REPORT ON PROCEEDINGS BEFORE

LEGISLATIVE ASSEMBLY COMMITTEE ON ENVIRONMENT AND PLANNING

INQUIRY INTO SUSTAINABILITY OF ENERGY SUPPLY AND RESOURCES IN NSW

At Jubilee Room, Parliament House, Sydney, on Tuesday 25 August 2020

The Committee met at 9:30

PRESENT

Mr Alex Greenwich (Chair)

Mr Anoulack Chanthivong
Mr James Griffin
Mr Nathaniel Smith

PRESENT VIA VIDEOCONFERENCE

Ms Felicity Wilson (Deputy Chair)

The CHAIR: Good morning everybody. Before we start, I acknowledge the Gadigal people, the traditional owners of the land and pay my respects to Elders of the Eora nation past, present and emerging, and extend that respect to other Aboriginal and Torres Strait Islander people who are present. This is the second hearing of the Legislative Assembly Committee on Environment and Planning inquiry into the Sustainability of Energy Supply and Resources in NSW. We will hold an additional hearing tomorrow. Today we have witnesses who will be taking part via videoconference, as well as attending in person. The hearing is being broadcast on the Parliament's website. I thank everybody for appearing before us. We appreciate the flexibility of everybody involved, especially those attending via videoconference.

CHRISTINE COWIE, Environmental Epidemiologist, Centre for Air Pollution Energy and Health Research, affirmed and examined

The CHAIR: Before we begin do you have any questions about the hearing process?

Dr COWIE: No, not really.

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

Dr COWIE: Yes, thank you. I am here to represent the Centre for Air Pollution, Energy and Health Research [CAR]. It is a National Health and Medical Research Council-funded centre for research excellence in air pollution and health. It is a fairly loose collaboration of about 30 different scientists working predominantly in epidemiology, which is really the study of the causation of disease, although we have toxicologists, we have atmospheric scientists as well, we have collaborated with CSIRO, and it is a capacity building centre. We are really funded to build the next cohort of scientists, predominantly.

The vision of CAR is for a healthier community through cleaner air and cleaner energy sources. We are in the second round of funding, with each being five-year rounds. This particular round we have also included energy sources and energy emissions as one of our areas of interest, but predominantly, we have speciality in air pollution epidemiology and air pollution health effects. It is a fairly new area that we have gotten into. The reason why we have forayed into this area is specifically for climate change, and the need to mitigate climate change. In our submission we are really addressing the third terms of reference, and specifically, the public health issue. We do not do research on economics, or environmental supply and energy sources. I will really focus on public health specifically.

It is clear to us that we need to rapidly move to a low or no carbon economy. I will not talk too much about climate change, because there is so much evidence out there, but it is clear that we need rapid change to combat climate change, and the rapid change really needs to be in terms of implementing new technologies which emit no carbon or as low carbon as possible. Obviously, there is a time period in which we need to move to that position, but CAR's position strongly is that we need to move as quickly as possible to a no carbon economy. As we speak there is abundant scientific evidence, and we are also seeing actuality of extreme weather events, the bushfires over the 2019-20 season, extreme rainfall events, and so on. It is affecting Australia specifically, as well as other parts of the world.

With climate change obviously we have the short-term impacts, we have air pollution emissions that we deal with, and that is really the main interest for CAR, and also these longer term climate impacts that we do not study specifically, but that impact on health. In doing that and in saying that we also need to be mindful of how we transition, and I suppose that is what you are all interested in, because it is clear to us that there is little consideration of the public health impact of any sort of transition that we are considering. For instance, a good example is in Europe a decade 15 years ago they made the transition to a rapid uptake of diesel vehicle engines to mitigate particulate matter, pollution, from diesel engines. Now, over time, they have realised that, although they have reduced particulate matter emissions, the emissions of nitrogen dioxide and nitrogen oxides has increased. That is specifically because of this diesel engine uptake. I raise that as an example of the sort of analysis that really needs to take place before we transition rapidly to a source that may have unintended public health consequences.

In venturing into energy emissions and sources, CAR decided to scope the literature to see what was out there. We conducted a scoping review, and I must say the submission that we made had the wrong numbers of papers specified. I think we mentioned that we looked at 5,000 abstracts, it was actually almost 7,000 abstracts reviewed, and we looked in detail at 82 papers. The point of that scoping review was to see whether any of the research taking place in energy transitions has a focus on public health, or even an interest in public health. What we found was that there were, not surprisingly, very few epidemiological observational studies. The majority of the research focused on modelling scenarios of energy transitions. By and large, those modelling scenarios really

indicated that when you have renewable energies replacing fossil fuel you will get a substantial decrease in particulate matter, both the fine particulate matter and the coarse particulate matter, as well as carbon dioxide and nitrogen dioxide.

Modelled further along, that would lead to a decrease in avoidable or premature deaths, and also a decrease in hospitalisations and emergency department admissions for conditions like asthma, for instance, and respiratory disease. We found that the review indicated that fossil fuel combustion in mining generates the greatest human health impacts. That was one particular study, but consistently, these modelling scenarios pointed to greater health benefits of transitioning from fossil fuels to lower carbon fuels. What the review also indicated was that in some of the lifecycle analyses that are conducted, there is very little consideration of public health impact. One example of that might be the whole issue of biofuels. There has been significant investment into biofuels in Australia, for instance, in the last five years or so.

There is a widespread assumption that these fuels are less hazardous than the fuels that we are currently using, petroleum, gasoline, and so on. In actual fact, there is very little health-based testing of these fuels that has taken place. Some of the studies that have occurred have shown—both in terms of production of biofuels, and also the use of biofuels—a decrease in pollutant emissions; some studies have shown an increase in pollutant emissions. Of course, there are all sorts of pollutants associated with production and also use of biofuels. We are not suggesting that biofuels should not be used, but what we are suggesting is that there is a lot more research conducted, and toxicological testing of some of these biofuels, and robust testing before they are adopted in a widespread manner.

We strongly endorse renewables. A couple of examples of our concern might be in terms of photovoltaic cells, for instance, with solar energy panels. What we would like to see in some of the life cycle analyses that are done, is they also estimate public health impacts—in other words, the ongoing use of photovoltaic [PV] cells is unlikely to cause any public health impact; however, the disposal at the end of their life, we do not get a sense that that has been adequately considered. There are a lot of rare and precious metals that are used, and elements that are used in the production of PV cells. What happens to those at the end of the life of the PV cells? Will they be incinerated using high-temperature incineration? What does that mean in terms of emissions? Will they be landfilled? What does it mean in terms of our landfill resources, and also, potentially, contamination in the water supply? Also, whether there has been any health assessment, in terms of producing the actual cells.

Another example is electric vehicles, which are often raised as the solution to all our transport problems. When we look in terms of the use of electric vehicles, it really needs to be stated that they will not solve totally the problem of on-road vehicle emissions, because all vehicles produce a substantial amount of what they call non-tailpipe emission pollution. Tyre and brake wear will produce substantial emissions, and the heavier the vehicle, the more the tyre and brake wear emissions that are caused. The other issue with electric vehicles is, it depends on where you are getting your source of electricity. If we are burning more coal in power stations to source that electricity, that is an issue in itself, and it is not really going far enough to reduce emissions.

It is also replacing one source of private vehicular use for another source of private vehicular use, and not solving the issue of congestion, which is—not at the moment, during COVID—a real issue for our cities, particularly large cities like Sydney. There is a lot of lost time in commuting, which means time away from family, time away from being able to engage in physical activity, which is conducive to better health, and it is further enforcing a sedentary lifestyle. CAR really supports investment in the sorts of active and public transport that increase physical activity and decrease a sedentary lifestyle.

The CHAIR: Dr Cowie, in the time that we have left, would you mind if we jumped into questions. I am sure you will be able to get to speak about different issues. In terms of gas-fired power and the potential health impacts of that, what have you found in that space?

Dr COWIE: That is not an area that we have researched, actually, so I could not answer that with any confidence unfortunately.

The CHAIR: Okay, no problem. More generally, in terms of the monitoring process and risk management process, you talked about the concerns around a transition, to make sure that it is done right and that the public health impacts are considered. How would you see that monitoring and risk management process done?

Dr COWIE: That is a really good question. I guess I do not have any quick or easy answers for you. Obviously, we are not involved in any of the regulatory or policy setting aspects of the energy sphere. The other issue with part of the scoping view that we did was that we noted that there are a lot of players in this whole space—a lot of regulatory players, as well as a lot industry players. I guess in terms of including a public health mandate, it would really need to reside with one of the regulators and implementers of energy regulation. I could not see it residing anywhere else, so I think it would have to be taken up in policy and government. As much as

you have the triple bottom line of environmental, social, and economic considerations, we strongly believe that public health needs to be in there as well. Whether that is part of social, or whether that is separate, I think it needs to be part of that triple bottom line.

The CHAIR: In terms of the public health outcomes in talking about a transition, there are obviously the very real ones - air pollution and impacts on asthmatics as a result of coal-fired production and other forms of emissions. Obviously, when you are a coal dependent or reliant community, and there is this market-driven decline that is happening, and so much of your community relies on coal, just that transition can also have a strong mental health impact on that community, exacerbated currently by COVID-19 and all the pressure that is coming from the pandemic. Have you looked into that, and ways in which communities are best supported through this transition from a mental health point of view?

Dr COWIE: No, we have not. That is not our area of expertise, so we have not looked into that.

The CHAIR: I might hand over to my Deputy Chair for any questions.

Ms FELICITY WILSON: You spoke earlier about power transition and the economy. Most of the evidence we have heard is that market forces alone lead to an expectation that we will transition away from many fossil fuels. That does not mean that everyone is agreed, but that is the predominant view from the evidence we have heard so far. But the discussion about the way in which we transition is very interesting, and the time we take to do it. I am not sure if you have been following some of the media commentary today, but I wanted to see if you can share your perspective on gas with us. Some media commentators are questioning the extent to which gas should play a role in that transition and how long for. Obviously, it is part of some of the strategic approaches being seriously considered at the moment across the country. Could you give us your view on gas?

Dr COWIE: Unfortunately, we cannot. It is not an area that we have delved into. Our area of expertise is looking at various sources of energy but no, we have not looked into gas. That is the short answer. But it is a fossil fuel.

Ms FELICITY WILSON: Do you have an overall view about the types of fossil fuels that are utilised through that transition, and how long you would envisage an appropriate transition, from a public health perspective?

Dr COWIE: We have we have not done any projections of that sort, in terms of how long. We would support a transition to renewable energies, more so than a transition to another fossil fuel, which gas is. Obviously, there is an economic cost, and other issues, as you said - in terms of mental health, and ensuring that people are employed - that also need to be considered, but our simple advice and advocacy would be around transitioning to renewables, as much and as quickly as possible.

Ms FELICITY WILSON: On that transition to renewables, I guess it is a bit of cautionary advice that you are sharing about the actual renewable sector itself, and whether or not what we are seeing as renewable is in fact better for public health. Is that accurate?

Dr COWIE: What we are cautioning is that it is best to study the full life cycle of how we produce any renewable or any alternative energy source—from how we consume it, to how we dispose of any by-products at the end of its life. We need to consider that full life cycle, and any public health impacts in that. To date, there has been a lot of environmental consideration, including life-cycle analysis of energy sources, but there does not seem to be any consideration of the public health impacts. For many of the renewables, they will be very small until you get to the end of the life span of that renewable energy source—so it might be the PV cells, it might be the wind turbine blades, for instance. In many cases the public health impacts might be quite tiny, but it would be good to have some modelling around them, and some intelligence around them.

Ms FELICITY WILSON: You spoke quite a bit about transport as an example when you were speaking about, for instance, the carbon dioxide emissions that can occur through biofuels. I want to get your perspective on two different contributors to those decisions. One is industry. Do you think industry is aware, or factoring in, those public health needs when they are considering what they are looking at pursuing? Secondly, you mentioned briefly the question about government policy, and the role policy plays in—it is probably not the right terminology in this context, but essentially picking a winner, or choosing a path down by which a specific product or technology is utilised. For instance, there was the example of biofuel.

Dr COWIE: I do not see any evidence that industry is specifically looking at the potential for public health impacts, for instance, in the biofuel industry. I am assuming that they consider environmental impacts and, by extension, they think a good environmental impact will also result in a good public health impact. In most cases it does, but that is not always the case. I suppose my example of the diesel emissions in Europe was an example of that. I guess what we are saying is that we would not want any unintended adverse consequences to

arise from a move that we think is beneficial for a whole lot of other reasons. Good testing, good modelling, and good consideration of public health impacts, as well as environmental, at the initial stages, is really what is needed, without strangling innovation and creativeness in moving this problem forward.

Mr ANOULACK CHANTHIVONG: Given that you focus your research on air pollution and public health in general, what is the centre's projected analysis on, say, as we move towards renewables, what is the impact on people's health based on the current trajectory? I might just use the hypothetical of if renewables made up 50 per cent in 10 years. What is the base case on the impact on public health on the current trajectory? Has the centre done any analysis on it?

Dr COWIE: We have not done any projections to date. This is a very new area for us, and we have very few people working in this area.

Mr ANOULACK CHANTHIVONG: You talked about a rapid transition in your submission, and in your introduction. What does a rapid transition mean and what is that time frame, in your view?

Dr COWIE: Moving now to move towards a low-carbon or no carbon economy, with the safety checks—

Mr ANOULACK CHANTHIVONG: Are there some metrics to that? That is by 10 years, by 20 years?

Dr COWIE: Again, we have not done the modelling. But if you look at climate change impacts, they are occurring now, and all the scientific evidence in that area—again, we are not involved in modelling climate change per se—is that we need to move now to limit temperature rise to 2 degrees, let alone the hope that we limit it to 1.5 degrees.

Mr ANOULACK CHANTHIVONG: Lastly, in the impact on public health, which is a focus of what you do, will the centre be looking at the impact it has on those who are adversely impacted by the transitions, such as communities who are losing jobs, losing their incomes, and the impact on their socio-economic and mental health wellbeing? Is that something the centre will also be examining, in terms of its global equation of net health outcome?

Dr COWIE: Again, it is not our area of research expertise. But we do, from time to time, engage with other researchers who study the mental health and psychological impacts of different transitions. We tend to link with other researchers. Researchers tend to have a narrow research focus a lot of the time. That is where their expertise lies.

Mr JAMES GRIFFIN: We heard yesterday from some witnesses around the transition from the coal industry in New South Wales into looking at moving away from coal and into rare earths—cobalt, nickel, and others that would be associated with the making of renewable energy projects, so the wind turbines and the blades that you mentioned before. Given what I have heard from you around the health impacts, which are backed up by the science, I guess it is a choice of doing nothing or helping that industry transition away to look at mining those particular elements. Is that something you would support? Because it is a shift and it is a key element of moving towards new technology and low carbon or no carbon.

Dr COWIE: Again, we have not done that analysis or modelling ourselves. We are advocating for a life-cycle analysis to look at these transitions. A life-cycle analysis would look at, if we move away from coal in this community but allow mining of other elements—metals—how do the environmental and health benefits stack up? And not just at the time of mining, but further down the line to the end of the product, and which one is the best solution to the issue? I guess that is what we are advocating, in terms of whole-of-life-cycle analysis of some of these issues, because that will give you a much more broad and all-encompassing view of whether one particular energy source is better than another. Can I just say something about the mental health impacts, too?

The CHAIR: Yes.

Dr COWIE: Could I say something about the mental health impact too?

The CHAIR: Yes, please.

Dr COWIE: Certainly, from a public health perspective, we feel sympathy for communities that are built around specific resources, and in Australia we have lots of towns in that particular circumstance. Broken Hill is a classic, Port Pirie, and so on. We have empathy for people whose livelihoods rely on a particular industry, because without work, there is a whole raft of other health issues—I do not think I need to go into detail, that poverty is linked to poor health on a whole number of different levels. Having employment available is crucial and very important to health and to supporting health in a community. But equally, if we do not move soon, we will be experiencing more extreme weather events and catastrophes, like we have seen, that also affect these and other communities. These are extremely complex issues, but if we can help affected communities transition to a

different income source, and can support those communities, that is what we need to try and do. Obviously, these are complex and difficult problems.

The CHAIR: The question is not necessarily if or when, but more how to make sure that all those things are considered. From what we have heard from you, it is just generally that, when it comes to the energy supply and energy resources in New South Wales, public health outcomes have not had the priority that they should have to date?

Dr COWIE: I think so, yes. Just even the consideration of public health. As indicated, there may be some renewable energy technologies that have little public health impact until the end of their life span, or they may at one particular stage, where you are mining something, so the impact is mainly on the workers, rather than the surrounding communities. It is the absence of any consideration of it or documentation that is of concern.

Mr ANOULACK CHANTHIVONG: I think that is right. When we are looking at public health, it has to go through the whole entire extraction, production, usage and disposal chain. If you are looking at the public health benefits of renewables, you also look at the potential public health costs. If you are going to produce photovoltaic cells, you still need an energy source to produce it, and whether that energy source is reliable and available to produce that as well. You do not make things out of thin air so to speak.

Dr COWIE: Yes.

Mr ANOULACK CHANTHIVONG: Any research that the centre is doing, the Committee and I would be interested in looking at a net equation on public health costs and benefits of this transition, particularly if it has had too-rapid a transition to an energy mix, where we do not have the supporting infrastructure in place.

The CHAIR: Thank you very much for appearing before us today. We may send you some further questions in writing. Your replies would form part of your evidence and be made public. Would you be happy to provide a written reply to any further questions we may ask?

Dr COWIE: Yes, of course.

The CHAIR: Thank you very much for your time and engagement with the Committee. We really appreciate it.

Dr COWIE: Thank you for the opportunity.

(The witness withdrew.)

FRANCES PIKE, Coordinator, Australian Forests and Climate Alliance, affirmed and examined

PEG PUTT, Australian Forests and Climate Alliance, before the Committee via videoconference, affirmed and examined

The CHAIR: Would you like to make any opening remarks?

Ms PUTT: Yes, I would. I am a committee member of the Australian Forests and Climate Alliance [AFCA] and also a coordinator of an international network of approximately 150 non-government organisations in 32 countries, specifically focused on the issue of the burning of forest biomass for energy generation. It is that use of forest biomass that we wish to address today. We do not have general concern about bioenergy, but we have a very strong concern about forest biomass. The first point I wanted to make is that forest biomass burnt in generators for energy production is at least as emissive of carbon dioxide as is coal. Depending on the feedstock, which is basically how wet it is, it can be up to one and a half times as emissive as burning coal. Obviously, that is in stark contrast to low emissions of other renewables. So it is not zero emissions, but nor is it carbon neutral.

The Intergovernmental Panel on Climate Change [IPCC] addressed this issue. They warned that combustion of biomass generates gross greenhouse gas emissions roughly equivalent to the combustion of fossil fuels, and if bioenergy production is to generate a net reduction in emissions, it must do so via offsetting those emissions through increased net carbon uptake of biota and soils. Treating sustainable harvesting as equivalent to carbon neutrality identifies the ongoing forest growth on landscape and assigns it to offset bioenergy emissions. The growth of trees over there is meant to offset the burning over here. However, trees over there were already growing and taking up CO2 out of the atmosphere. That does not constitute increased sequestration. There is a logical flaw, if you think that all you have to do is keep having trees growing somewhere, because they would have been growing somewhere anyway. You have to have additional net uptake, and that simply does not happen. That is really the first key point.

In Europe there was a mistaken idea that sustainability criteria could substitute for, or excuse, emissions and somehow contribute to carbon neutrality. When the European Union [EU] was reviewing its renewable energy directive recently, 800 scientists from around the world wrote to say that it had made a big mistake, and that sustainability did not in any way construe carbon neutrality. The European Academy of Sciences has taken up this case and continues to publish on it. The question becomes: How best do you deploy forests to tackle climate change? Because of the opportunity costs of burning forests, which is that you create big immediate emissions, and then need to wait for years and years and years for those to be recovered—in fact as long as it takes a forest to grow—you are much better to leave the forest growing, and actually have that ongoing sequestration, which removes carbon from the atmosphere and puts it into the wood.

There is also an impact on biodiversity, and that is an increasingly important consideration with the biodiversity process - not only internationally, but also with the sorts of damages New South Wales has seen in forests and ecologies, which were ongoing, but really exacerbated by the bushfires. I also wanted to address the fact that when we talk about residues or wastes being used, this is not a small amount of material. It is high volumes of low-value material coming direct from the forest, including whole logs. Lastly, the risks. In jurisdictions around the world, people doing or thinking about burning forests for biomass—and it always ends up to be forest material, because it is more reliable than the other forms—thought that would be a good thing. But as it has percolated, there are actually real problems with this idea that somehow you can assist tackling climate change. Regulations have been changed, but we see that this is an ongoing process in all sorts of jurisdictions as the gloss wears off, which creates a whole lot of risk for anybody invested in it, and for generators that have been established already—that type of thing.

So that has happened in the EU, with the second renewable energy directive clamping down and putting further constraints on efficiency especially. In the European Union, there is now a likelihood of a further review on biomass in the renewable energy directive. The United Kingdom has introduced much stricter provisions about efficiency and also about emissions from transport and harvesting of the bioenergy feedstocks, that are totally changing the investment environment, and the area from which the feedstock can be obtained. In Japan the feed-in tariff scheme has been moved out and changed to another method. Meanwhile, the criteria are becoming more restrictive for biomass, and they have got a sustainability working group that meets every year. It has been delayed this year. It has just started its advisory to Japan's Ministry of Economy, Trade and Industry , and it is looking at both emissions and sustainability from biomass this year. We would expect further changes.

In South Korea, they have briefly changed their subsidy regime to clamp down and in fact remove some incentives for forest biomass. This continues to happen around the world as the problems become apparent. Lastly, I just wanted to point out that substantial air pollution is involved. The emission of particulates is as high, or higher, than for coal plants. Nitrous oxides emissions are similar. Carbon monoxide and other products of incomplete combustion, benzene and formaldehyde, are also emitted. This is an area that really affects communities, and often has not been satisfactorily addressed.

