



ASPO-Australia

Australian Association for the Study of Peak Oil & Gas

www.ASPO-Australia.org.au

Oil & Gas Industry Working Group

Convenor: Phil Hart

Petroleum Facilities Engineer

7 Forbesfield Rd, Aberdeen

AB15 4NX, United Kingdom

+44 1224 323 099

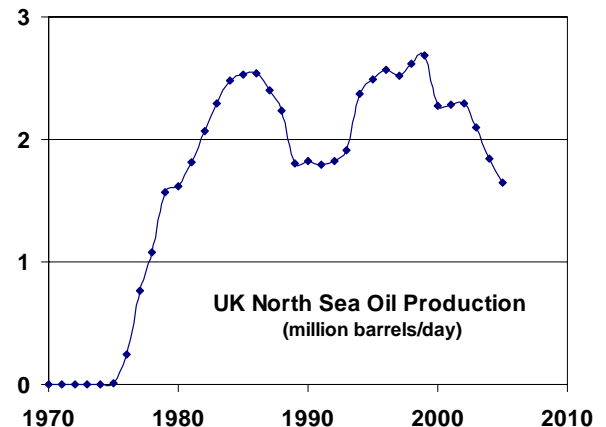
aspo@philhart.com

The Oil & Gas Industry Working Group of ASPO-Australia aims to raise awareness of the physical limits to further growth of oil supply. Leading figures within the oil and gas industry are acutely aware that future production is governed by geological and engineering constraints. They view with concern the myths and perceptions that have led to an assumption that continued growth in oil consumption is possible, and even likely.

We are unprepared for the peak in global oil production, which may well occur within five years.

After completing a Materials Engineering degree at Monash University in Melbourne, Phil Hart has been working for Shell UK Exploration and Production for five years in Aberdeen (Scotland); capital of the North Sea oil and gas industry. He is a member of Depletion Scotland, along with experienced colleagues from the UK oil and gas industry, who made their own submission concerning the near-term peak in oil production to the Energy Inquiry in Scotland in 2005¹.

Oil production in the North Sea peaked in 1999 and has declined by 39% to 2005². Gas production peaked in 2000 and has declined by 45% in the same period³. Failure to anticipate these peaks by UKOOA (the United Kingdom Offshore Operators Association), the DTI (Department of Trade and Industry) and the International Energy Agency (IEA)⁴ has resulted in an apparent shortage in 2005/06 United Kingdom winter gas supply and earlier than expected dependence on net foreign oil imports⁵. In contrast, early members of ASPO correctly predicted this peak for the North Sea⁴, only to have their scientific forecasts ignored in favour of more optimistic opinions. There is a vital lesson here for Australian Government predictions of future global oil production.



The following summarises the contribution three experienced and credible industry professionals have made to raise awareness of the likely near-term peak and future decline in global oil production.

Chris Skrebowski

Chris Skrebowski has spent his entire working career in the oil industry. He became editor of Petroleum Review in June 1997 having edited Petroleum Economist for the previous three years. Prior to that he had eight years working for the Saudis as an oil market analyst in London. Chris started his working career in 1970 as a long-term planner for BP and then joined Petroleum Times as a journalist just before the first oil crisis of 1973/74.

Major oil field projects have an extended timescale from discovery and appraisal of the field, through detailed design and construction of facilities before new production is realised. New production coming online within a period of around five years can be reliably forecast as the total capacity from planned developments. By comparing this to the decline from fields already in production, the net effect on global oil production can be estimated.

Chris Skrebowski has written such a study for Petroleum Review, a leading journal for the UK oil and gas industry. The most recent revision was published in October 2005⁶. His report covers more than 80 projects worldwide expected to be producing greater than 75,000 barrels per day before 2010, including production from non-conventional sources. These industry figures indicate that new production coming online before 2008 will

probably be insufficient to offset decline in existing fields, and that falling total global oil production will be self-evident by 2010.

Matthew R Simmons

Matt Simmons is the founder and Chairman of Simmons & Company International, a specialised energy investment banking firm. The firm has completed over 500 investment-banking projects for its worldwide energy clients at a combined dollar value of approximately \$60 billion. Matt Simmons publishes numerous energy papers for industry journals and is a frequent speaker at government forums, energy symposiums and in boardrooms of many leading energy companies around the world.

