Senate Rural and Regional Affairs and Transport Committee

Inquiry into Australia's future oil supply and alternative transport fuels

The Secretary
Senate Rural and Regional Affairs and Transport
Parliament House
Canberra ACT 2600

rrat.sen@aph.gov.au

Submission from:

Dr Melanie Fitzpatrick
Geophysicist, Climate Specialist
PO Box 159
South Hobart 7004
Australia

Tel: (03) 6224 0346
Mob: 0409 210 900
mfitzpatrick@tasmail.com

Introduction

The Australian Senate should be congratulated on calling for submissions about the very important subject of our current and future reliance on oil. As a geophysicist with a particular interest in climate change and the communication of climate risks to the public and policymakers I am glad to have the opportunity to comment. I have briefly summarised for the benefit of the committee some of the current scientific literature covering parts of the terms of reference (a), (b) and (d), where these are:

(a) the projections of oil production and demand in Australia and globally
(b) the environmental costs of alternative transport fuels
and
(d) options for reducing Australia's transport fuel demands.

I would like to make clear in this submission the urgency of acting on alternative fuels to oil for the transportation sector. To avoid social, economic and environmental upheaval it is imperative that Australia address our dependence on sources of cheap oil. Our food supplies, rural and regional infrastructure, transportation, medicines and plastics are all dependent on this same fossil fuel source. Even the oil industry admits that future short- and medium-term oil supplies are not in any way guaranteed (Akehurst, 2002). In the not-too-distant future (perhaps over the next five to ten years) oil production will reach its peak and decline thereafter. It will become expensive to extract. It will continue to be hard fought over by military powers. And the age of cheap oil will slowly disappear. This will have ramifications across the board for the Australian lifestyle - urban planning and development, industry, agriculture, economic institutions, and water resources to name but a few sectors that will be affected.

Developed countries (like Australia) that have benefited from the era of cheap oil, need to take a leading role of responsibility in exporting new technologies to developing nations. Countries like India and China wish to raise their living standards, but doing so with fossil fuel as the energy source will be untenable globally because of climate change impacts. Alternatives to oil in the transport sector *are* available. We do not have to wait for human ingenuity to create new ideas. We do however need to put in the research efforts to make these technologies feasible on the large scale. And we need to combine them with energy efficiency and changes in lifestyle. These ideas already exist and are being used elsewhere in countries like Sweden that aims to be oil-free in less than 15 years time (BBC, 8th Feb 2006). Our response to the changing of our oil economy will need to be one of adaptability and action. The peaking of world oil production will be the greatest risk management problem facing the global community. If we are to face up to the enormous dislocation both economically and socially that will result, we must start the planning process as early as possible. Australia can play a positive role by realising the potential opportunities that will exist in new marketplaces (conservation measures, urban planning, solar technology, biofuels).

(a) the projections of oil production and demand in Australia and globally:

When Will Oil Production Peak?

Whether "Peak Oil" occurred last year, or will occur in five years time or in two decades time, we must plan for alternative fuel sources *now*.

Globally, we are currently using almost 80 million barrels of oil daily. Historically, since the early 1900s, economic growth has been linked to oil use. Figures 1a and 1b clearly show that the higher a country's GDP the higher the overall energy use (US DoE, 2006). Cheap oil has made many countries wealthy and introduced a far higher standard of living. However, developing countries (in particular the more populated ones like China and India) that have not had access to this cheap oil are now claiming their rights to increase their standards of living also. Projections (US DoE, 2005) suggest that globally our oil use will increase to 120 million barrels per day by 2025.

