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SENATE

SENATE SELECT COMMITTEE ON WIND TURBINES

MONDAY, 29 JUNE 2015

SYDNEY

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SENATE

SENATE SELECT COMMITTEE ON WIND TURBINES

Monday, 29 June 2015

Members in attendance: Senators Madigan.

Terms of Reference for the Inquiry:

To inquire into and report on:

The application of regulatory governance and economic impact of wind turbines, with particular reference to:

a. the effect on household power prices, particularly households which receive no benefit from rooftop solar panels, and the merits of consumer subsidies for operators;

b. how effective the Clean Energy Regulator is in performing its legislative responsibilities and whether there is a need to broaden those responsibilities;

c. the role and capacity of the National Health and Medical Research Council in providing guidance to state and territory authorities;

d. the implementation of planning processes in relation to wind farms, including the level of information available to prospective wind farm hosts;

e. the adequacy of monitoring and compliance governance of wind farms;

f. the application and integrity of national wind farm guidelines;

g. the effect that wind towers have on fauna and aerial operations around turbines, including firefighting and crop management;

h. the energy and emission input and output equations from whole-of-life operation of wind turbines; and

i. any related matter.

WITNESSES

GREEN, Ms Lilli-Anne, Private capacity

Committee met at 08:35

Evidence was taken via teleconference—

CHAIR (Senator Madigan): Welcome. I declare open this final public hearing of the Senate Select Committee on Wind Turbines. We acknowledge the traditional owners of the land on which we meet and pay our respect to elders past and present. This is a public hearing and a Hansard transcript of the proceedings is being made. The audio of this public hearing is also being broadcast via the internet. Before the committee starts taking evidence, I remind all present here today that in giving evidence to the committee witnesses are protected by parliamentary privilege. It is unlawful for anyone to threaten or disadvantage a witness on account of evidence given to the 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 the 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 you are a witness here today and you intend to request to give evidence in camera, please bring this to the attention of the secretariat staff as soon as possible.

Do you have any comments to make on the capacity in which you appear?

Ms Green: I am CEO of a healthcare consulting firm with a national reach in the United States. My company works in all sectors of the healthcare industry. One of the core competencies of the firm is to develop educational programs to help doctors, nurses and other healthcare workers better communicate with their patients around various disease states. Currently, as a volunteer in my town, I am secretary of our energy committee and a delegate to the Cape Cod National Seashore Advisory Commission as an alternate. Cape Cod National Seashore is part of the United States National Park Service. In the late 1970s, I built a passive solar superinsulated home. I directed an environmental education school for several years. I work seasonally as a naturalist interpretive ranger for the National Park Service. I have been interested and active in the environmental movement since the early seventies. Today, I speak as a private citizen.

CHAIR: Thank you. Could you please confirm that information on parliamentary privilege and the protection of witnesses and evidence has been provided to you?

Ms Green: It has.

CHAIR: Thank you. The committee has your submission and we now invite you to make a brief opening statement and at the conclusion of your remarks, I will invite members of the committee to put questions to you.

Ms Green: Thank you. Until the beginning of 2010, I believed wind turbines were good and green. My town was interested in constructing wind turbines and a friend visited my office in early March 2010 to provide my husband and business partner and me with new information. Following the visit, I spent the next 10 hours researching wind turbines. That very day, after concluding my research, I was saddened but I became convinced there was credible evidence that wind turbines cause adverse health impacts for some people who live nearby. In the past, over five years, I have learned it is a global phenomenon that wind turbines make some people who live nearby sick and it is a dose response so these people become more ill over time.

My husband, who is now deceased, and I travelled to Australia and New Zealand in 2010-11 and subsequently created a film called *Pandora's Pinwheels: The Reality of Living with Wind Turbines.* We then travelled around the world in 2012 and conducted interviews in 15 different countries. Most of the people we interviewed expressed that they were in favour of wind energy prior to wind turbine construction nearby. There are some common symptoms people the world over report who live and work too close to wind turbines. A good summary is found in the book *Wind Turbine Syndrome: A Report on a Natural Experiment* by Nina Pierpont, MD, PhD.

It does not matter whether people live in English-speaking countries or in countries where people do not speak English. People reported to us they are made sick when they live too close to wind turbines, no matter what country they live in. We interviewed people in both English-speaking countries and non-English-speaking countries alike who reported to us they were not ill prior to wind turbine construction nearby and after the wind turbines were operational nearby they were made sick.

We interviewed people in five countries—France, Germany, Holland, Denmark and Sweden—who either needed an interpreter to speak with us or who spoke broken English. Some locations were quite rural with little or no internet connection. Still, the people we interviewed through interpreters expressed the same symptoms, others the world over described to us. These people with no or limited internet connection even used similar phrases,

analogies and gestures, as others did globally to describe their symptoms. What we actually found is most people are reluctant to speak about their health problems.

In the United States, there are privacy laws regarding medical information. Culturally, people do not openly discuss their health problems with strangers. We found this to be the case in the countries we visited around the world. It was a brave person who opened up to us about their health problems. Usually, the people we interviewed expressed they wanted to help others. If anything, people tended to minimise their symptoms or try to attribute the symptoms to other circumstances. Even when they acknowledged a common symptom such as sleep deprivation, many people who experienced additional common symptoms were reluctant to attribute these other symptoms to the wind turbines nearby. Furthermore, people the world over reported that they and their healthcare providers puzzled over health problems that appeared after wind turbines were constructed near their homes.

Many endured a huge battery of medical tests to try to determine what the cause of their health problems were. The medical tests, at a huge cost to the healthcare system, only ruled out various diseases. Typically, the cause of their sickness was not diagnosed by their healthcare professional. Frequently, we heard that the patients would be in a social situation with others in their neighbourhood and eventually people they knew well confided they had similar health problems that recently appeared, or after research online about a different topic these people reported stumbling upon the cause of their health problems, which were the wind turbines constructed nearby.

We even interviewed people who lived for 11 years near wind turbines in a non-English speaking country—and that was in 2012. Several people came to an interview to talk about their property devaluation. It was only during the interviews when they heard others speak about health problems that the people realised they had been suffering because they lived too close to wind turbines. One man in his 80s sobbed during his interview. He had been visiting his doctor for 11 years trying to figure out what was wrong with his health.

The woman who invited us to interview her and her neighbours learned about health problems from wind turbines when she saw the film I produced *Pandora's Pinwheels*, with interviews conducted in Australia and New Zealand, that was translated into her language. These people needed an interpreter; they did not speak English. She told me that her husband had passed away in the not too distant past due to heart problems. Before he died, he had complained quite frequently of common health symptoms people living near wind turbines experience. Although they visited their doctor frequently, no-one could figure out why he was so sick. She thanked us because, in seeing our film, it helped her to understand what her husband had been going through and why. It gave her closure that she did not have prior to viewing our film.

Another person at the interview told us she had to hold on to the walls of her house some days in order to walk from room to room and felt nauseous frequently. She knew she was unwell in her home and abandoned it. She did not know why until she saw our film. She came back to the area for the interview because she wanted to tell the world that wind turbines made her so ill that she sold her home at a huge loss.

One of the people I have known for the past five years lives in Falmouth, Massachusetts, which is very close to where I live—it is an hour and a half away. In 2010, he had recently retired to his dream home of many years. He was in great physical health, very fit and has over a 20-year record of normal to low to blood pressure. Since the wind turbines have been constructed in Falmouth, Massachusetts, he has reported that his blood pressure skyrockets to heart attack and stroke levels when the wind is coming in the wrong direction for him.

In Falmouth there are three wind turbines that are 1.65 megawatts near this person's home. This person's doctor, whom he has seen over the past 20 years, is in the Boston area and his doctor has been quite blunt. The doctor has told the patient that his life is in danger and he must move. Unfortunately, the Falmouth resident is crushed and cannot bear to leave his dream home at this point in time. He goes to other locations when the wind is predicted to be coming from the wrong direction. Others we interviewed in many different countries told us similar stories. Many reported they have abandoned their homes, sold their homes at a huge loss, purchased other homes to live in when the wind is coming from the wrong direction or in order to sleep in, and others spend time away from their homes at a huge and unexpected expense. People considered their homes as sanctuaries prior to the construction of wind turbines nearby. Now their opinion is not the same.

We have interviewed people on three continents who live more than five miles from the nearest wind turbine and are sick since wind turbine construction. I contend that we need honest research to determine how far wind turbines need to be sited from people in order to do no harm. People report to us that over time their symptoms become more severe. Many report not experiencing ill effects for some time following wind turbine construction, meanwhile their spouse became ill the day the wind turbines nearby became operational. They speak of thinking they were one of the lucky ones at first, but after a number of months or years they become as ill as their spouse. Not one person who stayed near wind turbines reported to us that they got used to it or got better; they all became more ill over time.

Since we are dealing with a dose response, we do not know over the projected lifetime of a wind turbine—say, 20 to 25 years—how far from people it is necessary to site wind turbines. To me, it is just wrong to knowingly harm the health and safety of people. There are responsible solutions to environmental issues that do not impact the health and safety of people nearby. Our humanity is in question when we continue to knowingly harm others. I thank you for your time today. I sincerely hope that you do take active steps to help the people in your country who are suffering due to living and working too close to wind turbines, and I am glad to answer questions you may have.

CHAIR: Thank you.

Senator LEYONHJELM: Good morning, Ms Green—I suppose it is not morning there. Thank you for your submission—

Ms Green: No, it is Sunday evening here.

Senator LEYONHJELM: Sunday evening? I am sorry to being interrupting your evening.

Ms Green: I am glad to speak with you.

Senator LEYONHJELM: You have interviewed people in 15 countries, I think you said, under all different circumstances and so on. I appreciate we are not pretending this is a gold-plated, statistical survey, but I am interested in your impressions because I think you have more experience of this than any other witness we have heard from. What do you think, based on your experience, are the common factors in the people you have interviewed in different communities living near wind turbines? What are the common factors to all of them?

Ms Green: I think we seriously do not have enough research to understand this problem fully. We saw the same symptoms. Slide 17 that I submitted has a listing of the common symptoms that Dr Pierpont lists in her book. I really believe that we just do not have enough information yet. But throughout the interviews, country by country, people described the same symptoms. Many times they used the same phrases to describe them and the same gestures—even if they were not speaking English. There is a common thread here.

Senator LEYONHJELM: Do you get the impression that not everybody exposed to wind turbines is affected the same? Have you seen evidence of substantial individual variation?

Ms Green: I have, indeed. Just as some people are more prone to asthma and some people are more prone to lung cancer, let's say, or any disease, we did see a variation. It appeared that if there were people who were, say, prone to migraine headaches, they were severely affected. But, again, there were people who did not seem to have the symptoms who were living either in the same house or nearby. I do not know whether it is a question of time, if over 20 years people become more sensitised and they will become sick. Very frequently we did hear the same theme running through the stories of the people we interviewed, where, say, the husband thought he was one of the lucky ones and six months later he could not sleep, he was experiencing ear pressure, ear pain and severe headaches or other symptoms.

Senator LEYONHJELM: We are aware of community groups in English-speaking countries who have expressed opposition to wind turbines, but we are not aware of that sort of phenomenon in non-English speaking countries. Have you encountered that?

Ms Green: Yes, indeed. We travelled around the world. It was a 10-year goal. We had it very well planned out and we thought it was for pleasure. But people kept emailing us and asking us to come and interview them. So we met people in a lot of non-English speaking countries, and they were such nice people, I have to say. They had just about any profession you would like to mention. They just wanted to tell their story. Many times these people wanted to talk to us for other reasons such as their house had been devalued because the wind turbines were nearby. As they were listening to other people in the room talking about their health problems, these people realised that they had been struggling with the same illness since the wind turbines were constructed nearby. They had never made that correlation before; in fact, they were quite frustrated. They told us that they would go back and back continually to their healthcare provider and talk about these symptoms, and they could not find a resolution or a reason. As I said, there is one man I recall quite vividly just sobbing—and that was in 2012; he was in his 80s. He had realised that since the wind turbines had been constructed nearby he was experiencing these symptoms that were the common symptoms.

Senator LEYONHJELM: Some witnesses have suggested to us that there is a relationship between not only the distance their residence is from the turbine but also the power of the turbine, the size of the turbine. Have you been able to come to any conclusions on that or is that outside your interest area?

Ms Green: No, it is not outside my interest area. In fact, it is quite alarming to me, because I have interviewed people who live near wind turbines that you in Australia would probably consider to be quite small and solitary—

wind turbines that are 100 kilowatts, even—and they are experiencing health problems, even people living near a 10-kilowatt wind turbine. Frankly, it is the nearest wind turbine to where I live, and a number of neighbours are having problems, and not just with the audible noise but with the infrasound and low-frequency noise, based upon the symptoms they are reporting to me. It really is quite alarming. In my state, Massachusetts, there is a woman who has told me she lives more than five miles from the nearest wind turbine and she is quite ill. The onset of her symptoms was when the wind turbine was constructed. When she went on trips she was fine; when she came back she was ill, and it has only become worse over time. That wind turbine is not as powerful as wind turbines in Australia, and it is a solitary wind turbine.

Again, we travelled quite a distance in France—mid-south-eastern France—over a number of days at the invitation of the people in the area and visited several different communities where there were wind turbines. One of the situations is that the wind turbine is 10 kilometres from one of the neighbours who is very ill and 12 kilometres from the other neighbour. The person who lives 12 kilometres away reported to us that she had been very supportive of the wind turbines. She is very well known as an environmentalist in the area, has quite a reputation as an environmentalist and is highly regarded. But she is quite ill, and it was very difficult for her to speak with us.

The other person related a story of trying to detect what the problem was because he could not sleep and was becoming so frustrated that he would go in his car to try to find the source of what was keeping him awake. He talked about going night after night until he went into the wilderness. He could not imagine what was there, and then he found the wind turbines. They were creating a humming noise in his head at that point. He could actually hear this frequency. In our discussions with researchers, medical professionals and scientists, one of the scientists told us that what people hear is mostly a bell curve—that is the way it was described to us. Most people hear audible noise within a certain range, but there are people who are more sensitive to noise, and they hear sounds that most people would consider inaudible.

Senator URQUHART: I have a lot of questions. I am not going to get through them all, so I am wondering whether you are able to take some on notice at the end.

Ms Green: I will try. I am very busy, but I will try.

Senator URQUHART: In your submission you say you run a healthcare consultancy. Do you have any qualifications in health care or medicine?

Ms Green: I have a background in education.

Senator URQUHART: What is the name of your company?

Ms Green: I do not want that on the record.

Senator URQUHART: Can I ask why?

Ms Green: I am speaking today as a private citizen. I would be glad to give you that information if it is held as in-confidence.

Senator URQUHART: Okay. How many employees do you have?

Ms Green: My husband has passed away. He was my business partner, and I have scaled back the business. I am the only employee at this point in time. However, I will tell you that I have created in our company, with teams of people, educational programs that have been implemented throughout the United States. One of the oncology programs that was created by my team, which was quite a large team, interviewed over 100 oncology patients throughout the United States and numerous doctors and nurses and was mandatory for all of the oncology nurses in the Kaiser health system in California.

Senator URQUHART: In your submission you say that 300,000 physicians and healthcare professionals have undertaken training through your company.

Ms Green: That is correct.

Senator URQUHART: What are the products or services? Is it communication? What is it that you actually sell?

Ms Green: There is a number of different core competencies in our company. One is developing educational programs around different disease states, such as oncology, diabetes, heart disease and various other disease states. Another path we have taken is to develop a service quality initiative. My husband was an extraordinary speaker and was often the keynote speaker for national conferences in all sectors of the healthcare industry.

Senator URQUHART: In your opening statement you talked about how you had interviewed many people from various countries. I could not find any of the transcripts, either in your submission or online. I am sorry if I have missed them.

Ms Green: You have not missed them. In the company we are still in the process of editing the films. It was a huge undertaking of many months, at huge expense. There is a lot of information that is still being edited.

Senator URQUHART: Are you able to provide copies of the transcripts and the full names of the people you interviewed?

Ms Green: No. It is on film; it is videotaped interviews, and the film is being edited.

Senator URQUHART: You talked about how you undertook the research after you had new information from people within your area who were concerned about wind farms. Was that the purpose of the interviews?

Ms Green: No. In my town, one month after we learned that our energy committee wanted to put one 1.65 wind turbine in our town—and we had conducted the research and people in our town were quite concerned—our board of selectmen, which is like your town councils, decided to not move forward with the project. I am now on my energy committee, as secretary, and we are devising a plan to become 100 per cent electrical energy efficient without wind energy but using other alternative methods. Are you asking me what propels me to do the interviews?

Senator URQUHART: Yes. I guess my real reasoning was whether the purpose of the interviews was to inform the body of research on international attitudes to wind farms. Is that why—

Ms Green: No. It is not an attitude; it is to understand the realities of living near wind turbines—living, working, attending school, being incarcerated near wind turbines.

What happened was that my stepson was living in Australia and we went to Australia at the end of 2010. I knew there was a location called Waubra and I had seen the Dean report that had been recently published. I put out one little email asking 'We will be in the Melbourne area and is it possible to meet some of the people that are living near the wind turbines at Waubra? Is it possible to see the Waubra area?'

It was amazing that I was connected with the people in that area of Australia. My husband and I drove to the area and we interviewed over 17 people in one day. They welcomed us into their homes. We did not know what to expect. We turned the camera on and we asked them questions, and they told us their story. We had no idea what we were going to find. We went to New Zealand and people emailed us after they had heard we had been to Waubra. They asked us if we would come and visit them and interview them. We did that in two different locations in New Zealand. When we came home we put together this film called *Pandora's Pinwheels*—

Senator URQUHART: You interviewed people—

Ms Green: During our 2012 travels we just thought we would go back to Waubra and talk to the people at Waubra because we had been emailing them over the year. But people around the world kept on emailing us and asking us to come and interview them.

Senator URQUHART: So you conducted interviews in 15 countries, as I understand it from your submission. Is that how you got the contact information on the people you interviewed?

Ms Green: I do not understand your question. Everywhere we were travelling people kept on emailing us and contacting us and asking if we would come and interview them and talk with them. They wanted to go on camera and tell their story. We had no agenda; we had no plan. We work in the healthcare industry; we talk about various illnesses and disease states, and we educate doctors and nurses about disease states. I am sorry; I want to retract that: we find a cross-section where patients are having issues with the communication around their disease state, and the doctors and nurses are having issues around communicating with their patients. We find those intersections and help doctors and nurses better communicate with the patients. So we are trying to improve patient care. That is what we do as one of the core competencies of our business.

When we found the health problems with the wind turbines and when we saw in every country we visited that people were saying the same thing, we wanted to get that word out to people like you who are hearing from your constituents that they are having health problems. That is all I want to do—to provide you with the truth.

Senator DAY: Ms Green, as you might imagine, we have received submissions from hundreds of people who have reported adverse health impacts and yet we are being accused of trying to destroy the wind industry. We are being accused of rigging this inquiry and of being engaged in a political stitch up. What has been your experience with such hostility towards genuine inquiry?

Ms Green: I really do not have a response for you, Senator. I have heard a lot of stories from people and I have experiences myself, but I really do not have a response on that topic.

Senator DAY: Okay. I will follow up then: you say that a number of governments around the world are realising there is a need for more or better regulation surrounding the wind energy industry. Which governments are doing better in this area, in your opinion?

Ms Green: I know that in my state, I have a new governor and my governor has a background in health care, and I am expecting that my governor understands that people do have health problems when they live and work too close to wind turbines in my state.

Senator BACK: Ms Green, I have just one quick question; I know that we are over time. In Australia, we are proceeding to have independent medical research undertaken for the first time. One of the proposals put to us is that they try and simulate this effect of either noise or infrasound, and do so in a one-off exposure in a clinically sterile circumstance for exposure times of somewhere between 10 to 30 minutes and an hour. From what you have learned and heard—and from interviewing people—do you think there would be anything to be learned in exposing somebody for a very limited period of time, and once only, in a sort of laboratory-type circumstance? Do you believe that is likely to lead to any reasonable outcome or result that we might be able to use?

Ms Green: Senator, I am not a researcher or a doctor. But given what I have heard from people and what people have reported to me, I find it highly unlikely that that would have any results that would have any validity.

Senator BACK: Thank you.

CHAIR: Thank you for evidence today to the committee, Ms Green. You will receive questions on notice and if you are able to come back to us with answers to those, that would be appreciated.

Ms Green: Absolutely. I would like to thank the committee; the chair, Senator Madigan, and the members of the committee, and also to thank you, Graham.

CHAIR: Thank you, Ms Green.

McMURTRY, Dr Robert, private capacity

[09:13]

CHAIR: I now welcome Dr Bob McMurtry by teleconference. For the *Hansard* record, will you please state your name and the capacity in which you appear.

Dr McMurtry: My name is Robert Younghusband McMurtry. The capacity in which I appear today is as an independent witness: I am Professor Emeritus of Western University in London, Ontario, and I have been researching and reviewing this topic for the past eight years; I probably have put in over 10,000 hours over those years. In addition, I have been in communication with or—more to the point—people have been in communication with me who are suffering adverse health effects. I have detailed my curriculum vitae and its summary. I will stop there.

CHAIR: Thank you. Could you please confirm that information on parliamentary privilege and the protection of witnesses and evidence has been provided to you?

Dr McMurtry: I can confirm it has.

CHAIR: The committee has your submission. I now invite you to make a brief opening statement. At the conclusion of your remarks, I will invite members of the committee to put questions to you.

Dr McMurtry: Thank you for the privilege of presenting to this committee. I will make 10 points that are in my executive summary on the assumption that the material has been read. First, adverse health effects have been reported globally in the environs of wind turbines for more than 30 years with the old design and the new. Second, the wind energy industry has denied adverse health effects, preferring to call it 'annoyance' even though annoyance, however, is an adverse health effect. Certainly it is a non-trivial effect when sustained because it results in 'sleep disruption', 'stress' and 'psychological distress'—those are direct quotes from others' research. Third, annoyance is recognised and was treated by the World Health Organization as an adverse health effect, which is a risk factor for serious chronic disease including cardiovascular and cancer.

Fourth, experts retained by the wind energy industry have preferred the diagnosis of nocebo effect to explain the adverse health effects, but the claim does not withstand critical scrutiny as there is a dose-response effect and nocebo does not have a dose-response effect. And there is a clear correlation between exposure and adverse health effects. Researchers have talked about dose-response. I should also comment that making that diagnosis without a comprehensive evaluation of a person or patient would qualify as malpractice, and I know that has been said in this committee before.

Fifth, the regulations surrounding noise exposure are based upon out-of-date standards ETSU-97, which fail to evaluate infrasound and low-frequency noise, preferring instead to use DBA. The issue of ILFN is a problem and it has been confirmed by numerous acousticians including Paul Schomer, a leading international acoustician. Sixth, the setbacks for wind turbines are highly variable across jurisdictions and here is the key point: there is no evidence base in human health research for the setbacks. The turbines have gone ahead without an evidence base.

Seven, there is an urgent need for human health research to provide evidence based guidelines for noise exposure. Eight, the call for third-party research and evaluation has been made by many including in France by the Academy of Medicine of France in 2006 and many times since. As I detailed to you, I made it before government bodies in Canada. Nine, there is an urgent need to monitor the health effects of people exposed to turbines over time and that has been missing virtually in all jurisdictions. Tenth, third-party evaluations of the economic and social benefits of wind energy are needed as suggested by the findings of the Auditor-General of Ontario—I sent his reports to you including highlights—and more recently by the Northern Ireland Assembly committee, and I understand that is part of the charge of this committee. With that, I would be very happy to answer questions.

CHAIR: Is it correct to say that in your experience there are different streams of opposition to wind turbines in the wider public? For example, one stream opposes the technology outright but another supports the use of technologies as long as they are appropriately regulated to safeguard people and the environment. Which stream are you in, Dr McMurtry?

Dr McMurtry: I am in the stream that says positioned safely and on an evidence base with, as I mentioned, guidelines. I think that is fine. There are clear applications for wind turbines when they are appropriately deployed, which is not happening currently.

CHAIR: There is a growing community of medical experts, doctors and acoustic engineers questioning the adverse health impacts of wind turbines and inadequate regulatory standards. On the basis of your knowledge on an international level, how are the opinions and standing of these professionals treated publicly by the wind energy industry?

Dr McMurtry: I am afraid there is a routine strategy that proponents of wind turbines, including the industry, on websites will name people and pillory them basically, assail their reputations. That is something that has been seen internationally, most specifically towards Dr Nina Pierpont from the United States, and towards Dr Sarah Laurie in Australia. But I have certainly experienced it personally to a lesser extent. It seems to be: if you do stick-up and say something or you have concerns about the wind industry then you can expect to be attacked.

Senator BACK: We know that.

CHAIR: Your submission comments on researchers in the Department of Biological Engineering at MIT undertaking research for the Canadian Wind Energy Association and also providing expert testimony to wind farm developers in its planning tribunals. I note you say here, however, they did not declare an interest when the research was published. You describe this behaviour as 'odd' in your submission. From a professional perspective, what does 'odd' mean? What are the professional requirements or etiquette when publishing research and declaring an interest?

Dr McMurtry: The key is to declare a conflict and that was done in the sense that they described their engagements with the wind turbine industry, especially Dr McCunney the lead author, and Dr David Colby. So that was done. But it is only a first step when you declare a conflict. There are many other things you should do to manage the potential conflict of interest, in particular take special care to control for bias. There are various ways of doing that.

I do not want to say negative things about Dr McCunney; I am sure he is a very capable person does good work in this field. The wind industry put the money before MIT and it was from that funding that the research was carried out. It was from funding of the wind industry an earlier part he participated in with the Canadian Wind Energy Association. He appears frequently on behalf of the wind industry and he references his work in both the papers I have cited. I view that as stretching things. I think some better management of the conflicts ought to be carried out. Two points, for example, could be: bring it before an ethics committee or at least get that kind of advice.

CHAIR: Finally, later in your submission I note you discuss the origins of nocebo. I presume from that discussion, you are aware of Prof. Simon Chapman and his work?

Dr McMurtry: I am aware of Prof. Simon Chapman, yes.

CHAIR: Prof. Chapman has also provided expert testimony to a wind farm developer in a planning tribunal but does not declare his interest in subsequent publications. Is there some sort of professional amnesty that allows

researchers to withhold disclosure of their interest? How do researchers and practitioners like yourself perceive that kind of behaviour amongst your peers? And what impact does this have on the professional standing of researchers more generally and the tenor of the debate and understanding in the industrial wind turbine area?

Dr McMurtry: There are a lot of elements to that question. The key consideration is that you should always declare a conflict of interest and manage it appropriately so that there is no discomfort being experienced by colleagues from whom you want to seek their opinions. As I said, an ethics committee would be included in that consideration. More importantly, the WHO and many other bodies have found that research sponsored by industry does not have the objectivity that characterises independent research. That has been described time and again with industry. I believe Dr Chris Hanning spoke to that in some detail at his presentation, the sorts of difficulties that you get into. As far as peers are concerned, when you are receiving money and it is a substantial amount for each appearance then I think ought to be extremely cautious about declaring and making a statement as he did in this most recent paper, 'I declare no conflict of interest.' That was what I found to be particularly odd. That quotation is included in my submission.

Senator LEYONHJELM: Thank you for your submission. I found it extremely illuminating, very thorough and you addressed many questions that I had in my mind so I really do appreciate it. What I am curious about though is you are a very experienced medical doctor. You have come down fairly clearly in support of annoyance as being the source of the adverse complaints that people have about wind turbines. We have heard from other witnesses who have suggested a vestibular effect, an effect on the vestibular mechanism and others who have suggested either the middle ear or perhaps inner ear. Why have you nominated annoyance as the source? Have you discounted the others? Or is there something else?

Dr McMurtry: Not at all. I do not mean to discount the other symptoms. I have referenced the diagnostic criteria for being exposed to wind turbines and suffering adverse effects. It was most recently in the *Journal of the Royal Society of Medicine* in the fall of 2014. Those sorts of additional symptoms are listed. What I have made clear, and this was first done by Pederson in her many papers, is that annoyance in the context of wind turbines translates to 'stress, psychological distress, difficulty initiating sleep and sleep disruption'—I believe those words, although from memory, are a direct quote—so it is a very serious business. The most common problems without question we find are sleep disturbance and stress. Those two are always there. Vestibular apparatus disturbance we are also finding. There is no question though when the vestibular gets perturbed, it can make you uneasy, make you feel unwell or nauseated, for example. It may be the mechanism. I am in no way discounting it and it is considered in my diagnostic criteria.

Senator LEYONHJELM: Do you have a feel for what proportion of the community that lives within a nominated distance of wind turbines or a wind farm actually experiences any symptoms?

Dr McMurtry: The lowest number I have ever seen is five per cent. The highest number I have seen is over 30 per cent. There is a range. Firstly, with ongoing exposure, the people I have seen who have been adversely affected become worse. Secondly, increasing numbers of people become adversely affected. What is missing in the research is longitudinal studies. Dr McCunney and I agree on this in terms of his paper that I was talking about earlier. What is needed is something more than cross-sectional epidemiological studies, which are studies at one point in time. They do not follow people longitudinally. Following people longitudinally—that is, over time—is crucial to understand the adverse effects. That has not been done. I agree that we should have cohort studies—that means a group exposed, a group not exposed—and compare them over time, and then you will have some notion of incidence. Anecdotally, when dealing with people, I have found that some do not start experiencing symptoms until a year or two out. I think the incidence might very well go up, and that is a concern.

In relation to the other research, if I may say before stopping again, there has been a missed opportunity. We absolutely should be doing the sort of work that has been done by Steven Cooper, where he looked at six people in three homes. They were adversely affected. You have to study those folks to understand the mechanism better. That is research that is really needed. It is only when that research is done, when we can hone down on the mechanism of the problem, that we can then inform the prospectus for the longitudinal studies of cohorts of people. I hope that is clear. You need research on adversely affected people to understand the mechanism and, secondly, of course, that you confirm that they meet the diagnostic criteria and that their adverse effects are reproducible when they are blinded. You want to do that to be sure. You have that group. Then you want to know exactly what is occurring. Steven Cooper moved things ahead great deal. Then you are well put up for the place to do the cohort studies or the longitudinal studies.

Senator LEYONHJELM: That does raise a question though. These sorts of questions have been asked; there have been complaints about wind turbines. You have been studying this now for six or seven years. Why is it that no definitive, independent research into this has been conducted over those years? It is quite a long time.

Dr McMurtry: I agree with you. I am dismayed by that, especially when it has been asked for nine years. It is coming back to the Academy of Medicine of France. I have pointed out many times in my publications and in my government presentations that there are two opinions and both cannot be right. One is that adverse effects are genuinely occurring and people are being harmed. The other opinion is that that is not the case and that it is in the news, a nocebo effect, or some other manageable problem. Both cannot be right. Always, I have heard calls for research from those concerned about adverse health effects. I have not heard them from those who are proponents—and certainly not from the industry.

To give you a very specific example, Paul Schomer, previously cited, is a leading acoustician internationally known for his standards for noise. He asked Duke Energy—and he has published this—to turn the turbines off and on, and they said they would not. That is pretty much the response you do get. There have been offers to do that. The Steven Cooper work was exceptional because the person who was responsible for that turbine installation in fact did turn off the turbines to enable him to do that research. I believe it was Cape Bridgewater.

CHAIR: Thank you, Senator Leyonhjelm. Senator Urquhart?

Dr McMurtry: By the way, I have debated publicly with proponents, including David Colby. I have always challenged, 'Why don't we do the research. Let's settle this', and the response has been: 'There is no need.' That is the response I have heard in debates, for example.

CHAIR: Thank you, Dr McMurtry. Senator Urquhart?

Senator URQUHART: Thanks, Dr McMurtry. I was just picking up the point that you talked about where the lowest number of people affected by wind farms was five per cent—I think I understood you correctly there—and the highest was 30 per cent. Did I understand you correctly?

Dr McMurtry: Yes you did. That has been the studies to date. As I mentioned, longitudinal studies may reveal a higher number.

Senator URQUHART: Can you just explain to me why the majority of wind farms in Australia do not have any complaints at all.

Dr McMurtry: I think I have heard Simon Chapman make that complaint, if that is who you are quoting. What I noticed about his research is that he was going to the wind farm people themselves and asking them if there were adverse health reports. That does not withstand critical appraisal. You must have an independent determination to determine if in fact there was a problem. That to me undermines this facility, substantially. So I think that claim is dubious. I will stop there.

Senator URQUHART: I did not hear that last point.

Dr McMurtry: The point I made is that when you are trying to glean information from the industry, whose interest is harmed by acknowledging problems, then you are not likely to get as accurate an answer than if you had independent determination of people's complaints. I am speaking specifically about Simon Chapman's work, and looking at his methodology.

Senator URQUHART: Do you live or have you lived near an existing or proposed wind farm?

Dr McMurtry: Yes. I do not live near a proposed wind farm. I live near one that is going to be built something in the neighbourhood of 1½ kilometres away. At the moment it is before the courts.

Senator URQUHART: I understand that you are a founder of the Society for Wind Vigilance. Is that right?

Dr McMurtry: Yes, in 2010. I was the founding chair, from 2010 to 2012, at which point I resigned.

Senator URQUHART: The status of the proposal is before the courts, I think you indicated?

Dr McMurtry: That is correct. There is always more than one proposal on the go, but the one that is most proximate to me is still in review legally, through a judicial process.

Senator URQUHART: How is the Society for Wind Vigilance funded?

Dr McMurtry: Just by donations from members.

Senator URQUHART: Who are the major donors?

Dr McMurtry: There is no major donor. The only income the Society for Wind Vigilance ever received was when they held a first conference in adverse health effects, which is described in my submission. We charged people $100 to come, as I recall. We realised some income from that. There was no surplus, I can assure you, because we had to cover the cost of the food and all the usual things you do with a conference. We have received no money whatsoever from any energy-related industry. Not ever.

Senator URQUHART: What about from other companies or organisations?

Dr McMurtry: No private enterprise company, no for-profit company, no agency and no charitable agency. Nothing. That has been suggested before. It is disturbing to me, because we are recurrently having to repeat what to me is obvious: there has simply been no financial support coming from outside. None.

Senator URQUHART: I think it is good to get that on the record. Thank you. Have you ever published any work in a peer-reviewed academic journal about the possible impacts of wind farms.

Dr McMurtry: Yes, probably several times. That is included in my submission. For example, I published two papers on the criteria for diagnosis: one in 2011 in the *Bulletin of Science, Technology and Society*, and the second one in the *Journal of the Royal Society of Medicine*, in either October or November of 2014. I have also submitted the peer-reviewed blogs from the *Canadian Medical Association Journal*, which is the lead journal in Canada, where I comment on the Health Canada study. That was peer-reviewed. We have also had something accepted that I submitted in confidence for the *Journal of Occupational and Environmental Medicine*. In addition, I have presented before the Acoustical Society of America. I have presented before government at three levels: municipal, provincial and federal.

Senator URQUHART: I wanted to pick up on the point about the *Bulletin of Science, Technology and Society*. I understand that this publication was de-indexed in 1995.

Dr McMurtry: SAGE Publications have since resurrected it. It now is appearing in the *Index Medicus*. More significantly, the *Journal of the Royal Society of Medicine* has been a recognised journal for over 100 years. The *Index Medicus* did not come along until later, or the similar indices. It is a progression from towards the diagnostic criteria, which is in the *Bulletin of Science, Technology and Society* to the second paper on diagnostic criteria, which was in 2014. That is a journal that is well recognised.

Senator BACK: In the PowerPoint presentation you sent us, you comment on biological gradients: that greater exposure should generally lead to greater incidence of the effect. It causes me to ask about the proposal with the independent medical research that has been commissioned now by the Abbott government her in Australia. One witness has proposed to our inquiry that a one-off, laboratory-based test for audible and infrasound could be undertaken with people who participate for periods of somewhere around about 10 to 30 minutes, or maybe up to an hour, once only. From your experience do you believe that the results of a study of that type would be of any value in determining possible adverse health effects?

