



COMMONWEALTH OF AUSTRALIA

Proof Committee Hansard

JOINT STANDING COMMITTEE ON TREATIES

Reference: Kyoto Protocol

WEDNESDAY, 18 OCTOBER 2000

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JOINT COMMITTEE ON TREATIES

Wednesday, 10 October 2000

Members: Mr Andrew Thomson (*Chair*), Senator Cooney (*Deputy Chair*), Senators Bartlett, Coonan, Ludwig, Mason, Schacht and Tchen and Mr Adams, Mr Baird, Mr Bartlett, Mr Byrne, Mrs Elson, Mr Hardgrave, Mrs De-Anne Kelly and Mr Wilkie

Senators and members in attendance: Senators Bartlett and Ludwig and Mrs De-Anne Kelly, Mr Hardgrave and Mr Thomson

Terms of reference for the inquiry:

- The implications for Australia of proceeding or not proceeding to ratify the Kyoto Protocol and meeting its target emissions levels by 2008 with regard to anticipated and/or predicted economic, environmental and social outcomes both nationally and in specific regional areas.
- The veracity of conflicting current scientific theories on global warming and any solutions proposed for it.
- What definitions and criteria Australia should develop and actively pursue in its national interest with regard to:
 - grandfathering,
 - trading credits,
 - carbon credits,
 - sequestration,
 - revegetation,
 - land management, and
 - definitions (eg “forest”).
- The economic, environmental and social implications of a punitive approach to any domestic regulation of industry including such proposals as a carbon tax and an incentive-based approach.

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Committee met at 1.07 p.m.

CHAIR—I declare the meeting open. Before welcoming witnesses, we must formally accept some submissions. There being no objection, submissions are received as evidence to the committee's inquiry into Australia's relationship with the World Trade Organisation and are authorised for publication. There being no objection, submissions are received as evidence to the committee's Inquiry into the Kyoto Protocol and are authorised for publication. Exhibits 3.2, 16, 17 and 18 are received as evidence to the committee's Inquiry into the Kyoto Protocol.

I welcome all witnesses who are appearing before the committee today. This is one of a number of hearings that we are undertaking across Australia to ascertain the implications for Australia if ratification of the Kyoto Protocol were to take place. Today we will hear evidence from scientists about some of the underpinning science and consequent science—I suppose that is how you could describe it—regarding the protocol. However, we will hear first from the aluminium industry, of which there are two representatives here today.

[1.09 p.m.]

COUTTS, Mr David Lawrence, Executive Director, Australian Aluminium Council

EWING, Mr Geoffrey William, Chair, Major Policy, Australian Aluminium Council

CHAIR—I have to formally advise you that, although we do not require evidence to be given under oath, these are hearings of the parliament and warrant the same respect as if they were taking place in either the House of Representatives or the Senate chamber. The giving of any false or misleading evidence is a serious matter and may be regarded as a contempt of parliament. You may like to make an introductory statement together or separately and then we will ask questions.

Mr Coutts—Thank you. What we propose, if it is acceptable to the committee, is that I will make a very short statement of key points on behalf of the aluminium industry as a whole, and immediately afterwards Mr Ewing could add some comments from his perspective. We think the questions that the committee might have will probably overlap between them, if that is acceptable.

CHAIR—Go ahead.

Mr Coutts—As I said, I am appearing and talking to the committee on behalf of the Aluminium Council, which is the industry body that represents the whole aluminium industry in Australia. That covers the industry from bauxite mining through alumina refining, alumina smelting, semifabrication and distribution. It is a long value adding chain. We have tabled a submission to the committee. I do not intend to go through all the detail in that, but I will take a couple of minutes to highlight a few key points.

There are some characteristics about the aluminium industry which it is really important to underline. The industry is internationally competitive and it is unsubsidised. It is a valuing adding and high technology industry. Value adding is very important because, as I just indicated, it is a long chain and by the time you get to semifabrications, you have increased the value of the bauxite ore by at least 100 times over what the bauxite itself is worth. Obviously we do less in semifabrication than we do in mining bauxite, but a significant amount of that is converted in Australia into end products in aluminium. The industry is regionally based, including in Queensland. I will leave Mr Ewing to perhaps put a map up there on the board and point out where the operations are in Queensland, if that is interesting to you.

The industry is poised on the brink of major expansion in Australia. That will only happen if greenhouse issues are satisfactorily resolved. The reason why that is important is that the industry is energy intensive and that is part of the competitive position of the industry. The competitors for that investment are almost totally outside countries that may be covered by the Kyoto Protocol if that is ratified. Satisfactory resolution of Australia's approach in the greenhouse is a critical issue there. To demonstrate, and to underline the reality of that potential expansion, there are at the moment at least three greenfield smelter proposals being talked about in Australia—one in Western Australia, one in Victoria and one in Queensland. These are, of course, at a very early stage but they are being seriously considered, and there are at least two brownfield expansion smelter metal proposals. There are several expansions and one greenfield

proposal on that alumina as well. If all this were to happen, or at least the most likely of these things were to happen, you would have something like a 30 per cent expansion in an industry which, in the case of alumina, is already the world leader and, in the case of aluminium, is the world's fifth-largest producer and third-largest exporter. It is a very major industry for Australia and a major contributor to the balance of payments.

The implications of the Kyoto Protocol, therefore, are of major significance for the aluminium industry and the economy we would say, particularly in regional areas. If anyone is in doubt about that, you have probably seen or been informed about the recent work that the Allen Consulting Group has released for the Minerals Council. There is a graph there which shows the loser industries and the line almost at the bottom is aluminium, so it is a very serious issue for us. I hope that is a scenario that will not come to reality.

The Kyoto Protocol itself we would regard, at least as it is being talked about, as having some flaws or some aspects which are difficult for Australia and our industry to deal with. Aluminium is a material which is in high demand, and for very good reason: it has a number of very particular uses and many of these uses are very environmentally friendly, such as light weighting of transport and things like that. The Kyoto Protocol, however, does not recognise the life cycle aspects of materials like aluminium, so it does not give any weighting to the potential benefits of the end use applications of materials like aluminium. It also, perhaps more particularly, would put all the cost of producing the metal on the point of production—in this case, Australia—in terms of emissions. While there is high embodied energy in aluminium—in a sense this is stored electricity—it can be recycled indefinitely at very low energy content. So all the benefits of that recycling and the end use go to the country that imports the metal and uses it. The analogy that I gave you is that, in a sense, you have stored that electricity by embodying it in the aluminium.

As far as the COP6 negotiations go, which are looming, in our view, the Australian government may well be put under considerable pressure in those negotiations. Nobody knows quite where it is going to go but there are certainly signs out there that some deals are being discussed with the European Union, the United States and G77. The likelihood, I feel, is that the sorts of deals that may emerge there may well not be in Australia's interest or at least have some concerns for Australia, and so the Australian negotiating team may well be under considerable pressure at those negotiations.

We have said that an endorsement of any outcome from COP6 should be subject to satisfactory resolution for Australia of some key points. The key points are the terms of the flexibility mechanisms that might be agreed, particularly emissions trading where, if there is to be international emissions trading, it should be as far as possible on a properly functioning market basis and not constrained by limits on how much can be traded and that sort of thing; that there should be no adverse impacts on Australia's international competitiveness which are out of line with the impacts on countries that we compete with; that there should be some concrete progress on commitments for developing countries—although we would acknowledge that that may need to look beyond the first commitment period; that there must be a satisfactory outcome on sinks; and that other major developed countries must agree to ratify the convention, especially the United States. The impact on Australia's trade-exposed industries, such as aluminium, must be taken into account in any decision by the government on Australia's response to COP6 proposals and beyond.

To conclude, the Australian aluminium industry does recognise that this is a very serious issue and a serious challenge for Australia. The industry has already done a lot to reduce its greenhouse emissions. The overall direct emissions in the aluminium industry have declined substantially since 1990. There is an additional factor, and that is emissions from electricity production, which is a different matter. But in terms of things the aluminium industry can do itself, there has been considerable progress on reduction of emissions. The industry does recognise that more needs to be done and is at the moment launching on discussions with the government as to how the industry and the government can work together to agree on what further can be achieved by the aluminium industry. In that context, today, tomorrow or very soon, the government will be announcing a light metals industry action agenda. I do not believe that announcement is being made today but it will be very soon. Part of what hopefully will happen under that action agenda is some sort of agreement on what more the aluminium industry might be able to do on greenhouse, but that has to recognise the time scales involved, the leading energy efficiency of the industry already, which believes that very little additional can be done with the existing technology, and the impacts on competitiveness.

That is all I would like to say. We have more detailed arguments and points in the submission. I will hand over to Mr Ewing to make the points for Comalco.

Mr Ewing—I, of course, endorse the comments on behalf of the industry that Mr Coutts has made, but the comments I shall make are from a Rio Tinto and, in particular, Comalco perspective. It may assist the committee if I indicate on the map the Comalco operations in Queensland. Weipa is up here, where we have one of the world's largest bauxite mines, wholly owned by Comalco. Down in Gladstone, we have Boyne Smelters, which is about the fourth largest smelter in the world. Comalco owns 54 per cent of that and operates it. It also has 30.3 per cent of the Gladstone Alumina Refinery, run by Queensland Alumina Ltd, which is the world's largest alumina refinery. It also has 42.1 per cent of the Gladstone Power Station in Gladstone. You would be aware that Comalco is currently undertaking a feasibility study to build a new alumina refinery in Gladstone as well. I perhaps should point out the assets of a sister company, Pacific Coal, which is a wholly owned subsidiary of Rio Tinto: I might not find it precisely on this map, but roughly in from Mackay we have the Blair Athol mine; in from Rockhampton, we have the Kestrel mine; and at Toowong, just north-west of Brisbane, we have the Toowong coal mines. So there are significant Rio Tinto assets in the state.

Rio Tinto supports efforts to curb the global growth in greenhouse gas emissions. It also supports the need for all sectors of the Australian economy to make an equitable contribution to the effort to reduce greenhouse gas emissions. We do believe that Australia's Kyoto Protocol target will be very challenging to meet. We believe that the protocol could have economic and trade impacts which, if not managed correctly, could fall heavily on energy intensive trade exposed industries such as those in which we are involved.

Comalco, with its partners, produces 642,000 tonnes of aluminium in Australia. It is highly energy efficient but nevertheless, of course, a very large user of energy. In fact, Comalco uses in the order of 25 per cent of the total output of the energy produced in this state. The aluminium industry, of course, is particularly sensitive to energy prices, and investment will flow to other countries if policies undermine the current competitiveness. Comalco, of course, is a participant in the Greenhouse Challenge program through Rio Tinto and the Aluminium Council; we have been a very early participant in that program. Since 1990, Comalco has reduced its gross

greenhouse emissions by about a million tonnes—in fact, over a million tonnes of CO₂ equivalent. Comalco has currently about 30 greenhouse projects under way at an estimated cost of something like \$1½ million.

The cost of some of the government's greenhouse policy proposed measures will be high. In particular, the impact of the two per cent renewables measure could be as high as \$26 million for Comalco alone and up around \$36 million for Rio Tinto throughout the country. Rio Tinto believes that additional costs from greenhouse policies are inappropriate before the Kyoto Protocol is ratified and the international mechanisms are operational. In any event, we believe that Australia should not ratify the protocol until there is ratification by other major parties and agreement by developing countries on a pathway to agree an emission limitation objective and until the various mechanisms and issues under Kyoto are all finalised so that we have an efficient outcome.

The recent study to which Mr Coutts referred, undertaken by the Allen Consulting Group for the Minerals Council, does indicate the potential for a significant detrimental effect on industry's employment in rural and regional Australia. I do not pretend to be in a position to expound upon the detail of that report but suffice to say that the recent presentation released on this particular report refers on page 13 to the Fitzroy area in Queensland and the employment impact, and it is a fairly graphic demonstration. We have this, according to this report, very significant, 10 per cent detrimental impact on employment in the Fitzroy area which includes the Gladstone-Rockhampton area.

We are concerned that the outcome of the current international negotiations on the protocol may not be compatible with the government's commitment to least-cost actions and the maintenance of industry competitiveness. Comalco believes that Australia's interests will be best served by standing firm on our critical requirements in order to obtain a more efficient and effective long-term global economic and environmental outcome.

Senator BARTLETT—I can understand that you are keen to minimise economic impact on the industry. In your statement about the ratifying of the Kyoto Protocol, which is what we are focusing on in this inquiry, you are saying that Australia should only consider ratification of the protocol on the basis that, among other things, there is no adverse impact on the international competitiveness of industry. Obviously that would be desirable, but what if it is not possible? What if there has to be some adverse impact on the competitiveness of industry? Are you saying then, 'Well, whilst we are committed to greenhouse reduction, that is too bad'?

Mr Ewing—I did not intend to say that there should not be any impact. We understand and we support, as we have indicated, the reduction of greenhouse gases as an objective. We think that the government's approach in principle on Kyoto was creditable. But what we are saying is that the impact must be broadly shared throughout the country. It is not, for instance, either the aluminium or energy intensive industries that should bear the brunt of any cost. We can acknowledge that there may well have to be a cost and that we would obviously have to participate in that, but what we are saying is that (a) the cost must be minimised and (b) it must be broadly shared throughout all sectors. Certainly we do believe that the cost should not be such that it will have the effect of driving industry offshore. We are not suggesting that is necessarily an imminent danger, although it is always a potential one. In our industry particularly we are mindful, for instance, that in the early 1980s Japan was one of the very large

producers of aluminium globally, and its energy was produced largely from oil fired stations. With the rise in oil prices, Japan almost overnight lost its industry and Australia was a real beneficiary of that. What we are saying is that we do not want something similar to happen in this country. It can happen rather more rapidly than anyone would like to see.

Mr Coutts—We said in our submission—indeed, on the front page—that there should be no adverse impact on the international competitiveness of the aluminium industry. I think that is a legitimate position to put. It does not mean that there should be no costs that might be borne by the economy and by the industry, but what we do say is that those costs should be in line on a fair and equitable basis with what our competitors are having to face. I think that is the key point. Add to that that the world is going to be wanting more aluminium. All the projections show a growth rate of three to four per cent per year, so it is going to be produced somewhere and there is no reason, in my view, on a global economic and environmental basis why a fair bit of that investment should not take place in Australia.

Senator BARTLETT—It sounds to me, from your statements today and your submissions, that you take climate change and greenhouse emissions seriously and credibly as something that needs to be addressed.

Mr Ewing—Certainly.

Senator BARTLETT—Do you see those goals you have set about sharing the cost around and minimising the impact on industry as being achievable alongside getting our emissions down, say—at least at this stage—to the Kyoto levels?

Mr Coutts—In my view, the task of getting Australia's emissions to what comes out of the Kyoto Protocol is a very difficult one. It certainly does present some very serious challenges to how to do that and at the same time maintain the competitiveness of industries like aluminium. I would not go so far as to say that that cannot be done, but it is a very serious challenge. I do not at this stage have the ultimate answer, partly because one will have to see what comes out of the negotiations at COP 6.

But the only other thing I would add to that is that one of the problems that we have in finding the right way to deal with this is the time frames that we are dealing with. There are going to be some very significant technological advances in our industry that will both improve its energy efficiency and, through that, reduce greenhouse emissions quite substantially and there are going to be things happening which are going to reduce the intensity of emissions from electricity generation, but that is going to take some time. I do not believe certainly the changes and the technology developments within the aluminium industry are going to come through in the next five to 10 years; it will take longer than that. So it is very important, in whatever solution we come to, to not lose sight of the longer term position that Australia probably should have in this industry, for short-term efforts. That is a difficulty of the Kyoto Protocol and the timing, I do acknowledge that.

Senator BARTLETT—Obviously a long-term focus is part of the environmental component that has driven Kyoto and other measures. But if we accept the majority of scientific evidence—as I see it, anyway—then it is reasonably urgent that we act. I am not saying nobody is doing anything; you have outlined things that we are doing. But one of the crunch points is: how long

do we wait to see if we can find out the best way to achieve this, in that balance between trying to minimise cost to industry versus ensuring that we meet these targets? Some of the evidence we are getting suggests that those Kyoto targets are really just a first step and we really need to do more.

Mr Coutts—All I would say on that is that, in my own view, there is a need for us to seriously try and address these issues. But if you listen to the scientific advice—and I have listened to people like Graeme Pearman and others very recently—that says, too, it is a very long-term issue that we are dealing with here. Yes, we have to start the process, but no matter what we do it is going to take significant time to bring this under control and to bring global emissions at least into a stability position, let alone reduce them. So we do have to, I think, be very careful to not lose sight of the long-term goal—which is to bring this under control—for short-term solutions which are not necessarily going to help with that long term. That is our view on that.

Mr Ewing—We as a group of companies certainly do not get involved in the science of this. We do accept that there needs to be action taken to reduce greenhouse emissions. As I have indicated, we have made some pretty big strides in this area since 1990. But we must make sure that the mechanisms we do introduce are effective, and we certainly have grave doubts that the two per cent renewables legislation, for instance, is going to move us in the right direction.

I made some comments earlier about perhaps pushing some of our industry offshore. This is not simply made from a self-centred and selfish approach in saying we want to keep our industry here—which obviously we do anyway. The reality is it is not going to produce an advantage for the world as a whole if we simply push the industries offshore. In fact, on the contrary, it may exacerbate the problem. In the case of the aluminium industry, we are one of the most efficient aluminium industries in the world. Were any government policies to make it more attractive for companies to operate offshore, there would be a very real possibility that those operations would have less stringent environmental controls and indeed less experience in best practice. They will be less efficient than us and that will in fact exacerbate the global problem. That will bring no advantage to anyone and certainly a great disadvantage economically to Australia.

Senator LUDWIG—You indicated that you accept the scientific data in relation to greenhouse gas emissions and global warming. On what basis? Is it because the government has said that you should accept it or have you considered it and commissioned a report on it?

Mr Ewing—I will speak from the Rio Tinto perspective. It is obviously a very complicated area and there is a great number of different views. All we are saying is that we accept that proper social duty, if you like, because there is a general community and certainly government view as a result of the Kyoto Protocol and other mechanisms that there is a problem. We are prepared to accept that and work towards it. As I have indicated, that is what our group of companies has certainly been doing. But we have not commissioned a separate report upon which we base that approach: it is simply our pragmatic approach as a good corporate citizen.

Mr Coutts—The aluminium industry generally follows the scientific debate with great interest, but we adhere to the position that we put in the report: we accept that there is sufficient reason for concern at increasing levels of atmospheric greenhouse gases to justify global action

and to move towards stabilisation, providing this is done with a long-term view in mind—which I have already underlined a couple of times—and on a fully global basis. We know that the scientific debate is still going on and that there are different views.

Senator LUDWIG—I was trying to explore with you the basis upon which you make that statement: whether it is a matter of attitude, belief or something of which you are reasonably certain.

Mr Coutts—We are in the aluminium industry, we are not climate scientists. So we have to take advice. There is a lot of advice out there and it is very difficult to interpret. But in our view the balance of it at the moment is such that you cannot ignore this issue. As we are such large energy users, I think it is a responsible approach to do what we can do to reduce our energy usage. There are other reasons for that as well, of course: reducing energy usage is a desirable goal anyway if you can do it.

Senator LUDWIG—What time frames are you talking about? Do you have any expectation of what you would consider to be a reasonable time frame in this context?

Mr Coutts—Do you mean in the context of improved scientific certainty?

Senator LUDWIG—No, in the context of ratifying the Kyoto Protocol and meeting some of the requirements under the Kyoto Protocol. I understand what your submission basically says. I will not guess what it says or try to read it back to you, but you do mention time lines. How long is a time line?