As shown in Figure 2, using research from the International Energy Agency (IEA), global oil discovery peaked in the early 1960s and has been declining ever since. Being a finite resource that takes millions of years to form, oil will run out sooner or later. Debate about when we reach the halfway point (after which supply cannot meet demand) has gone on for decades. This event known as "peak oil" has been intensely studied over the last several years by insurance companies, oil companies, governments and academic agencies. Peaking means that the rate of world oil production cannot increase, and that production will thereafter decrease with time (Hirsch et al., 2006). Figure 3 gives a graphical representation of the oil production rates historically and projected into the future including the geographical source areas. The "early" peak analysts claim that we may have passed the peak of oil production as early as last year; the more conservative analysts claim it will happen between 2008 and 2012; while the vested interests represented by specific oil companies, the "late" peakers, place their estimates at 2020 and beyond. In reading the scientific literature (eg. Al-Husseini 2004, Sandrea 2004, Campbell 2003, and Deffeyes 2001), the evidence for the middle of the road (2008-2012) predictions is convincing. Table 1 is a sobering summary of the predicted dates of occurrence for peak oil by researchers in the field.

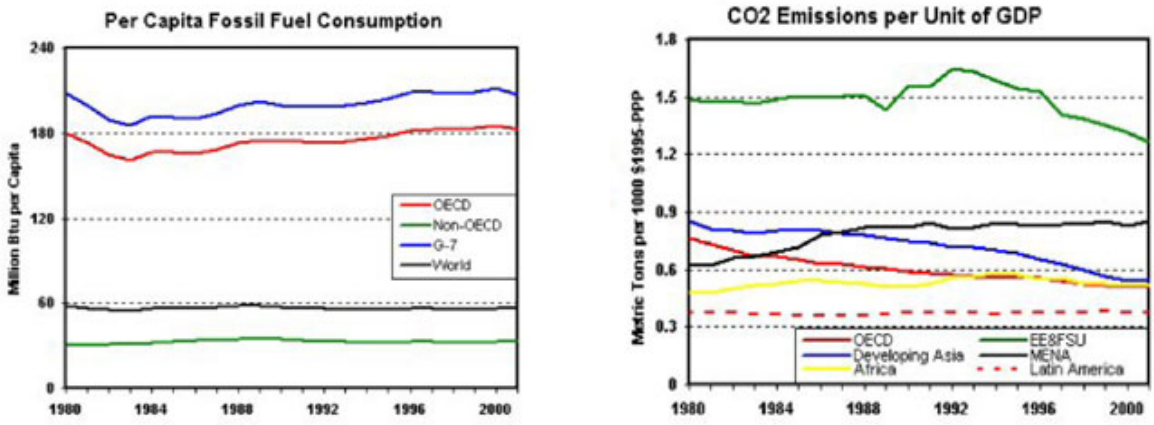

Figure 1a: *Per Capita Fossil Fuel Consumption for G7 (blue), OECD(red), non-OECD (green) countries and the world average (black).* ***Figure 1b:*** *Carbon dioxide emissions per unit of GDP for EE/FSU (green), OECD (red), Asia (blue), Africa (yellow) etc. Energy Information Administration, US Department of Energy, 2006.*

