

# The end of suburbia: what happens when all the cheap oil is gone and what are the health implications?

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## Introduction

Figure 1 shows that as oil production went up so did the world's population. Cheap oil enabled the human population to increase from 2.2 billion in 1938 to 6.3 billion in 2003; the greatest increase in history. This was only made possible by the increased production of cheap oil from 2.5 billion barrels in 1938 to 26 billion barrels in 2003. Cheap oil made possible the green revolution that introduced new strains of higher-yielding crops that could be planted more than once a year, but needed more and cheaper fertiliser made from oil and gas. Cheap oil enabled poor people to transport and trade their produce and to eat better.<sup>1</sup>

Soon we shall be forced to adapt to a world without cheap oil, also known as conventional oil. Before that day arrives we will have to learn to live with the world oil supply not satisfying world demand, which was 80 million barrels a day in 2003 and growing at the rate of 3% per year. That growth cannot go on for much longer because the oil discovered in the past 10 years is not sufficient. Around 2008, Australia will be vulnerable to increasing costs of imported oil and without new oil discoveries in deep water, far less oil will be produced. If discoveries are made, the oil will cost more.<sup>2,3</sup>

Since the mid-1990s, the average value of oil discoveries has fallen and discoveries from new fields have replaced only 40% of production. Saudi Arabia, which has the largest oil reserves, has been drilling for oil since 1938, but it now discovers much

less. Of the first 60 productive wells drilled from 1938 to 1969, Aramco found 300 billion barrels within 24 fields. Of the last 60 productive wells drilled from 1978 to 2003, Saudi Aramco found only 13 billion barrels within 50 fields. Another serious problem is that, after oil production peaks, proportionally more of the oil will be sour oil, which gets more costly to extract and refine as oil field outputs drop. The world's four largest oil fields are Ghawr and Burgan in the Middle East, Cantarrall in Mexico, and DaQuing in China. Together they produce one-tenth of the world's oil and the three largest of these are past their peak, producing lower-quality sour oil. This reduction in the amount of oil discovered, together with the much smaller oil fields now being discovered, was inevitable. Oil is a finite resource; the more oil that is found the less oil that remains to be found.

## The end of the age of cheap oil: 2008 to 2020

The European Union (EU) has predicted an increase in road traffic of 50% and an increase in air traffic of 90% in Europe by 2010. Similar increases are expected in the United States (US). It is also likely that by 2006 many countries, in anticipation of oil production peaking, will build up strategic stocks of oil and that will also drive up its price.<sup>3</sup>

China exported oil as late as 1992 but has become a net importer because of a steady decline in its indigenous oil reserves. By 2003, oil consumption was growing by more than 10% a year

## Abstract

In isolation, the depletion of the world's stocks of cheap oil is a risk management problem of global proportions. The risk would be manageable given an international agreement by all the developed nations to conserve much of the remaining cheap oil for essential purposes, but there is no such agreement nor is there any intent to create one. Evidence is presented to show that the synergetic interaction of oil depletion with other long-standing environmental problems will result in world food production peaking and then declining at a rapid rate.

Australian Census data for the journey to work and the growth of car ownership are analysed. It reveals that car/oil dependency is growing in outer suburbia, where most Australians live and where future population growth will be housed. It is argued that oil dependency, if not reduced, will develop into a serious threat to national security in a few years. Health promotion professionals have an important role in activating local, State and Commonwealth governments to implement 'travel smart' programs.

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and had reached 5.4 million barrels per day. China is now the world's second largest oil consumer after the US, which is consuming 20 million barrels per day. China will import more oil to fuel its runaway economic boom, which will generate a demand for oil of 14 million barrels a day by 2010. This will be required for oil-fired electricity generation, all kinds of motor vehicles and a car fleet predicted by official sources to increase to 140 million by 2020. Indeed, the demand for oil is increasing in all developing countries.<sup>5</sup>

Around 2008, when the world-wide demand for oil outstrips the global capacity to produce it, 'the big rollover' will have begun. This is the point at which world oil production goes over the top of a bell-shaped curve (known in the oil business as the Hubbert curve), which is shown on Figures 1 and 4. This curve is named after King Hubbert, the geologist who pioneered the science of predicting the peaking of oil fields in the 1960s and the peaking of mainland US oil production in 1976.

