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SELECT COMMITTEE ON FUEL AND ENERGY

Reference: Issues relating to the Fuel and Energy Industry

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SYDNEY

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SENATE SELECT COMMITTEE ON

FUEL AND ENERGY

Thursday, 12 November 2009

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

Senators in attendance: Senators Bushby, Cormann, Farrell, Hutchins and Macdonald

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

Terms of reference for the inquiry:

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

WITNESSES

CAMERON, Dr Ron, Executive General Manager, Strategy, Government and International Relations, Australian Nuclear Science and Technology Organisation	24
DOW, Mr Brendan, Managing Director, Ceramic Fuel Cells Ltd	37
DUTAILLIS, Mr Geoffrey Raymond, Chief Operating Officer, Infigen Energy Ltd	55
GEORGE, Mr Miles John, Managing Director, Infigen Energy Ltd	55
HARDY, Dr Clarence James, Secretary, Australian Nuclear Association	12
HARRIES, Dr John R, President, Australian Nuclear Association	12
HIGSON, Dr Donald James, Committee Member, Australian Nuclear Association	12
MYATT, Mr James, Chairman, Energy Retailers Association of Australia	48
O'REILLY, Mr Cameron, Executive Director, Energy Retailers Association of Australia	48
PATERSON, Dr Adrian, Chief Executive Officer, Australian Nuclear Science and Technology Organisation	24
SCHUCK, Dr Stephen Michael, Manager, Bioenergy Australia	2

Committee met at 9.00 am

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

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

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

[9.02 am]

SCHUCK, Dr Stephen Michael, Manager, Bioenergy Australia

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

Dr Schuck—First of all, as a bit of a preamble, Bioenergy Australia is an alliance of organisations from both the private and public sectors. We have got about 77 member organisations with a vehicle for Australia's participation in the International Energy Agency's bioenergy program which involves 23 countries. I represent Australia on the executive committee of IEA Bioenergy. The purpose of this submission is to alert the committee to the role Bioenergy could play in Australia and a substantial deployment worldwide. I will primarily address the terms of reference of the committee, the role of alternative energy sources and alternative fuels and energy supply.

I would like to have elaborated on my presentation by giving a presentation, which was impossible. What I have done is table to the secretariat a copy of our presentation which I gave to the Australian Academy of Science on 3 March, and I believe you have a copy of that before you. I have also given the electronic copies so you can look at it in greater detail. I have also had several documents that I have tabled with the secretariat. Unfortunately, I do not have the requisite 10 copies of each, but hopefully that will be disseminated. One of the reports is *Biomass energy production in Australia: status, costs and opportunities for major technologies*.

Just turning to the key points of my submission, there are several forms of biomass ranging from agricultural residues, forestry, wood processing wastes—woody weeds, for instance. There are six million hectares of infestation of *Acacia nilotica*, a northern Queensland woody weed that could be used for biomass. Other sources are: sewage, animal manures, energy crops, municipal solid waste and energy crops such as microbiology. Biomass currently provides some 52,000 megawatts of bioelectricity worldwide. That is of the same order of magnitude as Australia's total coal fired power industry.

In OECD countries, bioenergy provides 55.7 per cent of electricity from renewables. It is important to note that biomass can provide baseload electricity, unlike several other forms of renewable energy. What I have noted in the submission are some examples—for instance, the Alholmens Kraft power station in Finland has a capacity of 240 megawatts of electricity and the Avedøre-2 power plant in Denmark has an electrical output of 570 megawatts mainly through the use of biomass. On a lifecycle basis, which is also shown in the submission, bioenergy can have substantially lower greenhouse gas emissions than some other more expensive forms of renewables, such as photovoltaic energy. Biomass can also provide ongoing jobs, because of the ongoing nature of fuel procurement. I have noted several other benefits of biomass, such as addressing dry land salinity, one of Australia's biggest environmental problems.

It is worth noting that biomass co-combustion with coal is practiced at approximately 200 power station boilers world wide. I recently visited a power station in Belgium where they have converted a 125 megawatt coal fired power station to run exclusively on wood pellets. If carbon

capture and sequestration technology succeeds, which would be a great thrust to the coal energy, bioenergy will benefit from that, because of the similarities—apart from the fact that it is renewable source. That would provide a net carbon sink. I noted that biogas can also be produced from anaerobic digestion. There are some 170 megawatts of landfill gas and biogas capacity in Australia. In some countries, that gas is purified for injection into pipelines and also for transportation fuel. For instance, half of Sweden's automotive gas is derived from biomass.

I noted that biomass gasification presents opportunities for heat, power and transportation fuel. There is a plant in Germany that has been developed to produce synthetic diesel, which is very similar to the coal to liquids technology that Sasol has developed in South Africa and which has been running for several decades and provides approximately 30 per cent of that country's energy. The only difference is that biomass is used as the feedstock and it is low emission and renewable.

I noted pyrolysis bio oil in the submission. Since making that submission, the federal government has announced \$15 million funding for two pyrolysis bio oil projects under the Gen 2 program. That was awarded to Monash University and Curtin University. One of the partners of Monash is the Renewable Oil Corporation, an Australian company that is trying to develop the technology. Allied to pyrolysis is biochar, which is basically used for biological sequestration.

The submission also notes the quite extensive research and development on alternative transportation fuels, particularly in Europe and the USA and gives certain examples. That is elaborated on in the submission that I have tabled. There is quite a push towards developing, for instance, pongamia as an oil seed tree for biofuel feedstocks, and also microalgae. There is quite a huge push on globally and also in Australia. It is interesting in terms of algae that the South Australian Research and Development Institute is opening a federally funded photobio reactor tomorrow in Adelaide.

In summary of my summary, globally bioenergy capacity is approximately 52 gigawatts, the same scale as our total coal fired power industry. Biomass provides baseload power, provides permanent jobs, can stimulate rural economies and provide a variety of co-benefits besides fuel and energy. It offers the prospect of meeting the stationary energy side and also meeting a substantial part of future liquid transportation requirements. My final word on this is that bioenergy is not currently widely deployed in Australia. We are certainly lagging behind some overseas countries.

CHAIR—Can you talk us through the infrastructure issues that need to be addressed to allow significant growth in bioenergy production moving forward? You mentioned the potential and that at present it is obviously not reaching its potential. What are some of the infrastructure issues that we need to address?

Dr Schuck—In terms of infrastructure, an obvious and large requirement for bioenergy is on the feedstock side. So over half of the cost of, for instance, electricity could well be in the feedstock supply, and that is very underdeveloped. At the moment, the emphasis is on certain residues at point sources—for instance, at sugar mills where the gas is produced and that can be then used for electricity production. So, if you are going to increase the scale of this to a large extent, you basically need to move towards both better utilisation of our residues—and there are

some impediments to the large-scale use of certain woody biomass, particularly issues with native forest residues—and bootstrapping of the industry to grow energy crops and—

Senator HUTCHINS—Excuse me, Dr Schuck; what do you mean by ‘bootstrapping of the industry’?

Dr Schuck—Well, it is at an extremely low level at the moment. There is essentially no energy cropping in Australia, unlike overseas where they are basically using residues from other processes. The primary objective of, let us say, plantation forestry would be lumber timber. What we need to do is to build off that and use the silviculture thinnings—when they thin out the plant—using plantations as an example, and use that biomass by bringing it to a central energy plant. What is lacking is that the timber industry, in this instance, is geared up for timber production, and those thinnings are often just left on the forest floor, adding to fuel loading and the next bushfire. So what is required is the development of systems to retrieve that biomass and to economically provide it to power station sites.

Senator HUTCHINS—Aren’t those shavings and all that pulling carbon out of the air as well?

Dr Schuck—Yes. One thing that I did not cover—it is in this presentation as the fifth slide—is that the whole concept of biomass is that, when biomass grows, it absorbs atmospheric carbon dioxide and it is driven using solar energy. When that is taken to an energy plant, the process is essentially reversed. Through biocombustion or other energy conversion processes, that solar energy that was trapped in the chemical bonds of the biomass is reversed. When the biomass is grown in balance with its utilisation, it is basically carbon dioxide neutral and it is so recognised under the Kyoto protocol.

Senator HUTCHINS—If the shavings at the timber mill are in one way or another pulling carbon out of the air, what you are suggesting is to better utilise the shavings so that the carbon will not be pulled out of the air. I know that sounds simplistic, but I am not a scientist. I do not have ‘Dr’ in front of my name.

Dr Schuck—The carbon is pulled out of the air when the tree grows. When the mass of the tree expands, basically half that tree is carbon. Let us say the whole tree is then be taken to a sawmill, lumber is extracted and there will be shavings and sawdust on the ground. If you then use the sawdust—let us focus on that—for combustion, for raising steam, for driving a turbine, for producing electricity, with emissions going up the stack back into the atmosphere as carbon dioxide, that carbon dioxide is then recycled through the biosphere to another tree, which then grows. The fifth slide in the PowerPoint presentation shows the process, with biomass energy driving the process and the carbon dioxide being cycled back to the trees. That is why it is basically carbon dioxide neutral. It is simplistic.

I have also noted in the submission that when one goes into a comprehensive life cycle analysis, looking at the fossil energy involved in, for instance, the chainsaws, the transportation, the diesel in the transportation systems, you then end up with approximately 40 grams of carbon dioxide equivalent per kilowatt hour of electricity production, and that compares to about a kilogram for a coal fired power station.

Senator HUTCHINS—When we talk about sustainable energy, one of the things we as politicians look at is the cost. You would be aware that in a number of states the cost of energy has gone up significantly. In my state, New South Wales, the cost of producing coal fired electricity has increased by 22 per cent. Could you tell the committee what sustainable energy costs Bioenergy Australia has looked at. How do they compare to what we are paying now? What might we be expected to pay if you are able to have the scheme implemented in the way you have proposed it?

Dr Schuck—Only a proportion of the cost that the consumer pays is actually from the generation. There are obviously costs associated with its transmission as well which are reasonably substantial. I will focus on the production costs of bioenergy. Let us just focus on bioelectricity for now because you can talk about transportation of fuels as well. The cost is dependent on a number of factors. One of them is scale. You get economies of scale. The larger the scale of the plant, the more the unit cost can be reduced. The other issue is the source of the fuel. If it were to be a residue, which may have a negative cost—it might cost somebody to dispose of that material—then you could use it. It would only be in the extreme that you would have on the supply curve of the fuel something like an energy crop, which would cost you a fair bit of money to grow and transport.

So there would be a range, depending on scale and the conversion technology. It would also depend on the economic catchment area for your biomass fuel. If it happens to be at the point of source, say, at a sugar mill, where it is a waste product that you are using, there are just about zero transportation costs. But if you want to bring in forestry thinnings from 50 to 100 kilometres away then you will be paying something like 10c per kilometre per tonne to bring that in, as a rough rule of thumb.

The cheapest form of bioenergy is probably co-firing biomass with coal. This has been practised in New South Wales at some of the power stations to get renewable energy certificates. If you have a very low-cost waste nearby and you do not require new infrastructure because you are piggybacking off an existing coal fired power station then you can introduce a few percentage points of output using biomass. At the other end of the scale, something that is an energy crop could be configured so that it could be even an order of magnitude more expensive. With that form of bioenergy you would use the co-firing example.

Senator HUTCHINS—So, in essence, the infrastructure might already be there for this to be used.

Dr Schuck—In some instances. For instance, at Delta Electricity's Wallerawang power station, not far from Lithgow, they had to put in some capital equipment for handling the biomass. That was a transverse conveyor onto a coal conveyor and they co-milled the biomass with coal. You can only do that in fairly small amounts because the plant is specifically designed for coal. As I mentioned, there are about 200 power station plants worldwide that are co-firing biomass with coal at various percentages. The example I gave in the presentation, the Alholmens Kraft power station in Finland, can run from 100 per cent coal to 100 per cent biomass because of the nature of its technology. It basically depends on how it is configured and the economics. I guess the impending cost of carbon will also sway the economics.

From the infrastructure point of view, bioenergy is fairly complex. If the infrastructure you are referring to is bringing in the biomass from distant locations to a central plant, there obviously could be requirements like new trucks or possibly strengthening bridges if it is a rural area where they are not suited for that. They are all pretty conventional technologies. As for the power stations themselves, a traditional bioenergy plant can take different forms—and that is also in that presentation—but it is virtually identical technology to coal fired power. There are different types of boilers that have been around for in excess of 100 years, basically raising steam. So it would be very familiar to people in the power industry. Some countries have very large proportions of biomass in their power supplies. It is really a case of economics rather than infrastructure per se.

CHAIR—Are there any adjustments necessary to the grid because of where biomass plants would have to be located?

Dr Schuck—Bioenergy or bioelectricity—if you let me focus on what I guess you are asking about—can take many forms and many scales. At the larger industrial scale—and I have noted a bioenergy or multifuel plant substantially using biomass in Denmark—it is identical to a large coal fired power station. The only difference is at the front end, where they are basically using a renewable fuel rather than a fossil fuel. As one goes down the scale you can have plants ranging from several kilowatts right up to hundreds of megawatts.

At the smaller scale, the playing field is very tilted. For instance, the introduction of the new feed-in tariffs across Australia essentially excludes bioelectricity. They have basically been set up for small hydro—not all of them, but the main direction has been in supporting photovoltaic electricity. The next level has been small wind power and then small hydro—microhydro type systems. In countries such as Germany these feed-in tariffs provide for up to five megawatts of capacity under the feed-in tariffs. That is not available here and the schemes are not heading in that direction in Australia.

There are certainly many biogas plants in Australia that could benefit from those schemes and that have been held back, particularly in rural industries. For instance, at feedlots, piggeries and things like that, the manure is basically put in a pond or lagoon. It is not all that environmentally friendly. The best thing you can do is to put a cover over that to capture the methane and run a gas engine to produce electricity. So bioelectricity is many things. In fact, it probably assists the grid in part because you can distribute these around the system and possibly obviate the need to provide transmitted supply.

CHAIR—Okay. I note that at the end of 2005 there were about 96 bioenergy projects in Australia with a combined capacity of 646 megawatts. Where would they be located? Is there a theme in their general location compared to more traditional power plants? You mentioned regional Australia.

Dr Schuck—What I have noted in that list was extracted from the former Australian Business Council for Sustainable Energy, which has been renamed and slightly modified to the Clean Energy Council. This is from a plant register that they put together in 2005. It basically goes with the industry. For instance, with bagasse, Australia has approximately 27 operating sugar mills at the moment. The bagasse is basically residue from crushing sugar cane, so those power

plants would be at sugar mills and they are distributed mainly up the eastern seaboard of Australia, primarily in Queensland.

Two New South Wales power stations, at Condong and Broadwater, have recently been converted to 30-megawatt cogeneration plants providing the sugar mill and also electricity. That is 60 megawatts of new bioelectricity in New South Wales in the past two years. The paper industry—for instance, at Maryvale in Victoria and Visy's plant at Tumut—also provides generation for their own needs and a capacity for exports. I believe Maryvale has 55 megawatts of capacity.

Landfill gas is usually at the fringes of cities; basically where the garbage is dumped. For instance, in Sydney there are 11 megawatts at Lucas Heights plus another one just down the road. There are also ones at Eastern Creek and Belrose. It is basically where garbage is placed and gas extraction systems are put in. At our sewage treatment plants there are generating plants at North Head, Malabar and Cronulla. There is a food waste plant at Camellia near Rosehill Racecourse near Parramatta. There are lots of these distributed systems. They are typically about three megawatts. That is just the nature of where the biomass is. It is usually cheaper to transmit the electricity than to transmit the biomass, so really it is its location.

CHAIR—Given that, what is the level of public acceptance? How has that worked in terms of local community acceptance of biomass plants in their neighbourhoods?

Dr Schuck—It has varied. Generally bioenergy ran into a problem with some of the environmental groups over the issue of the use of native forest wood waste. That has been provided for under federal legislation under the Renewable Energy (Electricity) Act and its regulation. The requirements reflect in part community attitudes. I suppose it is fair to say that there has been quite a lot of opposition to the use of native forest residues for bioelectricity or biomass. I do not believe there is a large understanding of bioelectricity. It is more complex than the simple concept of putting up a wind generator or putting on a solar panel. It covers a multitude of industries and regulatory requirements. So it has not been easy. The early work that led up to the mandatory renewable energy target surmised that biomass would provide about half the renewable energy certificates. Up to about a year or two ago, cumulatively bioenergy provided about 24 per cent of RECs.

In the future, I think wind is going to move away. It is probably going to be the big winner as things go. There are still a lot of imposts on bioenergy. There are onerous requirements in terms of monitoring the chain of custody of the biomass, and there are the issues of food versus fuel that have arisen which have swayed community attitudes and are reflected at the political level. There is an important issue of water. That is important for Australia. All of these things need to be considered. There are also issues such as indirect land use change.

In the documents that I tendered, many of those issues are addressed. Certainly Bioenergy Australia looks quite closely, particularly through its participation in the International Energy Agency's bioenergy program, at these basic issues and at how to get bioenergy better recognised and to provide a much greater proportion of our future needs.

CHAIR—You mentioned a whole series of things and I would not mind going into a bit more detail for some of them. Firstly, around the regulatory and taxation issues, what are some of the

changes that you think ought to be made, from your point of view, to maximise the opportunities for the bioenergy industry in Australia?

Dr Schuck—There are quite stringent requirements for the use of forestry biomass. At the moment—and I am not acting as an advocate for the native forest industry—what happens is that, when native forest logging occurs, for instance, in New South Wales, you cannot use the residue. Only about a third of the trees would be taken away as lumber. The other two-thirds largely end up on the forest floor, adding to fuel loading. In New South Wales at the moment, you cannot chip that biomass and then take it to a power plant and use it for energy. It is excluded by regulations. I do not have the name of the actual act with me. That is an example. That is reflected in some other states as well where it is less well defined. I believe it is currently so in Victoria and certainly Western Australia and possibly Queensland.

You talked about taxation requirements. One of the concerns of the biofuel industry is that, under current arrangements, effective excise will be introduced for the first time on biofuels from 2011, ramping up in five equal steps to 2015. At the moment there is an excise relief of something like 38.124c per litre, which will gradually be reintroduced but not to the full extent of fossil fuel. It will be introduced so it basically ends up at about half—

CHAIR—Are you arguing that that should not happen?

Dr Schuck—You asked me what is holding the industry back. I am not really saying what should or should not happen. I am just basically—

CHAIR—I am inviting you to! I am giving you the opportunity to tell us what you want.

Dr Schuck—The industry has struggled because of the rising cost of feedstocks, and for a struggling industry to then have, for instance, an additional 19c per litre of cost passed on to the consumer for, let us say, biodiesel is certainly something that is going to inhibit that industry.

CHAIR—Just going through some of the other issues that you have mentioned, you talked about the concerns raised around the impact on food supply, and I guess land clearing is another issue. What is your answer to these sorts of concerns? How do you think that those sorts of issues that are raised from time to time should best be addressed?

Dr Schuck—Okay. Let us take land clearing. The regulation, I believe, does not permit using vegetation from land clearing as fuel for bioenergy, bioelectricity. So you end up in a funny situation where, if that land happens to be cleared—and I have seen this in instances of freeway construction, where the trees are piled up on the side of the road and burnt, and those emissions go unproductively into the atmosphere. If the biomass itself were to otherwise end up in the atmosphere, burnt for disposal, that would make more sense. That is an example. Maybe for housing estates or something like that, it would make more sense. It seems a bit strange. We seem to have regulations that—

Senator HUTCHINS—You are talking about New South Wales, obviously, in this regard.

