Chapter Two

Future oil demand and supply

World oil production and consumption

2.1 According to BP's *Statistical Review of World Energy*, world oil production in 2005 was 81 million barrels per day (29.5 billion barrels per year), and proven oil reserves at the end of 2005 were 1,200 billion barrels. Year on year production grew in the OPEC countries and the Former Soviet Union, and declined in the OECD and other non-OPEC countries in total.[1]

2.2 On BP's figures oil reserves continue to grow: annual additions to reserves through new discoveries and reserve growth are greater than annual production ('peak oil' critiques of this statement are considered below).[2] 'Reserve growth' refers to the commonly observed increase in recoverable oil reserves in previously discovered fields over time. This results from 'a combination of several factors, including conservative initial estimates, improvements in exploration and drilling technology, improved production technology, and various political and economic forces'.[3]

2.3 This raises the question: why then have oil prices been high over the last two years? The usual answers are that demand has grown because of strong economic growth, particularly in China, while supply has lagged because of insufficient investment in new capacity since the period of low prices in the late 1990s. As well, commentators point to the weather in 2005, including hurricanes in the USA which disrupted production; and geopolitical instability, which has caused the market to want 'precautionary inventories'.[4]

2.4 In this scenario there is no fundamental geological constraint on the supply of oil, and prices may be expected to fall again in the medium term as higher prices stimulate exploration and investment, and supply catches up with demand. ABARE predicts that oil prices 'could remain relatively high for a number of years, but should fall towards the end of the decade 'in response to higher global oil production and a substantial increase in oil stocks by that time.'[5] It should be noted that ABARE's

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1 BP, *Statistical Review of World Energy*, 2006, p.6,8. 'Production includes crude oil, shale oil, oil sands and natural gas liquids.'

2 Year on year change in reserves is found by subtracting production and adding new discoveries and reserve growth. On BP's figures world oil reserves were 770 billion barrels in 1985, 1,027 billion barrels in 1995, 1,194 billion barrels in 2004 and 1,200 billion barrels in 2005.

3 T.R.Klett, D.L.Gautier & T.S. Ahlbrandt, 'An Evaluation of the US Geological Survey World Petroleum Assessment 2000', AAPG Bulletin, vol.89 no.8 August 2005, p.1036

4 For example, P. Davies (BP), *Quantifying Energy - BP Statistical Review of World Energy 2006,* speech 14 June 2006. International Energy Agency, *World Energy Outlook 2005*, p.5

5 ABARE, *Australian Commodities,* June 2006, p.303ff.

analysis was not supported by the overwhelming majority of submissions and witnesses.

2.5 Geopolitical factors also include the failure of the global market. Unlike other commodities, 80% of the world's oil is owned by countries, which are entering into long-term energy supply agreements that are in effect energy treaties. China has signed agreements with Iran and Venezuela for oil and Turkmenistan for gas. It should not be assumed that surplus energy will be available for purchase, even if countries like Australia and the US have the finance. As the Venezuelan president has said, 'These energy contracts are designed as a great wall against US hegemony.'

2.6 The International Energy Agency (IEA) predicts that in a 'reference scenario' world demand for oil will grow to 92 million barrels per day in 2010 and 115 million barrels per day in 2030. It argues that resources are adequate to meet the demand providing there is adequate investment; but it concedes that 'financing the required investments in non-OECD countries is one of the biggest challenges posed by our energy-supply projections.' [6]

2.7 The US Geological Survey in 2000 estimated that the world's total of conventional oil produced to date or with potential to be added to reserves by 2025 is about 3,000 billion barrels.[7] Of this total, in round figures about 1,000 billion barrels has already been produced.[8]

'Peak oil' critique of official predictions

2.8 Proponents of the 'peak oil' theory argue that official estimates of future oil supply are over-optimistic, and that supply will be constrained by lack of resources soon enough to be a concern. They include a number of prominent oil industry experts including oil industry veterans Colin Campbell and Jean Leherrere; Kenneth Deffeyes (formerly of Shell Oil and Princeton University); Ali Samsam Bakhtiari (formerly of Iranian National Oil Company); Matthew Simmons (leading energy industry financier and a former energy adviser to US Vice-President Dick Cheney), and Chris Skrebowski (editor, *Petroleum Review*).[9] Peak oil views are expressed by the Association for the Study of Peak Oil and Gas (ASPO) among other groups.

