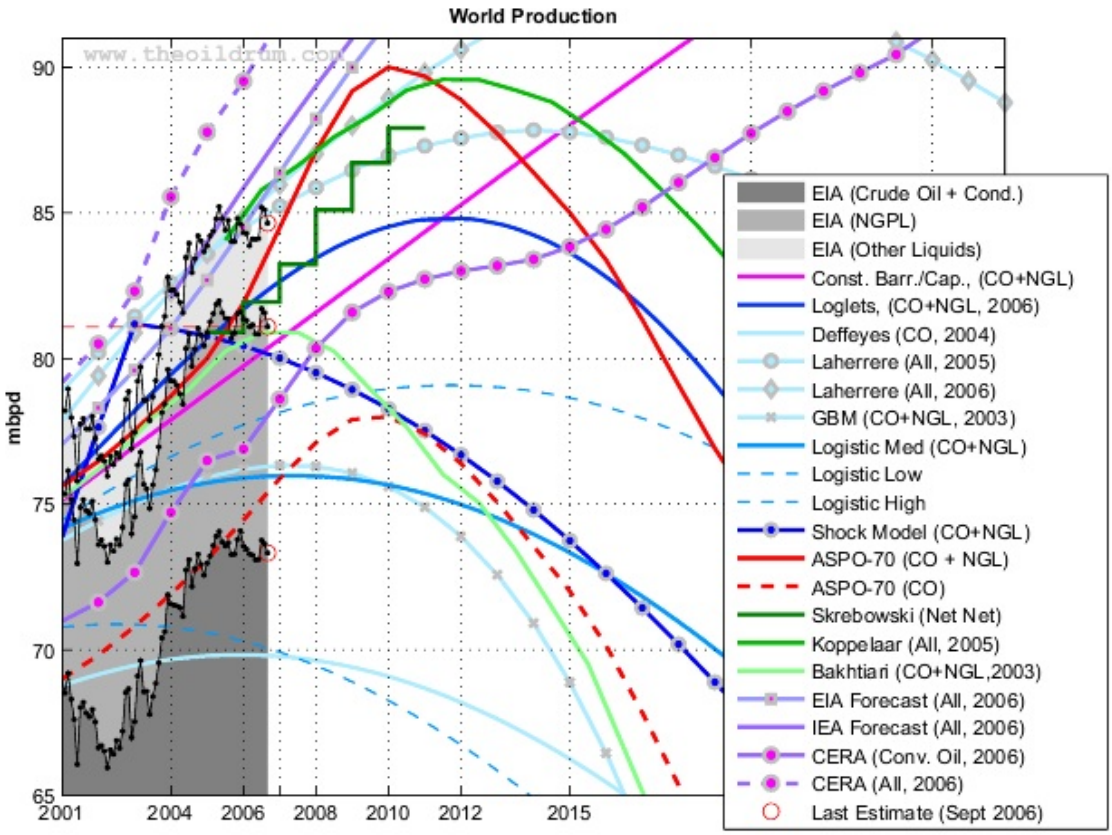
The Oil Drum
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

Peak Oil Update - December 2006: Production Forecasts and EIA Oil Production Numbers

Posted by Sam Foucher on December 14, 2006 - 11:56am
Topic: Supply/Production
Tags: ali morteza samsam bakhtiari, bp, chris skrebowski, eia, logistic, loglets, m. king hubbert, oil, oil prices, peak oil, rembrandt koppelaar, stuart staniford, update [list all tags]

An update on the last production numbers from the EIA along with different oil production forecasts.



World oil production (EIA Monthly) and various forecasts (2001-2027). Click to Enlarge.

What's new:

- IEA forecast (World Energy Outlook, 2006)
- IEA forecast (World Energy Outlook, 2005)
- IEA forecast (World Energy Outlook, 2004)
- Forecasts for Saudi Arabia

A French version is also available on TOD:Canada here.

Notations:

- *mbpd= Millions of barrels per day*
- *Gb= Billions of barrels (10^9)*
- *Tb= Trillions of barrels (10^{12})*
- *NGPL= Natural Gas Plant Liquids*
- CO= Crude Oil + lease condensate
- *NGL= Natural Gas Liquids (lease condensate + NGPL)*
- *URR= Ultimate Recoverable Resource*

EIA Last Update (September)

Data sources for the production numbers:

- Production data from BP Statistical Review of World Energy 2006 (Crude oil + NGL).
- EIA data (monthly and annual productions up to July 2006) for crude oil and lease condensate (noted CO) on which I added the NGPL production (noted CO+NGL).

The All liquids peak is now May 2005 at 85.205 mbpd, the year to date average values (9 months) are down from 2005 for all the categories. The peak dates are unchanged for Crude Oil + Cond., NGPL and Crude Oil + NGL (see Table I below).