Dr Schuck—No. That is a federal regulation.

Senator HUTCHINS—Is it?

Dr Schuck—Yes, under MRET—sorry, the Renewable Energy (Electricity) Act as it stands. I am not quite up to date with the renewable energy target legislation, but I believe everything was basically kept in place except for really scaling the target and the penalty and things like that. It actually says that vegetation from land clearing cannot be used for fuel.

Senator HUTCHINS—Is that meant to discourage people from land clearing?

Dr Schuck—A lot of these regulations, to my mind, were surrogates for sustainability criteria. So I guess things got a little bit out of kilter. To my mind, there are certain regulations, such as the higher value test for biomass or bioenergy of the fuel, that are really surrogates for sustainability concerns—for instance, that the forest would be vacuumed up for energy—rather than being kind of blind to what the end use was. They would rather have the sustainability in the plantation of the forest.

Bioenergy has linkages with the Rural Industries Research and Development Corporation, and they have recently done quite a bit of substantial work through the CSIRO looking at a sustainability framework and examining exactly what the different frameworks are internationally and how they could be applied in Australia. So this is beginning to happen. I guess the industry surged ahead in early days without some of these sustainability criteria in place, and it is only now catching up—things like the roundtable on sustainable biomass or something similar to that.

Senator HUTCHINS—The chair asked you about the food supply as well. Would like to comment on that.

Dr Schuck—Yes. There has been quite a bit of analysis. There was, to my mind, great media hype on this issue of food supply. I am not saying that the issue does not exist; it is certainly a real issue. A lot of it does not really relate to Australia; until recently we have been using wastes for our liquid biofuel production. It largely had to do with the corn-to-ethanol industry in the US. But a lot of the analysis that was done quietly with a cool head afterwards came to the realisation that there were some impacts but they were nothing near what had been portrayed in the mass media, going back over the last two years.

CHAIR—Is that all you have got to say on that?

Dr Schuck—I could keep talking but I do not know how much time is available!

CHAIR—No, no. In your opening remarks you also talked about job opportunities, economic opportunities, for rural and regional areas. Has your industry, as far as you are aware, ever done any sort of modelling to quantify some of those potential opportunities in terms of jobs?

Dr Schuck—Not Bioenergy Australia specifically but we have monitored it. For instance, the former Australian CRC for Renewable Energy, ACRE, which was based at Perth, commissioned a study a few years ago to look at the job opportunities from various renewable energy sources. They analysed wind energy. I think they provided a bit of benchmarking with coal fired power.

They looked at two bioenergy plants, and I think they were No. 1 and No. 2 in terms of job creation.

I have indicated in the submission that there are some quite substantial economic multipliers. One of the graphs in that presentation shows the work of a European Union study showing job creation over different time spans for different technologies, including bioenergy in its various forms. There was a power plant in Austria, near the Hungarian border, in an economically depressed area and they deliberately sited a bioenergy plant in that region to stimulate that local economy. I have seen similar papers. There is one also about the former East Germany where bioenergy was analysed to see what jobs it could create.

CHAIR—You talked about biomass or bioenergy as a proportion of the overall renewable energies target. What do you think would be a sensible target for Australia to adopt for the contribution of biofuels, given that at present it is substantially lower than what has been adopted in other countries?

Dr Schuck—I will just quote a study that was conducted and that Bioenergy Australia participated in. It was called the Clean Energy Future for Australia study. It was led by the WWF and was in part funded by a number of renewable energy organisations such as the former Australian Business Council for Sustainable Energy. Under a deep cuts in carbon dioxide scenario in 2040—this was conducted about four years ago—it identified that bioenergy could provide 29 per cent of the bioelectricity mix at that time without any leap of faith in technologies and just based on resources that the study's participants identified.

More recently, the Clean Energy Council conducted a bioenergy roadmap with funding from the Department of the Environment, Water, Heritage and the Arts. That identified that by 2040 we could increase bioenergy fourfold from the study date, which I think was a year ago—again, taking a very conservative estimate of bioenergy resources. If one were to look at, let's say, vastly expanding oil mallee production in Western Australia for combating dryland salinity and then using that biomass as a feedstock for running biobased industries such as electricity and fuels, that could provide many millions of tonnes of biomass that could be used for energy and fuel conversion.

Senator IAN MACDONALD—You were talking to the chair about the forest biomass. The problem in Australia has always been an antforestry issue. Is that as you see it? If so, what is the solution?

Dr Schuck—I really do not feel qualified to comment on that. I have got personal views. Certainly the concerns have been about the forestry side rather than the energy conversion or the emissions from that. I just found it intriguing—when I was once browsing the web—that WWF and the environmental movement were protesting outside the European parliament. They did this by basically dumping a big pile of woodchips outside with a big sign effectively saying, 'This is the true green energy source'.

Senator IAN MACDONALD—And yet you come to Australia and they are totally opposed to that sort of thing.

Dr Schuck—I do not know if they are totally opposed to it. There are certainly concerns about additional pressures on forests. There are those perceptions. I personally believe that this could be a win-win situation, that we should be expanding our forests. In doing so we would be providing additional biomass. It is interesting that, in terms of things like native forestry and fuel loading, there is a project now underway in Victoria by a company called TreePower Australia that wants to use burnt-out forests from the February bushfires for bioenergy. Taking that a step further, for ongoing fire hazard reduction we could extract a proportion of that biomass rather than carry out prescribed burning for fuel hazard reduction and perhaps productively using that biomass, if it is found to be economically viable, for reasonably small-scale bioelectricity.

Senator IAN MACDONALD—Dr Schuck, I should agree with you. WWF probably have been less opposed to it than some of their other colleagues in that movement. I see you mentioned algae as a biofuel. Are you aware of that being commercially available anywhere in the world? It is a great concept, but is it operating commercially?

Dr Schuck—Perhaps I could mention that Bioenergy Australia has taken a great interest in microalgae, and is holding a conference in three to four weeks time where this will be a major theme. Australia is one of the leaders in microalgae, but that is essentially for nutraceuticals. There are some very substantial algae ponds in Western Australia—I think in Hutt Lagoon. That is largely for betacarotene production and so on. The challenge is really one of economics. A lot of research is being directed now into trying to improve the economics of extraction of oil from these microalgae, which can have a 50 per cent oil content, and to do this on an economic scale. I think I may have mentioned before you came into the room that tomorrow is the official opening at the South Australian Research and Development Institute of their photobioreactor, which is being funded by the federal government through the NCRIS program to set up a national facility for the development of microalgae.

Senator IAN MACDONALD—Later this month James Cook University and a private company are launching their facility in Townsville. Are you aware of that?

Dr Schuck—I am aware of MBD. They are also speaking at the Bioenergy Australia conference on that topic. There is a lot going on internationally. Many, many companies have gone public and are doing lots of research. There is also an Asia-Pacific partnership project with Professor Michael Borowitzka from Murdoch University that is developing this on a fairly large scale in the north of Western Australia. They put out a media release within the last week, I think, announcing some kind of breakthrough in terms of microalgae strains that are not as subject to contamination.

Senator IAN MACDONALD—It all seems so remarkably simple when it is explained to you, but if it is so simple why hasn't it taken over the world energy supplies?

Dr Schuck—It is the economics. Up until now we have had abundant and cheap fossil fuels without any recognition of the carbon dioxide emissions. Algae have been developed quite extensively but not for energy in the past, and the problem is that the cost of producing algal oil, which is basically what you are heading towards, is at an order of magnitude greater than you need to make that viable for fuels under current pricing and regulatory arrangements.

CHAIR—Thank you very much, Dr Schuck.

[9.49 am]

HARDY, Dr Clarence James, Secretary, Australian Nuclear Association

HARRIES, Dr John R, President, Australian Nuclear Association

HIGSON, Dr Donald James, Committee Member, Australian Nuclear Association

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

Dr Harries—I will make the statement on behalf of the three of us. The Australian Nuclear Association is an independent, scientific institution made up of individuals drawn from professions, business, government and universities interested in nuclear, scientific and technical topics. Members of the ANA have a wide range of expertise and experience in nuclear issues.

I will make some comments on some of your terms of reference. First of all, I will comment on the role of alternative sources of energy to coal. We consider nuclear power to be a viable and feasible alternative to coal for the generation of baseload electricity. Nuclear power is a proven technology widely used around the world, although not yet in Australia. In many countries electricity generated by nuclear power is already cheaper than that from coal, even without the cost of carbon emissions. Other countries install nuclear to provide energy security. Nuclear power is part of the global solution to the challenges of climate change and energy security.

There are 436 nuclear power stations operating in 30 countries, producing 15 per cent of global electricity and 22 per cent in OECD countries. The extensive overseas experience demonstrates the safe operation of nuclear power plants at large-scale and high-capacity factors. Other countries are expanding their use of nuclear power. Around the world there are 52 nuclear power plants under construction and 135 nuclear power plants on order or planned, with approvals of funding or major commitments in place. Installing nuclear power plants in Australia would improve energy security. Nuclear fuel is easy to stockpile. Low fuel costs lead to relative insensitivity to fuel price variations. However, with 23 per cent of the world's low-cost uranium, Australia would be self-sufficient in sources of uranium.

I will now comment on the impact of emissions trading. Nuclear power is a low emitter of greenhouse gases. The greenhouse gas emissions for the whole nuclear fuel cycle are 10 to 100 times less than the emissions from natural gas or coal. For Australia to meet its future greenhouse gas targets, low-carbon technologies, like nuclear, must be included in the energy mix, as they are in most developed and many developing countries. Any emissions trading scheme would be expected to increase the cost of electricity from fossil fuels whilst having minimal impact on the cost of electricity from nuclear. This will make nuclear more economically attractive as it generates more baseload electricity in Australia.

Australia's export of uranium resources contributes significantly to a reduction of greenhouse gases emissions in customer countries. There would also be advantages in enriching uranium in Australia, instead of overseas, to increase export income and enhance security of energy supply

and control of nuclear materials. We are talking about the regulations, I guess, associated with these things.

There is an urgent need to develop regulations for nuclear power plants and other commercial nuclear-fuel-cycle facilities. The Australian Radiation Protection and Nuclear Safety Agency, which regulates the safe use of nuclear materials by Commonwealth entities, including new research reactors, is specifically prohibited from licensing nuclear power plants. The Commonwealth environmental legislation requires all nuclear matters to be considered by the Commonwealth, as for the whole country, so there is a total lack of regulation for dealing with large nuclear power plants or nuclear-fuel-cycle facilities. This lack of regulation for major nuclear plants is a major disincentive for any commercial proposal for nuclear power. The legislative and policy issues need to be resolved so that licensing processes, environmental and safety requirements for commercial nuclear power plants are established. I strongly recommend that the government explore the barriers that prevent nuclear power plants being built in Australia, and, in particular, the regulatory and legislative changes required to allow commercial proponents of nuclear power plants to be developed and proposed, and considered on their merits.

In conclusion, nuclear power is already a commercial reality in many countries. Currently, nuclear power is arbitrarily excluded from consideration of Australia's future energy plans, but this should change. Nuclear power should be considered on its merits. Nuclear power does not need the subsidies which are being sought by all renewable technologies, but it does need a regulatory and legislative framework to provide assurance that a nuclear power plant, when built in accordance with construction licence conditions, is allowed to operate. The Australian Nuclear Association strongly recommends that nuclear power be included as a viable option in plans for any Australia's energy future.

CHAIR—Thank you very much, Dr Harries. Clearly in Australia one of the barriers to nuclear being included as part of the energy mix is the issue of public acceptance and, related to that, the issue of the management of the waste. Could you talk us through what you think should happen to ensure we get past that barrier of public acceptance.

Dr Harries—First of all, I think public acceptance is clearly an important process. As I go around talking to different groups there is clearly a change going on, with people saying, 'Why don't we consider it as a realistic option?' We cannot even get to the point of consideration: we always have what to us are archaic arguments from long ago about particular issues. There are nuclear power plants operating around the world and they have been operating for to 50 years. All these nuclear power plants are dealing with their waste. The waste is being stored; it is a small amount of waste. It is a disadvantage of nuclear, but all of the energy sources for electricity have waste problems. We think the waste should be properly addressed. It can be managed; it can be disposed of. It needs to be done and done safely.

CHAIR—Do you as the Australian Nuclear Association get actively involved in community education?

Dr Harries—Yes, we do.

CHAIR—You go to events, speak to people and put the facts on the table. You have mentioned words like ‘nuclear is a proven technology’, which it is: it is reliable, it is secure, it has low carbon emissions. If you had to summarise that case in a couple of paragraphs, what would be your key arguments?

Dr Harries—Really what I said in this opening statement, that it is a proven technology and it is being widely used around the world. When we travel to other countries and turn on an electricity switch we are often getting nuclear electricity coming out of the power cord. These issues of proliferation of safety are being addressed, there is a lot of work going on and the process can be managed.

CHAIR—It is sometimes said that for nuclear to become a viable option in Australia we need bipartisan support in order to ensure that it does not involve inappropriate risk. It would take 10 to 15 years to get a nuclear power plant going if we decided today to have one. Is that right?

Dr Harries—No, it would be much shorter than that. England has just introduced a new policy and is talking about having a plant operating by 2018, which is in eight years.

CHAIR—They want to set up another 10, but they already have some going, don’t they? We would start from scratch. There are a few questions in this. How long would it take us if we made a decision today? How important is it to have bipartisan support? Also, haven’t we missed the boat to a certain degree because we have been so belligerent in not going down this path so far?

Dr Harries—I think nuclear does need bipartisan support for things to proceed. It is no good trying to have a commercial proposal come forward and then there is a change of government or a change of process and it is knocked on the head. It is not necessarily bipartisan support in the form of great enthusiasm for building but bipartisan support to say, ‘Let’s deal with this thing on its merit.’ If this thing can meet environmental, safety and other concerns, it can proceed.

CHAIR—Even from a lot of those in favour of nuclear—I am among those and I would like to see in this goes ahead in Australia sooner rather than later—the argument is that nuclear is okay and we should have nuclear but not in Australia because the costs do not stack up, the financial viability does not stack up. What is the argument in response to that?

Dr Harries—Until we have a definite place, one cannot definitely say what the costs will be. Overseas costs indicate that when one puts the cost of carbon onto fossil fuels then nuclear is economically competitive with coal, provided several plants are being built.

CHAIR—I am trying to get as much information on the record as possible to help the committee make its recommendations. The argument is this, and I am not saying that I unnecessarily agree. I am just putting the arguments so you can hopefully respond with as much detail as possible. Twenty million people are spread across a large continent. The argument is put that with access to cheap carbon and all of that nuclear is not necessarily going to be financially viable in the Australian setting. Even though people might be in favour of nuclear, they do not think it would work out in Australia. I want you to make the strongest possible case, if you disagree, for why you disagree.

Dr Harries—I will ask Dr Hardy to give some more specific details.

Dr Hardy—I would be happy to make some observations. I think you are absolutely correct: we do need to have a bipartisan approach to this topic. A new airport, a dam or an oil refinery are major capital investments. A nuclear power station is in the category of large capital investment with low running costs. This is the advantage and disadvantage of nuclear power compared with other forms of baseload generation. It is unfortunate that we have two Commonwealth laws, which were enacted many years ago, that prohibit the construction of nuclear power stations in Australia and the construction of other nuclear fuel cycle facilities except for uranium mining. As an example of the way we are slowly moving forward in public opinion and so on, I would point out that the previous government did initiate a review of the whole consideration of nuclear power for the future. This was led by Dr Ziggy Switkowski and the results were published in 2006. It took evidence from a wide variety of people, both for and against and so on. At the same time, a rather unusual and unique report was in fact published by the House of Representatives on the use of uranium and nuclear energy in the future in Australia. That came out with very positive recommendations that we should consider nuclear power. That was a joint parliamentary committee.

CHAIR—This committee has also made that recommendation, incidentally.

Dr Hardy—Gradually we are moving forward with a better climate of understanding, but it is very difficult to translate that into a public opinion change. But we do see a trend happening. In some public opinion polls that have been published in, say, the last year or two there has been a trend towards more people being supportive of nuclear power and fewer people opposing it. There has been some very strong opposition to this by some of the so-called environmentally conscious movements, like the World Wildlife Fund and Greenpeace. They have not generally been very much in favour of nuclear and they really prefer to put to the public, very strongly, that we must depend upon renewables. The present government has accepted that to the extent that it is giving very considerable financial support to the coal industry to assist it in its capture of carbon and burying it underground. It is giving substantial subsidies to the wind, solar and wave power industries. It is no doubt a good thing to assist those in their early stages, because they all admit that at the present time they cannot economically produce large amounts of electricity.

Again, the green movement is saying that we need distributed energy for the future of Australia, that we do not need any more baseload generators. This is a complete misunderstanding of the way society is moving in the world. World society is going to be increasingly in large megacities around the world. We are not going to find distributed populations. We have tried that in this country. Previous governments have tried to decentralise from, say, Sydney to Orange or Albury-Wodonga and this has failed. It is not going to happen. We are going to need massive, centralised generated electricity for the big cities of the future. At the present time, it is likely that only coal, gas or nuclear can provide this, until there is a major breakthrough in coupling wind farms, solar power or power farms into producing continuous electricity. That has not yet happened.

CHAIR—How does the cost structure of nuclear compare with some of the other alternatives to coal?

Dr Hardy—The UMPNER, with Dr Switkowski, published their report in 2006, and that is still giving some very good, reliable, comparative figures between coal, gas, oil, nuclear, solar and wind. I think their conclusions are still valid today. In Australia, with the availability of very cheap black coal—and to some extent cheap brown coal, which is the highest polluting of all of those technologies—coal is the cheapest form of production of energy.

CHAIR—Yes, but leaving coal aside.

Dr Hardy—When you add a carbon tax or a carbon system on to that fossil fuel generation, you will then bring it up to parity with nuclear. Nuclear would be more expensive today compared with coal. Dr Switkowski's report said that nuclear will be cheaper than wind power, wave power, biomass or photovoltaics.

CHAIR—I am trying to drill down on this. In France, 80 per cent of the energy comes from nuclear, and in Belgium it is about 56 per cent. England is moving it up. What makes it so much more expensive in Australia compared to those countries? Is it only because we have got access to cheap black and brown coal, or are there other reasons?

Dr Hardy—There are other reasons. In France and most countries in Europe they do not have access to cheap coal. They would have to import coal.

CHAIR—Is it only the cheap coal access or are there other reasons?

Dr Hardy—You said that in France 80 per cent of the electricity comes from nuclear power and they export it to other neighbouring countries. They are comparing it with expensive coal, even without any carbon control system, and expensive gas, which is coming from very far away. The North Sea gas is finished now.

CHAIR—So the single reason is the fact that we have access to cheap black coal and cheap brown coal. There is no other reason that nuclear would be more expensive in Australia than in other parts of the world.

Dr Hardy—In principle, yes. It is a simple matter of economics. Gas and coal are very cheap power sources compared with the high initial capital cost of a nuclear plant but with very low running fuel costs. If you do a complete system analysis—from mining the uranium, converting it into a form to put in a reactor, using it in the reactor and then storing the waste—and add the whole cost together, the overall cost for nuclear is cheaper according to the price of coal. When we have got coal at such a cheap price in Australia it cannot compete—

CHAIR—So the running costs of coal fired power stations are comparatively more expensive, are they?

