

Oil Outlooks

Is the New Zealand Government Under-Estimating
Future Oil Prices?



July 2007

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Introduction

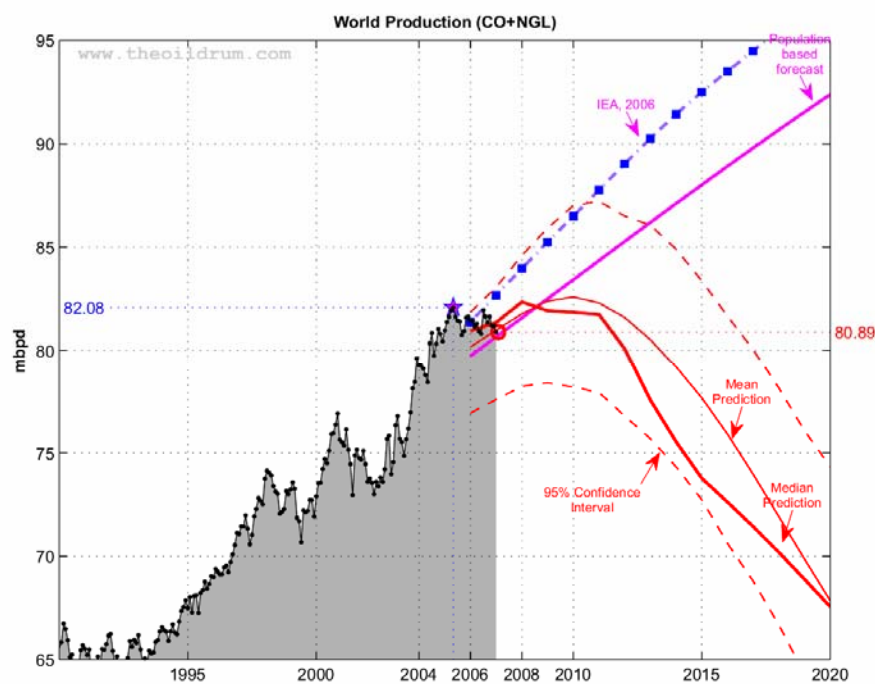
Oil provides about half of New Zealand's primary energy supply and virtually all of our transport needs.¹ The vast majority is imported², making the New Zealand economy vulnerable to price hikes and supply disruptions.

In 2005 the Ministry of Economic Development published *Oil Price Assumptions for Energy Outlook* (OPA). The authors tentatively attempt to forecast the future of the oil market. These forecasts underlie much of the government's future planning, including *Energy Outlook 2006* and the development of the *New Zealand Energy Strategy*. They provide a basic assumption that New Zealand's future energy supply will be similar to today's, although perhaps with a higher oil price. I believe this assumption is wrong, and that the government and individuals should begin planning for a radically different future.

Mainstream vs. Peak Oil

Mainstream oil industry analysts are forecasting higher levels of oil production and lower prices relative to today's levels³. However, there are number of other analysts with a very different perspective. They see oil production reaching a maximum, "peaking", and declining over the next decade. OPA refers to this as the "Peak Oil" perspective. The following chart compares the mainstream and Peak Oil perspectives:

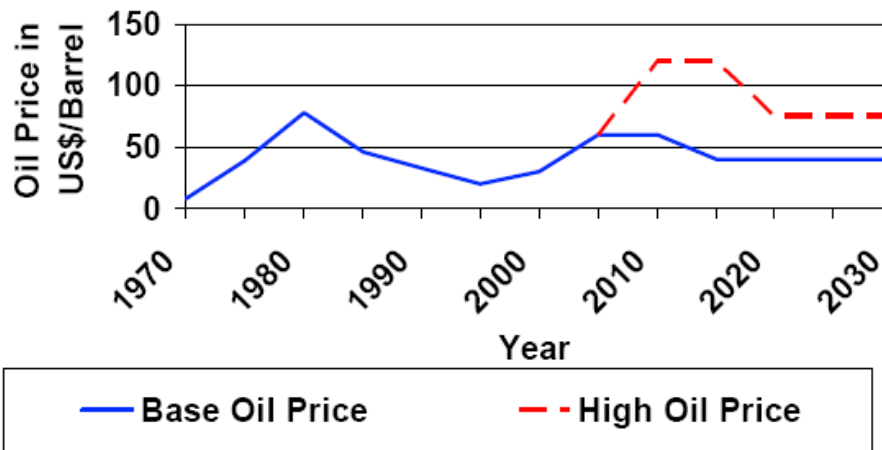
Forecast Comparison⁴



- **Mainstream** -The dashed blue line represents the International Energy Agency's (IEA) forecast for future oil production.
- **Peak Oil** -The thick red line represents the median of 12 production models that forecast a peak before 2020.
- **Observed** -Actual production of Crude Oil and Natural Gas Liquids (CO + NGL)

These two perspectives are irreconcilable and to account for this OPA proposes two sets of price assumptions:

Proposed Oil Price Assumptions⁵



- The Base Oil Price scenario. Oil prices stay around \$US60 a barrel out to 2015 then decline to \$US40.
- The High Oil Price scenario based on a peak in conventional oil production in 2008. The oil price rises to \$US120 in 2010 and stays there until 2015 whereupon it declines to \$US75.

