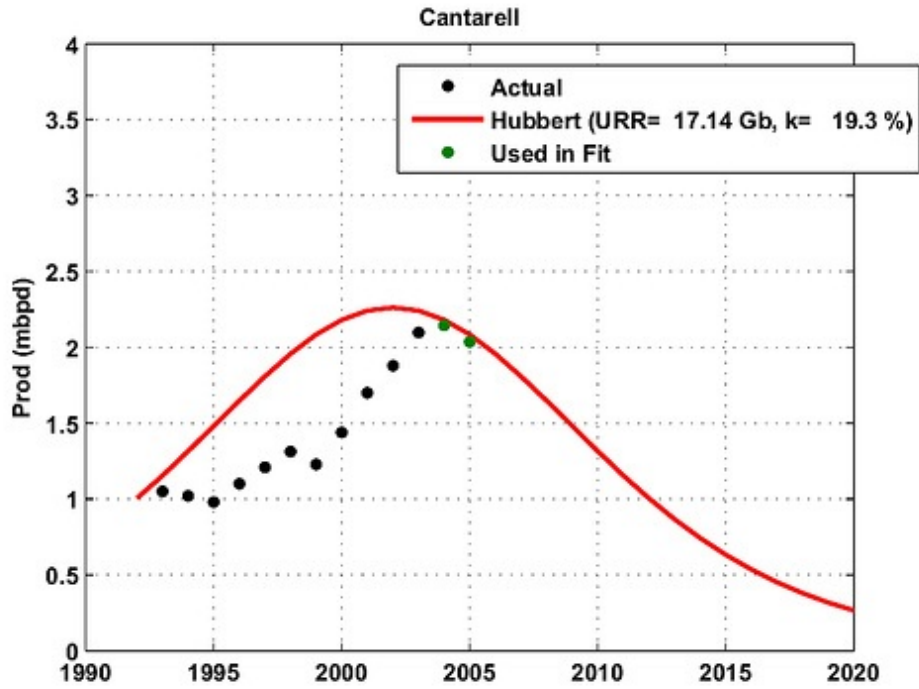
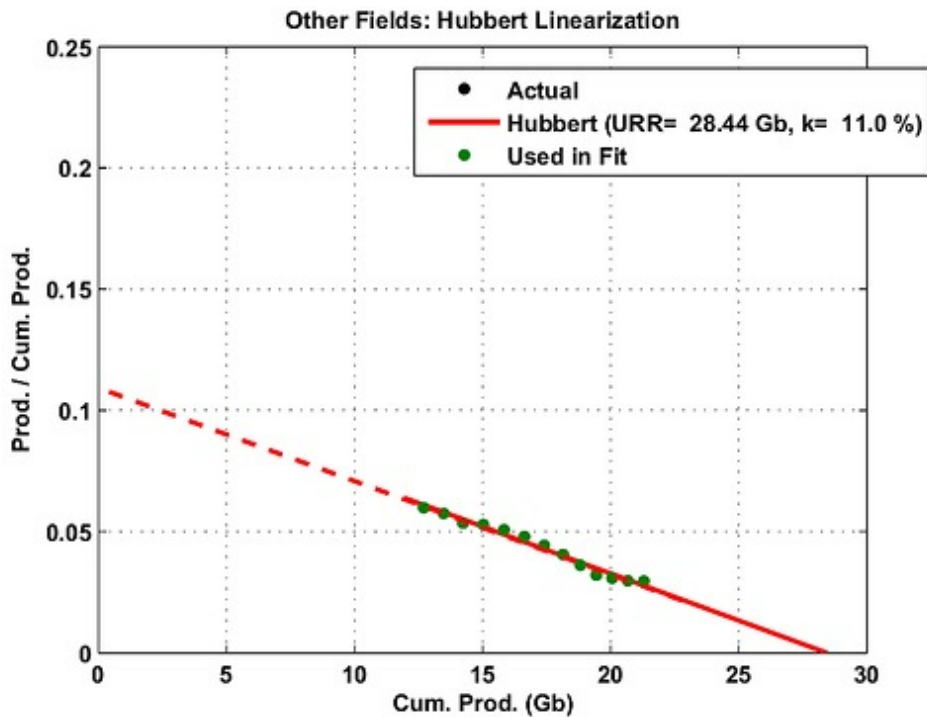


Fig. 5- Hubbert Linearization technique applied on the Cantarell oilfield (crude oil + NGL, data source: PEMEX). Cumulative production has been modified to match 11.674 Gb in 2005. [Click To Enlarge](#).

We apply a second Hubbert Linearization on the rest of the production as shown on [Fig. 6](#). The decline is comparable to the one derived from the total production.