Mr Coutts—As far as the aluminium industry goes, it is the same argument that I put before: the world is going to keep producing more aluminium. According to all the information I have, over the next 20 or 30 years a lot of that growth will be powered by fossil fuel—basically by coal. So it will not help the global problem if Australia does something to unfairly disadvantage itself in relation to whatever part it might play in that process. At the same time new technology is coming down the track for our industry. Some of it has quite dramatic potential implications for emissions, but that technology is long-term technology and it has to be introduced gradually into the industry. You cannot just pull out a smelter and introduce the new technology overnight. The time frame we are talking about for our industry to achieve some of these big gains is probably 10 to 20 years at least—maybe longer. That would fit with what I am hearing from many of the scientists: it does not matter, within sensible bounds, what you do now, it is still going to take that sort of time frame to start to turn around the *Titanic* in terms of the growth of global CO₂ levels.

Senator LUDWIG—They do say that, but they also say that you should stop now.

Mr Coutts—Some do, but people like Graham Pearman—whom I respect a lot and to whom I have listened fairly closely lately—are saying quite clearly that you cannot do that: you cannot just stop now because the world is going to keep using more fossil fuel; it has to. It is unrealistic to say anything else. Maybe over the next 10, 20 or 30 years that will gradually change, but it is not going to change in the next five or 10 years.

Senator LUDWIG—As I understand your submission, you have a specified number of caveats—Senator Bartlett referred to that list and Comalco has a similar list—that would need to be met before the Kyoto Protocol is ratified. Those lists are similar: two and three have perhaps been swapped around between your submissions, but they roughly accord. Is it a prioritised list? Is it a list that must be met or that you must be comfortable with?

Mr Coutts—From the broad industry point of view, the list is not particularly prioritised: in our view, they are all essential factors. I could probably rate them; but, basically, we regard them all as being essential.

Mr Ewing—I agree. We are saying that if each of the things on this list are not met, we will have a system that does not work. We really think they are all requirements, so prioritising them does not really help.

Mr Coutts—I could talk a bit more about them, but, if you are asking just about priorities, they are all extremely important.

Senator LUDWIG—I am trying to ascertain whether it is a wish list in a broader sense or an actual list that you think should be considered and answered prior to moving forward.

Mr Coutts—There is nothing on that list that we do not regard as being extremely important.

Senator LUDWIG—This may be conjecture on your part, but I am seeking a view on what it would take to push you to pack your bags and shift to an annex B country, if annex B countries were not, I guess, roped into the broad Kyoto Protocol at this stage. We know that they are not at present and that it is on the table. We know that Northern Hemisphere countries want something done about annex B countries but the likelihood of that happening in the short term is not great. From what I have read, it will not be resolved at COP6; they could at least make that plain.

Mr Coutts—Unfortunately, you are probably right about that. I can illustrate the point perhaps by saying that investment in aluminium and metal production occurs where you have competitive supplies of energy. There are other things, but that is the really critical issue that I think would be the make or break one for such investment. If Australia were to ratify the protocol and introduce an emissions trading system across the board with perhaps auctioned permits that were worth \$30 a tonne of CO₂ equivalent—just to name a figure—it would cost the aluminium industry in Australia about \$600 extra per tonne of metal on the current price of about \$2,500 a tonne, which is about a 25 per cent increase in cost.

Our competitors for that investment are virtually totally outside annex B— possible exceptions are Canada and Iceland, but one more smelter, if that, is probably as much as will happen in each of those countries—and would not face that cost at all. All the other countries are developing countries outside annex B. That means you would not get any further investment in the industry here and probably some of the existing investment would at least gradually run down, if not close.

Senator LUDWIG—Following that line, can you think of a better scenario in which you would run down your existing infrastructure to such a point in carbon trading where it would be

more profitable to trade it out and relocate your new plant to an annex B country? Would that be logical?

Mr Coutts—Do you mean if you had permits that you could sell?

Senator LUDWIG—If it was a free trading market and you had permits, you would have to have permits to have CO₂ emissions.

Mr Coutts—If they were totally auctioned permits, we just would not buy them, I presume. But if they were grandfathered or administratively allocated, I guess some of those issues would come into play.

Senator LUDWIG—Obviously, we do not know what a marketplace might look like, but there are those two predominant views where you have a grandfathered system or you have a market based open auction system. I do not know whether COP 6 will come to a concluded view about that.

Mr Coutts—I do not have any detail on that.

Senator LUDWIG—But, if either of those two promoted a view that you would run down your current infrastructure and, as a consequence of the 25 per cent at cost, move to an annex B country, unless there was a view that they were similarly going to be—

Mr Coutts—As I said, the first thing would be new investment. You would have to weigh a 25 per cent energy penalty here against no penalty in, say, Latin America, the Middle East or South Africa. It is very hard to see why someone would want to pay that penalty to invest in Australia, whereas, if you did not have that penalty, there would almost certainly be that investment here. Australia does have advantages that some of those other places do not have, with the general economic system.

Senator LUDWIG—That is why my remark was very much conjecture, but I am trying to get an understanding of the decision making process that you might go through when faced with this order of magnitude.

Mr Coutts—Ultimately, it is the companies, not the industry association, that make those decisions. It is probably better if Geoffrey keeps his head down.

Mr Ewing—A lot of it is, of course, conjecture and nothing is going to happen terribly rapidly, but obviously the impact will come more in the new investment area first. It is not a question of closing things down and racing off somewhere else. The very nature of the investments is that they are huge and long term and it takes a long time to build a smelter or an alumina refinery.

Senator LUDWIG—I understand; that is why I was more generalised.

Mr Coutts—So the order of things is: no new investment, running down existing assets and maybe closure in the long term in the worst-case scenarios, which we very fervently hope do not come to pass.

Mrs DE-ANNE KELLY—What is the value of Comalco's investment in Australia?

Mr Ewing—This figure is not precise, as we have one major investment outside Australia, which is the New Zealand Aluminium Smelter at Invercargill. The total investment in Australia is of the order of \$4 billion.

Mrs DE-ANNE KELLY—How many direct employees do you have?

Mr Ewing—The total number of direct employees is 3,500, but that includes New Zealand. So in Australia we are talking about 2,900.

Mrs DE-ANNE KELLY—You mention that the recent renewable energy bills before the Senate are going to increase mandatory costs by \$70 to \$95 per tonne of CO₂. Why is that?

Mr Ewing—If I may go to the submission—I think that is where you have taken the question from, Mrs Kelly, and it might help to recap here—we said that this legislation will necessarily erode Australian competitiveness because it will impose mandatory costs of \$70 to \$95 per tonne of CO₂ equivalents abated. That comes from some research carried out by the Australian Industry Greenhouse Network, as I recall. Perhaps Mr Coutts can say a bit more on the history of that.

Mr Coutts—I am not sure of the exact figures, but the council has done a lot of work on what this will cost the aluminium industry as a whole, rather than specifically Comalco. Our estimation is that it will increase our costs by about \$70 million per year as an industry. Comalco has about a quarter or a little less of metal production, so something like a \$15 million a year increase in cost for Comalco would be a quick guess.

Mr Ewing—Yes, that is basically how it is going to go.

Mr Coutts—That is a pretty significant increase in our costs, and of course they cannot be passed on, because we are an export industry and we export on a terminal world market through the London Metal Exchange. It is another impost on competitiveness. It is not a make or break issue by itself, but what it does do is divert funds from what we would regard as more effective greenhouse abatement and competitiveness investments to ones that we do not think are so competitive.

Mrs DE-ANNE KELLY—I notice that you quote, in fact, a number of countries that have higher assigned amounts than Australia in the original Kyoto round. You quote Portugal, Greece, Spain and Ireland. Has Australia not done as well as we have been led to believe?

Mr Coutts—There are two points to that. Firstly, yes there are countries that have higher amounts in that context than Australia. Because of the way the European Union is, they have a bubble where they have an overall target, but they have split that by agreement amongst their countries. As you have indicated there, a number of those countries have much higher targets

than we do. The other comment is that, yes, we have always said that Australia's task is very challenging and has not done as well as it might. We did accept that the outcome achieved at COP3 at Kyoto was probably a reasonable achievement, under the circumstances, by the government, but it is still a very challenging task for Australia, because of our economy, its nature and its energy intensity.

Mrs DE-ANNE KELLY—According to that, we could have done better.

Mr Coutts—It would have been nice if we had got a higher target. Those figures were not known at the time of Kyoto. The agreement of Kyoto was the European bubble figure of minus five or minus nine—

Mrs DE-ANNE KELLY—So the Europeans have got the better of us again?

Mr Coutts—Yes, absolutely. Anyone who does not see this as an economic issue is being short-sighted.

Mrs DE-ANNE KELLY—Moving on from that comment, do you see it as being very much an economic issue?

Mr Coutts—We see it as an environmentally important issue but certainly the way the national developments are going, it is an economic issue. Firstly, it has to be because it has impacts on countries' economies and, secondly, a number of countries are quite clearly approaching the negotiations in that way. The whole of the G77, for example, I am sure sees it totally as an economic issue.

Mrs DE-ANNE KELLY—On pages 13 and 16 you mentioned that there should be an evaluation of the economic and social wellbeing of citizens, particularly those in regional areas. As a regional dweller, I am very keen to hear that. However, you would be aware, through the media and others on the new economy, that we are now an IT-focused country. Why should we be concerned about old industries in poorly populated regional areas?

Mr Coutts—I wish I had brought the piece on the back page of the *Financial Review* on Monday—which no-one else seemed to have read, except me—by a gentleman called Stephen Koukoulas. There were a couple of paragraphs in there which I completely agree with. They basically said that, as the US economy perhaps stops being obscenely overvalued and perhaps moves to being just overvalued or a little more in balance, Australia may well be glad that it is not dependent only on 'new industries' like information technology. Of course, we should be growing those industries as we can. But Australia has one advantage and that is that it has a very solid base of old industries—although I hate that expression—like minerals and those sorts of industries which are world competitive, and many other countries do not have that. We have argued all along that there is a lot of potential in growth of those industries. That is why the government is about to announce a light metals industry action agenda. That is a technology development approach for those industries, and you then have a base to build these other industries on. Everybody wants to grow their IT industry, not just Australia. It is a pretty competitive world out there. We have competitive advantage in industries like aluminium—we certainly have that.

Mr Ewing—We certainly do not regard the aluminium industry as an old industry. In fact, we think aluminium is very much a metal of the future. We have not relied on this significantly in the submissions before the committee but, while aluminium of course itself is energy intensive to produce, recycling of it uses only something like five per cent of the amount of energy needed to create it. As Mr Coutts indicated earlier, the industry is growing at a rate of some four per cent per year globally, which is a fairly significant growth rate, and the recycling rates are really very good already and are improving. The amount of aluminium going into the transport sector, particularly the automotive industry and the aeronautical industry, is very significant because recycling rates are going up and because, for instance with automobiles, you use a lot less fuel. Fuel itself, or the burning thereof, exacerbates the greenhouse effect, but cars that have greater rates of utilisation of aluminium use far less fuel. So in the transport sector, the more aluminium we use—and not just in the transport sector—the better off we are ultimately going to be. We see the rate of growth of aluminium as being probably exponential in the medium term.

Mrs DE-ANNE KELLY—Mr Coutts, you have not mentioned the science to any great extent. Does Comalco accept the science or is it befuddled by the confused theories and opinions?

Mr Coutts—Geoffrey is Comalco; I am the industry as a whole. All I wanted to say on the science was that we understand and follow the debate. We understand there is a debate that has not yet reached its conclusion. It probably will not do that for some considerable time. The scientists cannot tell us for sure what the level of CO₂ in the atmosphere is that will be positively dangerous. So it is very hard to know just how hard to go in at this stage. We are not climate scientists and we just have to take advice. We have decided as an industry that it is a serious enough issue that we need to embrace it and to try to work with the government to contribute what we can. But we do not accept that that should adversely affect our competitiveness.

Mrs DE-ANNE KELLY—Mr Ewing, has Comalco evaluated the science?

Mr Ewing—No, we have not set out to seek our own reports on the science. Rio Tinto and all its subsidiaries accept that it is an appropriate action to take to endeavour to reduce global greenhouse emissions and so that is the course upon which we have been embarked for quite a number of years. While we obviously acknowledge as the industry as a whole that there is a significant area of debate as to exactly the impact, we do not attempt to evaluate all of that ourselves; we simply support efforts to curb the growth of greenhouse emissions.

Mrs DE-ANNE KELLY—Mr Coutts said ‘inconclusive’, though. Is that something you would agree with—that the science is inconclusive?

Mr Ewing—Again, we do not see that it is appropriate for a group like ours to come to a landing, if you like, on that. We accept that there are a variety of views but, from our perspective, all we wish to do is support the efforts to curb the growth at this point without getting into the debate at all on the science.

Mrs DE-ANNE KELLY—But you are going to have your costs go up by 25 per cent and you have not formed an opinion on the argument underlying that.

Mr Ewing—What we are saying is that we can see the perceived social need and the policy directions that governments have taken and we are prepared to accept that; but we are certainly not prepared to accept the costs going up by 25 per cent because we cannot. We do not see a need for that. We do see a need, as government has identified, for action which is going to curb greenhouse emission growth, but we are saying most empathically that the mechanisms which were employed must be ones which are—and we have listed a series of things—certainly effective and must not be at a cost which affects the competitiveness of our industry internationally.

Mr Coutts—It is very tempting to get into a debate on the science and, as I said, we follow this with some interest but the conclusion that we have come to is what I said—that there has been enough evidence brought forward to cause us, as a responsible industry, to take the issue seriously and to do what we can to improve our efficiency to contribute to that. This is also why I have said several times that the time frames here are very important and the big danger, in my view, is to let the politics and the policies move vastly further ahead than the science. So, while we need to take the issue seriously, we need to be conscious of the time it is going to take to turn these rising CO₂ levels around, if that is what we need to do. It is not five years: it is 20,30 or 40 years for that. We also need to be conscious of the time it is going to take to bring proper and effective actions into place. So the really big issue, I think, is to not let the politics get too far ahead of the science and to deal with these issues in the right time frame.

Mrs DE-ANNE KELLY—If I could put it another way, you are saying then that the science and the social and economic consequences should all walk hand in hand with the science outcomes?

Mr Coutts—As far as you can. You cannot do that exactly in lock step, because nobody knows where the science is going to end up. To the extent you can, I believe you have to tailor your response to something realistic in that frame. I do not think a lot of people are listening to the scientists in that regard, quite frankly. I underline that the aluminium industry has chosen to take this as a serious issue and to do what it can to contribute to it.

CHAIR—I would like you to be as brutally realistic as you can in answering the questions I would like to put to you, because we are not here to deal in public relations. If a harsh carbon withdrawal regime were imposed in Australia for whatever political reasons, where would you relocate the processing first—which other countries? Where would the board, for example, of Rio Tinto go? I assume most of the industry would follow.

Mr Ewing—I certainly share your comment that we must be frank and brutal about this, but I do not know that I can answer your question very directly because I think we are still at a preliminary stage, if you like, in the whole discussion. We do not know quite who is in and who is out. These questions are always finely balanced and there are always questions between perhaps governmental requirements, local costs and just general risk as another factor. Those factors can all change very rapidly. You may well be aware that with our proposed alumina refinery, where we are conducting a final feasibility study at Gladstone, for a couple of years we had narrowed the choice there between two locations, one being Gladstone and the other being Sarawak in Malaysia.

The particular option of Sarawak was chosen for a variety of primarily geographical considerations, as well as, obviously, some commercial considerations. It was a very fine balance, choosing between Sarawak and Gladstone. As I have mentioned, those factors—the commercial factors, the geographical factors and the governmental requirements in all their diversity—can all change quite rapidly. It is only when you are right down to the wire and have to make a decision that you can really make that decision, so it does not make sense to say, ‘We might choose Sarawak,’ or ‘We might choose Abu Dhabi,’ or somewhere else. The risk profiles of countries can change very rapidly too, which is another significant cost.

Mr Coutts—I can tell you something substantive on that, if you like, from a different perspective. I can tell you, I think pretty clearly, where the investment would be if it were not in Australia. That is, for metal it would be in the Middle East, Africa, Latin America to some extent and almost certainly India, China and Russia.

CHAIR—What about coal?

Mr Ewing—Maybe one smelter in Canada.

CHAIR—So you obviously follow energy and the cheapest energy is coal. Then there is the question of sovereign risk and geography.

Mr Coutts—The energy basis of those metal investments would vary from country to country. The Middle East, at the moment, is competitive because they have some flare gas, but I think one more smelter there would just about change those dynamics. Africa, at the moment, is coal, even though the new smelter is in Mozambique, which I would have thought would be hydro—but it is not; it is coal. India is coal. They have pretty poor quality coal, so they would probably import some Australian coal to produce the electricity for such a smelter, which is the ultimate irony.

CHAIR—Sarawak is also coal, isn’t it?

Mr Coutts—That is alumina, not metal. That is a different thing. China is basically coal as well. That is where the metal investment would be. Alumina investment would probably be from Africa, Latin America and India.

CHAIR—Okay. The next thing that is often talked about is the pipeline from the Katoomba gas field down the coast. How much do you think the pipeline depends on the smelting plans?

Mr Ewing—The refinery plan?

CHAIR—Yes.

Mr Ewing—There is no question that the PNG gas pipeline proponents will be very pleased when Comalco makes a final decision to go ahead because it obviously uses a base load which it simply does not have. They have stated, however, that the proposal is viable without the Comalco refinery but, as I say, the Comalco refinery would still provide by far the biggest load for such a pipeline. It is a bit hard to be objective about it from Comalco’s perspective.

CHAIR—But without Comalco, would they go ahead with the pipeline?

Mr Ewing—They certainly maintain that they can, but undoubtedly it would give it that extra load that would make it more certain.

Mr Coutts—There is certainly an active debate going on about that issue.

CHAIR—Could you take us through the life cycle analysis again? It is interesting; we have heard it once before. As a principle, is it embodied in any of the negotiations of the protocol?

Mr Coutts—It is not, and that is one of the big flaws in what is emerging from Kyoto, in our view. You have a metal or material that has big environmental advantages in its end use and its recycling but has energy emissions at its production phase. The way the protocol looks like it might work is to penalise the production phase and bring none of the benefits through to influence the decisions on where you produce the material. The life cycle argument says you need to somehow take account of the end use—that is, the light weighting of automobiles, et cetera—and the recycling. We have done some work, for example, on the life cycle aspects of automotive use, which very clearly shows that over the life of an average vehicle, if you light weight by about 30 per cent using aluminium, you make a significant net gain in greenhouse emissions for that vehicle, including the emissions from producing the aluminium in the first place.

CHAIR—One of the consequences, though, would be that you would kill more motorists?

Mr Coutts—You will have to elaborate on that for me.

CHAIR—Let me put it simply. If, on the one hand, the cost of protecting motorists from injury and death in crashes—

Mr Coutts—You mean the safety of the vehicle?

CHAIR—Yes—the cost of building a very heavy car so that they are not damaged.

Mr Coutts—It is my understanding that that is not the case. The properly designed car with light weighting of aluminium is at least as crashworthy as a heavier car. If you want to explore that further, I will have to go and get some more information. That is what I have been informed.

CHAIR—It was put to us in one submission somewhere that, if we are going to do cross-benefit analyses about the cost of increasing emissions—if they do warm the atmosphere or cause whatever bad consequences are asserted—we should weigh, in a sense, the cost of not doing it against the cost of regulating the hell out of you guys. The other way round is: if we had said, ‘Don’t worry about the greenhouse thing at all. Let’s have heavier cars—don’t worry about aluminium,’ more people would be alive now than might perish 100 years hence from the other—

Mr Coutts—My understanding very strongly is that there is absolutely no evidence to support that point of view. I would say that, if you are going to take a life cycle approach, ultimately you should take all those things into account. But I just do not believe they would give you that answer.

