



COMMONWEALTH OF AUSTRALIA

Official Committee Hansard

SENATE

RURAL AND REGIONAL AFFAIRS AND TRANSPORT
REFERENCES COMMITTEE

Reference: Australia's future oil supply and alternative transport fuels

TUESDAY, 11 JULY 2006

SYDNEY

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SENATE

RURAL AND REGIONAL AFFAIRS AND TRANSPORT REFERENCES COMMITTEE

Tuesday, 11 July 2006

Members: Senator Siewert (*Chair*), Senator Heffernan (*Deputy Chair*), Senators McEwen, Nash, O'Brien and Sterle

Participating members: Senators Abetz, Adams, Allison, Bartlett, Bernardi, Boswell, Brandis, Bob Brown, George Campbell, Carr, Chapman, Colbeck, Coonan, Crossin, Eggleston, Chris Evans, Faulkner, Ferguson, Ferris, Fielding, Hutchins, Joyce, Ludwig, Lightfoot, Lundy, Ian Macdonald, Sandy Macdonald, Mason, McGauran, McLucas, Milne, Murray, Nettle, Payne, Polley, Robert Ray, Santoro, Stephens, Trood, Watson and Webber

Senators in attendance: Senators Hutchins, Joyce, Milne, Siewert, Sterle and Webber

Terms of reference for the inquiry:

To inquire into and report on:

Australia's future oil supply and alternative transport fuels, with particular reference to:

- a. projections of oil production and demand in Australia and globally and the implications for availability and pricing of transport fuels in Australia;
- b. potential of new sources of oil and alternative transport fuels to meet a significant share of Australia's fuel demands, taking into account technological developments and environmental and economic costs;
- c. flow-on economic and social impacts in Australia from continuing rises in the price of transport fuel and potential reductions in oil supply; and
- d. options for reducing Australia's transport fuel demands.

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Committee met at 9.07 am**SAMSAM BAKHTIARI, Dr Ali Morteza, Private capacity**

CHAIR (Senator Siewert)—I welcome Dr Samsam Bakhtiari. These are public hearings, although the committee may agree to a request to have evidence heard in camera or may determine that certain evidence should be heard in camera. I remind all witnesses that in giving evidence to the committee they are protected by parliamentary privilege. It is unlawful for anyone to threaten or disadvantage a witness on account of evidence given to a committee, and such action may be treated as a contempt by a committee. It is also a contempt to give false or misleading evidence to a committee. If a witness objects to answering a question, the witness should state the ground on which the objection is taken and the committee will consider whether it will insist on an answer, having regard to the ground which is claimed. If the committee determines to insist on an answer, a witness may request to have that answer given in camera and can also ask for that at any other time. For this part of the program, with the committee's agreement, I propose that we first hear Dr Samsam Bakhtiari's opening remarks and then go to questions, firstly on the issue of the key peak oil arguments then looking at the sceptical, anti-peak arguments. I would like to welcome Dr Ali Samsam Bakhtiari, who has been kind enough to rearrange his schedule so that he can appear before us and speak with us. I invite you to make an opening statement.

Dr Samsam Bakhtiari—Thank you, Madam Chair and distinguished senators. I will begin with a short opening statement for you to consider. Crude oil is a commodity unlike any other. It is simultaneously a strategic raw material, a unique industrial feedstock and the most essential of fuels. It is also the most conveniently and widely traded form of energy and therefore the swing element in the world's energy mix. It is no wonder that the price of crude oil is the most important figure quoted daily worldwide. Its relevance could well rise significantly in the near future as the impact of peak oil or, in other words, the peaking of global crude oil production, becomes evident to all and sundry.

At present, worldwide crude oil output is stagnant at around 81 million barrels a day, give or take one million barrels. OPEC's 11 member countries are now limited to a maximum of 31 million barrels per day, having produced only 29.35 million barrels in May 2006, and the so-called non-OPEC countries, which represent the rest of the world, are capped at 50 million barrels per day. Thus the world now produces and consumes some 30 billion barrels in each single year.

Most of the world's major producers are struggling to keep oil production on an even keel, especially both the OPEC and non-OPEC champions—that is, Saudi Arabia and Russia—which are both producing some nine million barrels a day at present while facing almost insurmountable problems to avoid declines in the near future. Moreover, most of the world's supergiant oilfields are now getting old and some of them have entered terminal decline. Suffice it to mention the three largest ones: Saudi Arabia's Ghawar, Mexico's Cantarell and Kuwait's Greater Burgan oilfields, which are surely but steadily going downhill. The last supergiant to be discovered was the Kashagan oilfield in the north Caspian Sea offshore from Kazakhstan back in 1999, and it is now scheduled to begin initial production in 2008-09.

Not only have discoveries of supergiants dwindled to nil in the 21st century but yearly oil finds have plummeted to between four and six billion barrels a year. There is little hope that this trend will be reversed in the near future because most of the planet's petroleum provinces have now been explored for petroleum and there is only one last frontier area remaining—that of Antarctica, with its pristine wilderness and its population of some 20 million penguins.

The decline of global oil production seems now irreversible. It is bound to occur over a number of transitions, the first of which I have called transition 1, which has just begun in 2006. Transition 1 has a very benign gradient of decline, and it will take months before one notices it at all. But transition 2 will be far steeper, and each successive transition will show more pronounced declining gradients. My WOCAP model has predicted that over the next 14 years present global production of 81 million barrels per day will decrease by roughly 32 per cent, down to around 55 million barrels per day by the year 2020.

Thus in the face of peak oil and its multiple consequences, which are bound to impact upon almost all aspects of our human standards of life, it seems imperative to get prepared to face all the inevitable shockwaves resulting from that. Preparation should be carried out on individual, familial, societal and national levels as soon as possible. Every preparative step taken today will prove far cheaper than any step taken tomorrow. I thank you for your attention during my opening statement, and I am ready now to try, to the best of my abilities, to reply to any questions that you have.

CHAIR—In the first set of questions, can we concentrate on the issue of peak oil itself and defining that, and then we will move on to the other issues.

Senator JOYCE—Thank you very much, Mr Samsam Bakhtiari. I have been a follower of you for a while; I have been one of your quiet fans. With regard to Hubbard's peak, within the Ghawar oilfields and the Cantarell oilfields, can you explain to us some of the signs that these oilfields are running out of oil? I am talking about gaseous inertia or water inertia. What do you believe are the key indicators that these oilfields are past peak production?

Dr Samsam Bakhtiari—The supergiant oilfields are all very great oilfields. Today you have 40 per cent of world production in these supergiants. Managing a supergiant is a very difficult procedure. The larger the supergiant, the more difficult it is. I will firstly state the case of Ghawar. Why? Because it is the largest oilfield in the world by far. At the beginning, it was estimated that it had in 1952—that is when it came on stream, which is some 54 years ago—some 70 billion barrels of recoverable oil. That was 54 years ago. In the meantime, much of that has been already recovered. The situation for Ghawar today is that you have two major problems. It is still producing, we think, between four and 4½ million barrels every single day, but in order to produce that much oil much needs to be done. I will show you two points, if you allow me.

A whiteboard presentation was then given—

Let us assume that this is the oilfield. What is happening today is that they are injecting eight million barrels of sea water every single day. What do they get out? This is very schematic. They get 12.5 million barrels of liquid out of the field and they split that into eight million barrels of water and 4.5 million barrels of oil. The water that they are injecting is increasing constantly.

The last information I have is that it has grown now to nine million barrels, but I did not have time to check. These figures are very approximate, because we do not know exactly what is going on. But it is roughly of that magnitude.

So when they say that Ghawar crude is cheap, it is certainly not cheap any more, because you have to do all this enormous processing. You have these huge pipelines which come from the sea and an enormous compressor reinjecting that water under the oil column and pushing the column up. That is one point. There are problems. If you did not have problems you would not need to do all that.

They have done something else. Usually in all these supergiants you drill vertical wells and you take out the oil from the vertical wells by the pressure either of the gas or the water. That is how it is mostly in the four supergiants in Iran. But in the 1990s there was a new technology called horizontal wells. In Ghawar they thought that instead of relying on the vertical wells they would drill horizontal wells. Horizontal wells are both a blessing and a curse. Why?

A whiteboard presentation was then given—

Let me show you roughly how this works. You have a cap here. Here you have the oil. On top you have the gas and below you have the water. Naturally this is very schematic. A vertical well comes here in the middle of the oil column and you get your oil by either the pressure of the water beneath or the pressure of the gas from the top. With the gas here you say that this field is gas driven. Most of the Iranian fields are gas driven. Ghawar is water driven. It is either/or, but sometimes, very rarely, both.

The horizontal well is different. It comes down like this and then it goes horizontally for a few kilometres. The horizontal well is a blessing because you can get to the exact middle of the oil structure and so take out your oil more easily. But there is a very great danger with horizontal wells. They tell us that in Ghawar today there are 220, roughly, horizontal wells. The great danger of the horizontal well is that when the water reaches the well it is dead. So one day in the future at Ghawar, the water level will eventually reach the horizontal well.

Senator JOYCE—But there are signs of what they call ‘gas inertia’ and ‘water inertia’ in some of the wells already, aren’t there?

Dr Samsam Bakhtiari—Sorry?

Senator JOYCE—Aren’t there already signs that that is happening at some of their sites?

Dr Samsam Bakhtiari—Yes, it is happening but not on a large scale. When it happens on a large scale then Ghawar is going to collapse and you will have a cliff in the production of Ghawar. When you have a cliff there, the whole Saudi production system is going to fall apart. If that happens, we will start hearing bells ringing all over the place, and the price of oil is going to go through the roof.

Senator JOYCE—I will go to another question. I have heard you say before that China are prepared to pay any price for oil. Therefore, if they are prepared to pay any price for oil, they are prepared to go anywhere to get it. I got myself into a lot of trouble by suggesting that countries

would exploit the Antarctica. If China were prepared to pay any price for oil, which means they would be prepared to go anywhere to get it, and if there were areas of territorial dispute, is there the possibility that oil would be found in the Antarctic continent?

Dr Samsam Bakhtiari—Do you mean in Antarctica?

Senator JOYCE—Yes.

Dr Samsam Bakhtiari—I have studied oil reserves for the past 40 years, from when it was a very new science. In the beginning, there were a few specialists who were not very good, and then came the greatest specialist of oil reserves. He began working for a petrol consultant in the 1990s and, in 1995-96, established what is in my opinion the best set of oil reserves in the world. These are the oil reserves of Dr Colin Campbell. I think these reserves are the best. I have been able to prove not only that these reserves adapted very well to my model but also that they correlate the production of the 11 OPEC countries in a satisfactory way. So I have adopted them.

Dr Campbell is of the opinion that the total endowment for conventional oil of the planet is around 1,900 billion barrels. I think this is the best number that we have at present. I have been working with that number for the past seven or eight years. Out of that number of 1,900 billion barrels, Dr Campbell is of the opinion that for the two polar sectors, the Arctic and Antarctica, you should have roughly 52 billion barrels. I think that Dr Campbell splits that number roughly half and half between the two poles.

As you know, exploration in the Arctic began in 1995-96—and this exploration is now growing faster and faster. They have given to a research team of the USGS and the Geological Survey of Denmark a joint research project to explore the tectonics and oil sources of the Arctic. Their report should be out next year, 2007, which is the International Polar Year. Antarctica is today the last frontier for the petroleum oil industry. Whether the oil industry is going to go there, I certainly do not know. I know from the very early studies I have made that it is going to be very difficult—firstly, because of the conditions in Antarctica. For seven months of the year it is dark—and you are more aware of the temperatures than I am. Senator Joyce, I believe you have lately been down there on a four-week trip and have seen things first-hand. So it is certainly not something for tomorrow, because conditions are not ready yet. As you know, it is very difficult to drill in ice—and there is an icecap of at least 2,000 metres that you have to drill through before you get to the lower tectonics. But maybe one day, when the price of oil goes up to \$200 or \$300 a barrel, some oil companies will decide to try their hand there. That could be a possibility. I hope it will not happen. But some governments will have their backs to the wall and in suburbia there will be unrest over petrol. Many things could happen—among them, drilling in the Southern Ocean or Antarctica.

Senator JOYCE—I said it would be in the next 10 to 30 years. Do you think that is the time frame for the price of oil to go up to \$200 or \$300 a barrel? I note you have stated that you believe the production of oil will start to fall off to around 55 million barrels a day.

Dr Samsam Bakhtiari—Yes—in 2020.

Senator JOYCE—So that is within a time frame of 10 to 30 years. When will people start exploring new areas?

Dr Samsam Bakhtiari—It is extremely difficult to forecast precisely the price of oil in the future. I can see a range of \$100 to \$150 not very far into the future.

Senator JOYCE—That is \$100 to \$150 a barrel?

Dr Samsam Bakhtiari—Yes, this we are certainly going to get to. In my opinion, we could get there very easily. We are a couple of hurricanes or some geopolitical problems or a war away from having a worse problem than we have today. There you could go very easily, but after that where can this price go? I am studying that right now, and I have not reached a conclusion yet. There must be some outer limit, and I am beginning to think that maybe the outer limit could be \$300 per barrel. I am not so sure yet, because we are entering a brand new era in human history, an era we have not been prepared for at all. For the past six generations, we have been used to having cheap oil always available whenever we wanted it, more or less. Today, in 2006, all of this is beginning to change. We are entering an era in which we know nothing much, where we have a brand new set of rules. I am trying to find out what these new rules are. I have already reached two or three new rules. One of the new rules, in my opinion, is that there will be in the very near future nothing like business as usual. In my opinion, nothing is usual from now on for any of the countries involved. And the lower you are in the pile, the worse it is going to get.

Senator JOYCE—You also made the statement that steps made today are cheaper than steps made tomorrow. With regard to mitigating or alleviating the crisis that would be caused by an oil shortage or a price of oil that is completely prohibitive to the development of industry and the fundamental freedom of people to drive around, what steps do you envisage would be worthwhile taking today? And without loading your answer, can you refer to issues such as the production of a biorenewable fuel industry, the development of ethanol as a fuel alternative and biodiesels, and alternative forms of combustible material that can be used in internal combustion engines.

