



COMMONWEALTH OF AUSTRALIA

Official Committee Hansard

**HOUSE OF
REPRESENTATIVES**

STANDING COMMITTEE ON SCIENCE AND INNOVATION

Reference: Geosequestration technology

MONDAY, 12 FEBRUARY 2007

CANBERRA

BY AUTHORITY OF THE HOUSE OF REPRESENTATIVES

INTERNET

The Proof and Official Hansard transcripts of Senate committee hearings, some House of Representatives committee hearings and some joint committee hearings are available on the Internet. Some House of Representatives committees and some joint committees make available only Official Hansard transcripts.

The Internet address is: **<http://www.aph.gov.au/hansard>**

To search the parliamentary database, go to:
<http://parlinfoweb.aph.gov.au>

HOUSE OF REPRESENTATIVES
STANDING COMMITTEE ON SCIENCE AND INNOVATION

Monday, 12 February 2007

Members: Mr Georgiou (*Chair*), Mr Quick (*Deputy Chair*), Mr Hayes, Mr Jenkins, Dr Jensen, Miss Jackie Kelly, Mr Price, Mr Tollner, Mrs Vale and Dr Washer

Members in attendance: Mr Georgiou, Mr Hayes, Mr Jenkins, Dr Jensen, Mr Quick, Mrs Vale and Dr Washer

Terms of reference for the inquiry:

To inquire into and report on:

The science and application of geosequestration technology in Australia, with particular reference to:

- The science underpinning geosequestration technology;
- The potential environmental and economic benefits and risks of such technology;
- The skill base in Australia to advance the science of geosequestration technology;
- Regulatory and approval issues governing geosequestration technology and trials; and
- How to best position Australian industry to capture possible market applications.

WITNESSES

COOK, Dr Peter John, Chief Executive Officer, Cooperative Research Centre for Greenhouse Gas Technologies..... 1

LAVERING, Dr Ian Herbert, Manager, New South Wales and Queensland Projects, Cooperative Research Centre for Greenhouse Gas Technologies 1

VAN PUYVELDE, Dr Dennis Robert, Technical and International Projects Manager, Cooperative Research Centre for Greenhouse Gas Technologies 1

Committee met at 4.39 pm

COOK, Dr Peter John, Chief Executive Officer, Cooperative Research Centre for Greenhouse Gas Technologies

LAVERING, Dr Ian Herbert, Manager, New South Wales and Queensland Projects, Cooperative Research Centre for Greenhouse Gas Technologies

VAN PUYVELDE, Dr Dennis Robert, Technical and International Projects Manager, Cooperative Research Centre for Greenhouse Gas Technologies

CHAIR (Mr Georgiou)—Welcome. I declare open this public hearing of the House of Representatives Standing Committee on Science and Innovation and its inquiry into geosequestration technology. The inquiry arises from a request from Julie Bishop, the Minister for Education, Science and Training. We have called for written submissions and 46 have been received. We thank you for your follow-up submission. The committee is now conducting a series of public hearings.

Although the committee does not take evidence on oath, I would like to say that this is part of the functioning of the parliament and deserves the respect of an actual parliamentary hearing and that giving misleading or false evidence may be a matter of contempt. Would you like to add to your submissions or would you like to make an opening statement?

Dr Cook—I would like to make an opening statement. I have a version of that here, which I am happy to provide. I would like to very quickly touch on several topics which to my mind have been coming into prominence during the hearings and also as a result of recent discussions in the press, in government and so on. Those points are: can CCS make deep cuts in emissions; is there enough geological storage capacity; is it where we need it; how much does CCS cost, how much will it cost in the future and how much will electricity cost if we apply CCS; if CCS can make deep cuts in emissions, why is it taking so long to get it deployed in Australia and elsewhere; and, finally, would deployment of CCS occur faster if we had a carbon tax, emissions trading or some other price signal? Those are the points I am going to touch on. The document I will provide contains a more in-depth discussion of those various points, so I will skate over them.

I am not going on talk about the science, because I think you have heard enough about the science. You are well aware of how these things work; you are well aware of the capture, the storage and the transport side of the equation. You are also aware of the fact that carbon dioxide is injected in various parts of the world at present. There are about 100 locations around the world where people are injecting it for various reasons. We do have a number of examples that are underway at the present time and I am happy to talk about those if you wish me to.

In Australia we do have a number of LETDF projects that will progress CCS in what I call a commercially significant environment. A number of those are not of themselves fully commercial projects, but they do provide the future basis for a more commercial approach to CCS. Again I am not going to discuss those in detail, but I am happy to do so if you wish.

The first ever exercise in geological storage of carbon dioxide in Australia will be undertaken by CO2CRC, commencing essentially now. This week we will be drilling the injection well down to about 2,000 metres in the Otway Basin of Western Victoria. In mid-2007—in other words, in about four months time—we will start injecting the carbon dioxide. This is very comprehensive work that we will be doing. It is costing a lot of money—about \$30 million—for this first stage, but it is a very important exercise. It is one of the most significant exercises of its type going on anywhere in the world. We will have very sophisticated monitoring equipment around the site to be able to reassure the community that we do know what is happening, that we can understand the behaviour of carbon dioxide at depth and that this is a sustainable method of decreasing our CO₂ emissions. So it is a very important exercise.

We know that it can work. We know that it has the potential to make deep cuts. It is a question then of just how deep those cuts can be. We have undertaken a modelling exercise. I emphasise that, like all models, it depends upon the assumptions you make at the start of the modelling. I will not go into those in detail. We have used a number of models that are valid models as far as the IPCC and so on are concerned, and we have started to put our own conditions on those. Without making too much of a meal of this, we have found that, if we do not do anything, under, for instance, the IS92a model, the concentration of carbon dioxide will get to about 712 or 720 parts per million by 2100—in other words, two or three times the present concentration. That is a pretty significant concentration by any standards.

If on the other hand we deployed CCS globally—and under our model you actually have to start doing this, and then you ramp it in, starting in 2015—you could actually bring down the concentration of CO₂ to around 550 parts per million, which is seen by some as a target to go for. Other people would prefer to go for 450 parts per million. We think, unfortunately, we have probably already missed that one. But what we are seeing here is the following message. Can CCS make deep cuts? Yes, it can. Do we need to start it soon to make those deep cuts? The answer is yes. That is a fairly clear message I think that we can state at this stage.

Is there enough storage capacity in Australia and globally for the amount of carbon dioxide that we are going to emit and to sequester? Let me talk globally first. I see you have the summary for policy makers in front of you regarding the IPCC special volume on carbon dioxide capture and storage. You will find in there it makes the statement:

... while there are uncertainties, the global capacity to store CO₂ deep underground is large.

