Note on World Oil Production and Depletion Relations Near the Peak

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Introduction

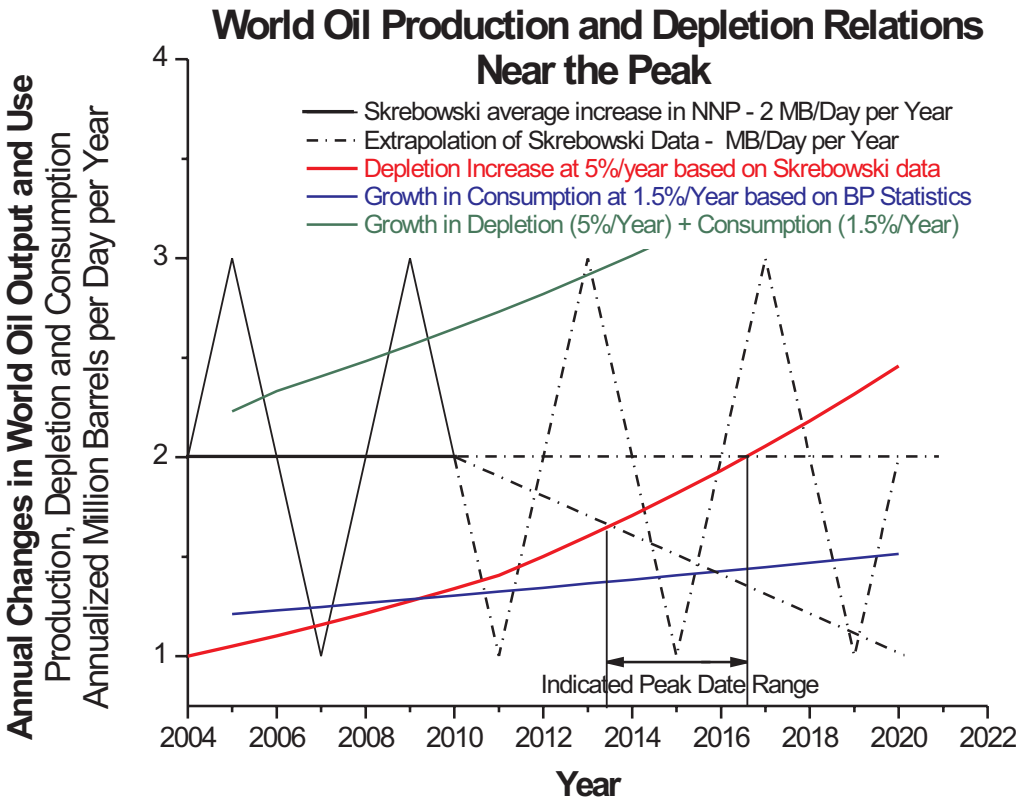
In papers and reports written in 2005, Chris Skrebowski, [1] Editor of the *Petroleum Review* (London), showed that the growth of world oil production from new projects is quite predictable over at least a five-year time horizon into the future. This projection was determined from a careful tabulation of projects announced by various production entities around the world. The estimate was found to be in close agreement with a similar new production projection contained in a proprietary report published in 2005 by Cambridge Energy Research Associates (CERA) of the U.S.A. which leads to confidence in the results. Such a procedure is made possible by treating the small error arising from the unreported (or underreported) minor new production additions not included in the standard industry information sources as negligible. The actual reported production from new fields may therefore be somewhat understated but this omission is small in comparison with other uncertainties in this field.

In contrast to the CERA study, Skrebowski further modified his projection by applying a correction to account for project slippage based upon experience. An example would be the delay of about one year to the Thunder Horse Project of BP and its partners in the Gulf of Mexico mainly due to damage from Hurricane Katrina. This correction is somewhat arbitrary but reasonably realistic. Skrebowski makes the further point that large new production projects are almost always subject to delays and only rarely to advances. The project `slippage' is counted as new production in the next year or, in some cases, even longer. After this adjustment, the revised output is termed the Net New Production (NNP) in this note.