Following a visit to Saudi Arabia in 2003, Matt Simmons studied several hundred technical papers submitted by Saudi Aramco to the Society of Petroleum Engineers. His research has finally exposed the unlikely and unfounded claim that the Middle East, and Saudi Arabia in particular, can provide for decades of continuing global growth in oil consumption.

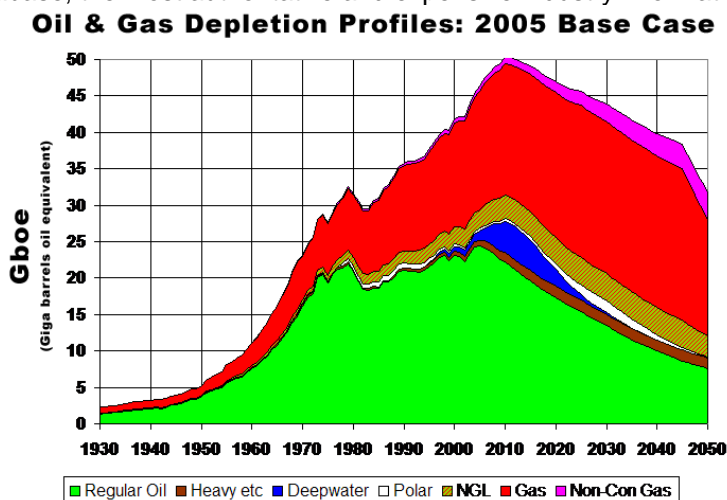
Saudi Aramco is a technically competent national oil company, able to manage the world's largest portfolio of production capacity over several decades. However, Saudi Arabia does not have inexhaustible oil reserves. Five now mature fields, all discovered between 1940 and 1968, have provided greater than 90% of its oil output for the last 40 years (Ghawar, Abqaiq, Safaniya, Berri, Zuluf/Marjan, Shaybah)⁷.

Oil and gas basins in the Middle East, as elsewhere, have been extensively explored and the geology is well understood, with only small discoveries likely in future. Rather than an abundance of future potential, what Matt Simmons has revealed is the potential for irreversible production decline from these old fields; the largest in the world. Falling production is already evident in Burgan, the world's second largest oil field in neighbouring Kuwait⁸.

Colin Campbell

Colin Campbell started his oil and gas industry career as a field geologist in Latin America and ended as an Executive Vice-President in Norway. In a form of subsequent retirement, he has written four books on oil depletion, and has published, lectured and broadcast widely on the subject.

Colin Campbell's pivotal contribution to peak oil awareness has been the development of a detailed and technical hydrocarbon production forecast, that models past and potential future production on an individual country basis, to formulate a valid global scenario. In addition to publicly available data such as the Oil and Gas Journal and the BP Statistical Review, Colin Campbell's model uses reserves, production and drilling statistics from the IHS Energy database, the most authoritative and expensive industry information source⁹.



The ASPO scenario forecasts a peak in 2010, with significant uncertainty on either side of this date. We can only state with reasonable confidence that peak liquid production will occur at any time between now and 2015. The importance of how the Senate Inquiry responds to this credible forecast cannot be overstated.

Recommendations:

1. Recognise that demand and higher prices cannot overcome fundamental geological and engineering constraints to continued growth of oil production.
2. Encourage urgent international measures to increase accuracy and transparency of oil and gas reserves and production data.
3. Support international efforts to adopt a [Depletion Protocol](#)¹⁰ to manage declining production of oil and gas resources, encouraging co-operation rather than competition and potential confrontation.

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Discovery and Production of Oil

According to the 'market experts', oil production is governed purely by economic theories. It is going to be a painful lesson for everyone, but even the economists will soon learn, as some already have, that production of oil is governed by sound geological principles and the laws of physics. The oil on which we have built our societies was created about one hundred million years ago. More of it is not now going to appear 10,000 feet underground in response to economic analyses that indicate the price is too high.