Dr Samsam Bakhtiari—Allow me to take your questions one by one. I said that steps needed to be taken, because now I am thinking that the price is going to go up. There is no other way. Now let me open a parenthesis: the price might go down tomorrow to \$55, but it will come back up again. So you will have in this period a high level of volatility, but eventually it will go to very great heights—maybe to \$200, maybe to \$300. As long as you have price driven oil, I think it is a very good thing whatever this price is, because one day you will have a question of availability. You will be ready to pay any price, but there will not be any oil.

I remind you that oil is a very special commodity, which is something that is very difficult to realise today. For example, you have no free market in oil. Naturally, you can go to the NYMEX stock exchange and buy as many barrels as you want at the price of \$74 now, but these are paper barrels. If you try to buy 10,000 barrels a day of real oil, of genuine barrels, you will have enormous problems getting that much oil on a regular and sustainable basis. So that is one of the problems that we will encounter in the medium term.

Any step you take today is to your advantage. I will give you one example. The city of Perth in Western Australia has free buses. I have been on these free buses. It is a fantastic service. Maybe today it is still too early. It might not be very economical but it is a marvellous step for the future, because one day it will pay enormous dividends, in my opinion. Also, they have a very light rail service going around 140 kilometres of their coast, and this links all of the

suburbs. One day this light rail service will save all these suburbs. I was asked about this yesterday. I think that Western Australia is at the forefront of the world in terms of steps being taken. And Australia is at the forefront today of the other countries, because the other countries do not know anything at all and are not willing to prepare. So the faster these new decisions are put in place, I think it will be of benefit to any society, especially societies with suburbs.

Senator JOYCE—You said it is not really a perfect market. Yes, you can go to the New York Stock Exchange and buy oil, but it is paper oil; you are not buying the actual product. You have also talked about how the price of oil will possibly go to a horizon of about \$300 a barrel. Of course, that would mean we would be paying about \$6 a litre or something like that for fuel for our car, which obviously means we could not afford to fill up. Do you feel the major oil companies have the intention to exploit an arrangement which has the world paying \$200 to \$300 a barrel for oil? Obviously it would be in their financial interests to get to that position, because it is maximising the returns on their stock on hand. Their stock on hand is the oil in the ground, and obviously there is a great financial windfall for them to keep the predominant means of internal combustion a mineral based oil product. The question I am asking is: will the oil companies drive the intention for people to continually use oil and be quite prepared to profit from a market of \$200 to \$300 a barrel? Will they ride us out to the very end? Will their intentions be to ride this cash flow window to its completion?

Dr Samsam Bakhtiari—I do not think it is in the interests of the oil companies for the price to go very high. I think they are very well satisfied with the present price, but I think it will not be in their hands. It will not be in the hands of the companies, it will not be in the hands of the oil producers. I can see Saudi Arabia and others being very worried by prices that are too high, but I do not think any one of these players can do anything about it.

When there is not enough oil, first you will have to raise its price and then you will have the problem of its availability. There may be some kind of worldwide rationing—I do not know. I am trying to look at the future but the future I am talking about, as you mentioned, might be beyond 2020. Maybe beyond 2020 we will have some reasonable idea. What will happen after that is very difficult to predict. I do not think the oil companies would like such a scenario at all. They will be forced—

Senator JOYCE—Who can afford oil at \$200 a barrel? Who would be using it?

Dr Samsam Bakhtiari—I think the Chinese are ready to pay anything for oil. I agree with you that it will be very difficult.

Senator MILNE—Recently we had the head of BP in Australia talking about their statistical review. They take at face value the claims, particularly of Middle Eastern countries, about the extent of their reserves. We are aware that a few years ago these countries readjusted their reserves, yet there were no new discoveries that would have justified that. This is a really critical question to ask because it goes to the heart of the argument. Could you give us your frank appraisal of the Saudi reserves, in particular, and the Middle Eastern reserves, generally, and the extent to which they have been inflated for political and economic purposes et cetera and do not reflect what is actually there?

Dr Samsam Bakhtiari—Most reviews of the reserves of the major Middle Eastern countries today, especially the BP Statistical Review of World Energy, mention reserves amounting to between 600 billion to 700 billion barrels. These are official reserve figures—in other words, the countries involved say that they have so much oil reserves available. The *Oil and Gas Journal* and BP take these reserves at face value. As you mentioned, in the 1980s these reserves were revised upwards. For example, in 1988 Saudi Arabia, which had reserves of 160 billion barrels, suddenly took these up to 260 billion barrels. Since 1989, it has kept this number of 260 billion barrels; there has been no change to it up to this day. So, for 17 years, it as if they have not produced anything.

In Dr Campbell's opinion—and it is also my personal opinion—the reserves of the Middle East are roughly one half of what is officially said and presented. In other words, there should only be between 300 billion and 350 billion barrels of oil. This is the best figure I have come up with. I and Dr Campbell, as a rule of thumb, divide the official reserves by two to get a number that we believe is the actual amount of the reserves in these countries. Does that answer your question?

Senator MILNE—It certainly does. Can you go on to tell us what your view is of the US Geological Survey and its accuracy in terms of the reserves?

Dr Samsam Bakhtiari—Every institution gives its own numbers, and we can only compare theirs to ours. You can see that the reserves given by the USGS, which is an endowment for the world of over 3,200 million reserves, is much, much higher than the numbers we are using, of only 1,900 million. Of course, we cannot accept such reserves as realistic, as we cannot accept the projections of certain institutions like the International Energy Agency in Paris, which predicts that the world will be consuming 118 million barrels per day in the year 2030 as realistic, because I cannot see how the world can get over 81 or, say, 82 per day right now, let alone in the future. I believe we are in decline. So you have an enormous discrepancy between what these institutions publish and what we believe in, whether it is in reserves or whether it is in production of crude oil per day.

Senator MILNE—Given what you have said about the fact that the Middle Eastern reserves are probably half of what they say they are, and given what you have just said about the US survey, how are we going to tell? Given that the Saudis and the other Middle Eastern countries keep on saying that their reserves are the same—and they have been saying they are the same for all these years whilst production has kept on going—how are we going to know? What indications are there going to be so that we can revise the estimates to be more accurate? If they are half of what they say they are, then the shock in the share markets et cetera everywhere around the world will be huge. You mentioned before that they may not be able to manipulate it forever because of the horizontal wells and the step change that will occur. Is that the main indication—when one of the wells goes kaput? Or what will happen, in your view?

Dr Samsam Bakhtiari—From an outsider's point of view, you have two ways of following what will happen. One is the price. The second is the production. If the production for the next couple of years remains stagnant, then it will mean the institutions that are predicting production of over 100 or 110 are wrong. By the way, the future is always predicted wrongly. So that is one basis. The other way of following this is by the price. If you see the price returning to \$50 and

staying there, it will mean that we were wrong. But, if you see the price continuing to increase, it will prove that we have been right.

So these are the two ways you can follow the story, but I will return to the French philosopher Pascal. He said the best way may be to take a bet and bet that we are right, because the ones who bet that way have not much to lose. If we are wrong, everything is going to be fine. But, if we are right, I think the ones who took precautions will be very much rewarded in the future.

Senator MILNE—What do you regard as the most authoritative estimate of world reserves? You have spoken about Colin Campbell. Is there anything that you would refer to or would you argue that that is the most accurate assessment?

Dr Samsam Bakhtiari—No, I certainly believe it is the most accurate. I have studied almost all, not all, of the reserve sets that I have been given or that I have come by. I can assure you that my personal archive is a very complete one. I have met almost everybody in this industry—and especially those at the world petroleum congresses, which were the Olympics of oil and were held every four years; before the internet age, at least—and I really think that the 1,900 billion barrels in Dr Campbell's set of data are the very best that you could find in the world today. I cannot imagine that we will have any better set in the future, especially given that Dr Campbell with Mr Jean Laherrere, a petrol consultant, have done very impressive research on almost all the oil provinces on the planet.

Senator JOYCE—Is that 1,900 billion barrels of recoverable oil from now to the end?

Dr Samsam Bakhtiari—1,900 billion barrels total is the estimate of convention oil. You have the non-conventional, which include, among others—

Senator JOYCE—Shale oil.

Dr Samsam Bakhtiari—the tar sands, the shale oil and the heavy oil of Venezuela and Orinoco and all these kinds of oils, which are classified by Dr Campbell as non-conventional.

Senator WEBBER—I want to continue to explore the impact of price. Obviously the higher the price, the greater the impact on consumer behaviour. In my home state of Western Australia, the higher price is making fields that were seen to be unprofitable worth developing. For example, we have all known that the Browse field has been there for a long time and now Woodside are looking at developing it. Could you give us an understanding of how an increase in price may bring other oilfields onto the market?

Dr Samsam Bakhtiari—I am sorry, I did not understand your question.

Senator WEBBER—I am asking about the relationship between the increase in the price and the increase in the development of fields that were previously seen as unprofitable. Does the increased price mean that there will be an increase in exploration with the result that new fields may come on stream?

Dr Samsam Bakhtiari—Yes, I understand now. Many people are of the idea that with the price increasing you will have new fields that before were not very profitable. Now, we will

certainly see some of these factors coming into play. For example, you have exactly what you mentioned in the North Sea: small fields with reserves of 50 million to 100 million barrels of recoverable reserve were left by the wayside in the 1980s and 1990s, when it was not at all profitable to go and develop these fields with prices of \$9 or \$10 per barrel. These fields might very well be developed now at prices above \$70. This will certainly happen not only in the North Sea but maybe also in America, where there are very small fields that now are going to be profitable and will be developed.

In my opinion, however all these are developed in the future, it will have very little impact on either peak oil or world production. It might make a change of, say, half a million barrels in total, not more, and half a million barrels will have very little impact. It will just shift the production curve upwards a bit but it will have very little impact. The reason is this: if you look at the US curve of decline, which was correctly predicted by Dr King Hubbert in 1956 and which peaked in 1970, it has been steadily coming down—but for the addition of Alaska. Alaska just shifted it a bit but it made no difference on the peak. It has been declining continuously since, notwithstanding the developments in exploration, exploitation and all the new technologies and the new investment that were possible at prices of \$36 in the early 1980s. So I think that neither investment nor new technology will have any significant impact on the process of transition that we have entered.

Senator STERLE—Can you explain the claimed inadequacies of optimistic official agency predictions of oil production? We have had submissions from oil agencies that have told us that it is very rosy out there because they are spending lots of shareholders' money—that is how rosy it is. Your report and your figures and Dr Campbell's figures are at completely the opposite end of the spectrum. Can you explain how the oil agencies could be so far removed from your studies and be so different?

Dr Samsam Bakhtiari—Maybe one explanation could be that they are interested parties and we are disinterested parties. If you hear some people saying today that the price of oil is going to drop to \$25 in the near future, and I think it is almost impossible for such a thing to happen unless there is a major catastrophe on a global scale—

Senator JOYCE—Like a meteorite or something like that?

Dr Samsam Bakhtiari—At least. They have some ideas, you know. Maybe they are saying this because they want to grow and buy smaller oil companies. They might say that they will buy at \$30 because the price is going to fall to \$25, so \$30 is a very good price and would be a very good price to pay a small company. And there are other problems. Nobody likes the idea of peak oil. Firstly, you have the politicians. Naturally, a politician will never say that there is such a thing as peak oil. It is suicide to give bad news so a politician will never do that. He will always say, 'The IEA says that we will be having 118 million barrels in 2030 so why worry?'

Secondly, you have the media. The media does not like peak oil. Why? There is no sponsorship for peak oil. The oil companies do not like peak oil because you should not say that your soup is cold; you should always say that it is very hot and very tasty, yes? So nobody wants to hear of this phenomenon of peak oil. I believe that some of the institutions—I will not name them; they are here and maybe you can guess which ones they are—are saying these things to

act as a protection for some politicians who can say: ‘Because these institutions are saying these things, then we follow them. We do not follow Campbell and others.’

Senator JOYCE—It could also inhibit the development of a biorenewable fuel industry too. If they say there is a lot of alternative product around, then they do not need a biorenewable fuel industry.

Dr Samsam Bakhtiari—I do not believe that there are alternatives around. In my opinion there is no alternative to crude oil. There is nothing that can replace it, and this is the problem the world is facing today. There are no alternatives and I will try to explain very briefly why. In general economics we are taught a very basic rule. When the price goes up, demand comes down, and you have the marvellous figure of Professor Sam Wilson to explain exactly how this works. For crude oil this does not work at all. We were always taught that when the price doubles demand will come down by something. In the past two years the price has tripled and demand has not come down by anything. How far can we go? Nobody knows. I think that it will take three digits—at least over \$110 or \$120—for us to start seeing demand maybe coming down.

Why? Firstly, you have no way of preserving oil products easily—no way at all. We are all used to the car and we want to drive that car as far as we can possibly pay for it. Even at prices of \$1.40 per litre for petrol you are beginning to have problems in the population economically, so what will it be like when the prices are much higher than that? \$1.40 per litre is one of the cheapest prices in the Western world. It is just a little above fuel prices in California today so it is very cheap.

Not only do you not have preservation, you do not have any means of substitution, and I will come back to your previous question on alternatives. There is no alternative to crude oil. For the ones who believe that GTL is going to be an alternative, I am sorry to say that this is not a fact. Today you have only 85,000 barrels per day of GTL capacity in the world. I do not think you will ever have much more than that, and 85,000 is nothing. It is a drop of water in an ocean.

The latest GTL plant has just been started in Qatar and I do not know how it is going to fare. It makes 34,000 barrels. It is an enormous plant. I think it cost one and a half billion dollars at least. It has two enormous reactors. If anything goes wrong with these reactors—my God, I do not know what is going to happen! So that is for GTL.