CHAIR—We could build our cars from balsawood and there would not be a lot of emissions from that.

Mr Coutts—Obviously, I am not speaking for any other material. If you build it out of paper or balsawood, you may get a different result.

CHAIR—I am just drawing a long bow. Mr Ewing, you produce very good aluminium, I suppose.

Mr Ewing—Yes.

Mr Coutts—The best, I would think.

CHAIR—No doubt. You have significant scientific input into the processes so that the product that you produce, based on the technical work that you do and so forth, is state of the art. If the company puts such emphasis—as it must, I suppose—into the technical quality of its product, why wouldn't it pay some scientific regard to a policy that was about to put its costs up by 25 per cent? I was a shareholder when I asked that.

Mr Ewing—We certainly have regard to the science. What we are talking about with the Kyoto Protocol and with the greenhouse debate is that we do not have a united global approach but an approach which affects just about every country on earth in some way or another. We do not see that it is, if you like, our business to try to gain, say, all of the other experts in this area. We are very focused on the communities in which we operate. Certainly the Australian government has made a commitment in relation to Kyoto which has to be translated into perhaps a legal obligation, but it is, nevertheless, a commitment. As a citizen of the country—and I do not use that in a grandiose sense—we are prepared to accept that commitment and say, 'We do accept that we must do our bit to try to reduce greenhouse gas emissions and we have, in fact, been doing it.' We were one of the very early signatories. We simply do not see that there is a commercial advantage in us being involved in the science of the actual issue.

CHAIR—If I were a fund manager owning a large chunk of your shares, I would insist that your first legal duty is to me. You have to do the best for your shareholders.

Mr Ewing—Indeed.

CHAIR—So, in that sense, if the choice is made—if one jurisdiction goes bad on you because of a policy change—you damn well had better move your smelter or you would be sacked by the shareholders. Right?

Mr Ewing—It is a question of finding that balance. As I have indicated, we want to obviously comply with the laws of the countries where we operate, and will. We simply have to

make a judgement as to whether or not it is worthwhile where we place our commercial efforts. We do not see it being worthwhile getting involved in the science.

CHAIR—I know you cannot afford to be too horribly brutal in public, but the shareholders want the dividends.

Senator LUDWIG—You are not suggesting that shareholders have any real clout?

CHAIR—You can imagine the board sitting there in London with the big fund managers from the city saying, ‘Now, how about our dividend?’ You have got a map of the world and you can colour, in various colour schemes, which jurisdictions are more aluminium friendly, let us say—be blunt—the scheme that is put in place, and whether you are in one annex or another or whatever. Then, if I were one of those fund managers, I would want to see those refineries and smelters moved so that the return on equity is what I demand.

Mr Coutts—They are a bit hard to move. That is why we keep talking about new investments.

CHAIR—Yes, that is what I mean. Is it a decision that the board is going to make, pay regard to—

Mr Ewing—We have made a commercial decision—and, indeed, it is driven by what we believe our shareholders, including all of those large fund managers, want—that the direction we are taking is the appropriate one and that we believe they would be complaining very loudly if we said that we were going to ignore the directions that our host countries are taking in relation to greenhouse gas emissions.

Mr Coutts—But surely the first step—and where everybody is at the moment—is to try to work with the government and the international process to get sensible decisions. That is the priority.

CHAIR—Yes, I agree. We should actually have a look at the share prices of those affected—this stuff that the Allen Consulting Group has done, for example—and compare that to whether it is the industry index or the stock index as a whole and whether shares are traded.

Mr Coutts—But you have got to recognise the Alan stuff is scenarios at this stage. Nobody is necessarily saying that is what is going to happen; it is what would happen if you had a certain outcome.

CHAIR—Fund managers will buy or sell your shares on the same scenarios. I used to be one. The analysts will give them advice.

Mr Coutts—They then have to arrive at a point of view that a certain outcome is likely to happen. I do not think we have got to that stage yet—at least I hope we have not.

CHAIR—We could go for a long time on this. Many thanks, and any further submissions you would like to make after COP6 would be welcome, because we realise that is a crucial thing we are about to hit. Is anyone going to observe it from the council?

Mr Coutts—From the aluminium industry, there are two people who are connected with the Australian industry. One is Maria Robertson from Comalco, who is actually going with the New Zealand delegation because she is based in New Zealand, but she will be taking a broad view, I think. We are also sending an observer from the Aluminium Council, a gentleman called John Hannagan, who you may or may not know. He is a Melbourne based consultant. That is basically to try and contribute to the public debate on this issue, which I think is going to be very important as we go through COP6, because there are going to be a lot of things happening and I think we all need to contribute to the public understanding of it.

CHAIR—You may decline to answer this question, but if you had a choice of which cabinet minister was to lead the delegation, which portfolio would it be?

Mr Coutts—I decline to answer that.

CHAIR—All right, you are dismissed for the time being. We will see you after COP6. Many thanks.

Mr Coutts—The committee will not be doing any sort of report prior to COP6?

CHAIR—No, I do not think so. We thought of doing a discussion paper, but we have not got time.

[2.20 p.m.]

BURROWS, Dr William (Bill) Henry, (Private capacity)

CHAIR—I welcome Dr Bill Burrows. The committee does not require evidence to be given under oath, but these hearings are legal proceedings of the Parliament and warrant the same respect as proceedings of the House or the Senate. Hence the giving of false or misleading evidence is a serious matter and may be regarded as a contempt of parliament. Dr Burrows, I invite you to make some introductory remarks of whatever length, which you may illustrate with slides and so forth.

Dr Burrows—Although I am giving this presentation in a private capacity, I have worked for 37 years researching woodland communities, mainly in Queensland but I also spent a bit of time in western New South Wales. I thank the committee very much for accepting my submission and for inviting me to appear today. I assume that you have been able to peruse the copious documentation that accompanied my submission. I apologise for the length and the scope of this material, but I have had a lot of difficulty for a long time getting people—both fellow scientists and urban dwellers particularly—to understand the woodland ecology population dynamics. I understand that it is difficult for people to understand situations in which very few people have been doing research over time.

It is unfortunate that in the current debate many urban dwellers have a very poor understanding of the structural changes that I refer to in the submission, particularly in our standing forests and woodlands. I am really referring to what has occurred since Europeans first arrived with their domestic livestock. It probably also needs to be emphasised that the points I am raising are addressed at the 99-plus per cent of what I call our ‘grazed woodlands’ or ‘intact woody vegetation’ that is not cleared each year. There is a lot of emphasis in this debate on the amount of clearing and little emphasis or appreciation of the fact that 99-plus per cent is not cleared each year. What is going on there is of equal, or greater, moment.

Since my submission was compiled, there have been further developments—of which you would probably be aware—in terms of the post-Kyoto negotiations that all lead to COP6. I will briefly draw your attention to a couple of those developments that are relevant to the arguments that I have put forward. Firstly, the USA’s proposal on land use, land use change and forestry for COP6, and particularly article 3.7, suggests that the base year greenhouse gas inventory should cover all human-induced emissions and removals in the land use, land use change and forestry sector. That is consistent with the position I put forward. In terms of what Australia has argued about its position vis-à-vis Kyoto, they drew attention only to the land clearing and not all emissions and all sources in the land use, land use change and forestry sector. Secondly, the United States stated that it agreed in part to the targets set out in annex B of the protocol—which details what its emissions would be; I cannot recall whether there was to be a five per cent or nine per cent reduction in 1999 net emissions—only on the expectation of significant credit from land use, land use change and forestry.

You might be familiar with the fact that there is a ding-dong argument going on between the United States and the European Economic Community on whether these components should be included or not. This was suggested to be part of the USA’s Kyoto bargain; it is in their written material. They had this understanding and therefore they want to include these things, which some countries say they should not include. Certainly from the point of view of scientific

completeness, it is very difficult to argue against the comprehensive case they are putting forward, if we are really interested in net effects.

Therefore, while I maintain that Australia does not qualify as a beneficiary under article 3.7, this country could equally claim, just as the United States has, that its Kyoto commitments were agreed to on the assumption that it could include land clearing effects in its 1990 baseline, as set out in article 3.7. It is a policy decision, it is not a scientific position, but it is one clearly that the United States is going along and saying, 'This was our understanding of the bargain at Kyoto,' which may be only their understanding themselves, and Australia could equally argue that we believe that we could include the emissions from land clearing and that would enable us to include that in our 108 per cent target.

CHAIR—Getting back to basics, can you give us a quick thumbnail lesson about this 1990 baseline agreement and our land use?

Dr Burrows—In terms of article 3.7, the Australia clause, which is the second sentence of article 3.7, really comes into play if the net emissions from land use change in forestry were a source in 1990. If I make a mistake, I have got colleagues behind me here who are a bit more erudite on some of these subjects than I, and they can knock me on the shoulder if I make a silly statement, because I do not want to mislead you.

That being the case, by aiming to include our land use change in 1990, we were able to include any reduction in land use change—in particular, we are talking about land clearing here—as part of our achievements towards our commitments in 2008-12. That has been the driver in Australia's position.

CHAIR—So we have said this land clearing, or the land use and land use change, was a source of emissions?

Dr Burrows—Yes. We include some in terms of forestry, but I argue in the submission that the amount of forestry included is very small relative to the total managed forest land in Australia. But also, under the American submission to COP6, where they would include all their grazing lands, cropping lands and forest lands, that means that it is complete accounting. I could produce some figures later on but, off the top of my head, we have got about 76 million hectares of woodland and forest in Queensland. We include in our inventory about six million hectares of forest.

CHAIR—We have got 76 million.

Dr Burrows—Yes, and we have acknowledged that about six million hectares of the standing forest and the change in that is included under our forestry sector. So you take that away and you are left with 70 million hectares. A lot of that is national park and crown land, such as state forest and so forth like that. But agriculturally we talk about having 60 million hectares of grazed woodland. Some of this forest land that is included in that six is in there, but the vast majority of it is not. Under the American suggestions, it would all be included. The assumption made by the Greenhouse Office and others is that, in terms of this Kyoto accounting, we have a situation where we basically only have three classes of forests: we have forest that is not being

affected by human activity and is in equilibrium, as it was in 1788; we have forest that is new, that is plantations; and we have forests that have been cleared.

What I am trying to point out is that there is an enormous amount of forest in here that is not included in either of those situations. I guess this is where you need the ecological understanding, but the people who are monitoring the woodlands, particularly in Queensland, would say that none of our woodlands, in particular, and just about all our woodlands and forests are not in equilibrium. In fact they are increasing in their carbon sequestration. The Americans, in their situation, want to include similar sinks in their total inventory, and that is the argument they have put forward to COP6. It seems to have had a lot of weight in the summarisation of the various countries' arguments made in Lyons in mid-September.

I have one final point regarding the overview. Irrespective of whether or not Australia can utilise the last sentence in article 3.7, in other words, count those emissions in 1990, I suggest that, should COP6 adopt the USA's accounting rules—and you have to make your own conclusions about the likelihood or not of that—this country has little to be concerned about from the Kyoto Protocol, at least to the end of the first commitment period. This result derives from the fact that, under the USA accounting suggestions, there is an estimated—and this is from our research—minimum sink of about 150 million tonnes of carbon dioxide equivalent per year in Australia's grazed woodlands which is presently unaccounted for.

CHAIR—There is 150 million tonnes?

Dr Burrows—Yes, that is a suggested estimated minimum sink per year.

Mrs DE-ANNE KELLY—Per year?

Dr Burrows—Yes.

CHAIR—That is sequestered in these woody—

Dr Burrows—Yes, in the woody vegetation. Such a sink reduces this country's most recently published net emissions of 520 million tonnes of carbon dioxide equivalent per year when you add land use change, which presently is not included in the official figures. When it comes to that, it would reduce it by about 30 per cent at this point in time. Depending upon how you would like to take it from here, Mr Chairman, I have some overheads that would support those suggestions.

CHAIR—Yes, put them up and then we will cross-examine you.

Dr Burrows—I will try to go through them reasonably quickly.

CHAIR—There is plenty of time.

Overhead transparencies were then shown—

Dr Burrows—I am not here to tell you about article 3.7.

CHAIR—No, but let us rehearse it again, because it is crucial to what you were saying.

Dr Burrows—Okay. Article 3.7 states:

Those Parties included in Annex I—

that is, the OECD people—

for whom land use change and forestry constitutes a net source of greenhouse gas emissions in 1990 shall include in their 1990 emissions base year or period the aggregate anthropogenic carbon dioxide equivalent emissions minus removal in 1990 from land use change—

not land use change in forestry, but land use change—

for the purposes of calculating their assigned amount.

That, I suggest, lead to Australia's course of allowing us 108 per cent in the assigned amount for the 2010 commitment period, which is the average of 2008 to 2012. Whereas most other annex countries have a 92 to 95 per cent target—that is, because they reduce it by some—Australia has the reverse by maximising its reported 1990 net emissions. In other words, the larger they are, if you increase them by over 100 per cent, the better off we will be. Under that logic, we would be better off if it was 1,000 million tonnes.

The IPC 1996 revised guidelines, the bible for what each country can and cannot put in their inventories, state on page 512 that forests classified as natural or abandoned regrowing can be excluded from the woody biomass stocks accounting only if there is no significant current human interaction with those forests and that, if they are being used as source of fuel wood or are being affected in other ways by ongoing human activities, they should be accounted for on an annual basis as part of change in forest and other woody biomass stocks. I certainly put it to you, Mrs Kelly, that grazing is a human activity in our northern grazing lands and that it has an impact on our tree-grass relationships. Under that instruction, I would include it. I made that point in a submission to the issues paper that was circulated by the Greenhouse Office earlier this year, and it is included in my submission.

Recently, Australia made a submission to COP6, presumably put together by the AGO, in which it outlined the suggestions it wanted taken forward. It just made the point—the second highlighted point on the overhead—that on this basis, 'Emissions occurring in the remaining subsectors, changes in forests and other woody biomass stocks, CO₂ emissions and removals from soils and other are not included under the term "land use change"'. In other words, whoever put together this submission to COP6 did not want changes in forests and other woody biomass stocks included. You can understand why: because it would reduce our net emissions in 1990 and we would count that 108 per cent would not be getting the advantage or the leverage that it would if they were higher. I will leave that. I would not like to get into it too much more either because I am here as a scientist, not as a policy person.

SBSTA summarised the submissions that the various annex 1 countries had to put in by 1 August—I think most of them did—in a meeting in Lyons in mid-September. It just pointed out that, in terms of article 3.7, the one where we highlighted the Australia clause before, this is what is coming out. This is post-Kyoto now; this is coming up to COP 6. It said:

A single pre-commitment period review process should apply to all elements of a Party's inventory, including all emissions and removals associated with land-use change and forestry. The eligibility of a Party to apply the final sentence of Article 3.7—

the Australia clause—

shall be based on a complete, reviewed inventory.

Under that—it is my reading of the English language—we would include the forestry and other components that are presently not included. That would by definition, in terms of the calculations, negate the Australia clause. We would no longer have a net source of emissions for 1990. However, I did point out that we could use the American argument and say, 'This is not our understanding of the Kyoto Protocol, and you cannot take that away from us or we will take our ball and go home,' or whatever else we do. We can now look at some points of the United States submission, leading up to COP6—this is the August one.

The United States proposes that LULUCF activities be included in a comprehensive manner pursuant to Article 3.4.

This is the one that is talking about additional activities.

... the United States agreed to the target set forth in Annex B of the Protocol, in part, on the expectation of significant credits from LULUCF.

That is the point I made earlier. In other words, 'If you won't let us do that, we'll take our big ball and go home.' That is what they are saying. There is enormous advantage to that country if they can count this because of the extensive areas of regenerating forests in the United States and the mainland. It proposed that the broad categories, as I said before, would be forest management, crop land management and grazing land management. This grazing land management is all in northern Australia again. To account for greenhouse gas emissions and removals associated with these management activities, the United States proposes a land based—that is, area based—counting system focusing on the changes in carbon stocks on managed lands during the commitment period. It is not looking for a rate change; it is just looking at what are the carbon stocks in 2008. Are they bigger or smaller in 2012? Divide that by five is my mean change, and that is how I have satisfied it. So that is all they are doing.

In this discussion of article 3.4 it has largely been proposed that it would not come into play until after the first commitment period. But there is, as there always is in these things, an out clause. Again, this is part of the US submission to COP6:

Article 3.4 gives Parties the option of applying the decision on additional activities to the first commitment period, provided that the activities have taken place since 1990. Because the land management activities proposed by the United States—

as they are going over northern Northern Australia—

are ongoing—

as they were and still are in this country—

and therefore have occurred since 1990, they could be applied by Parties in the first commitment period pursuant to the final sentence of Article 3.4.

I am a project leader within the COC for greenhouse accounting, and Andrew Thomson is our regional science meeting man down there. Our executive director, Ian Noble, has basically said that, in terms of the first commitment period, every country will win. By and large, if you are cynical they will, because if the American position goes through there, we will carry through automatically—and we are bloody mugs if we do not—and we will win. If the Huns—excuse the word; I was born in 1940—are going to cause us trouble, we will only worry when they overfly the channel; we will not worry when they accumulate on the other side. That is what we are all saying; we are giving ourselves some time.

Everyone said that the real problem, of course, is fossil fuel—everyone agrees with that usage. It is an excuse, I guess, for non-immediate action. But Australia is extremely well placed, because we have only 19 million people on a continent the size of the United States. We have an enormous landmass that is under management, just as the United States is. We can take advantage of that—and we can under the conclusions reached.

If we refer back to Australia's present position and look at their latest summary, they are only talking in the inventory about an area of forests—this is in the Niggy, which is slightly different from the Kyoto; it gives you some indication of the areas that we are looking at—of about 16 million hectares. In my submission I just pull out a figure from the Queensland forest industry; it was published in 1998. It talks about our forest areas—this is from the Queensland DPI forestry. It talks about 49 million hectares, but it says that privately owned timber resources are 20 million hectares—and I have not quite worked out how private gets on to leasehold, because mostly we are told that people on leasehold do not own the timber. Anyway, there are three million and 17 million hectares. So 20 million hectares just in Queensland alone, forgetting about that other side there, relates back to our having only 16 million for Australia as a whole. It gives you some indication that we have a selective inventory. We are putting some things in and some things out. We cannot add up.

Mr HARDGRAVE—Who is we?

Dr Burrows—It is someone who lives in a capital city other than here, I guess.

Mrs DE-ANNE KELLY—Who prepared that, Mr Burrows?

Dr Burrows—It was prepared by Environment Australia and the Australian Greenhouse Office.

Mr HARDGRAVE—But what would be the motive for fixing the figures like that?

Dr Burrows—I would be wrong to assume that they are fixing the figures. I believe—and I do this with the arrogance of counting trees in Queensland for 37 years; there are not too many other people that have been silly enough to do a stupid thing like that. So, that being the case, it is quite understandable that a lot of other people do not know what is going on. To be perfectly frank, I have been involved in the compilation of the National Greenhouse Gas Inventory since 1994—since the original inventory was put together. I was quoted as the best source for giving an estimate of the extent of tree clearing in this state before we had satellite imagery. I was constantly questioned about that so I could give some figures for 1990—and this was in 1993, leading up to 1994 when our first inventory was published—and I used my contacts in the

grazing industry and many other places to come up with a figure. It took a few months to get this figure, because I had to use my good relations with chemical companies, as well as certain contractors, blade plough operators and people connected with many other things that go on in Queensland, but Mrs Kelly and I will not bother to go into that. But we are leading to some tree clearing—what we would call development in our grazing lands.

