Submission
No 187

# INQUIRY INTO PACIFIC HIGHWAY UPGRADES

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**Subject:**

**Summary**

This submission is part of a joint submission that focuses on particular routes and other aspects of the upgrade. I would like to emphasis this aspect of our joint submission by submitting it separately as well, as I would like to focus on the validity of such road infrastructure projects. This submission raises the issue of oil depletion and requests the NSW government to consider this issue. Oil depletion is an issue that cannot be ignored and a failure to change our economy now in relation to this issue is extremely negligent.

## PEAK OIL

Peak Oil is a term that describes the production pattern of oil over time, with particular reference to behaviour either side of maximum production. The concept was first discussed by the late Dr. M King Hubbert in 1956. Dr Hubbert was a senior research geophysicist working for the United States Geological Survey for 12 years. He was employed as director of Shell's research laboratory in Houston for 20 years. He taught at Stanford University, the Massachusetts Institute of Technology and the Johns Hopkins University. Dr Hubbert described the production of an oil from a reserve in terms of the sharp rise of production after the first well is drilled, the peaking, or plateauing of production when half the oil has been extracted, and the decline in production after that production peak. This production pattern forms the shape of a 'bell' curve, as displayed in fig. 1 below, and is described as the Hubbert Curve. This production pattern is typical of all oil reserves, the aggregated production pattern of a nation, and the aggregated global production pattern.
Of particular concern was the decline of production once maximum production had been achieved. During this period, the oil pressure in the reserve decreases to the point where increasingly expensive technologies are required to extract the remaining oil. These technologies include pumping water into the well to pressurise the remaining oil from the reserve. The oil quality can also be reduced due to these technologies.
Dr Hubbert used this methodology to predict the production peak of US oil to occur in the early 1970's. His predictions were ignored, but where later proved correct, and this production peak in the US caused the oil spikes of that period. The steady decline in production in the US since that time has also been met with increased expense, as he predicted. Besides the Middle East, all other nations peaked in 1997. The world community of oil geologists and geophysicists are currently vigorously debating the global production peak.

The graph below from the Association for the Study of Peak Oil and Gas (ASPO), April 2005 newsletter [1], describes global production from the various oil producing regions and illustrates the bell curve used by Hubbert to describe production.

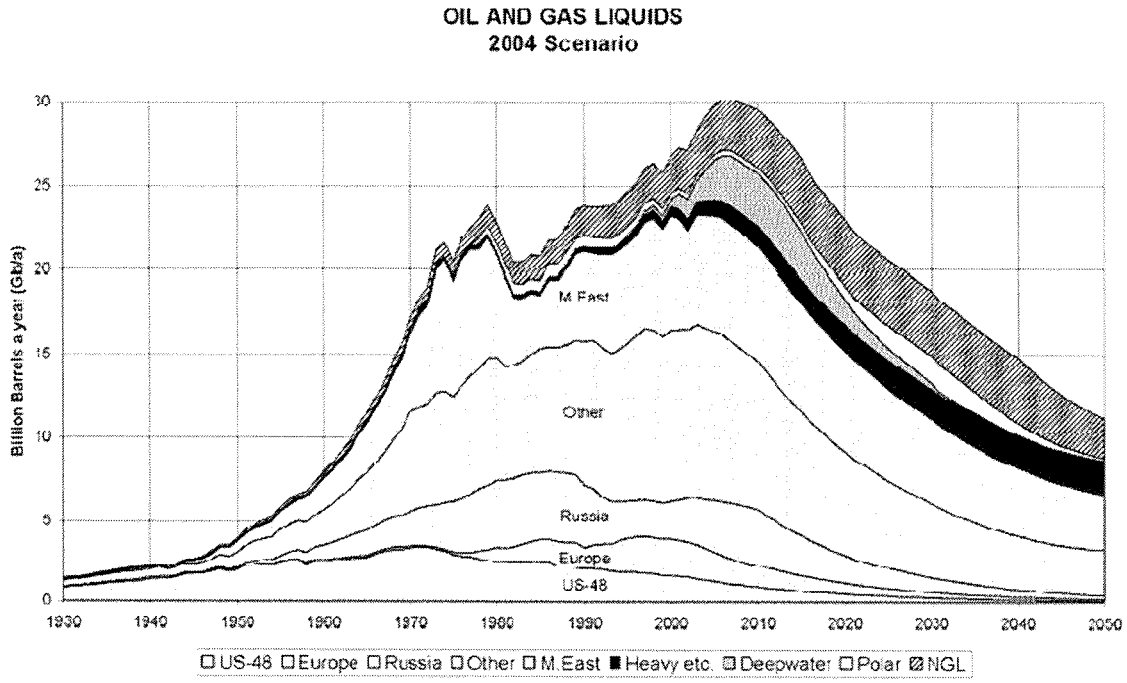

Fig. 1

As described by Hubbert, production patterns follow discovery patterns regarding oil and gas. The discovery pattern will follow a Hubbert curve, with the production Hubbert curve following some time after. The following graph from ASPO [1] shows discovery and production patterns since 1930.

