Comments on: „What is the Economics of climate change?"
(discussion paper 31/1/2006)

(A) This paper must be updated to include the latest research from James Hansen, director of NASA'a Goddard Institute of Space Studies (GISS)

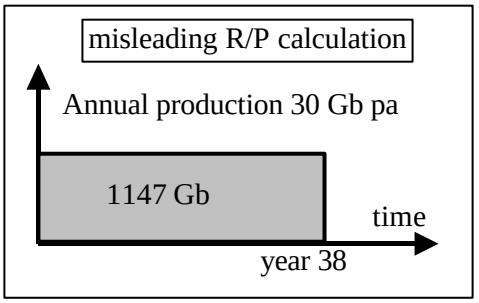
http://www.columbia.edu/~jeh1/newschool_text_and_slides.pdf

He basically says that in the previous interglacial period temperatures were 1 degree higher with sea levels 5-6 m higher. Therefore, additional warming must not exceed 1 degree. He demands 60-80% reduction of GHG emissions by 2050, that is –1.5% pa

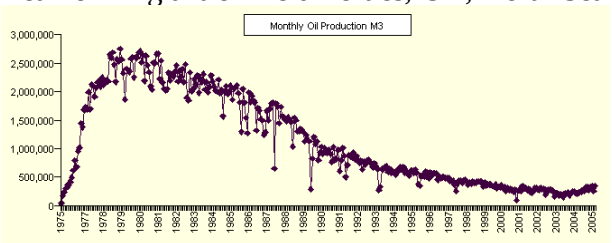
(B) Item 22 on page 10 and 25 on page 11: The International Energy Agency (IEA) knows about peak oil but is under political pressure to project too optimistic outlooks for future oil production. Here is a short overview on when to expect peak oil:

(1) BP proved oil reserves: These contain political data (unverified reports from Governments), not industry data. The International Energy Agency (IEA), Paris, (**www.iea.org**) found in its WEO 2004 (page 92) that 230 Gb of OPEC reserves are overstated. If this is the case, OPEC's oil depletion clock has to be advanced by 20 years! A summary of this problem is contained in submission 75 on energy efficiency to the Productivity Commission available on line at **www.pc.gov.au/inquiry/energy/subs/sub075attachment2.pdf**. The BP reserves should therefore not be used as a basis for multi billion dollar decisions.

(2) Reserve to production Ratio (R/P): It is common practice to use this ratio to calculate "how long oil will last", e.g. 40 years as indicated in the energy white paper "Securing Australia's Energy Future", page 119. However, this simplifying calculation is oil-geologically irrelevant. While the R/P ratio is a good indicator for the **size** of the reserves in terms of current annual production, it says nothing about the timeframe during which these reserves can actually be produced.



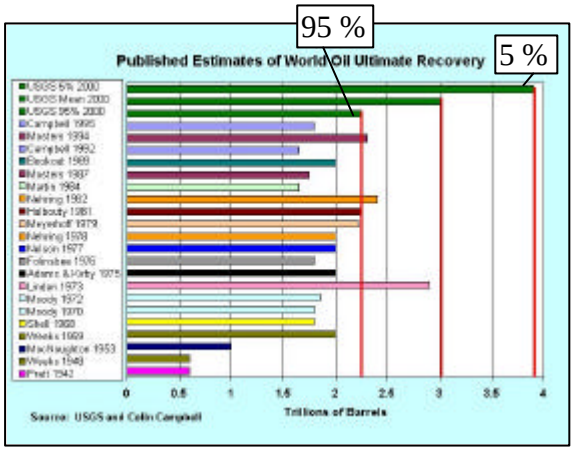
Peak oil in giant oil field Forties, UK, North Sea

