

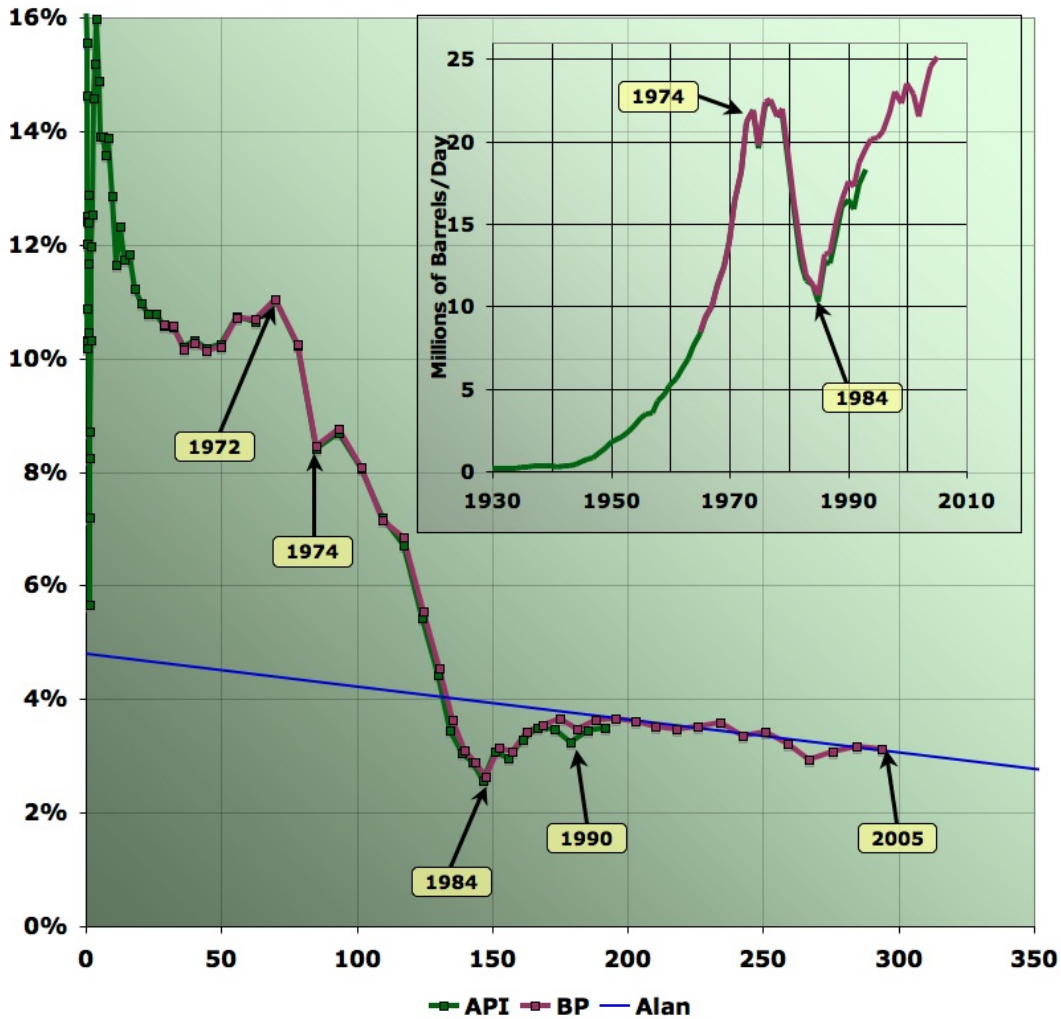


Linearize this...

