The Oil Drum
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Peak Oil Update - June 2007: Production Forecasts and EIA Oil Production Numbers

Posted by Sam Foucher on June 14, 2007 - 11:53am
Topic: Supply/Production
Tags: ali morteza samsam bakhtiari, bp, chris skrebowski, eia, logistic, loglets, m. king hubbert, oil, rembrandt koppelaar, robelius, update [list all tags]

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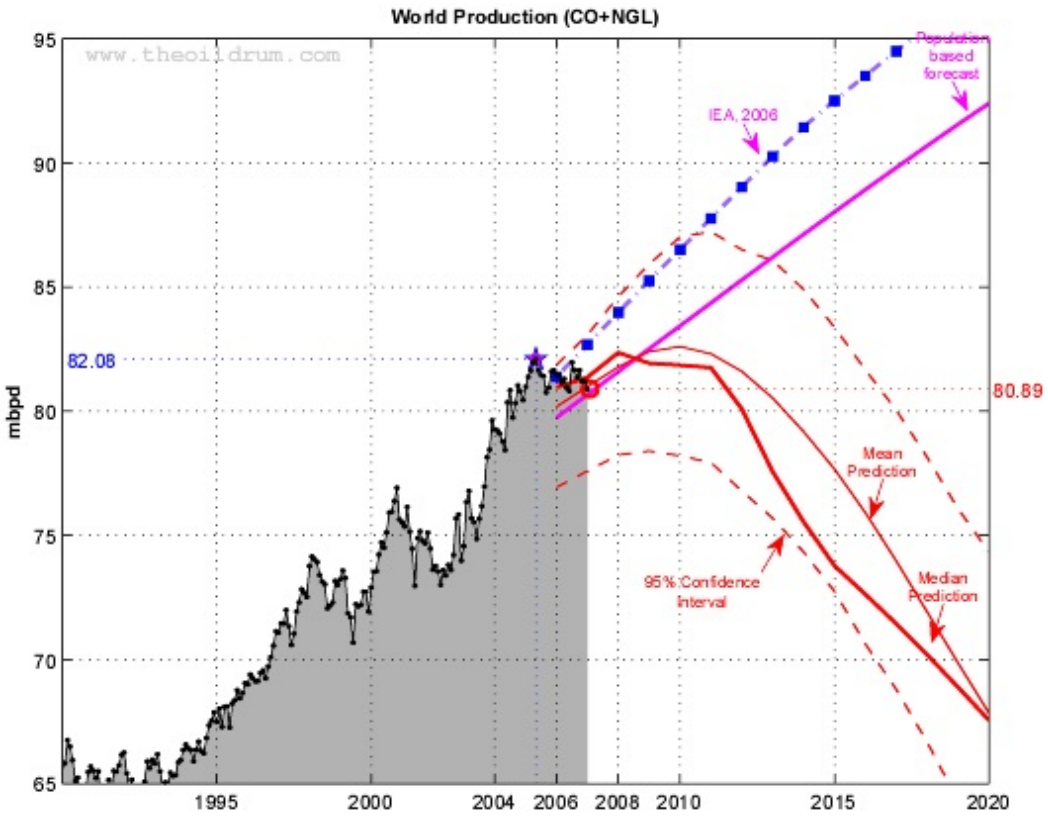
An update on the latest production numbers from the EIA along with graphs/charts of different oil production forecasts.



World oil production (EIA Monthly) for crude oil + NGL. The median forecast is calculated from 12 models that are predicting a peak before 2020 (Bakhiarti, Smith, Staniford, Loglets, Shock model, GBM, ASPO-[70,58,45], Robelius Low/High, HSM). 95% of the predictions sees a production peak between 2009 and 2011 at 78.23 - 87.12 mbpd (The 95% confidence interval is computed using a bootstrap technique). Click to Enlarge.

Executive Summary:

1. **Monthly production records are unchanged except for NGPL:**

1. *All Liquids*: the peak is still July 2006 at 85.43 mbpd, the year to date average production in 2007 (2 months) is 84.26 mbpd, up 0.2 mbpd from 2006.
2. *Crude Oil + NGL*: the peak date remains May 2005 at 82.08 mbpd, the year to date average production for 2007 (2 months) is 81.24 mbpd, down 0.06 mbpd from 2006.
3. *Crude Oil + Condensate*: the peak date remains May 2005 at 74.15 mbpd, the year to date average production for 2007 (2 months) is 73.09 mbpd, down 0.25 mbpd from 2006.
4. *NGPL*: the peak date is now February 2007 at 8.24 mbpd, the year to date average production for 2007 (2 months) is 8.15 mbpd, up 0.19 mbpd from 2006.