Hubbert's techniques have been further refined and by 2003 Hubbert curves had been plotted by researchers for all the 95 countries that have or can produce significant volumes of oil. It is known that 52 of these countries, including the US, are already well past their peak (greater than five years) while another 16, including the UK, Norway, Australia, and China, are at peak or will reach it soon. The remainder will peak within the next 25 years. By 2020, the easily extracted, high-quality cheap oil will be gone and the remaining oil will cost a lot more to extract and refine.<sup>5,6</sup>

The Association for the Study of Peak Oil (ASPO) Conference held in Paris in May 2003 evidenced a growing consensus on a scenario of world oil depletion of 5-10% per year; a recognition that oil reserves had been deliberately overestimated by the oil

industry; and that there were unlikely to be more major reserves found. Most delegates agreed that nearly all of the private multinational and national oil and gas companies had overestimated their gas and oil reserves to either maximise private company share values or to attract overseas investment into their national economies.

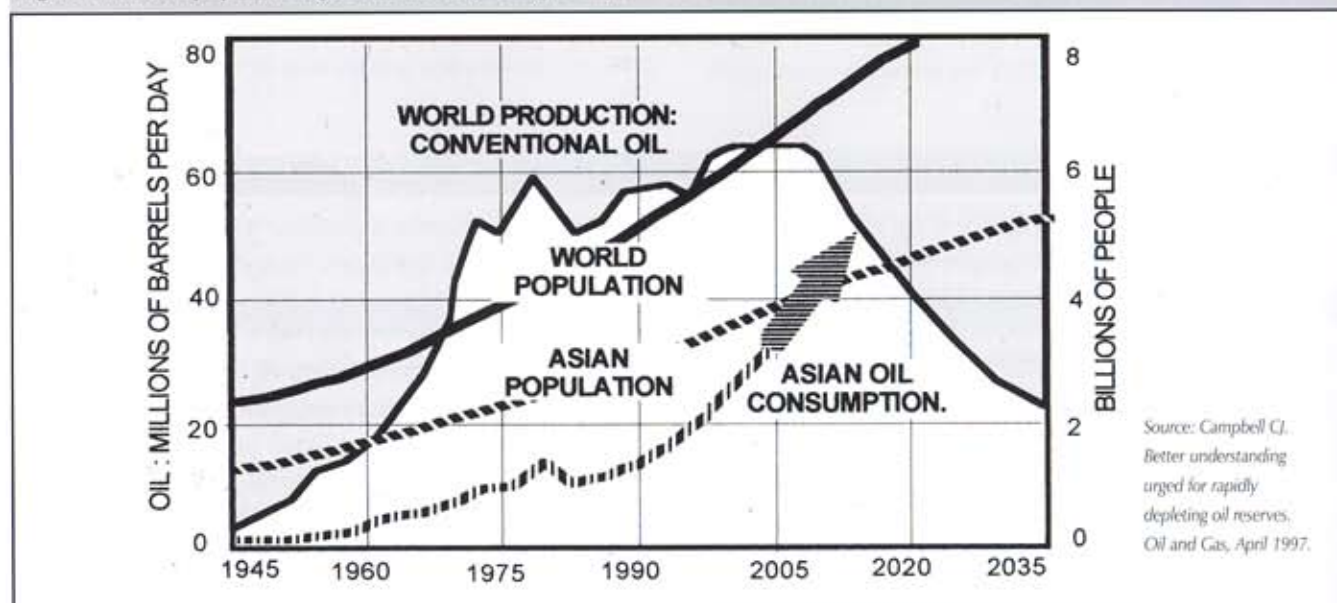
The ASPO Conference held in Berlin in 2004 confirmed the previous overestimates of oil reserves, that oil demand was surging, and that the resulting shortages would be permanent and not the result of deliberate supply constraint, as with previous oil crises. A keynote speaker, Jeanne Laherre, a retired geophysicist who spent 37 years with Total Oil, said: "The problem is not with the tank but with the tap." If the developed nations could decouple the per capita growth in oil consumption from increases in GDP, it would reduce the flow from the tap on the world oil tank and the remaining oil would last a lot longer.

ASPO provides its own estimates of oil reserves. Note that these estimates are being revised as new data becomes available and can be accessed at <http://www.asponews.org>.

