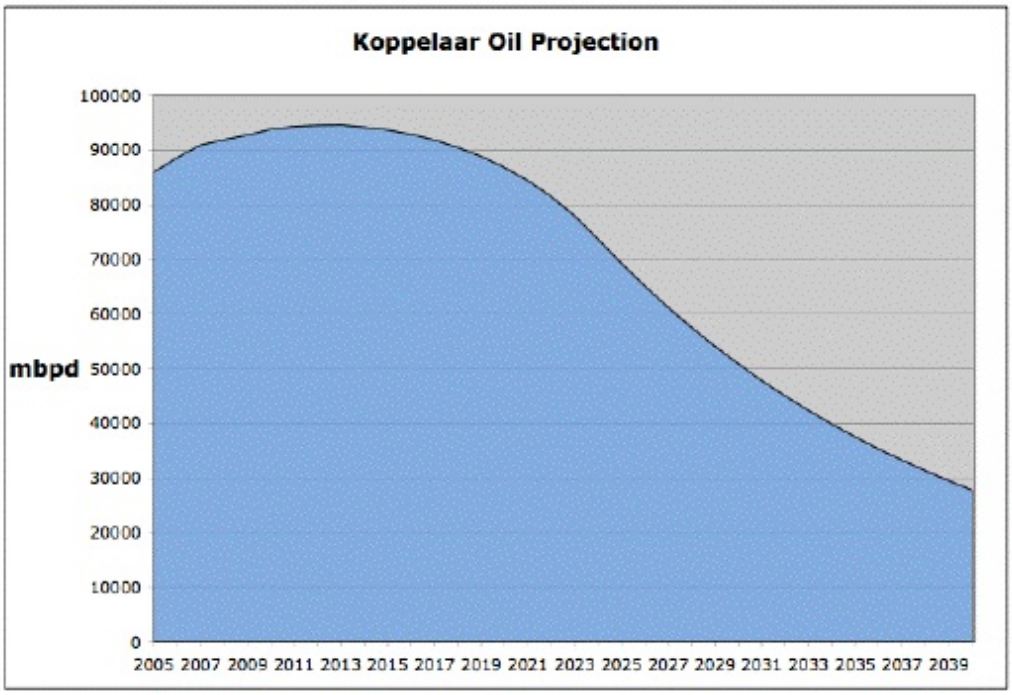
The Oil Drum
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

Rembrandt Koppelaar's Oil Peak

Posted by Stuart Staniford on September 10, 2005 - 8:06am
Topic: Supply/Production

Rembrandt Koppelaar at the Netherlands Foundation for Peak Oil has just produced an interesting analysis of future production. It's a bottom up analysis in the style of CERA or Chris Skrebowski's ODAC analysis. In this post, I want to outline what he did, and also suggest some lessons for future attempts of this kind. But here's his bottom line: about 2% annual growth in total liquids supply to a peak in 2013 at around 95mbpd and moderate depletion afterwards (rising to 6% annually).



Technorati Tags: peak oil, oil, gas prices

Lest I seem unappreciative in some of my critique later, I want to say at the outset some of the things I like about his analysis. Firstly - it's open. His assumptions and methodology are laid bare, so we can meaningfully investigate them. No proprietary databases, and no $2500 fee. Secondly, he's done a good job of assembling a big list of projects, against which other analyses can be checked. He has a much more nuanced analysis of depletion rates than the ODAC analysis. He was even kind enough to us linguistically challenged Anglo-Americans to write it in English, not Dutch. In short, he has tremendously helped anyone else doing the same task in future. Let's take a look in more detail.

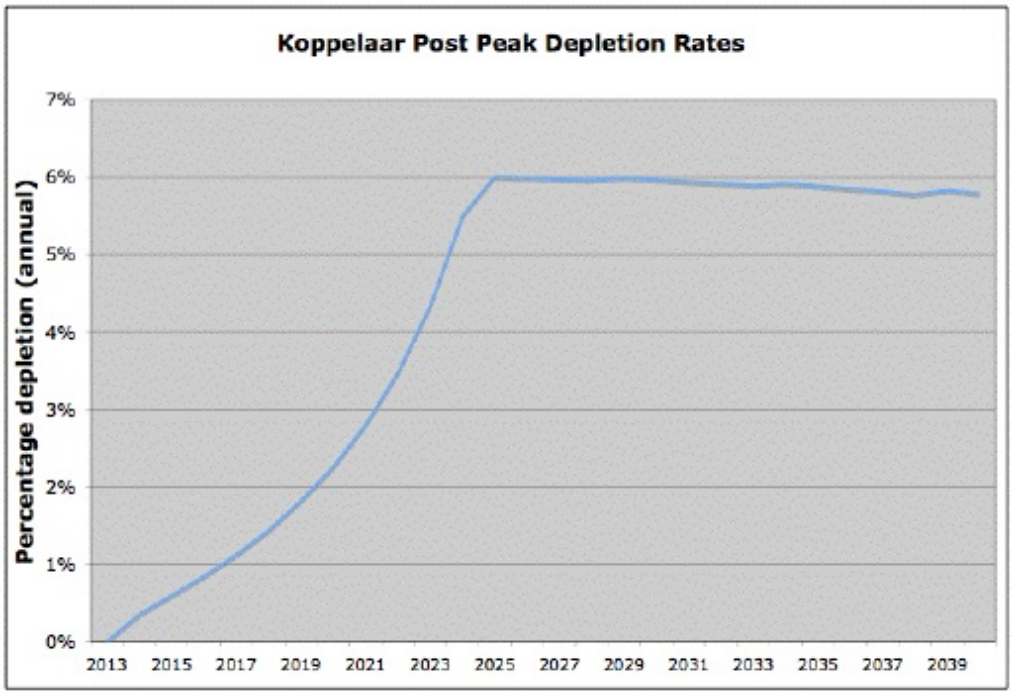
Koppelaar's Methodology

Koppelaar proceeds in a series of stages:

1. He gathers recent country production statistics from the IEA's Oil, Gas, Coal and Electricity Quarterly Statistics ,
2. For countries that have been in decline for at least a few years, he calculates the average production decline over those few years and extrapolates that decline rate into the future as the decline for existing production.
3. Otherwise, he takes estimates of decline rates on existing production from a wide variety of published sources (which he generally does a good job of footnoting). Where nothing useful is available, he uses a SWAG (Scientific Wild-Assed Guess).
4. Onto that base, he adds new production from a long list of projects which he itemizes.
5. For the long haul (past 2010), he decomposes production into four components (existing production in decline, bringing on known but not yet produced reserves, EOR projects, and projects from recent and future discoveries).
6. He makes estimates, that are pretty much SWAGs, of the change in those quantities over time, and then adds them up.

He by and large ignores issues of refinery bottlenecks, project delay, disruption, or war, though in some specific cases where they are factors today he assumes they continue to cloud the future (eg Iraq).

Here's what his total depletion rate ends up looking like:



So in terms of the Green-Yellow-Red model he's up towards the top of the yellow zone (give or take, depending on exactly what you believe the contraction threshold would be).

Critique

The following thoughts are offered in a spirit of improving our ability as a community to do this kind of analysis.

Error Bars

There are very large uncertainties here. Future depletion rates depend radically on what one assumes is the real state of non-transparent reserves and the way in which technology interacts with the fields. Projects often get delayed. Production profiles (as opposed to peak capacity) of future projects are often unknown. Wars and revolutions regularly make huge and lasting differences in production. When you add together lots of uncertain things, you get even more uncertainty in the total. I think we need to have analyses that don't present a single curve, but rather a range based on error analysis, so we can see that uncertainty very clearly in the graphs.

Treatment of Unconventional Oil

One of the reasons Koppelaar is much more pessimistic than CERA in the long term is that he doesn't assume a major ramp-up in production from tar-sands, oil shale, coal-to-liquids, etc, as CERA does. His statistics for Canada include some syncrude projects (ie syncrude is included in his definition of oil), but his long term extrapolation effectively assumes that the world will not develop it very much (Canada doesn't increase that much, Venezualan production is flat, and the US continues to decline at 5% a year). However, he doesn't justify this assumption. Certainly these sources are low quality and expensive to develop. Their EROEI is low, but it's significantly better than one and there's vast amounts of these resources. A long term projection needs an explicit theory on how much these sources will get developed and why (this obviously interacts very strongly with assumptions about future measures to combat global warming, and it has a lot to do with the relative economics of developing them versus conserving instead).

Conflation of Type II and Type III depletion

Chris Skrebowski introduces a helpful analysis of different depletion types. Type I depletion is where individual wells are being depleted, but the field can maintain production by drilling more wells. Type II depletion is where the field is depleting, but country production can be offset by new fields. Type III depletion is when the country as a whole is in depletion. We could imagine a Type IV depletion for when the whole world is in depletion.

Koppelaar, when he takes existing country production statistics and extrapolates them into the future is extrapolating the Type III depletion rate. But then, he **adds on new field production**. So he's treating the extrapolated depletion as though it was Type II, not Type III. To really know how to extrapolate Type II depletion, we'd need to know the recent history of new field development in the past years, subtract that out of the national statistics, and then extrapolate **that**, higher, depletion rate.

Depletion Surprises

New technology has led to some nasty depletion rate surprises in recent years. Use of seismic imaging, MRC wells, big frac jobs, etc has led to very high production followed by very rapid declines especially in small fields where the thing can be sucked dry in short order. The very high North Sea depletion rates of the last few years were not foreseen. Nor was the situation in Oman. It isn't at all clear at this point how widely that disease is going to spread. Matt Simmons is essentially arguing that this is going to happen to Saudi Arabia soon. Koppelaar effectively assumes this isn't going to be a big global factor. Even for the UK, he assumes 7% decline in future and adds new projects on top of that (whereas depletion 2004 on 2003 was 10%, and 2005 is running around 15% down on 2004 so far).

Production Profiles

As far as I can tell, if Koppelaar has a project that starts in 2008 with a peak capacity of Y, he pretty assumes flat production of the project at Y for its life. But modern offshore projects have a very different production profile from that (and most new projects are offshore) . See, for example, the anticipated White Rose profile. It rises rapidly, but not instantaneously, to the peak and then declines less rapidly. This is going to make a big difference in the near term numbers and has to be accounted for.

Conclusions

In summary, I think Koppelaar's analysis has a variety of interesting features, but I don't think we are good enough at this kind of thing that anyone should be trading stocks or making major life decisions based on the assumption that these bottom-up analyses are solid (of course the fact that different people can do the same kind of analysis and come out with wildly different answers should have already hinted at that).