That is a bit vague, but then it goes on:

Available evidence suggests that world wide it is likely that there is a technical potential of at least 2000 Gt CO₂ of storage capacity in geological formations.

It then goes on:

The economic potential of CCS would amount to 220-2200 Gt CO₂ ...

That means that the amount of CCS that they believe is feasible would range from 15 to 55 per cent of the total mitigation effort by 2100. In other words, they are seeing this as playing a very

significant part. They do not know whether it is that low level of 15 per cent or that upper level of 55 per cent, but what they are saying is, from their perspective, this is a pretty significant deal.

They think that the overall capacity is large, and in many cases that capacity is located in areas where we do have major sources of CO₂. That is not fortuitous; that is a consequence of the fact that a lot of the sources of CO₂ are in fact from coal and also of course natural gas and things like that, and those resources are derived from sedimentary basins. Sedimentary basins are where people live for the most part. It is where the land is flat and where the land grows things. So there is a whole range of reasons why people tend to live in those areas. So you get this sort of juxtaposition of where people live, where you get your coal, where you have your CO₂ emissions and also where you can actually geologically sequester the CO₂. That is a pretty positive overall correlation.

Of course, that is not the case everywhere. We are saying that there is a significant number of cases where that is the case, and that gives us grounds for optimism. For instance, there is a lot of discussion about China and so on at the present time. Certainly there are areas of China where we believe there is probably significant storage capacity. Is it sufficient? We do not know. Not enough work has been done there. But we do know that in the future almost certainly that capacity will be used. India is another one that is mentioned. That is a more difficult one at the present time because it has fewer sedimentary basins and perhaps more limited opportunities for conventional geological storage.

But it is important to emphasise that this area of geological storage, geosequestration, is in many ways in its infancy in terms of developing the right sort of models and understanding all of the principles that apply. I say that knowing that in a number of areas we have a very good picture, but there are some areas where we have to start looking at, if you like, out of the box type models so that we can start to take a different sort of approach.

Turning to Australia, the storage potential of Australia is much better known than that of most other countries. We started the work in 1999 and between then and 2003 we undertook what is called the GEODISC project, which provided us with a very high-level assessment of the storage capacity of Australia. In fact, in many ways I refer to it as a storage resource. It is like what you have in minerals, where you start off with a resource, you drill it, you better understand it, you work out how to do the metallurgy on it and you end up with a reserve that you can actually mine and about which you can state to the stock market, 'This is worth this amount of money.'

You go through that same sort of process in geosequestration. You start out with a very broad scale picture of where we might have storage capacity and then you focus in and work out where you can drill, where you need to drill again, what are the best ways of injecting that CO₂ and so on. We started this research a few years ago, and that was a very important step, because what it said was that Australia had a very large storage resource—enough for many hundreds of years of CO₂ at the present rates of emission. That is not to say we use all of that. Some of it would be too expensive to use; some of it would be too far away to use. Nonetheless, it is a potential resource to be used in the future.

Since then we have started focusing on a number of areas, such as the Gippsland Basin, the Perth Basin, the Central Queensland basins and so on. Again, we believe there are further grounds for optimism in a number of those areas. Particularly, we would point out the Latrobe

Valley area, which is adjacent to what appear to be very good storage opportunities. But similarly the Kwinana area has the potential there and also some of the Queensland emission points have reasonable prospectivity for geosequestration. We actually do not know a great deal about South Australia and the Northern Territory. There has not been a lot of activity there, but we are fairly confident that in areas such as the Cooper Basin in South Australia there would be a lot of storage capacity, but we have not done a lot of detailed work there—similarly in parts of the Northern Territory.

One of the areas that has received some coverage in recent times has been New South Wales. It is worth while outlining the current level of knowledge we have of that state and perhaps taking the opportunity to address a misleading impression that New South Wales is a lost cause. New South Wales produces more CO₂ emissions than any other state, and therefore it is very important from that point of view. There is no question that basins such as the Sydney and Gunnedah basins are geologically complex, their rocks are tight—in other words, they have low permeabilities near the surface and so on. But in fact we know very little about the deep rocks of New South Wales. The reason for that is that there has been lots of drilling down to about 500 metres or 600 metres and after that you cannot mine coal, so the drilling has stopped. There has been virtually no petroleum exploration in New South Wales, so that has not given us much in the way of deep information. There has never been a deep, or any sort, of well drilled offshore and yet we have a very large sedimentary basin offshore from Sydney.

If, for the sake of argument, it was possible to inject CO₂ into the offshore Sydney basin at the right sort of depths, that could provide us with a storage opportunity. It is high risk. The chances are it will not turn out to be the case; nonetheless, the need is so pressing that there is an important requirement to look into that potential opportunity.

In the long run—perhaps I should not say ‘in the long run’ but say ‘in the intermediate run’, because I hope it will not be the long run—we will within the next few years establish what the true potential of the Sydney, Gunnedah and Darling basins are. We are not at this stage at the moment. In other words, we know very little about them, but that is changing. The New South Wales government has recently established a ministerial task force, and we are involved in that process. We are very much integral to that process. We are developing more detailed programs in New South Wales to undertake the comprehensive and definitive assessment of that state, but for the present it is far too early to say there is no chance in New South Wales. We believe there are potential prospects and we are working to develop those prospects. Global storage capacity is large. It is not always where you want it, but it is there, and Australia does have a large storage capacity. What about costs?

CHAIR—Can I ask that you make this as simple as possible for us? This is something that we are constantly trying to grapple with. Just treat us as humble politicians.

Dr Cook—I understand the problem. Think of it in the following way. Anybody can quite reasonably ask the question, ‘How much is it going to cost?’ It is almost like saying, ‘How much does a house cost?’ Then you have to say: ‘Where is the house and what size is it? How big is the garden, what are the fixtures and so on?’ You end up saying, ‘It could be \$100,000 or it could be \$50 million,’ and that is part of the problem. We can do a lot better than that, I hasten to say, when it comes to this.

Mr JENKINS—You had me worried!

Dr Cook—We have looked at this in some detail, and you are aware of the range of costs. Let us start off with the pulverised coal plant. These are the figures coming from the IPCC. They give a range of \$29 to \$51 per tonne of CO₂ avoided for a new pulverised coal power station. When it comes to natural gas combined cycle, they give a number of \$37 to \$74 per tonne of CO₂ avoided. For integrated coal gasification combined cycle, it is \$13 to \$37 a tonne of CO₂ avoided. Those figures are actually given in US dollars, but for our exercise we found that it was best to just convert the numbers—in other words, to not worry about the rate of exchange and to just say, if it is \$US37, it is going to be around \$A37 Australian. That is sort of a rule of thumb that we have found when we have gone through this exercise.