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6 International Energy Agency, *World Energy Outlook 2005*, p.45. The reference scenario assumes no policies to curb energy demand or greenhouse emissions beyond what governments have committed to already: p59.

7 US Geological Survey: *World Petroleum Survey 2000*, table AR-1. p.ES-1. This is the mean (P50) estimate: there is a 50% probability that the true figure is at least this much.

8 Conventional oil production to 2005: 968 billion barrels: Submission 10, ASPO Ireland, p.3. *Recoverable* oil should not be confused with the total resource, known as the Original Oil In Place (OOIP). The world's Original Oil In Place is a much larger figure; but on average world-wide only about a third of it can be recovered. This is because, as oil in a reservoir is extracted, it becomes gradually harder and eventually impossible to extract what it left.

9 Bureau of Transport and Regional Economics, *Is the world running out of oil - a review of the debate*, working paper 61, 2005, p.4.

2.9 'Peak oil' proponents commonly predict a peak of conventional oil production somewhere between now and 2030. Their concerns are based on the following observations or propositions:

- World discovery of oil peaked in the 1960s.[10] Production may be expected to mirror discovery after a time lag (as happened in the USA, where production in the lower 48 states peaked in 1970). Production in many major oil-producing countries is in decline.[11] The world is presently using more oil than it discovers.[12]
- Official estimates of world reserves, future reserve growth and future discoveries are over-optimistic, as follows:
- Reported reserves in the Middle East are untrustworthy. State owned oil companies do not release field by field figures to allow independent auditing. In many countries reported reserves were increased enormously for political reasons, absent any significant discoveries, during the 'quota wars' of the 1980s. In some countries reported reserves have been unchanged for years, suggesting that new discoveries and reserve growth exactly match production, which is implausible.[13]
- The US Geological Survey's 2000 report is 'thoroughly flawed.' Its estimate of future reserve growth (which it predicts will be almost as important as future discoveries) is unsound. The estimate was made by extrapolating US experience to the rest of the world. This is unsound because of the different conditions and because US reserve reporting is driven by US prudential standards which are not necessarily replicated elsewhere. As well, 'it failed to understand that reserve growth is mainly confined to large fields with several phases of development, and will not be matched in the smaller fields of the future.'[14]
- The USGS 2000 estimate of potential new discoveries, to be realised, would require a drastic turnaround of the historic decline in the rate of discovery. Discoveries in the study period to date have been far short of the suggested rate. 'This is doubly damning because the larger fields are found first.'[15]

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10 In relation to this, peak oil proponents quote remarks by Harry J. Longwell, Director and Executive Vice-President, Exxon Mobil, Houston, 7 May 2002. This appears to show annual oil discovery declining in an irregular fashion, but with a clear long term trend, from about 60 billion barrels in 1960 to 20 billion in 2000.

11 Submission 135, ASPO Australia, p.2

12 This contrasts with BP's figures showing continually increasing reserves. The explanation may be that the BP figures include reserve growth. Peak oil proponents argue that, when discussing the trend in discovery, additions by reserve growth should be backdated to the discovery of the field.

13 K.Aleklett & C.J.Campbell, *The Peak and Decline of World Oil and Gas Production*, n.d. p.6

14 K.Aleklett & C.J.Campbell, *The Peak and Decline of World Oil and Gas Production*, n.d. p.9.

15 K.Aleklett & C.J.Campbell, *The Peak and Decline of World Oil and Gas Production*, n.d. p.9.

2.10 ASPO suggests that the total past and future production of conventional oil will be about 1,850 billion barrels, of which about half (968 billion barrels) has already been produced.[16] This may be compared with the USGS 2000 mid-range estimate of about 3,000 billion barrels already discovered or with potential to be discovered by 2025.