With this methodology, a reasonably accurate estimate of the net new production of world oil (which in this case includes total liquids from all sources including the oil sands of Alberta) can be made for at least a five-year time horizon into the future. The Net New Production was found by Skrebowski to be an average of two million barrels per day per year (annualized MB/Day) extending through to 2010 but with a variation of about one MB/Day from year to year. The new output is thus projected to vary from one to three MB/Day over this period according to the schedule of the completions.

This note has been prepared because many experts expect the peak in world oil production to occur during this time or shortly thereafter. Skrebowski himself states that the peak will occur in 2008 whereas the Association for the Study of Peak Oil and Gas (ASPO) places it later in 2010. In contrast, this author does not expect the peak until the 2015-2020 period using projections based upon geological assessment studies.[2]

If the output of oil to be produced from new projects around the world is known with considerable certainty - if only for a few years into the future - it follows that this quantity must be balanced at the time of the peak by the depletion of oil from the pre-existing production facilities. Knowledge of one determines the other. If this relationship were not true, a peak would not be found: instead production would either still be increasing or beginning to fall. It is also noteworthy that the peak is always approached from one side defined by the direction of the passage of time – for example, by proceeding from the left to the right on a graph when the X axis is designated as time. Should the oil production plot over time turn out to be a plateau rather than a peak, the balance between Net New Production and net depletion will hold throughout the duration of this constant period.



Procedure Followed in Plotting Figure

In the graph, the average Net New Production gain of two MB/Day per year estimated by Skrebowski is plotted as a horizontal line from 2004 to 2010 and is then extrapolated to 2020 and beyond. This is assumed to be the high side of the new production projection. On the low side, the production is assumed to fall to one MB/day/year by 2020 starting in 2010. The latter projection is represented in the plot as a simple straight line because the data is not known well enough to warrant the more probable actual complex logistic functions. The fluctuation about the average of from one to three MB/Day is also shown to illustrate how this rather large change from year to year can cloud the main relationships. This variation is larger than any of the yearly changes in the other relevant factors, and so may well explain at least in part why reliable price projections for an individual year are so difficult to make.

Skrebowski has also estimated the present net depletion from the pre-existing facilities at about one million barrels per day per year. It is reasonable to assume that this value will rise over time, and an increase of five percent per year was employed here starting from 2004. A problem arises with the estimation of depletion when oil from the Net New Production itself starts to decline. It is assumed here that there is a plateau period of eight years before this second order decrease begins in 2012. The total depletion in a given year after 2012 was taken as the sum of a larger value from the `old' oil and a smaller value from the `new' calculated year-by-year. The depletion of the `new' oil in each year was also assumed to be increasing at five percent per year after the passage of the plateau period.

With these assumptions, the Net New Production is found to be first balanced by the net depletion in the time period between 2013 to 2017 as illustrated in the plot. If no second order depletion from the `new' oil were taken into account, such as would be the case if the plateau period lasted until after the

peak was passed rather than the eight years assumed here for each yearly `vintage', the date of the peak is only delayed about one year. This adjustment for the depletion from the `new' oil production after the plateau period is thus not critical to the estimate. Despite the prediction of this range of dates for the peak based upon his data in this note, Skrebowski expects this milestone to occur in 2008

Plotting the data in this way makes it possible to check the self-consistency of published estimates of Net New Production, rates of net depletion, and dates for the peak (or plateau) for world oil production. Knowledge of any two of these factors determines the third.