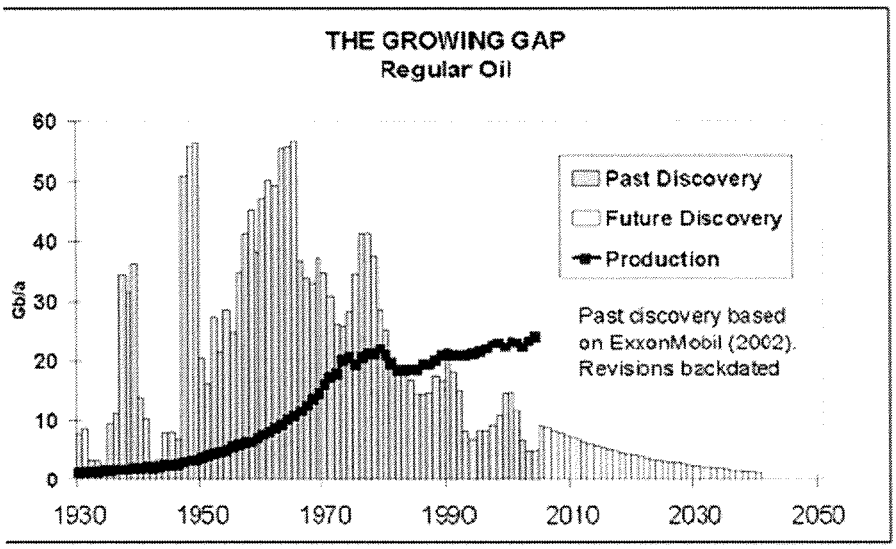


Fig. 2

The parliamentarian Andrew McNamarra [2], in his address to the Queensland parliament on 22 February 2005, when describing oil discoveries, stated - *New oil discovery across the world peaked in 1960 and we now find one barrel of oil for every four we consume. The six giant Saudi oilfields that produce the entire eight million barrels a day of Saudi production are all aged between 40 and 65 years. Nothing approaching the giant Ghawar field's size has been found in the last 50 years.*

Based on basic supply and demand economics, due to slowing production and soaring demand, the price of oil has increased over 500% since 1999 to the end of 2004, as illustrated on this graph from ASPO [1]. To date, August 2005, with the price at $64 per barrel, it has increased over 600%.

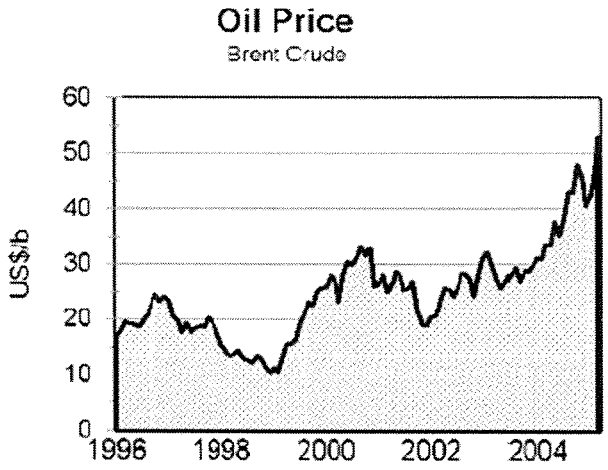

Fig. 3

Predicting global peak production is exacerbated by the fact that some countries have political motives for under-reporting or over-reporting their reserves, particularly in the Middle East, which hold the world's largest reserves and produces the majority of the world's oil. In the oil industry, a company's value is directly related to the value of its reserves, as is their OPEC production quota, so it is not surprising that reserve estimates can be considered to be somewhat higher than actual reserves. In the Middle East there are only market forces validating reserve estimates, but in the West, stock markets apply a validating influence on reserve estimates. An example of these reservoir-reporting inaccuracies is described by Andrew McNamarra [2] - *the Royal Dutch/Shell Group on 5 February 2005 cut its 2002 published estimate of its total oil and gas holdings by one-third. It reduced its 2003 estimate of oil reserves by 1.4 billion barrels, or 9.8 per cent, and admitted that two-thirds of its listed prospective wells in 2004 were in fact dry holes. Shell has been fined $US151.5 million for misleading stock markets.*

A significant number of oil geologists, politicians and investors have made public statements about the peak in oil production and its implications. The following are exerts of publicly reported statements from some of these people.