Dr McMurtry: I think it would have value, but not in and of itself. It is perhaps a necessary but insufficient condition. There are features of industrial wind turbine noise that, when people are in their homes, are very different from in the laboratory setting, and capturing all that in the laboratory setting is virtually impossible. This is basically unwanted noise and unpredictable noise. It occurs at night. It pulses and it also has the quality of resonating within the home. The sound energy comes out—it may be low-frequency or infrasound—and there can be resonance in the home. That cannot be captured in the laboratory. Some people, for example, are being disturbed at night and go outside and they are less disturbed. I would cite in particular Malcolm Swinbanks, a well-known acoustician, who described that very thing and presented it in Glasgow two or there months ago. That has been reported by many people. It has been found for as long as 30 years ago.

Senator BACK: People have put to us that infrasound can occur from waves crashing on the beach and trucks going along highways, and therefore there is nothing special about infrasound from industrial wind turbines, so why all the fuss. Could you comment on the different sources of infrasound and how they might affect people?

Dr McMurtry: What is very important here is to realise that my background is not as an acoustician. You might be better to direct that question to an acoustician. To answer as best as I am able, the acousticians have pointed out that there is a unique signature to wind turbine noise that has not be found elsewhere. I cite, for example, Steven Cooper, whom you have heard. There is also the recent work of Paul Schomer, as well as the 2012 publication with Walker, Hessler, Hessler, Rand and himself, in which they made clear that there were non-auditory and non-visual queues that disturbed people. The other sources of infrasound that people are talking about do not mimic, are not the same as, the signature that is coming from wind turbines. It is unprecedented, so it is crucial that any research captures exactly what people are experiencing.

Senator BACK: You made a comment a moment ago in response to a question from a colleague that you had commented on the Health Canada study. Briefly, could you point us to what your comments were on the Health Canada study?

Dr McMurtry: Yes. You have a copy of that in my submission. It is the *CMAJ* submission and, I think, appendix 7. Ms Carmen Krogh and I did it. I recently was on the same panel with David Michaud and I pointed out some of the shortcomings, but the single most important one is that it is a cross-sectional study. There are other important problems. They started out with 2,004 houses and some 400 were ruled out of scope—424, as I

recall; I am going by memory—and then, when they sent out the questionnaires, another 322 dropped out, which left 766 out of the original group. I wish there had been an analysis of the abandoned or non-eligible homes. I think an opportunity was lost there. Another opportunity lost is that the people most often affected—and I certainly know this from my own experience—are people who are over 79 and under 18. Children are more vulnerable than, say, young adults or middle-aged adults. The Health Canada study looked at people from 18 to 79 and then excluded the rest. They are leaving out the most vulnerable groups.

Senator BACK: Thank you very much. I appreciate that advice.

CHAIR: Thank you, Dr McMurtry, for your appearance before the committee today.

Dr McMurtry: I thank you very much for this opportunity.

DOLAN, Mr Peter, Operations Director, Science Assessment and Planning, Environment Protection Authority (South Australia)

Evidence was taken via teleconference—

[09:47]

CHAIR: Welcome. Would you please confirm that information on parliamentary privilege and the protection of witnesses and evidence has been provided to you.

Mr Dolan: Yes, it has.

CHAIR: I now invite you to make a short opening statement and, at the conclusion of your remarks, I will invite members of the committee to put questions to you.

Mr Dolan: Good morning. My opening statement is very brief indeed. The EPA in South Australia has relatively little involvement in the regulation of wind farm proposals. We really have involvement at two stages. The first is in the planning system. Under South Australian development regulations, wind farm proposals are referred to us for technical advice and response on noise. We receive relatively few, but we receive all of the wind farm proposals in South Australia. EPA's advice is provided back to whatever the planning authority is in each case, but we have advisory powers, not directive powers. Secondly, we regulate wind farms under the South Australian Environment Protection Act, under the general duty provisions in section 25. We use this provision because wind farms are not licensed in South Australia. So our involvement is limited to the technical aspects, particularly around noise. With that, I am happy to take questions.

Senator DAY: Good morning. In the 2009 South Australian EPA wind farm guidelines, it is stated:

The core objective of the guidelines is to balance the advantage of developing wind energy projects in South Australia with protecting the amenity of the surrounding community from adverse … impacts.

What are the adverse impacts?

Mr Dolan: Wind farms need to be correctly sited. Wind farms, like any large piece of industrial machinery, create noise and, if they are incorrectly sited, can have an adverse impact by being too noisy. Under the noise policy under our act we specify certain noise limits that should not be exceeded. The guidelines give particular guidance around the specific activity, which is wind farm development. The impacts are largely around noise. The noise levels that are in there are health based. We take that advice from the NHMRC and the World Health Organization.

Senator DAY: You talk about noise. We have come to use the word 'sound' rather than 'noise', because noise suggests audibility. Do you agree with that? Do you make a distinction between noise and sound—infrasound?

Mr Dolan: No, I do not really, but it does not matter. You can go from zero hertz up to 20,000 hertz if you like; I really do not mind. The range of sound which is detectable by humans is between about 16 hertz for very sensitive folk and about 20,000 hertz at the high end—that range of frequencies. The colloquially adopted term of infrasound generally means below 20 hertz.

Senator DAY: That is right. We have heard a lot of evidence and had submissions from hundreds of people regarding the adverse health impacts and the accusation that the EPA guidelines do not adequately protect the community from the noise or sound, infrasound, emitted by wind farms in South Australia. What is your response?

Mr Dolan: The guidelines are linked to the environmental protection policy, which defines noise as greater than 20 hertz. So it is technically quite accurate to say that the guidelines and the noise policy in South Australia are limited to audible noise.

Senator DAY: Are you saying that wind farms do not emit infrasound?

Mr Dolan: No, I am not saying that at all. Obviously wind farms emit infrasound but many other things in the environment do as well. We have done some studies on this. We were very interested a few years ago in the level of infrasound to which the community was generally exposed, because of the concerns people have. Wind farms do generate infrasound—much less than, say, road traffic, but they certainly generate infrasound. They are not considered to generate infrasound at a level which would require any regulation, however.

Senator DAY: We have heard a lot of evidence to the contrary. In fact our previous witness suggested that there was a unique signature infrasound from wind turbines. I take it that you disagree with that.

Mr Dolan: Wind turbines are particular generators of sound and noise. There are certain aspects of them which clearly are not common to other generators of infrasound. Easily the highest levels of infrasound found in the built environment come from road and vehicle traffic. I believe that your hearing today is in Sydney. There is

no doubt at all that all of you right now are being exposed to at least double the infrasound which is generated by a wind tower. Therefore you cannot make a direct link between overall general infrasound levels and health, because otherwise we would have an epidemic of health impacts. So it is logical to then assume that, if there is an impact on health, it is something to do with the particular nature of a wind farm. The two things that I am aware of that are generated by wind farms which are unusual are chop, the whooshing sound which can happen particularly when the blades pass through an inversion layer of denser air; and blade pass frequency, which is where the blade actually passes the tower itself. Those are the two distinctive things which make a wind turbine as a generator of infrasound different from other things like road noise, refrigeration compressors and so forth.

Senator DAY: We have heard evidence that in fact there is a quite distinct difference between the infrasound generated by that list of ambient noises that you have talked about—traffic and so on—and wind farms. That is an area that we are examining. Do you accept that it is part of the EPA's role as a regulator that you are charged with protecting the health, safety and welfare of citizens?

Mr Dolan: Of course.

Senator DAY: What is your response then to calls by the National Health and Medical Research Council for more research into this area to establish why so many hundreds, even thousands, of people are being adversely affected by living in close proximity to wind turbines?

Mr Dolan: There are two points there. Firstly, we rely on the NHMRC to give us advice on health matters. The EPA are not a health based organisation, although many of the standards we employ are health derived. We rely on them to do that work. If they reach a conclusion which says there is an issue, we will certainly address it. Secondly, I am not aware of evidence that thousands of people are adversely exposed. I am aware that we probably have three-quarters of the million people in Adelaide exposed to excessive traffic related infrasound. We are really talking about the difference between the nature of infrasound from a wind farm and from other sources, because, clearly, many millions of Australians are affected by infrasound from road traffic.

Senator XENOPHON: You would agree that rural communities have a lower ambient noise than city environments, wouldn't you?

Mr Dolan: Yes, absolutely. In fact, you will see in our guidance that we have a different standard for rural living zones as opposed to other zones. It is five dB lower.

Senator XENOPHON: In the third paragraph of the introduction to the 2009 SA EPA wind farm guidelines, it states:

The core objective of the guidelines is to balance the advantage of developing wind energy projects in South Australia with protecting the amenity of the surrounding community from adverse noise impacts.

What do you see as those adverse impacts, because they are referred to in the guidelines?

Mr Dolan: I think I just talked about that. Excessive noise causes all sorts of things from sleeplessness to irritability to, at an extreme end, direct health impacts. Clearly, we need to position wind farms such that they do not cause those problems for the community.

Senator XENOPHON: I know you did cover it, but I am just trying to focus on this. With the studies that the EPA has done to determine the acoustic amenity of rural areas, was that work related to dB(A)s or full spectrum?

Mr Dolan: That was full spectrum. We have done two or three studies. The first one was a wide study, which was very brief, to look at what the background levels of infrastructure infrasound were across the environment—everything from coastal communities to communities near wind farms and to urban communities—to get an idea of the total infrasound load, if you like. That is what supports my comments about how many people are exposed to different types of infrasound. That is one piece of work. Then, in response to concerns by certain members of the community, we re-ran those numbers looking at low-frequency noise—so not zero to 20 hertz but 20 to 200 hertz—to see if there was anything about that. Then, finally, we did a very large study in the vicinity of the Waterloo Wind Farm. It covered two months and involved six shutdowns of the wind farm. We did continuous work there. That, in full spectrum, went from zero hertz to 20,000 hertz.

Senator XENOPHON: But the guideline is only expressed in terms of dB(A)s. Is that right?

Mr Dolan: That is exactly right. The guideline is related to the noise policy under the Environment Protection Act of South Australia. It defines noise as 20 hertz and above—thereby, audible noise. That is why the guideline is dB(A).

Senator XENOPHON: Sure. Please correct me if I am going down the wrong path with this: if the guidelines are expressed in terms of dB(A) but the adverse impacts are, by the studies you have done, full spectrum, does that in itself indicate an argument for the guidelines to be altered or amended to include full spectrum?

Mr Dolan: That is a good point. It might. In fact, we have made several public comments on this before, including to a wind farm select committee in the South Australian parliament. We are really reliant on our colleagues in Health and NHMRC to make some sort of definitive statement about the health impacts. If they come to the conclusion there is a health impact below 20 hertz, we obviously would review our guidance and change it to reflect the impacts to make sure people are protected. I have not yet seen information which would suggest to me that is necessary, but I await NHMRC's findings.

Senator XENOPHON: The other issue is the point that Senator Leyonhjelm has made, I think, quite well. We have heard from acousticians about infrasound and how it is a bit like motion sickness. Some people, with motion, get travel sickness and others do not. We have heard evidence that a cohort of the population, up to about 20 per cent, can be more prone to adverse effects from infrasound. Is that something that the EPA has looked at in the context of protecting the amenity of the surrounding community from adverse impacts?

Mr Dolan: No, we have not as yet. The audible guidelines are based on protecting the entire community, regardless of their sensitivity. Clearly, people are affected by noise, whatever the frequency, differently. More elderly people tend to loose perception in the higher frequencies and to be more perceptive in the lower frequencies and so forth. I have actually questioned the health people about that, because we do tend to find that all of the folk who tie in with being affected adversely tend to be older, and that might be accounted for by the change in noise perception as people age: they hear lower frequencies better and lower frequencies not so well. But we have not yet done the work to modify the guidelines. We would normally review our guidance every five years—on a five-year cycle. We originally listed this in 2003. It was reviewed in 2009, or the new version was published in 2009. We are really waiting at the moment for the NHMRC. That is why our review that was due in 2014 has been delayed.

Senator XENOPHON: But, in terms of the noise levels from a wind farm that will not create an adverse impact, at the moment you do not take into account anything other than the dBAs; is that right?

Mr Dolan: That is correct; but, from my reading of the literature, achieving 35 or 40 dBA is adequately protective for infrasound as well. In fact, all of the studies I have seen from the United States and Canada would state that is true. One of the challenges—and I would be interested to see research in this area—is whether there might be some sort of impact from infrasound below perception levels. With infrasound, the lower the frequency, the harder it is to perceive, and it is generally accepted that you cannot perceive infrasound until 85 dBG, which is the range we tend to use. The levels we are finding near wind farms are much, much lower than that; they are in the order of 30 dBG lower. So it would be of interest if people did research in that area.

Senator XENOPHON: The EPA document refers to WHO guidelines, but my understanding is that these guidelines deal with road traffic noise in urban areas. That is not an adequate benchmark or comparator, is it, in terms of wind turbines in a hitherto quiet rural community?

Mr Dolan: It is true that when you are developing guidance you rely on what is available to you, and so we have relied on those guidelines—

Senator XENOPHON: But they are not terribly useful, are they, if they are for road traffic noise in urban areas, not wind turbine noise in a rural landscape?

Mr Dolan: I am quite interested in this view people have that the level of background noise necessarily changes things. I am not an acoustician, but it intrigues me. From a health point of view, the level of noise in total is the issue, not the difference between background noises. The difference between background noises is certainly an issue when you are talking nuisance, where people are disturbed and they are hearing a noise, particularly when a new noise source arrives. But, from a health point of view, it should make no difference.

Senator DAY: Given your interest in this and your role as director of the EPA in South Australia, have you been following our inquiry and some of the evidence that we have been receiving?

Mr Dolan: No, I admit I have not. I have just returned from two or three months of long service leave, so I am afraid, no, I have not.

Senator DAY: Can I strongly advise and suggest that you review the evidence received by this committee, because you will be quite surprised—in fact, you will be shocked—to hear just how wrong your understanding of the science and the evidence is on this particular topic, regarding sound and so on.

CHAIR: Mr Dolan, earlier you said wind farms create infrasound. Current South Australian guidelines say infrasound is not emitted from a well-maintained wind farm. Are South Australia's current guidelines flawed or are South Australia's wind farms poorly maintained?

Mr Dolan: The current guidance has a paragraph which says that that is true, and that will be changed as soon as we do a review, because it is clearly wrong. However, the actual levels we use to assess wind farms near communities are not affected by that. So it is more an editorial question; it does not change the nature of the guidance. But you are quite right: the current guidelines say that and they should not.

Senator LEYONHJELM: The South Australian guidelines increased the noise limit for primary production zones from 35 dBA to 40 dBA from 2003 to 2009. Am I correct?

Mr Dolan: Yes, I think so.

Senator LEYONHJELM: The Marshall Day Acoustics complaint investigation at Waterloo Wind Farm, house 1, show that wind farm noise exceeds the 2003 guidelines when the wind speed is above seven metres per second but rated power for those turbines is not achieved until the wind speed is 18 metres per second. If the 2003 guidelines had been applied to Waterloo, it appears on the face of that that Waterloo Wind Farm could not have been approvable or could not have operated within the guidelines whenever wind speeds exceed seven metres per second. Do you have any thoughts on that?

Mr Dolan: I am aware that the change in the guidance occurred to bring the guidelines in line with the revised noise policy under the act. Under the Environment Protection Act there is a series of environment protection policies, one of which covers noise. There was an update to that noise policy 2007, and the 2009 guidelines were modified to make sure that they were consistent with that. That is the reason behind that change.

We did an extensive study at Waterloo over two months in six houses from zero to 20,000 hertz. We investigated this in detail because a group of concerned citizens came to us and convinced me that we needed to do more work to understand this. We were able to arrange for six shutdowns of the complete station whilst our equipment was still running during periods of generation—so what we would consider peak times for noise generation. We did however select the sites that we monitored based on complaints—there were folk who had complained previously about the wind farm—and that was based on the assumption that if that is truly concerning them we should be able to find something. We did not. In fact, I was quite surprised at how certain the results were. At several of the sites the wind farm was not detectable at all.

At several sites residents who had filled out a diary for us recorded concerns about the wind farm when the wind farm was most definitely off. We continuously monitored throughout the period of the shutdown, before and after, and we made sure that we only used data where we had had operating machines going for at least two hours prior to and two hours after to see what contribution the wind farm made to entire spectrum, including infrasound. They clearly contribute but at no time did they exceed the South Australian guidelines during that period. In some sites you could not notice the difference in noise or sound whether the wind farm was operating or not. So, based on that study, we do not believe there is a need to change our guidelines, other than some tidy up.

Senator LEYONHJELM: Mr Dolan, we have heard a couple of witnesses severely criticise that study. Witnesses to this inquiry have told us that microphones were placed under trees or enclosed within reflective surfaces—in other words, inappropriate microphone locations; using microphones with adapters which raised the noise floor; and a raft of errors in tables and text, including wrong shutdown dates. The suggestion was made that five of the six shutdowns were timed for early evening when household noise is at its peak; thus rendering indoor measurements useless. They also said that no investigation of the critical period of the night when people were complaining—in other words, trying to sleep—from 10 pm to 7 am, as defined in other South Australian guidelines for noise sources other than wind turbines. I will not take up too much time, but another witness, an expert acoustician, has also criticised that study. Have you heard those criticisms?

Mr Dolan: I have heard some of them. There is clearly a small group of the community at Waterloo who were very disappointed by the findings of our study. They made several criticisms that I have investigated and found to be unfounded about microphone location and other matters. For instance, one of our instruments was placed inadvertently under a tree by the person who installed it and it was moved two weeks later. So, in the two-month study, the data from the earlier period where it was in the wrong place, was not included. Some of those things happened but were corrected. We had the technical aspects peer reviewed by colleagues in the New South Wales EPA, and we stand by the study. We do not think there is a problem with that study at all.

Senator XENOPHON: A constituent sent through to me details in relation to the 10 weeks of data gathered by the EPA at Waterloo in 2013—that is, that valid A-weighted data was collected for only four out of a possible 36 opportunities. Is that really enough data on which to base your conclusion about how much contribution the wind turbines will make to the noise environment?

Mr Dolan: We collected a very large amount of data. We also deliberately had a process on this occasion where we had community volunteers who kept diaries for us. We focused on our analysis on periods where

community members identified the wind farm as being an issue. We have terabytes of data and we focused on where people said they were affected. We did that quite deliberately to identify what it was that was affecting them. So there was the diary aspect, which pointed us towards periods where we believed there would be a significant problem.

The second aspect is the complete shutdown meant that, regardless of what else was going on—indoor noise, outdoor noise, domestic noise of whatever—the noise is the sum total of all of the sources. So, if you turn off one of those noise sources, as we did with the wind farm itself, you should be able to see the difference. Even if a member of the public inside the building cannot see the difference, our instrumentation should. We did find a difference at some sites when the wind farm was off compared to when it was on. So, clearly, the wind farm was contributing to the noise environment at those locations, but not significantly.

CHAIR: Finally, just for the *Hansard* record, you are not an acoustician or a health professional, are you? Is that right?

Mr Dolan: That is correct.

CHAIR: Thank you for your appearance before the committee today and thank you for your evidence.

Mr Dolan: You are welcome.

CHAIR: Our next witnesses are from Frontier Economics.

Senator XENOPHON: Chair, can I just disclose for the record—although I have done it before—that I have sought advice from Frontier Economics over the years and most significantly back in 2009 when, with Malcolm Turnbull, they designed an alternative emissions trading scheme for us.

CHAIR: Thank you for that disclosure, Senator Xenophon.

HARRIS, Mr Matt, Head of Climate Change and Renewables Policy, Frontier Economics

[10:15]

Evidence was taken via teleconference—

CHAIR: I welcome the representative from Frontier Economics, via teleconference. Could you please confirm that information on parliamentary privilege and the protection of witnesses and evidence has been provided to you.

Mr Harris: Yes, that has been provided, and we have returned that.

CHAIR: Thank you. The committee has your submission, and I now invite you to make a brief opening statement, and at the conclusion of your remarks I will invite members of the committee to put questions to you.

Mr Harris: Thank you for inviting me to discuss our submission. Frontier Economics, by way of introduction, is an economics consulting firm specialising in energy, competition, water, telecommunications and transport. I lead Frontier's climate change and renewables work and advise governments and policymakers on renewable policy design; regulators such as IPART on the effects of the RET on retail tariffs; the AEMC on the effect of the RET on retail and wholesale electricity markets and on retail prices; and renewable project developers and investors to value renewable assets and understand the effects of changes in renewable targets on the market.

Our submission to this inquiry is focused on the economics of the RET—in particular the cost and price effects. In brief, the RET does increase the resource costs of supplying electricity, as renewables are currently more expensive than other technologies. Otherwise a support mechanism would not be required. All modelling or analysis would tend to agree with this. But it has proven to be an effective mechanism for reducing CO_2 emissions.

The issue of price effects and who bears the burden of the RET cost is more complex. If the RET leads to oversupply of generation then this can suppress wholesale prices, at least in the short term. This is not unique to renewables; a subsidy to any type of generation would have this effect. This can partly offset the high cost of the RET levy. If this is the case then existing generators will bear the bulk of the RET costs via lower prices, and consumers may not face much of the net cost. But the extent of these price effects and the burden of these costs depends a lot on demand growth, retirement of existing generators, the size of the target and other factors.

Our submission also referred to previous analysis that we have undertaken that considered a low-emissions target, where low-emissions non-renewable sources such as gas might be included as eligible generation. We found this could reduce the cost of the RET while achieving the same level of emissions reduction. We viewed this as potentially a no-regrets option. If gas prices rose rapidly then you could still invest in wind if that became cheaper than gas, so the cost of the RET would not necessarily rise.

Having said that, I would be happy to answer any of your questions.

CHAIR: Thank you.

Senator BACK: Thank you very much, Mr Harris. At the end of the day, who actually pays for the large-scale renewable energy subsidy?

Mr Harris: It is retail electricity customers via a levy on their electricity bills.

Senator BACK: Following on from your introductory comments, can you give us some indication—perhaps in percentage terms—of the extent to which the subsidy increases the retail price of electricity. Are you able to tell us across the board or state by state or on notice?

Mr Harris: On average it is currently at around two to 2½ per cent of the retail bill, but as the renewable energy target rises, that percentage will increase. In the next years, the work we have done for the AEMC we have estimated that that will rise to around 3½ per cent or 4 per cent—perhaps 5 per cent—of a retail bill.

Senator BACK: How power purchase agreements, Mr Harris, what effect do they have on the retail price?

Mr Harris: How a power purchase agreement works is: a renewable project developer will sign a long-term contract with a retail electricity supplier as an alternative to selling the electricity and selling LGCs separately. So they will send a bundle electricity package, and the cost of that PPA will inevitably be passed through to retail consumers of electricity.

Senator BACK: Is it difficult to predict the likely impact of that?

Mr Harris: That is a contractual form or alternative to selling electricity separately to the LGC. So it will have the same effect whether it is under a PPA which is a long-term contract or the renewable assets sells electricity and renewable certificates separately. They are just two forms of achieving the same end, which is that

the electricity retailer will pay a higher price for that electricity and that price will be passed through to consumers. So, that two to three per cent of a retail bill that I talked about will include PPA costs in that.

Senator BACK: So useful modelling really requires the retail price to be considered rather than the wholesale price in this exercise. Is that what I hear you saying?

Mr Harris: Yes. So there will be two effects here, when we model the RET. One will be that the impact on the wholesale price will depend on the supply and demand balance in the market. We are currently in a situation where demand is falling and you are adding renewable generation capacity on top of that over the last year, so we are seeing quite a lot of oversupply in the market and that will tend to result in lower wholesale prices than would otherwise be the case. Having said that, you still need to pay a retail levy to fund the purchase of these LGCs. So, on the one hand, you might see wholesale prices slightly lower than otherwise would be the case. But then, once you add this retail levy, the net effect on retail residential prices can be ambiguous; it could be higher or lower, depending on your assumptions about demand growth retirements and the size of the target.

Senator BACK: I have just a couple more questions. The reduction of the target down from 41,000 gigawatts down to 33,000 will increase the RET price from about $46 to $51.50, as I understand it. Can you estimate or can you advise the committee what your modelling shows? How many RETs will need to be surrendered to meet the new target?

Mr Harris: I am not sure where you are getting those figures from—if that is the spot price of LGCs. Generally, for a reduction in the target you would expect that if anything the RET prices trade in the market would fall. But what has been observed is that there was obviously a lot of uncertainty about what would happen to the future RET target, and that was arguably suppressing current spot LGC prices. We have seen recently in the last few months that LGC prices have risen once there was certainty over an agreed target in the legislation. In terms of the number of LGCs that are required, the new target will be 33,000 gigawatt hours; so, from 2021 to 2030, that is 33,000 per year of LGCs that would need to be acquitted.

Senator BACK: One final question: in Western Australia domestically now the overall contribution of small-scale solar when combined is actually larger than Western Australia's largest network generator and obviously that is going to have impacts into the future. Is there a concern in your mind that many of the current generators of electricity in Australia might actually find themselves in unviable circumstances and could face bankruptcy or closure of their power station operations? Is that something that is addressing in your mind?

Mr Harris: Yes, it is definitely a risk, and this is partly what I was referencing when I said that existing generators could bear the bulk of this RET cost in the form of lower prices. When you have a scenario with low or falling electricity demand and then you also introduce additional entry of new capacity—either large-scale wind or small-scale solar, which is contributing to that falling demand—that will inevitably lead to lower prices in the short term, and one of the options is that existing generators might face a decision to retire. We have already seen in the eastern states that several large-scale generators have withdrawn from the market—have either mothballed capacity or retired.

Senator BACK: Is it the case then that, if there is more off-grid generation—or indeed if there are more small-scale solar contributions by residents, who, at the moment, are not being required to pay a fixed cost for the actual infrastructure—that is likely to cause governments or those who have responsibility for the poles and wires to actually start demanding some contribution of fixed costs, even from those who do not, day to day, require the use of the grid power?

Mr Harris: It is definitely a discussion or debate that is taking place, and it is being considered by, say, the AEMC and the networks as well. I would say that most customers who do have a solar PV have not disconnected from the grid entirely; they still are connected to the grid, and so they still pay some of the infrastructure charges. But there is an issue as to what is a fair and appropriate charge that they should pay if they are using energy at peak, as opposed to when their solar is generating and it reduces their daytime usage, for example.

Senator XENOPHON: I just want to ask you some questions about the economics of wind power in this context, and you may want to take some of these on notice. If you have, in a particular market, a heavy reliance on wind as a resource of renewable energy, or a heavy reliance on wind full stop, in terms of the energy mix, what does that do to short, medium and long-term power prices if, for instance, the preponderance of wind is squeezing out, say, large-scale solar or new hydro—the forms of renewable energy that would be more reliable than wind, or generally more reliable, depending on where they are located, such as large-scale solar? What implications are there if you do not get the mix right and have too much wind in the marketplace? I think that in South Australia the spot prices are much higher, as I understand it, than in other states because we seem to have a heavier reliance on wind energy.

Mr Harris: I guess there are two main factors with the impact on prices. One factor is that, in absolute terms, on average, prices will tend to be lower if you have a greater supply of surplus wind in the market. The second factor is that, as you point out, wind is intermittent, and it is uncertain when the wind will blow and so when you can generate. You cannot turn on a wind generator to always supply when demand is at its highest. That is very evident in South Australia, which has a large share of wind in the market. That tends to lead to quite volatile spot prices in the wholesale electricity market, and that should, ideally, send a signal to peaking gas fired generators or to hydro storage generators to generate more or to enter the market. So, on the one hand, as I said, it can tend to lead to lower average prices, but it can lead to greater volatility in those prices. So that requires a change in the generation mix to supply that residual electricity demand. Partly the higher prices in South Australia relative to other states, though, are due to other factors, such as the shape of demand—having, I guess, a 'peakier' demand to be supplied, which can be more costly. That is probably the leading factor for that.

Senator XENOPHON: But, in the longer term, is it desirable in the renewable energy space to try and get more reliable forms of renewable energy into the mix? Could wind distort investment decisions for baseload power—renewable or thermal, such as gas-fired—as distinct from if you had large-scale solar or an upgrade of hydro?

Mr Harris: Yes. There are certainly more reliable or more certain forms of renewable energy more valuable than purely intermittent. I guess, if you think about our energy use or requirements, one is: what is the overall energy use? But it is also providing energy when we require it. That certainty or that firmness of capacity of supply is certainly valuable in the market. You can have a lot of entry of intermittent renewables that can supply energy, but not necessarily when you need it. That will be less valuable to the market than a form of generation that can provide that certainty as to when you need it. What it means is that if you have a lot of entry of intermittent wind that provides the energy but not the certainty of supply you need to complement that with other sources such as peaking gas or storage in one form or another, and hydro is one form of that storage. There is a lot of hydro that can supply the New South Wales and Victorian markets but less so directly into the South Australian market, where there is a lot of wind.

CHAIR: Thank you, Senator Xenophon. Senator Urquhart?

Senator URQUHART: Thanks very much, Mr Harris. As I understand it the majority of the RET modelling, including the modelling done for the government, found that the previous targets, the 41,000 gigawatt hours, would actually lead to lower power bills from 2020 as renewable energy puts downward pressure on wholesale electricity prices. Do you agree with that?

Mr Harris: A lot of the modelling did find that. But, as I said, I think the net impact on the retail prices is a lot more complex and subject to your assumptions that are adopted for your modelling. Our modelling has tended to show that that target would lead to higher retail prices than the reduced target. Our submission pointed to that acknowledgement from another economic consulting firm, Roam Consulting, which said that this merit order effect or the suppressing of wholesale prices is likely to be transient and models may overstate this effect.

Senator URQUHART: Some have criticised your assumptions about the cost of wind energy. I understand that you put the capital cost of wind at $2,658 per kilowatt. Is that accurate?

Mr Harris: I do not recall off the top of my head what the assumption was in the particular report you are referring to. That is not what would be driving this outcome. As I said, there is a lot of agreement that the actual cost of the renewables will tend to increase the resource cost. In terms of the effect on prices, it depends a lot on the modelling assumptions themselves—what you assume about retirements, your actual approach to bidding, whether people will bid the same as they have historically. I think it would be generally acknowledged that there is a lot of uncertainty about that impact.

Senator URQUHART: I have also read that the Snowtown II wind farm could actually have a capital cost of $1,622 per kilowatt, which is significantly lower than the previous figure I stated. How did you come to that figure in your RET modelling?

Mr Harris: We had a large database of projects—proposed and actuals. Certainly that Snowtown quoted cost is at the very low end of any known projects, and it certainly would not support a lot of the PPAs that are being signed in the market. You can see cheaper and more expensive projects. We tend to take into account all of the known projects, both domestically and overseas, in our database. But, in terms of that $1,600, that is a lot lower than most other projects that we would be quoting.

Senator URQUHART: What assumptions did your RET modelling make about how much the cost of wind would fall over the coming years?

Mr Harris: I do not recall exactly off the top of my head, but it would not be a significant decline in wind costs, partly because wind is a pretty evolved or established technology already. Over the last few years there has not been a significant amount of decline in terms of technology improvements or gains to be had. What you tend to see with a lot of wind farms is that there is a trade-off. You can start to build larger blades and larger turbines et cetera that can increase the efficiency, but that comes at a higher cost. There are trade-offs in that regard. There is also potentially a decline in the quality of wind sites that are available. So, to the extent that project proponents might have found the best sites, over time you eventually see a decline in the number of potential sites with high-quality wind.

Senator URQUHART: Does your model assume that there will be no new coal power stations built in Australia?

Mr Harris: I am not sure exactly which report you are referring to, but in general we do not make a blanket assumption that there will be no new coal power stations built, but in most of the results that we have had over recent times, just because of the falling demand and the addition of new renewables, there has not been a need for new investment in coal.

Senator URQUHART: What assumptions did your modelling make about the cost of gas into the future?

Mr Harris: I do not have the exact gas price on me. I would have to take that on notice, but it is based on our internal modelling.

Senator URQUHART: If you are able to take that on notice and come back, that would be great. There have been reports that we are on the brink of a massive hike in the price of gas. Does your modelling take that possibility into account?

Mr Harris: We certainly have gas prices increasing over time, to acknowledge that there is a potential for LNG exports for Queensland opening up, and that does have an effect on the domestic gas prices. But, in general terms, we have not assumed the same extent of gas price increases that some other modelling results have assumed in previous years. Some of the prices that were getting up to around $15 or $16 a gigajoule in the next few years we think are too high. We would certainly take a lower view on gas prices than any of those assumptions in the near term.

Senator URQUHART: What was the figure that you came to on gas?

Mr Harris: It is rising over time. As I said, I do not have the exact figure with me. I think it was in the order of $10 a gigajoule.

Senator URQUHART: If you are able to update those figures on notice, that would be great.

Mr Harris: Sure.

Senator URQUHART: Did your model take into account the possibility of an emissions trading scheme in the future?

Mr Harris: We can and do take that into account, depending on the scenario.

Senator URQUHART: Did you take that into account, though, in your modelling?

Mr Harris: We have on occasion. I am not sure which particular modelling you are referring to.

Senator URQUHART: You have not done it with all your modelling—would that be correct?

Mr Harris: It depends on the project and the situation whether we assume a carbon price comes back in or not, depending on whether we are using our own assumptions or not.

Senator URQUHART: If you did not include it, how would that change the outcome?

Mr Harris: A carbon price would tend to increase the underlying wholesale price, and that would reduce the price that you would require for LGCs. So you would tend to see a shift. A renewable project would earn more from what we called the black energy price and less from the green energy certificates. But the bundled price for wind, for example, would not change.

Senator URQUHART: I have got a number of other questions, but I know that we are really stretched for time. Are you happy to take some on notice?

Mr Harris: Sure. That is not a problem.

Senator URQUHART: Thank you.

Senator DAY: I have just got one question. Grant King, of Origin Energy, has talked of the need to build thousands of megawatts of gas power to back up wind at a cost of what he says is billions of dollars, and the

expenditure of connecting wind farms to the grid is going to be a major factor in power price increases over the next decade. He says it could be 200 to 300 per cent. Do you agree with Mr King on that?

Mr Harris: I am not sure about the exact figure but, as I said, with intermittent wind, there is an expectation that prices will tend to be more volatile, and that should send a signal to complementary peaking gas plants. Having said that, if there is a lot of excess supply of generation in the market, particularly if there is some existing flexible gas-fired generation. There is not so much of a need for existing new gas if you have that excess capacity already in the market. So a lot of it depends on the market conditions. As I said, wind can supply a lot of energy but without necessarily the firmness or the certainty that other generation forms can have, so you do need other forms of generation to complement that and provide that certainty.

Senator DAY: Hence his conjecture that there could be a 200 or 300 per cent increase. They are saying that that is a possibility.

Mr Harris: I am not sure what he is referring to with that increase.

Senator DAY: I think there was a figure of $45 billion of tax on emissions over the next decade. In order to achieve that, the backup required could send power prices doubling or even trebling—basically, that is what he was saying.

Mr Harris: I would have to look at the context of those comments and what he was talking about.

Senator DAY: That was the pretext of my next question. If there is to be a reduction in the price of electricity, as suggested by the wind industry, where are the savings going to come from other than from just a reduction in demand?

Mr Harris: Sorry, could you repeat that? I did not follow your question.

Senator DAY: There have been quite a few claims that the price of electricity will continue to fall, according to the wind industry, and I am struggling to find how the price is going to fall given the backups that may be required.

Mr Harris: If you are referring to that merit order effect where adding additional surplus capacity in the market in the form of wind can suppress wholesale prices, as I said, I think that can tend to be observed but it tends to be transient and there is a limit to it, so you cannot continue to add more and more additional surplus capacity and continue to see prices fall indefinitely. Certainly, at the moment with the existing thermal generation in the market, prices are not going to continue to fall much below where they are at the moment because some of those existing thermal generators could not recover their fixed operation and maintenance costs. So you tend to see a limit to how much further those prices could fall.