OPA Methodology

OPA proposes a preference hierarchy⁶ for projecting the price of oil. In brief:

1. What the Oil Futures markets are saying. Although this only extends out for a few years.
2. What well known industry analysts are saying.
3. Their own understanding of the oil market

Key Points

The key points of this paper are as follows:

1. The OPA's assumptions regarding the Oil Futures market are increasingly uncertain.
2. The production forecasts (and therefore the price forecasts) of "well known industry analysts" like the Energy Information Administration (EIA) and the International Energy Agency (IEA) are flawed and have been unreliable in recent times. Production forecasts from analysts with the Peak Oil perspective have been more accurate.
3. The High Oil Price Scenario is inadequate for future planning.
4. Planning needs to accelerate at national and local government level to reduce New Zealand's dependence on oil.

The Crude Oil Futures Market

"There are people in BP who happen to be economists and so happen to think there's no problem, and there are people in BP who are geologists who are saying it's getting hard to find."

-BP exploration consultant, Francis Harper, November 2004⁷

Commodities traders buy and sell contracts for the delivery of a specific quantity of oil on a specific future date (out to 6 years). These contracts are called crude oil futures and their price can indicate where traders believe the actual price will go.

OPA Key assumptions

- The authors base their preference for the futures market on the assumption that...

*"...participants in these markets as a group are sharp people, who are well-informed about what is happening in the market. They also have a strong incentive to use their knowledge and intelligence to its full advantage, since they are putting their money and wealth (or at least their career) on the line."*⁸

- Writing in November 2005 the authors conclude that because the futures market is in [backwardation](#) (i.e. long-term future prices lower than short-term) it is reasonable to expect oil prices to follow suit:

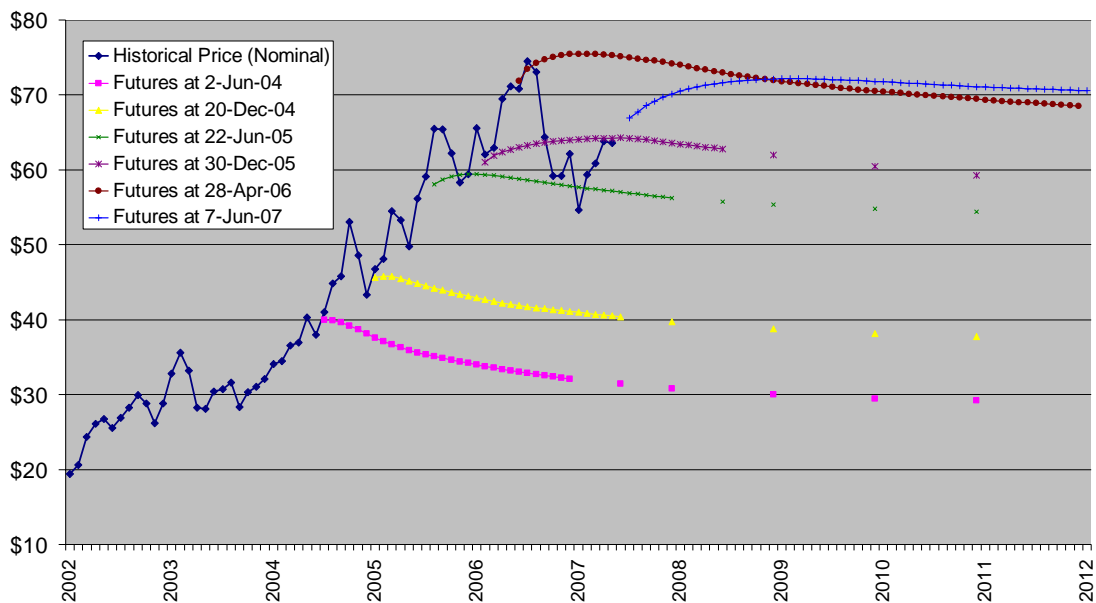
*"Overall, the futures market is telling us that it expects oil prices to decline over the next six years, but to still remain "high" by historical standards"*⁹

- At the same time the authors understand the market's limitations, stating:

"This does not, of course, mean that futures market price quotes always turn out to be the correct price projections—far from it."¹⁰

Are these assumptions still well justified in mid 2007? Consider the following chart:

Historical Oil Price vs. Futures Snapshots



Each smooth line represents a snapshot¹¹ of the futures market at a particular date while the dark jagged line is the historical price¹² in nominal terms.

The two earliest snapshots predicted a small increase followed by a decline and were the least accurate, undervaluing the actual price significantly.