Dr Colin Campbell and Jean Laherrere in the Scientific American of March 1998 - *Using several different techniques to estimate the reserves of conventional oil and the amounts still left to be discovered, we conclude that the decline will begin before 2010.* Colin Campbell is a retired English petroleum geologist, who was chief geologist for Amoco, a vice-president of Fina, and has worked for BP, Texaco, Shell, ChevronTexaco and Exxon.
On 20 May 2005 the ABC released a press release of an interview with the former deputy Prime Minister, John Anderson [3] - *Deputy Prime Minister John Anderson believes high fuel prices reflect the inevitable decline in the world's oil and gas reserves. He expressed deep concern about the long-term future of oil and says fuel prices will have to be high enough to encourage more exploration. Mr Anderson says the world could reach peak production of oil and gas far sooner than predicted because of the rapid increase in energy demands in China.*
ExxonMobil Corporation, one of the world's largest publicly owned petroleum companies, in their report The Outlook for Energy: A 2030 View, forecast a global peak in five years.
In the Business Magazine of 7 November 2004, Francis Harper of BP stated that he expects global oil production to peak between 2010 and 2020.
Errol Stock, an environmental scientist, interviewed on the ABC's Queensland Stateline, on 24 June 2005, stated that *Using the conventional oil reserves, the best forecast is somewhere between now and about 2035.*

Boone Pickens is a Texas oil tycoon, who started in the oil industry as a geologist for Phillips Petroleum, then founded Mesa Petroleum and Petroleum Exploration and is now Chairman of the hedge fund BP Capital Management. When addressing the 11th National Clean Cities conference in April 2005 [4] he said - *Global oil [production] is 84 million barrels (a day). I don't believe you can get it any more than 84 million barrels. I don't care what [Saudi Crown Prince] Abdullah, [Russian Premier Vladimir] Putin or anybody else says about oil reserves or production. I think they are on decline in the biggest oil fields in the world today and I know what's it like once you turn the corner and start declining, it's a tread mill that you just can't keep up with...So, when you start adding the reserves in these countries, you're not even replacing what you're taking out...84 million barrels a day*

*times 365 days is 30 billion barrels of oil a year that we're depleting. All of the world's [oil] industry doesn't even come close to replacing 30 billion barrels of oil. We don't spend enough money to even give ourselves a chance to replace 30 billion barrels. It may be because the prospects are not there.*

Dr Ali Samsam Bakhtiari [5] is a senior planning expert with the National Iranian Oil Company. When interviewed on the ABC's PM program on 9 August 2004 he predicted peak in 2006/07, with the price of fuel at the bowser in Australia at $3-4 in 2007. When asked why the increased price of oil will not have the effect of reducing demand, thereby reducing the price of oil he stated - *Oh yes but not this time around. You will cut demand first but then the supply is going to go down as well. In the previous ones it was not like that. You would cut demand and supply would go up and you would recalibrate the whole system. This time you will not be able to recalibrate. What I'm saying is that you don't have any more spare capacity neither in the Middle East, nor in OPEC, nor anywhere else.* James Howard Kunstler, in a speech he made in Hudson, NY on 8 January 2005 [6], made this observation on the differences between the 1970 crisis and the current looming production peak - *How did we get over it? The oil crises of the 70s prompted a frantic era of drilling, and the last great oil discoveries came on line in the 1980s - chiefly the North Sea fields of England and Norway, and the Alaska fields of the North Slope and Prudhoe Bay. They literally saved the west's ass for 20 years. In fact, so much oil flowed out of them that the markets were glutted, and by the era of Bill Clinton, oil prices were headed down to as low as $10 a barrel. It was all an illusion. The North Sea and Alaska are now well into depletion - they were drilled with the newest technology and - guess what - we depleted them more efficiently! England is now becoming a new oil importer again after a 20 year fiesta.* North Sea oil production peaked at 2.9 million barrels a day in 1999 and is set to fall to near half that level by 2007, which indicates how quickly production can decline from any one reserve.