You have coal to liquid. The only coal to liquid plant today in the world is in Secunda in South Africa. It makes 150,000 barrels per day of liquids. I can tell you that because I have visited it, half by helicopter and half by walking around the facilities. It is a very messy affair and it is very inefficient energy wise. Now the Chinese are trying to make CTL—coal to liquid—of one million barrels per day capacity. I think it is going to cost them \$10 billion at least. I cannot imagine how this site is going to be. I am waiting for them to finish, but it will probably take them quite a long time to get that one million barrels per day off the ground.

You mentioned ethanol, biodiesel and all that. This is not the future. This is not sustainable because in the future, if our predictions are correct, the No. 1 priority will not be transport and all that. The No. 1 priority is going to be food. And for food you will have to have top priority for fertiliser and insecticides and whatever you need to produce food only. So ethanol is a very,

very wasteful system. And again, however much you want to make some ethanol, it will still be a drop of water in the ocean. Just let me tell you that for every litre of ethanol you will need between three and four litres of water to produce it. The best way to go for these types of fuel, and certainly the most efficient way, is sugarcane. That is what the Brazilians are doing today. With sugarcane you need one square kilometre of sugarcane to produce 3,800 barrels of ethanol per year. It is not very easy and it is very inefficient.

So I cannot see any of these alternatives coming up in the future in a big way. Now, certainly solar power will have a small role to play. Today it is still very expensive at between roughly \$US7,000 and \$US10,000 per megawatt. But it could certainly play a role, especially in Australia where you have quite a lot of sun and quite a lot of land to develop that. Wind also, in windy countries, could play a small role. But these roles will amount to two to three, or maybe four, per cent of oil consumption over the next 15 or 20 years, and not more. The orders of magnitude are not at all the same. You will make a small dent with each one of these but not much more than a dent. Replacing crude oil is not that easy.

CHAIR—I would like to follow up on this issue of price. The Australian Bureau of Agricultural and Resource Economics—ABARE—in their submission to us have done predictions based on future oil costs of \$US30 per barrel. How realistic do you think that is?

Dr Samsam Bakhtiari—I believe you will never, ever see \$US30 per barrel again unless you have a bird flu epidemic that wipes out at least millions of people or, as Senator Joyce said, something hits the planet and disrupts all calculations.

Senator JOYCE—That takes out Europe.

Dr Samsam Bakhtiari—I cannot foresee anything below even \$US50 per barrel. That in my opinion would be very bad news, because if it goes back to, say, \$US50 per barrel for some reason and for a short period of time, people will think: ‘Ah! So \$US75 was just a spike and now we are back to the good old days and we can begin consuming again. Let’s go and buy that big SUV that we were looking at.’ You then lose two or three years at least. So \$US30 in my opinion is absolutely impossible. You can quote me on that.

CHAIR—Thank you. My next question relates to the industry. BP when they made a presentation to the committee said that the prices now are basically the same proportionally as the spike in the 1970s. What is your opinion of those comments?

Dr Samsam Bakhtiari—If you take into account inflation, it is the roughly same—it was \$US75 to \$US80 in those days. But those were spikes. Today it is a totally different problem. Today it is a transition into the unknown; then it was known. I am now personally of the opinion that if they had continued with the spikes we would have been much better off today. But they did not. After the two oil price shocks of 1973 and 1979 you had two price counter shocks in 1987 and 1998, when it dropped below \$US10 per barrel. That was very bad news, because then demand started going up again. If all these reserves had been better controlled, maybe the transition would have been much easier. Just to remind you, in 1950, which is not that long ago, global consumption was only 10 million barrels per day. That was very easily controllable with the reserves we had. What is not easily controllable is the 81 million barrels per day that we have today.

CHAIR—I want to go back to the price per barrel. What is your understanding of what IEA is saying is the standard price per barrel?

Dr Samsam Bakhtiari—In the world or in the Middle East?

CHAIR—In the world.

Dr Samsam Bakhtiari—It is very difficult to reply to that question because you have many costs per barrel, depending on whether they are onshore or offshore and whether those offshore are in shallow waters, deep waters or ultra deep waters. To make an average over all that is very difficult. I could not answer you. I can tell you that it is not \$75 per barrel; it is certainly lower than that.

Proceedings suspended from 10.20 am to 10.34 am

Senator MILNE—In your opening presentation, you said that you thought that in 2006 we had begun transition 1, and that it would be a relatively gentle stage, and then we would go to extreme discomfort, presumably in transition 2. Can you outline to me the time frames you see for each of the transition stages, and how they will proceed? What will trigger moving from transition 1 to transition 2? When do you expect the real crisis to hit in that transitional phase? You mentioned it, and I would appreciate more detail on it.

Dr Samsam Bakhtiari—Certainly. From now on, from 2006 to 2020, making predictions is an extremely difficult process, because we do not know exactly what to expect of these transition periods. But I have decided for the time being to split the next 14 years into four transition periods, which I call transition 1, 2, 3 and 4. Every transition period has a steeper gradient and I do not know exactly how long each of these will take, because it depends on many factors. Nevertheless, I envisage now that transition 1 should take between three, four or five years, but I would have to revise this every three to four months.

Now I will try to explain to you when I predict will be the end of transition 1 by drawing you a model on the whiteboard. We are here in 2006, which is, according to my model, the first year of transition 1. And we want to go all the way to the end of transition 1. Here, in the world of oil, we have the following: today, we have a demand for oil which comes from all of the countries and the regions on earth. The demand is about 81 million barrels per day. What happens to this demand is that it does trigger a supply. This supply comes from two entities. The first entity is non-OPEC and the second entity is the 11 OPEC countries. The OPEC countries are the marginal producer—that is, whatever non-OPEC produces is subtracted from the demand, and it leaves what is required from the OPEC countries to produce to make up the rest of the demand.

This is the system today. It is a very simple system. It has been in place since 1960, when they created OPEC. In my opinion, the international oil industry created the entity of OPEC for this very simple reason: to have a marginal producer. So far it has worked very well. But today OPEC is not playing its role, because it is producing oil out, which is not a good thing.

I will open a parenthesis here about the oil industry and the oilfields. There is nothing worse for an oilfield than to be pushed. I believe that is what is happening to oilfields like Ghawar and Cantarell. They have been pushed. A better example is the Samotlor oilfield of Russia, which

was a marvellous oilfield that the Soviets in the 1980s, when they badly needed money to have a system that would be a rival to the American Star Wars, destroyed, in my opinion. It was an extraordinary oilfield which could produce three million barrels a day. Today it is only producing 300,000 barrels a day. If they had managed that oilfield better, I think they would have had a much higher return. Pushing an oilfield is not very good for it. Letting an oilfield rest is the best thing you can do for it. The Iraqis' oilfields had a marvellous time during the 1990s because they rested for a long time. I would be glad if such a thing could happen to the Iranian supergiants—if they could rest for some time. I think it would not be bad.

Coming back after this parenthesis to this system, between the beginning and the end of T1, you will have the two major scales tilting. At the end of T1 you will have a supply, and this supply is going to dictate the demand. Here you will have entities which will have the marginal demand. So it will be a totally different system form what we had at the beginning. It is this tilting of the scale that will in my opinion determine the end of T1. We have just begun shifting from one to the other.

In the time frame of T1, you might have some volatility in that it will start shifting to one side and then shifting back again to the demand side and going back and forth. So one has to be very careful. But in the end it will be the total shift that will in my opinion make the end of T1 clearer. About T2, T3 and T4, it is still very early. I am working on the next transition, but first we have to get this transition right.

One thing I might add about T1 is that I see not only that business as usual is not in the new rules but also that mega projects are not to be begun, because mega projects are long-term projects that take 10, 20, maybe 25 years. Because we do not know exactly where we are going at this stage, it is very dangerous to begin mega projects. But people are still doing this. The Europeans have begun a freight train line from Barcelona to Kiev, which is roughly 2,600 kilometres. The idea of having freight trains is a very good idea, but it is a bit late now. If you have rails you might make the service a bit better, but you should not construct it from scratch because it will take 20 years and cost at least €20 billion. I do not think that such a project will ever be finished because the high oil prices will trigger rises in prices for all other commodities. You already see that steel is way above the usual prices. Copper has hit between \$7,000 and \$8,000, and it will go much higher than that. Nickel is \$22,000. I think \$22,000 is very cheap today; it will go much higher. All these commodities and all these metals will go very much higher, because it is the crude oil price which dictates the prices. Sugar is going up, orange juice is going up—everything is going up—because the price of crude oil is going up. It is the price of crude oil which more or less dictates all the other price hikes. In my opinion, you will have a correlation between all the price hikes in the future, and you can already see the first signs now.

Senator HUTCHINS—What do you see in transition phases 2, 3 and 4? Do you see any specific dates?

Dr Samsam Bakhtiari—No, not now, not yet. The gradients will get steeper, so the effects and the impacts will be greater. T1 is very benign; the gradient is very slow and you almost do not notice it. We will go from, maybe, 81 to 79½ over the next few years; it is not difficult. But T2 will be much more difficult—it is already—because it will start dropping considerably; then you will notice the drops every year, probably, and then it will get worse and worse. It is a process, fortunately, where the introduction is easier than the following phases. But it is still very

early to start predicting what T2 will do. Firstly, we have to see what T1 is going to do, because already, in many aspects, T1 is difficult to predict, with all the events that could take place in the next three to four years.

Senator HUTCHINS—But you yourself have made a prediction that you do not see that the rail link between Barcelona and Kiev will be, to use my words, economically sustainable.

Dr Samsam Bakhtiari—No.

Senator HUTCHINS—What should governments do if you say that supply will determine demand?

Dr Samsam Bakhtiari—I think that every society, every city and every government should do a certain number of things—many things; 1,001 things. There are not one or two solutions. There is no panacea. There is no silver bullet that you can just shoot to get rid of this. You have to start as early as possible and think about this type of future. I do not think the Europeans are ever going to make it. I do not think that Airbus A380 is a valuable aeroplane. It is a marvellous aeroplane, but it is arriving at the wrong time. They should have built it 20 years ago—and it would have been marvellous—when we were in the ascending curve of petroleum, not in the descending one, and not now that we have entered T1. I told them five years ago but naturally they did not want to listen at all, so they carried on. Now they have the problems and they are paying the penalties to all these companies already. It is still not commercial. I do not know why it will be commercial. I do not see a very bright future for that.

There is not too much innovation now; there is certainly a returning to commodities and exploration. I know of a company in Australia that invested very heavily and has just found a brand new copper mine. That is fabulous, because the copper they are going to extract in a few years is going to make enormous profits. If you put money into oil exploration—whether onshore or offshore—almost whatever you find is going to make money. These are types of investment. Or you could invest in agriculture but not ethanol or biodiesel.

Senator HUTCHINS—Yes, I was going to ask you about that—and I do not know if that is the point we are at, Madam Chair. You seem to be dismissive of alternative fuels.

Dr Samsam Bakhtiari—Yes. I do not think it is a very good idea. You can always try it on a small scale, but I think that energy wise it does not make much sense. Now we are in transition 1, I try to look at things from an energy point of view, not from an economic point of view. We do not know these days exactly what economics are. You have to think energetically and about the things you really need. For example, Western Australia—sorry, I am always coming back—

CHAIR—That suits three of us, so that's fine!

Senator WEBBER—We're okay with that!

Senator JOYCE—They are seceding!

Dr Samsam Bakhtiari—Really, I think Western Australia is doing all the right things. They were kind enough to have been the very first to invite me, and I am very happy for them.

Western Australia does not have enough water and the water table is falling. It is a very big problem. They are putting in two desalination plants. They are obliged to put in two desalination plants. The desalination plant will need fuel—it will need gas—to run. In my opinion, they have no alternative so they are obliged to do this. When you are forced then you have to do it. I see that one problem in the future in Australia, much more important than the oil problem, is going to be water.

Your precipitation is going lower and lower. I heard that in June you had an average of only 14 millimetres of rain instead of the normal 108 millimetres. When I crossed from Perth to Sydney in the plane, over 3½ hours, what I saw was very dry. I think one of the problems is water. When you consider that every litre of ethanol or biodiesel will take between three and four litres of water then you start having a problem on the water side and on the energy side. I think you have to reconsider the economics of all of that in the near future.

Senator WEBBER—On that optimistic note—being a Western Australian—what do you consider the prospects for the future of gas as an alternative?

Dr Samsam Bakhtiari—Gas is the big issue, because we are not only having peak oil but, according to my prediction, in 2008 or 2009 we are also going to have global peak gas. Peak gas and peak oil are two totally different things because oil is a very special commodity. Gas is not the same because you cannot just put it in a ship. You either have to consume it locally, pipe it to some other country or put it in a LNG tanker. You have only those three alternatives.

Fortunately, Australia has an enormous amount of gas, and I believe this is going to become very handy because the peak for gas will be between 100 and 105 TCF global production in 2008-09. Because of this peak in gas, you will have enormous problems all over the world but firstly in the US. The price of gas is going to go sky high. Today, it is incredibly cheap. Gas in the US has a threshold price today of between \$7 and \$8 per million BTU. This is going to go much higher. Every year you will have to add \$2 to \$3 to that price. The US price is going to affect all the other prices, and it has already begun in South-East Asia. All that will be linked through the LNG price that you will have, and the price of LNG is going to go very high.

I think that Russia does not have much gas anymore, although it is the largest producer in the world. I am very worried for the Europeans, and probably this winter you will see that the Europeans are going to have an enormous number of problems. If it is a harsh winter in Europe, you might have thousands of people dying. You had hundreds last year, but that was only the beginning. If this winter is harsh, you will have thousands dying because the Russians simply do not have enough gas to provide to Europe.

The Americans do not have enough gas. The Americans had the incredible chance to have the mildest winter last year in 100 years. If that had not happened, I do not know where the price of gas would be today. That was very lucky, and they now have enough reserves for the coming winter because all the storage depots are almost full. That is a positive point, but the Europeans do not have that kind of chance, so you will have lots of problems. The price of LNG is going to go sky high because everybody will want LNG—in America, Mexico and Canada, which are in full decline; in all the South-East Asian countries and especially in China; and even in Europe. If the Europeans cannot get the Russian gas, their only solution will be to get LNG from wherever they can.