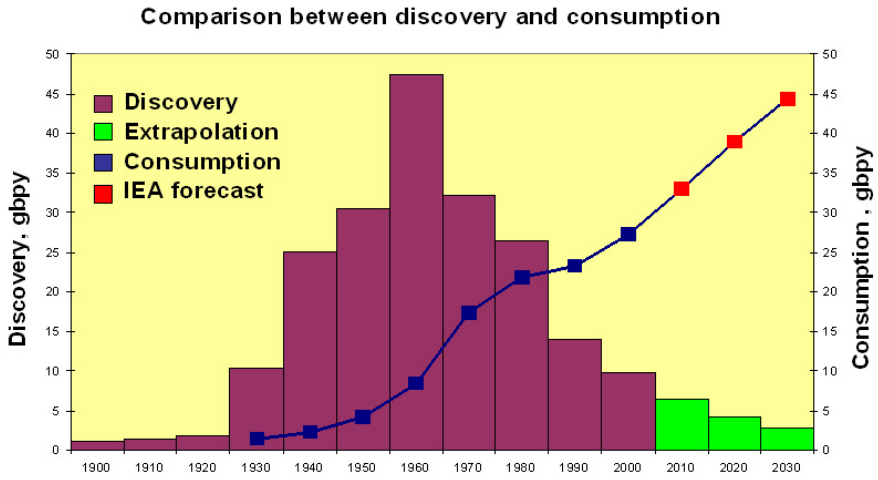

Figure 2: *Discovery of conventional oil and extrapolation of future discoveries and consumption of conventional oil and predicted consumption according to the International Energy Agency (IEA). Ten-year averages are shown. (K. Aleklett, www.peakoil.net, December 7th 2005)*

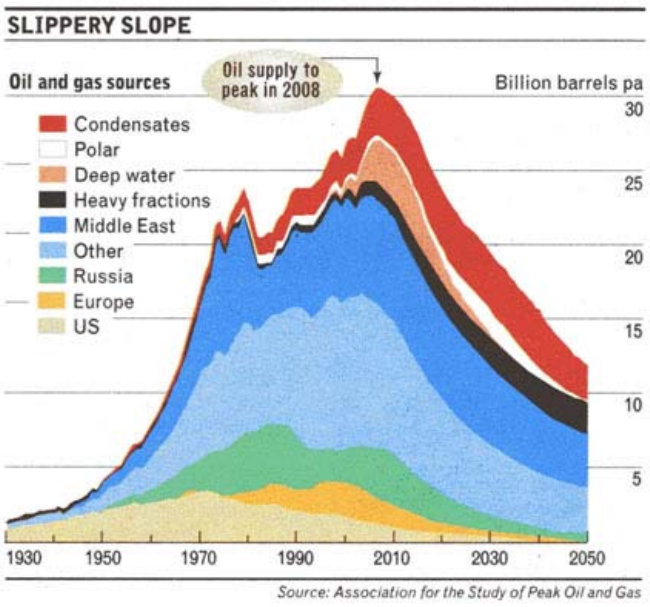

Figure 3: *Past and Future Global Oil Production - Association for the Study of Peak Oil (ASPO), 2004. As published in the Australian Financial Review January 15th 2005*

Table 1. *Projections of the Peaking of World Oil Production*

Projected Date	Source of Projection	Background
2006-2007	Bakhitari, A. M. S. ([18])	Oil Executive (Iran)
2007-2009	Simmons, M. R. ([19])	Investment banker (U.S.)
After 2007	Skrebowski, C. ([20])	Petroleum journal editor (U.K.)
Before 2009	Deffeyes, K. S. ([21])	Oil company geologist (ret., U.S.)
Before 2010	Goodstein, D. ([22])	Vice Provost, Cal Tech (U.S.)
Around 2010	Campbell, C. J. ([23])	Oil company geologist (ret., Ireland)
After 2010	World Energy Council ([24])	World Non-Government Org.
2012	Pang Xiongqi ([25])	Petroleum Engineer (China)
2010-2020	Laherrere, J. ([26])	Oil geologist (ret., France)
2016	EIA nominal case ([27])	U.S. DOE
After 2020	CERA ([28])	Energy consultants (U.S.)
2025 or later	Shell ([29])	Major oil company (U.K.)

From: Hirsch R.L., R. Bezdek, R. Wendling, 2006. Peaking of world oil production and its mitigation. AICHE Journal 52 (1): 2-8 JAN 2006. References given are cited in Hirsch et al's paper.

Given that our economic growth is so clearly linked to oil, and we have developed a dependence on cheap oil, Australia will face huge impacts in the very near future particularly in the transport and agricultural sectors. The transport sector alone accounts for over 75% of our oil use. Our city planning and transport networks have been formulated based on cheap oil. However the government has failed to recognise what the scientific community knows and is actively researching. Alarmingly, in the 2004 Energy White Paper, the Australian Government fails to even mention the subject of peak oil production. Figure 4 shows that even new oil discoveries are not keeping up with global consumption. Over the last 15 years we have reached the unenviable point of consuming oil beyond our means. Hirsch et al conclude that the problem of a global liquid fuel shortage brings it with it inherent risk management decisions. Their research shows that "Without massive mitigation at least a decade before the fact, the problem will be pervasive and long lasting."