In the article "Toward A Petro-Apocalypse" in Le Monde (Paris) on 10 May 2004, Yves Cochet [7] (Green), who represents Paris in the French National Assembly, and is former land and environment minister, writes - *The Hubbert's peak of the oil-producing Middle East should be reached around 2010, depending on the more or less rapid recovery of full Iraqi production and the growth rate of demand in China.* He urges European leaders and to plan for the coming peak, *Otherwise, rationing will come from the market through the coming rise in oil prices, and then be propagated by inflation, with the shock reaching every sector. Since the price will soon reach $100 a barrel, this will no longer be a simple oil shock.*

On 7 April 2005, the Financial Times (UK) published the article 'IMF warns on risk of 'permanent oil shock''. It stated - *Predicting surging demand from emerging countries and limited new supplies from outside the Organisation of the Petroleum Exporting Countries after 2010, Raghuram Rajan, IMF chief economist, said: "We should expect to live with high oil prices."... "The shock we see is a permanent shock that is going to continue...and countries need to adjust to that," said David Robinson, deputy IMF chief economist.*

Because of the fluctuating nature of oil production, it is impossible to determine exactly when the peak is occurring. The realisation of peak production can only be determined at some time after it has occurred, when there are no significant factors causing production to be reduced, and recorded production levels show a significant and continuous decline. Matthew Simmons, the Texas-based chief executive officer of the merchant bank Simmons

& Company International, specialising in energy investments, and who served on President George W Bush's Energy Advisory Committee between 2001 and 2004. On the ABC's Lateline program on 22 November 2004 he stated - *I don't think it is beyond the remote possibility that we will look back 10 years from now and say we actually had peaked, past tense, in 2004.* He says - *there are now just too many regions to ignore, which are now categorically beyond the peak.* Simmons published an article in Petroleum News in August 2004 in which he concluded that peak oil *could be the biggest energy issue the world has ever faced.* Simmons has done extensive studies of the Arabian oil fields, which supply the majority of the world's oil. Any failure in these fields will have significant effects on the current global supply of oil. In a presentation to the Hudson Institute on 9 July 2004, he stated his concerns regarding the Arabian fields. These concerns included intense water injection that is now required to pump the oil from the reserves, and where this process is masking the normal depletion pattern. He stated that Saudi Aramco has employed state-of-the-art geophysical tools to find new oil reserves and so far, the only commercial success has been in the Hawtah Trend reserve, which has produced a mere 200,000 barrels per day of extra light oil.
In an interview with Jim Motavalli for emagazine.com, Simmons states *Iran's oil peaked in 1971 or 1972 at six million barrels a day. And when it was at that peak level they had four fabulous fields that each produced over a million barrels a day. Each of those great fields now struggles to produce between 100,000 and 150,000 barrels a day. Iraq has two great fields, Kirkuk and Rumaylah, which have been about 80 percent of its production for the last 25 years. Kirkuk was discovered in 1927; it's the oldest producing field in the Middle East. Rumaylah was discovered in 1951. And those fields have been badly abused. And the real question is: Until Iraq develops some new fields, how much longer can Kirkuk and Rumaylah sustain the current 1.5 to 1.8 million barrels a day before they go into a production collapse?* Based on Simmon's concerns and the world's dependence on Middle East oil, we cannot afford to rely on optimistic faith in their continued production levels.

## INCREASING DEMAND AND INCREASING PRODUCTION

With oil production, in order to ensure a consistent supply and thereby maintain a steady price, new discoveries of the resource need to be made at the same rate as the resource is being depleted from current supplies that are in production. As can be seen in fig. 3, this is clearly not happening. Robert Ryan, the General Manager of Global Exploration for Chevron-Texaco, states in the July issue of the AAPG Explorer that world new discovery is down to 40% of production. In other words, the companies are far from replacing their reserves in any real sense. This situation is also described by US Vice-President Dick Cheney in 1999 when he was Chairman of Halliburton, in a speech he made at the London Institute of Petroleum Autumn lunch [8]. In it he said - *"From the standpoint of the oil industry obviously - and I'll talk a little later on about gas - for over a hundred years we as an industry have had to deal with the pesky problem that once you find oil and pump it out of the ground you've got to turn around and find more or go out of business. Producing oil is obviously a self-depleting activity. Every year you've got to find and develop reserves equal to your output just to stand still, just to stay even. This is as true for companies as well in the broader economic sense it is for the world. A new merged company like Exxon-Mobil will have to secure over a billion and a half barrels of new oil equivalent reserves every year just to replace existing production. It's like making one hundred per cent interest; discovering another major field of some five hundred million barrels equivalent every four months or finding two Hibernias a year. For the world as a whole, oil companies are expected to keep finding and developing enough oil to offset our seventy*

