

M. KING HUBBERT CENTER FOR PETROLEUM SUPPLY STUDIES

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A EUROPEAN VIEW OF OIL RESERVES

by
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*“All numbers are wrong: that much we know
The question is: how wrong?”*

This is an apt aphorism when considering the subject of oil reserves, which are about as slippery as oil itself. It is surprising that audited numbers, considered so important in many spheres, such as company reports or tax returns, are not required when reporting oil reserves. It is even more remarkable when we remember that the modern economy depends on cheap oil-based energy. You would think therefore that more attention would be paid to securing accurate numbers, but alas that is not the case. Perhaps for many purposes it does not particularly matter, but it becomes critically important to use valid numbers for how much has been discovered if we are to extrapolate that to determine what remains to be found in the future.

While no one can exactly measure the amount of oil in a reservoir far underground, the technical assessment of reserves is a straightforward business, being based on modern seismic, modern electric logs, and an advanced knowledge of the geological and engineering factors. There will always be some uncertainty until the field is finally abandoned, when its initial reserves equal its cumulative production, but the range of uncertainty can be defined and understood.

The technical aspects of reserve estimation are not the main problem: it is in the reporting of them that the difficulties arise. There are many vested interests involved, and it suits them to work in an environment of poor and non-standard definitions and to be free of audit. They can pretty much say what suits them.

I will list below some examples:

1. Major Oil Companies

The explorers estimate the reserves of a prospect prior to drilling based on their best guess of what it contains having taken into account all available information. But in practice they are often under

pressure to exaggerate to sell their idea or pass corporate economic hurdles. So the number ends up on the high side, possibly in reality having a 30-40% probability rating instead of the ideal 50%.

If the well is a success, engineers take over and with good reason prefer a much more conservative number both for reserves and oil-in-place, and use numbers having a probability of about 80-90%. They call the reserves “Proved”. The management too likes a low initial number subject to upward revision. It means that fluctuations in their assets can be smoothed to cover the lean years between occasional discoveries; it helps with collateral on debt; it comforts the shareholders by permitting the magic words of “replacing reserves” to appear in the annual reports; and it may even reduce tax by permitting a higher charge against depletion allowance. The *reserve growth* as it is called is commonly attributed to technology, when in fact much of it is nothing more than correcting initial understatement. Recovery factors are also sometimes claimed to improve over time. In fact in many cases this is no more than an apparent improvement based on comparing what the wells are actually found to produce as they approach exhaustion with an earlier understated estimate of oil-in-place. Oil-in-place is a concept that is used only during the early stages of depleting a field, and becomes progressively less relevant as more actual production data come in. Besides no one will ever know precisely how much oil-in-place there was: much of it remaining forever in the rock.

In short, major companies use reserves as a sort of pragmatic inventory to be held as low as possible for as long as possible.

2. Understatement by Countries

The British are known for a propensity to understatement: that certainly applies to their oil reserves. They report 4.5 Bnb (billion barrels) for Proved; and 10 Bnb for “Proved and Probable”. The USGS reports 19 Bnb, when so far as I can find out the median probability number is about 15 Bnb. You would not have expected the best guess to be three times the “proved” number for a shelf as well known as the UK North Sea.

3. Overstatement by Companies

Some independent companies may make wildly optimistic statements about new discoveries, although those subject to rigorous stock exchange controls are generally cautious in what they formally report.

4. Overstatement by Countries

Most of the world’s reserves are now owned by government companies in the main producing countries. They have their own definitions and motives in what they report, and are certainly free of external audit. Much of the difficulty arises from a failure to distinguish *conventional* oil from *non-conventional* oil. The numbers as given for example by the Oil and Gas Journal in its annual report are supposed to be for *conventional* oil only, but in fact sometimes include undeveloped heavy oil, which is something else. There are two main examples: Mexico and OPEC.

Mexico exaggerated its numbers by the inclusion of the large but barely producible Chicontepik Field. It may have had a reason for doing so as reserves were being taken as collateral for debt.

In 1987, Venezuela almost doubled its reserves by including some 20 Bnb of heavy oil, which had been known for a long time. It did so on the strength of a pilot plant, and may have genuinely believed that it was within its rights under engineering principles to do so (Roget, 1994).