I can tell you that, with gas prices in the US being around \$6 per barrel, you have LNG spot sales today of \$12 per barrel—and we are in a normal situation. So, wait for the panic and you will have prices of \$25 or \$30 per barrel, and maybe much more than that. For one week in March this year the British did not have enough gas and the price of gas shot up to \$258 per barrel oil equivalent. At first I thought I had made a mistake of one decimal place, but then I realised it was not \$25.8—it was \$258. For one week they were paying that price for their gas. And we are in a very normal situation now; we are not at peak yet. So you can imagine how it is going to be when it is at peak, with the panic in all those countries because of the winter months. Just wait and see how it develops this winter in Europe.

Senator WEBBER—That is pretty dark.

Senator JOYCE—Going back to the biorenewable fuels issue, ethanol is being used in Brazil, and the terminal gate price of ethanol in Australia is around 80c a litre, so the reason that it is not being utilised is that the oil companies refuse to take it up. I have heard of a lot of what is going wrong but what we are really looking for is the solution; we are looking for the way out. Or is the world as we know it going to come to an end and this is just a prologue to the end? We need to find the solution.

I do not say ethanol is a panacea but it is certainly a mitigating circumstance. We need to take it up. It could run conjointly with a whole range of issues. I have two questions. Firstly, if ethanol is not the answer, can you explain why it is being used so prolifically in places like Brazil, and why the United States, Europe and Asia are all taking it on board as a component of trying to deal with the impending oil crisis—or the oil crisis that is already here, apparently? Secondly, what is your solution? What is the noble horizon we need to head towards in order to maintain our current standards of living and economies?

Dr Samsam Bakhtiari—Allow me to take those questions one by one. First I will address the alternatives. Brazil can use ethanol as a fuel because of its enormous amount of sugarcane. There is also the idea of self-sufficiency. People like the Brazilians and the South Africans always have a complex about self-sufficiency. If the South Africans have gone after GTL and have pursued coal to liquids, it is because they want to be self-sufficient. It was not an economic decision; it was a political decision. I think the Brazilians are in somewhat the same situation. For them, because of the enormous amount of sugarcane they have, it does make some sense, but I really doubt that it makes a lot of sense in terms of energy. And I believe that, come the day there is conflict between producing ethanol or biodiesel and producing food, food is going to win because, first of all, you have to eat.

There is another danger in Brazil. They are destroying the Amazon rainforest at the rate of some 20,000 square kilometres per year and on that land they are planting food crops—in enormous amounts. I think that this will also be part of the future: when the other countries do not have enough food, they will go back to the Brazilians. Brazil has become one of the largest exporters of food in the world, whether it be soya beans, sugar, coffee or beef. It is almost anything. They have the surpluses. The Americans are also trying to get the ethanol. It makes a small dent for the time being, but not a very big one. I think that it is only a question of a few million gallons. I do not know what percentage you have, but it is not very much.

Senator JOYCE—Our percentage is pathetic.

Dr Samsam Bakhtiari—All of the others are trying. I heard there are a few million in Australia, but it will not make a very big difference, so I am not very keen on these types of bio alternatives. As for your second question about what should be done, there are many things. Everyone should study their own situation and see what can be done with the possibilities at hand, and not one thing, not two, but 10, 20 or 50. In my opinion, the first thing is to develop free public transportation, and that applies to everybody. Make it free from now. Even if it does not make very much economic sense now, it will in the future. Certainly, there is absolutely no doubt, as you go into transition 1, that free public transportation has to make sense. That is one of the things.

There are many other things that you can do. Plan; get new ideas from the grassroots. That is what Perth has been trying to do, to congregate 1,200 people from different walks of life in teams of eight, give them each a computer and have all of these ideas go back to the top for the selection of the ones they think are viable and useful. Have teams of elders. You have a fantastic man out there, Mr Brian Fleay. He predicted peak oil in 1995. It is extraordinary what he did. He was maybe the second person, after Dr Campbell, to have done that. And he did it almost from scratch. So people like this could have predicted that in 1995—in 1995 he wrote his book, so he must have predicted it in 1993 or 1994.

Senator JOYCE—Sorry, I have missed something. What is this team of elders?

CHAIR—What he is talking about is dialogue with the city.

Dr Samsam Bakhtiari—Yes, to have these people present their ideas and solutions, and then to build on that through a committee of elders. Or create steering committees through such people, and then get younger people to come in, very bright people, to start setting the priorities, because one day you will have to set priorities for the use of petrol. Have these in place soon, maybe in the next year or two. You will not need them in the next year or two, but have them in place already so that you are prepared. Get prepared for any eventuality. Have a special committee for that now. That is what I can see. I can advise that such things should be done this year or next year so that when or if the crisis really hits, then you have something to fall back on; you have a team that is already prepared and who has thought these problems through.

Thinking about these problems is very important, but there is something else. It is going to be very, very difficult to change the minds, to have the minds set on the new realities. For six generations we have been thinking one way—that is, that petrol is always there, petrol is not too expensive, oil products are not too expensive. We do not think about it. We do not think about fertilisers. We do not think about insecticides. Why? They are not that expensive, so it does not come into the day-to-day consideration. Petrol was always \$1, not that much of a problem. We are used to that. The problem is going to be when it becomes \$3 or \$4 or \$5. Then people will notice. Already at \$1.40, some people are beginning to think about it, so when it becomes higher they have to change their minds, their way of thinking and their way of planning.

Senator JOYCE—But changing the way people think is a very hard task. That is not really a solution; it is nirvana. I want to go back to shale oil. They say there are three trillion barrels of shale oil equivalent in China and two trillion barrels in the United States, and I think we have 440 billion barrels of equivalent shale oil between Proserpine and Gladstone. Surely if the price of oil keeps heading north, this potential oil will begin to be exploited. Can you give me your

impressions? You have gone through gas to liquid and coal to liquid. Do you have any opinions on the shale oil issue?

Dr Samsam Bakhtiari—Yes. There is a lot of shale—many thousands. There is an enormous amount of oil in there, but it is a very messy and difficult industry. In Canada, you have about 1.1 million barrels per day of synthetic crude oil produced, which is being exported mostly to the US, and which makes economic sense, especially at the prices of \$74 to \$75 per barrel. I think it costs them around \$30 to \$40 per barrel, so they are making some money. But I think it is limited, and I think the limits to that industry are, according to my prediction, roughly three million barrels per day. I cannot see Canada or the US together making more than three million barrels per day at the 2020 or 2025 horizon, investing enormous amounts of money. The shale oil industry is like the oil industry. You go to the best places first, naturally. And then, as you go along, it gets more difficult, it gets more expensive and it gets messier. I think you need roughly 2,000 tonnes of shale oil to make one barrel of synthetic crude oil. You can imagine, on an enormous scale, what that involves for the land and for everywhere else.

Already, at the level of 1.1 million barrels a day, the Canadian rivers are becoming so polluted as to have triggered alarm bells over Canada; the fish are dying and it will soon be impossible to clean up all the rivers. There are side problems for that as well. If one day we reach three million barrels per day I do not know what the situation will be there, but I do not think we can go further than three million; that is it.

There is also the heavy oil in Venezuela. Today there are 600,000 barrels of capacity. I do not think the Venezuelans can go beyond twice that amount, and with the government they have now they are stuck with their 600,000. I do not think anybody will be willing to invest in such expensive and difficult processes of exploitation. But even if the conditions were right I think they can go to 1.2. I really cannot see them going much further than that. So, yes, there is the potential but you have to transform the potential into production.

I forgot to tell you about the tar sands and the shale oil. All the heat you need for that comes from natural gas. You are spending 1½ million BTUs for every barrel you are going to produce; that makes a lot of gas. What the Americans are beginning to tell the Canadians is, ‘We’d rather have this gas than anything else.’ So you have other problems that arise in this exploitation—at most, three million for tar sands and shale and one million for the Orinoco heavy oil. That makes a total of four million over the next 20 or 25 years. It will not change a thing for people—it is a drop of water—in the 81 we are facing now.

Senator JOYCE—Everyone knows about the price of fuel in Venezuela—I think you can buy a litre of petrol for 6c or 7c or something; it is still cheap—and we know what the price of petrol is on the streets in Australia. The organisations that control basically from the wellhead to the bowser are predominantly the same four major oil companies. We know that the price of Chevron has gone through the roof and that the price of Caltex domestically has gone through the roof, so they are making a far greater return on their asset. Can you say what you believe is their interest in the future—where oil prices are going? Can you also give some sort of indication about what sort of control the major oil companies have through the whole process of oil production as it stands today, from the oilwell to the bowsers? What form of control do they have over the total production of that product? What sorts of profits do you think they would intend to make in the future?

Dr Samsam Bakhtiari—I think that oil companies are like all corporations: they want to make profits, and they want to make the highest return for their shareholders. In 2005, they set new records in every country for profits. I think that in 2006 they will have far higher returns and record profits of, maybe, \$50 billion for Exxon or something like that. It will be roughly the same, maybe \$40 billion, for BP and a bit less, maybe, for Shell. Their shares will be re-evaluated all the time as the price of oil goes up—and, as I told you, it can only go up.

But they control part of the system. You have many players. You have the national oil companies now, like Saudi Aramco, the National Iranian Oil Company and the national oil companies of Kuwait or Qatar. The oil companies control part of the system and it seems that their share of oil production is beginning to decline as well. It is still quite substantial, but it is also beginning to decline. Naturally, I think they are in it for the profits, and they control wherever they are from the wellhead all the way down to the retail. I think they get profit centres all along the way, and they are making enormous profits.

Senator JOYCE—The issue I am getting at is a transfer pricing issue. By the time the fuel gets to Australia, the same organisation controlled entity has made its profit offshore. It is only the final stage. The purpose of Australia is just to move the product, not to make the profit. That would be a fair statement, wouldn't it?

Dr Samsam Bakhtiari—Sorry, Senator?

Senator JOYCE—Everyone talks about the terminal gate price of fuel as if that is the true price. It is a transfer pricing issue. By the time the fuel arrives in Australia, the same controlled entity has made the profit overseas. The purpose of Australia is to move the final product of petrol—not to make profit but to move product—because the profit has been made before the product actually arrives in Australia. The purpose of the Australian retail market is to move product, not to make profit. Therefore, it would be the intent of the oil industry to keep exclusively their product out there in the market and not encourage an alternative market apart from their product, which is oil.

Dr Samsam Bakhtiari—Yes. Certainly that is one of the goals of any corporation which makes a product: not to have rivals in the field and to try somehow to destroy or not let them in. Certainly you have this factor. I do not think that any oil company would be very happy to see an enormous boom in biodiesels, unless they could control it, which they cannot. So it will be certainly in their interest to see alternatives. Some oil companies want to get into solar and into other types of alternatives, but I do not think it is their job or their way of doing things. Somebody is going to do it much better than that.

Senator STERLE—I have two questions. If we were to take all the alternatives around the world—solar, hydro, gas, CTL, GTL and all those—how far off subsidising our thirst for oil would that be? Could we supply the world's demands? Nowhere near it?

Dr Samsam Bakhtiari—Very, very little. In any scenario and in any field for the next, say, 20 years: very, very little. It is a drop of water. If you make the calculation of increasing even by 100 per cent every single year, it is still a drop of water in solar, in biodiesel, in anything.

Senator STERLE—So there really is no alternative at this stage?

Dr Samsam Bakhtiari—No.

Senator STERLE—You spoke about Western Australia and the free public transport. I think it is going to send some ripples, but we really are faced in the world today—and I can only talk of Australia and my home state in particular—with some very hard decisions to be made.

Dr Samsam Bakhtiari—Yes.

Senator STERLE—It will bring in a lot of side issues of employment and revenue for governments—all sorts of things will pop up. If we are not fair dinkum in what we are leaving for the next generation—for our environment, our economies, our communities and our world—we really are in serious trouble. I pick up on that earlier comment you made about public transport and integrating public transport in trains and buses and whatever else there might be. It is not nirvana; it is a reality that we really are confronted with and we have to face.

Dr Samsam Bakhtiari—Yes. Provided that our models and our predictions are correct, this is exactly what you are going to face very soon. I do not want to be more negative, but I have started looking into T2, T3 and T4, and, my God, there are some things I started seeing down there that really send shudders up my spine. But I will spare you that today. Maybe that is for another time.

Senator STERLE—We feel bad enough as it is.

Dr Samsam Bakhtiari—But I entirely agree with your statement. It should be done if only to get prepared so that if things go the wrong way you have something to fall back on—that you have some organisation which you have already set up. As the crisis develops you develop this organisation and make it ever bigger and more powerful to take care of the crisis. There are companies which are employing 300,000 people in 140 countries who do not know a thing about peak oil. I do not know how they are going to react tomorrow. The Europeans do not want to believe this reality. Next year they are going to start—they have already started—dying from the cold. According to my statistics, at least 900 people in eastern European countries froze to death last year. This year it is going to be double or triple that amount. This is the reality already. When there is a real crisis, how are they going to react?

The most important point is that governments do not to cause people to panic. The worst reaction to this type of crisis will be panic. If governments are not prepared there will be panic. The more prepared governments and institutions are, the less panic you will have. Panics are very costly. I entirely agree with what you just said. There is still time to get prepared. We are not that much down the T1 slope. It will be a very slow development, so there is time.

Senator STERLE—Apart from what you saw in Perth with the free public transport around the CBD, are any other countries taking that lead?