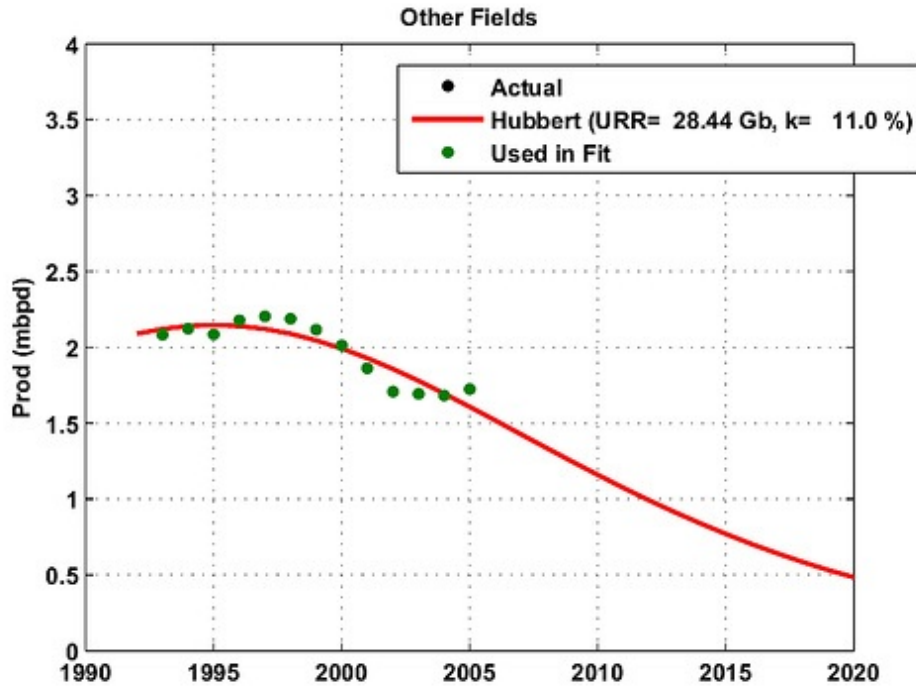


Fig. 6- Hubbert Linearization technique applied on the total production excluding the Cantarell oilfield (crude oil + NGL, data source: BP). Cumulative production has been modified to get 22.0 Gb in 2005. [Click To Enlarge.](#)

Finally, we put together the three above results on [Fig. 7](#). The red dotted curve is the sum of the two logistic curves estimated for Cantarell (in blue) and the rest of the production (in green). We can see that the resulting curve is strongly affected by Cantarell decline with a production down by 30% in 2010! The URR corresponding to the new curve is only 28 Gb + 17 Gb= 45 Gb (Close to the [ASPO estimate](#) at 50Gb).

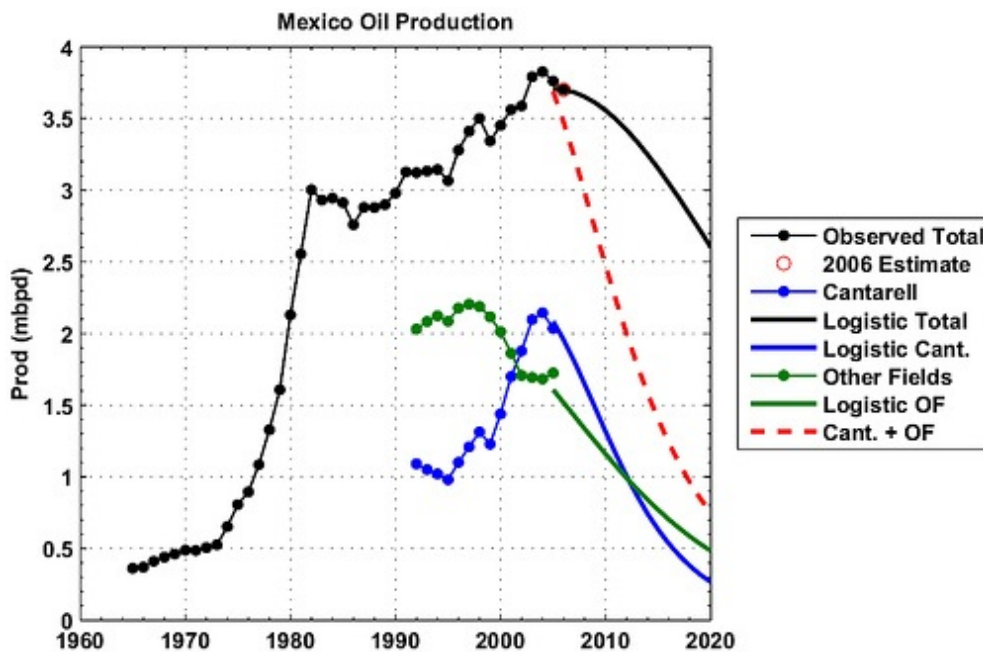


Fig. 7- The three logistic-based forecasts corresponding to the total production (black), Cantarell production (blue) and the rest of the fields (in green). The red dotted line is the sum of the green and blue line. The red circle is an early estimation for 2006 from the IEA (3.7 mmbpd). [Click To Enlarge.](#)