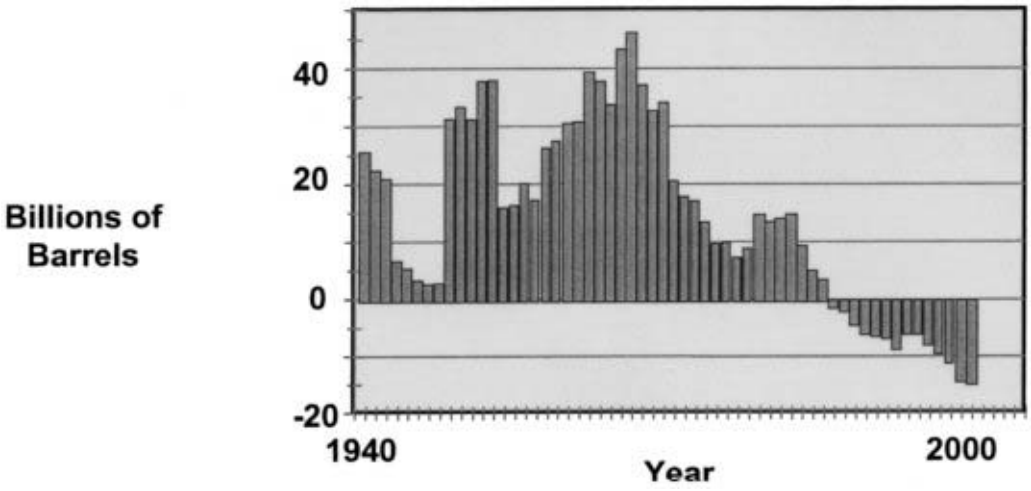

Figure 4. *Difference between annual world oil reserves additions and annual consumption - 1940-2000. From: Hirsch et al, 2006.*

(b) the environmental costs of alternative transport fuels:

The Accelerated Greenhouse: Why Coal is Not an Alternative to Oil

Coal as a fuel source (either liquefied, gasified or via electricity production) for transport options such as electric cars, hydrogen fuel cells etc, is not an interim nor a long-term solution for the transport sector. No reliable, technologically-proven, cost-effective method for sequestering the carbon from burning coal exists yet and the danger carbon dioxide emissions pose to increased global warming must be considered. Alternatives to fossil fuels in the transportation sector do exist but research and development is required urgently to enable these technologies to meet future demands.

Earth's surface has undergone unprecedented warming over the last century, particularly over the last two decades. The twenty warmest years on record include the last eighteen together with only two others lying outside this period (NCDC, 2006). These observations no longer fit the natural patterns of climate and can only be explained by taking into account human-induced (anthropogenic) emissions of carbon dioxide and other heat-trapping greenhouse gases. The benchmark for "dangerous climate change" specified under the Framework Convention on Climate Change has been proposed as "a rise in global temperature of only 2 degrees Celsius". With the current rate of increase in greenhouse gas emissions, this is projected to occur by 2050 (IPCC, 2001). Currently, Earth's surface temperature is rising at a rate ten times that usually seen during the warming after an ice age. Various international reports have listed the threats to our ecosystem that this rise in temperature will bring (Houghton et al. 2001, MEA 2005).

The environmental implications of continuing to burn oil, coal and natural gas are dire. In my 13 years of working in climate science, I cannot emphasise more strongly that the time to act is now. We are locked in to a certain amount of inevitable warming from our greenhouse emissions over the last two centuries. Mitigating our emissions is a crucial step in being able to curb global climate change. To avoid dangerous climate change will require a global reduction in emissions of over 60% by 2050 (IPCC, 2001). Between 1990 and 2005 Australia's greenhouse gas emissions increased by 25% (AGO, 2006). Transport emissions alone have increased by almost 50% since 1990. Over 90% of transport emissions are from road transport using oil. Figure 5 shows projections of greenhouse gas emissions for 2010 in various sectors.