I would get asked, because the pressure was on the Canberra public servants who were doing this, whether I could speed up the process, and I would say, ‘Slowly, slowly flows the don’. You just do not get commercial-in-confidence information. I cannot ring up Dow Chemicals and say, ‘How much chemical did you use last year?’ because they will say, ‘Are you going to tell that to Dupont tomorrow?’ So I had to do a little bit of caucusing there. It took a while—three or four months at least. Every couple of weeks I would get a phone call and I would give the best estimate at that time. Before I hung up I would say, ‘Who is concluding that the forest that is not being cleared is growing? We are measuring this. We have these permanent monitoring sites throughout this state.’ I was told each time that someone else was doing it. I did not know anything else about the components of the inventory at that time. I was just a grass mechanic in the big north and I was providing some figures. I assumed that they were, but they were not. So there was poor understanding.

Mr HARDGRAVE—To qualify that just one step further, out of that 1994 figure of 16 million figure, what did you contribute?

Dr Burrows—I did not make any contribution to that figure at all. If I had been asked at the time I would have said 60 million.

Mr HARDGRAVE—In Queensland or in Australia?

Dr Burrows—Just in Queensland—just our graze wood. Not in Northern Australia, not in New South Wales, not in the Northern Territory or the Kimberleys.

Mr HARDGRAVE—You raised the question of policy versus science. My response would be: How can we get proper policy without proper science? How do you reflect on that?

Dr Burrows—I would not like to be a scientist and be told tomorrow that I was going to be a policy person, because I would be shocking at it. I just do not have the patience for it, I must admit, although I have counted trees for 37 years—hugged them. It is difficult for policy people, if they have some different qualifications, to know what questions to ask. One of my mentors said a long time ago, ‘You don’t know what you don’t know.’ A lot of people who have been trained in different disciplines, and biological disciplines included, were based in southern Australia and did not have any appreciation of the northern woodlands—a lot of them still do not. I could randomly pick probably nine out of 10 people in Canberra. Given the information we put over our televisions and so forth and given the things we do in terms of the many things we regard as sacred such as land care and so forth, all we are doing in Australia is ripping trees out of the ground. An enormous number of them are naturally regenerating. When Hawkey said he was going to put in four billion trees, we would have hatched four billion trees in Australia that particular year that were new to the system. That is no problem. It is not a very sexy area—it is following population dynamics of woody plants in our grazing lands.

Another mentor of mine said, 'If you are going to get involved in this, you can only be prepared for posthumous fame because it takes so bloody long.' Trees live forever. They live a lot longer than we do. If you really want to follow through the life history, you do not have a chance. You have to try to do that in a way that passes that on. What we would like to see pass on from this, if you get the tenor of the submission and understand it, is that we have an enormous opportunity here, assuming we go along with our friends in the United States and count these things. I would not say that this is the way that we should be addressing greenhouse issues and global warming but, given that this is the game, we have an enormous opportunity. It gives industry enormous opportunities too.

Mr HARDGRAVE—To develop other projects?

Dr Burrows—Yes, and to follow through the aims of renewable energies and other things as well, but at a pace that they are more comfortable with.

Mr HARDGRAVE—If the 1990 measure was so corrupt in a scientific sense, if it was so wrong, is the effect on Australia now offset by your view that we could actually produce more greenhouse gas? In other words, we could sink a lot more. What was it—150 million tonnes a year?

Dr Burrows—Yes, that is what is not presently included. Just to qualify this, we obviously took a figure to Kyoto which said, 'This is our indicative baseline', but our baseline has not been compiled yet. It is not to be completed—I understand it has been put off a bit—until June next year. I think that is the current target. Obviously, every country that is a signatory to Kyoto has to declare its baseline at some time because that is how you can judge the success in meeting the commitments for 2008-2012.

Mr HARDGRAVE—But you said there was an incentive in having the baseline exaggerated in the interim days.

Dr Burrows—There obviously is. Sixty per cent of our hardwood comes from private forest land. The people in Canberra were trying to do a job in a hurry in 1993 to get an inventory together for 1990 as part of the framework convention on climate change, and they had pressure on them. They would have just come up here—as any good public servant would—and said to their corresponding agency in this state, in New South Wales and in other states as well, 'What figures do you have on forests?' and they would go to the state forest agency. The state forest agency would give them the figures for the state forests because they would not have these components for the private forests. So that is where it comes in. It should be corrected. If we are going to be honest with ourselves, it has to be corrected. We presented an indicative figure. I do not think we had a nominator figure in Kyoto. So we have been given an indicative figure. I would be surprised if any country has actually submitted their 1990 baseline yet in an official capacity.

Mrs DE-ANNE KELLY—Dr Burrows, am I to understand that the reluctance— or perhaps ignorance of it or whatever the cause may be—to include land use change in the forestry sector as a net sink, which you affirm it to be, is because it would bring that 1990 baseline down?

Dr Burrows—Yes.

Mrs DE-ANNE KELLY—So we have a much more difficult target to get down to, a lower baseline, in reducing emissions?

Dr Burrows—Yes.

Mrs DE-ANNE KELLY—If you want to expand on that, that is fine, but I have another question for you. There has to be a quid pro quo. In your opinion, does the 150 million tonnes per annum carbon sequestration from woody weeds that you mentioned more than make up for the fact that we would be starting from a lower baseline?

Dr Burrows—I had some idea that these questions might be asked. My colleague sitting behind me, Dr Beverley Henry, from the Department of Environmental Resources, just did some quick figures. We suggested that, given this new information, there are four possible scenarios—and it is not just new information; it is the possibility that the American position, which has a lot of weight bearing on it, carries forward into COP6. It looks like it is in the synthesising of the submissions at Lyons, which was the substantive report. There are four scenarios. The first scenario is that article 3.7 is not triggered. That is because we acknowledge our sink. The thickening sink is not in 2008 and 2012 either, so we do not include any end result of this ongoing thickening in these woodlands that presently are not accounted for. Industrial use and agriculture, based on projected 1990 figures, could emit 445 million tonnes of CO₂ equivalent in 2008 to 2012. But the present 1998 emission is 481 million tonnes. So it is already above that.

The second scenario is that article 3.7 is triggered—that is, we can get 108 per cent and we conclude the emissions from clearing in 1990 and the thickening sink is not in. That is probably close to the present position. We could then have net emissions of 558 million tonnes of carbon dioxide equivalent in 2010 on the average of those years, compared with the 481 million tonnes at present. That is still taking us above it when you project it through.

The third scenario says that article 3.7 is not triggered because we have identified this sink, but we can include the thickening sink in 2008 to 2012. Under that situation, industry and agriculture could emit 595 million tonnes of CO₂ equivalent compared with 481 million tonnes at present. This is the ice cream one—assuming that we use the argument the Americans have used: ‘This was the rule you gave us in Kyoto, and we’re not going to play unless you let us play with this. This is our understanding, not the rule’. We acknowledge that thickening is happening out there as the Americans want to account for all their forests, down to one acre and anything that is from half a metre to five metres tall or 10 per cent cover, which is a very small shrub. This is the ice cream result. Industry and agriculture could then emit 708 million tonnes of carbon dioxide equivalent in 2008 to 2012 compared with the present 481 million tonnes. Comalco would be laughing.

Mrs DE-ANNE KELLY—What is your understanding of the current debate, Dr Burrows? Are you in a position to follow what is happening in the lead-up to COP6?

Dr Burrows—I sense that countries, including Australia, are choosing positions in case the Americans win. They are acknowledging that the weight of that country will probably win over the European Community, which does not want to include basically any of the land use change and forestry sector. It wants to concentrate only on the fossil fuel situation. It may be the more

correct position but, in the short term, the Americans are likely to win on the grounds of pragmatism and because the biggest boy in town wants to play that way. I think the Greenhouse Office is considering some of those scenarios, but they would not acknowledge them publicly. I would be surprised if they did.

Mrs DE-ANNE KELLY—So at the moment the Greenhouse Office does not accept that there has been a flaw in not taking land use change and forestry as a net sink. Are they accepting the figures?

Dr Burrows—No. I have been involved in this debate: since 1993, I have said, ‘The King has got no clothes on’. At various times during that period the goalposts have been shifted. First of all, there was a concerted argument that thickening was a nonsense; it was a figment of people’s imaginations. If we had time, we could go through photographic evidence and some very detailed science. But the net of it is that today no-one is arguing about whether land, tree and shrub cover are increasing. In fact, some aerial photo interpretations in your electorate, Mrs Kelly—or in areas related to it—point to a 30 per cent increase in tree cover from the mid-1950s to the mid-1990s. That is in the areas not being cleared—remember that I am always talking about what I call ‘intact woodlands’, which constitute 99 per cent of northern Australia. People are now saying—they keep shifting the goalposts because this information is challenging some very cherished positions—‘It’s all just due to the rainfall in the 1970s, 1980s and 1990s.’ Some of those years were very dry—although the seventies were wet.

Mrs DE-ANNE KELLY—I remember that.

Dr Burrows—But so were the 1950s and some earlier parts in the century. I have a rainfall chart that I could give you to look at previous rainfall figures. There was a royal commission into the problem of woody plants in the western division in New South Wales in 1901. The flip occurred very quickly there because they had both sheep and rabbits. The whole tenet of this argument is in terms of the world’s savannas—or woodlands, as we call them in Australia; or grazed woodlands, to put it in perspective. I refer in the document to an international review. There is a very comprehensive paper at the back of the document that talks about these things from an international perspective and gives a large number of references.

But it is agreed by those ecologists who have studied this in some detail, as it is their nitty gritty, that essentially we are looking at communities which were hunter-gatherer societies before Europeans came in with their domestic lifestyle and which had a regular burning regime—and whether that was in the south-west of the United States or the dry savannas of South America, southern Africa or Australia does not make any difference. When we brought the European livestock in we grazed a lot of the fine fuels. If we had sheep, we did our best to put out fires. We also had rabbits that really grazed the fine fuels.

So very early in the piece we did not have the extent of fires we had under the previous Aboriginal management—and the situation is similar in the case of hunter-gatherers around the world. This had caused a balance to be kept in train between trees and grass in the savannas. A savanna is described as a mixture of trees and grass—it is just a balance between these; it moves up and down. But if you keep an open woodland situation, you have these regular fires. If you do not have them, the balance tends to shift in terms of more woody plants. The sheep started it, but the rabbits cleared things a lot quicker, so they had a royal commission in 1901.

In terms of those woody plants, if you know the Cobar-Byrock area, it still has box trees on it. There is still some excitement in New South Wales about cockies out there trying to clear those areas. It is marginal country, and I would not necessarily support it, but they are doing it. As Geoffrey Blainey said about Gippsland in *Triumph of the Nomads*—talking about the widespread ringbarking that was going on in the 1890s and the early part of the last century—from his perspective and looking at all the historical records, all the producers were trying to do was re-establish the original carrying capacity of the country that was there in the 1850s and 1860s. We have just repeated that over this country.

Moving north, for a long time we had a situation where the trees appeared to be reasonably stable in the monsoon areas of northern Queensland. As one of my mentors said to me—I have a few mentors and I remember their sayings; and you might have heard this one before—cattle have the decency to die before the grass does but sheep do not. We had that situation in Queensland for a long time but not in New South Wales or in south-west Queensland, where we have a south-west strategy trying to re-cover areas that have been flogged by sheep for a long time. But in northern Australia we had British cattle and they had the decency to die before the grass did.

Turning to agricultural science, this is practised on Mrs Kelly's property these days. She has Brahman cattle or Brahman-infused cattle and she uses dry season supplements in the dry season because she is close and represents a very vigorous sugar industry—if she can get molasses these days, because it is a bit short. She will be using molasses and urea to supplement the cattle feed so that they can eat that dry grass and then there is no fuel to burn. You will therefore have a lot more woody plants in future because the woody plants that are there are largely unpalatable to domestic livestock. That has occurred worldwide. I cannot get this through to a hell of a lot of people.

Normally there would be an argument. People would say, 'Okay, this went before the recent rainfall of the seventies. It takes you back to the 1890s, and it is still there today in the western division of New South Wales.' It is a situation that is continuous, but people would argue that it was human induced. I say that grazing with domestic livestock is a very human activity. All that the IPCC—that bible of rules—says in that original statement is: 'if ongoing human activities influence'. That is what the Americans have picked up. That is why they want to count all their growth and all their trees and to discuss the rest of the world. It basically gives the biggest emitter just about a neutral return or something of that order. In the short term, as everyone would acknowledge, in looking at land use change in forestry, these are only short-term palliatives.

If we really believe in global warming—and I do, from the best information I can gather—it is a serious thing for the world at large. But the Huns have not crossed the channel yet and there is a breathing space here. It may be that by 2020, when you young people are around and I am long since passed, that is when we really will have to be very serious, but we have a bit of time leading up to that.

Mrs DE-ANNE KELLY—Does the thickening have any effect on salinity or the prospects for salinity, and do the savannas and the change in the savannas then allow for sequestration of carbon underground? I think you may have written a paper about 10 years ago, which I cannot find anymore, that suggested that. It may have been written by a colleague?

Dr Burrows—It is very difficult—not too many volunteers dig up roots and try to measure their growth. You need a really sandy environment if you are really going to do it, and some people in Western Australia are doing it. By and large we say that, whatever growth we have got above ground, we apportion to below ground in terms of its root-shoot ratio. So if it has got 30 per cent of the total biomass in the roots—that is below ground—we would say that 30 per cent of the growth occurs below ground as well. The Americans are asking that that be included as well—and if they do, so do we. That is why we talk about the 150 million tonnes—it includes a metal allowance for that.

Mrs DE-ANNE KELLY—So that is sequestration underground?

Dr Burrows—Yes.

Mrs DE-ANNE KELLY—What about salinity? I know that is tangential to this inquiry and I apologise for that, but I cannot let you go without asking about it.

Dr Burrows—It is a good question. I worked in western Queensland for 16 years—down in Charleville and all up the west—and I spoke to people who knew the country in the fifties and who talked about the springs coming out of the Carnarvons. In the seventies the springs did not run as much. We have some situations that suggest that maybe the way you stop water running is to have more trees. The way you encourage and mobilise salt is to clear trees and have a lot more water passing through the system. The obverse of that, though, is that if you have more trees you are going to have less water passing through the system—and less water running down the Murray-Darling, by the way, because the trees have thickened up in the Carnarvon Ranges.

Going off on a bit of a tangent, if we have more there than in the desert uplands, which is our great intake for the Great Artesian Basin—fortunately the water coming out the other end is a million years old or so—and if we happened to live for a million years, we might find there is a little bit less water coming out; that is, if we maintain that thickening. In fact a birdo has done a study of the northern desert uplands—that is, north of Claremont; that big area again—that talked about the disappearing graminivorous bird populations there, irrespective of any tree clearing but not irrespective of any tree thickening. He did not twig to that. When you get more trees you have less grass. We have got a lot more trees in the areas that are not being cleared—there is less grass there and less carrying capacity on those properties. Some producers want to clear that land, but maybe they are not allowed to because certain governments think this is a bad thing. Things are not independent of one another—they have flow-on effects.

Mrs DE-ANNE KELLY—Thank you, Dr Burrows.

Senator LUDWIG—Mrs Kelly asked most of the questions that I had in mind. I did not quite get it down to the fine balance that Mrs Kelly got it to, but effectively, if we accept the argument that you have put, the 108 would not be 108?

Dr Burrows—No. It depends, though, if Australia went in there and argued that that was the basis of our agreement we came away from Kyoto with. That was our bargain—to use the Americans' term—and they may still be able to argue that way. I do not know. That is more in your area. But we could at least say, 'Presumably we were allowed this generous emission on

the basis that you accepted internationally that we were a large continent with enormous transport and energy transmission difficulties and with only 19 million people and that you were sympathetic to our situation. So when we put up a scenario to you that would help us you accepted it.' When you get better data—

Senator LUDWIG—Yes, I understand that argument. Effectively the sum total of your argument is that we should—if we accept the validity of your argument—argue that the woody area should be called a net sink rather than the reverse and, as such, we then have a greater carbon credit?

Dr Burrows—We have a better position in terms of one argument that we have been knocked all over the head with: that we are, per capita, the worst emitting country in the world, on the basis of things we took to Kyoto.

Senator LUDWIG—But that would then improve as a matter of course.

Dr Burrows—When we do count everything, we would be way down near the middle or the bottom end of the scale in net emitters. But a lot of established positions go on the basis that we are the worst emitter. There is a lot of vested interest in these things. I am only a scientist. I have no idea about those sorts of things.

Senator LUDWIG—You are not arguing for tree clearing to increase or woody areas—

Dr Burrows—No. I am not arguing for that and I am not arguing for any reduction in the reduction targets. I am saying that there are significant increases that have not been taken into account. I would say that if we knew those as well—if certain senators had a full appreciation of that—then their concerns to reduce the level of clearing in this state or this nation might be lessened on the basis of greenhouse. They may still be equally valid in terms of biodiversity, salinisation and so forth. I am not suggesting at all that there should be a change in that view, although I would argue that primary producers are not being acknowledged for the sink that they have there but they have to take all the baggage for the other. To me, that is an injustice in terms of scientific fact.

Senator LUDWIG—The thickening of the woodland would vary depending on the use of land. I noticed that you said that you had been out to work most of your working life around Charleville and the western area—or at least part of that. You would know from close experience that, in the drought around 1991 and just prior to that—around 1988 and 1989—there were about twice as many sheep as there are currently. We have had a flock reduction of about half since those times and those paddocks were, some would say, flogged. Since that time, there has been, obviously, a thickening, because the paddocks are nowhere near being flogged by sheep numbers—or so they say. This reduction was partly because of the drought, partly because of the wool price and partly because of changing pastoral demands and land use requirements. If that were to change again, though—if the price of wool were to go up—those pastures would then be restocked and the thickening would reverse, would it not?

Dr Burrows—No.

Senator LUDWIG—You would then have a different scenario. What I am getting at is: is it just a small phenomenon that you have picked up now or is it a longer trend that you are suggesting?

Dr Burrows—Certainly it is a longer trend. First of all, could I correct one conclusion?

Senator LUDWIG—Please. They are not my conclusions. They are what other people say.

Dr Burrows—When the bottom fell out of the wool industry, sheep numbers went down considerably but they have been compensated to some extent by corresponding increases in cattle numbers in that area. What the agriculturalist looks at is total grazing pressure and they have to see whether the combination of sheep, cattle, goats and marsupials makes the net effect much different. I would suggest that it is not, over the time frame that you are looking at. Could I just use an example here of the phenomenon that you might be alluding to.

Overhead transparencies were then shown—

Dr Burrows—This is 1957, in a place called Wongalee Wyandra, which is somewhere between Wyandra and Boatman, down the Nebine Road and about 90 miles south-east of Charleville. This property was sold as a settlement block and was taken up in the mid fifties. The proud owner built the normal garden which you build out there, which is a rock bed—nothing grows because it is too dry. This is mulga country. He took a photo in 1957. This is in 1994 from the same position. The garden bed is still there to verify that we are talking about the same property. And there is the change in the mulga population there. We have actually, north of Bolton, established Thruston National Park to protect the pristine mulga forest. We do this with all the elegance in the world and we talk to the urban people and we say, ‘We have done this on your behalf.’ I will not say any more.

Senator BARTLETT—You said a couple times, I think, in your evidence today that, in terms of how we count emissions and some of the decisions that are going to be made at COP6 in terms of land use, this is a policy decision rather than a scientific decision. I accept that it is a policy decision in terms of the fact that someone is going to decide how we count it. But surely the overall aim of Kyoto and related activity is to get the best possible outcome in terms of climate change and emissions, et cetera—and isn’t that driven by science? Shouldn’t the scientific evidence be the determinant of the policy decision?