### Commuting to work in a typical Australian capital city

The Census data for the journey to work and car ownership are very reliable for making intercity comparisons right down to local government level, being based on a 97% population sample. 'Journeys to work' are referred to as 'commutes' in the text and Melbourne is used as a case study of growing Australian oil dependence. Most commuter destinations are now beyond walking distance so walking has declined from 6.3% in 1976 to 2.9% in 2001 and cycling has stayed around 1% (see Figure 2).

Figure 1: World population growth and depleting cheap oil reserves.





The only sustainable trend is that 5% of those who worked did so at home on Census day. This was similar in all Australian capital cities and has increased since 1986, suggesting an increase will occur by 2006. In 2001, 80% of commutes were made by car; walking and cycling combined only accounted for 3.9%. These robust trends shown on Figure 2 are not sustainable and also apply generally to other capital cities. All the capital cities have an overall modal split that is similar to that of Melbourne, with the growth of female car commutes from 1976 to 2001 being the most dominant trend.<sup>7</sup>

Other sources show that car commutes have also become longer than most other weekday journeys; in 2001 they accounted for 32% of the total distance travelled by car. Car commutes are concentrated in the congested rush hours, and are subject to stop-start driving conditions and 'cold starts'. Peak-hour car commutes are responsible for around 40% of peak-hour emissions, fuel consumption and road congestion. Similar trends for all the other capital cities show increased congestion costs and vehicle fuel consumption to 2010.<sup>7,8</sup>

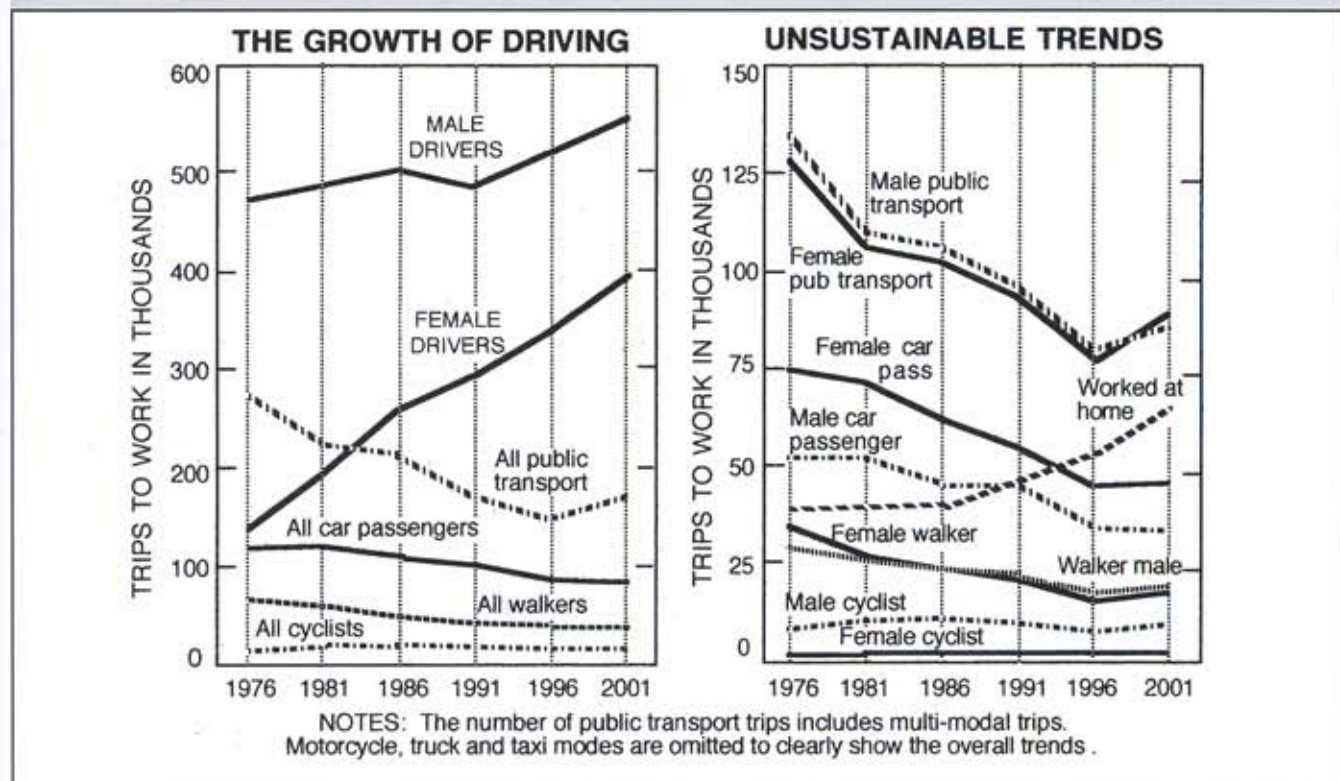
#### Most of the longer single-occupant car commutes originate in the outer suburbs

