

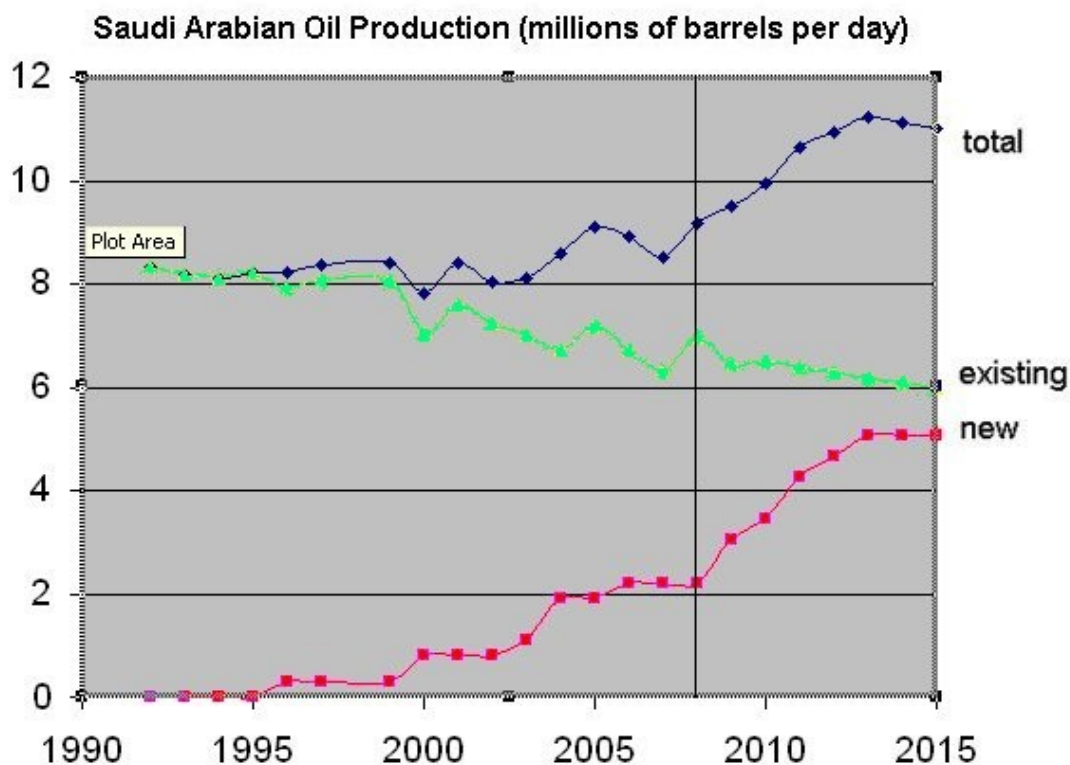


Yet Another Forecast for Saudi Oil Production

Posted by [JoulesBurn](#) on August 12, 2008 - 9:39am

Topic: [Supply/Production](#)

Tags: [aramco](#), [original](#), [peak oil](#), [saudi arabia](#) [[list all tags](#)]



Predicting the future of Saudi Arabian oil production is a rather daunting endeavor, given the limited amount of information available upon which to base a prediction. Presented here is an appraisal for Saudi production through 2015 based on an informed analysis of past production data and a simple extrapolation into the future. It is found that the oil production trend from the early 1990s through the present is driven more by the addition of new producing areas than by "peak and decline" in the Hubbertian sense. This trend will likely continue for the next few years leading to a new "peak", although more rapid decline in mature areas of Ghawar will eventually overwhelm both mitigation efforts therein and added production elsewhere.

"Data always beats theories. 'Look at data three times and then come to a conclusion,' versus 'coming to a conclusion and searching for some data.' The former will win every time."

—Matthew Simmons, ASPO-USA conference, Boston, MA, October 26, 2006

Rethinking the Peak

Has oil crude production in Saudi Arabia peaked? Some claim that it did as of 2006, although the

slate of new production -- including the redevelopment of Khurais and Manifa -- would suggest that 2006 levels will be exceeded in the next few years. The problem here is not with the concept of peak oil, since all individual producing areas will certainly exhibit this behavior, but rather with the idea that the nature of the peak and decline of an arbitrary entity is immutable to changes in the definition of said entity. Such changes can include large new discoveries which eventually increases the amount of oil available, new technologies which do the same, or political decisions about which fields to produce and when. The latter two of these certainly apply to present day Saudi Arabia.

