Appendix

Submission to the Inquiry into managing transport congestion by the Victorian Competition and Efficiency Commission.

If world oil production peaks before 2020 it puts the well being of all Australians at risk

By Alan A. Parker Melbourne, Victoria, Australia, September 2005.

1. INTRODUCTION

Over the last forty years Australia has become addicted to cheap oil, especially for transport which uses almost 80% of Australia's petroleum; 55% of road transport fuel is petrol, 39% diesel and 6% is LPG. The oil dependent transport sector is responsible for 76% of oil consumption and that has to be reduced as it poses a very serious threat to Australia's future economy and as a consequence the well being of all Australians. This paper discusses the impact of future oil shortages due to world oil production peaking well before 2030. The aim is to stimulate discussion with reference to the latest research papers published in 2005.

Since 1980 the gap between oil demand and oil supply, once considerable, has steadily narrowed and today is almost negligible. When oil consumption begins to exceed production by even a small amount, the price of oil could soar to well over US$100 a barrel, greatly increasing the cost of transport fuels, the petrochemicals used to make thousand of plastics products, fertilisers and pesticides for food production. With in a year or so this would create a global recession. The impact on the well being of Australians with outer suburban lifestyles, hinged on two or three car families and constant car trips to work, school and supermarkets, would be disastrous (Parker 2005).

It is uncertain when oil production will peak and then decline. Some governments are very concerned about this uncertainty but our government is unaware of the serious threat of reduced oil supplies prior to 2025. Therefore the aim is to stimulate serious discussion on this potentially dangerous energy security issue. Of great concern is research published in 2005 showing that reducing oil dependence on both the supply and demand sides must be initiated more than 20 years in advance of oil peaking, but is likely that peaking may occur much earlier. Several future outcomes are possible (Hirsch 2005)(Aleklett 2005).

1. Oil production peaks then declines around 2010 inducing a world wide depression, wrecking the Australian economy and producing mass unemployment.

2. Oil peaks between 2015 and 2025 making a less painful adaptation possible; provided that most developed nations agree to reduce oil dependence with strong government. market intervention, the introduction of fuel rationing, fuel efficiency standards etc.

3. Oil peaking after 2025 allows a timely adaptation with mutually agreed supply and demand side oil conservation measures recommended by the International Energy Agency (IEA).

Also of concern are the predictions of the Association for the Study of Peak Oil (ASPO) which predicts that oil will peak around 2010. The latest research shows that oil peaking presents the world with a risk management problem of global proportions because there is now an energy security-planning vacuum in Australia and many other countries.

Energy security is vital to every country's well being and all need a stable economy with assured supplies of oil. Indeed, frugality, the conservation of oil and gas is as essential as, protection from an invading force, for the preservation of a democratic way of life. This appendix concludes that a national Energy Security Plan is urgently needed to reduce oil dependency. Several practical long term transport measures to reduce oil consumption and road congestion are recommended and as well as IEA oil emergency measures (IEA 2005).

Conventional and non-conventional oil reserves

Some oil Industry terminology is used to describe the two basic types of oil reserves referred to in this paper "Conventional oil" and "Non-conventional oil". Also when "CO_2 " emissions are referred to it is shorthand for "all greenhouse gas emissions", as methane emissions from some sources of oil are high and even more potent than CO_2.emissions.

"Conventional oil" is typically high quality, free flowing light oil that is under pressure and in most cases pumps itself out of the ground until about half of the oil had been extracted from an oil reservoir. The "peaking of world conventional oil production" is the sum total of all reservoir production when it reaches a peak and is referred to as **"oil peaking"** or **"peak oil"** (Campbell 2005A). However, as the reserves of conventional are used up the remaining oil gets heavier and is less free flowing with more impurities, thus increasing the refining costs for vehicles that will require much cleaner fuels to reduce air pollution. Even so, compared to non-conventional oil the remaining heavy and sour conventional oil requires less energy, produces less CO_2 and costs much less to extract and refine into fuel and petrochemicals.

"Non-conventional oil" reserves are mostly heavy and tar like requiring a lot more investment and energy to extract from sands or rocks on the surface or under ground and then refine into usable oil products. It includes some high quality, free flowing light oil that is recovered from oil fields in deep water (<500 m) or from Polar Regions. Non-conventional oil can also be synthesized from coal or gas which will greatly increase its price and CO_2. emissions which needs to be buried underground in a safe way that prevents it leaking back into the atmosphere. This infant technology is called "carbon geo-sequestration" and is referred to here as **"sequestration"**

CONVENTIONAL OIL AND WORLD FOOD PRODUCTION 1938 TO 2035

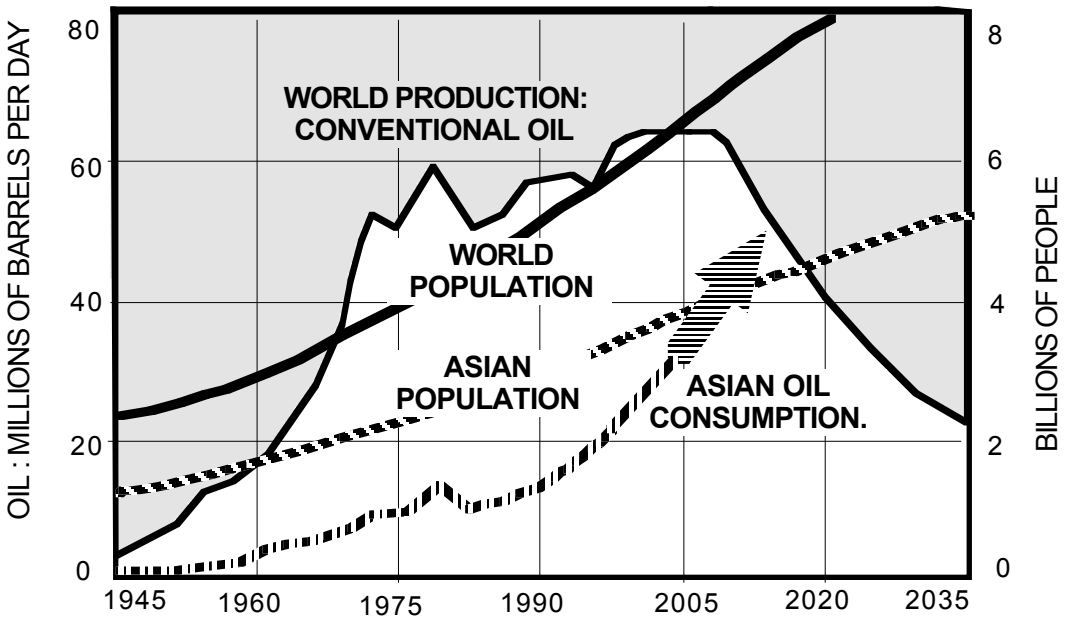
The future of the oil industry is plagued by many uncertainties the two most important of which are knowing when conventional oil production will peak and then decline and how long it will take for oil shortages to cripple economies and world food production.

Figure 1 shows that conventional oil production increased from 2.5 billion barrels of oil in 1938 to 26 billion barrels in 2003. As oil production went up, so did food production and the world's population increased from 2.2 billion in 1938 to 6.3 billion in 2003 the greatest increase in world history in a mere 65 years. Access to cheap conventional oil made possible the green revolution which introduced new strains of higher yielding crops, or crops that could be planted more than once a year but needed more and cheaper fertiliser and pesticides made from oil and gas. World fertiliser (nitrogen) production was 3 million tons in 1938; by 2003 it was 90 million tonnes. The world's fleet of tractors, cars, trucks and buses increased from 15 million in 1938 to 800 million today.

The synergetic interaction of the oil production peaking with other environmental "time bombs" that have been ticking away for many years will result in world food production peaking and then declining at a rapid rate in a few years. Oil production will be declining in the same time

frame as increased drought, storm damage and rising sea levels due to global warming; resulting in a decline in the availability and quality of fresh water; increasing salinity and soil loss and the spread of deserts. All of these environmental problems are beginning to reduce food production when UN estimates show that the world will have 1.7 billion more people to feed in the next 25 years (Heinburgh 2005) (Murrey 2005).

Figure 1 the growth of Conventional oil production, world population and Asian oil consumption.