Venezuela's action had the not necessarily intended consequence of increasing its OPEC quota, which prompted several other OPEC countries to retaliate with huge unsubstantiated increases, including Iran, Iraq, Kuwait, Abu Dhabi, Saudi Arabia, as has been now confirmed by an Iranian official (Barkeshli, 1996). Although the increases in 1988 were evidently motivated by quota considerations, it is possible that the previous numbers were understated, having been inherited from the major companies before they were expropriated.

The Soviet Union also in practice exaggerated its reserves because in its system it did not take into account economic and technical constraints (Khalimov 1993). In effect, its numbers were "high case" reserves with a probability of 5-10%.

5. Implausible Unchanged Reports

In 1996, forty-three countries reported numbers that were unchanged for one or more years. Since production inexorably eats into reserves, to hold the same number year after year is clearly implausible. Possibly the studies were simply not updated; or those responsible may have found it politically unpalatable to report declining reserves. In the absence of other information, it is prudent to reduce the reserves of such countries by the cumulative production of the unchanged period.

6. United States Geological Survey Numbers

For many years, the USGS has reported world reserves in serious and competent studies. It however uses its own definitions, considering it to be outside the remit of a geological survey to take into account technical and economic constraints. In fact its reserves, like those of the Soviet Union, are "High Case" reserves with a probability of occurrence of no more than 5-10%.

The foregoing briefly explains some of the factors that have to be taken into account in assessing reserve data. For many purposes, it does not perhaps matter particularly that the numbers are vague and unreliable. It does however become critically important in estimating future production and trends. It is furthermore vitally important to backdate reserve revisions to the discovery of the fields to which they relate when constructing discovery trends. Many people are misled by the huge reported increases in 1988. Quite apart from the validity of the numbers themselves, as discussed above, most of the reported revisions related to fields found up to fifty years before: nothing particular happened in 1988 in terms of technology or recovery.

My best estimate (Campbell 1996) is that world median probability conventional oil reserves stood at just over 800 billion barrels (836) as of the end of 1996. By median probability I mean that the chance of the actual proving above or below the estimate are equally matched. On this basis and plotting the past discovery trend, I think that there are just under 200 (180) Bnb yet-to-find. The world is producing about 24 Bnb/a yet finding less than 6 Bnb/a. For more complete information, it is necessary to turn to the authoritative database of Petroconsultants (Campbell and Laherrere, 1995).

On this basis; peak production can be expected around 2000 when half the world's ultimate endowment of conventional oil will have been produced. About half of what remains to produce lies in just five Middle East countries whose share of world production is inexorably rising. The scene must be set for another oil price shock to be followed by increasing shortages as production declines due to resource constraints. The production of non-conventional oil will no doubt rise in these circumstances: it may flatten the tail end of depletion but will have a negligible impact on the imminent peak.

It is surely time to pay some serious attention to this issue.

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With the opening of the North Sea, he returned to England in 1972 as General Manager of the Texas independent Shenandoah Oil Corporation, before rejoining Amoco to become Exploration Manager in Norway in 1980. In 1985, he was appointed Executive Vice-President of Fina in Norway.

He is now a petroleum consultant, living in France, and has had commissions from the Norwegian Petroleum Directorate; Bulgarian government; European Commission; Amoco; Shell; Esso; Amerada; Mobil; and others. He specializes in oil resource assessments, having published widely. His book "The Golden Century of Oil" was published by Kluwer in 1991, and another "The Coming Oil Crisis" is nearing completion. He has co-authored several major studies on world reserves of oil and gas and their depletion for Petroconsultants as based on their authoritative data.