Having said that, if you went to, say, 100 per cent renewables, for example, that would tend to force more and more of the thermal capacity out of the market, but, if you took it to its limit and assumed that that dropped prices to zero in the wholesale market because wind does not have a marginal cost of operating, they would still need to recover a very high price in the renewable certificates to cover their costs. So, if you took it to its extreme of 100 per cent wind, all you might see a drop in the wholesale price but the retail levy would be quite significant, and the net effect would actually be an increase in retail cost in that extreme case. That is even ignoring the fact that you would also need the complementary gas fired generation to provide the certainty when the wind is not blowing.

Senator DAY: I am not suggesting a scenario of 100 per cent—

Mr Harris: That is just to illustrate that this merit order effect does have a limit. It cannot continue indefinitely, and then you tend to see a rebound effect where, once you get beyond a certain threshold, the retail levy effect would tend to outweigh any merit order effect on the wholesale price.

Senator DAY: I am not suggesting a scenario of 100 per cent, but we are looking at it in the context of 33,000 gigawatt hours per annum. There are estimates of between 1,000 and 2,000 new wind turbines to be erected over the next six or seven years. In that scenario, I am just struggling to find a way that prices could fall given the backup supply that is required. I think you may have answered that question already.

CHAIR: Thank you for your appearance before the committee.

Mr Harris: Thank you. I am happy to take any questions on notice, as I said.

McGINLEY, Mrs Lauren, Marketing Communication Manager, Schneider Electric

MORRIS, Mr Brian, Vice-President, Energy & Sustainability Services, Schneider Electric

[10:44]

CHAIR: I welcome representatives from Schneider Electric. Could you please confirm that information on parliamentary privilege and the protection of witnesses and evidence has been provided to you?

Mr Morris: Yes, it has.

Mrs McGinley: Yes.

CHAIR: I now invite you to make a brief opening statement.

Mr Morris: Good morning, and thank you for the opportunity to present to the committee today. I am here representing Schneider Electric in my role as Vice-President of Energy & Sustainability Services. I have spent almost 30 years working in the Australian energy market in generation and consulting. I have held positions in technical, financial, energy trading and risk management areas. Schneider Electric is a large global company. We have operations in more than 100 countries and 170,000 employees globally. In Australia, we have about 4,000 people working in our commercial, services, manufacturing, and R&D operations. We also own the electrical accessory brand, Clipsal, which was founded in 1920. We work across a broad range of industries, such as utilities, infrastructure, industrial process, data centres, buildings and residential. Energy & Sustainability Services, the business that I lead in Australia, works with large commercial and industrial energy consumers to assist them in managing their energy cost risk, sustainability reporting, and project implementation. We provide advice to many of Australia's largest and best-known companies. To support our advice, we undertake significant modelling and analysis, and our clients rely on this advice to make informed risk management and investment decisions. Over recent years, we have seen a lot of uncertainty and rapid change in the Australian electricity market. This represents a substantial risk to large electricity consumers.

To better understand and plan for these risks, we were commissioned by a group of our large energy-consuming clients to conduct an in-depth study to identify and assess the areas of impact and the market drivers on future electricity prices. That was important to assist them in developing strategies to influence long-term electricity market outcomes. The project we undertook relied heavily on forecasting outcomes under a wide range of scenarios. Our forecasting methodology, which is typical for the industry, was that we prepared a benchmark forecast which was reflective of the regulatory framework at the time. So the reference scenario brought together a range of publicly available information. It was taken from government planning entities, regulators, and other official sources. While this did not represent the most likely outcome—what we were expecting the market outcome to be—it did actually represent the regulatory framework at the time we did the modelling. That reference scenario formed a useful baseline for our modelling and for comparison. From that, we undertook several scenarios of various market drivers. We tested them and compared them to the reference scenario to really understand the sensitivity of the market conditions and prices to the market drivers. We undertook modelling in relation to a number of scenarios: on carbon pricing, demand growth, natural gas pricing, renewable energy generation capital cost development and, of course, the Large-scale Renewable Energy Targets.

The results of the Large-scale Renewable Energy Target scenarios were released as a white paper—which I think you have all had the opportunity to see; it has certainly been made public—and served to inform Australian electricity market participants of the possible impacts of modifying or repealing the RET. The research suggested that the LRET, or Large-scale Renewable Energy Targets, really yield three benefits to consumers, who are our target audience here. Firstly, we found that the LRET would act as a hedge against increasing natural gas prices. The LRET directly influences the generation mix and, by reducing the reliance on gas-fired generation, the LRET reduces the sensitivity of the electricity markets to gas prices. The LRET therefore acts as a hedge against rising gas prices, which are expected to increase in the long term, due to linkage of the Australian east coast gas market to the global markets via the exporting of LNG and growing global and domestic gas demand. Secondly, we found that the LRET acted as a hedge against carbon emissions, and may keep carbon emissions lower in the longer term. By reducing carbon emissions, the LRET reduces exposure to the market—and our customers—to carbon costs, acting as a potential hedge against rising taxes or permit prices into the future. In addition, the low-emission volumes under the RET may also help keep carbon prices lower.

Finally, and most importantly for our customers, we found the impact of the LRET was on the long-term wholesale price. The LRET is forecast to result in a generation mix with lower marginal cost, lower carbon emissions and increased competition in the wholesale electricity market, all which serve to reduce prices. The scenarios investigated under the RET in its current form result in lower wholesale electricity prices than the scenarios of a reduced version of the RET or the repeal of the RET.

In summary, we found that the analysis suggested that the RET more than paid for itself through lower wholesale electricity prices and also provided the benefit of acting as a hedge against rising gas prices and against carbon emissions. I am happy to take any questions that you might have in relation to the white paper that we produced.

Senator URQUHART: The previous witness, Frontier Economics, who appeared via teleconference, put the capital cost of wind energy at $2,658 per kilowatt hour in the modelling. Do you think that that is an accurate figure?

Mr Morris: I am not prepared to comment on what Frontier Economics have done in their modelling. I am happy to talk about ours. We do not use a number that high in our modelling.

Senator URQUHART: Right. What number do you use?

Mr Morris: Our number at the moment is closer to mid $1,500 to $1,600 a megawatt hour.

Senator URQUHART: Which is the Snowtown 2 proposal?

Mr Morris: I am not sure what that was either. But that number underpins our modelling.

Senator URQUHART: Okay. What assumptions did your RET modelling make about how much the cost of wind would fall in future years?

Mr Morris: We ran various scenarios. One of the things we tested in the broader study that sat behind this was the capital cost of renewable energy projects. We tested the cost rising and falling. Again, we tested a range of scenarios. I have not got all the numbers with me today and really come to speak on that. I would say it is subject to many factors: metals prices, foreign exchange rates and all those sorts of things. There is a range of scenarios that could play out as to whether the capital cost increases or falls in the future.

Senator URQUHART: What renewable energy mix between solar and wind did you assume in your modelling?

Mr Morris: The model works that out. When you say solar, do you mean large scale or small scale?

Senator URQUHART: Large scale.

Mr Morris: Right. Essentially, our model is underpinned by the cost to capital cost and the operating and maintenance cost to run that plant into the future, like any modelling would be. I do not know the exact numbers, but certainly wind was cheaper than solar at the time. We are currently seeing solar start to become more competitive with wind. It is not quite there just yet, but it is starting to become more competitive.

Senator URQUHART: In your modelling, did you make any assumptions about what level of renewable energy could viably be built in Australia in the period to 2020?

Mr Morris: No, we did not. We just tested a range of scenarios to understand the pricing.

Senator URQUHART: Does your model take into account the downward pressure that renewable energy places on the electricity prices?

Mr Morris: The price would be an output of our model. Essentially, we put the RET in as a constraint that needs to be met—a target that needs to be met—and there is a range of technologies open to meet that target or that constraint, and the price is an output. What we found in general was the higher the renewable energy target, the lower the wholesale energy price and that is because you are putting zero cost energy into the mix.

Senator URQUHART: So the fact that we have gone from 41,000 down to 33,000, obviously the wholesale price is not going to be as low as what we would have expected at 41,000?

Mr Morris: That would be correct because you are building less generation. So there will be less generation in the market operating at zero or close to zero marginal cost, so we would see the wholesale price would be higher than at 41,000.

Senator URQUHART: What could be the impact of the merit order effect on electricity prices?

Mr Morris: The merit order effects work every minute of every day. Companies will make decisions based on their portfolio of assets every minute of every day and it changes all the time based on which plants are operating and which are broken down, and the strategies that people operating those plants might have in place. I am not sure there is actually an answer to that question.

Senator URQUHART: A bit of time has passed since you did your original RET modelling. In that time, what have we seen happen to the cost of various sorts of energy?

Mr Morris: When you say 'various sorts', could you clarify what you mean?

Senator URQUHART: I mean different sorts of energy. In terms of the original RET modelling, when you did your modelling, what have we seen happen with the various different sorts of energy, as in solar, or hydro or—

Mr Morris: We did not set out to model any particular scenario; we set out to understand, with really no preconceived ideas, sensitivity. In that sense we did not really care what was going to change. We just wanted to understand what the impact of potential changes might be. But we have now seen that the carbon tax has been repealed. We have seen that the renewable energy target has been set. We have seen demand continue to soften. They were all things we identified that were potential market outcomes and unknowns at the time, and our customers were looking to understand what their exposure to those potential changes could be and whether they needed to care about them or not.

Senator DAY: You talked about the hedge against long-term energy prices, but your power purchase agreements talk about the wholesale price. What about the effect on retail prices?

Mr Morris: We have not modelled retail prices. Our customers are usually the big end of town. They care about the wholesale prices and they pay their network prices separately. But I guess if you look at the retail price—the price we all pay at our homes—it is really made up fundamentally of the wholesale electricity price, the renewable energy charges and the network charges. If we took the network charges aside, the results of our modelling would still hold from a retail perspective, if you look at that wholesale energy cost and the renewables component in isolation. We have not tried to model the retail effect, in a sense.

Senator DAY: Could you do that? You are saying that the lower renewable energy target is going to have a net hedge—by which I presume you mean result in a lower wholesale price, which you are now saying will also result in a lower retail price—

Mr Morris: It forms a component of the retail price. The retail prices at the household level are really built top down, whereas for a large consumer the prices are paid bottom up, so they buy all the components separately. That depends on a whole range of things, like market competition in the electricity retail sector that is selling to the domestic and small customers, but the results would definitely still hold. Those electricity retailers that are selling to households and small users have to go and buy this wholesale electricity and the products in the market. How they bundle it up is very hard to understand. It depends on competition to a great extent.

Senator DAY: If it transpires that the bulk of the additional renewable energy comes from wind, do you stick by your prediction?

Mr Morris: Our model did at the time show that a lot of wind would, based on the assumptions we put into that model, be the predominant generation type that would meet the renewable energy target, wherever it was set, really. It was the most economic source at the time. But the market will work that out as it moves forward. That does not have to be decided today, and companies will make different investment decisions based on all those factors that change into the future as they decide to build generation—

Senator DAY: You probably heard my question to the previous witness, at Frontier Economics, about what Mr King from Origin was suggesting about the amount of backup. You are talking about the potential for rises in gas prices. He is saying that there is a potential for significant increases in price because of the amount of gas backup that is going to be required. Will there be an effect of wholesale and retail prices as a result of that?

Mr Morris: I am not across Grant King's comments or what supports those and what assumptions he has behind those, but I would say that there is a range of measures or means that you can use to mitigate demand spikes in the market. Certainly one thing we are seeing emerging is I guess the demand-side response. As buildings get smarter and more controllable through technology we are definitely seeing the demand-side response as a competitor to that—

Senator DAY: You can see my point. Some are saying prices are going to skyrocket, and others are saying they are going to fall, and we have to try to—

Mr Morris: We do not see large amounts of generation needing to be built in our modelling. I do not know what underpins Grant King's comments, but certainly our model does not see the need for that in the near term.

Senator BACK: Your figure in response to Senator Urquhart's question about your modelling $1,500 per megawatt hour: that is wholesale, isn't it?

Mr Morris: That is a cost to develop the project, and we convert it back to dollars per megawatt hour. That is a capital cost of construction when you amortise it over a project life.

Senator BACK: But, given the nature of your clients, you would be considering a large-client, wholesale-type market rather than a residential-consumer retail market.

Mr Morris: I guess we are modelling the supply side of the market—the generation sector rather than who is buying the electricity. From that sense it would be applicable to all users.

Senator BACK: You may not have heard the question earlier, and perhaps I could take you back to the comment you made a moment ago and that demand-side response where larger commercial buildings are now becoming more energy efficient et cetera and we are seeing lower demand, and of course introducing the small-scale solar. In our state, in Western Australia, we are seeing a very significant uptake of off-grid power. Do you see, from Schneider's point of view, the likelihood of some of the existing power station operators or generators actually being at risk in terms of the viability of their businesses? And, if so, what longer-term impact do you think that will have, if some of these actually go to the wall?

Mr Morris: I guess we could break that down into a couple of points. Certainly we are seeing a rapid growth in solar and in general and energy efficiency. We have a clear trend now, I think. Demand has fallen over recent years. I guess we will see whether that continues into the future. But at the moment we do expect solar penetration to continue. Yes, that will result in less generation being required to be dispatched every minute of every day, when the solar is actually operating. So yes, you could expect that generators will produce less. Whether that makes them unviable or not I do not know; I am not in a position to make that comment. That would be a comment for the boards and the operators of those power station assets, and taking into consideration their whole portfolio of assets. I guess what we have seen over recent years is really a re-aggregation of a large number of generation portfolios into a smaller number of larger portfolios. They will make decisions all the time about how they operate those plants and whether they run them or close them down.

Senator BACK: Finally, perhaps I can take you to hydro for a moment. There has not been a carve-out in recently passed legislation reducing from 41,000 down to 33,000. There has not been a concentration, that I can see, on encouraging the upgrading of existing hydro. I am not talking about new dams and new projects, but it is my understanding that there have been several significant advances made in the technology of the hydro generators and indeed the software programs that run them. Do you think this is an opportunity lost, and do you think there should be a focus on the opportunity for existing hydro to upgrade and contribute to the new targets?

Mr Morris: I believe that opportunity does exist, based on my knowledge, under the targets being set at 33,000. It does not say which technology needs to meet that target, and certainly any upgrades to existing hydro power stations, where they generate above their baselines, would be valid, I would expect.

Senator BACK: Is that their current baseline—just for my understanding—or is that their sort of achievable baseline?

Mr Morris: There is a baseline set for every hydro generator. That is published. Existing hydro does not receive any renewable energy certificates until it generates above that baseline.

CHAIR: What assumptions drive the lowering of wholesale electricity prices over time in your model?

Mr Morris: It is really the fact, as I mentioned, that you have low-cost generation coming into the market. Once it is built, it runs at zero cost. So it is usually first in—certainly cheaper than gas, coal and some of those other sources. It is first into the market and what we have found is that that will lower prices. If you put any zero-cost generation into the market it would certainly lower the wholesale energy price.

CHAIR: I have been led to believe that there are four key assumptions. What are they, in your opinion?

Mr Morris: There are many assumptions; I am not sure that there are four key ones.

CHAIR: What would be four key ones?

Mr Morris: In relation to our modelling? I could sit here and talk about these all afternoon. Electricity demand is one. You have to understand what you are trying to achieve. Our model would be set up—electricity demand needs to be met and also the renewable energy target needs to be met. Then our model would dispatch the least cost solution to meet all those targets. So really demand is a key assumption. The renewable energy target would be a key assumption. The cost of running those plants would be a key assumption, and there are many factors that feed into the cost. Once the plants are on the ground—the plants that are currently built—it really comes down to the operation and maintenance of those plants and then any upgrades. For new plant also the capital cost of constructing those plants would be a key assumption. And obviously a carbon price, if there was or was not one, would be a key assumption, because that really impacts the cost of running those plants from an operational perspective.

CHAIR: Would you agree that, as with any economic model, the veracity of the conclusions hinges substantially on the reasonableness of these assumptions?

Mr Morris: Absolutely. That is why, under this broader study that we put behind that, we are big believers in not just picking one set of assumptions and going with it. In all the modelling we undertake and the advice we give to our clients we are big fans of understanding the range of scenarios and understanding what makes a difference, what does not and where you need to place your efforts. So I would absolutely agree with that statement.

CHAIR: Amongst your assumptions, did you assume that wind would get cheaper at some annual rate as more is installed?

Mr Morris: In the other things that we tested that we did not publish in the study—so behind this—we tested a range of scenarios. I cannot recall what underpinned this one—whether we had a rising wind cost or a reducing wind cost. But certainly we have tested a range of outcomes.

Senator LEYONHJELM: I am sorry I missed most of your evidence, Mr Morris. I want to follow up on this point about zero cost for wind. That does not take account of any amortisation of capital?

Mr Morris: No. When I say zero cost I mean that once it is built it has a short-run marginal cost of close to zero. Once it is built, like anything—

Senator LEYONHJELM: That is only generation—no writing-off of capital?

Mr Morris: Once it is built you have an asset on the ground and you can choose to run it or not. It would be no different if you built a house to rent out. Once it is built you might like a higher price but you might have to rent it out for a price that you were not comfortable with if the market dictated that. I would say that is a capital cost and investment decision versus once it is push the button and on the ground. Then you are really into short-run operating costs, which is really what the wholesale market is set on.

Senator LEYONHJELM: You could say that about any power generation, couldn't you?

Mr Morris: Yes; absolutely.

Senator LEYONHJELM: If you accept zero price, you will have an impact. You would not go and invest $400 million on a new wind farm and then set your electricity for zero cost, would you?

Mr Morris: No; you would hope not. Certainly, people, I guess, make a range of assumptions. Developers do when they invest in plants—and all type of plants, not just wind farms. They could have a PPA behind it. They could take that market risk. They would undertake modelling. They might hedge into the forward markets. There are a whole range of things they could do to hedge their risk. The fact that we are talking about the spot market; they will run their generation at a short run. They have a really low short-run marginal cost, so it would be dispatched ahead of gas-fired plant, for instance.

Senator LEYONHJELM: Just one final question then, in that case; the chair is winding me up. Most of the wind farms are built with a substantial proportion of loan funds, so there would be servicing costs and so forth to deal with, investors expecting a return for the equity component of it. What would, in your view, in a modelling sense, be a normal expectation, a reasonable return on capital? At what level of electricity prices, of selling prices—and you have to take long-run averages here—relative to other forms?

Mr Morris: All the projects are a little bit different. Somewhere around that $90 per megawatt hour number, if you take the combined effect of the wholesale energy price that they receive and the large-scale LGCs. They do not really care where they get their money from. It could be a very high wholesale price and a low LGC price, or vice versa. Somewhere around that $90 mark. It moves around all the time, depending on the cost of technology and the capacity factors of the site—and even, as you mentioned, the interest rates.

Senator LEYONHJELM: And that $90 is above gas and coal, isn't it?

Mr Morris: It depends on the cost of the gas, I suppose. We have not really seen any new coal-fired power plants built for a long period of time, so they are really back to that operating at short-run costs. I guess we look at gas plants. If you have $8, $9, $10 a gigajoule gas and the most efficient gas plants—you could build up a heat rate of about seven or eight—then you are very quickly up into the same order of magnitude at the $70, $80 $90 a megawatt hour mark. The sensitivity of the gas price is a key risk.

Senator BACK: Mr Morris, the spot price of today I think is about $51.50. Who, in your modelling, ultimately pays the renewables energy certificate price amongst your clients? Is it the wholesale client, or is it the retail client?

Mr Morris: I guess it does not really matter in our modelling who pays—but the end consumers pay. The retailers have an obligation to purchase for every megawatt hour that their customers use, and they pass that on to customers via their electricity bill. We will pay for that in the same proportions right across the market. At the

moment, 11 per cent is what they call the RPP, or the renewable power percentage. The retailers would need to purchase certificates for about 11 per cent of our electricity bill or electricity consumption.

Senator BACK: I wonder, on notice, if you could give us an estimate as to how many renewable energy certificates you believe are going to be required to get to the 33,000 gigawatt target. If you could take that on notice, that would be fine.

Mr Morris: I can answer that now. You need 33,000 per annum once you get there, and that is published information; as to a trajectory each year, there is an explicit number that is published as part of the legislation and it is 33,000 per annum after 2021.

CHAIR: Thank you, Mr Morris, for your attendance here today and your testimony before the committee.

CHAPMAN, Professor Simon, AO, Professor of Public Health, School of Public Health, University of Sydney

[11:15]

CHAIR: Welcome. Could you please confirm that information on parliamentary privilege and the protection of witnesses and evidence has been provided to you.

Prof. Chapman: Yes, it has.

CHAIR: The committee has your submission. I now invite you to make a brief opening statement and at the conclusion of your remarks I will invite members of the committee to put questions to you.

Prof. Chapman: This will take about five minutes—is that okay?

CHAIR: Yes.

Prof. Chapman: I am Professor of Public Health, University of Sydney. I have a PhD in medicine and I am a fellow of the Academy of the Social Sciences in Australia. I have 500 publications in peer-reviewed journals which have been cited over 9,600 times. My Order of Australia was for distinguished service to medical research, particularly in the area of public health policy.

One of my long-term research interests is in risk communication. In public health, we need to understand how those who are unconcerned about high-risk threats can come to better appreciate those high risks and, conversely, how people's irrational and sometimes debilitating fears about extremely low or non-existent risks can be reduced. I have published research on the spread of very low-risk fears such as the 1990s panic about mobile phone towers, doctor-to-patient HIV transmission, anthrax panics, and, since 2012, on anxieties about wind farms.

I have published five papers and four letters on wind farms and health in peer-reviewed journals, and I believe I am the most published Australian researcher in this area. Five of these have been read online over 47,600 times. I have reviewed research on wind farms and health for the journals *Environmental Research*, *Noise and Health*, the *International Journal of Acoustics and Vibration*, *Energy Policy*, the journal *Psychosomatic Medicine*, and *Cureus*.

I have long formed the view that the phenomenon of people claiming to be adversely affected by exposure to wind turbines is best understood as a communicated disease that exhibits many signs of the classic psychosocial and nocebo phenomenon where negative expectations can translate into symptoms of tension and anxiety. The very obvious differential spatio-temporal distribution of complaints is the key indicator of this. It mirrors many past historical health panics about new technologies that have included the ordinary telephone, trains, television sets, electric blankets, power lines, computers, mobile phones and towers, and today's wi-fi and smart electricity meters.

The following problems immediately present themselves to anyone arguing that wind turbines are the direct cause of health problems. If wind farms were intrinsically harmful, why have the majority of Australia's wind farms never seen a single complaint? It is sometimes argued that, as with nearly all exposures to noxious agents, not everyone exposed get sick but only a few, and that it is only susceptible or noise-sensitive individuals who are affected. A small problem here is: why are there whole wind farms, whole regions, whole states and perhaps even whole countries where, mysteriously, apparently none of these susceptible people live? In Canada's Alberta province, for example, they have had wind farms for over 20 years, but in 31,000 public interactions with the relevant government authority there has not been a single complaint.

How is it that in non-Anglophone nations with large-scale wind farms like Germany, Denmark, Spain, Portugal, the Netherlands and Sweden there is little to no history of complaints? If, as I read in the submissions and transcripts of this committee, turbines are said to have acute, immediate effects on some people, within minutes or hours, why were there no such reports until recent years while wind farms have operated in different parts of the world for over 25 years? How is it that there are apparently only two known examples anywhere in the world of wind turbine hosts ever complaining about the turbines on their land? Why, the world over, have there been no apparent cases of wind farm construction and service personnel being affected?

If it is only recent, very large turbines that are the problem, how do we explain that there are 18 wind farms in Australia with turbines of one megawatt or higher which have never had a single noise or health complaint? How do we explain the findings of Taylor and colleagues in England that people with negative attitudes to wind farms report symptoms about even micro-turbines like the one less than three kilometres from where we are sitting today in Glebe Park? Why have there been no case series or even single case studies of so-called wind turbine syndrome published in any reputable medical journal? Why has no medical practitioner come forward with a submission to any committee in Australia about having diagnosed disease caused by a wind farm? Where in the

world is there even a single example of an accredited acoustics, medical or environmental association which has given any credence to direct harmful effects of wind farms? Why has no complainant anywhere in the world ever succeeded in a common-law suit for negligence against a wind farm operator if this is a real phenomenon?

In summary, I believe there is much evidence that belief in the harms of wind farms is the cause of harm from wind farms and that those who are intent on spreading this fear are largely responsible for that harm.

Senator URQUHART: There have been claims of a parallel between the wind industry and the tobacco industry in covering up health impacts. As an expert in both industries, do you have any comments to make on the credibility of this analogy?

Prof. Chapman: The tobacco industry, of course, spent many, many years covering up and denying the harms from tobacco, but it did that in the face of oceans of very, very strong evidence which had been building from the early 1950s. When those reports were aggregated in 1962 by the College of Physicians of London and in 1964 by the US Surgeon General, there was an immense amount of evidence which, collectively, led to causal statements being made about the relationship between smoking and ill health. That situation does not arise today, so wind companies who are denying and stridently objecting to some of these claims are doing so simply because there is not good evidence around, so why wouldn't they deny that?

Senator URQUHART: The committee has heard about the paucity of research showing health impacts of wind farms. In one list of peer reviewed articles claiming health effects of wind turbines that was published on an opponent's website, every single paper listed came from the *Bulletin of Science, Technology & Society*. Why do you think that we are seeing such a prevalence of articles here and very few in other medical journals?

Prof. Chapman: The *Bulletin of Science, Technology & Society* is an non-indexed journal—that is, if you go to any accredited indexing service such as Thomson Reuters or anything like that, you will not find that journal listed in there. In fact, for many years it did not publish anything and was, if you like, resurrected. It looks to me like it has all the hallmarks of a kind of vanity press journal. Everybody in academia is aware of many of these. We get junk email endlessly all day long from such journals offering to publish material in them at a cost. In summary I would say that the *Bulletin of Science and Technology* is not a journal that really anybody in science would give any credence to.

Senator URQUHART: The committee has heard that all the research providing evidence of health impacts from wind farms has been of low quality. From an academic perspective, what should the committee look out for when we are considering the credibility of individual studies? What are the hallmarks of quality research? What are the common flaws that we should be alerted to?

Prof. Chapman: It would take a very long time for me to go through what the hallmarks of the good methodological qualities of studies are. The big problem with investigating wind farms and health at the moment is the confounding factor of scary or alarming material which is almost ubiquitous. For example, for future wind farms to be established—they are not built overnight—there is lots of discussion, lots of planning, lots of community consultation. There is lots of opportunity for wind-turbine opponents to move into an area, start trying to frighten the local population and spread anxiety in the community. Presumably what would happen is that a proportion of that community would get very worried about it, and so when the wind farm was eventually built it would be impossible to tease out the nocebo effects in people's perception, behaviour and personal experience once the farm went from direct effects to the nocebo effects. I think it is beyond that now, and we would not be able to do that.

Senator URQUHART: You have raised the issue of the nocebo effect. Independent of its possible role in people's perception of wind farms on their health, what research has been done on this in other contexts?

Prof. Chapman: There is a great deal of research in clinical medicine. For example, when people are randomly divided into recipients of an active drug and of an inactive drug, many people who are taking the inactive drug become worried about symptoms that they may be experiencing which may have nothing whatsoever to do with the drug that they are being given—if they have been assigned to the placebo arm. That worry can cause them to start experiencing things. It is a well-known phenomenon. There is a very large literature in clinical medicine about the nocebo effect. There are also community examples and experimental examples. I know that you have heard from Fiona Crichton from New Zealand with her experimental work in that area.

Senator URQUHART: It is accepted as a legitimate medical phenomenon?

Prof. Chapman: Very much so, yes.

Senator URQUHART: The committee has heard that, while wind energy exists in a number of countries, there are t countries where health impacts are rarely raised. You did touch on some in your opening statement.

Prof. Chapman: Yes, there are countries where they are rarely raised—

Senator URQUHART: Why do you think we are having a different effect in Australia?

Prof. Chapman: Because of the concentration of anti-wind turbine activism in countries like Australia. It is fascinating to me that, when you go to a country like Canada, the Health Canada study would appear to indicate this phenomenon at play; they compared the rates of complaints in Ontario with those on Prince Edward Island—two provinces of Canada. Ontario is the epicentre of anti-wind turbines activism, but there is very little of that on Prince Edward Island and consequently the number of complaints on Prince Edward Island were much lower than the number of complaints—adjusted for the size of the population—from Ontario.

When I travel to Europe, which I do often for m work, I am often in the presence of colleagues who are working in public health and I raise this issue with them. Sometimes they say to me, 'Look, what is it that you are asking?' And I have to go through it again carefully, and they say, 'We have never heard of anything like this.' Friends of mine who have gone walking on the pilgrim's walk in northern Spain made an effort to ask local people as they walked across that, 'Are these wind farms that we are seeing affecting you?' The people looked at them as if they must be strange. They had never heard of anything like this.

So it is, as some people have observed, a phenomenon which perhaps speaks English. Of course, people working in other countries which are not anglophone do publish a lot in anglophone journals—in English-speaking journals—so the idea that there would be researchers who have information and are not putting it out in the English-language academic press is also not very credible.

Senator URQUHART: I just have one final question, and the chair is winding me up. I just want to look at the concept of formal peer review. Can you outline what it means for a piece of work to be considered peer reviewed. Is it just a matter of the researcher sending it to someone who has expertise in the area and getting their support? Just step me through what it means.

Prof. Chapman: Often you do that prior to publication, because you send it to colleagues and say, 'What do you think of this? Can you find fault with it? Can you help me improve it?' and that sort of thing. So that is informal peer review, but what peer review normally means is that you send it to a journal and the journal assigns reviewers to that. Usually the conditions are that both the authors and the reviewers are blind, so you receive something through the email and it does not have the names of the authors on it, and they do not get your name, and then you do a critique of it. All academics do this every week. It is a well-established practice. It is by no means flawless. There is a lot of very shoddy peer reviewing, and there is a big problem with people refusing to review. I was an academic editor for 17 years, and I still do it with supplements occasionally. Sometimes it is very difficult to get people to review, and you kind of move down the food chain. But, generally speaking, there are a lot of people who are very willing to do it, and you have people who have expertise in the area, and those comments are fed into the process, and the manuscript is revised accordingly.

Senator URQUHART: Thank you. I have a number of other questions, but I will put them on notice if that is okay.

Prof. Chapman: Sure.

Senator XENOPHON: Professor Chapman, recently the German Medical Association, at their annual congress, passed a resolution to call for research on infrasound and low-frequency noise and related health effects of wind farms. Are you familiar with that in broad terms?

Prof. Chapman: In broad terms I am, but I am also familiar with more recent information about that. I read the report in *The Australian* newspaper about that, but I have subsequently read also that in fact they have not called for a resolution; they have simply passed on somebody's motion. There is a world of difference.

Senator XENOPHON: Sure, but there is a school of thought amongst German doctors that it is something that ought to be looked at further.

Prof. Chapman: Of one German doctor who passed the motion.

Senator XENOPHON: Which was seen as valid; it was passed on for further consideration by the German Medical Association.

Prof. Chapman: Well, there used to be a doctor in Sydney called William Whitby, as you would know, who wrote a book called *Smoking is Good for You*. I would not generalise from that person's experience or views to Australian doctors at large.

Senator XENOPHON: I am not familiar with Dr Whitby's book. I do not know if he is still alive. Is he still alive?

Prof. Chapman: No, he is dead. He lived in Bondi Junction. I have a copy of his book.

Senator DAY: You have seen the movie, haven't you? Have you seen the film?

Senator XENOPHON: Back in November 2012, you gave evidence on the excessive noise bill that I cosponsored with Senator Madigan, and you made reference to 17 papers. One of them was a *Wind turbine health impact study* prepared for the Massachusetts Department of Environmental Protection and Department of Public Health. I am happy for you to take this on notice, but I think you took it on notice previously. The panel made recommendations, and it said:

In summary, **sleep is a complex biological state, important for health and well-being across a wide range of physiologic functions. To date, no study has adequately examined the influence of wind turbines on sleep.**

That was one of the reviews that you referred to. It is not unreasonable for there to be ongoing monitoring and studies in respect of that because, if you do not sleep, it can have quite significant adverse health impacts.

Prof. Chapman: Yes. About 25 per cent of the population, regardless of where they live—whether it is near wind farms or not—have had sleep problems in the past week. So lack of sleep is a significant problem. I have suffered from it at times, when we had grandchildren in the house and so forth. So, who could object to monitoring sleep patterns?

Senator XENOPHON: The government agreed to have someone deal with complaints and to have independent scientific monitoring of sound and any potential adverse impacts. You do not object to that, as long as it is done on a scientific and fair basis?

Prof. Chapman: Absolutely not.

Senator XENOPHON: Right. That might be useful in the context of this debate. Clive and Petrina Gare, who are wind farm hosts, gave evidence. I was in the room and heard them give evidence. They described, when quite close to the wind turbines, the noise and vibration and said that, although there are still some issues, things are now much better because the energy company provided a lot of acoustic insulation, sealing the doors and windows, double glazing and a whole range of measures, which was quite expensive. Do you accept that, in that case, given the way the Gares relayed their complaints, there is actually a noise impact? And they were hosts, so they admitted they were getting $200,000 a year, but their amenities of life were significantly affected.

Prof. Chapman: I would not make any comment about the Gares. I have not been to their house. I do not know the circumstances. Obviously, I can read their submission and form my own views about it. But people live with noise of all sorts all the time. I live under the main Sydney flight path. I live near a busy road. I live about 300 metres from a railway line. I have raised three children in that house; they have all slept like babies. None of my neighbours in the vicinity meet in the street and complain about the impossibility of living under this assault! It is something that people live with. So, when you have a new type of noise come into an area, such as a wind farm being built, it is a noise that has not appeared before—

Senator XENOPHON: I am sorry to cut you off, but my time for questions is limited. It has been put to this inquiry by acousticians that infrasound is almost analogous to motion sickness. Some people get motion sick; others do not. Do you accept that there may be emerging studies that, due to infrasound, some people may suffer adverse effects in terms of their vestibular function, while others are quite immune to it, analogous to motion sickness?

Prof. Chapman: Of course we know that some people get motion sickness and others do not. That is why I talked in my preliminary remarks about the susceptibility or the high sensitivity kind of hypothesis. How would it be that, for example, in the whole state of Alberta, in Canada, there is no-one with such susceptibility? How would it be that no-one has ever complained or reported a health problem in the whole state of Western Australia, for example? With the susceptibility hypothesis, you would have to have an expectation that it would be distributed fairly evenly—

Senator XENOPHON: Should we not be guided by science in terms of objective data that says that there is either infrasound—

Prof. Chapman: Who could disagree with that? But I think we would probably disagree about what the guiding science would be.

Senator XENOPHON: Finally, I know that this is a vexed and heated issue, but previously you have said or published about Dr Sarah Laurie from the Waubra Foundation that she is a deregistered doctor. Do you acknowledge that that is inaccurate?

Prof. Chapman: I have never said she is a deregistered doctor. I have said she is an unregistered doctor.

Senator XENOPHON: Right, but you did republish a tweet that referred to her as a deregistered doctor, I think, in March last year.

Prof. Chapman: I am not aware that I did that. I would like to see that tweet.

Senator XENOPHON: Okay. If I am wrong, I will apologise; but, if you are wrong, you would be happy to apologise to Dr Laurie for that?

Prof. Chapman: Of course I would, yes.

Senator XENOPHON: Thank you.

CHAIR: Thank you, Senator Xenophon. Senator Back?

