



COMMONWEALTH OF AUSTRALIA

# Official Committee Hansard

## SENATE

SELECT COMMITTEE ON FUEL AND ENERGY

**Reference: Issues relating to the Fuel and Energy Industry**

FRIDAY, 25 SEPTEMBER 2009

MELBOURNE

BY AUTHORITY OF THE SENATE



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**SENATE SELECT COMMITTEE ON  
FUEL AND ENERGY**

**Friday, 25 September 2009**

**Members:** Senator Cormann (*Chair*), Senator Hutchins (*Deputy Chair*), Senators Bushby, Fifield, Joyce and McEwen

**Senators in attendance:** Senators Bushby, Cormann and Hutchins

**Participating members:** Senators Abetz, Adams, Arbib, Barnett, Bernardi, Bilyk, Birmingham, Mark Bishop, Boswell, Boyce, Brandis, Carol Brown, Cameron, Cash, Colbeck, Jacinta Collins, Coonan, Crossin, Eggleston, Ellison, Farrell, Feeney, Ferguson, Fifield, Fisher, Forshaw, Furner, Heffernan, Humphries, Hurley, Johnston, Kroger, Lundy, Ian Macdonald, McGauran, McLucas, Marshall, Mason, Milne, Minchin, Moore, Nash, O'Brien, Parry, Payne, Polley, Pratt, Ronaldson, Ryan, Scullion, Stephens, Sterle, Troeth, Trood, Williams, Wortley and Xenophon

**Terms of reference for the inquiry:**

- a. To inquire into and report on: the impact of higher fuel and energy prices on:
  - i. families,
  - ii. small business,
  - iii. rural and regional Australia,
  - iv. grocery prices, and
  - v. key industries, including but not limited to tourism and transport;
- b. the role and activities of the Petrol Commissioner, including whether the Petrol Commissioner reduces the price of petroleum;
- c. the operation of the domestic energy markets, and petroleum, diesel and gas markets, including the fostering of maximum competition and provision of consumer information;
- d. the impact of an emissions trading scheme on the fuel and energy industry, including but not limited to:
  - i. prices,
  - ii. employment in the fuel and energy industries, and any related adverse impacts on regional centres reliant on these industries,
  - iii. domestic energy supply, and
  - iv. future investment in fuel and energy infrastructure;
- e. the existing set of federal and state government regulatory powers as they relate to fuel and energy products;
- f. taxation arrangements on fuel and energy products including:
  - i. Commonwealth excise,
  - ii. the goods and services tax, and
  - iii. new state and federal taxes;
- g. the role of alternative sources of energy to coal and alternative fuels to petroleum and diesel, including but not limited to: LPG, LNG, CNG, gas to liquids, coal to liquids, electricity and bio-fuels such as, but not limited to, ethanol;
- h. domestic energy supply and the domestic oil/gas exploration and refinement industry, with particular reference to:
  - i. the impact of Commonwealth, state and local government regulations on these industries,
  - ii. increasing domestic oil/gas exploration and refinement activities, with a view to reducing Australia's reliance on imported oil,
  - iii. other tax incentives, and
  - iv. securing Australia's future domestic energy supply;
- i. the impact of higher petroleum, diesel and gas prices on public transport systems, including the adequacy of public transport infrastructure and record of public transport investment by state governments; and
- j. any related matters.

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**Committee met at 9.10 am**

**CHAIR (Senator Cormann)**—I declare this public hearing of the Senate Select Committee on Fuel and Energy open. The Senate has referred to the committee models associated with fuel and energy, including the price of fuel, regulation and taxation arrangements and alternative fuels. The committee is due to provide its final report to the Senate on 30 March 2010. Today the committee is focusing on energy and fuel security and, in particular, to the terms of reference relating to the existing set of federal and state government regulatory powers as they relate to fuel and energy products, taxation arrangements on fuel and energy products, the role of alternative sources of energy to coal and alternative fuels to petroleum and diesel, domestic energy supply and the domestic oil and gas exploration and refinement industry.

This is a public hearing and a *Hansard* transcript of the proceedings is being made. Before the committee starts taking evidence, I remind all witnesses that in giving evidence to the committee they are protected by parliamentary privilege. It is unlawful for anyone to threaten or disadvantage a witness on account of evidence given to a committee, and such action may be treated by the Senate as a contempt. It is also a contempt to give false or misleading evidence to a committee.

The committee prefers all evidence to be given in public, but under the Senate's resolutions witnesses have the right to request to be heard in private session. It is important that witnesses give the committee notice if they intend to ask to give evidence in camera. If a witness objects to answering a question, the witness should state the ground upon which the objection is taken and the committee will determine whether it will insist on an answer, having regard to the ground which is claimed. If the committee determines to insist on an answer, a witness may request that the answer be given in camera. Such a request may, of course, also be made at any other time. Finally, on behalf of the committee I would like to thank all those who have made submissions and sent representatives here today for their cooperation in this inquiry.

[9.13 am]

**GROVES, Ms Michelle, Chief Executive Officer, Australian Energy Regulator**

**LEUNER, Mr Thomas Harry, General Manager, Markets Branch, Australian Energy Regulator**

**PATTAS, Mr Chris Paul, General Manager, Network Regulation South Branch, Australian Energy Regulator**

**CHAIR**—I welcome witnesses from the Australian Energy Regulator. I remind senators that the Senate has resolved that an officer of a department of the Commonwealth or of a state shall not be asked to give opinions on matters of policy and shall be given reasonable opportunity to refer questions asked of the officer to superior officers or to a minister. This resolution prohibits only questions asking for opinions on matters of policy and does not preclude questions asking for explanations of policies or factual questions about when and how policies were adopted.

Officers of the department are also reminded that any claim that it would be contrary to the public interest to answer a question must be made by a minister and should be accompanied by a statement setting out the basis for the claim. I particularly draw the attention of officers to an order of the Senate of 13 May 2009 specifying the process by which a claim of public interest immunity should be raised. I invite you to make a brief opening statement, and then the committee will ask you some questions.

**Ms Groves**—It had not been my intention to make an opening statement, so we are happy just to take questions directly.

**CHAIR**—Maybe I can ask you then, by way of a quasi opening statement, to give us a bit of an outline of the major issues for Australia in terms of energy and fuel security as you see them.

**Ms Groves**—Perhaps I will start by taking a step back, if I may, and explaining the role of the Australian Energy Regulator. We were established in 2005 as part of the energy reform program agreed by COAG that was leading towards a more national framework for energy markets and energy regulation in Australia. So we were established with the initial role of being the economic regulator for the electricity transmission system with the intention that further roles be transferred to us over time, which has now happened. We currently have responsibility for the economic regulation of gas transmission and gas distribution networks in all jurisdictions other than Western Australia, and we are responsible also for the economic regulation of electricity transmission networks and electricity distribution networks in all jurisdictions other than Western Australia and the Northern Territory.

As well as our role in economic regulation of network businesses, we also have a role in monitoring the compliance with rules and the enforcement of rules for all market participants in both the gas and electricity markets in Australia. That, once again, at this stage excludes the Northern Territory and Western Australia in respect of electricity, but it does include the Northern Territory in respect of gas. Western Australia, as you are probably aware, operates a

similar regulatory framework for gas but has a separate regulator, which is the ERA—the Economic Regulation Authority of Western Australia. They have a different type of economic regulation for their electricity networks, but the ERA is also the regulator of those networks.

Since 2005, through a process of amendments to the national gas law and the national electricity law and the rules under those pieces of legislation, functions have gradually transferred to the AER, initially from the ACCC and also from state and territory jurisdictional regulators. As part of the reform to the market institutions that occurred in 2005, a further organisation was established, the Australian Energy Market Commission. The AEMC is responsible for changing the rules and for conducting reviews at the request of the Ministerial Council on Energy in regard to both the gas and electricity markets in Australia. They are essentially the rule-changing body and a body that is more responsible for policy development or at least policy recommendations.

The third market institution in the Australian energy market is the organisation currently known as the Australian Energy Market Operator, AEMO, which commenced on 1 July this year. Previously the organisation was known as NEMMCO. In its new, expanded role it is responsible for the operations of the wholesale gas and electricity markets in the national electricity market and it has roles with respect to the various wholesale gas markets in all jurisdictions.

That is the environment in which we operate. I think it would be clear that we are very much the economic regulator and the enforcement body. We have what would be seen as a fairly limited role in policy or policy development, though we do at times input into policy development processes when we are asked to provide our views on how things need to be operationalised, for example, in the regulatory framework.

**Senator HUTCHINS**—Your input into policy would be pretty much reflected in your *State of the energy market* report?

**Ms Groves**—We hope for the *State of the energy market* report to be a fairly factual assessment of available data over the previous year in the energy market. It relies totally on publicly available data. The service we are trying to add there is to compile that all into one place for people and to provide some links through it—a bit of a story around what all that data is telling us about what has happened.

**CHAIR**—Hence my opening question. You are in an ideal situation where you have a snapshot of the nation other than Western Australia and the Northern Territory. If I can go back, what are some of the major issues that you observe, having that unique snapshot in terms of energy security for Australia?

**Ms Groves**—I suppose the issues that we are most concerned with would be around areas of network regulation and investment in those areas. In the time that we have been responsible for these areas, we have seen significant increases in the level of service that businesses need to deliver to go forward. I will get Mr Pattas to talk a bit about that if the committee is more interested in the sorts of numbers that we are talking there. We are seeing significant needs for investment in infrastructure. Our recent experience with respect to the New South Wales and ACT distribution assets and the current experience we have in examining the Queensland and South Australian electricity distribution assets have informed us that many of the assets are of an

age that they need to be replaced, and we are seeing that as one of the significant drivers for increased expenditure—initially from the requests from the businesses and then for the amounts that are allowed by ourselves as the regulator.

**Senator HUTCHINS**—You said these major assets are at an age where they need to have additional investment. Do you see evidence that there is this investment occurring?

**Ms Groves**—We certainly do. In respect of the New South Wales businesses, we have only recently finished their determination. They have just moved into their new regulatory cycle, so it is still very early in that cycle. Consistently over the past few years, much of the data that we have had has shown that the businesses are expending significant amounts of capital in developing or replacing or augmenting their networks. We certainly see that also with regard to the transmission networks.

**CHAIR**—If I can take another step back again, because I am quite keen at the beginning to get an overall strategic snapshot for how we can best use your evidence. You talk about economic regulations and presumably you look at things like demand, supply, price and investment. Is that right?

**Ms Groves**—Demand forecasting is an important component of the work that we do.

**CHAIR**—Just to put into perspective why we as a committee are so interested in your evidence, obviously we want to look at what the demand curve for Australia is going to be moving forward, what some of the supply pressures are going to be—investment obviously is part of that—and what you observe in that context. We have had evidence in recent weeks about some of the pressures around investment as a result of a range of things. Obviously the CPRS is a factor. We heard that as late as yesterday, when we were in La Trobe Valley talking to a particular coal fired power station operator there. I want to get a bit of a snapshot from you, as the economic regulator, of how you see demand trends, supply trends and investment—in your high-level assessment—tracking at the moment.

**Ms Groves**—In respect of the demand trends, the most notable feature is the separation, I suppose, from the increase in peak demand from the average increased demand. That is probably one of the most significant aspects that we need to deal with. In some areas, particularly over the past couple of years and into the next few years, average demand is not increasing at a particularly high rate but we see peak demand continuing to go up, so the gap between the peak demand growth and the average demand growth is getting wider. I guess that would be, in a general way, one of the more significant things about demand.

**Mr Pattas**—If I can add a couple of aspects on that. In the recent New South Wales decisions that the AER made, we saw increases of \$14 billion in investment in the New South Wales distribution networks, which is around an 80 per cent increase from the previous period. We saw a lot of that increase being driven, as Ms Groves has mentioned, by expanding peak demand, where effectively networks are being expanded to operate at relatively few times during the year. So effectively you are expanding the network to deal with peak demand that happens when it is over 35 or 40 degrees, which of course is only several times per year. That of course means that the average utilisation of those networks is lower because a lot of capacity is only used a few times per year.

**CHAIR**—That is the domestic and residential part of it.

**Mr Pattas**—That is domestic and residential, and business and industry.

**Ms Groves**—Peak demand is mostly driven by air conditioning, as you would be aware, so any of those areas that significantly require air conditioning will feed into those peak demand numbers.

**CHAIR**—Is that the only thing that feeds into it? Air conditioning, presumably, would not be a recent phenomenon. That is not something that just happened over the last two years.

**Ms Groves**—I agree that it is certainly is not a recent phenomenon, but the availability and affordability of air conditioning have increased, such that many people who would never have purchased air conditioners before now find themselves able to. In our conversations with our businesses, it is certainly the major input for them in terms of their peak demand, particularly at the distribution networks. Those then feed through to the transmission networks as well.

**CHAIR**—When you say that you see an increasing gap between average demand and peak demand, the single biggest driver of that is air conditioning; is that what you are saying?

**Ms Groves**—It is.

**CHAIR**—What would be the second and third biggest drivers?

**Ms Groves**—It is air-conditioning and it is not just in summer, I guess. Because of the nature of the air-conditioning systems that people by, which are the split cycle systems, they are increasingly being used for heating as well. We are seeing quite high peaks at times during winter which in some jurisdictions have not been there before. The peak demand is really driven by air-conditioning.

**Senator CORMANN**—I am really intrigued by this. Moving forward, energy is obviously critically important to ensure our economic growth. As population increases and as economic activity increases, to ensure that the supply of energy keeps track with the required demand is a key challenge. But you think that the main challenge is air-conditioning moving forward?

**Ms Groves**—No. I was just talking about one of the major drivers of demand, for example. From our perspective, that is particularly important when you are looking at the amount of investment that you need to make in infrastructure. What we do is build the networks to be able to meet the peak demand times. When you see such significant increases in peak demand, that is clearly a very big issues. As Mr Pattas said, what we find is that it lowers the average utilisation of the networks overall but people are paying for those networks to be there all of the time when they need them for only relatively short periods of time. That is just an issue about what people are paying for. As the peak demand outstrips the average demand, that issue becomes more pronounced.

**Senator CORMANN**—In your status of the energy market report published in November 2008, you made the point that generation investment has been slow to respond to rising demand, high prices and the need to replace ageing plant. What has been happening since then?

Obviously, you are painting a picture of moderate concern. Do you feel that anything has been happening since then in terms of policy settings to adjust the direction that we are moving in? Have things got worse or better since then in terms of your long-term forecast?

**Ms Groves**—I will ask Mr Leuner to comment in more detail, but in general I guess that our concern then was that what we had seen was a degree of uncertainty in the market in terms of generation construction. We thought that one of the major drivers of that uncertainty was the uncertainty around climate change policy. It was difficult for generators to make investment decisions in an environment when they were not certain. We think that as greater certainty comes in around what the climate change policies will be the market will respond appropriately. We think that we have begun to see some improvements in investment. I will ask Mr Leuner to—

**Senator CORMANN**—Have you? Have you seen improvements in investment?

**Mr Leuner**—Particularly in New South Wales and Queensland, and I think in the next two years in Victoria, there will be quite a bit more generation investment. That latest—

**Senator CORMANN**—In what sort of generation?

**Mr Leuner**—There is strong movement towards more gas fired generation at the moment, which helps to deal with the peakiness quite well, because gas fired generation can react quite quickly. Obviously, it is not as suitable for base load generation, because it generally has higher costs than coal. The latest AEMO statement of opportunities says that the demand/supply balance is looking better than it was previously based on our committed generation. There were some type of demand/supply balance situations forecast for Victoria and South Australia, particularly last year, by AEMO in their statement of opportunities, which is known as the SOO. But this year they are saying that the situation is going to be better in terms of the demand/supply balance looking forward into the next three or four years.

**Senator CORMANN**—We were told this week by a power supplier that they were holding back supply—this was in the national electricity market on the eastern seaboard—because of the low prices available in the spot market at particular points in time. Is that something that you observe? Presumably, they would be holding back so that they have got enough for your peak demand to maximise—

**Mr Leuner**—If they are holding back supply because prices are low, then that is naturally the way that the market should operate. If there is a shortage of generation capacity, the price will go up and I am sure that they will turn on. That is the market working quite effectively if they are holding back supply because prices are low. When the balance gets tighter, the price will rise, and I am sure that they will switch on.

**Senator CORMANN**—You mentioned earlier greater certainty once we know what the climate change policy settings are. Where that is tracking means that essentially no-one is investing in coal fired power generation anymore these days. That is the feedback we are getting. Existing plants are finding it difficult to refinance to invest in maintenance. Moving forward, obviously there is going to be a shift away from coal. Do you think that we have the answers in place to ensure energy security based on the demand curve that you see moving forward?