2. **Decline in crude oil + condensate continues**: February 2007 estimate for crude oil + condensate is 73.35 mbpd compared to 73.47 mbpd one year ago.
3. **New forecasts added:** Projections from Frederik Robelius and the Hybrid Shock Model.
4. **Average forecast**: the average forecast for crude oil + NGL based on 12 different projections is showing a kind of production plateau around 83 +/- 4 mbpd with a decline after 2010 +/- 1 year.

Notations:

- *mbpd= Million of barrels per day*
- *Gb= Billion of barrels (10^9)*
- *Tb= Trillion 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 (February)

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 February 2007) for crude oil and lease condensate (noted CO) on which I added the NGPL production (noted CO+NGL).

The All liquids peak is still July 2006 at 85.47 mbpd, the year to date average production value in 2007 (2 months) is down from 2005 for all the categories except for NGPL. The peak date for Crude Oil + Cond. is May 2005 at 74.15 mbpd (see Table I below).

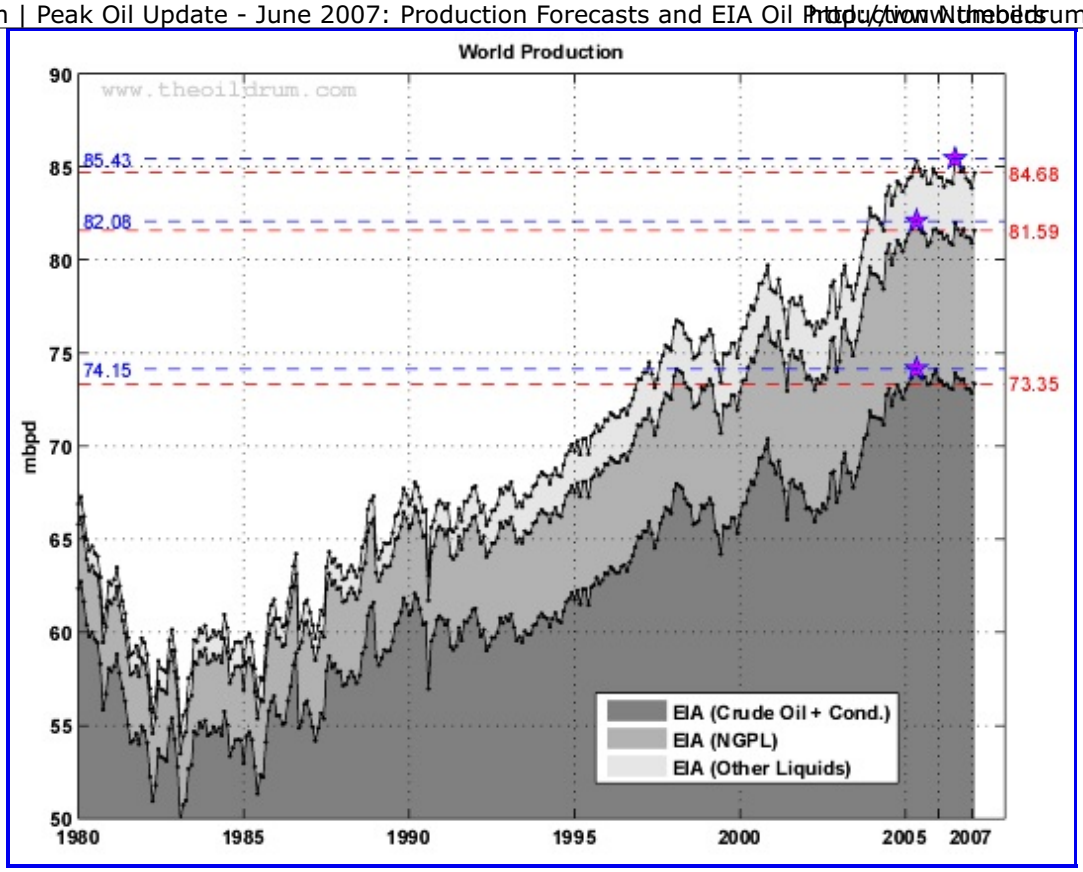


Fig 1.- World production (EIA data). Blue lines and pentagrams are indicating monthly maximum. Monthly data for CO from the EIA. Annual data for NGPL and Other Liquids from 1980 to 2001 have been upsampled to get monthly estimates. Click to Enlarge.