The forced reduction in oil use may at least have the positive side-effect of decreasing our global greenhouse emissions. However, this will only occur if we do not substitute oil for other high emission fuel sources like liquefied or gasified coal, shale and oil sands. Once conventional oil is exhausted, we will start extracting non-conventional or heavy oil (like shale oil and tar sands). Heavy oil has far higher carbon dioxide emissions than conventional oil per unit of energy delivered. If coal were proposed as an alternative in the form either liquefied or gasified (processes still in their infancy) or as a fuel source for electric vehicles or for the production of hydrogen for fuel cells (also in its infancy), the problems of greenhouse emissions would need to be addressed.

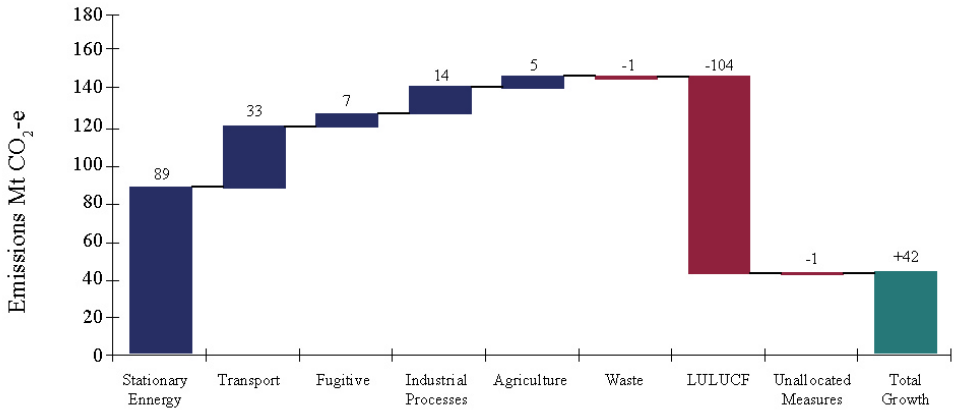

Figure 5: Australia's increases in greenhouse gas emissions (in Mt CO2-equivalent) between 1990 and 2010 from the Australian Greenhouse Office 2005 report ***Tracking to the Kyoto Target 2005****. In 2010 (in just four years time) the transport sector is predicted to have increased by 53% since 1990. Note that LULUCF represents already standing forest, which are a one-off accounting advantage in the Kyoto framework negotiated by Australia.*

Insurance companies specialise in calculating risks. Governments, businesses and the general populace however seem to lack the same analytical skills. One clear, recent example is the comparison of risk perception of two major global threats – terrorism and climate change. It is instructive to consider that the threat of terrorism (or is it really the shortage of oil?) has led us to a war over oil. But, as the UK Chief Scientist Sir David King claimed over two years ago, climate change is a far greater threat to the world than international terrorism (BBC, 9 Jan 2004). In developing a strategy of solutions to the problem of declining oil production we must consider other cleaner, safer alternatives than fossil fuels replacing other fossil fuels.

Biofuels

Currently only 2% of the world's transportation fuels are derived from biomass. Recently, a report by a researcher employed by BP claimed that biofuels could potentially cater for 30% of global transport demand without affecting food production (Science, 2005). Biofuels have several advantages over other alternative fuels in that they (i) are produced locally and hence have a low security threat, (ii) have low greenhouse gas emissions (iii) support agriculture, and (iv) can directly replace oil avoiding large-scale changes to infrastructure. This is a transport option that should be seriously considered in the Australian context as we may have the agricultural base to support the production of biofuels.