Source: Campbell, C. J. 1997. Better understanding urged for rapidly depleting oil reserves,Oil and Gas journal. Journal April 7 1997.

The oceans are warming and warmer water is slowly spreading towards the poles. Violent cyclones, floods, drought, tornadoes and violent storm surges will increase in frequency and intensity. This will destroy crops, plantations, terrace agriculture and other irrigation systems that have taken decades to be productive. In low-lying coastal areas sea level rises will flood farmland. In the longer term, sea water will permeate through the ground and waterways further inland destroying even more productive farmland. The interaction of hunger and of sea-level rises in vulnerable low lying areas in the developing world could produce up to 800 million refugees fleeing from starvation (Brown 2003).

Oil shortages and global warming will increase the number of the world's hungry by reducing the area of land and the amount of fertiliser and pesticides available for farming in developing countries. Oil to power-assist labour intensive agriculture in the developing world will not be affordable. Wealthy OECD countries will buy all the high cost oil to keep their car dependent transport systems going and for their oil intensive agricultural practices. For example, US food production consumes ten times more fossil fuel energy than it produces in food energy. Four litres of oil are expended each day to feed each American and, because power "comes from the barrel of a gun", they and other rich allies will get priority in accessing oil supplies. This will deprive the poor countries of the oil needed to power assist their labour intensive food production, with small tractors and light agricultural machinery and to transport their food to regional markets (Murrey 2005).

Because it takes a thousand tons of water to produce a ton of grain, fresh water, the acquisition and delivery of fresh water will become critical for many more countries in the next decade. Water scarcity, once a local issue, is now crossing national boundaries as major rivers are being dammed in one country thus depriving water to countries down stream. In 20 years, southern Australia will experience severe drought and permanent water shortages. Australia has perhaps the most nutrient deficient soils in the world, especially in the south-west corner of W A. Present crop production practices have only succeeded through extensive use of fertilisers and diesel fuel but in the future water shortages will decimate grain production (Brown 2003) (Flannery 2004) (Robinson 2005).

Sixty-five developing countries, home to half the developing world's population, risk losing about 280 million tonnes of potential cereal production as a result of this synergetic interaction of environmental factors which is made worse if the price of oil increases. This loss of food production capacity will drastically increase the number of undernourished people, severely hindering progress in combating poverty and food insecurity (FAO 2005). In the longer term perhaps there will be a Malthusian die-off from starvation in populous countries. In the worst case scenario a billion people could die (Parker 2004 B) (Brown 2003).

The new consensus on the need for quality data on oil reserves

In the western world, in the decade before the invasion of Iraq, there was an insider debate on peak oil between an articulate group of veteran geologists in the Association for the Study of Peak Oil (ASPO) and some neo-conservative economists. This surfaced in oil industry and science journals but did not surface in the mainstream world media till mid 2004. The veteran geologists argued that by around 2008 half the world's conventional oil reserves would have been used and oil production would peak.

By 2001 the veteran geologists had formed ASPO and held their first international conference and gained the support of many environmentalists. They argued that if enough non-conventional oil was produced to satisfy the predicted growth in the demand for oil without carbon sequestration it would produce so much more CO_2 that there would be a risk of destabilising the climate. To assess that risk they wanted a system of energy accounting introduced, based on "energy return on energy invested" (EROI), and to measure the impact of non-conventional oil production. ASPO argued that peak oil is only dangerous because there is no international agreement in place to reduce the flow from the tap on the global oil tank and proposed a "depletion protocol " to overcome the problem.. Many ASPO members wanted a depletion protocol in place because they recognised the potential threat to world food production (Campbell 2005).

Up until 2004 the counter view was held by some economists, many of whom held senior positions in academia, in national governments and international agencies. These economists were deceived by the limited data about oil production and reserves put out by Saudi Arabia and other OPEC countries which does not include details about how much oil is extracted from each reservoir and what methods are used to extract that oil; nor do they permit audits by outsiders. Indeed, the condition of the Saudi and other OPEC oil fields is a closely guarded secret. The neo-conservative economists never showed any concern overl f what oil shortages would do to world food production

In Australia peak oil did not surface in the mainstream media till mid 2005. Most Commonwealth Government energy reports before 2005 were a reflection of the wildly optimistic assumptions of neo-conservative economists (BTRE 2005). The attitude of the Commonwealth Government in 2005 still reflects the assumptions of the same group of neo-conservative economists and their willingness to support the use of carbon intensive heavy oil and non-conventional oil which will greatly increase CO_2 emissions in a few years time.

The consequence of this often heated debate which surfaced in confrontations at ASPO conferences - which were not attended by any Victorian or Australian government representatives was that ASPO geologists and many senior economists found a common cause for agreement. The 2003, 2004 and 2005 ASPO conferences on peak oil included both groups. In 2004 there emerged a consensus that the estimates of conventional oil reserves were inaccurate and that there was no international accepted standard for measuring when the peak oil would take place.

The waves of dissent with economic orthodoxy emanating from ASPO surfaced in Australia at some transport and oil industry conferences in 2004. A recent report from the economists' side in that debate finished up them stating the need for reliable data:

"Since Shell announced that it had significantly overstated its reserves, its market capitalisation immediately fell by almost £3 billion. However, the greater impact was probably on the doubt thrown on international reserve estimates. As one commentator put it, 'if Shell doesn't know how much oil it has got then it is likely that the world doesn't know how much oil it has got.' Confidence in the world oil market was further undermined by the record high prices (nominal) reached in October 2004"... "Some steps have been taken since then, although major benefits are yet to be realised. The Joint Oil Data Initiative, the UN Framework Classification for Energy and Mineral Resources and moves by regulators in the U.S. and the U.K. to incorporate external auditing procedures should all serve to improve reserves reporting and strengthen confidence in oil forecasts" (BTRE 2005).

Both the Iraq invasion of Kuwait and the US invasion of Iraq highlighted the importance of oil in the affairs of nations and their willingness to fight over it. There is nothing new in that, decades earlier the US and UK engineered the overthrow of Mossadec in Iran and replaced him with a monarch. The US would like to remove Iran's leaders today if they could and in the 1930s Churchill wanted to use poison gas bombs on the Kurds in the oil producing areas of Iraq and Iran so that oil supplies for the Royal Navy could be guaranteed. Protecting national interest is the reason for peak oil being on the political agenda of world leaders. On 4-5th February 2005, the G7 Finance Ministers and Central Bank Governors met in London and the following statement confirmed their need for reliable data.

"We discussed medium-term energy issues and the risks of current oil prices. Market transparency and data integrity is key to the smooth operation of markets. We welcomed concrete actions in improving data provision to oil markets and encouraged further work, including on oil reserves data, by relevant international organisations" (Aleklett 2005).

In 2005 ASPO's concern was about how much time would be required for a stable transition to less oil dependent economic growth. This concern was addressed by the US Department of Energy (DoE), which called for an investigation entitled the Mitigation of the Peaking of World Oil Production. The report to the US DoE states that action must start 20 years before peak oil to adapt to declining oil supplies and stated that:-

"Prudent risk management requires the planning and implementation of mitigation well before peaking. Early mitigation will almost certainly be less expensive and less damaging to the world's economies than delayed mitigation" (Hirsch 2005).

Without early mitigation the rapid development of China, India and Asia generally will quickly come to an end if they continue to create transport systems that are even one third as dependent on oil as those of the US and Australia (Pang et al 2005).

The Energy Research Centre (ECN) in the Netherlands takes peak oil seriously. In a 72 page report dealing with four possible scenarios of energy futures in Europe it devoted 10 pages to the global peak oil problem and why the timing of peak oil is uncertain. It states that ASPOs arguments have a lot of validity as the modelling of two of their four scenarios showed oil

production peaking between 2010 and 2020 and demonstrated that there are major uncertainties regarding the feasibility of keeping oil supplies in line with continuing increases in oil demand. They support the hypothesis that an oil peak somewhere in the period 2010-2020 is far from impossible and that:-

" While there are many events that could postpone an oil peak to after the year 2020, there are equally many events that could lead to an oil peak before the year 2020.....an oil peak in the near future is indeed plausible and that it would be useful to consider the possible consequences for global energy markets and the resulting drive for system innovations..... we are referring to the period up to 2020 rather than any one particular year... scenarios with limited availability of oil and sharply rising prices deserve serious attention in terms of the consequences for European energy transitions and related energy research, demonstration and development strategies" (Brugglink 2005).