Category	Feb 2007	Feb 2006	12 MA[1]	2007 (2 Months)	2006 (2 Months)	Share	Peak Date	Peak Value
All Liquids	84.68	84.41	84.48	84.26	84.46	100.00%	2006-07	85.43
Crude Oil + NGL	81.59	81.43	81.30	81.24	81.30	96.35%	2005-05	82.08
Other Liquids	3.09	2.98	3.18	3.02	3.16	3.65%	2006-08	3.54
NGPL	8.24	7.97	7.99	8.15	7.96	9.73%	2007-02	8.24
Crude Oil + Condensate	73.35	73.47	73.31	73.09	73.34	86.62%	2005-05	74.15

Table I - Production estimate (in millions of barrels per day (mbpd)) for February 2007 taken from the EIA website (International Petroleum Monthly). [1]Moving Average on the last 12 months.

The share of CO is now only 86.6% of the total liquid production.

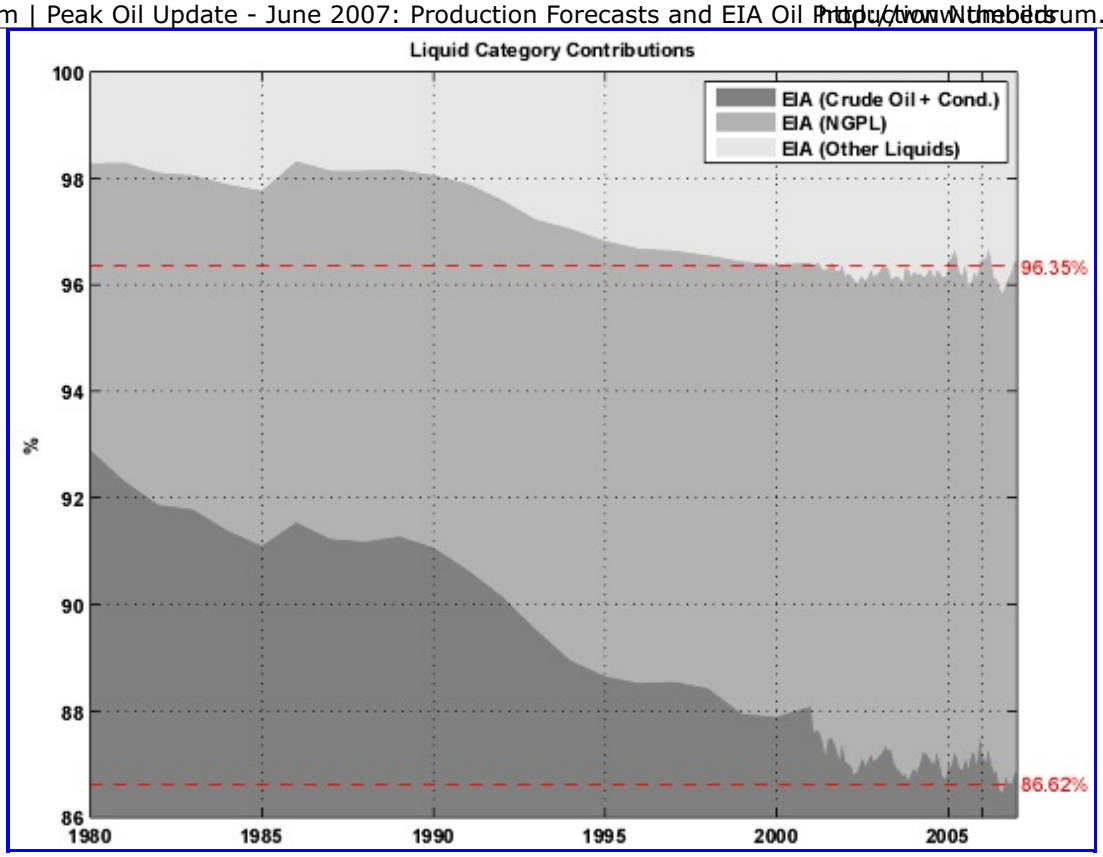


Fig 3.- Share of each liquid category to the total liquid production. Click to Enlarge.