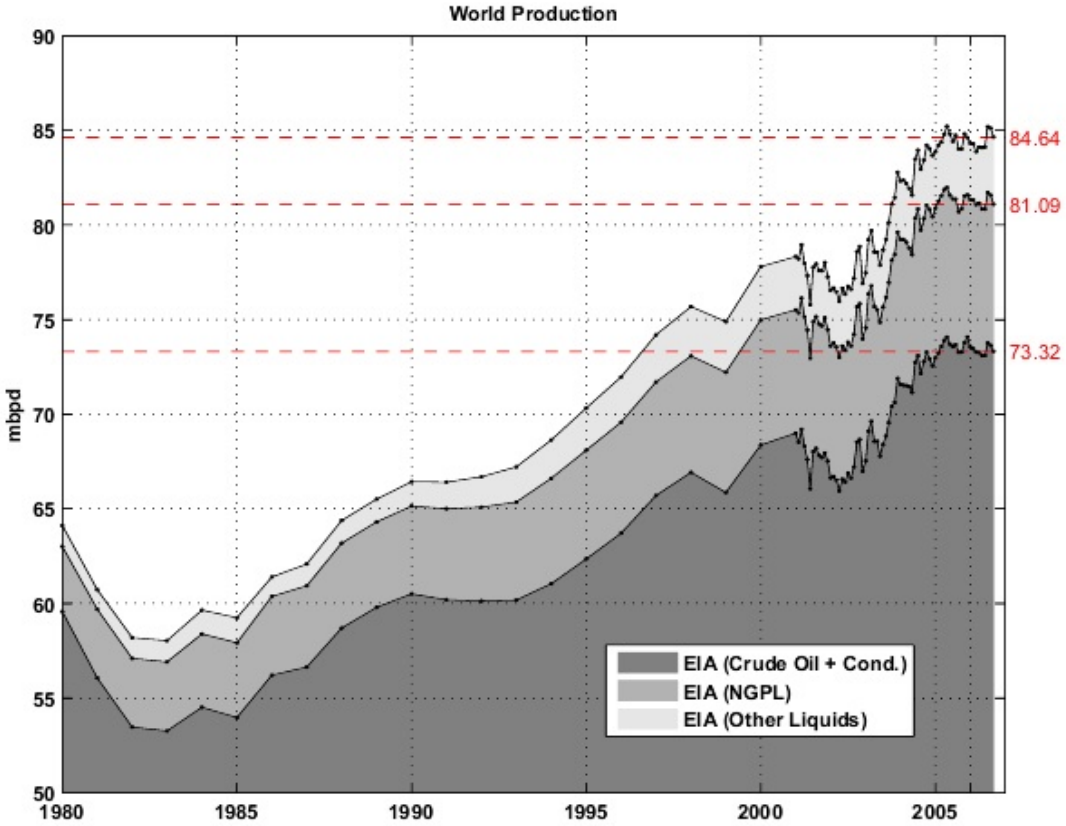


Fig 1.- World production (EIA data). Click to Enlarge.

Category	Sept 2006	Sept 2005	12 MA[1]	2006 9 Months	2005 9 Months	Share	Peak Date	Peak Value
All Liquids	84.64	84.01	84.43	84.41	84.45	100.00%	2005-05	85.21
Crude Oil + NGL	81.09	80.86	81.24	81.21	81.30	95.80%	2005-	81.07

Crude Oil + NGL	81.09	80.80	81.24	81.21	81.30	95.80%	2005-05	81.97
Other Liquids	3.55	3.15	3.19	3.20	3.15	4.20%	2006-09	3.55
NGPL	7.77	7.58	7.78	7.83	7.81	9.18%	2005-02	8.04
Crude Oil + Condensate	73.32	73.28	73.46	73.38	73.50	86.62%	2005-12	74.08

Table I - Production estimate (in millions of barrels per day (mbpd)) for September 2006 taken from the EIA website (International Petroleum Monthly). [1]Moving Average on the last 12 months.

The share of CO is now only 86.62% of the total liquid production.