The increase in consumption of oil on a world basis is also plotted in the figure based upon an initial 80.757 MB/day in 2004 taken from the *BP Statistical Review of World Energy.* World consumption is assumed to increase over the longer term at a modest average of 1.5% per year. This conservative value was chosen at the lower end of most long-term estimates for consumption appearing in the literature. With this rate at the low end of the probable range, it may be seen that the individual values for the gain in consumption for each successive year are less than the relatively high value of an average Net New Production of 2 MB/day/year found by Skrebowski and by Cambridge Energy Research Associates. Nevertheless, even this low value for the yearly gain in consumption may be overwhelmed by the lower ranges of the fluctuating new production throughout this period. This finding is yet another indication of the difficulties to be expected in predicting oil prices over short time horizons. Because depletion and consumption have the same numerical effect on the demand side of the oil equation, the increases for both were added together year-by-year and plotted in the figure. This total is only lower than the higher ranges of the fluctuation in Net New Production in the early years before about 2014. Increases in the Net New Production of an average of 2 MB/day/ year cannot overcome the additive effect of increasing depletion and consumption even if both are at the lower end of their expected range of values. This finding is thus supportive of the view that a peak in world oil supply is coming before 2020.

Retroactive Check for Consistency

Data taken from the BP *Statistical Review* for the past five years was used to estimate the Net New Production for those years retroactively. Demand for oil was generally strong, and most facilities outside the OPEC countries were operating effectively at capacity by the end of the period. Idle capacity in the OPEC group was gradually being returned to service. With the further assumption there was a negligible increase in NNP in the OPEC countries during this time, it becomes possible to estimate this value for each year using the following equation:

NNP = Change in Total Production + Depletion - Gain in OPEC Production

Date	**Production Total** K Bbl/day	**Production Change** K Bbl/day	**Net Depletion** K Bbl/day.	**OPEC Total** K Bbl/day	**OPEC Change** K Bbl/day	**NNP** K Bbl/day
2004	80260	3206	1000	32927	2241	1965
2003	77054	2611	952	30686	1831	1732
2002	74443	- 385	907	28855	- 1773	2295
2001	74828	- 122	864	30628	- 726	1468
2000	74950	2617	823	31354	1538	1902

In the table above, the NNP values appear in the expected ranges with good agreement for 2004. This finding supports the general approach taken here with the use of a year-to-year increase in depletion of five percent.

Summary

Reliable estimates of future world oil production are available for at least a five-year horizon based upon announced new expansion projects underway around the world because of the lengthy time required to bring them to fruition. The independent projections prepared by Skrebowski in London and by Cambridge Energy Research Associates in the U.S.A. in 2005 were found to be in close agreement. Skrebowski extended his estimate by making a deduction to account for the expected project `slippage' which was based upon recent experience arising from the delays that often occur in the large-scale undertakings needed to exploit new oil reserves. This corrected projection is termed the Net New Production here. At the peak, this value must equal the depletion occurring in the pre-existing production facilities. The date of the peak may be found by determining when the Net New Production relation intersects a plausible depletion scenario on the plot. Following Skrebowski, the depletion was assumed to increase five percent per year from a starting net value estimated to be one million barrels per day in 2004. Given these assumptions, the peak was then predicted to lie between 2013 and 2017. A retrospective estimate of the Net New Production for the past five years was confirmatory of this value.

The plot also contains a representation of the fluctuations about the average to be expected in the Net New Production due to the variation in size of the individual projects reaching the production stage in any given year. This fluctuation is large enough to screen variations in other relevant factors so as to make short-term predictions of price changes very difficult.

The main application of this type of plot is to check for self-consistency among published estimates of future production, rates of decline, and the date expected for the peak. Knowledge of any two of these factors defines the third.

References

1. Chris Skrebowski, *Prices Set Firm, Despite Massive New Capacity*, Petroleum Review, London, October 2005, pp. 36-40. See also:*The Emerging Reality of Oil and Gas Depletion – Where Reality Meets Theory*, Fourth International Workshop on Oil and Gas Depletion, 19-20 May 2005, Lisbon, Portugal. (Web: www.peakoil.net.)

2. J.H. Walsh, *Procedure for the Parabolic Projection of Geological Assessments of Conventional Oil and Gas Resources*, January 2004. (Web: pages.ca.inter.net/~jhwalsh/wpara1.html)

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