The figure below is giving the general context where all the forecasts are situated, in the following we will focus on the 2000-2025 period shown as a gray box.

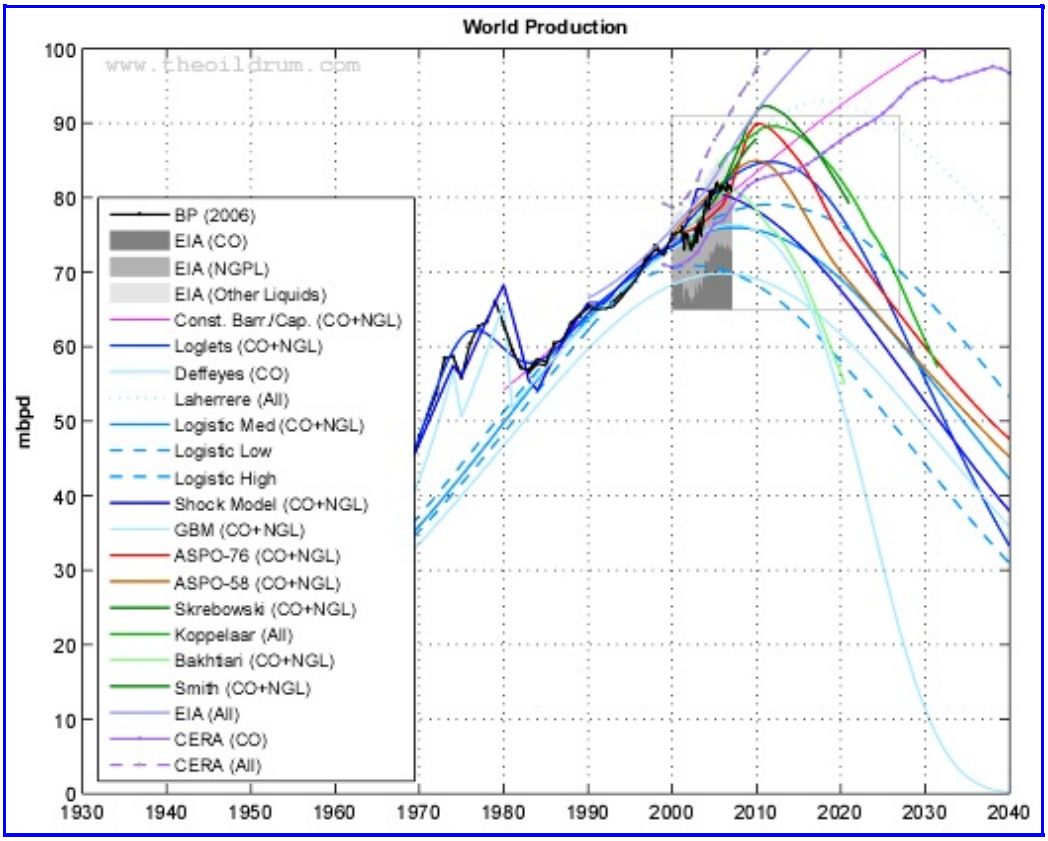


Fig 4.- World oil production (Crude oil + NGL) and various forecasts (1940-2050). The light gray box gives the particular area where the Figures below are zooming in. Click to Enlarge.

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.