Commutes by all modes are plotted against household density per square kilometre for the 16 statistical regions in Melbourne in 2001 on Figure 3. This shows the dominance of single-occupant car commutes and high car ownership levels in outer suburbia. The percentages of walking, cycling and public

transport commutes decline with decreasing household density. Most of the unsustainable commutes are located in the sprawling outer suburbs that have between 20 and 800 households per square kilometre and where 75% of the population now reside. In these areas, 80% of households own two or more cars; around 85% of those who are employed commute by car and they are responsible for 85% of the distance travelled by all commuters and for 70% of the drive-alone commutes in the metropolis. Furthermore, 78% of the car fleet resides in households with two or more cars. Walking, cycling and public transport account for only 13% of all commutes. Many city dwellers are likely to suffer considerable hardship because 90% of their journeys to work are by car, truck or motorcycle and there is no easy way of continuing to do that without cheap oil.<sup>8</sup>

There is a significant difference between the Inner Melbourne Region and the six outermost regions. The Inner Melbourne Region has a density of 1,300 households per square kilometre, commuting is far less car dependent, and 43% of commuters benefit from incidental exercise incurred in walking, riding a bike or in walking to and from public transport. When the petrol becomes expensive, most households in this region will be able to dispense with their cars and survive without petrol, as people did from the beginning of World War II to around 1950, when Melbourne was a more compact city. With current government policies, the growth of the oil-dependent transport system will inevitably retard urban economic growth not only in the outer suburbs of the capital cities, but also in provincial cities, which

Figure 2: Melbourne journey to work, ABS Census 1976 to 2001.



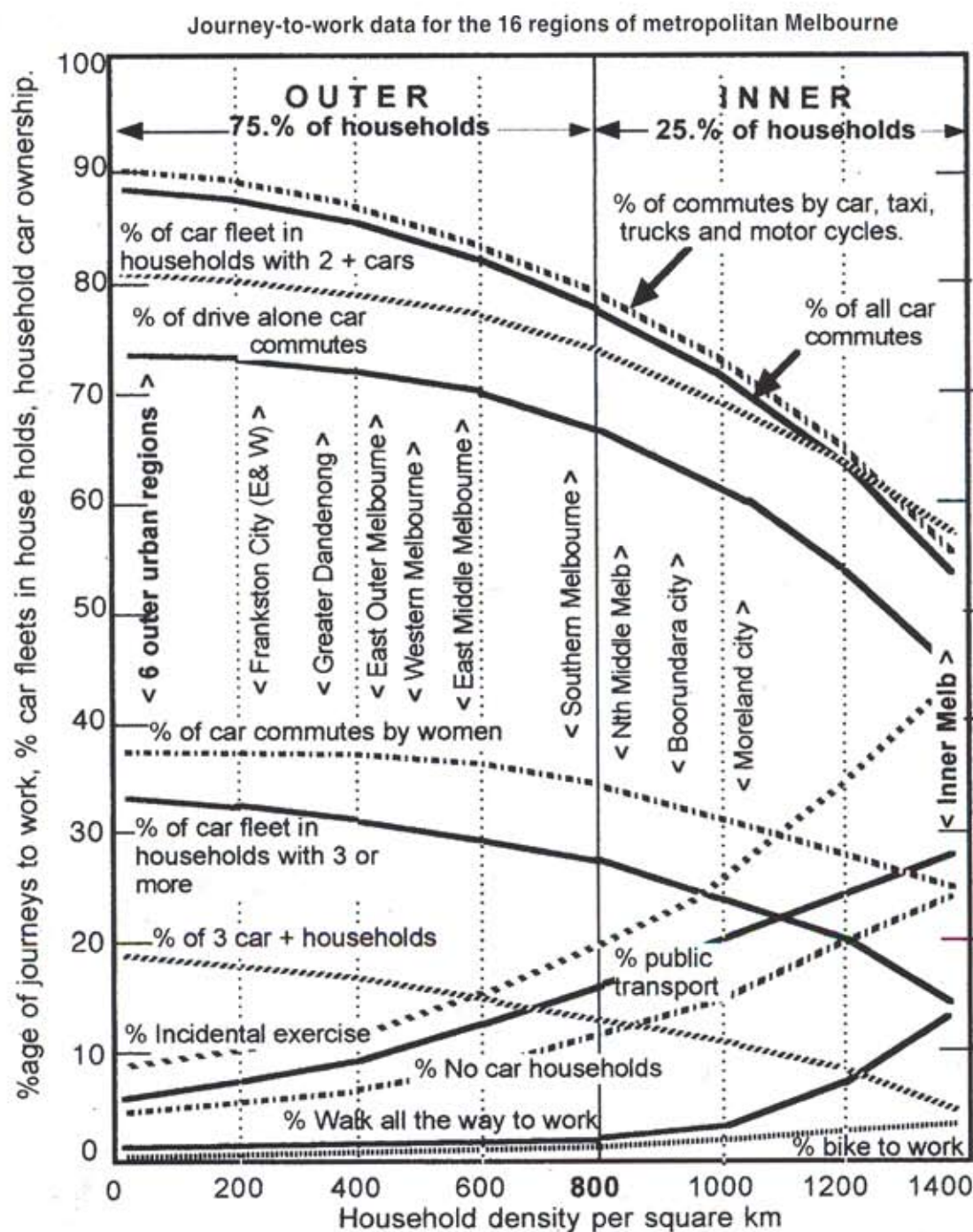
have the same level of car dependence. Data for eight Victorian provincial cities show this to be the case.<sup>7</sup>