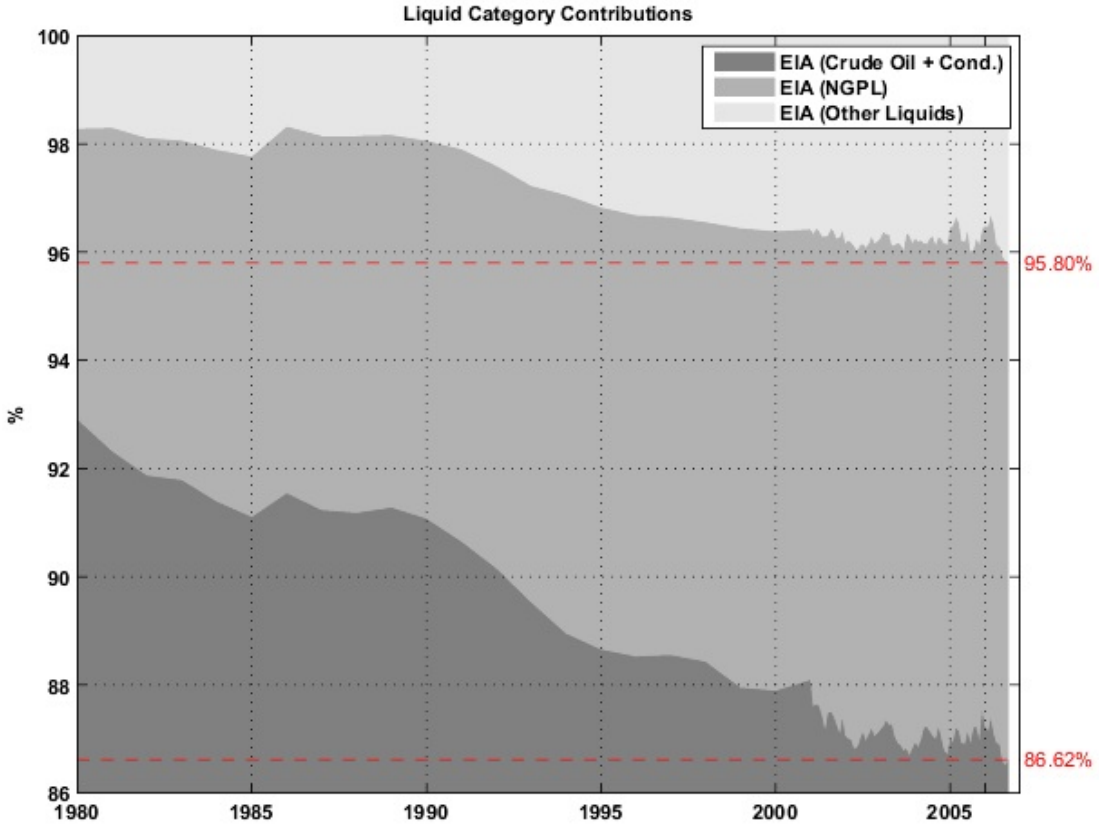


Fig 2.- Share of each liquid category to the total liquid production. Click to Enlarge.