Is it really critical when Saudi production peaks? Yes, given that this certainly means that, with no spare capacity, Saudi Arabia can no longer serve as the swing producer. The rapid price increase during 2008, while not proof of a Saudi peak, is nevertheless indicative of the impact on the world economy from a limited supply buffer.

Forecast This

Several forecasts for Saudi oil production have been offered on this forum, including these:

- [A Nosedive Toward The Desert](#), by Stuart Staniford
- [Saudi Arabia - production forecasts and reserves estimates](#), by Euan Mearns
- [Saudi Arabia: An Attempt to Link Oil Discoveries, Proven Reserves and Production Data](#), by Khebab
- [World Oil Forecasts, including Saudi Arabia, Kuwait and the UAE – Update Feb 2008](#), by Ace
- [Forecasts on Saudi Arabia liquids production](#), by Jean Jean Laherrère

Similar to the above analyses, I will use recent trends in prior production as an indicator of what is to come. The time period of interest is from the early 1990s (when KSA restarted many mothballed fields, including south Ghawar) to the present. What is different is that I will explicitly account for the contribution of newer production (from a myriad number of megaprojects) to the total during this period in developing a forecast for the next few years. In addition, I will not be concerned with a determination of remaining reserves, and will not be using the Hubbert Linearization (or HL) technique. The use of the HL technique for estimating future oil production in general, and for Saudi Arabia in particular, has a rather storied history on TOD. Instead of reliving these moments, I will just direct those interested to a compendium:

http://www.theoil Drum.com/tag/hubbert_linearization

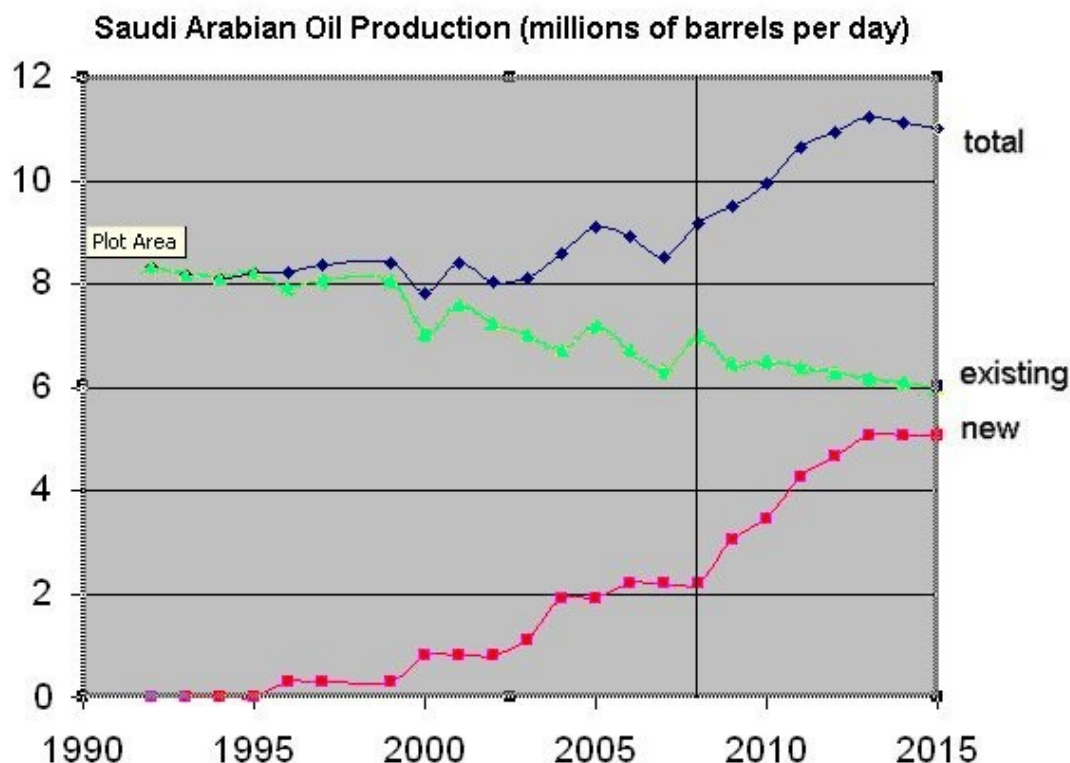
Accounting For Newer Production

If the present plans of Saudi Aramco are realized, about 5 million barrels per day of new production, equivalent to another Ghawar, will have been brought online in about a 20 year period as detailed below:

Project	Flow (10 ³ BPD)	Year
Haradh I	300	1996
Shaybah	500	1999
Haradh II	300	2003
Qatif	500	2004
Abu Safah	300	2004
Haradh III	300	2006

AFK	500	2008
Nuayyim	100	2008
Shaybah II	250	2009
Khurais	1200	2009
Manifa	800	2012

Importantly, production from these fields is managed such that it can be maintained at the target levels well into the future. This is accomplished by adding new wells, of course, but the net result is that any decline estimate which treats new production the same as pre-existing production will overstate the decline. But since the new production amounts (and start-up date) are known, we can isolate the existing production in past years by subtracting the new production from the total. This is shown in the figure below.



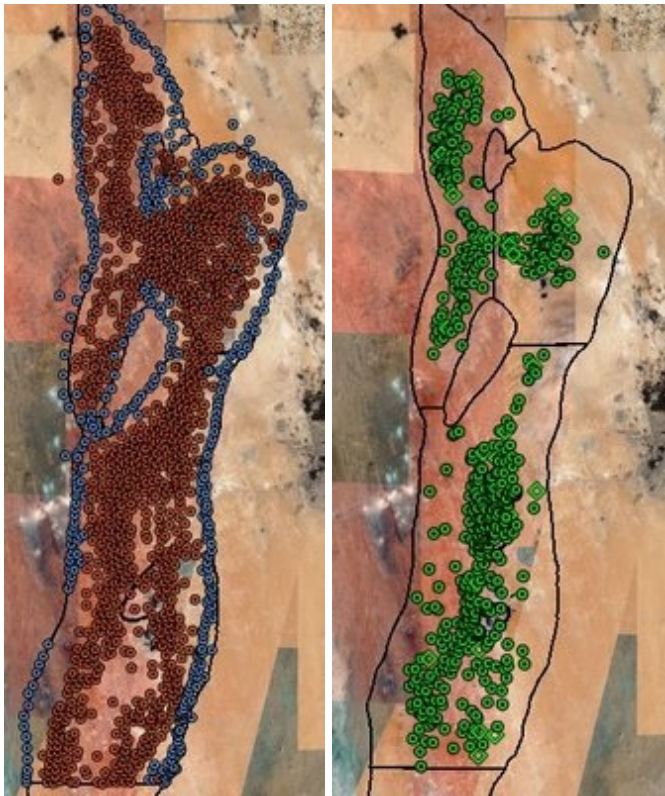
The data to the left of the black vertical line (the present) are known quantities. The new production (red) is subtracted from the total (blue) to obtain the contribution from existing production (green). The data to the right represents forecasts for what Saudi Aramco will add in terms of new production (red) and how much the existing production will decline in the next few years based on a linear extrapolation of that for prior years (green). The total production in future years is then calculated as the sum of these. Is a continuation of this seemingly linear trend probable? Most likely not, for reasons discussed below, but the point here is that nothing in the data itself suggests anything different than a continuation of this trend. It is interesting that the constant decrease (somewhat over 1% per year) is in line with the net decline admitted by Saudi Aramco (natural decline mitigated by additional wells added). Also, the effect of constrained production (either existing or "new") will be wrapped up in this as well, so it's best not to draw too much of a conclusion without additional information.

Whither the Peak?