Dr Samsam Bakhtiari—No, nobody. There might be a city or two, but I have not heard of any that have taken this drastic step already, and I have not seen such things at all. I can tell you that the future is to rails because rails are the most fuel efficient system. Would you like to see some figures on that? I can illustrate this for you on the whiteboard. This will give you an order of magnitude. At tonne kilometres per litre of fuel, aeroplanes are between two and three, cars

are between 10 and 22, trucks are between 65 and 85 and trains are around 320. So on these very simple figures, I think you can see that the future is to trains, but not trains that you build now; trains that you had and that you are going to spend money on. I have heard that Sydney in 2006 is planning to spend half its budget on roads and other infrastructures and half on public transportation—it seems to be roughly fifty-fifty. I think that as soon as you change this percentage towards rail and public, fuel efficiency might begin to make some sense. I think you can see the future here.

CHAIR—It is not planes.

Dr Samsam Bakhtiari—Aeroplanes will be the first casualty in the system. They are already making losses. I do not know how they can carry on because the jet fuel is directly proportional to the increases in crude oil. It is not like petrol. Petrol is very much cheaper because you have hidden subsidies and you have the taxes naturally.

Senator MILNE—I have a strategic question about Iran's contribution to global oil supply as well as to gas. What percentage of global reserves does Iran hold? If Iran were to stop supplying overnight for a geopolitical reason, what impact would that have on 81 million barrels used per day? In other words, T1 is assuming everything goes along smoothly. Let us assume there is a geopolitical crisis and Iran decides to stop supplying into that 81 million barrels a day. What impact would that have?

Dr Samsam Bakhtiari—At present I think that Iran is supplying roughly two million barrels of oil for exports. In the case of some geopolitical problem, you would have to take the two million out of the 81 million. That in itself would not be very harsh. Why? Because major consuming countries have their strategic petroleum reserves. They could start taking it out of their reserves. The latest data on the US SPR is that they have 688 million barrels in their reserves. I believe that the Japanese must have something around 120 million barrels. The Europeans, all together, have roughly the same amount as the Japanese. The Chinese are trying to build up a strategic reserve of roughly 40 million barrels, but they have not started yet. Maybe they hope for the price of crude oil to come a bit lower before they start. They could do that.

What would be impacting heavily on the price is the psychological impact of any geopolitical happening, whether in the Persian Gulf or in South-East Asia. Because the leeway in T1 is extremely small—as I have tried to mention to you—the slightest impact geopolitically will have enormous consequences. If you had in Saudi Arabia, for example, or anywhere else, some two million to three million barrels of spare capacity—that you usually had before—then people would not be so worried about this geopolitical impact. But you do not have spare capacity anymore. I do not believe the Saudis have any spare capacity today, although they say they have a million or 1½ million barrels. They have no spare capacity. Nobody, in my opinion—neither OPEC, nor non-OPEC, nor the Russians, nor the Saudis—has any spare capacity. It would have an enormous impact. The price could go anywhere.

I will give you just one example of what we in NOIC did in 1975 after the first price shock, when the price went from roughly \$2 per barrel to \$11 per barrel. To find out what the real price was NOIC set up an auction, saying, 'We have a few barrels and we are going to auction these barrels, so whoever is interested should give us a bid.' Through the bids, we found out what the

real price was. Some bids were up to \$41. There were people who were willing, at \$11 per barrel, to pay \$41.

Then you have the problem that the national oil companies today in the Middle East and in OPEC are not what they were in the past. That is another problem. If there is a disruption, as long as the system is working, you have little problem. It just goes on and on. You see that in cases of earthquake or catastrophe. Once there is a catastrophe, it is very difficult to put it back to the way it was before. You see it taking 10, 12 or 15 years to bring it back. If you have geopolitical problems in the Middle East, it will be very difficult after the crisis has been fortunately somehow solved to put the system back to where it was before. For all these reasons—and because of the herd instinct and the panic that might follow—you could easily have prices doubling overnight. If somebody were smart enough to have an auction, you would see prices that even I could not imagine today.

Senator MILNE—You have just talked about the strategic ramifications of even two million barrels being taken out. Australia, as you know, has just signed up to long-term gas exports to China at a fixed price. Given what you have just said, that looks like an increasingly bad deal.

Dr Samsam Bakhtiari—At a fixed price?

Senator MILNE—That is what I said. Yes, I can see that you are not impressed by the brilliance of that and neither are we, but nevertheless the Prime Minister and Premier Wen both opened the terminal in China recently, celebrating Australia selling bulk gas at a fixed price—to the horror of much of our country. But there are some people who are saying that given what we are having with peak oil and approaching peak gas and given Australia's wealth in gas and the importance of gas as a transition fuel Australia ought not be exporting gas, that we should be keeping gas as a transition fuel as transition 1, if you like, goes to the more difficult transitions 2, 3 and 4. What is your view about that?

Dr Samsam Bakhtiari—I cannot comment on political decision-taking by national politicians but I believe that gas is a very strategic commodity today and the more you have the better it will be. You will certainly see in the next few years, even during transition 1, cases of what they call in international law 'force majeure' and when you are confronted with force majeure then there are many decisions that you can take. Natural gas is certainly a strategic commodity today and commodities are becoming very strategic. Commodities like coal and copper, which do not seem to be very strategic, are very strategic. Uranium, for example, is already costing \$47 or \$48, which is still very cheap. Uranium was \$10 not so long ago when nobody was thinking about it, but I can see uranium going way over \$100 a pound. All other commodities are important, but natural gas is a very strong commodity. You can always use it domestically in the long term and I can see that happening easily for gas.

CHAIR—What would you recommend that we invest in? As a committee we need to make recommendations against our terms of reference, so what would you suggest we recommend should be the focus of government to deal with this issue?

Dr Samsam Bakhtiari—It is a very difficult question but I would have one major recommendation, and Senator Siewert touched upon it: to create some kind of national steering committee of experts in the field, dependent upon this committee maybe, to study as fast as

possible all these questions, then under the aegis of this steering committee maybe create a very small executive committee to study all that and the priorities so that you have something that is working. That is the only thing that I could recommend now—to study.

CHAIR—Where do ships fit in your chart? You have aeroplanes, cars, truck and trains. Where does sea transport fit in?

Dr Samsam Bakhtiari—Ships are way down. Shipping is marvellous, in terms of energy efficiency, whether it be cargo or container ships. That is marvellous. Shipping is very good.

CHAIR—One of the scenarios into the future is likely to be that there will be less air travel and more ship transport and cargo.

Dr Samsam Bakhtiari—Yes, certainly. Aeroplanes in transition 1 are at risk. They are already at risk today and they are going to be much more at risk than that. Air travel will have to be more and more reduced in the future and it is going to be more and more expensive.

Senator JOYCE—We might have to secede.

Senator WEBBER—You would not be the first. And I am not walking or catching the train from Western Australia.

Dr Samsam Bakhtiari—Shipping will come back because the factor of time is not going to be as important as the factor of energy efficiency.

CHAIR—If I understand you correctly, you are saying that we should be investing now as a matter of priority in public transport.

Dr Samsam Bakhtiari—Certainly, yes. Right now. As soon as possible. Start tomorrow on public transport. It is better than starting the day after tomorrow. You also have the problem that, at some stage, you will not be able to invest that easily. The further we go down the line, investment gets more difficult. People who think they will undertake projects in 10 years time do not realise the problems of making these projects. I will give you two examples. The Europeans have woken up to this lately. They now want to bring gas from the Persian Gulf to Europe, but that is a 20-year project and it will cost at least \$25 billion. It is not feasible today. They are dreaming. And even if they think of putting a gas pipeline from Iran to Pakistan to India, they are also dreaming. You cannot do that today. It is too late. You could have done that as long as you were on the curve, but when you are on the top the projects have to be smaller and smaller and you have to start them as soon as possible, and not get caught up by the events. It is a different way to do things.

CHAIR—I think we are finished. Thank you for giving us so much of your time.

Dr Samsam Bakhtiari—Thank you for your attention, Madam Chair, and thank you senators. I hope it was interesting.

[11.54 am]

KILSBY, Mr David John Edmund, Convenor, ASPO-Australia Working Group on Urban Planning and Transport

CHAIR—Welcome, Mr Kilsby. I apologise for delaying you and for shortening your time so that we can make up time. We will also take some time from our next witness and I apologise for that as well. You were here this morning to hear my introductory blurb, so I can save a couple of minutes by not repeating it. I invite you to make an opening statement and then we will go to questions.

Mr Kilsby—Thank you very much, Madam Chair. I will start by mentioning where the submission that we put in on urban transport and planning came from. ASPO is an international network of scientists that was started off by Dr Campbell, whom you have heard about this morning.

CHAIR—We have heard from a number of the ASPO subcommittees so we are pretty aware of the organisation.

Mr Kilsby—In fact ASPO-Australia is one of 20 international organisations and a number of working groups, of which urban and transport planning is the one that I am involved in. I think you have been rather inundated with submissions from all the working groups, or at least all the ones that were in place at the time of the deadline for submissions. There have been some more since then.

I watched the *Four Corners* program last night, and one of the things that struck me about it was the difference between the scientific approach that ASPO tries to follow and the economic approach that was exemplified by Dr Fisher from ABARE. ASPO has shown that in fact a random number generator would be a better forecaster of the oil price than the ABARE forecasts. If I had to put my money on either the laws of physics or the laws of economics, the laws of physics would be the ones that I would choose.

My own background is in transport engineering and urban planning. I would like to highlight some submissions that the urban planning and transport group made to you. There are a couple of points on transport and a couple of points on urban planning that I would particularly like to draw to your attention. On transport the key points that we wanted to make are that while the oil position is a national issue it is in the cities where there are more possibilities of limiting or moderating the demand for oil than in rural and regional areas. Urban transport planning is an issue that the Commonwealth government ought to take rather more interest in it than it has to date, if only to make sure that as much oil as possible is available in rural and regional areas.

Another key point on transport, as you have just heard, is that the most vulnerable transport mode will be aviation because what alternatives to oil are there for fuel in planes? There is nothing on the horizon there and, by extension, the parts of the economy that rely on a thriving aviation sector—particularly the tourism industry—are also very vulnerable. Road transport is quite vulnerable, although perhaps not to the same extent as aviation, because road vehicles

require a portable, energy dense fuel. That is why petrol and diesel are the fuels of choice. It would take decades to establish the infrastructure and the vehicle fleet to take advantage of any alternatives. And that is decades, as you have heard, that we have not got and alternatives that we have not really got either.

The other two main modes are rail transport and sea transport. They are possibly the least vulnerable because a railway locomotive is essentially a rolling power station on rails and a ship is a floating power station. In both cases there is a wider choice of energy sources available, mainly because the power plants are larger than for road vehicles or for aircraft.

On urban planning there are two points we want to highlight. One is that there are many people who have no option but to use their cars to get around. These people tend to live in the outer areas of our cities. The two gentlemen from Griffith University, who will follow me, I think, will make this abundantly clear. It seems to me that the provision of alternatives in such areas should be a priority for government. By that I mean the development of adequate public transport networks, of bicycle networks and of pedestrian networks. The second point on urban planning is that if we are faced with a physical decline of oil in the future—not just higher prices—then it is going to be necessary to establish clear priorities for the use of a more limited amount of oil. Put crudely, as you heard, this could involve a choice between feeding people and letting them drive to work. We will not have the energy resources to make drastic changes when it becomes evident that we have a problem. The sooner planning for a decline starts, the better. We do not have time on our side, as I think Dr Bakhtiari amply showed.

On the committee's specific terms of reference, going to oil availability, I would say that there will be less oil available in future and it will cost more. ASPO do not claim to have a crystal ball or that the future will unfold the way we expect it to, but we do say that this is a significant risk to urban transport and, hence, to the national economy. There are well-established risk management techniques which we think should be used. The risk of there being less oil is at least as significant as the risk of terrorist attack, for instance. There are no alternative fuels in sight that will completely replace oil for transport. There will be many flow-on economic and social impacts. I think the greatest community anger will arise from those places where alternatives to cars could have been provided but were not. Those are basically the outer areas of our cities.

Options for reducing fuel demand are mainly urban, possibly not technological development, but all the others—that is, the development of public transport and other policies that I would call business as usual, such as demand management techniques and economic measures—even though we would probably have to apply them in a different way to business as usual outcomes, would have effects in the cities rather than in the rural and regional areas. But, given that there is only a finite amount of oil to go around, applying them in the cities would ensure that there is in the areas where alternatives cannot be provided more oil to go around than there would otherwise be. I think that is as much as I wanted to say.

Senator HUTCHINS—Mr Kilsby, I meant to ask Dr Bakhtiari this, and my colleagues may have gone through this before. The doomsday predictions of finite fuel have been predicted once before, and it did not happen. Would you like to comment on this? In the seventies it was said that we were heading towards Armageddon in unavailability and that it was going to have the economic, social and inevitably political consequences that you have alluded to. Why is it different now? It did not happen then, so why should we take any more notice of it now?

Mr Kilsby—The situation now is rather different from what it was in the 1970s, because we were then still on the upward part of the curve that you have heard about. We are now very close to the top of it. We do not claim to have a crystal ball. It is entirely possible that we are wrong and that the people who have the attitude that you outlined are correct. But the best analysis that we can come up with shows that the production level cannot keep pace with the growth in demand. The situation now is one of a physical oil shortage rather than a politically inspired shortage, which is what happened in the 1970s.

Senator HUTCHINS—I suppose it is just recollection, but weren't the 1970s more concerned with an inevitable shortage in the future? I remember reading something about the Club of Rome and all these bodies preparing for a difficulty that did not happen.

Mr Kilsby—I was living in the Netherlands when the first oil shock happened in 1973, I think. It was not that the OPEC countries had anything in particular against the Dutch, except that the port of Rotterdam was the place where most oil was imported for Europe. Sanctions were applied against the Dutch and against the United States. From the United States we had reports of people shooting each other in queues at petrol stations while trying to get hold of this scarce resource. But the Netherlands scarcely missed a beat because they had an alternative in place. The alternative was mainly bicycle networks, which are very good in Holland. The Dutch enjoyed it so much that when the oil started flowing again they considered adopting the 'carless Sunday' as a feature of national life rather than an emergency measure, which was why it was introduced. That taught me that the more prepared you are and the more alternatives there are in place the better off you are likely to be when such a catastrophe occurs.