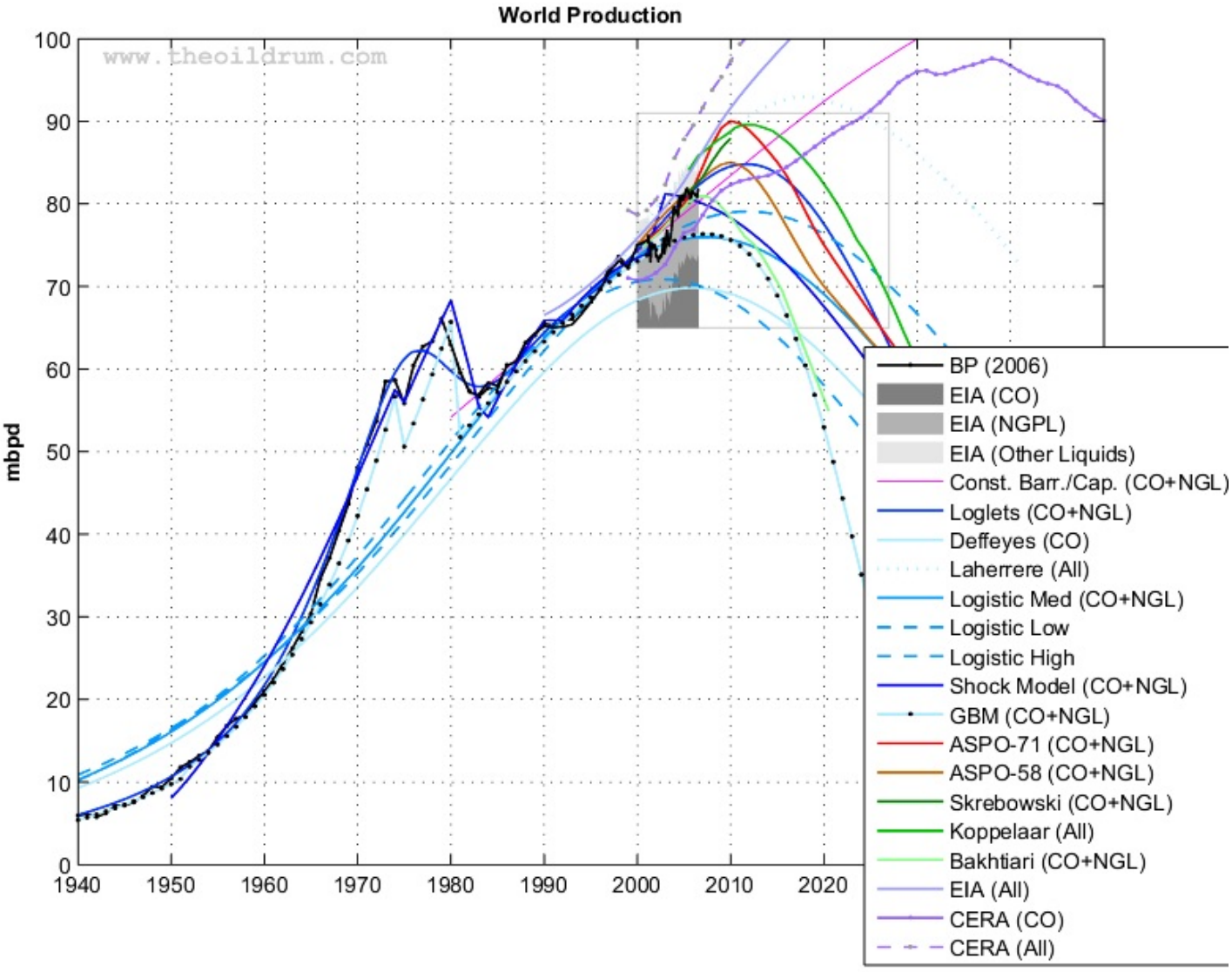


Fig 2.- World oil production (Crude oil + NGL) and various forecasts (1940-2050). The light gray box gives the particular area where the Figures below are zooming in. Click to Enlarge.

Business as Usual

- EIA's International Energy Outlook 2006, reference case (Table E4, World Oil Production by Region and Country, Reference Case).
- IEA total liquid demand forecast for 2006 and 2007 (Table1.xls).
- IEA World Energy Outlook 2006 : forecasts for All liquids, CO+NGL and Crude Oil (Table 3.2, p. 94).
- IEA World Energy Outlook 2005 : forecast for All liquids (Table 3.5).
- IEA World Energy Outlook 2004 : forecast for All liquids (Table 2.4).
- A simple demographic model based on the observation that the oil produced per capita has been roughly constant for the last 26 years around 4.4496 barrels/capita/year (Crude Oil + NGL). The world population forecast employed is the UN 2004 Revision Population Database (medium variant).
- CERA forecasts for conventional oil (Crude Oil + Condensate?) and all liquids, believed to be productive capacities (i.e. actual production + spare capacity). The numbers have been derived from Figure 1 in Dave's response to CERA.

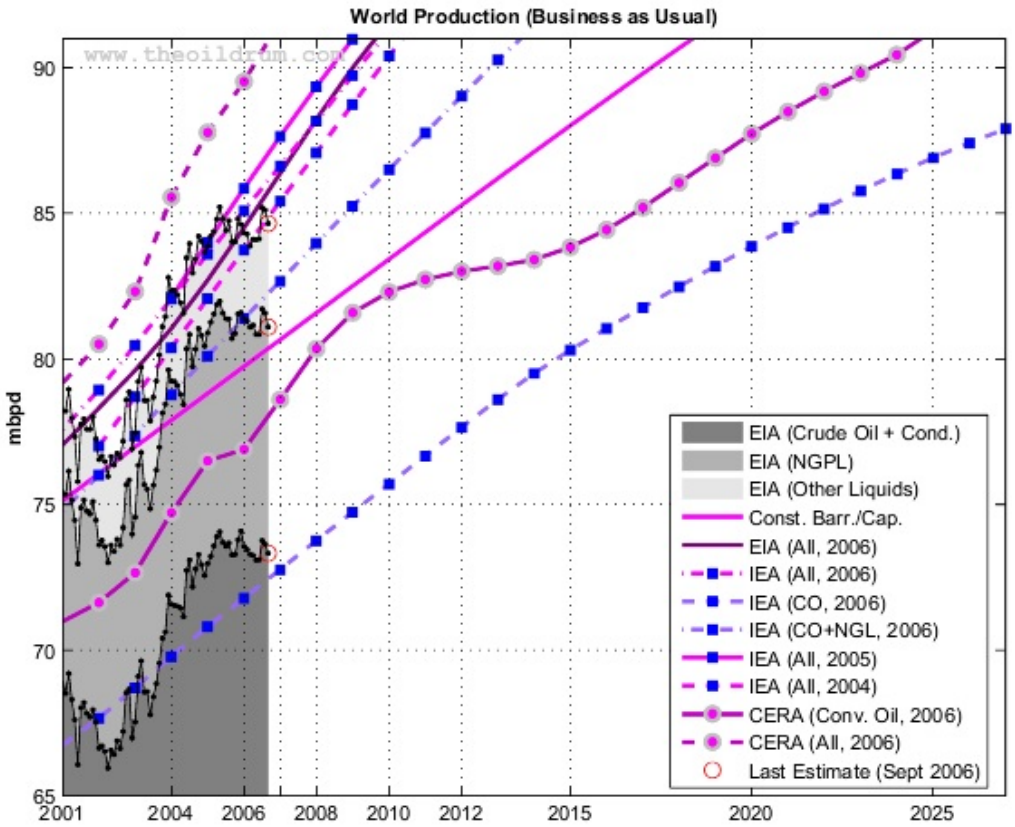


Fig 3.- Production forecasts assuming no visible peak. Click to Enlarge.

