REPORT OF PROCEEDINGS BEFORE

PUBLIC ACCOUNTS COMMITTEE

INQUIRY INTO THE ECONOMICS OF ENERGY GENERATION

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At Sydney on Friday 11 May 2012

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The Committee met at 9.30 a.m.

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PRESENT

Mr J. R. O'Dea (Chair)

Dr G. Lee (Deputy Chair)
Mr B. E. Bassett
Mr M. J. Daley
Mr R. Torbay
Mr J. D. Williams

CHAIR: Thank you for attending this public hearing of the Public Accounts Committee on the economics of energy generation. The Committee's inquiry is examining the mix of energy sources used in New South Wales, comparisons with other jurisdictions and the potential for alternative forms of energy generation. Today the Committee will be hearing from key stakeholders in the energy industry in New South Wales, including the CSIRO Energy Transformed Flagship, Pacific Hydro Australia, the National Generators Forum, the Public Interest Advocacy Centre, the Australian Nuclear Association, the Australian Energy Regulator, the Global Carbon Capture and Storage Institute and the Cooperative Research Centre for Greenhouse Gas.

I declare the hearing open. In opening the hearing, I remind everyone to switch off their mobile phones as they can interfere with the Hansard recording equipment. I welcome our first witnesses, Dr Alex Wonhas and Mr Paul Graham from the CSIRO Energy Transformed Flagship. Thank you for appearing before the Public Accounts Committee today to give evidence.

ALEX WONHAS, Director, CSIRO Energy Transformed Flagship, sworn and examined, and

PAUL GRAHAM, Theme Leader, Carbon Futures, CSIRO Energy Transformed Flagship, affirmed and examined:

CHAIR: Before we proceed, do you have any questions regarding the procedural information that was sent to you in relation to witnesses and the hearing process?

Dr WONHAS: I do not think we have any questions.

CHAIR: I invite you to make a brief opening statement before the commencement of questions.

Dr WONHAS: Firstly, thank you very much for the invitation to appear in front of this Committee. We wanted to provide a brief overview of our activities in New South Wales, to give you a good idea of the expertise that we provide. Firstly, I will give you our background on the Energy Transformed Flagship. This is where the CSIRO brings together all of its alternative energy research. It consists of 140 researchers and makes about a $40 million a year investment into alternative energy research and development.

Our goal is to enable an economically viable transition to a lower emissions and secure stationary and transport energy sector in Australia where research and development is applicable to do that. The flagship consists of three themes: one is represented by Paul Graham, who is conducting the energy sector modelling and analysis; but we also have extensive research on alternative supply technologies, both in the generation space and the fuel space; and we have extensive research activities on the demand side, including energy efficiency, smart grids, distributed generation and integration of renewables into the electricity grid. There are also two other areas in CSIRO that might be related to this inquiry. One is the work that we are doing in advanced coal technologies; and the other is on unconventional gas and geothermal, which we do not have direct line accountability for, but we can certainly endeavour to provide additional information on that, if that is required.

To give you a short overview of our footprint in New South Wales: it is actually what I would call the home of the Energy Transformed Flagship. In Newcastle we have about 150 researchers based, and another 50 across the State. We would like to build Newcastle as a precinct for energy research, together with the University of Newcastle. To give you a feel for the technology work that is being conducted here: there are two solar thermal plants operating in Newcastle, one of which holds a world temperature record for a solar thermal plant; and we also have a very large-scale grid storage application in Hampton, just over the Blue Mountains, where we smooth the output of our local wind farm, and that technology is currently being commercialised by a Sydney-based company globally. They are currently conducting several projects in the United States based on this technology.

We are also operating a carbon capture pilot plant with Delta Electricity; that is currently relocated to Vales Point from Munmorah. Once that is done, we will look at a hybrid concept for carbon capture that involves solar energy; and we will also understand the impact of power plant emissions on the post-combustion capture [PCC] process. Finally, in what might be an interesting aside for this inquiry, we have an extensive research effort in fugitive emissions, which are a major contributor to greenhouse gas in Australia; and, with the mines in the Illawarra, which are particularly exposed to that, there is technology that we have developed and are currently commercialising in China which can produce electricity from those emissions.

Finally, on the demand side, we have a large-scale laboratory, also in Newcastle, where we test the integration of intermittent renewable energy sources into the distribution grid; and we have various air-conditioning control technologies also being commercialised, by a company currently based in Sydney, on a global scale. And, finally, we are a partner in the Ausgrid Smart Grid, Smart City project. I might hand over to Paul to give a short overview of our energy modelling activities.

Mr GRAHAM: As I am sure you have already learnt at some stage during the inquiry, the starting point for New South Wales is in approximate terms 90 per cent coal, 5 per cent hydro and the last 5 per cent is wind, biomass and solar. In having to invest in energy technologies, CSIRO needs to do its own due diligence, so we study the future mix of Australia and each of the States. Two big drivers of change in the energy mix are managing the renewable energy target and the carbon price. These market price signals are essentially telling the market to make the next investments in either renewable or low-emission fossil power sources.

When we look at the options available, I think we can say with some confidence, although not without any uncertainty, that the next things to be installed on a large-scale will be mostly wind and gas-fired power generation. That is simply because those technologies are more mature and cost less than other options. As we get further out into time, we expect there to be more diversity in the energy mix. That would involve greater expansion of other technologies such as solar, geothermal and coal with carbon capture and storage. Of those three, solar is probably more mature than the other two. All of that comes with a great deal of uncertainty—technological, financial and social.

We have various research projects where we try to reduce that uncertainty a little. For example, on the social side we try to understand the community's attitudes to different technologies and the best practices in the way we deploy some of those technologies. On the financial and technological side, obviously we have all the research projects being undertaken to reduce the cost of some of those technologies. We also have an active engagement in trying to project the future of those costs. We have some public reports available where we have compared not only CSIRO cost projections but also all of those technologies from institutions around the world. We can make all of that available, so I will not go into the detail now.

I know that one of the terms of reference relates to dependency with other States. The two issues that I think should be highlighted are that if that scenario where we need to expand our low-emissions sources emerges, certainly for geothermal and solar technology, it would appear that the largest sources of those resources are in the north west of the State. That could mean we need to expand transmission out into that part of the State. If that were the case, it might require some significant long-term planning and interaction with other States around transmission in that region in general, not only for New South Wales but other States sharing that region of Australia.

The other major dependency with other States that is worth mentioning relates to CO_2 storage. We have a big coal resource here and on current economics and the cost information available, coal with CO_2 storage could be one of the financially viable low-emission technologies that this State deploys. I am sure the Committee has had or will get more information from other stakeholders about that. On current information New South Wales does not have enough storage capacity of its own and would need to work with other States, north and south, to secure CO_2 storage sites.

CHAIR: Thank you very much. The Committee very much appreciates the CSIRO being here today, not only because of your depth of expertise and involvement across a range of areas but also because you bring an independent analysis to an area where undoubtedly and understandably many stakeholders have vested interests. That is not to say that you do not have certain interests. However, my perception is that they are more aligned with the interest that this Committee endeavours to represent; that is, the public interest. To that end, we also appreciate the fact that you have foreshadowed providing some of that data, because it is a complex area and brings together a lot of the work that many have done. We do not intend to replicate it, but we do intend to try to source information that is reliable and to present the most accurate picture that we can. To that end, I am sure we will take up your offer to provide the analysis that you have done on relative pricing. I will begin the questions, but I will involve all members of the Committee. We have one apology today, but the Committee is representative of the broad Parliament. How do you think the New South Wales Government can best encourage investment in alternative forms of energy generation?

Dr WONHAS: The important thing is to be crystal clear about the objectives for the investment. I can think of four objectives in general: cost, security, clean energy and job creation. Unless you define where you sit on those objectives it is difficult to say how the investment should be structured. For example, one of the pieces of work that we did in 2009 was called the Intelligent Grid Report. We looked at Australia's energy system as a whole, with and without energy efficiency demand side response and distributed generation. We saw a very significant difference between those two scenarios. Expressed in net present value [NPV] terms, it was $130 billion at 7 per cent discount rate. So, depending on what parameters you set, you can get some very, very different economic and environmental outcomes in the energy sector.

CHAIR: You have touched on where you think some of the trends are heading, and in particular I think you referred to in the medium term, but also in the shorter term, what some of the more attractive alternative energy sources might be, or, indeed, energy sources. But if you looked at it in 20 years time what picture would you perhaps paint in terms of the breakdown then of the major sources of electricity, moving from where we are today?

Dr WONHAS: I think, as Paul already mentioned, the one characteristic where there is agreement amongst most forecasters is that it is going to be a mix of energy sources. At the moment, obviously we are quite heavily coal-dominated. Even in 20 years time I would expect, unless we do something very dramatic, we will still be quite coal-dominated, but we will then have an additional mix of probably a whole range of different technologies—most likely solar, due to its maturity; wind obviously, due to its maturity—and then probably the question marks start around the potential for geothermal and there may be a potential for wave, although the resource here in New South Wales is not as good as maybe in other States.

CHAIR: You have touched on wave, and this question relates particularly to wave energy. I note that Oceanlinx, along with other wave power companies such as Ocean Power and BioPower Systems, have received various government grants to develop wave power technology, but to date there has been fairly little to show for it, as I understand it. Do you think that wave power is a commercially viable energy source or will become one, or is it really more just, dare I say it, a nice thought, which I know CSIRO has at times championed or promoted? One comment that CSIRO might have made is that wave energy along the south coast of Australia was five times greater than current electricity needs. Wave power is not an area that, to date, we have really focused on, and you mentioned then. Do you think realistically it is something that we should look at in more detail or is it really just another possible green pie-in-the-sky potential source?

Dr WONHAS: The first part of your question touched upon the maturity of the wave industry. My assessment would be that wave is probably no different to many of the other emerging alternative energy sources. Many of them are struggling to demonstrate. I think wave has a number of demonstrations going. You mentioned Oceanlinx, which is obviously having some operations in New South Wales; I think Carnegie just received a grant to build a major facility in Western Australia. Obviously, with all of these technologies there are risks involved in developing them and I think we will probably learn over the course of the next five to 10 years whether they will ultimately be viable options or not, but at this point in time I would certainly consider them a contender.

In the second part of your question I think you touched upon some of the statements that we have made about the wave energy resource. I think the statement is true for almost any renewable energy resource, that there are plenty of renewable energy resources available. The real question to ask is what does it cost us to extract that resource? We are happy to make that available; we are about to publish a kind of follow-on report where we have taken the resource data and have tried to translate it into what is ultimately the cost of generation that we could expect from this. That is probably somewhere in an attractive range of maybe $150 to $200 per megawatt hour, if the technology is working at scale and for the longevity that we require it to be.

CHAIR: The Energy Transformed Flagship has been conducting research, and you alluded to it, into technologies for storing energy, and at the recent conference where I heard you speak and we spoke that was an area of discussion that we touched on. I am particularly interested if you could put on record some information about those projects, because my personal view is that storage is absolutely crucial to making some of the other technologies that are somewhat intermittent more viable.

Dr WONHAS: You are right; storage is a vital enabler, especially if you are thinking about a future electricity grid with a high penetration of intermittent renewables. That is why for many years we have conducted research into the space. We are conducting it in two aspects of storage: one is the development of actual new battery technology that is particularly suited to that task, and CSIRO has developed and now commercialised a modified lead-acid battery called the UltraBattery, which is cheaper than comparable batteries with similar performance and particularly suited to the grid integration of renewables but also for hybrid electric vehicle applications. It is currently being produced by East Penn in the United States, which is the largest independent battery manufacturer, and Furukawa in Japan.

The second aspect of what we are doing is that we are then using these technologies to basically do a grid integration of renewables, and that is where this project that is happening in Hampton in New South Wales fits in, where we have a large one-megawatt battery bank and we basically take the output of the wind farm and provide a more smooth output into the electricity grid, which then can support the grid and which can also provide regulation services for the electricity grid. They are probably the key aspects of storage research that we are conducting. Maybe there is one addition: If it goes ahead, we are also the lead research provider of the Moree Solar Farm, and that would obviously also have a very large storage and grid integration component.

Dr GEOFF LEE: Can I reiterate the comments of the Chair about the CSIRO's great reputation for being a fairly independent body and how it is doing some great research in all different areas as well as in

energy research. You mentioned in your opening statement and in some of your comments about the role of coal-fired power stations and that in the next 20 years we are fairly much going to be still reliant upon those, as far as you can see. If we are going to move towards a clean energy economy, the emissions obviously then become the problems. I mean we have so much coal it is probably a competitive advantage for New South Wales in terms of a large supply of quality coal for those power stations.

The first part of my question is: in the next 20 years what do you see is the likelihood of developing economically viable storage sites within New South Wales or anywhere? It does not really matter where it is; if it goes across the border we do not mind if it goes to Victoria or Queensland. What do you think will be the economic viability of large-scale storage facilities? The second part of my question is: can you give us an indication if it will make it economically viable when we are thinking about a $23 a tonne carbon tax, if it is actually repealed in, say, the next 18 months—which it may or may not be but could be? What will that do to its potential, because obviously the higher the carbon tax the more viable storage becomes? Is there a point where it does not become very viable?

Mr GRAHAM: I might handle that last question first. One of the interesting things about the market in general is that uncertainty about whether there is or is not a carbon price is just as important as whether there is one or not. For example, before we had the carbon price legislation it would still be difficult to go to a bank and say, "I want to build a coal-fired power plant", because even if there is the risk of some future carbon price, that is too much risk to build a $3 billion plant of any nature and that means it is not viable. So to some extent whether there is or is not a carbon price is not necessarily as big an issue, as long as we are reasonably clear from both sides of Government that we want a low emissions future, because then we are only really interested in deploying low emission technologies, or it makes it very difficult to deploy anything but that with the risk that you may deploy it and then it becomes financially unviable. I think in general what you can say is that the market will need more certainty around whether there is or is not a carbon price in order to go ahead with any type of plant. It is not unique to coal and it is not unique to renewables or to any particular plant type.

In terms of the cost of storage—and you will probably be able to get a better view from industry on this—the storage cost is not as big as the plant and capture components, as they are. The storage cost itself can vary quite a bit and it will not necessarily change the economics of coal with carbon capture and storage [CCS], but where it has an impact on investment is that you are not going to build that plant unless you are quite confident that you have a storage site, so where we have got to with that issue is essentially needing time to prove up the storage sites before an investment can proceed, but there is not an expectation that ultimately the storage will be the thing that changes the economics of the project, if you understand what I am saying.

Dr WONHAS: Building on this, I think you asked for what is really ultimately the range when carbon capture and storage will become economically viable. It is obviously always hard to predict the future cost of technologies, but I would say that when you look at current estimates for those technologies it is somewhere between $150 to $200 per megawatt hour in cost, so that is at least at this point in time quite well above at least current wholesale market prices. You also asked about the viability of storage in New South Wales. I should say that I am probably informed, but I am not the expert, but we can certainly provide some expertise on it in New South Wales. The general consensus is that there are reasonably promising sites and geological structures in Queensland and Victoria, but less so in New South Wales, so there would probably be more work required to establish viable storage reservoirs in this State.

Dr GEOFF LEE: You talk about the differential pricing of capture and storage of $150 to $200 per megawatt hour. I know it is hard to predict because 10 or 20 years is a long time in terms of technology advances, but are we at the start of the curve in terms of technological advances in carbon capture and storage so that the price will come down in the future? We know that solar started off being very expensive and we are reaching maturity curve, and perhaps without any great leap forward we are at 90 per cent maturity.

Dr WONHAS: I think for carbon capture and storage, as with probably most of the technologies we have discussed, we are very much at the beginning of the learning curve and when we look at, for instance, what is in the research pipeline in terms of new capture technologies that reduce parasitic power losses, et cetera, there is still a lot more innovation that can reduce the cost in the long term—I am very confident of that. The key challenge though, I think it is important to say, is people will only make the investment in those innovations when they see deployment of those technologies, so if those technologies do not get deployed and big industry does not get interested in it, it would be very hard to justify the research programs and development programs to bring those costs down.

Dr GEOFF LEE: So it is a market-driven or price-driven form of investment to drive costs down.

Dr WONHAS: Yes, without deployment of those technologies I would argue that, unless we have some phenomenal breakthrough, it is probably unlikely that we will see the costs coming down. That is exactly what we have seen across all of the existing technologies—be it wind, be it solar—where over the last couple of decades we have seen some significant cost reductions. It is all driven by deployment.

Mr BART BASSETT: Following on from what you said earlier about storage, you have not mentioned loss. What are the losses in going from, say, wind farm to battery technology and back to the grid? Are there significant losses?

Dr WONHAS: Losses depend ultimately on the technology deployed. I think with our technology about 85 per cent of the energy gets returned to the grid, so the loss is 15 per cent.

Mr BART BASSETT: You mentioned geothermal and said, for New South Wales, probably the north west of the State. Based on that, why do you think there has been a lot of talk about geothermal, certainly in publications, but it does not seem to have any legs? Does that relate to the technology itself or do you think there are impediments to investment in that sort of new generation project?

Dr WONHAS: I think geothermal is very comparable to the wave case that we have just discussed. I think it is probably at a comparable maturity stage. The characteristics of the technology are that you have to drill very expensive wells to demonstrate the technology at scale in a very uncertain environment and, therefore, it is very difficult to get investment because the return is uncertain. That is probably the inhibitor. The reason why people talk a lot about geothermal is because the promise is obviously very significant. As you know, if it all works—and, most importantly, if you can achieve very high flow rates between the well doublets—then there is the potential of generating dispatchable or baseload electricity at very competitive cost, but the challenge is that we have not really demonstrated that at scale and the investment required to get it there is very difficult. That, I think, is the challenge that this technology faces.

The second part of your question related to regulatory issues. One of the key challenges with geothermals is understanding water flow very deep down under the earth. That is not yet that well understood and that is certainly an area where we invest a lot in our research. I think that then flows through to the regulatory regime because, as I understand it, one of the issues is how the reinjection of the water into the ground is treated and I suspect if we better understand the dynamics of the groundwater flow it might be easier to regulate that.

Mr BART BASSETT: Because of coal seam gas having such interest in the media, and one of the big standouts is the concern for groundwater, based on what you just said, how much research is the CSIRO doing in understanding groundwater and the implications for energy?

Dr WONHAS: I do not have the exact numbers off the top of my head, but I can certainly try to find this out. Given the interest in this area, it is very high on our strategic agenda and we think it is important to grow that area of research.

Mr JOHN WILLIAMS: As one of the few research organisations providing a submission to this inquiry, how do you feel about an understanding that research and development relies primarily on a worldwide commitment? How do you feel about the level of worldwide commitment by government and private enterprise towards alternative or renewable energy production?

Dr WONHAS: I do not have the figures off the top of my head, but it is certainly easy to find them, but when you look at global investment into alternative energies it is very significant. When you look at Bloomberg New Energy Finance, I think they made some statements that renewable energy investment is actually outstripping conventional energy investment, which I would argue is probably making a statement in terms of global commitment towards those technologies.

Mr JOHN WILLIAMS: In that regard, do you think it is moving at a pace that will see the evolution in the near future?

Dr WONHAS: I think pace is always a question of balance. Working in alternative energy, obviously we are quite passionate about it. On the other hand, also from having done a lot of these projects we are quite

aware of the economic costs involved in that. So I think ultimately it is a trade-off between how quickly do we want to reduce our emissions and how much are we prepared to pay for it. I think that is ultimately not a question that we can answer from a research point of view; I think that is ultimately a question that society needs to answer.

Mr JOHN WILLIAMS: Do you think manufacturers or developers of renewable energy see an economic benefit in this investment?

Dr WONHAS: I would certainly hope so. Just to give you a concrete example that we are quite proud of and passionate about, the new solar thermal technology that I have mentioned is actually being manufactured by a local manufacturing company in the Hunter Valley. When you look at the potential growth forecasts for the sector I think it could be a significant growth opportunity. That said, as always in life, and when you look at the structure of the photovoltaics industry, which is obviously more mature than solar thermal, all of these industries are in a fast growth pace. They undergo quite cyclical variations. It can be kind of quite tough and not everyone is going to win in this game. I think in Australia we probably need to be quite strategic about if we decide to take this as a growth opportunity what parts of the value chain can we actually sustainably make money in and what parts maybe can we not compete in. Countries like China will probably be a lower cost manufacturing opportunity, but I am certainly convinced that if we wanted to there are certainly high value pockets of the value chain where we could see this as a growth opportunity.

Mr RICHARD TORBAY: Most things have been answered but I have a question specifically on solar. You mentioned there have been cost reductions and there is good investment in that sector. Is it ever going to be competitive in the short term with other power sources? Are we going to get to that level where it is comparably reasonable to go down the road of solar specifically?

Dr WONHAS: Are you referring to the argument of grid parity?

Mr RICHARD TORBAY: Grid parity, yes.

Dr WONHAS: I think the answer is, as often in life, it depends—and it depends on your definition. So maybe just to unpack what this grid parity argument means: Grid parity means that the retail cost of electricity is the same as the cost of power produced from your rooftop solar photovoltaic [PV] panel. It is probably correct to say that very soon we will come to the point where those two are equal. However, I think it is up for debate whether you then say this means that solar PV is doing exactly the same thing as our grid power.

The problem is in your retail electricity price you have a very significant component for transmission and distribution of the electricity from the wholesale market to the consumer. Unless you have storage at a significant scale actually the PV investment does not necessarily mean that you do not need that investment any more. That is basically a fixed cost, so you have to pay for that somehow. Therefore I think it depends on your definition of what you mean by competitive.

Mr RICHARD TORBAY: Because the fixed cost component may not be taken into consideration.

Dr WONHAS: Correct.

Mr RICHARD TORBAY: Do you have any comments in relation to the Federal Government's draft energy White Paper?

Dr WONHAS: No real, specific comments, no.

Mr BART BASSETT: In your opening statement you said something about emissions from mines, especially in the Hunter area.

Dr WONHAS: The Illawarra.

Mr BART BASSETT: Could you expand on what you mean about the emissions from the mines in that area?

Dr WONHAS: Sure. I think one of the quite significant parts of Australia's total emissions is what is called fugitive emissions from predominantly coalmining activities both underground and open cut. So that is

the methane that is captured in the coal seam that gets released into the atmosphere when you mine the coal. By the way it is otherwise the same methane that is also used in coal seam gas production. In particular the underground mines in the Illawarra have a very high intensity of that methane. In normal mining operations what happens is they basically pump a lot of air through those mines to extract that methane, because it is also an explosion risk, and previously they vented it into the atmosphere. Because of the very high greenhouse gas driving intensity of methane it has a very significant impact although the quantities of gas are comparatively small. So what can be done with this gas is the methane can be burned in a catalytic process and that reduces the intensity factor from, I think, 24 to one. That process generates heat so you can either just dissipate the heat or you can use the heat for electricity generation. There is this technology called Ventilation Air Methane Catalytic Turbine [VAMCAT] where you can basically use it for power generation.

Mr JOHN WILLIAMS: My last question relates primarily to the people I represent in some of the remote areas of New South Wales in regard to storage. Obviously those remote areas are faced with the option of connecting to the grid or, alternatively, providing for their own energy. Do you think the technology has reached the maturity and cost levels that make this is a feasible option for households to adopt solar particularly, which I guess would be the main option?

Dr WONHAS: I think absolutely. We have basically an internal road map of how we want to see especially our solar thermal technology deployed. We see the remote and regional communities as the prime market areas because in those communities, because the cost of alternatives is so high, these technologies are or will be very soon cost competitive. The storage problem especially when you move to a solar thermal technology can be solved through either thermal storage which is very cost competitive, much more competitive than battery storage. Secondly, you can then hybridise it with say fossil fuel sources like gas or coal or biomass. We would think that is one of the pathways of actually getting renewable energy cost effectively in the market.

CHAIR: Unfortunately we are running a bit tight for time. I will foreshadow a few questions on notice that we would appreciate a response to if you would not mind. First, we have talked about storage in terms of carbon capture and storage, but also storage of electricity produced particularly via wind and solar initiatives. I am interested in whether your Hampton Wind Park initiative is producing the results that you expected, and at what point do you think it will become commercially viable for all wind farms, or potentially solar farms, to incorporate that sort of battery storage technology in New South Wales? I am also interested in whether you think there is a role for government to better implement or introduce or facilitate measures to manage demand more effectively, and how we might do that.