Senator MILNE—Thank you for your submission. It certainly flows on from a lot of other submissions we have had from various local governments on the whole issue of a rapid transition to public transport. One of the big issues for Australian cities is that the most vulnerable live the greater distance from the centre of the city and that there has been a lack of planning for that. It has been put forward that maybe we should have a COAG meeting and get the Commonwealth and the states involved in considerable investment in Australian cities. Has ASPO talked to state transport ministers around the country about elevating city transport to the COAG status?

Mr Kilsby—ASPO would certainly advocate that, but we have not as yet had access to ministers to talk about it. ASPO has only been on the go since November of last year, and it is one of our aims to do exactly that.

Senator MILNE—My next question relates particularly to the tourism industry and the agricultural sector, both of which are going to be severely adversely impacted upon by rising prices and oil depletion. What about the aviation sector? At the moment air fares do not reflect the real cost of flying anyone anywhere. Have you done any predictive modelling on the point at which that cannot continue?

Mr Kilsby—No, I have not.

Senator MILNE—Do you have any thoughts about impacts on tourism generally? Have you modelled that or looked at that around the country?

Mr Kilsby—I am currently doing some work in Cairns, for instance, in Far North Queensland. I think it would be hard to find an Australian town that is more dependent on the tourism economy and on people arriving by plane.

Senator MILNE—Can you spell that out a bit more? What we heard this morning was that the new generation of huge global aircraft, the A380s, is unlikely to ever be economic because of the fuel costs. When you say that people will not arrive in Australia by air, do you want to expand on your thinking about that?

Mr Kilsby—My thinking is very much governed by what I am currently doing in Cairns. Most fuel in Cairns—because it is a long way from the refinery, which is in Brisbane—has to be imported by ship, and they currently import more oil for the airport than they import petrol jet fuel for the whole of Far North Queensland. It struck me that the airport is really much like a coaling station, in the days when ships used to run on coal. There are no local fuel resources at all. It all has to be refined in Brisbane and brought up to Cairns by ship. If that becomes less possible in future, then a large part of the economy of that city is going to collapse, because it is geared around servicing tourists. The tourists either drive—and it is a long, long way from anywhere else to get up there—or they come in by plane from Asia, because that is one of the first stops that they make.

Senator MILNE—Do you know of any other work, apart from that which you are doing, where tourism hubs that are more remote and dependent on air travel for their viability are looking at these projections? It would be good to have some specific examples of regional economies that are going to be significantly affected in the short term because of aviation fuel prices and availability.

Mr Kilsby—I am not aware that the aviation industry is even contemplating a shortage of fuel at the moment.

Senator JOYCE—You said at the start that you also do not believe that biorenewable alternatives are a panacea. I do not think that has been suggested. The suggestion is it is a mitigating issue; it is something to alleviate a problem, not fix it outright.

Mr Kilsby—That is right.

Senator JOYCE—In the context of it being a mitigating issue, do you believe it is a better alternative to doing nothing at all, which is currently what is happening? Or do you want to do nothing at all?

Mr Kilsby—I would see that as a way of sustaining the unsustainable for a little bit longer than it might otherwise be. On the one hand, it would postpone the crisis of oil for a little bit. On the other hand, it is a crisis we have to have sooner or later.

Senator JOYCE—What if we do not deal with the fact that the internal combustion engine is a major driver in the economy and, therefore, we need fuel that is compatible to that internal combustion engine? What if we do not create some sort of mitigating process to get us to some new horizon? What are your views about that? Do we just park all our cars in the garage, walk away and start putting crops in for horses again?

Mr Kilsby—That is going to be quite difficult to do. I think the longevity of the car fleet is one of the problems we have. It will probably take 20 years to turn over. The car industry is putting a lot of thought into what it can sell us in years to come, obviously. One of the big hopes of the car and energy industries is that we will be able to switch from an oil based economy to a hydrogen economy, which is one of the things we have heard about. But it will probably take decades before a commercially available hydrogen fuel cell car becomes available, and I do not think that is time that we have. Your question was about—

Senator JOYCE—The transition from internal combustion engines—we use biorenewables such as biodiesel or ethanol because they work on the same fundamental premise of an internal combustion engine, and they are easily overlaid into the design of the economy that is currently centred on an internal combustion engine. With other alternatives, they ask for a holistic change in the fundamentals of the capital that drives the economy. That is unlikely to happen overnight, so you are going to have some transition and some process to mitigate that issue. I know that the tractor that just put in a wheat crop for me is unlikely to be driven by photovoltaic cells; it is going to be driven by an internal combustion engine. The trucks that Senator Sterle drives up and down the highway are unlikely to be driven by wind power; they are going to be driven by an internal combustion engine. I am asking you about your vision for that transition period, which I believe strongly needs such things as biorenewable components to lessen the blow. Where we might end up in 30 years time is another issue, but we do not have to worry about 30 years time, we have to worry about 10 and five years time.

Mr Kilsby—The growth of corn and so on that you need to produce the ethanol and biodiesel requires energy of its own, and it requires land as well. I suspect that the conflict between the land and the energy that you need to supply the additives to petrol and the need for alternative uses of those lands and energy will be something that you have to consider.

Senator WEBBER—I want to pursue what Senator Joyce was talking about. All of our state economies are very different. I am from Western Australia, and we have the same issue of getting fuel from Perth into the north-west, only then the fuel is used to exploit our resource sector. I am not sure that biodiesels or anything else is an alternative for large haul packs in iron ore mines and what have you. And we do not have a large tourism sector there; it is purely a resource sector. I do not know of many tourists who go to Port Hedland. So that is an issue: all state economies are different, as is what confronts them.

You said in your opening remarks that you felt the need for more Commonwealth government interest in the development of urban transport. In addition to what Senator Milne has highlighted about some form of COAG process, has your organisation given any thought to how you think that can be developed? I know that every time we talk about the Commonwealth government spending more money on any particular part of our state economies, there is usually a fight afterwards and then an ad hoc arrangement over the shared responsibilities of state and federal governments. Obviously we need an overall plan, so do you have any other views about how we can organise that?

Mr Kilsby—It seems to me that climate change presents quite a good model for that. The Australian Greenhouse Office is a national office that tried to collect expertise in one place, and the fuel crisis that we are heading for is probably of similar magnitude. So something like an

Australian fuel office in central government would probably be the way to go as far as we can see.

Senator WEBBER—There is another issue that I want to pursue. We have had a discussion today about the fact that one of the issues we need to look at is increased use of public transport and the incentives we need to ensure people do that. There has been discussion about the free public transport network that we have in the CBD of Perth. There are other discussions about subsidising public transport. What do you think we need to do to make it more attractive? We have discussed this at previous hearings, overdevelopment and maintaining modern infrastructure to make sure it is reliable and that sort of stuff. What do you think? And if it is about subsidising the use of public transport, then who should pay, as it is seen as a state government responsibility?

Mr Kilsby—In terms of making it more attractive, there are probably three transport sectors. There are private and public sectors, but they both require motors, and there is also the unmotorised sector, which, at the moment, would not make much of a dent in the oil requirement because it only affects the shorter spectrum of trip making. It seems to me that with good urban planning we could perhaps do things to shorten the trip length, and then the third element would become more attractive as well. It is in those outer areas that transport is most difficult to provide. Sydney is clearly the largest Australian city and it is a long way to the CBD from where we are putting people in new houses now. There are probably two million people living out in Western Sydney at the moment, and the only public transport that is being provided of any significance is trains to bring them into the CBD. I think that the Department of Planning in the New South Wales government has an excellent idea in the metropolitan strategy where they are trying to introduce regional cities within Sydney to reduce the amount of trip making that goes on in terms of person kilometres.

Senator STERLE—I refer to page 4 of your submission and the recommendation that states: ‘7. That taxation and fiscal policy instruments should encourage sustainable transport.’ Could you explain that?

Mr Kilsby—At the moment, I think the taxation instruments actually encourage the opposite to sustainable transport with the FBT arrangements and so on. I know that in Canada they have recently introduced a system whereby travel to work by public transport is allowable as a tax expense. It is really that sort of thing that we had in mind.

Senator STERLE—I have had a lot of conversation with the pro-rail lobby. I do not want to talk about freight on trains because I do not think we will ever get common ground on that; I want to talk about public transport on trains. I cannot speak for Sydney, but I can speak for where I come from. We are just putting in a brand new railway 70 kilometres down to Mandurah. It is going to be wonderful—it really will be—but we have had a wonderful train system in Western Australia for a number of years to the northern suburbs and out to the east and to the west. But I still cannot find anything that says we have it right. How can we attract patronage onto public transport? I hear the pro-rail lobby say, ‘Throw a heap of money at us and give us the infrastructure,’ and I have seen some great planning for future suburbs. But we have rail and people are not using it. Why do you think that is? I know you have mentioned costings and all that. Are you suggesting that if we offer free transport people would get on the trains?

Mr Kilsby—No, I am not suggesting that. What I am suggesting is that we concentrate more on local transport, especially in the outer areas because at the moment we are offering people the alternative of travelling quite long distances to central areas, which is where activity tends to be concentrated in our cities, and I think, certainly in Sydney, that we have grown beyond that point. The rail network that Sydney has is probably the most extensive in Australia, but it is very old and you cannot fight your way onto a train at peak times; they are completely crowded, and they are going quite a long way into the CBD. It strikes me that we have to think a little beyond the niche market of getting people travelling to the CBD and start thinking about the more dispersed travel that happens in outer areas of our cities.

Senator STERLE—This is where I get confused. Do you mean putting in extra railway lines to service other suburbs?

Mr Kilsby—That would certainly help, but it probably takes 10 years to get a new railway line implemented and I suspect that is time we do not have. There are alternatives in producing alternatives to cars, and we already have some of these in Sydney. We have a busway that is about to open from the north-west growth area, which is about 40 kilometres from the CBD, to take people down to Parramatta, which is a lot closer than the CBD. We propose to build a railway line from there, starting in 2017, which is a long way away at the moment.

Senator STERLE—I am a bit confused: are you talking about integrating both forms of public transport—rail and bus?

Mr Kilsby—Yes.

Senator STERLE—I just had this vision that we were talking about railway lines and spurs and branching into the suburbs where the housing is already—that sort of stuff.

Mr Kilsby—No, I do not see that that would help very much.

Senator STERLE—But is it realistic?

Mr Kilsby—No.

Senator JOYCE—You talked about the development of railway lines. Do you have any comments on the fact that in some places in New South Wales they are actually ripping up railway lines and sealing the roads so that they can put all the heavy transport back on the road? Surely that is completely counterintuitive to where it is all heading at the moment—for instance, with the branch lines out in the regional areas that move such things as the wheat crop. I can quote you one example: the Baradine to Gwabegar line. They are closing that line down and transport of all the grain produce will go back on the roads. Surely this is completely against the whole inclination. Do you feel that the government—especially the state government—is lacking in capacity to effectively organise itself to make the moving of heavy goods on rail possible? Are people giving up on it? Do you have any views on that?

Mr Kilsby—That is mainly a freight problem. Australia's rail infrastructure for freight probably falls into two classes. On the one hand, there are some world-class facilities for the

bulk export lines and for interstate containerised traffic. On the other hand, things like the grain lines that you mentioned are in a pretty woeful state. I would like to see these developed further.

Senator JOYCE—Once people get something on a truck, they keep it on a truck, and that exacerbates the problem. It is the ability for rail to organise the collection of produce and things like that that are at the crux of the issue. Do you have any views on how rail could better organise itself to be an effective competitor in the transport industry rather than just being there?

Mr Kilsby—I think that would boil down to the economics of particular cases.

Senator JOYCE—Why is rail so ineffective in the transport market in New South Wales and Queensland?

Mr Kilsby—Because they concentrate on particular markets where they do have a competitive advantage. One of those is the long-distance containerised market. Certainly in urban areas there is virtually no freight that moves by rail. It goes from Melbourne to Sydney by rail, but there is very little that moves around within Sydney by rail.

Senator MILNE—We have a national obesity crisis and a national diabetes crisis and we have people paying huge amounts of money to go to gyms. We have the potential to move people by bicycle, but we have very little in the way of safe bicycle facilities. Everywhere we have been, people have said to us that safety is a big disincentive to their riding. The other thing is a bit like gas: you need a transitional fuel from cars to bikes. One of those is electricity. We have seen huge bureaucratic resistance to electric bikes and small electric cars, like the Riva and so on. Can you give any insight into why you think the bureaucracies are so reluctant to license electric bikes and small electric cars in Australia?

Mr Kilsby—I would support the introduction of a low-energy sector. I think that it is one thing that we in Australia are lacking. There is nothing between a bicycle and a car, effectively, whereas if you go overseas—certainly to Europe or developing countries—you see that most people move around on some sort of moped or light motorbike, which we do not have. I cannot really comment on why the bureaucracy are so hostile to that, other than to say that they are probably following their charters or their terms of reference, which say that they have to manage the road system in the interests of the people who are on it at the moment.

Senator MILNE—That is true to some extent, although there is an attempt to have the Riva car registered in Australia and that is being resisted furiously by the bureaucracy on safety grounds. Yet these vehicles are in the EU, in London and all over the place. Apparently they do not meet our safety standards, even though we have an MOU with the EU. As far as I can tell, what we are seeing everywhere is a huge bureaucratic resistance. Some would argue it is political; maybe it is. It is something I want to pursue. We have a chicken and egg situation. We do need safe bicycle lanes, but we also need to have some form of transition in terms of electric bikes. Anyway, I will leave it there.

CHAIR—Thank you very much. I am sorry for squeezing you for time, but I think we still managed to have an effective discussion about your issues.

Mr Kilsby—Thank you for the time.