CHAIR—Sorry, can you say that again? How many US dollars is the equivalent of 37 Australian dollars?

Dr Cook—We are using the numbers and not taking the rate of exchange; we are taking the numbers and saying, ‘That gives us an approximation.’ The reason for that is that our costs are lower than they are in the United States. That is the reason we do it. It all depends on things like energy costs. The cost of coal and natural gas is significantly more in the United States. So, if we have an energy penalty through the use of CCS—in other words, you use power to drive your CCS systems—it costs us a lot less to do that here in Australia than it does in the United States or in Europe. In Europe, the cost of putting in a pipeline is very much higher than it is in Australia because almost every few metres you have another house to go around or something like that. Those are the sorts of factors that have a profound impact on the cost of CCS. That is why it is quite difficult to take the numbers that you get from Europe or North America and say they are going to apply here. You look at those numbers and take the top end of that—pulverised coal is \$51 and you say, ‘Why would you do it for that?’ Well, you may not do it for that. That is the range. Is there scope for bringing down those costs? We think there is very significant scope for bringing down those costs.

CHAIR—What is that the cost of—capture, transportation, sequestration—

Dr Cook—That is the cost of avoiding a tonne of CO₂ through the application of capture technology.

CHAIR—So it is the whole lot.

Dr Cook—Yes, that is the cost for capturing the CO₂, and then that is amortised over a tonne of carbon dioxide, if you like. What that does not make clear is how long you amortise it over and how many millions of tonnes of that you amortise it over. We have tried doing that exercise in the Latrobe Valley, and I think this is one where we have good Australian numbers for this. There, the model ran on the basis of assuming that we had up to 50 million tonnes a year of CO₂. In other words, this is one of those exercises where you develop a network. You do not just have one power station, one plant and so on. You actually say, ‘Let’s pull together these power stations and let’s develop a network in which they share facilities and pipelines and so on and they all then take it offshore.’ This is based on taking it to an offshore storage site. So we took 50 million tonnes a year and we ran that for 40 years. In other words, we are talking about 2,000 million tonnes, or two gigatonnes, of CO₂ being stored.

The first question that needs to be asked is, 'Is there enough storage capacity there?' The answer is yes. We believe that there is readily available two gigatonnes and we believe that it is more likely to be six gigatonnes or more. So certainly there is adequate capacity in that area, taking that as an example.

CHAIR—I have just one point of clarification: what proportion of the CO₂ emissions is that 50 million per annum?

Dr Cook—From the Latrobe Valley—most of it. I think it is about 60 million tonnes. So it can make a very significant dent in that area. The indicative costs of doing that worked out over the period of amortisation and over those millions of tonnes of CO₂ to \$38 a tonne of CO₂ avoided. Those are the costs. Those costs would come down if you were, for instance, applying it to the Monash project, where you are going to have a fairly pure stream of CO₂ coming out as a result of the coal to liquids project. So the costs would come down, because this factors in the capture costs as well.

Turning again to the overall costs, the majority of the cost is in the capture process, which, as you know, is probably 70 per cent or 80 per cent. But in a way that should not be seen as a major barrier because we are going down a fairly well trodden path in terms of what the chemical engineers are used to dealing with and so on. This is not something that is seen as a major barrier.

Mr HAYES—What about, say, natural gas, LNG, where they need to strip the CO₂ anyway? That would bring it down further.

Dr Cook—That is right. That is a very cheap option, relatively speaking. Things like the Gorgon project are still very expensive. Nonetheless, in terms of per tonne of CO₂ it would be very much less than that. Essentially what you are doing there is just dealing with the storage costs. We have looked at the storage costs separately, which is the sort of situation you are talking about there. Again, depending on how far you are going to pipe the CO₂, you might be going to pipe it hundreds of kilometres, the transport costs can come in a very significant way. But if, on the other hand, you are going for realistic distances, 100 kilometres or less, then you are talking \$10 a tonne as being the sort of number you will come up with for the storage side of things. That is the sort of number that you might see in the gas industry. It could be \$10, it could be \$15. Obviously it depends on the particular circumstances of the project. But the main point is that it will be significantly less.

I think we have to remember that we are really at the start of the cost curve. By that I mean we are dealing with a very conventional cost curve for any technology. All technologies come down; they start high. Whatever technology you want to think of starts high and comes down. The rate at which it comes down varies with the technology. But there is no technology that we have ever had that I can think of where the costs have not come down, and we are right at the top of that curve. So we are confident that the costs are going to come down. In fact, at the present time you could say already CCS is competitive with some other forms of carbon-free or low-carbon energy in terms of the sorts of costs that we are talking about here for CO₂ avoided. But, as I emphasised, the costs for low-carbon power for CCS are site specific and fuel specific and they will vary from country to country.

There has been a lot of discussion about the estimated cost of nuclear and how that compares. I hasten to point out that we are not experts in nuclear power within the CRC. That is not our thing. So all I am doing here is taking some quoted figures. It looks like the figure quoted by Europeans is around \$30 a megawatt hour for nuclear. The Canadians seem to be quoting numbers of \$40 to \$60. In the United States they quote numbers of \$60 to \$70, if for instance you take some of the numbers coming out of MIT. In other words, the nuclear costs at the lower end appear to be cheaper than CCS at the present time. The upper end appears to be more expensive. I am merely using that as an example to point out it is not a cut and dried sort of thing. You have to look at the range of these costs and look at the particular circumstances.

We have also looked at how much further the cost can come down. The IEA, the department of energy, the European Commission and our own studies suggest that a cost reduction of 20 per cent to 30 per cent over the next 10 to 20 years for CCS is not unreasonable. That is the sort of cost decrease that we will see. In comparing other technologies and so on, I am not saying that CCS is the answer. That is absolutely not what we say. We always stress that CCS is part of a response that we will need, part of a portfolio of technologies. That will include energy efficiency, renewables and so on—the whole thing—and potentially include nuclear as well. There is certainly no reason for pessimism on the cost. In fact, there are grounds for significant optimism on the cost and the way it is going to come down. We expect it to come down. There will be nothing special about it doing that; it will do it—there is no question.

What will that mean in terms of electricity costs—which is very often what is asked? Again, it is quite difficult to get a straight answer on this because you have all the circumstances, the ‘what ifs’ and so on. But one way of looking at this is to say that, if it is \$20 a tonne for CO₂ avoided, that means it is a cost of around an extra 50 per cent on the cost of electricity at the generator. That comes down to about 15 per cent at the domestic customer because you are using the same infrastructure for the most part. That is why you get this difference. It is still a significant cost and we are talking right across the board.