Dr Burrows—I certainly agree; that is what the evidence should be. But there are a lot of vested interests, and really hard social and other decisions have to be made in conjunction with that, so nothing is independent, if you like. As just an observer from the side with no vested interest in the results, I saw that we came back from Kyoto with a great fanfare of how successful we were, and it is very hard to retract on that. I have had it on authority that it is very difficult to tell a certain senator that we might have found another hundred million tonnes of carbon dioxide equivalent, because we gave him other advice earlier. It is difficult for public servants to do that. It should not be; it should be that new information has come to hand and this is the situation as it stands today.

But, for all that, for all those concerns, the game has changed since the Americans made their submission for COP6. They said that they were going to count everything, so that opens it up

for everyone else in the world to count everything. As a scientist, I say that that should have been done right from day one. If I were concerned about global warming—and I am—I would be concentrating solely on fossil fuels. As a biologist, I believe left-hand side equals right-hand side and that somewhere down the track—maybe not in the short term that you are talking about—that is so. There is pragmatism and others reasons here and, as a nation and as a world community, we have focused on this real issue. As I say again, we have not crossed the channel yet. We have got to be working on it, but we might have a breathing space. If we are really going to address it, we have got to know where all our sources and all our sinks are. We cannot just include land clearing and forget about the forests out there. We cannot have partial inventories or have selective amnesia.

If we count everything, then we will really know the story, and that is the basis of where we will advance anything. We will only do it by full accounting. The CRC for greenhouse accounting, of which I happen to be a member, is trying to help towards that, and the NCAS, which is run by the Greenhouse Office itself, is trying to do that. But there are some things that they could do a lot earlier. If we are, as a nation, going to take advantage of ‘counting everything’, as the Americans say, between 2008 and 2012 we have to be able to do verifiable crosschecks that what we are talking about is unarguably true. The Americans say ‘just a change in stocks’. There are other arguments about this, but for simplicity’s sake, if we are talking—as the Americans say—about just a change in stocks, then we have got to be able to put that up in an non-arguable way so that everyone accepts it internationally, nationally and state—this is the federals as well as within the country—so that we all agree. With all of Mr Howard’s largesse and so forth, there is no commitment from the Greenhouse Office to put in place the system that monitors this change.

The system we have in this state for monitoring change is unique in Australia. It has been done under what we call a transept recording and processing system to try to understand the dynamics of woody plants in grazing lands to manage them for grazing purposes. Along came greenhouse, and all of a sudden we were measuring things that were pertinent and relevant to it that people may not have understood. We have 145 sites in the state. We are very proud of them. They are well spread. We are writing a paper about them now. My colleagues behind me here and some others are recording these changes, and we will document them in international scientific literature. So there will not be any argument about that. We have 145 sites, but the Americans, on a similar continental area, have 300,000. All I would like for this country is to have 1,000. The government in this state and the federal government should realise that this a major limiting factor come 2008 to 2012 and that it is no good putting in a monitoring system to measure change in 2008. You have to do it now. Everyone knows that there is climatic variation and so forth. There are other economic factors—for example, in the sheep industry that we were talking about earlier. We have to have an average in there. We cannot just measure it from one year to the next. That is why it is 2008 to 2012: it will be the mean of five years.

I can make a little plea here. We have been trying to do a little bit within Queensland Department of Primary Industries and the Queensland Department of Natural Resources, but we have do not have any support federally. We risk support state wide, because people say, ‘This is a federal issue.’ There is no much buck-passing. If you are counting trees—and I go back to my first statement—and you are measuring their growth, you have to be prepared for posthumous fame. You cannot just do it when you want to. You have to put your investments in now. If you can have any influence on that, I would certainly welcome it.

CHAIR—The whole issue of carbon sequestration and how to measure it in a particular plant is given to the CRC for greenhouse accounting, is it not? They have a responsibility to develop an objective standard?

Dr Burrows—Yes, and the NCAS is doing it as well in parallel. The national carbon accounting system is administered by the Greenhouse Office. Of course the Greenhouse Office is a partner within the CRC for greenhouse accounting, so there are a lot of incestuous relationships in there as well. The way you count trees has been known to foresters for quite a long time. It is not difficult.

CHAIR—Yes, deviation and all that. But how much carbon can you say that a species of oak, for example, will sequester, as opposed to one of the mulga trees? How do you know that?

Dr Burrows—Since the measures have been done in those respective communities.

CHAIR—The fibre of the wood, the density?

Dr Burrows—There are certainly different densities. What we talk about is basal area of the trees. Foresters talk about elementric relationships for individual trees. They measure their DBH, their diameter at breast height, and they can tell you the volume of timber, the weight of timber or the weight of all the carbon in the leaves in that which they just throw away.

CHAIR—So it is the diameter times pi divided by 40,000 by—

Dr Burrows—I would not know what the figures are.

CHAIR—Your colleagues behind are nodding.

Dr Burrows—There are mathematical relationships and, really, you have to go back. If you really wanted to be dogmatic about it, we put a dendrometer on them. It is just an expanding steel band with a spring on it that we put around the tree. We put a little nick where it was when we measured, and then we go away for a year or so and come back and measure the distance there. That is an accurate reflection of the growth in the tree. Then we have the relationship between that diameter at breast height or the circumference at 30 centimetres—wherever we take the ground measurement, an easier to acquire measurement—and, with a regression, we can get the relationship. It is mathematically simple. The big question is the representativeness of all your science. If we are dealing with 60 million hectares, we have to have more than 145 sites. We believe the 145 sites we have are reasonably representative, but we would love 1,000 so that ‘Hank the Yank’ will not have a go at us somewhere down the track.

CHAIR—This was argued out in Lyons. Under ‘definition of forest’ in the chairman’s draft you have option 1(a), a definition of a forest selected by each party itself—so the parties can just select their own definition; option 1(b), forest definitions for each forest type or biome occurring within the party’s boundaries; and option 1(c), where you give it all over to the Food and Agriculture Organisation, who have a very fiddley way of calculating it. Which is the American one—one definition or multiple definitions for each biome?

Dr Burrows—Mature height greater than five metres and a ground cover of greater than 10 per cent. But they have suggested within their submission, nevertheless, that it could be as low as 0.5 metres, and it still might be the 10 per cent ground cover. But that would include a lot of their shrub lands, or in Australia our saltbush lands. That might seem exciting in a way to really trap something. It is if it is an extremely large area, which it is through Utah and places like that, and maybe, you might say, in the western Riverina in Australia. But it is still only a small amount in there, and what you get is the sugar cane analogy—I see Mrs Kelly is here so I am throwing in something for her! You can only get 60 or 70 tonnes of sugar cane in a really good crop in 12 months—that is the ceiling. When you grow a tree that is replacing grassland, we might at our best, above and below ground, have 10 tonnes per hectare of grass, but when we put a tree on it and allow it to express itself, which most of our eucalyptus could, we could end up with 100 tonnes, so we have got 10 times the potential. When we have 10 tonnes of grass, every year we might burn it week or graze it and it will just go back to 10 tonnes. But the tree is accumulating over time, it is adding to that store so that it is a legitimate sink, whereas the other one is left-hand side equals right-hand side.

CHAIR—Can you draw a big and rather simple picture for us with your proposition that, if these woody grasslands or grazed woodlands or whatever are included back in 1990, when the actual figure is established in this first commitment period, that means that our actual, real scientific, net emissions are much lower—

Dr Burrows—Yes.

CHAIR—That means, therefore, that the 108 per cent is, in a sense, less—

Dr Burrows—If we do not win the argument because they say it was precisely if it does that and they read it verbatim and say, ‘No, you can no longer, because you have to include not only land use change but forestry.’ And when you do that, yes, I think we go back to around 360 million tonnes instead of around 450 million or whatever it was.

CHAIR—But, henceforth, if they are measured on the original baseline, they are obviously accounted for every year from now on so we get the benefit of their sequestration, don’t we?

Dr Burrows—We do because, the way the Americans are arguing, they are just talking about a stock change. If you were really being scientifically pure, you would talk about the rate of stock change, so the rate of stock change in 1990 was such, and you would have to have an increasing rate of stock change in 2008 to 2012. But the Americans have distinctly said, ‘We will just measure our carbon stocks, in continental United States plus Hawaii, in 2008 and we will measure them again in 2012. If we have got an increase in the land use change, land use and forestry sector, then that will be credited against our emissions from all our fossil fuel usage.’ If it was the other way around, it would be added to the debits, the sources, from our fossil fuel usage. They have brought it back to very simple terms and those terms are extremely favourable to Australia because we anticipate from the data we have got in the years that we have been monitoring, since the early 1980s, that there is at least another 50 years of this type of growth.

We talk about a basal area within our established woodlands, grazed woodlands, of about an average of 10 metres square per hectare. It peaks, in terms of its actual accretion of carbon, at

about 19 metres square per hectare. It does not mean it is zero after that, but that might give you an indication if we go from 10 to 20. Our basal area increment, which is measuring the rate at which the tree is growing, is averaging around two to three per cent per year. That is taking into account the good years and the bad years—and most of the years we have measured have been below average rainfall rather than above average, so we are on the bottom side of that. That figure is in congruence with published data from southern Africa by Dr Bob Scholes from Witwatersrand and it also fits very much with published data that has been experienced in forests and woodlands in the Indian subcontinent.

Mr HARDGRAVE—How lonely are you on this crusade, with this opinion? Are there many friends out there, any other scientific colleagues?

Dr Burrows—The only two I have got are with me.

Mr HARDGRAVE—You are really speaking heresy in the minds of the Suzuki principle of science—or I think PR is his doctorate. But in all seriousness, you are really speaking against a huge storm with an alternative opinion, aren't you?

Dr Burrows—I would just ask you to evaluate it in terms of the international literature. I do refer to this paper, which is in your compilation at the back, and one of these others refers to a bibliography which has got over 320 international references to analogous phenomenon worldwide. This paper, 'Trees in Grasslands—Biogeochemical consequences of woody plant expansion', has an extensive bibliography at the back.

Mr HARDGRAVE—So, apart from the Americans who are obviously pushing a position similar, your stand is well founded and others support it?

Dr Burrows—I would argue very strongly so. It is just within the Greenhouse Office that we have a little difficulty. The difficulty is related to who is in charge; I cannot say any more. I have to be careful.

CHAIR—Thank you very kindly. After the COP6, there are obviously some decisions going to be made here, so we might ask for another opinion then.

Dr Burrows—If I could say so, if you have any influence on our representatives there, you might suggest to them that, if we follow the American position, it will be not be detrimental to this country in terms of its industrial base and its potential industry base and so forth. That is just a comment which is outside of my bailiwick, which is in terms of society's requirements and so forth. So I really should not say any more than that, but I think we have a breathing space if we have got the wit to take advantage of it.

CHAIR—Many thanks; we will now move to our next witness.

[4.44 p.m.]

CALLAGHAN, Mr Jeffrey, (Private capacity)

CHAIR—Welcome. You are appearing as an individual, not representing the Bureau of Meteorology; is that what the submission said?

Mr Callaghan—I guess so; but the bureau hierarchy knows all about it.

CHAIR—Yes; it is not surreptitious! I have to inform you that these are proceedings of the parliament, as if they were taking place in the House of Representatives or the Senate, so they warrant the same respect; and the giving of any false or misleading evidence is a serious matter and may be regarded as a contempt of parliament. Would you please make some opening remarks and we will get into some discussion with you one by one.

Mr Callaghan—I have prepared a hard copy of the presentation of things I will cover, and any slides I will show will be in the figures there. Our primary concern, I guess, in this subject is the change in the extreme weather over 10-, 20- or 30-year periods since records began. Probably, transmitting that vulnerability of the impact from severe weather is pretty difficult when you have gone through a very quiet period since 1977 like we have in Australia.

Overhead transparencies were then shown—

Mr Callaghan—Right down the east coast of Australia, we have had a very quiet period, and people just do not understand the impact from tropical cyclones and related events. I guess we did not really know about these long-term changes until the last 10 years or so. When you look at some of the figures here, you will see some of those changes and how we have not experienced the disastrous events in, say, the 1970s, 1950s, 1890s and up to about 1918, when there have been events that are probably unimaginable to people today. When they do happen again, I guess they will be contributing them to global warming. I do not know anything about that—that is going on in the background—but we have been looking at the long-term variability.

CHAIR—One of the things we are trying to do, in a sense, with the underpinning science to the treaty, is to track back from effects that are speculated upon, such as severe weather phenomena. If you can give us a bit of a picture of the cycle of weather and talk about ENSO and its relationship, then we will worry about ENSO's causes and so forth; or, if you want to talk about them, by all means do so. As we get all the science in, we get a picture ourselves; so please go ahead.

Mr Callaghan—I will run through the figures as they appear in the paper. Are you all aware of the effects of ENSO? One of the things it does do, when you have the La Nina side of the phenomenon—that is, the heavy rain, cyclone, and gloom and doom in Australia—the cyclones are concentrated between Fiji and Australia. Figure 1 in your paper shows an El Nino episode, all the tropical cyclones that appear during the 1997-98 El Nino, which was one of the most severe El Ninos in history—or that we know about anyway; that, and the 1982-83 one. In this case, we have got cyclones occurring right over in French Polynesia—which is very rare; usually they do not occur east of the dateline. I guess that is something to think of for our Pacific cousins—and I will go into that in a minute. We have gone through a 20-year period. We

have been dominated by El Ninos, two of the biggest on record, and those people east of the dateline have really suffered from a recurring decadal change. If we extrapolate ahead, probably the next 20 or 30 years could be fine, from Fiji eastwards. I will pass around some of the extreme events we have had, from Fiji eastwards, since 1980—to help set the scene there.

These are hard to see on overheads, but they are on the Web. They show rainfall distribution. The top one is a La Nina composite, a sort of La Nina average of rainfall anomalies, and the bottom one is El Nino. The blue and purple areas means that, during La Ninas around Australia, you get much greater than average rainfall and the opposite during El Ninos. You can see globally that has an effect on Brazil and South Africa. The whole thing is a global phenomenon where you flip from La Nina to El Nino, and you go from situations where you get above average to below average, and vice versa. If you start to get long periods dominated by one or the other, that has huge consequences for planning: either extremely severe weather events or, on the other side, droughts. As an example, take the Caspian Sea: during La Ninas, the orange area means it is below average and, in El Ninos, it is above average. Consequently, from 1978 to 1985, the Caspian Sea rose by eight feet. I just read that the other day in the *National Geographic*. So, in this period dominated by El Ninos, the rainfall in that area was obviously much above average.

I will not put figure 3 up, but it goes along the same lines. The web site for those figures is the one in the paper, if you are interested in it. I will now show you the critical figure in the last 20 years. To generate this curve, which starts from 1957 to 1997, you get the monthly southern oscillation index value—and when that is positive it is La Nina; negative is El Nino—which is cumulative, so we just keep on adding. You can see that in the period from 1957 to 1997, although on average it was going up and down, it was going inextricably upwards. That means that over that period we were dominated by La Ninas. In the period since then, we have been dominated by El Ninos. If you went back to the Second World War, you would see it was inextricably going up. So, in that period from about 1945 until 1977, we had lots of horrendous cyclone events. For example, places like Bowen got hit by severe cyclones twice in 10 months, and the Gold Coast got hit by a severe cyclone in 1954.

These are things we just do not think about nowadays. It would be unbelievable to experience one of these events. The last really severe cyclone that has hit an urban centre was in the 1970s. Brisbane had the effect of Wanda in 1974, when 18 people died in the city, and Althea hit Townsville in 1971. It was safe because it happened at low tide, when there was no danger of a storm surge event. There have been only three really severe tropical cyclones since 1977, and they were not in relatively built-up areas. So we have got this problem.

This is an illustration of how planning is important. If we knew that this existed, we would have stopped the development going along the east coast. It has got to the stage now where, if we had a 1974 type flood on the Gold Coast, 16,000 houses would be flooded. There is a reference in my paper on that assessment. That number of flooded houses is a lot more than happened in Brisbane in 1974. These long-term changes indicate that planning is extremely important. For instance, in this period, there were a lot more severe lows developing in winter, and the beaches in California got eroded away. They had a hell of a problem in California with beach erosion during this period.

I mentioned the Caspian Sea and the southern Brazil case. There was a lot more extra tropical cyclone development and beaches were eroded. All around the world this had a huge impact. Say we go to an area like Colorado, where they use tapping into aquifers and things like that. If they get a multidecadal period when they are not going to get rain, there will be huge problems with water supply as the population grows. This long-term cycle of 20 or 30 years, or whatever it is, is going to be extremely important for planning as the population grows. We all know that, if we get any extreme event, it has a much bigger impact now because of the increase in population. That is certainly the case in the United States, and in the next big event in eastern Australia that will certainly be the case.

I would just like to illustrate the changes over that 20-year period on the south Queensland coast, where they have a big relationship with these sorts of things. The top period on this chart shows a number of tropical cyclone tracks from south-east Queensland where the graph is going up; where the graph is going down there are far fewer tracks. This one is covered by spaghetti and on that one you can see the huge change in tropical cyclones. I do not think you need to tell the people that—they know that. The old-timers—people my age—will all say, ‘Gee, it’s not like the fifties; we used to get all these cyclones around the Gold Coast.’

I will show you one of those pictures. The one I remember is Cyclone Dinah. It went past here in 1967. This was a category 4 cyclone. It went over Sandy Cape and it measured 944 hectapascals—I think you would realise that is a very deep cyclone, category 4—and God knows what would have happened, and luckily it recurved. Nevertheless, it washed houses into the sea, flooded houses at Sandgate, even though it was out to sea, caused storm surge effects on the Gold Coast and started horrendous erosion on the Gold Coast. But if that had come in it would have been a completely different story. It really cleaned up the Sunshine Coast, Brisbane and the Gold Coast. So that is a near event.

In 1967, which was a La Nina period, we ended up having another three cyclones that came close to the Gold Coast and then three very severe winter lows. I am bringing up Surfers Paradise surf club—I think your picture will probably be better than this—and in your photograph, just in front of the Surfers Paradise surf club, you can see half the road is gone. That is Cavill Avenue coming down there, just to the right-hand side there, so half the road going into all that footpath. I think there is even a building on the left-hand side there—

CHAIR—This was cyclone damage?

Mr Callaghan—Yes. It started off with Dinah, and this is La Nina, where you get numbers of cyclones, and then there were three others, and then there were three winter ones. That is the sort of effect you can get just with cyclones passing out to sea. This is just an example of the difference between La Nina and El Nino. Nothing like that has happened since then.

This was a severe cyclone that crossed the coast on the twin towns of Coolangatta and Tweed Heads. You would not think a severe cyclone would hit New South Wales, but this crossed the twin towns of Coolangatta and Tweed Heads in 1954, at the start of a La Nina period, and 26 people died in that event around the Lismore-Kyogle area—just massive rain. As it came into the coast, over a metre of rain fell in Springbrook, which is right on the border. So the area was hit by floods, storm surges and that much rain over a huge area—just catastrophic around the Lismore and Kyogle area. They are the sort of things that happened in the past.

When we look at the raw figures—that is one of your figures there—on the impacts along the east coast of Australia from cyclones, we have detected 176 of them. One hundred and eleven occur when the SOI is positive and 64 when it is negative, so you have almost got twice as much chance of getting a cyclone when the SOIs are positive—that is heading towards La Nina. There are break-ups and various ranges which you can look at later for the various values between plus five, zero and minus five, and they all have much the same relationship.

When we rank these—this is a grisly way of looking at it, I suppose—by the number of deaths that are caused by these events, the big one was 1899, when 307 died—probably another 100—and the centre of this was measured at 914 at Bathurst Bay in 1899. One hundred and twenty were lost off the ship *Ongala*, just off Townsville, in a severe cyclone.