Once isolated from the newer production contribution, the pronounced trend for existing fields since the early 1990s is a slow decline which gets masked by the new additions. One could claim a peak in 2006, but this lasts only until enough new production is added quickly enough to overwhelm the decline. Of course, after Manifa, the options for substantial additions become rather sparse. And without knowing what fields will be produced and when, predictions beyond 2015 are rather problematic. There is a lot of oil in smaller fields, but the logistics of developing the necessary infrastructure (including water handling) to simultaneously deliver from many fields the oil equivalent of another Shaybah or Khurais will be a much bigger project than either of those.

What if Ghawar Crashes?

If the trend for older fields differs from the above prediction, what is possible? To the extent that any of this production is being throttled back, then letting it all flow would certainly add to the total. But a stronger possibility is a steeper decline of existing fields based upon evidence, from satellite analysis of well drilling, of what it has taken in recent years to maintain production in [Ghawar](#) and [Abqaiq](#). A comparison of the distribution of newer and older wells in north Ghawar is shown below:



In the left image, red and blue placemarks indicate locations of oil and water wells respectively. In the right image, green circles denote recent well locations and diamonds indicate drilling rigs.

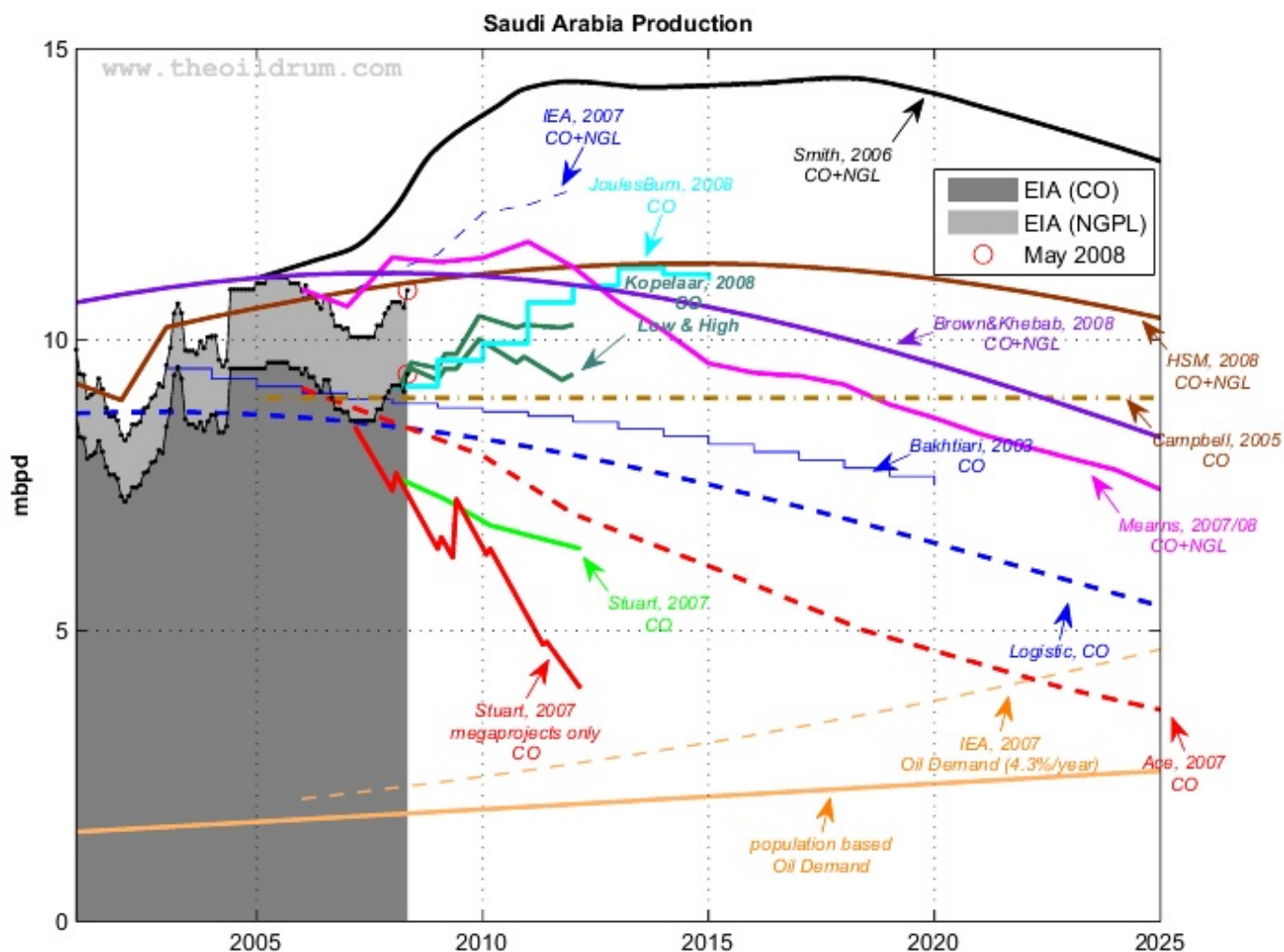
The number of newer wells and the expected productivity of the wells (especially given that these are most likely all horizontal wells) suggests rather serious decline mitigation. Furthermore, the concentration in the center of the field suggests that the days of adding more wells to keep the decline under control are limited indeed. If a steeper decline of Ghawar occurs in the next couple of years, it will possibly be masked by Khurais and then Manifa -- although the higher levels of production promised by Saudi Arabia will not materialize.