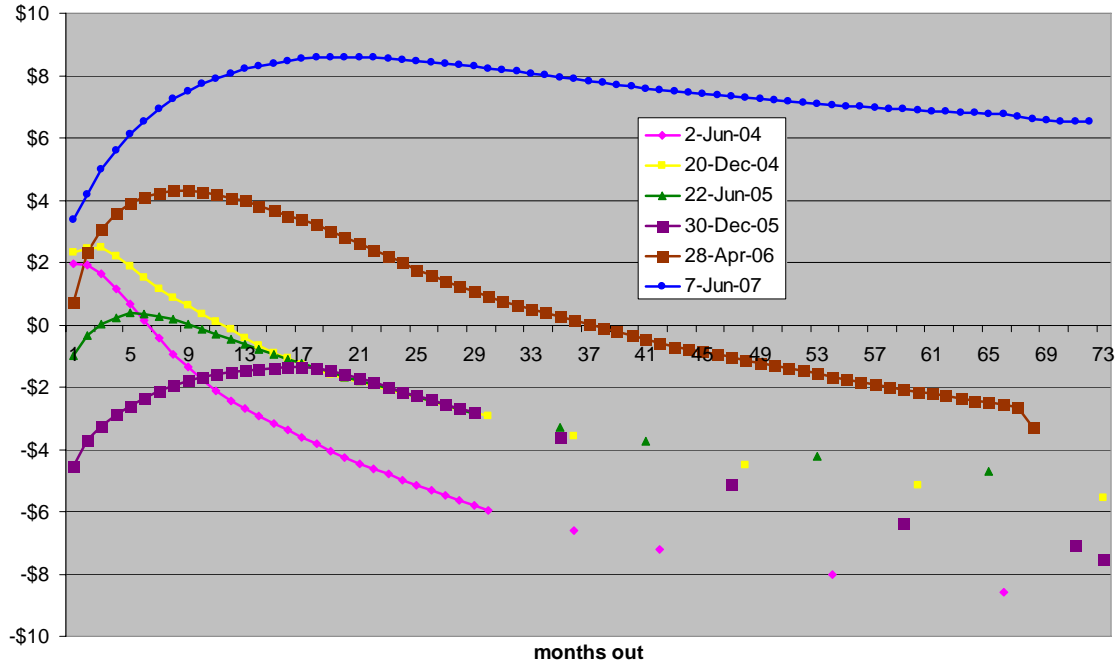
At this point the market consensus appears to have been 'The preceding run-up in oil prices was a temporary price spike caused by geopolitical tensions which will keep prices high for a few months. Higher prices will spur investment and further production, bringing prices down.'

The next two snapshots predicted that prices would stay flat near current high levels and have been reasonably accurate.

It is too early to judge the accuracy of the two most recent snapshots but it is clear that the futures market has undergone, or is undergoing, a significant change. Currently, the market is predicting sustained high oil prices at levels much higher than historical norms and significantly, higher than current prices

out to 6 years but still slightly lower than near-term prices . Consider the following chart:

Comparison of Futures Snapshots



Here the futures prices are plotted relative to the average monthly price of the month they were traded. Note the flattening trend in the price curves as they move from earlier to more recent snapshots. The 6 year forward price of the **earliest snapshot** is \$US10 below the price peak, while the **most recent snapshot** has the 6 year forward price at only \$US2 below the peak.

Energy intelligence analyst Jeff Vail suggests that this flattening trend represents a growing acceptance of Peak Oil theory amongst traders and a market transition from backwardation to [contango](#) - i.e. long term prices will be higher than near-term prices.

*"Analysis of [the futures market] tells us that there is a short-range geopolitical premium in oil prices, and that there is still a general market expectation that, over the long-run, the price of oil will decrease However, comparison to ... [the futures market] from 6 months ago suggests that the market is much less certain in their convictions regarding this point."*¹³

"Backwardation...is indicative of...the assumption that... shortages are only a short term market inefficiency and will eventually be corrected. However, should the crude oil market switch from backwardation to contango...that will suggest that the "market" has accepted the Peak Oil hypothesis that oil supplies will increasingly decline in the future, and hence that the commodity will get increasingly expensive. For this reason, I believe that the switch from backwardation to contango will be the market indicator that the peak in crude oil production is not only here, but perhaps more importantly that it is accepted by the broader financial community..."¹⁴

Analysis

The geological peak in global oil production is a one-time only, 'Black Swan' event. None of the traders have any experience with an all-time global peak. It may prove difficult for traders to incorporate peak oil theory into their trading behaviour, especially when "well respected" agencies continue to forecast production gains.

While they do have access to private high quality information, traders can be expected to rely on their own recent experience for guidance. For the last 20 years or more the 'free market' view that high prices dampen demand, spur investment and bring more production on-line has had currency. OPA underlines this view:

"...over the longer term, the oil industry appears to be a highly cyclical one, with periods of tight supply, high prices, and high investment followed by periods of glut, low prices, and low investment."¹⁵

The pre-2005 futures market reflected this view and failed to predict oil prices breaking the \$US50, \$US60 and \$US70 marks.

It seems reasonable to assert that if Peak Oil theory is correct, it would take some time for traders to integrate this theory into their behaviour. Geological constraints are absent in the 'tried and tested' free market view.

The recent flattening of the forward price curve supports exactly this conclusion. With this trend in mind, OPA's assumption that oil prices will decline over the long term appears doubtful.¹⁶

Industry Analysts

“...The public sector work of the International Energy Agency and the U.S. Energy Information Administration are probably the most respected of these.”

-Oil Price Assumptions for Energy Outlook¹⁷

In this section I will examine the accuracy of production forecasts from “well respected” industry analysts - the EIA and IEA, and analysts in the peak oil camp compared to recent actual production.

As the authors of OPA note, oil price projections are notoriously difficult. Price is function of both supply and demand. Focusing on the somewhat less complicated production forecasts makes for a less complicated comparison.