**Ms Groves**—I can probably answer part of your question. Some of what you are asking is outside our area of expertise. We think that the framework in which the national electricity market works is a very robust framework that will allow for the changes that need to occur for the market to respond appropriately once the market has the information that it needs. To that extent, we consider that the framework that we have in that national electricity market in Australia is extremely strong and flexible enough to deal with the challenges before it. That is not to say that there will not need to be changes made to the framework. The Australian Energy Market Commission is due to put out a report next week. It has just conducted a 12-month review on what changes to the national electricity market rules framework and more might need to be made to accommodate climate change policies. This is their area. They will be making recommendations to the MCE in a report next year. Out of their second interim report, we would support the positions that they took. Essentially, the framework will deal with the challenges before us, but along the way there might need to be some specific changes made to some rules—you would expect that. But our market is built to allow that to happen.

**Senator CORMANN**—In terms of your economic regulation responsibilities over the electricity transmission and distribution networks, does that include assessment of risk? Do you assess risk in that sort of context?

**Mr Pattas**—The question of the business risks and financial risks are questions for the networks themselves.

**Senator CORMANN**—Understood.

**Mr Pattas**—They are taken into account in the rate of return that the regulator sets for those businesses.

**Senator CORMANN**—I am looking more broadly. You control the economic regulation of electricity transmission and distribution. Do you look at the risk of a reducing energy mix? For example, if there is a reduction in our capacity to rely on coal and it becomes more—

**Ms Groves**—No.

**Senator CORMANN**—That is not within your scope?

**Ms Groves**—No. That is not within our area. To the extent that it is within anyone's area, while we would all clearly be concerned about that, the Australian Energy Market Operator is responsible for the operation of the wholesale electricity market. They do a lot of work, as you are probably aware, in anticipating what demand is going to be in the forward periods and estimating what supply we have available and we will have available going forward. They work to ensure that we will have adequate supply to match demand. They have a range of mechanisms at their fingertips to be able to deal with issues when they might have concerns about supply matching demand. The rule framework sets out a range of tools that give them powers to engage in processes to try and ensure that generators will be available. As a last resort, they can require existing generators to be available.

**Senator CORMANN**—You have now been operating for four years?

**Ms Groves**—Just over, yes.

**Senator CORMANN**—With your experience during those four years, have you got any suggestions in terms of how the regulatory framework for which you are responsible can be improved?

**Ms Groves**—Probably not at this stage. The regulatory framework is still relatively new. It was the subject of exhaustive review recently and it continues to be so, component by component. For example, when we commenced and the AEMC commenced, they immediately started the review of how transmission networks in electricity should be regulated. Out of that came the existing framework for economic regulation of transmission networks. Soon after that, how distribution networks should be regulated was reviewed and the framework was settled, and that only came into place at the beginning of last year. And we have just completed the new framework for the regulation of gas transmission and distribution. It has only been in place for just over 12 months. So the frameworks have all recently been reviewed through fairly robust, rigorous processes conducted either by the AEMC or through the Ministerial Council on Energy, who established the frameworks in the first instance. The processes were very public, with lots of submissions from interested stakeholders, with drafts being put out for comment et cetera.

**CHAIR**—The committee received some evidence from stakeholders that the energy regimes for the energy supply industry are intrusive and heavy handed and that this leads to additional costs being passed through to consumers. Do you have any comment on that?

**Ms Groves**—I suppose I would not disagree that these regimes are complex. We are in essence dealing with the regulation of natural monopoly infrastructure where there is evidence of a particular market failure that needs to be regulated. These are complex businesses and the amounts of investment that they are seeking to make are very significant. As Mr Pattas outlined, New South Wales distributors, for the next five years, requested \$14 billion in capital expenditure—that was just for those three New South Wales distribution businesses. So these are not insignificant questions. There are a lot of interested stakeholders and the framework requires the regulator to fairly closely examine the claims by the businesses of what they need and why they need it. We do test those claims. That means the businesses do need to supply quite a lot of information to us.

Our argument would be that much of this information is information the businesses would have available in their normal course of operation; it is information that you would need to know as a prudent operator. We constantly examine the balance between the costs and the benefits of requiring this information and we give businesses a large amount of notice and certainty by putting out guidelines about what we will be asking for. We also tailor that to specific businesses when they respond to us and say, for example, ‘This part isn’t relevant to us for these reasons.’ So we are aware it is a complex regime, but that is by necessity. A lot of information is required for the regulator to be satisfied that the businesses, in receiving these large amounts of money, are running as prudent and efficient operators.

**CHAIR**—Some witnesses have also argued that there is scope to streamline state and territory regulation, which goes back to the question: could the regulatory framework still be improved? Do you have any comment on that?

**Ms Groves**—We are the product of a streamlining of some of the state and territory regulation to date. That process is ongoing. The ministerial council is still overseeing the completion of the national retail framework and what are called the non-economic aspects of distribution regulation. Those reforms and amendments are ongoing and are scheduled to come into place next year. So there certainly is some still way to go. Until that process is finished it will be difficult to see whether or not there are other areas that still need to be the subject of examination at a more national level.

**Senator HUTCHINS**—As you are aware, this part of our inquiry is dealing with Australia's energy and fuel security and whether we essentially have it if we get into a bit of difficulty. The *National energy security assessment 2009* found that Australia's level of energy security had decreased. I wonder if you agree with this assessment.

**Ms Groves**—I do not think we would be in a position to comment on it. We have no particular expertise in energy security. To the extent that we do provide commentary in our *State of the energy market* report, for example, it is for the sake of completeness. I do not think we have any expertise that could be brought to bear on that that would be helpful for the committee.

**Senator HUTCHINS**—So your job is to regulate not to pontificate, so to speak.

**Ms Groves**—That certainly is our job.

**Senator HUTCHINS**—I wonder if you could tell the committee whether this is a correct interpretation of your role. We have been advised that the New South Wales government went on what was called a 'roadshow' to see if there were international investors interested in purchasing their power stations. First of all, under this regime do they need the AER's permission to look for international or domestic investors?

**Ms Groves**—No, there are no restrictions on those within the energy regime. It would be whatever are the normal foreign investment restrictions generally across the economy.

**Senator HUTCHINS**—So am I correct in saying that the New South Wales government has done this roadshow? Is that your understanding?

**Ms Groves**—We have seen that and we have spoken to the New South Wales government such that they have told us they are doing that, yes.

**Senator HUTCHINS**—In terms of regulation, you might be able to explain to me what we mean when we are talking about average and peak demand. You have said that the difficulty in the future is going to be attracting people to invest for an average when the real demand is for a peak. In terms of pricing, do you deal with the price of energy at all?

**Ms Groves**—No, not the price of energy.

**Mr Pattas**—We deal directly with the network charges—the costs of the networks and the charges. In a consumer's bill of course the charges are made up of the network charge or the transport charge, the distribution charge and the wholesale charge in the retail component. What we regulate directly is the network component, which is the transmission and distribution.

**Senator HUTCHINS**—So would I be right in making the observation that, to encourage people to provide equipment to meet a peak load where the average load is down here, in terms of pricing—and, for example, I am thinking about people who do not use air-conditioners; I do not have an air-conditioner—people are paying more money to turn their lights on to meet the cost of having the average peak load?

**Ms Groves**—I think the short answer to that would be yes.

**Senator HUTCHINS**—And is that more likely to increase because, as you said, of the increase in peak demand?

**Ms Groves**—It is growing.

**Senator HUTCHINS**—Could you tell us how much it is actually growing?

**Mr Pattas**—Maybe if we can just step back slightly. The investment needs are driven by a number of factors. We have been talking about demand, and peak demand in particular as one particular driver of that investment. The other important driver of that investment is in relation to ageing assets and reliability—and increased reliability standards. So effectively people are paying more because of the need to replace assets which were put in place 40, 50 or 60 years ago and also because of higher reliability standards. People are now making intense use of electricity—they are relying more on electricity; they have a lot of gadgets which rely on more reliable sources of power—and therefore reliability standards are changing or increasing. All of these factors together drive an increased need for investment; and demand, as we mentioned before, is obviously one of those drivers.

**Senator HUTCHINS**—None of us here are Victorians but we saw on television the catastrophe that occurred here last summer. So was there not enough peak supply available?

**Ms Groves**—There was a fairly complex range of factors that led to the outages that people faced, and there was a whole range of reasons for them. Perhaps I was not as clear as I could be. When we are talking about peak demand being different from average demand, by definition it clearly has to be. The peak demand is, for example, just for those days when it is very hot. But what the networks do, in thinking about going forward, is to build their networks in anticipation of that peak demand. So it is not that there is, for example, a difficulty in attracting people in to build particular infrastructure that is needed to meet peak demand. This is part of the normal course of business for our network businesses. And in anticipating what sort of investments they are going to need, for example, for the next five years—which is the period that we are generally looking at; as are they—they take into account both the average demand and the peak of demand when thinking about what sort of assets they need to put in place.

The events in Victoria were caused by a range of factors. There were distribution failures. In fact if senators have seen our *State of the energy market 2007* report then they will have seen that there is an essay in that which talks about reliability and the various causes of unreliability. The most significant of those in terms of you as a customer—the one that you see most often—is distribution network failure; for example, where a car runs into a pole down the street or those sorts of things. Those are localised issues. Far less frequently you might see outages because of a transmission system failure. They occur very rarely, but when they do they can potentially affect

a wider range of people who might be connected to that transmission asset. A third cause of unreliability is if there is insufficient generation to supply the demand at the time. That also occurs very rarely. So it is most often because of a network failure and it is most often at the distribution or localised level.

In Victoria a large amount of the outages that people saw, for several of those days at least, were distribution related issues. There were, however, transmission issues and there were some availability of generation issues as well that all combined because of the extreme weather in Victoria for those few days.

**Senator HUTCHINS**—Can I just ask, and this might sound a bit naive, but ultimately it is it your task to make sure that the investment is there and the structure is there so that if I want to turn a light on then I can? Is that your job?

**Ms Groves**—I would not characterise it in quite that way. I guess there are three market institutions who all have complementary roles in the energy market and complementary responsibilities. The Australian Energy Market Operator is responsible for the safe and reliable operation of the wholesale market, which is more towards ensuring that the generation is there. Our responsibility is to ensure that network businesses have sufficient money to make efficient investments that would be best expected from prudent operators. That is essentially our role. We have another role in terms of the enforcement of the rules generally, and I think that is also an important role for the integrity of the market such that people know that, when they invest in these markets and participate in them, the behaviour of other market participants will be in accordance with the rules.

The AEMC has a responsibility for ensuring that, as our market changes and develops and we face changing circumstances, the rules adapt to do that. They are the rules that we apply, for example, so they also have a role in doing that. We do not require or oblige network operators to build anything. There are mostly state government regulatory frameworks around reliability standards, for example, which set out the levels of service and reliability that they expect from these businesses in their licences. The businesses then come to us and say: 'This is the service we are required to provide. This is the level of reliability we are required to provide and this is the capital expenditure and the operating expenditure we are going to need for the next five years to do it.' That is when we examine those claims and at the end of a fairly public process we will make a determination that sets out the allowable revenues of those businesses that will translate into the prices. Then they go away, build and operate their networks.

**Senator HUTCHINS**—In the first statement you made which was about investment, you said that one of your tasks is to make sure that the investment is there for the next five years.

**Mr Pattas**—The efficiency incentives are there for it.

**Senator HUTCHINS**—Do you have any comment to make to the committee about that in light of climate change debate at the moment?

**Ms Groves**—In terms of network businesses?

**Senator HUTCHINS**—As the chair said, we have come across a number of operators of coal fired power stations who are telling us that they are not investing.

**Ms Groves**—That is in respect of the wholesale market as distinct from the network businesses. We will make some comments in regards to the network businesses specifically and then we will—

**Senator HUTCHINS**—You may well wish to take some of these on notice and come back to us.

**Ms Groves**—I am happy to do that. Certainly, we are finding businesses are talking to us a lot about some of the challenges of climate change in terms of the network businesses and they will need to make changes to deal with it. In the transmission network, and maybe Mr Leuner would like to add to this, we are probably going to see a significant change in the pattern of generation. Going forward, we are going to have different types of generation in different places from where it currently exists. The transmission network is going to have to be built to service that generation and the needs of customers around that. So there will be challenges for the network businesses through that. That is one of the big issues currently being examined by the Australian Energy Market Commission about whether or not we have the right rules framework in place and whether we need any additional regulatory tools to deal with some of those issues.

Some of the issues that we are grappling with now that the distribution networks are raising with us are the introduction of things like smart meters, moving to smart grid technology and what the requirements of that might be such that these businesses can operate their networks smarter and perhaps alleviate some of the problems that we have traditionally faced with very peaky demand. They will certainly be challenges for those businesses and for the regulatory framework going forward in terms of how to deal with those.

**Senator BUSHBY**—I was going to ask a question along the lines Senator Hutchins just finished with. In terms of the transmission companies, to quote Mr Pattas, basically having assessed their investment needs, their operating cost needs, you then set a maximum amount that they are allowed to earn. That is how it works and it is basically up to them to go off and spend that money that they earn within that cap. You presumably then oversee that in terms of their next round of discussions.

**Mr Pattas**—We take into account the performance and what has transpired in the previous period in making decisions about the next period.

**Senator BUSHBY**—In terms of the CPRS and its impact, and climate change action generally, presumably that is going to have a big impact on the transmission companies' need to invest and where they invest, particularly if renewables like wind continue to be used—and under the RET legislation we are going to favour wind at this stage. That is going to have a big impact on transmission needs, which will presumably lead to a lot of activity in your office in terms of need for increased revenues to be able to afford to put that infrastructure in.

**Ms Groves**—We certainly would anticipate that, as they have to build out the network to areas where it has not been before, they will be contemplating what they need to do that and will be making those cases as part of their regulatory determinations.

**Senator BUSHBY**—Yes, so they will be making a case for higher revenues, which ultimately means higher prices to their customers.

**Mr Pattas**—That is the general situation. What would happen, effectively, is that there are two components to that investment. One component is in relation to connections—that is, connecting the transmission system to these remote generator points such as wind farms. That connection asset is paid for directly by the generators, and it does not enter into what we call the regulatory asset base to be recovered by all customers. That component is paid directly and then, to the extent that there is augmentation of the system further down, closer to the main network, that is a shared cost which is recovered in the way you have just described.

**Senator BUSHBY**—So the augmentation would be necessary because of a higher power load going through—more electricity being passed through—rather than because of the additional cost of connecting a wind farm that is in a remote area.

**Ms Groves**—There may also be geographic expansion. There are tests that the transmission businesses do to determine whether or not assets that they are going to build should be part of the shared network—that is, part of the RAB. If the investment meets the regulatory test then it moves into the shared asset, so there is likely to be both geographic expansion and augmentation of the existing network to cope with increased flows.

**Senator BUSHBY**—Moving around a little bit, but still related to the climate change action, we have had it put to the committee that, in particular, the CPRS will lead to closures of coal-fired power stations, which is to some extent what it is intended to do—it is intended to drive alternative lower emission technology—and that this is likely to happen, particularly in Victoria, before new generational capacity has been built to replace the coal-fired power stations in Victoria, which will lead to a much greater need for power to be bought in, particularly from New South Wales, basically on the National Electricity Grid. I was just wondering what your thoughts are. If in four or five years time the major coal-fired power stations in Victoria start closing and there is not new baseload generational capacity online in Victoria—it is hard to see how it could happen in that time line—are the transmission networks up to bringing baseload power into Victoria?

**Ms Groves**—I would not necessarily agree with the first part of your statement, Senator: that we will see the departure of some of the power stations before the availability of new generation comes on board.

**Senator BUSHBY**—That is certainly what we have been told is likely to happen. We have heard lots of different views, but that is something that has been put to us.

**CHAIR**—As there is less investment in maintenance and other things, some things might have to close down.

**Ms Groves**—There certainly will be firms making particular decisions about their own commercial interests, and we cannot comment on those; we do not have expertise in those areas. What we would expect to see, though, is that the wholesale prices will significantly increase. For some of the power stations, it will still be very attractive to be there. I do not know if they will be there with the existing owners, but it will still be attractive for somebody to operate those

assets for a period of time because the prices will be quite significant if the new generation has not come in quickly. As new generation comes in, of course, those prices will go back to other levels and you might find then that it is less attractive for some of those power stations.

**Senator BUSHBY**—It has to compete with the carbon cost as well, and at that point it would be less able to compete with the carbon cost built into the prices.

**Ms Groves**—Yes.

**Senator BUSHBY**—We have had different views, but if there was a significant increase in the need to import electricity into Victoria as a result of the transition, is the transmission network able to handle that?

**Ms Groves**—Once again, we are not experts in this area and this would be a question that probably would be more appropriately directed to AEMO because they are the operator of the system. I would be happy to seek their advice and provide that to the committee, if that would be helpful, if you are not speaking directly to them.

**Senator BUSHBY**—I guess there are a lot of ifs there. It was put to us once again that the electricity connection between Victoria and New South Wales is less than the smallest of the large coal-fired generators and that, if one of those went offline, the grid could not actually replace that in full from Victoria. I do not know whether that is a fact or not but that is what was put to us. Is this going to lead to a need for further investment in the transmission networks, which will then lead to them coming to you and asking for more? How will you raise more money?

