"Is FSU oil growth sustainable?"

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The oil revenues, on which most OPEC countries so heavily rely, depend on the interaction of price and volume, which have fluctuated widely. At times of low price, OPEC governments face the dilemma of cutting production to support price or of using volume to deliver their needed revenues.

The onset of recession in response to the high oil prices of 2000 underlines the fact that the World's economy runs on energy and is vulnerable to price fluctuations. Oil price has been volatile, swinging from $10 to $30 a barrel over the past four years. OPEC did succeed briefly in providing much-needed stability under its declared policy of holding price in the 22-28 $/barrel range by the better enforcement of agreed quotas, but geopolitical pressures, following the 11th September, led it to allow the price of oil to fall.

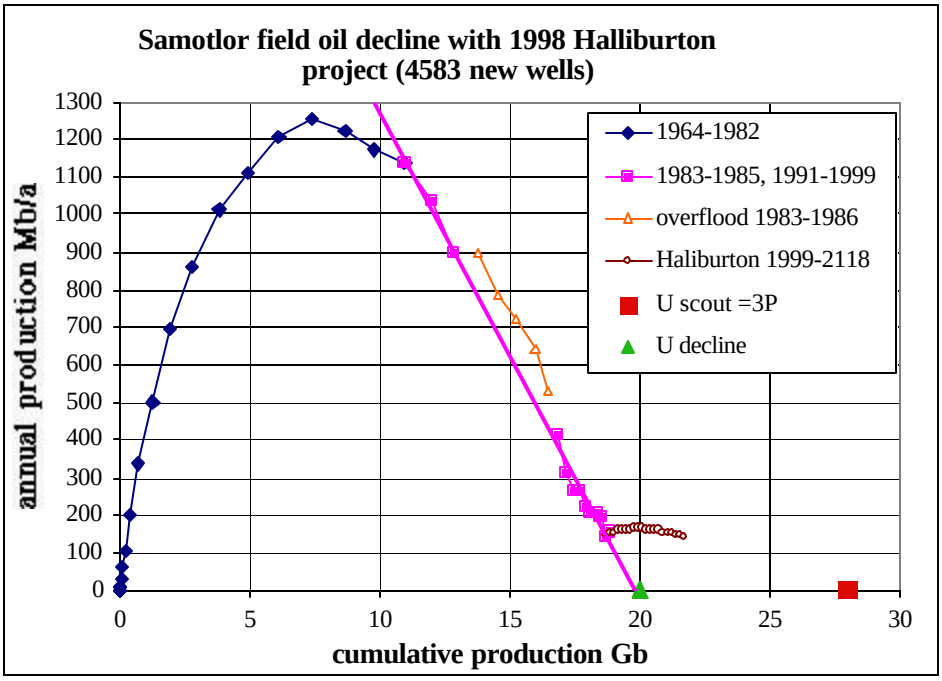
A new element entered the equation when OPEC sought support from non-OPEC countries, especially Russia, which had its own agenda in its relations with the United States. Although Russia's production costs are comparable with those of the US-48 in real terms, an adverse exchange means that its exports can undercut OPEC.

OPEC received assurances that Norway and Russia would cut production in parallel with its own cut on January 1st, but it is evident that in fact Russia has not respected the agreement, following the precedent of many OPEC countries which also fail to respect their quota obligations. But, behind these political acts lie the eternal underlying resource constraints, which are immune to politics. It is they that ultimately control the degree to which countries can increase production and for how long.

It is evident that oil has to be found before it can be produced, meaning that production has to mirror discovery after a time lag. To know the discovery trend, however, calls for valid information on the size of the reserves, which may be either under- or over-reported. In the case of the former Soviet Union, a good fit between the discovery and production trends is achieved by reducing the reported reserves by 45 percent (Laherrere 2001). Such an adjustment is further justified by the words of Khalimov, the former Soviet deputy oil minister, who first presented the Russian classification in 1979 at the World Petroleum Congress and stated later in 1993 that the FSU resource base was "strongly exaggerated due to inclusion of reserves and resources that are neither reliable nor technologically or economically viable".