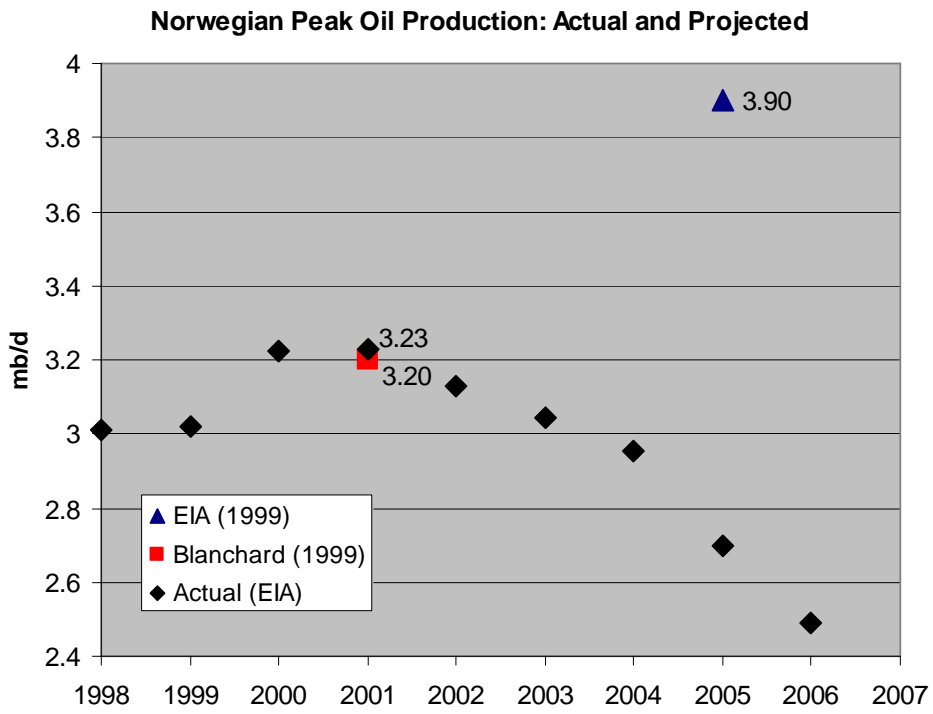
North Sea Production

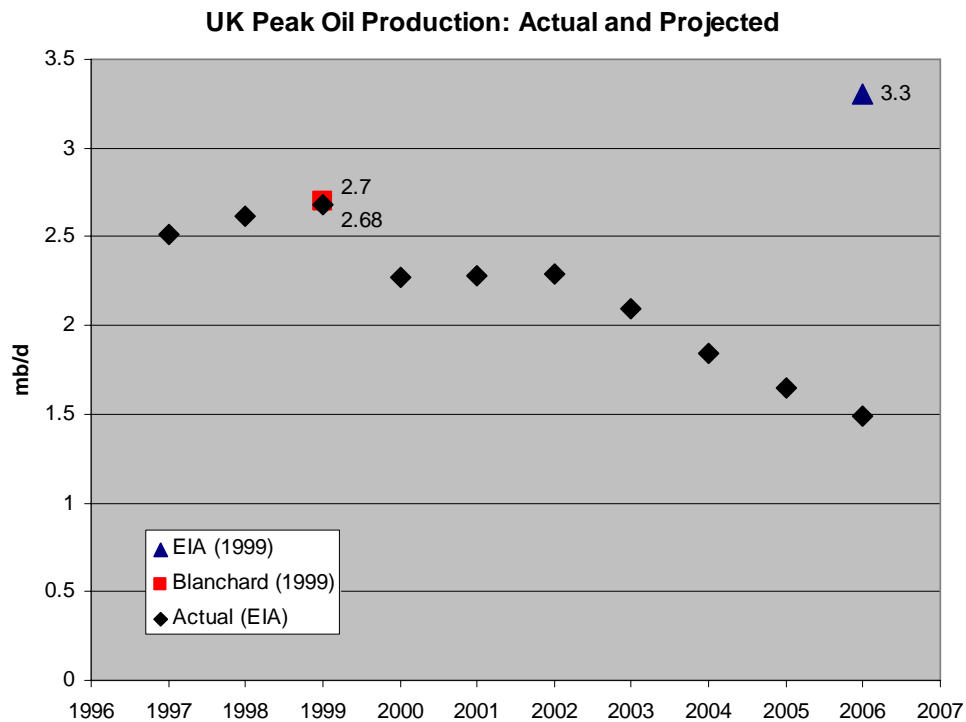
Most of the world’s major oil-producing countries do not make their oil field data publicly available. Two notable exceptions are the North Sea producers, the UK and Norway who publish high quality, field-by-field data.

It should be possible to project North Sea production with a greater degree of accuracy than most oil producing regions. How accurate were the EIA’s past projections and how do they compare to projections made by an analyst in the ‘Peak Oil’ camp?

- The EIA’s 1999 projections anticipated a UK production peak in 2006 at 3.3 million barrels/day (mb/d) and a Norwegian peak in 2005 at 3.9 mb/d.
- In the same year Roger Blanchard, at the time an associate professor of chemistry at Northern Kentucky University published a paper detailing his own projections for the North Sea. Blanchard’s forecast took into account the steep decline rates of the North Sea fields and was much more pessimistic. He projected 1999 as the UK peak year with production at 2.7 mb/d and 2001 as the peak year for Norway with production at 3.2 mb/d.¹⁸

The following charts summarize these projections along with actual production taken from EIA figures:





The EIA missed the Norwegian peak by 4 years and 700 kb/d. It missed the UK peak by 7 years and 600 kb/d. In contrast, Blanchard's projections were as accurate as one could hope to be.