The CHAIR: Could you talk to the branding of biomass as a renewable which has occurred and why, in your view, it is not a renewable?

Ms PUTT: Of course theoretically, if you cut down a tree, you can grow another tree and eventually replace it, so in that sense you could call it renewable. However, there are a couple of really important things. Renewable energy is conceived to reduce emissions, to help tackle climate change. The problem we have got with forest biomass is that, when you cut down and burn trees, you get immediate emissions that are equivalent to or greater than coal, so you are actually immediately exacerbating climate change and not attacking it. Until something has regrown to draw that back out of the atmosphere, we are actually in a situation that makes it worse, not better. Regrowing forest does not happen overnight. It takes decades to centuries, depending on what forest you are talking about, and we have got time frames under the Paris Agreement of 2030 and 2050, for emissions reductions to make a difference to what is happening to the planet and climate. That is way shorter than the time it takes even to break even on burning the forest material, let alone to get ahead. That is why it is not carbon neutral.

The CHAIR: Ms Pike, you have some good specific information in terms of New South Wales. The New South Wales Government is looking at increased biomass generation under its NSW Primary Industries Climate Change Research Strategy. Could you share your view on the direction of the Government's research strategy for bioenergy production, and risks and concerns you may have in this space?

Ms PIKE: Certainly. First of all the Government has been warned repeatedly on this by a consensus of scientists, both globally and in New South Wales, since at least 2012, but I would like to talk about some of the extreme risks. There is extreme environmental, financial, and reputational risk for using forest biomass as a form

of bioenergy. AFCA is not against bioenergy per se, of course. I would like to hand out these folders. I will just draw your attention to some of the most critical documents in them. There is an index there.

I am going to talk about three aspects of risk. One is air quality. Another is the almost imminent, inevitable lack of supply of feedstock. The third is the complete rejection of this form of bioenergy. There is no social licence for it. The people in New South Wales are extremely aware. Over 150 organisations have recently endorsed the AFCA and Nature Conservation Council of New South Wales' submissions against the expansion of any form of forest biomass bioenergy—not bioenergy per se, but forest biomass bioenergy—because of all the reasons that Ms Putt would have already explained. That was just in June. I will go through these three things in order. First of all, on air quality, we know that forest biomass wood combustion is particularly heavy in particulate matter. I draw your attention in the folders to one of the first documents you will find. There are three sections: air quality, the imminent failure of supply of feedstock, and the lack of social licence or scientific approval for it.

One of the first documents in the air quality section is a World Bank warning about COVID infestation, for example. I came across this quite recently. I was certainly not looking for it, but just found it. It draws connections with air pollution and particulate matter and the extreme danger of infestation due to that alone. There are various other documents referring to the American Lung Association et cetera. We have two pages of references to the extreme danger to human health. This is an unregulated industry. One of the last documents you will see is that the National Environment Protection Council, which sets threshold standards for a range of things including ambient air quality, in 2019 started the process of changing the threshold for nitrogen dioxide and sulphur dioxide. Both of these are emitted by bioenergy plants. With this unregulated, polluting technology, you immediately run the risk of being shut down or litigated against. This changing of standards is already underway at the Federal level. I would like to now talk about the failure of feedstock; I can go into great detail about this later.

The CHAIR: It is best to keep initial remarks as brief as possible. The purpose of this is for Committee members to ask questions, so I am really keen for them to do so. I would encourage you to submit these documents so we can include them.

Ms PIKE: We have already had a failure of the wood supply agreements, especially the native forest wood supply agreements, in New South Wales. Over the last 15 years we have had three incidents where the major recipient of wood supply agreements has sued New South Wales taxpayers for lack of supply. We have had to have a variation of wood supply agreements not that long ago, and that alone cost taxpayers $8.5 million. There is a failure to supply because, as the New South Wales Auditor-General said in 2009, North Coast forests have been cut faster than they can grow back. That warning was already there, and of course we had these incidents of compensation after that. They were not heeded.

We have a situation where there has been such a collapse of the sawlog industry and such unsustainable clear-felling and overcutting of New South Wales forests—everywhere, but particularly the North Coast and the South Coast—that in the remake of the Integrated Forestry Operations Approvals [IFOA], the regulatory system, the Natural Resources Commission was pressured to find more wood. They were actually looking at rebranding some old-growth forests to become available and changing mapping and definitions in order to get more supply. With the New South Wales IFOA, because of a relaxation of some regulations, there is going to be a doubling of the biomass taken out of forests. These already decimated forests are in imminent danger of further cutting. One of the main things that has not even been looked at is that in the last bushfires, 45 per cent of the New South Wales public forests—both plantation and native—have been lost. 850,000 hectares out of 2 million hectares have been burned. I cannot see how there will not be some kind of action if any of these facilities are promoted to be expanded. It is imminent financial risk, investor risk and reputational risk, so that is extreme.

In terms of the lack of social licence, I have a summary list which you can look at later, but the lack of social licence is across party boundaries. Here is an article from *The Australian*, *Biomass fuel: the great carbon con*. The Australian Religious Response to Climate Change—every denomination bar one—the Climate and Health Alliance of Australia and 150 organisations have endorsed a submission in June. It specifically calls not only for no native forest biomass, because of the critically important role of our native forests in removal and storage of atmospheric carbon dioxide, but it rules out any wood combustion. They understand that wood combustion is at least as emissive, if not more, than coal. Basically, this form of biomass just does not pass what is called the pub test, because your average person as soon as they hear about it is absolutely outraged. They know that this will emit more carbon into the atmosphere and destroy the forests when we are in the middle of an extinction and a climate emergency. I can go into detail on any of these other points if you like.

Mr JAMES GRIFFIN: I thought your opening comment about whether wood biomass is a renewable was actually a very generous one.

The CHAIR: It was talking about how it is often misconceived as a renewable, as a branding exercise.

Mr NATHANIEL SMITH: If you were advising the Government, through your own profession, experience, and research, what principles would you like it to establish in its policy and regulatory framework for development of the bioenergy industry?

Ms PIKE: In terms of the bioenergy industry, the main concept to get across is that it must not be based on forest biomass, because that would drive more intense logging. It extremely important to get across that this is not a residue-based industry; it never has been and it never will be. The first document in the second section of this folder, New South Wales Residue Report 2017, which came out in November, actually specifies, if you know how to read this document, that it does not want any leftover debris from the forest floor. It has absolutely nothing about that. It wants the mid stem of what are referred to as pulp logs, which really means immature logs, defined as residue or waste. It is a sleight of hand. It is a semantic trick. It is not residue; it is the immature trees of native forest ecosystems. It is the future sawlog industry in New South Wales. It is the home of wildlife. It is your catchments, your water regulator et cetera. It is absolutely not a residue-based industry.

There are various other documents and PowerPoint presentations from Fabiano Ximenes, New South Wales Department of Primary Industries [DPI] scientist, who is a major promoter of this. If you go to this document, there have been so many warnings. Australian Renewable Energy Agency [ARENA] has got the message loud and clear that Australians do not accept this, with the endorsement and multiple other summarised documents and representations that have been made. This document with these pie graphs dated 16 August 2020 from the New South Wales Department of Energy talks about the potential for wood and also grasses—including probably native grasses—to become part of this mad industry and to create atmospheric pollution.

Underneath here it talks about the origin of the New South Wales bioenergy industry and claims that the origin is bagasse, which is the residue from sugar mills, and it claims that this is the major feedstock of bioenergy in New South Wales. A quick analysis of this document—you have 10 pages here of the diagrams from the Government's own databases, the registry of who is getting the renewable energy credits et cetera—proves that in the last five years at least wood, forest biomass, is the major feedstock for bioenergy in New South Wales. It is unequivocal. It is all the Government's own graphs and records, and there it is. So this is, at the very least, a misleading document.

It is not a residue-based industry. It never has been. It was touted as that in the beginning or in 2012 when the Forestry Corporation NSW began representations trying to pretend to the public that this was a residue-based industry. They talked about leaves, branches and the fire hazard on the forest floor. It is a load of rubbish because, as their own document subsequently showed, legislation has been changed at the request of the lobbying arm of the logging industry. The legislation was changed in 2013-14, first of all by the New South Wales Government in the Protection of the Environment Operations Amendment Act for burning native forest biomass, and there is a mooted change now, I understand, to expand this well beyond just public native forest or plantation logging to include clearing and salvage logging in national parks—in what need to be recovering ecosystems. It is a little bit of a madness. It is not a residue-based industry at all.

Scientists warned in 2012—there is a letter in the document from scientists—that any change in legislation will drive intensified logging and this is exactly what has occurred. We see it now in the Natural Resources Commission attempting to get more wood. We see it in potential changes of legislation. It is extremely dangerous. It is not residue-based and everything can prove it.

Mr ANOULACK CHANTHIVONG: Thank you very much, Chair. Ms Pike, thank you very much for coming in. Earlier you mentioned the forests and biomass industry, and the outcome of extreme risk. Can you define what extreme risk is? What is your definition of extreme risk?

Ms PIKE: Okay. Extreme risk is—well, first of all, the environmental risk is circular. I do not wish to labour that point; I think that people have already covered that. I want to talk about the fact of class actions—litigation on air quality to do with the coal industry in New South Wales. I understand that there is a little bit of movement in that area but globally at the moment we have a situation where we have the Financial Stability Board globally that has set up a task force—the Task Force on Climate-related Financial Disclosures.

Membership of that includes 36 central banks and their regulators, et cetera. They are now promoting that you go beyond optional disclosure of climate-related risk and actually look at all aspects of your operations. They are really pushing for this to become obligatory—a mandatory situation. The Australian Prudential Regulatory Authority, the Australian Securities and Investment Commission [ASIC] and the Reserve Bank of Australia are now talking about this Task Force on Climate-related Financial Disclosures.

Mr ANOULACK CHANTHIVONG: Ms Pike, I will just cut in because I am very conscious of the time. I know the Chair is sensitive about it. I want to understand what you mean by extreme risk. In consequence to that, I want to get a better understanding what constitutes your concerns that contribute to the extreme risk

outcome. I am trying to get a definition of what constitutes extreme risk—whether it is financial, economic or social. What is it? What are the numbers you want to put up? I just want to clearly get a definition of what that actually is.

Ms PIKE: Well, in just very common language, I think you will be looking at litigation at local and regional level at the very least. You will look at resistance to this technology beyond the environmental risk, which is obvious. You will look at stranded assets. For example, Boral is setting up on the mid North Coast an $84 million diesel bitumen plant using native forest and plantation biomass. I have already explained that we have a shortage of supply. All the sums and all of the grants that have been given to Boral go to this point: It wants to be able to advertise it is greening up its national truck fleet by using a wood-based fuel source. It is simply that there is going to be a lot of expenditure and then there is going to be the potential for a stranded asset because all of the sums that have been done in development of this proposal have not taken into account the failure of the wood supply agreement already; nor have they taken into account that almost half of the volume of production forest has been lost.

Mr ANOULACK CHANTHIVONG: But I suppose that is just the risk of any decision in industry. There will always be risk in decisions and actions that you take. There are very few things that are risk-free. What I am trying to determine is what makes it, in your view, an extreme risk, instead of just a normal risk. I think the word "extreme" is actually quite important to me, because that adjective can create lots of debate, but also lots of confusion about what you mean by "extreme", and whether that adjective that is used actually (a) has not necessarily been defined and (b) also creates, I think, potentially unnecessary angst among different sectors of the whole industry equation.

Ms PIKE: I think the angst is entirely appropriate, because we are already looking at an industry that is failing. For example, the native forest logging industry in New South Wales has been propped up by about $23 million of taxpayers money every year. We have already seen compensation through New South Wales taxpayers for the failure of the wood supply agreements. This failure of feedstock is imminent and will have the most devastating consequences on wildlife. As I explained, the risk to human health is massive from any of these facilities. There will be actions taken by the public in regard to their health—there is no doubt about it—wherever these facilities are located.

When I talk about "extreme" I am talking about easily predicted risk, imminent easily predicted shortfalls in supply, easily predicted well-known problems and impacts on human health. These things are globally known. There is a consensus of scientists globally about this and economists have warned about it. For example, *The Economist* in 2011 had an article saying that European firms are scouring the earth for wood. We have seen those outcomes. In New South Wales there will be massive community outcry. Investors will lose money. Anyone associated with the policy promoting this is likely to be extremely unpopular with the public for very good reason.

Mr ANOULACK CHANTHIVONG: But I suppose that is the sort of risk for the market to determine as well?

Ms PUTT: Can I say something about that? I just want to say that I think one of the key issues here is that, if decision-makers determine that this is an energy feedstock to go ahead with and possibly incentivise in New South Wales, they will be doing so in the teeth of evidence that, around the planet parliaments have decided to go forward with this energy source and then have had to retract and increasingly put on more onerous conditions that restrict the ability to produce that energy and to make any money doing so. You see that across the range of issues, also including that it does not help to address climate change any time soon, if at all. If you make those decisions, that is one thing. But if you do it having the evidence before you that actually things are changing and will continue to change, then your decision itself becomes subject to some type of challenge arising from legal action from companies, or the public, or whatever. It is quite different to going forward just naïvely believing you are doing a good thing, if it is going in the teeth of all this evidence, that actually the industry is not what it was first thought to be and has to be wound back.

Mr ANOULACK CHANTHIVONG: Thank you for your comments. The risks you are talking about such as feed stock, litigation, and investor risk will be determined and assessed by the parties involved in that equation. They are the sort of things that markets as a broad term can work out for themselves.

Ms PIKE: The problem is—

Mr ANOULACK CHANTHIVONG: The use of the word "extreme" is always of great concern to me when we are debating contentious issues, because it is not necessarily accurately defined, and that in any transaction, risks are always present. Those who are best able to deal with the risks, are actually the parties. They will determine for themselves how much risk they are able to take on, and what mitigants they want to put in place.

Ms PIKE: One important factor here is the fact that this is an industry which is subsidised and so the risk is actually not being born at the outset in terms of research and development. Millions of dollars have been spent on promoting this industry. I can detail that later and provide lots of evidence for that. I have examples of companies that have actually said to me, "We have been living off the proceeds of research and development grants for over a decade", in relation to forest biomass, and are quite cynical about it as well. The fact that there are the large-scale renewable energy credits going to this form of energy which is non-carbon neutral, non-renewable and non-sustainable is not right. They are not actually bearing the risk and a lot of these companies know. In fact, it is a bit of a game just how much taxpayer subsidy you can get to set yourself up and look green and market yourself as a biotechnology or a company that is green.

For example, Boral actually said, "We are going to clean up 15 per cent of our national truck fleet with forest biomass diesel", and bitumen as well, so they are getting cheap finite resources that are going to run out at great expense to the Australian taxpayer, wildlife, people, health et cetera. It is all being subsidised so even if it goes wrong they do not have to worry. They have not really expended anything. It is the New South Wales Government's taxpayers, our future resources, our catchments. The other extreme risk—and there is an extreme risk, I will explain to you, I have observed in the past 10 years on the mid-north Coast.

In 2010 I saw what was happening with the clear-felling. I saw the regrowth of the young immature stands of trees that even age stands of trees that are no longer allowed to grow to maturity. I have observed an entire region turned to matchsticks and I was saying in 2010—I have a little video of me saying it ad hoc—that fires are going to rip through this and this is exactly what is happening. We have created a thing called the landscape bushfire trap. You can look at Professor David Lindenmayer's work on this and the many other ecologists across Australia who are warning against this treatment of forests because we are increasing their flammability and we are driving bushfires, so there is extreme risk.

The CHAIR: Thank you both very much for your time appearing before us today and the amount of detail you have provided both in person and in your written material. It is greatly appreciated and it helps us with our deliberation. We may send you some further questions in writing. Your replies will form part of your evidence and may be made public. Would you be happy to provide a written reply to any further questions?

Ms PIKE: Indeed. We have a lot of evidence to supply.

The CHAIR: Great. Thank you very much, Ms Putt and Ms Pike.

(The witnesses withdrew.)

(Short adjournment)

CHRIS GAMBIAN, Chief Executive Officer, Nature Conservation Council, sworn and examined

JOHN VAN DER KALLEN, Doctors for the Environment, affirmed and examined

GEORGINA WOODS, NSW Co-ordinator, Lock the Gate Alliance, before the Committee via videoconference, affirmed and examined

The CHAIR: We would like to give you the opportunity to make a brief opening statement. We ask that any opening statements be provided to Hansard and ideally kept to two minutes. There is a great deal of content that we are wanting to get through with this panel. In earlier sessions opening statements have taken up large chunks of time and we have not got to some questions.

Ms WOODS: Thank you, Chair. I will try to keep it brief, as our submission obviously goes into a fair bit of detail. The Lock the Gate Alliance is a national network of community groups and individuals around the country who are concerned about impacts of coal and conventional gas mining. Much of our submission is about the Hunter Valley, but we also hopefully will have the chance to go into some detail about the Namoi region. The water security challenges are quite different in those two regions. Neither the Hunter, nor the Namoi up in the north-west in the Narrabri area, have Renewable Energy Zones declared, so hopefully we will get the chance to talk about the importance of that. If I was to stress anything in these opening remarks, it is that to us the crucial importance is local leadership and agency, and public involvement in work to diversify and transition energy systems. This inquiry, we think, is vitally important to that, in bringing to the public a lot of the issues that you have already heard over the last day or so.

Witnesses yesterday spoke about local government and community leadership in the Hunter. We have supported that and been a part of it, but the region really urgently needs state government policy and financial support for those endeavours, because transition strategies will not work and bring lasting benefit to our region—I am based in Newcastle—if it occurs without the participation of the people who work for the coal industry,

others in society, and the broader community. It also will not work if it further degrades our river, air quality, biodiversity, and humanity, or it further entrenches the region's lack of agency and decision-making about energy. We have a lot of expertise and go gung-ho on this issue that will hopefully be able to lead us into our new future. I also put on the record that Lock the Gate supports the Hunter Joint Organisation of Councils' Hunter 2050 Foundation. We hope the Committee will get the chance to hear directly from councils, unions, environment and business groups in our region who want to cooperate to carve out that future.

The CHAIR: Thank you very much.

Dr VAN DER KALLEN: Doctors for the Environment welcomes the opportunity to present at this hearing. After recent years of drought, heat waves, bushfires, floods, and storm water damage, there is no longer any doubt that we are suffering from the impacts of climate change. Similarly, there is no longer any doubt that the main cause of climate change is the burning of fossil fuels. It is critical that we stop burning fossil fuels if we are going to have a chance of mitigating against climate change and its health impacts. The importance of this cannot be overstated. In an unprecedented event, 11 medical colleges and organisations in Australia representing about 90,000 doctors, or over 75 per cent of all doctors in Australia, wrote to the Prime Minister urging that the economic recovery from the COVID pandemic is not based on fossil fuels, and is focused on sustainable industries which will help mitigate against climate change:

> Climate change is a public health emergency. Failing to mitigate and prepare for climate change risks potentially catastrophic health and economic impacts. Australia has an unparalleled opportunity to act on climate change and invest in a cleaner, healthier, and more prosperous future.

Australia has an unparalleled opportunity to act on climate change and invest in a cleaner, healthier and more prosperous future. Many doctors and patients are bewildered and angry that there continues to be a denial of the science of climate change and a lack of progress in reducing carbon emissions. If a doctor knew that a patient had a critical blockage in an artery they would do something about it, rather than sit and watch the situation get worse. This Committee has a very important job in front of it. It is one of the last chances to create structural change that will protect communities against the worst impacts of climate change, and build resilient communities. If the Committee does not take this opportunity, history will not look at them kindly. As elected representatives of the community, you have a duty to look after the community, and attempt to protect them from future trauma. In the same way that a doctor has a duty of care for their patients, you have a duty of care to do the right thing.

Doing the right thing means building an energy system that moves away from the dependence on fossil fuels as fast as possible. The submission by the New South Wales Government provides an outline of many of the initiatives that need to occur, such as modernising the transmission grid. According to the TransGrid submission they have had generator connection enquiries totalling 48,000 megawatts, beyond what we are already producing in New South Wales. Doing the right thing means funding energy efficient programs, creating the Renewable Energy Zones, and developing bioenergy and hydrogen from renewable sources.

The Hunter Valley already produces much of the electricity in New South Wales, and it would be a perfect location for large-scale renewable energy, due to its current infrastructure and ready workforce. As pointed out in the Doctors for the Environment Australia Inc. submission, the Hunter Valley workforce has previously been impacted by the decline in coal prices, and we are seeing it again. These people, often young, should be given the opportunity for long-term sustainable jobs, which are good for them and their families, and not jobs that are dependent on the price of coal or gas. Furthermore, there are significant health impacts from all stages of production of fossil fuels on workers, their families, and local communities.

Of particular concern is the myth that gas is a safer fossil fuel than coal or oil. Gas is not a transition fuel. It is just another fossil fuel. According to the latest National Greenhouse Gas Inventory data, the "increase in fugitive emissions was driven by an increase of 17.9 per cent in natural gas production". It is unacceptable to allow this industry to expand, let alone give it government subsidies to do so. I suggest that the Committee cleans the slate, puts aside the past, and moves into the twenty-first century—a century that is going to be dominated by climate impacts. The submissions received for this inquiry have many sensible and viable alternatives to ongoing burning of fossil fuels, and the Committee has the opportunity to make history by protecting the community against energy insecurity and climate change impacts.

Mr GAMBIAN: Thank you for the opportunity to speak at this important and timely inquiry. As the peak body for nature in New South Wales, the Nature Conservation Council [NCC] and the member groups we represent have a strong interest in the sustainability of the state's energy supply. Global heating, caused primarily by burning fossil fuels, is among the most pressing and severe threats to our natural heritage. From the river red gums that line our great inland rivers, to the snow covered alpine meadows, and the coastal wetlands, the burning of fossil fuels threatens the future of our precious places and the web of life they support. We need look no further than the last bushfire season, in which 33 people and a billion native animals perished, to see that burning coal for electricity costs far more than four cents per kilowatt hour. There are three issues worth considering: The speed

of the transition to clean energy; the opportunities that transition presents; and the risks that transition must mitigate.