The simplest observation to begin with is that you must discover oil before you can produce it. Figure 1 shows the worldwide trend of oil discovery and production. This chart reveals several important facts:

- There were enormous early discoveries primarily in the Middle East in the late 1930's and late 1940's
- Worldwide oil discovery peaked in 1964 and has been falling ever since
- Every year since 1984, we have discovered less oil than we have produced
- We currently find one barrel of oil for every four that we use

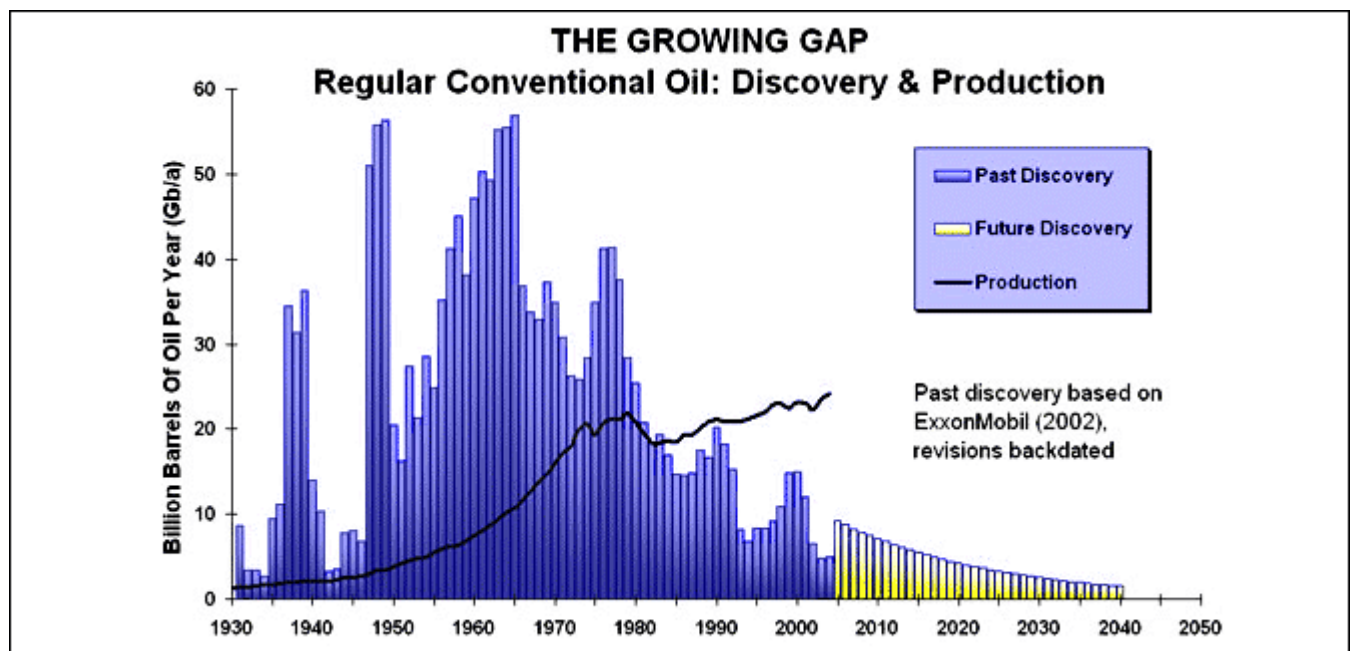


Figure 1: Past Discovery and Production Worldwide (ExxonMobil)

We are not 'running out' of oil - there is still a lot in the ground. But, we are reaching the point where the production rate will 'peak' and begin to decline. For a world built on an assumption of continuing growth in energy use and the economy, this is challenging news.

Middle East Oil Reserves

Incredibly, despite oil's fundamental importance, figures on oil reserves are very poor. Figure 2 lists the officially reported reserves figures for OPEC members - the 'Organization of the Petroleum Exporting Countries'. In 1985, Kuwait reported an improbable reserves increase from 63.9 to 90.0 billion barrels. Since OPEC production quotas were based on reported reserves, this had the effect of increasing their quota at a time when oil prices and revenue was low.