Chevron, the US's second-largest energy group - with a good environmental record - set up a web site, warning of the pressures of high demand and fewer fields and offering a forum of discussion and stated that :-*"One thing is clear: The era of easy oil is over. We call upon scientists and educators, politicians and policy-makers, environmentalists, leaders of industry and each one of you to be part of reshaping the next era of energy. Inaction is not an option"* www.willyoujoinus.com .

According to a report published in New York Times (Maass 2005) Sadad Al-Husseini who retired in 2004 as a director of Saudi Aramco, the giant state-owned oil company, revealed that the Saudi Government is seriously overstating its reserves. Husseini earned a Ph.D. in geological sciences from Brown University in 1973 and went to work in Aramco's exploration department, eventually rising to the highest position. He is one of the most respected and accomplished oilmen in the world. Husseini told Maass that

"You look at the globe and ask, 'Where are the big increments?' and there's hardly anything but Saudi Arabia,'....The kingdom and Ghawar field are not the problem. That misses the whole point. The problem is that you go from 79 million barrels a day in 2002 to 82.5 in 2003 to 84.5 in 2004. You're leaping by two million to three million a year, and if you have to cover declines, that's another four to five million." In other words, if demand and depletion patterns continue, every year the world will need to open enough fields or wells to pump an additional six to eight million barrels a day -- at least two million new barrels a day to meet the rising demand and at least four million to compensate for the declining production of existing fields. "That's like a whole new Saudi Arabia every couple of years," Husseini said. "It can't be done indefinitely. It's not sustainable" (Maass 2005).

His message, like ASPO, is that the world is heading for a devastating oil shortage. This contradicts the calming speeches of the Saudi Oil Minister, and predictions by the US Energy Information Administration (E.I.A.) who in 2004 provided a false forecast based on demand that by 2020 Saudi Arabia would produce 18.2 million barrels of oil a day, and that by 2025 it would produce 22.5 million barrels a day (Maass 2005). Those estimates were not based on real data about oil production and oil reserves, because no US intelligence agency is privy to the closely guarded oil data of the main OPEC producers; they merely assumed that if demand went up so would production. Husseini, said the forecast was:-

"unrealistic..... The expectations are beyond what is achievable. This is a global problem .....that is not going to be solved by tinkering with the Saudi industry."

Unreliable estimates and advice to member countries of the IEA and OPEC

The uncertainty in reserve estimates is not helped by innacurate short term and long term predictions by the International Energy Agency (IEA 2004 p.259) and OPEC which are

quoted by Australian neo-conservative agencies such as the Productivity Commission (PC 2005 p 249) The faster growth of oil demand in 2003 and 2004 has already resulted in far higher crude oil prices. The EIA, the statistical unit of the US Department of Energy, sees crude costing US$64 to US $65 next year -- up from US $58 in 2005 and US $32.5 in January 2004.

A prediction in 2004 of US $19.3 a barrel by OPEC for 2010 and 2020 is not credible. Indeed, On Monday 31 October 2005 OPEC president Sheik Ahmad al-Fahd al-Sabah said. *"The current oil price of about US$60 a barrel was about right."* The Sheik, who is also Kuwait's Oil Minister, said the current level was a balance *'acceptable to both consumers and producers'.* The Sheik said the growth in demand had slowed, which showed up in the easing price. But he did not expect the price to ease much further.

The IEA prediction in 2004 that there will only be gradual increases in the marginal cost of production and that by 2010 a barrel of oil will cost only US $22, a barrel is not credible either. The IEA prediction of US $29 a barrel in 2030 is based on the assumption that refined oil products can be produced from shale oil, tar sands and very heavy oils without huge increases in GHGs and far less energy returns on the energy invested to extract and refine them. This prediction is based on mostly unproven technology and low cost techniques for geo-sequestration of carbon that are still to be invented and proven in practice. (IEA 2004 p.259) IEA executive director Claude Mandel said that non-conventional oil resources can solve all our problems if there is a major investment in geo sequestration and other new technologies of US$ 6,500 billion in the next decade or so (Weekend Australian 2005).

The latest annual World Energy Outlook report from the IEA states that Global greenhouse gas emissions will rise by 52% by 2030, unless the world takes action to reduce energy consumption. It says that under current consumption trends, energy demand will also rise by more than 50% over the next 25 years and that oil prices will "substantially" rise unless there is extra investment in oil facilities because the world has seen *"years of under-investment"* in both oil production and the refinery sector and it estimates that the global oil industry now needs to invest US $20,000 billion in fresh facilities by 2030, or else the wider global economy could suffer (IEA Nov 2005).

How realistic is this IEA proposal for such increase in funding when we know there are no multi-billion dollar investments planned for Australia, the USA, India and China? Australia's partners in the new agreement to reduce CO2 emissions have no plans to fund projects and research at a fast enough rate to deal with the decline in the production of conventional oil. The governments of Australia and the USA are in league with the coal, and oil industries and they not going to commit funding on that scale. Indeed, the Bush and the Howard governments transport policies will not slow the growth in the demand for oil in their transport sectors. China has said it will spend US$180 billion on renewable energy but there is no sign of big spending on the sequestration of CO_2.

IEA chief economist Fatih Birol says *"We must change these outcomes and get the planet onto a sustainable energy path."* (IEA Nov 2005) but until the IEA stops stating what may or may not be theoretically possible from a technical perspective, with coal to oil conversion and tar sands etc, which they know to be currently politically impossible, little will happen. The IEA also warned consuming countries could no longer rely on major oil-producing countries to invest enough to meet long-term oil demand. Indeed, why should the Muslim oil producers and there not so fortunate Muslim allies who will have a total populaition of over one billion in 2020 squander the oil thatwill be needed for basic essentials of survival in the next 50 years..

The problem is that the IEA is not like the United nations; it has no brief to represent the interest of the poorer and developing nations. The IEA represents the 26 main industrialised nations who are the major oil consumers. The IEA needs to start telling the truth to power and spell out why we are on a fast track to mass unmployentand economic chaos and may be

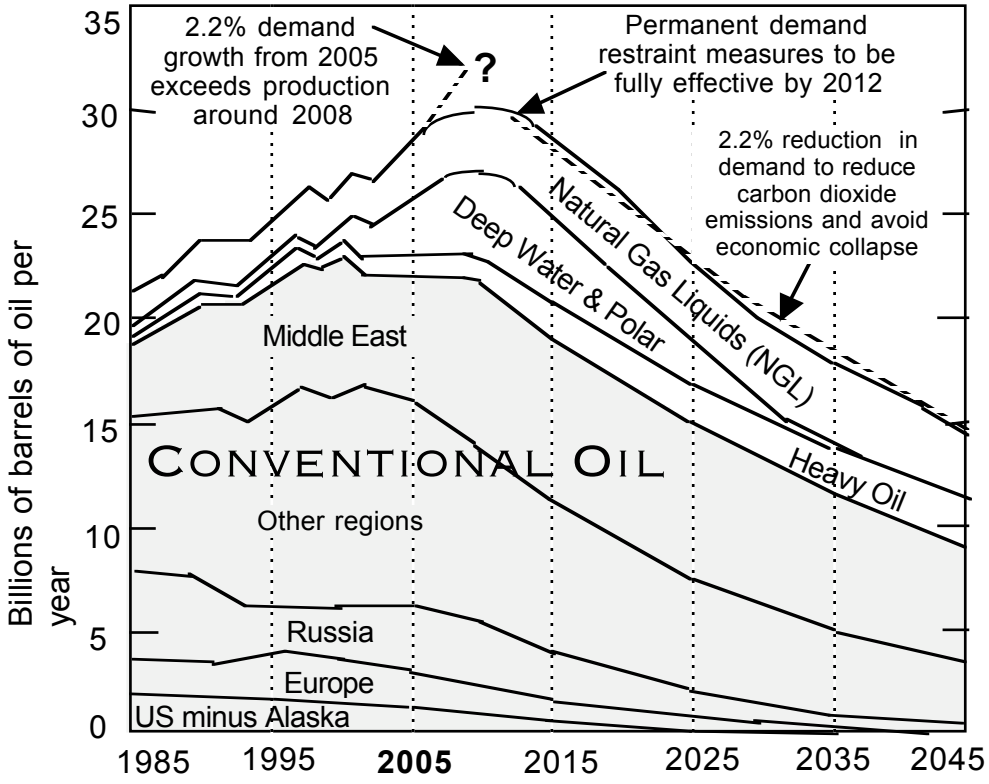
creating the precondition for future wars to gain control over the remaining conventional oil reserves. Unless IEA members make a serious effort to conserve oil and reduce the demand for oil starting as soon as possible the world will remain on an unsustainable energy path l putting the global economy, the world climate and world food production at risk.