**Ms Groves**—It may well do, and I guess from our perspective we would say that if the circumstances were such that we saw a change in the generation flows such that we needed different network investment, the framework is there to ensure that that can happen, so the businesses would determine what they needed to do to develop that capacity. One of the new roles of the Australian Energy Market Operator is the development of a national transmission plan. For the first time we will have a national transmission plan that will be updated on an annual basis and will look out for the next 20 years. These sorts of issues will be canvassed, I guess, and there will be a lot of information out to the market about what sort of investment is needed. If the businesses then come to us and say, 'We need to make this investment,' then that is what the framework enables them to do.

**Senator BUSHBY**—I have one final question. Last summer in Victoria the weather caused issues with the transmission side of things. Was that primarily because the infrastructure is old and needs replacing? Would modern infrastructure, new infrastructure, be as affected by weather events or is it more because the technology just cannot handle it in your view?

**Ms Groves**—I might have to take that on notice, once again. My understanding of the time is that it was caused by the continuous very extreme weather. If there had been other equipment in place, could that have coped? I do not know.

**Senator BUSHBY**—Would the latest technology, cost-effectively put in these days, cope with that or not?

**Ms Groves**—I could not answer that but we can get back to you on that one, if you like.

**CHAIR**—You mentioned that you expect wholesale prices to increase significantly as we transition into reduced reliance on coal and an increased reliance on other sources. Have you got any forecast in terms of what you expect the increase in wholesale pricing of energy to be, moving forward?

**Ms Groves**—No, we do not. If we saw the beginning of a premature exit of some generators before new generation came in, the way the market would respond to that would be through increased prices and for those of the generators remaining in the market it would become more attractive for them to be there. I was not necessarily making a comment about what will happen with wholesale electricity market prices. They are certainly beyond my expertise.

**CHAIR**—In this scenario where we had reduced power generation from significant coal-fired power stations, then you would say that the market would respond by significantly increasing the wholesale price of energy and that would then make it more attractive for other—

**Ms Groves**—That is the way the market will work. As the prices become higher it becomes more attractive for those who otherwise would be higher-cost generators perhaps, because they have a higher cost of fuel than the traditional ones, to enter the market.

**CHAIR**—Now a parochial question, as a senator from Western Australia, you mentioned in your opening comment that at this stage your regulatory responsibility for transmission and distribution excludes WA.

**Ms Groves**—It does.

**CHAIR**—When you say ‘at this stage’, do you see that changing in the near future?

**Ms Groves**—It was probably just an expression—

**CHAIR**—I just thought that I would clarify whether there was anything at the back of your mind.

**Ms Groves**—No, Western Australia is not physically interconnected with either the national electricity market or the national gas grid. When I say ‘at this stage’ that is obviously an expression I use, but we are not the regulator over there—

**CHAIR**—And you do not expect to be.

**Ms Groves**—and we have no expectation of becoming the regulator.

**CHAIR**—I just thought that I would clarify that. Thank you very much for your contribution to the committee.

[10.17 am]

**ANGWIN, Mr Michael, Executive Director, Australian Uranium Association**

**CHAIR**—Welcome, Mr Angwin. I invite you to make a brief opening statement and then the committee will ask you some questions.

**Mr Angwin**—I thank the committee for inviting us to make a second submission, which we did by way of our letter on 6 July in response to your invitation to speak to you today. On this occasion I want to address the expanded terms of reference, namely, energy security and issues associated with nuclear energy, and two of those terms in particular—the existing set of federal and state regulatory powers as they relate to fuel and energy products, and the role of alternative sources of energy to coal. Of course I am happy to answer any of the questions that you put to me even though they may go beyond those terms of reference.

I will briefly refresh you on your understanding of the Australian uranium industry. Australia is home to the world's largest uranium endowment. We have about 40 per cent of the world's low-cost uranium. We supply about 20 per cent of the world's demand for uranium oxide and we export about 10,000 tonnes per year. To be more precise, ABARE is forecasting export of 9,820 tonnes in 2008-2009 and the value of those exports is expected to be a little over \$900 million. ABARE is also forecasting uranium exports to expand to 14,000 tonnes by 2013-14 with a value of \$1.7 billion. You may recall that when I appeared before you in February I drew your attention to some economic research which we had commissioned last year, which estimated the net present value of Australia's uranium exports to 2030 to be over \$17 billion.

The industry comprises three operating mines with two new mines currently under construction with a view to operation in 2010, and there are excellent prospects of new mines in Western Australia over the next three to four years. Exploration expenditure reached \$220 million in 2008 and that is a 20-fold increase on 2004. While exploration expenditure will be lower in 2009, largely because of the Olympic Dam exploration program being concluded, it will remain at historically high levels and in fact expenditure in 2008-2009 was \$186 million.

The demand for Australia's uranium is being driven by increasing demand for nuclear power overseas. Most scenarios, forecasts and projections for nuclear power demand to 2030 see it rising by between 50 and 100 per cent. That demand, in turn, is being driven by economic and population growth, by the quest for energy security and by climate change. And on that latter point, nuclear power is a very clean source of electricity generation, producing about the same emissions as wind and fewer than solar and, clearly, very many fewer than the fossil fuels.

The research Professor Lenzen undertook for the association illustrates that point. I will go to Professor Lenzen's work briefly. The conclusion we asked the committee to draw from that research, in our letter of 6 July, was that it reinforced the case for expanding Australia's uranium exports to service the growing needs of a technology that is the only low-carbon technology available now to supply baseload electricity at a reasonable price. I will summarise the research in a little bit more detail. The research was a review of the academic literature largely since 2006. It showed five things that I would like to mention. The first thing it showed was that the

electricity-generating technologies currently available to provide electricity to meet baseload needs are either fossil fuel based or nuclear power or in some cases hydro.

The second conclusion that we drew from the research was that nuclear power and electricity from renewables are the most effective technologies for minimising greenhouse gas emissions. Fossil fuel, nuclear, hydro and wind technologies are mature technologies, according to the research. Those still in development include coal with carbon capture and storage, and the solar technologies. The fossil fuel based technologies are the lowest cost technologies per unit of output, followed by nuclear and wind, then hydro and then solar.

The last point that I want to summarise from the research is that in 2007 hydro was the least subsidised technology on the basis of subsidy per unit of output. Next came nuclear and geothermal, then wind, then coal and then biomass. Solar was the most heavily subsidised for the amount of electricity it produced. The research goes on to illustrate that all of the technologies have their pros and cons. They all have a number of issues that they need to address.

I would like to draw attention, as I am sure Professor Lenzen will do, to the limitations of the research as a decision-making tool. We have not put forward the research as making the case for any of the technologies or indeed for nuclear power in Australia, but we say it does make the case for nuclear power and that is the case for expanding Australia's uranium exports.

The second issue I wanted to draw on today, turning back to uranium specifically, is some of the remaining barriers to expanding Australia's uranium exports. In that regard, I want to turn to the committee's term of reference regarding state government regulatory powers as they relate to fuel and energy products. New South Wales and Victoria have both enacted legislation to prohibit uranium exploration and mining through, respectively, the New South Wales Uranium Mining and Nuclear Facilities (Prohibitions) Act 1986 and the Victorian Nuclear Activities (Prohibitions) Act 1983. The two pieces of legislation are similar in intent and content.

The Queensland government also banned uranium mining through publicly announced administrative policy. The association has analysed the Queensland administrative ban with reference to the Council of Australian Governments guide to best practice regulation. We have also analysed the Victorian legislation with reference to the tests for environmental regulation set out by the Victorian Competition and Efficiency Commission in its recent inquiry into Victorian environmental legislation. Those tests appear to draw on the COAG guide to best practice regulation. We have not specifically analysed the New South Wales legislation, but we are very confident that an analysis would draw similar conclusions to those we drew with regard to Queensland and Victoria. I want to hand up to the committee copies of the Queensland analysis and a copy of our submission to the Victorian Competition and Efficiency Commission review of Victoria's environmental legislation.

Best practice regulation, according to COAG, operates on a number of principles, including establishing that there is a problem, making a cost-benefit analysis, clarifying the policy intent, ensuring the regulation remains relevant over time, consulting with stakeholders, and government action being proportional to the issues identified.

I am not proposing to take you through those two pieces of analysis—though I would be happy to take questions on them—but we do consider that the regulation of uranium in the

eastern states fails to meet the test of best practice regulation. In particular, the key tests the bans fail to meet are clarity about the problem the legislation is intended to address; that the stated aims of the legislation, at least in New South Wales and Victoria, have not been reviewed for a generation and much has changed in that time; and that the alternatives to outright bans have not been considered, and there clearly are alternatives, as the cases of legislation in Western Australia, South Australia, the Northern Territory and the Commonwealth illustrate. We ask the committee to recommend at least a review of the legislation in New South Wales and Victoria and of the ban in Queensland by reference to the Council of Australian Governments approach to best practice regulation. That completes my opening statement and I would be delighted to take any questions from you, on the uranium industry generally, on Professor Lenzen's research or on the state of regulation in the eastern states.

**CHAIR**—Thank you very much. I note before we get into questions that this committee in its interim report in May recommended that Australia go down the path of expanding our uranium exports as a way of contributing to the reduction of emissions in the world. You have separated out the need to have a full global portfolio of technologies, including nuclear, from what should apply in Australia. You have said specifically that you do not recommend nuclear for Australia. Why is that?

**Mr Angwin**—It is not that we do not recommend nuclear for Australia. I should make the point that we are the advocates for the uranium mining and exporting industry and we are not the advocates for the nuclear industry. So when I say that we are not putting to you that the Lenzen research makes the case for nuclear power in Australia, it is not that we are not recommending it. Our view would be that it would be highly desirable for Australia to have a debate about nuclear power in Australia. Indeed, we think we are already having that debate. From the point of view of an industry and an association which is not only interested in our own future but also interested in Australia's future, we think a debate about the place of nuclear power in Australia would not go astray. It is something that we should do.

**CHAIR**—If you look at the two main sources of baseload power at this point—coal and gas—coal is clearly in the firing line with the policy settings envisaged by the government at present. Don't you think that Australia ought to have a much closer look at what could be a reliable alternative to gas, ensuring that we have a proper mix of energy sources moving forward?

**Mr Angwin**—I do say that. Whilst Australia, with its vast resources of coal, has a large stake in solving the question of carbon capture and storage, we think it would also be helpful for the debate which is currently taking place about nuclear power in Australia to continue. So we are certainly not against that. We would not rule that out. All I am saying is that we are not the principal advocates for that.

**CHAIR**—I understand that your focus is very much on the uranium mining and marketing side of things. However, I want to run through some of the arguments that come up to get your perspective, and it is a domestic focus. I understand your point about the global side of it. One of the key arguments that is put to us is that nuclear power is too expensive for it to be a viable prospect for Australia. Have you got a response to that?

**Mr Angwin**—I draw attention to a table which we provided in our submission of 6 July based upon Professor Lenzen's research which shows the generating cost in US cents per kilowatt hour of the various technologies. The generating cost is the levelised cost, so it is the cost inside the gate. What that shows is that the generating cost of nuclear power is US3c to US7c per kilowatt hour compared, for example, to large hydro, US4c to US10c; wind, also US3c to US7c; solar PV, US10c to US20c; and concentrating solar, US15c to US25c. I will not go any further than that, but that is all in there. What that demonstrates is that the cost is very competitive. It is true that nuclear power plants are very expensive to build, but the Lenzen research gives you an idea of the competitiveness of nuclear. I add that those costs are costs in the absence of a carbon-pricing mechanism.

**CHAIR**—These costs presumably make an allowance for the capital costs.

**Mr Angwin**—Yes.

**CHAIR**—That is inclusive of the upfront investment.

**Mr Angwin**—That is right. The only thing which is not included in that cost is the cost of waste disposal. That would add about 0.1c or 0.2c per kilowatt hour to the cost of nuclear, quite a small addition. As I say, it is the levelised cost, the inside the gate cost. If you add in the cost of waste disposal it would not do any damage at all to the competitiveness of nuclear, particularly if there were a carbon-pricing mechanism operating.

**CHAIR**—This is a very useful table because it presents the picture well in terms of all of the energy options. Public acceptance is, as we all understand, the key barrier in terms of nuclear energy. Have you got any ideas or suggestions on how the issue of public acceptance could be addressed in an Australian context?

**Mr Angwin**—There are two ways for that to be done. First of all is to make sure the facts are available to those who want them. Our experience in this area is that facts are absolutely essential. As an advocate of the uranium industry I can tell you that you can never afford to be wrong with your facts. So getting the facts right is the first point. The second point is that the nuclear fuel cycle is an economic and technological phenomenon that generates a lot of fear amongst people. There is a good deal of research about risk perception which illustrates that the nuclear fuel cycle is a technology out there on its own. On the basis of that research the conclusion that we have drawn is that people want to be reassured that the technology that they might have to live with in their neighbourhood, state or country is safe and will not cause them or their children harm. In order to respond to those fears you need to bring people into the decision-making process at a variety of levels, to allow people to express their fears and to make genuine and timely responses to the issues that they raise with you. In the uranium exploration and mining industry, that has a practical expression in the way our companies engage with their stakeholders locally in a way which is open, transparent and timely, enabling people to tell us why they worry and responding to those concerns first of all with facts and secondly by the quality of the engagement process. The additional point I would make is that has to be genuine and it has to be honest and open. You cannot spin that, because people will see through it. It has to be what you say it is.

**CHAIR**—If the government made a decision today to go down the nuclear path, at least, say, on a trial basis with one nuclear power station, how long would it take us to get that up and going?

**Mr Angwin**—That goes to a couple of other issues which would need to be addressed. First of all there is the question of the national political perspective on nuclear power. I think there would have to be a consensus—

**CHAIR**—Let us just assume a decision is made and that is where we want to go. How long would it take?

**Mr Angwin**—I think you would need to put in place the regulatory framework, you would need to build a skills base which enables you both to construct and operate a nuclear power facility and you would have to build it. There are others who are more expert than me at answering that kind of question, but it might take seven to 10 years on the optimistic side and up to 15 if you were a bit pessimistic.

**CHAIR**—I would like to go back to your specific area of expertise. As you have argued before, Australia, through our uranium industry, can make a contribution to the global reduction in emissions around the world by providing Australian uranium to nuclear power stations overseas. China and India are very much looking at using the nuclear energy option to reduce emissions. Do you think we are maximising our capacity to contribute to that as a nation at present?

**Mr Angwin**—No, I do not believe we are. That is partly because of the bans on uranium exploration and mining in the eastern states. Remember that the uranium mining industry is in a competitive situation, as our coal mining industry is, as our iron ore mining industry is, as the mining of all our resources is. There are other countries which wish to grow their uranium mining and exporting industries and they wish to capture a market share as well. Recently Australia shifted from being the second largest supplier of uranium oxide to the third largest, as Kazakhstan overtook us in production and exports. There is no room for complacency in Australia about our competitiveness in this area, notwithstanding that we have the world's largest uranium endowment. Having said that, we want to see the development of uranium mines in Australia take place in accordance with the environmental and other conditions which apply to our industry. We are certainly not suggesting that any of that should be short-circuited.

**CHAIR**—Have you done any modelling? Presumably there are emissions related to the mining of uranium in Australia but that is more than offset by a reduction in emissions, say, in places like China, France—Europe generally. Have you done any modelling as to what your industry can contribute in terms of a reduction in global emissions for every additional tonne of emissions in Australia?

**Mr Angwin**—Currently, as a rule of thumb, our uranium exports avoid about 400 million tonnes of greenhouse gas emissions annually. That is about 70 per cent of Australia's total emissions. Another way of looking at it is to think of the greenhouse gas emissions that would be avoided by Australia's uranium exports over the next 20 years, and that is about 15 billion tonnes. That is the equivalent of Australia being free of carbon dioxide for 15 to 20 years. Another way of looking at it is to compare it to our 2010 Kyoto target. I have forgotten the

figure, but the amount of greenhouse gas emissions that our exports avoid dwarfs our Kyoto target for 2010.

**CHAIR**—As a general point, increasing emissions in Australia as far as your industry is concerned would actually be a good thing in terms of reducing global emissions?

**Mr Angwin**—It does not matter where in the world you avoid greenhouse gas emissions; the thing is to avoid them. For example, the more uranium we export in order to respond to the demand for nuclear power—

**CHAIR**—Let me be more direct. Clearly the CPRS as it is currently designed is focused on domestic emissions reduction targets and there is an additional cost on your industry, as well as on many other industries, which will potentially make it less competitive compared to other countries. This does not acknowledge the contribution your industry can make to the reduction in global emissions. Do you think that we should be having a focus on what the contribution of any activity can make to the reduction of global emissions rather than having a focus on domestic emissions? Do you think the focus on the impact of global emissions is more important than the focus on domestic emissions and how do you think that applies to your industry?