Coal power stations are the single biggest source of carbon pollution in New South Wales, comprising 39 per cent of its annual total emissions, or 50 million tonnes of carbon dioxide per year. To put that in context, that is more carbon emitted by New South Wales coal power stations than the entire nation of New Zealand. It is more carbon emitted than the total carbon emitted by 146 other countries. Around 80 per cent of New South Wales electricity generation comes from burning coal, making our state one of the most coal-dependent electricity markets in the world. To avoid catastrophic climate change, all OECD countries, like Australia, need to stop burning coal by around 2030, but the current closure schedule of New South Wales coal power stations extends at least 15 years beyond that deadline.

NCC has completed a study into the opportunities for New South Wales from transitioning to clean energy. We found that there is a huge opportunity for regional jobs and regional economies in embracing the transition to 100 per cent clean energy by 2030. If this occurs, we will create 22,000 full-time jobs each and every year in New South Wales, secure $25 billion of investment in regional areas of the State, and save 60 million tonnes of carbon pollution each year. If policy settings support a jobs-rich transition to clean energy, far more jobs potential exists than we have estimated. For decades, workers in the coal industry have provided our state with energy, often working long hours in potentially deadly conditions.

Now that we know that coal is heating the planet, our state should ensure these workers and their communities are not left behind. We can probably all agree on that, but how do we translate it into action? Looking to Europe, which is much further along in this transition, is instructive. Germany alone has committed €40 billion—A$65 billion—in just transition funding to support its coal regions in developing new economic opportunities. Germany's coal industry is similar in size to Australia's. We recommend that the New South Wales Government guarantees that no worker will be left behind through the transition, and that coalmining regions will have sufficient time and resources to adapt economically. Central to making this guarantee is setting aside a substantial fund, with billions of dollars, to ensure that this guarantee will be met.

The CHAIR: In this inquiry yesterday we heard about the market-driven transition that is happening. There are media reports today on the inquiry into the bushfires, and that inquiry has undeniably linked bushfires to climate change. All of your organisations would know the amount of community motivation it takes to see real action on climate change. We had a statement on coal, which talked about diversification in coal-reliant communities. We had evidence yesterday of a skills gap when it comes to renewables. We know that a transition is happening—whatever forces are making it happen. The approach seems to be a bit more siloed than strategic today. We have a place-based strategy from the Department of Regional NSW, but we do not seem to have a statewide strategy when it comes to this. Ms Woods, you talk about the importance of the local voices and local leadership, how does that fit into a statewide strategy?

Ms WOODS: To us, both things really do need to happen simultaneously, and even though the evidence yesterday said there was a place-based approach to transition, we are not actually seeing anything tangible from the state government. There have been numerous plans, reports, and intentions drafted over the past seven to 10 years, but we do not have a pot of money that can be deployed to deal with this. We do not have a strong policy framework that gives confidence to people in the Hunter that this is actually being addressed and that we have what we need in place to do it. I query the robustness of that response. There is a need, obviously, for a statewide strategy. This is very important to the Hunter region, but we have four of the state's five power stations, and so that has much bigger implications for the whole of New South Wales.

As was raised yesterday, our coal industry contributes fairly substantially to the state budget, and that needs to be considered. I was quite surprised to hear yesterday that it did not appear there had been much consideration. The Future of Coal statement says that there will be a declining trajectory for thermal coal exports. It would surprise me greatly to hear that Treasury had not really considered the implications of that for New South Wales. We see the two things having to happen in a connected but distinct manner, because each of the coal regions do have very specific local conditions. In the international research on the different mining communities that have gone into decline because of the market, there are patterns that are similar, but the very clear message is that local strategies and responses need to be developed. They need to be developed in full view of the public, and they need to be led from within the region's concerned.

Mr GAMBIAN: I think that one of the problems we have is that, like a lot of the transitions that have happened to the economy over the decades, there is a tension between those people who are trying to hang on to the dregs of the past, and those people who have acknowledged the opportunity of the future. Years ago I was an official in the Finance Sector Union. The banking industry went through a massive transformation through the nineties. Fifty thousand jobs were lost out of the banking industry between about 1995 and 2005—huge transition.

It used to be that you would go to your local bank branch and there would be 20 or 30 staff there. Now that work is all done in a call centre, either in Australia or outside of Australia, or it is done in a big processing centre somewhere in suburban Australia.

Transitions are not new. How you choose to process that need for transition is very much a matter of choice, and largely a choice for government, so, with a clear strategy, with a clear vision that says, "The market is moving us in this direction, there is a climate change imperative that says we need to move into this direction anyway". We can either bumble into that, or we can take a very clear and deliberate approach. Our strong view is that we will get a better result on all measures—economic, social, environmental—if we take a clear, strategic approach, and not just hope that the market is going to take us there eventually. The market is definitely taking us there. That is not up for debate. The question is: How we will land up at the end, and what shape we will be in in the end?

The CHAIR: Dr Van Der Kallen, I will touch on one aspect of how the transition occurs. All members have expressed concern about the times we are in now, with greatly increased anxiety and stress as a result of the COVID-19 pandemic. You talk about a transition in coal-dependent communities. That will add pressure and stress. From a health perspective, including a mental health perspective, what do you see as the priorities in how we do the transition?

Dr VAN DER KALLEN: I think, to the first question about how, a transition authority is really important, and I think that that should be made up of people with expertise, including health, and those with expertise in psychological health are also important. I think that taking away doubt out of a person's mind helps improve their psychological wellbeing. I think we have seen that in the Hunter Valley already when coal prices dropped and there was a decline in employment, particularly in young people. That is clearly associated with an increase in mental health disease.

If people know what the plan is, and know what the direction is going to be, then they can feel secure, and security will give them a feeling of wellbeing, and will give them a feeling of place, and if they know there are good things happening that are going to protect their health, not just their mental health, this is going to give them a lot of positive feelings for the future, at a time when there is so much doubt about what is going to happen. I think that we are lucky that from this submission process you can see that there is almost a blueprint of how to do it from—I forget the woman's name from Germany who gave the plan about how they are going to transition in Germany. I mean, it is fantastic information, and I do not think that we really need to reinvent the wheel. It is a matter of putting these things into place.

The CHAIR: Ms Woods, in your opening remarks you referred to water security challenges. Obviously, New South Wales has experienced a massive drought. Could you talk to your concerns around water security as part of this whole discussion?

Ms WOODS: Yes, it is somewhat complicated. I will just begin in the Hunter. Our submission provided some details about the mining industry's place in the Hunter's river system. The mining industry now owns about 60 per cent of the high-security water in the region. The power stations and the mines combined have about 83 per cent of the highest security water access in the Hunter river system. The power stations have their own specific water licence type. A really useful report was prepared by the government recently—the Greater Hunter Regional Water Strategy—which forecasts the risks that that poses to agriculture, because agriculture tends to rely more on general security licences, which are the ones that are reduced during drought times. At the moment, the Hunter general security licences are at a lower allocation because of the current drought.

If the drought of record in the Hunter was repeated now—the thirties drought—general security licence holders would go without their entitlements for 12 years. So there was a route foreseen because agriculture is not able to start and stop simply. It needs that continuity. There is tight water security risk in the Hunter. I believe that that work was really triggered by the Millennium Drought, where the power stations and the mines were both really looking down the barrel of having to face water shortages, and they were saved from that, really, by the Pasha Bulker storm in 2007, which ended the drought for the Hunter, which was a great relief. But that put everybody on notice that there actually is quite a tight arrangement here with competing water uses.

I would also make the observation, I suppose, that the mining industry, although it owns 60 per cent of the high-security water, it does not generally use all of that water, or even most of it, because it uses rainfall and run-off that gets captured on the mine sites, and also groundwater that flows into the mines. That rainfall and run-off is generally not licensed, so it is prevented from flowing into the river system, but not actually formally required to hold a surface water licence. That is partly why the Maules Creek mine in the north-west is being prosecuted now for capturing surface water that it did not have entitlements for. When you switch between 2016, which were the numbers we included in our submission, and the last two years there, there is quite a dramatic change in the amount of water that the mines are having to pump from the river to supply their needs. It increased

by about 2.5 times between 2016 and 2018. Because the rainfall was not falling on the mine sites, they were not capturing it, so they had to start. During times of drought, water demand increases, as well as availability decreasing.

The mining industry is much smaller in the Namoi. The situation is more intense, because the Namoi has a less reliable water system than the Hunter. We have pretty reliable rainfall every year. Even during drought times, there is water in our dams, more often than there is in the Namoi. The Namoi has been experiencing really very dramatic drought over the last two years—the worst on record. And even now, following quite good rains this year, there is still a really severe deficit of rainfall over the last three years. That situation has started to cause quite difficult conflict between agriculture and mining, particularly around the Boggabri area where the Maules Creek mine was, essentially, running out of water, and having to go to the water market and outbid farmers at water auctions, and buying up agricultural properties in order to obtain the licences, and then building pipelines to pipe irrigation water to the mine site to keep the mine running. So there is a lot of concern in that district about the approval recently of the Vickery mine, for example, when there is already this developing conflict situation over water use. It is something that concerns a lot of people in our network.

I guess the other thing I would say to that is that climate change is actually worsening the water situation, not merely because it is changing rainfall patterns, but also because it is increasing evaporation. So the Greater Hunter Regional Water Strategy modelled, I think, a 10 per cent increase in evaporation rates from our dams, as a result of increased heat. So we are losing water, right from the outset. There might be less of it falling in particular seasons, and in some years, and then what we have we are losing more of, because evaporation rates are actually increasing quite dramatically as a result of climate change. The mines tend to have large water storages, and their evaporation losses are quite significant as well.

The CHAIR: Mr Gambian, I turn to your submission. You refer to reverse auctions for renewable energy projects. What do you see are the benefits of reverse auctions, and how would you respond to criticisms that they reduce competition?

Mr GAMBIAN: I am going to offer a disclaimer first of all, which is that I am not the expert in reverse auctions, although I think the broad point to be made about some of those mechanisms is that we need to create the best possible economic circumstances to spur on the massive investment in renewables that we need in this state. One of the ways that we can achieve that is to create market conditions that are going to give investors some certainty, and the more we can facilitate an environment where an investor or a developer knows that there is going to be a consumer for their product, particularly if government is that consumer, then I think we just have a lot more investment certainty.

We see that in all other sectors of the economy. To suggest that we would not need that in renewables I think is a bit ridiculous. We certainly support reverse auctions as a way to provide some of that security. Does that fly in the face of neoliberal market economics? Yes, probably, but I think everywhere that we see an emerging industry we have seen some sort of intervention to support that emergence, and it is a positive emergence.

Ms FELICITY WILSON: Thank you everyone for coming in. I have a little construction happening next to me, so I will do my best. If it gets too noisy, let me know. Yesterday, questions were asked which were a little bit more specific, around the transition. I am interested in the opinions and perceptions around hydrogen, and green hydrogen in particular; whether or not you think that this is a good alternative energy source for us, feasible. I am also interested in the discussion around uranium. I know, Mr Gambian, you have made some comments today on that. There are two developments there; one is about the mining of uranium, and the other is about nuclear energy. Either of those I would welcome your comments on. The last is a longer-term discussion for us but is in the media again today, which is the discussion about gas as a transition fuel—you have already spoken a bit about transition—whether or not we should be looking to gas, or the extent to which we should be looking to gas to be a transition fuel for us.

Mr GAMBIAN: I am not going to miss an opportunity—

The CHAIR: So hydrogen, uranium and gas.

Mr GAMBIAN: Three of my favourite topics. To go to the uranium question first of all, which obviously has been in the media in the last couple of days, really there are a couple of problems that we see. One is that uranium mining in New South Wales, even exploration in New South Wales, but mining, if there are uranium deposits that are going to be economic to extract, is an enormous drag on the state's water resources. Realistically, we are talking about uranium possibly being available in places like Broken Hill and Dubbo, two places that frankly cannot afford the water. Second, of course, are the eternal concerns about the toxicity of that extraction process, and what it might mean for the landscape and the groundwater and everything else.

The second issue I think is more troubling, and that is this debate that Mr Latham started last year—Mr Barilaro continued—which is the prospect of nuclear reactors being the solution to energy security in the state into the future. We reject that as a realistic option, on environmental grounds certainly, but also there are just solid economic reasons why it does not work. It is dangerous, it is expensive, and the question that still cannot be resolved, is what to do with the waste. It is not clean. We are talking about renewable, but we are also talking about clean. To the extent that there might have been a move to even open up the state to mining, we saw that as the start of a small but determined effort to try to turn New South Wales into a state that is oriented towards nuclear. We think that is a distraction from the main game here, which is wind and solar and pumped hydro and battery and all of that. We do not think it is necessary, and we think it comes with extraordinary harm.

In terms of hydrogen and gas; again, I am not going to claim technical expertise on these issues, but the prospect of green hydrogen, I think, is one that we absolutely should be exploring, because of the opportunity it could present. When we talk about that transition there is a big question there: Transition to what? As Tony Maher from the miners union often says, "You don't go from being a coalminer to a barista." What is the replacement industry going to look like? Green hydrogen very much could be part of that mix. Then you look at the sustainability of some of our energy intensive manufacturing industries. Again, if the technical specifications line up, then there is a huge opportunity there.

We are only going to know the answer to these questions if we are prepared to invest in research and be part of that discovery process. I think that would be a great opportunity for the state, and a specific opportunity for New South Wales. In terms of gas, I completely agree with what the other witnesses have said, which is it is not a transition fuel, it is just another fossil fuel. It does enormous damage in the extraction process. There is just no value in taking, effectively, a step backwards, when there is so much opportunity with the steps forward, from an economic perspective, but also from an environmental perspective.

Dr VAN DER KALLEN: May I add some comments?

The CHAIR: Yes, please.

Dr VAN DER KALLEN: The whole talk about the transition, one needs to remember the urgency of where we are at the moment. We have just dodged a bullet with the worst drought in most of the state, which was due to climate change. Much of the state still has issues with drought. The water resources were severely limited, to the point they were going to start trucking water to major towns in New South Wales. Luckily, the rains came. We have this urgency to change our energy system rapidly, and moving to nuclear energy is not going to work for us to do that, because there is a large lead-in time to actually producing electricity from that. Like Mr Gambian has said here, the damage to the environment is unacceptable, when we have got so many other options to produce energy, without needing nuclear.

Gas, as I said in my opening remarks, is not a transition fuel and is not an option; again, because of the immediate health impacts of using gas. Climate change has really accelerated over the last decade, and much of that is because of fugitive emissions, which are predominantly from the gas industry. Australia's emissions have been rising, the fugitive emissions. Predominantly, that is due to the gas industry. Remember, methane has a higher impact on global warming than carbon dioxide. Every stage of gas production has health impacts, from the environmental bit from where it is produced, to the transportation, to the burning. Since 2013 there have been over 1,500 journal articles outlining the health impacts from the gas industry. Again, we have got copious amounts of data from overseas now, from where gas is produced, showing the health impacts. This includes things like impacts on the size of babies born, the prematurity, the cancer risk, the cardiovascular disease. Burning and flaring of gas has similar health impacts. Gas should not be seen as our saviour in this situation. Similarly, uranium and nuclear power should not be seen as a viable alternative.

The CHAIR: Ms Woods, did you want to add anything to the discussion?

Ms WOODS: Yes, please. On the issue of hydrogen, I think Dr Briggs yesterday referred to the gap in the Hunter. Renewable energy is fantastic and important, obviously, but it is not of itself going to really provide the industrial underpinnings to replace the large-scale employment that the mining industry currently provides in the Hunter. Certainly, we think that renewable hydrogen is important. It must be renewable. You cannot just build a hydrogen industry based on continuing the fraction of coal and gas, which is already causing a great deal of environmental and social disruption. In the Hunter too, it is not just about mining and energy, but it is also bringing industrial facilities like Orica and Tomago, which underpin a whole lot of other economic activity for our region. If we could have renewable hydrogen in the Orica plant, if we could run Tomago on renewable energy and make it integrated in the grid as a sort of quasi storage facility, then those are the kinds of big planning problems that we feel like there is a market failure. It actually requires a fair bit of integration of environmental, social, and economic policy that we see as a proper role of government.

On the question of gas, hopefully the Committee is aware that people in our network, in the north-west alliance, in the north-west of New South Wales, are in the fight of their lives to stop the Narrabri gas project from going ahead in Pilliga Forest, 850 coal seam gas wells. There is a lot of debate about the idea that there is a need for that gas, but the reality is that in the electricity system, the use of gas for electricity has been declining. There has been a withdrawal of gas from the electricity system, because the gas export industry made it too expensive for it to make sense. Since we made our submission, and since the Committee started its inquiry, there has been a lot of developments. One of those just recently was AMEO's 2020 Integrated System Plan, which pretty clearly says there is going to be declining use of gas in the electricity system until 2030. The only circumstance in which gas will then come back into an increasing role in the electricity system after that would be if it was cost competitive with batteries, so if it cost less than or equal to $4 a gigajoule.

The gas from Narrabri will be roughly twice that cost, so there is a real mismatch between the way gas is being talked about in the energy system and the reality of the gas extraction economy, and how much money those companies need to get for gas in order to justify the economic investment of going ahead with these expensive gas fields. Our view is, of course, that the Narrabri gas project is not in the public interest, because of the damage it will do to groundwater systems and the Pilliga Forest. There are those difficulties, but we do not think they are insurmountable. What we should be doing is making plans for our regions that can last decades into the future, rather than continuing to ask regional communities to make these trade-offs, where there are cheaper energy and more jobs if they are willing to sacrifice environmental security and social cohesion.

I will just say one other thing that is really important for us in this conversation. There is a market failure, and there is a real failure of balance. Renewable energy is very important, and renewables and hydrogen are very exciting, but we are very clear that we do not want these new industries to repeat the mistakes of the mining industry, where there are decisions being made from outside the region, and demands being made of regional people that they sacrifice their amenity and their social cohesion and their local environment, for the sake of some big industry. We used to have ecologically sustainable development much more central to the planning system in New South Wales. We really want that the bump we are making in this transition is not just a bump off high-carbon energy sources, but also a bump back towards rebalancing of people, landscapes and economic interests.

Ms FELICITY WILSON: One of the real challenges is this question of transition. One of your earlier comments was that transition happens, and there are other examples that we can look at around the globe. One of the challenges for us is how to frame a transition that has so many impacts on so many different sectors of the community, and to make that transition with the existing technology opportunities that we have, or the technology that has availability in the short term. That is why the discussion around, for instance, gas and feedstocks, is so incredibly challenging. If we could turn on to 100 per cent tomorrow and have the type of baseload energy that we need as far as industrial processes are concerned, I cannot imagine that we would have the kinds of conflicts and challenges that we currently have.

I see a challenge for us as a community, and as representatives of those communities, is working out how to balance all of these competing issues. If I can paraphrase, you said that essentially the transition away from coal is 15 years too slow. There are the other organisations that would say that it is 15 years too fast. I understand that you have to present the facts and expertise that you have, but do you understand the perspective we have to come from in trying to balance these challenges? I do not hear from anyone, really, the answer to how we look at transitioning with least detrimental impact to the least number of people, if you understand what I am saying.

Ms WOODS: I think it is so important, and I am really glad that you phrased your question in that way. We do not in any way want to give the impression that we think this problem is simple or even quick. Based on our reading, not just of Germany, but of other regions and based on the experience of Cessnock, in the Hunter Valley, which has already been through a collapse in the coal industry in the past, this is something that we are talking about taking like a generation at least of work. Yes, it is very difficult, but there are two pieces to it. There are already things that are happening. In the Hunter region, one of the really big difficulties is domination of the mining industry over the labour force. The very attractive salaries provided by the mining industry for relatively low-skilled people makes it difficult for other industries to compete for labour.

Those are the rebalancing things, where policy could provide incentives to find other things that might attract people to other industries that the mining industry does not provide. There are lots of people working in the mining industry who complain a lot about the terrible antisocial shifts or the danger and all that sort of stuff. There is lots to be done there, and I guess we would just say that it is really difficult, but I hope that when you hear from people in the Hunter you will see that there is actually extraordinary willingness and desire for this to happen across the entire region.

I do not want to give you a false impression of unanimity, because there is certainly fear and resistance, but one of the really important things is putting things on the table and saying, "This is going to take several

decades to manage, but we value the contribution Hunter Valley has made to the state's economy, and the prosperity of our society over the last century and a half and, therefore, we are going to invest the money and the time and the policy that the region needs to make this difficult change." I hope we have not given the impression that we think it is not difficult. Certainly, the issue of gas is also very difficult, but these are the difficulties that we hope that we will together be able to say we are willing to face them and sort them out.

The CHAIR: Mr Gambian?

Mr GAMBIAN: Yes, I certainly endorse Ms Wilson's comments there. I guess the thing that I would add is that, sometimes in the course of advocacy, you do not stop and recognise progress. This government has taken some really important steps in the right direction, and that is the creation of Renewable Energy Zones, two of them now announced, and hopefully more to be announced into the future. As Ms Woods says correctly, this is slow work, but it is work that happens when you have a plan. The Premier has made it clear that the G\government has a net zero by 2050 target. That is very positive thing. The next thing that needs to come behind that is a road map to achieve that net zero by 2050 target, including a robust target for 2030 and 2040, I might say. But when we are working to a plan and we break these things down, they become a lot more realistic. The Renewable Energy Zones are really good progress.

The battery that AGL is talking at Liddell is really good progress. There can be more Renewable Energy Zones. We could do more with more wind, we could to more with solar, and we can do more with storage. All of those do represent opportunities to achieve that goal, but like Ms Woods said, do not for a moment think that we do not agree that this is an enormous challenge. We need to find a way, as we have said in our submission, to face up to the massive challenge presented by climate change, and the need to reduce emissions, but also to face the other balancing factors like the impact on the workforce, like the transition of the economy more generally.