Posted by [Stuart Staniford](#) on July 7, 2006 - 4:15am

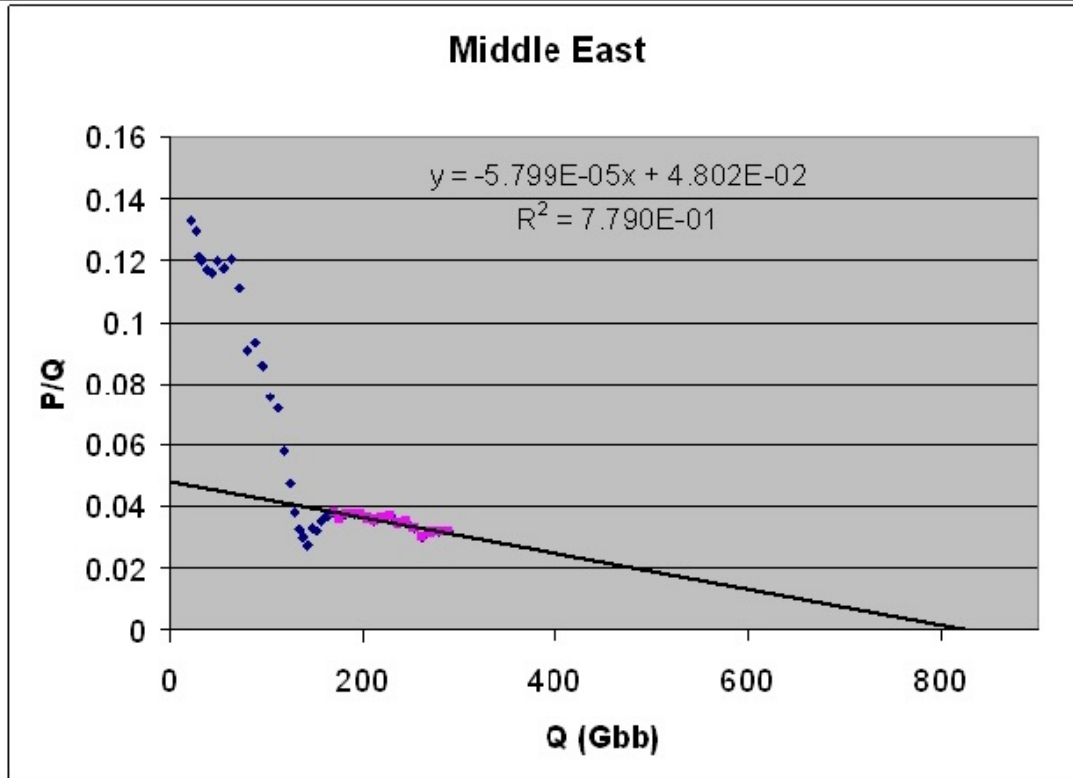
Topic: [Supply/Production](#)

Tags: [hubbert linearization](#), [hubbert peak](#), [oil prices](#), [peak oil](#) [list all tags]



Hubbert linearization of Middle East production from two sources (x-axis is Gb). Inset graph shows production versus time. Click for larger version. Source: American Petroleum Institute (courtesy J. Laharrere), and BP.