Senator BACK: Thanks. Professor Chapman, with respect to Alberta, I am afraid I have no understanding where the wind farms are located in the various jurisdictions you have mentioned, but I certainly can advise the committee and you about the four major wind farms in Western Australia. Esperance has the Ten Mile Lagoon wind farm and the Nine Mile Beach wind farm which, as the names suggest, are that far out of town. Albany they are about 20 kilometres from the town. Walkaway wind farm is about 35 kilometres from Geraldton and Dongara. The Collgar wind farm at Merredin is about 25 kilometres east. So I guess that captures an area that I will be very interested in, when we mention whether or not there are complaints.

Your PhD in medicine; am I to understand you are a medical practitioner? Or do you have a doctorate in a medical discipline?

Prof. Chapman: Yes, I have a PhD in medicine. I am not a medical practitioner. I do not have an undergraduate degree in medicine. But I actually brought in my academic transcript from the university. It says on it no less than eight times 'doctor of philosophy in medicine'. I do not think it can be clearer than that; I do have a postgraduate qualification in medicine.

Senator BACK: I wonder if I could understand what your PhD thesis was in.

Prof. Chapman: My PhD thesis, which was completed in 1984, was on tobacco advertising. But of course people working in medicine do not just work on the topic that they did their PhD thesis in—

Senator BACK: Absolutely not.

Prof. Chapman: They work in many other areas other than that. I assume you are trying to suggest that, because my PhD was in tobacco advertising, I should not work in any other area or I should not research in any other area. Is that what you are trying to get to?

Senator BACK: I make no suggestions of any type. If somebody has achieved a doctorate, it is an indication to the international community that they are capable of thinking in a certain area.

Prof. Chapman: That is right.

Senator BACK: It has been put to me—but you have clarified that. I will go back very briefly, and I know time is against us. You are a fellow peer reviewer of Dr Leventhal. In fact, he has appeared as a witness—in the 2010 NHMRC Rapid Review, in the UK low frequency space. He told the workshop in June 2011, as I understand it—I was not there so perhaps you can correct this—I am quoting, as I understand it, his comments. He said; that the symptoms of what he calls 'noise annoyance' were 'the same as those described by Dr Nina Pierpont as wind turbine syndrome'; that he had known about them for years; and that they were caused by audible noise from a range of different noise sources 'as well as wind turbines'. Is that an accurate portrayal, as you recall, of Dr Leventhal's comments, and do you agree with that opinion?

Prof. Chapman: I cannot recall Dr Leventhal's comments. I am quite happy to take that on notice and see whether I would agree or disagree with that. I am not an expert in noise. My expertise here which I articulated when I opened this morning is in social science research as it applies to the wind turbine phenomenon.

Senator BACK: We have had evidence supporting your contention that people who believe they are going to be adversely affected subsequently are. We have certainly now had evidence on two occasions to this committee—Mr Mortimer and his wife, and then Mr and Mrs Gare—and we have also had evidence this morning from the Canadian Professor McMurtry of many instances. I believe there was also an earlier witness, Ms Green. These were instances where the expectation of members of the community were very positive towards the likely construction of wind turbines—environmentalists, I think we have had instances. We have been told of evidence in the United States where people were very excited because they understood that not only where they going to be part of a new phenomenon but they were also going to enjoy cheaper prices for their wind generated electricity. In the context of your comments about nocebo, should we just dismiss that evidence because it does not fit the view that you have put to us?

Prof. Chapman: When I was coming in on the train this morning, I looked at the evidence given by Ms Green this morning. I am not aware that that evidence has any status other than her opinions. It has not been published in

any peer-reviewed journal. It has not been subject to any kind of critical review at all. I think that is the problem that the committee has to look at: you have any number of people who are willing to come in here and talk about their opinions, their impressions and their anecdotal stories, but that is a long way away from what we would call credible scientific evidence.

Senator BACK: I take you, then, to McMurtry, who told us in evidence this morning that he has undertaken some 10,000 hours of research. He is a professor emeritus at his university. He is a medical practitioner. Only in October last year, he was published in the *Journal of the Royal Society of Medicine*. Would you regard information to the committee from McMurtry as being more credible than perhaps that of Ms Green?

Prof. Chapman: I would like to see that paper. I would be quite happy to give you a critique or review of that paper. As I said, I review all the time, and it is no skin off my nose at all to do another one for you.

Senator BACK: Sure. In his submission to us, which is submission 146, he wrote some comments on the Health Canada study which I think you quoted a few moments ago. I have not yet had the opportunity of reading it, but it is in his appendix 7. Again, would you be kind enough to review his commentary, because, to put it politely, he was very dismissive of many aspects of the Health Canada study because of large numbers of households and houses being ruled out of the scope and, particularly, the fact that the study concentrated on those within the age range of 18 to 79, whereas from other evidence he seems to have been of the view that people under the age of 18 and certainly those over the age of 79 may in fact be in the most vulnerable cohorts. Again, I am not asking you to do more homework. He commented on the Health Canada study, which many have put up as being, if you like, an absolute signature study in recent times. He is dismissive of much of it, and I would be keen to have your comments on his comments. Thank you.

Prof. Chapman: I would be delighted to provide those comments to you.

Senator BACK: Thank you.

CHAIR: Professor Chapman, earlier Senator Xenophon referred to a retweeting of Ken McAlpine's tweet about the 'deregistered' Dr Sarah Laurie. That was on 20 March last year. It says 'Simon Chapman retweeted'. That is the tweet that—

Prof. Chapman: Could you read out the tweet for me, please.

CHAIR: It says:

Simon Chapman retweeted

Ken McAlpine@KenMcAlpine

NOT DROWNING, RANTING: Deregistered "Dr" Sarah Laurie doesn't like the medicine dished up by @ama_media: waubrafoundation.org.au/resources/open …

Prof. Chapman: I would regret having retweeted that one, because obviously 'deregistered' is incorrect.

CHAIR: That is right. As Senator Xenophon said, would you therefore apologise to Dr Laurie for retweeting that?

Prof. Chapman: I would apologise to Dr Laurie for retweeting that one.

CHAIR: Thank you, Professor Chapman. Thank you for your appearance before the committee today.

BEER, Mr Jason, Head of Projects and Service, Senvion Australia

KLADOUHOS, Mr George, Chief Financial Officer, Senvion Australia

SGARDELIS, Mr Peter, Development and Strategy Manager, Senvion Australia

WHEATLEY, Ms Megan, Manager, Communications and External Affairs, Senvion Australia

[11:50]

Evidence was taken via teleconference—

CHAIR: Welcome. Could you please confirm that information on parliamentary privilege and the protection of witnesses and evidence has been provided to you?

Ms Wheatley: It has.

Mr Beer: I confirm that.

Mr Sgardelis: I confirm that.

Mr Kladouhos: Correct.

CHAIR: Thank you. The committee has your submission. I now invite you to make a brief opening statement, and at the conclusion of your remarks I will invite members of the committee to put questions to you.

Ms Wheatley: Thank you very much for the invitation to participate in this inquiry. Firstly, our CEO, Chris Judd, is overseas at the moment, which is why he cannot participate in this public hearing. He wanted me to let the committee know that he would be very happy to speak with committee members when he returns later this week, if that would be at all useful.

I want to make two brief points. Since we made our submission, the International Energy Agency has released a *World energy outlook* special report looking at climate and energy. The report states that:

A transformation of the world's energy system must become a uniting vision if the 2 °C climate goal is to be achieved.

According to the IEA this is going to require phasing out fossil fuels, energy efficiency and a significant investment in renewable energy. The IEA estimates that investment in new renewables needs to increase from $270 billion in 2014 to $400 billion in 2030. If Australia is to make an equitable contribution to avoiding dangerous climate change, we need to see big changes in the way we supply energy, and it is our view that wind energy, being mature, proven and competitive, has an essential role to play in helping Australia to move to a low carbon economy.

The second brief point I wanted to make was that last week we were very relieved to see the future of the renewable energy target resolved. The industry has been at a standstill for a year and a half, and investor confidence is at an all-time low. It is very important for the future of the wind industry that the policy framework does not continue to change; otherwise, investor confidence will not be restored. Thank you.

CHAIR: Thank you. Senator Urquhart.

Senator URQUHART: Thanks, Ms Wheatley. I just have a few questions. There have been varying assumptions made about the capital cost of wind energy in Australia. What is the current range of this cost per kilowatt?

Mr Sgardelis: The capital cost of building a wind farm is roughly $2 million per megawatt. That varies. It is a function of, obviously, an exchange rate and commodity prices, but that, as a going rule, is roughly what wind farms cost to construct in Australia.

Senator URQUHART: The committee heard from Vestas that none of its workforce of 5,500 people who work directly on wind turbines globally have raised concerns about the impacts of these wind farms on their health. Does this mirror the experience of Senvion in the different countries where you have wind turbines?

Ms Wheatley: Globally, we employ over 3,400 people and we have installed over 6,000 turbines. We have not had a single reported case of sickness resulting from the operation of a wind turbine.

Senator URQUHART: The committee has also heard that there are many countries where the health impacts of wind farms are rarely raised as a concern. Is this borne out in your experience, given that you operate in a number of different countries?

Ms Wheatley: I will answer that by quoting our global CEO, Andreas Nauen. He was in Australia a few years ago and he was surprised by the level of debate about wind farms and health. At that time, he spoke about having very specific discussions in other countries about things like warning lights for high towers and said:

It's always a very solution orientated discussion… but this fundamental discussion of wind turbines causing illnesses, I don't see it anywhere else in the world.

Senator URQUHART: Analysis has shown that the majority of complaints about health impacts of wind farms occur in English-speaking countries. I understand that you have operations, including 16 wind farms, in Japan. What is the Japanese experience in relation to claims of health impacts?

Mr Beer: Our operations in Japan have not resulted in any feedback to us as an organisation around health impacts. We have not been questioned by our customers or our suppliers in Japan.

Senator URQUHART: So it is not a concern raised in Japanese communities?

Mr Beer: Not that we are aware of. No concerns have been raised with us directly.

Senator URQUHART: We have just heard from Professor Simon Chapman, who has found that the majority of Australian wind farms have not led to any complaints and that most of the complaints recorded have related to just six wind farms that have been the focus of organised opponent activity. Have you noticed a correlation between the level of opponent activity and community attitudes to individual wind farms?

Ms Wheatley: It is difficult for us to comment. In terms of the projects that we work on, we work with the clients that we build the wind farms for. They would generally be the interface between the community with respect to complaints about the operation of that wind farm project.

Senator URQUHART: There has been a majority interim report from this committee. Have you seen that?

Ms Wheatley: Yes, we have.

Senator URQUHART: Do you have any comments to make on the agreement of the government to set up a scientific committee into the potential health impacts of wind farms?

Ms Wheatley: In terms of research into the health impacts of wind farms, we support any research that is independent and credible and continues to add to the body of knowledge in this area.

Senator URQUHART: Are there any comments to make on the other recommendations of the majority report of this committee, particularly around the areas of the wind commissioner, the ombudsman, the national wind farm guidelines and the national environment protection measure?

Ms Wheatley: I will start by commenting on the establishment of the wind farm commissioner. In terms of the conditions outlined by Minister Hunt that attach to the renewable energy target, the commissioner's role would be to refer complaints from concerned community members to relevant state authorities and to help ensure that those complaints were addressed. We support this activity. The interim report from this inquiry recommended linking this role to the ability of a project to create renewable energy certificates. We do not support this as it would undermine investor confidence in new projects, particularly in the absence of a clear understanding of when this power could be used. Investors understand state requirements, which are very strict in Australia. But creating additional requirements would have an impact on investor confidence.

In terms of the national wind farm guidelines, there have been attempts to develop national wind farm guidelines in the past. These have not been successful. State-based planning schemes provide clear frameworks for the assessment of wind energy projects. This would result in different approaches potentially being taken around Australia to ensure that the unique needs of each state and community were being met. Because these effective and functional state approaches are in place, they make any national wind farm guidelines obsolete. There was, for example, the National Wind Farm Development Guidelines drafted by the Environment Protection and Heritage Council. These were developed for consultation and never finalised. There was a statement from the former Standing Council on Environment and Water. It made it clear that:

… it has become apparent that jurisdictions have developed, or are currently developing planning application, assessment and approval processes … The Environment Protection and Heritage Standing Committee has therefore decided to cease further development of the Guidelines.

It is worth noting too that state based planning guidelines for wind energy are very rigorous. For example, noise standards for wind farms in Australia are among the most stringent in the world.

Senator URQUHART: I am being wound up, so I will just ask one more quickly, and then I have a couple that I would like to put on notice if possible. Are you aware of any professional health or acoustics body—given that you have wind farms all around the globe—that holds the position that wind turbines are dangerous to human health as a result of infrasound?

Ms Wheatley: No, and we follow the guidance of bodies like the NHMRC in this matter.

Senator URQUHART: And in other areas around the world?

Ms Wheatley: Not that we are aware of.

Senator URQUHART: Thank you.

Senator DAY: I am new to this field and had no previous knowledge of or, in fact, even interest in wind farms until this committee, but I have a bit of a science background. Over the past two months, we have received hundreds of submissions and evidence from people around the world about the adverse health impacts. Ms Wheatley, you say you have installed 6,000 wind turbines, you are involved in this industry, and yet you say you have never heard of any health impacts. I have just googled 'health impacts wind farms', and 22 million references come up, and yet you have never heard of any.

Ms Wheatley: In terms of our projects, of course we have heard from communities who are suffering and who believe that that is as a result of nearby wind farms. I would just like to make the comment that historically bad science convinced a lot of people that there was a link between the MMR vaccination and autism. That link has since been debunked, but the fact that there is not a link does not in any way diminish the challenges facing the families with autistic children and their need for support. We are confident that our wind turbines are not hazardous to people, but that does not in any way diminish the distress and suffering of those people that you have been speaking to through this inquiry process.

Senator DAY: Can I suggest, then, that you look up the evidence that has been presented—in particular by a number of medically qualified people—regarding, particularly, the effect on the inner ear, the cochlea, and the outer hair cells and inner hair cells, and why it is affecting so many people.

Senator BACK: I just wonder if you could advise me—perhaps the chief financial officer, Mr Kladouhos, might be best—on the relationship between Senvion and Suzlon. Suzlon is linked to Senvion or is the parent company of Senvion. What is that relationship?

Mr Kladouhos: The relationship between Suzlon and Senvion was one where Suzlon was the parent company of Senvion, and I think that relationship, from memory, commenced back in 2011. Back on, I think, about 28 April this year, the Suzlon Group was divested of the Senvion Group to a company based in the US called Centerbridge, so Centerbridge took over the 100 per cent shareholding of the Senvion group on 29 April this year. So there is no further relationship between Suzlon and Senvion now.

Senator BACK: So there is no link, then, between Suzlon and Senvion with regard to the financial difficulty that Suzlon is in with regard to, I think, the multimillion-dollar defaults recently.

Mr Kladouhos: No, not at all. Even when the ownership relationship did exist between Suzlon and the Senvion Group, Senvion had a financial structure which effectively ring-fenced it from the Suzlon Group and the issues that the Suzlon Group had with its banking syndicate and its cashflow position.

Senator BACK: Can you explain in a bit more detail. Centerbridge is a publicly listed company?

Mr Kladouhos: No I do not believe that it is a publicly listed company, Senator. I believe that it is privately held. It is a private equity group based in the US that has investments in many different industry sectors and many companies around the world.

Senator BACK: Including in the energy sector?

Mr Kladouhos: I believe so, Senator. We have not had an opportunity as yet to delve into all of the different and varied investments that Centerbridge has, but I think it does have a couple of investments in the energy sector.

Senator BACK: Right. Thank you. You have very kindly given information that the cost of construction is about $2 million per megawatt for wind turbines. Could you give us some sort of an estimate, if it is not commercial-in-confidence, of what sort of a price per megawatt hour you would regard you would need in your power purchase agreements for a project [inaudible] backup for you to finance?

Mr Sgardelis: That is an interesting question. It varies on the wind resource you have on a particular site, the distance you are from the grid and the construction costs in your area. But recent auctions in the wind game have been somewhere between $80 and $100 recently in Australia.

Senator BACK: Would you be breaking confidentiality to provide the committee with a copy of a PPA?

Mr Sgardelis: We believe those particular wind farms that came out of the ACT auction are on the public record, so we can provide that link.

Senator BACK: If I could just go back to Centrebridge, Senvion and Suzlon. In terms of the Cape Bridgewater and Bald Hills wind farms, was Senvion responsible for the construction of both of those?

Mr Beer: Both of those wind farms—the turbines were provided by Senvion.

Senator BACK: Did you construct the two wind farms?

Mr Beer: For Cape Bridgewater, we were the turbine supplier. The customer undertook the construction of the wind farm. At Bald Hills we are under an EPC contract, so we have been the provider of the turbines and the constructor of the wind farm.

Senator BACK: Do you operate them both?

Mr Beer: At the moment at Cape Bridgewater we are the maintenance provider to our customer. For Bald Hills, the wind farm is still completing its reliability tests and is yet to be handed over to the operations team, but the intent is for us to be the operations and maintenance provider.

Senator BACK: We have obviously had evidence from different views during this inquiry. Were there any difficulties meeting Australian safety standards in terms of tower construction at either or both of the sites during construction?

Mr Beer: There were no difficulties in meeting that. Clearly there are some differences in the standards, which have required us to adapt our towers, but we have been able to meet those at both those wind farms and other wind farms we have provided.

Senator BACK: In both cases your insurers have been happy with your performance and information provided to them?

Mr Kladouhos: We have not really had any issues as such that we have needed to identify or advise our insurers of.

Senator BACK: Finally, I think I was told that some equipment had been stolen from the Bald Hills site. Is that the case? If so, did you inform both your insurers and the police about that theft of equipment, and what was the outcome of those inquiries?

Mr Beer: We did have a small amount of equipment that was stolen from the construction site on the Bald Hills construction. We have notified the relevant authorities. It was a small amount of equipment during the demobilisation of the site to us. There has not been an outcome from those investigations. Nobody was found to have stolen it, so that is still open.

Senator BACK: Then, if I could just go back, I have one final question with regard to operations. We did visit one of Pacific Hydro's turbines at Cape Bridgewater, and I think we were told that the turbines are actually controlled remotely, electronically, in Germany. Is that correct? If that is the case, how does the operator that far away optimise it to ensure minimal impact of noise on surrounding residents?

Mr Beer: The Senvion business has a centre in Germany called our permanent monitoring service. That team monitors the turbines across the globe. Their role is not to control the turbines in terms of maximising operations or wind; their role is to respond to faults that may arise on a turbine and to initiate the response and fault finding. The turbine control system itself actually takes into account the conditions at the site to determine, obviously, direction of the turbine, pitch, et cetera, to maximise the operation of the turbine.

Senator BACK: Is there any manual control at Cape Bridgewater itself by personnel on-site?

Mr Beer: The only on-site control is in relation to the maintenance of the turbines. So our team at site each day will attend to site. If there are scheduled maintenance activities to perform, they will liaise with the monitoring team in Germany to instruct them that we are shutting a turbine down, and then they will perform their scheduled maintenance works, and, at the end of that, notify the team in Germany that we are restarting the turbine, and that is the extent of their activity.

CHAIR: We heard evidence as to the turbines at Cape Bridgewater fulfilling noise compliance obligations in the conditions of the project's planning consent. Could you please confirm whether any of the Cape Bridgewater turbines have ever been adjusted to operate in a reduced noise mode?

Mr Beer: Not that we are aware of. That question is probably more appropriately directed to the customer, who needs to take into account their compliance with their permits, but we are not aware of any reductions in turbine performance as a result of noise.

CHAIR: Earlier in Senator Back's questioning, you spoke about the Bald Hills project. Could you enlighten the committee as to whether there was ever a problem with lifting gear that did not meet Australian safety standards being used in the erection of the turbines?

Mr Beer: Excuse me; there was a bit of background noise. Could you repeat the question?

CHAIR: Following on from Senator Back's questioning on the Bald Hills project, would you be able to inform the committee of whether there was ever any lifting equipment used that did not meet Australian safety standards at the Bald Hills project?

Mr Beer: We are not aware of any equipment that did not conform to the Australian standards. We are required to retest lifting equipment to meet Australian standards. So periodically we will retest items prior to the performance of any lift.

CHAIR: Thank you. There being no further questions, we thank Senvion Australia for their appearance today before the committee.

LAURIE, Ms Sarah, Chief Executive Officer, Waubra Foundation

[12:14]

CHAIR: Welcome. Could you please confirm that information on parliamentary privilege and the protection of witnesses in evidence has been provided to you?

Ms Laurie: Yes, it has.

CHAIR: Thank you. I now invite you to make a brief opening statement. At the conclusion of your remarks I will invite members of the committee to put questions to you.

Ms Laurie: Thank you, Senators, for the invitation to attend this Senate inquiry into regulatory issues relating to industrial wind turbines.

The systemic regulatory failure with respect to the way industrial and environmental noise pollution is regulated in Australia is not confined to wind turbine noise. As you would have seen from the submissions of the Wollar Progress Association; and residents living near the coalmines in the Upper Hunter region and residents of Lithgow impacted by coal fired power stations and extractor fan noise and vibration. Their stories, both with respect to the range and severity of symptoms and the way they are treated by the noise polluters and the government regulatory authorities, are all too familiar to the growing numbers of rural residents living near industrial wind power generators.

Once sensitised, residents affected by infrasound and low-frequency noise from coal fired power stations find they also react to wind turbines in the same way. The body and the brain do not care about the source of the sound and vibration. The reactions are involuntary and hardwired, and part of our physiological fight/flight response.

At the heart of this systemic regulatory failure of environmental noise pollution is the failure of the planning and noise pollution regulations, because they all fail to varying degrees to predict, measure and regulate the excessive noise and vibration in the lower frequencies—in the infrasound and low-frequency noise regions, specifically between 0.1 and 200 hertz. These regulations also permit levels of audible noise which are guaranteed to cause adverse impacts because they are so much higher than the very quiet background noise environments in rural areas. These rules are not fit for purpose, and guarantee that some residents will be seriously harmed.

There has been pretence that there is no evidence of harm at the levels of infrasound and low-frequency noise being emitted. This is untrue. There is an extensive body of research conducted by NASA and the US Department of Energy 30 years ago, which: established direct causation of sleep disturbance and a range of physiological effects euphemistically called 'annoyance'; acknowledged that people became sensitised or conditioned to the noise with ongoing exposure; and recommended exposure thresholds in order to ensure residents were protected from harm directly caused by this pulsing infrasound and low-frequency noise.

This research was conducted in residents living with sound and vibration from military aircraft, from gas and from wind turbines. Small rooms facing onto the noise source were described as being the worst. Residents described feeling unpleasant sensations at levels where the sound could not be heard but could still be perceived. These recommended exposure limits and the evidence of direct causation were widely known at the time but appeared to be ignored by noise pollution regulatory authorities and acousticians ever since and have never been adopted. This is a serious failure of the professional and ethical responsibilities of the acoustics profession.

Many medical practitioners remain completely ignorant of the effects of excessive noise in the lower frequencies, other than acknowledging that excessive night time noise could cause sleep disturbance which, if prolonged, could cause serious harm to physical and mental health. They do not realise that the neurophysiological stress, the cardiovascular pathology, the mental health pathology, and the cancers and chronic infections resulting from immunosuppression are all related to chronic sleep deprivation and chronic stress. Both these are designated as indirect effects from noise pollution by some, including the NHMRC in their 2010 rapid review.

However, the effects of chronic sleep deprivation are anything but indirect, as the UN committee against torture and cruel, inhuman and degrading treatment has specifically acknowledged. In addition, there is a substantial body of research which has established a disease complex called vibroacoustic disease, also caused by excessive infrasound and low-frequency noise. Most of that research has been done in an occupational setting. This disease causes permanent damage to a variety of organs and tissues including, for example, damage to cardiac valves from thickened collagen, which is now being reported in residents living near industrial wind turbines in Germany and in Australia. It is concerning that in Portugal this pathology has been identified in a child exposed to excessive infrasound and low-frequency noise in utero and in his early years. People living near coalmines in the Upper Hunter have also started to report pathology consistent with vibroacoustic disease.

Also of concern are the unexplained and life-threatening adrenaline surge pathologies being reported by residents living near coalmines and industrial-scale wind turbines in Canada and Australia: takotsubo heart attacks and acute adrenal crises with reported blood pressures well over 200 millimetres of mercury systolic. There is a concern among some cardiologists with an interest in takotsubo cardiomyopathies that excessive lower frequency sound energy could be causing some of these cases. At the moment we have minimal information about the exposure doses when these events occur but it is hoped that portable dosimeters which can accurately measure these exposures to infrasound will expand our knowledge.

In summary, there has been a fundamental failure of the health, planning and noise pollution regulatory authorities to listen, investigate and act decisively to stop the predictable and serious damage to the health of vulnerable rural community members. The systemic regulatory failure is not confined to rural areas, however. The culture of silence—the use of gag agreements to silence both sick people and independent acoustic consultants—has meant that important scientific knowledge is kept out of the public domain. This problem is increasing in scale because of the increasing industrialisation of our quiet rural areas and because machines are getting bigger, so there is a shift in frequencies generated down to the lower part of the spectrum. This problem is not going to go away. Planning and noise pollution regulatory authorities are invariably physically located hundreds of kilometres away from where the adverse impacts are experienced and are not held accountable to anyone for the public health disasters in rural communities which their decisions are creating.

The National Health and Medical Research Council has gravely failed the Australian public and the governments it advises by failing to ensure that serious conflicts of interest were not prevented with their choice of experts for their literature reviews. These have had a material impact on the quality of the advice from the NHMRC and have led to dangerously optimistic predictions about the safe distance of impact from wind turbine noise, for example. This has been achieved by cherry-picking data, ensuring the goalposts for the inclusion of studies were extremely narrow, and even resorting to misclassification of studies. The only possible reason for it was to ensure these studies were never included because they would damage the commercial interests of the wind industry. Incompetence is another, perhaps less likely, explanation.

The human cost of the failure to protect people from excessive noise pollution, especially at night, is terrible. I have personally helped to prevent a number of suicides of people who were utterly desperate because of the consequences of excessive noise pollution and who reached out for help. It was just lucky that I was available by phone or email and could help them find the help that they needed at the time. However, I am aware of others who did not receive such help and who did take their own lives. Sadly I have good reason to suspect that they are the tip of the iceberg and there will be more.

We need systemic regulatory reform and we need it now across all noise and vibration sources. The current system, where the noise polluters pay the acousticians handsomely to investigate, is not working to protect public health. He who pays the piper calls the tune. We also need tightly targeted research to accurately measure the exposure doses of people reporting adverse impacts inside their homes and to measure objectively their reactions to that noise as well as their reports of their symptoms. We need a commitment from the federal and state ministers of health and the chief medical officers in each state that this health-damaging excessive industrial noise pollution will be dealt with to protect people from further harm. A national noise pollution regulatory authority with strong powers to investigate, regulate, conduct targeted research and set standards free from commercial conflicts of interest, which are then actively and transparently enforced, is required right now.

Finally, there is the matter of which ministers are the most appropriate to have responsibility for this issue. It is the World Health Organization, not the world environment organisation, that has issued major reports over the last 10 or 15 years, such as the 2009 *Night noise guidelines for Europe*. It is our strong view that this is a public health issue and therefore should be under the direct and regulatory control of ministers for health, not ministers for the environment. Ministers for health have a stronger direct incentive to help prevent disease.

Senator DAY: Thank you, Ms Laurie. You have been here all day today and have heard evidence from a number of witnesses. For me, being on this inquiry has been a bit like living in a parallel universe. We have had people citing evidence from all over the world about the adverse health effects of wind turbines and then we have had evidence from people completely dismissing any connection whatsoever. He who pays the piper calls the tune. I accept that that could explain some, but it would not explain all of it. Can you shed any light on the rest? Why are so many people—public servants and others—so dismissive of there being any health impacts at all?

Ms Laurie: I think there are a variety of motivations. I am quite shocked that even now not one health authority has gone and directly investigated for themselves—not one. I think that says it all, really, in terms of the responsibility of health departments. I think there is enormous ignorance, as I have said, amongst the medical profession. There is a bias against believing that there is a problem with wind turbine noise.

I think people come at it from a variety of different standpoints. I know I myself was very reluctant to accept that there could be anything wrong. I used to take my children to go and watch wind turbines being built locally near our home. I had no idea about any adverse health impacts from wind turbines. I have a lot of friends who are Green-voting environmentalists, very concerned about the planet, very concerned about their children's futures. I wonder if that has something to do with it.

But, when you listen to the stories of people affected by noise when they are trying to sleep in their beds at night, it does not matter what the source of the noise is if they cannot sleep and they are having these other very distressing symptoms and deteriorating health. The people I speak to do not mind what the source of the noise is; they just want it to stop.

Senator LEYONHJELM: Ms Laurie, I have read your submission and I have heard your comments at various times. I am interested in your thoughts on this because you have spent a lot of time working on this. You are a medical doctor, aren't you?

Ms Laurie: That is correct.

Senator LEYONHJELM: It seems to me that it is a well-established scientific fact that infrasound can cause human harm.

Ms Laurie: That is correct.

Senator LEYONHJELM: I do not think anybody disputes that, do they?

Ms Laurie: Some do. It depends on the dose and it depends on the exposure time.

Senator LEYONHJELM: Yes. That is where I am going. So infrasound can cause harm. It is also not disputed by anybody that wind turbines emit infrasound. Have you heard anybody deny that, apart from the South Australian government?

Ms Laurie: No. Increasingly now I think the comments are that there is evidence proving that it is in fact emitted.

Senator LEYONHJELM: It seems to me the issue is whether enough infrasound is emitted from wind farms, under some circumstances if not all circumstances, to cause human harm. Would that be the proposition?

Ms Laurie: I think that is right. It is certainly a dose response relationship. However, people living near sources of industrial noise talk at various times about audible noise that is clearly disturbing to them if it is above the level of their television. I think Clive and Petrina Gare talked about that in their evidence. For some it is the pulsating, radiating quality of the sound that penetrates into their home and for some it is the sensations that they feel, which might be correlated to vibrations. Steven Cooper's work down at Cape Bridgewater went into that in the most considerable detail of anyone in the world.

There is still a lot we do not know, but it is the combination of the frequency that people are exposed to and the features of the house, the acoustic resonance that might happen in certain rooms. Even the position in the a room can have an impact, together with the individual's susceptibility. But until we measure what people are actually exposed to inside their homes—the sound and the pressure pulsations together with the vibration coming up through the ground—we will not know what their exposures are.

Senator LEYONHJELM: You mentioned chronic sleep deprivation and chronic stress as being key elements in this.

Ms Laurie: Yes.

Senator LEYONHJELM: Is there any particular reason for that? The reason for my question is that we have had other witnesses mention the Canadian health study, which focused on annoyance, which may not include those things. We have also had people suggest it involves the middle ear. I think somebody suggested it relates to the inner ear. We are hearing from a witness this afternoon who thinks it has a relationship to the vestibular mechanism. So why do you think chronic sleep deprivation is the key to it?

Ms Laurie: I think there are four key areas. Chronic sleep deprivation is the most widely reported symptom, and that seems to be the thing that really undoes people. Chronic stress can be associated with that. If you are chronically sleep deprived, that in itself can cause a chronic stress response. However, the chronic physiological stress is also part of what we are hearing from people.

The Japanese study, the Inagaki study, which measured the brain responses of Japanese wind turbine workers when exposed to reproduced wind turbine sound, showed clearly and objectively that the brain could not attain a relaxed state. Those EEG studies are precisely the sorts of studies I believe we need to do inside people's homes

to measure what their brains are responding to, because the clinical stories that they are giving are very consistent—that they are getting a physiological response.

Sometimes it can be that they are waking up in a very anxious, frightened, panicked state, and that can happen repeatedly. One of my colleagues from America, Dr Sandy Reider, has talked about a patient of his who woke up repeatedly in that state 30 to 40 times a night. It did not take long for that combination of sleep deprivation and repeated stress to wear this person down. He left and came back repeatedly. He was fine when he was away. He came back and got the same symptoms. He eventually moved away and his health is now improving. So the two are linked but separate.

However, I believe the vestibular system is actually the mechanism by which the brain is being affected by the sound energy. So it is via the vestibular system. Professor Salt's work has shown that, if you stimulate the outer hair cells in the inner ear, some of the afferent fibres will take that sound energy and translate it into pulses into the brain that stimulate the alerting response in the brain. I think that is really the crux of the physiological response in what we are seeing.

Senator LEYONHJELM: But we have heard evidence that obviously not everybody—in fact, not even a majority—of people exposed to wind turbine noise or sound are adversely affected. Dr McMurtry suggested it was somewhere between five and 30 per cent of people. If that were the case, it would tend to suggest that there is a source of individual variation and that something like the motion sickness mechanism, a middle ear or vestibular mechanism, might explain it. If chronic sleep deprivation was the explanation, I think you would expect—and I am interested in your thoughts on this—people to be broadly affected the same way, wouldn't you?

Ms Laurie: No, because everybody is impacted to different levels by the sound. Perhaps some examples will help. There are some couples where one partner was affected immediately when the turbines started operating and for the other partner it was months or years before they noticed an impact. I believe David Mortimer has given evidence to the inquiry. David and Alida are a good example. David was impacted very early on, within days to weeks of being exposed. Alida was fine for four years, and now she is quite badly impacted. Everybody is different, and everybody has different susceptibilities. Malcolm Swinbanks has shared with me some research from the 1970s related to the size of the helicotrema, which is a little hole in the inner ear. The smaller the hole, the greater the sensitivity to low-frequency sound. Alec Salt's work with guinea pig models has provided some confirmatory evidence of that. Apparently when that hole is blocked the sensitivity to infrasound and low-frequency noise increases markedly. I also have heard from pharmacologists, pharmacists, that if people are on narcotic medication for pain relief then that can increase their sensitivity to sound.

So, a wide variety of individual factors can influence that. From my experience there is a subset of people who are terribly impacted very early on. Those people are the ones who tend to present with acute vestibular disorder type of symptoms—dizziness and motion sickness, which can be accompanied by extreme anxiety. Those people often just cannot last very long, and they move if they can. Trish Godfrey is one who has given evidence; Mrs Stepnell is another. They would fit in that category. However, for people in the same house, exposed to the same levels, like Carl Stepnell, it took a lot longer. Eventually he was impacted but in a different way.

In understanding the public health consequences, when you look at the population surveys that have been done, just looking at the sleep issue, a number have been done in Australia, one by an Adelaide University master's student called Frank Wang. It was a population survey out to five kilometres, and 50 per cent of the people reported moderate to severe impacts from the turbine noise at Waterloo. From that, Mary Morris repeated his survey out to 10 kilometres—a smaller percentage, because it is a bigger area, so you get the dilution effect, but nevertheless she found that people were adversely impacted in terms of their sleep. Some of those people have subsequently had acoustic measurements done inside their house, which has confirmed that they are being subjected to excessive levels of low-frequency noise and that infrasound from the turbines is present. These people cannot see the turbines. Sometimes they can hear them. But they are being reliably and predictably disturbed—for example, when the wind is blowing towards them or when there is a cold, frosty night, because that cold air acts as a blanket to keep the sound energy down and stop the refraction up. That was something that Kelley and the NASA research showed 30 years ago. So, we have a lot of knowledge about what the impacts are and the distance of impacts.

Senator LEYONHJELM: But I have one final question: you mentioned this distance out to 10 kilometres; I have asked Steven Cooper what he thinks is an appropriate distance for wind turbines currently being constructed, and he says that 10 kilometres is probably about right. What is your view on that?

Ms Laurie: It depends on the size of the turbines and the power-generating capacity.

Senator LEYONHJELM: I mean the ones currently being constructed—three megawatts—

Ms Laurie: Yes, for three megawatts, 10, just based on the reports from the residents.

Senator LEYONHJELM: So, 10 kilometres for three megawatts?

Ms Laurie: Yes.

Senator URQUHART: There has been some controversy over your qualifications and professional standing so, for the record, could you let us know what your standing and professional qualifications are now?