Dr Hardy—The initial capital cost of fossil fuel stations is low. Maintenance costs would be moderately high. Fuel costs would be very high. If you are building a plant to last for, say, 25 or 30 years in your economic evaluation when you decide to build a plant, you will find it very difficult to predict the cost of coal and gas in Australia in 10, 20 or 30 years time, as you will not know whether there is a carbon added value or whatever.

CHAIR—I am with you now. So that is the residual risk of what happens to your fuel price. You cannot really predict, whereas once you have got the capital investment—

Dr Hardy—Yes.

CHAIR—What is the running time of a nuclear power station? For instance, if I make a capital investment in a nuclear power station today, how long can it go for?

Dr Hardy—The situation has changed quite considerably over the last few years. You used to build a nuclear power station to operate for 30 years. All the economic arguments—amortisation, discounting—were for 30 years. Some of them have operated for 30 years and are still very capable of operating. Many around the world have been given additional operating licences to take them to 50 years. So now designers of nuclear power stations are saying, ‘Well, there’s a pretty good history. We will build them now for 40 or 50 years.’ This, of course, helps the economics of the initial investment.

CHAIR—So the core of your argument really is that, given that there are government subsidies for these other energy sources for various reasons, if government wanted to assist our energy security moving forward with a low-carbon energy source which is proven, reliable, secure et cetera then really government should perhaps assist the start-up by making a contribution to it. Is that what you are suggesting?

Dr Hardy—No, I am not suggesting that. What the nuclear industry wants is not a subsidy. It does not want and demand a subsidy in order to build a plant in this country. It is completely opposite to solar, wind, ocean or carbon sequestration by the coal industry. My personal view is that the government should not give the coal industry any subsidies for carbon capture. They should ask the industry to do that. It is their life. If they do not do something, they will be out of business—so they will do something. The nuclear industry is not asking for a subsidy; it is asking for what I call a level playing field. At the moment the playing field is so heavily tilted, you are not allowed to even put a proposal forward because of Commonwealth acts.

CHAIR—If governments with bipartisan support were to say, ‘Okay, nuclear is now allowed to operate; we are happy to receive proposals for applications to build nuclear power plants,’ do you think that, without any subsidies whatsoever, there would be private sector proponents that would come forward and put proposals forward?

Dr Hardy—I believe they would. In a sense, those who are strongly against nuclear would say, ‘Well, there is a hidden subsidy. Government, you have got to set up a regulatory regime’—and that will cost money. But the cost of setting up a regulatory regime is a small amount of money compared with the huge subsidies being given to other industries which are allowed legally to operate.

CHAIR—In a sense, if you are saying you do not need government subsidies and people that want to argue against nuclear say, ‘The cost would not justify having it in Australia anyway,’ why would we not just open up the market for it and see what happens? If we can have an additional string to our bow, so to speak, as far as the energy mix, even better. That would be my personal view.

Senator IAN MACDONALD—You guys would be very much in favour of the CPRS as a means of putting realism into the nuclear debate. I will come back to that later.

Senator HUTCHINS—I have a few questions. It is an intriguing development—the British Labour government deciding to invest in further nuclear power plant. The chairman may recall, but we were told at one stage that ago that the British government was in fact looking at more coal fired power stations only a few months ago, and now they are looking at nuclear. We have also been told that Belgium, Germany, Spain and the Netherlands have adopted policies to phase out their nuclear power dependence by 2022. We are getting all this different information coming at us. I wonder if you would like to comment on the fact that one European nation—if Britain regards itself as part of Europe—is now investing in more nuclear power stations and at the same time other European nations saying they are going to phase it out.

Dr Harries—Certainly the recent British announcement of depending on three arms of energy—more nuclear, carbon capture and renewables—and, specifically, to fast track a new nuclear plant is very good.

CHAIR—Belgium and Germany recently announced that they were extending the running time of their nuclear stations. Is that right?

Dr Hardy—Yes, I think there has been a change of opinion in many European countries in the last few years. Italy, for example, was quite antinuclear for many, many years, but it now definitely plans to go ahead with building nuclear power stations there. Sweden, of course, had a well-known plan to phase out its power stations, but they have not been able to come up with any viable alternative, in a country which is heavily dependent upon electricity. The public is now demanding an answer from the government of that country as to how they will continue the economy of Sweden if they phase them out. So the government is changing its mind too.

There is no question that European countries are changing their attitudes. Even Germany is beginning to move away from its previous position of closing down everything and depending upon wind and solar. I think this is because industry in many of these countries have said: ‘Hold on, we’re paying a huge subsidy in Germany to support the wind industry. Why are we doing this when it is only giving us intermittent power?’ There is no question about it being intermittent. I went on a train journey from Vienna to Salzburg last year and I passed a wind farm along the side of the rail line that had 25 wind turbines and not a single one was actually operating. I was in Japan last year visiting the north of Japan at a nuclear conference and there was a huge wind farm around the big nuclear establishment on the north coast. They have over 100 wind turbines and when I was there I did not see a single one of those wind turbines operating. I think they have been put in a very unfortunate position where there are very low winds.

Wind has captured the public’s imagination, but it has not been able to deliver in many countries. The public now see this. In England there is no question of going back to build coal fired power stations. Public opinion will not accept that and probably would throw out the government if it said it was going to build half a dozen coal fired power stations. Public opinion has moved towards acceptance and is more accepting in Europe where you can go 50 kilometres in any direction and probably see a working nuclear power station. You cannot do that in this country. You depend on information and misinformation provided by the two opposing camps.

Dr Higson—Could I comment particularly on the European situation. The opposition to nuclear power in Europe substantially dates from the Chernobyl reactor accident in Ukraine. Subsequently, it has been realised that that was a uniquely Soviet event and need not be anticipated given some responsible technologies. The Swedes, the Italians and the British stopped using nuclear power and, as was mentioned, there was a referendum in Sweden in particular to close down their nuclear power stations. But they found they could not do it without buying electricity from France, which was generating it from nuclear power and generating the cheapest electricity in Europe. The policies in those countries have now changed and they are now going to nuclear. The German situation is slightly different. As you probably know, the decision to phase out nuclear power in Germany came from a deal with the Greens to support a particular government in power. That situation no longer exists. Whilst the Germans have not changed their laws, I think they are going to have to do the same things as these other countries and go back to nuclear.

Senator HUTCHINS—We have been told that if we want a nuclear power plant operating in this country we have to start now because it will take about 10 years, with regulations and whatever else. The second thing that we have been advised of, particularly by the University of Sydney, is that they are probably the only institution in this country that is training people to work in that field and that, in fact, there is a lack of professionals who would be available in this country, let alone in the industry, to operate effectively in the nuclear power industry. I wonder if you would like to share your observations on that with the committee.

Dr Harries—There are quite a few universities that have various scientific courses, but there is a lack of training for nuclear engineers in Australia. For the OPAL reactor, a lot of those engineers were trained on the job in that they were trained at ANSTO to operate the new OPAL research reactor. We had a visit there a month ago. ANSTO might be able to answer more fully as to the availability of trained people. With the increased number of reactors being built around the world, there is a need for more trained people, but overseas there are lots of educational institutions moving to fill that gap.

Dr Higson—This is a chicken and egg situation. There is no point in people taking courses in nuclear engineering in Australia when there is no possibility of them getting a job here. I am sure if there was a nuclear industry being developed in this country the universities would meet that challenge and start training people.

Senator HUTCHINS—Did the University of New South Wales have a nuclear energy course that they no longer have?

Dr Higson—Yes, that is perfectly true, because there was no prospect of work for the people passing through that course.

Senator HUTCHINS—So the University of Sydney and the University of New South Wales used to have such a course. You said there was on-the-job training, Dr Harries. Were there any other institutions in this country that were training engineers that no longer are?

Dr Hardy—The University of New South Wales was the major institution, going back 20 years or so. It is very good to see that the ANU in Canberra has set up a master's degree in nuclear technology, which involves public relations aspects as well as technical aspects. There is

still quite a lot of research being done in the universities in nuclear science and engineering generally across the country. This has been spearheaded by an organisation called AINSE Ltd, which is the Australian Institute of Nuclear Science and Engineering, in which all the universities in the country take part. ANSTO takes part as well. This has maintained a pool of people doing research and perhaps getting master's degrees and PhDs. Many of them have found they have to go overseas if they want to continue their careers. So we have a pool of people who have been trained in Australian research and the general knowledge of nuclear science and engineering who have probably worked overseas and come back to other jobs. So there is that pool.

I would make the point that if there was a level playing field and if a company, say, from overseas, put forward a proposal to build a new nuclear power station in Australia it would be very similar to the early days in China, going back 20 years now, when European countries put forward proposals to build a new nuclear power station in China and parts of the contract specifically said, 'The vendor will train so many hundreds of staff all the way through the requirements of the nuclear power station.' This was very, very successfully undertaken, particularly by the French, 20 years ago in China, where they took several hundred Chinese qualified scientists and engineers and trained them in France. Now, of course, they are in managerial and operating positions and China has in fact benefited enormously from that. We would, unfortunately, be in the position where we would have to rely upon a vendor helping to train us in their facilities. If you bought a reactor from France, there are many, many training centres in France that you could go to and you could have quick training in operating nuclear power stations, maintaining them and so on. I think that is the way we will be forced to go.

Coming back to the chair's question about how long it would take, I think Dr Switkowski has been saying quite repeatedly in public presentations recently that he thinks 10 years would be a reasonable figure to put upon it. It would probably take five years to sort out all the laws and regulations and the availability of a regulatory body in Australia so that a proposal could be put to that body and it could examine it seriously. Then it would take about five years from pouring the first concrete to actually operating a nuclear power station. So any way it backed up, you would not possibly be able to build one within 10 years. That is the sort of figure that most people accept as feasible.

I think he went on in that report to say he could envisage 25 nuclear power stations spread around the country by 2050, producing something like 35 per cent of Australia's electricity requirements at that time. You may say, 'How could you build 25 in the next 25 years?' That is entirely feasible: China is doing it, Japan has done it and Korea is doing it and has done it. It is technically possible, but we would need considerable support from overseas vendors.

Dr Higson—Can I just add to that, and enhance that particular line? Once the tactical and regulatory infrastructure were established for the nuclear industry, it could replace coal as a source of baseload electricity faster than any other source of energy except gas which, of course, is also a carbon emitter.

Senator IAN MACDONALD—What are the backgrounds of you three, and your positions in the association? What are your disciplines?

Dr Harries—I am a nuclear physicist.

Senator IAN MACDONALD—Right.

Dr Higson—I was originally a chemical engineer, but the first job I got was at Rolls-Royce, building nuclear powered submarines. I found this a very interesting line to get into. I am now also a fellow of the Australasian Radiation Protection Society, as well as a fellow of the Institution of Engineers. I have developed a particular interest in the biological effects of ionising radiation. That is probably my major contribution.

Senator IAN MACDONALD—I want to come back to that.

Dr Hardy—My background has been in the nuclear fuel cycle for many years. I worked in national laboratories, firstly in the United Kingdom, where I worked on developing the new methods of preparation of uranium fuel for the advanced reactors which were built in the United Kingdom in the seventies and so on. I worked for a couple of years in the United States on nuclear fuel production, and then I came to Australia in 1971 to the Atomic Energy Commission, where I was in charge of the whole fuel cycle from using uranium through to waste management.

Senator IAN MACDONALD—That is fine. Clearly, and it was obvious in any case, you know what you are talking about in this field. You mentioned in your opening statement that there were two pieces of legislation that prevent this that I guess date from the Cold War. What are they?

Dr Hardy—One is the Australian Radiation Protection and Nuclear Safety Act, which specifically prohibits the Australian Radiation Protection and Nuclear Safety Agency from regulating or promoting nuclear power or the nuclear fuel cycle. That is one act. The other one is called, I think, the Environment Protection and Biodiversity Act of 20 years ago. It is quite an old act which, again, prohibits the construction and operation of nuclear power plants or any fuel cycle facilities.

Senator IAN MACDONALD—You commented before about the European situation. I think their positions depend on the political persuasion of the government of the day. You mentioned about Germany, and that you anticipate there will be a move back to nuclear from renewables. I have been reading a paper by the Rheinisch-Westfälisches Institut für Wirtschaftsforschung—do you know what I am talking about?

Dr Hardy—I do not know which paper. What is the gist of it—

Senator IAN MACDONALD—Do you know the institute?

Dr Hardy—Yes.

Senator IAN MACDONALD—Dr Christoph M Schmidt is the president.

Dr Hardy—Yes.

Senator IAN MACDONALD—Is it a reputable organisation?

Dr Hardy—Yes.

Senator IAN MACDONALD—They put out a paper saying in effect that renewables are a waste of money and time and do not create jobs. They are talking about the German experience.

Dr Harries—We have to be careful commenting on a paper we have not seen.

Senator IAN MACDONALD—Indeed you have not. But I was really asking you if you knew the institute and whether it was reputable.

Dr Hardy—It is well known institute, yes.

Senator IAN MACDONALD—It is a very interesting paper about renewables and jobs allegedly created. Finally from me—because time is short—Dr Harries, in your opening statement you said nuclear power is viable in Australia. Did you mean technically viable rather than commercially or economically viable? Does it come back to your cost evaluation?

Dr Harries—I think that at the present time one could build a nuclear power plant in Australia, but the electricity from it would be more expensive than we currently get from coal.

Senator IAN MACDONALD—This is very hypothetical, because I do not think it will happen, but if, for example, the CPRS were passed and ended up with a 40 per cent figure on reduction of greenhouse gases and the subsidies were taken away, for example, from the coal industry—many, including you, have said they should not be there; I know you are not economists but nuclear scientists—then do you think that would change the attitude of governments, if not the population, to nuclear power?

Dr Harries—It might change the attitudes of both, because the price of electricity is going to become much more of a political issue. If we start having more lack of power then there will be more of a need to accept nuclear as being a viable option.

Senator IAN MACDONALD—I have one final question. You mention this in your paper; thank you for your paper. The reason it has been possible to manipulate public opinion against nuclear power is this belief that, if we have nuclear power, everyone will develop two heads or walk with funny limps or something.

Dr Harries—I do not think we had that in our paper.

Senator IAN MACDONALD—No, I am not quoting you. What can you say about safety that might change people's opinion? Someone at the UN told me that nuclear power stations are 'terrorist proof' these days. Do you have a comment about the safety aspect?

Dr Higson—This is one of the popular misconceptions about the safety of the industry. Let us talk particularly about nuclear power stations. If you speak to many people about bringing in nuclear power in Australia, they say, 'Oh, we don't want a Chernobyl here.' Of course we do not want a Chernobyl here, and there is a very easy way of avoiding having a Chernobyl, and that is not to build that sort of reactor or any reactor without a containment system. Nuclear power stations are demonstrably extremely safe and in normal operation the effluents from them are harmless. This is something that needs to be generally realised by the public because, as I say, there is this problem with Chernobyl. So far as terrorists are concerned, a proper containment

system around a nuclear power station is a vast steel-reinforced concrete structure. Before you can get a substantial release of radioactivity from a nuclear power station you have to smash that structure—break it open. This is almost impossible to envisage. You might, say, fly an aeroplane into it, but it is not the aeroplane itself which would cause the impact; it is the engines. It is a spherical, circular building. If you got a direct hit on it, the engines would go off to the side. The engines are the things that would cause the damage. If it is an absolute requirement by a regulatory organisation to design a structure which would withstand the impact of the largest aircraft engines in operation, this could be done. I doubt if this would become an absolute requirement, because the probability that it could happen is so trivial. But nuclear power stations are very well proofed against terrorist attacks.

Senator BUSHBY—Thank you for coming along today. To sum up what I understand you were saying, currently nuclear power is more expensive than coal in Australia but is at least competitive or cheaper than most of the renewables as it currently stands. Then the effect of carbon price might make it more competitive against anything that is on offer here.

CHAIR—You nodded, Dr Hardy. A nod does not get picked up by *Hansard*. I want to put the nod on the record.

Dr Hardy—Thank you for that.

Senator BUSHBY—One of the things that has been raised with us by a previous witness—I cannot recall who—is that nuclear energy is fine but the scale of it in Australia would not work. In all the places where it currently exists they are interconnected with other countries and the power that is generated through nuclear activities can be exported. We do not have that option here and it just wouldn't work for those reasons. I am paraphrasing and probably paraphrasing it very poorly. But are you aware of that argument and does it hold any water from your perspective?

Dr Hardy—The thing is that a nuclear power plant tends to have a better capacity factor than most of the other sources. Overseas they run on about 90 per cent. The size of grids in Australia is sufficient to take a nuclear power plant. We have coal power plants after all of similar size and if they are down for maintenance for whatever reason then the grid adapts to it. As to this question about export to other places, in small European countries it is a very important part of that whole mix but I cannot see that is an argument against nuclear.

Senator CORMANN—Thank you very much for your assistance to the committee.

[10.37 am]

CAMERON, Dr Ron, Executive General Manager, Strategy, Government and International Relations, Australian Nuclear Science and Technology Organisation

PATERSON, Dr Adrian, Chief Executive Officer, Australian Nuclear Science and Technology Organisation

CHAIR—Welcome. I invite you to make a brief opening statement. Then the committee will ask you some questions.

Dr Cameron—I thank the committee for the opportunity to address it this morning. The committee will note that our submission concentrated mainly on discussion of security of electricity supply and we welcome this opportunity to expand on the issues raised. As the committee will know, ANSTO is Australia's centre for science and technology expertise and maintains awareness of worldwide developments in nuclear systems and applications and their relevance for Australia. As a federal government agency ANSTO advises government on key nuclear issues and represents Australia internationally in key fora. It also supports informed and fact based public dialogue and understanding. In pursuing these aims we draw on ANSTO's established nuclear expertise and its global networks, including through the United Nations International Atomic Energy Agency and the OECD Nuclear Energy Agency.

In that context it is important to note that almost all OECD countries produce or use nuclear electricity and that a large number of them along with many developing nations, including those in our region, are planning for a new nuclear build. The main drivers for such use are the need to mitigate greenhouse gas emissions and to provide security of supply of electricity. Globally, we note that the level of greenhouse gas emissions has resulted in a rise of carbon dioxide in the atmosphere to 385 parts per million and that we are effectively locked in to rises well above 450 parts per million, which is often cited as a level of major concern. Major reductions and far-reaching actions are needed to stabilise this rate of increase.

The scientific evidence would suggest that we should be having a debate over reductions of between 75 and 80 per cent. At 15 per cent we are simply covering the growth in demand for electricity over the period to 2020. Most international studies also suggest that no single technology can hope to address the magnitude of the reductions required and that, conversely, no technology should be excluded from consideration, given the implications of global warming.

In terms of the security of electricity supply we note that many countries are turning to nuclear power because, although capital costs are high, operating costs are low and this gives long-term security. For example, in the United Kingdom the concern over the instability of gas supplies from Europe has significantly advanced their desire to turn to nuclear power. Only this week the UK announced that it was pushing ahead with 10 new nuclear power plants—which would supply up to 40 per cent of their electricity—and with an increasing program of spending on renewable energies to provide up to 30 per cent of their electricity needs. On that basis they are aiming for reductions of up to 80 per cent in greenhouse gas emissions by 2050. In their *Road to 2010* report they state:

... Nuclear power is a proven technology which generates low carbon electricity. It is affordable, dependable, safe, and capable of increasing diversity of energy supply.

and—

... is therefore an essential part of any global solution to the related and serious challenges of climate change and energy security.