You can see all these other ones. In 1916, 77 people died in Claremont*, the floods from a severe cyclone across the Whitsundays. In 1934 around the Port Douglas area the pearling fleet was wiped out there, 75 lost. You come down here, 1927, that was just floods all over the state from a cyclone, across to Cairns. It did a lot of damage there and caused loss of life all over the state right down to Brisbane. This was an incredible year, 1918. You can see there are two on the list there, one at Mackay and one at Innisfail. The Merilian sugar mill measured 925 hectapascals, and that was not in the eye, and the one at Mackay was below 930. So there are two category 4 or possibly category 5 cyclones in the one year, and there were about 100 lives lost in those events, so you can imagine if that happened today.

What I am trying to get at is that, when this happens again, I guess the first thing that people will say is ‘global warming’. While that is going on in the background—the evidence is overwhelming—these changes, the really severe weather events, are going to come around anyway. Strangely, in the 1950s, when I was growing up, there was that event I told you about at the Gold Coast. There was another one in 1955 when—I will show you what it looked like on the charts—a low moved from Normanton down to central New South Wales and 25 people died in places like Singleton and Maitland. They were horrendous floods—probably the worst floods that they have ever had in central New South Wales. That is a tropical system moving down. In those days, when they had all these events, the thing was that it was the bomb or the rocket tests in Woomera: there was always some phenomenon that was causing it. But in the period from 1890 to about 1980 there was a similar cycle of these disastrous events. So they come around anyway. I do not deny the effect of global warming, but these things come around anyway—that is the point I am trying to make. In the most recent two, there were 18 deaths in Brisbane in 1974 and 14 in the Whitsundays from Cyclone Ada in 1970. So it has not happened since 1974—almost a quarter of a century ago.

We are doing some research with our research centre in Melbourne. There are wonderful climate people down there, including Dr Scott Power. I have been doing some research on why these cycles change and what causes them. There is a buzz word now in the scientific literature: interdecadal Pacific oscillation. We can run through this figure later. You will see that, when it is negative, that is bad—which is opposite to the SOI when positive is bad for Australia. Just as a side convention, when it is negative we get these bad events in a cyclic pattern. For instance, when it was positive from 1978 to 1998, there were three events, one almost every seven years, whereas, on average, you can expect it every couple of years during a negative phase. There is a lot of research going into these long-term multidecadal cycles now. They pick up the same sort of data in the North Atlantic. You can see the problems with it—if you are going to go through

one of these periods when you are not going to get one of these horrendous events or if you are not going to get any rain. There are big problems with the water supply as the population expands. Say that we go through a La Nina dominated cycle. That is bad for the coast but good for the inland—for the rain. Then you come into one of these other cycles where you get droughts like those through the eighties and nineties.

Mr HARDGRAVE—And today.

Mr Callaghan—We have only got SOI data from 1876. You can see that it surged around here, then went down, then up and down. But this is the big change—this one from around the Second World War until 1977. There was a big drop there. There has been nothing like that in the whole data. It is a very small period that we have got to sample. By no means do we really understand it, but there is a reference in there for a mechanism. I do not know how true this mechanism is—why you get these big fluctuations. The green area, by the way, is when the IPO—that other thing—is positive. I have just drawn that in there. The whole curve is the cumulative SOI and the green is when the IPO is positive. They are quiet periods. This period in the forties was very quiet although, I guess, it was sort of going up but there was a big El Nino there. This IPO, when it is positive, enhances the El Ninos and, when it is negative, it enhances the La Ninas. Here it was positive. This period coincided with a whole heap of La Ninas/El Ninos anyway, and it enhances them. That is why we got this unbelievable 20 years which had such an impact around the globe and in Australia. It sent a lot of people off the land.

I turn to the mechanism that has been proposed. There is a reference there from Chris Landsea and Bill Gray, who are long-term hurricane forecasters in the Caribbean. They have a similar relationship with the El Nino/La Nina phenomenon from hurricane frequencies in the Caribbean. I do not know if you have seen that diagram—they call it a ‘great ocean conveyor belt’ or ‘thermohaline circulation’. It sinks in the Atlantic, goes right around, comes up in the Pacific and then back to the Atlantic. It takes between 500 and 2,000 years for particle transport through that cycle. The theory is that when this front is strong La Nina dominates and when it runs weak El Nino dominates. I do know how true that is, but the reference is there for you to look up if you want to. Some people look at this IPO—the Yanks call it PDO, ‘Pacific decadal oscillation’; the English and the Australians call it ‘interdecadal Pacific oscillation’—as the driving mechanism, just an oceanic circulation which when it runs weak accumulates a lot of warm water in the Pacific and is conducive to El Ninos. That is the theory. Nevertheless, whatever occurs or whatever it is driving it, there are these long-term variations in these extreme events and droughts.

Senator LUDWIG—Do you know where the next 20 years are going to go, by any chance? Is there any predictive value in it?

Mr Callaghan—Some people have stuck their neck out. Bill Gray reckons that because the salinity has increased in the Atlantic we are in for 20 years of La Ninas. I think the Indians think that too. They think they are in for an epoch of above average rainfall because the Indian monsoonal rain is much greater during La Nina.

Senator LUDWIG—I suppose you have got a 50 per cent chance of being right.

Mr Callaghan—It is like a lot of things. But one thing is for certain: I do not think we will keep going down like we have. You would not think we would be just keeping the El Ninos. We do seem to have flipped around. In the last two years we have had two La Ninas and now we are still in the La Nina phase, so maybe it has flipped around. There is some evidence to say we have.

Senator LUDWIG—Anecdotally, it seems that we have changed back to what I recall from about 20 years ago, when we had more of a cyclonic season, with more rain in the wet and a longer wet. Then we have had 20 years of dry. This summer seems more akin to what I remember from 20 years ago than what we have had in the last 20 years.

That aside, the thrust of your argument, in a nutshell, is that in looking at the Kyoto Protocol and at climate change we should not rely on anecdotal evidence about the El Nino effect and greater incidence of weather patterns which then point to greenhouse gases causing it—that other elements are causing these sorts of climatic changes, so we should look at the Kyoto Protocol and greenhouse gas emissions in their own right, rather than at the anecdotal evidence that it is causing climate change in other areas. Is that basically what you are putting?

Mr Callaghan—All of this data has been collected since the Industrial Revolution, so greenhouse is in there somewhere, I guess. I am no expert on greenhouse gases, but what we want to point out is this money to disaster managers. It is pretty hard to gee them up all the time when you go through these quiet 20 years. You can get these events. That is where we are coming from: trying to point out the vulnerability that people do not realise and the need for planning. Greenhouse gas is in there somewhere, because this data has been collected since the Industrial Revolution, but the changes are much more dramatic and a lot quicker than just a gradual increasing of the sea level and the temperature of the water.

You may want to talk to some people. Jonathan Nott at James Cook University in Townsville is doing some paleoclimatology stuff. There is another researcher by the name of Mat Haynes from the ANU, who I think works for AGSO now. They do not see much change in the humungous events—the big storm surge events. What they are doing is studying coral ridges around Palm Island and Bathurst Bay, up in North Queensland. But they are seeing this from the 18th century. They think that there was multidecadal variability even back then. This is very preliminary stuff but it might be worth talking to them. Talk to Jonathan Nott of James Cook University in Townsville. We are just looking from 1876 up until now. It is a very small slide. You can gain more appreciation only if you look at this coral stuff.

Mrs DE-ANNE KELLY—Thank you very much for coming and giving us all this interesting information, Mr Callaghan. But I am a little confused, because your data implies that, in the last quarter of a century, severe cyclonic activity has in fact declined. Is that so?

Mr Callaghan—In Australia, yes.

Mrs DE-ANNE KELLY—But the CSIRO's submission to us a week ago said that an increase in greenhouse gases should increase severe cyclonic activity. Your data is absolutely irrefutable; it is fact.

Mr Callaghan—Do you mean in the past?

Mrs DE-ANNE KELLY—Yes. Theoretically, we should be seeing, according to their scenario, more severe cyclonic activity. In fact, we are not, are we?

Mr Callaghan—I do not know. I do not know what they said.

Mrs DE-ANNE KELLY—I am just saying that yours is factual material. Is it possible that there are other factors at work that work over much longer time frames, perhaps over a couple of hundred years? I noticed actually, looking at your cumulative southern oscillation index, that there appears to be—would I be right in saying this or am I reading it wrongly—an 80-year cycle for some reason or other?

Mr Callaghan—Yes. The Americans reckon that they have detected a 70-year cycle. It is very difficult looking at a time series, especially a small time series, and coming up with a cyclic pattern. Some of the coral data shows longer periods, too. Getting back to the other point, you have to look at the whole Pacific Ocean. That is why I gave you that list of eastern Pacific storms. While we have missed out, they have copped it all. If you look at Fiji, you will not believe what they have gone through. And have a look at places like Samoa since 1980—they have copped it. For the whole Pacific basin, maybe it has increased. You would have to look at that. But it is just that distribution changes. Because of El Nino and La Nina, they flip from east of the dateline to west of the dateline. That is probably what CSIRO are on about: looking at the whole Pacific basin rather than your narrow little area.

Mrs DE-ANNE KELLY—Sure, and we should not take a narrow view, but nonetheless from our point of view, over the last 25 years, the Australian eastern seaboard has been very benign, has it not?

Mr Callaghan—Yes, and that is precisely the point we want to get across: it will not stay that way. It is not if but when that change will be.

Mrs DE-ANNE KELLY—It has really been interesting and I thank you.

Mr HARDGRAVE—I would like Mr Callaghan to go back and make some rain for the farmers just outside of Brisbane. I want to know whether the weather bureau has actually tried to test its statistical findings, over that comparatively short measure of time since 1876, with other sciences. In other words, you mention a chap from JCU in Townsville. We had a self-confessed tree hugger here a little earlier. Surely the growth rings of the trees will reflect dry and wet parts of history, which might give you something to go by. Do you have any knowledge of any of those sorts of things?

Mr Callaghan—Jonathan Nott's work has been encouraged by the Tropical Cyclone Coastal Impacts Program, TCCIP, which tried to get precisely that. They tried to get everyone from all the different disciplines to look at anything. People are looking at the coral, tree ring stuff and the run-off from the Burdekin River. I think, as you say, with only a terribly small amount of climate data, we really have to look at other things.

Mr HARDGRAVE—But you can look at patterns, as weather bureau professionals have to, to try to assess where things are going to come from.

Mr Callaghan—Yes.

Mr HARDGRAVE—You look at the past to try to work out what will happen next.

Mr Callaghan—That is right. The bureau and several universities are part of the tropical cyclone impacts program. I have mentioned it in the document. It is an effort to try to get other disciplines involved in assessing some sort of climatology of impacts rather than just the European history, which is terribly small.

Mr HARDGRAVE—Thank you.

CHAIR—Could you return to the slide of the SOI; the cumulative one? It is a yellow one going back to the 1870s. If you used the moving average—say, for argument's sake, we used the 20-year moving average; 1886 to about 1906, about that sort of length—the highest standard deviations would obviously be here, here and about there. So you could say that this has gone two or 2½ standard deviations away from the moving average if you arbitrarily use 20. But if you use 40—which is about 76 to 16 there—that length would suggest that this is only about the same standard deviation away from that moving average, but that it snapped back big time.

Mr Callaghan—Yes, there is nothing like that big drop in the whole sample, is there?

CHAIR—Depending on the length of the moving average that you choose, you can say that this is either very severe, severe or actually not all that severe. Can you not say that?

Mr Callaghan—It is such a small sample. I guess what you are saying is that it has come back to normal in a hurry. Is that what you are saying?

CHAIR—For example, if you were on the board of a casualty insurer, you had policies along the Queensland coast and you were calculating how much you should spend to reinsure yourself—which I gather is what a lot of people consult you about—

Mr Callaghan—That is right.

CHAIR—The time frame you use in this moving average is crucial in estimating how far into danger you are. Is that not so? If you use a really short one, it is almost madness; you should be running for the hills. If you use 40 years, it is a big deviation but it is not any bigger than it was at that point.

Mr Callaghan—Some of these triggers in the red part on the left-hand side is where you are getting all the activity. It is astronomical where we had dominoes from La Ninas and then El Ninos. But here it was more cyclical from one to the other—El Nino to La Nina. When you had the IPO reinforcing it, you had the extreme events. But in the green areas we can see the IPO was dampening the effect within the La Ninas and enhancing the El Ninos.

We used to think that was a normal pattern. You might have heard about the SOI, El Nino-La Nina phenomenon in a seven to 10-year cycle or something like that. But then we get to this period and there was just nothing like it in that time series. You had the biggest La Nina in

history—the 1974 and 1976 one; it was a huge event—which was followed by two of the biggest El Ninos in history. So we had two of the biggest La Ninas and two of the biggest El Ninos in history, which is significantly different from everything that went before.

CHAIR—As to the theory of global warming—if it has some causative relationship with this—the other way of looking at this cumulative index of dry as opposed to wet is the severity with which it occurs. How do you describe lots of severe rainfall as opposed to volatility of rainfall?

Mr Callaghan—Most of the rainfall in the tropics occurs in these extreme events: cyclones, monsoons, et cetera.

CHAIR—But there must be a cycle of volatility as well.

Mr Callaghan—The first thing you would think over if you looked at that would be that CO₂ was affecting that last 50 years. Some people have pointed that out. Is that affecting the strength and the prolonged nature of La Ninas and El Ninos? It is hairy to look at a short time, but that is the first thing that hits you.

CHAIR—If we asked you to, in the next few weeks or when you have time, estimate for us the volatility of the rainfall—not the actual amount of rain associated with La Nina and El Nino but how severely it fell—would there be a measure for that, such as millimetres per month, so that you could assess a cycle of volatility?

Mr Callaghan—I think so. The El Nino and La Nina set up the stage for the event, but when you get down to the day to day you are getting into chaos there. For instance, over the last two years we had strong El Ninos but we did not really get the cyclone impacts that you often do. It explains about 20 per cent of the variance, so there are a lot of other things that we do not know about operating. Nevertheless, statistically it is strong but it is not that strong.

CHAIR—If you plotted the volatility of rainfall, it would look pretty similar to that because, as you say, it tends to come in severe events.

Mr Callaghan—Yes, but also in other ways. As an example, in 1997-98 we had El Nino yet we had three huge floods in northern Australia—the Townsville, Katherine and gulf floods—due to chaotic weather events. You have the background there. They were three enormous events which flew in the face of the El Nino-La Nina phenomenon. That is the problem.

CHAIR—It is said to us sometimes that global warming, if it is true, causes severity and hence severity is more damaging than a steadier event or an event of less amplitude in the general cycle. Is that the best measure of the amplitude of severity?

Mr Callaghan—That last 50 years, which you might be looking at, is a small sample. But, as you pointed out, it does seem like nothing else on the whole graph. You have had this enormous rise and then a big fall. It was reflected in the weather. You can look at the figures there. From 1947 to 1977 there have something like 17 severe events in eastern Australia and three when it fell down. There are enormous differences that are not so clear early on. They agree but there is nowhere near as stark a difference as that rising limb and the falling limb since the Second

World War. For some reason or other the IPO and the La Nina-El Nino phenomenon has had a much huger effect since the Second World War. Perhaps it is global warming or perhaps just something that happens.

CHAIR—Could you help us by sending by email or whatever the tabular data behind that—those cumulative figures?

Mr Callaghan—It is just here. It is on the web, actually. I will just email the better monthly values of the SOI. That is all they are. I will email that to the secretariat.

CHAIR—That is so that we can give that data to a statistician to try out our own ideas.

Mr Callaghan—Let us know what you come up with.

CHAIR—Many thanks, Geoff. We might consult you again in a few months time.

[4.16 pm]

LOWE, Professor Ian, (Private Capacity)

CHAIR—I welcome Professor Ian Lowe to today's hearing. Professor, could you please state the capacity in which you appear today?

Prof. Lowe—I am a professor in the School of Science at Griffith University, but I am here today in a private capacity. I am not here representing any formal position that the Griffith University might have on global climate change.

CHAIR—These are proceedings of the parliament, as if they were happening in the House of Representatives or the Senate, and warrant the same respect. The giving of false or misleading evidence is a serious matter and may therefore be regarded as a contempt of parliament. I now invite you to make an opening statement, after which we will have some discussion or questions.

Prof. Lowe—Certainly. I have provided some written evidence. I assume that will be part of the information before the committee; so I will not repeat it. I will just make some preliminary remarks. The first thing I would say is that there is no longer serious disagreement in the science community with the view that greenhouse gas emissions are changing the global climate and demand our attention. The atmospheric science community was of that view at the 1985 conference. It had persuaded the rest of the scientific community by 1985, when the Intergovernmental Panel on Climate Change said that it saw a discernible human influence in climate change.

I have just returned from a meeting on the science of sustainability where, among other people, present were Professor Bert Bolin, the first chair of the IPCC, and Dr Jim McCarthy, who currently chairs their working group III. The evidence has got steadily stronger all the time—whether it is Dr McCarthy's scientific expedition finding water at the North Pole this northern summer where there is normally two or three metres of ice, the increasingly frequent incidence of coral bleaching, the decreased salinity in the Southern Ocean or the apparently more frequent extreme events. I do not know whether members of the committee talk to farmers. I am originally from rural New South Wales and I still have contacts in the rural community. I do not know anybody who farms the land who thinks that the growing seasons are the same as they were 20 years ago. So, in those terms, I think there is increasing evidence that the world is being changed by human influence. I see Kyoto as a minimal response in the sense that all Kyoto would do, if it were ratified and brought into force, is stabilise emissions of carbon dioxide and other greenhouse gases at about 2½ times the level that natural systems can observe. So it seems to me that we have a duty as a good global citizen to ratify Kyoto and, indeed, as we did with the Montreal treaty on ozone depleting substances, go on to work for a treaty which would be a more appropriate response to this serious problem.

The only other comment I want to make is that I am sure the committee will have heard evidence that it would damage the Australian economy to ratify Kyoto and attempt to comply with it. I do not believe there is any convincing evidence of economic damage. The studies that claim this commit one or more of three serious fallacies. Firstly, they neglect the cost of inaction—in other words, the cost to the Australian economy if climate change continues.

Secondly, they neglect the positive effects of the measures that we might take in response to climate change. Thirdly, they exaggerate the negative effects of responding by making palpably invalid assumptions about the nature of that response—the most obvious one being that we will attempt to change energy using behaviour through only the price mechanism, when even government economists know that energy use is substantially insensitive to the price.

I believe a coordinated strategy is possible, and it does not necessarily involve much government money. In some cases, it means changes to the signals that government sends or some reductions in expenditure or foregone revenue that at the moment encourages wasteful emissions. To summarise, I believe global climate change is the most urgent environmental problem that human civilisation is facing. The World Health Organisation says that it is the most serious problem that human civilisation has ever faced. Kyoto is a timid first step towards resolving that problem. We have a duty to ratify it and push for a stronger response. That would be our duty, even if it were at some economic cost. Fortunately, there is no convincing evidence that to do so would be at economic cost. Most of the things that we would want to do in the short term are win-win solutions.

Senator BARTLETT—I wish to focus on the protocol itself and the ratification of it. What is the specific benefit or gain of ratifying it sooner rather than later—rather than waiting for the US or others or waiting until some of the disputes over measurement of land use, for example, are more clearly resolved? Why should we ratify it as soon as possible?

Prof. Lowe—I do not think there are obvious benefits in not being the last to ratify, apart from the sense that it has been dragged reluctantly to the conference table. There is already an international sense of that. I was at both Geneva and Kyoto, and the dominant feeling at both of those conferences was that the Australian government was doing as much as it possibly could to sabotage the Framework Convention on Climate Change, firstly by arguing for differential targets when it was clear that there was no equitable formula for differential targets, and then when that did not derail the treaty by threatening not to sign unless we were given a more generous target than anyone else. So there is already a feeling that Australia is doing as little as it can in the area of global climate change, and I am not sure that is to our benefit.