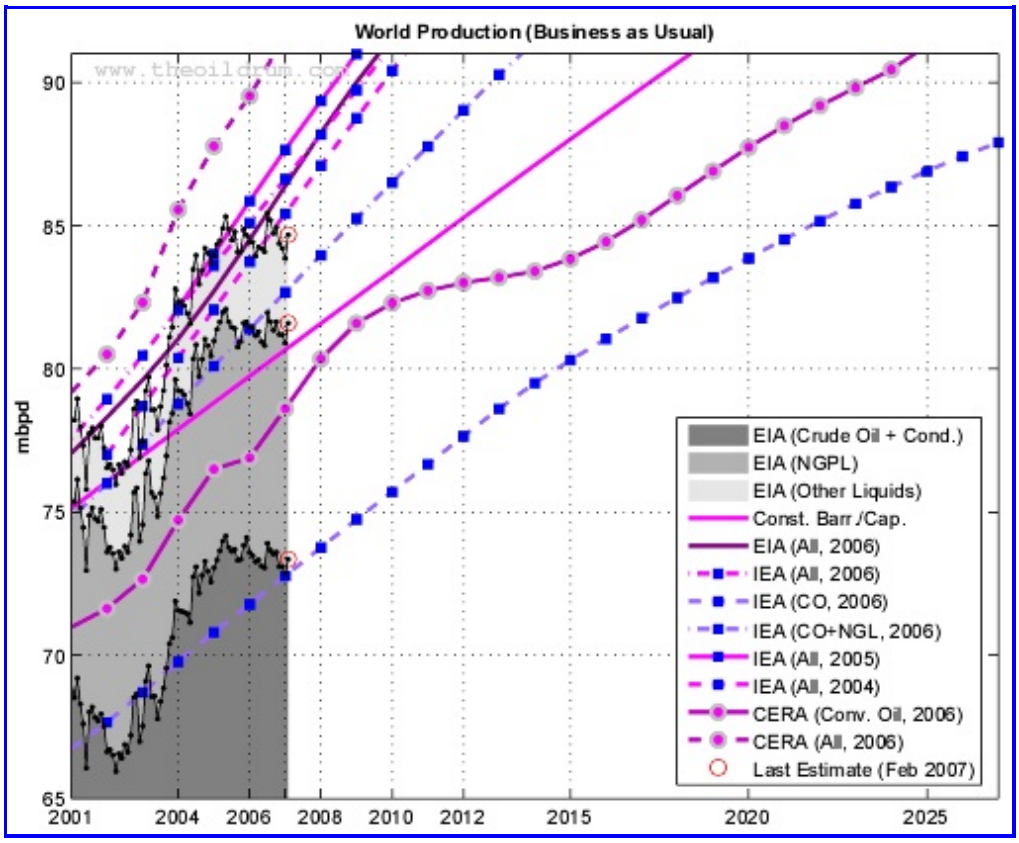


Fig 5.- Production forecasts assuming no visible peak. Click to Enlarge.

PeakOilers: Bottom-Up Analysis

- Chris Skrebowski's megaprojects database (see discussion here).
- The ASPO forecast from April newsletter (#76): 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.
- Forecast by Michael Smith (Energy Institute) for CO+NGL, the data have been taken from this chart in this presentation (pdf).
- PhD thesis of Frederik Robelius (2007): *Giant Oil Fields - The Highway to Oil: Giant Oil Fields and their Importance for Future Oil Production*. The forecasts (low and high) are derived from this chart.