This seems to us to be a credible and consistent response. In our submission we discuss whether Australia has security of supply, using the three criteria put forward by the Department of Resources, Energy and Tourism—adequacy, reliability and affordability—and analysed in the National Energy Security Assessment in 2009. The latter concluded that Australia's security was moderate on two criteria and low on the other one. The ANSTO submission makes the point that, if we add environmental sustainability, and health and safety issues—so-called externalities—to these criteria, the security of supply using coal, gas and planned renewables significantly deteriorates. Nuclear power is a demonstrated, mature and low-carbon option offering best performance against these five criteria. It is the best fit across all requirements.

We strongly support the government initiatives in moving to increase the use of renewables and to continue research into making coal generation a cleaner process. However, we believe that this is a necessary but not sufficient approach, given the magnitude of the emission cuts needed and the timescale in which action should be taken. Considered, careful and cost-effective use of nuclear power generation in the energy mix would increase the diversity of supply, support the government's objective of carbon pollution reduction, mitigate future trade risks in a carbon-penalising trade regime globally and achieve this without major impact on economic prosperity. This course of action would clearly have to take place in a situation of broad political support and sustained political will.

We recognise that there are a number of groups that strongly object to nuclear power, often citing issues of cost, waste and proliferation. Increasingly, safety is now cited less than it was before. In many countries nuclear is already competitive with coal, but in Australia the government's UMPNER review noted that it would require a carbon price of \$40 a tonne for it to be very competitive. This should be compared with the recent announcement from the government funded Global Carbon Capture and Storage Institute that carbon capture and storage will not be available until 2030 and that the value for carbon dioxide emissions would have to be between \$60 and \$112 per tonne, depending on the technology, before owners would invest in it. The institute predicts that carbon capture and storage would raise electricity prices by 78 per cent.

Our submission deals with the waste and proliferation aspects which, though challenging, are not fatal flaws. The ANSTO submission recommends that, as part of a comprehensive response, nuclear power be included as one of the technologies being analysed to address the major challenges facing Australia and that the costs and potential of this technology be studied with the same degree of rigour and seriousness as is being applied to the other approaches. We are open to questions from the committee.

CHAIR—You were saying a lot of sensible things and you are part of government in its broadest sense. Can you talk us through what status your statements and positions have in terms of government policy?

Dr Cameron—We are not a policy-making body. Clearly, the policy is made by government and the government is elected to make the policy. Our role is to provide evidence based material that should form part of that policy-making process. In this submission and others we are putting forward the evidence as we understand it. We are looking at the global issues to do with nuclear and what is happening and we are trying to interpret the relevance of that in the Australian context. In our submission we have tried to analyse the facts as we see them and to make scientific deductions from those facts.

CHAIR—What you have put forward to this committee presumably you have also put forward to government. What sort of feedback are you getting from the government in terms of them taking on board the recommendations that you are making based on the evidence?

Dr Cameron—We are awaiting the release of the green paper, as many people are, and the subsequent energy white paper. We have provided our information to that forum and we hope it will be taken into account.

CHAIR—You made some comments in your opening remarks about energy security. You said it is low on the other one and moderate on two criteria. Once you add environmental sustainability into it it is even worse. If the CPRS is implemented as it currently stands and we do not add nuclear to the energy mix, what is your assessment of Australia's energy security moving forward?

Dr Cameron—I will answer that by reference to the United Kingdom, which is why I quoted from that before. They went through a very similar process. In 2003 the United Kingdom said that nuclear had no part in its energy future. As a country they subsequently committed to reductions of around 80 per cent by 2050. When they did the economic analysis they found they could not make that work with their current energy mix and they had to include nuclear to make it work. So by 2006 the energy white paper produced by the UK said that nuclear is now an essential part of their future. When they did the analysis of the future and the reductions required they had to include nuclear to make it work. We believe a similar analysis will eventually occur here.

CHAIR—So a similar analysis will eventually occur. But as experts looking at the evidence and knowing what you know about energy demand moving forward and the economic structure of Australia, are you saying that, if we do not add nuclear to the energy mix, we will have an energy security problem moving forward and that essentially the facts will speak for themselves to the extent where Australia will have to come to a similar conclusion as the United Kingdom already has?

Dr Cameron—Yes, we are saying something along those lines. For example, when we look at the world—and that is one of the things we do for the government—we do not see any country that has successfully introduced renewables above about 30 per cent. That is probably the maximum a grid can cope with. Therefore, you say, 'What have we got to fill the gap?' In Australia we have coal and gas. The issue with those is that they are both carbon emitters and

any country that has such a heavy dependence on one type of fuel has not got security of supply by definition.

Senator IAN MACDONALD—How does the waste you produce from your facility compare with what the waste would be from a nuclear power plant creating electricity?

Dr Cameron—The waste that we produce in Australia is generally very small. After nearly 50 years, we have something like 4,000 cubic metres of low-level waste and about 400 cubic metres of intermediate-level waste. If you compare that with a country like the United Kingdom, they produce something like 21,000 cubic metres of low-level waste each year. Obviously the waste issues in Australia are a very small problem compared to global quantities.

Senator IAN MACDONALD—But that is because, apart from medical use, there is not much use. Could you help me with the comparison. What would be the annual waste of a nuclear power plant? Is that an unanswerable question?

Dr Cameron—I am not sure I could give you all the details. The waste that is of most concern to people is the high-level waste. I actually live in the Sutherland Shire in Sydney and swim in the pool that Ian Thorpe used to swim in. I am not quite as quick as him though! That pool is 50 metres long and two metres deep at the deepest end. If you made it two metres deep all the way along, the lifetime high-level waste from a nuclear power plant would fill half that pool.

Senator IAN MACDONALD—How much of that pool would your waste fill?

Dr Cameron—We do not produce any high-level waste. As I said, we produce something like 20 cubic metres of low-level waste a year and about five to 10 cubic metres of intermediate-level waste. So our numbers are very small. That is why the national store for Australia is looking like a small site.

CHAIR—We will be visiting you on 7 December too, so we will be able to assess that.

Senator IAN MACDONALD—What is required from the government in terms of regulation to allow nuclear power to be pursued in Australia? Have you raised that in your submission? I did not see it.

Dr Cameron—Yes, we did. If you turn to page 32 of our submission you will see that we discussed the government issues to be addressed. We talked about the Commonwealth legislation which applies and the state legislation which applies. We talked about how things are regulated. In point 6 and 6.1 we note that there are currently two acts that prevent the building of nuclear power plants, enrichment plants or reprocessing facilities. They are the Environment Protection and Biodiversity Conservation Act and the Australian Radiation Protection and Nuclear Safety Act. Both those prevent licences being given for those facilities to be built. There are also, as you know, various state acts that prohibit the mining of uranium et cetera—for example, in New South Wales.

CHAIR—That is in all states but South Australia and Western Australia now, isn't it? Aren't their bans on uranium mining everywhere other than in South Australia and Western Australia now?

Dr Cameron—In New South Wales and Queensland that is certainly the case.

Dr Paterson—Mining is permitted in the Northern Territory.

CHAIR—Yes, but that is not a state.

Senator HUTCHINS—Dr Cameron, I grew up in Cronulla. How many people actually do work out at ANSTO?

Dr Paterson—The core staff of ANSTO is of the order of 960. We have, in addition to that, about 140 contractors and there are a number of CSIRO staff members on the site to work on land and water issues, energy issues, and the detection and development of minerals.

Senator HUTCHINS—How many people would be employed in a power plant used for electricity generation?

Dr Paterson—A typical 1,000 to 1,600 megawatt plant would have of the order, depending on which country it and the regulatory environment, a core staff of about 600 to 700, which would be dominated by engineering and technical staff, with security and administrative staff being a small proportion. Typically, the associated jobs that are developed in the service industry—because there is a considerable service industry that supports the nuclear power industry—is about a job for a job. So each plant would tend to have directly associated supply chain jobs of the order of 1,400 to 1,500 for an 1,100 to 1,600 megawatt plant.

Senator HUTCHINS—We put to the Australia Nuclear Association earlier—and I will put it to you now—is that one of the concerns that we have had raised is that, if we had a nuclear power industry, we do not have the technicians or the engineers to man such an operation. Is that your observation?

Dr Cameron—I think there are two issues in that. The main issue to be dealt with initially is to set up a regulatory system that could do the licensing of that. That is where you would put your first effort—and it would take you a year or so to get that group of people in place. Then you would need to set up a project team with enough expertise in that team to be able to do the process of tendering and buying et cetera. Our experience in OPAL, for example, is that in the process of doing the tender, we put a large element of technology transfer into it. So as well as supplying us with the reactor, the vendor had to supply us with a training program. So by the time we had built the reactor, we had trained operators in place who had been trained as part of the process. That is normally how you would do it. So you need two groups. You need the regulatory group first that can set up the regulated frameworks and you need a project work that can do the tendering and the negotiations—be a smart buyer—and then usually as part of the contract with the vendor you develop an education and training process.

Senator HUTCHINS—One of the things that we have had put to us—and it is an observation of mine, too—is that renewable energy is seen as the answer to our reliance on coal, and it would appear that there is no shortage of money being thrown at these schemes which will not produce the energy we will need. You have said that it costs a lot of money to initially set up a nuclear power plant and you have also said that it will require significant bipartisan support for us to go down that path. Do you see any evidence of bipartisan support? I would suggest to you that, if

Commonwealth money were to be invested in the construction of a nuclear power plant, there would be far more scrutiny applied to that than there would be to wind farms, sun farms or any other sort of farms that are out there, as being seen as alternatives to coal.

Dr Cameron—There are a number of issues in your question, which I think are all very valid. I think one thing we would say first of all is that we all support the need for renewable energies to be developed. We support the need for diverse energy mix, because energy security comes from diversity in your energy mix. However, we note that renewables suffer from problems of intermittency, which are very significant in terms of making that energy mix work. Just recently the United Kingdom produced a report that essentially said that, for every 100 megawatts of electricity that they thought they could generate from offshore wind, they would need to have a reserve of 70 per cent of that in gas to deal with the times when that was not available. In some onshore areas of wind, it is even worse than that. So the concept of renewables is not a solution in itself. It is always going to need some ability to fill in the gaps and to provide a greater base load.

Dr Paterson—I would like to add a comment to clarify that. I think the first thing we need to do is be more robust in our classification of renewables. There are renewables that are low carbon and there are renewables that are not low carbon. For instance, if you study the renewables mix in Germany, you will find an interesting renewable called ‘non-renewable waste burning’—they burn waste from waste dumps. Although it is called a renewable, formally in the classification it is actually defined as a non-renewable. So I believe the discourse should move beyond renewables and non-renewables to low-carbon renewables, high-carbon renewables, low-carbon baseload sources and high-carbon baseload sources so that we can start to have a fuller debate.

I think it is also important to recognise countries like Denmark for their groundbreaking work in developing wind technology. Denmark first used wind technology to produce electricity in the First World War. I think this is little known. They had another experiment shortly after the Second World War, when they were energy constrained. They have subsequently developed the capacity to produce between 15 and 20 per cent of their electricity from wind, and they are a net exporter of electricity. But the only reason Denmark’s wind farms can work is because there is hydro power in Norway and Sweden. As the wind starts to blow, the people operating the hydro power plants turn them down. As the wind drops, they turn them back up again. In the case of wind from Denmark, which has a truly enviable reputation, it only works because of hydro power plants in another country, in another part of the grid. Therefore, when you talk about wind in Denmark, you have to talk about wind plus hydro power.

As I think Dr Cameron was indicating, in Australia the mix would be wind plus gas. That is the circle of integrity that has to be achieved in order to provide true energy security. If you compare, for example, France’s electricity costs and Denmark’s electricity costs, you will find that in Denmark they are paying twice as much for their electricity as France. That is because of their decision—which, I think, they have been very faithful to—to ensure that they maximise that particular form of renewable energy. So we are fully in support of pursuing renewables with passion and making the breakthroughs that are necessary. Wind technology is very mature now, so we are not going to see the costs come down very much. But we believe that if that is pursued in the mix, with appropriate support from gas plants, for example, then something that was previously an intermittent source of power will become viable with a gas plant hanging off it.

That is the way it works. But it is simply not correct, from an engineering or technology point of view, to assert that wind by itself can ever be a reliable source of energy.

Senator HUTCHINS—Maybe should we should mandate renewables for inner-city electorates so that they can pay twice as much!

Dr Paterson—I cannot comment on that.

CHAIR—You are asking for a policy opinion.

Dr Paterson—That is a policy position I cannot take!

Senator BUSHBY—Thank you for coming along today to assist us. My colleague Senator Farrell sent me a paper about a small generator of energy that works through nuclear activity of some sort. It is something that you would put in your basement—but it would power up to about 20,000 homes. Are you aware of what I am talking about?

Dr Paterson—Yes.

Senator BUSHBY—Can you tell us a little bit about that so that we can understand what that is.

Dr Paterson—What has been happening in the general world of nuclear technology development is that people have recognised that the very large plants that are available for base load, which are typically 1,000 megawatts to 16,000 megawatts per plant, often do not fit very elegantly into the grids of real countries. They work for people with large base loads—big grids like the United States, for example. But if you are a small country whose total grid is maybe only 7,000 megawatts, you cannot add chunks of 1,600 megawatts because you would create grid instability. So a number of companies—and there are probably half a dozen that are pretty serious about it around the world—are looking to develop small-scale nuclear energy systems. ‘Small scale’ means anything from 25 megawatts up to about 180 megawatts. Above that, medium sized systems are from 200 megawatts up to about 500 megawatts, and the large ones are above 600 megawatts.

A lot of these systems are based on civilianised derivatives of military systems, and therefore they do have some operating experience and tradition behind them. The key issue there is to make them inherently safe and to make them proliferation-resistant, which are the two key tests. I think that these systems have quite a long way to go before they become part of the mainstream nuclear mix, but I think you will see countries like, for example, India, which has made a number of medium sized plants, and Russia, which has some medium sized ones, seeing whether they can take those concepts and downscale them. There are at least two companies in the United States which have a long track record of both reactor design and fuel development and which are putting together small-scale capabilities, and those are the sorts of companies with track records that one can trust.

In the nuclear business track record is everything, and I think some of the more entrepreneurial companies with some of the more modern designs that have not really been tested except on paper and in computers are going to struggle to find acceptance within the 20-

to 25-year time scale. I tend to look at the technology maturity and the track record of the companies, the safety case and the possibility of early deployment as part of a general review of the mix. I do not think that they are necessarily going to arrive and be in somebody's basement; it is always more complicated than that.

Senator BUSHBY—Thank you for that. You talked about wind plus gas being the solution in Australia. I presume you are talking in the medium term there. A bipartisan approach taken at a national level would be needed to put nuclear energy in the mix. Even if that happened today we are still looking at a period of possibly 10 years before we could have power generation. In the medium term, what do you think is the solution? Is it gas? If we become subject to an international agreement and/or a domestic carbon tax of some sort, where do you think the answer is in terms of delivering energy security and supply before nuclear energy could come onboard if it were adopted?

Dr Paterson—I believe the way that we should address those questions from a science and technology point of view is to develop robust models that allow us to understand the technology maturity of all the options, how they will fit into the mix and what their costings will be. This is a well-established process. One would then have to add to that a clear understanding of different carbon scenarios. Under those carbon scenarios, the particular attractiveness of different options changes quite rapidly. One would then have to add to that a risk analysis of the realisation of the immature technologies. This particular discipline does exist in Australia, but I have not seen a report which rigorously treats all three disciplines for the costing of energy provision—

Senator BUSHBY—So what you are talking about here is the full, evidence based examination of all technologies that you refer to in your submission?

Dr Paterson—Yes. Preselection is a great danger. In no sense are we advocating nuclear as a solution. We are advocating the consideration of nuclear within a mix and within an evidence based framework.

Dr Cameron—To add to that: we do not want to leave the impression that gas is a solution that is low carbon, because gas is not low carbon.

CHAIR—It is lower carbon.

Dr Cameron—Lower carbon, yes. But, for example, typically coal emits about 1,000 grams of CO₂ per kilowatt hour and gas emits between about 500 and 600 grams. So, while it is lower, it is not what we would call a low-carbon technology; but, in combination with wind, you get a reasonable effect.

Senator BUSHBY—We still need to provide that baseload power, and the renewables are not in a state of development to be able to deliver that in the medium term. Presumably, something would need to replace coal if coal became unviable.

Dr Paterson—Coal is always going to be here. It is the elephant in the room and is going to stay the elephant in the room for all developed countries, I believe. It is not going to disappear. I think what we are talking about here is not substitution but a mix which can mitigate the maximum carbon.

CHAIR—And absorb some of the growth in demand.

Dr Paterson—Absolutely. Demand side management is valuable, but we are living in a water stressed country. There is going to be increased desalination. The electricity loads for desalination are massive. Unless you use high-temperature nuclear plants, it really uses a lot of electricity. If we move from petrol- and diesel-burning cars into more electric cars, we change the mix again. These rational future energy scenarios should not overestimate the demand side management aspects. Price is the best way to do that: if you increase the price, people make rational choices. But most of the estimates that I have seen in most of the policy papers that are negotiated, as opposed to fact based, in my view overestimate the demand side management; underestimate the challenges of a water stressed country; underestimate the transportation burden, which is a massive part of the carbon mix; and underestimate, in resource based economy, what it takes to run mines and to efficiently transport those goods overseas. So when we compare ourselves with some post-mining developed countries we may be achieving a false sense of security and not really understanding the true demands on the energy mix of the future in Australia.

Dr Cameron—I would like to add one point to that. We need to understand that in terms of maturity we are talking about cleaner coal being some time off, but it is just going to be ‘cleaner’ coal. It is never going to be clean coal, because it still emits all the particulates, sulphates and nitrates, which are still a concern from a health and safety point of view. So even that great goal we are aiming for is not going to give us the ultimate solution across those five criteria that we talked about in our submission.

Senator BUSHBY—From the basis of the evidence that you have given, what the previous witnesses have provided and other evidence that we have had before, I am fairly convinced that most of the obstacles in the way of nuclear energy are actually able to be overcome, except possibly the biggest one, which is public perception. I know you are not public relations experts but, from your perspective as people who work in the industry, how do you think we can actually address the public perception that there are problems with going down this path?

Dr Paterson—We have covered an aspect of this in our report, but I will amplify it with a few thoughts. It is absolutely essential that we recognise that clear direction-setting, political will and leadership tend to crystallise unformed public opinion. If one studies the polls around nuclear, one can see there has been a shift to consideration of nuclear in Australia, as there has been around the world. Normally the tipping point is associated with two things. Historically, the attitudes to nuclear in developed countries have had a gender distinction. Women have been far less supportive than men, and men generally have tended to support, endorse and advocate for nuclear. I think this gender disparity has been completely underestimated in public opinion-forming. It would be essential to understand that quite deeply in the Australia sitting and ensure that the informed debate is an inclusive debate and not an exclusive male debate, as it has tended to be in many countries. Secondly, it is essential that public opinion is led by facts, not by fear. Fear based policies have a short residence time in people’s minds, but they have a lasting tail effect. For instance, Chernobyl is often used in the news in Australia, yet all of the countries around Chernobyl are adopting nuclear power, so they obviously have a different perception of what Chernobyl meant than the general public discourse in Australia.

CHAIR—We are much further away from it.