So, yes, it is an enormous task and one I do not envy, but one I think can be achieved with a clear plan and a clear desire to get there. What is unhelpful is the contribution made by people—fortunately, I think, just around the edges—trying to bolster the coal industry, or bolster the gas industry, and make it an article of faith that somehow we are not really an economy if we do not have coal-fired power stations, and whatever nonsense that we hear from other places. Fortunately, I do not think that is the prevalent view in the Government or the Opposition, and that is a very good thing.

The CHAIR: Would you like to make any brief remarks, Dr Van Der Kallen?

Dr VAN DER KALLEN: Maybe a brief remark. I can understand the difficulty and the enormity of the job that lies in front, but I think that health could certainly be central to helping make a decision in which direction to go. Remember that, even now, in Sydney every year, approximately 150 people die from the pollution from coal-fired power stations. If you have health as a centre of the direction of the transition, then it makes it easier to decide which direction to go. The plan for the expansion of the transmission grid is a fantastic plan, and that would provide lots of opportunity for renewables as well as jobs. The final point I make is that, often when they talk about the cost of electricity from various sources, the health impacts, and the cost of the health impacts are not factored into it. If you put those into the equations, then the economics become even stronger for renewables and moving away from fossil fuel and nuclear energy.

Mr JAMES GRIFFIN: I want to focus on gas and hydrogen, because I think they are two of the sticking points for this reason: Yesterday we heard some terrific evidence from Beyond Zero Emissions, who spoke about manufacturing, building, transport, electrification, and so on, which I think goes some way in providing those structural changes that all three of you have spoken about, whether it is workforce, or changing industry. Then later in the day we heard about how hydrogen is critical as a part of that mix, to power the industry that is needed to create those jobs—whether it is green steel or, ultimately, the creation of batteries and so on.

The interchanging use of the word hydrogen and then sticking "green" before it and calling it "green hydrogen" is where we start to see some challenges in navigating this structural plan that we are all trying to work towards. I am concerned that "perfect" will get in the way of the "good", and whether hydrogen and gas are going to be two sticking points that will create a hurdle for us to move beyond. Is there a view that there is some concession that can be made around hydrogen first, and then that moves into green hydrogen? I do not know, I am just seeking your views.

Dr VAN DER KALLEN: There are two ways of making hydrogen. You can make it from renewable resources, or from fossil fuels. When you talk about hydrogen, it should always be the green hydrogen; the hydrogen derived from fossil fuels is just using another fossil fuel. Gas, as in liquid gas, again, is all those discussions that we have just had about fossil fuels and health impacts and the climate change impacts et cetera. It is pretty clear that that is accelerating climate change. Climate change is not going away; it will dominate this

century and we are only just seeing the beginning of it. Even today, we are seeing record temperatures in the north of Australia, we are seeing flooding overseas—it is happening every day.

If we suddenly switched off emissions today and made it zero, those effects will still keep going for 10 or 20 years. So, if in 10 years, we decide that we better do something about it, we would still have 10 or 20 years of pain, before things go down. So gas should just be out of the equation. Hydrogen from green sources is fine, as are renewables. As a Committee and as a government you have the opportunity to provide subsidies and incentives to go in certain directions, and you should use that power. That money should be used to help protect the health of the community, and help mitigate against climate change.

Mr GAMBIAN: When I was in year 9 I was asked to write a speech about the greenhouse effect, which just about nobody had heard of at that point—it was just starting to be discussed. Through my speech, and through my research, I discovered that we had about 30 years to solve this problem, otherwise we would have a catastrophic impact. I gave that speech when I was in year 9, which was in 1990. The days of the perfect defeating the good are long since over. We cannot afford that. I will celebrate any progress towards the ultimate goal of zero emissions, and the sooner the better. We will always advocate for the best option, but we stand ready to work with anyone who is prepared to move us in the right direction.

The CHAIR: Ms Woods, would you like to comment on Mr Griffin's question?

Ms WOODS: Yes. I think Mr Gambian's remarks are apt, and I do not think any of us are anywhere near a world that we would describe as perfect at this point. It is generous of you to ask us whether we are willing to make concessions, given how far behind we are from the world we wish we were all living in. I guess from our end, I do not have the answer on the technical stuff on hydrogen, and whether it should be retrofitted to renewables after we have already gone down the path of hydrogen from gas or coal. I would say that if we had a planning approach that was not led by companies that have a profit motive interest in the outcome, then we might have an easier time untangling these complicated matters, which involve not just the technical physics of the thing but also the economics of it, and the needs of the local community, and the environmental consequences of new industries.

That is what we are advocating for—a disinterested public interest; a realignment of priorities, to ask what the situation really is, and not rely on gas companies to tell us about the benefits of gas-fuelled hydrogen. Let us get a disinterested study on this, so we can understand what our choices are, what our constraints are, and what the best interests of the community will be. We do not feel that decisions right now in New South Wales are being made with those priorities in mind. I am not able to answer technical questions, but our approach will always be to take any opportunity to improve the way that the environment and people are considered in the planning system. I strongly reiterate that there is stuff going on, but the regional communities that are trying to make things happen absolutely need financial backing from the state government to do what they have already determined needs to be done and can be done.

Mr NATHANIEL SMITH: To the Doctors for the Environment, in your submission you call for stricter guidelines on water usage. As someone who is from an electorate that supplies Sydney's water—being Warragamba and other dams—can you provide more detail on this?

Dr VAN DER KALLEN: I think that when we have seen the ongoing and recent drought, and how precious water became, it goes against the grain to think that a lot of water is used simply for washing coal or suppressing dust, when it is such a precious resource. Agriculture and food security is going to become more of an issue as the climate change scenario bites. When summer temperatures get into the mid-40s it becomes very difficult to grow food, and we are seeing mid-40s not infrequently nowadays. As mentioned before, evaporation increases as the temperatures rise, so water will become the absolute precious resource that we have. I cannot give you all the details of how water is allocated between agriculture, et cetera, but the point being that we should definitely be considering water as one of our most precious resources.

Mr ANOULACK CHANTHIVONG: This is a universal question that would apply to all three of you. One of my main concerns is about the disproportionate impact that the change in the energy mix has on communities, in particular our coal mining or natural gas communities. What does a fair transition look like to you? Can you describe to me what you think a fair transition is?

Ms WOODS: I suppose for us the precondition for a fair transition is, firstly, that it is occurring out in the open, that there is publicly accessible information, and an ability for anybody in the affected communities to be involved, that it is run by a public authority so that it is transparent and accountable to the community, and that it is led by the people from that community, because they are the ones who understand best both their challenges and opportunities, and the unique ways their communities manage various change processes that affect them. Those are the circumstances. I am guessing you wanted something more specific about ensuring that people get equality of wages and conditions.

Mr ANOULACK CHANTHIVONG: Yes.

Ms WOODS: That is really important. I think that it is going to be pretty hard for new industries to match the wages the mining industry offers in the Hunter, particularly for the skill level. I think Dr Chris Briggs was pretty instructive on that yesterday, so I don't know if that is going to be possible. I don't know if fairness is where we are siding, to be honest, because there is a lot of socio-economic disadvantage in the Muswellbrook local government area, for example, and in Narrabri. To me the complicated question of what is fair needs to also consider those who have already been the ones who are disproportionately bearing the damage and difficulty that the current energy system is creating.

I certainly do agree that people who are working currently, particularly in the mining industry—I think the electricity transmission will be easier, in terms of making a direct correlation between new and old opportunities, skills and incomes. But there are a lot of people who work in the mining industry in the Hunter who base their personal financial situation around the incomes that they can get in that industry. I do not, I am afraid, have a simple solution to that, but I would certainly say that dialogue and up-front discussion of how long these things will take, and finding out from people what they need to make it work for them, would be the first step.

Mr ANOULACK CHANTHIVONG: Thank you Ms Woods. I suppose my question was: What is a fair outcome if we move to the new renewable energy mix? I am open to ideas of how that might be defined. That could go to Mr Gambian and Dr Van Der Kellen as well.

Mr GAMBIAN: I think it is a terrific question. What is a fair outcome? It is hope. As someone who many years ago spent fair bit of time, particularly in the Hunter, organising workers, I think it is feeling that, generationally, there is opportunity in that community, that the guts of that community will not be ripped out of it because of a loss of one particular industry, and that there is opportunity for kids. If you are a coal miner right now, you would not recommend getting into coal mining to your kids. You would be mad to do that, not just because of climate change and renewables, but because of the behaviour and practices of coal mining corporations,and automation within the industry. There is a looming threat to that community, one way or the other. I think what fair transition looks like is some sort of belief that you are going to have a job, and it is going to be a good job where you can participate in the Australian dream. The detail, of course, will be different for different people in different contexts, but we have to make sure that community has more than a choice between the coal mining industry and a Centrelink cheque.

Dr VAN DER KALLEN: I think that health is obviously one of the main focuses as well. People are disadvantaged, in the Hunter and other areas. Their health is impacted by that. A fair transition would help those who are disadvantaged in society, and sometimes they are harder to pick. The farming communities are really under a lot of stress and, again, this inquiry has the opportunity to provide more help for farmers and farming communities to be more resilient, and provide extra sources of income that are not traditional, which will have fantastic benefits, as far as mental health of farmers and rural communities go, in particular. We should look at some of those groups that are disadvantaged, and maybe look at a transition that might help those people along, rather than make their health worse.

Mr ANOULACK CHANTHIVONG: I read in Ms Woods' submission too that the German comparator has been used, not only in this one but others as well. That was a multi-decade process, and cost billions and billions of euros. How much do you think it is going to cost in New South Wales to achieve a fair outcome? That is the universal question to all three.

Mr GAMBIAN: How much do you have?

Dr VAN DER KALLEN: How much is climate change going to cost you?

Mr ANOULACK CHANTHIVONG: We like to use the German comparator, which is fine, but that required tens of billions of euros over 30 or 40 years to move from that. Are the current policy settings and financial investment sufficient to achieve the outcome that we want for everybody, both environmentally, and economically as well?

Dr VAN DER KALLEN: There is definitely some infrastructure funding that would be terrific. The grid plans are terrific. They would open up many areas in regional Australia, and you could boost the funding to those, so that you could accelerate those plans. In their own way, those areas are going to become more economically viable, and there will be further investment interest in those areas, and regional New South Wales will benefit. It seems to be one of the easiest things to do straight on.

Ms WOODS: In our submission we argued for a $2 billion initial contribution from the state government, to get the work underway in the Hunter region. I don't know how long that will last. I certainly agree that it will take a great deal of money. I do not think all of that money needs to come from the state government.

I think some could come from the federal government, because Australia as a whole has benefited from our mining industry, and is now in a position to give back. Some of it can come from industry itself. Many companies have made a great deal of money from the Hunter and the miners over the last few generations. It can come from multiple sources. I really strongly encourage the Committee members to read the coal transition synthesis report, which we cite several times in our submission. It looks not just at Germany, but also at the Netherlands, and other examples of these experiences from around the world.

Even the Ruhr Valley in Germany - which, as had been mentioned, has gone through a three-decade coal transition, and spent a lot of money on it, and saw its coal workforce reduce from about a quarter of one billion people down to about 5,000 at the moment - has higher unemployment than the German average. I do not think we should underestimate how challenging this is, and just how much needs to be put into it. As for fair, I really do think that the people of the mining communities of the Hunter want to be able to pass on to their children a region that has economic opportunity and environmental stability and beauty.

Ms WOODS: I think that is the kind of fairness that people will be able to rally around and get behind.

The CHAIR: In closing and in the interests of time, Mr Gambian, I might flip Mr Chanthivong's questions. What would you see as the costs of not doing this properly?

Mr GAMBIAN: We are already seeing the costs of not doing this properly. We are part of the globe, and what we do is directly relevant to what happens around the whole planet. Let us look at the costs in New South Wales alone in recent times: the worst fires on record, the worst drought on record, the massive economic impact of both of those events, the threat to our food security, the massive health cost, and its implications, as the good doctor has just pointed out, the massive impact on our natural environment, and the effects on humans that are caused by that. There is an incalculable cost to not taking action. I do not necessarily think we need to adopt the German approach. But even if we did, we are talking about a sum of money that is less than half of what we were able to find in a few weeks a few months ago to keep the economy afloat during the coronavirus pandemic. That money was well spent; that was a very good choice. But let us acknowledge what we are talking about here as well: an absolute, existential threat to our society and our economy. It is a comparable if not greater threat.

The CHAIR: Thank you all very much for your time today and your engagement with our inquiry. It is greatly appreciated. We may send you some further questions in writing. Your replies would form part of your evidence and be made public. Would you be happy to provide a written reply to any further questions?

Dr VAN DER KALLEN: Absolutely.

Ms WOODS: Yes.

(The witnesses withdrew.)

IAN HORE-LACY, Senior Advisor at the World Nuclear Association, Australian Institute for Mining and Metallurgy, before the Committee via videoconference, sworn and examined

DAVID FRITH, Director Policy, NSW Minerals Council, affirmed and examined

The CHAIR: We will now begin our next session. Thank you very much for joining us. Would either of you like to start with an opening statement?

Mr FRITH: Thank you for the opportunity to appear before the inquiry today. The New South Wales Minerals Council is the peak industry association that represents the New South Wales minerals industry. We have a pretty broad perspective on resources and energy policy, given our members produce a wide range of commodities used across a wide range of traditional and emerging technologies. Mines are also large energy users themselves. Across the board we see a bright future ahead for the New South Wales minerals sector and its economic contribution to regional New South Wales. We are in a very good position to benefit from the significant economic growth in our major export markets over the coming decades. The rapid global growth in new technologies will also drive increasing demand for the range of metals that New South Wales can produce.

Thermal coal is the state's biggest export. Last year our thermal coal export volumes set a new record, just beating the previous record set in 2014, and they are worth around $23 billion a year. Coal mining employment also reached an eight-year high. The embedded demand from existing coal generation assets in our customer markets, together with the current pipeline of new generation assets being constructed, and a forecast doubling of electricity demand over the next two decades in south-east Asia, are likely to sustain demand for our thermal coal exports for the foreseeable future. This is a view that is supported by the New South Wales Government's *Strategic Statement on Coal Exploration and Mining*.

It is also an exciting time for the metals sector. New South Wales currently has the strongest pipeline of metals projects that we have had for some time, with expansions announced or underway at several existing gold and copper operations. These include the $1 billion expansion at Cadia Valley Operations, just south of Orange, which is getting underway as we speak, and will employ 900 people during construction. There are also a range of new mine developments proposed for silver, coal, gold, copper, cobalt, nickel, scandium, rare earths, and a range of other minerals. Credit should be given to the New South Wales government for releasing the first New South Wales Minerals Strategy in 2019, which aims to encourage further investment in metals to take advantage of that growing global demand. As I said, I think there is a bright future ahead for the minerals sector, and the regional economies where the sector operates.

The CHAIR: Mr Hore-Lacy, would you like to make any opening remarks?

Mr HORE-LACY: From the perspective of the Australasian Institute of Mining and Metallurgy, which is a professional association, I want to address particularly items 2 and 3 of the terms of reference. New South Wales needs a range of electricity options. While the actual generating cost for wind and solar may be low, they are very materials-intensive per unit of electricity produced. More to the point, the levelised cost of energy, the LCOE, is not a useful metric as the supply proportion increases. It is 14 per cent now in Australia, and set to go higher. As the proportion of such intermittent renewables in the overall supply increases, the system cost of integrating them to meet continuous demand rises dramatically.

The Australian Energy Market Operator [AEMO] has failed to address this in its recent Integrated System Plan which, as was pointed out two weeks ago for the Victorian Parliamentary inquiry, really just amounts to an experiment. For Australia, a 50 per cent renewables target—that is 45 percent wind and solar, beyond a bit of hydro—will more or less double today's wholesale costs for the end user, adding about $65 per megawatt hour. That cost will need to be allocated fairly. That is very germane, I would suggest, to the terms of this inquiry. A high proportion of electricity supply from intermittent renewables is not attainable at reasonable cost—and you can look at California or Germany to see how that is working out—and nor will it ever provide process heat for industry.

Moving to incorporate a significant share of nuclear electricity in supply, as in pages 24 and 25 of the Australian Institute for Mining and Metallurgy submission, along with high efficiency, low emission coal and gas, would assure reliability at affordable cost, and incidentally build a highly skilled workforce. New South Wales hosts the technological and expertise core of such a program at Australia's Nuclear Science and Technology Organisation. Thank you.

The CHAIR: Thank you very much. I might start with a question to both of you, because it has been touched on in submissions and opening remarks. In terms of the expected growth of coal exports to south-east Asia, how long do you expect that to occur, given the decrease in cost of renewables? What sort of forecasting have you looked at there?

Mr FRITH: I think when we talk about the outlook for the coal industry globally, we need to be careful not to mask over some of the important regional variations that there are, particularly in the regions where we are exporting to in south-east Asia, that are in an early stage in their development process. I think with, as I said,south-east Asia, electricity demand is expected to double over the next couple of decades, and we will see similar kind of growth in places like China and India. There are around 1,500 gigawatts of existing coal-fired generation capacity in that region. There is a further 176 gigawatts that are currently under construction, and there is another 274 gigawatts that are in various stages of planning in the region as well.

With that existing embedded demand that there is, together with the growth in demand that they are trying to also meet, the outlook for New South Wales' thermal coal exports is quite bright for the next couple of decades. I think that is a view that is supported by the Commonwealth Chief Economist, the New South Wales Government's strategy, as I mentioned in my opening remarks, and a range of other forecasters as well.

The CHAIR: Mr Hore-Lacy?

Mr HORE-LACY: I have nothing to add to that.

The CHAIR: You spoke about mines as energy users in your opening remarks. Could you talk about the trends in relation to renewables actually powering those mines, and how that is happening?

Mr FRITH: I think in New South Wales the mines have the benefit of being connected to the National Electricity Market, so they are not like a lot of mines in more remote areas that may have to provide their own isolated or standalone generation sources. They do have a benefit of being connected to the national market. That being said, a lot of them are looking at ways to diversify their supplies of energy, given the steep increase in energy costs over recent years. We have seen examples of mines building solar capacity on some of their buffer

lands, for instance. We have a mine in the Hunter Valley that recently applied for development consent to build a solar farm on some areas of land that had been rehabilitated after being mined. Certainly, the industry is looking at those kind of opportunities, where they make sense, and where they can support them, on the land surrounding their mines. Others may be looking at opportunities like power purchase agreements or something like that to supplement their grid-supplied electricity. It is certainly on the horizon for a lot of these mines.

The CHAIR: Is there anything you would like to add on that, Mr Hore-Lacy?

Mr HORE-LACY: Simply that mines require a reliable supply of electricity.

The CHAIR: The New South Wales Government's statement on coal talks about supporting diversification of coal-reliant communities, to assist with the phase-out of thermal coal mining. In terms of that diversification process, what is particularly important from the Mineral Council's point of view?

Mr FRITH: Well, I mean we support the diversification of regional economies, and we have for a long time. The industry plays an important role in helping with that diversification and providing alternative pathways for employment for people right across regional New South Wales. That is something we support, and we support the development of the renewable energy industry as well, and potential downstream manufacturing opportunities that might come from some of the battery minerals that we have the potential to produce as well. That is something that we do support quite strongly.

I guess, based on the evidence that we have reviewed and that I have covered off in my remarks today, we do not see any kind of significant risk of a steep downturn in New South Wales coal exports. I think we need to make the distinction between the New South Wales domestic electricity market and the coal export market. With the domestic electricity market I think there is a fairly well laid-out plan for the retirement of thermal assets over the next 22 years or so. We can plan quite well for those retirements as they arise. Those time frames might shift slightly but, generally speaking, that road map, if you like, is laid out. We support measures to assist the workers at those power stations deal with the closure of those assets over time. But, as I said, broadly speaking, with the coal export market, the fundamentals supporting its ongoing production levels are quite strong, and we would expect to see that over the coming decades.

Ms FELICITY WILSON: Thank you for joining us today. I think that the essence of some of my questions to witnesses throughout the hearing so far stems from a view that is fairly consistent across industry and economists—that there is a need to transition away from fossil fuel-based energy sources. There are two distinct areas that would affect both of your entities: one is the mining element of that and obviously the other one is the electricity industry structure in the light of that 13 per cent. Obviously, we need to ensure that we have access to reliable electricity. We have heard a lot about transition. Can I get a sense from you both to what extent you are each considering transition within your own industries and whether or not you are looking at skills and training of the workforce?

We heard a lot yesterday about the opportunities for some of the workforce might be, in mine remediation, or there might be other alternatives with renewable energy, for instance. I would like to know whether you have looked at, for example, the model in Germany's longer-term transition out of coal mining. I am sorry if I am asking too much at once. I would also like to know whether you have a view on how Institute members would see opportunities for themselves with the transition, whether that is through certain potential feedstocks, or certain technological skills that you have, and whether or not this is something that is achievable and doable from your perspectives.

Mr HORE-LACY: Right. Perhaps I will lead off on that one, and Mr Frith can supplement. From our perspective, the transition needs to be to something that is reliable. The whole narrative of renewables has got a bit out of hand and a bit detached from reality, because it is highly subsidised. Alan Moran's recent paper or report on the degree of the subsidy shows it is huge. He maintains that each householder is paying about $1,300 a year now to subsidise the amount of renewables we have now. That is for a variety of aspects. The transition that I would see is replacing some of the fossil fuel capacity, if it is deemed that that is important for reducing CO2 emissions—and the World Nuclear Association is certainly a champion of that—into nuclear capacity.

For New South Wales, you could certainly deploy some large reactors, but the main transitional thing that is happening in the nuclear industry at the moment is returning to a focus on small reactors—not quite the same as the ones that operated in the 1950s and '60s, but much more advanced, in the same way as a current model motorcar differs from a 1950s or '60s model. They still have a lot of features in common, but there are some significant differences too. On pages 24 and 25 of our submission is mention of small modular reactors.