### Oil shortages could reduce the world population by 2028

The synergetic interaction of oil depletion and other environmental problems is likely to be a great threat to world

food production. A lot is known about environmental problems in isolation, but there is great uncertainty about how they will interact with one another and how increasing costs of oil will constrain efforts to deal with these problems. We know that cheap oil powers farm machinery such as tractors, refrigerated food storage systems, trucks to take the food to market and ships to export it. Most fertiliser and pesticides are petroleum

Figure 3: Melbourne commutes: 16 urban regions and household density.



Note: The percentage of incidental exercise = the total percentage of all public transport, cycling and walking journeys. The percentage of drive-alone commutes = car driver commutes minus car passenger commutes. Curves in outer regions have been statistically smoothed.



(oil) based. The world's fleet of tractors, cars, trucks and buses has increased from around 15 million in 1938 to 800 million today.<sup>1,9</sup>

Assuming adequate food production, the population of the world has been predicted by the United Nations (UN) to grow by 1.2% per year from 6.3 billion in 2003 to eight billion by 2028; i.e. 1.7 billion more people to feed in 25 years. The problem is that world cereal crop production has been shrinking on a per capita basis since 1984 and world tonnage of grain production and grain reserves have been dropping from 1999 to 2004. By 2008, most grain will be consumed almost as quickly as it is produced and the poor nations of the world will suffer, because there is not enough grain and what is available is not equitably distributed.<sup>1,10,11</sup>

World food production is likely to decline from around 2008 and perhaps a billion people or more could starve to death a few years later due to the interaction of the following.

**1. 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 10 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.<sup>12</sup>

**2. Oil for the mitigation of the worldwide depletion of soil is not affordable.** Cheap oil is needed to power the machines and desalination plants that combat increasing desertification and salinisation of the fresh water supply along the coastal areas due to rising sea levels and growing erosion of arable land. Because of desertification, 8,800 square kilometres of formerly productive land and 25 billion tons of topsoil will be lost globally each year through misuse or overuse of the land. Arable farmland has been shrinking by more than 1% every year, as an ever-larger proportion of the world's population lives in cities that are built on what was formerly productive farmland. Soil's long-term value as a renewable resource that will hold water and produce food, fuel and fibre is ignored by free market ideologues. As with oil, we are depleting the soil at a much faster rate than it is being rejuvenated.<sup>13</sup>

**3. Water for agriculture in most parts of the world is being used up.** Cutbacks in grain harvests will occur in many countries because the world's largest aquifers are being depleted in China, India, the US and Australia. These countries collectively account for more than half of the world's grain harvest. Because it takes

a thousand tons of water to produce a ton of grain, fresh water, its acquisition and delivery 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 and thus depriving countries downstream of water. 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 Western Australia. Present crop production practices only succeed through extensive use of fertilisers and diesel fuel, but in the future water shortages will decimate grain production.<sup>14-17</sup>