Year	Abu Dhabi	Dubai	Iran	Iraq	Kuwait	Saudi Arabia	Venezuela	Total
1980	28.0	1.4	58.0	31.0	65.4	163.4	17.0	364
1981	29.0	1.4	57.5	30.0	65.9	165.0	18.0	367
1982	30.6	1.3	57.0	29.7	64.5	164.6	20.3	368
1983	30.5	1.4	55.3	41.0	64.2	162.4	21.5	376
1984	30.4	1.4	51.0	43.0	63.9	166.0	24.9	381
1985	30.5	1.4	48.5	44.5	90.0	169.0	25.0	409
1986	30.0	1.4	47.9	44.1	89.8	168.8	25.6	408
1987	31.0	1.4	48.8	47.1	91.9	166.6	25.0	412
1988	92.2	4.0	92.9	100.0	91.9	167.0	56.3	604
1989	92.2	4.0	92.9	100.0	91.9	170.0	58.1	609
1990	92.2	4.0	92.9	100.0	91.9	257.5	59.1	698
1991	92.2	4.0	92.9	100.0	94.5	257.5	59.1	700
1992	92.2	4.0	92.9	100.0	94.0	257.9	62.7	704
1993	92.2	4.0	92.9	100.0	94.0	258.7	63.3	705
1994	92.2	4.0	89.3	100.0	94.0	258.7	64.5	703
1995	92.2	4.0	88.2	100.0	94.0	258.7	64.9	702
1996	92.2	4.0	93.0	112.0	94.0	259.0	64.9	719
1997	92.2	4.0	93.0	112.5	94.0	259.0	71.7	726
1998	92.2	4.0	89.7	112.5	94.0	259.0	72.6	724
1999	92.2	4.0	89.7	112.5	94.0	261.0	72.6	726

Figure 2: OPEC Reported Reserves from 1980-1999 (in Billion Barrels)

In 1988, other OPEC members followed suit, as they could not continue to see their own quotas reduced by Kuwait's new figures. Venezuela increased their stated reserves from 25.0 to 56.3 and Dubai from 1.4 to 4.0 billion barrels. Abu Dhabi almost tripled from 31.0 to 92.2 and Iran topped them with a new figure of 92.9. Saddam Hussein more than doubled Iraq's figure, with a bold claim for a clean 100.0 billion barrels of stated oil reserves.

Saudi Arabia, with the largest reserves resisted making the same response, but eventually could not bear the impact on their quota and in 1990 increased their reserves estimate from 170.0 to 257.5 billion barrels. Despite a decade of high production reducing reserves since then, Kuwait continued to report exactly the same reserves figure of 94.0 through the 1990's. Other OPEC members have similarly unlikely reporting trends.

Kuwait oil reserves only half official estimate-PIW Friday 20 January 2006, 1:32pm EST

LONDON, Jan 20 (Reuters) - OPEC producer Kuwait's oil reserves are only half those officially stated, according to internal Kuwaiti records seen by industry newsletter Petroleum Intelligence Weekly (PIW). "PIW learns from sources that Kuwait's actual oil reserves, which are officially stated at around 99 billion barrels, or close to 10 percent of the global total, are a good deal lower, according to internal Kuwaiti records," According to data circulated in Kuwait Oil Co (KOC), the upstream arm of state Kuwait Petroleum Corp, Kuwait's remaining proven and non-proven oil reserves are about 48 billion barrels

These inflated claims are still the assumed oil reserves figures for the OPEC countries. The true nature of OPEC oil reserves is probably closer to 380 billion barrels, before this erroneous reporting began, rather than the 726 billion barrels reported in 1999. In "Twilight in the Desert", Matthew Simmons¹ presents strong evidence that even Saudi Arabia is already at 'peak' and will not be able to make up for declining production from other regions or meet increasing worldwide demand.

This is at odds with 'official' forecasts of oil supplies continuing to increase until beyond 2020.

Predicting Future Discovery and Production

The U.S. Geological Society is a Federal Authority that published the "US Geological Survey World Petroleum Assessment" in June 2000. In what should become a famous mis-use of analytical statistical techniques, this report used Monte-Carlo simulations to predict possible future discovery curves, as shown in Figure 3.