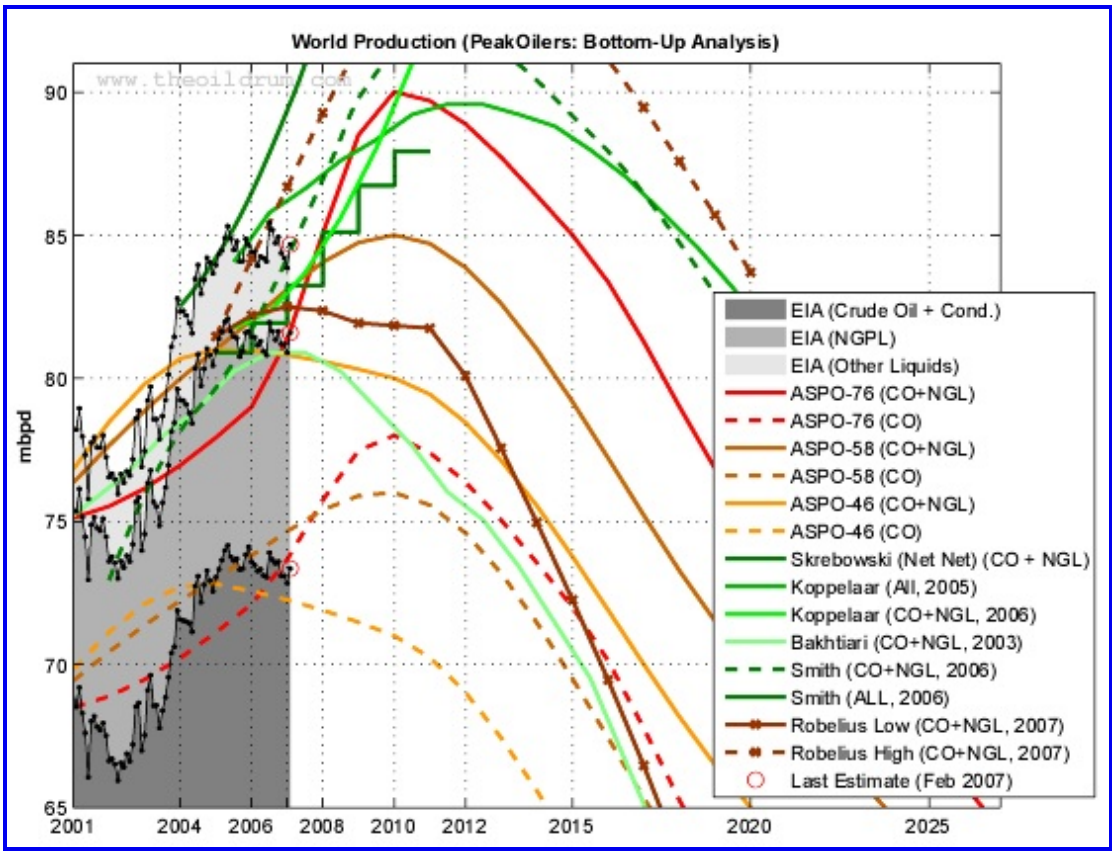


Fig 6.- Forecasts by PeakOilers based on bottom-up methodologies. Click to Enlarge.

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 as well as a review on TOD. The current estimate was done in 2005 based on BP's data (CO+NGL).
- The Hybrid Shock Model is a variant of the shock model described here. The forecast is based on EIA data (up to 2006) for crude oil + condensate, the ASPO backdated disovery curve and assumes no reserve growth and declining new discoveries.