**Mr Angwin**—Let me answer that with regard to our industry. We believe that there is a strong case for seeing the expansion of Australia's uranium industry as a key part of Australia's global approach to climate change policy. To be honest, we have been extremely disappointed that in the policy making process over the last two years concerning the CPRS and other inquiries and reviews related to that the contribution to Australia's uranium industry can make to global greenhouse gas mitigation has received almost no acknowledgement. Given the potential contribution that our industry can make to global greenhouse gas mitigation over the long term, we find that both surprising and disappointing. We would certainly like to see the contribution that our industry can make to that better acknowledged than it has been.

**CHAIR**—Do you think we should be exporting uranium to India?

**Mr Angwin**—Our view is that we should only export to countries which are signatories to the nuclear non-proliferation treaty and which have signed a bilateral treaty with Australia.

**CHAIR**—So the answer is no.

**Mr Angwin**—The answer is no. Having said that, I think there is a case for thinking that India should be brought closer to the conditions which apply to countries which are signatories to the nuclear non-proliferation treaty, but we have no wish to depart from what is a policy stance which Australia has taken for a very long time.

**Senator HUTCHINS**—Mr Angwin, thank you for coming here and breathing a bit of reality into the debate. The chairman asked you about the public acceptance of the whole issue of uranium mining. It gets tied up with nuclear power as well, but you are representing uranium miners, not nuclear power plants. Correct?

**Mr Angwin**—Correct.

**Senator HUTCHINS**—As much as I think you would like to, you cannot divorce the public perception that one is tied up with the other. I preface my question with this remark: we were speaking to a fellow who had been involved in the nuclear power industry and had worked in a number of places in the world. We specifically spoke to him about Chernobyl. He talked about how the, for want of a better term, workplace or safety culture there was absent, which probably contributed more to what occurred at Chernobyl than anything else. He particularly remarked to us that he had seen the same attitude in Japan amongst the workforce in the nuclear power plants there. Does the industry keep an eye on its product from the hole in the ground, say, at Roxby through to the plant in Argentina or China or wherever else? As I said, as much as you might like to divorce yourself from the end product, if we are going to get some common sense in the debate in Australia, you have to take ownership of where it ends up as well.

**Mr Angwin**—I will come back to that last point, which is an interesting one. I think that our industry, and indeed the nuclear industry globally, has stepped up its game with regard to what is called the stewardship of our product throughout the nuclear fuel cycle. Indeed, the stewardship activity in the global nuclear fuel cycle, including the uranium part of it, is being led from Australia by BHP Billiton, which chairs both the World Nuclear Association's Uranium Stewardship Working Group and the Australian Uranium Association's stewardship activities. Those activities are based upon the proposition that we are accountable for the safe and responsible management of our product throughout the nuclear fuel cycle.

So I think the first answer to your question is that the industry globally, including the uranium mining part of the industry, recognises the need to take a safe and responsible approach to the management of the product throughout the nuclear fuel cycle. If I can focus on Australia, which I know more about, that is being reflected in a number of activities that we have undertaken. For example, remember that we are miners here. We are in the process of completing guidelines for best practice in uranium exploration. We are in the process of working towards the same end with regard to the handling of uranium oxide in container terminals. The association has a code of practice which we adopted last year and with regard to which we have just completed our first survey. That identified a number of areas where we have some potential for improvement. I think that at both the global and the domestic level we have grasped the nettle of that problem.

The ambition is to establish relationships between the various sectors, the various phases of the nuclear fuel cycle, so that those kinds of issues are being addressed by one's peers, one's customers and one's suppliers. In the same way that customers for our product audit our performance, that is the kind of direction we would like to head in. We want to try to establish relationships which enable, for example, a uranium exporting company to visit and audit the performance of its customers. We are very, very conscious of that issue. Both globally and domestically, action is being taken to address it.

**Senator HUTCHINS**—Is that happening now? Are you able to visit and audit your customers?

**Mr Angwin**—I would not say we have actually done that.

**Senator HUTCHINS**—That is the object.

**Mr Angwin**—Yes. I know that companies in the industry have had those kinds of relationships. I could not say that the audit process has taken place yet, but that is the kind of initiative which we are aiming for.

**Senator HUTCHINS**—The chair asked you whether we need a nuclear power plant ourselves now and how long it would take to build one. You said if we had the skills to build it and had the right regulatory framework it would take about 10 years. President Hu made an announcement at the United Nations the other day about China's intention to convert to more nuclear power to reduce the amount of carbon emissions. I mention that because, as the chair said, we have been told that nuclear power plants are very expensive little operations. Because of the growth in the amount of nuclear energy and thus power plants—and I think you talked about anywhere between a 50 and 100 per cent increase in demand for nuclear energy—would you be able to give us a comparison figure between now and what it might cost in 10 years to build one? Equally, could you indicate in your contribution, Mr Angwin—realising that our inquiry is to make sure we have got fuel and energy security for the future in this country—whether this is something that we should be adopting now rather than waiting 10 years.

**Mr Angwin**—I might have to come back to you with some specific information about the likely cost of building nuclear power plants in the future. But I make the point that, as countries get greater experience with building large civil technology projects like nuclear power plants and as the technology itself improves, then the experience and the evidence is that the costs become more manageable. I am pretty optimistic that the kind of experience that the world has with any kind of technology—that, as you go along, as you improve it and you get more used to it, you can manage its costs better and contain its costs better—is what we find in regard to the nuclear industry as well. Remember that, for a very long time, there has not been a lot of nuclear power plant construction in the world. With something of a spike in that now occurring I think there is a basis for some optimism that, in the future, cost will be less of an issue than it is today. Remember that at the moment ABARE identifies that it is likely that 64 nuclear power plants will have been constructed by 2014, and that seems to me to be the basis for thinking that the technology issues and the cost issues might be better addressed.

**Senator HUTCHINS**—Does the association have a view on, to use my phrase, repatriating the waste?

**Mr Angwin**—I thought you might come back to that. The practice is for countries which use uranium to produce nuclear power to take responsibility for the waste. Indeed, in all the exports of our minerals, the countries to which we export take responsibility for the waste produced in the use of our product. Whether that is coal, iron ore, copper or any of those, they take responsibility for the waste. So, in practical terms, that is what happens. It is sometimes suggested that Australia has a moral responsibility to repatriate the waste. My response to that is that uranium oxide is handled by a number of players as it proceeds through the nuclear fuel cycle. It is handled by uranium miners, it is handled by companies which transport it, it is handled by companies which convert the uranium oxide to uranium hexafluoride, it is handled by companies which enrich the uranium and it is handled by companies which use the fuel to generate nuclear power. So I am not sure that the uranium producers have a greater moral responsibility than that of any of the other players in the nuclear fuel cycle.

The third point I would put to you is that the construction of nuclear waste facilities is much closer to being realised than it has been before. The Swedes have just decided on the site—indeed, the competition between two towns in Sweden to be the site of the repository has been resolved in favour of one, at the expense of the other, and the Swedes expect to have an operating repository by 2023, which is when they will need it. The French and the Finns are also making progress on that. If I can trail my coat just one more time, Senator, the last aspect of this is: should we see that as an economic opportunity?

The French and the Finns are also making progress on that. If I can trail my coat just one more time, Senator, the last aspect of this is: should we see that as an economic opportunity?

**Senator HUTCHINS**—Equally, enrichment should be—

**Mr Angwin**—That gets us into—

**Senator HUTCHINS**—Yes.

**Mr Angwin**—I am not sure about the size of the economic opportunity or indeed whether or not there is one. That is not an issue to which we have given a lot of attention. On the question of enrichment, there are some countervailing forces to that. One is an economic one: why would you build a large, complex technology like enrichment in Australia at a considerable cost when others already do it and have the capability and the regulatory frameworks to do it?

The second point is that the thinking in non-proliferation circles these days is that, to minimise the spread of sensitive nuclear technology, we should perhaps internationalise those aspects of the nuclear fuel cycle. The parliamentary Joint Standing Committee on Treaties last week, in a unanimous report, which was a very heartening development, indicated that it favoured the multilateralisation—I think that is the word used—of enrichment facilities. So, even if there were an economic ambition to have enrichment facilities in Australia, I think we would still be thinking about whether or not that was consistent with the multilateralisation of enrichment facilities, which seems to be the forward agenda for that part of the technology.

**CHAIR**—Thank you very much for your contribution to the committee today, Mr Angwin.

[10.59 am]

**LENZEN, Professor Manfred, Private capacity**

*Evidence was taken via teleconference—*

**CHAIR**—Welcome. Do you have any comments to make on the capacity in which you appear?

**Prof. Lenzen**—I am a professor of sustainability research at the University of Sydney.

**CHAIR**—I invite you to make a brief opening statement and then the committee will ask you some questions.

**Prof. Lenzen**—For this opening statement I would like to draw on two reports that I was commissioned to write. The first one is a report commissioned by the Department of the Prime Minister and Cabinet for the review of uranium mining and nuclear energy in Australia. This commissioned report focused on the question of whether nuclear energy was associated with a level of greenhouse gas emissions that was comparable to a natural gas fired power plant. A great deal of scrutiny went into this and the conclusion was that the claims were based on energy use for mine clean-up. I followed up these claims and I was able to show that they actually could not be substantiated and that, as a consequence, nuclear power would have to be seen as a low-carbon technology. That was the main conclusion from this first report.

Perhaps more wide-reaching is a report that I have recently completed that was commissioned by the Australian Uranium Association and this was aimed at generating a comprehensive picture of the state of electricity-generating technologies, especially their worldwide contribution to global electricity consumption. I would like to briefly summarise those findings before we go into questions.

Electricity is actually one of the fastest growing energy carriers worldwide and that is because it is so versatile. Especially in developing countries, such as India and China, large parts of the rural populations are now connected to the grid and we are witnessing a disproportionately large growth of this energy carrier. This is where the focus on electricity is important. I examined a range of technologies amongst which was nuclear fission, hydropower, wind power, solar photovoltaic, concentrating solar, geothermal power and biomass power.

They could potentially replace fossil fuel power in the future energy mix for electricity generation. I found that there were issues with all of those technologies but none of these issues were as large as the looming issue of climate change that is associated with fossil fuels. Further, the report found that there is no single renewable technology or low-carbon technology that can actually replace current fossil fuels and there is nothing that could supply the levels of electricity that we will need over the coming decade.

The conclusion then is that we do need a mix of power technologies and it was also clear that just renewables could also not replace coal. From there the recommendation was that it is only

sensible that nuclear energy should play a role in the future energy mix. I would suggest that we could move now to questions and I can respond more specifically to what you are interested in.

**CHAIR**—Thank you. Your table is very useful, incidentally, in comparing all the varying costs, emissions, barriers et cetera of the various sources of energy. In terms of nuclear generating costs, it has often been put to us either in this committee or in discussions generally that nuclear is too expensive an option for Australia which is why it is not a viable option as part of our energy mix moving forwards. Your table seems to dispel that somewhat. Can you talk us through that in a bit more detail?

**Prof. Lenzen**—I looked at a representative report, it is by Lim et al in 2006 that was commissioned by the EPRI—I think that is a US based research organisation. There was a literature review of a number of studies on the generating cost of nuclear energy amongst which was a study by MIT and others. These studies found conclusively that the cost of a kilowatt hour generated by nuclear reactors was anywhere between 3c and 7c and that puts it just about a cent or so above current coal and gas generated power.

**CHAIR**—This is in the absence of a price on carbon?

**Prof. Lenzen**—That is true: this is in the absence of a price on carbon. If you wanted to equip fossil fuel power plants with carbon capture and storage technologies, even if you extrapolated technology to the coming decades, it would add another 3c on top of coal, which would make nuclear fission more cost effective.

**CHAIR**—The costing here makes an allowance for the up-front capital investment?

**Prof. Lenzen**—Yes, in all of those. You make a good point. There is, of course, a variation. The variation in those cost estimates is to a large extent determined by the economic environment in which nuclear power plants operate. It is dependent on the investment climate in which nuclear power plants are being built. That is the reason for the range given in all those studies.

**CHAIR**—The other issue that gets raised around nuclear energy is that of waste disposal. Do you care to make any comments in relation to that?

**Prof. Lenzen**—Yes. Since you started with cost, I should note that in all these cost estimates there was a waste fee included. Of course, one thing that needs to be said is that there is not much experience of the operating characteristics of long-term waste disposal. However, there are a lot of studies, especially on the Swedish facility, on how such a facility may work. When I looked at this, I thought that the cost and energy assumptions that people have made in that case, even though it is just an engineering study, are pretty conservative.

**CHAIR**—You mentioned that you were commissioned by the Department of the Prime Minister and Cabinet to conduct a review of uranium mining and nuclear energy. What was the date of that? When did you deliver that report?

**Prof. Lenzen**—That was delivered in 2006 to the UMPNER. It was commissioned under Ziggy Switkowski. That was one of the four commissioned reports. We had the task of dealing

with the life cycle, energy and emissions from the entire nuclear fuel cycle, including mining and waste disposal.

**CHAIR**—Going through the entire fuel cycle, from mining to waste disposal, you came to the conclusion that nuclear energy is a low-carbon-emissions technology?

**Prof. Lenzen**—Yes, that is correct. I came to the conclusion that nuclear energy is in the vicinity of wind power, a little bit better than concentrating solar and significantly better than solar photovoltaic. The best of all is hydro, but that is because hydro plants have a very long life. Once the investment costs are recouped, hydro can generate some of the lowest costs and also some of the lowest emission characteristics. But nuclear fission is there with wind and is lower than concentrating solar power.

**CHAIR**—Has there been any follow-up work in recent years that you are aware of in relation to your report?

**Prof. Lenzen**—Yes, there has been. Of course, the report that was delivered to Prime Minister and Cabinet was also read by the people who are in part contesting this view that nuclear energy is a low-carbon technology. I have since had the chance of talking to some of these people and going through the arguments, and since then it has crystallised that the main sticking point and the main claim that leads to people saying that nuclear energy is not a low-carbon source is the assumption about mine clean-up. The main person holding this view is a Dutch person, Storm van Leeuwen. He says that the mines have to be cleaned up in a certain fashion in order to reduce the risk of radon emanation from rehabilitated mines. But the practice that is proposed there is actually not followed anywhere in industry globally; it is not done. Then I had extensive communication with one of the key experts on and critics of the uranium-mining industry in Australia, and even he assured me that this technique that was assumed for mine rehabilitation, which would lead to extensive greenhouse gas emissions, would not need to be followed in order to ensure low enough radon levels from rehabilitated mines. To me, that more than showed that those claims could not be substantiated.

**CHAIR**—We may already have this but I have not come across it, but, when you say that for the mining all the way through to the waste disposal it is a low-carbon emissions technology, do you have a table which summarises the proportions? Is it actually included here?

**Prof. Lenzen**—Yes, it is included there and also in the 2006 report in its executive summary.

**CHAIR**—So in this table here where you have got the CO<sub>2</sub> emissions, as far as nuclear is concerned that includes everything from mining to waste?

**Prof. Lenzen**—Yes, that is correct. It starts with the extraction of ore from the ground and ends with its disposal in a final waste repository.

**CHAIR**—So how does it compare to coal? Would coal be 11 to 12 times more CO<sub>2</sub> intensive than nuclear?

**Prof. Lenzen**—Yes. The results in the literature give such different estimates for different settings and has different scopes. So I tried to unravel all of this and give a comprehensive

picture of what the numbers actually are. There are a lot of studies on wind power which simply leave out the effects due to the variability of wind. Of course if you just assess a wind turbine then you get an emissions factor of, say, 20 grams per kilowatt hour, which is very low. But if you assume a systemic view where a wind turbine operates in a grid where it can only deliver up to about 20 per cent of the power—and during times of insufficient wind you have to back the system up by using expensive natural gas based capacity—and if you take that into account then the emissions characteristic of a wind based system is more like 65 grams per kilowatt hour, which is exactly the value we have found for nuclear power.

We did undertake some sensitivity analysis, because people pointed out, ‘Well, what happens if the ore grades decrease in the future?’ but only under very conservative assumptions could we maybe double the greenhouse gas coefficient of nuclear power. In any case, even under the worst-case assumptions it had nowhere near the emissions characteristic of a gas fired power plant.

**CHAIR**—The key barrier that you have identified for nuclear energy in your table is public acceptance, and I think we all understand the issue there. Are you aware of any strategies, initiatives or things that governments in other parts of the world have pursued to address successfully the issue of public acceptance?

**Prof. Lenzen**—That is a very interesting question, and actually the strategies differ substantially between countries—for example, whether or not nuclear energy is accepted depends very much on the public culture in a country, on the trust in the authorities, on the military history and so on and so on. There is no general answer to that question.

**CHAIR**—Given all of the things that you have read and given all of the things that you might have observed in other parts of the world, what do you think would be the most effective way of addressing the public acceptance issue in Australia.?