*one million plus barrel a day of oil depletion, but also to meet new demand. By some estimates there will be an average of two per cent annual growth in global oil demand over the years ahead along with conservatively a three per cent natural decline in production from existing reserves. That means by 2010 we will need on the order of an additional fifty million barrels a day.*

A significant shortage of oil can occur if demand increases too fast for new production technologies to be implemented, and for new discoveries to be bought into production. This situation will cause oil prices to increase before global production reaches peak. Dr Ali Samsam Bakhtiari [5] - *with China's phenomenal economic growth, the worldwide demand is growing and growing, and now it regularly matches peak production of 81-million barrels a day.* China is becoming increasingly dependant on imported oil, not just because of soaring demand, but because its own oil fields have long since peaked. From the article 'As China grows, so does its oil thirst', published on Market Watch web site - *"China will increasingly rely on imported oil for domestic growth as domestic consumption soars while output stagnates," said Liu Keyu, a researcher at China Petroleum Economics and Information Research Center under the state-run China National Petroleum Corp. China's Daqing oilfield -- by far the nation's biggest -- produced just 50.1 million tons last year, down from a peak of 56 million tons reached in 1997.*
In an article in the Guardian on 21 April 2005 ("The end of oil is closer than you think"), it states - *"[The] International Energy Agency says developing countries could push demand up 47% to 121m barrels a day by 2030, and that oil companies and oil-producing nations must spend about $100bn a year to develop new supplies to keep pace... According to the IEA, demand rose faster in 2004 than in any year since 1976. China's oil consumption, which accounted for a third of extra global demand last year, grew 17% and is expected to double over 15 years to more than 10m barrels a day - half the US's present demand. India's consumption is expected to rise by nearly 30% in the next five years. If world demand continues to grow at 2% a year, then almost 160m barrels a day will need to be extracted in 2035, twice as much as today. That, say most geologists is almost inconceivable. According to industry consultants IHS Energy, 90% of all known reserves are now in production, suggesting that few major discoveries remain to be made.* The article continues with a quote from Colin Campbell - *"All the major discoveries were in the 1960s, since when they have been declining gradually over time, give or take the occasional spike and trough," says Campbell. "The whole world has now been seismically searched and picked over. Geological knowledge has improved enormously in the past 30 years and it is almost inconceivable now that major fields remain to be found."*

The Lamp is a quarterly publication for ExxonMobil shareholders. In the first issue in 2003, the president of ExxonMobil Exploration Company, Jon Thompson, had this to say regarding future production requirements - *we estimate that world oil and gas production from existing fields is declining at an average rate of about 4 to 6 percent a year. To meet projected demand in 2015, the industry will have to add about 100 million oil-equivalent barrels a day of new production. That's equal to about 80 percent of today's production level. In other words, by 2015, we will need to find, develop and produce a volume of new oil and gas that is equal to eight out of every 10 barrels being produced today. In addition, the cost associated with providing this additional oil and gas is expected to be considerably more than what industry is now spending. Equally daunting is the fact that many of the most promising prospects are far from major markets — some in regions that lack even basic infrastructure. Others are in extreme climates, such as the Arctic, that present extraordinary technical challenges.* To appreciate the significance of these figures,

if we in 2015 need 80 percent of 75 million barrels per day (as at 2003), as new production we must open new oilfields that can give 60 million barrels per day. The North Sea at the peak of its production was 6 million barrels per day. This means we would need to find 10 new regions of the size of the North Sea and develop them up to production by 2015.
In a subsequent report from ExxonMobil called 'A Report on Energy Trends, Greenhouse Gas Emissions and Alternative Energy', released in February 2004, it reaffirms these figures or 100 million barrels per day required by 2015, being 80% of current production. The report then states that the report 'World Energy Investment Outlook 2003', released by the International Energy Agency (IEA) has calculated a $530 billion per year total annual energy investment. *Of that, the IEA believes that about 40%, or $200 billion per year, will be required for oil and gas, primarily for exploration, development and production. To put this figure in perspective, $200 billion is larger than the GDP of Norway, whereas $530 billion is larger than the 2004 U.S. national defence budget.*