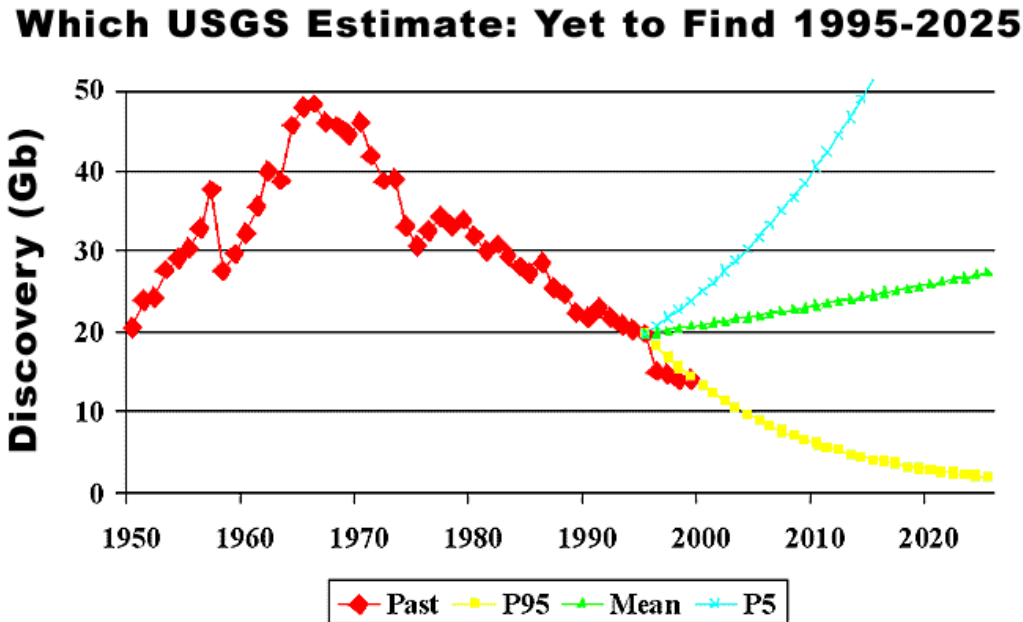


Figure 3: US Geological Survey - statistical discovery potential.

With 95% confidence, the USGS predicted discovery potential shown by the lowest yellow curve. They then made wildly optimistic predictions, which they gave a 5% chance of being correct, shown by the blue upper line. Using Monte-Carlo simulations, they derived the green middle line, which they described as the 'mean' or likely discovery potential between these two extremes. The past discovery data line shows, as in Figure 1, that discovery has in fact been decreasing steadily since the 1960s, an undeniable trend governed by geological facts. It is fanciful to suggest that we can overcome this geological reality and discover anything much more than predicted by the lowest curve - and data to 2005 confirms this (see Figure 1).

However, both the US Energy Information Administration (EIA) and the International Energy Agency (IEA) in Paris adopt the USGS 'mean' (and even the wildly optimistic 5% curve) as the basis for their forecast of future production, as in Figure 4. They also accept without question the official OPEC reserve claims, which are quite likely to be around double the real reserves. These are not just mistaken assumptions but very serious intelligence failures - by the principal agencies whose reports are used everywhere to form government and corporate policy.

"The projections presented by USGS, EIA and IEA regarding the future availability of oil give reason to grave concerns because the comforting messages of these studies unfortunately are not based on valid arguments. These studies ignore future limitations in the supply of oil which are meanwhile apparent, and by doing this they send misleading political signals."² [W. Zittel, J. Schindler, L-B-Systemtechnik](#)

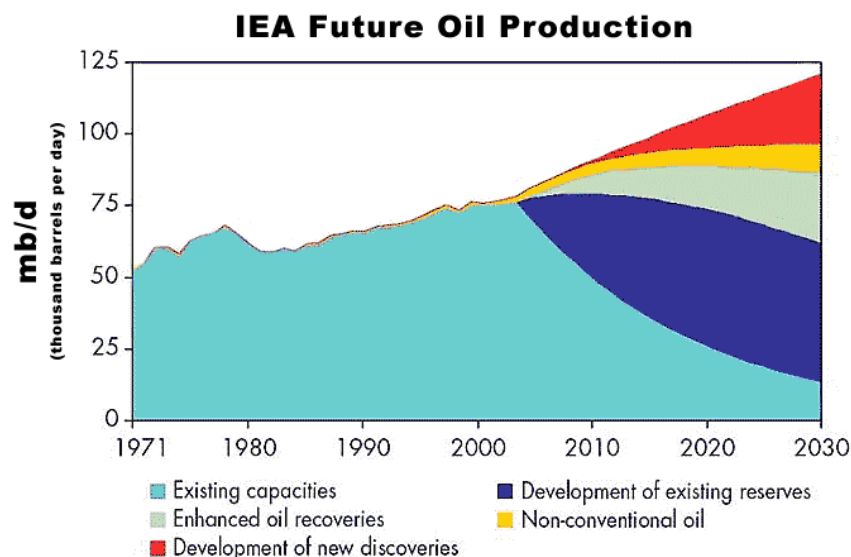


Figure 4: International Energy Agency Future Production Forecast.