**Prof. Lenzen**—What I would spell out in this sense is the vulnerability of Australia—and especially its agriculture and a lot of its natural resources—to climate change. I do firmly believe that, whether you like nuclear energy or not, very soon we will have to understand that with the looming threat we will have to implement every low-carbon source that we have in order to be able to reduce our emissions as quickly as possible—

**CHAIR**—As well as ensuring our energy security moving forward, I guess.

**Prof. Lenzen**—Yes, energy security is another point. We know that Australia is home to a large part of the world’s uranium reserves. It also happens to be, perhaps unfortunately for the future, the home of large coal reserves—but in a future world with restrictions on emissions you may not be able to exploit this resource for export. I think it would be unwise not to use Australia’s uranium resources for peaceful purposes. The experiences of Korea and China show that modern reactors are a far cry from those of 20 years ago and have been made more and more inherently safe. I believe that, with the expectations of future generations in India and China wanting to be as affluent as we are, there is simply no other way to go other than allowing nuclear energy into the energy mix.

**CHAIR**—If Australia made a decision today to go down the nuclear energy path, how long would it take us to have a fully-functioning nuclear power plant operating?

**Prof. Lenzen**—What I have read on this question is that even though Australia does not yet have a nuclear power industry it is in a similar situation to the US. There has not been much recent stimulus in the nuclear power industry and consequently there is some degree of skill shortage and supply chain bottlenecks. I believe this would only be a transitory problem. I know, for example, that at my university we have actually implemented a new nuclear science course with the aim of creating a new generation of experts. This is about foresight so that over the next decade we could in principle scale something up if we needed to, or at least have the option and not forego the option just because we do not have any skills.

**Senator HUTCHINS**—Thank you very much for appearing today, Professor Lenzen. As you may be aware, this inquiry is dealing with fuel and energy security for Australia and our future. We have had the opportunity to physically go to a number of operations and hear from a number of well-intentioned people. I wonder if you could comment on this for me. We keep hearing this term ‘clean coal’. Do you think that is a reasonable term? Is it an accurate term or is it just a term that makes people feel warm and fuzzy inside while in fact they are belching out all this CO<sub>2</sub> when they turn on their DVD players or whatever?

**Prof. Lenzen**—That is a good question. My experience so far has been that whenever clean coal is mentioned there is a lot of people, even amongst my academic peers, who actually do not know exactly what clean coal is. If you ask them to define it, a lot of people actually do not know exactly what is meant by that term and you get conflicting answers. Partly people think that clean coal is just about cleaning up air pollutants, which you can do through scrubbers—that is often done and it can be done. But when it comes to the main culprit, which is CO<sub>2</sub>, what I imagine is meant by clean coal is carbon capture and storage. This is also one of the areas that was covered in the report commissioned by the Australian Uranium Association.

It is interesting that in a global assessment the Intergovernmental Panel on Climate Change says the following: it is a viable technology, the capture action is proven, and actually there are places in the world where a few million tonnes of CO<sub>2</sub> are routinely stored under the surface—and they stay there; they have not measured any significant leakage rates. It can be done with a relatively moderate cost: about 3c per kilowatt hour.

There are two barriers to that going large scale. The first one is the energy penalty. If you add a capture mechanism to a power plant, you need about 20 per cent more power just to operate the capture plant. That of course means that either you have to build more capacity or you have less available electricity, which you probably could not tolerate. That is one, but the main restriction on scaling up to significant proportions is that there is a geographical mismatch between storage sites and large emitters. Usually, especially in Australia, good storage sites are not where the power plants are, and eventually you run into prohibitive transport costs for CO<sub>2</sub>.

**Senator HUTCHINS**—We were speaking to a nuclear physicist the other day, and he was commenting on carbon capture and storage, as we have been advised that that is one of the panaceas for Australia’s continued use of coal. He also said that in his experience gas always leaks, no matter how much you try to prevent it. I wonder if you have a similar view?

**Prof. Lenzen**—That is leakage measured from sites. You have to bear in mind that the aim is not to prevent all leakage. What you have to ensure is that the leakage rate is low enough so that the CO<sub>2</sub> will come out during periods that are long compared to the atmospheric lifetime of the CO<sub>2</sub>. It does not matter if the CO<sub>2</sub> eventually comes out as long as that happens over thousands of years. That is fine. You can tolerate low leakage rates. It is just that there is a threshold for those leakage rates. In the measurements for Norway, which are low, so far there has not been anything measured that would exceed dangerous leakage rates. I do not think that is the main issue. The main issue is the geographical mismatch and that there is simply not enough storage capacity to keep the fossil fuel power industry going and just sequester all of this. The IPCC reckons that about 250 gigatonnes of CO<sub>2</sub> would cover about 15 to 20 per cent of the mitigation effort.

**Senator HUTCHINS**—Professor, when the chairman asked you about some of the barriers to us using nuclear power here you said that one was skill shortages. You said words to the effect that the University of Sydney has created a nuclear science course. Is it just the University of Sydney that is starting to acknowledge that this is an issue that is coming, or are there other universities in Australia that are similarly preparing a workforce for us to deal with nuclear power plants?

**Prof. Lenzen**—I am not sure, to be honest. I would have to ask my colleagues.

**Senator HUTCHINS**—But the University of Sydney is.

**Prof. Lenzen**—Yes. Our School of Physics has implemented a postgraduate award in applied nuclear science.

**Senator BUSHBY**—Professor Lenzen, the chair asked you how long it would take to build a nuclear facility from go to whoa. Did you actually nominate a time period?

**Prof. Lenzen**—As far as I understand it, it depends on the regulatory environment and on the processes for siting and all of that. As far as I know, it would be in the order of about seven years.

**Senator BUSHBY**—Is that for the building or for approvals and building?

**Prof. Lenzen**—There are large variations in the approval times. It really depends from country to country. There is no general statement about it. I think on average, including approval, it is about seven years.

**Senator BUSHBY**—On average including approval. Okay.

**Prof. Lenzen**—That is including approval, yes.

**Senator BUSHBY**—Other evidence that we have had suggested it could be up to 10 years because of the approval periods and the challenges you face. If we were to look at that in Australia, we would probably have to also add time for public debate to get to the point of acceptance before we even started that process. To what extent, given the timetable that we are looking at—and here I am really asking about Australia; I understand that a lot of your evidence

related to us exporting uranium elsewhere for nuclear power there—might the renewable technologies that you have examined as at today develop during that time period and actually overtake nuclear as a solution? I am particularly thinking of renewable energy that could actually provide baseload power, such as hot rocks. Given that the technology will develop and there will be a lot of government pressure forcing it to develop, is nuclear just in the wrong place at the wrong time?

**Prof. Lenzen**—In averting climate change, time is quite a crucial variable in that calculation. If you reduced emissions now by a certain percentage, it would make a much larger contribution to preventing temperature increase than if you did the same abatement 20 years later because you would have 20 years where CO<sub>2</sub> just hangs around in the atmosphere and causes radiative forcing. From that point of view, not only how much you substitute is important but when you do it. To come to your question, from what I have read, significant geothermal deployment is still far away. It is still a few decades away, and that is due to simply not yet having enough experience with issues such as velocity, excavation of geothermal sites, geofluid temperature—because if the temperature is too low, you do not get much energy out—and so forth. It is very uncertain, actually, what the potential will be. You could say that we will wait and see, but I do not know whether we should do that given the news about accelerating climate change. I think we should deploy what we do know as quickly as we can.

What we do know is better than burning fossil fuels. For me that is important. Doing something quickly is also important, and I would not wait for a decade for technologies to become viable when we do not know whether or to what extent they will become viable. Solar photovoltaics has a long way to go in terms of cost, and the same holds for concentrated solar as well. The learning curves are actually slowing down, so these technologies have been hovering around at the 40c per kilowatt hour mark. That is far too expensive. With those costs even carbon capture and storage is cheaper, and I cannot see why one would go with a more expensive option under these circumstances. The only more realistic candidates are wind and hydro. As to hydro, Australia is a dry continent with a variable climate, and you know probably better than I do what the state of Australia's water is, at least in the southern parts. As to wind, I agree that we should deploy as much as we can, but it is not going to make it by itself. This is very clear.

**Senator BUSHBY**—The argument has certainly been put to this committee that carbon capture and storage, geothermal and other forms of renewable technology will develop to the extent that they will be able to replace fossil fuel based generation, but you are essentially saying that the uncertainties around the development of that technology make it a less attractive option than going with what we know, that it certainly can reduce our emissions and that nuclear is an option, despite the fact that it may take seven to 10 years to actually get that up and running.

**Prof. Lenzen**—That is what I am saying. I am not saying one should not invest in geothermal or solar technologies; one should. They will and they should play a role in future energy mixes. I would hope that these future technology developments would be successful. You can do dynamic calculations and start looking at scenarios for abatement in the next five years as opposed to doing the same abatement estimates but starting 20 years from now. It does make a difference.

**Senator BUSHBY**—I will ask the same question, substituting gas for renewables. Acknowledging what you have said, the other argument that has been put to us is that renewables are not capable of providing a solution at this point; there are too many uncertainties.

In the meantime, as part of the transition, we should move in a big way to gas, which is far more CO<sub>2</sub> emission friendly than what we currently use and can be deployed and up and running within five years.

**Prof. Lenzen**—Yes. I would support that statement. In the long-term the CO<sub>2</sub> emissions coefficient of gas is only half that of coal, and if you believe the Garnaut report, reducing emissions by this percentage is not enough for developing countries. Now, as the years go by, it is moving towards an 85 per cent reduction target. How we achieve this with renewables, I do not know. I would like to know from somebody a realistic way to achieve an 85 per cent reduction—which target I would support—just with renewables. I do not believe it. I have not seen a convincing argument where this would be possible.

**Senator BUSHBY**—Thank you very much, Professor.

**CHAIR**—This has been very useful and insightful evidence, so thank you for that. One of the other things that I forgot to raise with you before that gets raised with us is the high use of water for nuclear energy; obviously there are environmental issues related to that. Have you looked at that at all?

**Prof. Lenzen**—No, I have not looked at that specifically but also I have not come across it in the literature as being presented as a major issue. A nuclear power plant is a thermal plant and in that respect is no different to a coal fired plant, but maybe you know something that I do not know.

**CHAIR**—No, I am not an expert at all. We are here to try to learn. Certainly in the political debate, the high use of water is something that gets raised. I was wondering whether you would be able to provide us with any arguments that we might be able to direct in response. Maybe you can take it on notice and have a bit of a look at it and see whether there is something you can provide to the committee.

**Prof. Lenzen**—To put power generation in perspective in terms of water, first of all I cannot see any substantial difference between a nuclear thermal plant and a fossil thermal plant in terms of their cooling requirements. Water use for electricity is a small part of Australia's overall water use. Most water in Australia is used for irrigation in agriculture. If you want to address water issues, I do not know whether you should start with electricity. It is not the major usage sector.

**CHAIR**—Are there any environmental arguments against nuclear that you are aware of that we have not raised with you?

**Prof. Lenzen**—No. We have talked about radon, and I happen to be a radon expert because I did my PhD in radon. I never thought I would go back to this issue again, but there you go—you never know.

**CHAIR**—Thank you very much, Professor Lenzen; that was very useful. Thank you for your contribution to the committee.

**Prof. Lenzen**—Thank you for your invitation.

[11.45 am]

**CURRIE, Mr Glen Thomas, Chief Executive Officer, Sustainable Renewable Energy Company Pty Ltd**

**VELINS, Mr Eriks, Private capacity**

**CHAIR**—Welcome. I invite you to make an opening statement before the committee asks you some questions.

**Mr Velins**—I saw this inquiry as of great national strategic importance and made two submissions to it, the first in response to the original terms of reference and the second in response to the amended ones. Securing Australia's future domestic energy supply appears to be the essence of the inquiry. I would argue that each energy source should be judged in terms of its affordability, environmental impact, security, reliability and safety, thus complying with the various criteria of acceptability which can lead to an optimum outcome.

Australia is fortunate in that it has an ample supply of all primary sources of energy, with the exception of crude oil, and due to low taxation enjoys some of the OECD's lowest prices for fuel, electricity and also water. That era appears to be moving to a close as pressures are being generated for higher prices of all basic utilities. So how can one cope with this change? Technology remains the key to success and there are ample proven state-of-the-art technologies, as well as some new emerging ones, which are ready for application. The challenge of energy policy is to devise a path towards higher prices without losing Australia's global competitive advantages and economic wellbeing. Conflicting government policies have hindered capital investment in new technology. The optimum solution will lie in strengthening our energy markets within a sound fiscal framework. My submissions have identified some of the available options.

**CHAIR**—Mr Currie, do you have an opening statement as well?

**Mr Currie**—I do. I would like to submit a couple of documents in support of that. I speak in my personal capacity, though I have been invited through my involvement with the Australian Institute of Energy, for which I am the national treasurer. I was previously General Manager, Business, at CSIRO, so I have got an interest in technology and technology development.

**CHAIR**—The positions you are presenting are your private positions. Is there an official Australian Institute of Energy position on these matters?

**Mr Currie**—The way the Australian Institute of Energy is structured, it seeks to be all-inclusive and does not seek to champion positions, so although we are informed by the activities of the Australian Institute of Energy we cannot represent one or other solution.

**CHAIR**—It takes an academic approach to it rather than a policy position?

**Mr Currie**—That is correct—more of an academic rather than a policy position. I agree with Eriks that this is a critical direction and that the policy setting in the energy sector is going to be very important for Australia. I subscribe to the view put forward by Rifkin, who is talking about the third industrial revolution. He is talking about climate change and peak oil driving major changes within world economies. He is currently a lead thinker in the Euro area but is a US based economist and has a fairly good standing in the area. I refer you to him.

The key areas of peak oil and climate change mean that there will be changes right through the economy, but clearly policy settings in the energy area will help us take advantage of the opportunities that are going to be presented. It is not just a matter of making sure we are in a position to keep our carbon down or whatever in our domestic generation; it is also a matter of ensuring our technologies, which are addressing both Australian needs as well as export needs, are addressed. Rather than being a straight technology taker, the more domestic technology we have the better position we have globally. Using as an example the Joint Strike Fighter development, we have a hand in that game and we are going to get benefits in the long term. Similarly, with our involvement with FutureGen, an energy initiative in the US, we are positioning ourselves to take advantage of that technology and, in the long-term, to import less technology.

The paper that I have submitted indicates an overall position, which I have just stated, and responds to the five key areas which the inquiry is looking at at present—that is, regulation, taxation, alternative energies, their reliability and security, and then liquid fuels. I touched on liquid fuels fairly briefly. Eriks has got a much deeper background on liquid fuels, so I will direct any questions in the liquid fuels area to Eriks. My special areas of expertise are more on the innovation and technology sides, so I would suggest to questions in that area come to me. Innovation and business development around new technologies is certainly something I have got a deep understanding of. That is my introduction. Thank you.

**CHAIR**—Thank you very much. You have touched on this in a certain sense, but could you sum up in two or three paragraphs the major challenges in terms of energy security, moving forward? Would you care to give that a go?

**Mr Currie**—In terms of energy security, the liquid fuels side is probably the most vulnerable and, as Eriks has already mentioned, that is an area where we are not blessed with huge resources and are very susceptible to international imports. That said, there are some options in terms of coal liquefaction. There is the option of gas to liquids, and certainly we have got quite a lot of gas as opposed to liquid fuels. The other technologies around biomass and algae are not that far off from delivering some of the liquid fuels requirements. But I will just make the point that I am not championing biomass, for example, as the sole source of liquid fuels, because it certainly could not compete with the large volumes of—

**CHAIR**—Let me rephrase. Obviously, we are in an environment where demand for energy is going to continue to increase and there are policy settings that impact things like investment in energy generation distribution networks et cetera. Right now, without making adjustments to our policy settings, looking at the things that you mentioned before—affordability, and security and reliability of supply—do you think that we are on track? If we do not make any changes to policy settings, given everything else that is happening, do you think that we will be able to maintain an environmentally friendly, affordable and secure energy supply, moving forward?

**Mr Currie**—The answer is no. The key concerns I have got in terms of security of supply sit around the decreased investment in coal plants. I see that that as a key risk to our supply side at the moment. The peaks are being addressed by gas, but we are yet to really give clear indications to the owners of coal plants as to where the future direction is going to take them. I do not believe the policy settings are set in a way that is reducing our risk—

**CHAIR**—Okay. So what needs to happen to the policy settings to reduce our risk and to maximise our chances of ensuring an affordable and secure energy supply that is as environmentally friendly as possible?

**Mr Currie**—The introduction of the CPRS will certainly be very important—

**CHAIR**—In terms of ensuring a secure, reliable—

**Mr Currie**—A secure return on investment so the investors will know what return they will get on their investment. At the moment they will not make long-term maintenance decisions because they just do not know what return they are going to get.

**CHAIR**—Okay. Let us say that tomorrow we have got a CPRS, the one that is currently on the table; do you think that there would be investment in new coal fired power stations or maintenance of existing coal fired power stations?

**Mr Currie**—My opinion is that a CPRS with clear rules for a coal fired power plant would give it security to make more investment in maintenance.

**CHAIR**—That is not the feedback we are getting from the coal fired power stations. We went to one yesterday and the people there said that, if it stays the way it currently is, essentially it is no longer viable for them to keep going.