ASPO, ilike the IEA, is not like the United nations and does not represent all or any nation's national interests , but at least it trys to speak truth to power and spell out the consequences of peak oil to all nations. President of ASPO Kjell Aleklett said, *"We in ASPO know that the World does not have 20 years, we must act now"* ASPO argued that the light, clean and once affordable conventional oil is going to peak much earlier if current growth rates continue for much longer. Peak oil is only dangerous because there is no international agreement in place to reduce the flow from the tap on the global oil tank. ASPO called for such an international agreement and proposed a "depletion protocol " to overcome the problem, which achieves the following: -

"In outline, such a protocol would require producers to limit production to their current depletion rate, namely annual production as a percentage of what remains, which is a small burden insofar than few can exceed this limit anyway. More important, it would require importers to limit their imports to match world depletion rate. This would have the effect of moderating world prices so as to put them in better relationship with actual cost preventing profiteering and the massive destabilising financial flows that threaten the financial system. In humanitarian terms, moderating world prices would allow poor countries to afford their minimal needs" (Campbell 2005 B). (ASPO 2004).

ASPO data, shown on Figure 2 ,shows why action is needed now.

Figure 2 World oil and gas liquid production from 1985 to 2045: 2.2% demand restraint to cope with declining production



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Source: Oil production data from the April 2005 Newsletter of the Association of the Study of Peak Oil www.asponews.org

RESERVES OF AFFORDABLE AND NOT SO AFFORDABLE CONVENTIONAL OIL

Figure 2 shows world oil production increasing by 2.2% per year, which is the rate at which it increased in 2004 according the IEA, and then peaking between 2008 to 2012 followed by a 2.2% per annum decline in production to 2045 (ASPO 2005).That means that oil demand should be reduced to balance it with reduced oil production of 2.2% per year as follows:

- 2009 to 2020: reduction of 660 million barrels a year,
- 2005 to 2008: reduction of 715 million barrels a year,
- 2021 to 2030: reduction of 616 million barrels a year,
- 2031 to 2040: reduction of 515 million barrels a year,

Figure 2 shows the increasing proportion of heavy oil that is extractable from oil wells after they peak and the reserves of an increasing proportion of natural gas liquids (NGL). The known reserves of oil in deep water and in Polar Regions are also shown. It is expected that the cost of extracting oil from deep water (< 500 metres) will require more energy to extract and will produce more CO_2 but the technology is certainly improving (Bruhn 2005). as it is in the Polar Regions (Ronning and Haarr 2005).

Note the shaded area showing the changing regional mix of conventional oil production from 1985 to 2003 and the increasing proportion of non-conventional oil from 2004 to 2045. Figure 2 does not show any non-conventional oil from tar sands, shale or oil substitutes synthesised from brown and black coal, because these will greatly increase CO_2 emissions without carbon sequestration.

More CO_2 intensive non-conventional oil will be produced

By the time conventional oil production begins to peak most of the light sweet crude has been extracted and the remaining conventional oil gets heavier and more sour with more sulfur reducing the energy return on the energy invested and producing more greenhouse gas emissions. Even if there are large new discoveries of conventional oil in the Gulf of Mexico, the Artic Circle, Australia or any where else they will mostly be in deep water or hazardouos areas requiring far more energy to extract, transport and refine.

Once conventional oil production has peaked more CO_2 intensive non-conventional oil will be produced and once all the light sweet conventional oil has gone and non-conventional oil production greatly increases there will be huge increases in CO_2 emissions. This change is already underway in Canada which has huge reserves of tar sands and is planning, a 1160 km oil pipeline from the tar sand refining plants to the pacific coast to satisfy the need for crude oil in China and Japan. (Simon 2005)

One third of the energy in a barrel of synthetic crude oil made from, tar sands is required to produce it, making it a major emitter of greenhouse gases. A lot more research and development is going to be required to reduce the level of CO_2 (Gielen and Unander, 2005). Indeed the French oil giant Total SA, amid rising oil and natural-gas prices, is considering building a nuclear power plant to extract ultra heavy oil from the vast oil-sand fields of western Canada. This comes as high oil prices are removing lingering doubts about the long-term profitability of extracting the molasses like form of oil from sand. At the same time, prices of natural gas -- which oil-sands producers have relied on to produce the steam and electricity needed to push the viscous oil out of the ground -- have risen 45% in the past year and the US faces serious shortages of gas within a few years.

This is prompting Total Oil, which holds permits on large fields in Alberta that contain oil sands, to consider building its own nuclear plant and using the energy produced to get the job done. This is interesting because it shows the staggering investments which will be required to produce oil products from the Canadian oil sands.

Producing oil from shale also creates a large increase in CO_2, according to the World Energy Council, it requires hydrogen to be added to it and large inputs of energy to produce a useful oil product: -

"The term "oil shale" is a misnomer. It does not contain oil nor is it commonly shale. The organic material is chiefly kerogen, which can be converted into a substance somewhat similar to petroleum. However, it has not gone through the "oil window" of heat (nature's way of producing oil) and therefore, to be changed into an oil-like substance, it must be heated to a high temperature. By this process the organic material is converted into a liquid, which must be further processed to produce an oil.
www.worldenergy.org/wec-geis/global/downloads

The US has the largest oil shale reserves but large scale commercial production was not expected for 20 to 30 years. In 2005 that expectation changed as the price of conventional oil increased. With further price increases there will be a market for some high quality non-conventional sources of oil from tar sands and shale oil in Canada the US and Venezuela. The synthesis of oil from gas, brown and black coal will become marginally economic in many countries. Even so, in time all the low hanging fruit will be picked. There are limits to the amount of high quality coal, shale or tar sands that is available from which to make oil.

In Australia, a company called APEL is planning to build an "oil from coal plant" in the Latrobe Valley to produce low-sulphur diesel fuel from brown coal from the Flynn field near the Loy Yang power station. However, it is a condition of their mining license that they sequester at least part of the carbon dioxide emissions because it would otherwise result in a substantial increase in Victoria's greenhouse emissions. This is likely to be one of the first applications of "clean coal" and geosequestration (underground storage of CO2) technologies in Australia, but the feasibility of sequestration in Gippsland and the cost of pumping the CO2 deep underground are not yet established. The APEL oil from coal plant may be operating by 2009, but it will only produce about 50,000 bbl/day diesel fuel.

No one doubts the unrealised potential to make oil products from shale, tar sands, very heavy oils or to make oil from coal. What is unsound and very much in doubt is the the assumption that unproved greenhouse friendly technology can and will be developed in time to cope with the peaking and then decline of conventional oil production. Most of that new technology is 20 years away.