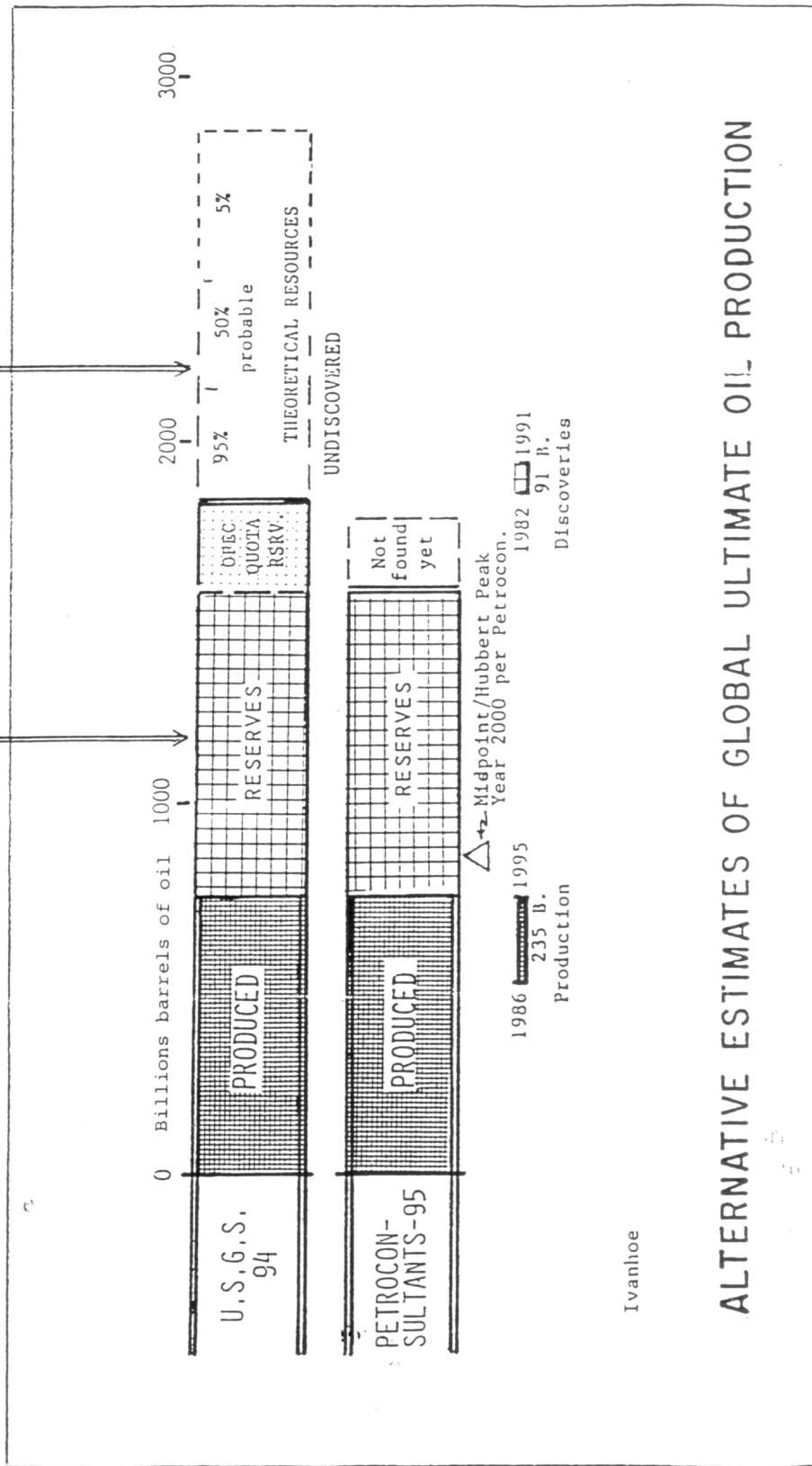
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Economists & laypersons commonly misinterpret two technical terms in oil reports, namely:

RESERVES (known) vs RESOURCES (unknown)



Ivanhoe

ALTERNATIVE ESTIMATES OF GLOBAL ULTIMATE OIL PRODUCTION

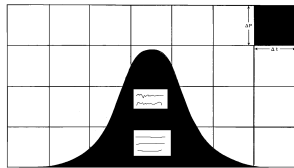
A graph by L.F. Ivanhoe showing differences between USGS: 1994 and Campbell/Petroconsultants: 1995 estimates of global ultimate production. (April, 1997)

“There are moments when everything goes well; don't be frightened, it won't last.”

Jules Renard (1864-1910)

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H.C. NEWSLETTER



The M. KING HUBBERT CENTER FOR PETROLEUM SUPPLY STUDIES
located in the Department of Petroleum Engineering
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The Hubbert Center has been established as a non-profit organization for the purpose of assembling and studying data concerning global petroleum supplies and disseminating such information to the public.

The question of WHEN worldwide oil demand will exceed global oil supply is stubbornly ignored. The world's oil problems, timing and ramifications can be debated and realistic plans made only if the question is publicly addressed. A growing number of informed US and European evaluations put this crisis as close as the years 2000 - 2014. The formation of this center is to encourage a multi-field research approach to this subject.

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