**Mr Currie**—That may be the case, and some of the plants might need to close.

**CHAIR**—The particular plant I am thinking about provides 20 per cent of Victoria's energy.

**Mr Currie**—One of the risks that we definitely have at the moment is that the policy settings are not likely to—

**CHAIR**—How can a CPRS then help ensure a reliable, secure supply of energy moving forward? I am just trying to tease this out a bit. The CPRS is one of the big sovereign risk issues. Clearly there is the element of uncertainty, but if it has the certainty of a bullet, as somebody coined the phrase at some point, that does not really improve things either, does it?

**Mr Currie**—The key policy settings are around a return on those assets, and it is beyond my expertise to talk about what those policy settings are. But I agree that the current policy settings are on a crash course in terms of investment in a coal plant.

**CHAIR**—In the written submission that you have just tabled you make some observations in relation to state regulatory frameworks. Would you care to expand on that for us a bit?

**Mr Currie**—I am the CEO of a renewable energy company and I am currently developing projects in various states in Australia. I am facing issues with a small to medium plant. The regulatory rules around small home one-kilowatt systems are fairly well defined, but anything above that, through to a large commercial plant, is poorly serviced by the regulatory regimes. For example, in Canberra in the ACT there is a rule in the system that if I build a renewable plant I am required to put in a transformer three times the size of the renewable plant to connect it to the network. That is just a hangover from previous structures and is not suitable for a small generator.

**CHAIR**—So our regulatory framework has not caught up yet with where we want to go in terms of environmentally friendly, secure and reliable supply of energy for the future.

**Mr Currie**—That is correct. Because of the skills and the structures within the regulators—and I am in this case talking about the ACT and ActewAGL—they are struggling to find information internally. We are working with ActewAGL, for example, to help them understand the industry and its needs. Obviously that is a process that all industries go through in terms of the regulators. Of course we are not the same as a billion dollar coal plant that goes and negotiates with the regulator. We are a much smaller entity and we are struggling to compete in terms of that game. Typical renewable power plants are a lot smaller than a coal plant or a gas plant; therefore, we are not easily fitted into the current regulatory regime.

**CHAIR**—Do either of you have a view as to whether Australia should include as part of its energy mix consideration of nuclear energy moving forward?

**Mr Currie**—I think it should be.

**Mr Velins**—I would suggest it be included as an option. I am a believer in economics; therefore, if the economic case is valid for a nuclear power station then I see no problems in going ahead with it. It is a very proven technology, it is fifty years old, it is widely used overseas, it is a growing technology and the third generation reactors offer quite a lot of promise. But it must be included as an option to stand on its own economic terms against other options that might be available at the time for the particular market.

**CHAIR**—To focus on that a bit more, we have had evidence from Professor Lenzen of the University of Sydney. He gave us a good overview of all of the various indicators that get assessed in terms of energy generation, including generating cost. His conclusion, having reviewed all of the evidence around the world, is that the generating cost for nuclear energy is essentially comparable to coal, gas and wind, much cheaper than solar, much cheaper than concentrating solar and quite environmentally friendly in terms of emissions. If the economics stack up, what you are saying is it is certainly an option that we should keep on the table and not rule out upfront.

**Mr Velins**—Yes, but my point was that there are five criteria for energy. Affordability is one; environmental is another. So one has to have trade-offs between the different criteria. Without having seen these figures, I would agree that nuclear is comparable with coal, CCS—

**CHAIR**—Gas.

**Mr Velins**—and gas, and is much cheaper than wind and solar.

**CHAIR**—The issue with nuclear, of course, is one of public acceptance, which in the Australian setting is a significant problem. As experts in the energy industry, what would be your suggestions or recommendations on how that could be addressed moving forward?

**Mr Currie**—I certainly do not have expertise in changing public opinion. I have an opinion that within the informed energy sector there is actually a very broad acceptance of nuclear as a possible solution, because the economics do stack up fairly well.

**Mr Velins**—I am of the view that we have to go through a crisis before we can move forward, and I suspect the crisis will come when the current policies on MRET, the ETS and so on will not deliver the outcomes with respect to emissions. I believe they cannot.

**Senator BUSHBY**—It is a big price to pay, though.

**Mr Velins**—That is the nature of policy, yes. I think we will go through a crisis and, once we go through that crisis, it will be easy because people will not enjoy blackouts. But it will not happen until we get to a stage of a series of blackouts. Queensland had them some years ago, when there were two or three failures in power stations because there was not enough capacity. Then coal fired power stations were built, and Queensland is an exporter of electricity now. I think we have to go through a crisis before the public will accept nuclear, and the crisis will be a dislike of blackouts.

**CHAIR**—So there is no option in your mind in terms of changing public opinion other than going through a crisis context? That has to be the turning point? It would take seven to 10 years to get a nuclear power plant going.

**Mr Velins**—I would have thought much longer.

**Mr Currie**—Much longer than that, yes.

**Mr Velins**—I would have thought 10 years for the paperwork and five to build. The ideal thing is education, but education has been around for a long time. The first reactor started in the mid-fifties. Nuclear has been around for a long time. I would like to think education is sufficient but it has not been, in practice. I think major changes in the industry have come because of crises.

My background, which I did not mention, is in the oil industry. I first worked as a student in 1958 at Kwinana, and the oil industry has been beset by a number of major crises—the nationalisation in Iran, the first OPEC crisis in 1973 et cetera. It is those crises that have changed the behaviour within the companies and within the public quite dramatically, more so than anything else ever before. If you look at demand after the second OPEC crisis, the demand actually declined for four or five years because the prices went up and there was uncertainty. That was a serious crisis. So I regretfully have to say I think we would have to go through a major crisis in electricity availability before nuclear would be acceptable in Australia.

**Senator HUTCHINS**—To follow on from your point, Mr Velins, I do not disagree with you about the crisis, but look at the situation in Victoria at Christmas time. We are not Victorians, but the trains did not run and the government's solution was to sack the train operator. It looks like that was the problem, not the issue that led to the trains not operating. So I do not disagree with you. Do you think Australians are prepared for the significant price increases for energy that they are facing with the introduction of these alternative taxation schemes or carbon pollution reduction schemes?

**Mr Velins**—My answer is no. I will come back to the indexed excise on petrol that the previous government had to stop because of the unrest about the one penny a gallon, or 1c a litre, increase. It is interesting that the price of petrol in, say, Europe is at least double Australia's, and they have a very high standard of living too and enjoy lots of cars, albeit maybe smaller and more efficient cars. No, I do not think Australians will pay full prices. The point I was trying to make is that the price rises in utilities will be not only in terms of electricity, which may double or treble, but also in transport fuels and water. All of these commodities are available in Australia at among the world's cheapest prices. Our water is a quarter of the price in England. England is not a dry country by any means. So all our utilities have been very cheap, and we have based our wealth on very cheap utilities. I am saying that era is coming to an end. How we will manage—whether we manage through clever government policies or go through a crisis—I do not know. I would prefer that it be managed, but I am not sure that it will be managed.

**Senator HUTCHINS**—You can see that the make-up of the institute is lawyers, accountants and industry professionals like you. Do you have any figures—has your institute done any figures—on what sorts of price increases we might look at in, as you said, water, energy and transport fuel costs?

**Mr Currie**—We have had submissions on the figures that are likely. I refer you to the table that I have handed out, generated by the Department of Energy in the US. These are US costings.

**Senator HUTCHINS**—Is this the one—*Levelized cost of new generating technologies?*

**Mr Currie**—That is correct. If we use the right-hand column, 'total system levelized cost', conventional coal at the moment—

**Senator HUTCHINS**—Could you just run us through that and explain to the amateurs here what those figures mean.

**Mr Currie**—The costings here are an estimate of the costs in 2016, so it includes some cost reduction in some of the technologies. The column 'capacity factor' on the left is quite important in terms of discussions of what Australia's energy sector is going to look like in 10 or 15 years. Moving off coal and the items in the top half of the list—advanced coal, gas-fired and nuclear—the next one down is wind, and that is a 35 per cent capacity factor. That is what is talked about in terms of intermittency with renewables. The research indicates that you can get to about 20 per cent of wind in the network and have it deliver about that amount of the capacity factor. The work that has been done by Mark Diesendorf indicates that you can take a certain amount of your network generation out of these intermittent sources like wind, but you really have to look at your baseload, which is the top part with the high capacity factor, to actually deliver your baseload electricity. You have to be able to turn on the lights at midnight and have them turn on.

The next columns there refer to capital cost, which is fairly clear and refers to capital cost per megawatt hour delivered; fixed O&M—the operation and maintenance is going to be higher for certain technologies than for others; variable O&M; and transmission, which is going to vary depending on the various locations and typical locations of plant. But the column I am directing you to is the right-hand column. Are there any questions about the overall structure of this before I go on?

**Senator HUTCHINS**—No.

**Mr Currie**—The right-hand column indicates that conventional coal, in 2016, is expected to cost US\$94 per megawatt hour. That compares to our current price of electricity in Victoria, which is about A\$140, or US\$120, per megawatt hour. That cost of US\$94 can be compared to the US dollar cost of Australian generation, which sits around US\$50 at the moment. So there are higher costs in the US at the moment anyway, and they are expecting those to continue to go up.

You have asked a question about the likely position of the population in adopting these new technologies. In answering that I would point out that these key technologies, such as nuclear, coal with carbon capture et cetera, are all sitting around that \$100 per megawatt hour costing. The current costing in Australia is around \$50 per megawatt hour so that is a doubling of the generation cost. It is important though that the generation cost of \$50 is compared to our retail cost which is somewhere around \$150. You have a good amount of the retail cost which is not sourced from the generation side. The impact could be as little as moving from \$50 to \$100 per megawatt hour. That of course does not take into account some of the other dynamics in the system and the possible increase in infrastructure costs et cetera, but it is quite feasible that we would be able to adopt some of these technologies by moving from a retail cost of about 15c per kilowatt hour in Australia to as little as 20c to 25c. That is not, in my opinion, likely to drive revolt in the street. It is going to be painful and obviously difficult for people in the community to cope with that increase. It is going to mean something like a 30, 40 or 50 per cent increase in their bill but it will not mean a doubling of the bill. That is my opinion anyway. Eriks may have a different opinion.

**Mr Velins**—I think what is important is this capacity factor. Wind is running at 35 per cent availability. In order to make it comparable with coal, you need to back it up. Generally, people exclude the backup costs for these intermittent renewable energies, wind and solar, and that backup is what? Gas? I do not know. I think it is important that all these are comparable. I do not think they always are comparable.

**Mr Currie**—That is why this is talked about as system levelised costs. It does reflect some of that backup cost required for wind. That is why in that right-hand column wind is shown as \$141. The actual raw cost is something like \$70 or \$80, so if you are going to put your toaster beside the wind farm, it will cost you \$70 or \$80 per megawatt hour, but this chart is a bit more realistic because it covers the backup cost and the other costs associated with wind.

**Mr Velins**—I think the issue that is not addressed very often with wind and solar is the control of the network because these are intermittent energies. It means something else has to shut down because wind would get preference. One needs to have an updated smart transmission network in effect to cope with significant loads of wind or solar generation. I think that is not included.

Some of the gap between wholesale and retail will be eaten up, in effect, by a redesigned distribution grid.

**Mr Currie**—I think that the point that Eriks raises there is that we are not just talking about a clear-cut change in adding some wind and possibly changing some large centralised coal plants across to nuclear, solar thermal or whatever. It is a whole rethink on the way the grid is designed and the way the grid interfaces. The interconnects need to increase. At the moment it is very simple, if you have a large centralised coal fired power station, it is about three gigawatts. That compares to some of our biggest wind farms which are about a gigawatt, so a renewable plant is by nature a lot smaller and more distributed, so you need more ability to move electricity from one place to another. That interconnection offers some difficulties, but it also offers opportunity because it means that you are more likely to generate electricity closer to your load and it means that you have the opportunity to move power more smartly and hence the term smart grid. One of the points I made in my submission is the idea of using a high-voltage DC connection and probably the most likely connection point would be going across from South Australia to deliver some of the geothermal energy across to the eastern seaboard. That type of initiative is a national initiative; it is not something that the New South Wales electricity grid can cope with. It comes down to national power distribution, the national grid and the national system in a far more complex manner than the current system that we have.

**Senator HUTCHINS**—In your paper you have part 2, ‘Taxation changes to improve our energy system,’ and then at point 5 you say, ‘Taxing the air conditioning could also reflect the additional cost to deliver the infrastructure required for the summer peak primarily driven by air conditioning.’ What do you propose there in terms of a figure? How would you determine it—by time, by volume, by excluding big families? How would you do it?

**Mr Currie**—I have raised there the cost of additional infrastructure that the air-conditioning peak is creating. I do not have a particular policy solution I am recommending.

**Senator HUTCHINS**—I know that we have had this issue of the peak costs and average costs raised this morning by the Australian Energy Regulator. They are certainly aware of it, and I was just wondering, as you have mentioned it in your submission, whether you had the magic wand for us look at.

**Mr Currie**—I mentioned the technologies in air conditioners just to use an example. I noticed in an ad the other day that I could buy a kilowatt-capacity air conditioner for about \$100 a kilowatt. My home runs on about a kilowatt and I could buy a four-kilowatt air conditioner that made my home a five-kilowatt load when the air conditioner is on. For \$400 I could make my home five times the size in terms of the load on the system. That is such a frightening dynamic. It is just something that is putting so much pressure on our system. It is not just the supply side; it is also the network side delivering that power. It is going to drive the crisis, I guess, that Eric alludes to—blackouts and so on.

**Mr Velins**—The obvious solution, Senator, is to reduce the peak, and that is typically by generating—in other words, each of us has his own power station at home in the form of a fuel cell, for example. That then would more readily be able to go up with the demand.

**Mr Currie**—And that is a key match for solar, in that solar generates its most electricity on a hot day when the air conditioner is running. Solar is very efficient when it is distributed. It is quite an efficient system to have on every house and therefore that is very close obviously to the load, which is the air conditioner which turns on on a hot day. So that type of network change is a very positive linking up between the air-conditioning load and the ability of solar to generate locally.

**CHAIR**—Are you aware of any research which quantifies Australia's energy demands over the next couple of decades? Have you reviewed any and could you recommend any to us?

**Mr Currie**—I was part of the development of the CSIRO work, which was indicating something like two per cent ongoing growth—

**CHAIR**—Compounded, presumably.

**Mr Velins**—The CSIRO made a major study two years ago. I tend to often use ABARE and its forecasts. I think that they are not bad. I think that they are wrong in terms of oil production for various technical reasons but not in terms of demand. But I would be quite happy to—

**CHAIR**—Do you think that they are too optimistic or too pessimistic—

**Mr Velins**—They are quietly optimistic. Their oil production is based on an econometric model, not a probabilistic model. In other words, there is a chance of finding oil or not finding oil. They are assuming that there is a link between basic price and reserves. Their longer term projections are something close to double what the Geoscience does, and I would use Geoscience Australia for reserves and longer term oil forecasts—and this was debated at some length by your predecessors a couple of years ago. But for energy demand forecasts, ABARE to me is better. IEA has similar studies, though I suspect they were given by this government—

**CHAIR**—Yes, probably sourced out of ABARE!

**Mr Velins**—Actually the US DOE does studies for major countries as well.

**CHAIR**—All right. Senator Bushby.

**Senator BUSHBY**—Thank you, gentlemen, for helping us today. We had a presentation by Geoscience Australia where they talked about the likely future of oil supply finds and so on. What they highlighted was that there was a large area that had been identified as potentially oil producing that had not been explored. Looking at the Great Australian Bight all the way down to the west coast of Tasmania, a similar area in the Caribbean showing similar potential for oil finds had thousands of test wells in it, and I think in that whole area of Australia there were about four. To use your ABARE comparison, that highlights that the economics had not yet driven the need to explore some of these areas and had not made it cost beneficial to do so. Could that explain the difference between ABARE and Geoscience?

**Mr Velins**—No, but I think you raise a very important point; I am glad you raised it. Australia is largely explored, even areas that are deemed to be old areas, and there are areas like the Great Australian Bight that have not been explored at all and there are areas that have not been

possible to explore as well, by law, such as the eastern side of the Great Barrier Reef, which is another prospective area known as the Townsville Trough. I think the issue is that, say, in the Great Barrier Reef, a deep-water well today costs anything up to about US\$100 million. You need a couple of wells before you could say 'I have something' or 'I do not have something', so that is a \$200 million flag fall. Only large Australian companies can participate in such exploration ventures, because they have the funds, and those same large companies also have interests overseas, because overseas—for example, in the Gulf of Mexico—there are still far more prospects than in Australia.

So in managing an E&P company one tends to rank all its prospects in order in terms of a number of criteria, some which I have outlined, and then, depending on available cash flow or the forecast cash flow, one cuts off the bottom and says, 'These are the prospects we are going to develop this year.' Now, if you do that sort of a ranking, you generally find it is more economic to spend your money overseas, and that is the reason why Australia has not been explored as much as it perhaps could have been: the chances of finding oil are much greater either in the Gulf of Mexico, offshore Brazil—except the government does not let you go into those areas, anyway—or still perhaps the west coast of Africa, and the Middle East is largely out of bounds.