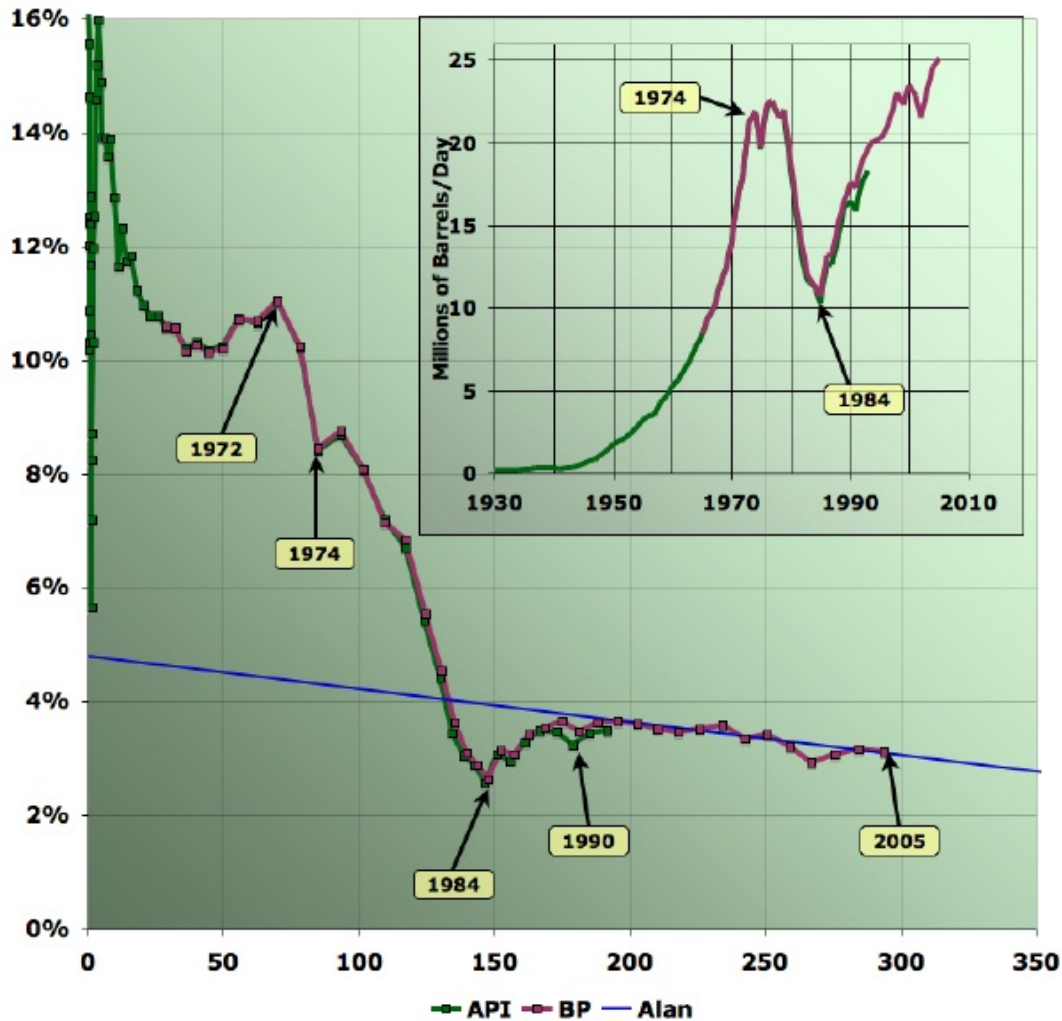
The other day, [Alan](#) posted this graph:



Hubbert Linearization of oil production according to [Alan](#).

It shows a [Hubbert linearization](#) of oil production for the entire Middle East. The total URR from this plot is 828Gb, and the implied data of peak to make cumulative production to date match up is in 2017. A number of people suggested that this is inconsistent with the idea that the world is at plateau production now (though as we'll see, that's not actually true).