Australia's own oil production peaked in 2002. According to a report in the Energy Bulletin, Geoscience Australia and the Australian Bureau of Agricultural and Resource Economics (ABARE) estimate that - *Australian stocks of crude oil in the ground will be exhausted [by 2009] if the current rate of production is maintained and there is no new discovery of reserves.* The former managing director of Woodside Energy, John Ackhurst, who chaired the ABARE study, said in 2002 - *Australian liquid fuel self-sufficiency is expected to decline from an average of 80 to 90 per cent over the past decade to less than 40 per cent by 2010.* On 29 April 2005, BHP reported in the Sydney Morning Herald that oil production out of Australia's oil production mainstay, the Bass Strait, dropped by 18 per cent in 2004 due to 'natural field depletion' or post-peak oil production rundown. This is a significantly fast drop in production from an oil reserve once peak production had been reached, and it has significant implications for the Australian economy. According to the Australian Petroleum Production and Exploration Association, on current trends in 10 years Australia will be producing only 280,000 barrels of oil per day while consuming around 1,030,000 barrels of oil per day. That will mean that we would be 78 per cent dependent on oil imports compared to only 30 per cent now. This will have very serious implications on our current accounts deficit.

## ARE THERE ALTERNATIVES TO OIL?

For Western economies to continue in their current form, with a strong reliance on growth and development, we will need to find an alternative source of energy that is as cost effective, and as energy intensive, as oil. There is very little support, if any, for the likelihood that such an alternative exists. A good summary of the overall alternative fuel option is provided by Andrew McNamarra [2] - *We have coal for electric power for 200 years, but coal cannot effectively replace oil. While it is possible to make synthetic fuels from coal and while hydrogen extracted from coal can power a fuel cell, these processes use more energy than they produce. In other words, they are net energy losers. This is the unavoidable impact of the second law of thermodynamics. Nuclear power suffers from the same net energy loss problem, as well as the known radiation and waste storage risks.*
*The only effective replacement energy source for oil is liquefied natural gas, but it is subject to the same Hubbert curve as oil and may even be disappearing at a faster rate. All other energy sources combined cannot replace the volume of energy we derive from oil. For some alternative energy sources, such as ethanol, far more energy is expended in planting, fertilising, growing, harvesting and processing than its end product renders. No other energy source can fly planes or drive heavy trucks and machinery. Further, most of*

*the world's fertiliser is now made from natural gas, and most of the world's pesticide is made from oil. As fuel prices double and then double again in the years after the peak, we will be faced with some very hard choices in the fields of agriculture, food distribution and transport generally.* The best prospect for an alternative energy source is from nuclear fusion, but the realisation of this technology has always been in the distant future and remains there today.

Oil is the most energy intense fuel readily available. It takes approximately 1 litre of oil to produce 20 litres of oil at the fuel bowser, ie. there is a 20:1 energy return on energy invested (EROEI). No other energy source that is currently available comes anywhere close to oil regarding EROEI.

The federal government has publicly expressed concerns regarding the viability of ethanol. In a letter from Nick Minchin, Minister for Finance and Administration, Deputy leader of the government in the Senate, published in the Age in May, the minister clearly states that they are not convinced that ethanol is an alternative worth pursuing. He writes - *The fact is, there is no current scientific evidence before the Australian government to suggest ethanol warrants even greater government support, such as mandating its use in fuel blends. The 2003 report into biofuels by eminent Australian research agencies (CSIRO and [ABARE]) could not be satisfied of the environmental benefits of the use of ethanol, and despite Baume's claims otherwise, the CSIRO has not been commissioned to revise their report. Further, other experts, such as David Pimentel of Cornell University, have found that the production of ethanol requires more energy than ethanol returns.* Production technologies would need to increase at all stages of ethanol production for this fuel to be considered as a viable alternative.