**4. Climate change depletes or destroys land and produces a tidal wave of refugees.** The oceans are warming and warmer water is slowly spreading towards the poles. Violent cyclones, floods, drought, tornadoes and 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, seawater will permeate the ground and waterways further inland, destroying even more productive farmland. The interaction of hunger and sea-level rises in vulnerable low-lying areas in the developing world could produce up to 800 million refugees fleeing starvation.<sup>17</sup>

**5. Global warming spreads tropical diseases over more inhabited areas.** It is predicted that the diffusion of respiratory disease will occur as the world warms and that around 600 million more people will die. For example, in Australia airborne vectors carrying malaria and Japanese encephalitis will head south into productive farming areas.

These five scenarios suggest that, worldwide, a billion or more people could be reduced to unemployment and poverty in the not-so-distant future. In the longer term, perhaps there will be a Malthusian die-off from starvation in populous countries. Because of its intimate knowledge of three of the five scenarios, the World Health Organization (WHO) is likely to be the first international agency to recognise the threat to human welfare from car/oil dependence. Global oil dependence is a threat to human life in the same class as a new deadly strain of influenza. So far, the WHO has focused on car dependence and the road accidents it causes by designating World Health Day to road safety in 2004. Hopefully, it will awaken national leaders to the threat to world food production resulting from the uncontrolled growth of oil dependence.

### **Oil dependence is a serious threat to national security**

The decline of Australia's oil production has been documented by Geoscience Australia, the Federal Government's geological



survey organisation. It has shown that at the 2003 rate of consumption, remaining economic reserves will only last 11.3 years. Furthermore, over the past 40 years Australia has become addicted to cheap oil, especially for transport, which uses almost 80% of Australia's petroleum. Fifty-five per cent of road transport fuel is petrol, 39% is diesel, and 6% is LPG. Transport predictions to 2010 for single-occupant car commuting, car travel generally, air passenger travel, inter-city road freight and intra-city commercial vehicle traffic all show unsustainable and growing levels of oil dependency.<sup>4,7</sup>

Australia has low oil prospectivity. Fields yet to be discovered are likely to be of small to medium size and to be 300 metres or more below the sea. Barry Jones, executive director of the Australian Petroleum Production and Exploration Association, has said that "the place where you are going to find a really big discovery is in deep water. The most likely new areas in south-east Australia are off the Tasmanian coast". However, his notion of "really big" is merely a medium-sized discovery by world standards.<sup>18</sup>

High levels of car and oil dependence are potentially very serious threats to Australian national security. The Commonwealth's current policies are based on science that has been corrupted by ideological considerations.<sup>4</sup> They assume that there is enough cheap oil in the world barrel for another 30 years.<sup>10,25</sup> That assumption has no basis in fact and ignores the complicating environmental problems that will turn a potential threat to national security into a very real threat. I believe the following four issues need to be addressed.

1. According to the Australian Petroleum Production & Exploration Association, by 2010 Australian oil production will cover only half of the country's needs and will cost between \$3 billion and \$12 billion at today's prices. It is more likely to be at or near the \$12 billion mark if significantly more oil is not found in deep water.<sup>18</sup>

2. In the unlikely event that major oil fields are found in deep water, providing enough oil for self-sufficiency for the next 30 years with some left over to export, there would still be a serious threat to Australian national security. The risk of the world economy and global food production imploding as a consequence of world oil depletion is very high and that could bring the Australian economy down with it.

3. A 1930s-type Depression in rich, sparsely populated countries such as Australia seems likely. Australia, unlike the US, the EU, China and Japan, is well endowed with natural gas, which could be used as a transitional fuel to replace petrol and diesel. However, Australia has no national energy security plan in place to do that. Nor is there any evidence of political intent to use gas in this way or to encourage Australians to buy smaller, gas-powered vehicles. For Australia, there is little time left to take

effective action to insulate itself from oil shortages that are likely to create an economic depression in the OECD economies. The shortages will initially cause the collapse of aviation and agriculture because of the high prices of jet fuel and nitrogen fertilisers made from gas and oil. A little later, road and rail passenger and freight transport, tourism, the petrochemical industry and the car industry will be working part time and will finally also collapse.<sup>19</sup>