According to the Oxford Institute of Energy Studies *"unconventional oil is unlikely to exceed 10% of the world supply before 2020*" (Skinner 2005).:

Another researcher in the non-conventional oil industry points out:

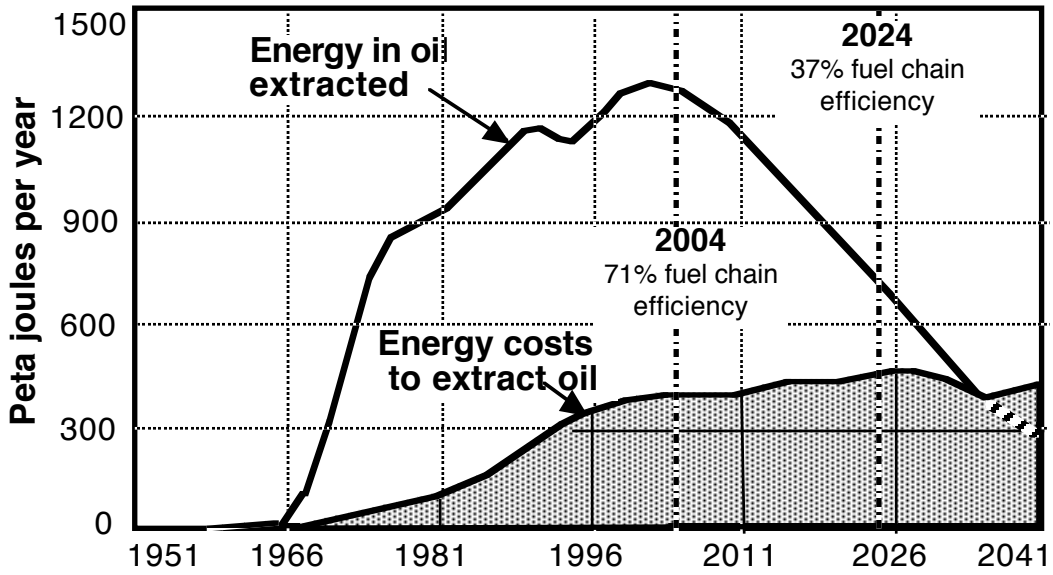
"While non-conventional oil is emerging as a new major source of oil, even an aggressive world-wide development scenario can only capture some 10 –15% of the required new oil supply in the next 20 years. In addition, non-conventional oil by itself cannot make up for the decline in world conventional oil production" (Isaacs 2005).

CSIRO modelling of the energy costs of conventional and non conventional oil in the long term in Australia found that:

"the energy return on energy invested (EROI)" in finding, extracting, transporting and refining oil will decrease. The reality is that the energy costs and benefits of oil extraction do change for the worse over time, as shown on Figure 3, and CSIRO scientists, recommend that physical energy profit accounting procedures should complement monetary accounting procedures for all important energy companies and national accounts (Foran and Poldy 2002).

Economists often fail to understand the importance of energy use in keeping our economic system functioning and becoming more ecologically sustainable or the need for a science based measure of energy efficiency:-

Figure 3 Energy costs and benefits of oil extraction 1951 to 2041



Source: Foran and Poldy (2002) Chapter 5 "The future of Energy" from "Future dilemmas: options to 2050 for Australia's population, technology, resources and the environment", by CSIRO Sustainable Ecosystems, Working paper series 02/01

"The critical importance of energy use to the maintenance and growth of our economic system is not properly acknowledged in most national analysis (that have a short term focus). Long run analysis suggests that energy use is responsible for 50% of production in a modern economy but represents only 5-10% of the cost. This tension between physical and economic realities effectively blocks the transition to a physical economy with low carbon energy sources", p 28 (Foran and Poldy 2002).

Achieving energy efficiency in all sectors of the economy requires that many actions be taken by individuals, companies and by governments who can encourage and discourage energy efficiency in many ways. Achieving energy efficiency is a change process that can be very costly and the resources available for doing it are limited. So it is necessary to identify those improvements to energy efficiency, which are crucial to the energy security of the nation. Then it is necessary to consider the options available that also allow a reduction in CO_2 emissions and then to determine what should be done.

The need is to prioritise the energy efficiency change process in a way that will guarantee Australia's energy security by reducing the transport sector's over dependence on oil. It does not matter that there is uncertainty about when peak oil will occur, what matters is the consensus that peak oil will occur and the commitment by international agencies to accurately predict the timing and then take appropriate action.

The IEA Executive Director Claude Mandel has no brief to spell out the climate change implications of extracting and processing non-conventional oil and CO2 emissions that would be produced. His proposal to throw US$ 6,500 billion at carbon sequestration and other unproved technology problems is not his responsibility (Weekend Australian 2005). The IEA has not produced any reliable evidence to show that the abundance of non-conventional oil can be reliably produced without destabilising the climate. Indeed, there has been no consultation with the Intergovernmental Panel on Climate Change (IPCC) which is the international agency with the responsibility to make the final judgement on that issue.

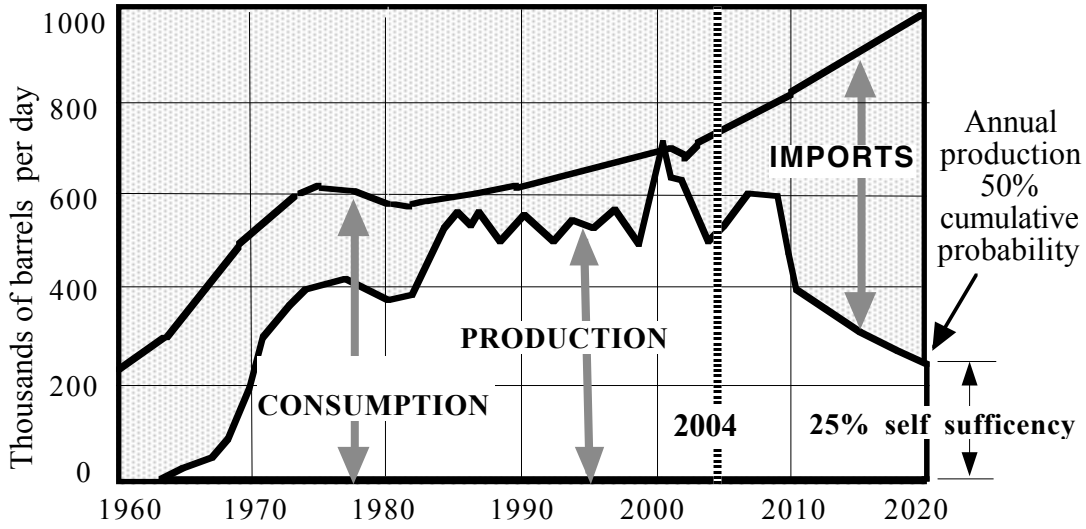
Most neo-conservative economists and politicians will of course ignore the need for the IPCC to have the last word on this issue because many of them will not accept the reality of climate change or the need to consider inter-generational equity or the use of the" precautionary principle. I am not suggesting that Claude Mandel takes this approach but many of the senior US republicans that refuse to take the sound IEA advice, to conserve oil and reduce the demand for oil, do take this approach.

In conclusion it would appear that ASPOs advice for the major oil users to collectively take action to conserve oil is sound advice. Hopefully the IEA will be doing more than suggesting that oil be conserved and will be giving out the advice that collective action is necessary to its members in a year or so.

Australians will become the worlds worst per capita CO_2 emitters

The IEA predicts, that without reducing the demand for oil, global emissions of greenhouse gases will increase by 52% by 2030. In an earlier report they stated that emissions would only reduce by 33% even under a scenario in which governments impose tougher environmental policies to reduce emissions (IEA 2005). Without carbon taxes in Australia, Canada, the US and Venezuela there will be no incentives for industry to develop carbon sequestration technology and far more CO_2 will be produced from non-conventional oil use and coal fired power stations.

Figure 4 Australian crude & condensate: imports, production, consumption and self sufficiency from 1960 to 2020.
"Oil and Gas Resources of Australia 2002" Geoscience Australia, March 2002.



Transport predictions to the year 2010 in Australia for single occupant car commuting, car travel generally, air passenger travel, inter city road freight and intra-city commercial vehicle traffic all show unsustainable growth of oil dependency. Over the last forty years Australia has become addicted to cheap oil, especially for transport which uses almost 80% of Australia's petroleum; 55% of road transport fuel is petrol, 39% diesel and 6% is LPG. The oil dependent transport sector is responsible for 76% of oil consumption and that has to be reduced as it poses a very serious threat to Australia's future economy (Parker 2004 B). Even the supposed abundance of natural gas will not get us far if we sell it all off as LNG for export instead as using it as a. transitional fuel in Australia. The NW Shelf partners expect production to begin falling from 2025!

The Commonwealth does not recognise this growing threat to national security but the decline of Australia's oil production has been documented and is shown in Figure 4. The disparity between the growth in oil consumption and oil imports and the decline in indigenous oil production predicts a serious loss of self-sufficiency between 2006 and 2020. The Commonwealth's policy on energy ignored oil for transport (Parer 2004).