Dr Paterson—Part of the challenge is that proximity gives you the ability to engage. I would therefore urge a more inclusive debate, I would urge a fact based debate and I would urge that people move away from fear and polarisation to engage in an issue which is of critical importance to the planet. Certainly from the point of view of what I have seen globally, where the debate has moved into an evidence based, politically conscious debate about the challenges we face with climate change, it has not been difficult for the public to fully understand the issues, to be fully engaged in the issues and to take well-informed positions on them.

Dr Cameron—I would just add a comment about the situation in the United Kingdom, which we looked at a lot because of the way they changed under a Labour government. Public opinion was pretty much against nuclear power when people thought the emissions reductions were only 20 per cent needed. When the government moved to saying, ‘We need 80 per cent and it’s serious and we must act quickly,’ people saw that they needed to be more open in terms of what they looked at. Many of those people came to an acceptance of nuclear as the lesser of two evils. That is a valid conclusion still. They recognised that the climate change issue was a much greater issue than the concerns they might have had about nuclear. That is how a lot of that public opinion moved.

Dr Paterson—The most iconic recent movement in the UK discourse is that UK Greenpeace is now neutral on nuclear. It is not advocating it, but it has gone silent on it.

CHAIR—I have just two questions to close this off. In your opening remarks you quoted the UMPNER report, which said that we require a carbon price of \$40 per tonne for nuclear to be ‘very’ competitive. Do you have any indication of how much the carbon price would need to be for it to be just competitive, rather than very competitive?

Dr Cameron—This has always been a difficult question to answer. A very recent study came out of MIT in the United States looking at the relative costs. They say that on an equal platform, if we assess the technologies equally, nuclear is competitive right now with all of those. However, the issue with nuclear is often because if you require an investment from the private sector they put in a risk premium to deal with the possibility of delays in the construction et cetera, so the cost of money goes up. When the cost of money goes up then the competitiveness changes. That is why in the United States they have agreed that for their rebuild on nuclear they will give an ability to subsidise the risk early on. In other countries they have agreed a subsidy out of the price of electricity generated to do that. What they are trying to do is to put the investment process on an equal basis so that nuclear does not get overly penalised in the investment market. If you do not overly penalise it, there is no reason why it could not be competitive now. But we recognise that there is an infrastructure development process—which, again, governments usually fund when they are introducing new technology. Governments are funding it with wind, with solar et cetera, so it would be a similar process. It is hard to answer what the number would be until you understand the financing process for it and how much government is going to be involved.

CHAIR—Going to some of the evidence that we received from the Australian Nuclear Association, as I understand it with nuclear the upfront capital investment is the biggest cost and then there are lower running costs, whereas with gas and coal the running costs become comparatively more expensive. There is a risk associated with that as well, because you do not know how those running costs are going to track, moving forward. So what you are saying is

that it is really the risk assessment around investment in capital infrastructure for nuclear. Once you compare that to the risk assessment of the running costs and the way that they are likely to develop into the future—

Dr Paterson—I believe that a number of countries have decided to do both, because you are either taking the higher capital investment upfront, with predictable costs at the end, or, in the case of a gas plant, a really low capital investment and unpredictable running costs. If you have both you are mitigating both capital risk and operating cost risk for the total mix.

I want to just explain exactly why nuclear is high capital upfront and why there is a risk premium. If the build process is highly codified and highly predictable and not subject to legal challenge, the risk premium goes down dramatically because that high capital cost is the interest burden on the capital cost of the plant before it operates.

In Japan, for example—and they have never stopped building nuclear plants in Japan—they are able today to go from first concrete to end of commissioning in 50 months. If you can do that in 50 months and you do it in a predictable way, your bank is going to stand behind you. If, however, you are halfway through the build process and a legal challenge can start that slows you down for five years then nobody is going to fund you. What they have done in the UK is they have changed the entire regulatory infrastructure to ensure that the build program can be done within the specified time windows. A reasonable government wanting to do reasonable nuclear would put in place an environment where the legal challenges cannot come after the start of building. The shutdown of the previous build programs was not driven only by safety fears; it was driven by the impossibility of financing plants that had potentially infinite build programs.

So, once it is understood that you can build the plants within the time specified and that it is not going to be extended for arbitrary reasons, the financing of nuclear plants becomes rather predictable. It is still high, but it is predictable. That then speaks to the medium-size and small-size plants. Of course, the capital risk goes away quite quickly in the medium-size and small-size plants because the total capital requirement goes down and the build process is more predictable. But that will only come in a subsequent generation of nuclear plants.

CHAIR—What you are saying here is that, in order to keep costs down, we need a clear, predictable and strong regulatory framework which means that you know what you are in for. You are nodding, so that is a yes.

Dr Paterson—Yes. Once you have that, you are in great shape. For example, not a single fossil plant has been approved in the United States in the last two years because the forward-looking cost of carbon and the regulatory environment is now unpredictable for carbon based plants, so nobody is going to build them. Carbon is now where nuclear was in the seventies and eighties.

CHAIR—In terms of small-size, medium-size and large-size nuclear plants, what is the largest coal fired power station in Australia in generating capacity and what would be the most likely size of a nuclear power plant in Australia when we start off?

Dr Cameron—The typical size of a coal fired plant in Australia is about 600 or 700. That is the larger size, but sometimes they have them in clumps, so that they have 1,200 in one spot and

some of them up to 1,400. If we are talking about nuclear plants, we would be talking about 1,000 megawatts or about 600 megawatts.

CHAIR—Are they available on the market now?

Dr Cameron—They are available on the market now. By the time we would ever get one, they would have built 20 or 30 of these around the world. These are the standard generation 3 plants that are being built now. As Dr Paterson said, we do not believe that the 1,600 megawatt plants are going to be suitable for an Australian grid, because the Australian grid is a long, thin grid, whereas European grids are strongly interconnected grids.

CHAIR—Has anybody ever done any comparative costings of nuclear power generation in the context of a clear, predictable regulatory framework and the medium-size nuclear power plants that are available on the market now?

Dr Cameron—Yes. If we go back to how these numbers are calculated, in our submission we talked about the comparisons of the different types and we have a graph that came from UMPNER showing you those. UMPNER uses a process called the levelised cost of electricity. The levelised cost takes into account the cost throughout the lifetime of the plant, but that formula has in it a little thing called the discount rate. The discount rate is really an indication of how much return people want on the investment. So you can easily alter that number to say that at a five per cent discount rate nuclear is very competitive and at 10 per cent it will overlap with some of these other technologies. So it is all to do with that assumption about the cost of money.

CHAIR—But the level of risk would influence the discount rate.

Dr Cameron—It influences how much return the investor requires on their money and therefore the discount rate that you put in.

Senator IAN MACDONALD—You spoke a lot about renewable energy. I want to mention a report called *Economic impacts of the promotion of renewable energies: the German experience*. It is by RWI. Their concluding summary says:

... we would regard—

Germany's—

experience as a cautionary tale of massively expensive environmental and energy policy that is devoid of economic and environmental benefits.

First of all, are you aware of RWI?

Dr Cameron—Yes.

Senator IAN MACDONALD—Are you aware of that paper?

Dr Cameron—Yes, we have seen that paper?

Senator IAN MACDONALD—Is it reputable?

Dr Cameron—I think the point we would make is the point Dr Paterson made before: that countries that make prior decisions about their energy mix before they have done the analysis often get themselves into difficult situations and end up with very high costs for what they want to do, but because of their commitment to it they have to pursue that. That is why we are arguing for a rigorous analysis of all the technologies before deciding what is the appropriate energy mix. I think the German experience is that, if you make too much commitment early on before the information is well known, you are likely to end up in economic difficulties.

Dr Paterson—I think one would want to applaud the leadership shown, for example, in looking at high-temperature solar in Australia. I personally have spent quite a lot of time trying to understand high-temperature solar, and I do think it is part of the future mix that is a real option. I think pursuing that in a way that provides more options that are available to this country and that may not be available in other places is absolutely essential.

I think the renewables story has now been around for long enough for us to get a deep understanding. I would not use language as strong as that in the article that you just read from, because a word like ‘devoid’ is not really a scientific word; it is quite an angry word in a way. But I would tend to go with the report of the House of Lords Economic Affairs Committee, which looked at wind and pointed out that from an economic rational analysis point of view investment in wind displaces other investments that you could make that had more economic value. I think that is the way that we should be having this discussion.

Senator IAN MACDONALD—Thank you.

CHAIR—Thank you very much for your contribution to the committee today.

Proceedings suspended from 11.27 am to 11.36 am

DOW, Mr Brendan, Managing Director, Ceramic Fuel Cells Ltd

CHAIR—Welcome. I invite you to make a brief opening statement.

Mr Dow—I will try and keep it brief. Ceramic Fuel Cells is an Australian company that was formed in 1992 to develop technology from the CSIRO. We currently employ around 80 Australians. All of our intellectual property is owned by the company and we make energy products for global markets. What we have developed for the Australian market is a product we call BlueGen, which is a mini power station for homes. It will be available in Australia from March next year. It makes all the power for an average residential home, plus export and hot water. It allows households to save substantial amounts of money on their energy bills. An average household will save more than \$800 a year and a larger household could save close to \$1,200 on their energy bill per year. Distributed generation is what we are talking about. Distributed generation can provide low-emission power and heat for homes. It can provide baseload power. We can also provide peak power. It helps to increase energy security and we can start today. In fact we have already started. We are actually collaborating with some of the world's largest electricity and gas utilities here in Australia but primarily within the European market.

Fuel cells in networks can reduce reliance on high-emission coal generation. They can increase the utilisation of existing underutilised gas infrastructure, particularly in summertime. It increases the use of abundant natural gas within Australia. We are fuel flexible, so we have the opportunity to use renewables and biofuels. We offset more coal emissions than renewable technologies such as wind and solar. It is little counterintuitive, but it is true. It is smart grid integrated and controllable, so we can reduce network capital costs. We can reduce grid congestion at peak times. There are no additional infrastructure costs for governments. There is no environmental impact in the adoption of our technology. There is no land acquisition required. There are no NIMBY, 'not in my backyard', issues. There is no public funding required from state or federal governments.

Existing state and federal regulations are currently impeding, but have the potential to help, the adoption of our technology by households within Australia, in that at a state level utilities are currently not obliged to pay for electricity that we produce at a fair and reasonable rate. At a federal level, our low-emission technologies do not qualify for renewable energy certificates. We have already proposed to various federal government departments that there should be a low-emission REC of, say, five gigawatts for small-scale—so less than 50-kilowatt—low-emission generation. Why? Because at the moment in Australia in particular it is very difficult for us to engage with electrical retail utility companies. They are very difficult to deal with. They are very slow moving and they are very obstructive with our technology because it is quite disruptive for them. But the inclusion as part of the REC scheme would obligate them to become involved with our technology. It would help to commercialise our technology and therefore to realise some of those benefits that I have just talked about. Twenty per cent renewables is a great target, but the remaining 80 per cent has to come from low-emission generation. We think a target of an additional five per cent for small-scale low-emission generation would be a good outcome.

CHAIR—Thank you very much, Mr Dow. Just as an opening question, you are saying that this is coming on the market in March. What would be the recommended retail price for this sort of home powered generator?

Mr Dow—Once we are in real volume production—and we started volume production in our factory in October—the householder could expect a price, installed, of around \$9½ thousand to \$10,000.

CHAIR—Obviously what you are saying is that it is environmentally much more—

Mr Dow—Simple economics for the unit would be that the householder would see a simple payback in year six or seven.

CHAIR—How long does it last?

Mr Dow—The unit lasts for about the same time as an existing hot water system. So you would link it to an existing or a new tank and it would last for about 15 years.

CHAIR—Can you describe how it operates?

Mr Dow—We use natural gas. So long as you have a natural gas pipe at your home we connect that directly to the unit. We connect it to water, which is used for start-up, and we connect it, obviously, to the grid. Then we electrochemically convert the natural gas—mostly methane—into electricity. The waste product is heat, which we recover as hot water. So we make all of your hot water for an average four- or five-person home. The waste product is water as well, which we condense out and reuse, and a small amount of CO₂. So our CO₂ emissions, for the record, only in electricity production are about 340 kilograms per megawatt hour. So if I compare that to the grid nationally, it is about a third of the current carbon intensity of the grid. It uses 95 per cent less potable water than existing generating technologies. So we do not necessarily need to be near a big cooling pond. We do not need large amounts of water. Water is primarily used for start-up.

CHAIR—What you are essentially saying is that there would be payback within six or seven years and that is under current policy settings, that is—

Mr Dow—That would be if we had an obligation of the utilities to pay for that electricity for you—

CHAIR—The surplus electricity that you can feed back in.

Mr Dow—on a one-for-one basis.

CHAIR—Yes.

Mr Dow—So at the current retail price, which around Australia is typically between 17 and 20 cents per kilowatt hour, if you were paid that price minus some delivery costs—minus the network delivery costs, for instance—so probably on average around 14½ to 15 cents, you would see a payback in about six or seven years. That is so long as we are in volume production.

CHAIR—It is also dependent, of course, on the price of natural gas.

Mr Dow—That is true, but the spark spread is unlikely to get narrower anytime soon in our view. In the long-term view of the energy industry, the spark spread is more likely to broaden, and the wider the spark spread the more rapid the payback. The challenge that the company faces in the current policy settings is that we are moving from relatively low-volume production and increasing that production over the next couple of years, so the inclusion under a low-emission REC, for instance, would assist in a much broader distribution and more rapid adoption of the technology in the Australian market.

CHAIR—You raise an interesting point. You do not qualify for renewable energy certificates—and I guess you are not a renewable energy, so from that point of view it makes sense—but what you are really saying is there should be a different category recognising low-emissions technology so that there is a bit of a boost.

Mr Dow—We think there should be a category that recognises the benefits of distributed generation. Distributed generation reduces strain on existing ageing infrastructure, so there is a benefit there. We think it should be for small scale so that it recognises the efficiencies you can get with small-scale cogeneration where you are producing electricity and heat at a total efficiency of about 85 per cent. Our electrical efficiency alone is 60 per cent net—60 per cent of the plug in your house.

CHAIR—Compared to?

Mr Dow—In Victoria it is about 20 per cent and in New South Wales about 25 per cent. So it is almost three times the electrical efficiency. It is the same amount of power but we are using almost only a third of the calorific value of fuel to power your house.

CHAIR—Have you put to government the proposition of having a category of low-emission certificates and targets?

Mr Dow—Yes, we have put that to Treasury and we have put that to the Department of Climate Change.

CHAIR—*Hansard* cannot pick up your smile, which seems to indicate that you may not have had a favourable response.

Mr Dow—You would know that we have not had a favourable response.

CHAIR—Talk us through your process with the government. Why is the government not taking this on board?

Mr Dow—Honestly?

CHAIR—Yes.

Mr Dow—To be frank and honest, it is the ideology of it not being renewable. If we are strictly not considered renewable then we are strictly not part of the renewable energy certificate scheme.

CHAIR—If our objective as a nation is to reduce emissions as fast as we can at the lowest possible cost then on the face of it technologies like yours have a contribution to make. I am very interested in this distinction between renewable energy targets and low-emission targets, I guess.

Mr Dow—If you put in renewable generating capacity, such as wind or large-scale solar, that will contribute to the reduction of emissions, but because they are not dispatchable technologies—they are not controllable technologies per se and they cannot be relied on absolutely for energy security—you need to have a spinning reserve of some description. Typically the way that energy companies deal with that is with open cycle gas turbines in Australia. We put in new gas fired power stations.

What we are saying is that, if you put this into every household in Australia—and this technology can go into every household and most commercial buildings—then you would be able to go some way towards meeting the reduction in CO₂ emissions as well as having dispatchable, reliable, controllable electricity using existing infrastructure. We are a summer peaking network. In the summer we have a gas network that is incredibly underutilised. If you put our technology in, you would increase the utilisation of existing infrastructure. You do not need new poles and wires. We do not need new transmission and distribution stations.

We are already well advanced in discussions with utilities in Europe—in the Benelux, the UK, Germany and France. We have shipped our first units to Japan. We are having some success in the Northern Hemisphere, but low-emission technologies are not so much on the radar here in Australia as much as renewables are. I think low-emission technologies are the bridge between completely renewable and where we are today. You need to have a path. This forms part of that path. The first generation of our technology uses natural gas and the next generation of our technology can already use things like ethanol and biofuels. We can use biodiesel and other renewable fuels.

CHAIR—Have your conversations with government concluded or are they still ongoing?

Mr Dow—Certainly ongoing.

CHAIR—So you are still pushing?

Mr Dow—We are still pushing. It has been difficult to get traction with the Department of Climate Change, because they are primarily focused on the CPRS legislation as it exists at the moment, which does not include non-renewable technologies. Certainly there has been an allowance made for waste gas from coalmines. We understand that that is an anomaly. There are other anomalies that have been included, such as the inclusion of heat pumps, which do not make electricity but actually use electricity. We understand that that is the reason for doing that. Going forward, we think that there should be a target that encourages really high-efficiency, low-emission technologies to become part of this mix. Renewables, between now and 2050, are not the only answer. They cannot be the only answer. There needs to be a transition.

CHAIR—A final question from me: this is clearly focused on the residential market. Is this something that comes in one size? Are you proposing to build modular generators for more small business/commercial applications?

Mr Dow—The target is for residential application because we can build lots of the same thing, which means we can get down to a really competitive, low cost relatively quickly. You can install these in the building we are in today. You could have one or two of these on each floor powering all of the lighting, emergency lighting and PCs in the entire building. You could have them in 24-hour convenience stores and use them for refrigeration, lighting, air conditioning and food management. As well as that you can use them in homes, large homes in particular, that have large demand, and also in small homes and even in apartment sized houses.

Senator HUTCHINS—Mr Dow, I see you are Victorian, and I will not hold that against you! I preface my remarks with that because we have had evidence in relation to peak load for a home and peak load in the community. Last Christmas Victoria could not meet its peak load. We understand that when an air conditioner is running—and I understand it is 36 degrees in Melbourne today—it may use around a five-kilowatt load. Is it correct that the BlueGen unit, which has an output of two kilowatts, would meet that home's electricity demand most of the time; however, not when the air conditioner is at its full capacity? Could you comment on that?

Mr Dow—That is true, because two is less than five, of course. But overall during the course of the year the unit would provide about 17,000-kilowatt hours of electricity. The average household in Victoria uses about 6,000 to 6 ½ thousand kilowatt hours per year. The further north you get, that increases. If you are in New South Wales that goes up to maybe 7,000, 7 ½ thousand. In South-East Queensland the average householder uses more than 10,000-kilowatt hours a year. So it is true to say that at that peak time we would not be providing all of the power. However, the unit can be modulated to provide part of the peaking power that would be required to power that air conditioner in that home or to power a pool pump.

Senator HUTCHINS—How would that occur? What would happen?

Mr Dow—In my opening remarks I mentioned the integration with smart grids. The unit could respond to a demand signal. The unit could easily respond to pricing signals. Where smart metering is going in, people are going to be charged at time of use. This is an opportunity for people to offset that time of use impost that will be put upon them by the electrical utilities. This really starts to put the power, if you like—not electrical power but the choice—back into the hands of the home owner, which we think is an important part of the process of people managing their energy consumption going forward. It gives them the choice to operate the unit on that basis. They can generate electricity in their home. They can generate electricity to charge their electric vehicles in the future. Electric vehicles will put a huge amount of strain on existing infrastructure. This is an opportunity to reduce the strain on ageing, creaking infrastructure. Electromobility is one of the big areas of interest, particularly in one of our key European markets in Germany, where the existing grid would not cope with a large-scale adoption of electric vehicles.