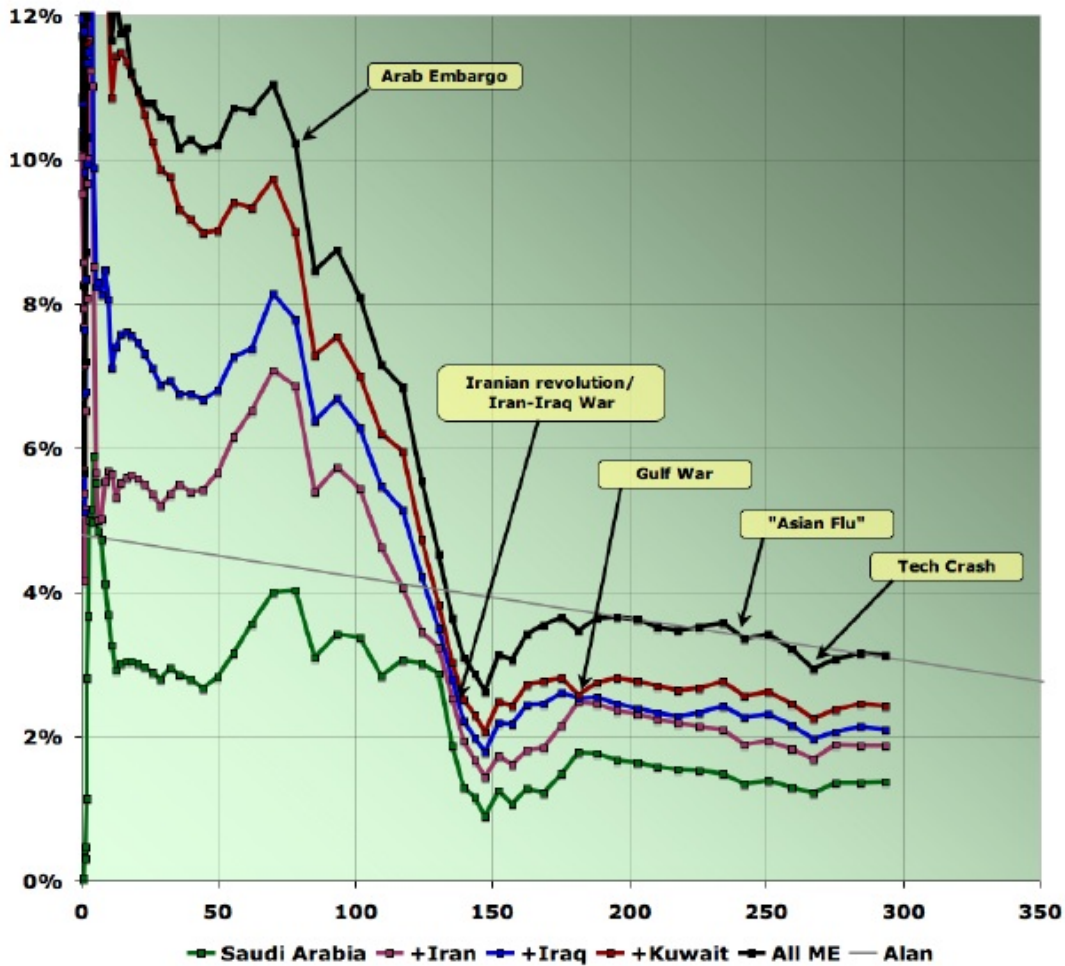
Anyway, let's take a closer look. Here I've reproduced Alan's linearization, but have focussed in on the area where most of the data is, and labeled various years that represent particular features of the graph. Also, I've inset the production versus time graph for comparison.



Hubbert linearization of Middle East production from two sources (x-axis is Gb). Inset graph shows production versus time. Click for larger version. Source: American Petroleum Institute (courtesy J. Laharrere), and [BP](#). Cumulative production at start of BP series was inferred from API series.