In the article 'Ethanol's Potential: Looking Beyond Corn' by Danielle Murray from Earth Policy Institute, it describes other negative aspects of ethanol production. It states - *Although ethanol's popularity is growing, today's inefficient production methods and conversion technologies mean that this fuel will only produce modest environmental and economic benefits and could impinge on international food security. The largest obstacle to biofuel production is land availability. Expanding cropland for energy production will likely worsen the already intense competition for land between agriculture, forests, and urban sprawl. With temperatures rising and water tables falling worldwide, global food supply and demand are precariously balanced. World grain reserves are near all-time lows, and there is little idle cropland to be brought back into cultivation. Shifting food crops to fuel production could further tighten food supplies and raise prices, pitting affluent automobile owners against low-income food consumers.*
Although a significant proportion of the existing production of sugarcane in Australia can be converted from food to fuel production, the volume of ethanol produced would not significantly replace our oil requirements. And the food source provided by the sugarcane would still need to be replaced by another food source, so the loss in arable land would still be significant. The article continues - *with world energy demands rising, biofuels will meet only a fraction of fuel needs unless there are substantial improvements in vehicle fuel economy.*

Uranium as a fuel source also has significant problems. Besides the long lasting and extremely toxic waste created from fission reactions, the availability of uranium is also in question. The Ux Consulting Company publishes world nuclear fuel spot and term prices, and provides consulting services on the nuclear fuel cycle. On 9 March 2004 it released a

statement on the availability of uranium which suggests that this resource may also be approaching a production peak due to increased demand. It states - *The decline in global commercial uranium inventories is rapidly shifting an inventory-driven market to one that is production-driven. Consolidation over the last several years has squeezed the number of uranium suppliers, reduced geographical diversity, and now several existing and future uranium production centers are in question. In the interim, long-term indicators are pointing toward a demand curve that will exceed supply within the next several years and ultimately lead to higher prices.* Uranium, as an energy source, also has a low EROEI ratio. When the energy involved in exploration, mining, transportation of the ore to reactors, commissioning and decommissioning of reactors, and the distribution of the energy from reactors to where it is used is considered, the EROEI is debatably close to 1:1, or less.

To use hydrogen as a fuel source it must be extracted from water. The energy required to create this hydrogen is greater than the energy released by burning the hydrogen. Using solar panels to electrolytically extract the hydrogen is considered to be the 'green' alternative to oil. However, this is a very energy expensive exercise. Solar cells produce electricity at about five times the cost of mains power (due to manufacturing costs). Electrolysis is about 60% efficient and the return of the hydrogen to electricity in a fuel cell is about 60% efficient. Then there is the compression of the hydrogen into tanks so that it can be used in vehicles. This equates to at least 28 times the cost of running an electric car from batteries charged by mains power. It is debatable whether the overall EROEI is greater than 1:1.
There are other problems with hydrogen that are also resource based. The article 'Carmakers gear up for the next shortage' which appeared in the Financial Times (London, England), 6 July 2005, states - *Today's experimental hydrogen fuel cells use so much platinum that there is not enough of the precious metal to replace all the world's petrol engines. As Kazuo Okamoto, the new head of research and development at Toyota, Japan's biggest carmaker, says: "With the current type of technology we know already that (platinum supplies) will not be sufficient." And the problem cannot be solved by just digging up more of the metal in South Africa, which has the bulk of the world's reserves. At the current 60g or so of platinum in each fuel cell, the world's 780m cars and trucks would use 46,800 tons of the metal - just below the 47,570 tons estimated to be still in the ground. And this assumes each vehicle has only 100 horsepower, the same as the base diesel engine in a Volkswagen Golf hatchback. "There is no other alternative to hydrogen," Mr Okamoto says. "So one day (precious metals) will be a big big problem. That will be the barrier to hydrogen."* Because of our massive demand for energy today, any fuel alternative will likely be limited by resource restrictions at various parts of its consumption cycle.

As the EROEI of an alternative energy source gets down to levels approaching 1:1, it becomes vitally important that production efficiencies are kept at a maximum to ensure that is worthwhile producing the fuel at all. In an interview with Richard Heinberg (professor at the Santa Rosa branch of the New College of California where he teaches courses on Culture, Ecology, and Sustainable Community) published in Z Magazine, May 2004, he states - *Suppose we were to invest $100 billion dollars over the next ten years in making a transition to a hydrogen economy and then discovered that, in fact, hydrogen has a lot of hidden costs. Well, we can't afford to lose ten years and $100 billion dollars going down the wrong road at this point.* When we are faced with these EROEI's from the alternatives to oil as a fuel, it will force our economies to ensure far higher levels of

efficiencies in the use of this fuel. Where oil has, in the past, been considered to be an almost free source of energy, alternative fuels (and the remaining oil), will be very precious.