Ms Laurie: Certainly. I am a medical graduate. I graduated from Flinders University with a bachelor of medicine, a bachelor of surgery, in 1995. I subsequently did postgraduate training in rural general practice. I attained my fellowship of the Royal Australian College of General Practitioners in 1998, I think it was, and subsequently was invited to become a clinical examiner for that college, which I did for a couple of years, until I became unwell. I attained my fellowship for the Australian College of Rural and Remote Medicine just after that, and I was one of the councillors on the South Australian Medical Association branch for a period of time, but that was prematurely cut short when I was diagnosed with an illness. I took time off and then subsequently had children, and I had intended to go back to work professionally as a country GP. A few other things got in the way, including finding out about what low-frequency noise is doing to people.

Senator URQUHART: So, currently you are not registered as a—

Ms Laurie: I am not currently registered to practise; that is correct. However, I am very keen to return. I really want to see some progress on this issue, because I do not want to abandon people who have invested a fair amount of trust and hope that things will change.

CHAIR: Just for the record: you have never been deregistered, have you?

Ms Laurie: I have never been deregistered, and apart from the defamatory complaint that was publicised and circulated from the Public Health Association of Australia, in which I believe the wind industry had a fair hand, I have never had any disciplinary complaints against me whatsoever.

Senator URQUHART: Thank you.

Senator BACK: Dr David Iser appeared before the committee in Melbourne. When did Dr Iser first report on what he believed to be the impacts and their causing of adverse health effects to people in the vicinity of industrial wind turbines?

Ms Laurie: May 2004 was when he wrote to Premier Bracks, Minister Brumby, Minister Delahunty and Minister Thwaites about the results of his population survey at Toora in Victoria. That was a world first. To my knowledge nobody else had ever done a population survey which demonstrated that not everybody was impacted but, of the people who were impacted, three were severely impacted, and I think five were moderately impacted.

Senator BACK: Did he report the actual clinical signs he was observing and did he validate medically the symptoms people were reporting to him?

Ms Laurie: He did in the sense that for some of them he was their treating doctor. In fact, that was why he became concerned about what was going on, because these people were presenting. People he had treated and known for a long time were presenting with these new problems, and some of them were very unwell, and that was why he did his research.

Senator BACK: That was the original work done. Can you tell me when the Waubra Foundation formed?

Ms Laurie: The foundation was established by Peter Mitchell in March or April 2010. I was invited to join in July or August 2010. I can give you the exact date, but I cannot remember it off the top of my head.

Senator BACK: We are actually talking about a six-year time gap between when Dr Iser first presented the population survey to the ministers of the Victorian government and when the Waubra Foundation was formed.

Ms Laurie: That is correct.

Senator BACK: Can you explain to me then why it is the Waubra Foundation that has been the butt of so many allegations and accusations of the spreading of fear if indeed Iser's work was out in the public arena for six years?

Ms Laurie: I think there are a whole lot of reasons for that. I think it is a case of shooting the messenger—clinical whistleblowers—particularly if there are significant sums of money involved, as well as some ideology and concern about the environment. I think there are a whole lot of reasons that the message of the foundation has not been well received. And I should say that from the inception Peter Mitchell, as an engineer, was well aware that large rotating fans could generate noise, some of which was subaudible, so could therefore potentially have an impact on human health. So, from the beginning the foundation has been concerned about a variety of noise sources. We are concerned about the interface of the sound energy on people and promoting research that will

help protect people. The source of the noise is a secondary consideration. We have been targeted particularly by the wind industry. If the coal industry and the gas industry were more aware of what we do, helping people directly impacted in communities like Tara in Queensland, up in the Hunter, in Lithgow, in Wellington and at some other sites, perhaps we would generate the same heat from them.

There is clearly a problem. The industry itself has admitted there is a problem. It is time that the facts were faced and we got some hard, objective evidence of what people are exposed to inside their homes, worked out exactly what thresholds are triggering this response and made sure that the noise pollution levels and vibration levels inside homes, no matter the noise source, do not exceed those thresholds.

Senator BACK: As a person with medical degrees and having been a fellow, as you have explained, of the college of rural practice and related areas, can you explain to me the circumstance of why you believe the Australian Medical Association has come out with its statement to the effect that there are no adverse health effects from industrial wind turbines in the face of evidence presented by peers within the medical profession refuting that.

Ms Laurie: I really cannot explain—I really do not understand—why they have come out and said that in the face of the clinical evidence that we know already about what sleep deprivation and chronic stress do to people. That position is not based on scientific evidence. The AMA have been repeatedly asked by people impacted by wind turbine noise to come and visit them, listen to their stories and listen to their own doctors. There are a number of doctors who have been prepared to stick their heads up above the parapet and say, 'I believe my patient is impacted by wind turbine noise.' Many of the people I speak to say that their doctors are not prepared to put that opinion in writing because they have seen what has happened to me and they are very concerned that they will be attacked, denigrated and publicly vilified and have their reputations smashed in the media. I can understand why the treating doctors are reluctant to put some of this in writing. For the Australian Medical Association to have come out with that position statement, in the face of the evidence that it was subsequently presented with, and refuse to either change it or investigate it, I think it reflects very poorly on the organisation.

Senator BACK: I have been nonplussed about it, but I just thought you might have had a more recent explanation, particularly given the history of some in the medical profession over time. Thank you very much and thank you for the work you do.

Ms Laurie: It is a pleasure. I should add that I have written on a number of occasions to the AMA and I am yet to receive any response whatsoever from them.

CHAIR: Ms Laurie, could you tell us when it was first known that people exposed to chronic excessive infrasound and low-frequency noise did not get used to that sound?

Ms Laurie: The first reference I can find is in Dr Kelley's work, the extensive acoustic survey that was conducted in Boone County in America with NASA and, I think, 15 or so American research institutions—General Electric were part of it; there were quite a number of aero-acoustics and mechanical engineering university faculties involved. I was very interested to read that because on, I think, page 199 of that 1985 acoustic survey they specifically say that there are residents who have become conditioned to the sound—the later terminology is 'sensitised' to it. What that means is that they do not become used to it and they get progressively more sensitive as time goes on. The reason this is important is that, if you do not have sufficiently low thresholds set to protect people, over time they are going to get worse and we are going to have more and more people in our communities who are chronically sensitised to the sound. That really is a terrible thing for the people concerned because then they can pick up very low-frequency sound energy from other sources. They end up in a situation where they find it often very hard to sleep—they are perpetually sleep deprived—and they have a physiological stress response. They do not do well. They can become profoundly depressed and acutely suicidal.

One of the interesting pieces of research which a marine biologist and acoustician sent to me the other day—and I believe Geoff McPherson gave evidence to the inquiring in Cairns on this—was done into wild seal populations in Scotland. The researchers subjected the seals to different sorts of sound energy but at the same levels. There was sound energy that had a rapid acceleration, so it was very impulsive. And there was sound energy which was at the same level but had a much slower rise of the impulse. They found that the seals that were exposed to the rapidly impulsive sound did really badly. They showed signs of being conditioned and sensitised to the sound. But the seals that were exposed to the slower rising sound energy at the same peak level became used to the noise. They were habituated to it; it just did not worry them. I think there is something very profoundly important about the rate of acceleration.

There is actually one paper—although, I have not managed to track it down—that was cited by Dr Norm Broner, who you will be hearing from this afternoon, and also Dr Leventhall. It was in Dr Broner's fairly major

review from 1978 of infrasound and low-frequency noise. This was a paper by a man called Bryan. It specifically talked about the rate of rise in acceleration of the sound impulse being important with annoyance for this particular case that he was reporting on. I do think there are scientific clues from a long time ago that help us to understand that, perhaps, it is not just the level but the rate of acceleration as well.

CHAIR: Going back to the AMA's position statement, why does the AMA's position statement not address audible noise concerns? Do you know?

Ms Laurie: Again, I do not know. You would have to ask the AMA. I think audible noise is reported by the residents to be a major problem. As I said in my opening address, if you have loud levels of audible noise pollution way above the background level, acoustic experts say that anything that is background plus five you are going to start to notice it. Background plus 10 is excessive and is going to cause an impact. Background noise levels in Australia might be 18, 20 dB—maybe 25. You have allowable levels in South Australia of 40 or 35. That is going to cause an impact, a significant adverse impact, particularly because this sound energy is being transmitted especially at night when people are trying to sleep. Quite apart from low-frequency noise or infrasound, if you have excessive audible noise then you have regulations that are not protecting people.

Senator LEYONHJELM: I would be interested in your thoughts again. You have spent so much time on this. In light of the fact there is a paucity of research, I think your investigations are as good as we are likely to get on some of these areas, so I appreciate your thoughts. You can get used to loud noises without becoming sensitised when they are not infrasound. I am a living example. I live under the flight path of Sydney airport. I have done so for 30 odd years. Unless it blocks out the TV, I sort of tune it out. Yet we are not hearing that people, or some people at least, are capable of doing that with very low-frequency sound. Do you have any thoughts on whether anyone can do it? And if they cannot, why not?

Ms Laurie: Professor Salt has done some interesting work looking at this. He uses an analogy which, I think, is a useful one. If you think of the cochlea as being a little bit like the pupil in the eye that regulates the amount of light that gets into your eye, then, in an environment with a lot of light, your pupil constricts, and so less light gets in. And the converse happens. In quiet country environments at night, when people are asleep, because there is not a lot of loud background noise in their environment, the cochlea opens wide open. What happens, according to Professor Salt, is that a higher proportion of the low-frequency sound gets through to the afferent fibres, which are stimulated and send a message to the brain, and that, we believe, is the basis for this waking at night in a panic state, or the disturbed sleep. As to the evidence that supports this, you might remember Mrs Gare talking about how she sleeps with a radio on and ear plugs in her ears. Having some additional noise helps to close the cochlea down, if you like, in terms of the amount of the very-low-frequency sound and infrasound energy that gets transmitted through the brain.

That is where I think EEG studies inside people's homes would help. We cannot do to the people what Professor Salt did to the guinea pigs, but I think if you have the EEGs you have objective evidence of what is going on. If you have concurrent full-spectrum acoustic monitoring at the same time, then you can see what people are exposed to and see what the brain response is.

Senator LEYONHJELM: Full spectrum, and do you have any thoughts on this argument amongst the acousticians that every 10 minutes is all right—and averages and so forth?

Ms Laurie: It is rubbish. We are talking millisecond responses. We are talking of a stimulus response. So, no, 10-minute averages will not cover it. It hides the peaks. The ear and the brain respond to the peaks.

Senator LEYONHJELM: I have no better idea than you, but I wonder whether it is the peaks we are talking about, rather than anything else, that are responsible for these adverse reactions?

Ms Laurie: My hypothesis is that it is these sudden peaks. That is why I am so interested in this idea that where you have more than one wind turbine generator and you have the synergy of the different frequencies from a number of towers, and the pressure bolt effects that people are describing, I actually think that that is a very, very important point. People are reporting being dropped to their knees suddenly with pressure waves—big, burly farmers being dropped to their knees. That is not happening at developments where there is only one wind turbine, in my experience. This is happening where there are multiple wind turbines. I suspect there is a cumulative impact from the forces.

CHAIR: Thank you for attending and for your evidence.

Proceedings suspended from 12:57 to 13:29

BROOKS, Mr David, Chairman, Parkesbourne/Mummel Landscape Guardians Inc.

CRAWFORD, Dr Michael Arthur, Private capacity

LYONS, Mr Michael David, Coordinator, Bodangora Wind Turbine Awareness Group

TOMLINSON, Mr Mark, Member, Residents against Jupiter Wind Turbines Noise Committee

CHAIR: Welcome. Could you please confirm that information on parliamentary privilege and the protection of witnesses and evidence has been provided to you?

Dr Crawford: Yes, it has.

Mr Brooks: Yes.

Mr Tomlinson: Yes.

Mr Lyons: Yes.

CHAIR: Thank you. The committee has your submissions and I now invite you to make a brief opening statement and at the conclusion of your remarks, I will invite members of the committee to put questions to you.

Dr Crawford: Thank you for the invitation to appear here today. I am speaking as a private individual, though I am also a board member of the Waubra Foundation and a member of the local group, Residents against Jupiter Wind Turbines. Members of that group have had extensive dealings with the New South Wales planning department as well as other New South Wales agencies in relation to Jupiter and other wind farms. While I am critical of the way the system currently operates, I acknowledge that the current New South Wales Minister for Planning, Rob Stokes, and his predecessor Pru Goward, as well as the secretary of the department, appear to be trying to improve the process. But institutional inertia is powerful and the changes are slow, meanwhile innocent people are being badly harmed and that will continue under current arrangements.

I have worked for more than 30 years as a management consultant to private and public sector organisations, normally advising the CEO and other senior executives on matters of corporate strategy and organisation design. While my first degree was in physics and maths, my PhD relates specifically to organisation design and my subsequent research was in corporate change. I also taught on executive programs at the Australian Graduate School of Management. That is by way of background.

It is clear to me that the current processes for approving and regulating wind farms in New South Wales are excessively complex and neither economically efficient nor socially just. They are essentially a tick-the-box planning exercise with little integrity, conducted at large public and private expense, to produce an outcome favourable to developers. As you have already discovered, conditions imposed by wind farm approvals are quite deficient and, unlike some industries such as coalmining in New South Wales, compliance testing and enforcement is virtually non-existent. Without effective compliance and enforcement in any field, conditions will be regularly breached.

It is possible to add some integrity to the current approvals system in various ways such as relying only on data provided by parties with no association with the proponent, not accepting judgements made by consultants hired by the developer to support their case and imposing decommissioning funding conditions guaranteed to not leave the taxpayer or the local community on the hook.

Alternatively, it is possible to remove most of the inefficiency, subjectivity and injustice by replacing the current regulatory process by a standards-based one that forces developers to absorb externalities through fair commercial transactions and imposes genuinely rigorous ongoing noise monitoring with material costs for breaches. Such an approach would be far more transparent and much less exposed to the risks of corruption than the current process. Our local group provided the previous New South Wales planning minister with advice on how that could be done but have heard nothing further. Hopefully this committee will have more success. Thank you.

Mr Tomlinson: Thank you for giving me the opportunity to speak here today. Residents against Jupiter Wind Turbines is a community group established in the Tarago area of New South Wales opposing the proposed Jupiter wind farm. A subcommittee was formed, now known as the noise committee, and members of this committee are tasked with investigating various aspects of wind turbine noise. Some of these areas are noise propagation and the effects of topography and geographical spread, the relationship between multiple turbines and wind shear relating to international standards—just to mention a few.

My role as a member of the noise committee is to investigate the background noise monitoring process as outlined in the various wind farm guidelines used in New South Wales. This role involves monitoring equipment set-up, data collection, data analysis and preliminary findings reports. This has also led into the investigation into

wind turbine infrasound. The committee purchased industry standard class 1 noise monitoring equipment and use the current New South Wales draft wind farm guidelines and the 2003 South Australia wind farm guidelines as guiding documents, as used by the Department of Planning and Infrastructure.

In January 2015, we commenced a monitoring program to ascertain the ambient environmental background noise at six properties around the proposed wind farm. We have currently completed five and, as a result, have discovered numerous deficiencies within the guidelines used for wind farm approvals. The major deficiencies include removal of extraneous noise; wind over microphone; position of monitoring equipment; checks and balances as to the accuracy of noise monitoring reports submitted by developer-paid acousticians; ongoing compliance monitoring; and others listed in our submission.

In our monitoring program, we employed a Svantek 977 class 1 noise data logger, a wind data logger positioned at microphone height, a wind data logger on a portable 10-metre tower and a TASCAM DR-40 digital sound recorder to achieve full 24/7 sound recordings for the purpose of extraneous noise removal. We have also purchased three microbarometers, which are capable of recording infrasound levels from 0.05 hertz to 20 hertz, with which we have recorded wind turbine infrasound out to 14 kilometres.

I must stress at this point that we are not acousticians and we do not purport to be such; we are simply a community group putting forward our views and observations after conducting background noise monitoring, according to the relevant wind farm guidelines used in New South Wales. We believe the current wind farm guidelines are in no way adequate and must be amended as a matter of urgency. Thank you.

Mr Lyons: In the interests of time, I think you will find you already have a copy of my opening address. I am quite happy to pass on making opening remarks, so that we can get on with more questions.

Mr Brooks: Before I begin my presentation, I would like to thank you for all the work that you have done on the issues of this inquiry, especially for your interim report. If all its recommendations are implemented then there will be some hope that wind farm neighbours will find some relief at last. Today, I will limit myself to three topics that concern planning and regulation. I will deal with each topic briefly and then draw some conclusions from them, taken together. For evidence in detail for what I shall say, I must refer you to my submissions.

Topic No. 1: first, I wish to summarise the situation relating to the unauthorised turbine relocations of the Gullen Range wind farm because this matter illustrates the unreliability, incompetence, negligence and impropriety of the planning and assessment of wind farms in New South Wales. I realise that you cannot directly affect state planning issues, but it is important that you should be aware of them if you are to make recommendations for the federal government's negotiations with the states through COAG, and for new measures regarding federal agencies. It is not an exaggeration to say that the suffering of wind farm neighbours is almost entirely due to inadequate planning and assessment at state level.

The project approval for the Gullen Range wind farm prohibits the proponent from moving turbines up to 250 metres from their approved positions without seeking permission from the Minister for Planning—that is condition 1.5. Moreover, section 75W(2) of the Environmental Planning and Assessment Act 1979 of New South Wales insists that modifications that are not 'consistent with the existing approval' require the permission of the Minister for Planning. The proponent ignored these conditions and built the infrastructure of the wind farm with 69 of the 73 turbine footings in the wrong place without seeking the permission of the minister. This was a clear violation of both the project approval and the EPA Act. Nonetheless the department of planning has allowed the proponent to submit a modification application in order to get retrospective approval for all these violations, and the department has consistently recommended that such retrospective approval be granted by the Planning Assessment Commission.

I cannot go into all the twists and turns by which the department has justified its response to this violation. You may wish to ask questions about that presently. Here, I only wish to point out that a project approval and a clause in a law, which have perfectly clear and intelligible meanings, are being deliberately disregarded by the department and that the department's only justification for this is sophistry. This makes a mockery of the idea of regulation. That is topic one.

Topic 2, much more briefly: the Gullen Range wind farmhas been approved under the completely inadequate South Australian noise guidelines 2003. When neighbours have asked for the approval to be reviewed because of the deficiencies of the noise guidelines, they have been told that this cannot happen because the EPA Act allows a developer to sue the minister for compensation if the minister revokes or modifies an approval. The planning law in this way gives certainty to the developer but excludes any possibility of relief to neighbours.

Topic 3: under the Renewable Energy (Electricity) Act, the federal act, the Clean Energy Regulator can consider suspending the accreditation of a wind farm if the regulator 'believes on reasonable grounds that the

power station is being operated in contravention of a law of the Commonwealth, a state or a territory'—that is subsection 30E(3). However, the regulator seems to have unlimited discretion to avoid forming a reasonable belief. There is abundant evidence in the public domain that the Gullen Range wind farm is in breach of New South Wales law, but the New South Wales department of planning refuses to say so and the Clean Energy Regulator refuses to consider all the evidence. Moreover, the Clean Energy Regulator has adopted the preposterous position that it can only test whether a wind farm is in breach of law in the present. It cannot, so it thinks, test whether a wind farm has been in breach in the past.

If the New South Wales Planning Assessment Commission gives retrospective approval to all the violations of the project approval of the Gullen Range wind farm, the Clean Energy Regulator will refuse to consider whether the wind farm has been in breach of New South Wales law and the wind farm will keep over a year's worth of renewable energy certificates, worth somewhere in the region of several million dollars to which, arguably, it is not entitled. Those are the three topics; two quick conclusions.

Firstly, a law or a project approval can be quite clear and unambiguous, yet a government agency will arrogate to itself the discretionary power to disregard the clear meaning of that law or that approval, and to render it meaningless. There is no check or balance to prevent such an abuse of power by that government agency. Both the New South Wales department of planning and the Clean Energy Regulator are guilty of this abuse of power. Secondly, when the law protects the rights and capital of a developer then the law is hard and firm and solid, and will be respected by government agencies. But when a law is likely to make difficulties for a developer, a regulatory agency will use sophistry to disregard the law and to avoid enforcing the law against the developer. This gives the developers a privileged position in the face of the law, offends against the principle of equality before the law and subverts any possibility of serious regulation.

Finally, in view of these facts, there needs to be a royal commission into wind farm development in Australia. Such a commission is necessary if the corrupt nature of planning, assessment and regulation is to be addressed and overcome. Thank you.

Senator DAY: Dr Crawford, I am drawing on your experience with organisation and corporate culture. Can you explain why, in the face of such overwhelming evidence regarding the adverse health effects of wind turbines, there is such a denial, which seems to defy all logic, by so many operators, regulators, commentators and others? It is a phenomenon which really intrigues me. You have got a PhD in this, so please enlighten me.

Dr Crawford: Without actually going to the PhD, I believe that it was Upton Sinclair who said something like, 'It's extremely difficult to get someone to understand something when their salary depends on not understanding that.' Basically, if you look at not just the wind industry but regulatory agencies in this area, and given the commitment of government to introduce renewable energy in this country, everyone's incentives are actually aligned with pretending there is no problem. To recognise a problem would put people in the situation where they then have to overtly recognise to themselves that they are behaving in a way which certainly some people would describe as evil—they are inflicting harm on others simply for their personal benefit in terms of ongoing salary and other acceptances.

Senator DAY: Thank you.

Senator LEYONHJELM: I have a question for Mr Lyons. You are part of the group opposed to the Bodangora wind energy facility in central New South Wales. I understand it will have 33 turbines. Can you tell us what is the level of opposition locally to that facility?

Mr Lyons: The community opposition was overwhelming—and still is. I think it has probably grown because people have got themselves a lot more educated as to the negative impacts of wind farms. When we did the submissions to the department of planning and infrastructure, it worked out, I think, that it was 94, 96 per cent opposed within the community. Of those that were not opposed, there were 163 total submissions. I think it was 152 opposed and, of the remainder, I think there were a mixture of government agencies, of which most of them had issues—still unresolved to this day. Of the individual ones, they were from host farms, host families. There were two anonymous and, of those two anonymous, one came from a distance of 50 kilometres outside the project area.

Senator LEYONHJELM: The facility has not been built yet—is that right?

Mr Lyons: That is correct.

Senator LEYONHJELM: When will it be built?

Mr Lyons: As soon as they get finance, and they cannot get finance until they get a power purchase agreement.

Senator LEYONHJELM: They have been waiting for the RET agreement, presumably.

Mr Lyons: That is correct.

Senator LEYONHJELM: How many host properties are there?

Mr Lyons: I am going on memory. This submission went into the department of planning a couple of years ago. I may be a couple out, but I think there were eight host families.

Senator LEYONHJELM: What is their view of it? Have you had any contact with them?

Mr Lyons: I have had very limited contact because a lot of them are my neighbours. I am the largest single non-host neighbour on the southern side of the project area.

Senator LEYONHJELM: Were you offered the opportunity to become a host?

Mr Lyons: Several times.

Senator LEYONHJELM: And you knocked it back?

Mr Lyons: Correct, yes.

Senator LEYONHJELM: Why was that?

Mr Lyons: The first time I knocked it back, I did not know anything about them, to be quite honest. The proponent was quite insistent that I host turbines, but I said no. I said, 'I am going to find out a little bit more about them first before I say yes or no.' At that stage I was pretty open minded. Another contact of mine had done a lot more research into them and through that person I then formed the opinion that these things were not something that should be inflicted on anybody. Call me a nimby if you like but I do not think that these things should be in anyone's backyard, let alone mine.

Senator LEYONHJELM: How much money do you think you turned down?

Mr Lyons: We are talking tens of thousands here. The situation is that Mount Bodangora, which is the name of the property, is the highest point across Australia on the latitude that it sits so it is reasonably high up, it is fairly well exposed to wind and there are quite a few ridges around. I think I could probably put up 10 turbines at least without any worries.

Senator LEYONHJELM: On the basis of $10,000 a year?

Mr Lyons: The contract, which you would have a copy of, is an original contract that I have. It is not something that we made up; it was actually handed to me by a potential host farmer, who eventually knocked the whole project back as well. I understand, from memory, that it was $11,000 for the first turbine and $10,000 per turbine per year after that.

Senator LEYONHJELM: So you are not the only local who knocked back hosting turbines?

Mr Lyons: That is a good question. I would have to get back you on to that.

Senator LEYONHJELM: I thought you said you got a copy of the contract from somebody who knocked it back?

Mr Lyons: Yes, you are quite right. There were several others. I was just trying to think how many, not whether I was the only one.

Senator LEYONHJELM: So was there more than one?

Mr Lyons: There was certainly more than one.

Senator LEYONHJELM: The department of planning and infrastructure, I gather, has told you that they do not have the resources to adequately check on this facility. Is that correct? Can you explain what they said?

Mr Lyons: Yes, they verbally told me that over the phone. They certainly were not prepared to put it in writing.

Senator LEYONHJELM: What exactly did they say?

Mr Lyons: Essentially they said that the department did not have either the financial resources or the manpower resources to check on whether or not the proponent had actually completed what they were supposed to do. As long as the proponent had made what looked like a an attempt to fulfil the director-general's requirements, that was good enough for the department.

Senator LEYONHJELM: We have been unable so far to get the relevant New South Wales authorities to come along and tell us how the process for approving wind farms in New South Wales operates. We do not know whether that is deliberate or not but we hope that we can resolve that before too much longer. In the absence of

that information, can you tell us who approves them and then who checks compliance with the planning approvals subsequently?

Mr Brooks: One fact that may be of interest to you in relation to this is my association went to the Land and Environment Court back in 2009. For that purpose, we subpoenaed all the correspondence between the department and the developer—the original developer. We got two volumes of correspondence. It was quite obvious from that correspondence that the department was indeed helping the developer to put the proposal in a form where it could get approval.

For my world—I used to be an academic—it was rather like a supervisor helping a postgraduate to write a thesis; so the supervisor will say you need more of an argument here, you need more evidence for this bit, this bit of your argument needs clarification and so on. The officials in the department of planning were doing that for the developer for months and months. Whether or not the people who then go on to recommend the proposal for approval are the same officials, I cannot tell you—you would have to ask the department of planning. But certainly the department of planning itself would seem to have a conflict of interest because if a supervisor helps a postgraduate to write a thesis, they do not then examine the thesis.

Senator LEYONHJELM: What contribution does the local council have to that process?

Mr Brooks: They can make a submission just like anybody else but they do not have any authoritative power of decision.

Senator LEYONHJELM: Once it is built and operating, what is your understanding of checking compliance with planning conditions?

Mr Brooks: This goes back to the developer, who will use the same noise consultant who did the original noise projections. That noise consultant will put in a report and then that, presumably, will be accepted by the department of planning. I do not think there is any compulsory obligation on the department of planning to do any independent checking.

Senator LEYONHJELM: Does the council have any role at all in verifying compliance?

Mr Brooks: No, because all of this is done at the level of the state government.

Senator URQUHART: Mr Tomlinson, can you tell me about your organisation, the Residents Against Jupiter Wind Turbines Noise Committee. How many members do you have?

Mr Tomlinson: On the noise committee, we have three members. The Residents Against Jupiter community group has in the vicinity of about 140-odd members.

Senator URQUHART: Is this like a subcommittee of that committee?

Mr Tomlinson: This is a subcommittee, yes.

Senator URQUHART: Are you funded at all?

Mr Tomlinson: No, we are not funded. We have had members donate some money to purchase equipment.

Senator URQUHART: Is this the equipment that you talked about earlier?

Mr Tomlinson: That is correct.

Senator URQUHART: What was the cost of all that equipment?

Mr Tomlinson: The cost was around $8,000 for the equipment we have.

Senator URQUHART: You said in your opening statement that you are not acousticians. Is there anybody in there that is qualified to actually run that equipment?

Mr Tomlinson: No, there is not although we have been in contact with some acousticians who have given us some guidance, one of those being Steven Cooper.

Senator URQUHART: Mr Lyons, can I ask you how many members you have in your awareness group?

Mr Lyons: We are a fairly loose-knit organisation, comprising every neighbour surrounding the turbines area. It is probably around about 30.

Senator URQUHART: What would be the area that you are looking at? What would be the radius of it?

Mr Lyons: Of the project area, I think it would be about 28,000 hectares.

Senator URQUHART: Are the 30 people within that area?

Mr Lyons: No, outside of that area. I may stand corrected on the 28,000 but I think that is what hectare area is of the project itself. We are outside that area.

Senator URQUHART: You said you called for submissions and I did not quite understand your numbers there so if I could just go back through them. I think you said you received 163 submissions. What was the process that you went through?

Mr Lyons: The project was put on public display for 60 days.

Senator URQUHART: Whereabouts?

Mr Lyons: It was at the local council. I think it was also online on the department of planning website, I believe, although I got my copy from the council, a digital copy.

Senator URQUHART: Was this the planning project?

Mr Lyons: This was for the Bodangora wind farm. It was on display for 60 days. I think the general public had about six weeks to put submissions in. We put in a submission of over 900 pages detailing what was wrong with the project. Basically, I think, we were totally ignored.

Senator URQUHART: So those 163 submissions went in to the local council?

Mr Lyons: No, this was a state significant development so it went into the department of planning.

Senator URQUHART: That was what I wanted to clear up. As the wind turbine awareness group for the area that you talk about, have you undertaken any research to determine the community attitudes to wind farms?

Mr Lyons: Very much so.

Senator URQUHART: Has it been formal or informal? How have you done that?

Mr Lyons: We held a community meeting which we funded ourselves within Wellington. I think we had about 200 or 250 people show up. We invited different speakers including Ms Sarah Laurie, who spoke here earlier today. We also invited the proponent and several other wind farm companies who were proposing to put wind farms in the Wellington area. Infigen were the only ones that actually showed up, which was the proponent for the Bodangora wind farm.

Senator URQUHART: Was that a question-and-answer type community meeting?

Mr Lyons: Yes, pretty much. Guest speakers would speak for a while and then it was open to questions and answers, a bit like this is today. It was very much overwhelmingly against the proposal. The research that we did as part of our response to the department of planning for our response to the EA was very much against the project. The community just does not want this project.

Senator URQUHART: The 200 to 250 people that came along, how big a radius do those people live in? Are they part of this group of 30 that are part of your awareness group or how was that made up? Do you know?

Mr Lyons: I do not quite get where your group of 30 fits in. Are you talking about that the Bodangora Wind Turbine Awareness Group? Probably about half of us were able to come that particular day.

Senator URQUHART: So the rest of the 200 to 250 people were from within that community?

Mr Lyons: They were from as far away as South Australia really. Dr Laurie came from South Australia. We had a couple of speakers from South Australia because that was where most of the wind farms that we knew of at the time were located, so we wanted to get some information from there. By far the vast majority of people were locals. By local I mean I would say within 30 kilometres probably.

Senator URQUHART: Mr Brooks, your organisation, the landscape guardians, how many members do you have?

Mr Brooks: Back in 2009 when we went to court, we had a maximum membership I think of 173. Since then, and especially since the wind farm has been built, people have got demoralised and so on so our official paid-up membership now is actually somewhere around 20. We are not the only organisation. There is also Crookwell District Landscape Guardians. I believe they have a membership of about 100, which is quite strong. The other thing which is relevant is that even though people do not pay their subscriptions and continue their membership, they still object to the wind farm. The whole community still knows each other. We still see each other.

Senator URQUHART: As part of your group, do you undertake research to determine community attitudes? How do you get your information?

Mr Brooks: We have not done that. We have had meetings. I might cite the Planning Assessment Commission meeting that took place in September last year, which was held in Crookwell in the RSL. About 200 people turned up to that. It was obvious just being in the room that the overwhelming majority were against the wind farm. I have never had any doubt from all our meetings over the years that certainly the overwhelming majority of people who are going to be affected by the wind farm are solidly opposed to it.

Senator URQUHART: Dr Crawford, you indicated at the start that you were also a director—I think that was the right terminology—of the Waubra Foundation and you are also part of the Residents Against Jupiter Wind Turbines Noise. Are you just on the committee or are you part of the larger group?

Dr Crawford: I am certainly part of the larger group. When we had a community meeting, I was elected as chairman. We had a community meeting in February last year with 200 people and that group elected me as chairman to chair that and pass the motions which went to the New South Wales government. I also happen to be a member of the noise committee.

Senator URQUHART: So you wear a few hats?

Dr Crawford: Yes.

Senator URQUHART: Mr Tomlinson, are you a member of other organisations or just the Residents Against Jupiter?

Mr Tomlinson: No, just Residents Against Jupiter.

Senator URQUHART: Mr Lyons, is your only membership of Bodangora Wind Turbine Awareness Group? Are you a member of other groups?

Mr Lyons: No.

Senator URQUHART: And Mr Brooks?

Mr Brooks: I am vice-president of New South Wales Landscape Guardians, which is a sort of umbrella organisation for—I will have to check the number. I cannot remember whether the number of our affiliated associations is eight or whether it has gone down to five, because again you have the problem of people not always renewing their subscriptions. But it is somewhere in that region.

Mr Lyons: I would just like to correct the record with you, Senator. Dr Laurie did not attend the Wellington public meeting; she attended the Planning Assessment Commission meeting in Wellington. She only did a teleconference presentation at the public meeting.

Senator URQUHART: Okay. Thank you.

CHAIR: Mr Brooks, in your previous evidence you mentioned that, in the planning process, the acousticians who were engaged by the proponents were the same acousticians who then later corrected, shall we say, their own work. Have you seen this in any other field in your professional career?

Mr Brooks: I used to teach English literature, so this sort of issue would not have come up except, as I said, in the case of examiners. Usually, you have to have quite a separation of powers between people who are helping the student and people who are doing the examination. In the case of a PhD, for example, the examiners cannot even belong to the same university; they have to be from a different university.

To come back to the noise compliance monitoring business, it is the same company that does the compliance monitoring. For example, in the case of Gullen Range, it was Marshall Day Acoustics. Whether they literally used the same individuals, I have no idea; but it was certainly the same company.

The other thing that is a bit dubious about the compliance monitoring is that it is to be done only at the same residences where the original background noise monitoring was done. In the case of Gullen Range, at the time there were 63 noninvolved residences within two kilometres, and Marshall Day Acoustics chose, I think, 17 at which to do the original background noise monitoring. So the compliance noise monitoring, now that the wind farm is built, is going to be done at those same 17 residences. It will not be done at all 63. It certainly will not be done anywhere outside two kilometres.

The other thing—and I think this is really the crucial point—is that both the original background noise monitoring and the compliance noise monitoring, and any additional noise audits that the Minister for Planning might order, are all going to be done in terms of the noise limits and the conditions of consent which are based on the South Australian noise guidelines. I had the asset manager from the wind farm come to my house. He sat down in my lounge room. He was going through this spiel about how concerned they were, how they wanted to help people and so on, and I said to him quite plainly, 'Look, you're not going to do anything you're not legally obliged to do, are you,' and he said no. I said, 'You're not going to test for infrasound, are you,' and he said no. I said, 'You're not going to test for low-frequency noise, are you,' and he said no. So we know, even before the compliance noise monitoring happens, that it is going to be inadequate.

CHAIR: Thank you, Mr Brooks.

Senator LEYONHJELM: Dr Crawford, I have a question similar to what Senator Day asked you before. You have done a lot of consulting to business. It occurs to me that if this were any other industry about which

accusations were being made, assuming that it felt that those accusations were unfounded, it would want to do everything it could to put them to bed, disprove them—say, 'We don't think there's any credibility to these accusations but let's do something to stamp them out.' I cannot think of any other industry that would not take that approach. The wind industry does not take that approach. Have you seen anything similar in any other sector?