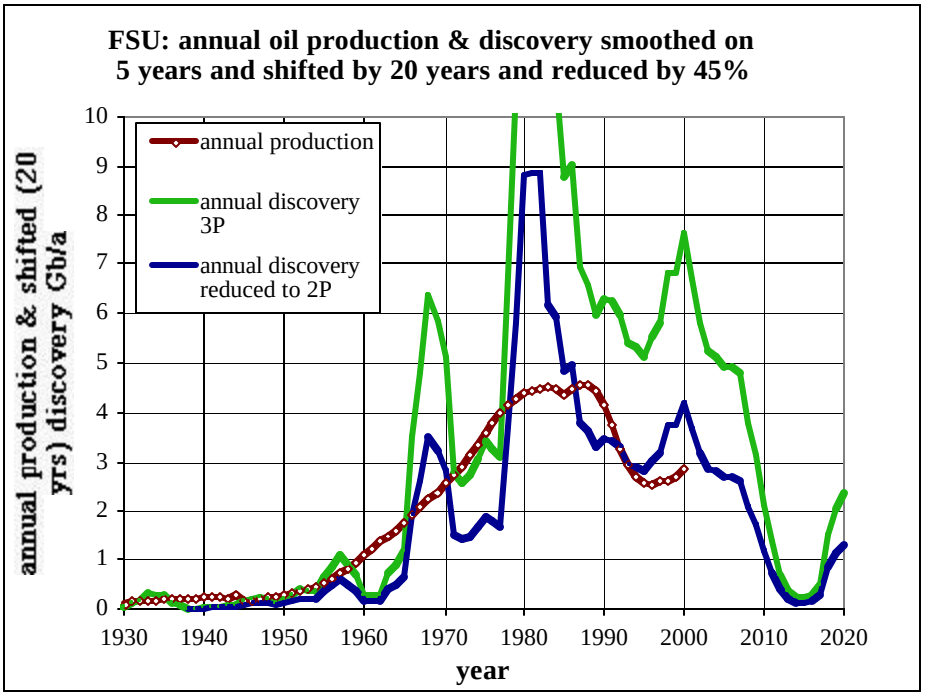
In fact, reserves of the combined A, B, and C1 classes in the Russian classification equate with *Proved*, *Probable* and much of the *Possible* reserves (3P) under the traditional western system. Gochenour (1997) has compared the A+B+C1 reserves of five Russian companies, giving a total of 49.4 Gb (billion barrels), which are treated as *Proved Reserves* in a US sense when in fact only 26.4 Gb (53%) may so qualify.

Further evidence for downgrading the reported reserves comes from decline analysis of individual fields. For example, the largest oilfield, Samotlor in Western Siberia, has already produced about 19 Gb, with production having fallen to no more than 400 kb/d. from a peak of 3.4 Mb/d in 1980. The field is reported to contain 28 Gb, but extrapolation of the present decline gives an ultimate recovery of only about 20 Gb. The field was in fact over-produced from 1983 to1986 to meet the dictates of a Soviet five-year Plan. In 1998, Halliburton was brought in to drill more than 4500 wells, including 3200 horizontal wells, in the hope of holding production at about 400 kb/d for around twenty years (Aaland 1998), but the project has yet to commence despite committed financing of 672 M$ (OGJ Sept 11 2000).



-Figure 1: Samotlor field oil decline with Halliburton project (4 583 wells)

For these reasons, we have plotted two different discovery curves in the following graph. The "official" values are shown in green, and the "corrected" values, based on the above evidence are shown in blue. A good empirical fit between the "blue" curve and actual production is provided by a 20-year time shift, but, at the same time, it is recognised that the fit may be misleading insofar as the development of fields under the Soviet system may not have followed a normal pattern.