There may be other ways of looking at that. One of the things we have looked at is, instead of imagining this as right across the board, imagining we do this in a progressive sort of way. With one of the models we have we decided to say, ‘Let’s every two years bring in a 1,000-megawatt power station and just spread the cost of that right across the power industry.’ I apologise for showing this document; we will provide you with copies, but it shows you the sort of modelling that we have done. Basically what that does is take the cost of electricity over about 20 years from about 7c up to about 8c a kilowatt hour. That is the rise in cost over that period.

This is not to say that that gives you enough; what it is saying is that that is one option for you to start to spread that cost. Why do you need to do that? The big problem we face is that the first mover in this area, if he or she brings on clean electricity with full CCS attached to it and so on, is going to go broke in no time at all if the costs are not in some way supported by government, if the costs are not spread across the network or if some other steps are not taken. I think we have to recognise that that is certainly an issue that has to be addressed. That is one reason why people ask why it is taking a long time to bring this on. That is part of the reason—because no company wants to go broke. That is part of the reason why they are not doing it at the present time.

Dr JENSEN—I am just trying to get this clear. Are you saying that what you are recommending is that effectively companies get charged a tax or whatever to the equivalent of \$70 or \$80 per megawatt hour?

Dr Cook—I am not recommending that.

Dr JENSEN—The price of electricity—

Dr Cook—What I am doing is looking at scenarios and looking at options. One of the options would be to say a stand-alone CCS that bears all the costs, and where its group of customers has to bear all the costs, is never going to work; it is never going to happen.

Dr JENSEN—I am just trying to understand exactly how you are proposing that this mechanism works.

Dr Cook—What we are saying with this model is that, rather than having a new 1,000-megawatt power station with CCS attached to it and then adding all the cost to that customer group and going broke in the process, we have to recognise that all the other members of the generating community have to bear some of that cost, to help this—

Dr JENSEN—Sorry; I am just trying to confirm how it works, Petro.

CHAIR—Just keep this brief and then we can come back to wholesale discussion, if you do not mind.

Dr Cook—I am happy to come back to that. Why is it taking some time? I have discussed why you have problems. The costings are one of the impediments that are faced. Maybe there are ways of dealing with that. LETDF is another model, you could say, for helping that, but that is not taking it through to full commercialisation. That is actually a demonstration project.

We do need to tackle that. In fact, if we look at the length of time we are taking to deploy these things, we are not going to see anything before 2010 really of any great significance in Australia in terms of actually storing a lot of CO₂. But that is no different to what is happening overseas. It does take a number of years to get these plants up, to put them in place. They are not simple things. They are complex; they are expensive. So we cannot expect anything much to happen in under five years. The main thing you will see happen is, first off, the Otway Basin project we are doing and then subsequently, in 2009 or something like that, you will start to see some of the LETDF projects being taken on. But I suspect it will be 2010 before there is any CO₂ being injected—that sort of order. That may prove to be slightly out but it is not going to be very far out.

Are there technological barriers to deploying it? For the most part, no. As we have indicated there is a need to define the storage capacity in some areas. There is not going to be a massive amount of money spent on new capture technology in New South Wales until they are confident that the storage capacity is there. That is not unreasonable.

Are there regulatory barriers and so on to overcome? What we found in taking the Otway Basin project forward is that there have been far more legal and regulatory obstacles than we

ever anticipated. These include landholder issues, uncertainties over which regulatory bodies have responsibilities, lack of knowledge of CCS within those regulatory bodies, multiple layers of regulation and so on. That is not to criticise Victoria because, in fact, this just happens because Victoria is first cab off the rank and this would have happened in any state. What we are doing is determining these various impediments, and it is actually going to be very helpful to commercial projects in the future. But, unless they are resolved, they will slow things down a little bit.

The lack of clarity on the issue of long-term liability will similarly slow things down if we are not careful. Most of the proponents of CCS projects are willing to accept the need to take on liability for the operation and closure phases of the projects. But to expect them to take on responsibility for hundreds of years after that is unrealistic, to be perfectly honest. In fact, the risk of leakage from a well characterised geological site is very low, so the liability is low. But the fact is that you cannot get insurance for hundreds of years, and who can guarantee that a company is going to be around for hundreds of years? It is one of these *quid pro quos* that governments have to take on from time to time. There is a public good in storing CO₂ and decreasing CO₂ into the atmosphere. Part of that trade-off is that governments eventually will need to take on long-term liability of some sort. How that will actually function and what it will cover and so on I do not know, but it is something that has to be addressed.

Finally, there is also the issue of clarity on the issue of licensing of offshore geological storage sites. That is something that is being addressed at the moment. There could well be something going before parliament in the coming months. That is a good thing because no major company will take on the responsibility for sequestering offshore CO₂ if they do not have rights to the land or the title or whatever else. That is, hopefully, being fixed.

One thing that is very important in terms of taking this forward is that we really do have to move on this rather than waiting for particular or arbitrary cost savings to be achieved—whether it is \$20, \$30 or \$40 a tonne. If we are going to do that, it is not going to happen, and we do need to get CCS underway now so that we can start to make deep cuts in emissions.

Finally, the point that I started off with was: what is the potential impact of emissions trading on CCS? Obviously that has been getting a fair amount of focus in the press in recent times. As I pointed out, one of the biggest impediments to the uptake is this question of the cost of the implementation. If a price was placed on carbon, would that have an impact? Yes, it almost certainly would. But would an emissions trading scheme remove that impediment? Possibly, but it depends on the effectiveness and that depends on how it is defined, with the length of time that it applies for, the price that is set for the carbon or the number of credits that are given out as part of this exercise. With too many credits, the price is low, so nobody is going to do CCS. Everybody will take a short-term sort of measure. If we deal with five-year time scales in the emissions trading regime then it is not going to work very well then either. We have to get the right time scale for emissions trading and we have to get the right number of credits and so on. So you have to get these things, I think, set up in the right sort of way.

Whilst I am very positive about an emissions trading regime and the fact that it is, if you like, technology neutral, which is no bad thing—it means all these technologies have to compete—at the same time we have to recognise that we are dealing with a long-term issue in addressing global warming and we are not going to do that on the basis of short-term emissions trading

measures. It has to be the right sort of emissions trading to make this all happen. Could we do it through an MRET type scheme that you apply to low-emission technologies? Maybe you could. That would be one way of doing it too. I am not advocating that necessarily; I am merely saying that that would be one way of doing it. We do need to consider those sorts of options. They will have an impact and they will help to take CCS forward, but it is not going to be the total answer; there are going to be other steps taken that will be needed as well.

CHAIR—Could I cut you short there?

Dr Cook—That is it.