Blanchard explains the discrepancy between the EIA's projections and his own in the paper's conclusion:

*"It doesn't appear that the ...EIA is considering the high decline rates of major North Sea oil fields ...when making projections of future production in the U.K. and Norway, or for that matter, in their global assessment . The rapid decline of major fields appears to exist in many producing basins around the world and must be considered in long-term supply forecasts. If this situation isn't recognized by national and international organizations that make projections of long-term supply, the future may present some unpleasant surprises."*¹⁹

Global Production

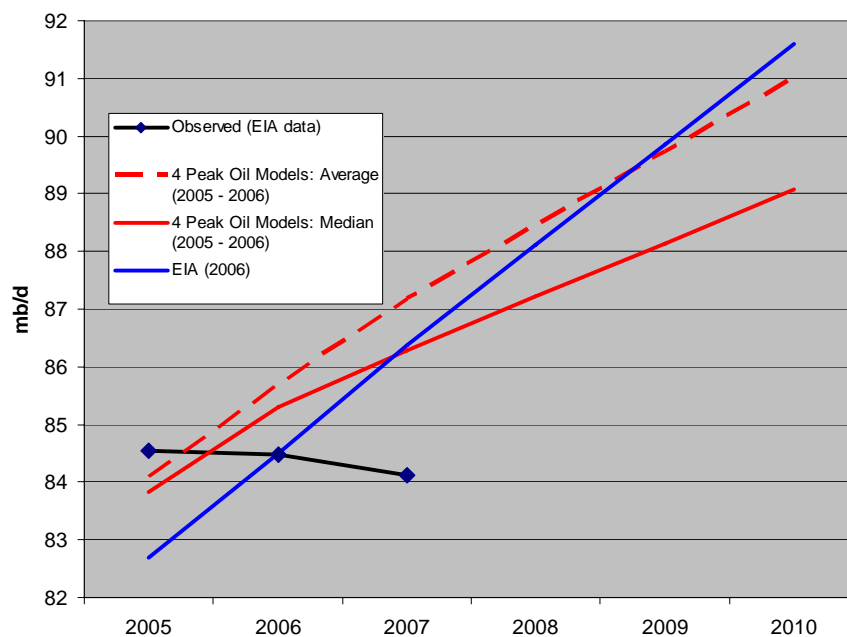
To compare the accuracy of Peak Oil forecasts and mainstream forecasts of global production I have used the average and median values of all Peak Oil models that I am aware of. This avoids picking a forecast that in hindsight has proved more accurate, and the comparison is clearer than including all models.

The average and median values could also be considered the 'consensus' view of the Peak Oil perspective.²⁰

Energy Information Administration (EIA) vs. Peak Oil Models

To complicate matters, there are a number of definitions as to what constitutes global oil production. The EIA uses an 'All Liquids' definition for forecasting. 'All liquids' includes conventional crude oil plus various other analogous liquids (condensate, natural gas liquids, non-conventional oil and bio-fuels). There are three peak oil analysts (with four models) who also use this definition in their projections.

All Liquids

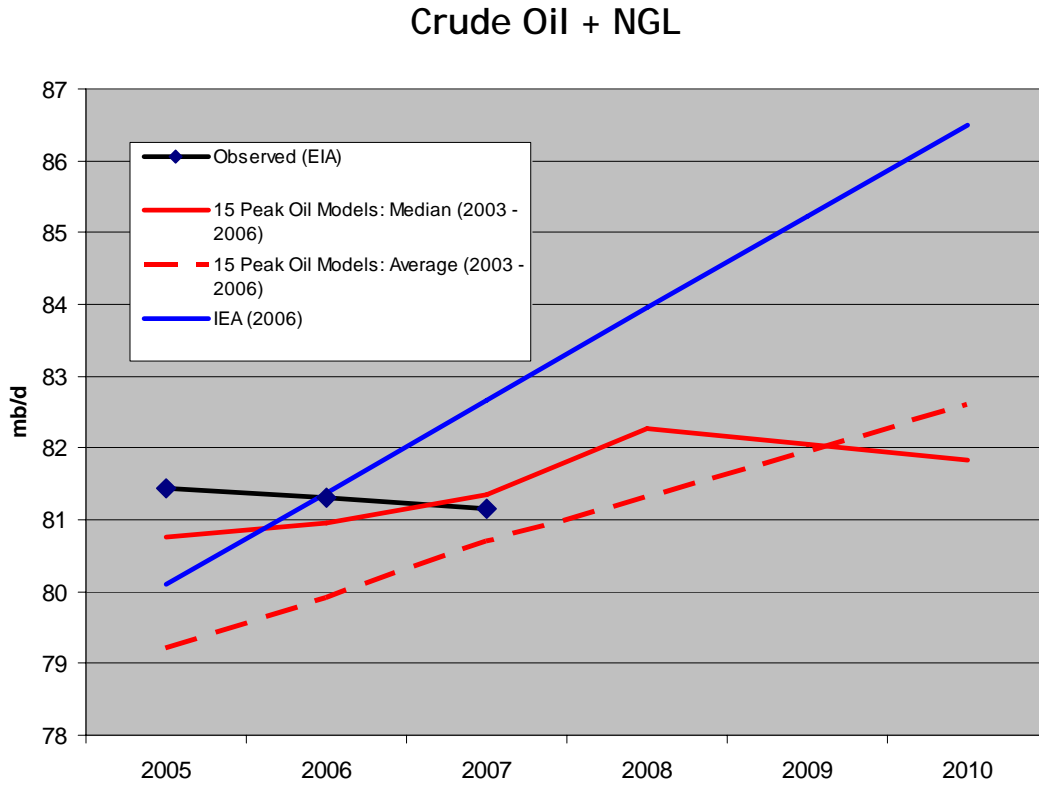


The chart above compares the EIA's 2006 'All Liquids' forecast; a median and average peak oil forecast; and observed production.