Another question is that the national electricity market was designed when the vast majority of electricity in Australia was sourced from fuel-based generators. Does the structure of the market, in your view, need to be reconsidered in the scenario where unscheduled or semi-scheduled renewable energy plays a greater role? Finally, we have touched on regulatory impediments to investment. If you have a view on any inappropriate or more appropriate action that government can take in terms of facilitating investment in new generation projects that would also be welcome. Mr Bassett was also interested in getting some data on groundwater.

Mr BART BASSETT: Yes. When speaking about groundwater, did you say you were finalising some data that would be made public?

Dr WONHAS: No. I think I was referring to an oceans report we are finalising. I think you asked a question about how much work we are currently doing.

Mr BART BASSETT: You were talking about planning—

Dr WONHAS: We are currently working through our strategy or what we think is the comprehensive program of work needed to support geothermal coal seam gas, shale gas, if and when that is coming, and carbon capture and storage, because they are a related set of issues. I can certainly share a draft of that if it would be useful to the Committee.

Mr BART BASSETT: That would be great, considering general community interest in groundwater and what you have said about how it relates to energy.

Dr WONHAS: Yes.

CHAIR: Would you please take those requests on notice. Is it reasonable for you to respond by 15 June?

Dr WONHAS: That should be fine. I have two questions. I think we can probably provide answers to all of the questions, but as to the question on the structure of the market I have to say that we probably have not done a lot of research on that.

CHAIR: That is fine. The Committee is also asking that question of others; you might have had a different perspective. It was more if you had a view. The Committee appreciates that you have a commercial interest as well as a public interest perspective, and to that extent you are interested in community attitudes—as is this Committee. In that vein I acknowledge the presence in the gallery today of Iain Walker from the newDemocracy Foundation. I know that CSIRO is going to be working with newDemocracy on a process that, hopefully, will be able to tap into community attitudes and views. I am unsure whether it is through your area or others but it might be appropriate to have a chat with Ian on the way out.

The Committee may have some additional questions to those already foreshadowed, which will be sent to you in writing. The replies to those questions, as well as the replies to the questions previously identified, will form part of your evidence and will be made public. Mr Graham, we might tap into some of your expertise on the economic analysis that we have not discussed in detail today. On behalf of the Committee I thank you both for appearing today. Keep up the good work!

(The witnesses withdrew)

LANE BRYCE CROCKETT, General Manager Australia, Pacific Hydro, affirmed and examined:

CHAIR: Mr Crockett, I welcome you to the Public Accounts Committee inquiry into the economics of energy generation. Before we proceed do you have any questions concerning the procedural information sent to you in relation to witnesses and the hearing process?

Mr CROCKETT: No.

CHAIR: Would you like to make a brief opening statement before the commencement of questions?

Mr CROCKETT: Yes, I would. Thank you for inviting me to appear before the Committee today. Pacific Hydro is a renewable energy company with experience in developing, owning and operating renewable power assets in Australia, Chile and Brazil. We have over 300 megawatts of operating wind farms and hydro power stations in Australia, and we have interests in solar and geothermal developments. Pacific Hydro is technology agnostic. Our basic principle is that we select technology for development based on lowest cost and lowest environmental footprint. We are proudly Australian owned by five million Australian superannuants through the industry funds.

I would like to make a couple of introductory comments about renewable energy in particular. I submit that renewable energy is a reliable, clean, affordable and economically attractive method for generating electricity. In the case of wind, for example, which is today's lowest cost form of renewable energy, we believe that our submission demonstrates that wind is popular in communities in New South Wales and provides jobs and economic growth in regional areas. Finally, I would like to submit to the Committee some quick discussion about the impacts of power generation generally and the economics of it. I would ask the Committee to take into account the broader impacts of power generation when it is doing its review.

By example, there was a study of electricity generation and health published in *The Lancet*, which is one of the world's most reputable health journals. It was found that there are around 24 air pollution-related deaths per terawatt hour from black coal-fired generation. To put that in a New South Wales context, that would suggest that there are around 1,500 deaths per year attributable to the pollution from emissions from black coal-fired power stations in New South Wales. There are also high levels of serious illness and the economic burden of this health impact to the State can be estimated to be around $1 billion per year. We also refer to past studies in Australia on the health and environmental costs, which attribute around $40 per megawatt hour to black coal-fired generation. I request that the Committee take those external costs into account in its review. Thank you.

CHAIR: If you were king for a day, how would you tell the New South Wales Government it should encourage investment in alternative forms of energy generation?

Mr CROCKETT: That is a very broad question to start with.

CHAIR: It is, but you are only king for a day.

Mr CROCKETT: Or even less. I guess what I would start with is the benefit to communities, both locally and generally. We talk a lot with farmers in New South Wales who are keen to put, for example, wind energy onto their properties. For them it is an extra source of revenue, which can make their lives as farmers a lot easier and more profitable. It also brings jobs and economic activity into the area. We also believe that in the long term it is better for not just the local community but the broader community as well, and that is on economic, environmental and health grounds.

The environmental one is clear—the fact that renewable energy does not produce emissions, just putting to the side biomass for a moment—there is a benefit to local and broader community. Also in terms of cost, while the cost, for example, wind power at the moment is higher than the cost of generating electricity from coal or gas, when you invest in a wind farm basically the costs for the wind farm for the next 25 years are predominantly locked in because the investment is completely up front whereas the costs of generation from coal and gas are subject to fluctuating commodity prices of the fuel.

If you look 10 or 15 years ahead, the equation can be very different. For example, if you look at gas where the price is expected to go to export parity, the costs of generation will be much higher. We expect over a period of time that, because the cost of generating from a wind farm, for example, does not really change over

the time, in terms of real cost the other forms of generation are rising, and can rise quite considerably. So investing now in renewable energy is good value. Perhaps I will leave that there for a kick-off.

CHAIR: On page two your submission you say that New South Wales is blessed with substantial potential for wind and solar generation, and good access to the high voltage transmission and local distribution networks close to renewable energy zones. Can you explain which renewable energy zones particularly you are referring to?

Mr CROCKETT: You will already see where the proposed wind farms are in New South Wales. That will indicate where the interest is by the industry. I guess that is already established. I guess probably less established are the resource zones for solar, but it is fair to say that the more west and the more north you go in New South Wales, the better the solar resource. We are a partner in the Moree Solar Farm, which has a fantastic solar resource. Moree is sort of at the end of the line, as it were, and it is just close enough to connect into the system. We do see some barriers for solar, though, in that as you go further west, obviously there is less connection infrastructure. We also have some strong views about marginal loss factor arrangements, which will hurt solar developments in the future as well.

CHAIR: You have touched on the Moree Solar Farm project. I know there is a little bit of controversy around that. Pacific Hydro is part of a group that won a tender and then it was rescinded, as I understand it, due to the spiralling downward costs of solar. Subsequently there was a revised tender process. You might give us an update on that project and your perspective on it. But I also would ask a probing question: Do you think to some extent, given that solar has been so heavily subsidised by government incentive schemes to date—perhaps less so now than in the past, not "perhaps", definitely less so now than in the past—in hindsight, do you think perhaps that Australia and New South Wales acted a bit too soon in encouraging renewable technology, particularly solar, without waiting to see where relative other technologies were? Indeed, going forward, might it be appropriate to see how different technologies or competing technologies emerge before we commit to large-scale investment in renewables infrastructure and continue to subsidise, or potentially pick winners?

Mr CROCKETT: Oh, okay.

CHAIR: It is a difficult question.

Mr CROCKETT: Yes, there are a lot of questions probably in there. Firstly, I will quickly talk about Moree. I do not really want to get into the specifics of Moree except to say that you are correct; it has gone back into a reselection process because we did not meet the conditions precedent for the Commonwealth funding deed. In saying that, the New South Wales Government was also very generous in providing some funding, and that remains on foot. But it is in limbo because of the Commonwealth funding, and we are still waiting to hear the outcome of that process.

More at a policy view, I think I would try to ramp up an answer there to say that investment certainty comes from policy certainty. One of the problems that I know the rooftop solar photovoltaic [PV] sector has had and generally in the renewable sector is the fact that there has been a lot of chopping and changing, both at State and Federal level, in policies. There still remains a lot of uncertainty out in front of us, probably more at the Federal level than at the State level. So those factors really hamper the ability of investors like ourselves to make investment commitments to new projects.

In saying that, I have some empathy for government policymakers in the fact that, when you have a situation like the falling price of panels for solar photovoltaics, which has come down probably unexpectedly high speeds—I mean, the cost has dropped extraordinarily quickly—to make policy and deal with those changes and that rapid timeframe can be challenging.

CHAIR: You refer to the importance of certainty in terms of government regulation and policy. I understand that and I do not disagree with you. Are there other regulatory impediments to investment in new generation projects you would particularly like to highlight?

Mr CROCKETT: Yes. I think we put the main one in our submission, and that is our view, which is that the national electricity objectives do not include an emissions reduction objective. When I say that, at the moment it includes all the good things like reliability, security of supply, efficiency, et cetera, and those are perfect objectives to provide a stable and cost-efficient power supply to consumers. However, we are in a transitional period where we are trying to move from dirty energy systems to cleaner energy systems. To do that

and not have any recognition of that in the national electricity objectives in our view remains a considerable problem.

It therefore means that the Australian Energy Market Commission [AEMC], for example, or the Australian Energy Regulator, as soon as they go to make any assessment on anything to do with the electricity market or system, cannot take into account the broader policies which are trying to effect that transition; so it cannot take into account the renewable energy target, for example; it cannot take into account a carbon pricing mechanism or a direct action policy that may be put in at a Federal level. It cannot take into account any policies that are put in place to effect the transition from dirty to clean energy systems.

The other one I would probably bring up is that there have been some changes at the State level in planning regulations. What we believe is fair and appropriate is that renewable energy should have the same type of planning regulations that all forms of large infrastructure should have. We very much argue against anything that is not a merit-based approach for planning assessment. Particularly we argue against arbitrary distances for planning because we believe that they are not appropriate and they cause precedent that can flow on to all different issues, which already we are starting to see in Victoria.

Dr GEOFF LEE: Thank you, Mr Crockett, for coming in and for your submission. My question is in two parts. The first part is concerned with fossil fuel, or dirty energy as you have described it, coal and gas, and then there is clean energy, which is wind, solar, biomass and those sort of renewable energy things. Without a doubt, coal and gas will be required in the future. What sort of mix do you expect in another 15, 20 odd years for so-called dirty versus clean renewable energy, obviously with the implementation of wind and solar? What sort of mix do you see as an overall proportion or an optimal hybrid blend of that to meet New South Wales power needs?

Mr CROCKETT: I guess you can have the mix you want to have. I recognise this, and there are economic consequences of transition. But in the same taken it is very much what New South Wales wants for itself. So there is no technological barrier to having a 100 per cent renewable energy powered system in New South Wales. It all comes down to what timeframe the State may wish to make that transition.

Dr GEOFF LEE: The renewables are obviously driven now on legislation, whether it is Commonwealth or State legislation, in terms of renewable energy targets. At what point can it be commercially competitive and we do not need legislative targets? Looking at it, we as legislators are imposing extra costs on the community by putting in those targets. At the moment coal-fired power stations are the cheapest to do. However, we as legislators have said that we believe clean energy and renewable sources are the future. Is there a point at which we can reach commercial parity in the future in five, 10 or 20 years time? When will wind be cost competitive so it does not need these targets and we can just put it in? When will solar be cost competitive? I guess we have to reach a point where there is some commercial parity; otherwise legislators have to make a decision that we are imposing costs on the community.

Mr CROCKETT: Yes, and I certainly understand your question and appreciate the need for renewables to be cost competitive. I guess what I was alluding to in the beginning of my opening remarks was when we talk about cost competitiveness we need to look at the overall cost to the community. Just taking the pure cost of generation without looking at the impacts to the community, that does not tell the story. So when I take your words you are "imposing costs on the community", in fact when you look at the broader impacts of other forms of generation—as I said I think the health and environmental cost of black coal on the community is around $40 a megawatt hour. If you add that to the raw energy price, then effectively wind is very close to being cost competitive. So I would say today wind is almost cost competitive when you take into account those external costs. It is our view that economists are always just parking those costs as externalities—

Dr GEOFF LEE: I understand the argument. If we take all the total costs, all the sundries, all the impact costs on the environment and on human beings and things like that, but if we are talking about a rationalist economic model in terms of how much it costs to stick it into the grid, when do you think different forms of energy will become cost competitive?

Mr CROCKETT: I am sorry, I am just trying to understand what you mean by "rationalist". That means ignoring the external costs.

Dr GEOFF LEE: If you ignore the costs of the deaths, the alleged deaths in the *Lancet*—I guess they know best—and the impact on human health and those sorts of issues, when do you think that will become cost competitive? I know it is a crystal ball. Coal could jump up 10 times tomorrow, obviously.

Mr CROCKETT: If we were to look at it versus new coal or new gas—let us say for a moment that there will not be a great deal of new coal because investing in it is potentially problematic under a carbon constrained future. Let us take it against new gas, for example. If gas moves in the eastern seaboard to export parity that means it will cost somewhere about $9 to $12 per gigajoule supplied in. I will start having to guess with numbers here but I think that pushes the cost per megawatt hour, particularly for an open cycle plant, probably above where wind sits today. With a combined cycle plant, maybe it is slightly less. Depending on how much of a carbon price ends up in the economy then that can change the equation as well. So maybe five years, maybe 10.

Mr BART BASSETT: How do you think the State Government can encourage greater competition in the energy market? You have already raised one issue regarding the distances with planning. You feel there is a constraint on wind farms; you did not put the words in there but I understand that is probably what you meant by that. If that is the case, what sort of independent research has the industry been doing to try to get better data on the anecdotal problems relating to frequency and distance of frequency disturbance to residents from wind farms?

Mr CROCKETT: What do you mean by frequency or frequency disturbance?

Mr BART BASSETT: The industry may use different terminology but from what I understand, having spoken to people in the Orange district, over long distances people say anecdotally it affects their health because they are being disturbed by the wind turbines.

Mr CROCKETT: Maybe we will start with the health relating to wind and then I will try to remember the first part of the question. I may have to ask you to remind me. There have been 17 international health studies, mostly commissioned by governments, which concluded that there was no direct physical interaction between what is emitted from a wind turbine and human health. So there is no physical interrelation between noise or whatever is emitted from a wind turbine. But in saying that, when you impose large infrastructure into a regional area that always causes challenges and can cause stress for some people in a community. I think the health experts describe it as a psychosomatic response. An individual determines their own response to how they perceive the impacts of a new piece of infrastructure being planted in an area local to them. There are all sorts of views about why that is and how that response is.

What we have done as Pacific Hydro is when this first became aware that there were some suggestions that low frequency noise, which I think is what you were alluding to by the frequency, emanates from the machine, which it does, and different machines have different noise emissions. What we did is we had an independent acoustic export go out and measure the low frequency noise from two of our existing wind farms, one in Victoria and one in South Australia, and then go and do exactly the same measurements at the beach, in the Adelaide CBD, next to a gas-fired power station and we have published that result. It is not a study. It is just pure measurement, so there is no manipulation of data. It is just output and we have put that output into the public arena. It shows that the low-frequency emissions from wind turbines are lower than at sea, they are lower than in the Adelaide central business district and they are lower than nearby to a gas-fired power station. From that we conclude that if people are suggesting there is some form of sickness, it does not come from low-frequency noise.

Mr BART BASSETT: I am certainly not suggesting sickness, just people talking about the frequency, just a general question. Would you be able to provide the results of that study? I think that would be interesting to have.

Mr CROCKETT: Certainly, yes. That is the reason we did it.

Mr BART BASSETT: How do you think the State Government can encourage greater competition in the energy market? And can you expand a bit on your geothermal activities and what is holding that back from your perspective?

Mr CROCKETT: Expanding competition: Investment in renewables in particular is driven by the renewable energy target and it also interplays with a carbon price. The one area that most drives new investment

in power generation is the retailers buying energy from generators who then on-sell to the retail market. One of the concerns we have, and this has been talked about in New South Wales and at a Federal level, is the size of three major retailers and the fact they have a significant proportion of the market—New South Wales and the national electricity market. I am not sure I have a suggestion about how to deal with that. That is a reality since New South Wales sold off their retailers. It just means there are now three very large retailers who control that market. We do not necessarily see that as good for competition but I am not really able to suggest what you might do about that. I just know that is a concern in the industry.

I was listening to Dr Wonhas when he was talking about geothermals, and he is quite right. To give you an example of the barrier for geothermal, for about $150,000 we can put up a wind mast and wait six months to a year and from that you pretty much determine the wind resource in that area that is good enough to take to a bank to get financing on. The equivalent cost in geothermal is somewhere between $15 million and $20 million to get to the same point. You can see it is an incredibly different risk equation for a business. It works in the oil and gas industries because the returns are so much higher and they can factor in a number of dry wells, knowing that one day they will get a gaseous or an oil-rich one and away they go. It is $50 a megawatt hour in the electricity market. At that, someone struggles to put $15 million to $20 million at risk.

In saying that, and I think Dr Wonhas touched on this, geothermal does have a massive opportunity in Australia to provide reliable dispatchable power. It is not necessarily near the grid, and that is another issue. Our view is that conventional geothermal is technology proven. There is no doubt about that, there are gigawatts and gigawatts of conventional geothermal across the world. There is none in Australia yet and that is because of the two things I just mentioned and the cost to prove the resource and its location. In our view it holds a really strong, medium- to long-term opportunity to be able to replace coal-fired generation when you retire it.

Mr JOHN WILLIAMS: In relation to the Moree solar farm, and obviously this inquiry is primarily about investigating the cost to electricity consumers in New South Wales, you mentioned Moree is at the end of the line and obviously you are going to generate solar power which will have some input back into the grid. Is there any direct benefit to consumers in Moree? Is there the opportunity to maybe offset some of those transmission losses they are currently experiencing?

Mr CROCKETT: It is an interesting question. Let me say commercially how the arrangements work. The way the national electricity market is is that the price you get paid is relative to a reference node here in Sydney. Then it uses what is called a marginal loss factor. Depending on how far away or how significant or what the benefit is, it either helps you or hurts you. In the case of the Moree solar farm it was a big factor which hurts the project. To go to that in a bit more detail, even though you are measuring it against a reference node here in Sydney the power never gets to Sydney. As you say, the power just goes into the local area—I do not think it gets past Tamworth to be honest—so that hurts the project commercially because the MLF system is just so coarse, let us say.

It does not really affect the Moree community because they already have a line that services their requirements. Where it would have an impact is if an additional load came into the area, say, a big mine came in and connected into the network, instead of having to build more infrastructure to get that out there, that would come predominantly from the Moree solar farm. So, there would be an offset of future investment provided by the Moree solar farm. It, let us say, insures you against having to spend a lot more money on future infrastructure investment in that region, but it does not really make a difference straight away. Does that answer your question?

Mr JOHN WILLIAMS: It does, and I can understand it. On that basis do you believe that as we move into some of these renewable generating projects, in a lot of instances—and you highlight solar—where its location is usually at the end of the line, is there an opportunity for us to review the current regime in regard to managing transmission losses?

Mr CROCKETT: That is a hard one for me to answer because it is under the national regulatory jurisdiction. I assume as a State you can help to advocate for national regulations to, say, become less coarse so that you can promote areas that are resource rich. As soon as you go west of the Great Divide you have a fabulous solar resource. That is the basic rule of thumb. But the infrastructure west of the divide is not so brilliant. I would suggest, if you are interested in following that, to do a review of what mechanisms you can adjust and what you could advocate for at the national regulation level to improve the opportunities there. We would certainly support that work.

Mr JOHN WILLIAMS: Obviously you list hydro as one of your renewable energy sources.

Mr CROCKETT: Yes.

Mr JOHN WILLIAMS: Are there opportunities for future hydro projects within the State? I probably allude to the irrigating districts in the Murray and the Murrumbidgee with that flow of that water. Is there an opportunity to capture some of that and convert it into energy?

Mr CROCKETT: Yes, but it will not be significant in its capacity. We have effectively run some hydro facilities on little irrigation dams in Victoria. If you have the infrastructure to plonk a little power station on, it makes good economic sense. It is not quite Pacific Hydro's business model anymore. We tend to work in the bigger. But certainly; otherwise it is energy going begging really. The only issue I would say you get is that the water gets released when the irrigators want it, so the power station owner will get no power over when they get to generate and, therefore, the value of the power from that facility will not be as high as other forms.

Mr JOHN WILLIAMS: But is there an opportunity within some river flows? There is a fairly consistent flow in the Murray and Murrumbidgee.

Mr CROCKETT: I would say yes, but again it tends to be quite low head. So it will be small capacity. You would get anything between one and five megawatts, say, per dam.

Mr RICHARD TORBAY: Bearing in mind the remaining time, I have a few brief questions and there may be a few I will have to ask you to take on notice. Can you explain a little about renewable energy certificates and how they assist in the growth of alternative energy projects?

Mr CROCKETT: Sure. The renewable energy target requires the electricity retailers in 2020 to provide 20 per cent of power to their consumers from renewables. So the certificate is set up to guarantee that that happens. Unfortunately, when it was lifted to the 20 per cent target there were a few, let us say, adjustments to it, which caused an oversupply through the rooftop solar in particular blowing the 5:1 ratio of RET. That got sorted at a Commonwealth level, but there is an overhang of renewable energy certificates in the market, which means that the market is very sluggish to call forward the investment in new infrastructure to meet the 20 per cent by 2020, which is a fixed target. That will come, but it is unfortunate that it is not coming now because there is actually no better time to invest in renewables than at the moment mainly because the market for wind turbines internationally at the moment is a bit soft. So the prices we are getting on the international market are very good, plus the Australian dollar is high and because they are nacelle and the blades come typically from overseas, the price of the dollar certainly helps. It is the best time to put it in the ground but, unfortunately, the market is not really calling for it yet and that is a shame because the orderly rollout would make it more efficient and more cost effective. If we have to wait a few years and then try to put it all in in the last five years, that will be at a higher cost to the electricity network.

Mr RICHARD TORBAY: Can a government do more to manage demand?

Mr CROCKETT: It is a tricky one because it is a market that went wrong because the arrangements missed with the market, as it were, and we are not really supporting that there are any other interventions that could cause other sort of market responses that might be unforeseen. We do have some ideas, but we are probably not going to canvass them just yet.

Mr RICHARD TORBAY: It would be handy to hear them, given the inconsistency of policy and some of these, as you say, stop and start processes that have had a significant impact on the sector.

Mr CROCKETT: Very much so. There is a review of the renewable energy target starting in July by the Climate Change Authority. I suggest you will see some of it play out in that.

CHAIR: I am reading that Mr Crockett is being a little circumspect or diplomatic regarding the RET. It has been put to me, and I will put it to you—not because I am an expert but because it seems to be consistent with what you were, and perhaps were not, saying. The large-scale RET was a good idea and worked well, and the small-scale RET bringing in five for one actually was almost counterproductive in that it flooded the market and, ultimately, hindered the objective. I have put it to you in blunt terms, particularly in the context where the whole existence of the RET has been questioned perhaps without an adequate discernment between large scale and small scale. Could I invite your comment on that?

Mr CROCKETT: Certainly. Let us go back, firstly, to the intention of the renewable energy target. The intention is to build industry capacity in renewables so that there is capacity within the country to efficiently deliver renewable energy throughout Australia, thereby providing clean energy and emissions reduction. That is the basic tenet of the legislation. You are right that putting a 5:1 ratio on solar created a lot more certificates than anyone expected and at the expense of the large-scale infrastructure. I have to say, possibly being undiplomatic for a moment, that the State-based policies also played a hand in that as well. So that 5:1 ratio plus some State-based incentives caused it to just go crazy. Of course, things then got wound back. I am from the large-scale sector, but I have some empathy with the small-scale sector because they were going up and down like a yoyo. What has happened is that there is a whole lot of overhang REC sitting in the market from that earlier boom. So we are all sitting waiting for those to flush through, which is frustrating, and then at the same time we are going through an RET review. Some parties are calling for some changes to that, which can cause some regulatory certainty. But at the end of the day it is bipartisan legislation in the Federal Parliament, so we do not expect any major changes to the legislation.

CHAIR: Thank you. We have run into a time issue again. May I put to you some questions on notice?