CHAIR—It was a fantastic presentation, and I will have a CO₂ explosion from Dr Jensen. Dr Jensen, why don't you lead off the questions?

Dr JENSEN—I was quite interested, as I was trying to get to before, in spreading the cost with new and old users. You were talking about \$70 to \$80 per megawatt hour. In effect, what happens with the new user and what happens with a user or a power utility that is producing power the old way?

Dr Cook—Under the sort of scenario we are suggesting, it would bear an additional cost. That cost for that 1,000-megawatt power station with CCS would be in the order of an increase of two per cent.

Dr JENSEN—In other words, is this an increase in cost to the consumer that from their power station—

Dr Cook—They presumably would pass it on, yes. Whatever happens, CCS or anything else will increase the cost of electricity. We cannot avoid that. Electricity will not stay at the same level.

Dr JENSEN—You were talking about the capacity as well. I think you were quoting 15 per cent to 50 per cent or something over the next 100 years. Are you talking about that being the full potential for storage of CO₂ in these geological structures—of the CO₂ produced in the next 100 years?

Dr Cook—The 15 per cent to 55 per cent was the figure given by the IPCC special volume for the role that it saw CCS playing in mitigation of total CO₂ emissions over the next 100 years.

CHAIR—Can I take you back to the costs and the notion of amortising over a period of time, which connects with your notion of the improvements in technology reducing the cost? For any particular extraction, don't you commit all your technology and costs up front? Take your network in the Latrobe Valley. You can buy a network; don't you have to put something there and invest?

Dr Cook—Yes, you do.

CHAIR—How much does it cost up-front?

Dr Cook—I can get you those costs precisely, but I think they are of the order of \$2½ billion.

CHAIR—So, if we wanted to capture in the order of 90 per cent to 95 per cent of emissions from the Latrobe Valley, it will cost us \$2½ billion.

Dr Cook—Yes.

CHAIR—If you commit that up-front, how does the cost of carbon collection and sequestration reduce over time? Is that with respect to other fields?

Dr Cook—The cost of that particular exercise would decrease throughout the life of putting the project together. You are never going to put all of those together in one instant in time. You would do it for this power station and the cost would be X and then for the next one the cost would be Y, where Y is 20 per cent less than X because you have had learnings coming out of the first one and so on. The cost would progressively come down during the life of developing the project. You would put together a project like that over 10 years and over the life of that project you would see the cost come down.

CHAIR—So that is where the savings come from?

Dr Cook—Yes. What I was saying was that over 20 or 30 years with a number of these projects, whether you are talking about individual CCS projects or these sorts of regional CCS projects, the cost will come down. There are two aspects to this. One is, as I say, the learnings. The other thing is that you get economies of scale. If you pull together a number of projects in the same region—and we have done this for the Kwinana area, for the Gladstone and Rockhampton area, and for the Latrobe Valley area. The Latrobe Valley is the one we have done in detail, but we have done the others better than back of envelope but not with the same precision. Again, each time we see savings coming out of those because of the fact you are able to bring a number of players together. If you do this on an individual basis with just one power station, one compressor, one separation plant, one injection plant, the costs do become higher. There is no question. That is the other way you bring down the costs—by getting players together.

You have to also look at the paradigm. Perhaps that is going to change. We are used to power stations being placed where the coal is. In the future is it going to be cheaper to put the power station where you have somewhere to inject the CO₂ and bring the coal to that location, or do we do it in some other way? There are various ways we are going to look at this paradigm.

CHAIR—The problem from my perspective is that it looks like an ongoing act of indecision extending over decades. Every time I come to terms with this, I say, ‘Yes, we are projecting further and further down the road, there are more investigations to be done and the technology is there, but we haven’t made it work.’ I am not frustrated; it is just that this is my image of what comes out of these hearings. Everything is in place but nothing is happening—to put it crudely.

Dr Cook—It is not a matter of saying it is all in the dim distant future. CCS is here and now—that is the first point. But it is primarily applied to the gas industry at the present time.

CHAIR—For coal in commercial quantities, where is it?

Dr Cook—The only place where it is happening at scale at the moment is North Dakota, where there is a coal gasification plant that is producing about two million tonnes of CO₂, which they ship north of the border in a pipeline to the Weyburn project. That is happening at the present time. But that is more about producing chemicals than producing power; it produces some power. When it comes to producing power and applying CCS, there are no actual impediments to stop us doing it now other than cost. We could do it now, but it would cost too much.

CHAIR—Why do you say that?

Dr Cook—Because how would you get your money back? There is no price on carbon. You have to compete in the marketplace with other electricity generators. How do you compete when your cost structure is 30 per cent, 40 per cent or 50 per cent more than theirs?

CHAIR—So for a commercial enterprise it would be too expensive?

Dr Cook—Under the present regime, yes.

Dr JENSEN—One thing that concerns me with this whole issue of carbon costing and so on is that in a way it is distorting the market. Why not just mandate that, as of date X, to generate one megawatt hour of electricity you are only allowed to emit so much CO₂—you have a realisation that there are some power plants out there that are still amortising their costs and therefore they have a problem into the future, so you give them a tax benefit to actually include CCS with a backstream to balance things out, but basically otherwise let the market decide which is the best way of mitigating CO₂?

Dr Cook—Overall, I do not have a problem with that, as long as you do not expect that to be instantaneous. You have to ramp these things in. You have to be doing these things sensibly so that you do not suddenly close down the Hazelwood power station or something like that—

Dr JENSEN—That is why I am talking about the back end and giving tax incentives to amortise the costs—the capital costs that they have already got in there.

Dr Cook—There has to be some form of government assistance. I do not know what form that should take—whether it is tax or whatever. But I would agree with the general principle, yes. I think what are you also saying is that we should not be picking technologies, and that is also a reasonable thing to say. What we also must recognise is that all the projections say that we are going to continue to use fossil fuels for the next 100 years and we are going to be using more coal, not less coal. Lots of people would prefer that it was not that way, but that is what the projections of the IEA and the IPCC suggest. In that situation at the present time we have no alternative other than CCS. That is where we are in this at the present time. We have no other option. Therefore, we do have to press ahead with this and we cannot do it solely on the basis of existing price.

In the case of MRET, there we have \$380 million. I think the Warwick Smith review said it is costing \$380 million. That mitigates six million tonnes of CO₂. So that is around about \$60 a tonne of CO₂ mitigated. I am not saying that to criticise in any way the MRET scheme or

anything else; I think in some ways it has been quite successful. I am merely pointing that out as an example.

If you were to do that for low-emission technologies, would it work then? The answer is almost certainly yes, because the sort of numbers that we have suggest it would be less than \$60 a tonne. I am not suggesting that you do that for every tonne of CO₂ that is emitted from a fossil fuel based power station, but it gives you an indication that already we have differences in the market.