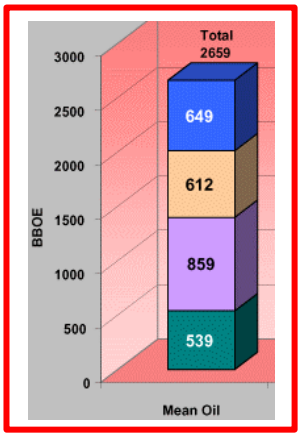


Source: **www.og.dti.gov.uk**

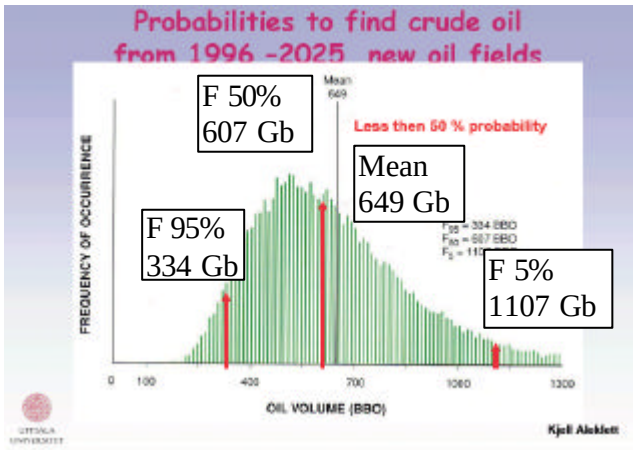
The production profile of oil over time is non-linear due to reservoir rock physics and usually follows a growing path up to a peak and then a declining curve after the peak. Therefore, current reserves may take 70-80 years to be produced, when production **peters out.** The critical event in oil history is the peaking, not the ultimate running out of oil. The global production curve is the superimposition of many peaking curves from fields all over the world at various stages of growth or decline.

(3) <u>Which ultimate recovery to use?</u> Apart from reserves, there are yet-to-be-discovered resources and oil from reserve growth resulting from technological advances. The total including past production (appr. 1000 Gb) is called ultimate recovery. We must understand that all estimated ultimate recoveries (EUR) have a probability attached to them. The larger the EUR, the less probable it is. For example, the longest bar in the chart of EURs (www.eia.doe.gov , left) has only a probability of 5%. For the purpose of deciding on additional oil dependent infrastructure, an estimate with the highest possible probability should be used. Thus, it is not safe to conveniently pick the highest EUR from a pool of estimates in the hope that we will be alright. Investors like super annuation funds need certainty that their investments get safe returns when funding oil dependent infrastructure.





The latest, most extensive oil geological assessment was done by the US Geological Survey (**www.usgs.gov**). However, the USGS 2000 mean estimate (right) contains 612 Gb hypothetical reserve growth oil and 649 Gb of undiscovered oil defying discovery trends in the first 10 years of its study period. Moreover, a mean estimate is not necessarily the most likely estimate. The graph below (http://www.aspo-australia.org.au//PPT/Aleklett.pdf) shows the interdependency between the probability and the size of the USGS undiscovered oil estimates. The 649 Gb has only a probability of less than 50%. Who would invest on such a low chance of success? Yet this is what governments (and banks) are relying on when they base their policy on these types of estimates. They should rather use the USGS 95% probability estimate of 2,248 Gb (as of end 1995) which is fairly close to many other estimates.