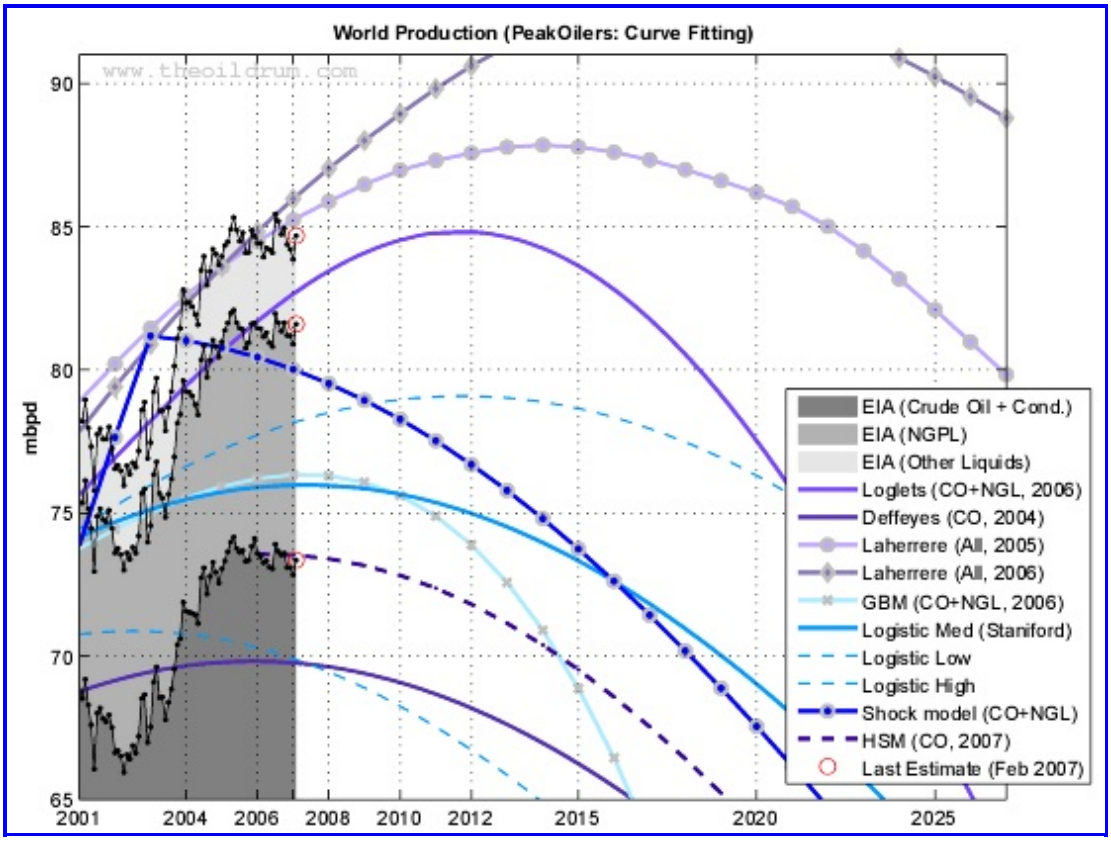


Fig 7.- Forecasts by PeakOilers using curve fitting methodologies. Click to Enlarge.

Production Growth

The chart below gives the year-on-year production growth (or decline) for each month. Growth has been weak (below 1%) since 2005..

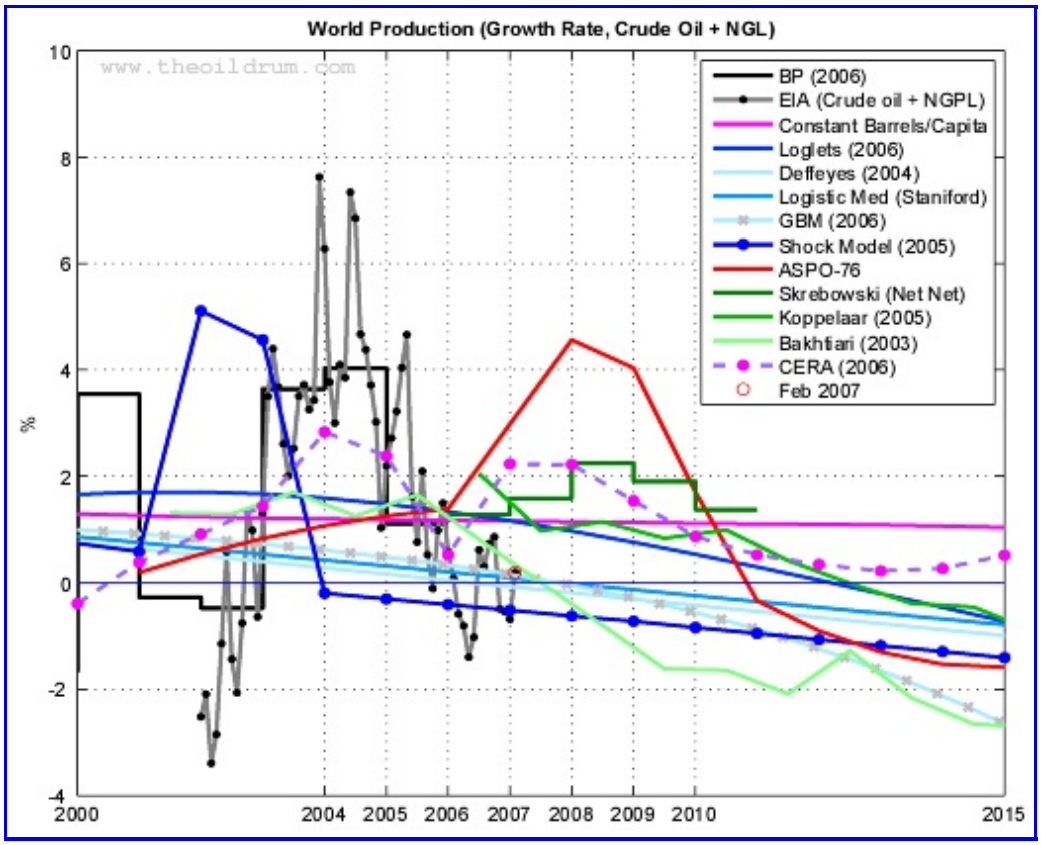


Fig 8.- Year-on-Year production growth. Click to Enlarge.