Dr JENSEN—I think this is the problem in actually putting on a carbon price—you charge too much and you are going to put people off; you charge too little and you will put them off actually doing anything about it because they can just onsell their problem.

Dr Cook—That is right.

Dr WASHER—Do you know roughly how many coal-fired power stations are there in Australia?

Dr Cook—I think it is about 30-something.

Dr Van Puyvelde—I think it is around the 40 mark—

Dr WASHER—How many of those would be state owned?

Dr Cook—Gosh. The Queensland ones and the New South Wales ones are state owned—

Dr WASHER—WA.

Dr Cook—And WA. Those are the ones. You could say that two-thirds of them would be state owned, I suppose, one way or the other.

Dr WASHER—So they are under government control. The thing that I am fascinated by that the mining industry complain about and that you mentioned as a problem is that, when it came to doing anything from a mining project, they found the states a bigger deterrent in terms of all their regulations, like heritage and other issues, than, say, Indigenous problems. I guess this is mining. We are looking at moving CO₂. Can you elaborate? If more than 50 per cent of these plants are owned by state governments—we federally do not own any of these power plants at all—what were the barriers that you saw in this project that would add to the costs in terms of time and finances? I think the project was looked at in Queensland. Did you see these real state barriers? You did allude to them. There are some real horrific barriers in terms of costing and timing. And what sort of barriers are they?

Dr Cook—The only one that I can talk about definitively is the project we have had in Victoria. It does change from state to state. In Victoria we have had to go through all the planning processes, which is fair enough. We have also had to go through the EPA, the Department of Primary Industries, the Department of Sustainability and Environment and so on. There is a whole range of departments that you have to go through. I suspect Victoria is not that different to the other states in that respect. Yes, we have had to look at Indigenous issues as well.

We have had to look at legal issues relating to the land and liabilities and so on. We have had to put new corporate structures in place to be able to handle those sorts of things. All these sorts of things have added significantly to our costs and added significantly to the time.

One of the reasons why a number of the companies are very interested in what we are doing is that they are finding out where some of these potential burdens are. Those burdens will apply in Victoria or Queensland. Offshore you have a different situation because of course that is primarily the responsibility of the federal government. But very often the day-to-day handling of that is handed on to the states so that the states do have an involvement in it. In the case of offshore, the complication will be because a number of the more prospective areas for storage are also areas that are either held by or potentially held by oil companies. That is a potential impediment that needs to be resolved in the fairly near future in order to make sure that does not stand in the way of, say, areas such as the Latrobe Valley using the Gippsland Basin for storage.

Mr QUICK—Where do you see us in 2050? From reading the Stern report and talking to global alarmists, 2050 will be like living in England when the buildings were covered in soot and grime and people were falling down by the wayside. Do you see clean air and life being beautiful?

Dr Cook—If I am able to see anything in 2050, I will be absolutely delighted.

Mr QUICK—The same with me—I will be 109!

Dr Cook—Apart from that minor consideration, I am an optimist. You can take a view that technology is the problem and it has caused all these difficulties and so on. But it has to be a significant part of the solution. Yes, there will be a change of habits and so on, and people will take things like energy efficiency more seriously than they do—and so they should. But I do also believe that we will continue to use power at probably about the same rate we are now overall, particularly if you take into consideration countries like China, India and so on. Globally we are going to be using more power, not less power, in the future. That is something we have to accept.

Will the CO₂ issue be resolved? I do not think it will necessarily be resolved, but I do believe that the scope is there to tackle it. I am optimistic about the potential of carbon capture and storage. I am optimistic about nuclear. I think all of those things will come into play. I think things like solar and so on will greatly improve. There is probably a limit to wind capacity. But these are all going to be part of that mix.

Mr QUICK—But is it going to be like the rail gauge? It took us 100 years to go from Perth to Brisbane, and each of the states did their own thing. We now have Peter Beattie saying he is going to spend \$1 billion in six or seven years time to have the first clean power station in the world. The Victorians are going to do their own thing. You are spending \$30 million in the Otway Basin. South Australia has all the sunshine all day every day. Are they going to totally go solar? Is that a political decision because there is a hell of a lot of marginal seats in the coal basins? In China at least they have a dictatorship where they can do it. You cannot breathe in Beijing most days of the week. They will get to the stage where the central committee will make a decision. But here we have six states, two territories and a federal government, and never the twain shall meet.

If we do it here in Australia, and India and China go gang busters as they have done, we cannot breathe anyway, so why are we spending billions of dollars and being no better off? We have solved Australia's problem, but the rest of the world is stuffed.

Dr Cook—We have not solved Australia's problem if the rest of the world carries on regardless because we are carbon dioxide takers, not givers, for the most part. The amount of carbon dioxide we put into the atmosphere is pretty modest. That does not mean to say we should not do something about it. But whatever happens to the rest of the world happens to us. That is the case.

Mr QUICK—But the punters are saying: 'If you increase our quarterly power bill by 30 per cent or 40 per cent, we all feel good inside, we are all soft greens and the rest of the world is going ahead, why should we take those steps—if nothing really changes and we are only contributing two or three per cent?'

Dr Cook—What you are asking is a fairly political question rather than a technical question. All I can do is answer as a man in the street and say—

Mr QUICK—They put us here and they are the sorts of questions they are asking. There is a huge cost to us. If we are only contributing a small percentage to the world's amount, the happy coal workers are busy sending it all off to China and India and burning it and we are trying to do something constructive here, what is the point of all this?

Dr Cook—I think you can take one view that, if we demonstrate this effectively here and we develop the services that go along with it, this will actually help us to continue to sell \$25 billion worth of coal to China because we then have a way of dealing with the problem through CCS. That is, if you like, a defence mechanism. There are other things you can point to and say we are starting to see a CCS business develop and we should be part of it. One of the ways to be part of it is to actually be out there doing it. Those are some of the positive things we can do.

If we are to do this on the basis of saying that we are only going to do it to the extent that we provide 1.6 per cent of the world's CO₂ or whatever it is and therefore we are only going to give one per cent of the effort, that will probably not help. We almost certainly will have to do more than our fair share, if you like, because some of the developing countries will say, 'Well, you've had the benefit of this for the last 200 years; now it's our turn to get the benefit.' I personally do not have any problem with the philosophy that we have to do a little bit more than China, India or somewhere like that.

Mr QUICK—So the Otway Basin is up and running, whiz-bang, you have solved all the problems and you have identified all the costs. You then go to China and say, 'Look, we've got this whiz-bang technology; we'll sell it to you for X million dollars per basin,' and this sort of thing—at what stage will that be? Will it be 10 years down the track that we have this super secret and we say, 'We'll sell it to you guys'? We have these pilot projects all over the place.