Mr CROCKETT: Yes.

CHAIR: Certainly, the Government's involvement should be definitive wherever possible, but sometimes we regulate things that can be counterproductive in the long term. Do you see a role for any further market deregulation? If so, how? How would that further market deregulation affect Pacific Hydro? Have you any comments on how the Federal Government's draft energy White Paper might affect energy generation in New South Wales? Earlier you touched on possible objectives at a government level, but in your submission you say particularly, "The objectives of the national electricity market should align with policy goals, including reducing greenhouse gas emissions." Would you provide us with a little more commentary on that? You made some interesting comments regarding objectives, including unstated objectives, on the national electricity market and how those objectives would need to change to align with the goals.

Mr CROCKETT: Certainly. It may be that we can put together the last two because we will send you our submission on the draft energy White Paper, which includes more dialogue around the national electricity objectives.

CHAIR: Thank you for appearing before the Committee today. The Committee may wish to send you some additional questions in writing, the replies to which would form part of your evidence and be made public. Would you be happy to reply in writing to any such questions?

Mr CROCKETT: Yes, of course.

CHAIR: We very much appreciate your input in your written submission and your oral evidence today.

Mr CROCKETT: It is a pleasure. Thank you.

(The witness withdrew)

(Short adjournment)

TIM REARDON, Executive Director, National Generators Forum, and

GREG EVERETT, Director, National Generators Forum and Chief Executive, Delta Electricity, sworn and examined:

CHAIR: Thank you for appearing before the Public Accounts Committee today. Before we proceed, do you have any questions concerning the procedural information sent to you in relation to witnesses and the hearing process?

Mr REARDON: No.

Mr EVERETT: No.

CHAIR: Would either of you like to make a brief opening statement?

Mr REARDON: Yes. By way of introduction, the National Generators Forum is the peak industry association representing electricity generators in Australia. My members produce electricity from all forms of generation technology including coal, gas, biowaste, hydro, solar and wind, and operate across all States and Territories. A few issues were raised in our submission that I will refer to quickly and summarise for the Committee's purposes. Firstly, in relation to forecasting electricity demand, there are various reports on forecast growth in demand in the National Electricity Market [NEM] and New South Wales which rely largely on demand forecasts from transmission network service providers. The majority of these are compiled and published by the Australian Energy Market Operator [AEMO]. These forecasts include information provided by the distribution network service providers. These forecasts will reflect an institutional conservatism. Network businesses have an incentive to overstate future demand to mitigate any external criticism of the possibility of electricity supply interruptions due to poor demand growth assessments. These forecasts could have a consequent impact creating speculation that a competitive market for the wholesale supply of electricity is flawed in some way, when the history of the National Electricity Market is that it is a very well-functioning market. I should note that AEMO has indicated to us that it intends to change the methodology for the development of its forecasts, and we provided some information in our submission in regard to the inconsistency with regard to those forecasts.

As I mentioned, energy demand and peak demand have risen consistently in the NEM in line with economic growth and in the order of 2 per cent or 3 per cent a year over the past three decades. That was up until about 2008; over the past four years there has been a flattening and progressively a fall in demand. This fall in demand is caused by a fundamental shift in the demand and supply balance in the market. The reasons for this are multi-faceted and include increases in price, changes in economic growth, changing industrial mix, distribution, generation, and better generation and energy efficiency programs. There is, however, very limited detail and publicly available data on the relative contribution of each of those factors to the decline in electricity demand. So, while half-hourly demand data is available at a regional level we are seeking to gain access to that data for a subsector or substation level, which would enable us to determine the relative contribution of some of those factors. This information would provide a starting point to identify trends in different market segments, for example, between residential, commercial, manufacturing or industrial purposes. This would allow both for better planning within electricity generating businesses and better forecasting on an industry-wide basis.

An additional issue relates to gas supply. This issue, which has arisen across most of the eastern seaboard, is that there has been an increase in gas price and restrictions of gas supply due predominantly to increased demand for exports of gas. Market prices, which are derived through a transparent, flexible and competitive commodity market, will drive efficient consumption of gas and gas-fired electricity in the National Energy Market. The NEM provides a good case study of how a market-based mechanism can operate. The National Generators Forum is not advocating policy intervention in the gas market. This would be equivalent to a subsidy to this type of generation and would affect the pricing and investment in the electricity market. Notwithstanding this there is a concern that proven gas reserves could be warehoused for export markets, which may take many decades to materialise. It is understood that Queensland and the Federal Government have a monitoring role in terms of those concerns and it may be appropriate for a similar monitoring of our gas supply in New South Wales as well.

Finally, this inquiry has quite ambitious terms of reference in looking at electricity demand through to 2050. With demand for electricity currently declining, economic indicators suggesting that there will be moderate gross State product, and the high value of the Australian dollar limiting future industrial growth combined with significant investment in renewable generation in recent years, it appears that the market will satisfy demand requirements for the foreseeable future. I will conclude my comments there. I am not sure whether Greg would like to add to those comments.

Mr EVERETT: No, I think it is better to answer questions.

CHAIR: Prior to commencing questions can I say that your written submission was particularly useful in that it addressed the terms of reference in a logical way. Some of the questions will touch on areas that you have addressed in your written submission. To that extent part of the purpose of today is to probe further on some of those comments but also explore other areas. If I could ask, first, what do you think will be the impact of the carbon tax on electricity generation in New South Wales and can you quantify that? There are other estimates out there, but the Committee is interested in your perspective.

Mr EVERETT: From the perspective of pricing the simplest mathematical calculation is to look at $23 to start with, multiplied by the full emission rate of 0.9, and that is roughly the average across New South Wales generators. It gives you a figure of about $20 and that is the increase generators would be including in their bid prices. That will not be fully recovered through the pricing and that is because there are times when other generators with lower emission rates or renewables would be setting the price and, therefore, there would be no carbon uplift. From a pricing perspective there will be an increase in price. The Independent Pricing and Regulatory Tribunal have outlined what the pricing will be to regulated retail customers.

As a result of the failure to be able to pass on the cost of the carbon tax all three generators have processed impairments to their asset values. Delta Electricity has impaired its Central Coast assets by $320 million, noting that its western assets were already impaired by $895 million. That was related to the gentrader transaction but the gentraders paid less—part of that was for carbon and you cannot pull apart how much was due to carbon. Macquarie Generation has recently impaired its assets to the tune of $700 million. Previously Eraring Energy had impaired Eraring power station by $580 million for carbon and subsequently impaired it by a further $938 million. Again, that was related to the gentrader transaction. How much of that was incrementally for carbon I am not sure.

CHAIR: Mindful of the fact that the carbon price and the existence of the carbon tax, and indeed the renewable energy target, is driven at a Federal level, how can the New South Wales Government encourage investment in alternative forms of energy generation? In that context, if there was not a carbon price how would the position of the New South Wales Government potentially alter, if at all?

Mr REARDON: Working on the basis at this stage that there will be a carbon price I think a nationally consistent approach, given it is a national electricity market, is the appropriate way to go. In the event that there was not a carbon price the answer would still be that there would still be a national approach to reducing CO_2 emissions and it would be our preference to have a consistent, national and bipartisan supported approach to reducing CO_2 emissions.

CHAIR: Other people have suggested that it might be best for the New South Wales Government to extricate itself from market intervention. Is that inherent in your response; that you think it is best managed at a Federal level and the New South Wales Government should stay out of it?

Mr REARDON: In the submission we noted two items, being the Greenhouse Gas Reduction Scheme [GGAS] and national Energy Savings Initiative, as the two schemes we would see as appropriate for New South Wales to step back from. That is a consistent summary of the position: It is increasingly an international response to carbon emissions and a nationally consistent response to carbon emissions—regardless of whether it is a carbon tax price or alternative mechanism. There are a lot of duplicative programs across many State and Territory jurisdictions. The Council of Australian Governments process which has been initiated to streamline the number of programs designed to address CO_2 emissions is something we will be actively engaging in. Regarding the two programs I mentioned I note that there has been an announcement made in relation to the closure of GGAS. The national energy savings initiative is another scheme we will pay close attention to.

CHAIR: You are saying that New South Wales regulatory or policy initiatives which attempt to regulate or interfere with the normal operation of the market may be counterproductive. In that vein are there other regulatory impediments to investment in new generation projects in the market?

Mr EVERETT: The only additional comment I would make is that from a generator's perspective the part 3A approval process provided a well understood pathway. The replacement processes are probably yet to be tested to determine how efficient they are and whether they are an equally efficient mechanism for gaining approvals.

CHAIR: How should the State Government, if at all, encourage greater competition in the energy market?

Mr REARDON: I think there is very strong competition in the energy market. There is competition between jurisdictions, there is competition within the States; I do not think there is a fundamental problem there that would warrant addressing.

Mr EVERETT: The only additional comment I would make is that an extreme level of competition exists at the wholesale level but within New South Wales there is a reduced level of competition at retail level. In particular, upon sale of the New South Wales retailers we saw fewer participants in the market.

CHAIR: We have asked a number of other parties whether they support retail price deregulation, do you have a view on that?

Mr REARDON: We would support retail price deregulation. Given the possible benefits of demand-side initiatives in managing peak demand there is opportunity there. There would be challenges from a consumer education perspective and possibly the technology side of things. In principle, we are supportive of competition at the retail level.

CHAIR: In the vein that State governments should perhaps stay out of things, do you think that there is a role for State governments in encouraging consumers to at least manage demand more effectively and if so what that role might be? Do you think that is occurring adequately at a Federal level?

Mr EVERETT: We are already seeing consumers managing their demand quite effectively. We have seen considerable decay in demand in New South Wales, in fact in all jurisdictions in Australia apart from Tasmania—which is fairly flat. What we are seeing amongst consumers is implementation of energy efficiency and even at peaks we are aware that retailers are managing some of those peaks with their customers to avoid some of the higher demand periods and reduce the peak demand. The initiatives that can be taken, in terms of smart meters and smart grid rollouts, are probably best done across all jurisdictions rather than State by State. I think the experience in Victoria, where there was quite a backlash against the smart meter rollout, demonstrates that for individual jurisdictions to run with those sorts of policies can be quite difficult.

Dr GEOFF LEE: If I could pick up on what you said previously about deregulating the market: Can you give me examples of other countries where deregulation does work and examples where deregulation does not work? The reaction I get from the consumer or average person when there is talk about deregulation of essential services such as electricity is fear that consumers will be at the mercy of the big companies.

Mr REARDON: We have had a deregulated wholesale electricity market for some time and the impact of that has been that supply has met demand, and price has come down over the past 12 years. All the fundamental economic indicators of success are certainly there. I do not see that there is any significant concern from a consumer, user or government perspective in regards to the overall operation of a deregulated wholesale electricity market.

Dr GEOFF LEE: Do you have any examples of where the price has been lowered overseas and passed on to the consumer?

Mr REARDON: All the regulatory environments in which a deregulated wholesale supply market operates overseas are slightly different. Certainly the United States and the United Kingdom are two in my mind that have wholesale markets that appear to have operated effectively over a long period of time. I would have to look at each individual market to go through others. We are certainly not unprecedented in terms of that.

Dr GEOFF LEE: Page three of the executive summary states that serious concerns arise from the operation of a large-scale renewable energy target scheme which mandates the use of renewable technologies and has the effect of artificially lowering wholesale market prices and thereby risks undermining future investment incentives. On current projections it will be costly to implement, the costs that will be borne by consumers and, nonetheless, not achieve its intended target. Do you say the costs will be borne by the consumers obviously by the renewable energy targets? Is there a percentage or an actual number that you can indicate about what its effect will be?

Mr EVERETT: The best thing is to point to the retail tariffs that have been approved 2012-13 by the Independent Pricing and Regulatory Tribunal. They have a very clear scheme component to them.

Mr BART BASSETT: You talked about monitoring the gas supply for the future in New South Wales and you compared that with what is happening in other States. What should the State Government do to ensure long-term energy security in New South Wales?

Mr REARDON: If you use the NEM as an example of a functioning national wholesale market for electricity, ideally a nationally competitive wholesale market for gas would be the ideal outcome. That is certainly probably looking more at the longer term timeframe of this committee's review through to 2050. In terms of direct action we are not seeking the Government to take any specific action but just note that there is an issue that has arise amongst electricity generators that there is certainly an increase in price of gas, and challenges at times in getting the supply of that gas.

Mr BART BASSETT: Based on that do you think there would be a benefit for the State to have a monitoring process in regard to future gas supply out of the State?

Mr REARDON: Whether that is a formal monitoring process—Queensland has established the Office of the Queensland Gas Commissioner—and whether there is justification for that type of approach I would have to question but I am certainly aware that there are potential issues that may arise. At this stage it is a competitive challenge for electricity generators in gaining competitively priced gas.

Mr EVERETT: If I can expand on Mr Reardon's comments. Initially he addressed the market development side of things and then the alternative is for the State to take a more hands-on approach as we may be seeing developing in Queensland. The sort of thing that we see in New South Wales is the short term trading market in gas. It is a very thin market. It is very much dominated by four or five participants and most others, including all the producers and all the major users have opted out of that market. The pipe liners do not participate. So that market operates in a non-transparent manner. The people who are in it are operating transparently but they see very little about what occurs around them in that broader physical aspect of the market.

The National Generators Forum would see that developing the market, so that there was much greater transparency, so there was greater confidence and volumes going through that market to the extent that it developed something like the electricity market where at least the spot price was sufficiently reliable that a forward contract market could develop around it, would be an excellent development to the extent that New South Wales could work with the other jurisdictions in trying to work up some sort of a national gas market that brought in a lot more of the players, if not from a commercial perspective but at least from information provision perspective, would really develop that market significantly.

Mr BART BASSETT: I would like you to expand on your earlier comment about regulatory impediments and your concern about what has replaced part 3A of the planning approval process. I understand you are concerned about projects' costs blowing out because of the time constraints regarding the approval process. Has anything in New South Wales been put to the regional panel process that has replaced part 3A?

Mr EVERETT: There is none that I am aware of. Certainly Delta Electricity has not put any through.

Mr BART BASSETT: There is nothing on the books to date to see if there has been a problem regarding it being handled by a regional panel?

Mr EVERETT: No, there is no evidence of any difficulty. Part 3A was a process that tended to work in terms of a well understood system for power generation projects.

Mr BART BASSETT: Based on your represented generators, how much do you think the market will change regarding percentage of what is producing power over the next 20 years?

Mr REARDON: We do not do any forecasting ourselves but, given where electricity demand is at the moment, and a declining demand, the infrastructure assets that currently exist, you would have to take some fairly creative assumptions in regards to what a carbon price impact over that, but I think it would be reasonable to presume that there would be a growth in renewables from where we are currently at. There would still be a very significant role for coal and gas for the foreseeable future.

Mr EVERETT: I think if you are looking over the next 20 years you actually may see quite a difference in the two decades. As Mr Reardon indicated, during this decade, with the incentives for renewables, I think in New South Wales we will see predominantly a growth in that area. Whether gas-fired generation will grow significantly there has to be question marks about because of the export parity pricing move of gas. But beyond that into the 2020s what we will see is the coal-fired assets in New South Wales, some of them approaching that 50-year mark, and that is where there are probably opportunities for there to be quite large-scale changes of technology, without stranding assets or incurring a lot of additional economic costs unnecessarily.

Mr JOHN WILLIAMS: In relation to forecasting of demand, and we saw a presentation from Delta, there is no doubt that it is a forward model at the moment and obviously if we could reach a forecasting model that was a little bit more efficient and reflected true market demand, do you think there would be any flow-on benefits to consumers in that regard? I know it would benefit generators, but will it have flow-on benefits?

Mr EVERETT: I think the flow-on benefits would be very significant. The forecast that we are seeing at the moment not only drives generation investment but, of course, drives network investment whether it be Transgrid investment or distributors' investments. Distributors' costs, in particular, are the ones that are the major influence in increasing prices at the moment. Having better defined forecasts I think would curtail some of the higher level expenditure that has been seen. It would also save costs, particularly in unnecessary generation.

What we are seeing in New South Wales, even based on forecasts we have so far, is that there is no need for new generation in the State. That is based on the Australian Energy Market Operator's current 50 per cent forecast. With a more realistic methodology, we would see even less of a need. Just to finish off: the other improvement in costs would come from greater certainty from fuel purchasing decisions. At this point in time, people tend to look at the actual capital investments that we have in networks and generation; not much attention is paid to the expenditure that is made on fuel stockpiles, or future gas purchasing costs, which may be set at levels that are higher than otherwise would be necessary.

Mr JOHN WILLIAMS: That leads me to ask: Do you see a role for measures to manage demand more effectively; and how can governments assist in managing that demand?

Mr REARDON: There is certainly a role for better demand management capability. There is a review going on at the moment of demand site management, being run by the Australian Energy Market Commission. I think the outcomes of that will be a step towards improved consumer choice. That can only have a positive impact on the management of peak demand, which is quite a serious issue in terms of both generator capacity and transmission capability. I think that would be a positive step. At this stage, I would say I would await the outcomes of that review before providing any specific outcomes in terms of government action.

Mr JOHN WILLIAMS: With forecast modelling, as a generator forum do you see any other modelling that you could adopt nationally to try to get more accurate forecasts?

Mr REARDON: I think all of my members undertake their own modelling. The Australian Energy Market Operator has indicated that it is changing its process. I am quite confident that the outcome of that will be a much more reliable system. Given that the Australian Energy Market Operator is the government agency providing that, organisations that would look at the market externally would rely upon government data principally. So I think what we will see in the near future is a much more reliable forecast, and I think that issue will be resolved.

Mr JOHN WILLIAMS: Is there any good modelling globally that we can adopt?

Mr EVERETT: One of the suggestions that have been put to the Australian Energy Market Operator is that we are seeing deficiency in the modelling mostly in the energy, that is, the gigawatt hours side of things. The methodology that is used at the moment is to look at the megawatt peak growth; and then there is an economic growth factor applied to that to then determine what the energy would be. Whilst that methodology worked very well from World War II, and we saw the Electricity Commission of New South Wales and other similar bodies built on the basis of that growth, which was quite predictable, since 2007 we have seen a decoupling of economic growth away from megawatt demand. The proposition that has been put to the Australian Energy Market Operator, as it works up its new methodology, is that it actually work from the ground up. So, rather than taking the global view of, "Here is the overall megawatts, and let us now apply an overall energy growth figure for the State to that," and rather than start from the top down, you actually start from the bottom and work your way up: look at what is happening at particular supply nodes and work your way through addition of incremental growth, whether there is population growth in those areas, what is happening on appliance sales and utilisation in those areas, and whether there is any industrial increases or decreases. We think that will deliver more accurate energy forecasts.

Mr RICHARD TORBAY: I am interested in teasing out the certainty or uncertainty in terms of government policy. I know you have touched upon this, but we will be asking questions about it over the next 20 or 30 years because the policy climate keeps on changing. I am interested in your view about what that is costing in terms of opportunity for investment in the sector.

Mr EVERETT: I am happy to try to address that. What we have seen so far is that the national electricity market has delivered investment to the levels that have been required. However, the pricing outcomes are such that the wholesale price has not increased; so current wholesale prices will probably end in 2011-12, if they continue on as they have for the preceding months, at about $30 per megawatt hour, and contract prices of now around $40 or a tad less than that. On the basis of that, what we are seeing are a lot of policy interventions, which are creating new generation that is subsidised, or causing consumers to change their demands, resulting in the oversupply. Therefore, on the one hand, you can say there is no need for other investment; or, alternatively, you can take the view that, because of those measures, there simply is a price outcome that would not support investment anyway. In reality, that is what the market is seeing. The result is low prices. Until that is worked through, there is not a normal basis for investment.

CHAIR: I might go back to your comments on the national gas market. You mentioned the Queensland commission that has been established to look at gas. I note that Western Australia has a reservation policy, which is another model that New South Wales might look at at some stage. But, in terms of current impediments to a free-flowing or proper national gas market, whether it be pipelines or other forces, how could we move to more of a truly national gas market, and one which would ensure secure supply between States? In that context, it has been suggested that if we enable production of more coal seam gas towards the north of New South Wales, that gas might be piped to Queensland, and it will all end up going offshore through Gladstone, as opposed to actually coming back to New South Wales. I am interested in teasing that out a little bit, from your perspective.

Mr REARDON: Infrastructure certainly would be one issue. Possible resolutions of the problem include electricity generators purchasing their own reservoir, so to speak. The National Generator Forum is not supportive of government intervening and establishing reservoirs for electricity generation; that would be tantamount to subsidising a particular technology. But certainly, infrastructure is one limit on a national gas market.

Mr EVERETT: This is a question that the Australian Energy Market Operator is turning its mind to at the moment: What is the next step that can be taken to move towards a national gas market? What we see at the moment are individual hubs in Adelaide, Brisbane and Sydney, and then a separate type of market in Victoria. So one step would be to have a commonality of markets. A second step would be to have an actual responsibility. The Australian Energy Market Operator administers those markets, but it does not have responsibility for reliability of supply; so obligations that it has in the electricity market are mirrored in the gas market. Those are the sorts of measures that would lead to a more reliable gas market.

CHAIR: You have rightly pointed out that New South Wales, relative to other States, has a competitive advantage in coal; and, to that extent, the introduction of the carbon pricing scheme takes away some of that competitive advantage. I know that one of your members, Delta, has a joint venture of sorts with the CSIRO, and I see that Mr Everett has specific knowledge in a different capacity. From the national generator

forum's perspective, should we be doing more in the CCS space? That is probably taking more of a New South Wales perspective than a national perspective.

Mr REARDON: As I understand the situation at the moment, CCS's limitation is more on a price competitiveness basis. Continuing to do the work to look at potential geological storage capabilities in New South Wales would be valuable, if only because when and if we reach the point when CCS does become a commercially viable proposition that information would be known and could be acted upon.

CHAIR: Mr Everett, do you have a perspective?

Mr EVERETT: The principal focus should be on the geosequestration side of carbon capture and sequestration. I would not describe the technology for the capture as mature, but it has been utilised in the gas and oil industry for some time. The cost of that will come down with the rollout of the technology when there is a commercial driver for it. It is really about understanding the geology and where those reservoirs would be for the injection on a commercial scale. The Department of Trade and Investment is looking at various areas in New South Wales and initially those steps have been more about a demonstration scale. But for all jurisdictions across all members, the interest is really in identifying a large volume reservoir for the commercial scale.

Mr JOHN WILLIAMS: A lot of the submissions talk about price deregulation as one of the aspects that this Committee should pursue. Do you support that? I know your position is primarily as a wholesaler of electricity. Do you believe that retailers would give up some margin in a deregulated market?

Mr REARDON: In economic theory that would be the principle that you would be looking to achieve.

Mr EVERETT: I believe that retailers would have to give up more margin because there would be more competition and more players. To be honest, that is a fairly basic economic principle. What we are seeing at the moment from a wholesaler's perspective is that the Independent Pricing and Regulatory Tribunal rates allow roughly $70 per megawatt hour as the wholesale cost of electricity and the actual market purchase price is about $40. So there is a margin for retailers of roughly $30 per megawatt hour at the moment just on that purchase. It is fairly common knowledge that if you seek a discount on your electricity price you can achieve about 10 per cent, and 10 per cent of the new rate of about $300 is about $30. That is a simplified approach, but it is not difficult to come to the conclusion that the discounts being offered at the moment are the difference between the regulated price for electricity versus what they actually pay rather than discounting their own margin.

Mr JOHN WILLIAMS: So you are absorbing the discount as generators?

Mr EVERETT: Yes.

Mr JOHN WILLIAMS: How far can we go? My observations suggest that the generators are doing the heavy lifting in this market and the retailers do not have any real capitalisation. They appear to be taking it off the top. Can we compress their situation, or do we have to rely on market forces?

Mr EVERETT: I think the market forces are delivering a change in business structure that we are seeing throughout the industry. The original structure was that there were merchant generators generating without any retail activity. The competition at the retail level has blurred and we are now seeing businesses involved in the whole supply chain through from generation, and often from the original fuel supply source, right through to retail. They manage the margin across the whole chain rather than work one particular element in one particular market. The wholesale market outcomes being delivered now are not sustainable.

CHAIR: Do you wish to add anything?

Mr REARDON: No.