**Senator BUSHBY**—Okay. Despite the fact that Geoscience Australia identified a number of areas like the Sorell Basin off Tasmania and others as being highly prospective—I cannot remember the exact terms they used—the other criteria that would be included when you are doing that ranking would push them down below whatever that cut-off is.

**Mr Velins**—Yes. Basically, it is risk management. These are what are known as frontier areas. It was very fashionable to look for frontier areas after the second OPEC crisis. Companies lost tens of billions of dollars, \$30 billion, \$40 billion or \$50 billion, looking for those areas. Companies are now concentrating on areas with which they are familiar in order to reduce the risk.

**Senator BUSHBY**—We have also had evidence—and I am interested in your views on this—that we have already reached peak oil or we are very close to it. During whatever transition may actually result over the coming decade as a result, we will still need oil. As known oil reserves start to diminish because we have passed that peak oil position, surely the economics will drive them back to those frontier areas?

**Mr Velins**—Yes, but, in terms of the economics, I was just reading an article this morning that said that the oil companies now pay about \$60 per barrel to try. That is a similar figure to tar sands, which is an alternative as well. It is similar to making it from coal, gas or shale oil, which has other problems. I think the economics are such that the cost of oil will have to rise much higher than the present price in order to provide an economic incentive to go back, for example, to the Great Australian Bight. The problem is that, when the price rises, demand will fall—it may even trigger a recession, so we would be back where we started.

**Senator BUSHBY**—But demand for petrol and oil based products, at least in the short term, is fairly inelastic, so demand will not fall immediately. It will actually drive technologies, and that will lead to a medium and longer-term fall, but demand is marginal in terms of its impact on price in the short term.

**Mr Currie**—I think that obviously, in a diminishing supply situation, you are going to get a balance between the development of alternatives and the ability to supply—and yet at the same time you have increasing global demand. So, even if we are not quite at peak oil, our demand is growing faster than our supply, so therefore we are at a constraint—

**Senator BUSHBY**—We are approaching that.

**Mr Velins**—Yes. But the obvious response to high oil prices is to buy a more fuel efficient car. The Australian fleet fuel average is somewhere between 12 and 14 litres per 100 kilometres, depending on whether or not you include four-wheel drives, I think. The best of the medium sized modern cars are about seven litres per 100 kilometres. The best of the little diesels and so on are about four, so they are lower than hybrids. So my view, which comes back to government policy, is that if there is a massive oil price—you ought to do these things in sequence; it is better not to have a price crisis first—and one had a mandatory fleet fuel efficiency target, which would take about a decade to implement, one could gradually reduce our fuel consumption by about half over a decade. That therefore minimises the impact of the higher prices, and we may well live quite well with the higher prices. It is faster to buy a new car than—

**Senator BUSHBY**—I understand what you are saying. I think that ultimately the answer will be a combination of all sorts of things, including more fuel efficient cars, government mandating certain aspects and the market driving other aspects of it. We saw with the high oil prices last year a significant shift away from larger cars to smaller cars in Australia.

**Mr Velins**—And that means public transport as well, of course. That is a variable that does not seem to be discussed very much. There is not much public transport.

**Senator BUSHBY**—How serious a threat to Australia's wellbeing, in an overall sense, do you see peak oil as being?

**Mr Currie**—Extremely significant.

**Mr Velins**—I think it is far more significant than an ETS. Peak oil will occur much earlier than the 2020 target for an ETS, for example. It is a very serious issue. I think it should be part of any normal planning process. You may not get the timing right, as no doubt the peak oil people said. Global oil production has been flat for four years. The increment has been met by Canadian tar sands and condensates. Oil has been flat for four years.

**Mr Currie**—It is interesting to note that last year the IEA moved to a position on peak oil, which was that we have actually reached peak oil. The IEA had been very conservative until last year, and their chief economist moved to that position.

**Mr Velins**—What is interesting about peak oil is that bodies such as the IPCC do not recognise peak oil. In those longer-term oil demand forecasts they use for their emissions forecast, demand for oil keeps on going up.

**Senator BUSHBY**—Despite the fact that that demand cannot be infinitely met?

**Mr Velins**—It probably cannot be met within the next 10 or 20 years. One of the issues I have with those models is that they reject the possibility of peak oil. I think oil companies accept the principle of peak oil; the issue is about timing—whether it was last year or will be in five years time or whatever.

**Senator BUSHBY**—And also consequences. That is what I am interested in. Clearly, oil is a finite resource. There is probably lots more of it in the ground but, in terms of getting it out, we have probably reached or are very close to a peak. We are not about to run out of it tomorrow, but we may well be facing an oil-constrained world where, given the dependency of most economies on oil—not just in terms of transport but in terms of its input into plastics and all sorts of things—it is going to have a big impact. I am interested in your views on where Australia should go.

**Mr Velins**—Australia has options. It has lots of coal, brown and black; lots of natural gas; and lots of shale. Shale has particular technical problems as well as additional environmental problems, but one can make transport fuels from coal, as Sasol has done since the fifties or sixties.

**Senator BUSHBY**—In the quantities that we will need?

**Mr Velins**—Yes. It is a matter of plant, but there are commercial-sized plants. I think Sasol has three plants, making about 200,000 barrels a day. Shell is building the first large-scale gas-to-liquids plant in Qatar; that should be running in a year or two. That has two trains, with 65,000 barrels a day. Our demand is roughly 900,000 barrels a day. Two GTL plants can meet, for example, all our diesel needs, which are about 250,000 barrels.

**Senator BUSHBY**—That is for Australia?

**Mr Velins**—For Australia, yes. But remember that that would cost \$100 a barrel or whatever—more, certainly, than the present oil price. So there are technologies, and Australia has the natural resources to make, in effect, synthetic transport fuels.

**Senator BUSHBY**—It might be a good way of putting the massive brown coal resource that we saw yesterday to use if they cannot put it into power stations.

**Mr Velins**—That has been one of the options, of course, but that project has been either deferred or cancelled by Anglo Coal and Monash. So the technologies are there. My reaction, again, from a policy point of view is that, being a conservative person, I would love to see one GTL plant making diesel in Australia. That would cover half our diesel needs.

**Senator BUSHBY**—Thank you.

**CHAIR**—Thank you very much, Mr Currie and Mr Velins, for your contribution to the committee.

**Proceedings suspended from 12.33 pm to 1.15 pm**

**JACKSON, Mr Robert, General Manager, Policy, Clean Energy Council****WARREN, Mr Matthew John, Chief Executive, Clean Energy Council**

**CHAIR**—I welcome Mr Warren and Mr Jackson from the Clean Energy Council. I invite you to make a brief opening statement, and then the committee will ask you some questions.

**Mr Warren**—Thanks, Senator. The Clean Energy Council is the peak body representing the clean energy industry in Australia. It comprises more than 300 companies, deploying a range of clean energy technologies. The Clean Energy Council supports the development and implementation of government policy that accelerates the research, development, demonstration and deployment of clean energy generation and energy efficiency technologies. The purpose of these policies is to contribute to the broad suite of measures needed to mitigate the threat of dangerous climate change by reducing Australia's emissions of greenhouse gases.

Decarbonising energy generation in Australia and globally is a time-constrained technology and investment challenge. New clean energy and energy efficiency technologies need to efficiently deliver large-scale and reliable supplies of energy. This efficiency needs to reflect actual abatement of greenhouse gases. These technologies need to be as safe as possible for those working to install and manage them, for the community more broadly and for the environment. Optimal clean energy policies must also recognise that technologies are at different parts of their grub curve, requiring different support mechanisms to achieve long-term least cost. We may not yet know the cheapest and most reliable technologies to deliver this transformation, because they are still under development. Some proposed technologies may fail either because of technology barriers or because they are not competitive against other emerging technologies. Therefore the policy measures advocated by the Clean Energy Council need to incorporate all of these fundamental objectives: accelerated deployment of existing and proven technologies; creating optimal conditions to accelerate innovation in development of emerging clean energy technologies; minimising the cost of the energy transformation by driving dynamic efficiencies through competitive market practices; ensuring actual and measurable abatement of greenhouse gases by the effective deployment of clean energy technologies; and delivering technologies that are safe to install and operate and are sustainable for communities and the broader environment.

To this end, the Clean Energy Council welcomes the parliament's passing in August of an expanded renewable energy target as a foundation strategy to accelerate deployment of proven technologies and development of emerging ones. A carbon pollution reduction scheme is also needed as quickly as possible to underpin the transition to a decarbonised energy system. Beyond these key platforms there remain a number of supporting policy challenges for governments. These include ensuring competitive energy markets and allowing projects access to markets, ensuring the integrity of these measures, stimulating the financing of new projects and measures to encourage more investment in the inherently risky research into new technologies and the development of both thinking about and the design of smarter networks to shift to a more dynamic electricity market.

**CHAIR**—Thank you very much, Mr Warren. In your opening statement you provided a very strong focus on reducing greenhouse gas emissions and on strong action on climate change. Of

course, there is a significant need in terms of our energy security moving forward as well, hence your focus on research, development and technologies et cetera. In that context, what is your position on nuclear energy?

**Mr Warren**—We have no position on nuclear energy. We do not represent it. We do not have a formal position on it.

**CHAIR**—The name of your council is the Clean Energy Council. Would you agree that nuclear energy would fit into that? In regard to all of the things that you have just put on the table about needing to invest in proven technologies, nuclear would be a proven technology which would be able to achieve rapid reductions in greenhouse gas emissions. Of all of the things that you have put on the table, nuclear would fit the bill, wouldn't it?

**Mr Warren**—We do not represent the nuclear industry. We do not represent nuclear technologies. It is a definitional issue for our industry.

**CHAIR**—So, rather than a clean energy council, you are a peak body for a certain section of the energy industry. Is that correct?

**Mr Warren**—No. We call ourselves the Clean Energy Council and we do not represent the nuclear industry.

**CHAIR**—But you represent a certain section of the energy industry.

**Mr Warren**—Yes, and that will presumably increase over time as we move to a decarbonised economy. The scale of the section of the energy industry that we represent will change depending on the development and the introduction of other technologies.

**CHAIR**—Do you agree that nuclear energy is a proven technology?

**Mr Warren**—It is definitely a proven technology.

**CHAIR**—Do you agree that it is one of the lowest carbon emitting energy technologies?

**Mr Warren**—Yes. There are different metrics, but it has a lower carbon intensity than, say, fossil based fuels. That is clear.

**CHAIR**—The University of Sydney, which appeared this morning, essentially puts it on par with wind generation in terms of its level of CO2 emissions.

**Mr Warren**—I have seen different metrics, but it is not something I am close to. It is lower than—

**CHAIR**—If Australia did have a nuclear energy industry, would they be able to become members of the Clean Energy Council?

**Mr Warren**—I would say not at the moment, no. The board would review it, but I think it falls outside what we consider to be eligibility for membership.

**CHAIR**—On what basis?

**Mr Warren**—I am trying to recall. It is in our constitution. Robert, can you recall it?

**Mr Jackson**—Again, we are working off my memory. I do not know that it is explicitly excluded from our membership position, but at the moment none of our members are investigating nuclear in Australia. If a nuclear proponent were to come to us, it would be a decision of the board as to whether their membership were accepted or not.

**CHAIR**—How do you become a member of your organisation?

**Mr Jackson**—Membership is finally approved by the board.

**Mr Warren**—If you are either investing in growth or deploying the clean energy space then—

**CHAIR**—I know. I am just really intrigued. I support a lot of what you have said in your opening statement. It was a very assertive statement in terms of what was required and in terms of reducing emissions, yet a technology that would fit the bill on all of the things that you have raised is excluded.

**Mr Warren**—Equally, we do not represent companies investing in or developing carbon capture and storage technologies. So, again, it is not that they do not potentially have a role to play and that they, if successful, are not an important technology. That is not the scope under which we operate.

**CHAIR**—So you represent some clean energy?

**Mr Warren**—Honestly, it is semantics. It is clean energy because it is beyond just renewable energy. You can argue about the definition and say that geothermal is not strictly renewable in that it is sourced from the earth's crust, which is a very long term energy source. You can argue that solar energy is not renewable, because ultimately the sun is going to peter out. You can get stuck on semantics for about three weeks on this, but we represent those technologies that deploy clean energy. We do not represent clean coal and we do not represent nuclear. That is a reasonably succinct description.

**CHAIR**—You represent hydro, wind, solar, geothermal and biomass. Is that right?

**Mr Warren**—Yes, and wave.

**Mr Jackson**—Energy efficiency.

**Mr Warren**—It goes into smart metering, smart grids, transmission, infrastructure and financing. It is an increasingly broad church.

**CHAIR**—Looking at Australia's energy demands moving forward, what changes to the policy settings do we need beyond what is currently on the table to ensure an affordable, secure, reliable and environmentally sustainable supply of energy?

**Mr Warren**—I think the challenge at the moment is on a range of fronts. What we have noticed as an industry—and I think it will be the case should the CPRS pass—is that we focused heavily on getting the renewable energy target legislation passed and until those major policy hurdles are out of the way it is hard to see the dynamic behind them because they preoccupy you. I think we are seeing that with the large energy generation sector. It is really preoccupied with the design features of the CPRS. Once that is passed, we expect there to be a lot more dynamism within that market as well.

Thinking about the things you would need, we think one of the serious challenges for the entire energy sector, not just us, is the financing of infrastructure and the investment required. It used to be the case before the imposition of extensive measures to reduce greenhouse gases that, as you would be aware, large-scale generation assets were pretty safe and dependable investments and attractive to superannuation funds and other investment sources because of their stability, but that has changed. I was talking to someone in the industry a few days ago and the risks in developing just coal fired generation have increased markedly in the last few years because of the risk of a carbon price and uncertainty about how that will evolve. Gas to electric is probably the safest bet among the technologies because of its lower carbon intensity, but there are still concerns about the price of gas and how the carbon price will affect its viability in the markets over the next 20 or 30 years, which is the life of the infrastructure.

Within the renewable space, you have proven and tested technologies like wind, solar and hydro, which are able to be developed now, but there are a range of risks beyond just the commercial risks—of technological obsolescence and of how policy measures may change in the future to advantage or disadvantage different technologies. So we want this transformation to the best solutions, and carbon capture and storage as well, should that prove to be commercially viable. I am sure that some will say that they will need investment in nuclear power stations for the same reasons.

**CHAIR**—Carbon capture and storage is something that needs to be pursued, but it is not a proven technology.

**Mr Warren**—Correct. Again, you do not want to have carbon capture and storage technology fail because we fail to raise the capital needed to find out if it works at a commercial price. That applies to all these spaces. But in the current financial markets it is still challenging for all project proponents to raise the capital to invest in infrastructure for the grid. Where the grid gets developed is a function of which technologies you think are going to play a role in the grid over the next generation, and that is by no means clear, so there is a risk premium on all these investments.

**CHAIR**—Are there any issues from a taxation or regulation point of view that you think the committee should focus on?

**Mr Warren**—You would be aware of recent events within our industry, but prior to this we worked on this with a company called Solar Systems, which received support under the Howard government's LETDF and from the Victorian state government as well. It has been put into administration. We are not fully au fait with the details, but that reflects the observation from where we sit that, despite the genuine good intentions of governments in Australia to provide

capital and support for these kinds of technologies, it is the mechanism by which that support is provided which needs to be improved.

We do not want Solar Systems and companies like that to fail because they could not raise capital or develop their technology. If they do fail, we want it to be because the technology did not work or it was superseded by much better technology. That means we are getting some work done and we will be advising governments in the immediate future on recommendations to make adjustments to the tax laws to incentivise investors and venture capital funds to take greater risks and spend more money in supporting these kinds of technology development.

**CHAIR**—In your submission to the energy white paper, you talked about the need for more recognition of the role of energy efficiency and the need for complementary policies. Would you care to expand on that a bit for the committee?

**Mr Warren**—I think the International Energy Agency estimates that, to deliver the sort of abatement required by 2030, 55 per cent of it will have to be delivered by energy efficiency measures. The problem with energy efficiency is that it is not one policy area; it has probably six to 10 discrete policy components. You have measures to reduce peak load demand—for example, from air conditioners on hot days and heaters on cold days. Then you have measures to reduce more constant demand—getting all use of energy more efficient over time, such as through efficient fridges or hot water systems in households. You have varying peak load. As you get, say, more renewable energy technologies into play with wind and solar, the provision of cheap electricity may occur at different parts in the day. We have conventionally encouraged hot-water tanks to operate at night-time because that is when electricity is cheapest because the demand is lowest, and large-scale coal generation still continues to operate through the night. Those may change over time as well. Each of those policy measures are different within households, the commercial sector and the major industrial sector. That is just the starting point of the debate. It is an overlay of complex issues. But, successfully delivered, energy efficiency can deliver the lowest cost energy. It is potentially the cheapest way of reducing greenhouse emissions and improving the efficiency of the economy but it is by no means a simple exercise.