PeakOilers: Bottom-Up Analysis

- Chris Skrebowski's megaprojects database (see discussion here).
- The ASPO forecast from the last newsletter (#71): I took the production numbers for 2000, 2005, 2010, 2015 and 2050 and then interpolated the data (spline) for the missing years. I added the previous forecast issued one year and two years ago (newsletter #58 and #46 respectively). There was no revision since August 2006.
- Rembrandt H. E. M. Koppelaar (Oil Supply Analysis 2006 - 2007): *"Between 2006 and 2010 nearly 25 mbpd of new production is expected to come on-stream leading to a production (all liquids) level of 93-94 mbpd (91 mbpd for CO+NGL) in 2010 with the incorporation of a decline rate of 4% over present day production"*.
- Koppelaar Oil Production Outlook 2005-2040 - Foundation Peak Oil Netherlands (November 2005 Edition).
- The WOCAP model from Samsam Bakhtiari (2003). The forecast is for crude oil plus NGL.

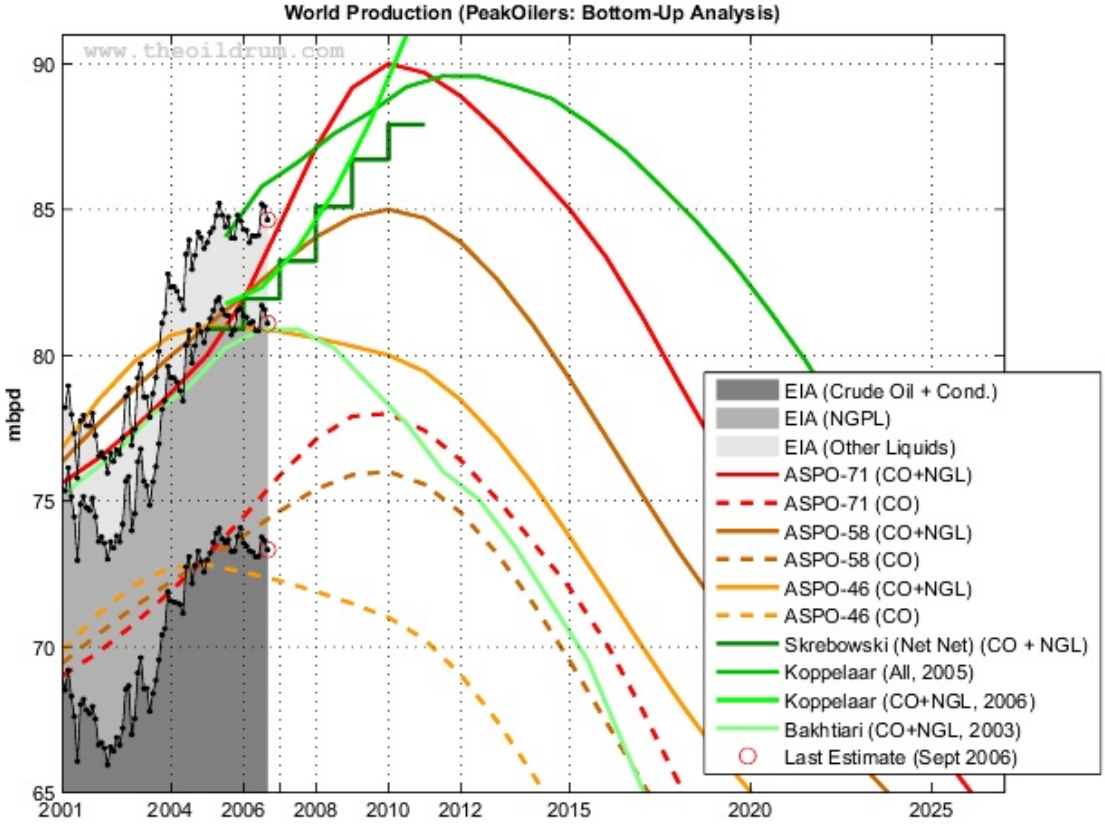


Fig 4.- Forecasts by PeakOilers based on bottom-up methodologies. Click to Enlarge.

PeakOilers: Curve Fitting

The following results are based on a linear or non-linear fit of a parametric curve (most often a Logistic curve) directly on the observed production profile:

- Professor Kenneth S. Deffeyes forecast (Beyond Oil: The View From Hubbert's Peak): Logistic curve fit applied on crude oil only (plus condensate) with URR= 2013 Gb and peak date around November 24th, 2005.
- Jean Lahèrrere (2005): Peak oil and other peaks, presentation to the CERN meeting, 2005.
- Jean Lahèrrere (2006): When will oil production decline significantly? European Geosciences Union, Vienna, 2006.
- Logistic curves derived from the application of Hubbert Linearization technique by Stuart Staniford (see this post for details).
- Results of the Loglet analysis.
- The Generalized Bass Model (GBM) proposed by Prof. Renato Guseo, I used his most recent paper (GUSEO, R. et al. (2006). World Oil Depletion Models: Price Effects Compared with Strategic or Technological Interventions ; Technological Forecasting and Social Change, (in press).). The GBM is a beautiful model that has been applied in finance and marketing science (see here for some background). The estimation in Guseo's article was based on BP data from 2004 (CO+NGL).
- The so-called shock model proposed by TOD's poster WebHubbleTelescope . You can find a description of his approach on his blog here. The current estimate was done in 2005 based on BP's data.