CHAIR: On behalf of the Committee, I thank you for appearing here today. The Committee may wish to send you some additional questions in writing, the replies to which would form part of your evidence and be made public. Would you be happy to provide a written reply to any further questions?

Mr REARDON: Yes.

CHAIR: As I said, the Committee appreciates your written submission and your oral evidence today.

(The witnesses withdrew)

EDWARD JOHN SANTOW, Chief Executive Officer, Public Interest Advocacy Centre, sworn and examined:

CHAIR: Welcome to this hearing. Do you have questions about the procedural information that was sent to you?

Mr SANTOW: No.

CHAIR: Would you like to make a brief opening statement?

Mr SANTOW: I thank the Committee for the opportunity to address members. My organisation, the Public Interest Advocacy Centre [PIAC], is an independent non-profit law and policy organisation. We work on behalf of disadvantaged people such as people experiencing homelessness, people with a disability, indigenous people and so on. PIAC has long done work in the area of energy and water. The perspective that our energy and water consumer advocacy program offers is largely one of advocating on behalf of more disadvantaged consumers. I anticipate that my contribution will be relatively contained. I would like to raise a few issues: price deregulation, contributions to the cost of energy, time-of-use tariffs, energy security and, if there is time, energy literacy.

I begin in relation to price deregulation. I note that the question of price deregulation has arisen in the course of this inquiry. It certainly arose first in one of the submissions—something that Mr Daley noted in one of the earlier hearings. Since then it has become the subject of some of the discussion here. We certainly agree that the question of price deregulation is hugely important, as you well know, and in the 2004 Australian Energy Market Agreement [AEMC] there was general agreement to phase out the exercise of retail price regulation for electricity and gas where effective retail competition could be demonstrated. It is, of course, the role of the AEMC to assess whether competition is, indeed, effective.

The central question then in this regard is: when can we be confident that there is effective retail competition? That is clearly a vital question, and not just for the AEMC but also for the New South Wales Parliament. I commend this committee for responding to this issue as it has arisen, but I am also concerned that the committee would stray not just a small amount but a very long distance, in my view, from its terms of reference if this becomes a significant focus of the inquiry or of the committee's report. I just note the practical point, which is that there are many people and organisations that have strong views certainly but also useful perspectives in relation to this question, but, perhaps relying on the terms of reference as they would be commonly understood, many would not have anticipated that this question was within the formal remit of this committee under the current terms of reference. I just make that point as a question of process. Hopefully it is not inconsistent to deal briefly with a few substantive matters in relation to price deregulation?

CHAIR: Not at all.

Mr SANTOW: We are yet to reach a final view on that question, but I make five points in relation to that substantive question. The first is that we are principally concerned to achieve positive consumer outcomes, especially for those vulnerable and most disadvantaged consumers. So, if it can be shown that price deregulation can be achieved in a way that provides adequate protection for those consumers we would be happy to support it.

The second point is that many of the questions in relation to price deregulation remain unresolved and, so far at least, I do not think that a clear, compelling case has been made that the time is now right for deregulation—at least, it has not been, I think, properly established. There are plenty of people who are arguing quite persuasively for that but I guess what we are recommending is that the New South Wales Government should ensure that there is a broad, consultative process to ensure that all relevant stakeholders who have a strong interest in this issue are able to have their say and contribute to what is a fundamentally important issue.

The third point I would make is just to draw your attention to something that the committee is probably well aware of and that is the central question whether there is effective competition in the market. That requires a very careful analysis of key criteria, and I would draw your attention in this regard to the key criteria that the AEMC used in their analysis in Victoria. First was in relation to customer awareness, that is, their awareness about their ability to choose their energy supplier and their knowledge about the products and services available. Second is the customer's choice by entering into market contracts and changing retailers. Third, the customer's willingness to act on market information—that is kind of a factual question. Fourth, a customer's capacity to

access and understand information that enables them to compare offerings, and when I adverted at the beginning to the question of energy literacy or electricity literacy that would certainly be relevant here. Fifth, customer attitudes and their willingness to try new retailers. Finally, the impact of regulation in promoting effective consumer choice in the market.

My next point—and I recognise I am doing more than one number-list here—my fourth general point on the substance of price deregulation really relates to PIAC's own research in this area. We undertook research, which we published last year, on this issue in relation to five regional centres in New South Wales—Cooma, Lismore, Bourke, Wagga Wagga and Orange. That report, which is available on our website, "Choice? What Choice?", found that consumers in these areas are generally not being exposed to high levels of competition. Between 51 per cent and 65 per cent had never been approached by a retailer about changing supplier, for example, which we think is a very high proportion—certainly it is lower than consumers in South Australia, Victoria and metro areas of greater Sydney. As a result, between 73 per cent and 84 per cent of consumers had never switched provider, compared with 50 per cent in Victoria and South Australia. So there is clearly, at least on the basis of the geographical areas that we looked at in regional New South Wales, a problem there in relation to the functioning of the market that currently exists.

CHAIR: Can I just clarify: You say not approached as opposed to not having an alternative available? Did you do that analysis?

Mr SANTOW: No, it is not necessarily that there was no alternative available; it is simply that it was never made clear to them. In summary, our research suggests that despite the introduction of retail contestability in New South Wales in 2002—so 10 years ago—large areas of the State have not developed a sophisticated and competitive retail market.

My fifth point is that while we accept that an effective market can be beneficial for all stakeholders, I guess we need to be really careful about what we would be giving up if we moved to price deregulation. There are some particular benefits to price regulation that perhaps are difficult to quantify but, nevertheless, are important and need to be assessed carefully. For example, the nature of the national energy market means that, as a practical matter at least, there is likely to be a benchmarking effect from prices in neighbouring States, some of which do have deregulation and some of which do not. So, as the number of States with retail price deregulation increases there may be a danger with the loss of this benchmark and that will lead to higher prices. If I can repeat that and say it more clearly: As price deregulation spreads across the markets in the National Energy Market, that benchmarking process is likely simply to fall away.

Those are the general points I would make on the substance. The final point I would make in relation to deregulation is in relation to the role of the Independent Pricing and Regulatory Tribunal [IPART]. Certainly for the time being we recommend that IPART should continue to regulate prices. Of course, that is a matter on which IPART relies on instruction from the New South Wales Government. I guess what we are saying is that in the meantime we propose that the Independent Pricing and Regulatory Tribunal should continue to regulate prices at least until a formal Australian Energy Market Commission [AEMC] review has been completed and its conclusions have been formally adopted by the State Government. I note that in Victoria that process took a bit over 18 months. That is all I have to say initially in relation to price deregulation. I am happy to answer questions on that, or perhaps go on and answer questions at the end.

The next issue I wanted to address was in relation to the contributions to the cost of electricity. A number of the terms of reference for this inquiry direct the Committee to compare the approach in New South Wales with other jurisdictions, so with that in mind I note that in New South Wales network costs, which are commonly referred to as poles and wires, make up about half of the total average electricity bill. That is significantly higher than in Victoria. In Victoria the precise figure is harder to calculate because of the nature of the market, but the Australian Energy Regulator [AER] estimates that it is about 40 per cent as distinct from about half—50 or 51 per cent—in New South Wales. That means that, in our view, improving the efficiency of distribution network service providers should be a real priority, and for obvious reasons, because that has the potential to place downward pressure on electricity bills in New South Wales. In this context we draw your attention to the research conducted by Bruce Mountain on behalf of the Energy Users Association of Australia. He found that in New South Wales and Queensland the distribution network service providers, or DNSPs, were declining in efficiency across the two previous and current determination periods, whereas in Victoria and South Australia the distribution network service providers there remained at about the same level of efficiency across the same periods. Government-owned distribution network service providers, as we have in New South Wales and Queensland, currently charge almost twice as much as privately-owned distribution network service

providers, and that gap has been getting bigger and bigger since 2001 and is projected to increase even further until at least the middle of the current decade.

The next point I wanted to address was in relation to customer protection and time of use tariffs, which I appreciate have been raised in this inquiry. We see the value and the reason behind considering such measures, and again we are not inherently opposed to those measures. The concern that we have is that moves towards time of use tariffs tend to discuss consumers as if they were one homogenous group. In other words, they tend to aggregate all consumers and treat them all alike, perhaps not paying enough attention sometimes to the fact that there are people with low levels of discretionary use of electricity or energy more generally, and they simply are unable to shift their load to off-peak or shoulder pricing periods. For those people, any mandatory adoption of time of use pricing would really have the potential to pose quite significant challenges. We, at the Public Interest Advocacy Centre, have done some research recently on the question here and our research has really focused on the use of electricity by people with physical disability. When asked in this research whether this target group of people with disability have a condition that requires their living spaces to be heated or cooled, 75 per cent of people answered 'yes'. In addition, 39 per cent of people relied on some kind of in-home service or product that runs on fixed schedules that cannot be easily moved to accommodate the peak electricity price periods.

CHAIR: Can you give the Committee an example?

Mr SANTOW: Yes, the risk is that you have someone who is totally reliant on a motorised wheelchair. We are getting very strong information from groups that represent people in that category who say, "We need to charge the wheelchair every day, which sucks up quite a significant amount of electricity", and they are already starting to say, "We are curtailing our activities, going out less frequently and engaging less with the community." That, as a human rights-social justice question, is really terrible, and it is not a result we are looking for.

CHAIR: It is an important point and I am trying to understand it because I have thought about this in another context. I understand that that is a concern in relation to the cost of electricity or the cost of energy generally, but how does it relate to a particular time of day? Why could they not charge the wheelchair at a low peak time or a shoulder period, as long as there was proper education and information so that they were aware that that was a better way to act?

Mr SANTOW: That is the key question, and I guess it goes back to the statistics that I referred to before, that just under 40 per cent of the respondents to this survey said that the nature of products and services that they relied on did not allow them to—

CHAIR: And I am consciously challenging that, because it is an important point that you are making, but one which does not logically flow in my mind. Can you give me examples? Forty per cent of people may say anything in a survey, although I am not saying that was the case in this case. You are presenting a very important perspective, but it is one that has to logically follow through, and I cannot see the logic.

Mr SANTOW: I would be happy to follow up in greater detail in a written form, but the sorts of things in a general sense that we are hearing back are that it is a combination of factors. Sometimes you will have a person with a disability who relies not just on a series of products or machines to assist them, but people to assist them as well. It may be that there is a person who needs to operate the washing machine or other electrical gizmos that they are reliant on to live a dignified life and the cost of having their helper come in at midnight, if that is when it is cheaper to run the electricity, would simply not work. Those are the sorts of problems.

CHAIR: I would like to receive something in writing from you because I think this needs to be delved into a little more.

Mr SANTOW: Certainly.

CHAIR: My own thinking on the issue was that in fact vulnerable people who may not have a job or may have a disability and are there all day in some ways have greater flexibility to use electricity at a time which is not a peak time. That was my own conclusion, having thought through that issue, but I am happy for it to be challenged. Everybody struggles with higher electricity prices, but if moving to a deregulated market which involves time of use charging results in lower electricity prices, then arguably it helps those people.

Mr SANTOW: I follow.

CHAIR: I am not dismissing what you are saying, but I cannot see the evidence for it, and that is why I am challenging you to provide that evidence.

Mr SANTOW: I am happy to do that. I probably need to move on, but I would simply say that those assumptions you have made seem very logical and were probably shared by my own organisation when we started to undertake the research, and I guess we were as surprised as anyone else by the data we were receiving.

CHAIR: Let us not get bogged down now.

Mr SANTOW: I guess the general point though is that we need an understanding of how different policies affect consumers and careful thought must be given to ameliorating any real, provable disadvantages that arise as a result of moving to time of use type policies.

The next issue I wanted to address was energy security, which is the third item on this Committee's terms of reference. We certainly commend the Government and this Committee specifically for focusing on this issue. Clearly providing for appropriate energy security involves making very significant investments in infrastructure. We accept that proposition. I would say that in considering those investments we would urge some caution because, perhaps obviously, those investments can sink costs into the energy supply for a very long period of time, ultimately leading to higher prices that are very difficult to shake. I guess what we are urging—and I know that this Committee is interested in the issue—is to consider how to be more agile in the supply chain process through measures like better demand-side participation.

A related point is that while energy security is very important, we would urge the Government not to sacrifice everything to the altar of having a gold-plated energy network if what that means is that increasing numbers of vulnerable customers are simply priced out of the market, with all of the devastating consequences that flow from that. Those are not just consequences in terms of your ability to participate as an autonomous individual, but also economic consequences. If you are a person with a disability and you are unable to get around it stops you from being a full economic actor in society as well.

To put that in other words, clearly the public has a low tolerance for problems with energy supply. I accept that. But I would also make the point that the public has an even lower tolerance for a system that delivers a very reliable supply to the wealthy but leaves many people—when I say many people, I have mentioned people with a disability but it also includes people in rural, regional and remote areas, small businesses and people on low incomes more generally. It leaves those sorts of people unable to afford that supply. So what we are urging the Committee as a general proposition is to see this issue of energy security also through the lens of sustainable access to energy to ensure that there is not disproportionate spending of resources to ensure access when it is perhaps only theoretical access.

The last point I would make relates to a number of the things that this Committee has been looking at but perhaps most closely relates to the question of preparing the market for perhaps eventual price deregulation. That is improving energy literacy. In our experience we believe that consumers need to be more skilled in the intricacies of retail offers in order to become more effective participants in the energy market. It is sometimes hard at least outside of government to see which jurisdiction has responsibility for increasing consumer energy literacy and I guess our observation—I do not make this critically at all but I think it is a fact nonetheless—is that the efforts that are made do not always seem to be coordinated as well as they might be and sometimes they are very time limited by periodic funding. For example, at the Federal level you have got the Low Carbon Communities program. That would be the last point that I would make but I am happy to respond to any questions.

CHAIR: We do have some questions and it may well be that we will give you a few of them on notice because your address has been fairly comprehensive, which has been great in a number of areas but it does limit our time a little bit.

Mr SANTOW: That is fine.

CHAIR: In asking this question I acknowledge that this Committee is looking at energy security, but that means providing reliable security in a sustainable and affordable way. We are very conscious of the affordability. What do you see as the main causes of rising electricity prices?

Mr SANTOW: I think the statistics speak for themselves a bit. When you look at the cost stack and you see network costs at, as I say, almost exactly half, and those network costs seem to rise often more speedily than any other items on that stack, that seems to be a core issue. There is no question that the combination of green schemes and the carbon tax have an impact. In regard to the carbon tax, certainly for the sorts of consumers that we have greatest concern about the Federal Government has put in place or is in the process of putting in place some compensation which in due course we will be better placed to see whether that is effective compensation. But certainly network costs seem to us to be of greatest concern. So reducing those sorts of things as much as possible seems to me to be a crucial response.

CHAIR: You touched on the carbon tax and that there is compensation at a Federal level. Ironically there is targeted compensation for energy bills only at a State level, despite the fact that at a State government level we are obviously not responsible for the carbon tax or the Renewable Energy Target [RET] scheme. I do not know if you have got a perspective in terms of how appropriate the various compensation structures are, but what I will ask you is what do you think the impact of the carbon tax will be on consumers and those people you are talking about and on the industry in New South Wales?

Mr SANTOW: It is a difficult question to answer. I guess it does require some prediction. I would make a few points. First I would say that it is a bit early to say whether the mechanism put in place at the Federal level to compensate people in respect to the carbon tax is sufficient or appropriate. We will need to assess those in due course. The second point I would make is a more general point. That is that there are at the Federal and State level a number of schemes—and we are grateful for that—that have the objective of ensuring that disadvantaged consumers are properly accommodated. I think that the introduction of the carbon tax provides a real opportunity to undertake a comprehensive review of all of those schemes to make sure that they are operating in the most efficient way possible and are providing compensation and assistance to people who most need it. Where there are inefficiencies then they can be addressed perhaps holistically rather than, as sometimes seems naturally to happen, that these schemes are addressed one by one.

The third point and the last one I would make about this is that we acknowledge that the carbon tax is a really significant change. It is kind of beyond our institutional remit to comment on whether that is a good thing or a bad thing; it is a policy question for others. But I would make the point that when other taxes of really great significance have been introduced in Australia great care has been taken to ensure that all of the relevant players, retailers and others operate fairly and appropriately. So, for example, there was significant concern when the GST was introduced that retailers and others would not use that as a cloak to increase prices unnecessarily. In New South Wales that would be much harder to do, again, because of the transparency that price regulation brings with it. If price deregulation were to occur, careful consideration would need to be given to ensure that there was still that transparency about how prices might increase as a result of the carbon tax or any other such government-imposed cost.

CHAIR: How do you think the State Government could encourage greater competition in the energy market and thereby reduce prices through market forces for those that you rightly identify should be in our minds when making decisions? Hand-in-hand with that, how do you think the New South Wales Government could encourage investment in alternative forms of energy generation? In other words, do you have a perspective on the State Government's role in encouraging greater competition and alternative forms of energy generation, and is there a conflict between the two?

Mr SANTOW: I do not see that there is an inherent conflict between the two. In relation to increasing competition, I guess reliance on the things I have already said such as energy literacy. I would also like to keep my powder dry on that question, or no wetter than it has already been, noting my initial comments about the terms of reference for this inquiry. I think we would be reluctant to give too much of an off-the-cuff response to that. It is an important question that needs to be considered and it probably will be fully considered in another—

CHAIR: When I say "conflict between the two", the Government is conscious of the need for a more environmentally sustainable future, but that costs. That will mean that those people you are highlighting will, to some extent, have to pay more for their electricity. That is the reality. Where do you think the balance should be?

Mr SANTOW: There are a number of opportunities to improve the efficient use of energy, especially among low-income households. We have obviously seen the Commonwealth scheme—and I make no comment about that. I would simply say that often it is those households at the lowest end of the income bracket that have the highest capacity to increase their efficient use of energy—for example, relying less on heating in winter by

having proper insulation and so on. Incentives to assist in that process could allow you to close that circle and allow the Government to pursue those two objectives simultaneously.

Mr BART BASSETT: Can you explain what is meant by the term "social tariff'? What is your view about the use of social tariffs in the electricity market?

Mr SANTOW: The United Kingdom, from my understanding, has a social tariff. Perhaps we could explain this in greater detail in a written submission, but, very briefly, a social tariff is designed to ensure that, irrespective of whether one has had price deregulation or not, there is a baseline way of ensuring one has access to electricity. It is for the people who are most vulnerable, most disadvantaged in the community.

Mr BART BASSETT: Do you hold any concern about the suggestion that vertical integration of retailers and generators may inhibit competition in the electricity market? And, if that were the case, what is your view on this issue?

Mr SANTOW: I am not able to give an off-the-cuff answer in that regard.

Mr JOHN WILLIAMS: As a member of Parliament I deal with a lot of disadvantaged people and a lot of welfare agencies in my electorate, and I regularly see the challenges they face. We have touched on the Federal Government's support for those dealing with the carbon tax. Effectively that is a rational way of doing things but, unfortunately, it is provided through welfare payments, which people will consume. That will mean when the quarterly electricity bill arrives they will have a more expensive bill but no money. In speaking about this social tariff, do you think the Federal and State governments should be looking at providing that support through a different process?

Mr SANTOW: The point you make is a very good one. What we have seen in New South Wales—in other Australian jurisdictions as well—is that the prices for energy have been increasing at a faster rate than the modes of assistance that government at the Federal and State levels provide. The answer is perhaps to have a social tariff—that would certainly address that issue. The other option, which I put to the Committee a moment ago, is that if there is a comprehensive review of all of the forms of assistance—I acknowledge that there are some very important forms of assistance; in fact, the majority of the important forms of assistance are at the State level—and, if it is considered comprehensively, EAPA would be a very important form of assistance in your electorate, for example. That probably forms the most effective basis of ensuring that going forward there is adequate protection for the most disadvantaged consumers.

Mr JOHN WILLIAMS: This inquiry is limited and we are all focused on lowering the impact of electricity prices on families and households, but the fact is that the internal cost is going to be there, whether we like it or not, and we have to find a way to manage our way through it. I will share with you a couple of observations I have made. Generally speaking the disadvantaged buy low-cost whitegoods that seem to have high electricity consumption. Do you recognise that as a problem? If so, do you see any way forward for the Federal or State governments to provide assistance in supporting the purchase of more-efficient whitegoods?

Mr SANTOW: We might need to take that question on notice.

Mr JOHN WILLIAMS: Your comment about providing insulation to reduce heating costs is valid. The challenge I see is that most disadvantaged people rent their homes and under their commercial arrangement it is probably not possible for them to have insulation. Do you have a comment as to how we could find a way to support that situation?

Mr SANTOW: Again, that is a very good point. A carefully targeted strategy needs to be in place in respect of each different form of accommodation. Many people who are disadvantaged do not own their home but even within that category there are a series of sub-categories, such as people who live in caravan parks, people who live in social housing and in private housing as well. I guess as a general proposition, without wanting to be trite, assistance would need to be carefully targeted to accommodate the owners of each different form of accommodation. I think it can be done, but it needs to be done in a consultative way with each of the relevant peak bodies. I do not think I could give any more specificity than that.

Mr JOHN WILLIAMS: Are you happy with the way we distribute energy accounts payment assistance [EAPA] vouchers in New South Wales?

Mr SANTOW: We think it is a very, very important scheme. We acknowledge that the New South Wales Government has established a working group which my organisation, the Public Interest Advocacy Centre [PIAC], is contributing to. Those vouchers have not always kept pace with the increase in costs of energy, and that is obviously a problem, but we would hope that the outcome of the working group process will ensure that the voucher system will continue and will also be able to improve itself to get to the levels that they need to get to.

Mr RICHARD TORBAY: I am mindful of the time, but I would be interested in getting some information about what you think the Government should continue to do or look at to protect disadvantaged consumers. You have mentioned deregulation, the vouchers and other things. I would be interested if there is data on that, that would be good to see. There may be some other things that have not been touched upon today. Is there anything off the top of your head you can think of? In my view, it would be good to know things that you think would protect disadvantaged people in the future.

Mr SANTOW: I do not think I could really expand on anything I have already said, other than to say that if the State Government goes down the path of price deregulation, there just needs to be very careful measures put in place. For example, in Victoria, the legislation has a mechanism for reintroducing regulation if the Government is of the view that it is simply not achieving the objectives that it sets out to achieve. If we are to go down that path, there need to be very clear objectives that the promises that are made on behalf of those people who advocate for deregulation need to be adhered to. If at the end of a period of time we see that actually deregulation has not brought with it the benefits that many are anticipating, then there needs to be some kind of get-out clause.

Mr RICHARD TORBAY: Okay. Do you have a view about what you consider the main sources of electricity will be in New South Wales in 20 years time? How do you see the sector going?

Mr SANTOW: We do have some views about that, but I think that is well beyond the remit of my organisation, so we would avoid the slant of that question.

Mr RICHARD TORBAY: No worries.

CHAIR: Did you put in a submission to the Federal Government's energy white paper?

Mr SANTOW: Yes, we did.

CHAIR: Is there anything you particularly want to highlight from that submission that could be particularly relevant to this inquiry, do you think?

Mr SANTOW: Not that I recall. Without wanting to come back to the point I have already made, I guess we interpreted the terms of reference for this inquiry in such a way that it would have been hard to anticipate some of the questions that have since risen. But perhaps the best way to approach that is to have another careful look at our submission to that inquiry and add that to our written comments.

CHAIR: Certainly, the terms of reference are fairly broad in many ways, but they are not exhaustive. I am highlighting this particularly given your acknowledged interest in the public interest. We are also taking aspects of those terms of reference, particularly as they relate to barriers to adopting alternative forms of energy, to a number of public forums. We are undertaking a deliberative process both in the city and in a country location. That will also add a valuable informed public perspective to our own considerations and inquiry.

Mr SANTOW: I would certainly commend you on behalf of the Committee for doing that. I think that is an important step.

CHAIR: Certainly we acknowledge and thank you for your participation and input into this inquiry's considerations. We have identified a number of areas in the course of this questioning where you will come back to us. There are no additional questions on notice because we have got through all of them, albeit it has taken a little extra time. On behalf of all members of the Committee, I thank you for appearing before the committee today. If we need to send some additional questions in writing, those replies, in addition to the replies you have already indicated you will provide, will form part of your evidence and will be made public. I take it that you are happy to provide a written reply to any further questions, in addition to those we have identified and recorded in the transcript?

Mr SANTOW: Yes.