The Role of Technology

Arguments about the effect of higher prices and the role of technology are commonly used to deny the imminent reality of peak oil.

"The economists all think that if you show up at the cashier's cage with enough currency, God will put more oil in ground."
[Kenneth S. Deffeyes](#), Princeton University Geologist.

"Most of the world's oil was found long ago with technology no more advanced than the hammer and hand lens. Some 60% lies in about 300 easily found giant fields. But over the last 20 years, we have seen amazing technological advances in the exploration arena." [Jack Zagar](#)

Geochemistry to identify the oil potential around the world. Seismic technology to define the size and shape of reservoirs. Drilling technology for longer, deeper, more accurate and multi-lateral wells. The industry has and continues to use advanced technology, but the trend is inescapable. We can only find smaller fields that are more difficult to produce. New technology often temporarily increases production rates, draining oil fields faster, but rarely does it significantly increase the ultimate amount of oil that can be recovered.

Past Predictions

The final argument used against those who predict a near-term peak in oil production is that people have always been predicting the end of oil and they have always been wrong.

In 1956, geophysicist M. King Hubbert working for Shell predicted oil production in the continental United States would peak in the early 1970s. He was proved right, but even in 1970 the industry scorned his prediction. They gloated that production levels continued to set records, only to see the predicted decline commence in the following years.

Following the same methodology, Hubbert predicted a world 'peak' in oil production for around the year 2000. This will be only a few years early, not because we have discovered more oil than he predicted, but through the oil shocks of the 1980's we used a little less in the meantime, slightly delaying the peak. Made half a century ago, Hubbert's prediction is still sound because he understood the principles of geology which underlie the discovery and production of oil.

In "The End of Cheap Oil" [[Scientific American, March 1998³](#)], with more than 40 years of oil industry experience, Colin J Campbell and Jean H Laherrere predicted that world oil production would peak in this first decade of the 21st century. As in the United States in 1970 and the United Kingdom before 2000, the economists scorn this prediction, but science is not on their side.

Forecast by the Association for the Study of Peak Oil & Gas

ASPO was formed in 2000 as a network of scientists and engineers affiliated with European institutions, having an interest in determining the date and impact of the peak and decline of the world's production of oil and gas, due to resource constraints. With substantial experience and access to authoritative industry databases, they have prepared their own robust forecast of future oil and gas production. For more information see ASPO's website at www.PeakOil.net

In stark contrast to the prevailing assumption of ever-increasing supplies, the ASPO scenario forecasts a peak in 2010, albeit with significant uncertainty on either side of this date. With reasonable confidence levels, it can only be stated that peak liquid production will occur at any time between now and 2015.