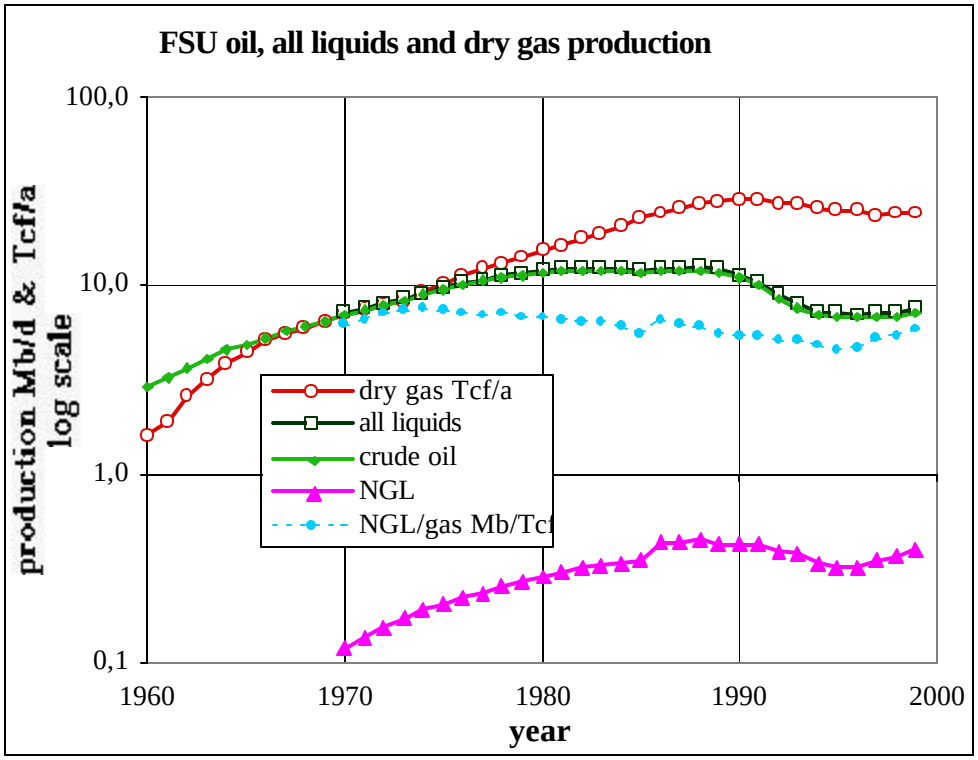
-Figure 2: FSU annual production and discovery smoothed on five years and shifted by 20 years and reduced by 45%

The reduction of reserves by 45% partly makes allowance for the Soviet system of classification, but also recognises that there may be as much as 30 Gb in undeveloped fields, particularly in East Siberia, which do not yet deserve reserve status.

The amount of oil discovered to 2000 is given in the following table:

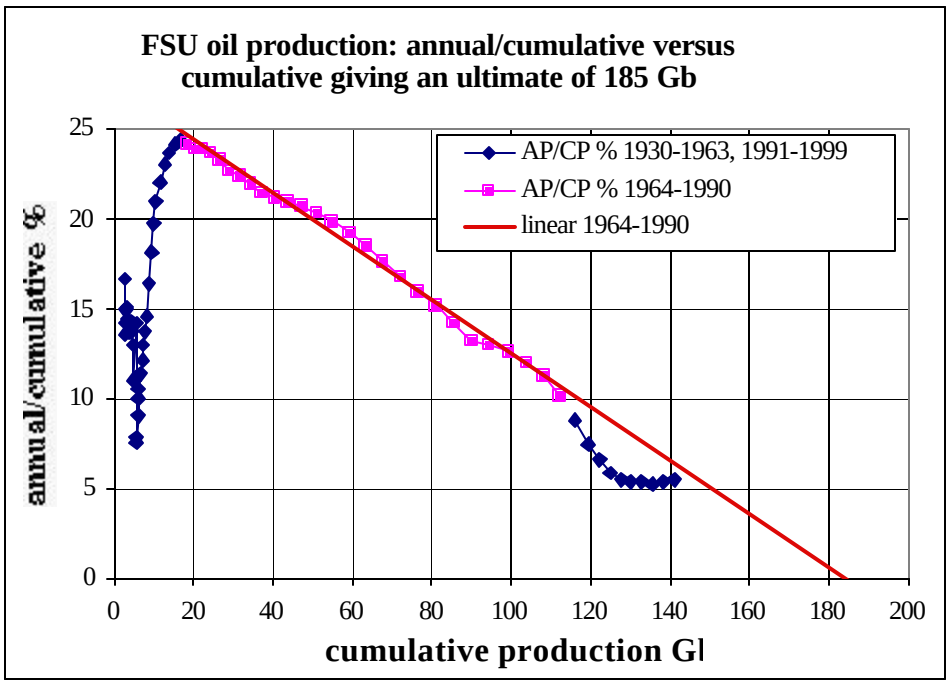
FSU fields	oil Gb	condensate Gb	gas Tcf
in production	250	21	1800
developing	10	1	240
discovery	30	3	360
total	290	26	2400