Note that Cantarell decline rate at 20% is not exceptional and that steeper decline rates (around 25-30%) have been observed on [Norway's top fields](#). 2006 will definitely be a turning point for Mexico oil production (see also [Dave's post](#) for the political context). Of course, the red line represents the worst case scenario where no new developments can offset Cantarell decline. The reality will probably be between the black line and the red line. Even the IEA is not very positive, from the last [IEA report](#):

Mexico– April actual: Official production data from state company Pemex showed a rise of 20 kb/d for crude and 10 kb/d for NGL versus March, reaching 3.37 mb/d and 440 kb/d respectively. However, this Report has trimmed expectations for crude production in 2006 overall by 30 kb/d, to 3.27 mb/d. It is increasingly difficult to see offsets for declining Cantarell field production before 2007. More immediately, the campaign for the 2 July Presidential election has seen oil sector reform become an issue. The reversal of production decline and falling reserves is expected to require tax reform in order to boost Pemex's budget, and an opening of the upstream sector to foreign company participation in deepwater hydrocarbon developments.

I give also the official production forecast from PEMEX and Wood Mackenzie who are seeing growth in the Ku-Malloop-Zaap (KMZ) field.

Fig. 8- PEMEX production forecast (2004). [PeakOil.nl](#). Click To Enlarge.

Fig. 9- Wood Mackenzie production forecast. [OilOnline](#). Click To Enlarge.

[Update by Khebab on 07/15/06 at 6:30 PM EDT] Following the many comments about the HL using only two points, I added the Fig. 10 below that shows alternative curves for Cantarell's decline. The exponential solution follows the comment made by [plucky underdog](#).

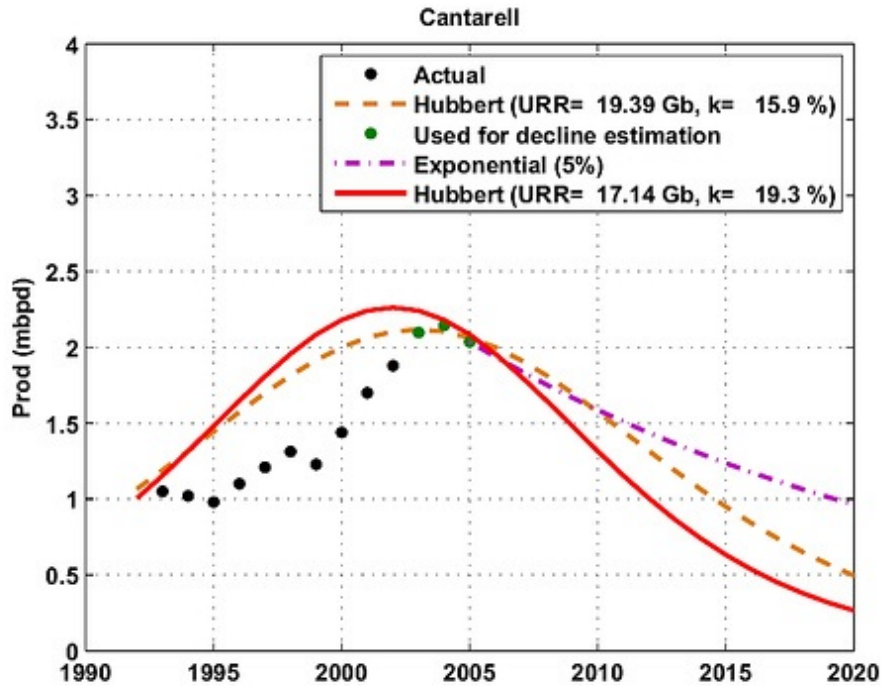


Fig. 10- Various decline estimate for Cantarell: 1) In red: HL result using two points (same result as Fig. 5); 2) In orange: HL result using three points; 3) In purple: exponential decline

References:

- [TOD: Trouble South of the Border -- Mexico's Oil Production](#)
- [ASPO: newsletter #35](#)
- [PEMEX: Liquid Hydrocarbons Production](#)
- [PEMEX: Hydrocarbon reserves 2005](#)
- [BP: Statistical Review of World Energy 2006](#)
- [GraphOilogy; Mexico's Ability to Export Oil](#)



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