The Department of Environment and Heritage has released figures that show that Australia's transport greenhouse emissions have galloped ahead in leaps and bounds. A 29% increase has occurred from 1990 to 2003 but Commonwealth agencies have no policies to reduce further increases. With current policies, carbon intensive non-conventional oil will be used and carbon dioxide emissions from the oil dependent transport sector will greatly increase (Karvelas 2005).

The absence of carbon tax in Australia, uncontrolled oil dependence and the use of coal to generate electricity will drive up per capita CO2 emissions. The use of brown coal in Victoria to generate electricity; Hazelwood power station will produce 445 million tons of CO_2 over the next 25 years and ensure that Victoria will become the worlds worst per capita CO_2 emitter.

THE NEED FOR A STRATEGIC OIL RESERVE AND OTHER MEASURES TO CONSERVE OIL

Australia in few years will have a high level of import dependence and remote geographic location, but does not have an oil security stock holding above that which is commercially optimal. That puts Australian energy security at risk. There is need for a strategic oil reserve of 6 months diesel and petrol to provide a buffer to keep the economy going with a rationing plan to ensure that these reserves are used for essential purposes. The Commonwealth government is ignoring the need for a strategic reserve of oil and deisel and many of the measures needed to reduce oil dependence shown on figure 5. Its current policy does not even reflect the draft oil emergency measures of the IEA .

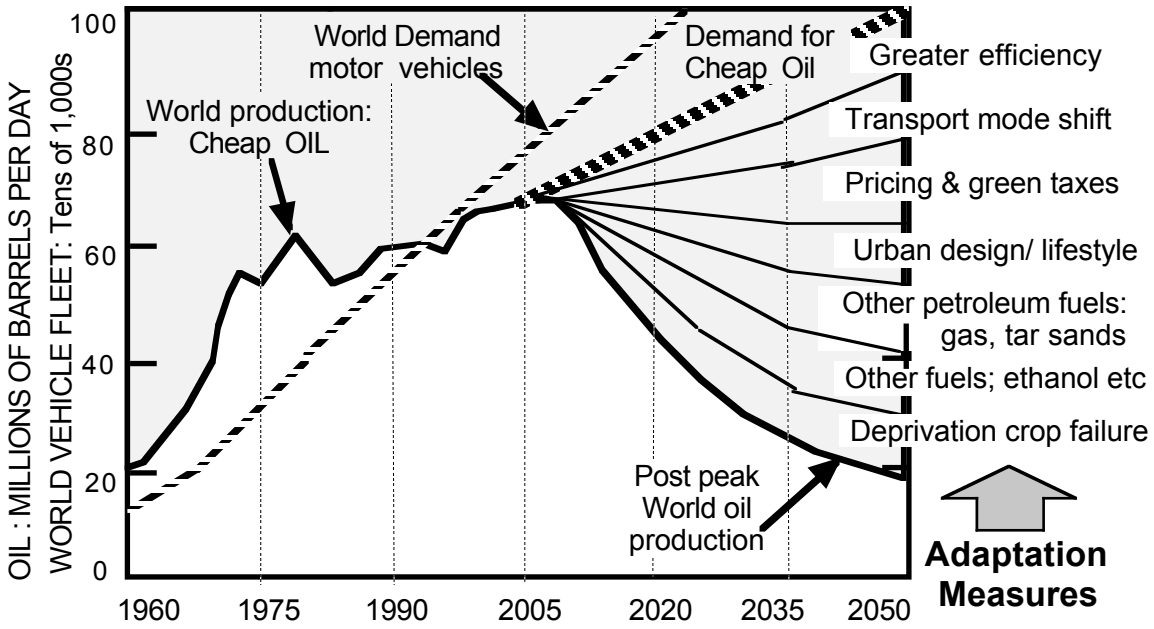
Figure 5 illustrates most of what needs to be done to allow world transport/energy policy to evolve in a way that will lead to a reduced demand for oil that keeps pace with reducing oil production. Space does not permit a detailed discussion of the global implications of the seven 'adaptation measures shown. However, some of these measures can be easily implemented by Australian Local, State or Commonwealth governments given responsible leadership. They are outlined in the following six recommendations.

1) Transport mode shift and and lifestyle change

The adaptation measures of 'transport mode shift' and 'lifestyle change' can best be made at local government level by the promotion of Travel Smart programs or 'Individualised Marketing' which have already made very significant reductions in car travel rates. Programmes have been completed, or are underway, in several Australian states. Western Australia has the most successful programmes. Travel Smart programs for the able bodied need to be applied

in the outer suburbs of the capital cities where most single occupant car commutes and driving generally originate to increase walking, cycling ,car sharing and the use of public transport.

Figure 5 Adaptation measures to reduce world oil consumption



Source: Post peak scenario outlined by Ron (Swenson 1998)
Motor vehicle demand added by Alan Parker June 2004

2). Transport mode shift; the use of electric bicycle for the elderly and lame.

From a strategic transport planning perspective investing in bikeway networks would be cost effective in Australian and NZ cities if they enabled bicycles and electric bicycles (E-Bikes) to be more safely used instead of cars (Parker 2001). The best E-Bikes are designed and made in Japan and weigh only a few kilograms more than bicycles. They have electronically controlled power assistance via sensors in the cranks linked to a computer chip. There is no clutch to worry about after switching on with a key. The power assistance operates automatically on starting, going uphill and combatting headwinds. Power cuts out at 24 km per hour so they can be safely used on shared footways (Parker 2004 A).

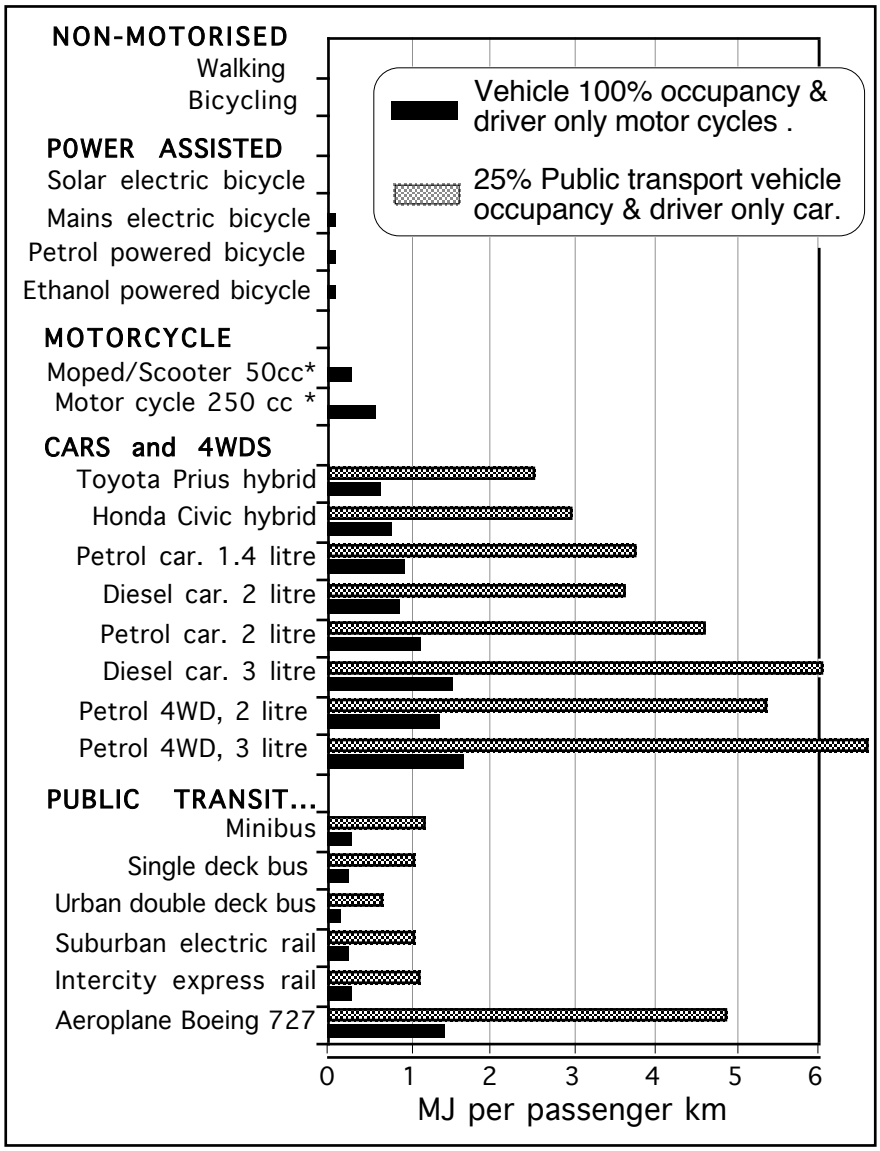
Figure 6 shows that the E-Bike is very energy efficient using between one twentieth and one sixtieth of the energy used by cars per km. E-Bikes have great potential as access modes to public transport in the low-density areas of Australia's capital cities. However the Australian Road Rules need to be revised to allow E-Bikes of 300 watts power output to be classed as bicycles as they are in NZ. Nearly all of the safest Japanese E-Bikes cannot be purchased in Australia as they would be classified as motor cycles. Disabled people should be allowed use E-Bikes of 600 watts power output as they are in NZ. and the U.S.