[12.32 pm]

DODSON, Dr Jago, Research Fellow, Urban Research Program, Griffith University

SIPE, Dr Neil Gavin, Head of School, School of Environmental Planning, Griffith University

CHAIR—Welcome. These are public proceedings, although the committee may agree to a request to hear evidence in camera or may determine that certain evidence should be held in camera. I remind you that your evidence to the committee is protected by parliamentary privilege. It is unlawful for anyone to threaten or disadvantage a witness on account of evidence given, and such action may be treated by the Senate as contempt. It is also a contempt to give false or misleading evidence to the Senate. If you object to answering a question, you should state the grounds on which you object. The committee shall determine whether we will insist on you providing an answer and, if we do, you may request that that answer be given in camera. I invite you to make a brief opening statement. Then we will get stuck into some questions. Thank you for appearing today.

Dr Dodson—Thank you. We have made a written submission to the inquiry, which was effectively a covering letter describing some research that we at the Urban Research Program at Griffith University in Brisbane have been undertaking regarding the potential distribution of adverse impacts arising from the socioeconomic costs of rising fuel prices. This report was sent to the committee. I do not know whether you have all seen it; perhaps you have.

CHAIR—Yes, we have. I must say that a number of people also have been quoting your research to us.

Dr Dodson—Since that came out in December 2005, we have received quite a lot of media coverage of it, so we suspect that a few people have read it. We will run very quickly through that. Since you have all read it, we will not dwell too extensively on it. We have just recently completed another research paper which examines specifically the impact of rising fuel prices on households with mortgages, and we will also report to you today briefly some outcomes of that.

We believe our original paper *Oil vulnerability in the Australian city* was the first attempt in Australia to really comprehend on a very close spatial neighbourhood scale the likely distribution of urban impacts of rising fuel prices. This research builds to some extent on research interests that both Dr Sipe and I have had over many years in terms of the distribution of socioeconomic opportunity in Australian cities and the connections between socioeconomic status and access to transport services. This is a continuation of research we have had a longstanding interest in.

The first study we undertook was an attempt to understand the distribution of the socioeconomic impacts of rising fuel costs. We became aware that there were very few data sets that were able to illuminate the issue at a very fine level of spatial detail. Therefore we decided to create an oil vulnerability index, as we term it, based on ABS census data. That is not ideal data to use for this kind of research; however, we feel that as a first cut piece of investigation by

academics in Australia, it is worthy of some attention by the committee. Subsequently we have also submitted it to a refereed international urban research journal. The referees were unanimous in agreeing that it should be published and reported to the scholarly community, so we feel confident that our approach has some validity.

In our index, effectively we combined what we describe as an indexed indicator of car dependence, which is the variable within the census of the mode of travel used for the journey to work, with the proportion of households within a given locality that have two cars or more. We decided that together those two variables were a good indicator of the level of car dependence experienced by households. We then combined that with the ABS socioeconomic index for areas, which is the measure the ABS uses to describe socioeconomic status. So together we felt that car dependence and socioeconomic status were useful markers of the likely vulnerability experienced by localities to rising fuel costs on the basis that, if you have high levels of car dependence, your fuel costs are going up and you are of modest or low socioeconomic status, then your capacity to absorb that rising price relative to your income is probably far reduced.

Moving to the results, our initial study investigated Brisbane, Sydney and Melbourne. The choice of cities was largely due to time constraints in our own research schedules.

Senator JOYCE—Where's St George on that?

Dr Sipe—St George is not on the map.

Dr Dodson—We have focused solely on the major cities in Australia, using the definition of the urban areas for these cities provided by the ABS. Unfortunately, St George falls slightly exterior to that definition.

Senator JOYCE—I thought I was a major city!

Dr Dodson—I might mention St George later on, though.

CHAIR—It's got some bad news for you!

Dr Dodson—No, it relates to further research that we are undertaking. I have just outlined the way the ratings are done. On these diagrams, the areas in red and yellow are the most vulnerable; those in green and dark green are the least vulnerable. On the image that you see before you, the inner city areas tend to be less vulnerable in our measure to rising fuel prices and it is the outer suburban areas, particularly those in the growth corridors of Brisbane, which are most vulnerable. If we look at Sydney next, a comparable effect is seen in Sydney, although there is some centralisation within the western suburbs. But you can see high vulnerability areas extending along the north-west and south-west growth corridors with lower oil vulnerability concentrated within the CBD and, to some extent, the areas immediately around the CBD and on the North Shore.

In Melbourne there is a comparable effect, particularly with the growth corridors in former industrial areas or areas that have had a high concentration of industrial employment which has since been heavily restructured over recent decades. They have structural unemployment in some of those localities to the west, north and south-east of Melbourne but also with relatively poor

provision of public transport in those localities. So combined, you have high car dependence and relatively low socioeconomic status, which contributes to the patterns of oil vulnerability we have presented. As with the other cities, the inner city and middle suburban areas appear to be exhibiting the lower levels of vulnerability to rising fuel costs.

In our first study, we attempted to chart the population numbers within these different categories by oil vulnerability rating: the higher on the scale, the more vulnerable they are. This slide shows Brisbane. If we go to Sydney, there is a similar distribution, and in Melbourne too. You can see there is some variation in the distribution of oil vulnerabilities between these cities. We have just counted those in the highest vulnerability categories in numbers of population. These people are likely to be experiencing the worst socioeconomic impacts of rising fuel costs. There are, however, a large number in the moderate vulnerability areas who may also be highly impacted.

In our next study, which came out about a week ago, on mortgage and oil vulnerability in the Australian city, we used a similar method of indexing. But, in this study, we have combined ABS census data on car dependence with data on the proportion of households with mortgages and on income this time around. We decided that, for assessing the impact of rising fuel prices on these households, income was a better measure than socioeconomic status—largely because those at the very lowest end of the socioeconomic spectrum were less likely to be homeowners.

The reason we chose to specifically investigate mortgage vulnerability is that it is apparent that the Reserve Bank of Australia is now conceiving of the inflationary impacts of rising fuel costs as a key issue that it needs to address through its control of the interest rate settings. The recent rate rise that came through, I think, in early June was indicative of this perceived relationship that the Reserve Bank sees and is now seeking to address. We felt that there is potential for not only rising fuel costs to impact on households but also rising mortgage costs as interest rates go up. We see this as a twin vulnerability, particularly given that there may be some inflexibility in the labour market in terms of the ability of incomes to rise commensurate to the increases in transport and interest rate costs.

This is our index, called a VAMPIRE—vulnerability assessment for mortgages, petrol, interest rate expenditure. We always like to use a good acronym for our research. Again, similar to the patterns of vulnerability shown in the socioeconomic oil vulnerability in the size that we showed previously, this study shows a much more widespread distribution of vulnerability in many more areas that have higher vulnerability status. We have done five cities this time. It is primarily those in the outer growth corridors of Brisbane. It is the western suburbs of the Gold Coast, away from the coastline. In Sydney, again, it is in the outer western suburbs along the growth corridors. By comparison, the inner city, the North Shore and inner south-east are relatively less vulnerable. In Melbourne, it is far more distributed in a broad arc right around the outside of Melbourne, compared to the previous assessment of socioeconomic vulnerability, which was fairly tightly concentrated. This is far more general. In Perth, again, you see that phenomenon of a lower vulnerability in a city with a much higher vulnerability arc around the outer and middle suburbs.

The reasons we see these patterns in Australian cities, we feel, are primarily related to the operation of housing markets which tend to provide the cheaper and newer housing in outer suburban and fringe localities. Households seeking to purchase a home for the first time are

more likely to locate in those areas, and those on modest and lower incomes who are seeking home ownership are also more likely to locate in those areas because of the way that the housing market is structured.

However, this means that they run into the problem of the relatively poor provision of public transport services in fringe and outer suburban areas compared to the inner-city localities. This is a problem of historic government underinvestment in public transport infrastructure and services in the outer suburbs. This dates back to the shift in Australian transport planning practice that occurred after the Second World War, when planners began to move away from the previous Australian model of largely transit oriented development based around the existing rail and tramway lines to modes of urban development based on the private motor car and the provision of roads and major freeways.

The result is that public transport services have not kept up with growth. The highest quality public transport services are situated within the inner cities. Those on the fringe experience a far lower quality of service in terms of the frequency of services, the hours of operation, the days of operation and, importantly, the connectivity between not only individual modes but also between modes.

In the best public transport services in the world you find a high level of integration between modes, with central planning to ensure that, for example, buses connect to rail stations that give passengers time enough to transfer. The heavy rail system will convey them at high speed to another connection point and then transfer them to another local bus service to take them to where they want to go. In large part that type of public transport service does not exist in Australian cities. It does exist in some localities, but to a large extent the outer and fringe suburbs are poorly served by public transport. We see that as the key point of vulnerability in the context of the rising fuel prices in Australian cities.

In terms of our suggestions or recommendations regarding improvements to public transport, we think there needs to be dedicated public transport statutory type authorities within each state government that stand alone and are independent from the immediate departmental control of state bureaucracies. We also feel there should be strong federal government interest and involvement in public transport planning, coordination and funding. There is some opportunity for partnership arrangements between the federal government and the states. I will leave that to you to contemplate.

In particular, suburban public transport and circumferential public transport routes is required. The majority of public transport heavy rail and bus services in Australian cities are radially focused—that is, they travel from the outer suburbs into the CBD. There is a paucity of public transport services that travel around the outer suburbs that provide the quality of service found within inner and radial areas. We see some scope for expansion of rail services to new fringe estates, particularly in the growth corridor areas of Brisbane, Sydney and Melbourne. For example, Rowville in Melbourne's outer south-east was promised a train line in 1969. They have been waiting almost 40 years for that to materialise. They are still waiting. Now they are facing rising fuel prices. We see some scope for those rail lines that have been planned for many decades in a lot of instances but have not materialised to be introduced and completed.

There was some discussion in the earlier presentation about how one might finance public transport. If you look at the total transport budget that state governments currently expend, there is actually multiple billions of dollars available for transport. The trouble is that most of it is currently dedicated to providing major road infrastructure such as freeways and tunnels. If you add in tollways, the sums are in the multiple billions. If those projects were postponed—they do not need to be cancelled; they can just be postponed in the budgetary process—that money could be transferred to the funding of specifically local scale public transport services to make sure that the outer suburbs have as high a quality of service as those in the inner city.

We feel that there would then be a high level of amelioration of the oil vulnerability and the mortgage vulnerability that we have described. Should oil prices decline in the future then it would be possible to still revisit further road construction and road projects. However, if it did turn out that a peak oil scenario did happen then Australian cities would be protected, at least partly, in terms of the personal-private cost of transport by provision of improved public transport services.

Finally, we perceive a need to improve local-scale amenity in terms of walking and cycling and access to local shopping trips so that households, in responding to rising fuel prices, are able, even if they do not make all their trips by public transport, to start to cut out a few of those minor local trips that might save them money over time. Those primarily involve walking to the local shops and to employment and other services.

Senator WEBBER—That raises a lot of questions actually. Dr Dodson, you spoke about road expenditure versus provision of local public transport. I am from Perth, so I was very pleased to see that there was something about that.

Dr Dodson—Perth is somewhat of an exception to this general rule.

Senator WEBBER—Absolutely, and we will get to our train line in a minute. In fact, that is what I wanted to say. In Perth, we have got fast-developing suburban corridors. It is relatively cheap to build roads because of our sand base, as opposed to a lot of the other challenges around on this side of the country. What do you mean by the provision of local public transport in terms of that swap from developing roads to developing local public transport? It is much cheaper for me to build a major road or extend the freeway to allow people to get into the city to work than it is to build the train line. It is quicker. Surely, it is not necessarily an either/or, if I am going to allow the city to keep developing. It has to be both. I cannot leave them out there not being able to get anywhere.

Dr Dodson—That is certainly the case. However, given the concern that has been expressed to this committee about rising fuel prices, there is strong potential that there will be less demand for those radial roads that provide access to the CBD. In the future, people will be making fewer trips; therefore, the existing road space potentially would have less traffic on it and there would be greater demand for public transport if fuel prices continue to rise. The problem at the moment is that Australian cities do not have particularly good public transport services in those outer suburban areas, so there is a lack of good examples or models with which to expand upon. However, there is enormous scope, we believe, for provision of local bus services within local suburban areas that would connect to higher frequency arterial bus services and to rail services, where they exist, with timed connections. They would be timed to arrive a few minutes before

the train departs so passengers have time to transfer and get ready for the train and then passengers offloading from the train have time to get onto the bus that ferries them to their local area. We feel those kinds of services would be critical in a scenario where fuel prices were markedly higher than they currently are in order to provide metropolitan access to households, particularly in the outer suburbs.

Dr Sipe—I would just add that we are not really talking about not spending money on roads; we are talking about having more of a balance. In south-east Queensland with the latest regional plan, basically about 20 per cent of the transport funds are spent for public transport and 80 per cent is for roads. Some of those roads are not necessarily to service newly developing areas. They are trying to move traffic faster through the city by spending \$3 billion on a tunnel. We would really question whether, in 10 years, there is going to be anybody who can afford to pay the toll and the fuel to use the tunnel. It is really that issue of bringing things a little bit more into balance, because clearly at this point in time the roads lobby is in charge.

Dr Dodson—It is worth noting that, in Australian cities where public transport is provided at a high level of service quality and interconnectivity, people will use it. In our research report we mention the member for Wentworth, Malcolm Turnbull, who has recently achieved the ability to use his parliamentary vehicle allowance to purchase a yearly public transport ticket. We found it curious that, while Mr Turnbull is one of Australia's richest citizens, he would deliberately choose to use public transport. The reason he is able to make that choice is that the high-quality services are there. He can get around inner city Sydney easily and efficiently. The newspaper quoted him saying that it is more efficient to use public transport in Sydney. He has that choice because he lives in an electorate where those services exist. Households in the outer areas of Sydney, where that level of quality does not exist, do not have that choice.