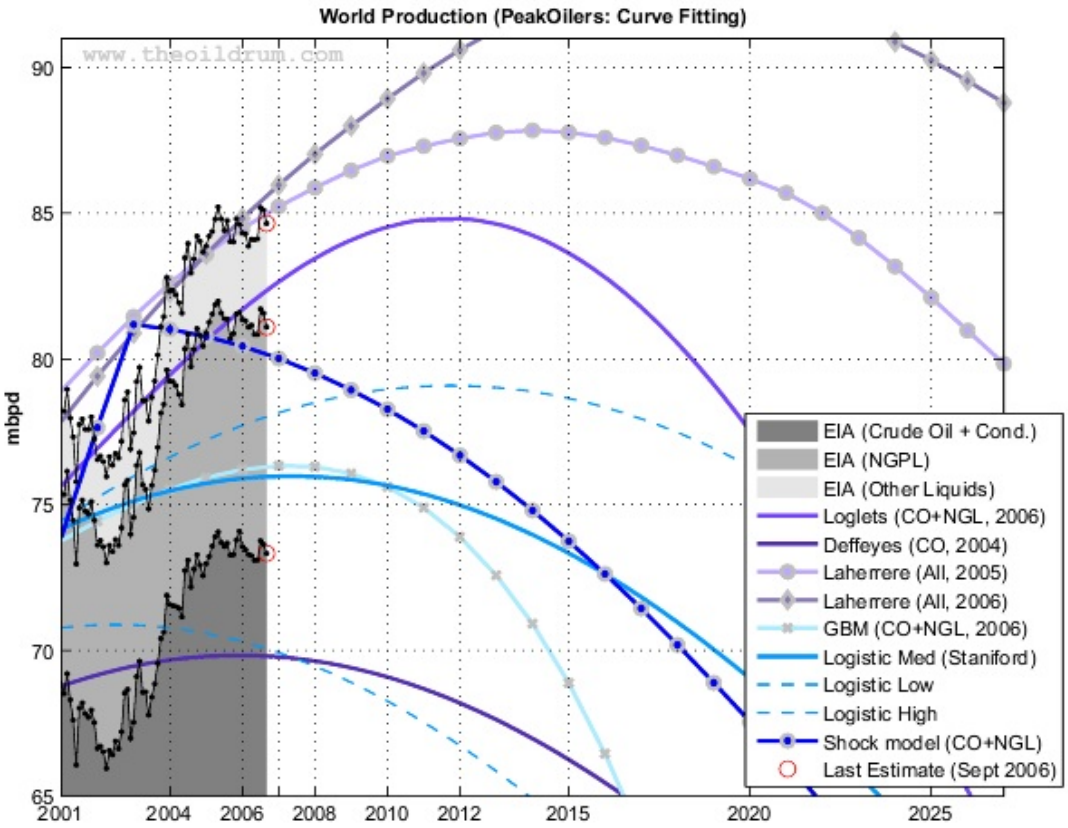


Fig 5.- Forecasts by PeakOilers using curve fitting methodologies. Click to Enlarge.

Production Growth

The chart below gives the year-on-year production growth (or decline) for each month. Growth has been weak (below 1%) most of the year but went back in positive territory since last July.