2.11 There are large resources of non-conventional oil (such as Canadian tar sands and Venezuelan heavy oil).[17] However peak oil proponents argue that the difficulty, cost and environmental problems of exploiting them mean that they cannot make much difference to the scenario of future decline suggested by their figures for conventional oil.

2.12 Other commentators who reject peak oil concerns commonly argue (among other things) that pessimistic views of peak oil do not allow for the likely increase in oil exploration and technological advances in oil recovery which would be spurred by rising oil prices. However the Committee notes that the increasing costs associated with such recovery are such that there comes a point where the costs outweigh the benefits.

2.13 The US Energy Information Administration in 2004 estimated the peak of conventional oil for various scenarios of supply and demand growth, assuming a decline path after the peak which maintains a reserves to production ratio of 10 to 1. Most of the scenarios lead to a peak between 2025 and 2050. For example, using the USGS 2000 mid-range estimate of the recoverable resource, and assuming 2% annual growth in demand, leads to a peak in 2037. The outcome depends crucially on the assumed rate of demand growth, and by contrast is 'remarkably insensitive to the assumption of alternative resource base estimates…'

> For example, adding 900 billion barrels - more oil than had been produced at the time the estimates were made - to the mean USGS resource estimate in the 2 per cent growth case only delays the estimated production peak by 10 years.'[18]

2.14 The effect of these scenarios on long term oil prices is of course much harder to predict, as it also depends on other factors such as economic growth, the trend in energy consumption per unit of economic output, and the development of alternative fuels. ABARE's long term projections of demand for oil assume an oil price of $US40 per barrel, on the grounds that oil prices will be held to that level by competition from substitutes, such as oil from coal, which become viable at about that level.[19]

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16 ASPO Ireland, *Submission 10*, p.3

17 Estimated recoverable reserves are 315 billion barrels of tar sands in Canada and 270 billion barrels of heavy oil in Venezuela. ABARE, *Australian Commodities*, June 2006, p.305

18 J.H.Wood, G.R.Long & D.F.Morehouse, *Long Term World Oil Supply Scenarios - the future is neither as bleak or as rosy as some assert*, US Energy Information Administration, 2004, p.5-7.

19 ABARE, *Australian Commodities,* June 2006, p.303ff. Dr J. Penm (ABARE), *Proof Committee Hansard* 18 August 2006, p.59.

Comment

2.15 The Committee recognised that there is a convergence of concern about increasing atmospheric concentrations of greenhouse gases and declining global oil supplies. It was understood that solving the transport fuel challenge without reference to reducing greenhouse gas emissions would be a flawed response. The Committee determined to identify transport fuel solutions that were also consistent with the objective of reducing emissions.

2.16 Peak oil proponents have criticised official estimates of future oil supply with detailed and plausible arguments. The Committee is not aware of any official agency publications which attempt to rebut the peak oil arguments point by point in similar detail.

2.17 In the Committee's view the possibility of a peak of conventional oil production before 2030, even if it is no more than a possibility, should be a matter of concern. Exactly when it occurs (which is very uncertain) is not the important point. Australia should be planning for it now, as Sweden is doing with its plan to be oil free by 2020. [20]

2.18 In the Committee's view it is clear that gas will be the most significant transition fuel option for Australia, and as such a national reserve should be established.

2.19 Most official economic forecasts seem to regard the 'long term' as extending to 2030, and are silent about the future after then. In view of the enormous changes that will be needed to move to a future which is less dependent on conventional oil, the Committee regards this as inadequate. Longer term planning is needed.

2.20 The 2005 'Hirsch report' for the US Department of Energy argues that peak oil has the potential to cause dramatically higher oil prices and protracted economic hardship, and that this is a problem 'unlike any yet faced by modern industrial society.' It argues that timely, aggressive mitigation initiatives will be needed and that timing this is a 'classic risk management problem':

> Prudent risk management requires the planning and implementation of mitigation well before peaking. Early mitigation will almost certainly be less expensive that delayed mitigation.[21]

2.21 It should be noted that peak oil proponents do not claim that peak oil is the cause of present high oil prices. If the oil price declines in the next few years, as ABARE predicts, this does not dispose of peak oil concerns. Peak oil is a different and much longer term concern.