The main significance of these is that they will be largely built in factories. What has opened over the last 50 years is that the cost of building things onsite—large construction projects—has gone up remarkably, whereas the cost of making things in factories has essentially stayed much the same in real terms. So this new

generation of small modular reactors will be largely factory-built and shipped to site, and then assembled. The reason they are called modular is because, to build a decent-sized power station, you need several of them—up to a dozen, perhaps, side-by-side. That becomes easier to finance, and they are capable of load following to fit in with any preferential uptake of renewable power in the grid, which is intermittent and, to a large extent, unpredictable.

Mr FRITH: I think I have outlined our views on the future of coal demand for New South Wales thermal coal exports. We have not seen a justification for any kind of workforce transition planning in our industry based on the evidence that we have reviewed. What we would like to see is a growth in mining in New South Wales, and the metalliferous sector provides a range of opportunities there. There is the potential to grow employment in the mining industry in New South Wales, through the increasing global demand for metals. In terms of transitional issues, the industry is very focused on taking into account its carbon emissions.

In the coal industry there are a range of funding mechanisms set up to invest in reductions of emissions at mine sites in Australia, but also taking account of the emissions from coal-fired power generation, through measures such as high-efficiency, low-emissions power stations that can also be coupled with carbon capture and storage, and reduce emissions by upwards of 90 percent. There are a range of measures that the industry is taking on that front. Another opportunity for fossil fuels is the production of low-emission hydrogen. There are quite a few facilities around the world—I think around seven—that are producing hydrogen from fossil fuels, paired with carbon capture and storage. They are producing that hydrogen at a scale that could meet New South Wales' target of 10 per cent hydrogen in the domestic gas network. That is another potential opportunity for the coal industry in New South Wales.

Ms FELICITY WILSON: Mr Hore-Lacy, thank you for providing your expertise on nuclear, and thank you Mr Frith for your contribution on hydrogen, to a certain extent. You may not have a clear response to my question, because you have stated that you are not looking to transition away from coal mining. If there is a move away from coal mining in the future, as many people have said to us—whether that is consumer-led, regulatory through commitments to decarbonisation, or industry-led—to what extent have you considered some of the challenges that these communities and your own members will face?

You have said that you see opportunities for the expansion of mining and coalmining, but are there other alternatives that we can look to? In the opening statements today, there was discussion about whether or not gas will be a transition fuel. There is also the discussion about hydrogen and the renewed discussion about uranium as mining options for the State, and the potential for nuclear energy. I have found that the evidence from other witnesses to this inquiry so far is quite different to what we are hearing from you, Mr Frith. Do you have any comments to make around that?

Mr FRITH: The only comment I could make is that the mining industry has a very diverse range of skills and experience, from environmental scientists to engineers and surveyors—all kinds of different skills that are associated with the mining workforce. Those skills are very much applicable to other industries, so if, in some kind of future scenario, there was a shift away from mining, then there might be a high level of transferability for a lot of those skills. I cannot comment in any further detail on that.

Mr HORE-LACY: I would simply make the point that moving into nuclear power generation would involve significant upskilling, which would be of value to [technical malfunction] in New South Wales.

Mr NATHANIEL SMITH: Thank you, Mr Hore-Lacy, and Mr Frith, for participating in this inquiry. Firstly, I would like to personally thank your members for the work that they do in regional communities, and for the opportunities you provide in those communities, especially my regional community in Wollondilly. I was a little bit annoyed with a participant earlier in the day who referred to people who work in mines as low-skilled and paid quite well. I thought that was quite disgraceful. People who work in mines are highly skilled. I have been down a mine myself and I have seen it firsthand. Please go back and thank your members for the great work you do in regional communities. Mr Frith, in the NSW Minerals Council's *Mining for Recovery* report you identify new metal projects that are currently in the pipeline. For the benefit of the Committee, could you describe how those projects would provide opportunities to the renewable sector?

Mr FRITH: We recently released a report that outlined, I think, 32 potential mining projects that are currently in the planning pipeline, with a capital investment value of around $13 billion. I think 11 of those were metalliferous projects, and there are also a couple of other metalliferous projects that were not captured in that list that are currently underway, like the Cadia Valley Operations expansion I mentioned earlier. There are projects like: The Bowdens Silver project—silver is used in the solar industry; the Clean TeQ Sunrise project, which is a nickel, cobalt, and scandium project—so battery minerals, as well as scandium, that is used in lightweight transport materials; Regis Resources McPhillamys Gold Project; and the expansions at Evolution and Cadia gold and copper mines that have been announced recently.

There is a big pipeline of projects and there are a couple of potential opportunities. These materials are integral to renewable energy infrastructure and battery infrastructure, and it presents opportunities for the renewable sector, and potential manufacturing opportunities in regional New South Wales, particularly in the Central West. There is also an opportunity from an electricity demand perspective. Metals processing is typically quite energy intensive, and so having those demand centres close to where some of these proposed Renewable Energy Zones are could be of benefit to renewable energy infrastructure and generators in that region. There is also an opportunity to co-locate potential renewable energy infrastructure on mine site buffer lands. Again, potential opportunities to grow the renewable energy industry. So there is a range of opportunities in that regard.

I think one point of caution would be around land-use conflicts between renewable energy infrastructure and mineral exploration. There have been a couple of instances where quite promising and advanced exploration projects have been held up in some ways when renewable energy infrastructure has been proposed over those tenements. There is a potential to sterilise the state's mineral resource assets in some strategic areas if those kinds of considerations are not taken into account in the planning process. I think there are huge range of benefits from the growing minerals sector, but there are just a couple of those land-use issues that we need to be cautious of.

Mr NATHANIEL SMITH: Mr Hore-Lacy, when you referred to modular reactors earlier in response to a question from Ms Wilson, you said you would have to bring about 12 modules together to get it up and running. What would the cost of that be, just a ballpark figure, and for how many homes would that provide energy?

Mr HORE-LACY: I always steer away from the number of homes because there are too many presuppositions in energy use but, basically, small reactors are defined as those under 300 megawatts. That is pretty much the same size as many coal-fired generating units. Our small modular reactors, the ones that are actually made in factories and shipped to site more or less entire, are smaller than those, however. You are looking at, typically, 35 to 60 megawatt units, and you would lump as many of those together as you want to make the size of power plant you want.

As regards costs, again, it is very hard to put figures on, but typically nuclear plants are more costly than coal-fired plants, but they are a lot cheaper to run. I do not know whether that is an adequate answer, but the sorts of small reactors we are talking about range in size from 1.5 megawatts, as the smallest one—that is one that will actually fit on the back of a semitrailer—up to 300-megawatts ones which you would actually need to build on site unless it was composed of several smaller modules. But these are running and operating in a couple of parts of the world now. The main thing is that there is a large surge of development there. There are about 30 or 40, maybe even 50, designs of small reactors coming forward and some of them are very, very innovative and very interesting designs. There are also some that are simply evolutionary from current world-proven designs, but just at a smaller scale.

Mr ANOULACK CHANTHIVONG: Technology will continue to increase. How does the mining industry take that into account, in terms of jobs growth in the industry. Given the demand factors involved, will you need more employees, or will technology replace some of that human capital?

Mr FRITH: Are you talking about in terms of automation and that type of thing?

Mr ANOULACK CHANTHIVONG: Yes.

Mr FRITH: Automation is only adopted in New South Wales to a limited extent, as far as I am aware, and in the instances where it has been adopted, there has not been a net impact on jobs. So there is probably going to be more automation as we go forward, and the use of technology, and the mining industry is an early adopter of technology, but to date we have not seen any significant implications for mine employment. As I mentioned, coal mining employment is at levels that we have not seen for around eight years, so it is quite high, while production is around the same level as eight years ago.

Mr ANOULACK CHANTHIVONG: At least in the general media commentary, a lot of fund managers are moving away from fossil fuel industries—not totally, but it seems that that is the direction in which they are going. How does the minerals industry remain competitive in the face of massive amounts of financial resources being invested in technology and renewables, in their adoption and also, I suspect, in the increasing demand for renewables? That is the trajectory. How does the industry remain competitive, in the face of that sort of competition?

Mr FRITH: As you say, it has been quite widely reported around some of the decisions by financial institutions not to invest in thermal coal, or to put criteria around the types of thermal coal investment that they will invest in, such as it needing to be the latest technology, but there is still a wide range of potential funders or financiers who engage with the industry. I think there was the example of a coal mining operation or coal mining company that operates in New South Wales, that earlier this year refinanced a $1 billion debt facility that was

oversubscribed, and there was no increase in funding costs, and ended up involving a range of both Australian and overseas financial institutions. So there are, certainly, some institutions that are making those decisions but there is still a wide range of funding options available, and many of those will come from our customer markets where they have a strong understanding and a strong recognition of the role that Australian coal plays in delivering energy security in, particularly, the Asian region. So there is still a wide range of funding opportunities available.

Mr ANOULACK CHANTHIVONG: That is it from me, thank you.

The CHAIR: Thank you very much for appearing before the Committee today and for your engagement with our Committee processes. We may send you some additional questions in writing. Your replies would form part of your evidence and may be made public. Would you be happy to provide written replies to any further questions?

Mr FRITH: Yes.

Mr HORE-LACY: Yes, certainly.

The CHAIR: Thank you. We greatly appreciate your time today.

(The witnesses withdrew.)

(Luncheon adjournment)

ROD CAMPBELL, Research Director, Australia Institute, before the Committee via teleconference, affirmed and examined

The CHAIR: Mr Campbell, do you have any questions about the hearing process?

Mr CAMPBELL: No, I have done a few of these kinds of things before.

The CHAIR: Would you like to make a brief introductory statement?

Mr CAMPBELL: I will make a brief introductory statement. I am Rod Campbell. I am the Research Director at the Australia Institute. We are an independent research organisation, mainly based in Canberra. The Institute generally, and myself in particular, have been quite involved in debate around New South Wales energy issues for more than 10 years now. In particular, I have looked at the economic assessment of coal mine projects, namely export coal mines, and I think New South Wales has a big problem. I think there is not enough planning being done for the inevitable and desirable phase-out of the coal industry. I think there is a lot of policy and political momentum behind attempts to expand the coal industry, even while we are seeing the economics of a lot of projects look increasingly vulnerable.

One policy initiative that the Australia Institute has been promoting for quite a while now is the idea that we do not need any new coal mines, and that one policy that could achieve better outcomes for communities, the New South Wales economy and, in many cases, coal investors themselves, would be to have a moratorium on new coal mines. We are seeing a lot of the more speculative and less beneficial, less economically viable projects already going to the wall and some being abandoned, others facing very fierce community resistance. It would be desirable, in our view, to begin planning for the phase-out of coal in New South Wales, and putting a moratorium on new coal mines would be one way of getting there. Our submission has quite a bit of data on the background of how we got to this position, and what might happen under such circumstances, but I am happy to take questions on our submission, or anything related to those areas.

The CHAIR: We appreciate that. We might start there. The submission talks about world coal demand having plateaued and New South Wales exports declining from a peak in 2014. Prior to our break we heard from the NSW Minerals Council. It talked about exports growing and being quite strong, particularly to south-east Asian countries. It did not respond to any assessment it has done of risk, given the declining cost of renewables. Could you potentially talk to that? While in the domestic electricity market people see a clear shift, there seems to be some dispute about the export market.

Mr CAMPBELL: Sure. It is a little bit crackly, so if I do not come to some of those points, please prompt me. I did not hear what the Minerals Council had to say. I think what is important to realise, and is outlined in our submission, is that the plateauing of New South Wales coal exports, and world coal demand - and they are clearly related to each other - was not predicted, at least not by New South Wales or Australian government agencies, and not by coal industry bodies like the Minerals Council. Quite the contrary. When I began working on these issues around 2010, 2011, the outlook was for absolutely unbridled coal export growth. There is a good example. In our submission there is the forecast made when the fourth coal terminal was being proposed for Newcastle. I think that was from 2014. The forecasts are from 2012, sorry. Those forecasts are saying we should

be exporting 100,000,000 tonnes more than we actually are out of New South Wales at the moment. The plateauing or the decline; I could argue with the Minerals Council over whether we are declining, or plateauing, or whatever.

The fact is, huge growth in coal exports was forecast right up until recently. Indeed, a lot of official agencies and the Minerals Council are still saying we are going to have strong growth in coal exports, out of Newcastle and New South Wales more generally. This just is not true. If this were true, the fourth coal terminal, the T4 project, would not have been abandoned. If this were true, you would not see such delays in projects like Shenhua Watermark, and a lot of other projects that we can talk about in detail if necessary. The industry and New South Wales Planning has been caught off guard by the world actually doing something on climate change, reducing coal demand, by renewable energy actually becoming cost competitive in a lot of situations. There is a real opportunity here. This should be seen as a great thing from a global perspective. This is exactly what we need, a rapid decline in international coal trade. We need to be planning for it, not fighting it, and planning on the ways that it can bring the least disruption and the most benefit to the New South Wales community.

The CHAIR: Moving back to the domestic market, we also had a witness question the reliability of renewables, despite the fact that indeed some mines themselves are powered by renewables. What is it that we need to do to ensure the reliability of renewables? I also ask, as you would know, in New South Wales there are some having a conversation about nuclear energy and uranium mining, and if you would comment on that.

Mr CAMPBELL: Sure. The first thing to notice regarding reliability is that while renewable energy is certainly variable, the New South Wales fleet of coal-fired power stations breaks down regularly. There is certainly no monopoly on reliability being held by coal-fired power stations in New South Wales. Our submission has some of the statistics. I have only got a hard copy in front of me. There were 21 breakdowns of New South Wales coal-fired power stations in 2018. Once a fortnight there is a breakdown in a coal-fired power station. That brings huge challenges to the grid, because unlike renewable energy, where the forecast of the wind or the sun is fairly reliable, these things happen often without warning. In terms of reliability, this is an issue that the entire grid and all its participants are facing, not just renewable energy generators.

It is probably a little bit out of my expertise to be talking about exactly how renewables should be firmed and made more dispatchable within the grid. I have a reasonable understanding of the economics of how batteries and pumped hydro storage is shaping up, but in terms of exactly how it is done, that is not really within my area of expertise. In terms of the economics of doing so, that is becoming rapidly cost competitive, certainly compared to building any new capacity, and in particular regarding building new nuclear capacity. As an economist, I despair as to why we spend any time talking about building nuclear generation at all. We are just not cost competitive. It has not been ever and probably never will be.

Mr JAMES GRIFFIN: We have heard from witnesses today and yesterday that, as we go through this transition, the challenge around baseload and dispatchable power is still one that a lot of witnesses are grappling with, and how we deal with that. Hearing your comments, and reading your submission, what is your view, in terms of the solution, in dealing with that particular challenge as we phase out the coal-fired power stations?

Mr CAMPBELL: Again, the engineering of exactly how to do so is outside of my expertise, but I think in terms of—and we talk a little bit about this in our submission—the New South Wales grid is still very coal heavy. I do not have the numbers in front of me, but I do not think you would see any kind of reliability issues really entering in until there was a substantial amount more renewable energy in the grid. Again, turning to the economics of what is going on, I think there is some really good work being done around renewable energies in New South Wales, and in fact a separate Australia Institute submission jointly with the University of New South Wales addressed some of that in more detail. It is probably not exactly my area of expertise.

Mr JAMES GRIFFIN: That is okay. Thank you.

Mr NATHANIEL SMITH: You mentioned the reliability of coal-fired power stations. For the Committee's benefit how many coal-fired power stations are there in New South Wales currently running?

Mr CAMPBELL: I think there is Bayswater, Eraring, Liddell, Mount Piper, Vales Point; so five. They are the ones I can think of. There are some smaller facilities, but they are the key ones.

Mr NATHANIEL SMITH: You talked about coal-fired power stations breaking down. They do not all break down at once. Following up on Mr James Griffin's question, if we are moving towards transition, how are we going to replace that baseload power to run our schools and hospitals, things like that?

Mr CAMPBELL: I think there is a bit of a misconception around the idea of baseload supply. Baseload supply would be really useful, or is really useful, to the extent that we have baseload demand, but we do not. In Australia we generally have quite peaky demand, where large amounts of power are demanded for very small periods of the year. The amount of capacity that is required to run 24/7 is very small, and also further challenged

by periods where renewable energy is really cheap and really available. We do not need a lot of base-load supply in Australia; we need a lot of dispatchable supply. You can see this, with most of the coal-fired power stations that we are discussing are not running at anywhere near close to capacity anymore. If you look at the history of Mount Piper and its neighbour, Wallerawang, which was closed not too long ago, the expectation was that many more units would be built there.

In fact, the requirements for real base load, in terms of keeping power to hospitals, or power to aluminium smelters—an aluminium smelter is a big user that needs consistent supply—in terms of 24/7 constant power, is actually quite small. We need to be looking at how to make our energy systems dispatchable and, in terms of one policy response that the Australia Institute has been involved with, we have seen the Australian Energy Market Commission recently recommend changes to allow demand response, so that the large users can adjust their demand profile to change those peaks, and address some of those reliability issues around peak power. As I said, with so much coal still left in the New South Wales grid, I do not think we are really seeing serious issues around base load reliability emerging anytime soon. I think the challenges are around reducing emissions, addressing peak demand and planning for that.

Mr NATHANIEL SMITH: You also talked about shutting down coal mines across New South Wales—are we talking just thermal or coking coal mines as well?

Mr CAMPBELL: That is an interesting question. The climate does not care what kind of coalmine it is. We need to be reducing emissions, and that goes for the steel industry as well the thermal power industry. The need to reduce emissions from steelmaking is present as well, and eventually metallurgical coal will hopefully go the way of thermal coal. Another really important point to make about metallurgical coal in New South Wales is that it is generally low quality. The international market for that kind of low quality metallurgical coal is quite small. What you see in New South Wales coal proposals is a small amount of low quality metallurgical coal being used for public relations purposes, "Our mine is a metallurgical coal mine", when it really is a thermal coal mine. The economics of the mine are abundantly driven by thermal coal, and there is a small amount of semi-soft coking coal that may or may not get sold off. In Queensland it is a much more complex issue, where there really is very high-quality coking coal, for which there is large demand that will be around for a long time. New South Wales metallurgical coal is not high quality, and I do not think it is nearly as desirable or as big an issue, because New South Wales coal mines are generally dominated by—with a handful of exceptions, particularly around the Illawarra—

Mr NATHANIEL SMITH: If I can butt in, that is around my electorate of Wollondilly, where it is all coking coal. The two major mines are coking coal mines—South32 and SIMEC. You need coking coal to make steel, windmills, renewables.

Mr CAMPBELL: I did see you were the member for Wollondilly. I think that is a really relevant policy discussion to be having: what are the coking coal needs of the steel mills in the Illawarra; and how best to address that and/or how to incentivise their transition to cleaner technology. Similarly, down that way we are seeing ridiculous coal mine proposals, in particular the Hume coal proposal, which is clearly uneconomic, clearly presents a major risk to water resources, and has become a zombie project in the name of being a coking coalmine when it is exactly the kind of project where dubious economics and strong community opposition—it should be knocked on the head. The valid issues around coking coal and the requirements for it in the Illawarra—that does not mean that every mine that has a few lumps of coking coal should be entertained, especially when they are such damaging propositions.

Mr ANOULACK CHANTHIVONG: I want to ask two questions. The first one is regarding the department's capacity to undertake economic assessment impact of projects. In your view, has that changed at all? I note, of course, that your submission was done almost this time last year. Do you think there has been improvement in the Department of Industry, Planning and Environment [DPIE]?

Mr CAMPBELL: Absolutely not. I think there is a really strong recent example of how DPIE—no, they have spectacularly failed to increase their capacity to scrutinise proponents' economic assessment and the overall economic case for coal mines. The most recent example is the Narrabri Gas Project, which is abundantly uneconomic in purely financial terms. We know this, and it is not just the Australia Institute saying this, that is Santos's own accounts. Santos's accounts value the Narrabri Gas Project at zero and have done since 2016. Similarly, the co-owners of the project, Hong Kong-based CLP Group, which also owns the ironically named Energy Australia, carry the Narrabri Gas Project at zero in their books. Yet the department accepts the economic modelling that has been commissioned by the proponent, that suggests the project is worth $2 billion.

Both those numbers cannot be right. It is a crime to lie to your auditors, whereas lying to Planning seems to bring absolutely no consequences for economists and proponents. The department either lacks the technical capacity or the political support to be able to call out those ridiculous assessments. I could reel off examples all

day—my other favourite is the Cobbora coal project, which was abandoned despite the department accepting the proponent's idea that it was worth $2 billion. We have talked a little bit about the T4 coal terminal. At one stage its economic value was estimated at a staggering $36 billion—abandoned. So, no, I think it is really problematic that the department either lacks the economic skills or the administrative and political will to seriously assess these projects.

Mr ANOULACK CHANTHIVONG: But, Mr Campbell, fundamentally, is it the department's responsibility to do the economic assessment? Should it not be more focused on the environmental assessment? You made your point about Cobbora. They might have claimed the economic benefit to be $2 billion, but the fact that it was abandoned on economic grounds means that the economics of the market works it out for itself, does it not?

Mr CAMPBELL: Yes, but that is exactly the problem, and this is exactly the need for some planning to go on in New South Wales because, at the moment, the current policy settings are, effectively, to leave the development of New South Wales resources entirely to the market. That results in large numbers of projects that sit there not generating any benefit, not generating any revenue, not generating any jobs. They often go in and out of care and maintenance, but that is not costless. It may be of low cost to the proponent, but these projects impose significant costs on local communities. If you go and speak to people in Gloucester and say to them, "Has the Rocky Hill Coal Project" - leaving aside its rejection in the Land and Environment Court - "imposed costs on the community?" Absolutely it has.