4. A White Paper, *Saving Australia's Energy Future*, released on 15 June 2004, assumes that centuries-old dirty fossil fuels such as oil and coal should not, and will not, give way anytime soon to solar, wind or tidal power. The White Paper assumes that there will be no problems with global or indigenous oil supplies for the next 30 years and totally ignores the evidence that there will be major problems within a decade. There are likely to be more wars over oil and gas reserves as there has been in Iraq, or to secure pipeline access across Afghanistan.<sup>20,21</sup>

5. There is no practical alternative to oil in the next few years and we have to adjust to a growing oil scarcity. For example, a hydrogen economy cannot be created in time and the only practical option for Australia is to use natural gas as a transitional fuel and conserve the remaining indigenous oil resources. The timetable laid out by the Bush administration in its \$1.2 billion hydrogen economy policy statements is not credible. The hydrogen economy is not the quick-fix to oil depletion. On the contrary, a 2004 report from the US National Academies of Science concluded that, "under the best case scenario the hydrogen transition will do little to cut oil imports or greenhouse gas emissions during the next 25 years". That conclusion is supported with sound research.<sup>22,23</sup>

## National adaptation measures required to reduce oil demand

Australia's access to cheap energy supplies has been a source of competitive advantage. However, it has also been an incentive to waste finite resources, particularly oil. There is now a need for a crash program to conserve oil reserves and to greatly increase the energy-efficient use of Australia's remaining oil within the context of a national energy security plan. It can be done; oil is more efficiently used in the transport systems of Japan, the Netherlands, Switzerland and Sweden because energy efficiency has been on their national security planning agenda since the first oil crisis in 1974.<sup>24,25</sup>

A great deal is known about the characteristics of more energy-efficient transport systems. This is why, at international conferences on oil depletion, adaptation measures to combat global oil depletion have been proposed. One set of adaptation measures, shown on Figure 4, would almost reduce the demand for oil to match the depleting supply. Swenson realised that deprivation and crop failure had to be shown as an adaptation



measure because there was not enough time to do what was needed. Six years later there is even less time and as result there may be even more pain.<sup>26</sup>

The adaptation measures on Figure 4 also apply to Australia. The most significant of these for health promotion professionals are 'transport mode shift' and 'lifestyle change', where a significant contribution can be made at local government level by the promotion of 'travel smart' programs. However, the Commonwealth will need to introduce road pricing and green taxes to encourage Australians to change their transport behaviour and lifestyles, promote greater fuel efficiency, and to promote the use of other fuels, including the use of natural gas as a transitional fuel.<sup>19</sup>

Australia is one of the world's leaders in the application of behavioural change programs that persuade people to drive less. These programs, called 'travel smart' or 'individualised marketing', have made very significant reductions in car travel rates. Programs have been completed, or are under way, in several States. Western Australia has the most successful programs. The average reduction in car-kilometres travelled in the completed WA projects is 13% at a benefit:cost ratio of 30:1, far higher than that of most transport projects. Similar results have been obtained in Europe and the US.<sup>27,28</sup>

The travel smart individualised marketing programs in WA have covered suburbs with some 158,000 people to date, and have resulted in an annual saving of some 115 million car-kilometres,

or 11 million litres of petrol. Extrapolated to Australia's urban population, this would equate to about a thousand megalitres of oil saved each year.<sup>28</sup>

In 2003, the Commonwealth provided \$6.5 million over five years for travel smart programs; that was matched one-for-one with State funds and calculated to target 186,000 or 4% of Australian households in five years. At that rate, it will take 96 years to target every occupied household in Australia.