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20 Commission on Oil Independence [Sweden], *Making Sweden an Oil-Free Society*, June 2006.

21 R.L. Hirsch, R. Bezdek & R. Wendling, *Peaking of World Oil Production - impacts, mitigation and risk management.*2005, p.6-7.

Oil production and consumption in Australia

2.22 Commercial crude oil production in Australia started at Moonie in 1964, and grew dramatically after the discovery of the offshore Gippsland oilfields in the 1960s. It has mostly been between 400,000 and 500,000 barrels per day since then. As gas production has increased, production of associated condensate has also increased, to around 150,000 barrels per day.[22]

2.23 Future production depends on continued production from known reserves, additional production from known fields because of reserve growth, and predicted new discoveries.[23]

2.24 The rate of new discoveries has declined significantly since the discovery of the supergiant Gippsland fields in the late 1960s. More recent smaller discoveries have slowed but not reversed the overall decline in reserves as oil is produced.[24] Geoscience Australia predicts that Australian production of crude oil plus condensate will hold at current levels of about 550,000 barrels per day until about 2009 and decline thereafter to about 224,000 barrels per day by 2025, as reserve growth and new discoveries fail to match the rate of production.[25]

2.25 Australia's demand for petroleum (including crude oil and condensate) is over 750,000 barrels per day, and is projected to rise to over 800,000 barrels per day by 2009-10, and over 1,200,000 barrels per day by 2029-30 - an increase of almost 2% per year over the period.[26]

2.26 On Geoscience Australia's figures, it appears that over the next 20 years Australia's self-sufficiency in oil and petroleum products will decline from 84% to 20% (using a middle range estimate of future production), or from 98% to 31% (using an optimistic estimate of future production).[27]

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22 Geoscience Australia, *Submission 127*, p14,16. Condensate is a light oil-like liquid produced from gas fields. 1 barrel = 158.987 litres.

23 'Reserves': oil in known reservoirs which can be extracted commercially with today's prices and technology.

24 Dr C. Foster (Geoscience Australia), *Proof Committee Hansard* 12 May 2005, p.4.

25 Geoscience Australia, *Submission 127*, p.13. Midrange (50% probability) estimate. An optimistic (10% probability) estimate is for production of 342,000 barrels per day in 2025.

26 Geoscience Australia, *Submission 127*, based on ABARE, *Australian Energy - National and State Projections to 2029-30*, 2005, p.63

27 Geoscience Australia, *Submission 127*, tables 1 & 2. Taking the P50 and P10 production estimates in table 1 as a percentage of the oil equivalent consumption estimates in table 2. 'Middle range estimate' = P50 figures: there is a 50% probability that the true figure is at least this much. 'Optimistic estimate' = P10 figures: there is a 10% probability that the true figure is at least this much.

2.27 Geoscience's production estimates do not formally include future gains from reserve growth, enhanced oil recovery in fields nearing depletion, and undiscovered resources in basins which have not been explored or have no discoveries to date. These may be partly accounted for in the more optimistic estimate.

2.28 ABARE predicts that Australia's self-sufficiency in liquids fuel consumption will decline from 78% in 2003-04 to 49% in 2029-30. The large difference from Geoscience Australia's estimate seems to come from a higher estimate of future Australian production, based on an estimate of undiscovered resources by the US Geological Survey in 2000.[28]

2.29 In either case Australia's oil self-sufficiency is predicted to decline significantly. The predicted demand growth is a much more important cause that the variation of predictions about future Australian production.

2.30 The Australian Petroleum Production and Exploration Association (APPEA) notes that Australia has historically been a net exporter of oil, gas and petroleum products; however this situation has turned around in the last two years because of rising prices and a fall in domestic crude oil production. In 2005 imports exceeded exports by $4.7 million. APPEA suggests that by 2015 this figure could be in the range of $12 billion to $25 billion, depending on assumptions about Australian production and price.[29]

28 ABARE, *Australian Energy - national and state projections to 2029-30*, report 05.9, October 2005, p.45

29 Australian Petroleum Production and Exploration Association, *Submission 176*, p.8.