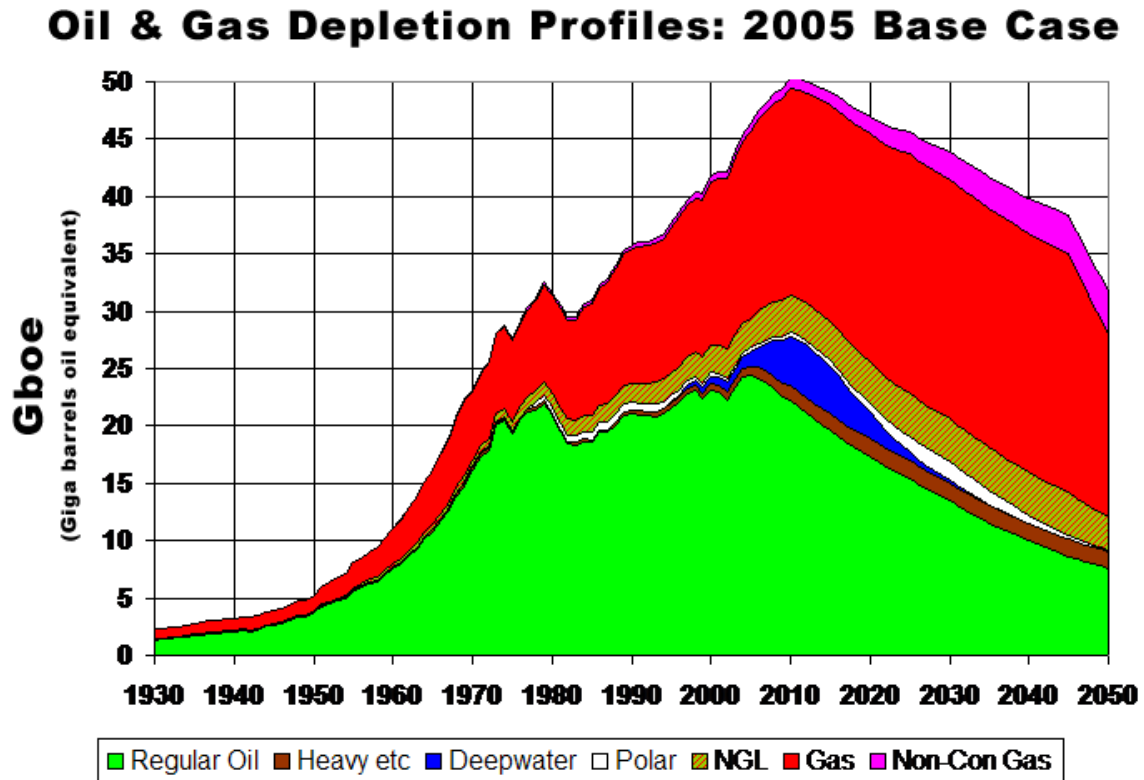


Figure 5: Production as forecast by the Association for the Study of Peak Oil & Gas.

Current Production

Production statistics available in February 2006 from the Energy Information Administration (EIA, USA) and the International Energy Agency (IEA, Paris) show the current record monthly production of 84.8 million barrels per day was achieved in May 2005. Contrary to forecasts from these same agencies, there was no clear growth in oil production through 2005, so it remains a low possibility that 2005 could be the year of peak production.

Independent analysis in Chris Skrebowski's Mega Projects Update⁴ and Colin Campbell's ASPO Forecast both indicate that decline in global oil production may be evident within five years. Such is the immediacy and importance of our predicament, that there is no room for complacency, half measures or delaying action.

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Appendix B - Projection of Oil Production in Australia

The following is an edited extract from the ASPO Country Assessment for Australia¹:

Exploration for oil began early, with a reported small discovery being made in 1900. As many as 157 wildcat wells had been drilled onshore by 1930 despite very little encouragement. A new chapter opened in the 1960s when important discoveries were made in a Tertiary basin in the Bass Strait between Australia and Tasmania and on Barrow Island off Western Australia. The three largest fields were Kingfish (1967) with 1200 Mb, Halibut (1967) with 850 Mb and Mackerel (1969) with 450 Mb. They stimulated renewed interest in exploration generally, resulting in a number of finds both in onshore Palaeozoic basins and in other marginal basins.

The last campaign came with the opening of the huge NW Shelf. It forms the passive margin of the continent facing the contact with the Eurasian Plate, bordering Indonesia. It is made up of a thick sequence of Mesozoic and Tertiary sediments. The former contains several rather lean source-rock intervals, which in many areas lie below the oil-generating window, explaining the preponderance of gas-condensate finds.

Exploration is now at a mature stage, and, to judge from the discovery trend and field size distribution, is unlikely to deliver more than about 1.4 Gb in new finds. A total of 4200 wildcats have been drilled so far. Peak exploration was in 1985 when 184 wildcats were drilled. The number has since declined to about 80, and is expected to continue to do so as the list of viable prospects dwindles, coming to an estimated end around 2035 after another 650 wildcats have been drilled. Australia may have some deepwater potential, but that is most uncertain.

AUSTRALIA		<i>Oil</i>
<i>Rates Mb/d</i>		
Consumption	2002	0.84
per person b/d		0.042
Production	2002	0.63
	Forecast 2010	0.45
	Forecast 2020	0.29
Discovery 5-yr average		0.3 Gb
<i>Amounts Gb</i>		
Past Production		5.8
Reported <i>Proved Reserves</i> *		3.5
Future Production		5.2
From Known Fields		3.9
From New Fields		1.4
Past and Future Production		11
Current Depletion Rate		4.2%
Depletion Midpoint Date		2001
Peak Discovery Date		1967
Peak Production Date		2000