Hydrogen Fuel Cells

The use of hydrogen as a transport fuel is in development in a number of countries including Canada, Japan and Germany. Currently in Vancouver, Canada, there are buses that run on a mix of hydrogen and compressed natural gas, the source of energy used to create the hydrogen being hydro-electricity. BMW released its first hydrogen-powered car in 2000, using solar energy to create the hydrogen fuel. The main hurdle still to

overcome with this technology is the production and storage of the hydrogen after it is created from separating water molecules. Proposed large-scale sources of hydrogen include using wind, solar, natural gas, coal, nuclear, or even manipulation of algae to produce hydrogen. Any production of hydrogen for fuel cell use in transportation applications must be done as an environmentally sound process. Currently hydrogen technology is many years away from being viable, but if personal transportation is to remain as part of the modern lifestyle this will possibly be the part of the long term solution. If hydrogen is created with a non-petroleum, zero-carbon fuel it becomes a sustainable, renewable source of energy for our transport system.

Alternative fuels for use in public and private transport such as biofuels and hydrogen will take several decades to be introduced to our car fleet. Development of these replacement technologies needs to be happening *now*.

(d) options for reducing Australia's transport fuel demands:

Energy Conservation and Lifestyle Changes

A decrease in dependence on oil will only be possible by incorporating energy efficiency into existing infrastructure, practicing energy conservation and by encouraging lifestyle changes.

The only positive angle on the coming oil shortage is that if we are sensible we may decrease our carbon dioxide emissions and mitigate global warming impacts locally and globally. In all other respects we will find our energy and transport intensive culture requires radical changes in the way it operates. Time frames for changing a petroleum-based economy and infrastructure are on the order of two decades (Hirsch et al., 2006). If the oil peak does indeed hit sooner than in 20 years time, then we are already behind on the planning side.

There are many ways to reduce Australia's transport fuel demands. Efficiency and reductions in use of private transport will be required. Once again, the Australian Government 2004 Energy White paper failed to mention energy conservation as a viable option but I regard it as a crucial part of the strategy to deal with a changing fuel base.

Energy Efficiency and Conservation

Pedestrian and bicycle transport
Most Australian cities are generally poorly planned for both pedestrian and bicycle use. These forms of transport need to be actively encouraged and become a normal part of our cultural landscape. This may require shifts to more de-centralised work locations, better use of community spaces, and greater acceptance of lifestyle changes.

Public transport infrastructure
Currently, less than 10% of Australians use public transit to their workplace. But our urban environments are still being planned around individual vehicle use. There is currently a GST on public transportation. Mass transit needs to be a solution to the rising cost of fueling individual vehicles.

Fuel efficiency of cars
A century ago the Model-T Ford was produced, running on 25 miles to the gallon. The average car in the US today covers just 21 miles to the gallon, while the massive cars like the Ford Explorer using our city streets travel a mere 16 miles to the gallon (UCS, 2006). While cars exist on the market that can easily triple these distances (eg. hybrid vehicles), we need to ask why it is not a requirement that certain fuel standards are not met in the same way that emissions standards need to be.

Conclusions

The economic boom that cheap oil provided the global marketplace will not continue. A clever country would start shifting the dependence on fossil fuels to a more resilient and long-term set of alternatives, some of which include energy efficiency, biofuels, solar, wind, hydrogen fuel cells and new technologies that may be developed given suitable research funding. Energy efficiency accompanied by changes in lifestyle will be the greatest contributor in the short-term, with technological changes necessary in the long-term. Unlike the transitions from earlier fuel economies in human history (wood to peat to coal to oil) there is no quick fix available that can take the place of oil. This time we will need to call on ingenuity, cleverness, and community consultation to ensure that we practice moderation and share the Earth's resources in an equitable and fair manner. Australia's economic growth can no longer be tied (directly and indirectly) to profligate use of cheap oil. We must be the leaders providing developing nations with solutions before their economies also become locked into an ever-diminishing resource.

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