Forecast	2005	2006	2007	2010	2015	Diff[2]	Peak Date	Peak Value
All Liquids								
Observed (All Liquids)	*84.56*	*84.51*	*84.26*	*NA*	*NA*		*2006-07*	*85.43*
IEA (WEO, 2004)	82.06	83.74	85.41	90.40	98.69	-1.16	2030	121.30
IEA (WEO, 2005)	84.00	85.85	87.64	92.50	99.11	-3.38	2030	115.40
Koppelaar (2005)	84.06	85.78	86.61	89.21	87.98	-2.36	2011	89.58
Lahèrrere (2005)	83.59	84.47	85.23	86.96	87.77	**-0.97**	2014	87.84
EIA (IEO, 2006)	82.70	84.50	86.37	91.60	98.30	-2.11	2030	118.00
IEA (WEO, 2006)	83.60	85.10	86.62	91.30	99.30	-2.36	2030	116.30
CERA[1] (2006)	87.77	89.52	91.62	97.24	104.54	-7.36	2035	130.00
Lahèrrere (2006)	83.59	84.82	85.96	88.93	92.27	-1.70	2018	92.99
Smith (2006)	85.19	87.77	90.88	98.94	98.56	-6.62	2012-05	99.83
Crude Oil + NGL								
Observed (EIA)	*81.45*	*81.33*	*81.24*	*NA*	*NA*		*2005-05*	*82.08*
GBM (2003)	76.06	76.27	76.33	75.30	67.79	4.91	2007-05	76.34
Bakhtiari (2003)	80.24	80.89	80.89	77.64	69.51	**0.34**	2006	80.89

ASPO-46	81.00	80.95	80.80	80.00	73.77	0.43	2005	81.00
ASPO-58	81.00	82.03	83.10	85.00	79.18	-1.86	2010	85.00
Staniford (High)	77.45	77.92	78.31	79.01	78.51	2.92	2011-10	79.08
Staniford (Med)	75.81	75.94	75.97	75.52	73.00	5.27	2007-05	75.98
Staniford (Low)	70.46	70.13	69.71	67.92	63.40	11.53	2002-07	70.88
IEA (WEO, 2006)	80.10	81.38	82.67	86.50	92.50	-1.43	2030	104.90
Koppelaar (2006)	81.76	82.31	83.68	91.00	NA	-2.44	2010	91.00
Skrebowski (2006)	80.90	81.42	82.59	87.32	NA	-1.35	2010	87.92
Smith (2006)	80.53	82.81	85.45	91.95	88.60	-4.21	2011-02	92.31
Loglets	81.12	82.14	83.02	84.65	83.26	-1.78	2012-01	84.80
ASPO-76	77.92	79.00	81.35	90.00	85.00	-0.11	2010	90.00
Robelius Low (2006)	81.45	82.19	82.50	81.84	72.26	-1.26	2007	82.50
Robelius High (2006)	81.45	84.19	86.67	93.40	92.40	-5.44	2012	94.54
Shock Model (2006)	80.76	80.43	80.01	78.27	73.74	1.23	2003	81.17
Crude Oil + Lease Condensate								
Observed (EIA)	*73.65*	*73.39*	*73.09*	*NA*	*NA*		*2005-05*	*74.15*
ASPO-46	72.80	72.56	72.25	71.00	63.55	**0.84**	2005	72.80
Deffeyes (2004)	69.81	69.81	69.71	68.90	65.88	3.38	2005-12	69.82
ASPO-58	73.00	73.80	74.65	76.00	69.50	-1.56	2010	76.00
IEA (WEO, 2006)	70.80	71.78	72.77	75.70	80.30	0.32	2030	89.10
CERA[1] (2006)	76.49	76.89	78.60	82.29	83.83	-5.51	2038	97.58
ASPO-76	71.11	72.10	73.66	78.00	72.00	-0.57	2010	78.00
HSM (2007)	NA	73.56	73.53	72.82	69.53	-0.44	2006	73.56

Table II. Summary of all the forecasts (figures are in mbpd) as well as the last EIA estimates.[1] Productive capacities. [2] Difference between the observed production for 2007 and the predicted value (in mbpd), the value in bold indicates the best forecast (i.e. the oldest with the lowest difference.

Next update probably in September.

Previous Update:

Februray 2007
January 2007
December 2006
November 2006
October 2006
September 2006

OilWatch last issue:

Oilwatch - June 2007

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