CHAIR: Thank you very much for appearing today, and thank you for your ongoing great work in your normal role, representing those who do need special representation.

Mr SANTOW: Thank you.

(The witness withdrew)

(Luncheon adjournment)

ANTHONY ROGER IRWIN, Member, Australian Nuclear Association, affirmed and examined:

CHAIR: I welcome Mr Irwin from the Australian Nuclear Association. Before we proceed do you have any questions concerning the procedural information that was sent to you in relation to witnesses and the hearing process?

Mr IRWIN: No, it is clear.

CHAIR: Please state your occupation and in what capacity you are appearing before the Committee today?

Mr IRWIN: I am appearing before the Committee today as a representative of the Australian Nuclear Association.

CHAIR: Is your occupation in the nuclear industry?

Mr IRWIN: I spent 30 years in the United Kingdom operating large power plants. I was reactor manager for the OPAL reactor at ANSTO and I am now a visiting lecturer for the ANU.

CHAIR: Would you like to make a brief opening statement before the commencement of formal questions?

Mr IRWIN: Thank you. I thank the Committee for inviting the ANA to give evidence. The ANA is an independent scientific institution providing a forum for information about the peaceful uses of nuclear science. When we are looking at the energy mix, in New South Wales, 89 per cent coal; in Australia, 77 per cent; in the world, 41 per cent. So there is obviously a very high dependence on coal in New South Wales for the very good reason that it is the cheapest source. However, with a requirement to reduce emissions, New South Wales now starts from a very high level of emissions per kilowatt hour and plant has a long economic lifetime so the mix will be quite slow to change.

We believe you need to consider all the options because there is not a single solution to economic low emissions electricity generation. You also need various types of generation, both base load, intermediate and peaking. So if we are looking at replacing coal, coal is base load, and the options for base load low emission technologies are particularly restricted. So nuclear is a proven low emissions base load technology. Generation, 14 per cent worldwide; there are 334 reactors operating worldwide and 61 currently under construction.

Emissions for the whole nuclear fuel cycle, including mining, construction and the waste, are 10 to 100 times less than gas and coal. I think the question is: Can we manage the disadvantage of nuclear while taking advantage of this low emissions technology? The three areas that tend to be of concern are economic, safety and waste. For economics, several studies now show that nuclear can be the cheapest levelised cost of electricity for low emissions. Certainly, if you look at the draft energy white paper, the figure in that, nuclear comes out very well. It is very competitive with coal; if emissions are limited or we have to pay for our emissions. The fuel costs for nuclear are a very small proportion of the operating costs. So it is much less sensitive to fuel cost changes.

You have to examine the local situation for a nuclear power plant and the financing options. It certainly can be competitive. There is also this option of small modular reactors nowadays. This sizes up from 25 megawatts electrical. You can add modules as required so you get a lower initial construction cost and they are very good for remote locations. As far as the energy security is concerned, of course Australia is self-sufficient in uranium supplies, which is very useful. On the safety, on the basis of deaths per kilowatt hour of generation, nuclear is by far the safest of all the generation. There have been no deaths from radiation at a nuclear power plant except Chernobyl. Even at Fukushima the 20,000 deaths were from the tsunami and none was from radiation, even in this very extreme accident.

Modern reactors have passive safety systems that need no external supplies so avoiding the sort of problem they had in Japan, relying on gravity pressurised tanks and natural circulation. Also, as I mentioned, small module reactors, smaller quantities of nuclear materials, underground reactor vessel, passive, normal and emergency cooling systems make it a very safe system. As far as the other concern, the radioactive waste, waste is managed worldwide. A modern nuclear power plant, say, a 1,000 megawatt plant, produces in the range of

two shipping containers a year of low level waste, a small amount of intermediate level waste and about 35 spent fuel assemblies a year. They can either be gone through reprocessing or dry storage, and then finally either burn in one of these integrated fast reactors or put in a deep repository. In Sweden the Forsmark repository is now going through licensing and should be under construction by 2015. So the ANA recommends that nuclear is considered as an option.

CHAIR: How would you say the State Government can best ensure long-term energy security in New South Wales? If you were king for a day how would you advise the State Government to do so?

Mr IRWIN: I think you have to look at all the options. If we are seriously going for low emissions, then we have to look at all the low emissions options because there is not one stand-out low emissions option that will satisfy all the needs. There will obviously still be a need for gas for peaking, because gas is a quick start and you need quick start for some of the applications. You also need base load and base load emissions. If geothermal finally comes through, that is an option. If CCS is a success, it is an option. The advantage in nuclear is that it is already a proven option so you know exactly where you are with nuclear.

CHAIR: You said that the options for base load are restricted and nuclear is an alternative to coal. In terms of replacing base load, would you see more intermittent sources of energy as being a potential replacement as technology around storage developed? Is it fair to say that just looking at base load in isolation is not appropriate when you now have storage becoming a real possibility for some of the more intermittent sources of energy?

Mr IRWIN: If it is a true economic possibility—I think this is the other point—solar thermal is very interesting but the cost of it is very high. Nuclear is a lower cost option.

CHAIR: How would nuclear power compare to existing generation in New South Wales in terms of cost?

Mr IRWIN: Without any carbon feature on it—

CHAIR: We have a carbon feature there at the moment so we have to acknowledge that.

Mr IRWIN: If you look at the studies—and we have quoted several examples in our submission—nuclear is certainly competitive with any other base load technology, competitive with coal with CCS.

CHAIR: Why do you think countries like Germany and Japan are moving away from nuclear?

Mr IRWIN: Germany is moving not for any technical reason. Germany is purely a political decision. It goes back to 2000 when there was a change of government. They decided they want to eventually get rid of nuclear. It was a fairly long time scale, 2022. When Merkel's Government came in she reversed that and extended the period. Immediately post-Fukushima there was some concern worldwide and they took that opportunity to again go back to the 2000 policy. Germany is the only country to have shut down a nuclear power plant post Japan.

CHAIR: What do you think are the most successful examples of nuclear powered electricity generation plants that we should be looking at?

Mr IRWIN: The most successful country is France, which has around 74 per cent nuclear generation, and one of the lowest electricity costs in Europe, and supports a lot of Europe. In our region, areas like South Korea have a very good nuclear program which is a substantial contribution to electricity generation. The main construction is currently in China. There are 26 reactors being constructed in China and some of the latest designs in the world like Westinghouse Advanced Passive. That is being constructed now in China.

CHAIR: You refer to more conventional nuclear power stations and also some of the smaller units that are being contemplated at the moment. Can you give us the time frames around those different types of nuclear technology? If approval was given, how long would it take to build a nuclear power station or to implement a smaller scale nuclear generator in an Australian context?

Mr IRWIN: Reactors like the Westinghouse, it has a generic design approval from regulators, which means it is basically accepted worldwide subject to your local regulatory agreement. You could buy one of those

off the shelf now. The small modular reactors, there is not a full-sized demonstration in work at the moment. There will be by around 2018, 2020. That will certainly be an option for Australia. Of course, when you think about Australia there are also legal requirements to go through before we can start thinking about building a nuclear power plant. This is why we suggest that it may be a good option to think about these legal requirements now, then you will put yourself in a position that you can be able to build a nuclear power plant if everything else works.

CHAIR: When you say off the shelf, how long does that mean in reality it would take to build a nuclear power station in Australia?

Mr IRWIN: The module one now like the Westinghouse, construction time is of the order of less than four years. It is built in modules and you bring the modules to site and just assemble them. It is a lot better than the old stations.

CHAIR: You refer to the obvious barrier in an Australian environment of the government legal situation, particularly at the Federal level, which does not permit that first hurdle to be overcome at the moment. What laws and policies at the Federal, State or local government level would need to be changed to construct a nuclear power station in New South Wales, and how long do you think it would take to implement all the regulatory and safety provisions that may be required if you got through that initial legislative hurdle?

Mr IRWIN: At the moment the nuclear regulator, the Australian Radiation Protection and Nuclear Safety Agency, is not allowed to license a nuclear power plant. So there have to be changes to the Australian Radiation Protection and Nuclear Safety Agency Act to allow them to issue a licence. Then, for New South Wales, there is a prohibition law against the building of a nuclear power generation facility. There will have to be changes there. As far as the regulating and licensing concerns, licensing proceeds in steps, so there is a site licence, a construction licence and an operating licence. You can help this process by what is called the generic design certification. For instance, the Westinghouse plant has a United States generic design certification. A regulator can take that as a contribution towards proof that this design has been examined and is basically safe. It speeds up the whole process.

CHAIR: So, realistically, given those legislative and construction hurdles, and the best case scenario, how long would it take to have a nuclear power plant operating in Australia or in New South Wales?

Mr IRWIN: My estimate would be about 10 years.

Mr BART BASSETT: I have read a bit about thorium. I was wondering what your thoughts are on the potential use of thorium as a fuel in nuclear reactors and what advantages it has over the traditional. Further, I have read that a thorium plant was in the United States, operating at a small commercial level, but I understand it did not continue. What was the reason for that, if you know?

Mr IRWIN: Thorium is a very interesting material. It is not a fissile material like uranium. You cannot fill a reactor with thorium and it will work. It is what is called a fertile material so you can breed uranium from thorium. So, you put thorium in a uranium reactor and it breeds more uranium, which you can then use in another reactor. So, it is not a direct thorium cycle, it is a breeder cycle. It has some advantages because the uranium you produce is now 233 instead of 235. You get a different sort of radioactive waste mix, and there are some advantages in that. Thorium is abundant, there are huge quantities worldwide. It is more abundant than uranium and I think long term it will be a good alternative, but the extra cost of what you have to do to thorium at the moment means it is not really worthwhile with current uranium costs and uranium reactors. It has been used in the United States; it has been trialled in Germany as well. Several countries have done several trials on thorium. When you look at the next generation of reactors, it is an alternative fuel. I would not say the sort of fuel you would be interested in in this context in this sort of timescale.

Mr BART BASSETT: Probably from a transmission point of view, in what sort of locations in a State like New South Wales would you consider putting a nuclear power plant?

Mr IRWIN: It really depends on the size of the plant. If you want a fairly large plant, it is always best for cooling purposes, if it is a normal light water reactor, to put it on the coast because of the large cooling supplies that you can then obtain. The small modular reactors you can put anywhere. They are the size of a filling station. You can have air cooled condensers quite easily with others. So, you have far less restriction on where you can put them.

Mr JOHN WILLIAMS: With regard to location, I am led to believe—and you may correct me—that one of the challenges for siting a nuclear reactor is to ensure there is a zero level of background radiation so it is located in a sterile environment. Is that correct?

Mr IRWIN: No. Background radiation is everywhere. There is not a lot of variation in Australia in the background radiation levels.

Mr JOHN WILLIAMS: When we look at the new technology—and this is just commentary I have heard and I want to put on record—they tell me the new technology will waste at a lesser life than it had historically. The new reactors utilise the material much better than their predecessors?

Mr IRWIN: Yes. Modern reactors do utilise more material, but the next generation of reactors that is being researched, particularly by a program led in the US, will actually be able to burn some of the waste from the existing light water reactors—the existing fleet of reactors. That is going to be a really exciting development because that will get rid of one of the big problems: the spent fuel radioactive waste.

Mr JOHN WILLIAMS: The other feature of the latest technology is "improved safety levels". Can you highlight some of those changes?

Mr IRWIN: Certainly. As I mentioned, reactors like the Westinghouse reactor have what they call passive safety systems. One of the problems in Japan is that they lost their electricity supply and water supplies. They were reliant on outside supplies. Modern reactors have passive safety systems. So within the reactor building they have water tanks gravity fed to provide water to the core. In addition, they have tanks that are pressurised with gas, which again inject into the core, and then they use natural circulation as well. They can survive for quite a long time without any external supplies. Particularly with the small modular reactors, that is much easier to do. Some of the small modular reactors operate normally with natural circulation. They do not need any pumped circulation.

Mr JOHN WILLIAMS: Is that in crisis or in normal running?

Mr IRWIN: No, the small modular reactors have natural circulation. They operate normally without any pumps.

Mr JOHN WILLIAMS: My electorate is close to the South Australian border and I am continually listening to that State's news. South Australia has major challenges with future electricity supplies from mining developments around Roxby Downs, and the Leigh Creek coal reserve is diminishing due to its limited life. Can you see South Australia perhaps being the first State in Australia to have a nuclear reactor? Do you see that as its best option?

Mr IRWIN: It certainly would be a good option because they are talking about having gas pipelines very long distances for a gas station to Olympic Dam, which is quite an expensive option.

Mr JOHN WILLIAMS: Would the nuclear option be cheaper for South Australia to consider?

Mr IRWIN: You would have to cost it, but I would expect it to be cheaper, yes.

Mr JOHN WILLIAMS: Obviously, politics reign supreme and in most circles uranium and nuclear reactors are dirty words. From your observations in Australia, do you see us overcoming the high level of resistance towards this technology?

Mr IRWIN: I do because I talk to a lot of people. I do Rotary talks and things like this. A lot of people say, "Give me the information, I'll make up my own mind", "Let's consider it as an option", "It's got disadvantages, it's got advantages, let's look at them all and see if you can manage the disadvantages with it."

Mr RICHARD TORBAY: How quickly can a nuclear plant react to changes in demand? Can it be ramped up and slowed down? What are the time frames associated with reacting to demand?

Mr IRWIN: Because of the low fuel costs, it is best to operate base load plants at full output. That is the economics of it. France has to cycle theirs because of its very high number of nuclear power stations. So

France cycles between about 20 per cent and 100 per cent power because they have to maintain the grid with nuclear reactors. You can do it, but economically it is not the best way. It is also slower than gas plants. It is not the sort of plant you would use for a peaking role.

Mr RICHARD TORBAY: Have you done any research on what power sources will look like in 20 years? From which areas will be sourcing our power?

Mr IRWIN: From?

Mr RICHARD TORBAY: What part of the alternate energy sector—solar, nuclear? How do you think it will look in 20 years' time? Where will we be getting power from?

Mr IRWIN: I think it depends very much on the progress with things like CCS, solar thermal, geothermal. If all of those do not become economically competitive or if there are major problems with them, then I think people certainly will turn back to nuclear. That is the sort of feeling I get from the draft energy White Paper: nuclear is a reserve option. I think really instead of being a reserve option it would be better if it was on the table now with everything else and you looked at it in detail.

Mr RICHARD TORBAY: You mentioned that the people to whom you spoke in the community were happy to look at the options. In respect to locations, I am sure that Fukushima did a lot of damage to people's perceptions but, surely, for the next level of consultation people will say, "Yes, I'll look at the options, but as long as it's not close to me." Is that part of the feedback you are getting?

Mr IRWIN: Yes, it is interesting. I came from the UK and I operated power plants for years in the UK, but my last one was equivalent to Port Botany; it was on Heysham Harbour in the north-west. It was alongside the port with a town of several hundred thousand close by. For countries that have nuclear power and have had it established for a long while, there is a lot more acceptance of course because they are used to living with it. It is going to be far more difficult for Australia because of not living with it. It is ironic that we have the largest uranium source in the world and we do not use it ourselves.

Dr GEOFF LEE: One criticism of nuclear energy reactors is the problem of what is done with the waste. In your submission you mentioned available technology to dispose of it. For a nuclear plant suitable for New South Wales, if there was to be one—of course, we are not advocating that but considering all options—how much nuclear waste would be involved and what types? Where would you put it? Where would you advise it be put? Are there safe geological deposits in New South Wales to store it deep underground? What is the best way to do get rid of the waste?

Mr IRWIN: A modern nuclear power plant, say, about a 1,000 megawatts electrical large plant, produces three types of waste. The low-level waste is the normal operational waste—clothing, resins, filters, this sort of thing—and produces about two shipping containers a year, 150 cubic metres a year from a modern plant. That is suitable for near-surface repositories. Practically every country that has a nuclear power plant program has a repository. Good examples are El Cabril in Spain, which is probably world's best practice. Basically, you put it into a concrete chamber just underground packaged in containers filled with concrete. It is around the 300 years surveillance for that sort of assembly. Low-level waste is fairly easy to handle. There is a small amount of intermediate-level waste, much less than one shipping container a year. That would normally be stored on site at the reactor and eventually taken to an intermediate level store, which is basically a building in which you put a storage cask. Finally, there is the spent fuel. A big power station would consume about 35 spent fuel assemblies a year on average. You initially put those into a cooling pond to let the heat decay for a while, and then you have the option of either putting it through a reprocessing process so that you recover the uranium and plutonium for reuse and the other radioactive waste you normally vitrify, put it into a cask and then store that.

At the moment there is one deep underground repository which has just been licensed, in Forsmark, Sweden. That is the first in the world to be a deep repository and that will take fuel from all the Swedish reactors. That is 500 metres deep in very old granite rock; that is the sort of repository. But if Australia started a nuclear power program you would not have to look at the final spent fuel situation for many years because initially you would just store it and cool it. In the sort of time frame we are talking about, this new concept of the integral fast reactor will be used to burn that sort of fuel and reduce the waste in that way.

Dr GEOFF LEE: How long do they put the waste into the storage ponds to cool off? Does it take many years to cool off?

Mr IRWIN: It would stay in a cooling pond for, say, 10 years. It is to get rid of the initial decay heat.

Dr GEOFF LEE: Is it worldwide practice? I know there is some resistance to moving radioactive waste to other countries that are prepared to take it. Is that an international no-no at the moment?

Mr IRWIN: Countries generally are responsible for their own waste. For instance, the radioactive waste from Lucas Heights that went to France for reprocessing will not be kept by France. The waste is sent back. Countries normally will not take radioactive waste. The only exception is the United States. Some research reactor fuel that the United States provided goes back to the United States and there is no return of waste.

Mr JOHN WILLIAMS: What has Canada done with its waste? There are a couple of major reactors in Canada.

Mr IRWIN: Yes, Canada has several CANDU-type [Canada deuterium uranium] heavy water reactors. At the moment they store all their spent fuel so it is in dry canisters pending either use in a fast reactor system or deep disposal, and they are keeping their options open at the moment. Most countries are keeping their options open.

CHAIR: Mr Irwin, you certainly give the impression that uranium and indeed the waste are not as potentially hazardous as is generally the public perception. Following up Dr Lee's question about radioactive waste and how it might be stored, you made a comment in your submission that:

> Technology is available to dispose of radioactive waste so that its capacity to contaminate the environment would be far less than that of the naturally occurring ore body from which the uranium originally came.

Can you explain that a little more?

Mr IRWIN: Radioactive waste decays over time so eventually it gets down to a level that is equal to the original ore body.

CHAIR: Over what period of time?

Mr IRWIN: It depends on how you process the waste. If you take out all the longer-lived parts of the waste then you are looking at the fission product side, which is 300 years. If you do not take out the longer lived material then you are looking at the longer time scale.

CHAIR: So it is not immediate safety; it is treatment over time.

Mr IRWIN: Yes.

CHAIR: I understand. You also state that nuclear energy is a secure form of energy because uranium is easy to accumulate and store. How much uranium is it safe to store and for how long would that amount fuel a nuclear plant?

Mr IRWIN: A normal nuclear plant would keep about two years supply of fuel stored. That takes up a very small area. You would get two years supply in this sort of room. It is very good for energy security because you are not limited by transport problems or sudden increases in costs because you can hold your fuel on site.

CHAIR: How safe is uranium stored in that context?

Mr IRWIN: You can handle it. There is no problem.

CHAIR: When you talk about uranium exploration, as we did recently in New South Wales, or potential mining for export, what are the safety implications or difficulties or is uranium just the same as any other mineral?

Mr IRWIN: It has additional hazards to other minerals because the ore is slightly radioactive. There is a very comprehensive series of safety measures for uranium mining in Australia. It is a very highly regulated and controlled industry.

CHAIR: Are you saying I could handle it without hazard?

Mr IRWIN: Oh yes; well, miners do.

CHAIR: Sure. If it goes near water does that create any additional hazards? In what circumstances is it not safe, because as I said there is a public perception—and there are probably people who will read this transcript who have a perception—that uranium itself is hazardous or fraught with safety risk? Certainly that it is more so at the other end when it is radioactive waste. I am trying to get your perception on whether that is reality or a misconception.

Mr IRWIN: I think we do a very good job in regulating the mining industry in Australia. There are very large mines and they are highly regulated and operate safely.

Mr BART BASSETT: I have a general question. We talk about perception in the community and of course they have concerns for a number of reasons. Has your industry ever looked at the public relations aspect and getting some of the facts as you see them out to the community as opposed to the community being confused because they get bombarded by information from all over the place; that is, the coal seam gas industry?

Mr IRWIN: The industry does try to get the facts across but there is still this underlying perception that radiation is everywhere and always dangerous. We quite happily go and have a CT scan, which is about a three-year radiation dose for an average person, and yet we are worried about radiation. There is a lot of confusion and misunderstanding about the effects of radiation.

CHAIR: You mention the price stability of uranium in your submission. Might that be affected by an increased demand for uranium from India and China and the increasing ability for established nuclear power stations around the world to increase their energy output, as well as the growing number of nuclear power stations that you have referred to in places such as China?

Mr IRWIN: The history of mining shows that as the price rises then mines that were perhaps uneconomic become economic and more uranium is found. There has been a history of greater exploration with demand, as with all materials. The main point with nuclear power is that the fuel cost is only about 10 per cent of the operating cost so that a significant change in uranium price does not affect operating costs in the same way as, say, a change in coal prices or gas prices would. It is less sensitive to changes in fuel costs.

CHAIR: Whenever nuclear energy is raised in a community forum invariably someone will ask, as indeed Mr Torbay did in an earlier question, "Would you have it in your electorate?" or "Would you want it in your suburb?" Would you be comfortable having your residence within a kilometre of a nuclear power plant?

Mr IRWIN: I am not sure there is room in Kirribilli for a nuclear power plant.

Dr GEOFF LEE: It is certainly a novel idea.

CHAIR: I ask that question because it is the same question which everybody around this table will get asked. What is your response?

Mr IRWIN: Personally I would prefer to have a nuclear power plant than a chemical plant or coal fire power station or other sorts of industries. The best place is to put it within a reasonable distance of where you need the load but where you have an isolated area. There is an emergency planning zone [EPZ] around most nuclear power plants. That is to minimise the immediate effects around that plant. That is a fairly small zone. You have a fair amount of freedom in where you locate it.

CHAIR: Modular nuclear reactors aside, which can be more isolated, are there locations in New South Wales that have been identified as appropriate and if so, where?

Mr IRWIN: I am not aware that any work has been done to look at exact locations.

CHAIR: Mr Irwin, is there anything you would like to say in summary?

Mr IRWIN: I hope that nuclear energy will be considered on the table with the rest of the options.

CHAIR: The fact that we have actively invited your participation today, and we are also reading a number of submissions from parties with an interest in nuclear energy, demonstrates that this Committee does see it within its proper scope to entertain nuclear as one of the options that will be addressed in the report.

Mr IRWIN: If I can answer any more questions in the future I will be happy to.

CHAIR: The Committee may wish to send you some additional questions in writing and the replies to those questions would form part of your evidence and be made public. Would you be happy to provide a written reply to any further questions?

Mr IRWIN: I would. If the Committee would like any informal information in the future, I would be happy to provide that as well.

(The witness withdrew)

[*The proceedings continued via teleconference.*]

TOM LEUNER, General Manager, Wholesale Markets Branch, Australian Energy Regulator, and

MARK ANDREW WILSON, Director, Wholesale Markets Branch, Australian Energy Regulator, affirmed and examined:

CHRIS PATTAS, Acting Chief Executive Officer, General Manager, Network Regulation South, Australian Energy Regulator, sworn and examined:

CHAIR: Will you comment on the regulation of transmission and distribution network revenues? How does the Australian Energy Regulator make the determination?

Mr PATTAS: The regulator receives applications from each of the network businesses, that is distribution businesses and transmission businesses, at the outset of a review process which allows the regulator to then form a view of the regulatory allowances for each of those businesses over a five-year period. We receive at least four to eight applications per year from the network businesses which covers their regulatory periods, as I said, of at least five years. In setting the regulatory allowance we take into account the criteria and the objectives in the rules. We take account of the information that the businesses provide to justify their spending proposals, and any other information that we have at hand, that we can analyse in order to form a view on what the appropriate spending allowances for these businesses are. Those spending allowances in turn determine the prices or the charges that those businesses can levy on customers over that regulatory period. In a broad overall sense that is how that process works.