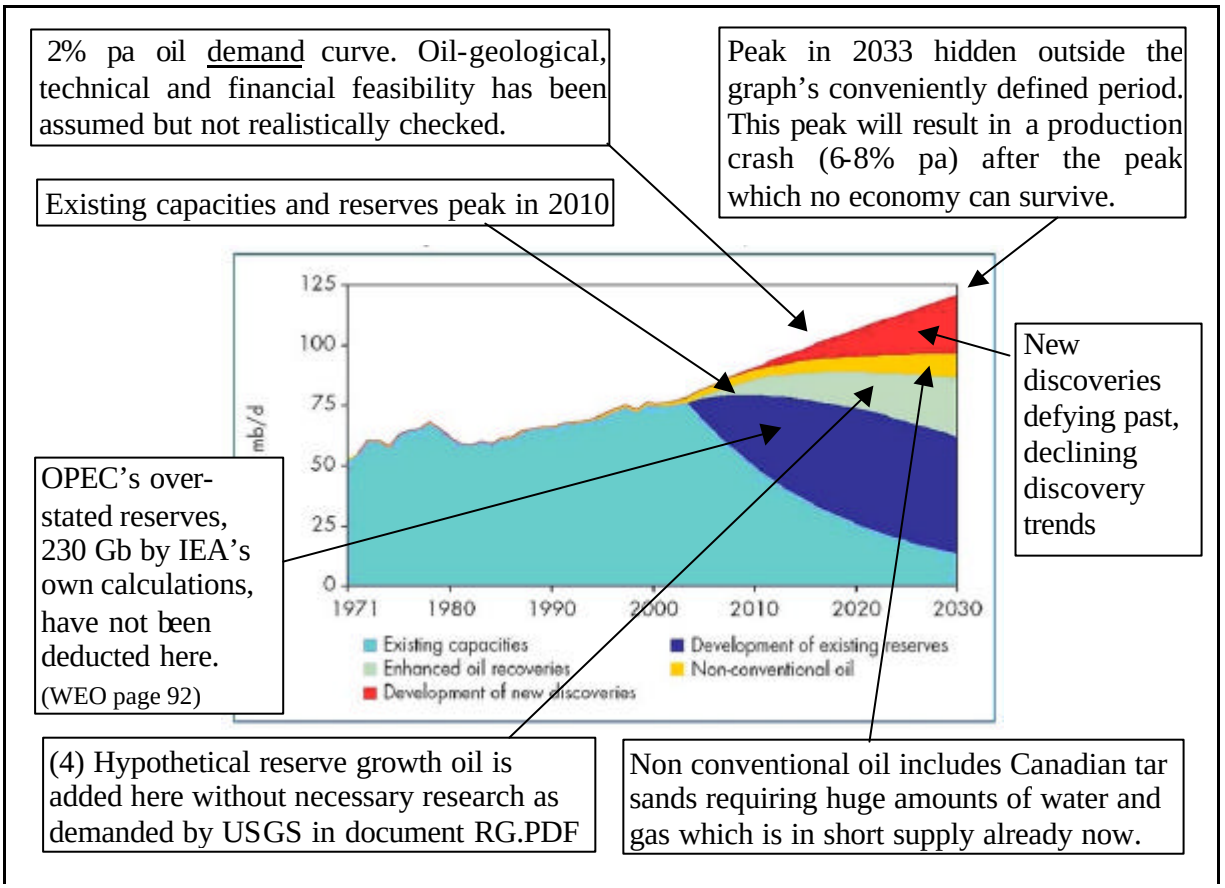


(4) <u>Timing and Probability of Global Peaking:</u> The USGS did not forecast oil production. The public relations wing of the Department of Energy, the Energy Information Administration (EIA) published scenarios (not forecasts) in which reserves and resources are freely distributed under 2% demand growth curves, an oil-geologically questionable and highly unrealistic procedure which leads to late, theoretical peaks after 2030. In order to observe the EUR, these late peaks are necessarily followed by production crashes of between 6% and 8% pa. which no economy can survive. They are non-desirable doomsday scenarios.

Even the high USGS 2000 mean estimate will produce a **<u>2016 peak</u>** if one assumes a more modest 2% decline after the peak (see front cover). The much safer and more conservative

USGS 2000 95% probable estimate will therefore peak years **before 2016**. An evaluation of these scenarios can be found as submission 75 on energy efficiency to the PC available online at: **www.pc.gov.au/inquiry/energy/subs/sub075attachment1.pdf**

On the basis of the USGS 2000 mean estimate, the IEA prepared a projection of future production contained in its WEO 2004 (embellished Fig. 3.20 below, page 103) which,



however, is inconsistent with other findings in the same report. It also assumes that huge investments are made and that these are successful which is by no means guaranteed.

In a smaller table (3.4, page 102) the WEO 2004 also reveals its 90% probable case which **peaks between 2013 and 2017**. These are the hidden warnings by report writers which are too often overlooked.

Other peak oil years		
Matthew Simmons **Investment banker, Advisor to Cheney's 2001 energy task force Book "Twilight in**	**Worried about oil production from the world's giant oilfields, in particular in Saudi Arabia: "….that peaking of oil will never be accurately predicted until after the fact. But the event will occur, and my analysis is leaning me more by the month, the worry that peaking is at hand; not years away…." http://www.simmonsco-intl.com**	**Peak oil at hand (if production in Saudi Arabia were sustainable)**