Down in Wollondilly, if you go and talk to the huge numbers of local people who are very concerned about the Hume Coal Project, they have spent years of their life worrying about the impact on their property around a project for which, essentially, the policy settings are to approve it, and then wait and see if the market requires it. That imposes really significant costs. The Watermark project in the Liverpool Plains has effectively been approved. The market has not required it, and you still see the Gamilaraay people and local irrigators spending a lot of time and effort worrying about the project.

Just leaving everything to the market still imposes large costs on New South Wales communities that have not been considered. So absolutely, it should be the responsibility of the department. I would argue its fundamental responsibility is to ensure that projects being proposed are likely to result in a net benefit to the New South Wales community. A project that sits there as a zombie project, being fought over for years, abundantly brings a net cost to New South Wales communities. These kinds of projects should be being called out by the department for what they are—dud projects that get knocked on the head and remove on.

Mr ANOULACK CHANTHIVONG: That is certainly right. Undertaking any assessment of a project, in particular such magnitude, when you are dealing with billion-dollar projects, does take into account economic and social benefits that is partly the responsibility of Government and the proponents as well. From what I am hearing, you are a big advocate of an assessment process to take place that can justify a decision or action or inaction, so to speak. How does that then reconcile with the point that you make—that we have to have a moratorium? A moratorium makes the whole analysis process redundant, does it not?

Mr CAMPBELL: Oh, no. Well, it would in regards to coal mines—

Mr ANOULACK CHANTHIVONG: Yes.

Mr CAMPBELL: —because we do not need new coal mines. There are some graphs in our submission. New South Wales has already approved coal supply capacity out to 2040, that is reasonably in line with what should happen, in excess of requirements if the world sticks to the Paris Agreement. It is important to say that a moratorium is not a permanent ban. If in five or 10 years time there was a need for new coal mines, the moratorium could be lifted. But the point is that a moratorium would do away with the assessment process, in as much as there would be no more assessment of coal projects. New coal projects are entirely speculative in New South Wales at this point.

Mr ANOULACK CHANTHIVONG: I suppose that is why you have the assessment process—to determine its viability. Either way I think having a process of an independent—

Mr CAMPBELL: But the current assessment process is not assessing their viability, because of what we are talking about. The capacity of the department is so low that they are accepting assessments that are contradicted by proponents' own books.

Mr ANOULACK CHANTHIVONG: Yes, but a moratorium takes away the whole assessment process entirely. What I am trying to achieve clarity on is that you sort of cannot have both. You cannot advocate for the need for a strong economic assessment by the department, this, that, and the other, but at the same time say that we should have a moratorium, which bans the assessment determining the viability of a particular project. I am

just saying that, whatever that project is, surely a thorough and robust assessment process, internally and externally, needs to take place for decisions, so that decisions can be made transparently and fairly to the proponent, the community, and the government at large. To me it is contradictory that we should increase the level of capacity to assess, and assess fairly and strongly, but at the same time we should not allow that assessment to take place, because we have reached a conclusion before going through the process. That is the bit I am struggling with. That does not come out clearly, from the way I read your submission anyhow.

Mr CAMPBELL: Yes. Look, a moratorium on new coal mines just means that new coal mines would not be assessed because—we could spend the rest of the afternoon talking about it—but under the climate policies that New South Wales and Australia have committed to, there is no need for any new, particularly thermal, coal mines, so there is no need to assess anymore. In particular, by not assessing, approving, or commencing any more new thermal coal mines you actually protect the interests of existing thermal coal mines. We avoid a race to the bottom, in terms of supplying export markets at the cheapest possible price, and we return to trying to get the most value out of existing mines.

No, we should not be assessing any more thermal coal mining projects, but I do not see that as contradictory to should we be improving the ability of the department to assess economic modelling commissioned by proponents, in relation to any number of other kinds of projects, such as the coal seam gas projects we have just talked about, that would not be affected by a moratorium on new coal mines. There is any number of other mining and energy projects that would not be affected, where strengthening the department's capacity, ability, and political support to question those claims would be beneficial.

The CHAIR: Just one final question from me going back to the initial point around coal exports. Has the Australia Institute quantified the potential risk to New South Wales of relying too heavily on a high demand of coal exports into the future, in terms of the hope for the jobs that that will create or maintain, or the export revenue that that could generate, or not?

Mr CAMPBELL: We have done a lot of work modelling what would happen under a coal mine moratorium. Under a moratorium, where existing coal mines are allowed to keep producing until the end of their economic lives, this allows a very slow and very gradual phase-out of the industry, which results in minimal economic disruption, minimal change to employment, and minimal change to government revenue. I guess that is for two reasons. Firstly, because of the slow nature of that transition, but also it is important that coal is a really small part of the New South Wales economy. Coal accounts for around 2 per cent of New South Wales government revenue. It is less than half of 1 per cent of employment in the state. I think it is around 3 per cent of gross state product. Despite having a large coal export industry, the coal industry in New South Wales is really small, and it carries a political clout that is not backed up by its economic size. Ideas like a phase-out of the industry should not even be seen as particularly controversial, let alone challenging to plan for.

The CHAIR: Thank you very much for appearing before this inquiry via teleconference, Mr Campbell. It is greatly appreciated. We may send you some further questions in writing. Your replies will form part of your evidence and may be made public. Would you be happy to provide a written reply to any further questions?

Mr CAMPBELL: Yes, of course.

The CHAIR: Thank you so much for your engagement with the Committee and its processes, and thank you as well to the Australia Institute.

(The witness withdrew.)

BENN BARR, Chief Executive, Australian Energy Market Commission, affirmed and examined

OLIVER NUNN, Senior Economist, Australian Energy Market Commission, affirmed and examined

The CHAIR: Thank you very much for joining us today. Would either of you like to make an opening statement?

Mr BARR: Yes, I will. I thought it would be useful to outline the role of the Australian Energy Market Commission and what we are focusing on now. The Commission was set up by what was COAG Energy Council a number of years ago, and it plays an important role in the National Energy Market. Energy Ministers set the strategic policy direction for the National Electricity Market, but the Commission has two jobs. First, to make sure the regulatory framework is up to date, to respond to the challenges that are facing the sector, and I will get into how it does that; and, secondly, to provide advice to Ministers on what sort of changes should happen. It keeps the regulatory framework up to date by doing things that are called rule changes. Anyone, apart from the

Commission itself, can put in a request to make a rule change, and the Commission goes through a statutory process of weighing up whether the rule change is consistent with the national electricity objective or the national gas objective. That is a core part of the work we do, and it is an open-access regime, which anyone can participate in.

We also provide advice. Ministers can ask us for that advice, or we can see an issue and provide that advice to ministers. We provide advice on things like regulatory sandboxes or standalone power systems to energy ministers so they can make decisions around where to go with the legislation. You would all be aware that the sector's change of pace just keeps on rolling, and so one of our priorities at the moment is doing work as one of the members of what is called the Energy Security Board. That is made up of Dr Kerry Schott, David Swift and the three market bodies: Ourselves, as the Commission or the 'rule maker'; the Australian Energy Market Operation, which is the operator that keeps the lights on; and the Australian Energy Regulator, that enforces the rules across the system. We are playing a key role in that. The most important piece of work is the design of the energy system post-2025. What needs to happen? We have got five other priorities, but I will open it up for questions now.

The CHAIR: Your submission highlights the importance of collaboration among government, market entities, industry, and consumers, particularly when it comes to the future grid distribution. Where do you see areas for improvement in that space?

Mr BARR: In terms of the collaboration or in terms of where the grid needs to go?

The CHAIR: Both.

Mr BARR: In terms of collaboration, one of the core principles of the Commission is that you do not get good policy outcomes without doing real stakeholder engagement and collaboration. I think the core vehicle to do that at this moment in time—and I will give you a good example of something that has worked pretty well—is around that post-2025 work. The Energy Security Board will be putting out a consultation paper in the next few weeks, or the next month or so, looking for feedback from all parts of the system around how that should improve. A good example of where that has worked well is through a process we run that looks at the future of the electricity network, and a body that was set up consisting of consumer groups, market bodies, and industry to look at those challenges facing the grid. That body then proposed some rule changes, which the Commission is currently now looking at. You can always get better at consultation, and in a COVID world there are real challenges for us, and anybody that is trying to collaborate. We are constantly looking for new ways in this environment to collaborate with different individuals, whether it is workshops, getting them in for one-on-ones, or collaboration around what the regulatory framework needs to look at.

Where does the grid need to go and what are the challenges facing it? The two big issues relate to how consumers are changing their preferences, and how technology is changing the way that they consume and create energy. Two big pieces of work that we and the Energy Security Board are looking at are around what we call distributed energy integration. Distributed energy is things like solar photovoltaic panels that you have on your roof, small-scale batteries, or it could be an electric vehicle. The history in Australia was that there was a real boom of solar PV. I can remember when that was a niche product and not many people had it on their roof, and now it is everywhere. I think what we want to do at the Commission is learn from what happens when you get that technology boom and the price falls so much that it is economic for a customer to put on their roof, and how you get the frameworks in place ahead of the game, and not play catch-up, which I think is what happened with solar PV.

The other part of that is what we call the evolution of a two-sided market. Currently, the way the system is set up is, that a generator generates energy, it goes to a poles-and-wires business, and then it goes to a consumer, who consumes it. It is what we would call a traditional one-way market. The way the system is transforming, there will be more of a two-way flow, and that is evidenced by solar PV. The poles-and-wires businesses were not set up for consumers to generate electricity on their roof to go back into the grid. There will be more and more of that in the system, both at a technical level, and also at the regulatory and the policy level. It needs to evolve to be able to cope with that. There is a piece of work that we are leading for the Energy Security Board, around a two-sided market, and it is trying to look at the models that customers can benefit from in regard to those changes, whether they participate or not—and that is a key thing. Sometimes the criticism is that if you do not have solar PV you are paying for other people. What we want to do is make sure you get the regulatory settings right so that everyone, whether you can afford an electric vehicle or a battery, benefits from that integration into the system.

The CHAIR: How will the Commission deal with establishing rules to deal with some of the recommendations that came out of the bushfires inquiry today? It talked about some pretty large disruption in different areas. We heard about standalone power stations and emergency power stations. How would the rules process work in responding to that?

Mr BARR: Yes. We actually put out a rule change around standalone power systems earlier this year, which really looked at that particular issue. The way the system was set up was a network business, so a poles-and-wires business, could not put in place one of those standalone power systems that was not connected to the grid. So that meant they could not get a return on their business, so they were not encouraged to do that. What the rule change that we put in place is trying to say is: Where there is a demonstrable need, a network business should be allowed to do that. It does not need to be connected to the grid. They should still be able to get a regulated return, and that should encourage more of these standalone power systems throughout Australia in bushfire-affected areas. That is a really good reform that should assist with that.

The CHAIR: Would the same sort of process apply to, say, a mine that decides to be powered by renewables and connects itself?

Mr BARR: That is a good follow-up question. This is particularly directed at network businesses, and so that is what the rule change will apply to, but we have made some recommendations about a regulatory framework for non-network businesses. I am pretty sure—I could check, though—that that recommendation has gone back to ministers for their consideration because, currently, it is kind of unregulated. If you are a mining company, and you want to put in your own microgrid and your own solar photovoltaic system or diesel generator, then you are not regulated under the national electricity system.

Ms FELICITY WILSON: I acknowledge that you are unique, compared to most of the witnesses from whom we have heard: You are, obviously, not opinion-driven, as many of them are, although they often have facts behind their opinions. We talk a lot about how to transition the energy sector, so we talk about different types of technology. I know that you have a technology-neutral approach. We talk about different types of technology for electricity generation, but also different fuel options, like hydrogen or even nuclear, for instance, and how we support communities if the transition occurs. I know you do not have a position on specific technologies, but what insights can you share with us about what technologies or fuels are best-placed to meet the future needs of the energy market?

Mr BARR: Thanks for the question.

Ms FELICITY WILSON: Does that make sense?

Mr BARR: It does. It is a very broad question. On fuels, I probably will not go into it too much, but I will talk a little bit about technology, and come back to the submission we made. From our point of view—you are right—we are really looking at setting up a market, and rules, that incentivise the best technology to meet the needs of the energy sector. What our submission points out, though, is that sector is really changing. One of the fundamental changes is around the uncertainty of both generation—so the stuff coming in—and also demand. It used to be pretty certain. You had thermal base load generators generating at a steady rate to meet pretty stable demand that did what we would call a "load curve". It would go like this every day, and you would know, roughly, on hotter days it would go up; on colder days the gas consumption might go up.

But what we are seeing is a few things. Because you are getting more variable renewables into the system, that only generate when the wind is blowing or the sun is shining, that generation mix is a lot more variable—depending on a lot more factors—but the demand is also more variable, because you have got that change of customer preferences. So you are getting consumers this amazing array of generation. The growth in solar PV throughout the system is exponential. You have got uncertainty at both levels, and so one of the things that our submission says will be really important, and it is also picked up in AEMO's annual Integrated System Plan, is these variable renewables will keep coming into the system, because the prices are falling.

But what is needed in that system, to meet that, is technology that can firm and do it quickly. It is going to need to react more quickly to changes in demand in generation a lot faster than has traditionally happened. There is definitely some work that we are doing looking at the economics of battery storage, and how those firming technologies, not just like battery storage and pumped hydro and gas plants but how those plans that can what we call 'ramp faster'—move more quickly—to meet the change in demand and supply, how they become more economic, and what are the signals that are needed to get them into the market. Does that answer your question?

Ms FELICITY WILSON: Yes. You referred to solar PV and the variability in people relying on electricity coming through the grid. With the move towards more people, from a retail perspective, introducing more of their own renewable alternatives at home, whether that be heat pump, battery, solar, PV, things like that, and even significant changes to construction and building to reduce demand; we talked in the past about the "death spiral" and at what point not enough people will be investing in the broader network to affordably enable what we need invested in the network. Other witnesses have given evidence about making sure that we have the right investment in the transmission network and things like that but, at the same time, there has been, as you say, a big

move away in the retail space, and a lack of any real certainty about the peaks over time, and how much of an impact that will have.

If we need to have a strong transmission network, regardless of technology, or regardless of how we are putting electricity down the wires, what advice do you have for us about that retail element where people are making their own decisions about introducing different products, making decisions at home? I know that different jurisdictions—different states—will have different government policies, and different incentives. You have had to make rule changes over the years to enable a lot of these elements. Do you have any insights for the Committee about how the retail market interrelates with the transmission system?

Mr BARR: There are some good points in there. You are right: Demand used to increase with economic growth. Most predictions say demand is going to be pretty flat, even though you are going to have these wild swings. There will be more transmission needed, because the way the generation fleet is changing—so, we had a small number of large plants and direct lines to those plants and to big demand centres, whether it is a smelter or a city. The way generation is changing is, you get smaller, more modular wind or solar storage, and they will be in different locations, so you will need more transmission to meet that need. With the retail side of things, it is really interesting, because it is like so many industries that are facing changes to business models and how consumers want to interact with the retailer. So, in our last retail competition report we focused in on not so much the profitability of retailers, although we did look at it in terms of the impacts of COVID-19, and making sure that the Australian regulator had enough information to see that retailers were not going to collapse due to COVID-19.

But what we looked at was around consumer protections. How do you make sure that, when you do not have a direct relationship with an electricity retailer, and you are buying your electricity, when you get your electric vehicle, for example, it is a bundled package? How do you make sure you are still getting protections for an essential service? We made some recommendations in that report that the protections need to change and evolve, just like these technologies are changing and evolving. We want people to have the same level of protections, but we want them to be more flexible to your circumstance. You might not want to get a hard copy bill in the post; you might want to have a look at your phone and see what your rights and responsibilities are, or have an app. That is one of the recommendations which picks up on that change, which is to say, actually it is an essential service, and customers should get those protections, no matter how they get their electricity.

Mr JAMES GRIFFIN: I want to pick up on your last comments. Is the commission preparing for life after those big large-scale depots and the connection? Are you doing that by virtue of where the market and the technology is going?

Mr BARR: Yes.

Mr JAMES GRIFFIN: Or are you hedging, and trying to have a blended pathway in the planning and the rules that you are making?

Mr BARR: No, that is a really good question. It is a bit of both. The really long-term work, the looking at how does the system evolve over time; we are doing jointly in that Energy Security Board, and it is called that. What system and market do we need post 2025, which actually is not that far away, right? But at the same time, we can do real changes for here and now. A good example is what is called system security. System security has this bundle of issues, where those big coal plants used to provide services to the electricity system—I am not an engineer by the way—which, just by their very nature of having these big spinning turbines, kept the system stable. So you could have a fault and they would self-correct, get back to 50 hertz to keep it. The more you get—it is not really renewables—inverter-based generation, digital-based generation, you lose that inertia and spinning reserve. We are looking at long-term answers to those questions, but also we have got six rule changes in at the moment from a range of different people, and we are looking at what we might need to do in the short-term, but tied to that longer term vision as well.

Mr JAMES GRIFFIN: The Committee has heard two conflicting views from a variety of witnesses. One is simply to proceed at haste with renewables and immediately close coal-fired power stations, whereas others have suggested, for example, we can no longer supply maximum energy demands at the moment, so we have an energy security crisis.

Mr BARR: Yes.

Mr JAMES GRIFFIN: The Committee is trying to explore the truth and the middle ground? I think the Commission provides some clues into how it is preparing for the future.

Mr BARR: Yes, I think system security is a real live issue, and it is a solvable issue too, though. It is not like this is an impossible issue that cannot be solved. It is going to take a little bit of work. I was in energy when the lights went out in South Australia in 2017, and there was a range of factors in that. A lot of things

happened that caused that. But one of the fundamentals of an electricity system is for the lights to stay on. Lights on, prices down is a fundamental part of the system which drive what we do. I think there has been a boom in the uptake of renewables, both at that customer level, and also at that generation level. Over the past three years, I am not sure of the number of committed projects, but something like 12,000 megawatts.

Mr NUNN: One hundred projects.

Mr BARR: Yes, 100 projects, so you have had a real boom. With any boom comes stresses and strains to the system. That is natural in any industry. It is our job with AEMO, the operator and the regulator and the Energy Security Board, to look at that and design a system that can deal with those challenges, because they are coming, right, it is a just a matter of when.

Mr ANOULACK CHANTHIVONG: Is the current network capable to accommodate the changes in the take-up of PVs and battery storage? Is it capable, in its current form, to accommodate that changing usage and supply, not only from the wholesaler, but also it stems from the retail end as well.

Mr BARR: It is one of these questions—the network is a big thing, and it really depends where in the network and the level of penetration. I come back to my original statement, it was not set up for two-way flows. We have got these three rule changes from a good bunch: a South Australian network business, SA Power; the Total Environment Centre; the Australian Council of Social Services; and also St Vincent's de Paul, looking at that very issue, around what sort of changes do you need to put in place to enable more capacity for that two-way flow. It is a live issue to look at. In certain parts of Australia, Western Australia and South Australia, the penetration of solar PV is at such high levels that the system is struggling to cope. They are doing things which probably you could improve.

What happens often is, you are a home owner, and you want to put solar PV on your roof, and you will go to the network, and they will say "You can't have much, because the local substation has got so much and the most important thing is to keep the lights on." They limit the amount you can either put on, or that you could export into the grid. What we would prefer is market signals that mean you are sending a signal about how much and when, you know, you could have on your roof. That is a process that we need to go through now in the rule change we need to go through.

Mr ANOULACK CHANTHIVONG: I have a keen interest in equity in pricing or charges, because not all consumers would have the capacity to put on a 10 kilowatt battery plus panels, and the network still has to be paid for. How do we address that with rule changes, so that those who are on the most modest income are not penalised due to their own economic circumstances?

Mr BARR: Absolutely, that is why St Vincent's de Paul and the Australian Council of Social Services jointly sponsored this rule change, because they are alive to that. This is one of these collaborative approaches that we were involved in, getting different people in the room to look at this issue. It is a controversial issue, because people have invested in their solar PV, people think they have a right to get paid for the energy that they export, absolutely, but it does impact on the system as well, and the system needs to take into account those impacts.

Mr ANOULACK CHANTHIVONG: Are the rule changes coming?

Mr BARR: They are in now, so they are out for consultation at this moment in time. If you want some more details I can provide them.

Mr ANOULACK CHANTHIVONG: Yes, please. I think they would be most useful. I suppose that is also related to my next question. How do we make wholesale pricing cheaper? I think generally retail is there. It is a monopoly market. How do we reduce the cost of the actual wholesale networks so it then flows onto the retail consumers?

Mr BARR: Yes. Certainly, as I said before, one of the driving goals of the Commission, the national electricity objective, benefits consumers and it benefits them around price. Some things that have happened, we have been involved in, that are aiming to do that are a couple of things. One, we have a rule change which is called wholesale demand response. This comes to this concept of the two-sided market where, at the moment, the way the wholesale energy market works, it is really generators who bid into that market. What this rule change is trying to do is, allow, at the first stage, large load, or demand. So a manufacturing business or a data cell. They can bid into that wholesale system. So when you have got more people bidding in, you should have downward pressure on those wholesale prices over time.

The other one Mr Nunn and I were talking about, before we came in, was around the change to what is called—I will get slightly technical for a minute—a five-minute settlement. The way the wholesale market sells at the moment is a 30-minute block. This change is coming in a year or 18 months time, moving the market to

five-minute settlement. That should assist in downward pressure on wholesale prices, because it will allow those technologies coming into the market, like storage, which can react very quickly, again, to put some downward pressure on prices. Again, at a macro level, though, get those settings right to get the right generation, to match up with demand and send those signals over time. That usually gets you the best price outcome.

Mr ANOULACK CHANTHIVONG: My last question is around the interventionist policy approaches that you write about, that we should avoid them. Are there any in place in the New South Wales market at the moment?

