Australia's future oil supply and alternative transport fuels

A submission to the Senate Inquiry into Australia's future oil supply and alternative transport fuels from Alex Roberts

a. projections of oil production and demand in Australia and globally and the implications for availability and pricing of transport fuels in Australia;

"Natural hydrocarbons represent millennia of stored solar power collected by plants and distilled by geologic accident. The flare given off by igniting an ounce of charcoal starter lasts a few seconds, but the energy was derived from, say, a prehistoric tree fern absorbing sunshine for nine years" (Kunstler 2005, p.112)

The exact date for peak extraction (the word production denotes creation/manufacture rather than what it actually is – depletion) of crude oil globally is currently unclear and will probably continue to be so until after it has occurred – what is clear is that it will happen and the sooner we plan for it the less drastic the consequences will be. This is particularly so given that current evidence seems to show that it has already happened for Australia and has either already happened or soon will happen for the rest of the world.

Australia: According to some Australia is unlikely to find more than another 1.4Gb of oil (ASPO 2003, p.8). Peak exploration for oil was in 1985, yet peak discovery was in 1967 (ASPO 2003, p.8). Peak extraction most likely occurred in 2000 (see below) and extraction has fallen sharply since (it was down to 71.5% of the 2000 peak by 2003 – drawn from Geoscience 2005, p.98).

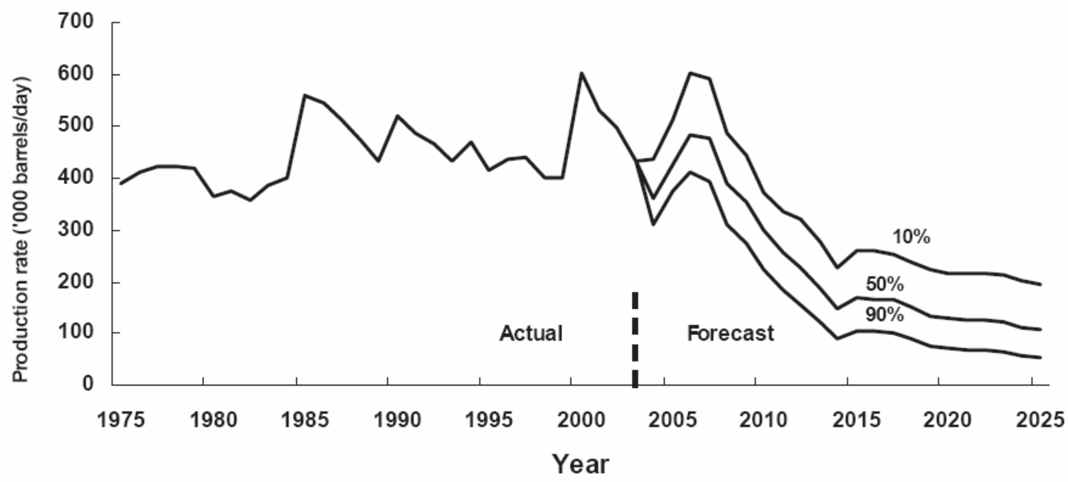


Figure 7.2 Australia's annual production of crude oil 1975–2003 and forecast annual production at 90%, 50% and 10% cumulative probability 2004–2025

Taken from Geoscience Australia 2005, p95.

As noted by the Australian Government, “Clearly the resource about which there is most concern is crude oil” (Geoscience 2003, p.99).

Globally: There is a great deal of uncertainty about the world’s oil supplies. This is particularly so for the OPEC nations. “During the 1980’s, many OPEC countries cheated on export quotas. Kuwait was the worst culprit, arbitrarily adding 50 percent to its reported reserves in 1985 to increase its quota, which was based on reserves.” (Heinberg 2003, p.74). This was confirmed recently when the Petroleum Intelligence Weekly found that Kuwait’s oil reserves are only half those officially stated – 48 billion rather than 99 billion (of which only 24 billion barrels are fully proven) (Reuters 2006). Simmons (2005) also raises significant concerns that Saudi Arabia may already be reaching its peak. There is a strong need to know just how much is still available from these nations yet there is no real transparency about just how much they do have left. No planning can truly reflect the situation until this is known.