the desert" ISBN 0-471-73876-X		
K.S. Deffeyes **Princeton Uni Paperback ISBN 0-691-11625-3; page 157**	**"The mathematical peak falls at the year 2004.7; call it 2005…. and there is a fair amount of jitter in the year to year production…. There is nothing plausible that could postpone the peak until 2009. Get used to it."**	**Peak oil 2005-2009**
C.J. Campbell **Oil geologist from Ireland, founder of ASPO (Association for the Study of Peak Oil & Gas)** **www.peakoil.net**	**"When writing, it is easy to describe the situation in terms of 'an imminent peak' without putting a specific date to it.... The real point is not so much the exact date of peak but the statement that the First Half of the Oil Age, which was characterised by growing production, is about to be followed by the Second Half when oil production is set to decline along with all that depends upon it. On that at least we can stand firm."**	**Regular oil peaked 2004** **All liquids peak 2010**
S.Bakhtiari **Senior expert, corporate planning division, National Iranian Oil Co.**	**"The latest World oil production capacity model simulation predicts that worldwide crude oil production (inclusive of all other hydrocarbon liquids, such as NGLs etc) will peak during 2006-2007"** **www.stcwa.org.au/BO2/Bakhtiari-O&GJ -April%202004.doc**	**Peak oil 2006-2007**
Chris Skrebowski **Editor of Petroleum Review**	**Chris balances supplies from new oil fields with decline from existing fields in the slide show *Production Reality* (slide 43): "Whatever approach we use the answer seems to be peak by 2008; before that, if all goes to plan, the world can, possibly, meet likely demand; after that demand can only be met by massive demand destruction".** **http://www.energyinst.org.uk/content/files/chrisskrebowski.pdf**	**Peak oil 2008**
PFC Energy **Strategic advisors in global energy, Washington**	**"OPEC production capacity and reserves will suffer from the additional strain and some models suggest that even OPEC will struggle to fill the differential between Non-OPEC supply and global demand beyond 2015-2020". Source: www.csis.org**	**2014 (high demand) 2020 (low demand)**

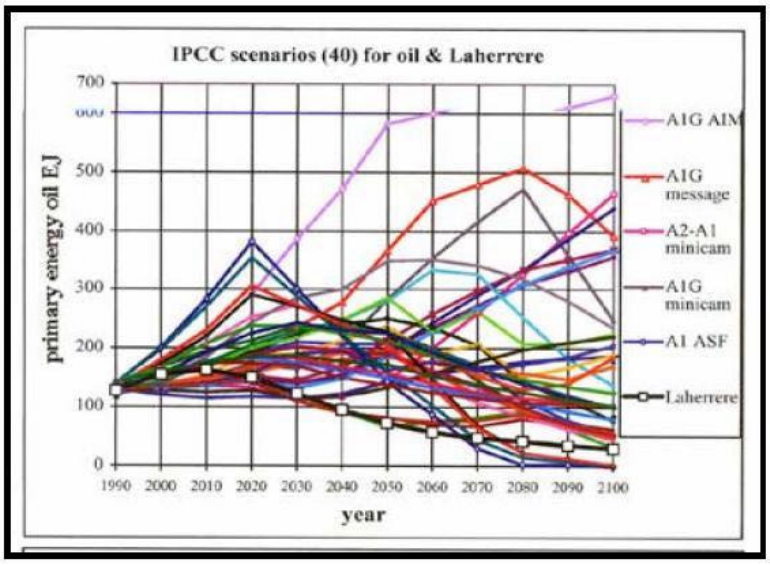
The author of these comments has just completed a submission to the Australian Senate's Inquiry on oil supplies which can be down loaded (4 Mb) from:

http://www.aph.gov.au/Senate/committee/rrat_ctte/oil_supply/submissions/sub69.pdf

This submission links the double challenge of peak oil and global warming. It contains 16 specific recommendations under the Australian context. In general, preparing for peak oil will also help reducing green house gas emissions.

It is worthwhile to also look at submission 74 by Brian Fleay who compared the IPCC primary energy scenarios with Jean Laherrere's oil production forecast on page 38:

Figure 9
IPCC 40 Oil Scenarios & Laherrére
1990-2100



Source: http://www.aph.gov.au/Senate/committee/rrat_ctte/oil_supply/submissions/sub74.pdf

With global oil production peaking around 2010, many IPCC scenarios are too high. However, there is a big danger that the world goes back to coal (e.g. CTL) without geo-sequestration (which may also be limited, both in timely physical implementation, geological potential and funding). The 2001 IPCC scenarios also do not seem to include the 100s of coal fired power stations now planned in China.

In the worst case scenario peak oil will weaken the world economy to such an extent that there is not sufficient financial strength left to finance renewable energy supplies, geo-sequestration and the necessary electrification of the land transport system.

One of the things which must be immediately done is to incorporate GHG reduction targets in EPA legislation. As an example here in NSW, a recent application for the expansion of coal production in a colliery near Sydney is legally required to consider and propose how to mitigate the impact of mining operations on the local flora and fauna, but not to quantify CO2 emissions and how to deal with it.

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