The other global political problem is that within a few hours of the Kyoto targets being announced I heard representatives of countries like China saying that they did not see why what they saw as their legitimate development aspirations could be curbed if the best that a high emitter like Australia could do was only keep increasing emissions. If we fail to ratify the treaty, having been given more generous targets than anyone else, it is really sending a signal to the developing world that the OECD countries are not serious about global climate change. The reason that is important is that, on all current projections, the combined emissions of the developing countries will be greater than those of the annex 1 countries before the Kyoto period. Unless the annex 1 countries show they are serious, there is no prospect of a global agreement—and there has to be a global agreement that includes countries like China if the problem is going to be resolved.

Senator BARTLETT—So you are saying that it is essential and that you believe that inevitably—by the environment imperative if nothing else—a global agreement will be developed, but it is going to be a lot slower to develop that global agreement if we still drag the chain with just the Kyoto Protocol?

Prof. Lowe—That is right. There will at some stage be a global agreement that will be a lot stronger than Kyoto, and in a sense Senator Hill recognised that when he told the Business Council earlier this year that the business community should support Kyoto, because if Kyoto does not hold it will probably be replaced by a regime that will be less generous to the special interests of Australia.

Senator BARTLETT—In terms of the views amongst the scientific community, we had evidence earlier today from Dr Burrows, suggesting that we miscalculated the value of sinks in terms of vegetation in Queensland. I do not know whether you are aware of that particular line of argument, but in terms of the broader issue of disputes about those sorts of things—and the area of forestry and land use still seems to be one of the less clear areas—how much should we try and nail down the science of that before we proceed, whether it is with ratification or whether it is with other measures to reduce emissions?

Prof. Lowe—There are two points about that. One is that the area of land use change is complex and difficult, and the scientific community has been counselling against the simplistic view that you can absorb carbon just by planting trees or release it just by clearing them. Since before Kyoto, the CSIRO division of atmospheric science was saying that to our government and the New Zealand atmospheric authority was saying that to their government. More recently, the International Institute of Applied Systems Analysis at Luxembourg in Austria released a report that essentially said that including land use change in the Kyoto Protocol makes it a cheat's charter, because it is both impossible at this stage to estimate with any scientific precision the effect on the atmosphere of land use change and—even if it were—impossible in most countries to document, in a way that is internationally verifiable, what land use changes are occurring.

That being said, the Kyoto Protocol was essentially agreed to without land use change being included. The land use change is known internationally as the 'Australian provision', because it was included when the Australian delegation got up at 4 o'clock in the morning, when the treaty was effectively signed, and insisted on land use change being incorporated. The rest of the world thinks this is a scientifically uncertain issue that complicates the treaty. But the rest of the world agreed to the treaty with no reference at all to land use change.

We have to try to improve the science of land use change, because the atmosphere cannot tell whether carbon dioxide comes from clearing vegetation or burning coal—it has the same impact. But at the moment the science is very uncertain. In that sense, Dr Burrows is right. While he has a different view to that of some other scientists about the direction of the signal, the consistent advice that I am hearing is that we cannot say with certainty what will be the size of the change to the carbon in the atmosphere from specified land use changes.

Senator BARTLETT—Accepting what you said about the flawed nature of some of the forecasts about economic damage, there is also the argument—which I am sure you are familiar with—that it is in terms of not just economic damage to Australia but also future investment decisions in, for example, the aluminium industry. The argument is that the future smelters will not be set up in Australia; they will be set up in China, South-East Asia or Africa, where they are not subject to the Kyoto Protocol. The technology they have results in greater emissions than if they were based here. What is your response to those arguments?

Prof. Lowe—I will make two comments about that. There is no doubt that a decision like ratifying the Kyoto Protocol has an effect on investor behaviour. That produces winners and losers, as do decisions to float the dollar, reduce tariffs or introduce a goods and services tax. These all change the system of rewards and the signals that investors see. I am not persuaded by the argument that it is our moral duty to smelt aluminium using clean Australian coal, because otherwise people will use dirty Taiwanese coal. It is at least as likely that they will otherwise use clean Icelandic geothermal energy or clean Canadian hydro-electricity. The law of conservation of capital does not say that any investment that does not occur in Australia will inevitably go to somewhere where the carbon cost to the atmosphere will be greater.

There is no doubt that Australia signing the Kyoto Protocol, and making serious attempts to implement it, would discourage carbon intensive industry. That raises the question of whether encouraging carbon intensive industry is in Australia's long-term economic benefit. That is a complex issue, and there is not agreement even among economists about whether it is in Australia's economic interest to have more firmly the trading pattern of a third world country, in which we export commodities and import manufactured goods. It is a complex issue, but I am not sure whether it is even in our interest—let alone the global interest—to say that we should hold off from Kyoto so we will have more coal fired smelting of aluminium in Australia.

Senator LUDWIG—In your paper, you suggest we should be switching to alternative energy sources, sources other than fossil fuel. What time frame are you suggesting for that? The alternative energy supplies are not as cost effective as fossil fuel at this point in time or in the very short term. But you advocate an end to fossil fuel now, so we have what most people would consider a cost gap. How do we jump over that gap?

Prof. Lowe—I certainly do not advocate closing down the existing coal fired power stations, because that is neither physically possible nor economically sensible. I said in my paper that if we decided now not to build new coal fired power stations and to make future electrical capacity cleaner—using either gas turbines or renewable energy—the cost burden of that in the short to medium term would be quite small and probably acceptable. I did some calculations based on the fact that as a subscriber to the Energex Earth's Choice scheme I pay 20 per cent more for my electricity to get 100 per cent of it from renewable sources. That costs me about the price of a cup of coffee a week to get 100 per cent of my electricity from renewable sources.

I accept that the first units of renewable energy are the low-hanging fruit that are cheaper than the next tranches. I would infer from that that a move to, say, 20 per cent of electricity from renewables over 10 years would probably impose a cost burden on the typical household of a couple of dollars a week. That is so far down in the noise that it would be politically acceptable now. In fact, I would go further and say that if the community were asked, 'Would you be prepared to pay as much as \$2 a week extra in 10 years time to have a commitment that new generating capacity will be gas or renewables?' I think there would be a solid majority for that today.

Senator LUDWIG—Do you say that the household is the greater user of energy requirements? My understanding is that it is industry that uses the majority of energy—that is, requirements for power—such as the aluminium industry and a whole range of other industries. The basis upon which you extrapolate is not valid in my view. Are you saying that the figures

you would use are predicated on a household accepting a greater burden of the cost? How would that translate to industry then accepting it, if they are the majority users of power?

Prof. Lowe—Householders do not use the majority of electricity in a state like Queensland; they probably use about a third. The next significant group of users is the commercial sector: offices and small industry. Historically, the reason it has been almost impossible to interest those users in energy efficiency measures is that energy costs represent such a small fraction of their operating budget. I was for seven years on the National Energy Research Development and Demonstration Council, and we had several proposals from large energy intensive industry to look at ways of reducing their energy bill, because it is a significant part of the operating cost of something like an aluminium smelter. But, for a building such as this one, for the Myer Centre or for small-scale industry, energy is a very small fraction of their operating budget, so it does not appear on their cost horizon. I suggest that small increases in that area would probably also be acceptable.

The problem is, as you say, energy intensive industry. Historically, we have provided subsidised electricity to energy intensive industry like aluminium smelters. It would have a much bigger impact on those industries if we withdrew the current subsidies than if we applied the cost penalty that a commitment to renewable energy would imply in a time scale of 10 to 20 years. Unless it coincided with that policy change, it would not be a serious problem. In some cases, those subsidies have been locked in. For example, the Queensland government sold the Gladstone Power Station to Comalco for a price that was somewhere between half and two-thirds of its net value. That constitutes a permanent subsidy which cannot be recovered. In a sense, they have been insulated from energy prices—unless we apply a carbon tax to the burning of coal.

Senator LUDWIG—I appreciate that. Thank you very much.

Mrs DE-ANNE KELLY—Professor Lowe, you made a number of assertions in your paper without submitting documentation or giving a list of articles to support them. Are your qualifications in science or economics?

Prof. Lowe—I am a physical scientist. My doctorate is in applied physics and I lectured in material science at the Open University in Britain for 10 years before I came back to Australia. I have been in the School of Science at Griffith University since 1980.

Mrs DE-ANNE KELLY—So you have a scientific background?

Prof. Lowe—Yes.

Mrs DE-ANNE KELLY—Doesn't it trouble you that there are plainly differences in the scientific community? You say that there is no serious disagreement. We have had papers submitted to us from people like Professor Hansen from NASA in the United States, who originally, apparently, was an advocate of greenhouse gases causing global warming. He is now asserting that it is due to particulate matter and other gases. Don't papers like that from well-regarded scientists concern you?

Prof. Lowe—It does not concern me that there is disagreement, because the way scientific operation proceeds is by argument and counterargument, by weighing up the evidence against theory. In the period that I have been aware of this climate change and carbon dioxide issue, there have been quite significant changes in the view of the scientific community. For example, I have conference proceedings dating back to about 1980 in which some atmospheric scientists were saying that they thought there was measurable climate change, but there was not even agreement at that stage about whether there was a climate change signal that had emerged out of the noise. In 1988, I was director of the government's Commission for the Future and we had a joint project with CSIRO to have public discussion of the climate change issue. At that point, the view in the atmospheric science community was that the atmosphere was changing and the climate was changing, but the evidence was not persuasive that one was causing the other. Neither were outside the previous experience to a view that was persuasive.

Mrs DE-ANNE KELLY—Professor Hansen from NASA, for instance, would be a serious scientist. Are you familiar with his papers?

Prof. Lowe—I am not familiar with that paper. He is certainly a serious scientist.

Mrs DE-ANNE KELLY—So it would be a serious disagreement, would it not?

Prof. Lowe—Yes. I would like to see that paper.

Mrs DE-ANNE KELLY—It was made as one of the submissions to the committee, so it is certainly available to you.

Prof. Lowe—I was talking to the Intergovernmental Panel on Climate Change, the co-chair of working group 3 and the first chairman last week. They said that the evidence is getting stronger all the time. The issue is that it is a judgment of the point at which the evidence is convincing. I suppose, if I could quantify where the scientific opinion has been in the 20 years that I have been across the issue, in 1980 probably five per cent of scientists thought that human activity was changing the climate and that it was a serious problem. In 1990, it was probably 30 per cent. Today, it is probably 80 or 90 per cent. But it is not 100 per cent. It is probably a good thing that the majority is not always right because it means that the majority opinion continues to be tested. In the past, there have been scientific theories that have been overthrown by more work or more analysis.

Mrs DE-ANNE KELLY—Although it may be a minority according to your estimation, there certainly is serious disagreement.

Prof. Lowe—Yes, but most of the disagreement in Australia is from people who are not atmospheric scientists. I suppose that was why I said that. I have debated with people who are electrical engineers who assert that the climate is not changing, but I have not met any serious atmospheric scientists in Australia who have been working on the issue and who do not think that there is a serious problem.

Mrs DE-ANNE KELLY—You talk about the uniquely generous target at Kyoto that Australia has attained and yet there are other countries with higher assigned levels, are there not? They have got less energy intensive exports, so, when you look at it in context, Australia

has not achieved that generous an outcome. I can quote you some: Portugal, 127 per cent; Greece, 125 per cent; Ireland, 113 per cent. Ireland is hardly a backward nation.

CHAIR—The Emerald Isle is green.

Prof. Lowe—I said that Australia achieved a uniquely generous target at Kyoto. What Kyoto decided was specific targets for Australia and several other annex 1 countries and an overall target for Europe. Within that overall target, there have been negotiations within Europe in which countries like the UK and Germany have agreed to make larger reductions to allow expansion of what are seen in Europe as semiagrarian economies like Portugal, Greece and Turkey. But Kyoto did not assign those a more generous target. They have been obtained by internal negotiation within the European Community.

Mrs DE-ANNE KELLY—Nonetheless, they have come out pretty well, haven't they?

Prof. Lowe—For countries that have semirural economies.

Mrs DE-ANNE KELLY—But we have a semirural economy.

Prof. Lowe—We use much more energy per head than countries like Portugal, Greece or Turkey. The other comment I would like to respond to, though, was on the issue of us having an energy intensive economy. The OECD report on energy policy in Australia said that it is a common misconception that Australia has an unusually energy intensive manufacturing sector and therefore an unusually energy intensive economy. They said that, as a fraction of the economy, manufacturing is not unusually large in Australia; in fact, it is smaller than in most OECD countries. Our manufacturing sector is not unusually energy intensive by international standards. What is true is that our exports are unusually energy intensive. So a policy of increasing the price of energy would have more of an effect on our exports than it would on the economy as a whole, because our export sector is unusually energy intensive. The reason for that historically is the one I have already mentioned: that we chose to subsidise electricity to bring aluminium smelters to Australia.

Mrs DE-ANNE KELLY—Aluminium would make up a fairly modest component of our overall exports, though, would it not? I think it comes down more to figures that were quoted in the federal parliament only in the last sitting, which are that financial services, for instance, make up seven per cent of the domestic economy. Primary products, and that includes mining, make up seven per cent of the domestic economy as well but the exports from primary products make up 50 per cent of our exports. The exports in the financial sector make up one per cent. So it proves your point that exports are going to be severely affected.

Prof. Lowe—They are going to be affected. Within exports, manufacturing is a smaller component than mining or agriculture but the minerals component adds up to about 30 per cent of our exports. Not all of that mineral component is energy intensive. Probably aluminium accounts for around 10 per cent of our exports, so that 10 per cent would be affected. I think the effect on our overall economy would be much less than is claimed. At the moment, in terms of rate of change, tourism looks to be a more important part of our international economic performance than aluminium smelting, in the sense that aluminium smelting does not look like expanding but tourism clearly is expanding.

Mrs DE-ANNE KELLY—We cannot all be tourist operators.

Prof. Lowe—No. Again, I am not suggesting we close down our aluminium smelters but what I am suggesting is that the policy which was seen historically to make sense—that of subsidising electricity to bring more aluminium smelting to Australia—probably does not make a lot of economic sense now and certainly would not make sense in terms of trying to meet the Kyoto target.

Mrs DE-ANNE KELLY—You have mentioned that there is no convincing evidence that we would suffer economically. You said that you base that on three premises: the cost of inaction, the positive effects of implementing Kyoto and a tendency to exaggerate the negative effects.

Prof. Lowe—Yes.

Mrs DE-ANNE KELLY—Leave aside the cost of inaction—because there is still some question over whether there is some validity to the whole question of greenhouse; I think that is why our committee is looking into this. In regard to the positive effects of implementing Kyoto, have you seen the recent report by Allen Consulting which shows, for instance, that in the Fitzroy region here in Queensland there would be a 10 per cent reduction in employment; in my home area of Mackay, a six per cent reduction in employment; and the most hard hit regional area in Australia would be the Latrobe Valley out from Melbourne. Of course, there are other areas in between those extremes. ABARE has also told us at our hearing in Canberra that they believe that one of the more immediate effects would be a lack of investment in the aluminium industry and final movement offshore. They are pretty devastating effects for regional areas. As I said, we cannot all be tourist operators. What positive effects do you see ameliorating those, bearing in mind you have a very negative view of what you have called the simplistic view of sequestering carbon, or storing carbon in trees? With respect, just looking at the economic argument for the moment and putting science aside, what is in it for regional Australia? What are these positive effects for regional Australia?

Prof. Lowe—Any policy change affects the pattern of behaviour and any change produces winners and losers; that is true of any change in the tax structure and any change in the reward structure. As a specific example, there was a proposal in Queensland to build a hydro-electric scheme in the wet tropics, the Tully Millstream proposal and I remember it was being argued that this was a good thing to do because it would create jobs in regional Australia and reduce our dependence on fossil fuel or electricity. I am struggling to recall the exact figures, but my recollection is that the Tully Millstream proposal would have created something like 200 construction jobs for about seven years and then about 10 permanent jobs in operating the facility. I calculated that by installing solar hot-water systems on roofs of Queensland houses so as to reduce electricity use in Queensland by the same amount as Tully Millstream, and assuming that if you install a system now and the average life is 15 years you would have to go back and replace it in 15 years time, in a 15-year cycle this would have created something like 400 permanent jobs in Queensland compared with 200 construction jobs and 10 ongoing jobs.

The point I was making is that that is a particular case of a quite general rule, which is that measures that reduce energy use in general are labour intensive rather than energy intensive. So in general they produce more jobs than the sorts of measures that they would replace. To take a

specific example, the most cost-effective way of meeting a Kyoto-type target in Queensland would—

Mrs DE-ANNE KELLY—Could I just interrupt you for a moment? I do not mean to be disrespectful, but I recall an economist saying once, ‘We can’t all make money by taking in each other’s washing.’ I think it is a very worthy idea to encourage solar use but, worthy as it is, we are talking about exports—and that would be very much a domestic activity, wouldn’t it? The loss of the aluminium industry, for instance, would mean the loss of 3,500 jobs, in just that one sector in Central Queensland. It is an export industry; we need to replace those jobs and also replace those exports. Solar-hot water systems would be a domestic industry. I take your point that it would create employment, but it is not going to replace exports, is it?

Prof. Lowe—I do not know anybody that has proposed closing down the aluminium industry.

Mrs DE-ANNE KELLY—ABARE has said that that would be a consequence in the long-term.

Prof. Lowe—It is a circumstance of the not very intelligent assumption which is made in their modelling—which is that, although energy use is substantially insensitive to price, we would try to change energy use by the price mechanism. There is no doubt that, if you tried to change energy use in the aluminium industry by the price mechanism, you would make it uneconomic. There is no doubt about that. That is why, it seems to me, that not many governments are silly enough to choose as a policy measure the one they know to be least effective and to do the most damage—but most of the modelling assumes that we will be that silly.

The reason I was pushing the example of solar hot water is that what the Kyoto target requires us to do is to limit our emissions to a given level. In a sense, it is up to us where we choose to limit emissions. The most cost-effective way of making significant reductions in emissions in a state like Queensland is to make it mandatory for all new dwellings to have solar hot water and start a program—which both the Commonwealth government and the state government already have under way—of encouraging existing householders to replace their old hot-water systems when they die with solar hot water. That is economically beneficial for the consumer because the typical pay-back time in Queensland is somewhere of the order of six or seven years and the guaranteed life of the new solar hot-water systems is 12 years. There is no doubt that is in people’s economic interest.

If I were making greenhouse policy, the sorts of things I would be doing would be measures like that that reduce emissions with no damage whatsoever either to the economy or to the consumer. In fact, there is the considerable benefit to the consumer that they reduce their electricity bills. Similarly, mandating better appliance efficiency standards—

Mrs DE-ANNE KELLY—I noticed that in your recommendations and it is a very worthy recommendation. I notice also in your recommendations, though, that you flag a carbon tax which would undoubtedly have a negative impact on industries such as aluminium.