Senator WEBBER—That brings me to another point, which is the socioeconomic argument around that. We were having a discussion before about the incentives we need to give people to use public transport. Some people in Victoria and other places have talked about perhaps making it free. It seems to me that, if you accept what you say about the current infrastructure—and it is absolutely right—you are therefore subsidising the rich.

Dr Dodson—You could—

Senator WEBBER—If you are going to make it free—and most of the infrastructure is in the inner city, where people are fairly affluent—you are not really helping those in the northern suburbs in my home town or in the western suburbs here.

Dr Dodson—I might respond to that by suggesting that there is a subtlety to that observation in the sense that the processes of housing market restructuring in Australian cities over the last two or three decades have resulted in the gentrification of the inner city. Wealthier households have returned to the inner city, after a couple of decades in the 1950s, the 1960s and the early 1970s when they began to depart the inner city. If you look at it in the sense of a subsidy, it is based on a combination of existing infrastructure, housing market change and labour market change. As we point out in our paper, there is a serious inequity when you have your lowest and most modest income households in localities on the fringe, where now they are facing high transport costs. That is a serious social equity issue that we feel that governments should address through their transport policies.

Senator WEBBER—I notice one of your recommendations was to encourage more local access to employment services. Given the urban and suburban sprawl that we have, how do we do that? I do not know of many outer metropolitan areas that want an industrial estate next to them. To make this work, you need large-scale employment. The corner shop cannot employ that many people.

Dr Dodson—You can provide access to industrial areas through the provision of high-quality public transport. That is how industrial areas serviced their labour needs historically until the development of the private motor car. In terms of local services, the postwar period in Australian cities saw a shift away from high streets and local shopping strips towards regional, car based shopping malls. In conditions of rising fuel prices, we would suggest that there may be greater opportunities for providers of services and retailers on the local scale, where they previously would not have been particularly competitive relative to the regional shopping malls. Now that the costs of travel to those regional services are increasing, as fuel prices rise, the relative competitiveness of those local services may increase.

We see that there is an opportunity to support that kind of travel behaviour through making local trips by walking and cycling far more pleasant than they typically are for those living in outer suburban estates—where there may not be cycle facilities, where the footpaths may be poorly developed or where there may be limited shading. All of those local amenities that encourage people or support walking and cycling need to be considered and provided in areas where they are insufficient.

Dr Sipe—With development over the past couple of decades, developers in new housing estates have not been providing local retail. There may be a shopping mall but local retail is missing. In Western Sydney in a lot of these areas governments have allowed people to set up shops out of their homes because this need is basically not being provided. In the US it has gone to the extreme where developers are now subsidising corner shops and local retail rather than putting in a golf course, because they view it as something that is lacking. They support it even though the money is not there in the initial years of a new development to make it financially viable.

Senator WEBBER—I accept a great deal of what you have to say, but where does that leave people in regional Australia? There are lots of towns in my home state where there is not a lot of local employment and people basically live on some form of social security. There is no public transport and they are paying \$1.75 a litre for petrol. What do we do to address those kinds of social problems?

Dr Dodson—That is a question we have not undertaken an enormous amount of research into. However, we have recently submitted a grant application to a federal government agency to examine that issue. I think that issue needs to be contemplated within the much larger issue of the impact of rising fuel prices on productive and socioeconomic structures within rural and regional Australia. I see the transition from relatively cheap motor fuel that can drive truck based freight haulage to a greater emphasis on rail as a likely outcome. Although we have not done the research to demonstrate it, we see that as a likely scenario where fuel prices continue to rise or stay at high levels. Therefore the socioeconomic impact on individuals and households needs to be understood within that broader context. There is a possibility that transport systems and settlement patterns in regional and rural areas may undergo significant restructuring in order to

better align settlement patterns with the rail infrastructure. That is a potentially stark or extreme depiction, but I think in a forum like this there needs to be debate about what is going to happen with rising fuel prices. I cannot offer any specific solution in that regard, however.

Senator MILNE—Congratulations on this work. It is long overdue. It is great to have something of this kind in the public arena. It is terrific. I have a couple of issues. The first one is the spatial expansion of cities. The frustration I have in this argument is that we can talk about the need to provide public transport, we can talk about the need for transport around the circumference of suburbs but, the minute you put that in, developers and local government see the opportunity to expand another 10 kilometres or 15 kilometres beyond that. That is our problem. Every time we try and anticipate need, people then see it as potential to develop further. Where is there any emphasis in the country on containment of the physical size of cities so that we can start providing adequate transport and adequate services into the future, given the carbon constraints and the oil price and depletion issues we are facing?

Dr Dodson—The issue of urban expansion in terms of infrastructure has been of great concern to governments for the last 30 years—since the original oil shocks in the 1970s. Many state governments have put in place urban consolidation policies to encourage higher density development within existing urban areas, although those have been fairly uneven and partially applied. There has been extensive urbanisation in greenfield sites since that period.

Dr Sipe—I guess the most recent example is in south-east Queensland, where, with the regional planning effort over the past couple of years, they have established an urban footprint. I guess we will have to see to what extent—

Senator MILNE—They adhere to it.

Dr Sipe—Right. There were a few areas that had not been decided on and some of those have flipped from nondevelopment into the development realm. We are hoping that this provides some containment on that issue of expansion.

Senator MILNE—The other big issue, and you mention it in your submission, is this. If we were to persuade the federal government to work in a cooperative way with the states and to start seriously investing in public transport provision as a way of dealing with this issue, with the productivity of cities, with congestion, with health issues, with climate change et cetera, financing would become the major issue. If people pick up the argument they are then going to ask, 'How do you propose we pay for this?' Have you looked at any financing models that would fit with the fact that we are a federation of states and that local government has the planning provisions and opportunities as well? How far advanced are you on that? That is the key question. If we can get to the persuasion, which I think we are going to have to get to because the circumstances are upon us, how do we pay for it?

Dr Dodson—Our suggestion, as we have outlined today, would be to shift the balance in existing states funding from roads towards public transport, walking and cycling. There is probably some scope for that to occur at the federal level as well. Around \$7 billion to \$8 billion is spent in federal road funding. A lot of that goes to rural and regional areas, so it would probably not be appropriate to transfer that to public transport provision—although perhaps some sort of regional public transport coach or train network assistance might be worth

contemplating. However, I think there would be some significant scope for the use of some of those federal road funds in partnering arrangements or co-financing arrangements with states to identify areas of high public transport need within Australian cities and to plan and coordinate the rollout of new, high-quality services to those localities. As we suggested, it would probably require a dedicated federal government agency to undertake the research, analysis and planning to determine what measures would be the most appropriate in any given locality or circumstance.

Dr Sipe—The only thing I would add is this. As you can tell, I am not from these parts. I come from America. There seems to be a reluctance on the part of both the Commonwealth and the state and local governments to incur any debt in providing public facilities. I see that this is an untapped resource. A lot of these facilities should not be paid for by existing taxpayers. There is an intergenerational issue. They should be paid for over the 20 or 30 years of the life of the project. It seems that governments want to be debt free, and I am not sure that that is necessarily a good thing. Maybe the US is not the best example, having gone to the other extreme, but I think there is some middle ground there in financing projects over a period of time using revenues from public transport or toll roads. I think that is a much better way of doing things than these public-private partnerships that we have seen around Australia.

Senator JOYCE—I want to follow up on one question that Senator Milne put to you. Do you have any idea of the ideal size for a city? As an outsider, as someone who does not live in a city, I came down here the other day and I saw a bus driving around with nobody in it. I thought, ‘Well, that just goes to show that you can have cheap transport that nobody uses.’ What we see as investment in transport infrastructure might just exacerbate the problems that are already there. In your study, do you talk about an ideal size for a city or can cities just get as big as they like?

Dr Dodson—The question of an ideal size of a city is one that exercised the minds of a number of urban researchers in Australia in the 1960s and 1970s; I am not sure that it was ever resolved. The result was the decentralisation program under the Whitlam government, which sought to shift population to regional areas such as, I believe, Bathurst-Orange in New South Wales, Albury-Wodonga and parts of Victoria. I am not sure whether they had a program in Queensland or other states. I would not wish to comment too much on the success of those programs. I do not think they are perceived as having had a dramatic impact on changing the rate of growth of Australian capital cities. There may be some scope in the future to revisit questions of decentralisation of urban populations to rural and regional centres. We certainly have not done any analysis or investigation of that type of policy. The problems would be in providing employment and other services in such localities to make it feasible.

Senator JOYCE—I will put the question on its head, then. Do you feel that, with unplanned transport infrastructure in place, there is the potential to exacerbate transport problems for an area and create more red areas? I am thinking about the south-east corner of Queensland, obviously. Wouldn't an ad hoc growth to an area basically exacerbate problems that are going to be almost impossible to fix because there would be houses where you wanted to put transport infrastructure?

Dr Dodson—That comes down to a question of good planning. Until the postwar period, housing development occurred effectively in unison with rail and tramways. It was after the

postwar period that the private motor car gave households and individuals the capacity to travel almost anywhere at will within the city, and that enabled the extensive, often low-density, development you see in, for example, the North Beaudesert shire area of south-east Queensland. Our view would be that well-coordinated and well-planned development with a strong public transport component to it can ameliorate those problems, but it will not necessarily solve them universally and provide some utopian type of urbanisation.

Senator JOYCE—What is the cost of fixing the problem that is already there? The houses are already there; the roads are already there. If you want to put in a rail infrastructure, you are going to have to start moving houses and roads and changing everything around. Have you done any costing of your potential loss because the planning process was not proper and in place at the start? A lot of this is a nirvana; it is never going to happen because the cost of putting in new rail networks will be prohibitive.

Dr Dodson—Perhaps yes and perhaps no. I note that the Queensland government is currently expending large sums of money in putting road tunnels through the centre of Brisbane. It is building a number of bus lanes that go through existing inner city localities, many of which have far higher real estate values than those out on the fringe. In terms of the cost of providing new fixed route infrastructure for public or even road transport, I am not sure that the cost of purchasing the corridors and lines for that is necessarily prohibitive. It does not seem to be at the moment.

CHAIR—There are also other forms of public transport, too, like light rail. I understand that that is much less disruptive and you can move a lot of people. Have those things been factored into your equation?

Dr Dodson—In some areas there are opportunities for upgrading underutilised rail infrastructures. There are a couple of train lines in south-east Queensland that are underutilised that could potentially be upgraded. But also simply providing bus services that operate in a coordinated way across outer suburban areas would, in many cases, provide a sufficient level of service that would match or be comparable to a rail service if it were planned, well coordinated and operated efficiently.

Senator JOYCE—What are you going to use as motivation? Once someone jumps in their car to drive to the train station, how are you going to encourage them to get out? It is the same issue that people have in regional areas where, once they put stuff on a truck to get it to a railhead, they say, 'Don't bother stopping; keep going.' It is the same idea with the car: once they jump in the car to drive to the train station and they have the radio going, how are you going to encourage them to get out?

Dr Dodson—The way to do it is to provide the highest possible quality of service that you can so it makes it easy and efficient for them to do it. That level of service exists in many instances in the inner areas of Australian cities, and a high proportion of households and individuals use it. It is the lack of service and the poor quality of service in the outer-suburban areas that prevent people from using public transport, in my opinion. The rising price of motor vehicle travel will be a strong motivational element in encouraging people to use public transport. But the trouble is that it needs to be there and it needs to be of high quality so that they can use it.

Senator JOYCE—I was interested that you were looking at Brisbane. Brisbane is a unique town in that it is hilly and therefore you will need tunnels or bridges in order to get around the place. Because houses are parked on the sides of hills in places like Waterworks Road, there will be an immense capital cost in trying to set up the infrastructure—unless you move the roads, because the roads follow the accessible paths in the lower areas of the topography. Is there a sense that the cost of this is going to be astronomical, as opposed to better planning and getting people to live in areas where the cost of this infrastructure would not be so great?

Dr Sipe—That is what they are trying to do with the regional plan.

Senator JOYCE—Yes, they are moving them but they are just moving them down the street. They are moving them to Ipswich when they should be moving them over the hill and far away.

Dr Dodson—There does not seem to be an immense topographical constraint to the provision of existing public transport services. Buses could easily run along the large arterial roads and the major roads that already exist throughout south-east Queensland. The trouble is that existing government planning is focused on not impeding motor vehicle traffic. In the case of the eastern suburbs of Brisbane, we have Old Cleveland Road, which is a major arterial road, yet the government is now planning to tunnel a busway to provide public transport under that road for approximately 25 kilometres out to the eastern suburb of Capalaba. From my perspective, you can always use existing road space for buses. So there is a question about the opportunity cost of using tunnelling, which is going to cost billions of dollars, to provide that service when you could use the existing road service and coordinate services with the regional rail network, and then have plenty of money left over to provide very high-quality local suburban bus services for those in the outer suburbs who are going to be most affected by rising fuel prices. I am not particularly concerned about topography being an impediment to improving public transport.

Dr Sipe—There have been a number of questions about getting people to use public transport. The evidence we have been able to put together over the last six to nine months suggests that that is not going to be a problem, that the price of fuel will take care of that. The real question is: are the public transport companies and authorities planning for this? For example, in Brisbane they basically now publish how many buses go past the bus stop because they are full. The problem is not getting people on; it is providing the capacity. That is what we see as the real problem. Who is building buses? What happens if every city in the world decides it needs 100 more buses?

CHAIR—We are not going to have enough carriages on the Perth trains. Come peak hour now, we are packed in like sardines because we do not have enough carriages on our trains.

Dr Sipe—So who is looking out for this? Somebody should be thinking, ‘If all the cities in Australia are facing this problem, what about all the cities in other parts of the world?’ I have not read that General Motors is going to give up building Hummers and begin to build train carriages and buses.

CHAIR—In view of the time, we will have to wind it up. Thank you very much. I found that very useful—and fascinating, actually.

Dr Dodson—Would you like a copy of our latest publication? How many would you like? We have 10.

CHAIR—Yes, most definitely. If you have 10, that would be great.

Committee adjourned at 1.20 pm