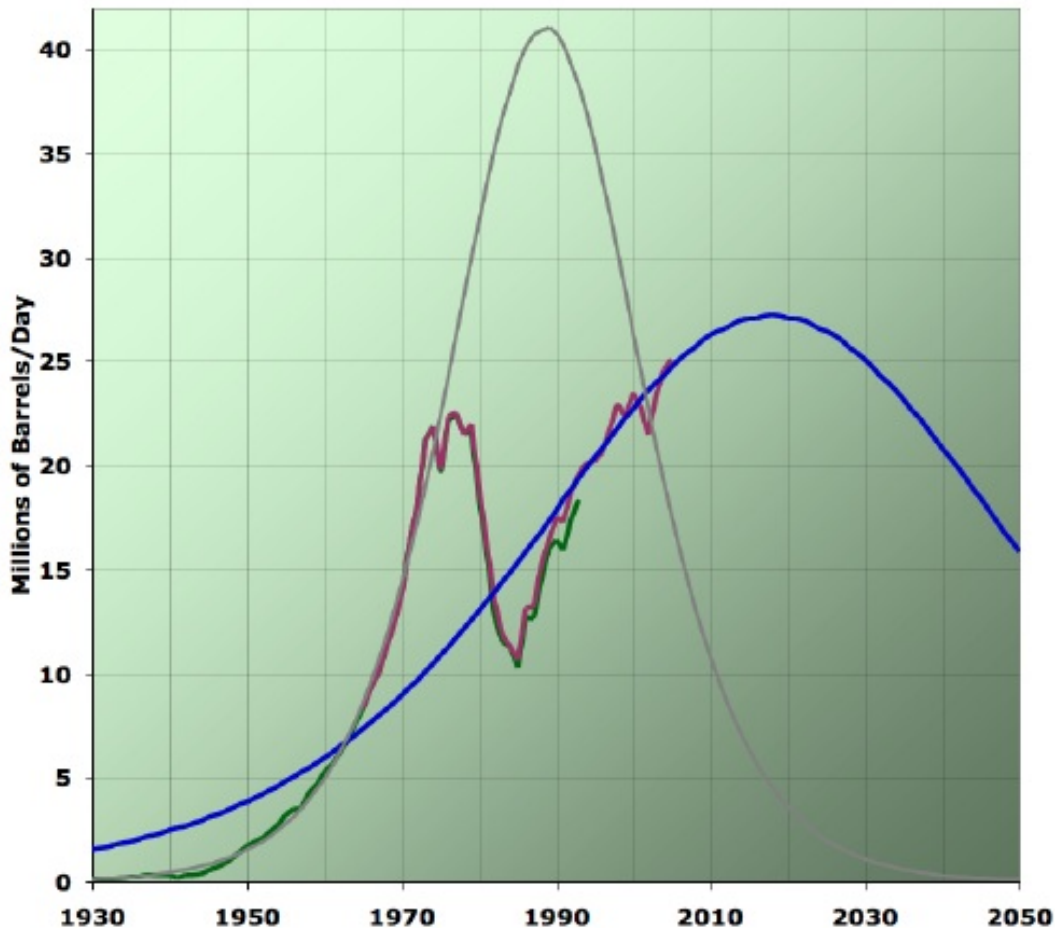
As you can see, especially in the inset, the history is marred by massive shut-ins for various reasons (wars, revolutions, and OPEC's role as a monopolist maintainer of prices). It seems to me that this makes extrapolating this series a little problematic and I have less faith in linearization in the Middle East than elsewhere (recall the poor stability of the [Kuwait linearization](#), for example, which I subjectively estimated might need an error bar of a factor of 2 on the URR).

For another view of the situation, here's the linearization with the vertical scale blown up some more, and with a kind of "stacked" linearization. I've plotted what each country's production adds to the y axis (P/Q recall - but all of them are divided by the same total Q for the entire Middle East). I've also marked some historical incidents that affected oil production so you can see how they play out.



Hubbert linearization of Middle East production broken down by key countries (x-axis is Gb). Bottom line shows the Saudi share of production, next line adds Iranian production and so on. All lines are divided by the cumulative production of the entire Middle East. Click for larger version. Source: American Petroleum Institute (courtesy J. Laharrere), and [BP](#).

Finally, here's what two Hubbert peaks would look like in production versus time:



Production versus year for Middle East, together with two Hubbert peaks. Blue is Alan's with $K=4.8\%$, $URR=828$ Gb, and peak halfway through 2017. Grey has $K=12\%$, $URR=500$ Gb, and peak in 1988. Click for larger version. Source: American Petroleum Institute (courtesy J. Laharrere), and [BP](#).

The blue curve is Alan's 828 Gb, $K=4.8\%$ line peaking in 2017. As you can see, it fits the recent history (from about 1992 on) fairly well, but does a terrible job earlier. The gray line is an eyeball fit to the front of the curve. It has $K=12\%$ and URR of 500 Gb. The idea is maybe if production had continued unconstrained by oil shocks and price increases, it would have followed that path (peaking in 1988 and we'd be well on the downside by now). Presumably if that is what **would** have happened in an alternative universe with enthusiastically free-market Middle Eastern governments, then in **this** world we'd get to go for a little longer based on not having used the area between the gray curve and the actual data. We'd have about 200 Gb of Middle Eastern oil left.

What should we believe? I don't have a clue, to be honest. If I had to speculate, I'd guess somewhere in between.

One last thing worth noting: Alan's curve only rises by a couple of million barrels per day between now and its peak in 2017. It takes until 2009 to get another 1mbpd over 2005. So if non-OPEC production was peaking now, even in Alan's scenario, we might well be at the global plateau already (that is if non-OPEC production declines at least 1mbpd by 2009, and at least a couple of mbpd by 2017).



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