John Anderson [3], hinted at the need to start evaluating an alternative now. His statements also indicate that the members of the federal government are also aware that there will be no simple transition to an alternative fuel that will enable our economy to function as it is now. He states - *While people talk about new technologies and they say as soon as oil reaches a certain price everybody will switch over to hydrogen and what have you. The reality is that it may not be as simple as that and you have to wonder whether over the next decade we won't start to get towards peak production and that could be a very interesting time and a very challenging time.* This is a strong statement issued from the top levels of Australian government. We need to seriously consider all aspects of energy depletion, how we are to replace oil as a fuel source, and/or how we are to transform our economy to exist with less oil.

## THE NEED TO IMPROVE ENERGY EFFICIENCIES IN TRANSPORT

In regard to the future availability of a cheap fuel to provide our current modes of transport, of both people and freight, it becomes increasingly evident that expenditures that support the current modes, and on infrastructure for those modes, is very questionable. Ignoring the implications of Peak Oil can be viewed as a waste of the remaining cheap fuel we have, and the missing of a very important opportunity to use the remaining oil to convert our economy and transport industry into one that uses its fuels, and energy, far more efficiently. A brief description of the situation we are about to face, and the changes required is expressed by Andrew McNamarra [2] - *The challenges we face after peak oil will require localised food production and industry in a way not seen for 100 years. Local rail lines and fishing fleets will be vital to regional communities. Self-contained communities living close to work, farms, services and schools will not be merely desirable; they will be essential.*

On 8 February 2005, the US Department of Energy published a report analysing viable technologies to mitigate oil shortages associated with the upcoming peaking of world oil production. It studied 3 different scenarios - where a crash program of conversion occurred as the peak occurred, the same crash program started 10 years before the peak, and where the crash program started 20 years before the peak. It stated - *Improved fuel efficiency in the world's transportation sector will be a critical element in the long-term reduction of liquid fuel consumption, however, the scale of effort required will inherently take time and be very expensive...For the foreseeable future, electricity-producing technologies, eg., nuclear and solar energy, cannot substitute for liquid fuels in most transportation applications...No one has yet defined viable options for powering heavy trucks or airplanes with electricity.*
Typically, the 20-year option provided the least economic disruption. One of their recommendations states - *Government intervention will be essential, because the economic and social impacts of oil peaking will otherwise be chaotic, and crash program mitigation will need to be properly supported. How and when governments begin to seriously address these challenges is yet to be determined.*
This report is very relevant to the proposed highway upgrade. It clearly urges government policy to change from one of 'growth at all costs', to one where serious consideration of energy consumption is exercised, particularly with regard to transport. This sentiment was

also expressed by Professor Tor Hundloe (Program Director, Environmental Management at University of Queensland) on the ABC's Queensland Stateline program on 24 June 2005. In the interview he said - *We're all saying the markets going to solve it, the market will solve it, prices of petrol go up, we'll find some alternative, it's not going to be like that unless we get a lot smarter and our governments get smarter and our investors get smarter.*
Matthew Simmons also confirms this need. In an interview with Jim Motavalli for emagazine.com, when asked whether a hydrogen economy could replace the current oil economy, he said that it couldn't and that it would need to be a far greater overhaul than simply replacing the fuel source. It would need to be a restructure of the industry, he states - *So it actually has to be a far more basic sort of overhaul. I think, for instance, that we have to get our freight business off the roads and back onto rail. That would be five to 10 times more energy efficient.*

The transport industry is one of the most significant consumers of oil and will therefore be the economy sector that will either be the one requiring the most significant structural changes, or suffer the greatest economic upheaval, depending on how we plan for it. Of the 30 nations of the OECD, in 1973, transportation accounted for 42% of oil consumed, growing to 58% of consumption by 2004. During both World Wars, and in the 1970s energy crisis, the industry suffered significant rationing, providing us with a historical precedent for the situation that will soon effect us. In the article by Yves Cochet [7] he states that the first to be effected will be aviation and intensive agriculture (fertilisers and farm machinery). He continues - *This will occur unless stabilising policies are used -- for a time and in some other sectors -- to lower taxes on oil as prices rise. But afterwards ground transport, tourism, the petrochemical industry, and the automotive industry will feel the depressive effects of a reduction in the quantity of oil (depletion). To what extent will this situation lead to a general recession? No one knows, but the blindness of politicians and the usual panicked over-reaction of markets allows us to fear the worst.* This clearly indicates that changes need to be made to our current modes of transportation, and to modify our dependence on transportation to effectively reduce this economic sector's consumption of oil.

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