*Oil & Gas Journal

Table 1: ASPO Summary of Australian Production and Reserves¹

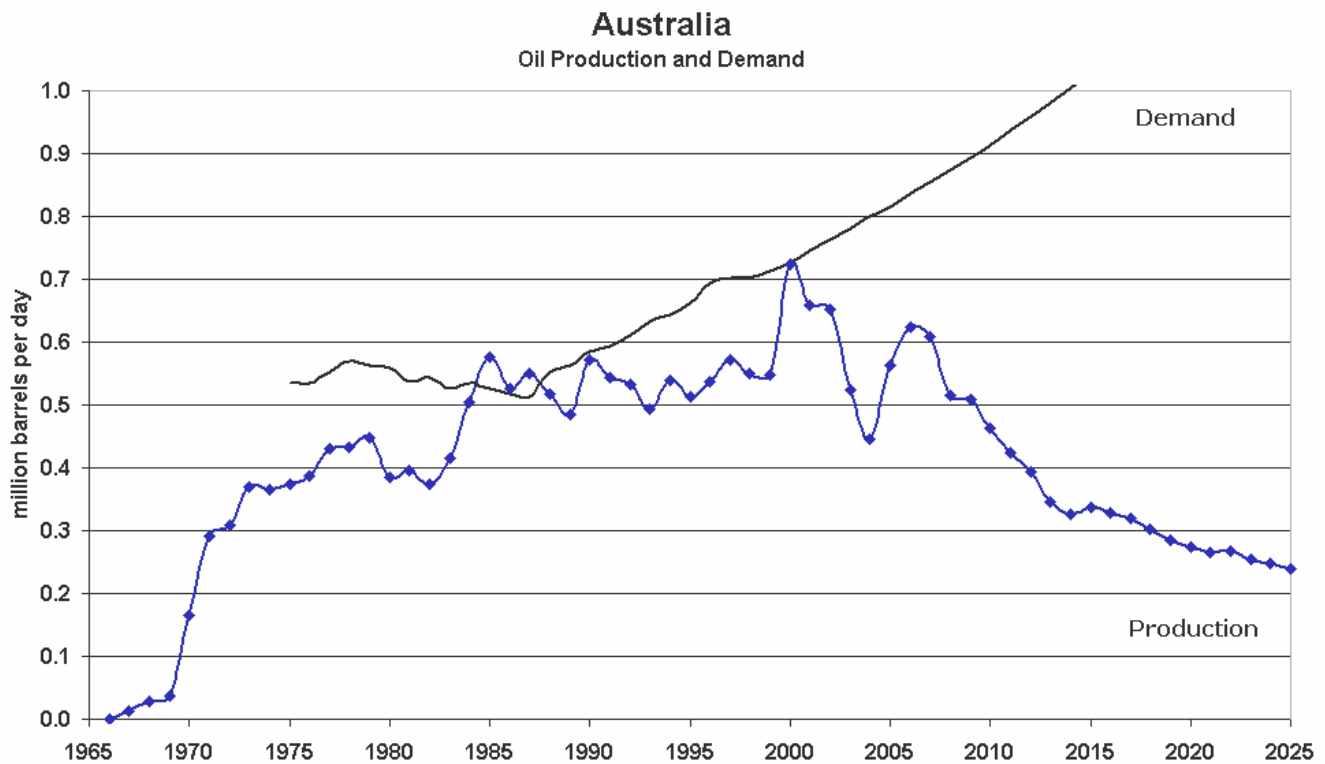


Figure 7: Geoscience Australia, Actual and P50 forecast oil production² and APPEA demand.

Oil production peaked in 2000, some thirty-three years after peak discovery. After 2006, it is set to fall steeply, as has been confirmed with surprising frankness by the industry³. Table 1 and Figure 7 show reasonable agreement between production forecasts for Australia from Geoscience Australia and the Association for the Study of Peak Oil.

About 178 Tcf of gas has been discovered, of which 18 Tcf have been produced. Production stands at about 1 Tcf/a, potentially rising to a plateau of, say, 6 Tcf/a in 2020. The gas also yields a substantial amount of gas-liquids, contributing about half the total liquid production by 2010.

Australia already imports about 25% of its oil, but with even static consumption, the percentage is set to pass 50% by around 2015. The cost of imports will rise steeply with the conflicting demands from other countries for scarce supplies.

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