One of the problems in measuring world's oil production relates to the treatment of condensate, natural gas liquids (NGL) from gas plant, and refinery gains. Data from the US Department of Energy indicate that FSU crude oil represents 94% of the combined production of crude and NGL, without reporting any refinery gain. Approximately 6 Mb of NGL are produced for every trillion cubic feet of gas, when for the world the average is 25 Mb/Tcf, as Russian gas is very dry.



-Figure 3: FSU oil, all liquids and dry gas production

The extrapolation of past liquids production in a plot showing the percentage of annual to cumulative production versus cumulative production is an elegant method for determining an approximate value of the ultimate production, assuming a "business as usual" scenario. The relationship for combined crude and gas liquids plots as a straight line from 1964 to 1990, pointing to an ultimate of around 185 Gb. The trend from 1990 to 1999 is anomalous because it reflects the breakdown of the FSU, and can be ignored.



-Figure 4: FSU oil production: annual/cumulative versus cumulative

Past production may be modelled with a single Hubbert curve for an ultimate of 185 Gb, having a peak in 1984 of 12.8 Mb/d. It shows a good fit until 1985 before the pattern was distorted by under-production from 1991 to 1999 (representing over 5 Gb).

The new growth in production comes from several cases. First is the restitution of the under-production from the 1990-1999 period. Second is new production from the Caspian, comprising some 25 Gb from Kashagan and overcoming the technical difficulties of Tengiz and Sakhalin, 30 Gb from undeveloped fields (in East Siberia) and an estimated 10 Gb from new discovery. But producing discoveries looks to be difficult for some Majors, as BP & Statoil withdrew from Kashagan, and Marathon from Sakhalin.

This new cycle represents about 65Gb, which together with the old cycle of 185 Gb gives an ultimate of 250 Gb. Subtracting the 140 Gb already produced means that there is 110 Gb left.