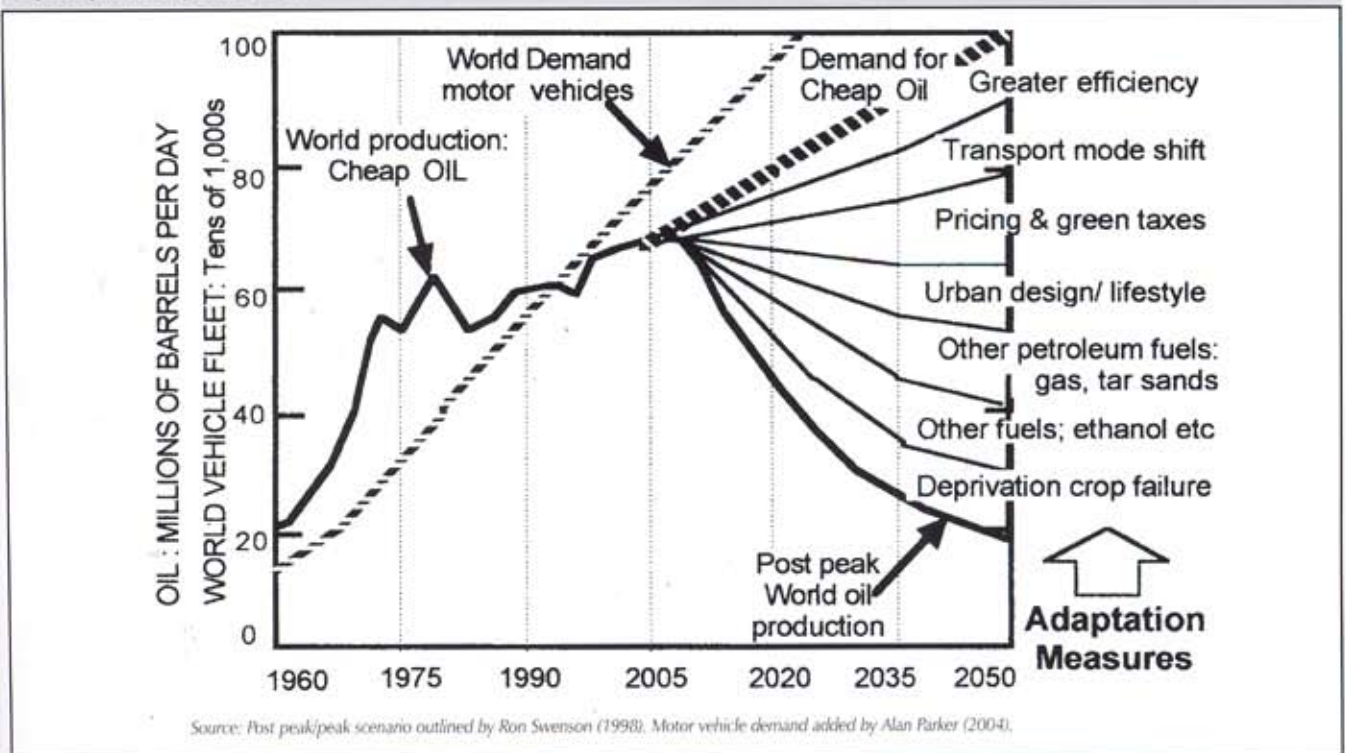
### Conclusions and recommendations

Within 10 years, there could be a 1930s-type Depression in most countries, including Australia, because of rising oil prices. However, Australia has the means to survive oil shortages if the governments recognise that unsustainable levels of car/oil dependence will grow into a serious threat to national security and to the health of many Australians.

Health promotion professionals have an important role to play in activating local, State and Commonwealth governments to understand the health implications of oil depletion and the need for a national energy security policy. Furthermore, they can be active at the grass-roots level. They can motivate households to reduce personal oil consumption in passenger transport and increase the level of incidental exercise in the community by taking part in travel smart programs.

Travel smart programs need to be applied in the outer suburbs of the capital cities where most single-occupant car commutes

Figure 4: Current world trends in the demand for oil and motor vehicles with possible oil conservation measures to adapt to post-peak oil production.



and driving generally originate. The following specific commuter behaviours are proposed for targeting, measuring and evaluation by local government every five years using the Census data:

1. Reduction in drive-alone car commutes by women.
2. Reduction in drive-alone car commutes by men.
3. Increased use of public transport.
4. Increase in walk and bicycle commutes all the way to work.
5. Increased intermodal access to the public transport system.
6. Reduced household car ownership via car-pooling, informal car sharing or the development of car clubs.

There is a need for the Commonwealth to upgrade the funding of travel smart programs to at least \$50 million a year or little will be achieved. To reinforce travel smart programs, adequate funding for public transport and bikeway networks in outer urban areas is needed. Health promotion professionals have an important role in lobbying the Commonwealth Government to provide that funding.

In my view, within 20 years there is likely to be a Malthusian die-off of the world population because of a decline in food production in the poor or densely populated countries that do not have access to cheap oil. Furthermore, the political will to prevent this does not exist. Health promotion professionals should raise this issue with the WHO.

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