CHAIR—It is not exactly Viagra! We are told that the technology is there.

Mr QUICK—I know. We have these 100 examples around the world. With this Otway Basin thing it seems that you guys are finally going to lock it in place, it is all in the box and you are going to wrap it up and present it to someone. As a layman, is that right?

Dr Cook—I wish it were, but it is not quite that simple because all of these things are site specific. They all depend on the geology in that location.

Mr QUICK—I find it hard to believe that we do not know what is underneath Australia. We have mining companies that have been operating for a hell of a long time, we have some of the finest scientific minds and CSIRO has been operating for goodness knows how many tens of years, and we do not have the capacity to say what is in the Sydney basin or offshore of Sydney.

Dr Cook—Yes, it is amazing, isn't it? I agree with you.

Mr QUICK—It is embarrassing. Think of the hundreds of millions of dollars poured into science organisations every year, and we have this dearth of information.

Dr Cook—Yes. We have, and we need to do something about it. What we need to do is undertake studies of that deep geology. In some areas we know a great deal about the deep geology. We know quite a lot about the deep geology in the Otway Basin area. That was one of the reasons we went there. We know a lot about the deep geology in the Gippsland Basin because it is an area from which people have been taking oil for the last 40 years. Yes, they have been drilling lots of holes and doing lots of mining in New South Wales, but most of that has been in the top 300 or 400 metres—nothing more than that. Our interest starts around about the 1,000-metre mark, which is where you have to put the CO₂. That is why you have this gap. Yes, it is surprising to many people. It is surprising to the New South Wales government I think in many ways, but they are now recognising that there is a real gap there and it has to be addressed.

Mrs VALE—I understand that each site has its own challenges and its own problems. Can you tell me who is the world leader when it comes to this kind of technology that you are working on here in Australia?

Dr Cook—I am not saying it is me. I was interviewed by a committee of the International Energy Agency about a year or so ago. They said, 'Dr Cook, where does CO₂CRC fit in the world in terms of its standing?' I said, 'I think we'd be in the top half dozen.' They said, 'Well, we think you're in the top three.' That was their view of CO₂CRC in terms of the work that is being done. One of the great things we have been able to do through the CRC system is to bring together a whole range of organisations—CSIRO, Geoscience Australia, the universities and so on. That is something that no other country is able to do very effectively. I think it is a credit to the CRC system that it is able to do this sort of thing.

It is through that combination. It sounds a bit trite to talk about a 'Team Australia' approach, but nonetheless that is what it is—highly effective, very cost effective, scientifically effective and the only way that we can really make a difference on the world scene. If we had half-a-dozen different groups in Australia each doing their own thing, quite honestly we would not be noticeable. It is because we have been able to pull it together through the CRC system.

Mrs VALE—Do you have any international links with other technical bodies with whom you are working?

Dr Cook—Yes, we do. We have many links. I mentioned the Otway Basin project. For that one we are very heavily involved with Lawrence Berkeley National Laboratory in the United States and the Alberta Research Council in Canada; both of them are very highly regarded organisations. We have very strong research links with Japan and China, and we are developing them with India. We have them already with a number of countries in the European Union, the United Kingdom, Germany and the Netherlands. So, yes, we do have very strong links.

Mrs VALE—How far down the track, then, are those scientific minds in those countries to coming up with this technology?

Dr Cook—In terms of geosequestration, we are actually ahead of most of those countries. There is no other research project that is comparable to the Otway Basin project being done by any other country. The difference is, of course, you have three or four commercial projects—the Sleipner project of Norway, the In Salah project in Algeria and the Weyburn project in Canada—and a lot of learnings are coming out of those projects. There is also a project called Snohvit, which the Norwegians will be undertaking or starting in about the next 12 months or so. So they have those commercial projects. But there is a limited amount of monitoring being done on those commercial projects. So what we are able to do because we are a non-commercial project is a whole range of things that just are not possible when you are subject to commercial pressures. So we will have a better understanding of what is going on than just about any other project that we know of. It is a very trailblazing sort of project.

Mrs VALE—Hence, there is your problem with costs too. As always, whenever you are a path finder in any industry, the costs are—

Dr Cook—Yes, we have been hit hard by costs, not least because the resource sector is doing pretty well at the moment, as you would know, and the downside of those costs have escalated. Whereas we had anticipated it would cost us a couple of million dollars to drill a well, it has cost us \$5 million to drill a well. That is a direct outcome of the boom in the resources sector.

Mr QUICK—When does your funding run out?

Dr Cook—It runs out in 2010.

Mr QUICK—Then you have to jump through the hoops again?

Dr Cook—We start in about a year's time. We are optimistic that we will get a renewal, and that is certainly what we will be aiming for.

CHAIR—You made a point that it is not about picking winners, which I agree with—that lots of technologies have to contribute to reduction. How is it possible to not pick winners without a carbon-trading or carbon-costing scheme? Is it possible to say solar and wind will not be disadvantaged by whatever happens to geosequestration? Is there any way of trading off by a direct mechanism rather than by a market mechanism? If the question does not make sense, tell me that the question does not make sense.

Dr Cook—I am struggling a bit. Are you regarding, say, MRET as a market mechanism or not?

CHAIR—To some degree, I would regard it as a market mechanism. I would certainly regard carbon trading as a market mechanism or a carbon tax as a market mechanism.

Dr Cook—So you could have a MRET that also covered low-emission technologies as being an approach. None of those things necessarily have to compete with each other at this stage. Eventually they will have to. Eventually the winners have to emerge from this. By ‘winners’ I am talking about the ones that give the most bang for the buck—in other words, that produce the maximum mitigation of CO₂ at the minimum cost. That has to be the aim of this. It cannot be unlimited funding. I am not sure that I am answering your question.

CHAIR—What you are saying is that, at the end of the day, it is a comparison at the end of the process about what contributes most efficiently. What strikes me is what we are trying to do is to get a level playing field at the beginning of the process rather than the end of it.

Dr Cook—Yes, but one of the difficulties is that it is not necessarily level because when the wind does not blow you do not have wind power, when the sun does not shine you do not have solar power and so on. We have to have that underpinning baseload power. That is the starting point. So you are not actually competing—you should not be considering that you have baseload power competing with solar, say, because they are not really. It is a sort of an add-on, if you like. It is part of the total contribution that is made, but we have to have that underpinning baseload power. That is why you were saying about South Australia that they are going to go solar. One way you can go solar is if you have an underpinning of other power—in other words, baseload power—to back that up. I have seen that in Denmark and so on, where they are able to have 20 per cent wind because they are able to draw on coal-fired electricity from Germany, Poland and various other places like that. We have to bear that in mind, I think, in terms of how we set up our electricity markets and how we set up our response to carbon dioxide.