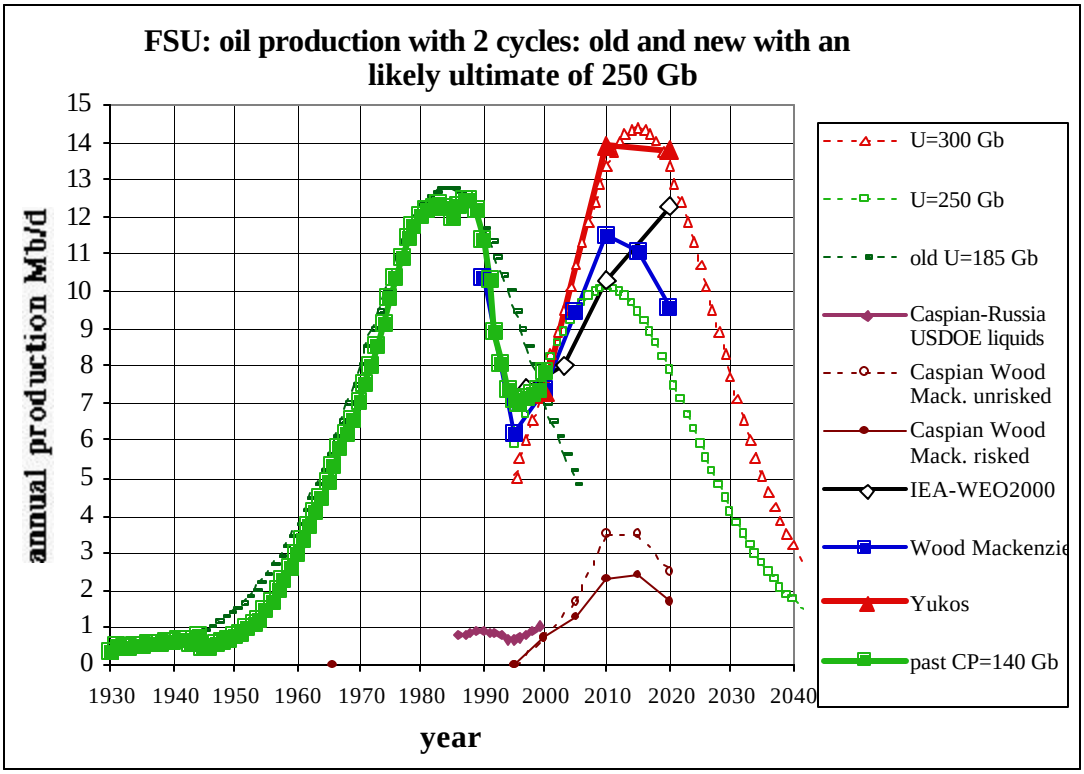
The following graph compares the two cycles, with alternative 250 Gb and 300 Gb ultimate recovery assumptions, showing past production and various forecasts from the International Energy Agency (IEA 2001), Yukos (Leonard 2002), and Wood Mackenzie (2001).

The new Caspian discoveries have been analysed by Wood Mackenzie (McCutcheon & Osbon 2001), giving an "un-risked" curve (all will proceed according to plan) peaking at 3.5 Mb/d in 2015, and the more realistic risked curve (expect delays and disappointments) peaking at 2.5 Mb/d in 2012.

Yukos forecasts a peak of about 14 Mb/d in 2010-2020, assuming remaining reserves of 140 Gb and as much as 50 Gb undiscovered for the FSU (termed Russia and Caspian), which gives an ultimate of 330 Gb. It expects that East Siberia will produce 600 kb/d in 2010 and 900 kb/d in 2020 thanks to a new pipeline to supply China, which has agreed to pay world prices at the border.

Modelling production on the basis of an ultimate recovery of 300 Gb is in agreement with forecast of Yukos, but the evidence discussed above suggests that a model built on 250 Gb may be more realistic, and forecast of Wood Mackenzie is in between. The difference is

substantial, having a major impact upon what the region can be expected to produce in competition with OPEC.



-Figure 5: FSU oil production with two cycles: old and new with a likely ultimate of 250 Gb

The Russian companies seem ready to fight a price war as they make adequate profits at 18$/b, but there are also over-riding national issues at stake, including international debt servicing (USDOE Dec. 2001).

The evidence suggests that, the countries of the former Soviet Union countries, apart from the offshore, were thoroughly and efficiently explored under the Soviet regime. It follows that the larger productive basins, and most of the giant fields within them, have almost certainly been found, giving a discovery trend that will effectively control future production. How much of this production that is available for export to world markets depends on the growth of domestic demand. It is evident that OPEC has little to fear from Russian competition over the longer term, but in the meantime its exports put pressure on price.

In fact, in national terms, OPEC, particularly Saudi Arabia, and Russia both need prices higher than 18$/b. A price war achieved by flouting agreements would be in neither party's best interest. The new Russian oil barons might learn from the experience of their predecessors in capitalist America, where the government had to intervene through the Texas Railroad Commission to regulate over-supply following the discovery of the East Texas field in 1930, when oil fell to 10 cent a barrel. Cheating against prorationing was widespread ("hot oil", Yergin 1991) leading to further State intervention, this time at the request of the industry itself. OPEC too might remember that its founders sought to extend the principles of the Texas Railroad Commission to world supply, and that cheating on agreements serves rebounds on the perpetrator. Lastly, the consumers might stop vilifying OPEC in its difficult task of managing the depletion of a precious resource and actively contribute to a better solution for the benefit of all.

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