Senator HUTCHINS—You said that low-emission generation is not on the radar as much as renewable. Is there any place in the world you can point to where governments are seeing renewable and low-emission generation as a combined effort rather than one versus the other?

Mr Dow—There are a couple in particular that I could easily point to. One is in Germany. We have located a factory there that builds part of the core technology that we have. There is a capital subsidy there for combined heat and power units, units that produce heat and power and can deliver that to homes. Our unit would qualify for a subsidy of about €3,300 and there is also a feed-in tariff available for those combined heat and power appliances. In the UK there is a generating and feed-in tariff regime being brought in from April next year by the Department of Climate Change over there for non-renewable, combined heat and power systems in homes. They are two examples. A third example is in the Japanese market and a fourth in the Korean market where both of those governments are offering substantial incentives for people to purchase these units and install them in their homes running on natural gas, not running on hydrogen. People think about fuel cells as being hydrogen. Hydrogen is quite a problematic fuel. Running on natural gas means that we can use existing infrastructure at lowest cost. There are four markets, and in California at the moment there is a consultation process around feed-in tariffs for using the co-gen type technologies that we make.

Senator IAN MACDONALD—Can you feed in to the grid from this?

Mr Dow—We use an inverter technology which is similar to what solar PV uses.

Senator IAN MACDONALD—I think in Victoria you use the example that produces 17,000 year and the average house was—

Mr Dow—About 6,500.

Senator IAN MACDONALD—So there is a good income capability out of it?

Mr Dow—If you were paid 14c or 15c by the utility as a minimum. That is not premium. That is basically a one for one price not including GST. For the electricity that you produced you would get a six or seven-year payback.

Senator IAN MACDONALD—Is that what the six or seven years is based on?

Mr Dow—Yes, it is based on that. We haven't sought a premium feed-in tariff in the same way that solar have.

Senator BUSHBY—What do solar get paid?

Mr Dow—61c. We are seeking a one for one. When we are in volume production we think our technology will stand on its own commercially, as it should. We have not sought capital subsidies from government. They are available in other countries around the world. We have not sought that here because we do not think they are necessary. But we think the inclusion as part of the REC scheme is an important part of the puzzle that in a sense obligates or forces retail utility companies to become involved in distributed generation and in particular in the types of technology that we have developed.

Senator IAN MACDONALD—Have you looked at the ACT? They have a fairly generous feed-in tariff. Does that apply to you?

Mr Dow—No, all premium feed-in tariffs apply to renewable technologies—we are back to the renewable word—like solar and wind. We are not renewable.

Senator IAN MACDONALD—You mentioned south-east Queensland. I come from North Queensland where it would be worse again, so there would be no saving for me up there.

Mr Dow—The larger your house—in fact, the larger your demand—the bigger the saving because you would be offsetting the 20c of electricity all within your home. If you are running a couple of air conditioning units, a pool pump and various other devices for home comfort, your electricity usage is probably 10,000 or 12,000 kilowatt hours. That is probably a very large bill. We would offset all of that and only export a smaller amount back to the grid.

Senator IAN MACDONALD—What it would cost me would be the cost of my gas and what little water I put into it. Is that right?

Mr Dow—The water at start up but the cost of the gas, yes. The cost of fuel for one kilowatt hour is around 5c to 5½c. That is how much it would cost you in fuel to run the unit.

Senator BUSHBY—I am just looking at the brochure that you gave us and the dimensions on the back. It is about the size of a dryer or dishwasher?

Mr Dow—Dishwasher size, yes.

Senator BUSHBY—It would fit under a standard bench?

Mr Dow—The unit has been designed for indoor or outdoor use. It can go outside. Typically it would be sitting next to a tank. The tank would not necessarily need to have a gas boost. It would have one if you had a large household or lots of teenage girls.

Senator BUSHBY—I have three daughters. They are not teenagers yet but they will be.

Mr Dow—Typically it just sits next to a standard hot water tank without necessarily needing a gas boost as well. It would produce about 200 to 300 litres of domestic hot water in a single day.

Senator BUSHBY—So the heat that it produced would not also be useful in the southern states for heating in winter, you would need additional heating as well?

Mr Dow—You would need additional heating. The target of the technology was to make it so electrically efficient at 60 per cent that the heat it produces is relatively small. It is useful but it is relatively small.

Senator BUSHBY—You do not want surplus heat because it is more efficient to have it this way.

Mr Dow—The units that we produce for the European market have within the box a condensing boiler system. For hydronic heating, which is typically used in Western Europe, the system would come with a hydronic heating device onboard as well.

Senator BUSHBY—Could you get one of those in Australia, if that is what you wanted? I am from Hobart and it gets pretty cold there in winter.

Mr Dow—If that is what you wanted then you could get one of those from one of our partners in Europe, yes.

Senator BUSHBY—I see. You would have to bring it in from Europe.

Mr Dow—They are quite large companies, so they could.

Senator IAN MACDONALD—Do you build these in Australia or do you just import them from Germany?

Mr Dow—The BlueGen unit is assembled and built in Australia.

Senator BUSHBY—You note in your submission that the company was originally set up with a consortium of the CSIRO, the federal and state governments, and industrial companies. Is there any retention of government involvement?

Mr Dow—No. All of the government bodies' shareholdings have been reduced to nil.

Senator BUSHBY—How long ago did that happen?

Mr Dow—Sorry, the federal government is still a small shareholder. It has, I think, about 400,000 shares. We have over a billion shares on issue.

Senator BUSHBY—Are the federal officials that you have been negotiating with on this issue aware that the federal government is still a shareholder?

Mr Dow—We tell them. But it is such a small amount.

Senator BUSHBY—It is small.

Mr Dow—The company is a listed company so we have got all of our capital over the last five years, at least, from public capital markets.

Senator BUSHBY—About the buyback of power, you mentioned earlier that the current solar rebate is at a premium price of 61c a kilowatt. Obviously that is subsidised. Presumably the power companies are not going to be happy paying 61c unless there is some government input into that. How does that work? Is that state, federal or a combination of both?

Mr Dow—It is different for different states. Some states have a gross tariff and some have a net tariff. Some have a gross amount, so it is the total amount that you produce, and others have a net feed-in tariff, so it is the amount that only goes into the grid. The interesting thing about the solar feed-in tariff is that a typical household would buy a one to 1½ kilowatt system for their roof. That will produce about 2,000 kilowatt hours of electricity a year.

Senator BUSHBY—And cost probably twice as much as one of these things.

Mr Dow—Unsubsidised, you would expect to pay \$18,000 to \$20,000 installed. You produce about 2,000 kilowatt hours—less than one-third of what you need in Melbourne and less than one-fifth of what you need in North Queensland. The rest of the power comes from the grid. So, yes, you are offsetting two to three tonnes of carbon dioxide, but with BlueGen in Victoria you are offsetting 18 tonnes and in New South Wales and Queensland you are offsetting about 12 tonnes of CO₂. At the start I said it is counterintuitive that we offset more carbon dioxide than a truly renewable technology, but it is due to the fact that we produce from the same amount of capital five or six times as much power.

Senator BUSHBY—The buyback rate of 14c or 15c a kilowatt that you are talking about obviously would vary depending on the energy retailer—

Mr Dow—Not necessarily. The state government would review the reasonableness of a ‘reasonable price’.

Senator BUSHBY—What I was getting at was that each of the generators would have a cost per each kilowatt of power and they would know what that is. Would that be an economical way for them to produce power that they could then retail?

Mr Dow—Sure. To give you an example: through VicUrban, which is the Victorian land development authority, we have received offers for a demonstration program that we are running for the power that we produce with them. Those offers have ranged from 5c to 20c per kilowatt hour. That is the first thing. The second thing: if you imagine that in the long run the household does not need to own the device—the utility can own the device—then the utility can make electricity in your home cheaper and deliver it to your house cheaper than they can using the existing infrastructure and even cheaper than using really cheap brown coal fired power stations.

Senator BUSHBY—So what you are saying is that if you took a city like Sydney and said, ‘We need to power this; let’s wipe the slate clean in terms of how we actually do it,’ you could power Sydney cheaper with these than you could if you went off and built a black coal power station, which is probably the cheapest way of doing it in Australia at this stage?

Mr Dow—That is right. If I were a utility and put a unit in your house, the delivered cost of that electricity would be about 11c to 11½c per kilowatt hour under the pricing schedules that we have today. To deliver the same kilowatt of electricity to a house by using coal is somewhere around 14c to 14½c per kilowatt hour.

Senator BUSHBY—That is the cost of delivering, not the spot market price.

Mr Dow—That is not the spot market. It is the average cost of delivering the electricity to your home. It is based on the cost of generating plus the network delivery costs, which are substantial. We are only talking about it at a residential level here. Large power stations, whether they are gas fired, coal fired or use some other method, still require large amounts—

Senator BUSHBY—I am not saying that you could replace them, but in a hypothetical situation the cost in a direct situation would be lower this way from scratch.

Mr Dow—And the really important number there is that the electrical efficiency is at 60 per cent. No other technology has reached that. The total efficiency—because we can also use the heat—is at 85 per cent.

Senator BUSHBY—The efficiency in terms of greenhouse gas production is also superior.

Mr Dow—It is incredibly low. If all generating capacity in Australia were at 340 kilograms per megawatt hour we would not be talking about a CPRS.

Senator BUSHBY—I have two final questions that are related. How viable is this technology going to be in Australia if you do not succeed in either/both being able to get buyback at a one-for-one basis and/or getting a suitable rec treatment of your power?

Mr Dow—It makes it more challenging. It may change the timeline for Australia somewhat. It may make the product a little more niche—a little less mainstream. Our primary markets are in Western Europe and Japan at this stage.

Senator BUSHBY—Is the market that you have in those areas dependent on government treatment of that technology in any shape or form to give you a similar advantage to other technologies in those places, or is it just because cost of energy is higher there so you are more competitive?

Mr Dow—Cost of energy is very helpful, of course. Where we have high energy costs, like in western Europe, then the business case is absolutely compelling. You can have a simple payback for a household of four or five years much more quickly.

In the long run, without government support, without RECs and without having to obligate utilities for feed-in tariffs, the business case stands on its own. Similar technologies are in a transitional phase coming out of research and development and early commercialisation—we travel across what we call ‘the valley of death’, which is that transition from making hundreds to making thousands and tens of thousands. For us, those types of regulatory or legislative changes support the early and more rapid adoption of the technology within Australia. If we do not have an obligation of utilities, and if we do not have a low-emission renewable energy certificate then, yes, in Australia it may change the timeline somewhat. But eventually, because we are in these other markets, the capital cost will be reduced such that the technology here can make sense.

It would be sad for us to have to go and take the technology to the rest of the world—

Senator BUSHBY—If it takes off elsewhere before it does in Australia?

Mr Dow—We are an Australian company, it is Australian technology and we pay tax in Australia. It would be a bit crazy to take the technology offshore in the hope that one day we may come back here because of some really simple tweaks to the legislation that really do not cost the government anything.

CHAIR—I am from Western Australia and Western Australia is not part of the national electricity grid or market. How do all of the things you have told us about buyback et cetera play out in the Western Australian market?

Mr Dow—I have not spent a lot of time on the Western Australian market, but I am certain that the economics will be sound in Western Australia as well. As long as Western Australians use a lot of electricity for their pool pumps—

CHAIR—Western Australia is structured a bit differently I guess; you do not have the spot market—

Mr Dow—You do not. In the end, it is not one of our initial target markets. But I am certain that it will make sense. I was curious about where your accent was coming from, so it is a Perth accent?

CHAIR—My accent is not really from Western Australia!

Senator IAN MACDONALD—It is a Subiaco accent!

CHAIR—So Western Australia is not one of your early targets? That is presumably because it is different to the national electricity market, which is not really national.

Mr Dow—That is one of the reasons. It is isolated, yes. If we had a distribution partner that came to us and wanted to take the technology into the Western Australian market we would be pleased to talk to them.

CHAIR—I was interested in your comments in response to some questions by Senator Bushby. One of the energy suppliers, rather than build another major power station to deal with residential demand, may well want to roll out your technology as an alternative. But you have not had any conversations with anybody in Western Australia?

Mr Dow—I did not say that we had not had conversations. We have had—

CHAIR—But have you had any conversations in Western Australia?

Mr Dow—Not really in Western Australia—though, actually, Western Power was one of our shareholders.

CHAIR—We are not that far away, to be honest. Clearly, state and territory governments are the main drivers in terms of energy markets, supply and retail et cetera. Are there any regulatory changes beyond what we have talked about around low-emissions certificates that you would be looking for at a state and territory level?

Mr Dow—At a state and territory level it is really just under the local electricity acts to obligate electricity utilities to pay a fair and reasonable price—that is all.

CHAIR—Thank you very much for your contribution to the committee today.

Mr Dow—No problem.

[12.15 pm]

MYATT, Mr James, Chairman, Energy Retailers Association of Australia

O'REILLY, Mr Cameron, Executive Director, Energy Retailers Association of Australia

CHAIR—Welcome. I invite you to make a brief opening statement and then the committee will ask some questions. Perhaps you might want to address whether your membership includes Western Australian organisations.

Mr O'Reilly—I can address that upfront. It does include Western Australian energy retailers, you will be pleased to know.

CHAIR—Excellent.

Mr O'Reilly—In terms of an introduction, I should say that there would not have been an energy retailers association 20 years ago because in the 1990s we embarked on energy market reform in this country to create the national electricity market, to link the states and to change the industry by introducing competition into generation through the national electricity market and into retailing and introducing choice to consumers. The objective of that really was to deliver an efficient market, with better prices for consumers. The competitive dynamic in the generation of retail was to deliver better outcomes for energy users. I think, on the whole, that process was relatively successful, although it remains incomplete. For instance, in the state of Victoria, independent worldwide surveys have shown that the market in Victoria is the most competitive in energy retailing in the world. That is based on the number of customers switching or choosing their supplier each year.

I think one of the things that you need to be mindful of though is that the role of an energy retailer is really to purchase electricity from the wholesale market, transfer it to the customers, package it up for a better deal and maintain their relationship with the customer. So we are very much an intermediary. I have given you a diagram of how a retail price is determined. Around 45 per cent of that is the wholesale cost of electricity which is purchased either from the spot market or by hedging between generators and energy retailers. Another 40 to 45 per cent is the regulated cost of shipping the energy to the consumer. Then the retailer packages it up, with marketing costs, IT costs, customer relationship costs and so on, and promptly contributes around 10 to 15 per cent of the enterprise, which hopefully includes a margin.

Our membership is very diverse. The sector includes anything from top 20 Australian stock exchange listed companies like AGL and Origin to newly listed new companies like Australian Power & Gas, the company of which my chairman is CEO. It was only established in 2006. It is a sector that includes small, large and specialist retailers, some of whom focus on green offerings and some of whom just focus on customers. That is the role of the retailing sector.

One of the things that concerns us which I wanted to address today regarding your terms of reference was the issue of federal and state regulations. Obviously climate change policy is going to present pricing challenges going forward. If you look at that component of the energy

price that is the wholesale cost of electricity then obviously inevitably part of the climate change response means that we will be going to higher cost sources of generation. You can expect that to increase. Then the network costs of shipping electricity will grow because of growth in peak demand and also new investment will have to occur in transmission to link remote renewable energy generation to the grid. So I think there are going to be cost pressures there. It is therefore important, particularly given the retail sector is established to be competitive and offer the best prices to consumers, that we are also mindful of other regulation and how that might impact on costs.

One area that has been concerning us in recent times is the growth in regulation from state and federal governments as it relates to various aspects of climate change. There is often uncoordinated policies in areas of energy efficiency. There are different approaches to feed-in tariffs for solar—gross and net, different rates and so on—and all of this provides presents an administrative and cost burden to the retailing sector which ultimately costs the consumer but obviously has a greater impact on companies that are smaller, the new entrant retailers that are there to establish and compete for customers and deliver better deals. From the point of view of the energy retailing sector, we all accept the imperative of climate change, but I am sure that federal-state regulation is not being done in the most efficient way and that, therefore, any attempts at achieving greenhouse gas abatement are not being done at the lowest cost to consumers. I do not know if my chairman wants to add anything to that.

Mr Myatt—That is a valid point. The margins that are available to retail businesses are generally at the lower end of the spectrum—five to six per cent—so compliance costs and costs related to dealing with multiple jurisdictions restrict the amount a business can grow. The essence of competition in the energy markets has really sat with the new entrant retailers, or the smaller retailers, who come in and challenge the bigger guys, win market share and force the overall competitiveness in the market. So we have to understand that, with every different state scheme that comes in, there are serious costs of compliance also associated with it.

Mr O'Reilly—With your indulgence, Chair and Senators, one final remark is that, obviously, aside from Victoria, the price at which we can sell to a lot of our consumers remains regulated at a state level. So, if a state regulator underestimates the true cost to the retailer of selling to their consumers and does not allow the full pass-through of a lot of these costs, ultimately the retailers get squeezed, and the competitive model and the very business survival of some of the companies in this sector are jeopardised.

CHAIR—If the CPRS goes through, it will clearly have an impact on the price of energy. As you say, the price at a state level in all states other than Victoria is regulated. Do you expect any issues, from a viability point of view, if the regulator does not allow for some of those cost pressures to be readily passed through?

Mr O'Reilly—We certainly have expressed concerns about this issue. The Australian Energy Market Commission ran a review of energy markets in light of climate change policy, and we indicated that retail price regulation and the ability of regulators to pass through all the costs of climate change policy was a concern for us. It is not particularly a criticism of the individual regulators; it is simply that you cannot expect, with a very uncertain future, anyone to look forward one or three years—which is how long these retail regulation paths sometimes go—and forecast what is going to happen to energy prices. We all know that they are trending in a certain

direction, and the inevitable inclination is to try and keep the increases as low as possible. The risk is that that is at the expense of the retailers. We are worried about it. The Australian Energy Market Commission in its report acknowledged those issues, and we are encouraged by the fact that the Ministerial Council on Energy have said that they will be changing the amended Australian Energy Market Agreement to ensure the pass-through of the Carbon Pollution Reduction Scheme and the renewable energy target. I would say that policymakers recognise the issue. But, at the end of the day, in some states the implementation lies with the regulator, and expecting a regulator to get the forecasts right for one or three years is, in our view, optimistic.

CHAIR—So you are saying there is a consciousness but the issue has not been totally addressed yet to your satisfaction?

Mr O'Reilly—No, it has not been addressed. We think that the end game has to be to take the Victorian approach, which is not willy-nilly deregulation—it simply says that every customer in Victoria will be guaranteed supply. Retailers set a default offer. If they do not do anything, they are given a certain rate. That rate is put on the website of the regulator, who monitors all those prices and, if the regulator feels that the market is not competitive enough, they can call for a review of competition, and there remains the long-term threat of re-regulation. At the end of the day, it is letting competition and the competing retailers determine the price in the market. If someone is charging too much then an Australian power and gas company or another one of my members will come and take the customer off them.

CHAIR—In your submission you made some specific remarks about Queensland and New South Wales. What discussions have you had with the state governments in those two states and how are they telling you they will be addressing this price regulation approach in the context of the CPRS moving forward?

Mr O'Reilly—In the case of New South Wales, there is a stated policy to keep retail price regulation until 2013. That, on the current timetable for the Carbon Pollution Reduction Scheme, will be after the CPRS has started.