Dr Crawford: Sure. All industries want ultimately to be seen to be good citizens. Sometimes they do it by actually being good citizens and sometimes they do it by suppressing any contrary evidence. I think we have seen at least two other examples: the tobacco industry, whose history is essentially the same as this; and the asbestos industry in Australia, where the companies involved tried first to hide the involvement of asbestos in the harm it was causing and then to arrange their assets in such a way that they protected shareholders against those who might have claims on them. We are in a society where directors of companies typically believe that their responsibility is primarily to maximise value for their shareholders. They do that within the bounds of the law. If the law allows them to behave in ways, as it does in this case, that harm other people, then they typically believe that it is their obligation to do so. We have seen that certainly in the tobacco industry and in the asbestos industry in Australia.

Senator LEYONHJELM: I have speculated that one day there may be a class action similar to those that have occurred in the tobacco industry and the asbestos industry in which the wind industry is found liable in tort. Do you anticipate that possibility as well?

Dr Crawford: I certainly think it is likely that a number of parties will eventually go that route. Obviously as the industry grows it brings more people into harm and grows the number of people who will do so. One of the issues, of course, is which of those companies will still be alive when that occurs. Whilst there are some major companies that have probably a long life ahead of them, there are also a number of other companies in the industry that will have passed off their responsibilities to someone else. If there is a claim down the track, they will not be the ones who have to field it.

CHAIR: Thank you all for appearing here to today and for your evidence.

BUCKNELL, Mr Lionel Douglas Wentworth (Douglas), Member, Association for Research of Renewable Energy in Australia Ltd

GLOVER, Mr Mark Berry, Member, Association for Research of Renewable Energy in Australia Ltd

McGUINESS, Mr Sam, Member, Association for Research of Renewable Energy in Australia Ltd

[14:13]

CHAIR: Welcome. Could you please confirm that the information on parliamentary privilege and the protection of witnesses and evidence has been provided to you?

Mr Bucknell: Yes.

Mr Glover: Yes.

Mr McGuiness: Yes.

CHAIR: The committee has your submission. I invite you to make a brief opening statement. At the conclusion of your remarks, I will invite members of the committee to put questions to you.

Mr Bucknell: Thank you. First I congratulate you on the conduct of this inquiry. We have been engaged observers at public hearings and have intently followed your progress, including the interim report and the wind turbine commissioner proposal. Your work here will last on the public record and be proven over time to have added a great deal to the public understanding around wind turbines and their relative value or otherwise. In our view, you have covered the detail and the terms of reference items with one major exception, and that is why we are here today.

The ARREA submission directly addresses that missing point, which is the economic impact of wind turbines, including the associated matters on how effective the Clean Energy Regulator has been, the adequacy of monitoring, the energy and emission input and output equations and related matters. This issue is fundamental. It goes to the very heart of what the Renewable Energy (Electricity) Act 2000, the act, is supposed to be doing. Specifically, if the second object of the act, reducing greenhouse gas emissions, and the third object being ecologically sustainable are to be met, the encouragement of additional generation, which is the first object, must be achieved by displacing thermal production. In order to assess the economic impact, historical performance data is crucial and a fundamental benchmark. Under the current regime adopted by the CER, it appears that no real effort has been made to verify the claims by the wind industry as to the actual performance of wind turbines as they relate to the fundamental task of reducing greenhouse gases in the electricity sector.

This is why we, ARREA, commissioned the Wheatley study to independently investigate the effectiveness of wind power in reducing greenhouse gas emissions from electricity generation in Australia during 2014, using actual empirical five-minute data from each of the grid-connected generators. We were at the Joe Wheatley teleconference you held in Canberra. We are not here to revisit the technical detail. That is why we and you got the expert in. However, we are here to focus on the outcome, to connect the dots, to explain why this is important to the terms of reference and your final report recommendations.

As a headline reminder, analysis of the actual data in the NEM in 2014 shows that wind power production has overstated the emission reductions by 22 per cent—that is, 100 per cent minus 78. It is 22 per cent overstated. This percentage will continue to increase as the percentage of wind power entering the NEM increases. The current lack of performance measurement is just not acceptable. It would not be tolerated in any other industry, let alone one reliant on mandated subsidies. It should not be up to entities like ARREA to commission this independent research. Performance measurement should be a fundamental and first step in any oversight regime, particularly where taxpayers' funds and electricity consumers are involved. The CER should have independently commissioned this research, or the Senate, or perhaps in the future the wind turbine commissioner. The CER should be admonished for this failure to properly monitor the true impact of an industry which comes at a high cost to the nation's economy and electricity consumers in particular.

Many are asking: is this regulator asleep at the wheel? Do we have another HIH royal commission occurring here? Or do they already have the information but are not releasing it? Senators should be concerned about the impact that this lack of measurement has on the CER fulfilling its responsibilities under the act and regulation. There are financial flow-on impacts to electricity consumers and in respect of public moneys received by inappropriately issued RECs. The issue of CER's effectiveness exists regardless of your political views, regardless of whether you like or dislike wind turbines and regardless of the environmental and social impact issues. This is a public accountability issue. We are urging all to make a joint recommendation on this matter, and that involves an audit of the CER.

In 2014 electricity consumers effectively paid wind farms $100 for emissions reduction and they got only $78 worth of value. The dollar value of these certificates that did not lead to a reduction in emissions was estimated at $70 million in 2014 alone. What is more, it will get worse year by year as more turbines are installed. This 22 per cent or $70 million in ineffective wind production is not ecologically sustainable as defined by the act. The act's definition of 'ecologically sustainable' includes 'promoting improved valuation, pricing and incentive mechanisms'. That is the act's definition. Including the 22 per cent ineffective wind production is clearly not consistent with this principle. In particular, it clearly distorts valuation and pricing and creates unjustified incentives. Under regulation 15A(a) electricity omitted from this calculation includes 'electricity that was generated by using an eligible renewable energy source that is not ecologically sustainable'. Let me restate that: electricity produced by a wind turbine that is not ecologically sustainable cannot be counted. They cannot issue RECs for it.

The approach taken above is what parliament intended for regulation 15A(a). The issue was also the core of the amending act—the Renewable Energy (Electricity) Amendment Act 2006—with the explanatory statement saying that it would:

… enhance market transparency and improve business certainty, provide increased opportunities for solar and bioenergy technologies, and improve the operational effectiveness and efficiency of the Act.

The Wheatley research has now clearly established using the actual empirical 2014 data that 22 per cent of the electricity generated by wind as the eligible renewable energy source in 2014 was not ecologically sustainable and should not have received RECs.

No-one likes being ripped off, but what is worse is when the gatekeeper, the regulator, the CER, is complicit or is turning a blind eye. Please do not add insult to injury to your electors by ignoring this problem, which is only set to get worse. Senator Back has repeatedly asked the CER for details on regulation 15A(a). The CER has responded to those questions, including on notice, with answers relating to other regulations, including regulation 15A and 15A(b). They have tried to answer using ineligible energy sources, which is regulation 15 and not relevant to the question asked. It appears as though the CER is avoiding answering the question or making up its own legislative rules.

ARREA believes renewable energy is very important for the sustainability of Australia's future. However, the current policy settings in regard to wind turbines are flawed. Their implementation has led to systemic failure. The simple production of electricity from wind, subsidised or otherwise, to the extent that it does not effectively offset thermal production does not serve any material economic purpose. It duplicates electricity production, distorts market signals, especially compared to other renewable energy sources such as solar, and leads to inappropriate public perceptions about the value of wind power, to the detriment of the long-term sustainability of our nation.

Our recommendations as per our report stand, and those recommendations are that this committee:

1. Receive the full Phase 1 report—CO2 Emissions Savings from Wind Power in the National Electricity Market (NEM), by Dr Joseph Wheatley, Biospherica Risk Ltd, Ireland.

2. Obtain an assurance from the CER that nominated persons—the wind energy companies—will be advised of the need to apply, consistent with the Act and its regulations, a 0.78:1 relationship when issuing certificates.

3. Confirm that the Regulator will use its powers under the Act, including Part 15A Civil Penalty Orders and/or Enforceable Undertaking under S15B, to uphold the purposes of the Act.

4. Seek that the Australian National Audit Office (ANAO), conduct a performance audit on the CER's compliance with its role under the legislation. In particular:

a. What information did the CER hold on wind effectiveness in offsetting CO2 emissions at both 30 June 2014 (end of financial year) and 3 May 2015?

b. What Risk Management and Fraud Mitigation practices and processes are in place, have they been appropriate? If not, who should be held responsible and what rectification actions is required.

c. If all public monies collected in respect of the Act are appropriate.

d. If there are financial or other incentives, including but not limited to, the collection of public monies under the Act that are distorting the CER's role in achieving the Objects of the Act.

e. If the expenditure of public monies by the CER has been appropriately focused on achieving the Acts objects.

CHAIR: Thank you, Mr Bucknell.

Senator LEYONHJELM: I read your report yesterday, at the end of 550 other pages.

Mr Bucknell: Thank you, Senator.

Senator LEYONHJELM: If my questions were answered in your submission, that is the reason: it has gone in one eye and out the other. I assume the 0.78 ratio which I think you mentioned is attributable to spinning reserve. Is it?

Mr Glover: Can I just answer that one. The Wheatley report basically showed that wind power supplied 4½ per cent of system demand in 2014 but only reduced CO_2 emissions by 3½ per cent. Wind power generation is intermittent; in fact, in Australia it fails completely over 100 times a year. The grid must supply sufficient power at all times, and therefore, when the wind is blowing, backup power must be available at all times. In practice, a significant fraction of South Australia's wind power displaces low-emissions gas generation within South Australia, and in fact in New South Wales we are importing power from South Australia and it is displacing black coal. The dirtiest power of all is brown coal. That is not being displaced at all by wind power generation.

Senator LEYONHJELM: Yes, but the explanation for the 0.78 is this backup that you are referring to?

Mr Glover: He did not measure spinning reserves or cycling. That is not even included in that. In fact, if we go forward, if we can get more data—in the back of Wheatley's report he lists his requirements—I think that 22 per cent inefficiency will actually become greater, because that was not measured.

Mr Bucknell: If your direct question is in relation to 0.78, 0.45 production by wind only offsets 0.35 in emissions. If you divide one by the other, you get 0.78.

Senator LEYONHJELM: Have you compared that to solar, geothermal and hydro?

Mr Glover: We have not done the studies there. To an extent, what solar is actually doing is reducing demand on the grid. Households that are running on solar reduce the total demand on the grid, so it is a lot harder to measure, because we do not know how much solar is being produced at any one point in time.

Senator LEYONHJELM: I was talking about large-scale solar.

Mr Glover: No, we have not scoped that.

Senator LEYONHJELM: Are you confident that the ANAO is the appropriate organisation to investigate the performance of the Clean Energy Regulator? My impression is that it is primarily concerned with accuracy of financial accounts.

Mr Bucknell: That is correct. There are two types of audits: there are financial accounts audits and there are performance audits. The audit that we are asking for is an audit of the correspondence that is held within the CER, particularly in relation to regulation 15A(a). Why have we got to the point we have got to? Why is this 22 per cent currently being counted? Why is it currently a one to one relationship? When RECs are issued, there are public moneys that are received by the CER, so it is a financial and a performance issue. We think the ANAO is set up to do those types of audits. This is not an unusual request; it is simply a request for an audit.

Senator URQUHART: Thanks very much, Mr Bucknell. How many members does ARREA have?

Mr Bucknell: Seven.

Senator URQUHART: How do you go about becoming a member? I have looked for you on the internet. I cannot find a street address, a website or a Facebook page, so how do you—

Mr Bucknell: We are a public company that has been registered for a number of years. In fact, I can give you some details on that. You are offered membership by the organisation, and we are on the public record.

Senator URQUHART: Okay, but you do not have a website, a street address or a Facebook page? I have not been able to find any.

Mr Bucknell: No.

Senator URQUHART: Can you describe the structure of your organisation. Who are the key personnel?

Senator URQUHART: Would you describe the structure of your organisation. Who are the key personnel?

Mr Bucknell: The three directors are on the public record. We have seven members, as we have described. We are an organisation who are most concerned about ensuring that renewable energy in Australia and the decarbonisation of the Australian economy are done in the most efficient and effective way. That is why we have raised funds to have the Wheatley research done.

Senator URQUHART: I understand that spokespeople for your organisation are Tony Hodgson and Rod Pahl—is that correct? And they were also spokespeople for an opponent wind group called Friends of Collector—is that right?

Mr Bucknell: I understand that to be correct.

Senator URQUHART: You said that you have not received any research grants and that you raised that money yourselves through your organisation.

Mr Bucknell: That is correct. These are privately raised funds. As I said in my opening statement, we think this is research that should have been done independently by the CER or by the Senate. Public moneys should have been used and, in our view, they should be admonished for the fact that they have not done that research, because it is required in order for them to be able to know how many certificates should be issued underneath the act.

Senator URQUHART: Do any of the key office holders within your association have any research qualifications?

Mr Glover: No, I do not think so. We have a number of people in the organisation with a number of different skills. I am actually a qualified geologist, so I have a scientific background. Mr Bucknell used to work for APRA, so he knows how the regulators work. I was also the Australian country treasurer for the Bank of America Merrill Lynch for over 10 years, so I have a strong background in banking. We have backgrounds in PR, economists and stuff like that who are all members. It is a broad background.

Mr McGuiness: I have been a farmer for 29 years and I have dealt with parasites most of that time, so I am pretty well qualified in this area too.

Senator URQUHART: I presume you mean parasites on the backs of sheep or cattle.

Mr McGuiness: Just all parasites. There are an awful lot.

Senator URQUHART: Aside from the work that you commissioned Joseph Wheatley to do, what other research have ARREA undertaken? Have you undertaken any other research or is it just the work that you commissioned Joe Wheatley to do?

Mr McGuiness: That is the only commissioned work that we have done so far. There are other works to do with waste to energy. Part of our group is looking into stand-alone solar as well, especially in regional areas.

Senator URQUHART: You are looking at doing some research into that?

Mr McGuiness: Absolutely.

Mr Bucknell: And we made a submission in relation to the review of the renewable energy target.

Senator URQUHART: Thank you very much.

CHAIR: Gentlemen, in order to accurately measure CO_2 abatement going forward and the concerns that you have raised, what additional data and resources are required, do you believe?

Mr Glover: The Wheatley report, as I said earlier, omitted start-up and power plant cycling. CO_2 emissions were not calculated for power stations not despatching electricity to the grid. Most coal fired power stations are at their most efficient when running at 100 per cent capacity. As this capacity is reduced, CO_2 emissions per megawatt hour rise. If this reduction in capacity is due to wind power generation entering the grid, this increase in CO_2 inefficiency needs to be measured. The input data needs to be improved with actual fuel use data by individual generators at short time intervals, preferably five-minute time intervals. An emissions parameter for individual generators is required to include zero load energy consumption data, that is when they are not producing, incremental heat rate slopes—this is starting to get into the engineering side—start-up energy costs and thermal relaxation times. Obviously, if you shut a power station down because wind power comes on, the coal is still burning, the heat has to dissipate out of that power station and CO_2 is still being produced.

This data will help measure efficiency of generators at different capacity points, as well as measure CO_2 emissions when these generators are not supplying electricity. In many cases these coal fired power stations are on standby, where they are burning coal but not supplying electricity—in essence, waiting for the wind to drop. As we have stated, there have been other reports done that I think show the whole wind power fleet in Australia switches off 130 times a year. The other thing required is: both 'sent out' data and 'as generated' data are needed for each generator. 'As generated' data basically includes the power used in the generation process, whereas 'sent out' is the actual power delivered to the grid. Obviously, there is a certain amount of electricity used within the plant; that needs to be picked up as well.

We are proposing that a detailed multi-year CO_2 abatement study is needed to reduce the statistical uncertainty and provide clear information about the variability of wind power effectiveness. I suppose really what we are suggesting is that the Clean Energy Regulator would probably need to create a full-time position to properly calculate these CO_2 emissions. The computing power is there to do it on a five-minute basis, if we can get the real fuel feed in data and all the other engineering data for each generator. I think it is probably a full-time job for one person.

Mr McGuiness: What happens is: to start a coal fired power station, they might use up to 35,000 or 40,000 litres of diesel to get it up to an operating temperature. This is a small one—say, a 150 megawatt one. When you get it up to temperature—and I will use an example of one that I know a little bit about in the Hunter—that consumes 80 tonnes per hour of coal to keep it ticking along. It might not be generating any electricity, but you cannot stop feeding it coal. They have to have a thermal efficiency where they do not crack and heat and cool down; otherwise they break. Then it gets a bit complicated. You have thermal reserve, where it is hot and generating a small amount of steam. It uses a thermal generator. Then you have spinning reserve, where it is spinning, and then you have spinning reserve that is synchronised to the grid. Basically you just dump the clutch and she is jamming sparks into the grid. All of those have to stay warm the whole time. You only shut a big thermal generator down if you have a breakdown or a maintenance schedule. These people are scheduled generators. They schedule into the grid to supply electricity 12 to 18 months ahead of when they actually generate. When wind comes into the system, they pull down—but only for a very short period of time. They have to be sitting there so, if something happens, that spinning reserve is ready to drop into the grid.

So there are thermal reserves and spinning reserves. The emissions on those, because they are not generating into the grid at the time, are not necessarily calculated. If we got the correct data and the government did the correct job and got their legislation so it worked, rather than nice and fluffy at the moment, you would get some real evidence of what is going on—and then you would be fair dinkum about getting results.

Mr Glover: Interestingly, under the last carbon tax regime, you only paid a carbon tax when you were supplying electricity to the grid. There was no carbon tax charged if you just happened to be burning coal and not supplying electricity.

Senator DAY: Could you just elaborate further, Mr Bucknell, on the difference between ecologically sustainable wind turbines and non-ecologically sustainable ones?

Mr Bucknell: Absolutely. I think this does go to the heart of a number of questions asked in relation to regulation 15 and regulation 15A. Regulation 15, which is how the CER answered the question on 15AA, relates to eligible and not eligible energy sources. For the record, wind farms do only use eligible renewable energy sources under the act, by definition, but it is not relevant to the question. They do not use any ineligible energy sources, but it is not relevant to the question of reg 15AA. Reg 15AA excludes electricity produced by a wind farm that is not ecologically sustainable. That is why the 22 per cent in 2014, and an increasing percentage in future years to probably 30-plus per cent, is not ecologically sustainable.

Perhaps I could just run through that a bit more clearly for you, if I can. 'Ecologically sustainable' is defined in the act. It means an action that is consistent with the following principles of ecologically sustainable development:

Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations.

That is point a). And then it goes on to b), which is irreversible environmental damage—not relevant. It goes on to intergenerational equity, which is not particularly relevant, and the conservation of biological diversity, which is not particularly relevant. But point e) is:

improved valuation, pricing and incentive mechanisms should be promoted.

Actions that improve valuation, pricing and incentive mechanisms are ecologically sustainable. Excluding the 22 per cent is ecologically sustainable. It is defined in the act. We just want them to do it.

CHAIR: There being no further questions, we thank you for your appearance here today before the committee.

ALLAN, Mr Norman David, Private capacity

BROWN, Mr Peter, Private capacity

GRIMA, Mr Ricky Lee, Private capacity

GRIMA, Mrs Theresa Ann, Private capacity

[14:41]

CHAIR: Welcome. Could you please confirm that information on parliamentary privilege and the protection of witnesses and evidence has been provided to you?

Mr Brown: Yes.

Mr Allan: Yes.

Mrs Grima: Yes.

Mr Grima: Yes.

CHAIR: The committee has your submissions. I now invite you to make a brief opening statement, and at the conclusion of your remarks I will invite members of the committee to put questions to you.

Mr Allan: I would like to thank the committee for allowing me to speak today. I live in Clarence, which is near Lithgow—about 150 kilometres west of here. I have a specialised engineering business in Lithgow, which I established in 1990. I make and repair components for industry, including wind farms, coal mines, railways, power stations, earth moving and farming, and also the general public.

I am not opposed to industry, but I am opposed to poor practices and plant and processes that cause community disturbance or health problems. I would like to address the committee because I have a problem with infrasound, or low-frequency sound. This problem arose approximately 2½ years ago and has impacted my family in the following ways: sleep disturbance, head and sinus pressure, body shakes, trembles, racing heart, nausea, vertigo, numbness of limbs, oppressed feeling, and a foggy, blurred reality with no sense of ease and difficulty relaxing—literally living with a fear of torment from a relentless noise or vibration source.

I have attempted to resolve this problem by contacting the nearby mines: Clarence, being four kilometres away, and Springvale, being 11 kilometres away. They were both polite and performed compliance sound tests and told me they complied with the New South Wales industrial noise policy. I contacted the New South Wales EPA, which came and did sound tests also. I have now been told that the noise cannot be heard by the human ear so therefore it does not exist. By this reasoning, diseases like Ebola do not exist, because we cannot see them. New South Wales industrial noise policy is blind to the problem. The New South Wales EPA advises the health department and planning commission, so these are also blind to the problem. The last correspondence from the EPA has told me that the problem is my house creating noise all by itself. That is ridiculous.

Mrs Grima: We would like to thank the senators for the opportunity to speak today. We are Lithgow/Blue Mountains residents. We are subjected to relentless low-frequency infrasound and vibration, which has been measured and confirmed at our home by acoustic specialist Steven Cooper. The source of our intrusion is being emitted from two sources: a large ventilation fan from an underground coalmine owned by Centennial Coal and the Mount Piper coal fired power station, owned by Energy Australia. We experience the same sorts of symptoms and sensations as people exposed to wind turbine noise and vibration. We know this because the symptoms we experience in our home and our community we also experienced on 18 May while travelling past a wind farm in the town of Taralga.

Since October 2014 I have kept a diary logging our sleep disturbances, symptoms and other disturbances. It has become apparent, reading through the entries, that I am subjected to nightly sleep disturbances and trying to get by on very little restful sleep. On a bad night I wake repeatedly, as does my husband, who is now noticing the impacts far more than before. To complement my diary entries I have accessed the power output of the Mount Piper power station on the AER website to try to ascertain what specific operation conditions of the power station are affecting us most. I have also tried acquiring the operational data for the ventilation fan for the same reason, but Centennial Coal is not required to supply that and so far has refused to do so.

On 22 June we received a reply from the New South Wales EPA regarding low-frequency intrusion, and this is just a little of their response: 'There are some low-frequency components potentially generated by both collieries and Mount Piper power station that have the potential to be an annoyance. The EPA has no regulatory capacity to formally require action.' It further recommended that we, the residents, engage an acoustician to determine

whether we are able to mitigate noise propagation. They are suggesting that we fund and find our own solution to this infrasound and vibration generation that is being imposed upon us.

This infrasound is not just affecting my own family, including my children; it is also affecting others in the Lithgow area. And I must acknowledge that one of the most disturbing places is the Lithgow high school. I was present recently, on Wednesday 24 June, and I was impacted by extreme head pressure, nausea and dizziness. This was not the first time I have had this experience there, and I know I am not alone, as some of the children also report these symptoms while at school. I question whether this could be the reason Lithgow has some startling health statistics, such as heart attacks at a rate almost 50 per cent greater than that of the rest of New South Wales. Excessive environmental noise is well known to be associated with increased cardiovascular disease and decreased immunity.

We ask the senators to recommend that all forms of industry regulate low-frequency noise and vibration and that we are able to live in our homes and our community without this intrusion. What we are subjected to is inhumane. We are disregarded and left powerless because of lack of effective regulation. We are trapped in our home, and speaking out publicly about the problem will make it harder for us to sell our home and to relocate. We do not want to move. We are now sensitised to infrasound and low-frequency noise, and we can perceive it from other sources and at significant distance over many kilometres when we cannot hear the noise. The only way our health will start to improve is if our exposures are reduced, but the New South Wales government regulatory authorities have said they are powerless to act because there is no regulation covering these frequencies. And the companies and the acousticians who work for them now appear to be involved in a cover-up. Even if we left our home, which we do not want to do, where can we go? Where will we be safe and get a good night's sleep?

Mr Brown: Thank you for this opportunity. I live in Muswellbrook in New South Wales. I am addressing this committee in reference to the regulatory governance of industrial noise pollution in usually quiet rural areas. My partner and I have lived at our current address for the past 7½ years, but my family have owned and occupied this property for more than 32 years. What was initially a uniquely quiet rural area has become what I would now describe as an industrial wasteland, surrounded by coalmines and bombarded constantly with noise, dust and vibration.

For us it has become a nightmare and not the lifestyle we sought and paid for. We are surrounded by coalmines to the east, north and west, and a further mine is planned to the south. Four years of complaints by us about the barrage of infrasound and low-frequency noise we are subjected to to the government departments have so far fallen on deaf ears. There is, it seems, a systematic failure by government bodies to address the complaints of affected residents. There is an unstated bias toward industry over the rights of landowners, aided and abetted by the planning and compliance departments. It is unreasonable to believe that individuals have the resources to obtain justice for themselves against multinational companies or a government wedded to these industries.

These projects come with the provision of independent review as part of their approvals. This is always touted by all in defence of its being a fair and equitable system. But it is ironic that, when you request to trigger this mechanism, the determination of allowing you this provision or not can be subject to the results of reports commissioned and paid for by the proponent. This can hardly be called independent, and obviously there is no review. It is truly another failure in governance. The health impacts of infrasound and low-frequency noise are not new or unknown; rather they are simply ignored. I refer you to the federal government paper dated October 2009 'Leading Practice Sustainable Development Program for the Mining Industry: airborne contaminants, noise and vibration', subsection 3.2 'Health amenity', which states:

> The indirect effects of noise and vibration on the health of people exposed to excessive levels have been extensively documented. Investigations have found that prolonged exposure can adversely affect mental and subsequently physical health, particularly in those most sensitive to noise.

It also states:

> Low-frequency noise can be particularly annoying and can result in complaints many kilometres away from the source.

It must be said, then, that until projects such as coalmines—or, for that matter, wind turbines—are made to include the comprehensive monitoring of noise and vibration across the full spectrum as part of their approvals, people's health and wellbeing will be continually put under threat.

Senator LEYONHJELM: Thank you for coming along. I read your submission with great interest. I must say I think Centennial Coal's cooperation with the investigation is substantially greater than the wind turbine companies have shown so far. It seems to me the investigation has halted because it requires an on-off study. Is that correct?

Mr Allan: Yes.

Senator LEYONHJELM: I do not remember the timing. How recently was the request by Steven Cooper for an on-off study made?

Mrs Grima: Last year when he did testing at our residence in October he requested on-off testing and they did not want to comply. They said that the fans cannot be turned off. We know they have back-up fans. Since then we have had a letter from the EPA stating that they recommend on-off testing and that the company that did the review of Steven Cooper's report, which was Global Acoustics, also recommended on-off testing. I recently had some correspondence with them with regard to the work that they are planning on doing, and that was not addressed in their correspondence either.

Senator LEYONHJELM: What is the work that they are planning—anything to do with this noise issue?

Mrs Grima: It is to do with the conveyor belts and the coal washery.

Senator LEYONHJELM: Without wanting to sound like I am taking sides here, there does seem to be some degree of willingness to investigate this issue by Centennial. Am I right there, or not?

Mr Allan: Yes but—

Senator LEYONHJELM: Not to your satisfaction?

Mr Allan: No, in my opinion, from information I hear. It is quite easy to stop and start the fan in a reasonable amount of time. It seems to vary. We feel there was a bit of manipulation.

Mrs Grima: We feel there was manipulation in regard to the fan operations when Steven Cooper was having the testing done. There was testing done prior to Steven Cooper by EPA and SLR, I think. They both came back saying they found something but they did not know what they have found. Then, we had a little bit of a reprieve in the disturbances we were getting. At that time, Steven Cooper was enlisted to come and do some readings.

Senator LEYONHJELM: That is interesting. Have any of you sought medical advice in relation to the symptoms you have described?

Mrs Grima: We have. The doctor we saw told us to get out. He said, 'You just need to leave.'

Senator LEYONHJELM: Did he offer any sort of diagnosis or other options for treatment.

Mrs Grima: He said it was quite controversial at the moment and he did not want to delve into it any more. He just advised us not to wait around for change, and that we needed to get out.

Senator LEYONHJELM: Did he say why he did not want to delve into it any more?

Mrs Grima: Just because of the current situation with the Senate inquiry.

Senator LEYONHJELM: I see. How do you feel about coal mines in general, and coal mines in your area?

Mrs Grima: We did not have a problem with moving into the area. We knew there were coal mines and power stations. We felt that there would be regulations to govern anything we would have a problem with in the future. We never expected to have a problem with low-frequency noise. We came from Western Sydney, where we had road traffic noise, helicopters and sirens, nightly. We never thought that we were going to be exposed to low-frequency noise and that it would be a problem for us.

I would like to state also that when we purchased our house the people we bought the house from cited noise as the reason they were leaving. They asked us if we were affected by noise, to which we answered, 'No, we have come from Sydney, from traffic noise, and that did not bother us.' She was glad that the person purchasing the house was not bothered by noise.

Senator LEYONHJELM: Does any of you have any business relationship, commercial relationship or employment relationship with the coal mine?

Mr Allan: Yes. I have in the past, but no longer. I worked in the coal mines for eight years. That was with Centennial Coal, when they first kicked off in the area. It is one of the oldest mines there. I value the mines and I value them for the community. I am amazed that they are jumping on this and trying to do something about it. I grew up with a coal fire in the house. I have seen it go from everyone having coal. When you went to the tech college during your apprenticeship, they had coal. The factory I worked at had coal. Then I worked in the coal mines. I admire the job they do, for the efficient base load generating capacity you get from coal. So I have no personal problem with coal. Also, in my experience working with engineering, I was fortunate enough to be involved with maintenance work on probably two of the beginning wind farms in the country—two very small units—which I do not think have any problem with infrasound. I was absolutely amazed at how efficient they are for what they do, but I realise that coal is the base load source we need.

Senator LEYONHJELM: Mr Brown, do you feel the same way?

Mr Brown: I actually am employed at present at a coal mine.

Senator DAY: Anyone can answer this question. In our interim report we have recommended the appointment of a wind farm ombudsman or commissioner, primarily due to what appears to be a lack of regulation or oversight by state planning and EPAs and so on. Can you tell me a little bit more about your experiences with the state based regulators in this area?

Mr Allan: Is this to say the EPA?

Senator DAY: The EPA, and planning.

Mr Allan: Very polite. Sometimes hard to get motivated. It was not until you did a bit of whinging that they started to take notice of you. I know they are fully aware of infrasound and how it works. I know this from the questions they ask and from when they came to set equipment up at our home. It was there for six weeks. I collared one of the fellows to see if he could give me some advice on what to do with the house to stop this. When I collared this fellow he actually said to me, 'Don't worry about making your house single storey.' I actually prompted him by asking him whether I would be able to stop this by making the house single storey and double-brick and with double-glazed windows and changed the stature of the house so that it is not so exposed. He said, 'Don't waste your money. You won't stop it.' I asked him about putting a wall in front of the house. He replied, 'You'd better make it four times the size.' He was then quickly shunted off to the side to keep installing equipment. A lovely fellow. Very professional. I think government authorities—

Senator DAY: I guess the question is more towards how proactive the regulators or departmental officers been in responding and finding out more in order to get on top of this.

Mr Allan: I would not say they have been proactive. I would say it is more: we hope you go away. Other people I know have tried to ring them. They ring me and ask how bad it was for me last night, to which I reply that it was shocking and I have tried to ring EPA but they will not return my phone calls.

Mrs Grima: I have a letter from the EPA, which I am happy to table, stating that it is hard to attenuate, that it impacts inside people's homes, that they do not measure inside people's homes, and that they know it causes an annoyance. But they basically state that there is no regulation to enforce it.

Senator DAY: That is my very point. Do they then initiate, or say they are looking at, changing the regulations so that they can—

Mrs Grima: My husband and I have been invited to a consultation phase, where they are talking about changing the legislation for industrial noise policy. Their last recommendation was that we attend a community consultation phase of the changes to the industrial noise policy.

Senator DAY: When was that?

Mrs Grima: That was on the EPA letter—22 June, just recently. It says:

The EPA again recommends, and it has been discussed previously, that you raise any concerns regarding low-frequency noise and infrasound during the review of the industrial noise policy. Furthermore, you may wish to engage an acoustician to determine if you are able to mitigate noise propagation and/or generation within your residence.

Senator DAY: Thank you for tabling the letter.

Senator URQUHART: Mr Allan, you said you worked in the mines for eight years.

Mr Allan: Yes, I did.

Senator URQUHART: When did you start there?

Mr Allan: 1996.

Senator URQUHART: So you would have left in around 2004?

Mr Allan: Yes.

Senator URQUHART: Was that when you started the business you are in now?

Mr Allan: I had the business in my back yard for years. When the mine finished I started working for myself.

Senator URQUHART: When you were working in the mine did you experience and of the issues you are experiencing now?

Mr Allan: No, definitely not.

Senator URQUHART: Why?

Mr Allan: Why not?

Senator URQUHART: Yes. Why do you think you were not?

Mr Allan: I was underground in the mine and then I was basically across the road from Mt Piper Power Station. The power station was running on full load and I think the low-frequency emissions on full load are a lot lower, or very, very controlled, than they are at low load. That was a very small mine and probably used a ventilation fan of, say, 100 horsepower, whereas, in my opinion, the ventilation fan we are having problems with is 3,500 horsepower, and it is working on a shaft like a giant organ pipe. It is 400 metres in length and 3.5 metres in diameter. The sound emissions, as Steven Cooper has said, probably have the power to travel 15 kilometres and lose three decibels in the low frequency. I was not at the mine. I could go home. I lived in a different place. I think that the problem was not there at that stage. But without the on-off testing, we cannot be sure. I can only go on what we know, what we hear and what we feel.

Senator URQUHART: Mrs Grima, is this the same one that is in your submission?

Mrs Grima: No. This was just recent.

Senator URQUHART: Right. That is all, Chair.

CHAIR: Mrs Grima, gentlemen, the obvious question arising from your submission is that, if it is true that adverse health effects are being imagined by residents close to wind farms and are being caused by anti-wind farm activism, how does that account for your experiences arising from the coal mining industry?

Mrs Grima: I can speak for us. We do not see the ventilation fan that is affecting us and we do not see the power station that is affecting us. We cannot view it from our property. Within six months of moving to the area, I started getting symptoms. I have been there approximately 5½ years. We approached Lidsdale Siding when they were doing an expansion of their business and told them of our symptoms. We told them that we did not want our symptoms getting worse but that we did not know where they were coming from. In the meantime we have met Norm Allan, who also had the same sort of symptoms. We came to the conclusion that it was the ventilation fan. It was not until Steven Cooper had done his acoustic testing that it was confirmed that, on our property, while we were being subjected to some of the ventilation fan the power station was our major concern. We are approximately six kilometres from the power station and we are eight kilometres from the fan. I do not understand how the nocebo effect can be a factor in our situation.

CHAIR: In your local area, has your concern been heightened by a group other than yourselves, the affected residents?

Mrs Grima: No. We have a lot of people, who we know of through speaking to them, who are affected but are too scared to speak up for fear of reprisal. Because we live in a community that is largely dependent on mining, they do not want to rock the boat, as such. But we do know there are lots of other people in the community who are affected.

CHAIR: I realise that this probably would not give you much satisfaction, but I asked a retired worker from the power industry in Victoria about worker protection against low frequency in and around the turbine rooms, the coal crushers, the conveyor belt engines, et cetera. He went on to tell me that the workers were not allowed in the turbine rooms or near heavy grinding equipment that produced low frequency because it made workers sick. Have you been in contact with any of the union organisations covering workers in the coalmines near your homes as to whether they have had any problems reported to them by workers who are on the site or living nearby?

Mrs Grima: No. Personally, I have not.