Observed 2007 data is an average of the first three months. If, as expected,²¹ the rest of 2007 stays on this course, then both the Mainstream and Peak Oil forecasts will have overestimated 2007 production by about 2 mb/d. Forward to 2010, actual production must reverse the recent decline and add more than 6 mb/d in the next three years for the EIA's forecast to be more accurate.

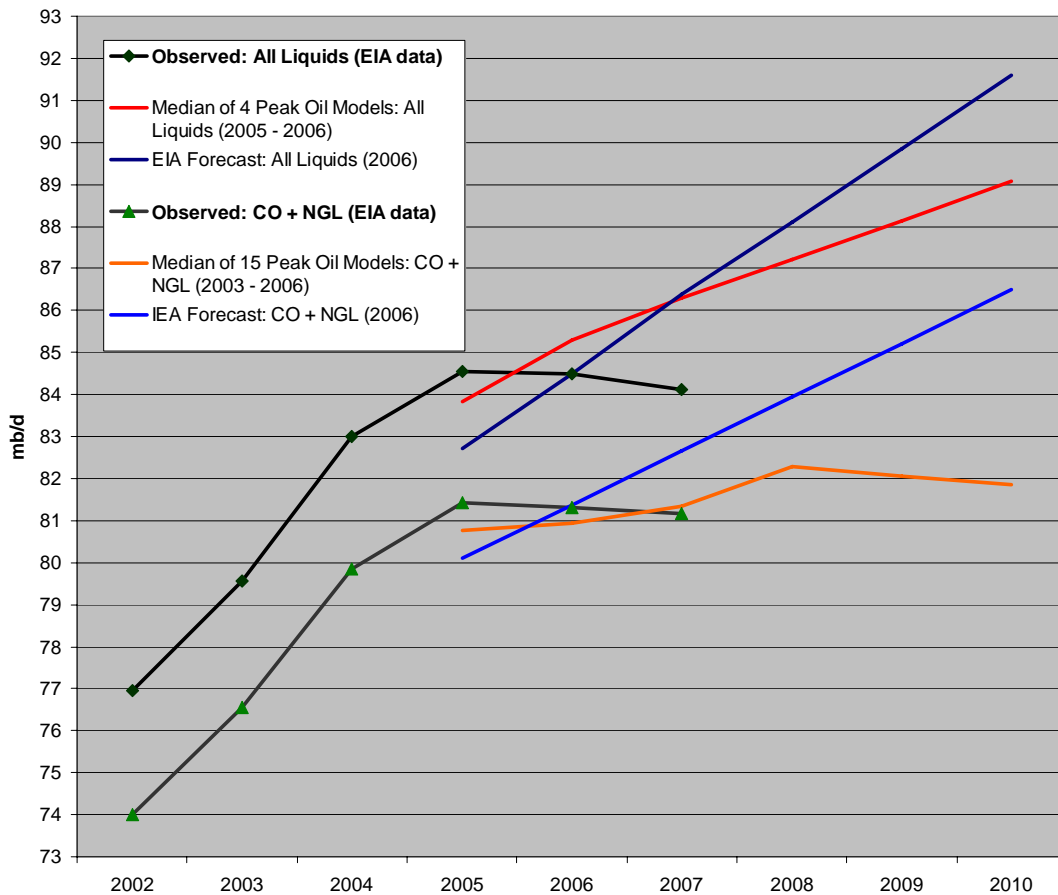
International Energy Agency (IEA) vs. Peak Oil Models

The IEA along with most Peak Oil forecasters use a 'Crude Oil + Natural Gas Liquids' definition in their forecasts. The following chart compares the two perspectives with observed production:



The preliminary 2007 data conforms closely to the Peak Oil Median forecast. The IEA's forecast is, thus far, overestimated by 1.5 mb/d

Forecast Summary



The chart above summarizes both definitions with a broader view. Production growth slowed in 2005. Despite record high prices, production declined slightly in 2006 and 2007. This profile conforms to Peak Oil theory where production reaches a plateau before declining.

Forecasting Methodology

For global production forecasts the EIA uses a price-based model that does not include geological constraints. Quoting from the International Energy Module:

*"The supply of oil from other non-OPEC regions is determined by two factors: world oil price and non-OPEC production lagged one period."*²²

Dave Cohen, an analyst with the Association for the Study of Peak Oil & Gas comments on the EIA's assumptions:

*"...[Peak Oil means that] after the peak or high plateau of production is reached, the world oil supply can not be increased beyond that level at any price. The EIA makes just the opposite underlying assumption – non-OPEC supply is highly sensitive to price changes in all cases."*²³

*...The EIA's market clearing model describes an ideal world in which macroeconomics and OPEC's policies determine the future oil supply. Alas, the world we live in is not so simple..."*²⁴

Most Peak Oil analysts use a 'bottom-up' analysis of oil field decline rates and forthcoming developments. They concentrate on actual oil flows and 'below ground' factors. While based in geological reality rather than macroeconomic theory, Peak Oil models do not usually include 'above ground' geopolitical factors. These factors (insurgent attacks, resource nationalism etc) are likely to accelerate the oil production decline at a rate faster than a purely geological model suggests.²⁵

IEA Chief Economist Comments

Fatih Birol, chief economist at the IEA, commented on future global oil production in a recent interview with *Le Monde*²⁶

"If Iraqi production does not rise exponentially by 2015, we have a very big problem, even if Saudi Arabia fulfills all its promises. The numbers are very simple, there's no need to be an expert..."