The process itself involves receiving the application and putting it out for comment. There is a draft decision stage and the regulator forms an initial view of the proposal. That is also subject to further comment and consultation with stakeholders, and then that culminates in a final decision by the regulator which determines the relevant allowances. After that the businesses or any other interested party could appeal that decision to the Australian Competition Tribunal on its merits and/or alternatively they can also appeal to the Federal Court on a judicial or an administrative review basis. That in essence is the broad process that we follow for determining allowances for these businesses.

CHAIR: Will you provide an overview of the capacity and use of interconnectors in New South Wales? In your opinion are there any market benefits in expanding interconnector capacity?

Mr LEUNER: Do you want to cover the capacity of them? I will ask Mark Wilson to discuss the capacity of them and answer that question.

Mr WILSON: The capacity of the interconnectors varies over time according to the capability of the network infrastructure and according to the offers that generators make into the market system optimiser. The generators put in offers to the market operator so that the market operator can dispatch generators to meet demand and an outworking of that is the flows on the interconnectors into and out of New South Wales. There is no set interconnector limit. It depends on the network conditions at the time whether all the network elements are in service and it also depends on the offers made by the generator. There is not really a single number that you can put to each of the interconnectors either coming from Queensland or Victoria.

CHAIR: Normally I would share these questions amongst committee members but given the logistics I will ask them. Will you briefly outline the purpose and processes involved in Australian Energy Regulator's regulatory investment test for transmission?

Mr LEUNER: The regulatory investment test is a cost-benefit analysis that assesses the economic efficiency and applicable reliability standards of proposed transmission developments including interconnectors. The test requires a business to consider the costs across the national electricity market of the proposed investment they intend to make, but also alternatives. The purpose of considering the alternatives is to see whether the proposed investment is the best option from an efficiency perspective. When they wish, for example, to expand an interconnector they would publish a proposal. They would seek submissions from interested parties and, particularly, they would seek alternative proposals that might be able to achieve the same benefits for less in costs. After that they there is a step they have to follow to publish the test. I think there is a

second round of consultation as well. Eventually they either pass or fail the regulatory investment test. From there they can decide whether and when to build the proposed investment expansion.

CHAIR: Will you comment on the current reliability requirements for the national electricity market? Could a small reduction in the reliability requirements lead to significant savings in network costs?

Mr PATTAS: We are probably not in the best position to comment in any deep sense on the reliability requirements, or changes to the reliability requirements, and what that might mean. We would look at these requirements in the context of our regulatory decision-making when we look at a business's proposal as I mentioned earlier. We take those essentially as a given because they are determined by the jurisdiction. In that context, in that kind of detailed analysis we would look at the impact of those reliability requirements, or any changes thereof, and what that might mean for new capital spending or any other cost changes. You would also be aware that those standards in New South Wales are currently under review by the Australian Energy Market Commission at the request of the New South Wales Government. There is a general view that changes to those standards may well mean changes to the future capital needs of the distribution businesses in that State.

CHAIR: I note that in that regard you have been a little more circumspect in your comments than one of your regulatory colleagues was on his recent appointment. Is that a fair observation?

Mr PATTAS: I would say the changes to those requirements are bound to have an impact on future capital needs; there is no doubt about that. But the actual extent of that is of course a matter that would need to be considered in some detail, and that is what we would normally do as part of our regulatory assessment process.

CHAIR: The national electricity market was designed when the vast majority of electricity in Australia was sourced from fuel-based generators. Does the structure of the market need to be reconsidered in a scenario where unscheduled or semi-scheduled renewable energy plays a greater role?

Mr WILSON: The market rules have been modified over the past several years to take account of increasing amounts of wind generators, whose outputs are intermittent in nature, and I think it is fair to say that the market rules manage the operation of those intermittent generators quite successfully. Quite a lot of work was done in preparation for wind generation coming into the market, because that was quite correctly regarded as a different technology and a very different generator as far as being able to dictate the output of the generator. That was seen as a problem, and there are now obligations for all of the wind generators to offer into the market and for the market operator to use the automatic wind energy forecasting system. That all works quite well.

CHAIR: Does anyone else have anything to add on that?

Mr LEUNER: I have just one further point to add to what Mark Wilson said. Prior to a few years ago, all wind farms were treated as unscheduled in the system. This effectively meant that if the wind was blowing it was treated as a lower demand in the system. But now, all new wind farms have to be what is known as semi-scheduled, which is sort of a halfway house between a fully scheduled thermal plant and a non-scheduled very small plant. That means, for example, that they have to bid in, as Mark Wilson said; and they can also be ramped downwards, for example. Obviously, a wind farm cannot be ramped upwards, because it depends on the wind; but they can be ramped downwards if market conditions require that.

CHAIR: I move to the next question. Does the operation of the national electricity market truly open up competition between all the States—obviously other than Western Australia, which is separate—in such a way that all States have equal access to electricity supply? Obviously Tasmania has some constraints as well. But is it a truly national electricity market, subject to those States identified as being somewhat out of the system?

Mr LEUNER: It is truly a national market in the sense that it is all subject to one set of rules. There is one frequency across the whole market—although Tasmania is separated by a DC cable, so it is a little bit different. However, there is price separation between the regions at times. For example, if the price in Victoria is $30, that does not necessarily mean the price in New South Wales and South Australia will be close to that; indeed those prices might be much higher or much lower. That price separation means that sometimes, particularly in the context of competition and analysis of competition law issues, the Australian Competition and Consumer Commission does not think of it as a national market, but rather a State-based market in which each

region has its own market—with the constraints provided by the interconnectors being factored in. Hopefully that answers the question.

CHAIR: Does anyone else want to comment on that? No. I understand there is a fairly significant price differential between Western Australia and the eastern States. How do you think that is affected by the fact that there is a national electricity market operating, other than in Western Australia?

Mr LEUNER: I do not know anything about the Western Australian electricity price, so I cannot really comment on that question. I do not know whether Mark Wilson knows anything about that.

Mr WILSON: The market design in Western Australia is fundamentally different from the national electricity market. Generators in Western Australia receive payments for capacity, whereas in the national electricity market that is not the case. So it is very difficult to make a direct comparison of wholesale energy prices because there are in effect two revenue streams for the generators in Western Australia. So it is difficult to compare the two. I think there were good reasons for having a very different market design in Western Australia: the number of players is much smaller. In the national electricity market, where we have a very high price cap and no capacity payments, this means the prices are very volatile, but we have a large number of players and that means ideally we get a competitive response most of the time; whereas in Western Australia they could not take an energy-only market design because you have only a relatively small number of players. So it is difficult to compare Western Australian and national electricity markets just on a face value basis.

CHAIR: Are there situations where electricity generators in one State within the national electricity market could withhold supply from another State if, for example, faced with a shortage within their own domestic environment? For example, could Queensland withhold supply of electricity from New South Wales to secure its own demand needs, at the expense of New South Wales?

Mr LEUNER: The Australian Energy Market Operator dictates through its systems where electricity flows. So the States do not have any day-to-day control over that. However, I guess if a State government were really concerned, it might quickly write new legislation, or something like that, and try to extract itself from the whole of the national electricity market and stop exporting any energy. I guess that is possible. But, in the current framework, it is not possible. I will check with Mark Wilson to see whether he has any other comments to add to that.

Mr WILSON: The only thing I would add is that the market operator has strong powers to direct a generator if there is insufficient supply to meet the demand, to meet reliability needs. State borders do not come into consideration when the market operator is making that decision. I am just building on Tom Leuner's first point: that, under the current arrangement, that is not really possible.

CHAIR: Is that situation different for direct gas supply between the States? Obviously gas which is used by a generator in Queensland has to be available through the network in the form of electricity flowing down from Queensland. But, in terms of supply of gas as a commodity in itself, and the supply between say Queensland and New South Wales, it is quite a different situation, is it not?

Mr LEUNER: That is one of the by-products of dealing through bilateral contracts between users and the pipeline, and then the customer ultimately. Again, State governments do not have any day-to-day involvement in that at all. I must admit that I am not an expert in this space, so it is a little bit of a guess. However, if a State wanted to bring into play its emergency powers or a similar function, I am sure it could ultimately stop gas flowing out to another state if it really wanted to. It would be a very difficult exercise and it would be overriding the bilateral contracts that exist between the market players.

Mr PATTAS: I wonder about State constitutional issues involved in trying to prevent those sorts of things going into another State. That is simply a query.

CHAIR: Are you aware of Western Australia's 15 per cent gas reservation policy and how it works?

Mr LEUNER: I am aware of it, but I do not pretend to know much about it.

CHAIR: I am probably talking about gas a little outside your area of responsibilities. I was trying to draw a parallel and to work out to what extent there is a security of supply of direct gas as opposed to electricity. I will not probe further unless anyone has any further comment.

Mr LEUNER: No.

Mr PATTAS: No.

Mr WILSON: No.

CHAIR: Are there other ways that New South Wales' energy needs might be better secured without having to compete directly with the relevant export market price for gas? Again, that may be outside your normal comfort zone.

Mr LEUNER: Can you ask the question again?

CHAIR: Are there ways other than a domestic gas reservation policy, for example, that New South Wales' energy needs might be better secured without having to compete directly with the relevant export market price for gas? I suppose I am answering the question myself. It may be that the national electricity market provides sufficient security of electricity supply such that you would not need to worry about direct supply of gas for electricity production, for example.

Mr LEUNER: I cannot really think of a good answer to that question. I am sorry. Anything that a government did would be interfering with the market price, which obviously comes at some form of cost in terms of efficiency, changing the supply-demand balance or something like that. If the market price goes up when the gas exports start from Queensland, that is the market at work. It is difficult to see a solution that would ensure there is cheaper gas or more gas for New South Wales that I can think of.

Mr WILSON: I am not sure whether you are worried about energy security or price. As far as energy security is concerned, we have a very high market price cap for electricity. That means the price of gas can go up a long way from where it is now and it would still be much cheaper to produce electricity than the market price cap. One of the things that the Australian Energy Market Commission does through its reliability panel is to determine the market price cap in order to satisfy the standard for electricity supply. If it looks like there is going to be a change in supply costs, which means that in order to meet the reliability standard the market price cap has to be increased, that would be a mechanism to ensure that the reliability standard is met from the wholesale perspective.

CHAIR: Do you have any view about deregulation of retail pricing of electricity in New South Wales as has largely already occurred in Victoria?

Mr PATTAS: We probably do not have any specific views on it. Of course, this is subject to a series of reviews by the Australian Energy Market Commission on an ongoing jurisdictional basis. It is due to do its next review of New South Wales next year or the year after. That will produce a recommendation that goes to the relevant Minister in that State. There is a process there for determining those things and the Australian Energy Regulator would not have any official view about that.

CHAIR: Can you comment on the rationale—and I know it is not your decision—for Federal carbon tax subsidies for Victorian generators that use brown coal predominantly but not for New South Wales generators using black coal?

Mr LEUNER: I do not think the Australian Energy Regulator would like to comment except to note that the carbon intensities of the Victorian plants are higher. I understand that is the main factor in that.

CHAIR: Is it not an issue that you have considered in terms of competitive neutrality or fairness in the market?

Mr LEUNER: No.

CHAIR: I am trying not to push the political barrow. How can the State Government most effectively ensure long-term energy security in New South Wales?

Mr LEUNER: I will talk about electricity first.

CHAIR: Yes.

Mr LEUNER: I think the concept is that the private sector will build the necessary generation as and when it is needed based on price signals. Those price signals come through the spot market and the futures markets in the national electricity market. That is the concept, so in a way it is a matter of being prepared to rely on the private sector to fulfil those needs and the State Government not necessarily having to build anything itself.

CHAIR: Are there any other comments on that?

Mr PATTAS: No.

Mr WILSON: No.

CHAIR: Some of your comments, and indeed comments from other people, suggest that perhaps the State Government would be best staying out of the space in both a regulatory sense and in terms of trying to pick winners between different alternative energy sources on the basis that the market should be allowed to operate in its normal market-oriented fashion and to the extent that regulation is needed it is covered now at a Federal level. Can you comment on that?

Mr PATTAS: I think we would agree with that sentiment. It reflects what Tom just said.

Mr WILSON: We are on the record as saying that the market design is a good one in that it has delivered the right capacity at the right time in the market as exemplified by the fact that we have had very high reliability as far as the wholesale market is concerned and as far as the network businesses are concerned. I think that the market design as it is is quite sound.

CHAIR: Would it be fair to say that while there may be threats to energy security in New South Wales they would not be any more or less than for Victoria or Queensland given the design of the market? Or are there additional risks at the local level that should be highlighted?

Mr LEUNER: I think that is correct. New South Wales did have some concerns during the drought because a lot of the plant lost access to cooling water, which did in turn push up the prices significantly. However, there was never an energy shortfall as I understand it. It is just one issue that I think is more prevalent in New South Wales and Queensland than in South Australia, Victoria and Tasmania. Please correct me if that is not accurate.

Mr PATTAS: That is correct. In fact, the Australian Energy Market Operator regularly reports on its assessments of energy going forward using a number of different mechanisms, including the statement of opportunities that goes for 10 years and also the energy adequacy assessment process. That grew out of the drought and the concerns to which Tom just referred. None of those reports by Australian Energy Market Operator flagged any significant energy security issues that I understand and, as I said earlier, there has always been a very reliable market, albeit sometimes those 10-year ahead forecasts that come out of the statement of opportunities process will flag shortfalls because they are so far into the future and it relies on a market response to those shortfalls. That is only funded out of visions by generators to invest, so you sometimes get a false sense of unreliability going forward because it does not make sense to invest until it is really needed.

CHAIR: But if you have failure at a local level then you rely on the interconnectors being there and the electricity being able to flow from other States. What you are saying is that there is no real threat in terms of an undercapacity, as you analyse the situation?

Mr WILSON: But, in fact, Australian Energy Market Operator takes all of that into account when it does its reserve assessments, which are done on an hourly basis for the next week on a weekly basis for the next two years and on an annual basis for the next 10 years. So they are continually assessing reliability going forward against that reliability standard that I talked about earlier that the reliability panel sets.

Mr BART BASSETT: We were talking earlier about the bid price and wind generators. Could you clarify that again? We have got the bid price going in for power. The capacity of the wind generators, does that not go into the network first, so everything they are producing goes into the network before any other energy producer?

Mr WILSON: That was the case before the concept of semi-scheduled generators was born. So we are talking about four or five years ago when the first wind farms were built. They got first rights to dispatch, but there is only a handful of those generators and most of those are in South Australia. But ever since that time every new wind generator has to offer into the market and be dispatched the same as any other generator; there is no preference at all for a wind generator versus a thermal generator.

Mr BART BASSETT: Thank you for clarifying that. Lastly, regarding transmission across the Queensland-New South Wales border, what is your position on the capacity there?

Mr LEUNER: I understand that they did a regulatory investment test, or it was a slightly different test when they did it but it is a similar concept. They did that some years ago on the concept of expanding the interconnector between Queensland and New South Wales, and that analysis, which was conducted jointly by Powerlink, the Queensland transmission company, and TransGrid, the New South Wales transmission company, found that it could become economic in the future to expand that interconnector—and when I say economic I mean that the benefits from a market yield perspective outweigh the costs. So I understand that they will be doing another assessment on the possibility of expanding that interconnector in the next few years. It will be interesting from a perspective to see whether it passes the regulatory investment test and then whether indeed they build the expansion.

CHAIR: That is it for questions from our end. Do you have any final comments, statements or questions from your end?

Mr PATTAS: Not really. We are honoured that we have been invited to address your committee today and thank you very much for that.

CHAIR: Thank you all for appearing before the committee today via teleconference. The committee may wish to send you some additional questions in writing, the replies to which would form part of your evidence and be made public. Would you be happy to provide a written reply to any further questions and, if so, who would be the best contact of the three of you?

Mr LEUNER: We would be happy, and just send it through to me—by email is fine.

CHAIR: There may or may not be. We certainly appreciate your time today in not only the assistance you have provided today but your willingness to respond to any further questions.

Mr LEUNER: I will just add that we do have access to a huge amount of data and we also produce the state of the energy market report. I will send up a few copies of that report to the executive there, and if you require any data about the outputs of the various New South Wales generators or their bidding practices or anything like that, it is all ultimately public data so we can help you in that regard and provide it to you. Just send through your request to me.

CHAIR: Excellent. I understand you will be sending a copy of the bidding practice with that material, and that will be much appreciated, thank you.

Mr LEUNER: It is a tricky thing because the bidding practices vary on a five minute by five minute basis around the clock. But we can send you the bidding behaviour of the various generators in New South Wales perhaps on a few typical days, and that might provide an indication, if that is helpful.

CHAIR: Wonderful. Thank you once again for your time.

(The witnesses withdrew)

(Short adjournment)

DIANE ELIZABETH WILEY, Program Manager, CO2CRC, School of Chemical Engineering, University of New South Wales, sworn and examined, and

BARRY JONES, General Manager, Policy and Membership, Global CCS Institute, affirmed and examined:

CHAIR: Thank you for appearing before the Public Accounts Committee to give evidence. Do you have any questions concerning the procedural information sent to you in relation to witnesses and the hearing process?

Professor WILEY: No.

Mr JONES: No.

CHAIR: Could you state your occupation and the capacity in which you are appearing before the Committee today?

Professor WILEY: I am the program manager for CO_2 capture for the CO2CRC and I am also a professor of chemical engineering at the University of New South Wales. I am appearing in my first capacity.

Mr JONES: I am the general manager of policy and membership at the Global CCS Institute.

CHAIR: And are you appearing in that capacity?

Mr JONES: I am.

CHAIR: Would either or both of you like to make a brief opening statement before the commencement of formal questions?

Professor WILEY: Yes, thank you for the opportunity to speak to the Committee. The CO2CRC is a world leading research and development centre focused on carbon capture and storage, commonly called CCS. Our partner organisations come from the coal, gas and power industry as well as local, state and federal governments. We have more than 150 researchers from CSIRO, Geoscience Australia and at least 12 Australian and international universities. We have three major research areas in CO_2 capture, storage and economics.

The International Energy Agency and other bodies who are analysing energy trends maintain the view that carbon capture and storage must be part of the technology mix if we are to manage climate change efficiently at a global level. This will be particularly important for Australia and New South Wales given the significant exposure our economies have to fossil fuels, both through exports and electricity generation. International Energy Agency modelling suggests that climate mitigation solutions without carbon capture and storage could cost countries 30 to 50 per cent more, and in many cases the emission reduction targets would be difficult or impossible to meet. Comparative cost analyses show that carbon capture and storage is a competitive technology when compared to other low-emission technologies, particularly when baseload electricity is required.

The CO2CRC capture research program focuses on four technologies for CO_2 capture, for pre-combustion capture, post-combustion capture and natural gas separation. The technologies are solvent absorption, solid adsorption, membranes and cryogenic hydrate systems. We conduct laboratory bench-scale and small pilot-scale research in each of these technologies. In addition, we have completed field pilot trials for our solvent, adsorption and membrane technologies for pre-combustion capture and post-combustion capture funded by the Victorian Government ETIS Scheme and Brown Coal Innovation Australia. We should soon be commissioning a pilot plant for trials of our Mark 3 UNO solvent at Hazelwood power plant in the Latrobe Valley.

The CO2CRC storage research program seeks to characterise the effect of geological, geomechanical, geochemical, geothermal and hydraulic conditions on the storage of CO_2 as well as to develop reliable and cost effective risk analysis, monitoring and verification techniques. Probably our best-known project is the Otway storage project in Victoria where 60,000 tonnes of CO_2 was injected into a depleted gas reservoir between 2008 and 2010. Although the injection has ceased, we continue to monitor the reservoir. In the last year, with

additional funding from Australian National Low Emission Coal Research and Development, we conducted tests to successfully evaluate the residual trapping of CO_2 in a saline reservoir at the site.

The CO2CRC economics research covers all aspects of the CCS chain. We have the capability to evaluate the costs of CO_2 capture using solvent, membrane and adsorbent technologies from a wide range of emission sources, including pre-combustion, post-combustion and oxy-fired brown and black coal-fired power plants and biomass-fired plants; natural gas combined cycle plants; iron and steel plants; cement plants; and oil refineries. Our storage evaluations cover saline reservoirs with and without pressure relief, depleted oil and gas reservoirs, coal seams and enhanced gas recovery.

We are currently identifying the best options for connecting different emission sources to different storage locations around the east coast of Australia using pipeline networks. We are also comparing what we call implementation pathways for power plants—particularly focused on New South Wales. This research recognises that we do not need to and would not be able to install 100 per cent low emission energy generation at one time. So we are comparing options for installing CO_2 capture at new power plants with retrofitting CO_2 capture to existing plants. In addition, we are considering staged installation and upgrades along with the benefits of flexible operation of the capture plant to match with the daily demand cycles for electricity. We are also able to compare the lifetime costs of power plants fitted with CCS to other low emission energy generation technologies including wind, nuclear, geothermal and solar thermal.

In relation to the terms of this inquiry, it is our view that ensuring a reliable, secure, sustainable, low emission, low cost energy supply will rely on four major elements. These are: improving energy efficiency across all parts of the energy chain from generation through transmission and distribution to consumption; more renewable generation; more gas generation; and fitting new and existing coal and gas generation with CCS. The New South Wales Government needs to ensure all of these options are supported.

CHAIR: Mr Jones, did you wish to add anything?

Mr JONES: I will just briefly explain the role and functions of my organisation for background. The Global Carbon Capture and Storage Institute was initially established by the Australian Government in 2008. We operate as a not-for-profit entity whose role basically is to advocate for CCS as a technology around the world, to support projects and share knowledge among those projects in order to advance the technology and accelerate the deployment of the technology, and also work to explain the technology to a wide range of audiences. We are a member-based organisation. We have 344 members from around the world including national, State and local governments and a very wide range of corporations and research organisations.

CHAIR: I was not aware that your organisation was established by the Federal Government in 2008. That makes it even more perplexing why carbon capture and storage was excluded specifically as part of the $10 billion Clean Energy Finance Corporation remit. Can you give some rationale for that, and do you have a particular view on why it was seen as not warranting the same level of available support as other new generation technologies?

Mr JONES: I can explain my understanding. I should explain the institute is completely separate from government. We are a company established under the Australian Corporations Act so we are not part of the government in any way.

CHAIR: So you are not funded by government?

Mr JONES: We are funded by government but we are independent of government, so we operate independently of government. My understanding is that essentially the argument was that CCS was excluded from the Clean Energy Finance Corporation because there are separate funding streams available for CCS. So, for example, there is a CCS flagships program operating in Australia which provides several billion dollars worth of potential support for CCS projects and technologies. So there are other funding mechanisms and other support measures for CCS in addition to the support for clean energy technologies available through the Clean Energy Finance Corporation.

CHAIR: So there is Government support for—

Mr JONES: There certainly is government support in Australia for CCS as a technology, yes.

CHAIR: At a New South Wales government level, is there any support currently?

Mr JONES: I am less familiar with that. I do not know whether Professor Wiley knows?

Professor WILEY: Yes, there is some funding through Coal Innovation NSW which has taken over responsibilities from the New South Wales Clean Coal Council. But I should point out that that is in fact existing funding; I do not believe there is any new funding so far on the table for that new entity.

CHAIR: Can you brief the Committee on some of the carbon capture and storage projects that are currently underway within Australia and overseas, and what they aim to achieve? I know you referred particularly to the Otway Project. You might go into a little bit more detail on that and any other projects that you think particularly are model projects for us to be aware of.

Professor WILEY: The Otway Project, as I mentioned, is a storage project. There are two main areas where we anticipate that CO_2 would be stored underground. Those are in depleted oil and gas fields or in saline aquifers. As I mentioned, we have already put a significant amount of CO_2 into a depleted gas well and we have done some testing for one of the major mechanisms for CO_2 trapping in a saline aquifer. So we have conducted both of those trials to date. That is really the only storage project as such until Gorgon comes on line in 2014 which will then be one of the biggest potential CO_2 storage projects in the world.

In terms of capture there have been a number of trials going on. As I mentioned, we have conducted trials of our technologies for pre-combustion capture at Mulgrave and for post-combustion capture at Hazelwood. There has also been a trial by CSIRO at Loyang. All of those of course are on brown coal-fired power plants. There has been a trial here in New South Wales at Munmorah with Delta Electricity and the CSIRO. The CSIRO has also had trials at Tarong in Queensland.