Mr Allan: I know a fellow who works in the power industry and goes from power station to power station. He said that at some power stations, depending on the area you work in, you will be instantly nauseous. There are areas there that produce high levels of infrasound and other areas where you are quite comfortable. I have walked through the turbine hall at Wallerawang Power Station while it was running, and it was quite often the norm. The control room is right there; the turbine is 20 metres away. But low-frequency sound, in my opinion, travels probably dozens of wavelengths before it actually propagates and starts getting itself sorted out to do damage or excite a structure. Around the power stations, you will probably find the big hollow structures that propagate, say, a soundwave divided to 10 cycles a second. A 34-metre soundwave will propagate in an area of half length or whatever and repeat itself. So I think that it depends on lengths of buildings and structures and the distance away from the actual source. My son and I will go for a drive to the fan on a Saturday night—or we used to; it gets a little bit traumatic. We would go for a drive to the coalmine fan, and at the fan source, very close to the fence of the enclosure where the fan is, it is quite fine, but when you start getting 300 or 400 metres away it will start really racing your heart and shaking, and it will sound like someone has a subwoofer in the back of the car. It is a different perception. We need to get away from what you hear; it is more about what you feel. If a young hoodlum in a car with a big subwoofer drives past, if you take away everything you can hear and just have everything you feel, that is a sensation.

Senator LEYONHJELM: Just a little follow-up to that: can you describe what happens when you go away from your homes, leave the area and then come back again.

Mr Brown: The symptoms subside.

Senator LEYONHJELM: They subside but do not disappear?

Mr Brown: It depends on how long you are away.

Senator LEYONHJELM: I see.

Mr Allan: We pulled up in the car park across the road over there, and we were a few storeys underground in the sandstone. As soon as I turned the car off—because we use it as a bit of a loudspeaker because of the size of the vehicle and whatever; it is a bit old, and you get a bit of an idea of what is going on, because you can actually hear a resonance—I was constantly expecting to feel the sensation, and I could not feel it. So it is that market, or I take my oldest son to football in another town, and as soon as you pull up you do not feel it; you feel a relief. It is basically a pressure lifted off you. It is very subtle. Until you are traumatised by it, you would not believe it.

Mrs Grima: The head pressure, I find, is the most disturbing for me. Recently we went to Taralga, and we went past the wind farm, and my husband was physically sick. I urged him not to pull over and to keep driving, because my head felt like it was going to explode. I just did not want to stop, because I knew that was what we were experiencing, because to the left of us there was this wind farm. If we had stopped, we would not have stopped that exposure to what we were feeling, so we had to keep driving. So I feel that that is unsafe in itself.

CHAIR: Thank you for your appearance here today.

Proceedings suspended from 15:13 to 15:23

DABNEY, Mr August, Business Analyst, StarCore Nuclear

CHAIR: Welcome. Could you please confirm that information on parliamentary privilege and the protection of witnesses and evidence has been provided to you.

Mr Dabney: Yes, it has.

CHAIR: I now invite you to make a brief opening statement, and at the conclusion of your remarks I will invite members of the committee to put questions to you.

Mr Dabney: First of all I would like to thank the committee for giving us the opportunity to present today and to be involved in this important issue. Australia is a leader in developing, promoting and advancing technology and technical applications across a range of issues, and, in particular, in altering energy systems to diversify sources. That is very important. Australia has experience in doing this logically to ensure a stable economy and support trade and industry, but also to do so by making smart choices and leading by example.

It is in this regard that I am here today, to talk about nuclear as a possible choice—specifically, small, modular reactors, or SMRs, for applications off grid: for example, for mine sites, government installations or remote communities. These are plentiful in Australia and they make up a significant proportion of the Australian energy system.

We make this presentation in particular not to the detriment of or to exclude other sources but to work in concert with them. This is to identify opportunities that might otherwise be omitted from current plans, and in particular to deliver a system that is safe, secure and lower cost and will support the growth of other sources.

Senator LEYONHJELM: The reason you are here is that I thought it was relevant to our terms of reference and because of the fact that we are accused of being anti-renewables rather than just concerned about issues raised in relation to one form of renewable. Do you describe nuclear energy as renewable?

Mr Dabney: I would not describe it as renewable; I would describe it as a clean energy source.

Senator LEYONHJELM: Most people have a perception of nuclear being Three Mile Island, Chernobyl and, more recently, the Fukushima tsunami. Would you bring us up to date on the latest technology—the kind that you are involved with.

Mr Dabney: Certainly. Fukushima, Three Mile Island and Chernobyl all had significant impacts on the nuclear community. Since 1996, there has been not only a marked official standpoint but a marked growth in this technology up to what is now called Generation IV technology, which is the reactor that we have developed, and small modular reactors in particular. I will use our reactor as an example, but I can presume that our competitors provide similar reactors of the same level. A Generation IV reactor is inherently safe. What that means is that it is physically incapable of going into meltdown. It also has extreme safety measures in place to make sure that it essentially cannot experience any of the pre-existing conditions that have happened, and it is tested for events like Chernobyl, Fukushima and Three Mile Island. They have put the reactors through those events and found no incidents of radiation leakage or damage to the facilities. So this is a hyper-safe, very, very secure facility.

Senator LEYONHJELM: The usual objection to nuclear power is waste. What is the situation there?

Mr Dabney: Since the development of the integral fast reactor in the eighties, the waste half-life has gone from several hundred thousand years to less than several hundred years. Not only can these facilities use this waste to a much larger extent but an integral fast reactor will use it for decades. So the level of waste that people are used to hearing about from reactors as they used to be has since changed, almost for decades. These reactors have been around for several decades. The particular one that we have developed was designed in 1947 and first implemented in 1953, so these have been tested and used for a long time.

Senator LEYONHJELM: The type of reactor that you talk about is this small modular reactor. Is that a company decision or are they different from what you might use for baseload for a major city?

Mr Dabney: Small modular reactors by definition are 300 megawatts or less, so you would not use it for a city; specifically we are talking about off-grid applications. The attraction here is that it is much more difficult to use other sources that are clean to provide the energy because you have baseload requirements. Larger nuclear would be a baseload replacement. However, in the case of a small modular reactor you are looking, in the case of our smallest reactor, at something that is around 20 megawatts in size and could work for a small town or a refinery and also works in load following. So it can both provide the baseload and follow the requirements of the community or the refinery.

Senator LEYONHJELM: We heard from witnesses in Queensland who suggested that turbines were an appropriate electricity option for remote communities, especially offshore islands and so forth, and were a superior alternative to diesel generators, but that the separation distances from the turbines to communities would

need to be substantially less than the one to two kilometres under the standard rules. What would be the situation? How would that compare to one of your small modular reactors?

Mr Dabney: In terms of comparing SMRs one to one to any renewable source, obviously for the baseload power you have two different supplies. If you are going to turn a renewable source into a baseload power source, you require a battery. Batteries, in my opinion, have not reached the point of being viable in these off-grid opportunities, because they add at least 15c per kilowatt hour to your costs right away. Our SMR runs at about 18c per kilowatt hour, and that cost is going down. I think other SMRs would run similarly. So you are looking at a much cheaper alternative here. As for replacing diesel generators, I believe that most of those have been in place in the past because of the low initial investment cost. If you are going to put in a wind farm, you have to do a major up-front investment as well as then dealing with your capacity factors and the loss of energy when you use your batteries. So there are a lot of things to be considered there. As for whether they would be comparable, I believe that an SMR would be less costly, particularly in that instance, and SMRs have a lot of additional benefits that they can provide other than electricity.

Senator LEYONHJELM: Like what?

Mr Dabney: Like fresh water and heat for industrial or home purposes. Our reactor provides internet connectivity, which is very big for remote communities in terms of education and health.

Senator LEYONHJELM: How does it provide internet connectivity? I read that in your submission.

Mr Dabney: It is run through a satellite connection. That is basically a signal from our headquarters to the facility, and that requires such a small amount of data for us that we can actually load the community's internet connectivity onto that bandwidth.

Senator LEYONHJELM: What separation distance do you require between one of your reactors and the local community?

Mr Dabney: Part of being a generation 4 reactor is making sure that there is no effect on the surrounding environment. That includes groundwater—no radiation leak whatsoever. So when the facility is removed there is no clean-up required. It is a very simple process. What that means is that you can also put it as close as you want. It is more an issue of the comfort of the community and how they feel about it. It is also a low-profile facility, so it is not very visible.

Senator DAY: When you say 'not very visible', is it the size of a house, or the size of a dog kennel, or the size of a hotel?

Mr Dabney: For our facility, the current design is 100 metres long by 30 metres wide, and it is two storeys high, so it is about a shop or a building.

Senator DAY: We have heard quite a bit of evidence about the adverse impacts on humans, animals and property values from wind farms. What has been your experience with impacts on those and others?

Mr Dabney: I am no expert on this area but, from my own research and comparisons that we have made to other sources, I think the main difference for us is the low impact of the space needed. Per kilowatt hour, nuclear is the highest producing source there is. When it comes to remote communities and protected areas, which Australia is heavy in, that is a major issue, because a lot of facilities take up a large amount of space and require lots of landscaping and geological alignment. In the case of wind and solar, from what I understand, it is several magnitudes more space, which I presume would be a big effect, and I presume it would also cause a large effect for biodiversity. However, again, I am not an expert on that, and I think the point here is that nuclear is probably the best option for disturbing as little land as possible.

Senator DAY: The cost comparisons between generation by wind and your small nuclear reactors?

Mr Dabney: For off-grid, because wind is very dependent upon the situation and the capacity factors, the average I have heard is 30c per kilowatt hour. As I said, we are at 18c per kilowatt hour. Generally if SMRs are operating around our range I would say that is a significant saving.

Senator DAY: I am from South Australia. Our state government has initiated a royal commission into the nuclear cycle. Are you planning to make a submission to that?

Mr Dabney: We are, yes. We are very interested. We have been following that closely and look forward to the further results from it.

Senator DAY: Is there anything further on that—location or particularly, say, our Olympic Dam mine site? We just had a power station shut down at Port Augusta. Would that be a suitable site, given its proximity to Roxby Downs, Olympic Dam?

Mr Dabney: Definitely. The royal commission has a lot of opportunities there, and the reason I am not directly addressing it is that it is a very large topic and I realise we have a limited amount of time. There are all sorts of opportunities. I will briefly address SMRs. The area of Grey is an absolutely immense area with a lot of opportunities for SMR to not only reduce power costs but also help out a lot of communities out there dealing with generators and high fuel costs or whatever other issues they are dealing with. Olympic Dam has been there for years, and I understand from talking with other people from South Australia that they are very used to having nuclear in the area and that they look forward to seeing what comes out of the royal commission regarding opportunities not only for power options but also for recycling, building the economy, fuel waste disposal and whatever else is available.

CHAIR: Could you just explain to me the difference between the SMRs you are referring to and the smaller reactors that they are now fitting into naval vessels—ships, submarines? I have been led to believe that they are a lot smaller than they once were. Are there any similarities between what you are speaking about and what other people are speaking about?

Mr Dabney: Yes. In fact, that is actually where the first SMRs came from. The USS *Nautilus* was the first SMR on a submarine, and that is where the idea came from to create a small nuclear reactor that could be kept in a very confined space without having to worry about radiation leakage and providing power without using oxygen. That was the key thing in submarines. The real advantage there is mass production. You can put it on a production line and create these cores. R1s are about the size of a car. A reactor core is about the size of a car.

CHAIR: What is the cost of those?

Mr Dabney: Because it is a production plant, your first-of-a-kind is probably going to cost around $50 million, but that cost decreases significantly over time. You are looking at about $30 million by the time the production line is ongoing. And I should mention that part of that construction is that by using an investment plan we actually do build, own, operate, so there is no up-front investment cost. We put it in the ground and the community or the refinery does a power purchase agreement with us for the life of the reactor at 18c a kilowatt hour.

CHAIR: Finally, for this size of reactor we are talking about, I imagine there is ongoing research.

Mr Dabney: It is one of the most cutting-edge parts of nuclear power at the moment. China has been heavily investing in it. They actually have a high-temperature gas reactor, which is our form of reactor, operating at Tsinghua University. It was a 10-megawatt one, and they have had that operating since 2003. It was so successful that they recently put on two more 100-megawatt additions to it. I believe they put them online this year. It has been one of the biggest areas of research. Because of the lower initial investment costs you are able to use a lot of technologies in different considerations than at a larger operation, and they are much safer and much more feasible.

Senator LEYONHJELM: I have a couple of follow-up questions. The renewable energy target is intended to reduce greenhouse gas emissions, and as a result of the renewable energy target we are seeing a lot of investment in wind turbines, but it is coming at the cost of increased electricity prices due to their renewable energy certificates. If instead of wind turbines we had nuclear power stations constructed along the lines of the technology you are talking about, would they need renewable energy certificates? And would they have the effect of reducing greenhouse gas emissions at the same rate as is occurring with wind turbines?

Mr Dabney: They would not require certificates or subsidies. These operate at 18c. Those costs have gone down since our last case, but I am quoting a test case that we had last year. These operate at 18c per kilowatt hour without subsidies. That is simply on our basic power purchase agreement. There are varying metrics to carbon removal. Obviously anything that is produced uses some carbon. However, generally these SMRs are on par with wind turbines going into it. They produce no carbon once in operation. I would say that yes, they would have a major impact on the RET in terms of reducing carbon emissions and greenhouse gases in general.

Senator LEYONHJELM: Without increasing electricity prices due to the—

Mr Dabney: Considering the other options that are currently in place—and this is a major part of the Australian energy network—these remote locations have a very heavy power usage. Considering what is currently in place, we are talking not only about major reductions in cost but also about major reductions in carbon emissions. Between the two, I think it could be a huge benefit to the RET.

Senator LEYONHJELM: Excellent. Thank you.

Senator DAY: You say one of these small modular reactors is 20 megawatts?

Mr Dabney: Yes.

Senator DAY: What is the average use for a house?

Mr Dabney: It depends heavily on location, but I would say a generic round number would be about 1,000 homes. The other purpose of these reactors is that because their energy can be used for different applications—not just electricity but also heat, and that can be converted into other uses—quite often you will find that this will also be used in tandem for businesses in the area, for greenhouses in certain environments, for industrial processors—you can use it for SAGD for oil sands development. So, there are a lot of applications. We also help out with the development of those when we build the reactor.

Senator DAY: You say you own and operate: so, you provide one of these and over the life of the reactor, provided that you had an agreement for 18c a kilowatt hour, there would be no up-front—people would pay for it as they used it—

Mr Dabney: Yes.

Senator DAY: rather than before they used it. There is a lot of debate going on now about the cost of infrastructure with the cost of sewerage plants and water plants and so on, whereas in past times people paid for it in their rates as they used it. You are saying you would adopt that model.

Mr Dabney: Yes. The purpose is to remove the burden of allocating those funds and making it much easier for these remote communities and places that have had hard times in the past trying to figure out where their power sources are going to come from. It is about trying to make it more of a moral high ground in terms of being able to be carbon neutral and still getting the economic benefits.

Senator DAY: Yes, without the long transmission lines and the costs and the depletion—

Mr Dabney: Yes.

Senator DAY: Thank you.

CHAIR: Senator Back, I believe you are back on the line. Do you have any questions?

Senator BACK: No, I haven't. I will listen with interest for the last few minutes.

CHAIR: There being no further questions, we thank you, Mr Dabney, for your appearance before the committee today.

CARLILE, Associate Professor Simon, Private capacity

[15:46]

CHAIR: Welcome. Could you please confirm that information on parliamentary privilege and the protection of witnesses and evidence has been provided to you?

Prof. Carlile: It has.

CHAIR: Thank you. I now invite you to make a brief opening statement and at the conclusion of your remarks, I will invite members of the committee to put questions to you.

Prof. Carlile: Thank you all for the opportunity to meet with the committee. By way of introduction, I am a researcher and an academic in the Faculty of Medicine at the University of Sydney. I am a neuroscientist by training, but I have had roles in senior management in higher education as well is working as a chief technology officer and the CEO of a number of different technology start-up companies. I specialise in audio and my PhD was in auditory neuroscience, and my current research focuses on various areas of hearing science.

I would like to start out by saying that as a neuroscientist, I know of no good neuroscientific evidence that wind turbines are harmful to human health. I also believe that wind turbines will play an indispensable part in our energy solutions for the future. Having said that, I would like to examine the first of those statements in more detail.

Scientifically speaking, a negative finding is always problematic to interpret. Does it mean that we have no effect of the experimental treatment, and in this case it will be the effects of wind turbines on human health? Does it mean that we have not asked the right question? Or does it mean that we have not looked in the right place? Logically, the absence of evidence does not mean there is necessarily an absence of effect—in other words, a negative finding does not discriminate between a lack of evidence and a failure to find the evidence. Strong statements have been made about the effects of wind turbines on the basis of the available evidence, but I think the question really is: are the strengths of those statements justified?

As you will know, the NHMRC sponsored two studies of the available data and those studies concluded that the quality of the data was not good and that further research was needed before a scientifically strong statement could be made. I would like to make two observations about that research that I believe are relevant for this committee. First, it is critical that the research be aimed at examining possible physiological mechanisms on the influences of infrasonic energy on the human nervous system. Research that examines this only on a population level misses a very important fact of human biology—that is, there are significant individual differences in every aspect of human function that we have studied scientifically to date.

For example, we know the susceptibility of people to motion sickness such as sea sickness varies significantly across the population. If there are, say, 1,000 people on a ferry on Sydney Harbour, only one of those might be seasick. Viewed as a population, you might conclude then that the evidence that a Sydney Harbour ferry produces sea sickness is highly insignificant. But on an individual basis, it would be trivial to demonstrate that one person on that ferry had a very different physiological reaction than everyone else on the ferry.

Given the great diversity of the reported responses of people to wind turbines, this suggests that, like much of what we already know about biology, there are significant individual differences in this situation, and this can only be addressed and understood by examining the biological mechanisms of those interactions and is a very good reason for looking at it at the mechanistic level, as it is widely accepted in the biomedical industry that only a good understanding of biological mechanism provides the basis for innovative solutions and transparent objective measures of any kind of effect. What might these mechanisms look like?

In his recent scientific review published in the magazine of the Acoustical of Society of America, Professor Alec Salt identifies several potential biological mechanisms by which infrasonic energy could stimulate the nervous system. Professor Salt has been studying the neurobiology of the inner ear for nearly four decades and has published countless scientific papers on the subject. I will summarise his review simply by saying that there is a clear prima facie case that infrasonic energy can influence the neural receptors in both the auditory system and the vestibular system—the system responsible for our sense of balance. I am happy to talk through the biology if there is interest in the committee, but the key message is that infrasonic energy does affect sensory cells of the nervous system and that this would provide the basis for any possible influence of infrasonic energy on the functions of the nervous system. This does not prove of course that infrasonic energy is deleterious to the function of the nervous system. That is a question that requires significant biological research going forward.

The second general observation I would like to make is about the nature of the research that is required to properly examine and potentially manage these issues. To date, much public discussion about the issue has

centred around the NHMRC, as is necessarily the case in regard to matters of public health. As you will know, there is also much discussion in the area of scientific research and science research policy of the benefits of a multidisciplinary approach to this research question. Certainly, my own research has benefited enormously from combining the talents of people in biology, electrical engineering, psychology and mathematics. This will also be undeniably beneficial in examining the potential problems and driving out innovative solutions to the effects of wind turbines on human health.

As I discussed previously, the current mechanistic data indicates a prima facie case and it also identifies a range of disciplines whose activities would need to be coordinated for any such multidisciplinary research effort to be effective. At a high level, we can think of this as three different compartments. The first is the receiver: the people themselves. The second is the transmission: the means by which the effect is delivered to the people. The third is the emitter.

We look first at the receiver side and the relevant research areas would include hearing and balance neuroscience, research audiology, systems neuroscience, particularly with a focus on arousal and sleep. From the transmission side, the relevant research areas would focus on architectural and environmental acoustics. Interaction with the built environment, I think, requires particularly careful attention. It is a significant area of physical interaction that has not been looked at in great detail to date and it is also an area of much potential innovation for the management of any potential detrimental effects. From the emitter side, the relevant disciplines would include structural engineering, high-power engineering and aeronautical engineering.

So this, I think, brings into focus the possible role of the National Health and Medical Research Council in funding and management of such a research program. While there is undoubtedly much biological research that needs to be done, the essential multidisciplinary nature of the research requires a body with a much broader range of expertise than that of the NHMRC. Possibly a body such as the Australian Research Council College of Experts or the Chief Scientist needs to be involved to provide a broader scientific overview. Positioning Australian entrepreneurship so that it is able to quickly capitalise on the outcomes of such research and deliver innovative solutions into the renewable energy industry will also play an important part in driving the return on investment in that research.

In conclusion, the evidence that infrasonic energy can have an influence on the human nervous system is actually quite strong. Whether this is deleterious or not is a matter for future research. In turn, this research needs to be highly interdisciplinary in its nature to be effective not only in understanding what the potential mechanisms might be but in driving innovative solutions to the problem. Thank you all again for the opportunity to present this evidence.

CHAIR: Thank you, Professor Carlile.

Senator URQUHART: Thanks, Professor Carlile. Have you published any peer-reviewed research into the health impacts of wind farms?

Prof. Carlile: I have not.

Senator URQUHART: What about health impacts of infrasound?

Prof. Carlile: I have not.

Senator URQUHART: You talked about seasickness and the physiological effect of that. What research do you base that statement on?

Prof. Carlile: The statement of—

Senator URQUHART: About how wind farms are likely to cause symptoms akin to seasickness. You have been reported as saying that.

Prof. Carlile: There are several pieces of work. One that I am aware of is in *The Journal of the Acoustical Society of America*. There is also quite a lot of non-scientific but medical descriptive evidence in terms of presenting symptoms, and they are very similar to seasickness.

Senator URQUHART: Thank you. The turbine manufacturer Vestas appeared before the committee a couple of hearings ago, and they said that, out of their workforce of 5,500 people globally who work directly on wind turbines, not one has made a complaint of symptoms arising from wind farms. If the turbines were to cause balance issues, wouldn't you expect this to show up in those who work directly on the turbines? Why are they not affected?

Prof. Carlile: Let me look at it this way: if someone were very sensitive to motion sickness, I would not expect them to be taking a job as a sailor. I think the issue is really one of a broad range of individual differences, so there will be people who will not have any effects at all, whereas there will be those that may end up being

profoundly affected. In all of the research that we look at in physiology of the human body, there is of course the normal distribution around any measure that we would make, whether that is IQ, bone strength, weight or height. So it is a matter, I think, of individual differences.

Senator URQUHART: Do you think it is quite bizarre, though, that out of 5,500 people globally there would not be at least one or two, if you use that analogy that you just pulled?

Prof. Carlile: They are self-selecting.

Senator URQUHART: The people are self-selecting their employment—is that what you mean?

Prof. Carlile: I would think so, yes. If someone is not comfortable in a particular job, they are not likely to stay there.

Senator URQUHART: In Australia, Professor Chapman has collated a list of the impacts that individuals have attributed to wind farms. You are probably aware of that. They include a number of things, such as autism, bee extinction, cataracts, dolphin beaching and haemorrhoids—there is a large list. Do you think that there is any way that there could be a legitimate link between these conditions and wind farm activity?

Prof. Carlile: That is a pretty broad list.

Senator URQUHART: It is a very broad list—244.

Prof. Carlile: For some of the items on that list, I could conceive of how that might be physiologically possible. Other things on the list are beyond what I would think would be possible.

Senator URQUHART: If that is the case—if there are some things on that list where you think physiologically people do accept that that is what has caused it—why do you think that people are thinking that it is wind farms that lead to those sorts of problems?

Prof. Carlile: I think Simon Chapman's work, in its sociological basis, has shown that you can significantly influence the outlook of a group of people in a variety of different ways. I know that he claims, for instance, that the appearance of wind farms is sufficient to psychologically affect some of those people—or, he might argue, all of those people.

Senator URQUHART: Do you think that that is the case?

Prof. Carlile: I do not doubt that that is a reasonable mechanism.

Senator URQUHART: So you agree with that?

Prof. Carlile: Well, I would not say I agree with it all, but I do not doubt that it is a reasonable mechanism. It needs to be seen in the context, though, that there is a broad range of sensitivity across any population for any variable that we look at.

Senator URQUHART: Yes, of course. Health Canada has undertaken a health study to determine whether there are health impacts of wind turbines—are you aware of that?

Prof. Carlile: Yes.

Senator URQUHART: The study included over 1,200 households, 4,000 hours of acoustic data, medical expertise, self-reporting, and objective health measures including blood pressure and heart rates, using a peer-reviewed methodology and measures of statistical significance. The preliminary findings of that study showed no association between wind turbine noise and self-reported health problems. Are you aware of any robust, large-scale epidemiological research that has come to any conclusions different from those of the Health Canada study?

Prof. Carlile: No, I do not think that there are, and I think that part of the problem is—as I tried to illustrate by talking about seasickness on the boat—that, if all you have is a hammer, everything looks like a nail. It might not be the right question that is being asked, and I think there is a sustainable argument in that regard.

Senator URQUHART: In Australia, Professor Gary Wittert from the University of Adelaide undertook a study which found that medical prescription levels were no different for people living close to wind farms from those for people living further away. Are you aware of any international population-level research that has had any other findings?

Prof. Carlile: Not of that nature, no.

Senator URQUHART: I just want to take you to Fiona Crichton's work in New Zealand—you are aware of that, obviously?

Prof. Carlile: Yes.

Senator URQUHART: It seems to provide strong evidence that exposure to negative messages about infrasound is highly linked to people's perception of the health impacts that wind turbines have on them. Is it

possible that people might be misattributing their health concerns to wind turbines as a result of exposure to antiwind messages?

Prof. Carlile: Some people may; yes.

Senator URQUHART: So is it also possible that antiwind messaging could lead people to experience stress that may exacerbate their health problems?

Prof. Carlile: For some people, that may well be the case.

Senator URQUHART: That is a concern. We have had a number of people who have come along to the committee with health issues. They have attributed them to the wind turbines. But some of them have not sought medical advice. That is a concern that I have raised with them in relation to getting proper medical advice.

The committee has heard from the Association of Australian Acoustical Consultants that there is no evidence that infrasound from wind farms could be damaging to human health. Are you aware of any professional acoustic body that holds the position that infrasound from wind farms has adverse health impacts?

Prof. Carlile: I do not think any acoustical body does hold that view.

Senator BACK: Thank you very much, Professor Carlile. The NHMRC recently advertised for parties interested in undertaking medical research in this space. Were you an applicant?

Prof. Carlile: No, I was not, and the reason is that I have accepted a role as vice president for research for one of the world's largest hearing aid companies and I move to Berkeley in three weeks; otherwise, I certainly would have liked to have been a player.

Senator BACK: Even when a successful party or parties have been identified, if you were approached by NHMRC as to some sort of an oversight, monitoring or auditing role, would your new position at Berkeley preclude you from actually having some further involvement?

Prof. Carlile: That would be something that I would need to negotiate with the CEO of the company, but, on the face of it, I would not have thought that I would be necessarily precluded.

Senator BACK: You did mention seasickness, and I understand, from previous writings, that you may be of the view that the sorts of impacts on the inner ear, in terms of balance, are on the vestibular system. This is not my area, obviously, but my recollection was that you may be of the view that the neurophysiological effect of this sound impact might be similar, in fact, to the balance impacts of seasickness. Am I right in that? If so, can you expand further on that view.

Prof. Carlile: Certainly. Looking at it from a physiological perspective in terms of the coding of the energy—the coding of the stimulus, if you like—the detectors in the vestibular system are very similar to the detectors in the inner ear, which are sensitive to sound. That provides a potential basis, in the first instance, for the way in which that energy may well be encoded by the vestibular system rather than, say, the auditory system.

Secondly, the inner ear, as you would know, is an incredibly intricate system where the balance of a variety of different fluids in the ear plays an important role in its normal function, so disruption of that fluid balance is going to affect both the vestibular system and the auditory system, because they are contained within the same bony chamber. The vestibular system projects to particular nuclei in the brainstem that we also know can, when stimulated, induce sensations of nausea. In fact, some of the anti-emetic or anti-nausea drugs that you can take for seasickness target the neurotransmitters in those particular nuclei.

This is not proof, of course, that this is the way that this energy is actually affecting the central nervous system. Rather, as I said before, it is simply a prima facie case that I think is worth examining.

Senator BACK: So, in a sense, it might not be an auditory response at all; it might be a vestibular balance response that is possible or at least could be part of a complex that actually results in those clinical signs.

Prof. Carlile: I absolutely agree. In fact, we have known for hundreds of years that the lowest frequencies that we can hear are of the order of a few tens of hertz, and we are talking about frequencies that are much lower than that, so you would not expect the system to be able to produce for you the sensation of sound, because it is outside the range in which that would be excited. That does not mean, though, that those particular sensory receptors cannot be excited, producing other kinds of input into the central nervous system. So there is another reason why it makes for a quite reasonable hypothesis to be considering the vestibular input.

Senator BACK: Are there age differences for younger people, middle-aged people and older people in their sensitivities in this area?

Prof. Carlile: In the vestibular system or in the auditory system?

Senator BACK: In the auditory system—I guess both, but principally in the auditory system.

Prof. Carlile: Yes. Mainly what happens in the auditory system is a decrease in sensitivity to high frequencies, and this occurs as a consequence of two things: (1) the ossification of the middle ear bones, which become calcified; and (2) a loss of sensory hair cells within the inner ear itself. We know as well that the system of balance does tend to also deteriorate with age, and one of the contributing factors, for instance, relating to the increase in falls in the elderly is vestibular dysfunction.

Senator BACK: The reason I ask is that, in relation to the Health Canada study that Senator Urquhart mentioned, Professor McMurtry from Ontario in Canada was advising us that for whatever reason—I am not yet sure—400 households were ruled out of the study reasonably early in the piece, and then another 322 were, and then people below the age of 18 years and over the age of 79 years were excluded before they got to the stage of their final report and conclusions.

I am just anxious to know, and I will obviously follow up to inquire, why each of those various groupings were excluded. Particularly when it comes to the age impacts, I am concerned whether there was deliberately or inadvertently an attempt to try and exclude those who might have actually been more highly responsive.

Prof. Carlile: Yes, that is a reasonable concern. The larger concern I have though is that the overall epidemiological approaches that look at this on a population basis are not very sensitive to the fact that you may have small numbers who are highly sensitive. So you could still have people who are affected quite negatively but because of their numbers, if they are relatively small, they will actually become diluted in the statistical approach that is taken. So I am very strongly advocating a mechanistic view of this sort of research.

Senator BACK: Yes, I understand.

Senator LEYONHJELM: My impression is that there is not very much dispute that infrasound, low-frequency sound, can cause deleterious effects in humans. There is also no dispute that wind turbines emit infrasound. The question is whether enough infrasound is emitted to cause the adverse effects claimed by those people who live in proximity to them and who believe they are affected. I am very interested in your theory that it is the vestibular system, somewhat similar to motion sickness.

We heard from a witness this morning that he thought somewhere between five and 30 per cent of individuals exposed to wind turbine noise were likely to be affected. On the basis of that, considering your background, do you have experience with individuals which would allow you to assess whether or not five to 30 per cent is a reasonable number? Or is your example of one person on a boat of a thousand people more indicative of where you think it might end up?

Prof. Carlile: I do not think the work has been done to give you a sensible answer to that question. Again, because they are epidemiological studies, that will dilute those numbers. We really need to be understanding where these effects are so we can measure people individually. I think that is the only way we are going to really start building up a picture of a percentage.

Senator LEYONHJELM: I was once on a boat with 400 people and I was the only one that got seasick so I have some sympathy for that one person on a boat of a thousand.

Prof. Carlile: That was usually my mother.

Senator LEYONHJELM: I am also wondering whether this nocebo effect, which we have been told is the wrong term—it should be psychogenic—is also individually variable. If suggestion can lead to an illness in individuals, is that also as individually variable?

Prof. Carlile: I am not a psychiatrist. I have studied psychology in my undergraduate degrees and my view would be, yes, that some people are likely to be negatively influenced.

Senator LEYONHJELM: So it might be one in 1,000 or five to 30 per cent by the powers of suggestion?

Prof. Carlile: It might be.

Senator LEYONHJELM: I guess the issue for us that we are wrestling with is: given we have heard evidence that there is denial of any problem by some people, there is denial of a big problem by plenty and there is the 'not us' problem—that it is 'not us' that is causing it involved with this—from a regulatory point of view, it is difficult to know what to regulate. If it is the vestibular system then setting a maximum sound level based on dB might be the wrong approach. How would you approach this? Let us suppose it was vestibular, not auditory, that was the origin of it or perhaps a combination of both. How might a regulator go about mitigating it?

Prof. Carlile: Quite right. If we think about the transmission then it might be through the air or it might be through the substructures into which the houses and the turbines themselves are bolted. Simply using microphones which are sensitive to airborne sounds is not going to be enough.

The issue with buildings is actually quite an interesting one because the wavelengths of the infrasonic frequencies that we are looking at are very long so you necessarily assume then that if a building or part of a building is going to resonate, it is going to have to have a pretty large volume. My first scientific publications were in the *Proceedings of the Royal Society* looking at applying what is called a Helmholtz resonator to understanding how, of all things, frogs' ears work. What we discovered when working through that math was that if you have a volume which is vented in two places, it can be much, much smaller than the wavelengths which stimulate it which cause it to resonate. What that means is that relatively small rooms, if they vented in certain ways, could resonate at very low frequencies. That is why we were saying that looking at the built environment and the interactions with the wind turbines is again potentially another very rich vein of research.

Senator LEYONHJELM: Without wanting to contradict you, we have heard evidence that individual rooms in houses are particularly bad in terms of sensations felt by some individuals. But also the acousticians who have appropriate instruments claim to be able to measure that in those rooms as well. If they wanted to measure whatever is causing the vestibular disruption—is it pressure; is it ground waves—what would they measure?

Prof. Carlile: That is what an accelerometer would do. It would measure how much the ground was moving at those frequencies.

Senator LEYONHJELM: I understand.

Prof. Carlile: I think one of the other issues that comes up repeatedly is that the airborne sounds are usually measured with an A-weighting on sound level metres, which emulates the normal sensitivity of the human. We know we have no auditory sensitivity at these low frequencies so in fact all of that energy is filtered out prior to the overall pressure level being measured.

Senator LEYONHJELM: Yes, we have had several witnesses tell us the A-weighting is totally inappropriate to this issue.

Prof. Carlile: Absolutely.

Senator LEYONHJELM: Do you agree with that?

Prof. Carlile: It does not make any scientific sense whatsoever.

Senator DAY: I was on a boat from Brisbane to Stradbroke Island with 20 people and only one person did not get seasick. All the others, when they got there, could not explain it. They said they never get seasick. It turned out that this pleasure craft used to be some kind of prawn or fishing boat and the design of it was quite different to the normal pleasure craft. How that kind of motion affects people who would not normally be affected was interesting. We talked about the Canadian study quite a lot in this inquiry. We heard evidence from Dr Bob McMurtry this morning, who is a Canadian medical practitioner. Are you aware of any of his particular work or studies?

Prof. Carlile: I have not read his papers, no.

Senator DAY: I encourage you to read his submission to this inquiry because it touches on a lot of those things that you spoke about. If you are not aware of him, I have got no further questions other than to encourage you to have a look.

Prof. Carlile: I will look through his submission with interest.

CHAIR: You spoke about multidisciplinary research, which is something that I have been calling for for quite a while. We have heard an abundance of different opinions and different evidence presented before this committee. Because it is such a complex thing that we hear about from people complaining, what I am getting from the evidence that you have given here this afternoon is that to find a solution to what people claim is happening to them, you have to have an open mind and you have to have people from different medical and engineering disciplines to try and work out what the problem is, and not have a preconceived outcome as to what the problem is. Is that correct?

Prof. Carlile: That is absolutely the case. I think one of the advantages of the multidisciplinary approach is that people bring quite different toolsets, both intellectual and technical, that they have available. I have put together a number of multidisciplinary teams in the course of my research practice. The hardest thing to do is to get people speaking the same language so that they actually understand each other. But once you get over that hurdle, it really drives innovative thinking. Think about like this: if you stayed within one discipline area, it is like digging a deep hole deeper. But if you bring in this multidisciplinary approach, you have got a whole variety of different ways of looking at the problem that interact in ways that you would not have anticipated. I am not suggesting anything I have said is necessarily the case. What I am arguing is that there is a need for a program of

research and it must have a set of characteristics about it if it is going to be successful and that is one of the key ones, I believe.