CHAIR—If the legislation gets through the Senate.

Mr O'Reilly—If the legislation gets through the Senate, which I am not assuming will happen. But the regulator there has a brief that they have to set prices until 2013, so they are right now undertaking that process.

CHAIR—So they are setting the prices now—

Mr O'Reilly—They are doing a process to determine that price path until 2013.

CHAIR—Irrespective of what happens?

Mr O'Reilly—That is right. So they are trying to forecast a very uncertain future, which is very difficult. In the case of Queensland, there is certainly no stated policy or commitment to removing retail price regulation. All state and territory governments have signed the Australian Energy Market Agreement and they have indicated that they consider retail price regulation a transitional mechanism until there is effective competition and it can be phased out. So the stated

policy through the federal-state agreement is that this will happen, but, with the way things are moving, it will not occur in a time frame that is consistent with the proposed start of the Carbon Pollution Reduction Scheme.

CHAIR—So if the New South Wales regulator sets prices for electricity up to 2013 and the CPRS comes into effect 1 July 2011, what does that mean for your members?

Mr O'Reilly—It will mean that they, particularly those that have large customers in New South Wales, will be hoping that the regulator builds in sufficient flexibility to revisit their forecasts if they are wrong. The Australian Energy Market Commission has recommended this, and the regulator is saying that it will build in a volatility allowance and that it will consider every six months reviewing what is called the 'wholesale cost' of electricity in the market. So that says that they recognise the issue.

CHAIR—When is the decision on the price trajectory to 2013 expected to come down?

Mr O'Reilly—Around March next year.

CHAIR—You mention in your submission that you are unconvinced of the value of feed-in tariff schemes. Can you talk us through that?

Mr O'Reilly—I will allow my chairman to intervene here. Retailers will not in the end pay the full costs of this, but we have to have systems. We pay the customer and recover it from the distributors and the government, but ultimately we have to be the payer to the consumer, and there is a lot of administrative burden associated with that. I think it has been generally recognised that, in this country, we are looking at price rises to deal with climate change and that small-scale renewable generation that is supported by feed-in tariffs represents a very high-cost option to achieve carbon abatement. Australia has grown up with the advantage of low-cost energy, and therefore I think we need to be very careful about doing any extra things that add to the price pressures on the community. At the end of the day, a feed-in tariff gets paid by the entire community, not by us, because it gets spread across all electricity prices. Therefore, it represents a subsidy from people who do not have solar panels to those who do. Whether or not you think that will be egalitarian, I do not know, but I would have thought that not many vulnerable customers—who are often a focus of policy—have solar panels.

Senator HUTCHINS—As you may be aware, gentlemen, one of the tasks of the committee is to make recommendations to the Senate around energy security. In your submission to the energy white paper you have described a number of issues which act as an impediment to investment. Would you like to highlight those to the committee, and what do you think should be done about it?

Mr O'Reilly—In terms of energy security, the first thing to say is that we have operated this market for a long time since it began in 1998 on the basis of a fairly stable generation merit order, as it is called. In other words, certain levels of demand are determined by the lowest marginal cost generator. You therefore start with the low levels of demand—the brown coal—and you move through black coal and into gas and renewables. And that has delivered low-cost energy for Australia.

Now inevitably, when you price carbon you are going to change that. And that is what it is meant to do. It is meant to change the types of generation that you have. But that process will not happen overnight and you cannot assume straight away that a large power station can be replaced. The important thing is that we look at this move to lower emissions generation as a transition. As far as retailers are concerned, if this is not done in a smooth transitional fashion then they will often bear the brunt of volatile prices in the electricity market. For instance, in a particular case, if a generator ultimately got into trouble and could not honour their hedge positions with retailers, some retailers would then be put into a situation where they have to cover their position from the spot market, perhaps at much higher prices.

So from a retailer's point of view, whilst I know there is a debate about assistance to generators in response to the Carbon Pollution Reduction Scheme, our view is that in the interests of smoothness of transition we do support transitional assistance for generators as an important process in ensuring some stability in the market and protecting the position of retailers. So I do think transitional assistance to generators is a critical thing for retailers as well as it is for generators. We are the counter party.

Earlier this year we commissioned Farrier Swier to do a report on the potential impacts of climate change policy on the retail sector and what were the major risks for us. It obviously identified the issue of retail price regulation but it also looked at issues such as generator distress impacting on retailers and the inevitable increase in gas prices that come from more use of gas-fired generation. So those are issues that are important for the short-term energy security of this country. Because, in the long term, we obviously do have a lot of that gas. We can do a transition to forms of generation but it has to be done smoothly.

The problem is, though, that all of that investment is at the moment clouded in uncertainty, and uncertainty continues. The Carbon Pollution Reduction Scheme, and the discussion about a price on carbon, is obviously not something that is new and if you look in the generation sector in recent times, most of the new investment has simply been in gas or in wind and, whether there is a carbon price or not, people assume there will be one and they respond accordingly.

So, to the best extent possible, if we are going to get a transition in the types of generation that we have, we need certainty on carbon policy as much as anything. But from a retailer's point of view I think we do need transitional assistance to the existing generators to ensure a smooth implementation of the Carbon Pollution Reduction Scheme if that is to occur. Do you want to add anything, Mr Myatt?

Mr Myatt—Yes. I think the point you need to understand a little bit—and Cameron touched on it—is as a retailer you talk about generators having exposure to the spot market. In fact, very little of the output is actually to the spot market. The majority of the generator's output is bilaterally contracted or contracted through a futures market type of structure. So for adequate—

CHAIR—Except in Western Australia.

Mr Myatt—Except in Western Australia, that is true, where it is more just a bilateral market. But even still there is still a forward position that has to be created. What is happening in the market at the moment, with all the uncertainty, is the fact that generators are unwilling to contract forward. So you have retailers who are signing customers who have customers who are

signed to them—who you really cannot just get rid of—so you have an exposure to a short position that you need to buy energy, yet you do not have any liquidity on the wholesale contracting side of the market. It would be like any commodity market where, all of a sudden, people who had the commodity were no longer offering contracts for sale because they were uncertain about what the pricing structure would be, what their financial viability would be.

You end up with this situation where, while we have a little bit of certainty now around 2010-11, post July 2011 there is virtually limited liquidity in the wholesale markets going forward. As a retailer, you are unable to hedge your position forward, so you are taking a fully exposed position to what would be ultimately a spot market. So that is certainly an issue around uncertainty.

The other thing is that as the spot market is likely to be more volatile, for the reasons that Cameron mentioned before, in the market that we have at the moment there is a mechanism called credit support by AEMO, which used to be NEMCO, where the more volatile the market is the more a retailer has to put up to the market for credit support. These costs are very significant costs. They can often be two to three times the usage of energy for 42 days ahead. Those costs create a large burden, particularly on smaller retailers who are not investment-grade rated so therefore have to pay a higher cost on the credit support that they provide to the marketplace. So there are those issues that do very much affect the retail business going forward, primarily driven by uncertainty.

The other point that the paper makes was that, as we see more remote generation being connected, it will drive into having constraints being caused in different parts of the network that were not there before, which links into more of this volatility comment around the spot market where we might have a more volatile energy market to deal with, which does impose additional burdens on retail and businesses.

Senator HUTCHINS—Mr O'Reilly and Mr Myatt, when you talk about transitional assistance in the market, would I be right in concluding that that assistance would mainly be required for the smaller retailers? The bigger ones could sustain a new regime whereas the smaller ones could not? If that is the case, what is the impact for the consumer?

Mr O'Reilly—In terms of transitional assistance, I was more referring to the assistance going to the generation sector for the write down on the values. It is more that if the generation sector is distressed and acts accordingly then it impacts on the—

Senator HUTCHINS—We have actually been out to a generator who was saying he was going to get very distressed.

Mr O'Reilly—They seem to be very publicly distressed. The thing for retailers, as Jim explained, in terms of the market and the hedging, is that any behaviour driven by a generator that is as a result of distress ultimately impacts on retailers because there are so many counter-party hedging contracts. That all adds up to volatility in the market. There is no question that in terms of the retail sector more volatility means more risk and probably more risk for newer players, smaller retailers in the market. Is that fair?

Mr Myatt—Absolutely.

Senator IAN MACDONALD—You mentioned Queensland. Could you explain the ultimate position if the CPRS comes in and Queensland maintains its regulatory regime? What is going to happen? It is a squeeze from both end then. Is that right?

Mr O'Reilly—We are the squeeze because the retailers cannot pass on the costs. As you see from that diagram, we cannot pass on those higher generation costs or those higher transmission costs. Then ultimately you have a tough situation for a retailer. It is called margin squeeze.

Senator IAN MACDONALD—What happens—you go broke and all shut down?

Mr O'Reilly—It is a worst case scenario and I would consider it a low probability. In any industry if you face a situation of a much higher rising cost base and your end-selling price is potentially fixed then you are in a dangerous situation. I think that the regulator and the government in Queensland understand that is not a situation they want to see, because if a retailer goes bust it is not only a problem for the business but also a problem for the community and the government. There is a thing called the retailer of last resort—those customers moved overnight to a new supplier. That is a worst case scenario and I think it is something that the government and the regulator are mindful of. Companies can get hurt if there is not a proper allowance for the cost rising. They may not be going broke but they are not going to be investing in the new generation that might be required for Queensland's growth.

Mr Myatt—An analogy to maybe think about is the credit crisis and the second-tier banking sector. The cost of wholesale money and credit rose significantly and you now see no second tier banks operating in that space. Some of them got bought up by the big banks, who could absorb it better through their more diversified business models. What has happened now to the end consumer is that home loan interest rate spreads have opened up because there is no second tier competition in the marketplace. I doubt whether we would see a crisis situation where no-one is retailing, but certainly it would put such a squeeze on the market that the competition elements would no longer be as active as they were before. Ultimately, the larger retailers would have to absorb until the markets could move. The danger is not only whether the regulators move in line with the increased wholesale price but also how quickly and how effectively they move in line with those increased wholesale costs. A delay of six months or 12 months would have a significant impact on a smaller retail business model, who has far less robustness around their cash flow. These businesses are very high cash flow businesses as they are. A retailer gets paid generally 90 days after the customer first starts consuming energy, so you have quite a long cash management cycle anyway. Anything that extends that certainly would put financial pressure on smaller retailers. We are not just talking about those with 100,000 or 200,000 customers; we are talking about sub one million customers, probably.

Mr O'Reilly—If you try and constrain retail energy prices one way, someone will always pay. In the case of Western Australia, they had a freeze on retail electricity prices for nigh on 15 years, and the current government there is having to grapple with that. All that has meant is that electricity prices were kept artificially low. They could do it, I suppose, because the government owned the retailer and the generator, but of course the government owned generator at those prices is losing money. So the Western Australian taxpayer has been paying a great big subsidy to the energy sector in Western Australia to deliver those artificially low prices. The current government is attempting to get them back towards cost reflective levels, but they were 100 per cent below, so it will take time to do that. The taxpayers in Western Australia might have been

getting lower electricity prices, but they were probably paying higher taxes to pay for that subsidy. You cannot keep any product at a below cost reflective level in a sustainable way for any length of time.

Senator BUSHBY—Most of the questions I want to ask are related to energy security and the impact of price regulation. The other aspect of price regulation, quite apart from subsidies—and you did touch on it to some extent—is the lack of ability to reinvest, do your maintenance properly and all those sorts of things. You do not have the flexibility to make sound medium and longer term business decisions because you just do not have the security of income to do it. Would that be a fair statement?

Unknown witness—There are no price signals coming through that say, ‘We’ve got a tightening of supply. Prices go up; that should encourage new investment.’ If you are suppressing those signals you will not get the new investment. This is particularly critical in a modern context because really a lot of the energy infrastructure we have today was built by governments—a lot of it was privatised in the last two decades. I do not know that any of the state governments intend to build the new generators, the new transmission lines. They may have to build some of the transmission lines and some of the networks but there is an expectation, particularly in generation, that new investment is going to come from the private sector because the states are not in a position to do that. That makes it even more critical that you get all the investment price signals coming through the market. Price regulation runs the risk of suppressing those signals. Therefore, you do not get the required investment.

Senator BUSHBY—Concerning energy security issues from two directions, one in terms of not getting the reinvestment in the issues, you need to guarantee that you will have a secure, ongoing supply that is not going to have maintenance issues and, also, from what you mentioned just then, if there is an expectation that the private sector will be building them, they may well not and where do you go then?

Unknown witness—You get a tightening of supply and demand, which is not good.

Senator BUSHBY—Exactly and future supply issues. Thank you.

CHAIR—Thank you very much for your contribution to the committee.

Unknown witness—Thank you for having us.

Proceedings suspended from 12.46 pm to 2.00 pm

GEORGE, Mr Miles John, Managing Director, Infigen Energy Ltd

DUTAILLIS, Mr Geoffrey Raymond, Chief Operating Officer, Infigen Energy Ltd

CHAIR—Welcome. We have Senator Farrell from South Australia with us via phone conference. Thank you to Infigen Energy for hosting the committee at the recent site visit to the

Capital Wind Farm. I invite you to make a brief opening statement. Then the committee will ask you some questions.

Mr George—Good afternoon and thank you for your invitation to attend this public hearing of the Senate Select Committee on Fuel and Energy. Infigen Energy is Australia's leading specialist renewable energy business. It was established in 2003 and has been listed on the Australian Securities Exchange since 2005. Infigen is a top-150 company on the Australian stock exchange and is Australia's largest wind energy generator, with five major projects representing over 500 megawatts of existing installed wind energy capacity. Our attendance by invitation today follows a site visit undertaken by members of the committee to Infigen's Capital Wind Farm near Bungendore in New South Wales a couple of months ago. This site visit was arranged by Infigen to enable members of the committee to gain a practical understanding of the process of electricity generation from wind energy. We hope this tour was helpful in that regard and we would be pleased to respond to any questions members may have about the wind farm site visit and the presentation materials we provided on that day.

The Capital Wind Farm is the first large-scale wind farm in New South Wales capable of supplying enough electricity to power over 60,000 homes. That is equivalent to around one-third of Canberra's homes. The wind farm is one of many we plan to build over the next few years as Australia's electricity generation industry turns to renewable energy. The wind farm will be officially opened by the Prime Minister of Australia next week. The Capital Wind Farm has been good for both the local and Australian economies; over \$100 million has been invested in Australian products and services. A number of key components were sourced from Australian companies, including towers from Keppel Prince Engineering in Portland and RPG Australia in Dalby and the substation and powerline works from ABB Australia. Engineering, technical and environmental consulting firms and many local contractors have also secured substantial work on the project. The project has provided direct regional employment opportunities for over 120 people on the site, with 10 people directly employed for ongoing operations and maintenance. Many other people have been employed in the industries across Australia which have provided goods and services to establish and operate the wind farm.

We are also very proud that Capital Wind Farm is home to Australia's first wind farm apprentices. The turbine supplier Suzlon Wind Energy and RMIT have worked together to train up Australia's first 10 electrical apprentices with a particular focus on wind farms. The output from Capital Wind Farm is contracted to satisfy the energy requirements of Sydney Water's desalination plant. This will meet Sydney Water's long-term commitment to powering the plant with 100 per cent renewable energy. The decision means that the desalination plant will be carbon-neutral when it starts supplying water this summer, also contributing to Sydney Water's broader commitment to be fully carbon-neutral by 2020.

So why do we need wind farms? In July this year, the government released a report prepared by Professor Will Steffen, Executive Director of the ANU Climate Change Institute, which highlighted that the climate system appears to be changing faster than earlier thought likely. The report stressed the need for early, effective action to avoid crossing dangerous thresholds in the climate system. Australia is highlighted as being particularly vulnerable to these climate change impacts. In response to global concerns about the impact of climate change, electricity generation has entered a new era. Renewable energy generation makes a major contribution to reducing greenhouse gas emissions from electricity generation. As a result, global investment in

renewable energy generation from sources like wind is accelerating and electricity generation markets around the world are facing a major transformation. Wind energy now accounts for over one-third of all new electricity generation capacity being built in Europe each year. In the US, over 40 per cent of all new electricity generation built in the last year was in the form of wind energy. In India and China, too, wind energy will make a substantial contribution to those countries' future electricity generation sources.

In Australia, we are moving in the same direction, with the key driver for early adoption of renewable energy being the expanded renewable energy target legislation recently passed by the federal parliament with the support of both parties. The expanded renewable energy target requires a steady increase in the uptake of renewable energy to reach 45,000 gigawatt hours per annum by 2020. We anticipate that around 800 megawatts of additional wind energy capacity could be built each year to contribute towards satisfying this target. This level of growth in clean renewable energy is equivalent to supplying the energy used by over 350,000 Australian homes each year.

Wind energy also makes a positive contribution to the security of our electricity system. Distributed generation from sources such as wind and solar energy is inherently less risky and less costly than centralised generation such as large coal fired plant. Electricity demand is variable. Accordingly, generation systems evolved long ago to include significant proportions of variable generation elements that also double to backup wind. At the level of wind energy penetration currently existing and expected under the expanded RET scheme, our existing and proposed new fossil fuel fired generation plant will provide the diversity of generation sources required to more than adequately accommodate the variable nature of wind energy.

In conclusion, wind energy reduces global emissions by displacing fossil fuel fired generation. It will have a positive impact on jobs, particularly regional jobs, and it will contribute to improving our energy system security. Infigen Energy is Australia's largest specialist renewable energy business and the largest generator of wind energy in Australia. Our investment in wind energy in projects like the Capital Wind Farm is contributing to making Australia's clean energy future a reality.

Thank you again for your invitation to attend and contribute to this public hearing. My colleague Geoff Dutailis and I would be pleased to answer any questions you may have.

CHAIR—Wind energy clearly is the most successful out of all of the renewable energy sources at this point in time, yet one of the arguments which is put to us quite often by other energy providers is that wind is not able to provide a sustained supply of baseload power and that it has to be backed up by either coal or gas fired power stations. What is your response to that?

Mr George—The fact is that generation systems developed a long time ago to cope with a variable electricity demand. Electricity demand varies quite a lot during the day. Accordingly, in most countries, including Australia, there are different types of generation, including slow start response, baseload coal fired power, in some countries nuclear, then intermediate gas fired plant, gas peaking plant which has a short response time, hydro plant, spinning reserve—those are the types of generation and tools that grid operators have to deal with the naturally varying demand for electricity. Those same tools and those same generation sources double as a backup for wind,

particularly at the level of penetration Australia, which is less than 2 per cent. At levels up to 20 per cent renewable energy, even if a large proportion of that was provided by wind, there would only be a small proportion of additional incremental capacity which would be gas fired power to provide the backup for that wind energy generation component. Anybody who has a technology interest in coal fired power or renewable baseload technologies would argue that wind has this disadvantage but the reality is very different. It is just not true that each incremental megawatt of wind energy requires an incremental megawatt of backup.

CHAIR—So what you are saying is that you can increase your capacity and you will not have to increase your backup at the same rate.

Mr George—That is absolutely right. There would only be a small proportion of the incremental increase in wind energy capacity that would require backup. At the moment with the level of penetration that is there now there is no requirement for incremental backup.

CHAIR—As you say, the demand for energy can vary during the day. I guess it is around those peak periods where the issue is, isn't it? How would you cater for that other than through a degree of backup?