What is known is that worldwide peak discovery of oil occurred in 1965 (Leggett 2005, p.57-58). The top five largest fields were found in 1948, 1938, 1961, 1951, and 1926 respectively (Leggett 2005, p.60-61). According to some we have not found in a year as much oil as we have used in a year since twenty to twenty five years ago (see Leggett 2005, 6p.1). So whilst there have been increasing technological breakthroughs in the oil extraction industry the most amount of oil was discovered 40 years ago and in any year we have not “replaced” what we have used in a year in two decades. Given this trend it would seem rash to rely too much on the propsect that there will be more.

A recent example of this is that one of the largest oil fields found in Russia in a decade, and in the world of the past three years, will amount to around 600m barrels of oil (ODAC 2006) – about what the world consumes in eight or so days. Oil exploration in deep sea areas seems to have peaked in 1996 (Leggett 2005, 66) – and one might have concerns with further oil extraction from deep sea extraction areas such as the Gulf of Mexico given the weather last year. Months later 25% (364,195 barrels of oil per day) of oil extraction from the Gulf is still shut-in (MMS 2006) and some will continue to be so until the second half of 2006 (ABARE 2005, 650). This is much greater than the impact of Hurricane Ivan the year before (ABARE 2005, 651). The next hurricane season for the US starts in three months (1 June). I am sure our American neighbours are hoping (and I join them in that) that they will not face the same trials again this year, however the US is in a period of increased hurricane activity and the expectation is that climate change will increase the intensity of these storms (Pew Center 2006). Such factors must be considered in looking at the size and reliability of global oil supply.

Aside from the question of whether there is enough oil out there for the moment, there is the matter of security and reliability. For instance the current situation in Nigeria, Iraq, and Iran do not imbue one with confidence. Currently there is no sign that any of these factors will quickly and easily resolve themselves.

Even if one were to accept that there is all that extra oil out there, there are still significant issues. For instance, the eternally optimistic International Energy Agency predicts that whilst there are plenty of energy resources including oil left, the rise in global energy demand will require investment of $17 trillion by 2030 to access these resources (IEA 2005) – near on $680 billion per year or close to $2 billion a day. Given such investment is going to be necessary it may be far more worthwhile and prudent to invest such huge sums in non-carbon based fuel and transport systems.

b. potential of new sources of oil and alternative transport fuels to meet a significant share of Australia's fuel demands, taking into account technological developments and environmental and economic costs;

The question of potential of new sources of oil has been addressed in (a). On the question of alternative transport fuels two oft cited ones are discussed below.

Biofuels: The first concern for biofuel crops is "space" – for example George Monbiot (2004) calculated that in order for the UK to switch fully to biodiesel it would require four and a half times the arable land of the UK. The growth in the global market for bio-diesel has been answered in Malaysia with vast deforestation which puts many species at risk in order to plant oil palms to produce bio-diesel (Monbiot 2005). As noted below, world cereal use is already close to exceeding world cereal production – the types of organic material used to produce bio-fuels needs to be considered carefully to ensure that it is not crowding out agricultural production or remaining ecosystems.

The other problem with biofuels is the issue of the energy returned on energy invested (EROEI). If it takes more energy to grow, harvest, process and transport a crop than is gained out of the crop then the process is futile. Differing crops/by-products have differing EROEI ratios and the EROEI will also depend on a range of other conditions.

Therefore the question of biofuels needs to be looked at in specific contexts. It will undoubtedly have a role but it is questionable as to whether it could meet Australia's current fuel demands.

Hydrogen: It is important to note that hydrogen is not a fuel as such – it is an energy carrier. Therefore it has an EROEI below 1. This does not immediately invalidate it as a fuel – it can be produced in a number of ways including by renewable sources. However there are some significant issues that would need to be addressed before significant energy and resources are dedicated to creating a hydrogen-based transport infrastructure.