In 2005 the production of E-Bikes in Japan will be around 210,000 and in China, the production of electric bikes, mostly with throttle controlled power assistance and higher power outputs of 300 to 400 watts, is expected to reach ten million. Chinese consumers will have a wide choice of models to pick from now that petrol powered bicycles, mopeds, and light motorcycles with polluting two stroke engines are being banned in their major cities.

Electric bicycles are now mass produced and could be safely used in Australian cities to

reduce air and traffic congestion if measures to encourage walking and cycling in this appendix and the main submisson are implemented. Figure 6 shows petrol, diesel, ethanol & electricity energy use of passenger vehicles and aircraft. Electric bicycles with battery's charged by solar PV roof tiles are the most efficient form of motorised transport that conserves oil by replacing car trips..

Figure 6 Petrol, diesel, ethanol & electricity energy use of vehicles



3). Mandating standards for the improved fuel efficiency of cars.

The average car in the Australian car fleet is bigger and consumes more fuel in 2005 than a decade ago, despite the fact that engine efficiency has improved. Meanwhile, the world's best car designers in Germany and Japan have created vehicles that could slowly create more energy efficient car fleets that use far less oil and, in the long term, could mostly rely on off-peak main electric charging as their energy source.

The energy efficiency of the Japanese petrol electric hybrid cars indicates the importance of

using hybrids and putting in place fuel efficiency standards to ensure the mass market take up of this technology. For essential long distance travel by car on rural freeways new diesel powered vehicles maybe more appropriate

Sound and effective fuel efficiency standards have been mandated in the past and could be done again. Former US President Jimmy Carter introduced the Energy Policy and Conservation Act of 1975, which improved the energy efficiency of the US car fleet directly and required US car companies to double the fuel efficiency of their cars over phased periods of years. It improved the energy efficiency indirectly of the world's car fleets by providing an incentive to overseas car companies to produce more energy efficient cars for export to the USA. The direct incentive of the US CAFE standards (as they are now known) was very effective when introduced in 1975 when the average car in the fleet consumed 18 litres/100 km. By 1987 the average fuel efficiency of the car fleet improved to 9 litres/100 km Then the average fuel efficiency of the car and SUV fleet reduced to 9 5 litres/100 km in 2004 because of the failure to upgrade the CAFE standards (Bezdek and Wendling 2005).

Bezdek and Wendling have recommended that for new US cars a new standard be phased in to ensure that by 2015 average fuel consumption of the car fleet will be 5.7 litres/100 km and for the SUV and light truck fleet to be 7.6 litres/100 km, giving an overall 50% increase in fuel efficiency. An Australian car fuel efficiency standard is needed to ensure that by 2015 average fuel consumption of the car fleet including 4WDs will be 5 litres/100 km and for the SUV and light truck fleet to be 6.5 litres/100 km. giving an overall 50% increase in fuel efficiency.

The Australian government needs to intervene now to ensure that the car industry co-operatively produces petrol electric hybrid vehicles. Tax and other incentives should apply to the ten imported cars that are recommended by the Dept of Transport and Regional Services as the top environmental performers with the best greenhouse and air pollutionn ratings (Easdown 2005).

If hybrid petrol/electric and gas /electric cars and LCVs are built in Australia then fuell economy improvements of 40% or more are possible (Hirsch 2005).

4). Green taxes to decouple the growth in oil consumption from the growth of GDP

The national peer review of the Netherlands transport system by the OECD (European Conference of Transport Ministers) identified the Netherlands as having the best passenger transport practice for the EU (ECMT 2001).The Dutch have been moving towards ecologically sustainable transport with their National Environment and Policy Plan (N.E..P.P.) by:-

"Decoupling economic growth from the growth in fuel consumption. (N.E.P.P. 3. 1998)

As this plan evolved the Dutch greened their tax system as well as providing the infrastructure to improve the performance of their transport system.

NEPP 3 makes it very clear why non-motorised travel is considered to be so important and why the car, which in the 1960s to 1990s was regarded as a sacred cow is now subject to many regulatory constraints. The transport objectives of the NEPP are:-

- Vehicles must be as clean, quiet, safe and economical as possible.
- The choice of mode for passenger transport must result in the lowest possible energy consumption and least possible pollution.
- The locations where people live shop, work and spend their leisure time will be co-ordinated in such a way that the need to travel is minimised.

Without the NEPP it was expected that car kms would increase by 72% over the period 1986 to 2010. With the NEPP this increase will be lowered to 48%, a positive step towards ESD. Dutch experience with implementing the NEPP suggests that there is the potential for a shift of at least 10% of all “drive alone” commuter trips to multiple occupant trips.(Parker 2001) This is in addition to using bicycles to substitute for short, highly polluting car trips (Wellemen 1999).

Dutch experience shows that greening the tax system could provide incentives and constraints to use cars less so that tax reform results in the conservation of oil reserves and the use of more energy efficient vehicles which will reduce greenhouse gas emissions. It would be based on the principle that the polluter must pay in the following ways:-

1. The internalisation of environmental costs. The future costs of oil depletion need to be built into the price of diesel, petrol and aviation fuel so as to encourage fuel conservation, the purchase of more fuel-efficient cars, LCVs, trucks and aircraft.

2. Reduce the long lead times in adapting to oil depletion by increasing fuel taxes every year to pay for the introduction of alternative fuels, particularly gas, and to build the infrastructure needed to encourage walking cycling and public transport.

3. For those who cannot do without cars for essential purpose in business, or are disabled, provide tax incentives for the ownership of more energy efficient cars and disincentives to the ownership of large cars and 4WDs in urban areas.

4. Provide incentives for telecommuting; informal and formal sharing of cars; and innovative forms of car leasing such as the Dutch "Call-a-Car" scheme. Eliminate subsidised car parking and provide incentives for commuting by bicycle.

5. Establish the general principle that car travel to and from work is a personal expense. Salary packaging for commuting, or for vehicles owned by other family members, will not be subsidised. Season tickets on public transport and the provision of bicycles for commuting and/or work business should be salary packaged instead.

The achievement of the ‘big picture’ planning and transport outcomes induced by the Australian Commonwealth “Greening” of the tax system, would be dependent on state funding and investment being radically changed so that they reinforce and complement these tax reforms.

5. Abundant natural gas should be used as the transitional fuel

Australia is well endowed with natural gas, which can be used as a transitional fuel to replace petrol and diesel and to give Australia a competitive advantage in starting to be less dependent on oil. Many IEA members, like the US, do not have enough indigenous gas reserves to use it as transitional fuel prior to oil peaking and subsequent oil shortages .

There is also a need to retain a significant part of our natural gas resources as bridging fuel for the transition from fossil fuels to renewable energy. As the CSIRO identified in 'Future Dilemmas', a large amount of gas will be needed for power generation and transport fuel during this transition, even if a 'Factor-4' type economic development and low population growth strategy were adopted to reduce the growth in energy use (Foran and Poldy 2002). Australia needs an energy security plan in place to competently use this resource.