**Senator HUTCHINS**—Thank you, gentlemen, for coming along today. As the committee has been meeting over a number of weeks and months, one of the things that has struck me—and I would ask you to respond to this observation—is that there is no clear path around what clean energy is, how we get there and, in the end, how much it is going to cost. In my opinion, I do not think consumers in this country are aware of what policymakers are talking about as the ultimate cost of energy. I do not think they know what they are being asked to consider.

You talked about how Solar Systems went into administration. I preface my remarks with this—and, as I said, welcome your observations—because maybe the situation with Solar Systems just reflects the fact that, as we have heard, in this country solar power is not an alternative to the cheap energy we have with coal. We have heard how much of a solution carbon capture and storage might be. We heard this morning from a professor of physics at the University of Sydney and we have also heard in our travels that it may well be a solution, but do we know how much it is going to cost? The fellow from the University of Sydney said it was probably mismatched, and from what I have seen, at least in our travels, is that paying for hundreds, if not thousands, of kilometres of pipeline to be put somewhere in the middle of

Australia is going to cost a sizeable fortune. I would like to hear your opinion too, Mr Jackson, if you do not mind.

**Mr Warren**—We do not necessarily express views on technologies outside our jurisdiction, except that I think we all welcome breakthroughs in any of these spaces. If carbon capture and storage can be developed and driven down to an affordable cost then that is welcomed. But cost is the major challenge for it, as it is for clean energy technologies. So, to go back to your question, you are right; cost is the primary issue. I think households and businesses are not aware of the potential cost increases that are incurred, and that is not helped any by retail price controls on electricity in all states bar one in Australia—and in some jurisdictions they are 75 per cent lower than they should be to reflect the true, full cost now. So it is a politically sensitive space, because that demonstrates those jurisdictions are concerned about that immediate commercial relationship. But, at the same time, without the full price, without deregulation of those markets and probably greater competition within the electricity market, there will be no incentive or weak incentives for businesses and households to improve their efficiency, as well as for making switching to clean energy technologies relatively affordable because the full price of carbon based energy is realised. That deregulatory framework is fundamental for this to progress.

And there is a degree of uncertainty. I would suggest that anyone who tells us they know what the future is going to look like does not know what they are talking about, because we do not know what the future is going to look like. There were predictions made before the renewable energy target legislation was passed about what would happen straight after it passed, and none of them have come to fruition. So it is very hard to project into the future.

I do not think the experience of Solar Systems reflects that solar technology is not working; I think it is one company's experience. There are myriad reasons, I suspect, why that happened. It does reveal the uncertainty of R&D and technology development, and that uncertainty exists, I am sure, in CCS as well as in the development of these clean energy technologies. The main issue we would point out is that we get a sort of a first-market approach from proponents in this debate. I have been thinking about this for a while, because I am all for first-market policy when you can get it. The problem with this issue is that it is time constrained. We want to use markets to drive outcomes because that is the most efficient way; however, we also have to accelerate the results. We need to do 30 or 40 years of research and transformation in 10 years. First-market theory does not allow for that, and sometimes we have got to force measures to find out more quickly whether or not they work and at what price. That means it is going to be more expensive, in the same way that getting a rush job on a redevelopment of a property is more expensive. There is no point doing this in half-measures. Either you do not bother doing it or you do it as quickly and decisively as you can—and that is going to cost more.

**Mr Jackson**—I would just add a couple of things, if I may. Firstly, we have got to realise that we have come from 100-plus years of very cheap coal generation here in Australia and around the world. It will cost money, of course, to decarbonise that coal or to find alternatives. As Matthew has just said, we have to cram in a whole lot of R&D and other development to bring some of the technologies through their learning curves and to become as efficient as they can be. Some of these technologies are going to be relatively cheap compared to others; we do not quite know what. We certainly have lots of people telling us lots of different things as they develop their technologies, but it will cost more. What has happened in Australia is that, on the back of this very cheap coal that we have here, we have been building extremely inefficient buildings

because the cost of electricity has been so low. We have plenty of opportunities now, as the costs start to rise, to improve these inefficiencies. So, while the price of electricity might go up, it will not necessarily translate into an increased cost to the user as they improve their efficiency.

As for exactly which will be the technologies that win in the end, I expect to be surprised. I think there is a position for solar in its varying forms, but I also hope that geothermal, ocean, extra bioenergy and, potentially, carbon capture and storage will all be part of the mix.

**Mr Warren**—And wind.

**Mr Jackson**—And wind, of course.

**Senator HUTCHINS**—Thank you.

**Senator BUSHBY**—I am interested in the energy efficiency side of things. It has been put to me that there are up to 50 per cent energy savings in energy efficiency. Is that realistic?

**Mr Warren**—Yes.

**Senator BUSHBY**—Is it realistic in an economical manner? I know what you are saying about the need to renovate the house quickly. I imagine energy efficiency could be income positive for a lot of aspects of the economy.

**Mr Warren**—You would probably be aware there is some research that started circulating about two or three years ago from McKinsey that projected a possible scenario for the cost abatement curve through to a 20 per cent reduction in emissions in Australia and globally. That inferred that the first tranche was through energy efficiency, and that actually made money. That may be true, but if it was that easy and that obvious then people would be doing it now.

**Senator BUSHBY**—That is why I am asking.

**Mr Warren**—There are market impediments but it is unlikely they are just informational. There are companies in the space now that provide services to large energy users to reduce their power bills, but that clearly is only a fairly small proportion. The complexity of energy efficiency is understated in most cases. There are lots of little schemes—whether it is changing light bulbs, putting insulation in houses or making other micro-improvements—and they are all worthy, but there are myriad changes like that required. There are a number of different schemes under proposal but we have not seen a CPRS kind of scheme which delivers that transformational change as an overarching—

**Senator BUSHBY**—Surely an emissions trading scheme would provide economic incentive for energy efficiency.

**Mr Warren**—It would to a degree but, again, a carbon price will take time to take effect. Certainly revealing the full price of energy and electricity to consumers is crucial. Without that there are weak incentives to improve energy efficiency.

**Senator BUSHBY**—Compensating the vast majority of energy users for the higher prices will not drive efficiency, will it?

**Mr Warren**—If you compensate any household or other entity indirectly then it still pays a high price for electricity but is compensated indirectly so that it can use that money for other things. If you compensate through the electricity price then of course you will not get any change.

**Senator BUSHBY**—Increasing the size of people's resources is probably less effective than putting the price up and forcing them to use those scarce resources in a more efficient manner.

**Mr Warren**—Things like regulations and standards are probably more relevant in this space than others. The free market thinking is that if people want to pay more for a very large television that has very high electricity consumption then so be it. Just as a way to make cars better and safer is to regulate them to be safer rather than letting road deaths be the driver of that performance, there might be a point where we say a similar thing for energy. We suspect regulation will play a greater role here than in other policy spaces.

**Mr Jackson**—I suspect we also forget that research, development and so forth are going on in the energy efficiency space, just as they are in the generation space. If you walked into Beacon Lighting a few years ago and looked for a light globe, they would have all been incandescent tungsten filament tubes. In recent years that has been growing and growing, and more and more technologies are starting to come on with the compact fluorescents and now the LED lights. However, I look around this room and I suspect that they are just standard down lights that are shining on us now. They could be replaced with much more efficient light globes probably in the same fittings or at least with minimal change, but the Radison for its own reasons has not done that. Part of that is getting us as users of these lights used to the slightly different characteristics of the new lighting or, alternatively, improving the new lighting to a point where we do not notice the difference.

**Senator BUSHBY**—To the point where it delivers similar characteristics.

**Senator BUSHBY**—Deliver similar characteristics.

**Mr Warren**—Yes. There is still research and development going on even in the energy efficiency area that will make it easier for us to evolve as time goes on.

**Senator BUSHBY**—The attractiveness of energy efficiency to me is that you can deliver equivalent cuts in carbon dioxide and equivalent gases without necessarily impacting on the way we do business generally to the same extent. It mitigates the overall impact of climate change policy if you can do it in an easy way that actually saves the Radison on its power bill.

**Mr Jackson**—Absolutely. But there are issues to do with access to capital. While it might make sense to do so, has the owner of the building got access to the capital to do the work? Yes, the NPV might be good, but if you have not got any money in the bank at the time—

**Senator BUSHBY**—Absolutely. There are obviously barriers to it and they are barriers that government policy can assist with. To some extent, that is what I am interested in hearing about.

**Mr Jackson**—Some of those barriers can be overcome with regulations, with education or with other mechanisms.

**Senator BUSHBY**—I accept Mr Warren's comments about the likelihood of having a road accident is not necessarily going to drive some of the safety improvements to the extent that we need. Speaking as a free market politician, maybe this is a case where regulation is appropriate. Changing the subject slightly, you are here to talk about clean energy and its ability to supplant less clean forms of energy. We have had a lot of evidence presented to us that the clean energy sources at this point are not capable of adequately providing sufficient security and reliability of power in the short to medium term through the transition process, primarily because none of the generally accepted clean energy sources of power are yet capable of replacing coal fired power stations. We were at the Yallourn coal fired power station yesterday. It provides 20 per cent of Victoria's energy. If that closed down in three or four years time as part of the CPRS project, there is nothing yet that could replace that within that timeframe. What are your comments about that?

**Mr Warren**—I would say that I do not think that there is anything that could replace Yallourn in three or four years if it was shut down, because it would take that long just to build some gas.

**Senator BUSHBY**—They are some of the practical issues that have been thrown up to us. How do we deal with those?

**Mr Warren**—It would take 10 years to build another coal fired generator from woah to go, I suspect. Would that be unrealistic?

**Senator BUSHBY**—You can build gas in less than five.

**Mr Warren**—If you really got in your bike, you could build gas maybe just in time in four years. But that would be fairly ambitious. There are different constraints on the renewable technologies, but the same sort of logistic constraints would apply in those short runs. That is why the approach of achieving a renewable energy target of 20 per cent by 2020 is good. It may need to be higher. If we are successful early, it can go higher. That would be a great problem to have.

**Senator BUSHBY**—But in the meantime, you have a proposed CPRS, which is, as we understand it, likely to provide permits—at an inadequate level according to some—to help the coal fired generators for maybe another three or four years. After that, the argument is that they will become unviable and there will be no incentive to invest in upgrades and maintenance in the meantime. I am talking about the transition; I am not talking about 2020; I am talking about what happens between what happens and 2020. It puts at risk the security of supply—Victoria is a great example—of energy for Australians if we cannot solve that problem in the meantime.

**Mr Warren**—I am not an expert on this, but I am referring to some good research—and I am sure that you have heard of this—from one of our board members, Paul Simshauser. He wrote some papers on this. The nature of the electricity market, and the advantage of the electricity market, is that the whole thing does not collapse overnight. What happens is that eventually there comes a point where aspects of or entire units of the most inefficient coal fired generation

are closed down either temporarily or permanently or turned off for a while and then turned back on. But eventually they are phased out.

**Senator BUSHBY**—Which is in a sense the intention of climate change policy.

**Mr Warren**—That is the idea. As that happens, that creates a slight undersupply, which creates a spike in the electricity market which makes the other coal fired generators down that end slightly more commercially viable in the short run. I think it is called the wounded bull theory. So, as these weakest generators, the least efficient, most carbon intensive generators, drop off gradually, they make it easier for the other generators to survive in the marketplace until, inevitably, they are next. And that is the way it is supposed to work.

**Senator BUSHBY**—I think that actually fits in very well with what was put to us in regard to the Victorian coal fired generators. Because they are brown coal fed, they are less efficient in meeting carbon costs, which will be much higher, so they will drop off the perch before similar generators in New South Wales, which would lead to Victoria having to import energy from New South Wales and other parts of the grid. They already do that to some extent, some from Tasmania and even South Australia at times, I think. But for this transition period it is going to increase their dependence on energy generated outside—

**Mr Warren**—Yes.

**Senator BUSHBY**—Victoria, which has the potential to threaten the reliability of power in Victoria.

**Mr Warren**—That depends. At the same time, it is unlikely that most of those generation assets—and Rob would know more about this—will just go idle. They are likely to be switched. My understanding was that the weakest of the bulls is a power station called Playford in South Australia and that that is quite a good site for gas fired baseload generation. So you would not just shut it down; you would replace it, or potentially replace it, with a large gas generator to fill in the gap. The challenge there—and again it is not our space entirely—is accessing the gas, because that is constrained by infrastructure. This comes back to some of the risks about where you build new capacity, how you develop the grid and which kinds of technologies you develop a grid around, because projecting those sorts of investment cycles is not entirely clear. And the location of some of that generation may change. For example, new gas, particularly in Northern Australia, might be built in conjunction with large-scale solar, because you can reduce the carbon intensity of that gas usage considerably. Again, there is a premium on all that investment. Inevitably, the market will build behind it, whatever it is.

**Senator BUSHBY**—There is a premium on it all. Quite clearly, even what you were just saying there about the uncertainty of the grid and all those sorts of things highlights the uncertainty of this transition period and its potential impact on Australians. Where my free-market views do come into play is in the fact that the government is going to have to drive a lot of this to rebuild the building more quickly. But governments do not always make the best decisions, and there are obviously a lot of options in terms of how they manage this transition period. The key to ensuring Australians get through it in the best possible shape is government making the right decisions. That is the challenge. Looking at all these options, how do we

encourage the government to pick the options that are going to deliver the best outcomes for Australians?

**Mr Warren**—We do not try to prescribe beyond the RET, which we think is a reasonable, quite achievable target. The fact that the price for certificates did not skyrocket when that legislation passed indicates a degree of confidence within the electricity market that they agree. The second point I would make is that most of the major generators, the companies we are talking about, both government and privately owned, are members of ours and have investments in clean energy technologies and will scale those up. They will match that with other technologies according to what they see as both the efficiency and cost of those clean technologies, and their complementarity with other technologies. Our role is really to try and help optimise that relationship. So, in a sense, providing there is dynamism and competition between those players, and access to capital to make those investments, then you should be comforted that they will probably make prudent decisions or reasonably prudent decisions.

**Senator BUSHBY**—But it is also an issue because, as a committee, we have seen information that shows that a lot of the large companies that have made investments in energy in the last couple of decades are going to suffer severely in terms of their bottom line as capital revaluations of their assets occur, and they are already occurring. Their ability to go out and seek new capital at a time when they most need to, because the policies are driving that to gradually occur, is actually impaired by those very same policies because their asset value is being severely weakened. Their ability to do that is not as strong as it was, so we need new players or for them to find a source of capital somehow. It once again makes it more uncertain, in this transition period, where we are heading and who is going to be able to afford to do that and deliver the new sources of energy generation that we are going to need.

**Mr Warren**—Rob might have more to say on this. There are two things I would observe. One is that my understanding is that the rationale behind compensation for large-scale generators is to compensate them for the loss in the value of their asset—

**Senator BUSHBY**—But it is very much partial compensation, even by the government's own assessment of the impact.

**Mr Warren**—We will leave it for others to argue that, but we certainly acknowledge that that is the rationale. That is useful in the ability to be able to reinvest in cleaner technologies. The second thing is that the most useful thing we can do as an industry and as an industry association working collectively is to try to do everything we can to drive down the cost of these technologies and to prove them to market so that investors and governments have great certainty as quickly as possible about whether and on what scale these technologies can play a role. Can they do a lot or can they do more? It is the certainty that is required. Bringing that forward, it is resolving that uncertainty, and proving through technologies either the failure or success is the most useful thing we can give investors.

**Senator BUSHBY**—I cannot argue with any of that. I think we discussed earlier that nuclear technology is a proven technology. This morning we heard from Professor Lenzen. He is strongly in favour of the need for action on climate change. He is strongly in favour of looking forward and making sure that we have technologies that are capable of removing as much carbon as we can from the atmosphere. His view was, looking forward, the only proven technology and

the only way we can do that is nuclear technology. That is not to say that he was not also very supportive of the need to do what you are doing as a complementary measure. As a backup in case that does not come through, you also need to put some eggs into the nuclear basket.

**Mr Warren**—Australia is one of maybe four countries in the world that at least has the capacity to power itself entirely from renewables. That is not because we are clever; it is just because we are a very big country with extraordinary wind assets, extraordinary sunshine, extraordinary thermal and world-best hydro. The southern ocean currents along the south coast are remarkable in terms of an energy source. We could be the lucky country over again. It does not mean that that is going to happen, but at least we have the potential. There are plenty of economies around the world, without pointing them out, that do not have anywhere like those assets and they have a huge energy demand, and they have serious questions over their existing energy policy. It really comes down to trying to resolve that uncertainty so that governments can make prudent decisions and companies can make prudent decisions. The quicker we can have certainty about where the grid needs to run and what design it should operate under, the cheaper the transition will be.

**Senator BUSHBY**—And with more security and more reliability, hopefully.

**Mr Warren**—Yes.

**Senator BUSHBY**—Thank you very much, gentlemen, for your input.

**CHAIR**—Yes, thank you very much for your contribution to the committee.

**Committee adjourned at 1.56 pm**