Prof. Lowe—I think what I said is, as the government’s working group on ecologically sustainable development said 10 years ago, that there should be a serious study of the costs and

benefits of a carbon tax. You might recall that when a minister in a previous government suggested the possibility of a carbon tax there was an almost hysterical reaction from some parts of Australian industry, who managed to argue simultaneously that it would have no effect and bring the economy to its knees—which is a remarkable conjunction of arguments. But, in any case, the idea was dismissed without any serious analysis. Nobody, for example, compared a consumption tax that reflects the embodied carbon in goods and services with a consumption tax which reflects the embodied dollars in goods and services, which we call a goods and services tax. My view is that, if we wanted to have a general consumption tax, a carbon tax might, on analysis, have made more sense than a goods and services tax based on dollar value. All I am arguing is that—

Mrs DE-ANNE KELLY—I think you are going off into the scrub now. With respect, you still have not answered my first question. If I could just counter what you have said. The reality is that I do not believe that the original suggestion about a carbon tax included compensation for those who would be disadvantaged. Nonetheless, that is tangential to what we are discussing. I am still interested in these positive effects of implementing Kyoto. Other than job creation, which I readily accept from measures such as solar energy, how are we going to counter the huge costs that are going to be imposed on agriculture and manufacturing, which have been identified in the Allen report?

Prof. Lowe—Sorry; which the Allen report claims, on the basis of their modelling. I have tried to say in my submission that, like most of the modelling, it makes assumptions which are questionable and, in my view, indefensible and argues logically from those assumptions. I only studied a little bit of philosophy as a soft option to fill up my degree, but one thing I did learn is that if you start from false assumptions and argue logically you inevitably reach false conclusions. And I think most economic modelling does that. If you analyse the Allen report and the ABARE reports and similar pieces of work: they start by assuming that we know both the size of the economy and the balance of the economy and fuel prices and the energy dependence of the economy 10 or 15 years in advance. My view is that we do not know that for next year, let alone for 15 years down the track. Then, having made those assumptions, they assume we also know how the economy's balance over that 10- or 15-year period will be influenced by changing energy prices. On the basis of all those questionable to indefensible assumptions and with no accounting for the benefits of the changes they propose, they come up with a big number for negative effects.

I do not think that work is intellectually defensible, and if it is of interest to the committee I will table the report which I did for the then Department of Arts, Sport, Environment, Tourism and Territories nearly 10 years ago in which I analysed competing economic models. What I concluded from that, firstly, was that the models which adopted that simplistic approach came up with a wide range of views about what carbon tax would be needed to achieve a Kyoto like target ranging from \$20 a tonne to \$200 a tonne. The modelling studies which attempted to quantify benefits as well as costs concluded that neither could be quantified with any precision but the benefits appeared to be about the same size as the costs. I suppose what I am saying is that I do believe there is any convincing evidence that trying to meet Kyoto targets would impose economic costs on regional Australia or on Australia as a whole.

What is clear is that trying to meet Kyoto targets would produce winners and losers in the same way as imposing a GST or deregulating the finance industry or floating the dollar

producers winners and losers. But it seems to me that some of those who have been arguing in this debate have been imposing a much stricter test on the Kyoto response than we impose on other areas of economic policy. They are arguing that there should be no losers, only winners. But in other areas of economic policy governments all the time introduce measures that have losers as well as winners if they are convinced there is an overall benefit for the community.

Mrs DE-ANNE KELLY—Other than the study done some 10 years ago, have you done modelling similar to Allen Consulting's showing positive effects of implementing Kyoto?

Prof. Lowe—No, I am not the modeller.

Mrs DE-ANNE KELLY—Do you know of anyone else who has?

Prof. Lowe—Modelling done by people like Hugh Sadler in Canberra has looked at the positives as well as the negatives, and there has certainly been modelling work overseas which I have quoted. I think I quoted a pulling together of 11 specific sectoral studies in Europe that concluded that, for Europe as a whole, reducing emissions by 15 per cent would generate about two million net jobs. I am not saying that the European experience is necessarily transferable to Australia, but what was interesting about that study was that I think all but one of the sectoral studies found that more jobs would be created than lost by Europe meeting its Kyoto obligations.

Mrs DE-ANNE KELLY—With respect, that is Europe, not Australia. I just find that extraordinary, if you do not mind my saying so. Of course Europe is very involved in pushing for Kyoto because they can see a benefit. We should not be pushing it because we can see a benefit for Europe, and we do not know yet what the benefit is for Australia—if there is one.

Prof. Lowe—With respect, I do not think there is any evidence that there would be disadvantage for Australia. I think the European politicians, generally, are responding to public opinion.

Mrs DE-ANNE KELLY—With respect, I have just quoted Allen Consulting. They have made a submission to the committee that I am sure my colleagues have read. I have asked you for different modelling that has a positive outcome, and you are not aware of any—other than the Sadler modelling. I do not think that has been submitted to us as yet, has it, Mr Chairman?

CHAIR—Where is he from?

Prof. Lowe—He runs a consulting company in Canberra. I will get you the details of that. What I did say was that, when I reviewed all the modelling in 1993, there were about 10 modelling studies, two of which attempted to quantify benefits as well as costs. The eight that looked only at costs all concluded that there were costs, which is hardly surprising. The costs varied from minimal to very damaging, although the most extreme one that concluded that there would be great damage made the extraordinary assumption that the effect on the entire economy could be modelled by extrapolating from four sectors—aluminium, iron and steel, coal, and oil and gas. Having cost the four sectors which would be most affected by reducing energy use, they concluded there would be greater economic damage from reducing energy use. The two

which looked at benefits as well as costs, as I said, concluded that they would be about the same size.

Mrs DE-ANNE KELLY—ABARE made the point to us, though, that it was very difficult for them to undertake a study of the effects on the Australian economy, particularly in regions, until they knew the outcome of COP6. So, with respect, a study taken 10 years ago—and, of course, none of the COP results were known from any of the negotiations—would surely be a little dated. I do not mean that disrespectfully.

Prof. Lowe—No. It is entirely true. The studies were looking at the Toronto target, which was a much tougher one than the Kyoto target, and they did not include the so-called Australian clause of counting land use change and if it can be quantified, nor did it include any of the things which are still being argued about leading up to COP6 and which, in my view, are very unlikely to be resolved at COP6—for example, the clean development mechanism and joint implementation. The only thing I would say is that all of those things which have been added since those studies—the Kyoto target, which is more generous than the Toronto target, and the incorporation of the clean development mechanism, joint implementation and the possibility of emissions trading—reduce the likelihood of there being an economic cost to Australia, regardless of what resolution comes out of COP6.

CHAIR—I have just a couple of things. It was put to us that the atmospheric science community that has custody of this IPCC group does not include much of the geosciences and therefore there was perhaps not a sufficient amount of research or work done on possible causes of climate fluctuations by geoscientific or geographic phenomena—ice surges, the effect on ocean currents, the ENSO phenomena and so forth. What do you say about that? I am trying to get a picture of the entire spectrum of science and that part of it which is dealing with the IPCC stuff.

Prof. Lowe—It is certainly true that historically the Intergovernmental Panel on Climate Change was set up as an expert body on atmospheric sciences. It is clear that there are a range of other factors that affect climate, including ocean circulation, natural events like volcanic eruptions and issues where there is a link between geological features and the atmosphere—things like changing ice cover and factors like that.

The meeting I attended last week in Sweden included representation from the International Geosphere Biosphere Program. I can summarise their view by saying that, yes, there are complicating factors that stem from natural geological features. This is not by any means completely understood. For example, the general interpretation of the average global temperature this century—which showed a significant increase up to about 1950, almost no increase between 1950 and 1980 and a very steep increase since 1980—is that there are natural changes on which is superimposed the human induced climate signal. The scientists involved in the International Geosphere Biosphere Program are convinced that human action is changing the climate. If anything, they are more concerned than the atmospheric science community. Their view is that the changes which are happening might stimulate much more rapid change than any of the atmospheric models suggest by interfering with ocean currents. The appearance of clear water at the North Pole this summer, which none of the models predicted, is a much more dramatic manifestation of climate change than anyone expected. Clear water, where there

is normally two or three metres of ice even in mid-summer, represents changes to the global system which atmospheric models do not include.

There is also a feeling that the sea level has increased more than the more conservative models predicted because of factors we do not understand which seem to be leading to the currents warming the ocean depths much more rapidly than you would expect of simple models. I have been a sceptic about sea level rise because I remember at school doing an experiment which demonstrated that water is a very poor conductor of electricity. You can wrap copper wire around a block of ice and sink it to the bottom of a test tube and apply a Bunsen burner halfway up the test tube and boil the water at the top without melting the ice because water is a very poor conductor of heat. Normally you apply heat to the bottom of a body of water and you warm it by convection. On the basis of that, I argued that the top 100 metres or so of the ocean is quite thoroughly mixed and comes to a temperature close to that of the atmosphere. But there is no mechanism that I know of which would explain the ocean depths being warmed by a warmer atmosphere. The ocean scientists were telling me last week that the ocean depths do appear to be significantly warmer, and nobody understands that. That is a long way of saying it is very complicated.

CHAIR—So the GC models do not take account for those stochastic events, such as clear water at the North Pole and so forth.

Prof. Low—No. There is a fundamental sense in which they are very optimistic. Global circulation models are known in the trade as ‘equilibrium models’, which assumes that changes are slow and reversible. My concern since the mid-1998s, when I first started looking at this issue has been that, if we are really changing the composition of the atmosphere in a human generation by as much as it has previously changed over geological epochs—hundreds of thousands of years—it is entirely likely that that is not a smooth reversible process. It may precipitate changes that are much greater than those models predict, which may be better or it may be worse—we simply do not know.

CHAIR—So, in some sense, the scrutiny of the economic models has been reasonable so far. How do we apply scrutiny to the GC model?

Prof. Low—I would suggest the same sort of scrutiny we apply to the economic models, which is to look at the assumptions, make our judgments about how valid they are and then do worse case analyses. I would suggest that most of the economic advice to you has been worse case analyses—for example, what is the worse possible consequence of responding to Kyoto? I do not think we have done worse case analyses of the climate—for example, what would be the worse possible case outcome of doing nothing about it? In those terms, I think we are remarkably close to speeding down an unlit road with very poor headlights. If our headlights were better and we could predict with greater certainty what would be the outcome of doing nothing, that might be the best option. My concern is that we cannot predict that with any certainty and we may well be causing changes that are much more serious.

CHAIR—To your knowledge, has anyone modelled or sketched a scenario of the effects on, for example, the national security of Australia or some of our allies of ratification and the consequences of it? Has anyone thought of that side of things?

Prof. Low—I have said a few things about the effect on our international position. It seemed to me that the worse possible outcome for Australia would be if we did not ratify Kyoto and other countries did, and we were seen to be outside the global consensus. Examples like South Africa show the problems for a trading nation if their policies are seen as being out of line with that of the global community. In terms of the international agreement falling over, my view is that, as a significant primary producer, we probably have more to lose than many other countries from there not being an agreement on climate change. Most countries in Europe do not export food. They export goods and services, which are elaborately transformed and fundamentally independent of things like the weather. They may be disrupted by occasional extreme events like mud slides or floods, but they are substantially independent of the weather.

The IPCC studies suggest that the sort of climate change which is predicted will have very significant winners and losers in agricultural production. The preliminary studies that I saw reported 10 years ago suggested, for example, that there would be quite significant negative impacts on the agricultural enterprise in Queensland if the sort of climate change that is predicted came to pass. There are groups within the Queensland Department of Primary Industries who are working on refining those models. The preliminary results that were being given to conferences as long ago as 1988, all suggested significant disruption of the agricultural enterprise because the places where you will be able to grow wheat, for example, will not be the same places people grow wheat now. So those who grow wheat will either have to move physically or adapt to growing something different.

CHAIR—Understood. We could go further. There are worries expressed about the general nature of treaty obligations in parts of the developed and developing world. An example was given to us privately wherein, if you measured compliance with obligations, for example, under human rights treaties of such glowing paragons of virtue as the People's Republic of China or the Democratic People's Republic of North Korea—who are signatories to these human rights conventions—why on earth would you believe that they would not cheat like mad on their obligations under Kyoto? I say that rhetorically but it is something that has got to be borne in mind when, in a democratic jurisdiction, people elect you to either make or not make these commitments and yet, in places where people do not have the democratic choice, they do not even meet the obligations.

Prof. Lowe—Sure. It is a very big question: what would the sanctions be for non-compliance with Kyoto? That was why IIASA said that they were very worried about the inclusion of land use change. They called it a cheat's charter. They said that it was almost impossible to envisage any scheme of international verification of the pattern of land use change, whereas most countries have good energy statistics and you can work out how much coal they are burning, how much oil, how much gas and, therefore, what their carbon dioxide emissions are. It certainly seems to me that prudent policy makers should, in the short term, only do things that meet our international obligations without damage to the Australian community. That is why I have argued for measures like better appliance efficiency standards and a move to cost-effective renewable energy that benefit the consumer as well as the environment as the initial responses.

CHAIR—Lastly, one of the assumptions in the GCMs is that there is no change in the science of carbon emissions in that there is no innovation. I assume it is a linear thing—the more carbon used, the more carbon emissions. There is no assumption of an improvement in technology that means you may, for example, be able to burn the same quantity of coal but emit

less carbon into the atmosphere. This is what we asked some of the CSIRO people and, despite the history of innovation in science, they said, 'No, there's no such assumption built into the model.' They called it a projection—they would not call it a prediction. Fair enough—whatever they want. But, if they assume economic growth, demand for energy and so forth, and it goes like that, at no point in that projection was there any allowance because they said that there could not be—that you cannot model something that has not happened. Yet we said that in the past there has been lots of scientific innovation that has made, for example, the motor car less polluting than it was years ago, so why should we believe the models if they do not include what is obvious to us? If you are a scientist, you innovate every day—you dream up ideas in the shower. Why don't you put innovation in these models?

Prof. Lowe—There are two reasons. The IPCC projections that I have seen do have some that they call frozen efficiency forecasts for which they assume that there are no gains in efficiency. There are others which assume a two per cent per annum improvement in energy efficiency and measures like that. The problem with those models is working out how those efficiency benefits will be taken up. For example, if you look at the OECD as a whole, the energy related carbon emissions per unit of economic output have been reduced by 25 per cent since 1970, largely because of energy efficiency measures that were implemented in the light of the first OPEC oil crisis in the early 1970s and the policy changes that flowed from that. Nothing like that has happened in Australia politically because the OPEC oil crisis coincided with the only time in our history when we were self-sufficient in oil, so there was not the demand for a political response. But not all of those improvements in efficiency have been translated into reduced emissions. The most obvious example in Australia is the performance of the car. There have been huge advances in engine technology, in tyres, in brakes and in hydraulics in the last 40 years, but the average fuel requirement per passenger kilometre in Australia of the vehicle fleet is exactly the same today as it was 40 years ago. Why? Because all the improvements in efficiency have been taken up in cars getting bigger and heavier and being more likely to have frills like airconditioning, power steering, automatic transmission, power brakes, CD players and so on—all of which consume energy, so all of those efficiency improvements have been swallowed up in greater comfort.

It is difficult to quantify what will happen with general efficiency but I suspect what they were alluding to was the fundamental chemical problem which is that, if you burn carbon, you produce carbon dioxide. The only way you can get around that is to move to fuels that burn less carbon and more hydrogen. That is why burning gas rather than coal produces less carbon dioxide emissions.

I think the most hopeful sign is what is happening in the motor vehicle industry. The President of the Ford Motor Company has been saying for 18 months that he expects to preside over the demise of the internal combustion engine in his term as president, which is a reflection of the fact that Ford, like other motor companies, has prototype hydrogen fuel cell vehicles. Iceland have already committed themselves to being a hydrogen economy: they have converted their buses to hydrogen and they are converting their ocean-going trawlers. They are producing hydrogen from renewable energy, like geothermal and hydro, and so they are using renewable sources to store transport energy in the form of hydrogen. The combustion of the hydrogen only produces water. I think that that is the most hopeful sign. Remember that 40 per cent of global energy related carbon dioxide emissions are from transport. So if that sort of revolution happens

in land transport, which is entirely conceivable within 15 or 20 years, then we would have achieved much more than Kyoto to reduce emissions.

CHAIR—Unless the genetic engineering processes of innovation had it that you could produce trees that absorbed 10 times the carbon they do now, for example. Again, we are asked to make decisions to penalise people—chuck their families out of work and so on—on the basis that it will not happen and yet, when I was a kid, Maxwell Smart had a shoe phone. We have nearly got the same. Everyone would make fun of that—

Prof. Lowe—Dick Tracey had a wristwatch—

CHAIR—Exactly. Hence, in making policy, you make some pretty horrible decisions on the basis that it will not happen. We have to make that risk assessment, too, in a way.

Prof. Lowe—Sure. There is no doubt that we should be planting more trees because there are benefits in reducing salinity as well as benefits in absorbing carbon.

CHAIR—Or putting the AGO's budget into an institute of genetic engineering like the sports institute. These are the choices we have with a finite budget. Perhaps we ought to pause there for a month or two. We are going to have COP6.

Mrs DE-ANNE KELLY—I would like to ask a quick question. Regarding ethanol blends in car fuel, is that, in your opinion, sound?

Prof. Lowe—Yes. I have been saying this since I first gave a public lecture in Brisbane in 1977. I pointed out that you can blend ethanol into motor spirit up to 20 per cent without having to change the performance of the engine in any way. We have proved that technically by using ethanol as a fuel supplement in Queensland during World War II. The technology for producing power ethanol exists; indeed Shell did a trial of a petrol ethanol blend in the Mackay region, marketing it as petranol in the early 1980s. The only problem is that, at current prices and, dare I say it, at current fuel tax levels, blending ethanol significantly increases the pump price of petrol.

Mrs DE-ANNE KELLY—Why is that?

Prof. Lowe—Simply because it costs more to grow sugarcane, produce sugar from it, ferment it to ethanol and produce the equivalent energy content of ethanol than it does to refine petroleum. But in the long term, I do not think there is any doubt that those sorts of fuels will play an increasing part because we can grow them, we can produce them, whereas petroleum is a limited resource.

Mrs DE-ANNE KELLY—You are aware that CSR tie their ethanol price to molasses, which of course has a very stable price worldwide. Molasses is a by-product of sugar. You do not make ethanol from sugar, you make it from the cheaper by-products—the trash and the molasses—and that brings the price down considerably.

Prof. Lowe—It does. When I was on the National Energy Research and Development Council we funded several studies of fuel ethanol, and they all showed that there are technically

no problems. But, at the price at which it could be delivered then, the oil companies were resistant to using it. There is a precedent: during World War II we legislated to essentially require the oil companies to use alcohol to make our oil go further.

Mrs DE-ANNE KELLY—Should we do that again?

Prof. Lowe—I think we should, because there is a balance of payments benefit to using a locally grown fuel rather than one that is imported from OPEC. There is a regional employment benefit and a regional economy benefit in that we are using locally grown fuel, and there are arguably environmental benefits. One of the initial motivations of using ethanol is that it was an octane enhancer, and you could turn a standard fuel into a super fuel without having to put lead in it. We know that there are environmental problems with lead. I have been on the record for nearly 25 years arguing that we should use ethanol as a fuel extender in northern New South Wales and Queensland because of the regional economic benefits as well as the broader scale economic benefits of reducing our dependence on imported fuel, where we basically have to pay whatever price the rest of the world decides will be the market price of west Texas crude.

Mrs DE-ANNE KELLY—What would you suggest as an ideal mandated blend?

CHAIR—It will be National Party policy now!

Prof. Lowe—Physically, you can blend up to 20 per cent without changing the operating characteristics. The fundamental limitation is our ability to produce material that we can ferment to ethanol. If we turned the entire sugar crop of Australia into ethanol, that would produce about 10 per cent of our liquid fuel needs, so it could never be more than a supplement. But it could be targeted as a quite significant supplement, particularly in regional Queensland.

Mrs DE-ANNE KELLY—Thank you, Professor Lowe.

CHAIR—Thank you for your clear evidence.

Resolved (on motion by **Senator Bartlett**):

That this committee authorises publication of the evidence given before it at public hearing this day.

Committee adjourned at 5.22 p.m.