CHAIR: There being no further questions, we thank you for your appearance here today before the committee.

RAE, the Hon. Peter, AO, Private capacity

[16:21]

CHAIR: Could you please confirm that information on parliamentary privilege and the protection of witnesses and evidence has been provided to you?

Mr Rae: Yes, it has.

CHAIR: I now invite you to make a brief opening statement. At the conclusion of your remarks, I will invite members of the committee to put questions to you.

Mr Rae: I have submitted a CV with relevant roles I have had in relation to this inquiry. I was the founding chairman of the REN Alliance since 2004. I was with the Renewable Energy Generators of Australia from 1999 to 2009 as a founding member of REN21, the relevance of which I will explain, and as vice chairman and executive board member of that from 2008 to 2013. I was chairman of Hydro Tasmania from 1993 to 2004 and during that time we developed a number of wind farms. One of them we finished planning before I left although construction had not started—that was Musselroe. I was also a senior vice president of the World Wind Energy Association from 2005 to 2011. I more recently was chairman of the Tasmanian Renewable Energy Industry Development board from 2009, reporting in 2011.

I have provided a diagram linkage so that you can perhaps more readily see how the REN Alliance operates. In 2004, after the Bonn International Renewable Energy Conference, it seemed to me that we needed to try to draw together the associations relating to renewable energy. We brought together the International Hydropower Association, the World Wind Energy Association and the International Solar Energy Society. Later, the International Geothermal Association joined. Then, in 2009-10, the World Bioenergy Association was formed, and it joined. Those constitute the REN Alliance.

The REN Alliance is a body which tries to ensure that the renewable energy associations talk to each other and operate in cooperation not, as had been the case, with a 'mine is better than yours' type approach, which had been damaging to the industry as a whole and not particularly helpful. The Renewable Energy Policy Network for the 21st Century has the acronym REN21, and I was involved from the foundation of it. I would like to produce—and I have asked for the copies to be distributed—the *Renewables 2015 Global Status Report*, which has only just been published. I was able to collect these; they were sent from Paris over the weekend. REN Alliance is a cooperating partner in IRENA. IRENA is the International Renewable Energy Agency, which has 141 nations as members and another 31 in the process of becoming members. So 172 nations have either become members or applied.

IRENA was created in 2010 for the development of an international cooperation in relation to the development of renewable energy. That operates out of Abu Dhabi in the United Arab Emirates. There is also the IREC—the International Renewable Energy Conference—which is held every two years. The REN Alliance has helped prepare that and has participated in it. There is also an association in the scientific committee ECOS—Efficiency, Cost, Optimisation, Simulation and Environmental Impact of Energy Systems. I have suggested to them that they simplify their name, but they seem to like to have all those names describing their function. There are also the Energy Globe Awards international jury and the board of the Energy Globe foundation. The Energy Globe foundation gives awards around the world—both for nations and then for the best in the world—for sustainable development relating to energy. It is an amazing collection. Every year you get to judge which are the best out of the thousand or more entries received. Some of the fabulous things that come out of some of the developing nations are particularly interesting.

Having been invited to attend as the honorary chairman of the REN Alliance, I do want to make the point that I have not had an opportunity to consult them and, therefor—whilst I speak with the experience of the years that I have had as chairman—I do not have the authority to speak on the behalf of collective of those organisations, in relation to this inquiry. Wind turbines, however, are an important component of the alternative energy sources of renewable energy as distinct from fossil fuel and nuclear. Renewable energy capacity has developed very rapidly over the past 10 years, since the first international renewable energy conference in Bonn, in 2004. This has been the result of two main drivers. Firstly, the agreement at Bonn in 2004 by 154 nations, when they published the Bonn declaration, to provide support for, and to push for, the development of renewable energy and the consequential adoption of policies to drive the development of renewable energy in its various forms. Secondly, the resulting huge drop in cost of renewable energy from technological development and economies of scale.

We are now at the stage in relation to electricity generation that farmers were at with draught horses when the tractor became available, and comparable to typewriters and computers. Let us look at the very relevant facts. The REN21 *Renewables 2015 global status report* provides the facts that 141 nations—it is now 172—had joined or

were in the process of joining IRENA. Last year, for the third year in succession, investment in renewables exceeded investment in fossil fuels and nuclear generation. Fifty-nine per cent of net additions to global power capacity was provided by renewables, taking total capacity to nearly 28 per cent and supply to 23 per cent of global electricity and heating.

The energy world is in a state of transition, and all of the renewables, but in particular wind, hydro and solar, are growing rapidly. There are 164 countries with renewable energy targets, with 145 having renewable energy support policies. China is the leading investor in hydro, solar PV, wind power and solar water heating. The five top renewable energy countries are China, the USA, Brazil, Germany and Canada, while the five top on a per capita basis are Denmark, Germany, Sweden, Spain and Portugal, while India is the fifth highest developer of wind power.

The least-cost new power generating capacity in many countries of the world is wind. From the facts available, it is clear that the conversion to renewables is in full swing for many reasons, not just that of climate change. The cost of renewable energy has reduced dramatically over the past 10 years and is now competitive with or cheaper than fossil fuel generation in many circumstances, and I refer there to Bloomberg New Energy Finance Australia, which published the estimate in February 2013 that wind was A$80 versus new coal at A$143 and new gas at A$116, but also to Lazard, which has published comprehensive research in relation to world prices and, in particular, those in the USA, and sensitivities, which confirms that, in many cases, wind is the most cost-effective. IRENA has also published an assessment of the cost of the various forms of generation and has confirmed that, in many places, wind is the most cost-effective.

The conversion process is inexorable; only the timescale has yet to be determined. Fossil fuels are finite and will be replaced over time. One hundred per cent renewable is achievable. There are some estimates of the exhaustion of fossil fuels before the end of this century. The recent commitment by the G7 nations to phase out fossil fuels by the end of this century suggests to the cynic that they may all be accepting that estimate. Whichever it may be, the commitment is clear and will accelerate the pressure to gain advantage by being at the forefront of change and to adjust the economic emphasis and activity accordingly.

As is normally the case, those who are at the forefront of the development of technology and operational systems will gain economic advantage through both domestic performance and export trade. The race is on to see who gains the greatest advantage. At present, Germany is the leader, but China is challenging. Latecomers have to buy the technology from those who develop it. There are clear environmental advantages in converting from fossil fuels to renewables and, while we are experiencing some difficulties in reaching international unanimity, there is very strong community pressure from the world to heed the warnings and to react accordingly.

Renewables deployed according to the available resources, and in whatever is the appropriate combination according to location and demand, will enable the developing world to stage their access to electricity with the development of their local economy and skills. That is a particularly important point.

Distributed generation has great advantages—in the developing world in particular, but generally—over centralised generation, which requires expensive grid systems to deliver. It depends upon population density and localised demand. A developing community can more readily afford to build and operate a solar farm or some wind turbines than to build a coal or diesel fired thermal power station.

Water management is an increasingly complex and demanding necessity in our increasingly heavily populated world. Hydro, including pump storage, is an obvious part of water management and can be aided by co-located wind turbines, solar farms or both. Those combinations are clearly an increasing part of the new approach to the provision of electricity.

Intermittent and variable forms of renewable generation need storage for the management of supply to markets which experience full-time demand but at substantially varying levels, with peak and off-peak periods every day. Pump storage and hydro can provide that form of delivery far more economically than can a coal or uranium constant-load power station.

The use of such storage also has the environmental and economic advantage of eliminating waste. Other forms of storage of electricity are developing rapidly, as happened with the mobile phone. The rate of development of batteries is now evidenced by the Tesla range of batteries for large-scale storage through to domestic and electric motor vehicle use. There are others entering that market, including some Australian manufacturers.

Tesla's capacity to travel up to 500 kilometres on a single battery charge has hastened the rate of conversion from fossil fuels. Electric motor vehicles, which are replacing fossil fuel engines, can be better supplied in rural areas by distributed generation from renewable energy sources, providing another clear economic advantage from local wind and solar generation.

Each country must adopt its own method of approaching the new energy supply and management need, but it is surely relevant to note (a) the fact and nature of the change which is taking place, (b) the trend in that change and (c) the economic and environmental opportunity which it creates, including for wind turbines, which have a highly competitive cost profile.

There are numerous reasons other than the environment of the world for embracing the change. These arise from, inter alia, city density and management; the desire and opportunity for individuals to manage their own supply and not be beholden to big utilities; rural development and, particularly for wind turbines, the generation of power for the rapidly increasing use of irrigation; for local development diversity; and, importantly, all that is involved in the Millennium Development Goals. The acronym WEHAB—water, energy, health, agriculture and biodiversity—describes the primary concerns in achieving the Millennium Development Goals. You can add to that the issue of security of supply, which is an important reason a lot of countries are interested in developing renewable energy which they can control within their borders.

The rapid population growth in the world demands new approaches to many of our methods of living and trading. The renewables link well with the requirements that we have. Again, wind turbines constitute an important option for lifting the one million plus of the world's population who do not have access to electricity into the modern world, able to have access to education, health and pollution-free energy for the basics such as cooking. This applies to Australians living in remote communities as well as those in other parts of the world.

There are many more points to be made, but all lead to the important socioeconomic and environmental advantages of continuing the strong world trend of using and further developing wind turbines in the world community—including, of course, Australia. This form of world economic growth, while also achieving environmental protection, is well described in many books and papers but probably nowhere better than in a book called *Cents & Sustainability*, written by three well-qualified Australian academics and published in 2010. The book describes the manifold ways in which it is possible to successfully decouple economic growth from environmental pressures. The book is comprehensive, using material from around the world, all extensively referenced.

CHAIR: Thank you for tabling REN21's *Renewables 2015 global status report* for the committee. Are you aware of the disclaimer in the front of the book?

Mr Rae: Yes.

CHAIR: There is a paragraph that says:

Although the information given in this report is the best available to the authors at the time, REN21 and its participants cannot be held liable for its accuracy and correctness.

Are you aware of that disclaimer?

Mr Rae: Yes. I would just comment, though, that it is the most accurate and well-researched and objective of any of the—

CHAIR: Well, that is not what I asked you; I asked you whether you were aware of the disclaimer in the document you tabled.

Mr Rae: Yes.

CHAIR: Thank you.

Senator DAY: You are, like me, a fellow of the Australian Institute of Company Directors. I just want to ask you a little bit about risk management. Isn't there an inherent risk for Australia in what you are saying to us? I think there are now 31,000 scientists who are questioning and saying that there is no convincing evidence that humans either are causing or can influence global warming. You say here in your submission: 'Irrespective of whether climate change science is or is not valid, the conversion from fossil fired generation to renewables is the course to follow.' Isn't there an inherent risk factor in this? You are saying that irrespective of whether it is true or not—

Mr Rae: Yes, because I suggest that there does not need to be climate change as a reason for changing from a finite resource to an infinite resource and reducing the risk of running out. Perhaps I could give an example. Saudi Arabia has just announced, last year, that it is spending US$110 billion on a 10-year conversion from fossil fuel to renewables for its total domestic operation. They have done that on the basis of reducing risk. The risk is that they run out—and will definitely run out—of their oil and gas supplies and, if they do not have a substitute, be left with a situation in which they do not have anything other than a capacity to import by one means or another. A lot of countries are doing that.

Senator DAY: But we will never run out of coal. We have 600 years of supply of coal left. Saudi Arabia can afford to do that, but what about poor countries that cannot afford it?

Mr Rae: How many years is somewhat dubious. There are different estimates in relation to that. But if it is to be used—

Senator DAY: I think my point is that if you say that irrespective of whether it is causing climate change we should be changing it from a finite to an infinite resource, as you have just said—and coal is virtually infinite; it could be 600 or 1,000 years supply; I do not know—I am just thinking about the inherent risk in what you are proposing here today.

Mr Rae: There is no inherent risk in changing to something that is an infinite resource, and that is a resource of which, as long as the world is operating, there are sources that are replenishing constantly, which can generate power to drive our increasingly diverse but power supplied community. I cannot see what the risk is.

Senator DAY: The risk is paying three times more than you need to.

Mr Rae: IRENA, REN21, Lazard, Bloomberg—they have all done their assessments as to what the cost is, and the cost of wind has come down dramatically, as has the cost of solar. Wind is now in many circumstances around the world the cheapest form of electricity and certainly, Bloomberg said, in Australia wind is cheaper than new coal.

Senator DAY: If you do not take into account the capital cost up front.

Mr Rae: If we start talking about the full economics of it, we would need to have regard to what is spent on subsidies to fossil fuels, which are about five times those of the subsidies around the world in relation to renewable energy.

Senator LEYONHJELM: You are not talking about the diesel fuel thing, are you?

Mr Rae: Not just diesel fuel—the subsidies for exploration. There is a whole swag of subsidies of various sorts. The world figure is five times.

Senator URQUHART: I had some questions, but I notice that in part of the paperwork you have given us it says 'Wind turbines and human health'. That came from your pack, didn't it?

Mr Rae: Yes.

Senator URQUHART: It says: 'In my experience around the world there are only a few centres where this concern appears to arise and be concentrated. Overall it is not a matter which arises until the risk of it is raised by people who do not like having wind turbines placed near to where they live. I have not heard of any occasions where those who work at operating wind farms have expressed the health concern. It follows that as the complaints arise selectively then considerable caution should be adopted in making any findings on the issue and in particular in imposing further restrictions and costs based upon that concern. The need for a cautious approach has been highlighted by the absence to date of peer reviewed, professional research, preferably from a number of different countries and locations. If the concerns are considered by the various state and national governments in the few parts where they arise to have sufficient validity, then the case for further investigation on a worldwide basis may well have been made out. But surely the process should follow the normal course in such matters and precede the introduction of any further penal or control measures beyond those which already exist.'

In relation to that statement, which you have provided to us in writing, are you aware of the interim report this committee has put forward? There are a number of recommendations attached to that.

Mr Rae: Yes, I have read it.

Senator URQUHART: Would you like to comment on some of those recommendations in the context of that statement you have put out? Do you think there is a need at this stage to implement the recommendations right now? Or are you saying there should be further peer reviewed, professional research done prior to that?

Mr Rae: Talking generally and not specifically, I would start from the point of view that when wind farming was introduced the World Wind Energy Association, amongst others, produced some guidelines for the proper development of wind farms. Since then, various countries, various states in nations, have developed their own rules. There are a whole set of rules that are intended to provide for social and environmental safety in relation to wind farms. If those can demonstrably be characterised as not effective, then the case for further regulation may be able to be made out.

But I would have thought that you would have to make the case by acceptable forms of research before you introduce new regulation over and above that which has been developed and which may or may not be being fully enforced. I would have thought that anyone seeing the development of the nanny state at the moment would find

it hard to disagree with. You need to have good reason to add to regulation, and regulation which is being introduced needs to be reviewed regularly. I say that as somebody who once had a role of being a deregulation minister. I know how difficult it is to deregulate. One needs to be cautious about how and when you regulate, and to make sure that the costs and the problems that are imposed by regulation are justified. It may well be that that case can be made out.

Senator URQUHART: Sure. In terms of Australian wind farm planning restrictions, how do they compare on a global scale given your expertise in the global area?

Mr Rae: They vary around the world, but Australia has probably some of the more strict.

Senator LEYONHJELM: Do you represent all sectors in the renewable industry?

Mr Rae: The associations which are formed for the various technologies were brought together to form an alliance, which is not a strict organisation, it is an alliance, and I am the chairman of that.

Senator LEYONHJELM: Do you have a policy regarding all renewables as equally legitimate or some more legitimate than others?

Mr Rae: I have not heard it argued about illegitimacy. I am not quite sure what you mean by illegitimate.

Senator LEYONHJELM: Do you think that wind has any advantages over solar or hydro or anything else?

Mr Rae: It depends. Amongst the renewables, one of the important points to have regard to is that you cannot have hydro everywhere, you cannot have solar everywhere and you cannot have wind everywhere on an efficiently operating basis. The whole point of bringing the technologies together was to get people to recognise the need to combine them in certain circumstances or develop one and not the others in other circumstances, depending upon the location and the purpose.

Senator LEYONHJELM: One of the points I am getting to is that the solar industry has been very critical of the wind industry for grabbing the lion's share of the settling of the RET. Have you heard those criticisms?

Mr Rae: I am aware of the criticisms. I find it is more evident in some places around the world than in others. It seems to have developed quite significantly in Australia and *The Australian* seems to like to publish very one-sided reports in relation to that debate. I would hope that a more objective approach is adopted by the coal industry in Australia and its publicity agents, *The Australian*.

Senator LEYONHJELM: That was actually the solar industry criticising the wind industry that I was referring to—nothing to do with coal. Anyway, I am being wound up, so thank you.

Senator URQUHART: Mr Rae, I have a couple of other questions. We have run out of time. Am I able to put them on notice?

Mr Rae: As far as I am concerned, by all means.

Senator URQUHART: Thank you very much.

CHAIR: There may be other committee members who may submit some questions to you on notice, Mr Rae. Thank you for your appearance today before the committee.

Senator BACK: Have we run out of time?

CHAIR: Sorry, have you one quick question?

Senator BACK: Mr Rae, what do you think the impact will be, if any, of the decision of the United Kingdom government to withdraw financial subsidies for land based wind turbines? Are you aware of that? Do you know why the UK government made that decision and what impact might that have on other jurisdictions?

Mr Rae: The UK government have done that primarily because there is a fairly heavily populated community of wind farms onshore and they have developed a deliberate policy of developing offshore, and they are one of the largest developers of wind energy in the world.

Senator BACK: That leads me to the question I wanted to pursue very briefly, if time permits. I am not aware of any adverse health effects from solar or hydro energy or the newly emerging wave energies, but we are questioning the adverse health impacts of wind. For hosts, operators, constructors and governments, be they planning at state or local level, do you believe there is a risk in the event that adverse health effects are shown in relation to proximity to wind turbines? Has your group investigated that question from a risk point of view?

Mr Rae: It is not a matter which has been investigated to a great extent, because substantiated complaints of the type that have been made to this committee have been relatively rare. I do not know why there has been a greater prevalence of complaint here than in other parts of the world, but it would only be speculation were I to try to answer that. I do not dispute the fact that, if there are a lot of complaints, if people are concerned about

something, there is a responsibility on the part of the government and the parliament to try to ascertain the truth of the matter. I am just not in a position to make a judgement as to the actual cause and whether the complaints are valid or whether they are, as some people suggest, caused by some other factor. I am not in a position to do that.

Senator BACK: Thank you.

CHAIR: Thank you, Mr Rae, for your appearance before the committee today.

BRONER, Dr Norm, Managing Director, Broner Consulting Pty Ltd

Evidence was taken via teleconference—

[16:57]

CHAIR: I welcome Dr Norm Broner. Could you please confirm that information on parliamentary privilege and the protection of witnesses and evidence has been provided to you?

Dr Broner: Yes, it has been.

CHAIR: I now invite you to make a brief opening statement and, at the conclusion of your remarks, I will invite members of the committee to put questions to you.

Dr Broner: Thank you very much for the opportunity to address this hearing. I am sure it has been a very long day for you. At the outset I would like to say that, long before this hearing, I have been the subject of comments which have called into question my independence and impartiality and thus the reliability of any testimony I might give. I would like to take this opportunity to correct some statements made about me and then I would like to put the case for the science.

I studied mechanical engineering at Monash University and I completed my degree in 1973. I did well and I was given the opportunity to do graduate study. I decided to investigate the impact of low-frequency noise and infrasound on human performance because I had read an article in what was then the Melbourne *Herald* about the possible impacts of low-frequency rumble and infrasound on the reaction times of car drivers on the M4 motorway in England. I started this work at Monash University and then I transferred to Chelsea College in London, where I worked under Dr Geoff Leventhall and did my PhD on low-frequency noise annoyance and infrasound. I completed my PhD in early 1979 and then I returned to Australia, where I have since worked full-time as an acoustical consultant. So I have over 40 years of experience working with infrasound and low-frequency noise—and, by the way, that means that Dr Leventhall has at least over 45 years experience. This included exposing ourselves and others to infrasound in an infrasound chamber. Many of those people who have given evidence to you probably have more like five years of a broader experience in this area. I think one of the main problems is that people discuss the infrasound but they do not talk about level; generally they are really only talking about frequency. I have been the President of the Australian Acoustical Society twice; I am currently immediate past president. I have been recognised by the Australian Acoustical Society with the award of a fellowship, and I am a fellow also of the Institution of Engineers Australia. I sit on a number of Standards Australia committees dealing with various aspects of noise. I formed my own opinions about low-frequency noise and infrasound based on my earlier research way back in the late seventies and also in the early eighties, and I have been involved in further research and continued to form my opinions well before wind turbines were even raised as an issue.

I would like to take this opportunity to defend myself and my reputation, which I believe has been impugned in relation to my inclusion in the NHMRC reference group. During the recent hearing in Canberra, which I heard part of, a suggestion was made by one of the panel, when questioning the NHMRC, that I was not independent. In February 2014, Senator Madigan, you asked Professor Anderson the following question in Senate estimates:

Why is the only acoustician on that panel someone who has officially undisclosed strong financial ties with the wind industry and perhaps possibly a vested commercial interest in denying the adverse health effects?

I assume that I was the person being referred to in that question, and I want to make clear that I do not have any direct financial ties with the wind industry, apart from having conducted a very few consulting projects out of the thousands of projects that I have been involved in in my career. Further, I have no commercial or other interest in denying adverse health effects. In fact, if my denials of health effects were accepted then that would actually close down a potential area of work for me. Senator Back, on 26 March, stated in relation to me:

… he is a paid consultant for SKM, which is a large multinational company with significant commercial interest within the global wind industry. He has performed work for wind developers, which was not publicly disclosed during the review process, as far as I understand it. During the time of the wind farms and human health review, Dr Broner authored or approved a report titled *Flyers Creek Wind Farm—technical review of supporting documentation*, dated 12 July 2013, containing influential advice which, it is reasonable to argue, the New South Wales department relied upon in making its decision to approve this particular project.

Contrary to Senator Back's understanding, my professional associations were disclosed. Yes, I did work at that time for SKM, which, as he said, is a very large multinational, now called Jacobs. I am aware that other parts of the company worked for wind developers, but I did not have anything to do with them. My only involvement was in acoustics. I did not hide work done for wind developers. I did author a review of supporting documentation for Flyers Creek for the New South Wales Department of Planning, and my report is publicly available. As an

acoustics consultant, I am sometimes asked to peer-review acoustics reports against the relevant standards, and I do this as part of my standard consultancy practice. I am available for consultation by any interested party in the public debate, and I worked to support a council in one case. When the suggestion was raised at last week's hearing during the questioning of the NHMRC, the NHMRC correctly jumped in and stated that I am an acoustic consultant who has worked for both sides of the fence. I state categorically that I am not in the pocket of any wind farm developer and never have been. I am entirely independent of any particular group or interested party, and I strongly resent any suggestion to the contrary. My independence and integrity are not for sale. I am, however, an engineer and scientist who seeks the answers by proper study and scientific analysis and not based on hearsay.

I now want to turn to low-frequency noise and infrasound due to turbines. My work leads me to believe that wind turbines are similar to other noise sources. We have known about wind turbine noise signatures for many, many years. There is nothing new about this. When people live close to wind turbines, they can be annoyed by them, just as they might be due to other noise sources. There is no dispute about that. I have no doubt that the wind farms can be quite audible at, say, 500 metres distance, and they can be audible at further distances, depending on the circumstances, in terms of background and ambient noise levels and the conditions.

Inaudibility is generally not required by criteria. The question is: what are the residents who complain responding to? I say that it is not the infrasound level that is causing a reaction, because the infrasonic level is well below the perception threshold, even accounting for people who may be more sensitive to sound. There is nothing special about infrasound from wind turbines. It is no different to any other tonal noise problem, except that this tone happens to be blade pass frequency—about 0.85 hertz. The point here is that it is at a very low level relative to perception threshold, even when you are close to the turbine. With wind turbines occasionally you do have amplitude modulation and impulsivity, as it is known—whoosh and whish—and these are special audible characteristics that are relevant to wind turbines. They are audible and there currently are methods for characterisation of the amplitude modulation that are being developed.

I believe what people are actually responding to is the audible sound associated with a noise source, in this case due to the wind turbines. With respect to infrasound. Infrasound level in various situations has now been fully documented. Infrasound level near to wind turbines is really not that different from many other anthropomorphic and natural noise sources—for example, walking on the beach or travelling in a car, train or plane, you are exposed to levels of infrasound either higher or similar to those from wind turbines. I would hazard a guess that where the committee is currently sitting today you are exposed to levels of infrasound similar to that generated by wind turbines. But I do not think any of you would be claiming that you are not feeling well because of it.

I am not saying that the complaints by people who claim to be affected are not real. I do believe that they honestly believe they are affected. What I am saying is that I do not believe it is due to infrasound. I believe infrasound has been given a bad wrap here. There are many comprehensive studies internationally that have looked at the issue of wind turbines and the effects, with particular interest in the potential impact on health, sleep, quality of life et cetera. Indeed, a recent NHMRC review concluded that there is currently no consistent evidence that wind farms cause adverse health effects in humans.

More recently, I think attention has been drawn to the Health Canada study. With respect to illness and chronic disease, it concluded that no evidence was found to support a link between exposure to wind turbine noise and any of the self-reported illnesses, such as dizziness, tinnitus and migraine, and chronic conditions such as heart disease, high blood pressure and diabetes. No association was found between multiple measures of stress, such as hair cortisol, blood pressure, heart rate and self-reported stress, and exposure to wind turbine noise. Further, the results did not support an association between wind turbine noise and self-reported or measured sleep quality. Also, while some people reported some health conditions, above, their existence was it is not found to change in relation to exposure to wind turbine noise.

This is probably the sort of study that the NHMRC had in mind when noting the need for more research. This information only became available after the conclusion of the NHMRC study. I think that the Health Canada study might well fulfil the goal. Also, work in Japan by Tachibana and his group has come to similar conclusions, including that infrasound is not a problem.

It is interesting that in this case it seems to me we keep looking for the proverbial needle in the haystack. This seems to reflect an attitude that the only reason we have not found it is that we are not looking hard enough, or we have not found a good reason. It seems to be taken as a given there is an impact due to infrasound, and that we need to look harder. Is there any other situation where recent research shows no impact and yet people refuse to accept it and say that we have to keep looking.

I believe that these recent studies I have mentioned—the Health Canada study, in particular, and Tachibana's recent work—do not support some of the recommendations in the interim report that was published a few days

ago. If you told me that the cause was audible low-frequency noise due to the turbines, then I would actually agree, depending on its level and circumstances. The recent study by Mr Cooper at Bridgewater, which, by the way, Mr Cooper agreed was not a scientific study, highlighted how the six complainants could hear the wind turbine noise at what Mr Cooper called hot spots, both inside and outside the houses. These residents drew his attention to these locations where they said the wind turbine level was the worst for them. They were responding to the audible noise from the wind turbines.

A very important factor is that we have known for over 40 years that the response of an individual to a sound is dependent on many factors. I think you may have heard that the acoustical stimulus is not the only factor that plays a role in how we respond to noise. In fact, it is only a small determinant for any one individual, and can only explain some 10 to 15 per cent of the variance in the response. Other factors that are important, and these have been demonstrated for many of the noise sources we are exposed to, include perceived control of the noise source, attitude to the noise source, time of day, previous experience with the noise source and biological factors.

When it comes to the community, however, acoustic stimulus is more accurate, in the sense that we can explain 25 to 30 per cent of the variance. So we can more confident in predicting an overall community response to a noise. Indeed, this is how noise criteria are set. A decision is made to protect in the order of 90 per cent of the community, and the noise level is set accordingly. What this means is that there will most likely be people who will not be protected by the criteria. They would be annoyed by a given noise source. So it is a matter of policy and assessment as to what the criterion noise level should be. A further point that follows from this is that even if a noise is audible it does not mean that it will have a health impact or other impact. Whether it does or not will depend on factors surrounding the physical stimulus, and not only the physical stimulus.

Many people have strongly suggested that A-weighting should not be used for wind turbine noise criterion and the infrasound level should be specified. I believe that specification of infrasound is not at all necessary and I believe this could be detrimental to the residents, because infrasound, in my opinion, is not the issue for them. I believe it is the audible low frequencies and higher frequencies that the residents may be potentially reacting to. For this, the A-weighting has been shown to be adequate for circumstances where that is the case.

To summarise, I believe infrasound is not the source of any complaints due to wind turbine noise. I believe that low-frequency audible noise may be a possible source. The current research shows that wind turbine noise does not cause health impacts when A-weighted noise criteria are met. I believe that A-weighted noise level criteria are therefore adequate to describe wind turbine noise, just as it is for many other noise sources. I note that both the recent Canadian and Japanese work found that the use of A-weighting was validated.

Senator BACK: Thank you Dr Broner. I appreciate your evidence. I understand that you were one of the international advisers assisting the Health Canada study. Is that correct?

Dr Broner: That is correct.

Senator BACK: Earlier this morning we heard from Dr McMurtry from Canada. I am not sure how many households started out the process. By my calculation it was just under 1,500. He made three observations. The first was that 400 households were ruled out of the scope of the study, and I am not sure why. Subsequently, another 322 were removed. I am sure I wrote it down correctly when he said that people under the age of 18 and older than 79 years of age were then excluded before the conclusions of the study were undertaken. His point was that many of the people in the under-18 and over-79 years in fact are most vulnerable to the effect of sound. Is my summary of what Dr McMurtry said consistent with your recollection as an external international adviser?

Dr Broner: The truth of the matter is that I do not recollect those details. I was involved in certain aspects of advice. I was not involved in choice of houses, and I really do not remember. I am happy to take that on notice and respond.

In relation to the age groupings that you have mentioned, I really do not recall that discussion either. I am not aware of any information or research that suggests that these groupings are more sensitive than the others that have been mentioned, but I am happy to take that on notice and respond to you on that.

Senator BACK: I would be appreciative if you would. I understand that McMurtry—whose submission was No. 146—actually did write a commentary on the Health Canada outcome, which appears as his appendix 7. So, in asking you to do a bit of homework, I would be appreciative if you would pick up any comments he may have made also.

If I take you to the work of Kelley and associates in the 1980s, you would be aware of that work.

Dr Broner: Yes.

Senator BACK: I am reading here: 'It concluded that impulsive infrasound and low-frequency noise caused annoyance and sleep deprivation at sound levels that could not be heard by the ear.' Is that a conclusion with which you would concur?

Dr Broner: Could you just repeat the wording, please.

Senator BACK: Yes. I am reading: 'It concluded that impulsive infrasound and low-frequency noise caused annoyance and sleep deprivation at sound levels that could not be heard by the ear.'

Dr Broner: My reading of the Kelley work is that in fact, when they did their studies, they had sounds which had high levels of low-frequency noise—more so than any infrasound—and that his conclusions were on the basis of that testing. So I would not agree that it was on the basis of the infrasound.

Senator BACK: My recollection is that the NHMRC literature study review committee in fact, at the end of the day, rejected the work of Kelley and associates. Am I right in that? If so, can you recall why that would have been rejected?

Dr Broner: I cannot recall, but I would think that the basis of that was that there was no direct relationship between his work and health impacts, which were the focus of the NHMRC study.

Senator BACK: You were the only acoustician on that literature study review committee?

Dr Broner: I was on the reference group. For the study, the NHMRC engaged a totally independent body to do all the reviews.

Senator BACK: I take you to a second one. I know the chair is going to wind me up; it is a bit hard for him to do it, because he cannot see me, so that is fair enough. I take you to the work of Moller and Pedersen, the Danish acousticians. They made the observation that large turbines emitted a higher percentage of their total sound emissions as infrasound. In your capacity on the NHMRC advisory committee, did you ensure that the review panel examined their paper in detail?

Dr Broner: Yes, that paper was discussed. I do not recall all the details, because it was a bit of time ago and a lot has happened since then, but certainly that paper was reviewed. My recollection of that paper is that they indicated that, as the wind turbines increased in power output, there was a trend downwards towards an increase of low frequencies, but it did not directly relate to infrasound, as I recall. I think it was around the 100 hertz region where the increase had occurred.

Senator BACK: Following your comments on audible sound, can I ask you: as turbine sizes increase, is there likely to be an increase in audible sound further out from the turbines?

Dr Broner: When you say 'further out', you mean simply with increase in size, presumably.

Senator BACK: Increase in size leading to the audible effects a greater distance away from the turbines.

Dr Broner: It is actually an interesting question because, generally speaking, even though turbines have increased in output and size, the overall sound power level and the spectrum have not changed that much, and I am aware that generally there are efforts to try and minimise the noise due to wind turbines. I am not sure how much larger they can get. Certainly, if it were the case that the sound power increased then, depending on that increase, nominally the increase would follow at the distances wherever you measure now.

Senator BACK: My final question relates to separation distances. I think I recall that you have provided advice to the New South Wales Department of Planning, and we had the Australian acousticians appear before us in Adelaide and we were talking about separation distances. As someone with no expertise in this field at all, it seems to me incongruous that Queensland seems to have adopted a two kilometre distance between turbines and the closest residence and New South Wales one and a half—and I think that is the NHMRC's recommendation—but then Victoria and South Australia have recommended only 1,000 metres. It is not possible across a state boundary that safe distances would vary by 30 per cent. So what is the right space or distance—or, indeed, are none of them, if you like, long enough to safeguard people?

Dr Broner: That is a very difficult question to answer because, as I explained in my statement, the resultant impact on any one person is dependent not only on the noise level, which is dependent on where you are in relation to the wind turbine—what distance you are away—but also on other factors. I am not aware of what decisions were behind the choice of the various setback distances. I would assume that they are based on some nominal notion of what would be an acceptable noise level at the various distances, and that that would then be related back to research that is available for noise sources in general and then also whatever information is currently available in relation to wind turbines.

CHAIR: Dr Broner, I believe you are the past president of the Australian Acoustical Society—is that correct?

Dr Broner: That is correct.

CHAIR: The Australian Acoustical Society I believe has a code of ethics which stipulates that acousticians must put the health and safety of the public above commercial considerations. Dr Broner, do you think that failing to insist to noise polluters that the full acoustic spectrum is measured is consistent with that code?

Dr Broner: I have already just indicated that I believe that the infrasonic part of the spectrum is not really what is potentially at issue here. So, from that point of view, I think my answer would have to be, 'No'.

CHAIR: I note that the critical Kelley NASA research findings from the USA in the 1980s from the NHMRC literature review were omitted. If that body of research had been included and given the weight it deserves, the NHMRC literature review would have had to say that there was evidence of direct causation of symptoms, including sleep disturbance and stress symptoms from pulsing infrasound and low frequency noise. Who on the expert panel decided that the Kelley NASA research should be omitted, and could you explain to me why?

Dr Broner: First of all, I think there was something you said in your statement there that I actually did not agree with. Are you able to repeat it? I am sorry.

CHAIR: In short, I said: as I understand it, the Kelley NASA research findings from the USA in the 1980s were omitted from the NHMRC literature review.

Dr Broner: My recollection is that it was discussed to some extent. I really do not recall to what extent, but it had no direct impact. The other relevant thing is that the Kelley work was based on the Mod-1 and -2 turbines, which were downwind, and the character of today's upwind turbines is different. The question is about health impacts and whether any information was available that related directly to that particular issue. My recollection is very vague at this point, I have to admit, but my recollection would be that, first of all, all of these things were discussed. I was not the only one on the reference group. It was discussed by the reference group and I think the reason that, in the end, it was not included was that it did not have any direct bearing on the question at hand.

CHAIR: There being no further questions, thank you for your appearance today before the committee. On behalf of the committee, I would like to thank all witnesses for appearing today and for their cooperation with this inquiry. The committee will now adjourn.

Committee adjourned at 17:26