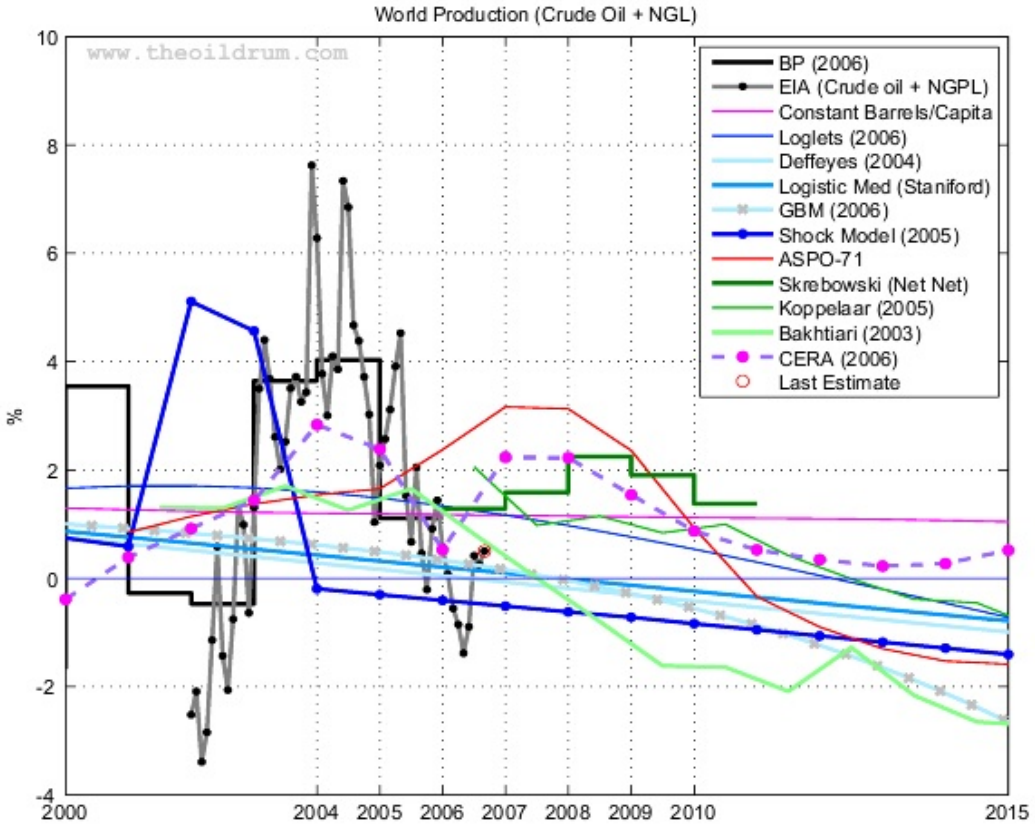


Fig 6.- Year-on-Year production growth. Click to Enlarge.

Forecast	2005	2006	2007	2010	2015	Peak Date	Peak Value
All Liquids							
Observed (EIA)	84.49	84.41	NA	NA	NA	2005-05	85.21
Koppelaar (2005)	84.06	85.78	86.61	89.21	87.98	> 2011	> 89.58
EIA (IEO, 2006)	82.70	84.50	86.37	91.60	98.30	> 2030	> 118.00
IEA (WEO, 2006)	83.60	85.10	86.62	91.30	99.30	> 2030	> 116.30
IEA (WEO, 2005)	84.00	85.85	87.64	92.50	99.11	> 2030	> 115.40
IEA (WEO, 2004)	82.06	83.74	85.41	90.40	98.69	> 2030	> 121.30
CERA[1] (2006)	87.77	89.52	91.62	97.24	104.54	> 2035	> 130.00
Lahèrrere (2006)	83.59	84.82	85.96	88.93	92.27	2018	92.99
Lahèrrere (2005)	83.59	84.47	85.23	86.96	87.77	2014	87.84
Crude Oil + NGL							
Observed (EIA)	81.37	81.21	NA	NA	NA	2005-05	81.97
IEA (WEO, 2006)	80.10	81.38	82.67	86.50	92.50	> 2030	> 104.90
ASPO-71	80.00	81.90	84.48	90.00	85.00	2010	90.00
ASPO-58	81.00	82.03	83.10	85.00	79.18	2010	85.00

ASPO-45	81.00	80.95	80.80	80.00	73.77	2005	81.00
Koppelaar (2006)	81.76	82.31	83.68	91.00	NA	> 2010	91.00
Bakhtiari (2003)	80.24	80.89	80.89	77.64	69.51	2006	80.89
Skrebowski (2006)	80.90	81.42	82.59	87.32	NA	> 2010	87.92
Staniford (High)	77.45	77.92	78.31	79.01	78.51	2011-10	79.08
Staniford (Med)	75.81	75.94	75.97	75.52	73.00	2007-05	75.98
Staniford (Low)	70.46	70.13	69.71	67.92	63.40	2002-07	70.88
Loglets	81.12	82.14	83.02	84.65	83.26	2012-01	84.80
GBM (2003)	76.06	76.27	76.33	75.30	67.79	2007-05	76.34
Shock Model (2006)	80.76	80.43	80.01	78.27	73.74	2003	81.17
Constant barrels/capita	78.81	79.73	80.66	83.42	88.01	> 2050	> 110.64
Crude Oil + Lease Condensate							
Observed (EIA)	73.58	73.38	NA	NA	NA	2005-12	74.08
IEA (WEO, 2006)	70.80	71.78	72.77	75.70	80.30	> 2030	> 89.10
CERA[1] (2006)	76.49	76.89	78.60	82.29	83.83	> 2038	> 97.58
ASPO-71	73.10	74.45	75.87	78.00	72.00	2010	78.00
ASPO-58	73.00	73.80	74.65	76.00	69.50	2010	76.00
ASPO-58	72.80	72.56	72.25	71.00	63.55	2005	72.80
Deffeyes (2004)	69.81	69.81	69.71	68.90	65.88	2005-12	69.82

Table II. Summary of all the forecasts (figures are in mbpd) as well as the last EIA estimates.[1] Productive capacities.

Saudi Arabia

The Figure 7 below gives Saudi Arabia production for crude oil and NGPL (data from the EIA: Monthly Energy Review for CO and the International Petroleum Monthly for NGPL).

- IEA World Energy Outlook 2006 : forecasts for CO+NGL and Crude Oil (Table 3.2, p. 94).
- IEA World Energy Outlook 2005 : forecast for All liquids (Table 3.5).
- EIA, International Energy Outlook 2006 : World Oil Production Capacity by Region and Country, Reference Case, 1990-2030 (Table E1, p. 155).

I've added a simple domestic consumption forecast based on a population forecast by the UN and a constant number of barrels per capita at (see here for details). In order for exports to remain at their 2005 level and assuming the aforementioned consumption model, production needs to grow by (orange dotted line on the charts).