The sustainable transport coalition in WA has produced a booklet advocating that the Commonwealth encourage the use of LPG, CNG and LNG in the motor vehicle fleet. This should include preferencing gas for government fleets; providing financial incentives for vehicle conversions, or purchase for dedicated gas vehicles; and financial support for

provision or conversion of fuel storage and distribution infrastructure (STC 2004).The use of gas as a transitional fuel in all government, company cars and salary packaged vehicles needs to be considered

Given a reduced growth in transport and a growing proportion of fuel efficient vehicles in the car fleet and LCV fleet over ten years, the demand for oil could be greatly reduced. During this period short-term dual-fuel conversions would work for many older vehicles, but this is not a long-term solution.

Ethanol may have limited use in some rural areas for cars and LCVs, but is not a solution for urban fuel supplies because of the low energy return on energy invested. However, ethanol used as a fuel additive to petrol can reduce air pollution and improve engine efficiency. Ethonal used to power assist motorised bicycles has a lot of potential because these vehicles would use less than one litre per 100 km., if they had small two stroke engines of the kind designed by the Orbital Engineering Co and there would be hardly any pollution. With such a fuel efficient application the low energy return on energy invested in ethonal production would not be a problem .

6). National energy security plan needed to Implement the adaptation measures

Japan provides a good example of a national energy security plan (the Dutch NEPP produces similar results) This was developed in response to the oil crisis of 1973 when several oil dependent industries were closed for several months. They formulated the view that national security was about enabling Japan to survive oil shortages; that oil conservation is just as important as having a military capacity and that oil dependence was a serious threat to their way of life. Japan's energy security policy has reduced oil dependence in the transport sector from 80% in 1973 to 50% in 2004 thus reversing a negative trend (Hook, W. 1994) (Alford 2005).

They reduced their dependence on oil by creating the finest rail system in the world for urban commuting and intercity transportation, which is sustainable because it is reliant mainly on hydroelectric and nuclear energy sources. Intermodal passenger transport is highly developed with 6 million bicycles being used to access rail stations, with very efficient modal interchanges which link buses and trains and provide secure bicycle parking (Parker 1993).

In 2005 Japan has zero population growth and has transport infrastructure in place that will reduce the impact of future oil shortages. The government recently introduced a national campaign urging the Japanese to replace their older appliances and buy hybrid vehicles, as part of a patriotic effort to save energy and fight global warming. Competition did not create their hybrid vehicle technology but sensible energy security planning (Hook, W. 1994). To achieve what the Japanese have done there is also a need to reduce oil demand for freight transport in Australia.

There are two measures that need to be implemented together to reduce the consumption of diesel oil as there are synergetic benifits. Firstly, the big engines made overseas and used by the growing number of B-doubles are very efficient and the engines that run efficiently on bio-diesel are available. Also the big HINO 700 series diesel /electric hybrid trucks are reducing diesel consumption by 10%; and the use of such vehicles needs to be encouraged. All diesel trucks have to use Australia's poor quality fuel, which reduces their engine efficiency by 10% to 12 % and the fuel needs to be cleaned up. There are commercially available trucks with very efficient engines designed to run on natural gas and their use needs to be encouraged.

Secondly, there is a need to build up the interstate rail infrastructure, which many government inquiries have revealed to be in a run down condition, so that it can take a lot more freight and

do so safely. The inland rail freight route from Melbourne to Newcastle should be a top priority that would reduce the predicted increases in road congestion from trucks in all Australian cities. The short term goal is to stop freighting goods that are in the category of 'taking coals to Newcastle', which has been done overseas, and to steadily increase the price of diesel so as to deter unnecessary freight movement. A Energy Security Policy must be produced with both demand and supply side measures for both passenger and freight transport .

5). IEA oil emergency demand restraint measures

Mention must be made of work done by the IEA on oil emergency demand restraint measures as a result of some IEA member countries, looking for ways to improve their capability to handle oil market volatility and possible supply disruptions in the future. The IEA prepared a report to show how short term disruptions in world oil supplies could be dealt with.

Table 1. Summary of oil saving effects of demand constraint policies for passenger transport summed across all IEA countries

Potential oil saving	IEA proposed MEASURE
VERY LARGE 370 million barrels a year	**Car pooling:** large program to designate emergency car pool lanes along all motorways, designate park-and-ride lots, inform public and match riders signals.
	Driving Ban: odd even license plate scheme. Provide police enforcement, appropriate information and signage.
	Speed limits: reduce highway speed limits to 90 km/hr. Provide police enforcement or speed cameras appropriate information and signals.
LARGE 185 million barrels a year	**Transit:** free public transport (set fares to zero)
	Telecommuting: large program, includes active participation of businesses, public information of benefits of tele commuting, minor investment in infrastructure to facilitate.
	Compressed work week: Program with employer participation and public information campaign
	Driving Ban: 1 in 10 days based on license plate, with police enforcement and signal.
MODERATE More than 36 million barrels a year	**Transit:** 50% reduction in public transport fares.
	Transit: increase week end an off peak service and increase peak service business hours 10%.
	Car pooling: small program to inform public and match riders.
	Tyre pressure: large public information programme.
SMALL Less than 36 mill- - ion barrels a year	**Bus Priority:** bus priority usage and convert some other lanes to bus only lanes convert all existing car pools & bus lanes to 24 hour

Table 1 shows the opportunities to achieve substantial reductions in transportation oil demand quickly and cheaply – if national leaders are prepared to act and sell politically unpopular demand constraint measures to their people. In the event that Peak Oil is proved to be be less than 10 years away these measures could be applied almost emmediately

The IEA has recommended technical solutions for the restraint of mostly urban road transport that could reduce oil demand on their own without any restraint of intercity freight and air travel of fixed sources of oil use. Some measures may make sense under any circumstances; others are primarily useful in emergency situations. All can be implemented on short notice – if governments are prepared (IEA 2005 C).

The IEA report examines potential approaches for rapid uptake of telecommuting, "eco-driving", free public transport and car-pooling, among other measures. It also provides methodologies and data that policy makers can use to decide which measures would be best adapted to their national circumstances. It may be prudent to introduce these restraints unilaterally before the timing of peak is known or if provisional estimates indicate that peak oil is less than 10 years away.

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CONCLUSION AND SUMMARY OF RECOMMENDATIONS

There is a significant risk of world oil peaking before 2010. This is the worst case scenario, that would induce a world wide depression, wreck the Australian economy and produce mass unemployment in Victoria. Outer suburbanites would be terribly disadvantaged as would be the poor in rural areas. The Commonwealth and state government need to develop a risk management strategy to cope with that. If oil peaks between 2015 and 2025 a far less a painful adaptation is possible, if most of the harsh measures in the following recommendations are implemented, and the transport research community takes a strong advocacy role in persuading governments to actually reduce oil dependence.

1. Develop car fuel efficiency standard to ensure that by 2015 average fuel consumption of the car fleet including most 4WDs be 5 litres/100 km and for the SUV and light truck fleet to be 6.5 litres/100 km. giving an overall 50% increase in fuel efficiency.
2. Conserve oil reserves by the use of natural gas as a transition fuel; the manufacture of energy efficient hybrid electric cars and LCVs and the building up a strategic reserve of 6 months diesel and petrol

3. Embody the costs of oil depletion into the price of diesel, petrol and aviation fuel and other green taxes designed to decouple the growth in oil consumption from the growth of GDP. Use the green taxes to rebuild and enhance rail infrastructure into all urban areas.
4. Promote and fund the uptake of telecommuting, eco-driving, car-pooling and Travel Smart programs in all urban areas.
5 Change current land use planning practice to eliminate urban sprawl and provide public transport services in new residential and industrial areas.
6. Change the constitution of road planning and building agencies to make it their responsibility to reduce the demand for road space and travel by car.
7. Build urban bikeway networks for bicycles and electric bicycles and provide secure bicycle parking at all modal interchanges and railway stations.
8. Encouraging the use of electric bicycles with solar electric and/or over night battery charging.
9. Support in principle ASPO's call for a new plan on the scale of the Marshall Plan to cope with coming end of the age of affordable oil (ASPO 2004).
10. To implement the above recommendations an Australian Energy Security Policy needs to be produced to mitigate oil dependency with both demand and supply side measures.
11. Research must be funded to prioritise the most effective mitigation measures.

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