Mr JENKINS—I apologise that I have been in and out. Earlier on, Dr Cook, you put carbon capture and sequestration technologies in the context that they are only one part of the suite of things that we would have to do. I think we have reached an interesting stage with energy that is derived from coal in Australia. Certainly there has been a helpful sort of debate over the weekend that indicates to degrees that we will see a continuation and what we should be looking at are the technologies that are best placed to reduce the effects of carbon release or to reduce the carbon released.

What I am interested in is whether, in pursuing energy efficiency renewabilities and at the same time looking at geosequestration or whatever, whether there is any advantage in all these things going on at the same time in making them not only economically viable but viable in other ways? We talk about the environment a lot in these things, but we do not talk about the community thing, which is part of this debate about the continuation of coal. We are seeing all these things going forward at the same time and building on each other. Should we be looking at there being some symbiotic relationship between everything, or are they just singular elements?

Dr Cook—You can find limited symbiotic relationships between these things. I know that CSIRO has been working on one system of trying to combine solar with some aspects of CCS,

and it is good to try and do that sort of thing. The crossovers are probably fairly limited for the most part. We have been wondering about whether we can do some things using algae, CO₂ capture and so on as well. You certainly look for these opportunities. But for the most part they appear to be niche opportunities. To come back to your question—should these things be pursued in parallel?—they are never going to be precisely in parallel but you certainly should be pursuing them, because at the moment you cannot be sure that solar, wind or anything else has reached its full potential. So, yes, we need to pursue all those.

We do not know quite what that mixture will look like in 10, 20, 30 or 40 years time. The only thing I would reiterate is that if we are still using lots of coal in 30 or 40 years time then there ain't any option other than CCS at the present time that we can see. Will that be replaced by, say, nuclear? Maybe, but that is a political issue, that is an issue for various countries and so on. I would not pretend to say how that debate is finally going to come out. But there seems to be general understanding that we will continue to use coal. Why will we continue to use coal? Probably because in 50 or 100 years time it will be the only hydrocarbon that we have—the only form of carbon that we have. We probably will have used all our oil and just about all our gas by then. We know that we will still have coal. I find it hard to believe that we are just going to leave it in the ground, quite frankly. I think we are going to continue to use it. For that reason, I think we are going to continue to need CCS.

Mr JENKINS—If somebody were to argue to you that CCS was just an end of pipe solution—I think you have half given me the answer in that last statement—what would you say? People say that it is wasted effort and that we should be doing it at the front end.

Dr Cook—People do use the term 'end of pipe solution' in a fairly trite sort of way, so I will give a trite response and say we are actually putting CO₂ back where it came from.

Dr WASHER—Just as a suggestion, I can foresee a time—I think the questions are asked there—where on a global trading mechanism we will sort this out. Basically I think the products that will be put in our marketplace will be mandatorily labelled in terms of the carbon signature that had to come to produce them. That will also be in terms of the technologies we have. Beattie obviously is entertaining this coal-fired new power station because he needs to demonstrate that we can have clean coal technology because of the \$24 billion a year profit that we will be making out of coal export out of Queensland. So that is motivated by money and profitability.

In return, say, for China, India, the US, South Korea, Japan or whichever country—we will pick on the whole lot—as one of our trading partners, I think it will be mandated that most countries will have a carbon signature level that you have to have to make that product. If it is not acceptable it will not get into the country—if it is that bad. Otherwise, a consumer will decide whether they want to poison the atmosphere for their grandkids and buy the damned stuff. But it will be labelled, and clearly labelled. I think the market will decide. I think that is the only hope that we can do this on a global level.

Dr Cook—Yes, I do not have any problems with that sort of approach. I think it would be fine.

Dr WASHER—I am talking out loud, really, to get a response like, 'Well, that's blarney,' or something.

Dr Cook—I think that is reasonable. Indeed, I think it is limited to how far you can push it. People can buy green electricity now. The fact is that not that many people do buy green electricity when they have the opportunity. People still look at the dollar and say, ‘Do I want this one that is clean or am I prepared to save an extra \$50 and buy this slightly dirty one?’ All too often maybe they actually buy the dirty one. So I think there has to be an element of, if not compulsion, active persuasion to make people go for these things. I think you have to take some of the choice out of it.

Dr WASHER—Yes. I would go as far as to say we already do this in food. If food is not up to standard, we do not let it in the country. If the atmosphere is not going to be up to standard, we are not going to let a product that contaminates that into the country.

Dr Cook—Yes. What we have to make sure of is that, if this sort of situation arises and the WTO or whoever starts applying sanctions, we are not going to be adversely affected by those sanctions because they say, ‘You’re putting out something that has needed a lot more CO₂ to produce it than this country.’ Certainly I think that is one of the defensive mechanisms that we have available to us so that we can start to deploy CCS. We do have real advantages with CCS, and it is important to potentially use those advantages. One is that that we have good technology people. The second is that we have a lot of storage opportunities in Australia. The third is that the disposition of our infrastructure for electricity also lends itself to the application of CCS. I think we have a number of distinct advantages which we can play.

Mr QUICK—Do you see the stage where China says, ‘You’ve got all that capacity; we’re going to ship it down and we’ll pay the Victorian government to store it’?

CHAIR—It is a long pipe, mate.

Mr QUICK—But we ship stuff backwards and forwards.

Dr Cook—You can actually ship CO₂. There is one ship that I know of in Europe that actually runs CO₂ around. It is not that difficult to do. You ship it in there just as you do with LNG. It has a different specific gravity, but that is all. You could potentially do it. Do we have areas where you could do it? Yes. There are enormous areas off Western Australia where you could certainly do it. Will we do it? God knows. There would be all sorts of political issues to address. But philosophically I do not have a problem with that. It is a global approach to a global problem. If we can be part of that solution and gain benefit from doing that, perhaps financial benefit, then I do not see any problem with doing that.

CHAIR—Thank you very much, Dr Cook. Ian and Dennis, thank you very much, particularly for your silence in the course of this! Thank you for being here. That was very illuminating. I am not quite sure where we are going to end up, but we are getting somewhere. That was very helpful.

Dr Cook—Can I leave you with some documents? One is the set of papers that covers the numerous issues that I have dealt with. The diagrams have just arrived that I would have used had I had the opportunity, but I will leave you with them anyway.

CHAIR—Your verbal explanation was worth a million photos.

Resolved (on motion by **Mr Jenkins**):

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

Committee adjourned at 5.58 pm