So there have been trials of the independent components of the technology and you are probably aware that one of the issues at the moment is that all of the components of the technology work. But actually having an integrated project there to date, I guess Mr Jones can better comment on that. But certainly in Australia there have been no integrated projects yet and that will present a challenge to implementing that still for power plants in Australia.

CHAIR: When you say integrated projects can I clarify what you mean?

Professor WILEY: All of the capture projects at the moment have been what you call catch and release. We have demonstrated that the capture technology works but it is not connected to a pipeline, so we do not have any CO_2 pipelines in Australia. In fact the trial that is planned with Delta is planned to be by road tanker, which is an acceptable option for a small trial but once you get to full scale implementation you will need the pipelines. Then the trial that we have conducted in Victoria, that has been not involving separation from a power plant. We have used our own source of gas in the Otway field in that location and then put it into the storage reservoir, so again it would not be considered as an integrated demonstration of capture from a power plant. Mr Jones might want to comment internationally.

Mr JONES: We track the progress of large-scale integrated projects around the world. By large-scale we mean, for power stations, projects that aim to capture at least 800,000 tonnes of carbon dioxide a year and for industrial projects at least 400,000 tonnes a year. As Professor Wiley said, they are integrated projects so they aim to capture, transport and store the CO_2 all in the one sort of project boundary, if you like. We currently estimate that there are eight operating large-scale integrated projects around the world. Two of those are in Norway, one is in Algeria and the remainder are in North America. All of those projects are in non-power sector applications at the moment. Six are from natural gas processing where the carbon dioxide is separated from the natural gas stream as part of the production process and then transported and stored, there is a fertiliser project and a synthetic fuels project as well at a large-scale operating. In addition there are seven of these large-scale projects under construction around the world at the moment. One of them is the Gorgon project, which Professor Wiley mentioned, here in Australia. When completed that will be the largest project storing carbon dioxide in a saline aquifer in the world.

Importantly, of those seven projects under construction, two are in the power sector. There is a project in Canada that is under construction called the Boundary Dam project, and a project in the United States called the Kemper County project. They are both power sector projects and they will be the first large-scale integrated power sector CCS projects when they are completed in the next few years. The Boundary Dam project is a post-

combustion capture project—that is, the carbon dioxide will be separated from the flue gas that comes out of the power station. The Kemper County project in the United States is an integrated gasification combined cycle plant, which operates as a pre-combustion source where essentially the carbon dioxide is separated out before the fuel is burned.

CHAIR: We have a number of competing technologies at the moment. Why should governments invest in carbon capture and storage technology in preference to other low emissions technology, if we should at all?

Mr JONES: What we would say is that they should not do it in preference; they should do it in addition as part of a suite of clean energy technologies. Professor Wiley mentioned some work done by the International Energy Agency [IEA]. The IEA has consistently demonstrated over a number of years now in its work that if the world is to achieve the kind of greenhouse gas mitigation targets that they have stated, then it will require basically every available technology to be deployed. We need energy efficiency improvements at a large-scale, we need a large deployment of renewable technologies, we need CCS and we need other alternatives as well. The IEA estimates that in order to meet those mitigation targets you need every available technology to be deployed. That is why we say CCS is not an alternative to other technologies; it is a necessary part of an overall energy technology mix that one needs to meet greenhouse gas mitigation targets.

CHAIR: My understanding is that carbon capture and storage is still quite some years off becoming a commercial-type reality. Can you give us some idea of the likely time frames and the likely comparative costs compared with pursuing some of these other technologies?

Mr JONES: Sure. I think it is important to recognise that CCS is not one technology. CCS is a range of different technologies applied to a range of different industries. It is certainly not just a technology that is applicable to coal-fired electricity generation, for example. It is applicable to a wide range of industrial sources as well. As I said before, of the eight operating projects around the world none are in the power generation sector at the moment and only two of the seven under construction are in power generation. That overall number of projects is a very small fraction of what the IEA says would be necessary in the future. The IEA is talking in the order of 3,000 large-scale CCS projects by the middle of this century if we are to meet those mitigation targets. There is no doubt there is a very large ramp up required at some stage over the next few decades.

CHAIR: I am trying to establish in my mind how viable they are. Are they exploratory? Are they pilots? If the carbon tax is $23 per tonne that is some incentive to ameliorate the cost, but it is not going to come anywhere near the level of the cost of storage, I am trying to get an idea of how commercially viable some of these other plants might be. If they are not—and my understanding is that they are not commercially viable in the sense of cost offset—then at what point do you think they would become viable?

Professor WILEY: Can I perhaps answer that question?

CHAIR: Yes.

Professor WILEY: In terms of the technologies, as you are probably aware, all of the technologies work—that is not in question. One of the big issues particularly I guess in Australia at the moment is where would we store the CO_2. So there is an effort going on at the moment—you cannot have an integrated project unless you have a storage site. So that is something that is particularly taxing us at the moment. In a more direct answer to your question, let us say that we had a storage site and we had the investment to put on a power plant. It would still probably take you between five, seven or 10 years to get the whole train up and running. Because even if you know you have a suitable site there is still a lot more proving up to be done to ensure that the site will actually hold the CO_2, working out the drilling patterns and so on.

In terms of the cost, the major cost is that it is like building a power plant. So there are two options: you build a new power plant with CCS or you retrofit CCS to an existing power plant. Either way it is a big investment and, as I know this Committee has already heard, that is a large amount of capital that an investor has to find and they are not going to do that until either the carbon price is high enough so that it will warrant doing that or if you are going to install baseload plant in any case then it would make sense to say, "Why can't we install the plant with CCS?" In terms of the cost, our analyses show that CCS is in the ballpark with all the other low emission technologies.

I think the public has this perception that it is way out there, it is just out of mind that you would even install it. That is not the issue—the issue is the initial capital investment. In fact, once installed, the costs in terms of levelised cost of electricity fall in the ballpark with all the other major technologies the Committee has been looking at: nuclear, wind, solar thermal and geothermal—they all fall in a similar ballpark. Yes, wind does tend to be on the low end and, remember, it is project specific—it depends where you install the wind, do you require transmission line upgrades and all of those other costs—CCS tends to fall in the middle and, from our costing, solar thermal, geothermal and nuclear tend to fall at the slightly higher end, but they are all in the ballpark of what you would anticipate to be spending. Given that we know how the national electricity market works, it is already a basket of costs in any case. So it is not out of the question to install CCS. It is more how do we find the storage? How do we find the capital investment that needs to go into either retrofit or to build the new plants?

CHAIR: I understand what you are saying and I do not disagree, particularly in the context that the competitive advantage of New South Wales is relatively in fossil fuel or black coal in particular. So if it is in the ballpark in terms of comparative costs then it does make sense to do the things that you are suggesting—to find suitable sites and those issues. But the starting point is whether it will be in the ballpark, and that is what I am questioning. You have probably read the testimony of the Coal Alliance given on the first day of this inquiry. One of the things they were suggesting was that perhaps there is a need to better map the potential in New South Wales.

Professor WILEY: Yes.

CHAIR: That seems fairly limited from what we have heard to date. I would be interested in your views as to what the potential is in New South Wales and to what extent there is still a big question mark over that question.

Professor WILEY: First of all let me say that I am not a geologist, but from everything I hear our geologists telling us the main issue for New South Wales at the moment is that we do not know—that is the best answer we could give you. Unlike in Queensland, South Australia or Victoria where there has been quite a lot of exploration, and they already have quite a lot of data that we can use to evaluate if there are suitable storage sites, we simply have not had those types of drilling programs in New South Wales. We have relied on our coal and the sorts of information that you get from well bore logs and things like that simply do not go deep enough for us to know with any confidence whether we actually have any suitable reservoirs or not. Now the national carbon storage mapping taskforce—whichever way round those words go—looked at a number of areas and suggested that perhaps out in the Darling Basin or perhaps where some of the drilling programs are now going up around Gunnedah would be quite prospective but again the simple answer at the moment is that we do not know because we need to take the drills out, drill the core and look at the core and evaluate whether there are actually reservoirs there.

CHAIR: Why has that not happened in New South Wales when it has happened in other States?

Professor WILEY: In terms of actual CO_2 core drilling, it is only starting to happen in other States now as well. CarbonNet is just being funded now to do that. The Collie South-West CO_2 Geosequestration Hub is now being funded just to do that. ZeroGen did do a drilling program in relationship to their proposed flagship, which has since now not progressed, but there simply has not been the drilling program for CO_2. As I said, in the past we have been relying on information coming from the drilling programs looking for natural gas and looking for oil, and we have not done that in New South Wales.

CHAIR: It has been more fortuitous that they just found some sites interstate whereas they have not found it in New South Wales. To that extent also, can you tell me who is driving those mapping processes? What role might or might not government have in that?

Professor WILEY: You say "fortuitous". It is fortuitous in the sense that the information already existed. The geologists had quite a lot of information to rely on. I should perhaps have explained that to store CO_2, you need to go down more than a kilometre underground, and most water bores do not go nearly deep enough. That is why, even if you look in New South Wales, you can see where all the water bores have been drilled, and they are just not deep enough mostly, whereas you have that information from oil and gas exploration. It is fortuitous in the sense that people have gone out for other commercial reasons.

The mapping process in Australia was driven by the Federal Government in conjunction with the State Government departments' geological surveys. There has been a very high-level assessment that the CO2CRC was involved in. In fact, our economics team was involved in doing the economic assessment of those reservoirs, but that was just for the storage side of it. That did not include the capture components of that. So at the higher level, there is a fairly high-level assessment that has been done or what are the most prospective locations, and that is now what the New South Wales Government department is relying on in terms of doing the current drilling program.

It is important to understand also that that drilling program is very small. In the oil and gas industry, they count on a 10 per cent chance of success. I forget just how many wells we are talking about drilling. It is actually quite a small number of wells, even relying on the fact that we are hopefully drilling in the most prospective locations. So, really, if you say, "How could we be more successful?", well, we need to drill more holes. We need to have a more extensive mapping program.

Mr JONES: If I could just add to that: the evidence from the Gorgon project in Western Australia is that even where the local geology is quite well understood, in the case of Gorgon from decades of oil and gas exploration on Barrow Island, it is still necessary to spend considerable sums of money to prove up that location as a CO_2 storage location. Gorgon were confident that they understood the local geology enough to be able to do that further drilling to prove up the CO_2 storage potential under Barrow Island, but still had to spend considerable amounts of money to be absolutely confident in that storage potential. That was an area that was reasonably well understood because of oil and gas exploration, largely.

CHAIR: Who has funded that? What role did government play?

Mr JONES: In the case of the Gorgon project, it is overwhelmingly funded by the project proponents themselves. There has been some government assistance, but it has been very small.

CHAIR: Is that the same model that you looked at in New South Wales? What is reasonable to ask in a New South Wales context?

Mr JONES: If I can sort of generalise back to previous questions: the evidence from projects around the world is that there is not a simple answer to that question, in a way. The projects that are operating around the world are doing so for a variety of reasons. For example, the projects in Norway are purely incentivised by the carbon tax that exists in Norway. They receive no additional government assistance, if you like. The carbon tax makes it worthwhile to do the project in Norway. In Algeria, it was a decision by the project proponents to store the carbon dioxide from their natural gas processing—again, with no government assistance.

In the United States, the projects that are operating in the United States and Canada largely are incentivised by being able to sell the carbon dioxide for enhanced oil recovery, so they are getting a revenue stream from their projects. The power station projects that are under construction in the United States and Canada are able to proceed because they are getting some government assistance and are able to sell their carbon dioxide. There is a mix of funding sources available to them. It will always depend on local circumstances, at this stage of carbon policy, if you like, around the world, as to what makes a project work and what does not make a project work.

Dr GEOFF LEE: Professor Wiley, I commend your centre for having 150 researchers, which is simply fantastic. For the capture component of the research, is there any likelihood of any disruptive innovations, or are we talking in terms of becoming more efficient with the technologies that we already understand? I know it is a speculative question.

Professor WILEY: Yes, and I am aware that I have only a short amount of time to answer that question. There are three main technologies that we see on the horizon at the moment. Solvent technology is the technology that is being investigated, and it is commercial. At the moment you could buy it off the shelf, so to speak, but that is costly because of the energy that is consumed by the capture plant itself. That is most likely going to be incremental changes, perhaps in conjunction with looking at how the capture plant integrates to the power plant. There are some opportunities there.

With membrane technology, it may well be a disruptive change. If you look back to membrane technology in the water industry, the disruptive change was when people worked out how to use submerged membrane systems. There was also a big change in the water industry because membrane technology went

through a lot of materials development. We are likely to see that also in the gas area because so far there has not been much effort worldwide on actually developing membrane materials for power plant capture. So there is likely to be quite significant improvements there with the membrane technology.

With adsorbents, again there has been very little work in that area. It is quite successful for oxygen separation from air, so we are hoping that we will find some materials that might actually solve that problem. Are there other disruptive technologies out there? Your guess is as good as mine.

Dr GEOFF LEE: Thank you. I know it was a speculative question, but I think it is important.

Professor WILEY: But we are hopeful that the costs will come down significantly.

Dr GEOFF LEE: I am sure the CRC will look forward to a disruptive technology being developed in-house. My final question relates to the storage of CO_2 in aquifers. I understand you said it is more than a kilometre underground. Is there any environmental risk that this poses that we understand? What are the environmental risks?

Mr JONES: I think geologists would argue that the consequences, if I can put it that way, of putting CO_2 that distance underground are fairly well understood. The type of reservoirs we are talking about are those that are deep and that have a very well-defined cap rock, so there is a trapping mechanism to make sure that CO_2 does not come up again. There are well understood analogues from the storage of things like natural gas underground where we know that it is possible to contain gas underground for many millions of years.

The studies that have been done, both desktop studies but also by looking at some of the operating projects around the world, are giving the geological profession a very good understanding of what happens to CO_2 when you inject it underground, where it goes, and how it behaves. In a general sense, the risks are well understood, and the risks are generally quite low of putting CO_2 at that depth underground. The evidence is it stays there, it migrates in a well understood pattern through the rock, it is contained by the impermeable layers of rock above it and, because it is well below any potable aquifers or water or other usage used by humans, there are really very few environmental consequences of putting it down there.

Dr GEOFF LEE: Does it interfere with any aquifers? I am not an expert in geology, either. But obviously if you change the aquifers a kilometre underground, does it have any interference or potential interference with aquifers further up the scale?

Professor WILEY: Generally, they are all in separate horizons. In fact, it is one of the reasons why you need to do the characterisation—to look for any interconnections. But, generally, there are multiple layers of rock and so you are looking at a distinct layer where there is unlikely to be connections to other layers. As I said, that is the reason for the characterisation. Also I should add to what Mr Jones said. Over the longer term of course the CO_2 will dissolve in the water and react with any of the minerals in the water or in the rock structures. So eventually the CO_2 will mineralise. It will tend to be stored there permanently over time.

Mr BART BASSETT: In projects currently underway around the world what is it costing to store, say, a tonne of carbon? Do we have any benchmarks?

Mr JONES: We do. I wish I had that at hand.

Mr BART BASSETT: If you do not have it at hand, if you could provide that.

Mr JONES: I can certainly provide it on notice. The storage cost is low. So in an integrated project by far the largest component of the costs are in the capture component, followed by the storage and in the transport generally, depending on how far you need to transport. The storage costs are the order of about $10 a tonne or something.

Professor WILEY: The estimates we have been doing, based on our ETIS projects, the capture costs can range anything between $60 to $100 a tonne or even more if you do not have a particularly good capture technology, but we would not be suggesting you implement those. As Mr Jones said, the transport costs are quite variable because it depends on how far you are transporting them. The transport and storage for the ideal sorts of projects are about $10 to $20 a tonne but if you go to the carbon storage task force report you will see costs there of $1,000 a tonne or more if you are going to transport very long distances and try to put the CO_2

into very poor reservoirs, but that is just an estimate. We are not saying that anybody with any thought would actually do that.

Mr BART BASSETT: A moment ago you referred to the capturing itself. Storage is the cheap component—

Professor WILEY: Yes.

Mr BART BASSETT: —and capturing $60 to $100.

Professor WILEY: Yes.

Mr BART BASSETT: I assume that will get cheaper, otherwise where is the benefit when you are considering a carbon tax of $23 a tonne?

Professor WILEY: That is correct. Our targets in the CO2CRC are to try to bring those costs down to $20 to $30 a tonne for the capture itself and obviously to look at ways of trying to make the transport and storage cheap as well. Certainly, over time there is no reason not to expect that. Look at the sort of numbers that the rooftop solar PV have been seeing. As we have seen production coming out of China there has been massive reductions in those costs. So as I mentioned, maybe not in the solvent area but certainly in the membrane area or the absorbent area we are expecting to see large reductions in those costs in the next 10 to 15 years, which is well within the time frame, as I mentioned earlier, of when you might be able to actually implement a full-scale plant.

Mr JOHN WILLIAMS: Just to explain the transport, and we are looking at this project at Delta. That truck that we will put the gas or liquid into, it has a capacity of about 35 tonnes?

Professor WILEY: It will be like a standard tanker, so I am not sure what capacity that would be.

Mr JOHN WILLIAMS: How many days operation would that represent?

Professor WILEY: My understanding—and you would be better off asking Delta that question, but I think they are talking about five or six trucks a day but this is a small demonstration project so it is only a small-scale trial of whether you can capture it. Can you put it into something and then put it into a reservoir? But that is nowhere near full scale again. Off the top of my head, I cannot recall just how much they are talking about capturing.

Mr JOHN WILLIAMS: So there are huge volumes?

Professor WILEY: There will be relatively large volumes. I think they were talking about 10,000 tonnes per annum equivalent but how much they are looking for in a storage site, I just forget off the top of my head. I am looking at Mr Jones but I am not sure if he remembers either.

Mr JONES: No. Things like Delta are orders of magnitude below what is ultimately required but again the transport of CO_2 in large quantities is already being done. There are thousands of kilometres of CO_2 pipelines operating today in the United States. They have been operating for decades. They already transport tens of millions of tonnes of CO_2 a year around the United States. So the transport technology for CO_2 is very well understood and pipeline transport is happening now on a large scale.

Mr JOHN WILLIAMS: Obviously it uses a fair bit of energy in converting it from gas to a liquid. What does that represent? Is that significant?

Professor WILEY: There are two main components of the cost of the capture plant. One is the actual capital, because they are very large plants and again that is one of the issues as to why we need to do the demonstrations. Even though these technologies are used in industry, they are at least an order of magnitude bigger when we talk about a full-scale operating power plant. So there is a lot of investment in capital. Yes, the issue of how much energy you then use in the capture technology itself and to compress it to get it down to a super critical state, again off the top of my head I cannot remember what the relative ratios of those are. But in fact looking at both of those issues is what our capture research is all about. How do we reduce both of those components of the cost?

CHAIR: If no storage sites are ultimately viable on a commercial basis in New South Wales, given the reality that I suppose transport costs are less likely to come down in the same order of magnitude as other technology, would it make sense for New South Wales to pursue that? Looking at New South Wales as opposed to the rest of Australia, where there may be viable sites, do you think it is sensible for New South Wales to pursue this as a priority, along with other initiatives?

Professor WILEY: One of the options to consider is whether you would actually transport the CO_2 to other locations in Australia. That is why I mentioned in my opening statement that we have been looking at the major emission sources, the potential storage sites and the cost of that. So there are other places that New South Wales could look to store the CO_2. In Queensland Surat Basin or Eromanga Basin have both been proposed, down to the Gippsland Basin. That would then depend on the business model for the CCS industry. Certainly, our costs show that again in terms of the impact on a levelised cost of electricity it is not out of the range to consider doing that. That would be a business decision for the proponents. What I do think though, and certainly what our calculations have been showing, is the role of government looking at how to facilitate the development of those pipeline networks becomes quite crucial. There is a big difference in cost between building a single pipeline for each power plant to each storage location or saying that what we need is a national infrastructure and we need to build large pipelines that then individual proponents can feed into with their individual emissions. So there is a role there.

CHAIR: What economic modelling exists on that at the moment?

Professor WILEY: As far as I am aware, just our modelling. ACIL Tasman may have done some of that for CarbonNet but again I would have to take that on notice to check.

CHAIR: I apologise if you have provided some of that information and I cannot recall it.

Professor WILEY: We did not make a submission. I do not know that we were asked to make a submission.

CHAIR: Would you provide some of that? Part of our challenge is trying to compare options on an economic basis.

Professor WILEY: Certainly.

CHAIR: If you would not mind supplying some of that modelling—

Professor WILEY: Certainly.

CHAIR: —based on storage sites in New South Wales as opposed to storage sites in other States which would obviously require more transport infrastructure.

Professor WILEY: Certainly.

CHAIR: Thank you. That would be useful. If CCS is deployed in New South Wales, would those technologies most likely be manufactured in New South Wales or Australia, or would it be overseas? Obviously there is a bit of a leg up in some jurisdictions overseas already. Is there a sense of to what extent we rely on overseas technology versus home grown, not that it is the predominant factor?

Professor WILEY: Certainly there probably is a role for government in looking at how they can facilitate the development of a new industry. Again, as I said, you certainly can purchase this equipment off the shelf. At the moment Alstom are offering it. Mitsubishi Heavy Industry will offer it as well. But for our pilot plants in Victoria we have had them built by a couple of local engineering firms in Victoria, so it is quite possible that you will see a combination of those. I think yes, the Government probably should be looking into how they can also facilitate the development of that new industry.

CHAIR: From your comments it seems there is certainly not a uniform and perhaps not even a general agreement in the research community regarding the best methods of capture, transport and storage. Is there a growing consensus of best technologies? How experimental is everything still or to what extent are we starting to see a clearer picture of how it might be best to capture, transport and store carbon dioxide?

Professor WILEY: To go back to what Mr Jones alluded to earlier about storage, there are no arguments about how to do it. You drill wells. Again you will get differences as to whether you use vertical or horizontal or deviated wells but that is standard technology.

CHAIR: Fairly established?

Professor WILEY: It is fairly established and you can ask someone to design that for you. But the issue is how you prove up the field. Again, that is established technology; there are no questions about how you do it. You simply have to do it. You have to go through the process of drilling the wells, taking seismic, doing the calculations and simulations. The same with transport: As Mister Jones said, if you are going to transport any large amounts, particularly if you are talking about power plants, it will be pipelines. As I said, though, the structure of the pipelines—do you build single pipelines or you say we should have a national infrastructure and therefore save lots of costs—again, I think that is a reasonably straightforward answer. You say what is it going to cost and what is the best way of getting this to happen. But you are right in the capture area.

There are still questions about what the technology of the future will be. We have just said, if you want to buy something you could buy it off the shelf. That is available but it is going to be expensive. The jury is still out on where it will go in the future because, again, all of these capture technologies from our assessments again fall in the ballpark. So, until there is a game breaker or a game changer, a major breakthrough, the best thing in our view—and I think most people around the world will agree—is to pursue again a range of technologies because we do not want to lock into a solution that in the longer term proved to be uneconomic.

CHAIR: Can I ask on the transport, and if you use pipelines, whether or not they have to be dedicated pipelines? Have you explored the possibility of multipurpose pipelines? Or is that a bit alien to reality?

Professor WILEY: I am not sure how you would use them or what you mean by multipurpose pipelines?

CHAIR: I do not know whether you could use a gas pipeline. Whether you could put carbon dioxide into a gas pipeline?

Mr JONES: My understanding is ideally it is a fit for purpose pipeline. So, you need to take account of the physical and chemical properties of the particular gas you are putting down the pipeline. While the pipeline technologies are broadly comparable, it is best to have dedicated CO_2 pipelines just because the nature of CO_2 is a bit different to the nature of natural gas, for example. It does different things and you need slightly different chemical properties in the pipeline.

Professor WILEY: To answer that, there has certainly been a trial, using an existing gas pipeline, because it is really a question of does it do the job. I believe the Longannet and Golden Eye projects were looking at again using gas pipelines. So, it is basically will it do the job? Then you certainly could do that.

CHAIR: Is there anything else either of you would like to add?

Professor WILEY: No.

Mr JONES: No.

CHAIR: Thank you for appearing before the Committee today. The Committee may send you some additional questions in writing the replies to which would form part of your evidence and be made public. I know you will already be providing some information to us. Would you be happy to provide any additional responses in writing to any further questions?