These issues include:

- As a gas it is difficult to store requiring high-pressure storage tanks – which in itself requires a fair amount of energy (Deffeyes 2005, 159);
- It can be stored as a liquid in which case it needs to be kept at minus 253 degrees Celsius;
- Currently most hydrogen is produced at the site of use – in the US only 3 percent of hydrogen produced is traded (Deffeyes 2005, p.155);

- It takes about 4.6 times more energy to move hydrogen through a pipeline than it does for natural gas – and current natural gas piping could not be used for hydrogen (Heinberg 2004, p.129);
- Currently a "loaded forty-ton tanker truck is designed to carry about twenty-five tons of gasoline. Because hydrogen is so light, a comparably sized tanker truck transporting hydrogen would only be able to carry about half a ton of hydrogen. The relative energy consumption by the truck compared to the energy value of its cargo would make hydrogen uneconomical at almost any distance" (Kunstler 2005 p.114);
- Hydrogen needs less than one-tenth the energy needed to ignite air and gasoline – it is possible that as a gas it could self-ignite from the heat generated by decompression in an accident (Kunstler 2005, p.113);
- "A wide range of hydrogen concentrations will burn, 4 to 75 percent by volume of hydrogen, the remainder being air. A flame moves through the hydrogen-air mixture at about ten feet per second. There is a second, and more dangerous, combustion mode. In mixtures between 18 and 60 percent of hydrogen in air, an explosion can result: a shock wave that moves at six thousand feet per second." (Deffeyes 2005, p.163);
- A hydrogen-air flame is almost invisible;
- "Fuel-cell cars and buses are to be found today on the roads of many cities around the world, but not yet at prices affordable by most people" (Leggett 2005, p.208); and
- "Fuel cells use their hydrogen about twice as efficiently as internal combustion engines use their gasoline, per unit of fuel. Currently, however, they cost one hundred times more per unit of power, and hydrogen itself is about five times as expensive as gasoline" (Wald in Leggett 2005, p.208).
- Research is still being done for storing and releasing hydrogen chemically – this would avoid high-pressure storage tanks – however even if this does occur hydrogen will still not be easy or inexpensive (McCluney 2005, p.160).

This is not to rule out hydrogen – but there are obviously important questions of generation, transport/distribution, fueling stations, safety, and technology that should be answered. To quote Heinberg (2004, p.129) "hydrogen may have a range of useful functions in a post-petroleum economy. But more studies need to be done on its practicality *before* large sums are invested in new infrastructure."

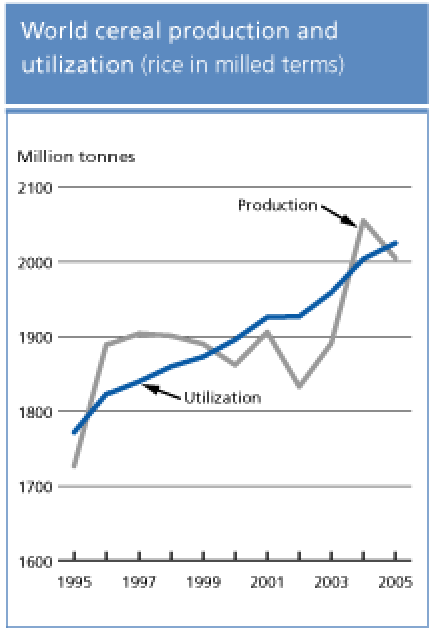
Flight: There is also the matter of alternative fuels for air transport. Problems in using hydrogen as a fuel for aircraft include the need to keep it in liquid form (for space reasons), which requires it be kept at minus 253 degrees Celsius, associated insulation, the tanks would still have to be larger than they currently are for kerosene/aviation fuel, and that it would require the redesign of the engine to burn hydrogen (Heinberg 2003, 174). There would also likely be security and safety concerns given the increased volatility of hydrogen over aviation fuel.

c. flow-on economic and social impacts in Australia from continuing rises in the price of transport fuel and potential reductions in oil supply; and

The most direct impact of continued price rises for oil will be to Australia's current account. Australia's oil import bill increased 35 per cent last year (to $17 billion) on top of a 28 per cent rise in 2004 (The Age 2006). This will only increase further as Australia's domestic supplies are depleted and global oil prices rise – the costs to Australia's economy will be enormous. Australia already has a sustained current account deficit problem. Whilst the oil element may in future be partly offset by increased exports of natural gas, Australia simply cannot afford a larger current account deficit.

Another direct impact will be an increase in the actual cost of building and maintaining roads - "Asphalt incorporates large quantities of oil, and road-building machines run on refined petroleum" (Heinberg 2003, p.173). There will also be a significant impact upon the airline industry which uses roughly 10 per cent of oil (Heinberg 2003, p68). Airlines have been struggling to remain profitable with the recent oil price increases. As mentioned earlier, the alternative of using hydrogen as a fuel poses problems. For the airline industry it is particularly troublesome. It can be expected that even if hydrogen somehow became feasible as a fuel for aeroplanes, the costs for the airline industry would still increase dramatically – this would then pose significant problems for tourism which is heavily dependent upon cheap flights. Other industries would also experience difficulties without cheap international travel.