Mr BARR: I have not done my research on interventionist policy approaches in New South Wales, so I cannot answer that at the moment. What I would say is, the point we were trying to make is, that it is up to governments. Governments do things in energy for a variety of reasons. There are absolutely valued reasons around reducing carbon emissions for economic growth. It is actually a jobs thing; it is not an energy thing. Absolutely, that is why governments are voted in. What we would say is, when you are designing those mechanisms, think about how the market works. The point we make in the submission is, you want to make sure that if you are subsidising a generator, that they are physically there when you need them. You want them to be generating when you need them. That was really the point we were trying to make.

The CHAIR: Thank you both very much for appearing before us today. We may send you further questions or requests for further information. Your replies would form part of your evidence and be made public. Would you be happy to provide a written reply to any further questions?

Mr BARR: Absolutely.

The CHAIR: Thank you both very much.

(The witnesses withdrew.)

CHRIS GILBERT, Senior Economic Advisor, Energy Networks Australia, before the Committee via videoconference, affirmed and examined

JILL CAINEY, General Manager Networks, Energy Networks Australia, before the Committee via videoconference, affirmed and examined

The CHAIR: We have with us from Energy Networks Australia Mr Chris Gilbert and Dr Jill Cainey. Mr Gilbert, would you like to make any opening remarks or a statement?

Mr GILBERT: I was going to leave that to Dr Cainey, but I can do that in her absence.

The CHAIR: Mr Gilbert, if you could proceed with your opening remarks, that would be wonderful.

Mr GILBERT: On behalf of Energy Networks Australia I thank the Committee for inviting us to participate today. Energy Networks Australia are a national institution representing Australia's electricity transmission and distribution networks, and its gas distribution networks. Our members provide more than 16 million electricity and gas connections, to almost every home and business across Australia. Transmission is critical infrastructure that facilitates connection and generation, including increasing amounts of renewable generation. Interconnection to other states allows New South Wales to share its energy resources with those states and contribute to increasing security supply, and the lowering of the cost of electricity for New South Wales customers. Consumers are keen to install rooftop photovoltaic power stations.

Distribution networks are developing the capabilities to facilitate the opportunities for consumers - for those with energy resources and for those without - to benefit from energy resources, such as PV and battery. One of the key supporting capabilities is increased visibility of the network, and its moment-to-moment operation. Over $16 billion in network savings can be achieved by 2050, through improving existing tariffs, including by introducing new network tariffs and retail pricing options, and by establishing a framework for networks to buy grid services from customers with the distributed energy resources. We are actively working with the Australian Energy Market Commission to ensure that small solar customers can continue to connect their solar and are able to export to the grids. Mr Barr introduced that real change process a little earlier. To date, the focus of decarbonisation has been on the electricity sector, but gas networks are on their own decarbonisation journey.

New fuels such as biogas and hydrogen have the potential to become mainstream and complimentary energy solutions that will use existing and new infrastructure. The gas industry has developed a strategic plan, *Gas Vision 2050*, with the aim to decarbonise gas, in line with Australia's long-term decarbonisation targets. Energy consumed from gas is higher than Australia's total electricity end use, with gas providing around

21 per cent of that end use energy consumption. We will be releasing an update to *Gas Vision 2050* in the very near future, covering our progress to date, and providing research and modelling that shows that the total system cost of a green hydrogen route would be lower than pursuing electrification. Finally, standalone power systems have the potential to deliver huge value to customers, improving reliability, improving the bushfire response and safety, and reducing network bills for everyone. That concludes my statement. Thank you.

The CHAIR: Thank you very much, Mr Gilbert. If you are happy, we will proceed with questions. If you want to refer any questions on notice to Dr Cainey, we can definitely do that. I will start by asking, from a distribution point of view, what is needed to increase opportunities for renewable energy?

Mr GILBERT: Of course. So on a distribution level, the really big concern for us at the moment is continuing to connect distributed energy resources, such as solar and batteries. Consumers are rapidly adopting, and the role of the distribution network is changing. The network is now providing two-way flows as customers are both exporting and importing electricity. Customers expect to be able to export electricity to the grid. Ben Barr introduced the rule change process earlier with South Australia Power Networks, St Vincent de Paul, the Australian Council of Social Service, and the Total Environment Centre but I will try to provide a little bit more detail.

It is a bit counterintuitive, but the rationale for the rule change - and the rule changes in the Australian Energy Market Commission at the moment - is that giving networks the option to charge for exports, under very certain conditions, will actually increase the amount of solar that can be exported to the network. Of course, a very important point to note here is that, whenever the network gets additional revenue, that revenue is revenue neutral and other customers do not pay those charges, so the network always ends up with the same amount of revenue. Right now to connect solar it is a first in, best dressed approach to the network. Everyone can connect their solar until the network reaches capacity and it starts to reach technical limitations, at which point connecting more solar might become unsafe.

At that point there are two options. We can either not allow anyone else to connect their solar to the network, which is not ideal when trying to decarbonise, or we can make targeted investments to facilitate greater uptake of solar. Not allowing anyone else to export to the network is not fair, because other solar owners are already connected. If we can make targeted investments in the network solely to allow more solar to connect, the idea of export charging is that solar owners would contribute sometimes, maybe just in peak solar export periods, to support these investments, so that other customers may not have to bear the brunt of these costs.

Some solar customers might choose not to export in peak solar periods, which could let other solar customers connect and we would have more solar connected to the network when we really needed it. But one other thing we are pushing for is for some negative tariffs to be considered, which means that customers would be rewarded above their current feed-in tariff for exporting solar when we really need it, when it is contributing a lot of value to the market and to the network. All of this is much fairer than the current first in, best dressed approach. I think Ben Barr referred to it a little earlier as "getting ahead of the game" and I think this sort of reform falls into that bucket. Any export charging would have to be kept into line. I hope that is just a bit of background.

The CHAIR: Yes, absolutely. That is helpful. I believe we now have Dr Cainey with us.

Dr CAINEY: Hopefully you can hear me.

The CHAIR: Yes, we can. Mr Gilbert already gave opening remarks on behalf of Energy Networks Australia and has already provided a response to a question which you may have heard. One next question from me is: What State-based support is needed to improve transmission infrastructure?

Dr CAINEY: Transmission—obviously we had the Integrated System Plan, which is the national plan provided by the Australian Energy Market Operator and was recently published. We fully support that plan. Obviously there is a critical part for transmission in New South Wales in that plan. And I know that the cost—these are major projects. They are much bigger than routine augmentation, so it is key that there is good planning support and that the New South Wales government, if you like, can facilitate the engagement with community for the building of transmission.

Transmission has an important part to play in New South Wales, but also the interconnections between other states allow, as was said in our opening statement, New South Wales energy resources to be used elsewhere in the National Electricity Market and allow, if you like, extra resilience and to share those resources with other states, both into New South Wales and out of New South Wales. I know New South Wales has provided some support, in terms of early planning work. There has to be some clear understanding of how funding for the transmission is supported.

The CHAIR: Thank you. Mr Gilbert, anything to add to that?

Mr GILBERT: No, thank you.

Ms FELICITY WILSON: Thank you both for joining us today. You spoke in your opening statement about decarbonisation, particularly gas as an option, but for gas and hydrogen. We did hear from a couple of your members about this as well. One of the references that you made in your submission, to a hydrogen industry development, was the 2030 production target for the National Hydrogen Strategy. I just wanted to know, from a broader industry perspective, what you think the current state of play is for the opportunities for hydrogen as an industry in New South Wales, whether or not you think that it is going to be a strong transition option for us, and how long you think that might take for us to see that dividend.

Mr GILBERT: Yes. It is very challenging to sit here and say with a straight face, "I am certain I think that we will be where we need to be", and certainly I am not really in a good place to say that we can get there or not. But I think the 10 per cent injection target by 2030 is entirely achievable. I think the $2 per kilogram target that Mr Finkel set for us is also achievable. We have been talking to some large producers of electrolyser plants on the capacity that we will need to be able to reach that target, and we think that that is achievable. The main challenge, and it will continue to be the main challenge, is the cost of electricity.

The cost of electricity accounts for about 80 per cent of the total cost of producing hydrogen, if you are producing it through electrolysis. So one of those barriers is making sure that there is enough electricity available for electrolysis production, which - if the continued freedom with solar and wind continues - we will likely be in a position to reach a 10 per cent injection by 2030. Jemena has a gas project at the moment called the Western Sydney Green Gas Project. They are intending to start injecting into the network in the very near future. That project at the moment is being constructed. There is another in South Australia that is nearer completion and is likely to be blending as early as November this year.

Ms FELICITY WILSON: On this hydrogen discussion, which we have had with a number of different witnesses with varying perspectives, I guess I would characterise it as, generally, people are really positive about hydrogen, if it is green hydrogen. The pathway to get in there, I guess, is the question mark for a lot of people. In the media today, as you mentioned, there was debate about whether we should be relying on gas as a transition to renewables, particularly with the 10 per cent injection. At what point would we see a genuine de-carbonisation, a genuine transitional way? Do you have any perspective on that?

Mr GILBERT: For me I think the investment is likely to be exponential. It is very similar to the solar life in the mid-90s, where, early on, solar roof was a luxury. It was expensive. I did not have the economy of scale, but now in 2020, we can look back and say "Well, we made it". We think it is similar trajectory for hydrogen, as long as we can have similar policies and innovation to drive that investment and make sure those economies of scale are realised. We are not the only country trying to do that. There are numerous European countries who already have well established net zero targets for gas and electricity. They are surging ahead with hydrogen pathways of their own.

I think we can either lead by their example, or we can wait to see what happens. One of the problems with waiting to see what happens is we might lose the opportunity to become a really big export player, and we might miss out on the skills and the opportunity to develop an industry here, because we will not have the experience. Part of the projects that our networks are rolling out now, the trainings and learnings, will inform our ability to scale up, and to really realise those longer term gains, which will help decarbonise.

Mr ANOULACK CHANTHIVONG: You make some points about tariff reform and pricing changes. What does that look like? Specifically what are the financial mathematics for different types of consumers?

Mr GILBERT: I guess there is a lot of answer to that question. The pricing is cost reflectivity. So what we want is for the costs to be distributed in a way that the people who are incurring those costs, or resulting in those costs needing to be incurred, will pay. So part of the real changes underway at the moment is cost reflectivity and solar, when we are at capacity, generally requires network upgrades to install more solar, and allow more capacity to connect to the network. The export charging framework has not been developed yet. The three real changes with the AEMC at the moment do not go to that level of detail. But they are the start of a conversation, in which we will be able to flesh out those issues a little more. As I mentioned earlier, it might only be 30 hours a year where we would need to utilise the export charges. In attempts to try to get customers to curb their solar exports, if they do not need to export, they might buy a battery instead, they might utilise some other way of using their solar as well. It is hard to say, with confidence, what that would look like but that will be something that will be discussed through the AEMC process.

Mr ANOULACK CHANTHIVONG: When is that due to be finalised?

Mr GILBERT: Off the top of my head, I am not sure. My apologies. I imagine it would be a process that would be ongoing for at least the next 12 months.

Mr ANOULACK CHANTHIVONG: In a related question, with stand-alone power systems [SAPS] and micro-grids, as they become more prevalent, does that mean those consumers who do have SAPS or microgrids do not actually have to pay for the network? Is that a correct understanding?

Mr GILBERT: No, not necessarily. Current customers that are connected to the network who are transferred to a stand-alone power system will not see any change in their bill. The idea is that, when we install a stand-alone power system, that the customer experience remains the same. For customers who are already connected to a stand-alone power system, and who never had a network connection, are not captured under the national electricity rules and the customer protection framework. It is only customers that are now being transitioned from the network to a stand-alone power system that would be captured by this protection.

Mr ANOULACK CHANTHIVONG: Will that have adverse pricing impacts on those on the lower income scale?

Mr GILBERT: The financial theory with SAPS is that a stand-alone power system makes sense for a customer, or a group of customers, or even a town at the end of a very long wire. They can be very expensive to maintain, sometimes upwards of $1 million. When that wire is looking to be replaced—it is at the end of its life, and either needs replacement or upgrade—then we would look at the feasibility of installing a stand-alone power system, and not replacing the poles and wires. If that reduces the overall network costs, then all customers will benefit, not just the customer being transitioned to SAPS, because the overall network costs will be lower.

Mr ANOULACK CHANTHIVONG: Dr Cainey, Mr Gilbert mentioned we are almost at capacity with solar exporting to the network. How far are we based on current projections before the network is unable to accommodate the increase in supply from solar and batteries, and so forth?

Dr CAINEY: It tends to vary from location to location, so there are some states that are very close. It is the point at which solar has a technical impact on the network, and also within a state there will be places, within the network, that can take more solar PV down other locations. Quite frequently solar PV is adopted in clusters, and so I do not actually have the figures for networks in New South Wales. I understand while there may be some issues in some places, they are not extreme. It would be difficult for me to project for the range of distribution networks in New South Wales a specific date, when that would be a problem. But networks are working hard to develop the capabilities to manage and optimise exports. We talked about cost reflective tariffs. There are tariffs you can develop such as a solar sponge tariff which, if you like, soaks up solar generation at mid-day, and helps facilitate management of increased deployment of solar PV. There are a range of options before you might want to augment the network.

The CHAIR: Thank you both for appearing before the Committee today. We apologise for the technical difficulties that you experienced, Dr Cainey. at the outset but I appreciate your ability to work with us through those. The Committee may send you some further questions in writing. Your replies will form part of your evidence and be made public. Are you happy to provide a written reply to any further questions we may ask?

Dr CAINEY: Yes, of course.

Mr GILBERT: Yes.

The CHAIR: Thank you very much for appearing today and your engagement with this Committee. It is greatly appreciated.

(The witnesses withdrew.)

(Short adjournment)

HENRY ANNING, CEO ResourceCo Energy Systems, Bioenergy Australia, before the Committee via videoconference, affirmed and examined

The CHAIR: Do you have any questions about the hearing process?

Mr ANNING: No, thank you.

The CHAIR: Would you like to make a short opening statement before we begin with questions?

Mr ANNING: Very briefly. Firstly, thank you. We welcome the opportunity to take questions from the Committee. I am the director of Bioenergy Australia, standing in for our CEO, Shahana McKenzie, who is unfortunately ill. Bioenergy Australia is the national industry association committed to accelerating Australia's bio-economy. Our mission is to foster the bioenergy sector to generate jobs, secure investment, maximise the

value of local resources, minimise waste and environmental impact, and develop and promote national bioenergy expertise into international markets. Bioenergy Australia is a growing association body with over 100 member organisations. The purpose of our submission to this Committee is to highlight how the development of a bio-economy would result in a sustainable energy sector in New South Wales with significant economic and employment outcomes in regional areas.

The CHAIR: Thank you. In relation to biogas and impacts, your submission talks about a reduction of greenhouse gas emissions and groundwater contamination and improvements to air quality. Could you take us through the monitoring and reporting that you do to be able to back that up?

Mr ANNING: Yes. At a broad level, bioenergy obviously covers many different types of energy and many different feed stocks, technology or conversion processes, and outputs. In relation to biogas specifically—again, depending on the different types of biogas—there is a range of monitoring processes that are necessary to ensure, as you would expect in Australia, international best practice, in relation to the capture of biogas; whether it is from, for example, a landfill gas capture system, or whether it is from an anaerobic digestion plant, and then the use of that biogas, whether it is used in a reciprocating engine for electricity, for example, whether it is used directly for heat replacement in a manufacturing boiler, or whether it is, in fact, upgraded to biomethane, for injection into the natural gas grid.

The CHAIR: Other submissions have referred to concerns about deforestation and conversion of food to energy. Could you speak to that, and also to how waste is defined as well?

Mr ANNING: Yes. There are probably three topics there. I will touch on them briefly, and I am happy to dip into any of the three in more detail. First, around forestry and deforestation, forestry is a significant user already of bioenergy. Most major sawmills in Australia, and in New South Wales in particular, would utilise their residues in their own kiln, as part of their process. Generally, best-practice forestry from a circular tree or from thinnings from forest yield something in the order of 55 per cent or 60 per cent of construction material or construction timber. Obviously, the offcuts and the by-products from that are otherwise residues or waste products that can be used for bioenergy purposes. There are, obviously, strong protections in New South Wales and Australia around forestry generally, and around specific concerns around things like old-growth forests, which are obviously restrictions that should be in place, and absolutely protect those parts of the environment that have that sort of heritage. As you would probably be aware, there are certification schemes in terms of forestry as well, such as the likes of Australian Forestry Standard and the Forestry Stewardship Council, that certify best-practice forestry outcomes.

The bioenergy that is already occurring in the likes of New South Wales and Australia obviously has to comply with all of the requirements of the various forestry and best practice legislation in place. There are significant opportunities to achieve more in terms of residues that are otherwise going to waste or being stockpiled from forestry and other sectors. The second comment was along the lines of food versus fuel, as it is sometimes termed. Again, there are ongoing and very constructive relationships between the bioenergy industry and the likes of the National Farmers' Federation. There is, federally, a Bioenergy Roadmap under development, which has heavy involvement of the National Farmers' Federation in there. There are significant opportunities for regional Australia and for the agricultural sector, in relation to bioenergy, and that is starting to be realised. The likes of anaerobic digestion capture from the pork industry—the pork industry has a target of being carbon neutral by 2025, and a net exporter of energy, as one example.

It is also a significant example in terms of the residues from agricultural practices—be they almond husks, which are used in Victoria for energy purposes, or bagasse, which is already the major generator of electricity in northern New South Wales, from a couple of sugar mill cogeneration plants. So, getting into the detail of food versus fuel, again, there are very strong sustainability protections around food-grade agriculture being used for things like fuel only where it cannot be used for food in the first place. At the same time, in Australia we see some lost opportunity, of some feed stocks going overseas to be then processed into bioenergy, and be used overseas, which really is a lost manufacturing opportunity here. A lot of canola goes overseas to Europe to be made into bioethanol, and a lot of Australia's tallow from our meat processing industry goes to Singapore to be made into bioethanol, and goes to the Californian biofuel market—again, lost opportunities, I think, for Australian growth. The last point there was around waste and probably the waste sector. Perhaps in my response I will limit that to waste in the urban waste context—waste that would otherwise go to landfill.

Obviously, there are lots of processes happening nationally and within New South Wales around the waste sector. There is the 20-year Waste Strategy being developed in New South Wales at the moment. There has been a lot of activity in the circular economy and the waste hierarchy over the last few years, triggered by multiple factors, one of which being the China Sword recycling bans, but that is only a small part of the waste sector. There are many projects under development in New South Wales already, and significant potential for many more, using

wastes that go to landfill, and therefore achieving a higher order outcome—be they municipal wastes for energy from waste plants, or food wastes for anaerobic digestion plants, or construction and demolition timbers that go to landfill that can be, again, used for energy purposes. I guess one of the things about the bioenergy sector is the breadth of it, in terms of the feed stocks, the technologies and the outputs—keeping in mind the outputs go well beyond electricity, and into all types of energy, in terms of heat as a key one, as well as liquid fuels.

Ms FELICITY WILSON: There is quite a discussion in the media and in different communities, where there is concern about the types of plants that produce biogas, or even things like waste energy plants. There is a lot of community pushback against some of those plants. As you already acknowledged, there is often some concern as well about food versus fuel, for instance. Some evidence we heard earlier today spoke to whether or not these more renewable alternatives of energy, for instance biogas, genuinely consider the entire lifecycle or impact on the environment, the impact on public health, things like that. Can you talk through to what extent those issues factor into the work that Bioenergy Australia does and how that would be a focus of the sector?

Mr ANNING: They are very important issues, even to the extent there is a perception around the issues as much as what the facts may be. There is obviously a lot of work that happens, and a lot of Australia's references in this regard around bioenergy do point to Europe, and all the work that has been done in Europe and the UK around the lifecycle assessment and the classification of all bioenergy feedstocks, effectively, as renewable, and what that implies in terms of carbon reductions and the carbon cycle. There are absolutely, in every project, significant approval processes that take into account all of these variables that we are talking about, in terms of potential for air emissions from particular types of technologies in particular areas, whether they are biogas plants or thermal plants, as well as greenhouse gas risk assessments, noise assessments, odour assessments, et cetera. The extent to which any particular issue is relevant to a subset of bioenergy does differ on a case by case basis, but they are absolutely issues that are front of mind for us, and we do a lot of work on the policy side with federal and state governments, and with project proponents, to ensure projects that are being developed, and the industry generally, is done so in a sustainable and absolutely best practice manner.

Ms FELICITY WILSON: One of the other issues we have also been talking about in seeking to transition away from fossil fuels and decarbonise, we talk a lot about the communities that already rely quite significantly on essentially fossil fuel-based industries, or to avoid electricity generation. Could you talk through what your perception is about the opportunities for some of those, let us say more regional communities as far as jobs and skills and opportunities from your sector as a transition for longer term fuel, noting particularly with agricultural products it is something that can be more regional than city based?

Mr ANNING: Absolutely. I implied this before, but just to state it more clearly, perhaps one of the things to keep in mind, for want of a better phrase, is again, the broadest definition of energy. Electricity in New South Wales is about 40 per cent of emissions, and there are a lot of the other energy sources as well. Nationally, and at a state level, over the last 10 years the term "energy" has almost been used interchangeably with electricity, and it ignores the other 60 per cent of emissions, at both a state and national level, that also need support and policies and technology solutions, be they in industrial heat use or transport fuels or agriculture or fugitive emissions that, to be honest from a technical perspective, are probably harder than electricity, but a lot of those technical solutions already exist today.

In terms of transition of fossil fuels, I think there is a huge opportunity for bioenergy, both in the transition phase and also in the post-transition phase. There are a number of coal-fired power stations, for example, that are actually reducing their emissions while they continue to operate in that phase by the use of bioenergy, and obviously sustainably sourced wood pellets or construction timber is being used in a number of coal-fired power stations of different scales in developed OECD countries. There is a phase there. To the jobs question, with bioenergy, you are talking about two key differences, in terms of jobs, for a lot of other renewables. One involves supply chains, because you are talking about getting a feedstock to a point. That naturally leads to more jobs, compared to some stationary renewables, and you are generally talking processing plants or processing equipment, with many operational jobs at the point of processing. Again, that differs somewhat to other renewables, which can be a little bit more set and forget.