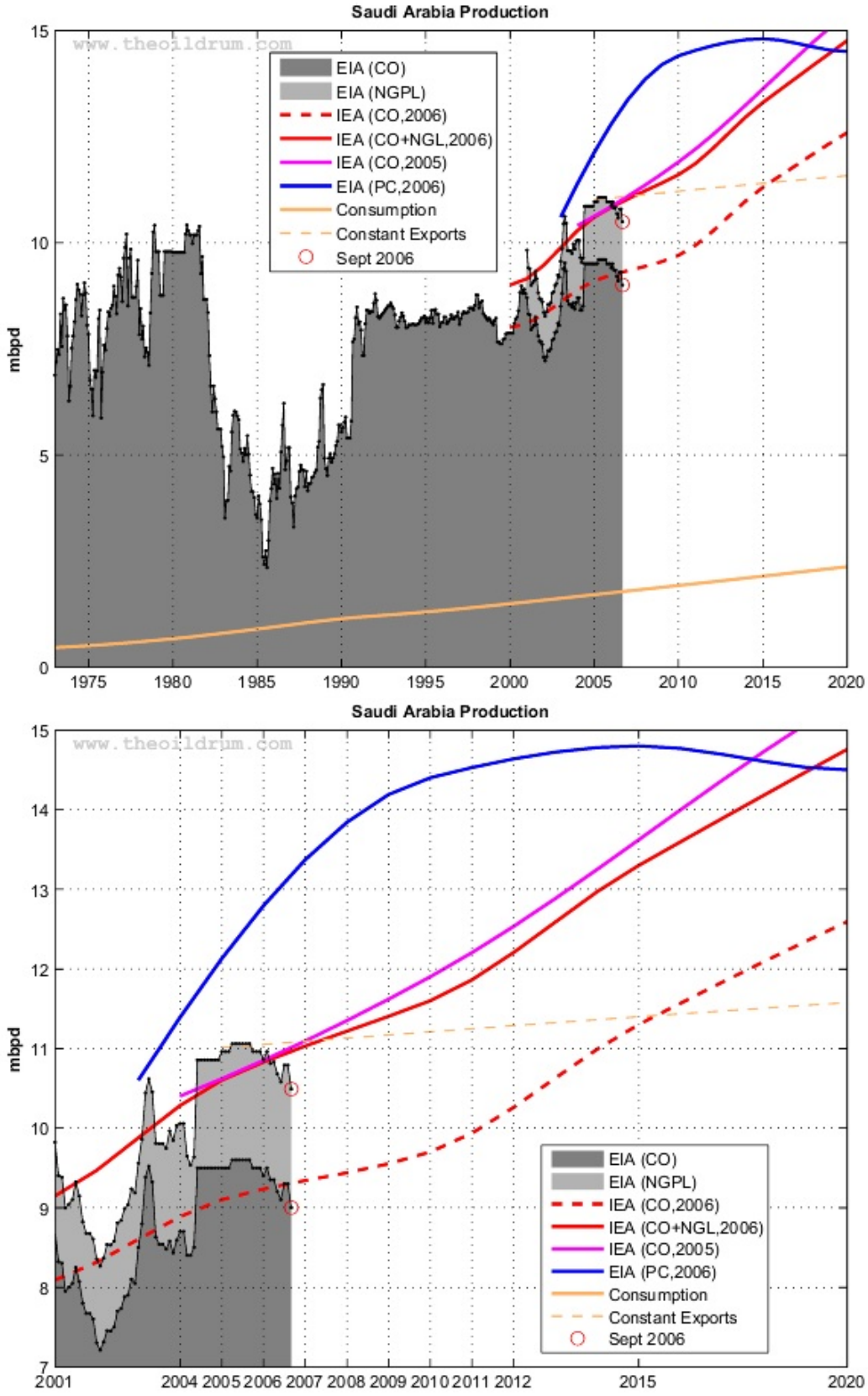


Fig 7.- Saudi Arabia oil production (EIA Monthly) and various forecasts (2001-2020). The EIA estimate is a productive capacity (PC). Click to Enlarge.

Forecast	2005	2006	2007	2010	2015	Peak Date	Peak Value
Crude Oil + NGL							

Observed (EIA)	11.01	10.75	NA	NA	NA	2005-04	11.06
IEA (WEO, 2006)	10.60	10.83	11.03	11.60	13.30	> 2030	> 17.30
IEA (WEO, 2005)	10.62	10.85	11.09	11.90	13.62	> 2030	> 18.20
EIA (IEO, 2006)	12.13	12.79	13.37	14.40	14.80	2015	14.80
Crude Oil + Lease Condensate							
Observed (EIA)	9.55	9.28	NA	NA	NA	1980-11	10.41
Consumption							
Cont. Barrels/Capita	1.71	1.75	1.79	1.92	2.14	> 2050	> 3.43

Table III. Summary of all the forecasts (figures are in mbpd) as well as the last EIA estimates.[1] Productive capacities.

Next update in January.

Previous Update:

November 2006
October 2006
September 2006