Agriculture will be negatively impacted. "Modern industrial agriculture has become energy-intensive in every respect. Tractors and other farm machinery burn diesel fuel or gasoline; nitrogen fertilizers are produced from natural gas; pesticides and herbicides are synthesized from oil; seeds, chemicals, and crops are transported long distances by truck; and foods are often cooked with natural gas and packaged in oil-derived plastics before reaching the consumer." (Heinberg 2003, 175). Heinberg (2004, p.21) also raises the concern that cereal consumption/utilisation (which makes up 80 to 90 percent of world food supply) between 1999 and 2003 outstripped production with shortfalls being met by declining reserves.



Taken from FAO 2005, p.1.

Indeed the Food and Agriculture Organisation (FAO) released the above chart in December 2005 showing that in the last six years only in 2004 did production exceed utilization. As world utilization/consumption grows to feed a growing population there will be increased demand on oil. The impact of higher oil prices on global food production and trade could be significant.

It can be expected that manufacturing will be negatively impacted. As world freight costs increase the benefits to consumers in developed nations from multinational firms taking advantage of international labour arbitrage will dissipate (at least in many manufactured goods). Manufacturing will also be impacted upon by the increased costs of many natural resources – mining for instance is very energy intensive. Recent price increases in products such as copper and steel have been due to demand – some future increases will be due to the higher energy costs of producing those metals.

It could also be expected that the combined price increases that might be experienced in these areas could result in significant inflationary pressures. Australia has not experienced much high inflation yet outside of fresh food and fuel. When demand for oil outstrips supply that situation cannot be expected to continue. This inflationary pressure will result in interest rate rises causing significant economic discomfort to many Australians.

There would also be flow-on effects to a whole host of other aspects to modern life. Oil is used in plastics, in many pharmaceuticals (i.e. aspirin), consumer goods, consumer electronics, toiletries, synthetic clothing, some building materials, chemicals, and so on. Oil has become incredibly prevalent in our society and our economic system.

All of these problems will be made worse the longer Australia waits to tackle the issue. As oil prices continue to rise in the face of increased demand and falling supply the price of taking remedial action will also increase. Our current transport infrastructure in Australia alone embodies billions, possibly trillions of dollars. Any new infrastructure will likely need a substantial portion of the remaining oil/energy to build and put in place. The countries that do this first may have to pay increased costs in terms of development but this will be smaller than the cost of waiting for oil to hit $100, $200 and so on before engaging in a massive overhaul of the transport infrastructure. Though it is worth noting that such a price increase could trigger a widespread recession – in which case the oil price might temporarily decrease. Then the overhaul would have to be done in the midst of widespread economic problems including a much reduced tax take.

d. options for reducing Australia's transport fuel demands.

Options for reducing Australia's transport fuel demands are many. Probably the two most significant and effective would be a large increase in public transport infrastructure (particularly in the form of light rail and trams) and shifting the majority of freight to rail. Whilst these might be seen as drastic they would substantially reduce oil use in Australia and could also be effective in combating our contribution to climate change (provided the electricity generation network can be effectively de-carbonised). These options would obviously need close co-operation with the State and Territory governments who share jurisdiction for these matters but the Federal Government has powerful leverage available to it in the form of AusLink. There could also be significant benefits to citizens - "Mass transit users typically spend $200 to $2,000 per year for travel, considerably less than car owners spend" (Heinberg 2003, p173).

Conclusion

Overall there are many concerns over the future reliability and supply of oil. There are hard questions that have to be asked of the alternatives. Oil has in many ways been a wonderful windfall for humanity but it may turn out to be a very brief one. Other options such as natural gas and coal liquefaction (as done by the Germans in World War II when their oil supplies were short) have not been addressed here but then they may only be temporary answers, for natural gas extraction will also peak and coal will become more expensive to mine as fuel prices increase. The remaining oil should be used in building a sustainable transport infrastructure rather than being used in a series of short term answers as oil becomes progressively more expensive and cheap energy becomes a memory. This will serve to minimise the economic disruption caused by our heavily transport and oil dependent economy.

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