Summary

An analysis of recent crude oil production data for Saudi Arabia, in conjunction with data on recent projects which have added additional supply, indicates that the most recent production peak in 2006 will be surpassed with the additions of the Khurais and Manifa producing areas. Beyond these, however, more rapid decline of Ghawar and other older fields will overwhelm any potential additions from their remaining as yet undeveloped fields.

Author's note: Westexas pointed out some errors in the most recent Saudi production data, and the data has been updated to reflect this correction. This does not significantly affect the forecast presented here, however.

Ed note: Khebab just posted this in the comments, I thought it should probably be moved up in the body of the post...it's a graphic of all of the myriad forecasts on one plot:



Click To Enlarge.

and the numbers:

Forecast	2006	2007	2008	2010	2015	Peak Date	Peak Value
Crude oil + NGL	10.58	10.16	10.66	NA	NA	2005-04	11.06
Observed (EIA)							

IEA (WEO, 2006)	10.83	11.03	11.22	11.60	13.30	2030	17.30
IEA (WEO, 2005)	10.85	11.09	11.35	11.90	13.62	2030	18.20
EIA Low Prices (IEO, 2006)	12.45	13.11	13.70	14.40	15.01	2030-01	18.60
EIA Reference Case (IEO, 2006)	12.57	13.27	13.86	14.46	14.79	2030-01	17.10
EIA High Prices (IEO, 2006)	11.82	12.19	12.49	12.65	11.06	2010-01	12.70
Smith (2006)	11.39	11.78	12.73	14.08	14.38	2018-01	14.50
Mearns (2007)	10.72	10.95	11.37	11.52	9.51	2011-01	11.68
IEA (2007)	10.73	10.80	11.17	12.17	NA	2012	12.57
HSM (2008)	NA	NA	10.93	11.12	11.30	2015	11.30
Brown&Khebab high case (2008)	11.11	11.13	11.14	11.08	10.56	2008	11.14

Crude Oil + Lease Condensate

Observed (EIA)	9.15	8.72	9.22	NA	NA	1980-11	10.41
Logistic	8.66	8.59	8.51	8.29	7.51	2003	8.75
Bakhtiari (2003)	9.08	8.98	8.90	8.76	8.20	2003	9.50
Campbell (2005)	9.00	9.00	9.00	9.00	9.00	2006	9.00
Ace (2007)	9.02	8.73	8.44	7.77	5.96	2006-01	9.15
Kopelaar high (2008)	NA	NA	9.38	9.76	NA	2009-12	10.00
Kopelaar low (2008)	NA	NA	9.49	10.28	NA	2009-12	10.40
JoulesBurn (2008)	NA	NA	9.19	9.94	11.02	2013	11.23

Consumption

Cont. Barrels/Capita	1.75	1.79	1.83	1.92	2.14	2050	3.43
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