Mr George—At the moment the generation system needs that anyway. So, if as you say, at a peak time during the day—either eight o'clock in the morning or six o'clock at night—the generation system that we have provides that. More and more incremental and more costly generation is switched on to accommodate those peak demands. On a very hot day, for example, when you need a lot of energy to supply air conditioning loads, you get all of the generation system turned on, including the very expensive generation. All of that system is there all of the time. To the extent that there is backup required to counter the natural variability of the generation, that same plant can be used to back up wind.

The grid operators treat wind like negative demand. So they have variable demand during the day and they subtract from that the variable wind generation. They still have a variable load they have to satisfy. It is really not that different.

CHAIR—In terms of storage, it is not at this point in time technically feasible to store energy produced at times of lower demand through wind to supply into the market at times of higher demand? Is that something that is technically feasible right now?

Mr George—It is technically feasible, but it is not economically viable. Even if it were economically viable, it would be just as viable for a coal fired generator to do that as it would be for us. That technology is good for shaving the peaks—in other words, when the electricity price is very high to discharge your storage into the network. It is not something that is peculiar to wind generation.

CHAIR—Your argument would be that wind can take responsibility for an increasing proportion of our energy demand but it will only ever be one part of a diversified energy mix?

Mr George—Absolutely. A reasonable target for Australia could be 15 to 20 per cent.

CHAIR—That is great. That is very useful.

Mr Dutailis—I think that is an important point to highlight, certainly from a renewable energy generator's perspective. Any country given their challenges has a portfolio for the solution and they have baseload options, peaking options and renewable options. Australia has a dominance of one generating technology and for all sorts of reasons we are driven to change that. But they can all coexist and they should all coexist.

CHAIR—We have had some witnesses talk about the renewable energy targets and the renewable energy certificates and there not being a similar process for the energy sources that would describe themselves as low-emission technologies. Do you have a view on that?

Mr George—For low-emission technologies are you talking about combined cycle gas-fired generation?

CHAIR—We have had somebody here this morning promoting what was described as modulated generator power—making power in your own home through gas. They are telling us that it is three times more efficient in terms of carbon emissions than the traditional process. There is no real avenue for that. I am just trying to get a sense whether there would be value in a policy sense—obviously, you would have the renewable energy target and continue to pursue it—to have a low-emission technology target on top of that for technologies that are not strictly renewable.

Mr George—Our view is that the current scheme, which is completely technology neutral, is the right way to go.

CHAIR—It is not really technology neutral, is it, because it is only focused on renewables? If we want to reduce emissions as quickly as we can and as cost effectively as we can, there is very clearly a strong and important role for renewables but there may be an equally important role for low-emissions technologies to take us further.

Mr George—I am not familiar with the technology you described earlier, but certainly for large-scale combined cycle gas-fired generation, for example, that should be competitive in the market now because we would expect that that, plus peaking gas-fired generation capacity, would be the second major technology to grow in Australia without any subsidy or any additional incentive. It would be much cheaper than, for example, a coal fired plant in an environment where carbon is properly priced.

CHAIR—Two organisations raised it with us this morning, but I was just interested.

Mr Dutailis—Was it Ceramic Fuel Cells Limited?

CHAIR—Yes.

Mr Dutailis—I am familiar with that. It is a minigenerator concept and it uses gas as a co-gen. Harping back to Miles's point, though, where you are heading to is a low-trajectory approach to reducing emissions over time. In amongst the portfolio of solutions, there are technologies which will set us on that trajectory to get low-emissions electricity or energy generated. I do not think anybody is suggesting there is a step change overnight to renewables. I

do not think that is realistic. There is certainly a place for low-emission technologies to take us to that end game.

CHAIR—You mentioned the developments in terms of wind energy in the US, UK and other places. The UK also announced a couple of days ago that they will be building 10 new nuclear power stations in order to help them achieve an 80 per cent reduction in emissions over a certain time frame. Do you think that in Australia that should also be a part of the energy mix, so we have wind up to 15-20 per cent, gas, less and less coal, and nuclear as a potential additional energy source to make sure we have a diversified energy mix?

Mr George—I certainly acknowledge that nuclear has a very low carbon impact but there are obviously other major impacts that need to be considered.

CHAIR—Such as?

Mr George—Dealing with the waste from nuclear power generation would be the biggest issue. Presumably it would be dealt with in that scenario. But, otherwise, I agree that nuclear power would seem to make sense. My understanding is it does not have the popular or political support on either side of the House.

CHAIR—The reason we are having inquiries like this is to assess what the facts are and what the evidence is to see whether the popular opinion and political opinion should be encouraged in a particular direction.

Senator FARRELL—I was lucky enough to go along to the Capital Wind Farm and found it absolutely fascinating. One of the issues that were raised out there was the issue of the noise and complaints from nearby residents, whether real or imagined, that noise is being generated at unacceptable levels. I must admit that when you got close up to the turbine there was a bit of noise but you would not think it would have translated to any of the nearby homes. What is the company doing on that issue and how is it dealing with issues at the community level where there is—rightly or wrongly—this perception that wind farms are noisy and interfering with the environment?

Mr George—We take very seriously our relationship with the local community at all of the wind farms where we operate. As part of the design process, we undertake extensive noise analysis and modelling to determine what the noise impacts will be on any relevant surrounding houses or other relevant receivers of noise.

Australia has some of the toughest standards in the world in terms of wind farm noise and those standards are targeted at and met by our existing wind farms. The standard was originally developed in South Australia. It is a standard that noise at any residence should not be greater than 35 decibels or five decibels above the ambient noise in any place. We are required to satisfy that requirement. Where landowners have a concern that they think that noise from the wind farm might exceed what has been approved in terms of the planning application, we take those inquiries very seriously as well.

We undertake wind monitoring in some cases, to see whether our original modelling has been in error. We also are certainly willing to have discussions with anybody who says that the noise

is affecting them in some way that is not measurable. But the fact is that our wind farms are designed, and do comply, with all of the relevant technical standards. In the event that a wind farm—I am not talking about our wind farms—

Senator FARRELL—I was thinking more in practical terms of that particular wind farm, there obviously were some issues there. Are they continuing issues, or have they now been resolved or is there some process for the resolution of them?

Mr George—There is process for the resolution of them; they are not yet resolved. So we have had some issues raised about noise from the wind farm from some people who live in reasonable proximity to the wind farm to some people who live a long distance from the wind farm, and they have argued that some sort of inaudible noise is affecting them. The process is that we are undertaking analysis ourselves—

Senator FARRELL—What sort of inaudible noise?

Mr George—Frequencies below the threshold of hearing.

CHAIR—So it is counterintuitive, isn't it?

Mr George—Yes, it is counterintuitive. We do have a process for resolving those things, as I said, by testing. That is the process that we will be going through in relation to the concerns that have been raised at Capital regarding noise.

Senator FARRELL—Do you think you can resolve those issues? The impression I got from some of the people out at the farm was that there was almost nothing you could do for some people to keep them happy. They would just continue to complain about the noise, even if all of the scientific evidence tended to suggest there really was not a problem there.

Mr George—As I said, we do seek out science where we expect to obtain broad community acceptance of the wind farm. We have certainly got that at Capital. Where you have somebody who opposes the wind farm for some reason—whether it is noise or some other reason—given the scale of the projects, it is inevitable that at some of our sites there will be somebody who does not like it for some reason, whether that is because they perceive there is a noise issue or they do not like the look of the wind farm or they have some other concern. It is sometimes hard to tell whether the issue that is raised about the wind farm as a concern is the underlying issue that that person has. You would be aware that landowners who have turbines on their property receive rent for having those turbines on it. We have had arguments from other neighbouring properties, saying, 'Well, we have to look at the wind farm so we should be paid rent too'—those sorts of arguments. In some cases, I guess I am suggesting that there may be unstated reasons why somebody would complain about the noise of the wind farm. Obviously there are also genuine concerns about noise. What we try to do is to deal with any genuine concerns as best we can.

Senator FARRELL—Are you able to keep us updated on how those issues are being dealt with?

Mr George—Yes, we can certainly do that.

Senator FARRELL—That completes my questions, Chair.

Senator IAN MACDONALD—You mentioned that you have your own carbon fuel backup. Did you say that?

Mr George—No, we do not have it directly. The backup for wind energy generation is provided by the electricity generation system as a whole in the national electricity market.

Senator IAN MACDONALD—When these things first started, a lot of the conservation groups at the time were saying that there was a visual pollution caused by wind farms. That argument seems to have disappeared. Do you have any comment on that? Is it ever an issue?

Mr George—Personally, I think it is in the eye of the beholder. Some people like the look of them, some people do not. Three issues are raised in relation to some wind farms. One is the noise, which we just discussed a moment ago. As I said, this should be something that can be designed out.

Senator IAN MACDONALD—Regarding the noise: there is one in Ravenshoe where I come from. The cows always seem to end up camping around the windmills. Whatever the noise is, they must like it.

CHAIR—They have air-conditioning!

Senator IAN MACDONALD—Is that what it is.

Mr George—I think they like the shade.

Senator IAN MACDONALD—Is that what it is. Okay.

Mr George—Another one that has been raised historically is impact on birds; but, again, that is generally a design issue. If you do not put your wind farm in a migratory bird path you should not have significant issues. The third issue that is raised is what they look like, but it is really hard to argue with somebody that a wind farm looks good, because that is obviously a matter of opinion. Our experience is that a lot of people are quite happy to look at a wind farm. Another argument we have heard is that people would be much happier to look at a wind farm than a coal fired power station.

Senator IAN MACDONALD—But the wind farms tend to be out in pristine, rolling countryside. I quite look like the look of them—I am one of those who do—but I can understand people who say that. It is the same people who do not like high-rises along the seashore; it pollutes others' views. But it is not a major issue these days, I take it.

Mr George—Not at our wind farms. We take particular care when we are going into any new area to try to make an assessment of what the local community attitude to wind farms is—including what they look like, because there are some wind farms that have been rejected by the local community essentially because of what they look like. We want to maintain a good relationship with the local communities where we have our wind farms; after all, they are long-

term projects. We typically have a 25-plus-year leasing arrangement with landowners where the wind farms are located, so we want to live together happily with the local community.

Senator IAN MACDONALD—Are the amounts you pay by way of leases public?

Mr George—They are not public for individual leases. It depends very much on the size of the machine. Often, the rent is paid as a proportion of the capacity of the machine. Typical figures would be \$5,000 to \$10,000 per machine per annum.

Senator IAN MACDONALD—So if you have 20 on your property—

Mr George—You have done very well.

Senator IAN MACDONALD—You don't need too many cows to milk or slaughter!

Mr George—Yes. A typical landowner would have four or five turbines on their property. Given that the turbines are typically several hundred metres apart, you need quite a bit property to have four or five turbines.

Senator IAN MACDONALD—I did not go to your property outside Bungendore, but I have seen it from driving past Bungendore. Is that on private or government land?

Mr George—Private. There are in total about half a dozen landowners who own that land, including one family in particular, various members of which own quite a lot of the land.

Senator IAN MACDONALD—Finally, a previous witness sent us a paper from a German institute called RWI-Essen. The paper is called *Economic impacts from the promotion of renewable energies: the German experience*, and the final paragraph of the executive summary says:

... we would instead regard the country's experience as a cautionary tale of massively expensive environmental and energy policy that is devoid of economic and environmental benefits.

In the full paper they go through the reasons they come to that conclusion. Have you heard of that paper?

Mr George—I have not heard of the paper, but I understand the argument. The argument is that Germany has both low wind speeds and low levels of solar radiation yet it has been a leader in wind and solar energy development. So it has been a very expensive exercise, but the German government and German people have decided that they want to have a high proportion of renewable energy and so have made that commitment. Australia, by contrast—

Senator IAN MACDONALD—It was a political decision to form a government, I think, but anyhow.

Mr George—The point is that Germany in the area of wind, for example, has a capacity factor, which is a measure of the intensity of the wind, of around 25 per cent. In Australia it would typically be greater than 35 per cent, so it is typically nearly 50 per cent more wind. That

obviously improves the economics for wind energy generation. The way they compensated for that was by having very high tariffs for wind energy in Germany, so the argument is that Germany has paid very expensively to have a higher proportion of renewable energy than, for example, Australia would.

Senator IAN MACDONALD—Your point is that Australia is better suited—

Mr George—There is an excellent wind resource, by world standards, in Australia.

Senator IAN MACDONALD—When you and your colleagues in the industry place your fans, do you have the best wind places in Australia or do you have the best wind places that are close enough to the markets to be useful? Is distance from a mass of people important in where you place them?

Mr George—It is one of the three key criteria for a successful wind farm. The three criteria are: firstly, obviously it has to be windy; secondly, you need to be reasonably close to a section of the transmission grid that is going to be able to accommodate the energy that is produced; and, thirdly, you need community acceptance. It is one of the three key principles. To use an example, it may be very windy on the Great Australian Bight—in fact it is—but there are no transmission lines anywhere near there and it would be very expensive, from the point of view of both capital expenditure and operating costs reflected in transmission losses, to establish a wind farm in that area. We look at those three criteria when we are establishing a wind farm, to determine what will give us the best economics. There are windier places than where we have wind farms in Australia, but they would not satisfy the other two criteria.

Senator IAN MACDONALD—You might be pleased to know that Senator Cormann is going to join Western Australia up to the national grid!

CHAIR—It probably will never happen, unless Wilson Tuckey's HV DC line comes all the way down! Going back to the issue of peak demand and intermittent energy sources, there has been some public comment regarding the potential of smart grids in addressing issues relating to peak demand and intermittent energy sources. Would implementation of smart grid technology assist the development and usability of wind energy? Can you talk us through how such a technology would work.

Mr George—I will have a quick go at it, but Geoff is probably better qualified to talk on this than I am. Initiatives like smart grids in the US or in other places are really designed to overcome what otherwise is an inefficient use of transmission capacity. In that sense, where wind needs a good connection point, as I have just described, any system that better manages the grid to accommodate the electricity that is generated is a good thing, from our perspective.

Mr Dutailis—I think it is right. As you no doubt have heard, the primary driver behind the smart grid is about energy efficiency and managing demand, which is a big part of the challenge ahead of us in managing our emissions. That is the primary driver behind the smart grid. There are some smarts sitting behind the so-called smart grid that will allow variable generators—and other renewable technologies, for that matter—to integrate better with the grid and be part of a distributed generation model, as opposed to a centralised one. Elements of the smart grid that come with it will very much help renewables, including wind.

Senator BUSHBY—Thank you for coming along and assisting us today. I think you have covered most things, but I have just a couple of questions. Firstly, you mentioned wind farm apprentices that you have been taking on. I am curious—and there is a specific reason I am asking this—as to the degree to which the skills that are required for renewable energies in general, but particularly from your perspective of wind farms, are available in Australia and whether there is a need for increased focus on training people in this area.

Mr George—Again I will ask Geoff to answer this question; I know it is something he is very passionate about.

Mr Dutailis—We have had a lot of lessons in this area, particularly given our experience in the US, which has gone through significant growth in wind energy across the country. The examples I will give you draw on that. The chief components of a turbine are relatively simple. You have mechanical components which are well known to a lot of people—gearboxes and heavy rotational equipment. At the other end, you have kinetic energy from the wind going into mechanical and being transformed into electrical, so there are standard electrical components as well—generators, transformers. The bit that sits between those is the controlling type equipment which goes into the electronics area, so you have three known areas of skill sets.

Those skill sets are available across other industries, so when you start to look at the skills you need in the wind energy sector, you are starting to draw on skills that are known on areas and available, typically, throughout most parts of Australia. It is about redirecting those skills and, yes, honing those skills to be more focused on a turbine as opposed to a standard turbine generator. So there are still some challenges in doing that. Not every country has the mobility in their workforce to pick and choose from. That is more of a challenge in Europe, for example. So what we have started to do in the US, for example, is to put a training program in place to encourage people to come into the industry, first of all, and also to encourage the reskilling of people who already have the basic technology skills to move into a different area—a renewable industry as opposed to one they might be in.

Senator BUSHBY—Where do the apprentices get their formal education from as part of their apprenticeship?

Mr Dutailis—In that example it is RMIT out of Melbourne, but in the US we work very closely with the trade schools. Obviously in Australia we have a similar system, so we would very much go that way.

Senator BUSHBY—The reason I am asking this is that I actually had a proposal put before me to look at one of the Australian technical colleges which is not being supported by the government at this point and actually using the facilities that are there to try and develop a centre of excellence in technical skills for renewable energy. Do you think something like that would be a good thing in an overall sense?

Mr Dutailis—Absolutely. That is exactly the kind of thing that needs to be encouraged by the industry, and we have had examples of that in the US. It comes down to the location of it relative to the centre of that industry, so that would be one of the primary things to look at initially. A centre of excellence would be perfect.

Senator BUSHBY—The other thing I wanted to ask was: as I understand it, wind energy does not compete, in the absence of carbon prices, particularly well with a lot of the other forms of fossil energy that we use in Australia, but it is probably the most cost effective of the renewables that can actually deliver power at this point. What are the major costs that are involved in wind energy? Where do the costs come from? Presumably they are capital up-front costs rather than ongoing costs, but there would be ongoing costs as well. What scope is there for those costs to reduce with the greater economies of scale as wind is taken up further? Will it actually become cheaper? I note from the presentation that was provided when I went to Capital Wind Farm that there are already 100,000 wind turbines up around the world. You would think there would be some economies of scale. I will let you answer the question.

Mr George—I might have an initial go at it. The capital costs, as you suggest, are the key costs for the wind farm. Obviously the fuel is free. The capital costs are driven largely by the cost of the turbines and the various associated components, including the towers, blades and electronic gear. The ongoing costs are very small. That is demonstrated by EBITDA margin—earnings before interest, tax and depreciation. As a percentage of revenue it is around 80 per cent. In other words, our costs of production are only around 20 per cent of the revenue that we generate. Those costs are really split into three areas. One is the actual operation and maintenance costs of the turbines. That is to maintain them, and Geoff can talk about that in more detail if you would like, but the basic operation and maintenance cost. The second thing is the cost that we are charged by transmission grid operators to connect our wind farm to the grid. They are typically annual charges. The third cost is the one we discussed briefly before, which is the cost to pay landowners rent. So those are the operating costs.

In terms of the scope to reduce costs over time, the wind industry has demonstrated a very big scope to reduce costs over time. Fifteen years ago a typical machine would be a 200-kilowatt machine on a 40-metre tower. Today a typical machine would be a two-megawatt machine—10 times the size—on an 80-metre tower. There is an improvement in efficiency from the design of the turbines, the scale of them, the height above the ground, which has a big impact, because wind speeds are generally higher as you go higher above the ground, and the energy captured by the turbine is proportional to the cube of the wind speed.

So those factors in scale and height have contributed to a halving of the cost of wind energy expressed as a lifetime cost—that is, dollars per megawatt hour of production—over the last 15 years, and those costs are continuing to come down.

Senator BUSHBY—So the curve is still heading down; it is not flattening out?

Mr George—It is not as steep as it was in the early years, but it is definitely still going down. For example, I mentioned that the typical machine is two megawatts. We have three-megawatt machines already operating and there are prototypes for 4.5-, five- and even six-megawatt machines around now.

Senator BUSHBY—That is per tower?

Mr George—That is the installed capacity per tower.

Senator BUSHBY—Thank you. That is all I have. Thank you again for the tour; it was very interesting.

CHAIR—Thank you very much for your contribution to the committee today. I would like to thank all witnesses who have given evidence to the committee today.

Committee adjourned at 2.40 pm