...Within 5 to 10 years, non-OPEC production will reach a peak and begin to decline, as reserves run out. There are new proofs of that fact every day..."

These comments appear to put Birol in opposition to his own agency's forecasts.

The High Oil Price Scenario

“A careful review of all the estimates leads to the conclusion that world oil production may peak within a few short years, after which it will decline. Once peak oil occurs, then the historic patterns of world oil demand and price cycles will cease.”

-US Army Corp of Engineers, September 2005²⁷

The authors of OPA are open-minded enough to include a high oil price scenario centered on a possible 2008 peak in conventional oil production. Although this is beyond the scope of OPA, I believe that price-based scenarios are one-dimensional and unlikely to provide an adequate map for navigating the post-peak environment.

I advise planners to consider:

- [EROEI \(Energy Returned on Energy Invested\)](#)

While difficult to quantify, EROEI is an important metric for assessing an energy source's viability. Conventional oil has an EROEI ratio of >10 : 1²⁸. Alternative liquid fuels have a much lower EROEI that hinders their development, scalability and utility. For example, oil produced from tar sands has an EROEI of around 3:1²⁹ and ethanol from corn an EROEI of 1.24 : 1³⁰.

- [The Rise of Resource Nationalism & Energy Mercantilism](#)

Oil producing countries are less inclined to let the market dictate their oil production. Former Saudi Arabian exploration and production head Sadad Al-Husseini comments in a personal communication to ASPO-USA:

“There has been a paradigm shift in the energy world whereby oil producers are no longer inclined to rapidly exhaust their resource for the sake of accelerating the misuse of a precious and finite commodity. This sentiment prevails inside and outside of OPEC countries but has yet to be appreciated among the major energy consuming countries of the world.”³¹

Author W Joseph Stroupe outlines the rise of a Russian-led energy alliance. He comments:

"In application to India, China and the other rising powers of the East, [neo-mercantilist] refers to the...strategy of concluding rigid, private bilateral long-term supply contracts between themselves individually and producers they each target around the globe. This has the net effect of securing oil and gas exclusively for the individual consumer state at the expense of the liquidity of the global oil market, and hence at the expense of oil's fungibility."³²

- [The Export-Land Model](#)

Oil geologist Jeffrey Brown has noted that once production in an oil exporting country goes into decline, net oil exports decline at a faster rate due to rising domestic consumption. In this model, the short-term increase in oil revenues stimulates oil producing countries' domestic consumption leading to a rapid decline in oil exports.

Conclusion

“Unfortunately, there's a lot of talk, but very little action. I really hope that consuming nations will understand the gravity of the situation and put in place radical and extremely tough policies to curb oil demand growth...”

-Fatih Birol, IEA Chief Economist, June 2007³³

OPA gives the crude oil futures market and mainstream industry analysts the greatest weighting when projecting the price of oil.

The futures market is still predicting an oil price lower in the long term than in the near-term. However, the basis for applying such an assumption to actual prices looks increasingly uncertain as the forward price curve flattens in a manner consistent with a growing acceptance of peak oil theory amongst traders.

Production forecasts of mainstream industry analysts have been woefully inaccurate even when high quality oil field data has been available. Their models are simplistic, largely price-based and steeped in ‘free market’ assumptions. In contrast, production forecasts from analysts in the peak oil camp have been more accurate and include geological constraints. Furthermore, a top official at a mainstream agency has publicly made comments that put him close to the Peak Oil camp.

There is good reason to believe that the Peak Oil perspective is accurate. New Zealand looks likely to face oil shocks in the near term.

The Government should revise their forecasting methodology and rapidly accelerate the implementation of policies to reduce New Zealand’s oil dependence. Such policies are complementary to the Government’s commitment to reduce greenhouse gas emissions.

©Simon Tegg
simontegg@yahoo.co.nz

References & Footnotes

¹ *Energy Supply and Demand Balance for Year End March 2005*. Retrieved 12th June, 2007 from http://www.med.govt.nz/templates/MultipageDocumentTOC_____21694.aspx

² Ibid

³ See the IEA's *World Energy Outlook 2006* http://iea.org/textbase/weo/fact_sheets/fs_oil.pdf

⁴ Peak Oil Update - June 2007: Production Forecasts and EIA Oil Production Numbers. (June, 2007) *The Oil Drum*. Retrieved 28th June, 2007 from <http://www.theoil Drum.com/node/2620>.

⁵ Samuelson, R., Taylor, M. (2005) *Oil Price Assumptions for Energy Outlook*. p.19

⁶ Ibid p.5-6

⁷ Orange, R. (November 2004) Oil supply to peak sooner than we think, says BP scientist. *The Business*. Retrieved 30th June, 2007 from <http://www.energybulletin.net/3041.html>

⁸ Samuelson, R., Taylor, M. (2005) *Oil Price Assumptions for Energy Outlook*. p.4

⁹ Ibid p.9

¹⁰ Ibid p.4-5

¹¹ Futures data acquired through internetarchive.org. Retrieved 7th June, 2007 from http://web.archive.org/web/*/http://www2.barchart.com/dfutpage.asp?sym=CL&code=BSTK.