Mr JONES: Yes

Professor WILEY: Certainly.

(The witnesses withdrew.)

SARAH McNAMARA, Head of Government Affairs, AGL Energy Ltd, and

TIMOTHY ANDREW NELSON, Head of Economic Policy and Sustainability, AGL Energy Ltd, sworn and examined:

PAUL BRENDAN ASHBY, General Manager, Commercial Development, AGL Energy Ltd, affirmed and examined:

CHAIR: Would any or all of you like to make a brief opening statement before the commencement of questions?

Ms McNAMARA: I think we are happy to refer to our submission to this Committee.

CHAIR: Would you be able to tell the Committee about AGL's current generation development projects?

Mr NELSON: I am happy to do that. AGL is Australia's largest renewable generator. We have over 1,000 megawatts of renewable capacity. We also own a third of the Loy Yang power station in the Latrobe Valley in Victoria. There is a process underway, still awaiting ACCC determinations, in relation to a proposed acquisition of the remaining equity in that power station. In New South Wales we have several projects of relatively small size. That said, we are the incumbent and historical gas retailer and also have a significant electricity retail base. We also have a proposed power station at Dalton, a several hundred megawatts open-cycle gas turbine peaking power station.

CHAIR: You are obviously pretty well experienced in the electricity market. Looking forward with some vision to the future, what would you say will be the major sources of electricity in New South Wales in 20 years time?

Mr NELSON: In a 20-year outlook it is hard to tell because the economics of generation technologies are likely to change over that time. I guess in the next 10 years, which is probably a little easier to foresee, certainly with where electricity demand is at over the past few years, it has certainly been slower than it has been historically, and with the significant renewable capacity that will come into the market as a result of the 20 per cent renewable energy target implemented by the Commonwealth Government, you are likely to see over the next 10 years quite a lot of renewable capacity being deployed throughout the national electricity market, including New South Wales, with the remaining capacity requirements largely being open cycle gas turbines because of increasing peak demand. Beyond 2020, based on current technology and current thermal fuel costs, you are likely to see combined cycle gas turbines being the technology of choice. But that said, the gas market is undergoing change and if gas prices were to increase significantly from where they are today then that makes the investment decision beyond 2020 a little more difficult to foresee.

CHAIR: Mindful of the fact that we have renewables, albeit with some extra cost attached from the Federal Government and where we are heading on future coal and gas prices, where do you see electricity prices going in New South Wales, particularly with reference to some of those inputs and government imposts?

Mr NELSON: In terms of retail electricity prices, they sit today, depending on where you are, anywhere between 20 cents to 25 cents a kilowatt hour. They are very rough numbers, but it depends on where you are. That translates to $200 to $250 a megawatt hour. At the wholesale level, the long-run marginal cost of a coal plant or even a CCGT is somewhere between $50 and $60, and an open cycle plant might cost you $95, $100 a megawatt hour. Wind in that context is around $100, $120 a megawatt hour and then you have a whole bunch of technologies, which are probably more expensive than that. In terms of future retail electricity prices, most of that over the next few years is likely to go up as a result of networks more than anything else, and that is that divergence between, I guess, the wholesale market at this end and then the networks, which is the physical delivery component. Of that, most of it is distribution networks, not transmission. In terms of wholesale markets, the critical question becomes at what point does a gas-fired plant become the marginal price setter in the National Electricity Market? That is difficult to foresee at this point in time. Then I guess the other issue, which is very difficult to forecast, is at what point gas prices might move as a result of the significant LNG export out of Gladstone.

CHAIR: What impact do you think the carbon tax will have on electricity generation in New South Wales?

Mr NELSON: In terms of the physical mix, not a lot in the short term, but that is largely a result of the fact that we do not need a lot of new baseload and intermediate plant. At $23 a tonne, if we needed new plant it would actually go some way to resolving the uncertainty of it: whether you go with coal or gas. But again, that is on the basis of current thermal prices. Where that goes from here I guess is up for debate. In terms of what a carbon price means for end use electricity prices, this is very back of the envelope, rule of thumb, but at $23 a tonne you multiply that by around point 9 tonnes per megawatt hour, which is roughly the intensity of the NEM. You get around $20, $21 a megawatt hour.

Dr GEOFF LEE: What is AGL's position on coal seam gas?

Mr ASHBY: AGL has a number of coal seam gas developments in stages between rank exploration, very early stage exploration, through to ready for development and in fact some existing production in New South Wales. To summarise, about half of our resource base sits in Queensland where we are not the operator. We own half of a field that sits up in the northern Bowen Basin that is connected to Townsville. That is not connected, therefore, to the rest of Australia in the sense of pipeline. So in a sense, that is isolated and very much a point-to-point source. The rest of what we have in Queensland is small scale conventional natural gas. We have a storage facility near Roma and we have some exploration in the Galilee Basin in central Queensland. Closer to home we have three areas of interest to AGL. We have about 700 petajoules of gas in the Gloucester Basin, about 100 kilometres north of Newcastle, we have we think about 500 petajoules of gas in Prospect in the Hunter Valley, west of Newcastle, and right on Sydney's doorstep we have our Camden facility where we have about 150 petajoules of gas of which 40 per cent is currently developed and producing about 5 per cent of New South Wales's requirements. The rest of it is undeveloped and awaiting us being able to get access to that gas. We have a large amount of undeveloped gas of the order of 1,300 petajoules right on Sydney's doorstep in New South Wales awaiting development.

Dr GEOFF LEE: Barring any legislative policy or government restrictions or impediments or anything, are you saying that coal seam gas seems to be a viable future alternative for AGL?

Mr ASHBY: Absolutely. We think it certainly is viable in comparison to simply buying the gas from a third-party supplier like Esso-BHP in Victoria or Santos in the Cooper Basin in central Australia. We certainly think it is viable because we do not have to pay the long transport costs you have to pay to buy the gas from interstate. If it is right on Sydney's doorstep, it does not cost much to transport into the region.

Dr GEOFF LEE: What sort of costs are involved?

Mr ASHBY: About $1 to $1.50 to bring the gas from different parts of Australia to New South Wales.

Dr GEOFF LEE: That makes it worthwhile?

Mr ASHBY: Certainly, because when you think about it, we do not have to pay that taxi fare, if you like, if the gas is nearby. It also allows us to be competitive because we can tell those third-party suppliers like Esso-BHP and Santos, "Hey, if you don't give us the gas at a reasonable price for our customers, we'll do it ourselves." It gives you the leverage to be able to negotiate in the market to get the best outcome for customers in New South Wales.

Dr GEOFF LEE: Based on the known quantities you mentioned earlier, how long will AGL's supply last?

Mr ASHBY: At the moment we are going nowhere with any of those developments. Apart from the five to six petajoules per annum we are producing out of New South Wales, 140 petajoules of demand annually, that obviously will last us for another 10 years, but it really depends on when we can get access—some of it because of approval; some of it because we need to do more work with community engagement. Whatever the case, until we can get access to that gas that is a hard thing to predict. But let me guess. I would suggest that if we were able to get access to the Gloucester gas north of Newcastle, the Hunter Valley gas west of Newcastle and the northern extension of the Camden fields in south-west Sydney, and we are able to bring those into development over the next three to five years, which is our aim, we should be able to supply 40 per cent to 50 per cent of New South Wales's demand by ourselves from those fields.

Dr GEOFF LEE: Over what sort of time?

Mr ASHBY: Just to quantify that in round numbers, that is, let us say, 60 to 70 petajoules per annum of gas, divided into about 1,300.

Dr GEOFF LEE: About 20 years?

Mr ASHBY: That is quite a number of years. Well over a decade.

Mr BART BASSETT: Based on your answers about coal seam gas, with Queensland exporting its gas, do you think coal seam gas in New South Wales also could be exported? If so, will that cause a problem for the supply in New South Wales?

Mr ASHBY: Certainly we have heard and, of course, you would need to ask the operators of the fields in the northern part of New South Wales what they intend to do to be definitive on that point, that Santos's Gunnedah Basin reserves could be used for either domestic supply or sale into Queensland. Whether the gas then goes into an LNG export facility is another matter. I would point out that TRUenergy owns 20 per cent of those reserves. TRUenergy is not a traditional LNG producer. So I imagine that 20 per cent of that gas may well end up, let us say, in a power station. I think that is not going to make a big difference to the supply/demand situation because, when you think about it, prior to that that gas was owned by a company called Eastern Star Gas, which was taken over by Santos. Eastern Star Gas wanted to bring the gas to Newcastle, but then export it all out of Newcastle. I believe that idea is now on the shelf and the only decision for Santos to make for those northern fields is whether they want to bring it north, send it into Queensland or perhaps some other disposal option that suits them: on-site generation in that area, for instance, or doing something with TRUenergy.

That strategy is part of that company's future. It is clear though what AGL wants to do. We own about half of the resource in the State. Our resources are not sitting near the Queensland border, they sit on the doorstep of the Sydney metropolitan area and we have absolutely no interest in exporting that gas for LNG. We have 100 per cent interest in making sure we can service our 700,000 Sydney customers. That is what we think is going to happen; that is our aim. I do not think that is going to make any difference to the big picture because we still have supplies coming out of Victoria from Esso-BHP and we have said many times that we do not want to cut them off. The stuff that we want to do ourselves in the Sydney Basin is purely to diversify the risk and to make sure that New South Wales is not importing the majority of the gas. That is not to say we want to get to a situation where we are 100 per cent self-sufficient either. It is always healthy for us to have competition from Central Australia and from the Gippsland Basin within ourselves to make sure we get the best outcome for those resources. Our expectation at AGL is to produce about half the gas into our own portfolio from our own supplies and still take about half that gas from third parties and on-sell it into the market.

Mr BART BASSETT: Based on that, what do you think future coal and gas prices are going to do in their potential effect on electricity prices from AGL's perspective?

Mr ASHBY: I will not touch coal prices. I will give you the industry view at the moment about gas prices. The industry view, and it is one that I share directionally—I am not going to say it will increase by 50 per cent, 100 per cent or 150 per cent, but I think almost certainly gas prices will increase, for two reasons. Firstly, the LNG export markets in Queensland will almost certainly go ahead, in our view, and that will provide for the first time in Australia's eastern States history a linkage between an international market price and the local market. Even though there will be a trickledown effect that will take some time to wind its way through into the southern markets, because this is very much a south-west Queensland-type phenomenon, that almost certainly will have an influence on local prices once the existing legacy contracts in our market at the moment that are still at, let us say, around $5 delivered into the Sydney market, roll off. They roll off through 2015-2020 pretty much completely into this State. Once you have to re-contract and backfill those contracts that will have to be done at a price that is able to attract the supplies, for instance, out of the Cooper Basin. The Cooper Basin has an option: it can sell the gas to Queensland or sell the gas to New South Wales. It is already selling gas to Queensland at a much more elevated price. The connection will occur that way. That is the first thing. It will go up by 50 per cent to 100 per cent in my view.

The second reason prices will go up is because of the cost of development. Most of the reserves growth that has occurred in eastern Australia in the past five years has been on the back of the assumption that the price would go up. If we were just talking about the same prices that we have been talking about and selling gas into

the market for the past 10 or 15 years, then most of those reserves would be sub-commercial. Therefore, by definition they are not reserves; they will disappear. So the other reason gas prices have to go up is to ensure the cost of the industry—there is inflation in the industry for all sorts of reasons, and the only way we are going to be able to get those resources out of the ground is to see the price go up and encourage the producers to produce. We have done our own independent assessment of all the suppliers in eastern Australia and our view is that the price needs to go up by, again, about 50 per cent to 100 per cent to attract those reserves into the market. No matter how you look at it, it is either a connection to LNG through international markets or an increasing cost of development. Both of those things are pointing to an increase in prices.

Mr BART BASSETT: I have a bit of a controversial question. Based on everything said you have said to me, gas and access to gas is extremely important to your company. Is that a fair statement?

Mr ASHBY: Absolutely.

Mr BART BASSETT: As an industry and as a company why did you seemingly allow the negative feelings about coal seam gas to get out of control, from my viewpoint, and why did the industry not try to correct what was going on?

Mr ASHBY: That is a good question. To sum it up, we just did not see it coming. The gas industry in Australia is over 40 years old. The coal seam gas industry in this State is over 15 years old. In fact, there was exploration going on over 20 years ago. There were small pockets of opposition at the time. Anyone who was down in the Macarthur region would recall the early 2000s when the Camden operation was first getting up. It was reasonably controversial, but it died down because the sun kept coming up the next day, the gas started flowing, jobs came to the local area and people were happy. I think it is fair to say that we just did not see it. The people either side of me are much more in touch with a lot of those stakeholders that we see and we probably just did not predict it. The industry is not very good at teaming up and giving an industry view. We compete with each other; we like beating each other up. In fact, when you hear about someone's misfortune there are people who sometimes say, "That's great."

CHAIR: It is just that way in politics, dare I say.

Mr ASHBY: We just did not see it and it got out of control. Sarah and Tim may want to add to that.

Mr NELSON: Mr Bassett asked a very good question and it extends beyond coal seam gas. If you look at the energy industry more broadly on the east coast now, there are very few issues that the industry deals with where there is not some form of community opposition and a lot of it has to come back to how the industry communicates. It is something we are very aware of. To your point, we probably should have got onto things sooner than we did. That is not just coal seam gas; it is across a whole range of issues. It is certainly something that not just AGL but everyone operating in this space is very cognisant of.

Ms McNAMARA: Both AGL and all of our industry colleagues have gone to quite a lot of effort to get factual information out about the coal seam gas industry and our practices and our intentions for the future. Where we have failed I think is that our detractors are using very emotional arguments and sometimes misrepresenting the true state of affairs. Sometimes our responses do not get as much attention as we would like. That is something we need to address in order to get the real story out there and make people feel more comfortable about our industry and our intentions.

Mr BART BASSETT: Politicians face those problems all the time, repetitively getting the message out. Thank you for your frankness.

Mr RICHARD TORBAY: You touched on competition in the energy market a moment ago. How can the State Government encourage greater competition?

Mr NELSON: If you look at the various National Energy Market jurisdiction regions, a lot of the States are already highly regarded internationally for having significant competition measured through churns—how many people are switching around. I think longer term the answer we would give is deregulation of retail pricing, but there are processes underway through an Australian Energy Market Commission review of competition and all of those things. Other policy measures that governments could start to look at are incentivising the technology that would facilitate greater consumer control of their energy consumption—things like smart meters, which enable retailers to offer time-of-use pricing and those types of innovative pricing

products. One of the things that we are very keen on is trying to incentivise our customers to use less at various times of the day because it is a more cost-effective way for us to serve them than just to continually build power stations and for the network businesses to continually build network capacity.

I think a combination of deregulation of prices and the introduction of smart metering technology would work. One thing I have not touched on is those things cannot be deployed without significant consumer education. That has been learnt in Victoria. The cart was put before the horse; in the sense of a meter rollout without the necessary education as to how it will benefit consumers in the long term. With a combination of education, flexible pricing arrangements and technology that facilitates that time-of-use pricing you would be in the perfect environment for competition.

Mr RICHARD TORBAY: You have touched on government policy and a number of the submissions talked about "certainty" because there have been a lot of changes at a policy level. I am interested in your view on the investment process into the future. If it can be achieved certainty has to be a positive factor in terms of investment into the future. It is probably presently having a negative impact on investment given the uncertainty that is occurring at a policy level.

Mr ASHBY: On the gas development side we are struggling with the uncertainty around deploying the capital to develop gas on the gas market side. We would echo those concerns. Our shareholders, stakeholders, and 700,000 customers need some certainty going forward that we can supply them with gas. At the moment we are concerned that two or three years from now we will be starting to fall short. We know the other producers are interested in the liquefied natural gas markets and we are worried that we are going to be left short.

Mr RICHARD TORBAY: Can you touch on what regulatory changes you would suggest? What changes would you suggest would support you in the future?

Mr ASHBY: All I can say on the gas side is that we see the process that has been gone through and we are supportive of that process. Like all companies we like to know the rules and what we have to do. We will make sure we do a better job with our communities and stakeholders in the local area; that is our responsibility and we acknowledge that.

Mr RICHARD TORBAY: As long as you know what they are.

Mr ASHBY: We think that we do a reasonably good job in our local areas. When you see the media reports you are seeing media stories coming from all sorts of different directions. At the grassroots level in the local government areas that we deal with we think we do a reasonably good job. It is not perfect and we have discussed there are issues. What we need to know is what we need to do to satisfy other stakeholders, the wider community, the State Government and the Federal Government. We need a clear road map to move forward. We act on a lot of the things that we see are emerging from the various committees and ongoing work and we are committed to complying with that and getting on with it. We want to be able to do that. That is our key goal.

Mr BART BASSETT: You have talked about interaction with your local communities and we talked about the facts being disseminated to local communities. I am assuming you have done that. If you have not are you considering doing it? Your company has 700,000 customers—have you informed those customers about your product, where it comes from, the shortage of the product and what benefits come from ensuring supply in order to factually correct some of the misconceptions about coal seam gas? Have you put that information in the bills in order to supply it to your customers?

Mr ASHBY: One of the challenges is that in regional areas most of the community are not connected to gas. Rather than trying to use the leverage of the Sydney market to say we are trying to take the gas out of the local area and give it to the people in Sydney, we are trying to talk about reticulating local areas within our development areas. In that way we will be offering something more for the local community. Other than the Upper Hunter Valley—where Singleton is connected to gas—and Camden, most of the other areas, such as Gloucester or other areas in the Hunter, are not connected. It is hard to use that argument. The locals say: We are not that interested in what is happening in Sydney, what are you doing for us in the local community? That is what our focus has been in recent times—trying to work out solutions.

We can certainly do things on the electricity side and we are thinking about offering some good community programs, good electricity prices to local communities and doing a whole bunch of things, in

addition to the gas development, to show we are trying to put something into the community and not just take the gas away and send it to Sydney.

CHAIR: Obviously there are various incentives and schemes at a Federal level—more now than when the New South Wales Government started its involvement in grant schemes. Given that there are a number of initiatives and regulations at a Federal level that are encouraging emerging electricity generation projects and encouraging more environmentally friendly energy; is there a role for the New South Wales Government in that area? If there is what do you think it is?

Mr NELSON: I guess we have always taken the position of a national approach to green schemes, for want of a better term, to address climate change. To refer back to the concept of uncertainty: One of the most difficult things in the electricity industry is the concept that both of the major political parties in Canberra agree on the outcome—which is a five per cent reduction on emissions—but there is disagreement on the mechanism. That is having an impact on investor confidence. How that is resolved is beyond me to answer. In terms of the role the State Government has; it has a significant role around the facilitation of planning and all of the things which allow investors to make investment decisions within a nationally consistent framework that is set by the Commonwealth. We are in a national electricity market so it is hard to justify State-based initiatives. It makes it more difficult to harmonise the experience of consumers in Brisbane, Sydney, Melbourne, and Adelaide or anywhere in between. AGL has been on the record pointing out the shortcomings of the State-based feed-in tariff arrangement in New South Wales. I guess it is in that context that a national approach is preferable to us.

CHAIR: I invite your comment on this proposition: New South Wales does not have a medium to long term energy security problem in relation to electricity because of the national electricity policy. Some of the issues you are highlighting in terms of security are more about direct gas supply to people, rather than production of electricity, which is what our Committee has been focused on—maybe too much so. Gas is an important form of energy, sometimes as a substitute or alternative for electricity and sometimes used in its own right. Is there an energy security issue, as relates to electricity in New South Wales, in your view and can you compare that to direct gas?

Mr NELSON: Certainly for electricity I do not perceive a security of supply issue. With gas I think that there potentially could be but Paul is probably best to talk to that.

Mr ASHBY: We are definitely concerned about security of supply of gas in New South Wales.

CHAIR: Not electricity?

Mr ASHBY: Not electricity, I agree with Tim. In the olden days we could rely very comfortably with Santos's joint venture supplies out of Central Australia and Esso- BHP supply out of Victoria. New South Wales lived on that for some decades. We have noticed those fields are in decline in Central Australia. Even the facilities are starting to get old. We have had a number of major disruptions—the Longford explosion in 1988, a number of issue in Moomba through the 2000s. When those facilities go down—and there is only one pipeline bringing each of those things into Sydney—we have a problem in New South Wales and there have been major issues over the past decade. Almost certainly that will happen again, there is no doubt about it.

Yes, there is a security of supply issue. One of the ways we can deal with that is build some storage in New South Wales. Thankfully we heard an announcement today that New South Wales PAC has passed our Newcastle gas storage facility and we now have approval to move forward with that. We are now just waiting for the Federal Government and the Environment Protection and Biodiversity Conservation Act. That is a great move and that storage will provide additional security of supply. It will not solve everything, but it helps. The only thing to add to that is that what a lot of the research in the market is showing is that, as Tim said, perhaps not in the next 10 years but in the decade beyond that, there will be a convergence with gas-fired generation and electricity because that is where most of the growth is being forecast. Price is where the gas market feeds into the electricity market. A lot of the research is showing that if there is a shortage of gas that will feed into the gas price, if the gas price is higher that will feed into higher electricity prices.

CHAIR: Assuming alternatives do not fill the void?

Mr ASHBY: Assuming other alternatives do not fill the void. But you have heard that at least in the next decade most of the research is pointing to gas to take most of the growth. Once the mandatory Renewable

Energy Target is done in 2020 the expectation is that gas will then take off as the marginal supplier. The gas price therefore will be very important to the electricity price.

CHAIR: What is your view, in the same way that we have got a National Electricity Market—not truly national but almost national—on the movement towards more of national gas market which might involve more guaranteed supply and free-flow of gas between the States?

Mr ASHBY: Of course we now have short term trading markets in all the major demand centres already now in Australia. In a sense that is a lot of the way toward making sure we do have more competitive gas markets at the wholesale level. Apart from an additional trading hub at Wallumbilla which is near Roma in Queensland which the Australian Energy Market Operator is currently looking into, I would suggest we are nearly there. It is not truly national but we have trading markets very much like they exist in other parts of the world now operating in Victoria, Adelaide, Sydney and Brisbane. I do not see that we need to do a lot more to already get a really good outcome for wholesale and consumers because we have already these trading markets that ensure that supply and the price justifies bringing on new demand.

CHAIR: I note that you made a submission to the Federal Government's Energy White Paper. Do you want to make any comment on anything relevant in the context of how that overall initiative is relevant to this inquiry and energy generation in New South Wales?

Mr NELSON: Probably just one comment. There has been a lot of discussion around the Renewable Energy Target. I think I can safely say—and it is an extreme term—that it would be catastrophic for investor confidence if that is tinkered with, given it was introduced with bipartisan support. It is the one policy that the energy sector looks to and says, "There is bipartisan support for this at the Commonwealth level." The carbon price debate, I will put that to one side because that will be resolved at some point. This particular policy allows us to get on and actually build new plant in a way that is not seen as overly risky from a regulatory perspective. I cannot see how investors could react positively to it being amended in any material way.

CHAIR: Would you draw a distinction between the large-scale renewable energy target, to which I think you are referring, and a small-scale five-to-one certificates which arguable had a retrograde effect?

Mr NELSON: Absolutely. The large-scale Renewable Energy Target is where you have significant incumbent investment—big wind farms, big biomass plants and some hydro. I think it is fair to say that Mr Jones who spoke earlier about the significant reduction in solar costs, the heat is largely coming out of the small-scale scheme because of the unwinding of the multiplier. I think it would be fair to say that the very significant uptake of solar PV is likely to slow down as a result of that, and that is a good thing both for consumer and prices, but also for the industry. It is not in solar PV installers, of which AGL is one, interests to see this boom-bust cycle of renewable energy take off. It is a very good clarification that you make. The large-scale Renewable Energy Target is very important for renewable investor confidence. The heat is largely coming out of the small-scale scheme.

CHAIR: The committee may wish to send you some additional questions in writing, the replies to which will form part of your evidence and be made public. Are you happy to provide a written reply to any further questions.

Ms McNAMARA: Yes.

CHAIR: I note that commencing in June or July the committee will engage with the public through some deliberative processes to get their views on some of the alternate energy options. It is important to get the view of the public. It will allow informed public opinion. We will finalise our report in November 2012.

(The witnesses withdrew)

(The Committee adjourned at 5.08 p.m.)