We had some data in our submission, in terms of anaerobic digestion projects, basically saying there would be 4.2 jobs ongoing direct and 2.1 ongoing indirect jobs per megawatt electrical capacity, comparing that to the 56 megawatt solar farm, which has five employees, in terms of maintenance of that. I appreciate they are different assets that achieve different things. From a jobs perspective, bioenergy has a very high number of operational jobs. As a final point, the regional nature of bioenergy, and the regional nature of feedstocks, means that the vast majority of the jobs in bioenergy will be in regional Australia—the aggregation of agricultural feedstocks, whether that is on-farm anaerobic digestion, whether that is the likes of projects like the sugar mill co-generation projects in northern New South Wales. Of the hundreds or thousands of jobs in bioenergy in New South Wales now, the vast majority are in regional New South Wales.

Mr NATHANIEL SMITH: In some of your submissions you obviously talk a fair bit about biogas and the fact that it can be used in the existing power infrastructure. We heard yesterday about other gases, blends of hydrogen, methane, and natural gas being used through the system. Future appliances in homes would need to incorporate the use of hydrogen if that were to come in in certain areas. Coming to the point of the customer, which is always what we have to keep front of mind, would the use of biogas have any effect on household appliances?

Mr ANNING: No, it does not. The biogas is upgraded to biomethane, which can be a direct replacement for natural gas, as opposed to hydrogen, as you say, where once it gets over a certain percentage, can result in changes needed at the consumer end. The upgrading of biogas to biomethane for injection in the gas grid is coming in Australia. It is coming a bit more slowly than certainly we would like, and a lot of people would like. In France at the moment there are something like 250 anaerobic digestion plants under development, all of which will be injecting gas into the gas grid. That opportunity absolutely exists in Australia, to do similar. The argument can be made that biomethane or biogas should be used in the gas network even, rather than electricity, for the points I made before; that it is harder to decarbonise the gas network. The policy settings in Australia, as opposed to France, are quite different, so the triggers are not there yet to drive up the rate of development, but we hope at some point we will see a rapid increase.

Mr NATHANIEL SMITH: Following on from that, we are seeing a lot of greenfield and new developments happening, especially in south-west Sydney, in my area, and in the area of the member for Macquarie Fields. With new greenfield developments we will see more sewage treatment plants, which can help develop biogas or methane gas. Do you think that should be more front of mind in the planning system, when it comes to planning for utilities; biogas can come from new sewage treatment plants in those new greenfield areas?

Mr ANNING: Absolutely, I think there are probably two elements to that. One is the biogas that the treatment plant can produce itself; the second is if it is actually doing what is called co-digestion, and taking in third-party organic waste to supplement their own material, to maximise both the business case - because they get paid to take that material - and also the biogas output. Sydney Water does that at a number of its plants. The Bondi Sydney Water treatment plant is a net exporter of electricity, which is neat, I think. Sydney Water does co-digestion at a number of their plants, and they do biogas anaerobic digestion at a broader level. At the same time, one of the challenges there is that the thought process and the planning horizon for water corporations does not necessarily always lend itself to innovation or entrepreneurship, shall we say, in terms of having a business model, where you have your regulated business, and then you have a model where you are taking third-party waste round the rubbish collection. So, there are structural challenges as well.

Mr ANOULACK CHANTHIVONG: Can you give me a very quick run-down of the economics of biogas in New South Wales? How many people do you think you would employ, how much economic generation, what are some of the basic numbers on it? I did not see it in your submission.

Mr ANNING: Yes. Again, biogas is one model of bioenergy that I would think of in two categories. One is biogas from urban waste. For example, household food waste, or commercial industrial food waste—projects similar to the EarthPower project in Sydney, which you may be aware of. In those categories, a bioenergy or anaerobic digestion plant gets paid to take its feedstock, because that waste would otherwise typically go to landfill. The other category is more of the agricultural anaerobic digestion. That is usually what is called "behind the meter" at a piggery, an abattoir, or a chicken processing plant, for example, where they have an onsite wet-based stream, and it may or may not have a disposable treatment cost at the moment. They can use that to generate biogas at an anaerobic digestion plant. The economics of the two models are generally quite different. Again, one of them being paid to take a feedstock and one of them not, and one of them dealing with a more complex, mixed-up, contaminated feedstock, as opposed to a more homogenous feedstock.

In New South Wales at the moment there would be tens of anaerobic digestion plants at a number of the abattoirs and piggeries, and a couple of food waste plants as well. There is the potential in New South Wales for a multiple of that. Exactly what the number is, I do not have to hand. Whether those plants are generating electricity or not is also a question. A lot of the abattoirs would tend to use that directly back in a boiler, because they have a lot of industrial heating demands, for hot water for sterilisation and cleaning, so it would not necessarily equate exactly to a megawatt electrical. Often, if it is replacing natural gas, which has obviously gone up about three times the price in the past 10 years, the best economics for something like an abattoir may be to replace natural gas. There was a report from ARENA that looked into industrial heat use that was released last year, which found that there was at least 600 petajoules of natural gas and coal used in manufacturing for industrial heat in Australia each year. It roughly splits to population, so a lot of that would be in New South Wales and, again, things like biogas and biomass are great technologies to help decarbonise those sectors.

Mr ANOULACK CHANTHIVONG: Is it regulatory barriers or lack of financial support that is preventing the industry from growing very quickly?

Mr ANNING: I would say it is a bit of both, and it does depend on the subsector. So, in some parts of bioenergy, financial support such as something on the renewable heat side to help get the first couple of projects away, as most emerging sectors need—as solar and wind needed five years ago—would certainly help accelerate the development of those sectors. In other parts of bioenergy, whether it is in the energy from waste space, where there can be other regulatory barriers and difficulty securing appropriate sites with appropriate social licensing setback. I would not say it is one size fits all. Again, I would highlight to the Committee that there is the Federal Bioenergy Roadmap process that is underway, and that it is due to report over the next month or two, which is doing quite a detailed assessment for the economic modelling of the potential for bioenergy in Australia, and the biggest opportunities for those different subsectors of bioenergy—whether the big opportunities are in biofuels for aviation, or biofuels for maritime, or stationery electricity or heat for biogas, for example—and the exact sizing and jobs potential that would flow off the back of that. That is something that we expect to be published. It is a work in progress and the Committee may be able to get access to drafts, et cetera.

Mr JAMES GRIFFIN: Do you feel that bioenergy will get a fair run or a good outcome from that national paper that is being put together? Because, from my reckoning, what you have outlined this afternoon actually presents a key piece of the puzzle in a lot of what we have been hearing over the past two days around decarbonisation, the challenge around transitioning economies and workforces from coal into other forms of energy and, generally speaking, some of the solutions around powering manufacturing and industry from waste to energy. I am conscious that, if the Committee were to wait for that national paper to be published, we would hope that it would give a fair hearing to some of what you have outlined.

Mr ANNING: We certainly have high hopes for that paper, and it is reasonably well advanced so, again, the Committee may be able to get access to some of that work in process. The IEA recently described modern bioenergy as the overlooked giant of the renewable energy field. I think that is a fair summary, and I think that is the case in Australia as well. Solar and wind have had a lot of the profile, nearly all the policy has been focused on electricity, and fantastic outcomes have been achieved and will continue to be achieved. There will be more work to do around dispatchability, pumped hydro, and transition of the communities and fossil assets over time. I think it is the other 60 per cent of emissions that are a bigger challenge, and that is where bioenergy has a huge potential and ability to play a role if we get the policy settings and structures right.

Mr JAMES GRIFFIN: I agree with you. Thank you.

The CHAIR: Thank you for joining us and for your engagement with our Committee, Mr Anning. We may have some further questions for you, the answers to which would form part of your evidence. Should we send those to you, are you happy to respond to those in writing?

Mr ANNING: Absolutely, thank you. I welcome the invitation and opportunity.

(The witness withdrew.)

ANTHONY TAYLOR, Policy and Research Adviser, Business Council of Co-operatives and Mutuals, affirmed and examined

The CHAIR: Would you like to make any opening remarks?

Mr TAYLOR: Sure. Thank you for the opportunity to appear at the public hearing today. I am sure everyone has been saying that since the commencement of this inquiry a lot of things have changed. We have had a series of crises that have demonstrated the importance of community resilience, and the importance of that to a sustainable society and economy. In the bushfires, co-ops like Cobargo Co-operative Society were there for their communities, because the co-op is the community. The Cobargo co-op was trading right after the fires, without power, to get supplies to its customers—the local members. Through the COVID pandemic, the 700 co-ops and mutuals headquartered across New South Wales continued to focus on serving their members and retaining their staff.

Co-ops and mutual enterprises are businesses that are owned by members rather than shareholders. The members can be customers, as in the case of a mutual bank like IMB Bank; their suppliers, as in a farmer and co-op like Norco Co-Operative; or a local community, in the case of a renewable energy co-op like Goulburn renewable energy. The co-op model has a number of advantages for ownership of renewable energy assets. It provides community participation and ownership, which can build social license for innovative solutions. It can

include a wide part of the community, like renters, in ownership of renewable energy. It keeps wealth, services, and employment local, and builds local resilience. It harnesses local know-how and capital investment—co-ops like Hepburn Wind have demonstrated this—and it is a scalable and replicable model of community ownership.

The key message I would like to stress today is that co-ops are the only type of business corporation that is regulated by New South Wales, and therefore the New South Wales Government has the power to modernise and streamline co-ops' regulation, to allow for greater investment by communities into local assets, such as renewable energy assets. I think that is particularly important in the context of COVID. When a co-op invests there is no leakage of wealth; the benefits are shared amongst the members, and the wider community where the co-op is situated, and it behaves this way because of that wide ownership.

In our submission, we put forward a number of recommendations for how the New South Wales Government could improve the regulation of co-ops. At a high level, our recommendations were to streamline co-ops' regulation, foster community investment in renewable energy through cooperatives, and ensure co-ops are recognised in all government business programs and websites. I note a couple of developments since we made that submission; a lot has happened in the past 12 months. On the first point about regulation, in the past 12 months, ASIC has advised that it has no role in the regulation of capital raising for cooperatives. Previously, that was ambiguous, and it was one of the barriers for things like renewable energy, where the investment part is important. That has been clarified, which is important.

Also, Queensland has adopted Co-operatives National Law, and once that comes into force, which is likely to be in 2021, there will be complete legislative harmonisation across Australia, which removes some other barriers for investment in cooperatives. Those are positive developments that reduce the barriers to the use of co-ops in New South Wales as a crowdfunding vehicle and a vehicle for investment in renewable energy, but New South Wales can still do more to streamline investments in co-ops. The State can lead the development of national regulatory guidelines for cooperative capital investment, and it can remain committed to participation in the Modernising Business Registers Program at the Commonwealth level.

The CHAIR: Thank you very much. In terms of the contribution that you would like to see cooperatives make to the renewable energy market, and the economic opportunity created as a result of that, what potential do you think cooperatives have for New South Wales? What can the New South Wales Government do to modernise its approach to cooperatives?

Mr TAYLOR: I think the potential is probably shown through some of the existing examples, both in Australia and overseas. You may have heard of this example, and I apologise if you have been taken through it before. Hepburn Wind is a well-known example of community energy in Australia, and I think it shows the potential for a community to be able to pool a significant amount of money in a co-op. That is really the potential we see. To take you through that case, Hepburn Wind operates two wind turbines—4.1 megavolts—and to get those up and running, 2,000 members raised $10 million. That was supplemented by government grants of $1.5 million and a bank loan of $3.1 million, but you can see that the bulk of that finance came from members, who are by and large, local community members. Since it started operating it has returned approximately $250,000 to community causes out of its profits, it has abated approximately 90,000 tons of carbon dioxide emissions, and it has also started paying dividends to its members who invested in the co-op—it paid about $250,000 in dividends to members last financial year. Now that it is starting to pay off its debts and pay dividends to members, it is also looking at how it can invest in new energy projects—it is looking at a solar project.

You can see that once a co-op gets up and running, it can potentially use its surplus to continue to meet its purpose. In New South Wales there are exciting new co-ops, like Goulburn renewable energy co-op, that I understand has got some State Government funding recently for a solar project. Haystacks Solar Garden in the Riverina is another project I am aware of that is in development. It is fair to say community energy in Australia is still at a small scale, but when you look overseas to countries like the United States or Germany—we could take many examples—you can see the scale that can be achieved through cooperative ownership.

In the United States there is a massive cooperative energy sector that serves about 42 million people. Many of those co-ops formed in the New Deal, with government backing to get access to finance at that time. Much of it was driven by farmers looking to electrify the regions where they were living, to boost the economic opportunities in those regions, and bring processing into the regions that needed electrification. Today, as a result of that, the legacy is that there are 834 distribution co-ops and 63 generation co-ops in the United States, and because they are owned by customers, they returned $1.2 billion of credits to members, who are purchasing power through the co-ops. They really pack a punch in the US. They work together and that is how they get the scale.

In Germany more recently, co-ops have been more popular in the energy sector. There are about 1,000 energy co-ops in Germany. The bulk of those have been formed in the last 15 years. Across the 855 co-ops formed between 2006 and 2017, there was investment of €2.5 billion, and they have around 180,000 members. To give

an idea of an individual member's stake at the grassroots level, the average member has invested €3,700, but the average minimum to enter into a co-op and become a member is €600. Solar gardens, which maybe some of the other witnesses may discuss, are a mechanism that allow renters, or anyone in the community, to invest. The principle for co-ops is one of open membership, where you set the bar for people to come in at a reasonably low level, so that everyone can participate. That is where the potential is. If that sparked a follow-up question, please jump in.

The CHAIR: What motivates the formation of a co-op? Why are people deciding to form them?

Mr TAYLOR: Co-ops are often formed because of a market failure of some sort, or because of community aspiration. With the confluence of COVID and the bushfires, we will see the aspiration of communities to have independence around energy—an aspiration that maybe was already there—combining with the need to do that. It will become more of an imperative. That is when co-ops really form. If you look at the history of farmer co-ops in Australia, they formed to develop the market and get a product to market that was not going to otherwise get there, or was not going to be sustainable for the farmer. Energy communities, particularly in regional areas, see that they need to do the same thing to secure energy, and have a stake in the development of renewable energy.

Ms FELICITY WILSON: I found your contribution really interesting conceptually. You may be aware that we spent quite a bit of time talking about the impacts of navigating that transition, particularly in regional communities. As you say, there has been particular interest in co-ops, and experience of particularly agricultural co-ops, in regional communities. You mentioned that in Germany about 1,000 energy co-ops were formed in the past 15 years. You then went on to say that one of the reasons co-ops are formed is because of market failures. I wanted to understand whether there was any role government policy played. You hear a lot about Germany as an example of transitioning away from coalmining, for instance. Was government policy a factor there? Are other policy elements a factor? Or is it more correlation rather than causation?

Mr TAYLOR: I might need to take that question on notice to provide detail. It is not just that there are market failures. In countries where you see co-ops thrive, it is due to a combination of the drive from the community, but also the enabling environment from government and the policy settings. That is the case in Germany, at a high level. I can take that question on notice and give a more detailed response. I realise that I did not answer the second part of your question, which also goes to the enabling environment or the policy environment, what government can do to encourage communities to do the sorts of projects together through co-ops or other forms of organisation. I touched on that in my opening remarks.

There is potentially unfinished business in New South Wales—steps that can be taken by the New South Wales Government to encourage communities to form co-ops. One of those things is, on the capital investment side, having regulatory guidance for communities. ASIC has regulatory guidance for when people are using companies and seeking to invest. What we are suggesting is that there be similar guidance for co-operatives. When you raise capital in a co-operative, you have a disclosure statement, which is the equivalent of your information, or prospectus, for a company. If there was guidance around what is required in that, it would give investors and co-operatives more confidence on what they need to do.

I also mentioned government business programs and websites. To give an example of where there could be improvement, I had a look the Business Connect information sheet on starting a small business. That tells you that there are four structures that you can use to form a small business. They are a trust, a partnership, a company, or a sole trader. It does not mention that a co-op is an option that is regulated and incorporated here in New South Wales. A small improvement would be to ensure that information sheets, like that, include some information about co-operatives as one of the options for communities, whether it is a small business, or a community group looking at options for what they want to do together.

Ms FELICITY WILSON: I did read a bit about the Goulburn example that you had filed to us through the link that you shared. I would be interested in understanding the scale, if that is something that you can comment on. As I said earlier, how do you ensure industry, jobs and opportunities for people in regional communities if there is not a transition away from the often large-scale industrial facilities that provide a lot of jobs to people in those communities? What kind of jobs numbers are we are looking at here, on average, in some of those energy co-ops? Is it more about the investment structure and, as you say, the "sticky money" that stays around in those communities?

Mr TAYLOR: Again, and I hate to say this, but I will need to take that on notice. I have seen some statistics about the economic impact of these co-operatives. If I go back and look at those, I should be able to provide you with a full answer.

The CHAIR: In addition, if you could provide any information on work that has been done to look at what deems an area appropriate or potentially inappropriate for a co-operative in New South Wales that would also be quite interesting. How do you know if a co-operative is going to work for a community?

Mr TAYLOR: It can potentially work in any community. The test is, there has to be a membership of some sort that wants to do it. A strong candidate for a co-op has community leaders who are driving it and a steering committee or some people respected in the community who are willing to put time into it. That is really the clincher of whether a co-op is appropriate.

Ms FELICITY WILSON: My last question is about the nature of the type of investment. This may or may not be something that you can answer. Obviously, solar is something that we are seeing happening in New South Wales using a co-op model. Is there interest in other areas? What type of technology or energy co-ops do you think could be successful in New South Wales?

Mr TAYLOR: It is really diverse. I have seen a lot of recent solar-focused projects. As I mentioned, Hepburn is a wind farm. We have been discussing the idea of collaboration among businesses for battery storage in regional Victoria. It is not just individuals in the community, it is also businesses in the regions—or anywhere—that could collaborate around this. It could be a group of manufacturers who want to reduce their energy bills in a way that has a sustainable outcome. That could be done using battery storage, as an example.

Mr JAMES GRIFFIN: The large growth of co-ops in Germany, was that number specifically related to energy co-ops?

Mr TAYLOR: That was specific to energy co-ops.

Mr JAMES GRIFFIN: In general terms. Thank you for that clarification.

The CHAIR: Following on from Ms Wilson's question, you can take this on notice, the limits that determine the size of energy generation projects that are supported by cooperatives, how large scale are these projects, basically?

Mr TAYLOR: How big can a co-op be?

The CHAIR: How big can a co-op be?

Mr TAYLOR: I think Hepburn is a good example, that was $10 million. I think the Goulburn project, from what I can see that is publicly available, they are looking at raising a couple of million dollars from members, I think. That is a good scale for individual cooperatives, and then further scale could be achieved through collaboration, or over time as they grow. If you look at examples in the United States, they do scale to a very large extent over time. It just reminds me that co-ops are common in other utilities as well, not just in energy. An example, at a large scale is Welsh Water, which became a mutual after being a privately run water utility;that is an interesting case study, at a much larger scale, where I think the capital raising involved was a couple of billion pounds. There is no reason why it cannot be at that scale.

The CHAIR: Do the cooperatives form their own grid and transmission infrastructure, or do they connect to the wider infrastructure?

Mr TAYLOR: That part of it is outside of my expertise.

The CHAIR: It would be interesting to know.

Ms FELICITY WILSON: The question of capital raising is interesting. The drive from people within the community, and you want investors from within the community because you want the return to be within the community, but to get that kind of scale, do you have any information you can share with us about capital raising for really large scale projects? And, whether or not there is appetite within markets to finance those projects and support this structure, this model?

Mr TAYLOR: That is a really good question. There are mechanisms for cooperatives to raise capital from members and non-members, and one of those mechanisms is called a cooperative capital unit. They can be offered to members and to non-members. It could allow, for example, one large partner investor, maybe a sympathetic investor, to be a large partner investor to a large amount of community investors, for example. Cooperative capital units were a reform in New South Wales, originally in the cooperatives Act here in the 1990s, but they have been underutilised. The market side of it, the market pre-operational understanding of those, there is a gap I guess. Something that the New South Wales Government could do is to promote the opportunity of cooperative capital units, or assist with the market readiness for use of those securities.

Ms FELICITY WILSON: Is the goal over time for more and more community members to take up those shares or that equity, or is the goal for that larger scale investor to retain that holding in the long term?

Mr TAYLOR: It is really flexible what the purpose is. It could be either objective.

Ms FELICITY WILSON: I find it interesting. It might be big companies, or even mutuals, that can sometimes talk about seeding projects, and smaller projects are also great, but some of the projects that we need might be really large scale projects in communities. It is interesting to know that structurally it is feasible. Whether or not there is market interest is something for us to consider.

Mr TAYLOR: It is something we are working on with the Business Council. At the moment, we have a farming program, and something we are doing through that program is developing some tools specifically for farmer co-ops to be able to use the wide range of securities that they can use, which would include cooperative capital units. I would be happy to share what we are doing in a bit more detail in that project. It is basically the aim of building the market readiness and understanding amongst the co-ops as well of what they can do.

The CHAIR: Thank you, Mr Taylor, for appearing before us today. You have taken a few questions on notice and we will make sure that those do get through to you. We may want to ask some additional questions, your responses to those will form part of your evidence. Would you be comfortable in providing us with responses to those questions?

Mr TAYLOR: Certainly.

The CHAIR: That concludes the public hearing for today. I think all the witnesses who have appeared today. I thank the Committee members for a good and collegial day, the Hansard staff for looking after us, the staff of the Department of Parliamentary Services and the awesome Committee staff for their assistance, including all the technological challenges we are facing these days.

(The witness withdrew.)

The Committee adjourned at 16:14.