¹² NYMEX Light Sweet Crude. Historical price data retrieved 7th June, 2007 from <http://octane.nmt.edu/gotech/Marketplace/Prices.aspx>

¹³ Vail, J. (December 2006). Curve Ball: Extracting Geological-Economic vs. Geographical-Political Impact on Oil Prices *Jeff Vail: Energy Intelligence*. Retrieved 11th June, 2007 from <http://www.jeffvail.net/2006/12/curve-ball-extracting-geological.html>.

¹⁴ Vail, J. (March 2006). When Will Peak Oil Tip? (from Backwardation to Contango). *Jeff Vail: Energy Intelligence*. Retrieved 11th June, 2007 from <http://www.jeffvail.net/2006/03/when-will-peak-oil-tip-from.html>.

¹⁵ Samuelson, R., Taylor, M. (2005) *Oil Price Assumptions for Energy Outlook*. p3

¹⁶ In any case, the futures price for a December 2012 contract is now \$US16 higher than the prices quoted in OPA. See <http://www2.barchart.com/dfutpage.asp?sym=CL&code=BSTK>

¹⁷ Samuelson, R., Taylor, M. (2005) *Oil Price Assumptions for Energy Outlook*. p5

¹⁸ Blanchard, R. (1999) *The Impact of Declining Major North Sea Oil Fields upon Future North Sea Production*. Retrieved 27th April 2007 from <http://www.hubbartpeak.com/blanchard/>.

¹⁹ Ibid

²⁰ Data for the charts in this section is taken from Peak Oil Update - June 2007: Production Forecasts and EIA Oil Production Numbers. (June, 2007) *The Oil Drum*. Retrieved 28th June, 2007 from <http://www.theoil Drum.com/node/2620>. Also, *International Petroleum Monthly*. Retrieved 29th June, 2007 from <http://www.eia.doe.gov/ipm/supply.html>

²¹ Note: in the last six years the average production for a given year has never varied more than 1% from the average of the first three months of that year. See <http://www.eia.doe.gov/emeu/ipsr/t14.xls>

²² *NEMS International Energy Module (IEM) Model Documentation Report* (March 2007) p9. Retrieved 25th June, 2007 from <http://tonto.eia.doe.gov/FTPROOT/modeldoc/m071%282007%29.pdf>

²³ Cohen, D. (June, 2007) *The EIA's Simple Model of a Complex World. Association for the Study of Peak Oil and Gas – USA*. Retrieved 30th June, 2007 from http://www.aspo-usa.com/index.php?option=com_content&task=view&id=151&Itemid=76

²⁴ Ibid

²⁵ Vail, J. (April, 2007) *Five Geopolitical Feedback-Loops in Peak Oil. Jeff Vail: Energy Intelligence*. Retrieved 29th June, 2007 from <http://www.jeffvail.net/2007/04/five-geopolitical-feedback-loops-in.html>.

²⁶ Sans l'or noir irakien, le marché pétrolier fera face à un "mur" d'ici à 2015. (27th June, 2007). *Le Monde*. Retrieved 28th June, 2007 from <http://www.lemonde.fr/web/article/0,1-0,36-928476,0.html>. English Translation from French at <http://www.dailykos.com/storyonly/2007/6/27/165424/633>

²⁷ Fournier, D., Westervelt, E. (2005) *Energy Trends and Their Implications for U.S. Army Installations*. Retrieved 1st July, 2007 from <http://stinet.dtic.mil/cgi-bin/GetTRDoc?AD=A440265&Location=U2&doc=GetTRDoc.pdf>

²⁸ Staniford, S. (September 2005). *On Low Quality Hydrocarbons (Part I). The Oil Drum*. Retrieved 27th June, 2007 from <http://www.theoil Drum.com/story/2005/9/21/1156/96411>

²⁹ Ibid

³⁰ Shapouri, H., Duffeld, J., Graboski, M. (1995) *Estimating the Net Energy Balance of Corn Ethanol*. Retrieved 30th June, 2007 from <http://www.ers.usda.gov/publications/aer721/aer721.pdf>
Note: this study is not peer reviewed and the net energy estimations include the energy content of animal feed by-product . Other peer-reviewed studies give a worse EROEI.

³¹ Cohen, D. (June 2007). *A Paradigm Shift. Association for the Study of Peak Oil and Gas -USA*. Retrieved 30th June, 2007 from http://www.aspo-usa.com/index.php?option=com_content&task=view&id=155&Itemid=76

³² Stroupe, W. J. (November 2006). *THE NEW WORLD OIL ORDER, Part 2 Russia tips the balance. Asia Times Online*. Retrieved 29th June, 2007 from http://www.atimes.com/atimes/Central_Asia/HK23Ag01.html.

³³ Sans l'or noir irakien, le marché pétrolier fera face à un "mur" d'ici à 2015 (27th June, 2007). *Le Monde*. Retrieved 28th June, 2007 from <http://www.lemonde.fr/web/article/0,1-0,36-928476,0.html>. English translation from French at <http://www.dailykos.com/storyonly/2007/6/27/165424/633>